ERGON. ENERGY NETWORK

energex

Part of Energy Queensland

Electrical Safety Rules

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Electrical Safety Rules

This version

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This document Shall be reviewed no longer than every two years.

Electrical Safety Rules

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Electrical Safety Rules

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PURPOSE

This Standard outlines the mandatory Electrical Safety Rules to be complied with by all internal personnel and external service providers when operating or performing Work on, Near or in the Vicinity of the Ergon Energy Network and Energex electricity supply networks. This document supplements existing legislative framework and ensures all Work is performed in accordance with the standards of electrical safety required under the *Electrical Safety Act 2002, Electrical Safety Regulation 2013,* and the *Electrical Safety Codes of Practice*.

SCOPE

This Standard is to be used in conjunction with the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus,* the *EQL Standard for High Voltage Live Work Management* and the EQL policies, standards, manuals and Approved procedures outlining the requirements for Safe Work.

The Electrical Safety Rules within outline the minimum requirements for Safe operation of the High Voltage networks (control and switching), Work on or Near Exposed High Voltage Electrical Apparatus (access Work) and Work performed without direct contact with Exposed High Voltage Electrical Apparatus.

This Standard details the control measures necessary to manage the electrical safety risks associated with operating and working on, Near or in the Vicinity of the Ergon Energy and Energex networks, ensuring persons performing the Work are electrically Safe. Workers have a duty to take reasonable care for their own electrical safety and to not adversely affect other people's electrical safety. Workers must cooperate with these Rules relating to electrical safety at the workplace.

This Standard does not cover the management of Remote and Embedded Generation Systems. The requirements for responding to Faults and unplanned outages are covered in the *Fault Management Standard*.

This Standard supersedes elements of the Energex *Operating Practices Manual* and the Ergon Energy *P53 Operate the Network* document suite; where there is conflicting information, the Rules detailed in this Standard Shall take precedence.

DEFINITIONS, ABBREVIATIONS & ACRONYMS

Air-Break Switchgear multi-phase disconnectors and single-phase Disconnect Links and switchable fuses operating in open air.

Approved having appropriate organisation endorsement in writing for a specific function.

Authorised Person a person who:

(a) has enough technical knowledge and experience to do Work that involves contact with, or being Near to, the Electrical Apparatus; and

(b) has been Approved by the person in control of the Electrical Apparatus to do Work that involves contact with, or being Near to, the Electrical Apparatus, or is authorised to act for the person in control of the Electrical Apparatus.

Authority Holder (Authorised Person in charge) an Authorised Person to whom a Non-Access Work Authority, HV Live Work Authority or Vicinity Work Authority has been issued and is the person responsible for compliance with the requirements of the Non-Access Work Authority, HV Live Work Authority or Vicinity Work Authority.

Auto-Reclose the operating sequence of a mechanical Switching device whereby, following its opening, it closes automatically after a predetermined time.

Automatic Circuit Recloser (ACR) an enclosed mechanical Switching device typically installed on an overhead line, capable of making and breaking rated load and Fault currents that trips automatically under Fault conditions and then closes automatically after a predetermined time.

Bond the connection of conductive objects together to ensure that they are at the same electrical potential.

Breaking Capacity value of the prospective breaking current that a switching device is capable of breaking at a stated voltage and under prescribed conditions of use and behaviour.

Bulk Supply Substation a substation with multiple relay-controlled switchgear, used for Switching and/or transforming a Transmission voltage (e.g. 132 kV or 110 kV) to a Sub-transmission voltage (e.g. 66 kV or 33 kV) or a distribution voltage (e.g. 22 kV or 11 kV).

Busbar low impedance Conductor facilitating common connection for several circuits.

Cable an Insulated Conductor, or two or more such Conductors, laid together, whether with or without fillings, reinforcements, or protective coverings.

Circuit Breaker an enclosed mechanical Switching device typically installed at a substation, capable of making and breaking rated load and Fault currents that trips automatically under Fault conditions.

Clearance the shortest distance between two conductive parts.

Common Multiple Earthed Neutral (CMEN) an earthing system of which the Low Voltage neutral Conductor and the Low Voltage earthing system are connected to the High Voltage earthing system.

Commissioned connected to the network.

Conductor a wire, Cable or form of metal designed for carrying electric current.

De-energised separated from all sources of Supply but not necessarily Isolated, Earthed, discharged or out of commission.

Disconnect Link a single-phase Switching device which in the open position provides an isolating distance.

Disconnection Point an adequate break created by the removal or absence of Conductors and deemed no longer a source of inadvertent energisation. The break Shall:

(a) not be able to be re-established by normal Switching operations; and

(b) maintain the Exclusion Zone appropriate to the voltage or maintain the defined electrical Non-Flashover Distance appropriate to the voltage; and

(c) be created in accordance with Approved procedures.

Disconnector a multi-phase Switching device which in the open position provides an isolating distance. Also referred to as air-break switch or isolator.

Distribution Management System (DMS) a network schematic which can be used to remotely manage the distribution network while displaying alarms, operations, and device status in real-time.

Distribution Transformer a transformer whose primary function is to Supply LV. This includes pole mounted, ground mounted and padmounted transformers.

Do Not Operate Board (DNOB) a safety sign bearing the words 'Do Not Operate' used to identify Isolation Points or Operator Earths.

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

Earths Approved earthing devices applied for the earthing and short-circuiting of Electrical Apparatus.

Earth Connection a connection to the general mass of earth by means of an Earthing Electrode or Earthing Electrodes electrically connected at a given location.

Earth Potential Rise (EPR) a voltage between an earthing system and reference earth (Remote Earth).

Earthing Electrode a metal rod, tube, pipe, plate, or other Conductor buried in or driven into the ground and used for making a connection to the general mass of earth.

Earthing Point used interchangeably with Earth Connection.

Earthing Switch a mechanical Switching device for earthing parts of a circuit, capable of withstanding for a specified time currents under abnormal conditions such as those of short-circuit but not required to carry current under normal conditions of the circuit.

Electrical Apparatus any electrical equipment, including overhead lines and underground Cables, the Conductors of which are Live or can be made Live.

Electrical Hazard potential source of harm when electric energy is present in an electrical installation or equipment.

Energised connected to any source of electrical energy.

Exclusion Zone for a person, operating plant or vehicle for Electrical Apparatus, means the distance from the Electrical Apparatus stated for the person, plant, or vehicle in the *Electrical Safety Regulation 2013 Schedule 2*.

Exposed bare; or not effectively Insulated; or not effectively guarded by either a fixed barrier or an Earthed metal shield.

Expulsion Drop-Out Fuse (EDO) a switchable fuse in which the fuse carrier drops into the open position after the fuse has interrupted current.

Fault a term to describe Electrical Apparatus failure, which is a physical condition that causes a device, component, or an element to fail to perform in a required manner, for example, a short-circuit, broken Conductor or an intermittent condition, and generally leads to an Unplanned Outage.

Fault Level the prospective maximum current or power, which will flow in a circuit that is subjected to a Fault.

Field Auto-Reclose Operator an Authorised Person who can disable/restore the Auto-Reclose functionality of ACRs on overhead distribution lines for Vicinity or HV Live Work.

High Voltage (HV) a voltage greater than 1000 V AC RMS or 1500 V ripple-free DC.

HV Enclosure an enclosed area where voltage is transformed or switched, excluding padmounted Distribution Transformers.

HV Live Work High Voltage Work performed under a HV Live Work Authority on or Near components of Electrical Apparatus Energised or capable of being Energised to High Voltage without implementing the full protective practice of isolating, proving De-energised and earthing.

Inoperable for the purpose of earthing, means all electrical and mechanical operations whilst in the closed and circuit Earthed position are inhibited as intended and designed by the switchgear manufacturer.

Instructed Person a person who is acting under the supervision of an Authorised Person for the Electrical Apparatus.

Insulated separated from adjoining conducting material by a non-conducting substance which provides resistance to the passage of current, or to disruptive discharges through or over the surface of the substance at the operating voltage, and to mitigate the danger of shock or injurious leakage of current.

Interconnected a network consisting of two or more individual power sources normally operating with connecting tie feeders.

Integral Earthing the facility in which a Circuit Breaker is used to earth a Busbar or circuit of metal enclosed/clad switchgear.

Isolated means disconnected from all possible sources of electricity Supply and rendered incapable of being made Energised without premeditated and deliberate action.

Isolation Point an Approved adequate break that prevents any inadvertent energisation, for example from lightning, Switching or back energisation. (A DNOB Shall be attached at the Isolation Point).

Lethal Current is current in excess of 40 mA AC or 150 mA DC through the human body.

Live Energised or subject to hazardous induced or capacitive voltages.

Low Voltage (LV) a voltage greater than 50 V AC RMS or 120 V ripple-free DC, but not more than 1,000 V AC RMS or 1,500 V ripple-free DC.

Manual Switching all Switching not performed via Remote Control.

Mobile Switching Switching performed via electronic Switching schedules with two-way real-time communication between field devices and the DMS.

Near means a situation where there is a reasonable possibility of a person, either directly or through any conducting medium, coming within the relevant Exclusion Zones.

Nearby Electrical Apparatus which is outside the scope of the Permit or Authority but identified by the Switching Operator as a potential Electrical Hazard at the Work area.

Nominal Voltage means the AC (phase to phase RMS) or DC voltage by which a system of Supply is designated.

Non-Commissioned not previously Commissioned i.e. under construction or installed but has not been previously connected to the Commissioned network at that site.

Non-Flashover Distance the minimum phase to earth Clearance that includes a margin of 10% (for Clearances of 1300 mm or less) and 6% (for Clearances of greater than 1300 mm) to allow for variations in construction dimensions.

Not Electrically Connected (NEC) Electrical Apparatus disconnected from all sources of Supply by the removal or absence of Conductors, appropriate to the voltage and insulating medium and, not able to be Energised by Switching and identified in accordance with an Approved procedure.

Not Electrically Connected (NEC) Work Area an area where an authorised document has been issued to allow Work on Not Electrically Connected Electrical Apparatus.

Operator Earth Approved earthing and short-circuiting equipment applied to Electrical Apparatus (with DNOB attached), as a requirement for the issue of an Access/Test Permit, to ensure the Electrical Apparatus is Earthed.

Orifice an opening in which Withdrawable Equipment connects to a Busbar or circuit. Also referred to as a Spout.

PED Portable Earthing Device.

Permanent Earthing Point (PEP) a permanent Earth Connection such as a Substation Earth Grid, steel tower, High Voltage earth or Low Voltage neutral on a bonded earth network.

Power Transformer a transformer that transfers electric energy in any part of the circuit between the generator and the distribution network (HV).

Reasonably Practicable in relation to a duty to ensure electrical safety, means that which is, or was at a particular time, reasonably able to be done in relation to ensuring electrical safety, taking into account and weighing up all relevant matters including:

(a) the likelihood of the hazard or the risk concerned happening; and

(b) the degree of harm that might result from the hazard or the risk; and

(c) what the person concerned knows, or ought reasonably to know, about —

  i. the hazard or the risk; and

  ii. ways of eliminating or minimising the risk; and

(d) the availability and suitability of ways to eliminate or minimise the risk; and

(e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

Recipient (Authorised Person in charge) an Authorised Person to whom an Access/Test Permit has been issued and is the person responsible for compliance with the requirements of the Access/Test Permit.

Remote Control a facility for indirectly initiating the operation of Electrical Apparatus remotely from the Electrical Apparatus.

Remote Earth part of the Earth considered as conductive, the electric potential of which is conventionally taken as zero, being outside the zone of influence of any earthing arrangement.

RPEQ Registered Professional Engineer of Queensland, demonstrates an engineer's qualification, with appropriate competency and experience.

Rules 'these Rules' are in reference to this Standard, the Electrical Safety Rules.

Safe means not posing an unacceptable risk to life, health or property.

Safety Control a control implemented to help manage Electrical Hazards while working under a Non-Access Work Authority, HV Live Work Authority or Vicinity Work Authority.

Secondary Systems a general term used to describe all protection, instrument transformers, metering, data, control, and communication bearer systems used for the protection, measurement, and control of primary equipment.

Separate Earthing System an earthing system of which the Low Voltage earthing system is separate and distinct from the High Voltage earthing system.

Shall is to be interpreted as mandatory.

Should is to be interpreted as advisory or discretionary.

Shutter a lockable barrier to prevent access into the Orifice of metal clad switchgear.

Substation Earth Grid for the purpose of these Rules, means the earthing system of a Bulk Supply or Zone Substation.

Sub-transmission means Nominal Voltages of 33 kV and 66 kV.

Supervise in relation to electrical Work, means Supervise the way the electrical Work is performed.

Supply provides electrical energy.

Switching Work involving the operation of Switching devices, links, fuses, or other connections intended for ready removal or replacement, making and breaking bridges via Live Work as part of an operating process, proving electrical Conductors De-energised, earthing and short-circuiting, locking, and tagging of Electrical Apparatus and erection of barriers and signs.

Switching Coordinator an Authorised Person who coordinates Switching, performs Switching by Remote Control and approves the issue of Work Approvals.

Switching Operator an Authorised Person who takes the lead role in the process of performing field-based Switching and issues Work Approvals.

Switching Operator's Assistant an Authorised Person who assists a Switching Operator perform Switching.

Switching Sheet a document or electronic schedule that is part of a Safe System of Work. Each Switching Sheet Shall have a unique reference and Shall list a step by step Switching process.

SWER Single Wire Earth Return; an electrical distribution system based on single wire delivery and using the Earth for return currents.

Transferred Voltage a potential rise of an earthing system caused by a current to earth transferred by means of a connected Conductor into areas with low or no potential rise relative to Remote Earth, resulting in a potential difference occurring between the Conductor and its surroundings. The definition also applies where a Conductor, which is connected to Remote Earth, leads into the area of the potential rise.

Transmission means Nominal Voltages of 110 kV and above.

Untrained Person a person who is not an Authorised Person or an Instructed Person for the Electrical Apparatus.

Validation a documented process between organisations to ensure High Voltage Electrical Apparatus is suitable for the purpose of isolating and earthing and is correctly identified and in the correct sequence to enable Safe access and testing.

Vicinity means a situation where it is unlikely that a person will, either directly or through any conducting medium, come within the relevant Exclusion Zones.

Voltage Transformer (VT) an instrument transformer for obtaining measurements of High Voltages suitable for metering and protection purposes.

Withdrawable Equipment apparatus (e.g. Circuit Breaker or Voltage Transformer) that can be withdrawn, i.e. disconnected from the network from its point of connection (e.g. spout or Orifice) and then inhibited from accidental reinsertion due to locked Shutters.

Work means Work of any type, whether or not electrical Work, performed in accordance with a Safe System of Work.

Work Approval verbal permission from a Switching Coordinator or a document (Permit or Authority) issued, giving approval to perform Work.

Work Clearance when installed in a relay and enabled (ON) it will inhibit manual close, disable Auto-Reclose and enable quicker protection operation. It will also activate SEF protection regardless of the SCADA status.

Worker a person is a Worker if the person carries out Work in any capacity for a person conducting a business or undertaking, including Work as – an employee, a contractor or subcontractor, an employee of a contractor or subcontractor, an employee of a labour hire company who has been assigned to Work in the person's business or undertaking, an outworker, an apprentice or trainee, or a student gaining Work experience.

Working Earth Approved earthing and short-circuiting equipment, applied to Electrical Apparatus, additional to Operator Earths following the issue of an Access/Test Permit.

Zone Substation an intermediate substation, with multiple relay-controlled switchgear, used for Switching and/or transforming a Transmission or Sub-transmission voltage (e.g. 132 kV, 110 kV, 66 kV or 33 kV) to the primary distribution voltage (e.g. 22 kV or 11 kV).

REFERENCES

Acts, Regulations & Codes of Practice

Queensland Electrical Safety Act 2002

Queensland Electrical Safety Regulation 2013

Queensland Electrical Safety Code of Practice 2020 Working near overhead and underground electric lines

Queensland Electrical Safety Code of Practice 2020 Works

Queensland Electrical Safety Code of Practice 2021 Managing electrical risks in the workplace

Queensland Work Health and Safety Act 2011

Queensland Work Health and Safety Regulation 2011

Standards & Guidelines

Australian Standard AS 2067:2016 Substations and High Voltage Installations Exceeding 1 kV a.c.

Australian Standard AS 5804.1:2010 High Voltage Live Working Part 1: General

ENA DOC 003 – 2021 National Guidelines for Safe Access to Electrical and Mechanical Apparatus

ENA NENS 04 – 2006 National Guidelines for Safe Approach Distances to Electrical and Mechanical Apparatus

Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus 2023

Energy Queensland Controlled Documents

Barrier Systems for Work in Outdoor Substations (Bulk Supply or Zone) – 2885278

Radio Frequency Radiation (RFR) SWMS R326 – 1887850

Secondary Systems Switching Roles, Responsibilities and Training Reference Manual – 21273971

Standard for High Voltage Live Work Management S016 – 691348

Standard for Personal Protective Equipment (PPE) S031 – 691352

Switching and Access Training and Authorisation Reference Manual – 1683135

Working On or Near Exposed Live Parts SWMS R323 – 1887674

Ergon Energy Network/Energex Controlled Documents

Earthing of High Voltage Electrical Apparatus Supplementary Guide – 7046604

Standard for Operating Practices – Work Involving the Energex Low Voltage Network – 7371353

Manage Low Voltage Switching for De-energised Access on the Network Procedure – 2882932

Fault Management Standard - 11044700

Section 1
SAFETY PRINCIPLES

1 SAFETY PRINCIPLES

The guiding principles for operating and performing Work on, Near or in the Vicinity of the Ergon Energy and Energex networks are prioritised as:

1. Safety of People and Community
2. Protection of Network Assets
3. Reliability of Supply

1.1 Fundamental Safety Principles

The following fundamental safety principles underpin the risk control framework for safely operating and performing Work on, Near or in the Vicinity of the Commissioned Ergon Energy and Energex networks:

1. All Work on the HV network Shall be performed under the approval of a Control Centre by suitably trained, competent and where required, Authorised Persons.
2. All HV Exposed Electrical Apparatus Shall be regarded as Live until Isolated, proved De-energised by Approved means, Earthed and short-circuited.
3. Before commencing De-energised Work on or Near LV Exposed Electrical Apparatus it Shall be Isolated, proved De-energised by Approved means and Electrical Hazards Shall be documented and effectively controlled in accordance with Approved procedures.
4. Non-Access and Vicinity Work Shall be performed while maintaining the relevant Exclusion Zones at all times.
5. If Exclusion Zones have the potential to be encroached, Work Shall be performed under access via an Access or Test Permit as per the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus* and these Electrical Safety Rules.
6. All HV Live Work Shall be performed in accordance with the *EQL Standard for HV Live Work Management* and Approved procedures.
7. All LV Live Work Shall be performed in accordance with Approved procedures and Workers Shall hold an LV Live Authorisation.
8. Prior to any Switching or Work commencing, Workers Shall identify site-specific hazards and ensure effective controls for Safe Work are in place.
9. Any Switching or safety incidents associated with Work governed by these Rules, including near misses, Shall be reported and recorded.
10. Test before you touch: irrespective of a Permit being in receipt, Workers Shall test to prove De-energised before they touch.

1.2 Exclusion Zones

An Exclusion Zone is a prescribed safety area around Exposed Electrical Apparatus that no person, operating plant or vehicle may encroach until the conditions for Safe Work are in place. The prescribed Exclusion Zone distances in the below Tables Shall be applied in all directions from Exposed Electrical Apparatus (Figure 1).

Exclusion Zone requirements apply to both electrical and non-electrical Workers. Electrical Workers must not rely on their qualifications to assume they can Work safely on or Near Energised parts but must adopt at least the same control measures as non-electrical Workers to ensure the Work can be carried out safely.

Authorised and Instructed Persons can Work at closer Exclusion Zone distances than Untrained Persons.

The following tabulated Exclusion Zone distances are stipulated in Schedule 2 of the *Electrical Safety Regulation 2013* and *ENA NENS 04 – 2006 National Guidelines for Safe Approach Distances to Electrical and Mechanical Apparatus.* These Tables are tailored to the nominal system voltages of the Ergon Energy and Energex networks.

Note: Entities such as Powerlink Queensland and Queensland Rail may have differing Exclusion Zone distances; reference Shall be made to entity-specific Exclusion Zones where applicable.

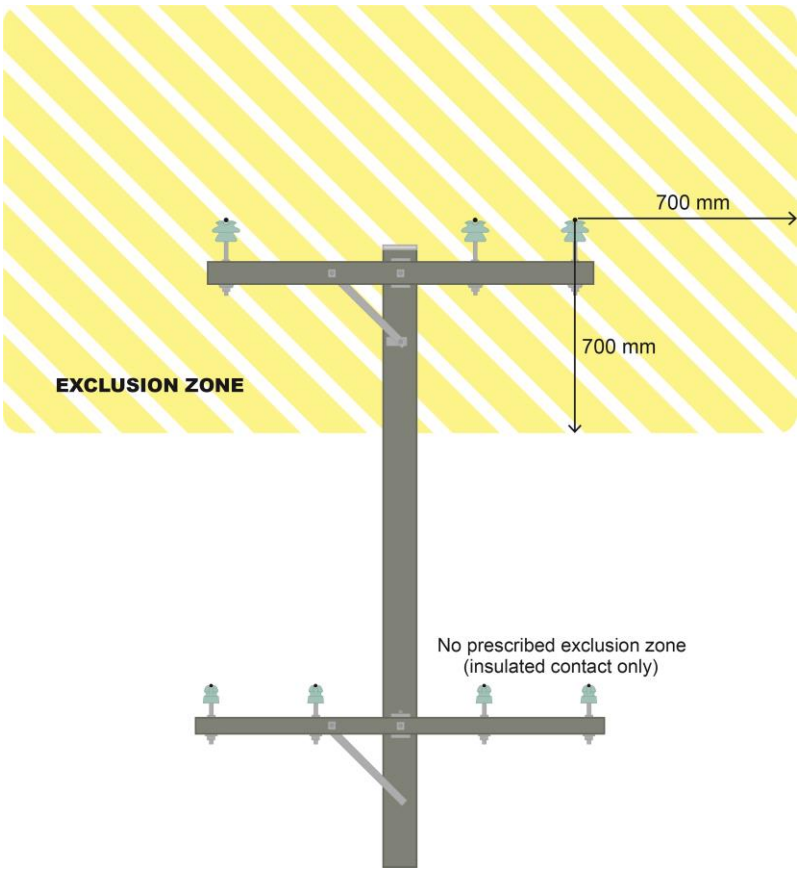


Figure 1: Exclusion Zone for Authorised or Instructed Persons & No-Touch Zone (11 kV & LV Depicted)

In reference to the Tables below, consultation is to be with the network asset owner being either Ergon Energy Network or Energex; the purpose of the consultation is to determine the voltage of the Electrical Apparatus and inform the network asset owner that Work is being carried out Near the Electrical Apparatus.

Table 1: Exclusion Zones for Untrained Persons (Exposed Electrical Apparatus)

Nominal Phase to Phase Voltage of Electrical Apparatus	Untrained Person (mm)	Operating Plant (mm)	Operation of Vehicle (mm)
Insulated LV (with consultation and insulation verified by an Authorised Person)	No Exclusion Zone prescribed	1000	300
Uninsulated LV (with consultation)	1000	3000	600
Insulated LV (without consultation with, and without insulation verified by an Authorised Person)	3000	3000	600
Uninsulated LV (without consultation)	3000	3000	600
HV, up to & including 33kV (with consultation)	2000	3000	900
HV, up to & including 33kV (without consultation)	3000	3000	900
66kV, 110kV & 132kV	3000	3000	2100
220kV	4500	6000	2900
275kV	5000	6000	2900

Table 2: LV Exclusion Zones for Authorised or Instructed Persons (LV Exposed Electrical Apparatus)

Nominal Phase to Phase Voltage of Electrical Apparatus	Authorised Person or Instructed Person (mm)	Operating Plant, with Safety Observer or Another Safe System (mm)		Operation of Vehicle (mm)
		Uninsulated Portions of Plant	Insulated Portions of Plant	
Insulated LV (with consultation & insulation verified by an Authorised Person)	No Exclusion Zone prescribed	Maintain Visible Air Gap	Contact Allowable	No Exclusion Zone prescribed
Insulated LV (without consultation or insulation verified)	No Exclusion Zone prescribed	Maintain Visible Air Gap	Contact Allowable	600
Uninsulated LV	No Exclusion Zone prescribed	1000	Contact Allowable	600

Table 3: HV Exclusion Zones for Authorised or Instructed Persons (HV Exposed Electrical Apparatus)

Nominal Phase to Phase Voltage of Electrical Apparatus	Authorised Person or Instructed Person (mm)	Operating Plant, with Safety Observer or Another Safe System (mm)		Operation of Vehicle (mm)
		Uninsulated Portions of Plant	Insulated Portions of Plant	
HV up to & including 33kV	700	1200	700*	700
66kV	1000	1400	1000*	1000
110kV	1000	1800	-	1000
132kV	1200	1800	-	1200
220kV	1800	2400	-	1800
275kV	2300	3000	-	2300

* These also apply when operating plant is uninsulated and the Conductor is Insulated with insulation verified by Authorised Person. If insulation is not verified then treat as uninsulated Conductor.

Note: The tabulated Exclusion Zones are applicable for HV aerial bundled conductor (HVABC) without an Earthed metallic screen and covered conductor thick (CCT).

1.2.1 Low Voltage No-Touch Zones

Where the *Electrical Safety Regulation 2013* does not prescribe an Exclusion Zone for LV Electrical Apparatus, a 'no-touch zone' as per the *Electrical Safety Code of Practice 2020 Working Near overhead and underground electric lines* is applicable. The no-touch zone allows Workers to go as close as needed but not touch the LV Electrical Apparatus.

Contact with Live LV Electrical Apparatus Shall be managed as follows:

(a) Authorised Person: Insulated contact only.

(b) Instructed Person: no contact allowed.

1.2.2 Exclusion Zones for Cables

Cables with an Earthed metallic sheath (also referred to as a metallic screen) and intact over-sheath (outer covering) are not considered Exposed Electrical Apparatus and the prescribed Exclusion Zones are not applicable.

Where a metallic sheath is absent, has been removed at a Cable termination (Figure 2) or is damaged, the unscreened section of Cable Shall be treated as Exposed Electrical Apparatus and the tabulated Exclusion Zones apply. The application of an Exclusion Zone is to safeguard against inadvertent encroachment into the unscreened area.

Care must be taken where unscreened Cable is installed below the Ground Safety Clearance level (2440 mm above ground level) without protective barriers or obstacles; such installations Shall be reported.

The operation of Magnefix MD4 switchgear (also referred to as Hazemeyer) while standing directly in front of the unit is permissible provided the maximum possible distance is maintained.

Depending on the sheath bonding configuration, metallic sheaths will have induced voltage and possibly circulating currents present. Furthermore, the metallic sheath may carry Fault current during network Faults. Due to these hazards, Exposed metallic sheaths and associated connections Shall not be touched without the appropriate approval. Refer to *Section* 4.2.2 for information on metallic sheath hazards.

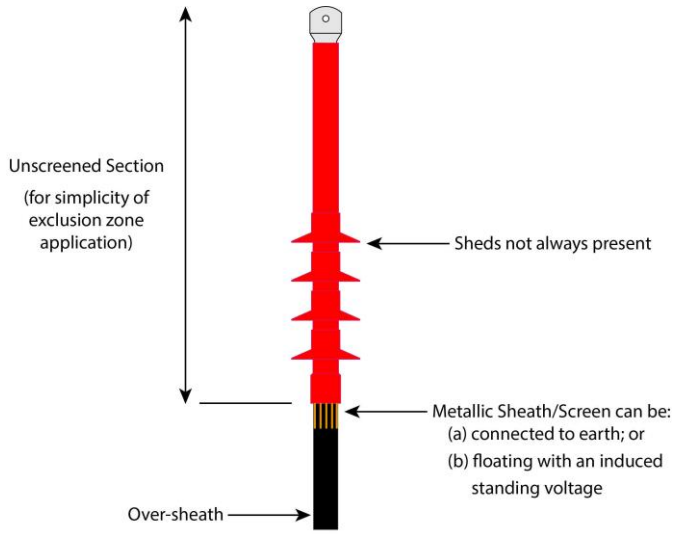


Figure 2: Cable Termination Depicting Unscreened Section

1.3 Proximity Terminology

In relation to these Rules, the terminology defined in Figure 3 is designed to clearly describe the location of Work to be performed as well as the hazards and other considerations associated with the Work. The terms ‘on’, ‘Near’ and ‘Vicinity’ are used to describe Work and its location while the term ‘Nearby’ is used to describe other Electrical Apparatus.

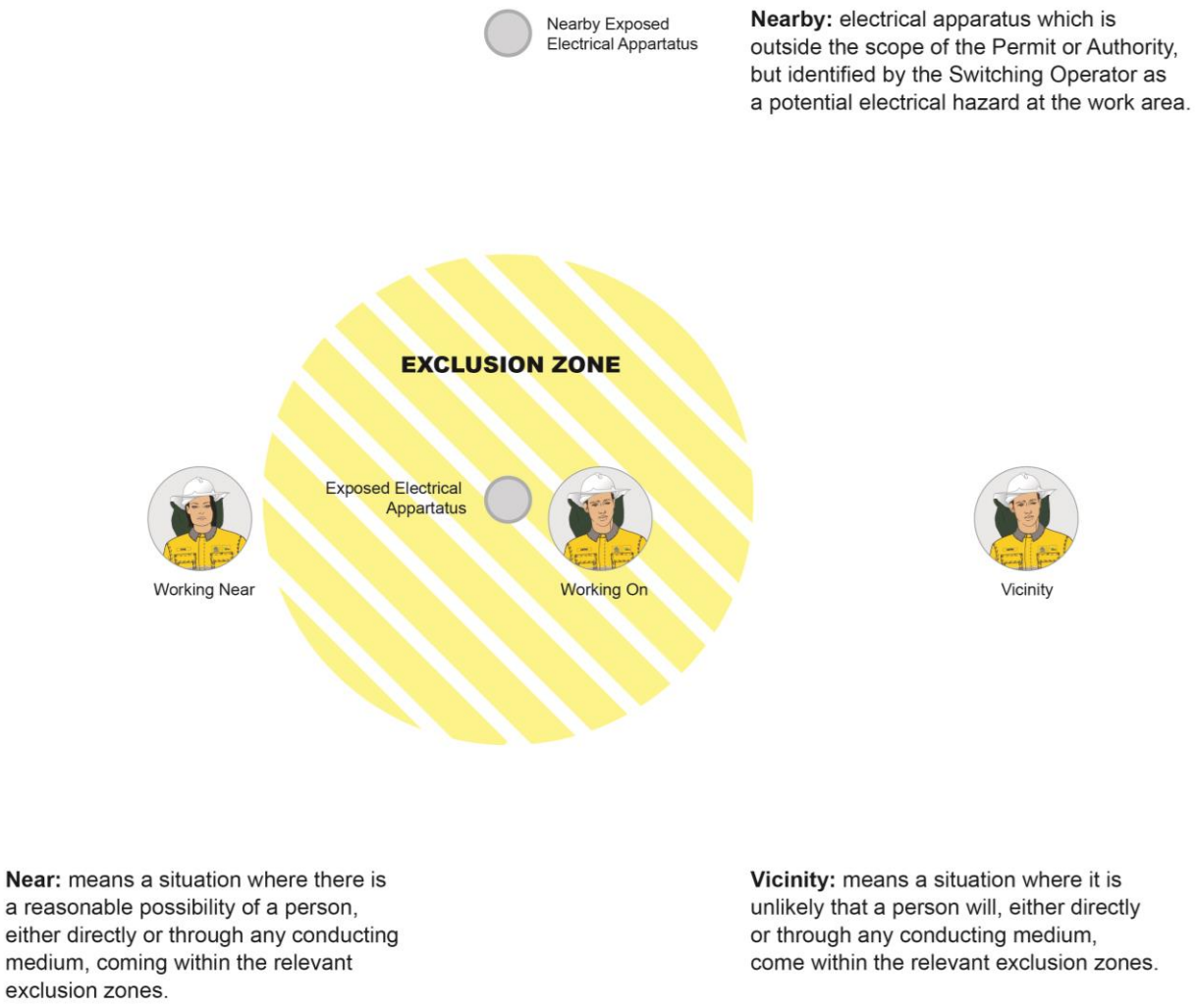


Figure 3: Proximity Terminology: On, Near, Nearby & Vicinity

1.4 Hazard Identification

It is important to be aware of and understand the hazards encountered when working on, Near or in the Vicinity of Electrical Apparatus. It is equally important to understand how these hazards can be managed to ensure Safe Work.

Prior to any Switching or Work commencing, Workers Shall identify site-specific hazards and ensure effective controls for Safe Work are in place.

When performing electrical Work, Workers Shall assess whether they are operating within three metres of Exposed Energised electrical equipment. If so, they Shall implement appropriate control

measures in accordance with legislative requirements, including de-energisation where practicable and Safe Work procedures where Live Work is unavoidable.

1.4.1 Electrical Hazards

In addition to non-electrical hazards (working from heights for example), site and task-specific Electrical Hazards Shall be identified and documented. Electrical Hazards include, but are not limited to:

(a) inadvertent energisation

(b) contact with Nearby Exposed Live Conductors

(c) making direct contact between two different potentials

(d) Step, Touch and Transfer Voltages when working uninsulated from the ground

(e) operating Switching devices beyond their rated capacity

(f) open-circuiting current transformers with current flowing in the primary Conductor, including induced current circulating between Earths

(g) sources of induction and radio frequency radiation

(h) sources of back energisation (backfeed)

(i) sources of stored energy

(j) ferroresonance

(k) leakage current

(l) disconnection of neutral and earthing system Conductors.

1.4.2 Operating Plant Hazards

Safety Observers Shall be used to prevent operating plant from encroaching into Exclusion Zones. Furthermore, consideration Shall be given to earthing operating plant in accordance with Approved procedures to effectively manage induction hazards.

1.4.3 Hierarchy of Controls

The following hierarchy of controls must be worked through to choose the control or combination of controls that eliminate or effectively manage the identified hazards. The hierarchy of controls are ranked in order of preference and effectiveness as:

1. **Elimination** – attempt to eliminate the hazard (e.g. de-energise Nearby Electrical Hazards)
2. **Substitution** – involves replacing a process with one that is less hazardous
3. **Isolation** – prevent Workers from making contact with the source of an Electrical Hazard
4. **Engineering Controls** – implement engineering controls to minimise the risk (e.g. Working Earths and temporary bridges)
5. **Administrative Controls** – involve the use of Approved procedures to control the risk
6. **Personal Protective Equipment (PPE)** – the least effective control.

Caution: chosen controls must not introduce new hazards.

1.5 Training & Authorisation

All Work, operation and Switching of the network requires training, competency, and for various roles, an authorisation. When performing trained and authorised roles, all of the following requirements Shall be met:

(a) a person performing a trained role Shall be deemed competent to perform that role

(b) a person performing an authorised role Shall be suitably authorised for the Work being performed

(c) a person performing an authorised role Shall be assessed and re-authorised at intervals specified by the relevant management standard.

1.6 Work Approval

A Work Approval forms part of an overall Safe System of Work and is typically a document issued as an approval to perform Work. A Work Approval can also be a verbal permission from a Switching Coordinator to commence Switching or perform minor Work that only requires notifying the Control Centre.

A Work Approval document designates the Electrical Apparatus subject to Work activity as well as the person responsible for the electrical safety of the Work. Furthermore, it allows all Workers to have visibility of the recorded safety precautions or controls in place for Safe Work.

The following Work Approval documents are issued for the associated categorised Work:

(a) Non-Access Work Authority – Work on the HV network while maintaining Exclusion Zones

(b) HV Live Work Authority – HV Live line and Live substation Work

(c) Vicinity Work Authority – Vicinity Work with Auto-Reclose disabled as a Safety Control

(d) HV Access Permit – Work on or Near the HV network

(e) HV Test Permit – minor Work and testing with lethal current on the HV network

(f) LV Work Permit – Work on or Near the LV network

(g) Authority documents not issued by a Control Centre for Work on Not Electrically Connected Electrical Apparatus (Construction, Test and Maintenance Authority).

Work on Commissioned Electrical Apparatus Shall not commence until the relevant Control Centre has been notified and a Work Approval has been received, and where required, Earths are in place as per the requirements of the Work Approval and these Rules.

Two different types of Work Approvals cannot be in effect at the same time for the same part of the network. Two different types of Work Approvals can, however, be in effect at the same time for different Electrical Apparatus at the same location so long as one cannot interfere with the other.

1.7 Documentation Return & Retention

All documentation relating to Work on the network, including Switching Sheets and Work Approvals Shall be retained for a minimum of three years and five years respectively in accordance with the *Queensland Energy Sector Retention and Disposal Schedule QDAN 618*.

Upon the completion of Work, all field documentation associated with the Work Shall be returned to the relevant Supervisor.

Where external service providers or multiple work groups are in possession of documentation associated with the Work, the completed documentation Shall be returned to the relevant Supervisor/Manager responsible for the location where the Work was undertaken.

1.8 Auditing & Compliance

Auditing of Switching and Work activities Shall be undertaken to continually assess compliance with the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus* and these Rules, as well as to identify areas for improvement in order to ensure Work is electrically Safe.

Supervisors/Managers or other representatives Shall conduct field-based audits to monitor Work Approval and safety requirements compliance.

A post event auditing program of completed field and Control Centre documentation relating to Switching and Work activities, Shall be conducted on a select portion of the Work performed on the Ergon Energy and Energex networks.

1.9 Reporting of Incidents & Near Misses

Any Switching or safety incidents associated with Work governed by these Rules, including near misses, Shall be reported and recorded in the entity corporate system. This will enable the continual review of the effectiveness of controls and where practicable, allow improvement to hazard management and these Rules.

Section 2

NON-ACCESS, VICINITY & HIGH VOLTAGE LIVE WORK

2 NON-ACCESS, VICINITY & HIGH VOLTAGE LIVE WORK

This Section outlines the Rules for Work performed on or in the Vicinity of the Commissioned network without direct contact with HV Exposed Electrical Apparatus.

These Rules apply to the following three Work categories:

(a) non-access Work such as substations Work and Work on auxiliary control equipment

(b) Vicinity Work such as vegetation management

(c) HV Live Work.

Non-access and Vicinity Work Shall be performed while always maintaining Exclusion Zones. If Exclusion Zones have the potential to be encroached, Work Shall be performed under access via an Access/Test Permit as per the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus* and these Rules.

All HV Live Work Shall be performed in accordance with the *EQL Standard for HV Live Work Management* and Approved procedures.

2.1 Work Authorities

Approval to commence Work is governed by a Switching Coordinator through the issue of the appropriate Work Approval in the form of either a:

(a) Non-Access Work Authority

(b) Vicinity Work Authority or

(c) HV Live Work Authority.

Figure 4 outlines the applicable Work categories and the associated Work Authority to be issued for each type of Work being performed.

Any of the three Work Authority documents Shall be issued to an Authority Holder. The Authority Holder is responsible for ensuring all Work is compliant with the requirements of the Work Authority and Shall be suitably authorised. Table 4 outlines the required Authority Holder authorisation for each Work Authority.

Table 4: Authority Holder Authorisations

Work Approval	Authority Holder Authorisation
Non-Access Work Authority	Access Permit Recipient Substation/Lines or Test Permit Recipient*
Vicinity Work Authority	Authorised Person
HV Live Work Authority	Any HV Live Work Authorisation

* Where electrical testing performed under a Non-Access Work Authority may produce Lethal Current, the Authority Holder Shall hold a Test Permit Recipient authorisation.

The Work Authority Shall clearly denote the following:

(d) unique identification number

(e) Electrical Apparatus subject to Work activity (asset ID or apparatus between asset IDs)

(f) worksite location/address

(g) type of Work being performed

(h) any Safety Controls in place

(i) protective devices with Auto-Reclose disabled (where applicable).

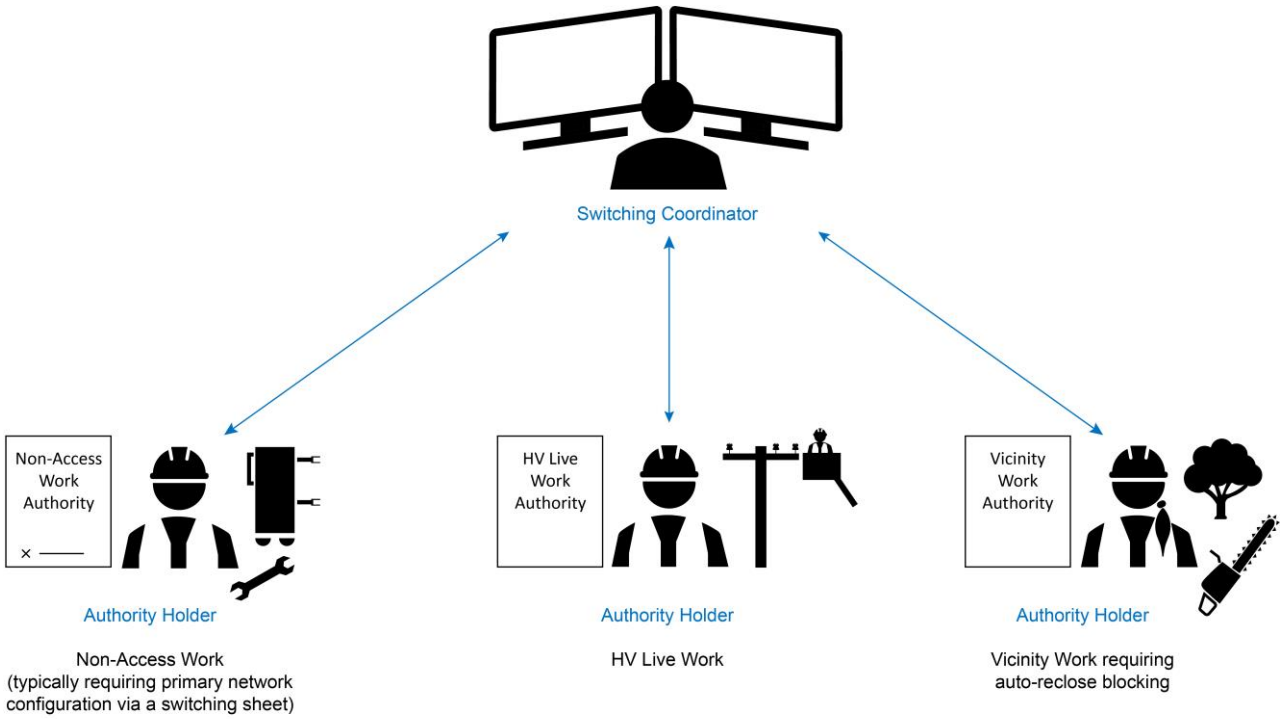


Figure 4: Work Categories & Associated Work Authority

2.2 Responsibilities of the Switching Coordinator

The Switching Coordinator is responsible for the issuing and cancelling of a Work Authority while dealing directly with the Authority Holder.

Prior to issuing a Work Authority, the Switching Coordinator Shall:

(a) ensure the correct Work Authority is applied for the type of Work being performed

(b) ensure all pre-control checks have been completed

(c) where Auto-Reclose is to be disabled, confirm the correct protective devices are identified then perform the following and record times for each:

i. remotely disable Auto-Reclose and tag the required protective devices; and

ii. where Remote Control functionality is not available, instruct a suitably authorised Switching Operator or Field Auto-Reclose Operator to manually disable Auto-Reclose and tag the required protective devices.

(d) record the name and contact number of the Authority Holder

(e) issue the Work Authority.

Following completion of the Work and surrender of the Work Authority, the Switching Coordinator Shall:

(f) cancel the surrendered Work Authority

(g) where Auto-Reclose has been disabled, perform the following and record times for each:

i. remotely remove tags and restore Auto-Reclose on the required protective devices; and

ii. where Remote Control functionality is not available, instruct a suitably authorised Switching Operator or Field Auto-Reclose Operator to remove tags from the required protective devices and manually restore Auto-Reclose.

2.3 Responsibilities of the Authority Holder

The Authority Holder is responsible for:

(a) receiving a Work Authority

(b) ensuring the Work Authority received is appropriate for the Work being performed by confirming all the details documented are correct

(c) supervising the electrical safety of the Work

(d) transferring a Work Authority

(e) surrendering a Work Authority.

The Authority Holder of a Non-Access Work Authority is also responsible for:

(f) applying identification means to ensure the Electrical Apparatus subject to Work is clearly identifiable

(g) completing the Abnormalities Section.

2.4 Responsibilities of the Workers

Workers have the responsibility to understand the limits of the worksite, the location of Nearby Exposed Live Electrical Apparatus and any Safety Controls in place for Safe Work.

Workers Shall comply with any safety directions given by the Authority Holder supervising the electrical safety of the Work.

2.5 Issue & Receipt of a Work Authority

Prior to any Work commencing, the Switching Coordinator Shall issue the appropriate Work Authority to a suitably authorised Authority Holder; refer to Table 4 for the required Authority Holder authorisation.

Prior to the issue and receipt of a Work Authority, the Switching Coordinator Shall deal directly with the Authority Holder to confirm:

(a) the unique Switching Sheet identifier and/or the Work Authority identifier are correct; and

(b) worksite location.

2.5.1 Receipt of a Non-Access Work Authority

The Authority Holder of a Non-Access Work Authority Shall acknowledge the issued document is fit for purpose by signing with the following declaration:

(a) the Electrical Apparatus subject to non-access Work is clearly defined and correct

(b) the Work details listed are accurate and the Safety Controls in place are adequate for the Work

(c) no access is granted to any HV Exposed Electrical Apparatus

(d) Exclusion Zones can be maintained at all times while performing the Work

(e) Nearby Exposed Live Electrical Apparatus have been identified

(f) the Authority Holder has responsibility for supervising the electrical safety of Workers performing Work under the Non-Access Work Authority

(g) no Safety Controls Shall be altered as specified on the Non-Access Work Authority.

Only the Authority Holder is required to sign a Non-Access Work Authority.

2.6 Transfer of a Work Authority

A Work Authority may be transferred to another Authority Holder; however, no more than one transfer is permitted.

The outgoing Authority Holder Shall confirm the incoming Authority Holder is suitably authorised and advise the Switching Coordinator of the name and contact number of the incoming Authority Holder as well as the time and date of the transfer.

The incoming Authority Holder Shall become familiar with the conditions of the Work and for a Non-Access Work authority, sign the document, making the same declaration outlined in *Section* 2.5. The incoming Authority Holder Shall advise all Workers of the change of Authority Holder.

2.7 Surrender & Cancellation of a Work Authority

At the completion of Work, the Authority Holder Shall advise the Switching Coordinator and surrender the Work Authority. The Switching Coordinator Shall cancel the surrendered Work Authority and record the time of cancellation.

When surrendering a Non-Access Work Authority, the Authority Holder is required to sign-off, acknowledging that Workers no longer have approval to Work on the stated apparatus. All pre-energisation checks Shall be confirmed completed and any abnormalities Shall be advised to the Switching Coordinator including any incomplete Work and whether the apparatus is unserviceable.

No sign-off is required for a Vicinity Work Authority or HV Live Work Authority. The Authority Holder is responsible for ensuring all Workers are informed and understand they no longer have approval to Work.

2.8 Non-Access Work

A Non-Access Work Authority will typically be used as an approval for non-access Work requiring primary network configuration via a Switching Sheet. Secondary Systems isolation may also be required to protect Workers from Electrical Hazards and prevent any inadvertent operation of in-service protective devices (refer to *Section* 9).

Common Work performed under a Non-Access Work Authority includes, but is not limited to:

(a) Circuit Breaker operating mechanism Work

(b) withdrawable Circuit Breaker truck maintenance

(c) protection maintenance and panel modifications

(d) oil sampling of ground or instrument transformers

(e) topping up SF_6 where the loss of gas pressure poses a hazard

(f) performing on-load tap-changer functional checks over the full tapping range

(g) Work on a metallic Cable sheath or over-sheath (refer to *Section* 4.3.4)

(h) Work on auxiliary control equipment of pole mounted switchgear where network security and reliability will be impacted

The Electrical Apparatus under non-access Work Shall be clearly identifiable. The Authority Holder receiving the Non-Access Work Authority is responsible for the application of the appropriate identification via the following means:

(i) attaching signage to define the Electrical Apparatus under non-access Work; or

(j) other means of identification appropriate for the worksite such as roping, switchgear panel covers or the display of the Non-Access Work Authority at the entry to a worksite.

2.8.1 Work Exempt from a Non-Access Work Authority

Non-Access Work does not apply to Withdrawable Equipment stored as spares in switchrooms or removed from switchrooms.

Risk assessed Work that can be performed safely without the need for Safety Controls via Switching and without impacting network security or reliability, does not require a Non-Access Work Authority. Work for which a Non-Access Work Authority is not applicable includes, but is not limited to:

(a) performing oil sampling of a Power Transformer

(b) topping up SF_6 in a non-switchable GIS chamber for which the rated lightning impulse withstand voltage can still be maintained with SF_6 at atmospheric pressure

(c) performing on-load tap-changer functional checks without exceeding statutory voltage limits.

For Work where a Non-Access Work Authority is not applicable, Workers Shall notify the relevant Control Centre of the Work prior to commencement.

2.8.2 Safety Controls – Isolation, De-energisation, De-loading

Although not making direct contact with HV Exposed Conductors, Safety Controls in the form of isolation, de-energisation or de-loading are implemented under a Non-Access Work Authority.

The following hierarchy of Safety Control preference applies to non-access Work:

1. Isolation
2. De-energisation
3. De-loading.

Where applicable, isolation Shall be implemented except where it cannot be reasonably achieved, in which case de-energisation of the Electrical Apparatus Shall be implemented.

Where certain scenarios require some Electrical Apparatus to remain Energised in order to perform the Work, de-loading may be used instead of isolation or de-energisation as an appropriate Safety Control for the Work (e.g. Work involving voltage regulators where mains Supply to the control box is required).

If there is doubt regarding the safety of the Work or if inadvertent energisation of the Electrical Apparatus poses a hazard, the Work Shall be performed under access via an Access/Test Permit.

The following tasks Shall only be performed under a Non-Access Work Authority when the Electrical Apparatus has been Isolated:

(a) Work on withdrawable Circuit Breaker trucks and Voltage Transformers (Withdrawable Equipment)

(b) Oil sampling of ground or instrument transformers (due to low oil volume)

(c) Topping up SF_6 where the loss of gas pressure poses a hazard (e.g. a Circuit Breaker)

(d) Work where inadvertent energisation would leave plant Energised without protection.

When an Isolation Point is created for non-access Work, a DNOB Shall be placed in a prominent position. Where possible the DNOB Shall be physically attached to the Isolation Point. Where it is impossible to physically attach a DNOB to an Isolation Point, a DNOB Shall be placed in a prominent position and as close as possible to the Isolation Point such that operating the device cannot be accomplished without encountering the DNOB.

The following tasks may be performed under a Non-Access Work Authority when the Electrical Apparatus has been De-energised or Isolated:

(e) Operation of Remotely Piloted Aircraft (drones) hanging flags on Conductors

(f) Work on a metallic Cable sheath or over-sheath of a HV Cable where the conditions of *Section* 4.3.4 are met.

2.8.3 Work on Withdrawable Equipment

Work on withdrawable Circuit Breaker trucks and Voltage Transformers (Withdrawable Equipment) can be performed under a Non-Access Work Authority provided the following requirements are met:

(a) the withdrawable device Shall be completely withdrawn (racked out); and

(b) all Shutters (Busbar and Cable/circuit) Shall be closed and locked with a DNOB placed.

Where specific switchgear design does not allow Shutters to be locked with DNOB placement, a DNOB Shall be placed and secured in a prominent position such that the Shutters cannot be accessed or disturbed without encountering the DNOB; this option Shall only be used when 2.8.3(b) cannot be met.

Following the completion of Work and prior to racking in any Withdrawable Equipment onto a switchboard, Workers Shall perform pre-energisation checks.

2.8.4 Electrical Testing Under a Non-Access Work Authority

Electrical testing that may produce Lethal Current is only permissible under a Non-Access Work Authority when performed on Withdrawable Equipment that has been completely withdrawn.

All electrical testing Shall be conducted in accordance with Approved procedures and all persons performing the testing Shall be competent in performing the test activities and in the use of the test equipment.

No other Work is permissible on or Near the Withdrawable Equipment during the setup and duration of the testing. Following the attachment of test leads, the apparatus to be tested Shall be

considered Live and all persons Shall stand clear until the testing has been completed and the Electrical Apparatus has been fully discharged.

Following the completion of testing, the person in charge of testing Shall ensure all Electrical Apparatus is fully discharged.

2.9 Vicinity & High Voltage Live Work

The following checks and Safety Controls Shall be performed prior to Work being performed under a Vicinity Work Authority or a HV Live Work Authority:

(a) clash detection check with other Work

(b) protection reach verification

(c) disable Auto-Reclose and tag the necessary protective devices.

2.9.1 Vicinity Work

A Vicinity Work Authority will be issued as an approval for Work performed outside of Exclusion Zones such as:

(a) vegetation management Work; and

(b) other Vicinity Work requiring the disabling of Auto-Reclose as a Safety Control.

For vegetation management performed by an external service provider, the Vicinity Work Authority is used as a written agreement made by the relevant Control Centre with the external work group, that the specified HV Electrical Apparatus will not be re-energised either automatically or by manual reclose.

A single Vicinity Work Authority document Shall only cover one work group on one or more feeders. If more than one work group is involved, additional Vicinity Work Authority documents Shall be used.

In the case of multiple feeders, the Outage Coordinator will determine the appropriate number of Vicinity Work Authority documents required based on an assessment of the potential impact to network security. If the network security risk is intolerable for Auto-Reclose to be disabled on all feeders for the duration of the entire work program, Auto-Reclose Should be enabled progressively as Work on each feeder is completed; this will require multiple Vicinity Work Authority documents.

An Authority Holder is responsible for supervising the electrical safety of the Work and thus cannot receive multiple Vicinity Work Authority documents intended for multiple work groups.

2.9.2 High Voltage Live Work

HV Live Work is performed in accordance with the *EQL Standard for HV Live Work Management* and a HV Live Work Authority is issued as an approval to perform such Work on the network.

A HV Live Work Authority will be issued for both:

(a) standalone HV Live Work (e.g. a pole replacement); and

(b) vegetation management performed via HV Live Work.

HV Live Work methods used for breaking and making HV bridges are considered Switching operations and Shall be performed under the direction of a Switching Sheet with no requirement for a HV Live Work Authority.

Any commissioning or decommissioning of Electrical Apparatus via HV Live Work Shall be performed in accordance with Approved commissioning and decommissioning procedures.

2.9.3 Safety Control – Disable Auto-Reclose

The disabling of Auto-Reclose (also referred to as reclose blocking) on protective devices Shall be implemented as a Safety Control for all HV Live Work and all Work performed under a Vicinity Work Authority.

All types of protective devices that can trip and automatically reclose Shall be considered when coordinating Auto-Reclose disabling, including Circuit Breakers, ACRs and fuse protectors.

Pulling the protection lever of fuse protectors disables all protection. Therefore, the upstream protective device must be tagged and have Auto-Reclose disabled. This requirement applies to all in-line fuse applications (e.g. MDOs), as these devices may not grade with upstream protection.

Auto-changeover schemes Shall also be considered when coordinating Auto-Reclose disabling.

The Applicant is responsible for nominating the worksite. The Switching Coordinator is responsible for confirming that Auto-Reclose is disabled on the correct protective devices at the commencement of Work for the nominated worksite.

The protective devices with Auto-Reclose disabled Shall be tagged and listed on the Work Approval.

2.9.3.1 Protective Devices Requiring Disabling

For normal network configurations, Auto-Reclose Shall be disabled on the first protective device upstream from the worksite. This Shall apply towards all directions from which the worksite is Energised.

Under abnormal network configurations, the upstream protective devices from an abnormally fed worksite may not grade as desired. For an abnormally fed worksite, all protective devices up to and including the first normally fed protective device Shall have Auto-Reclose disabled. This is not required where protection settings are altered to ensure the necessary protection grading.

Figure 5 shows various network configurations and the protective device treatment for each.

Figure 5 (a) depicts a normal network configuration for which only the first device upstream from the worksite has Auto-Reclose disabled.

Figure 5 (b) depicts an abnormal network configuration for which all protective devices up to and including the first normally fed protective device have Auto-Reclose disabled.

Figure 5 (c) depicts a normal network configuration for which the worksite is Energised from two sources of Supply; here the protective devices in each direction from the worksite have Auto-Reclose disabled.

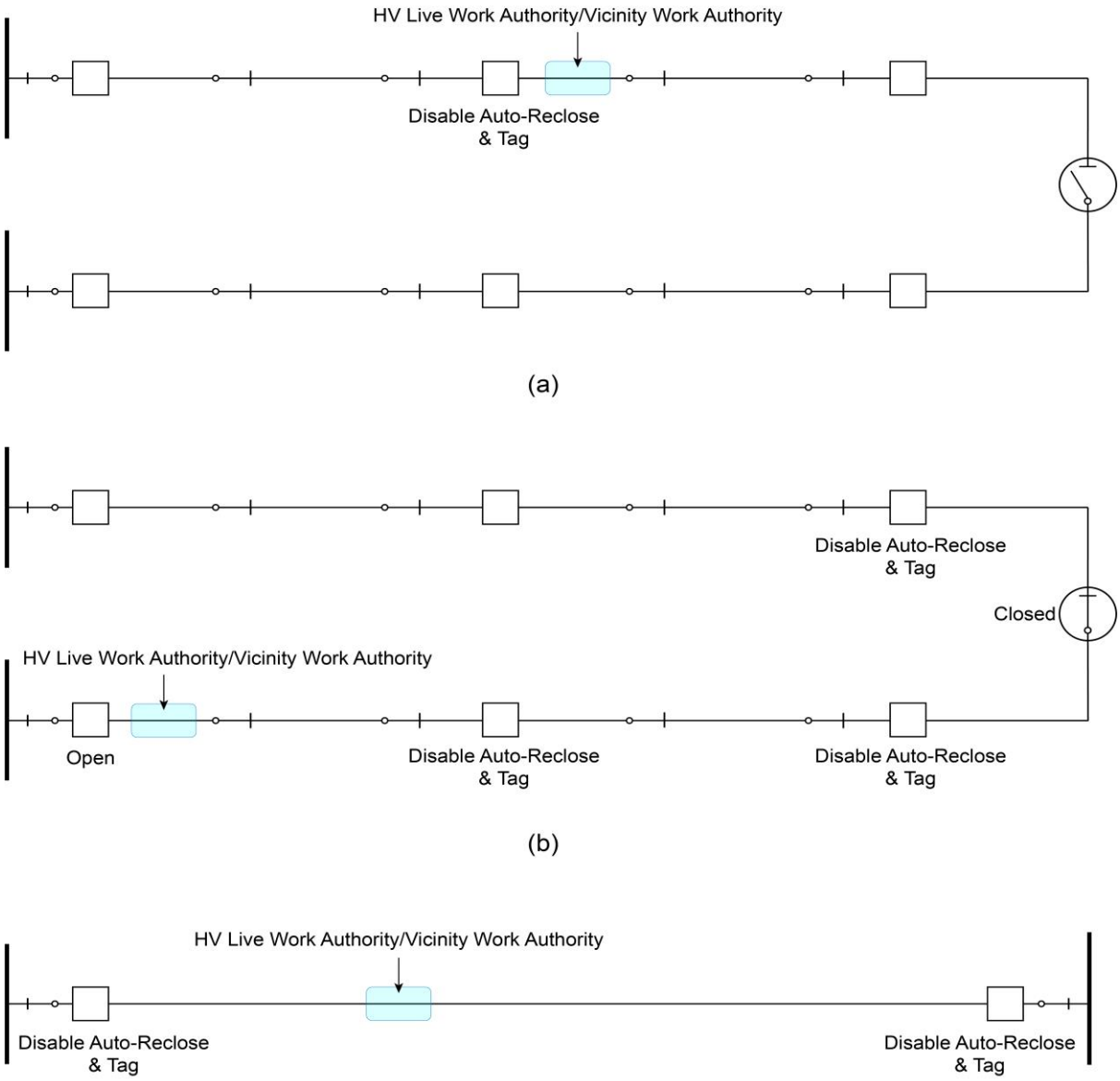


Figure 5: Protective Devices Requiring Auto-Reclose to be Disabled & Tagged

Note: If the requested protective device has no protection settings, has a protection abnormal alarm or is out of service, i.e. the device is not active, the next upstream protective device Shall have Auto-Reclose disabled. Furthermore, devices with known grading issues or a recent history of mal-operation Shall be regarded as not active and the next upstream protective device Shall have Auto-Reclose disabled. Further advice Should be sought from the Protection Engineering Department or Network Operations Engineers in these scenarios to confirm adequate Fault Levels and clearing times.

Protective devices Shall be operational in the circuit subject to Work activity and capable of detecting and clearing Faults at the worksite whilst being set to not reclose and re-energise the apparatus where inadvertent contact has been made.

Where protective devices have the facility to be set to faster trip settings (Live Line Work Clearance mode), these settings Should be applied. The device will be set to prevent reclosing whilst also offering quicker protection operation.

2.9.3.2 Manual Disabling/Restoring

Switching Operators or Field Auto-Reclose Operators Shall manually disable Auto-Reclose on all non-telecontrolled devices (including telecontrolled devices with a communications link failure) as requested for the Work.

The manual disabling and restoring of Auto-Reclose either on the overhead network or in a substation, is considered a Switching operation and Shall be carried out under the direction of the responsible Switching Coordinator.

If Auto-Reclose is to be manually disabled/restored, the Switching Operator or Field Auto-Reclose Operator will be issued with a copy of either the authorised Switching Sheet or the authorised Work Approval. All disable and restore times Shall be recorded on both the field copy and Switching Coordinator's copy of the Switching Sheet or Work Approval.

Following a disable operation, the Switching Operator or Field Auto-Reclose Operator Shall tag the device to prevent premature restoring of Auto-Reclose functionality while Work is still being performed.

2.9.4 Treatment of Generation

In addition to disabling Auto-Reclose on the first protective device upstream from the worksite, Work Clearance settings enabling faster protection operation Shall also be applied where installed. This applies to all directions of network Supply for meshed configurations.

Work Clearance settings Shall also be applied on Ergon Energy Network/Energex owned protective devices dedicated to generation sites where settings are installed and can be activated remotely.

Where a generation system is identified as non-compliant with the relevant standards, including protection system performance, it Shall be Isolated from the network until the non-compliance is rectified (non-compliant systems Shall be identified by a system note on the relevant Distribution Management System).

Section 3

WORK ON OR NEAR EXPOSED HIGH VOLTAGE

3 WORK ON OR NEAR EXPOSED HIGH VOLTAGE

High Voltage Exposed Electrical Apparatus Shall be regarded as Live until it has been Isolated, proved De-energised by Approved means, Earthed and short-circuited.

Before commencing Work other than HV Live Work on or Near HV Exposed Electrical Apparatus, one of the following types of Permits Shall be in receipt:

(a) an Access Permit for Work on or Near HV Electrical Apparatus; or

(b) a Test Permit for testing where lethal currents are involved.

All persons entering the work area are to sign on the relevant Permit, declaring they understand the limits of access, the safety precautions in place and the location of any Nearby Live Conductors. All persons Shall be authorised unless they are an Instructed Person under the supervision of an Authorised Person.

3.1 The Work Area Becoming Live

Despite working under access conditions with the necessary safety precautions in place, lethal hazards are present in the event the work area becomes Live and Workers are at risk of becoming a path for Lethal Current flow. To prevent this, Workers Shall avoid contact between two conductive parts that are not electrically bonded together (two different potentials). Where possible, Workers Shall:

(a) avoid uninsulated contact with Conductors while working from the ground

(b) not Work with an open point between Earths that are not bonded to a common Earth Connection point

(c) not Work uninsulated from or Near conductive structures (such as concrete poles) and their conductive fittings unless working under equipotential conditions*.

* Equipotential conditions are met when a structure and all conductive parts attached to that structure are bonded to the same Earth Connection point that the phase Conductors are bonded to.

Workers must understand that earthing and short-circuiting in combination with the operation of protective devices will not always prevent harm to Workers in the event the work area inadvertently becomes Live. The protection system performance is influenced by a range of factors including the quality of Earth Connections, the reliability of protective devices and the strength of the electrical source.

3.2 Access Work Hazards

It is important to be aware of and understand the hazards encountered when working on or Near the Commissioned network. It is equally important to understand how these hazards can be managed to ensure Safe Work.

Some access Work hazards encountered include but are not limited to:

(a) inadvertent energisation:

i. back energisation from generation sources

ii. contact with Nearby Exposed Conductors

iii. isolation breach.

(b) induction:

i. magnetic induction caused by Fault or load current in Nearby Conductors

ii. electrostatic induction caused by voltage on Nearby Conductors and atmospheric conditions.

(c) transferred earth voltages from network Faults

(d) open points in the work area

(e) stored energy in capacitors and Cables

(f) misidentification of apparatus

(g) lightning.

3.2.1 Nearby Exposed Conductor Hazards

Where Work has a reasonable possibility of encroachment into the Exclusion Zones of Nearby Exposed Live Conductors above, below or adjacent to Electrical Apparatus to be worked on, that Nearby Electrical Apparatus Shall also be placed under access to eliminate the hazard.

Where there is doubt surrounding possible contact with Nearby Exposed Live Conductors, the Nearby Electrical Apparatus Shall be placed under access.

3.2.1.1 Work Displacing Conductors Above Exposed Conductors

When Work above Nearby Exposed Live Conductors has the potential for uncontrolled Conductor movement (causing inadvertent contact), the Nearby Electrical Apparatus beneath the work area Shall be placed under access unless a procedure is available to manage the risk. Such procedures Shall be risk assessed and Approved by an appropriately experienced RPEQ as well as the relevant level of Manager where required under the risk management framework. Auto-Reclose on Electrical Apparatus beneath the work area Shall be disabled and protective devices tagged as part of any such approval.

3.2.1.2 Work Displacing Conductors Beneath Exposed Conductors

When Work beneath Exposed Live Conductors involves Conductor displacement but is unlikely to come within the Exclusion Zone of the Exposed Conductors above, the Work may be performed while effectively managing the risk of inadvertent contact using control measures detailed in Approved procedures.

Auto-Reclose on Electrical Apparatus above the work area Shall be disabled and protective devices tagged for Work.

3.2.2 Induction Hazards

It is important that Workers understand and manage the various induction hazards present when working under certain access conditions. Induction creates a voltage on Nearby metallic objects and Conductors in the work area.

Workers Shall not become a path to earth or a series path across an open point for current flow.

The Recipient Shall inform all Workers of the induction hazards present at the work area and manage the hazards with Working Earths and earthing continuity.

3.2.2.1 Magnetic Induction

The magnetic fields from Fault or load current flowing in Nearby circuits can induce hazardous voltages on Conductors in the work area (Figure 6).

With a circuit under access Earthed and short-circuited at two or more points, the induced voltage will drive a circulating current around any closed loops (Figure 7). The magnitude of this circulating current will be dependent on the induced voltage and the impedance of the closed loop.

Common sources of magnetic induction include Nearby circuits on the same structure or other structures in proximity, circuit crossings and buried Cable circuits. These sources may not be obvious as they may not be visible from the work area.

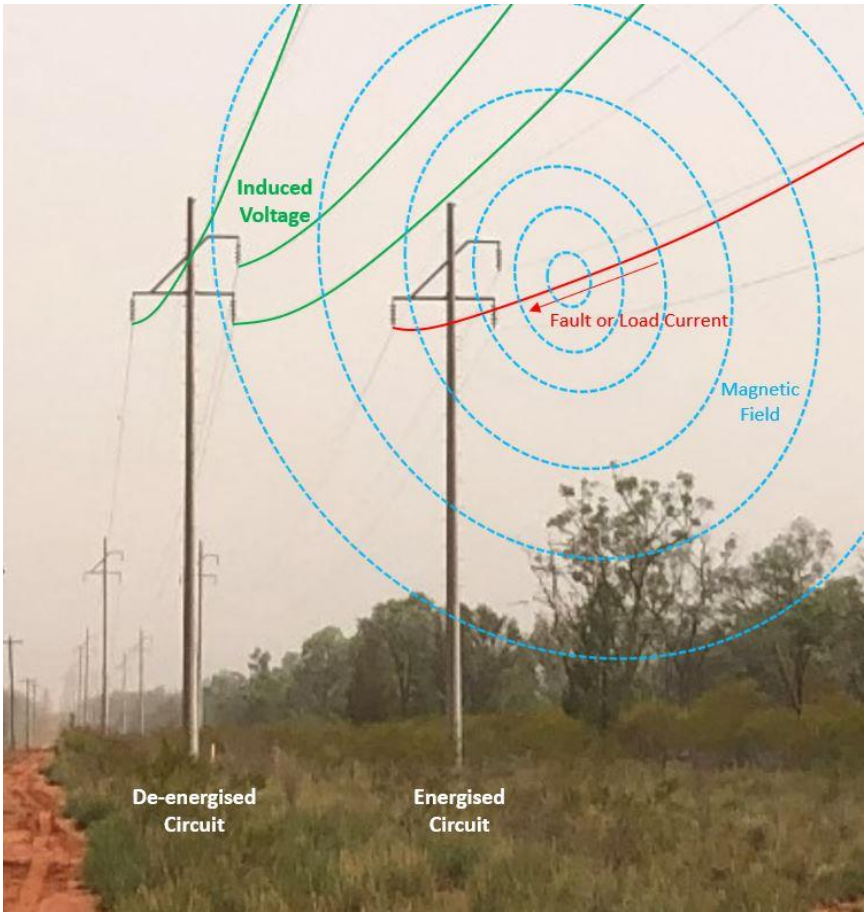


Figure 6: Magnetic Induction Hazard from Current in Nearby HV Circuit

The voltage induced at the work area is dependent on the following factors:

(a) magnitude of the current in the Nearby circuit

(b) d: distance to current carrying Conductors (induction reduces with increased separation)

(c) L: length of parallel run (how far the circuit under access runs parallel to the Nearby circuit)

(d) position of Earths.

The induction hazard Shall be managed by the following prioritised control measures:

1. De-energise Nearby circuits posing an induction hazard.
2. Minimise the Isolated area and control the induction hazard by applying Earths as close as possible on both sides of the work area and maintain earthing continuity at open points.

Figure 7 and Figure 8 illustrate how the placement of Earths at the work area can reduce the induced voltage encountered under magnetic induction conditions.

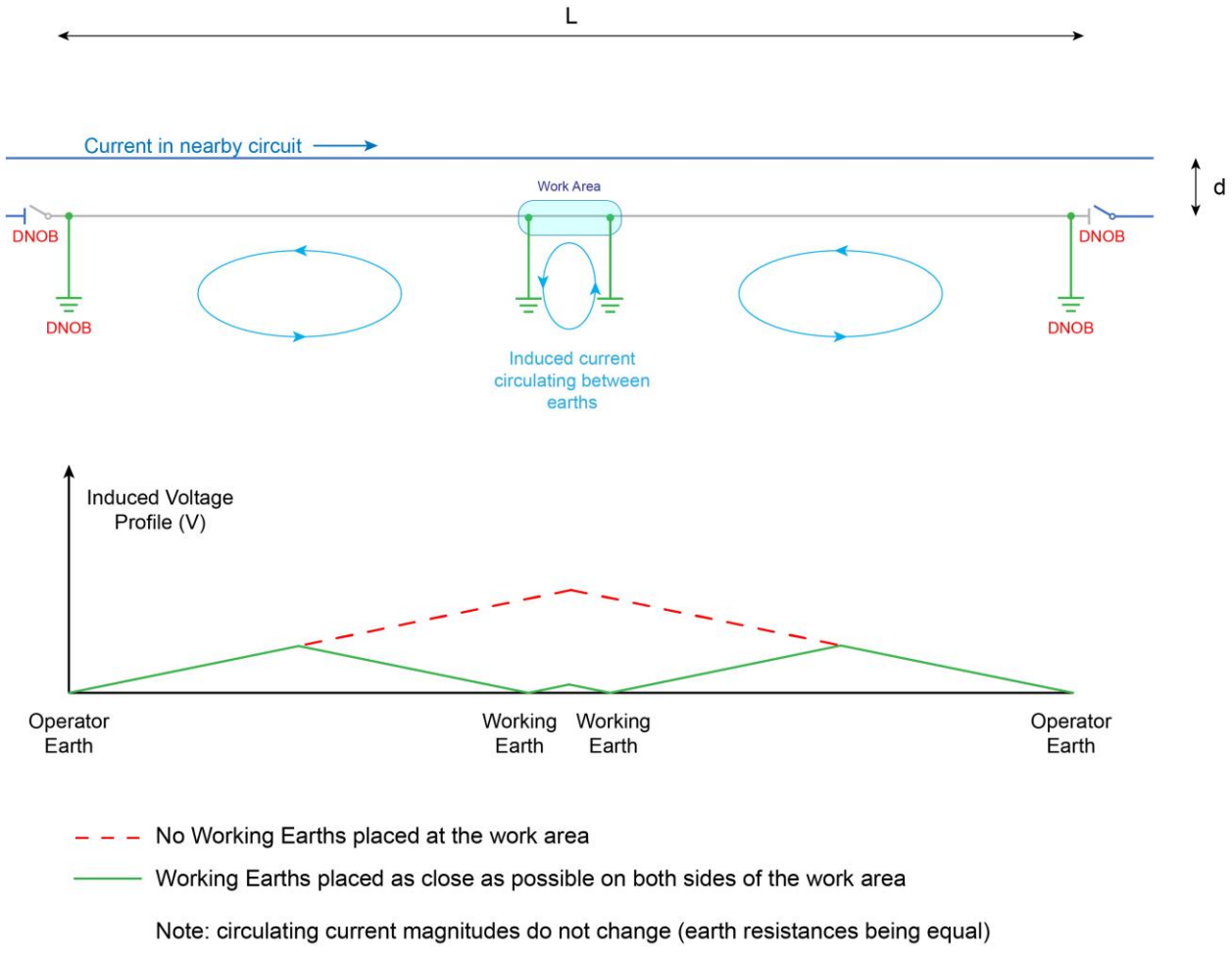


Figure 7: Magnetic Induction Hazard: Induced Voltage Profiles from Fault on Nearby HV Circuit

Continuity of earthing Shall be confirmed and maintained for the duration of Work and no Worker Shall contact two different potentials at the same time. Refer to *Section* 3.5.4 for the requirements to manage open points created under access.

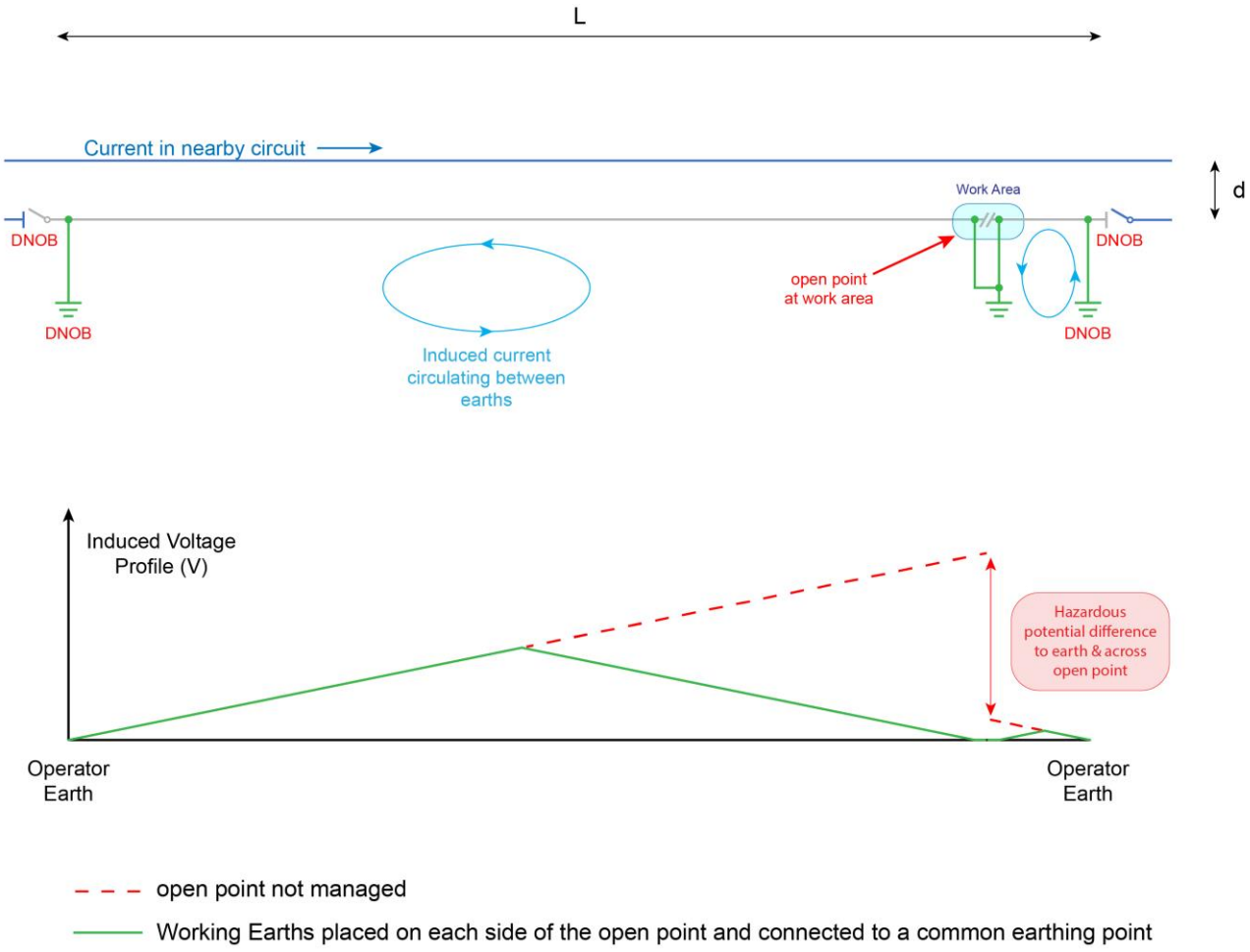


Figure 8: Magnetic Induction Hazard: Induced Voltage Profiles Across an Open Point

3.2.2.2 Electrostatic Induction

Electrostatic induction describes a statically induced voltage on metallic objects and the Conductors placed under access resulting from:

(a) capacitive coupling from voltage on Nearby Conductors; and

(b) atmospheric conditions such as cloud movement or wind blowing over Conductors.

These induction hazards can be managed by applying Earths as close as possible to the work area.

3.2.3 Earth Potential Rise & Transferred Earth Voltage Hazards

An Earth Potential Rise (EPR) is a potential rise of an earthing system relative to Remote Earth, caused by current flowing through an earth resistance.

A transferred earth voltage is an earthing system voltage transferred by means of a connected Conductor into an area with a different earth voltage such that:

(a) an EPR is transferred into an area with low or no potential rise relative to Remote Earth (0 V); or

(b) a Remote Earth reference (0 V) is transferred into an area experiencing an EPR.

In both cases, the transferred earth voltage results in a potential difference between the Conductors and earth at the work area.

Earth voltages can be transferred both out of, and into, substations via Earthed Conductors, including Cable sheaths. A Substation Earth Grid that rises in potential while supplying a network earth Fault creates two possible occurrences of a transferred earth voltage at the work area:

(c) Conductors with Operator Earths connected to the Substation Earth Grid are worked on outside of the substation – Figure 9 (a); and

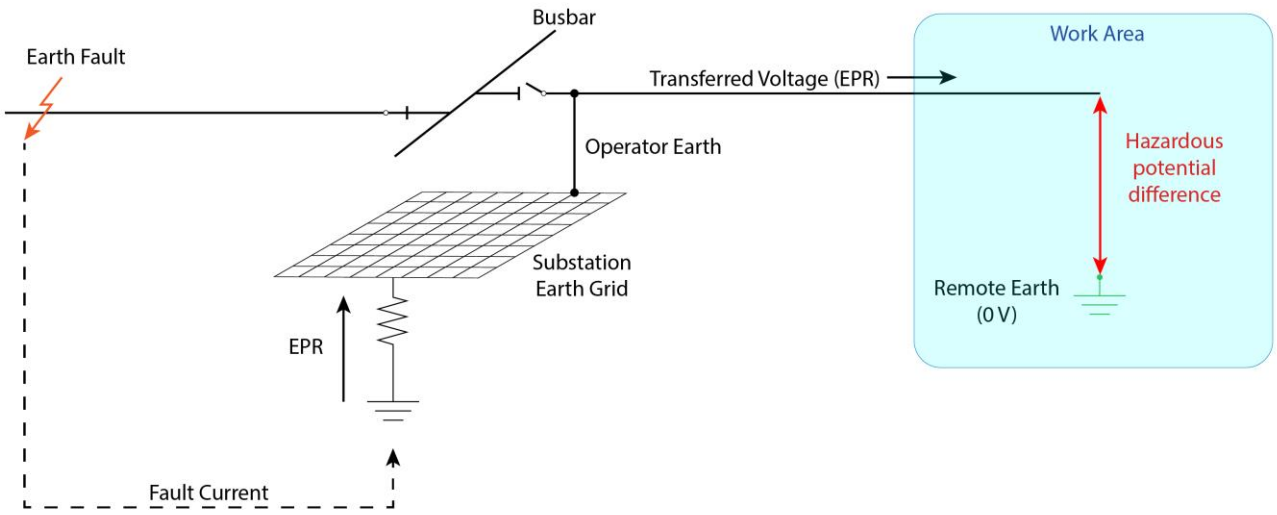
(d) Conductors with Operator Earths connected to an Earth Connection remote to the substation are worked on inside the substation – Figure 9 (b).

In both scenarios the transferred earth voltage exposes Workers to possible differences in potential such that the Workers:

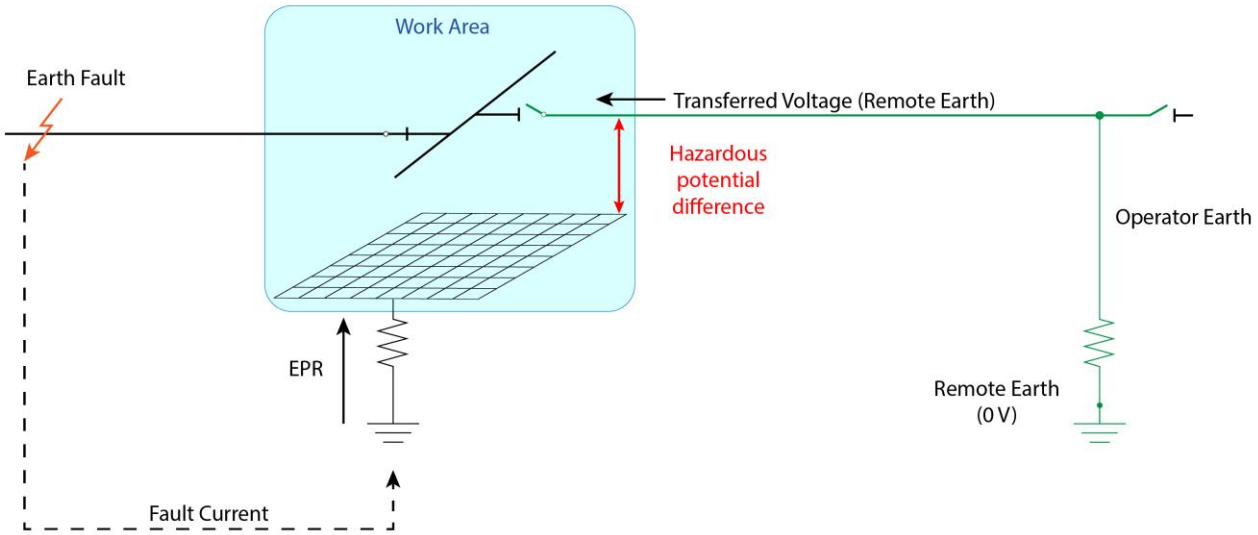
(e) hands are at the Transferred Voltage and feet are at Remote Earth; or

(f) hands are across an open point (such as a Cable joint) such that one hand is at the Transferred Voltage and the other hand is at Remote Earth; or

(g) feet rise with local EPR and hands are at Remote Earth.



(a)



(b)

Figure 9: Transferred Earth Voltage Scenarios Involving Substation EPR

3.2.3.1 Work Inside a Substation

The hazard of a transferred earth voltage into a substation work area can be managed by ensuring all Conductors to be worked on are Earthed to the Substation Earth Grid; this will minimise the difference in potential between a Worker's hands and feet. Where possible, it is preferable not to place Operator Earths outside of the substation.

3.2.3.2 Work Outside a Substation

The hazard of a transferred earth voltage from a substation to a remote work area Shall be managed with the placement of Earths at the work area (where practicable) in conjunction with the conditions outlined in *Section* 3.1.

While working uninsulated from the ground, hazard management Shall be in accordance with Work specific Approved procedures where practicable and available. These procedures Shall consider the use of controls such as equipotential bonding or insulation where practicable and by minimising uninsulated contact with Earthed Conductors where these control measures cannot be implemented.

3.2.4 Misidentification of Apparatus

Accessing any Cable connected plant can be hazardous when Cables are not visibly traceable from the Isolation and Earthing Points to the terminations.

It is possible for access to be granted to Energised plant where incorrect labelling is present.

Before any Work commences, the Recipient Shall test, prove De-energised to safeguard against incorrect labelling.

3.2.5 Lightning

When the time interval between seeing a lightning flash and hearing the corresponding thunder is less than 30 seconds (10 km distance), all Work Shall be suspended and Workers are to take shelter in a Safe place.

Do not recommence Work on the network likely to be affected by lightning until 30 minutes after the last thunder is heard or all storm cells are more than 10 km away.

3.3 Electrical Supervision at the Work Area

The Recipient of an Access/Test Permit is responsible for supervising electrical safety at the work area.

Prior to Work commencing, the Recipient Shall ensure all site-specific Electrical Hazards and associated control measures are documented and understood by all members of the work group.

Where access involves a large work area, a single Access Permit may be used, provided the Recipient can adequately Supervise the electrical safety throughout the work area.

Where the Recipient cannot adequately Supervise the Work across a large work area, additional Permits and Recipients Shall be used.

3.4 Isolation

Isolation is paramount and is a primary control measure for managing electrical safety for access Work on or Near the Commissioned network.

All work areas to be placed under access Shall be Isolated from the HV system and known LV sources of Supply capable of back energising the HV system. Isolation Shall extend to connected mobile generation.

Electrical Apparatus Shall be Isolated before the application of earthing, unless the design of Electrical Apparatus does not allow this to occur. In this situation Approved procedures Shall be used.

For HV Electrical Apparatus to be deemed adequately Isolated via an air gap (broken bridges for example), it Shall be separated from Exposed Live Conductors by at least the minimum fixed Clearances stated in Table 5.

Note: This clause does not apply to commercially manufactured switchgear, which to be suitable for use as an Isolation Point must meet the safety requirements specified for Disconnectors in the relevant Australian Standards.

Table 5: Minimum Fixed Clearances

Nominal System Voltage	Minimum Fixed Clearance (mm)
HV up to 11 kV	320
22 kV	320
33 kV	380
66 kV	630
110 kV	1100
132 kV	1300
220 kV	2100

Caution: when performing certain testing, typical isolation distances may not be adequate for the applied test voltages and insulating medium. For example, HV withstand testing of switchgear can apply up to 1.7 times the nominal system voltage for which the values stated in Table 5 and the declared isolation performance of commercially manufactured switchgear may not be suitable. In such circumstances, increased isolation distances are required.

3.4.1 Approved Isolation Points

Only devices Approved by Asset Standards Shall be used as an Isolation Point.

Vacuum switched devices Shall not be used as an Isolation Point (for example, a vacuum switched ACR, Circuit Breaker or fuse saver). The presence of a vacuum leak will eventually lead to flashover across the open contacts and thus re-energisation of the work area. As the integrity of the pressure within vacuum interrupters cannot be practicably assessed, devices using vacuum interrupters as a physical break cannot be used as an Isolation Point.

The following are commonly used HV Isolation Points on the network:

(a) Disconnectors with and without aids (also referred to as Isolators/Air-Break Switches)

(b) Disconnect Links

(c) Expulsion Drop-Out Fuses

(d) Gas Insulated Load Break Switches

(e) Gas Insulated Sectionalisers/Load Transfer Switches

(f) Live Line Leads

(g) Open/Broken Bridges

(h) Ring Main Unit Switch-Disconnectors (also referred to as Isolators)

(i) Ring Main Unit Switch-Fuses

(j) Metal Enclosed Switchgear Disconnectors (Isolators)

(k) Busbar/Cable Shutters with Circuit Breaker truck withdrawn (racked out).

Devices with insufficient oil level or gas pressure (if applicable) present Shall not be switched to create an Isolation Point, however, such devices may be suitable for isolation once in the isolated position; refer to the manufacturer's manual for lightning impulse withstand voltage ratings without the insulation medium or seek engineering advice.

3.4.2 Temporarily Installed Isolation Points

In addition to the above, the following temporary installations are suitable for use as Isolation Points:

(a) Temporary in-line shackle: two insulators connected in series installed in a span of overhead Conductor (also referred to as 'flying shackle')

(b) Temporary in-line link: a Disconnect Link in parallel with a tensioned insulator

(c) Temporary crossarm mounted Link

(d) Temporary air-break Disconnector/load break switch

(e) Temporary in-line links and in-line shackles are installed in a span of overhead Conductor.

Where Conductors will be displaced from attachment points during the Work (replacing poles, crossarms or insulators for example), the following conditions Shall apply (Figure 10):

(f) temporary in-line isolation devices Shall not be installed in the same span as the Conductor displacement; and

(g) a robust conductor attachment point Shall be maintained between the work area and the temporary in-line isolation devices.

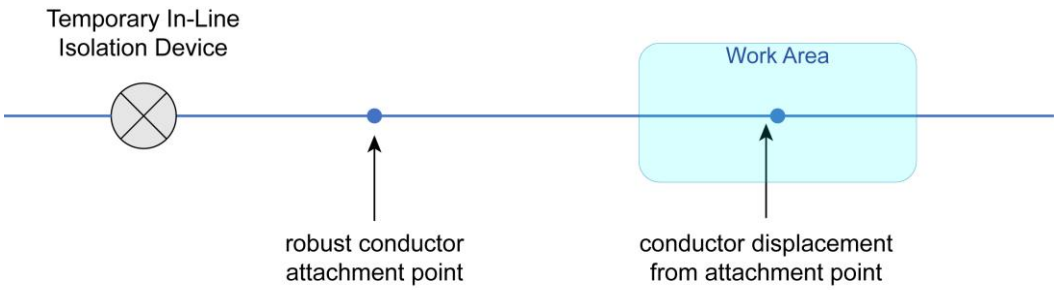


Figure 10: Use of Temporary In-Line Isolation Device with Conductor Displacement

3.4.3 Isolation Security

Any Switching leading to the issue of an Access/Test Permit or to the restoration of the network following cancellation of all Access/Test Permits Shall be carried out in accordance with a Switching Sheet.

All Isolation Points associated with an Access/Test Permit Shall be clearly identified by the placement of a DNOB in a prominent position. Where possible the DNOB Shall be physically attached to the Isolation Point. Where it is impossible to physically attach a DNOB to an Isolation Point, a DNOB Shall be placed in a prominent position and as close as possible to the Isolation Point such that operating the device cannot be accomplished without encountering the DNOB.

Where it is possible, the Electrical Apparatus used for isolation purposes Shall be secured in the open position by locking or other Approved means. Where possible, primary control circuits Shall be electrically Isolated through use of a dedicated isolating switch/Circuit Breaker, or the removal of links/fuses.

Isolation Shall extend to Remote Controls associated with Isolation Points, and any Remote Control associated with Electrical Apparatus being worked on Shall be disabled.

Where the integrity of the Isolation Point could be jeopardised, all Work Shall immediately cease. The Access/Test Permit Shall be suspended or surrendered and cancelled and Work Shall not continue until approval is provided by the Switching Coordinator.

When an Isolation Point has been created to prevent an LV source of Supply back energising the HV system and Approved Work is taking place on the LV Isolation Point, the integrity of that HV and LV isolation Shall be maintained by an Approved procedure.

If Isolation Points change during the course of Work, under an Access/Test Permit, then prior to Isolation Points being altered, all affected Access/Test Permits Shall be surrendered and cancelled and new Access/Test Permits issued reflecting the new Isolation Points.

The Switching Operator Shall confirm the successful isolation status of a device immediately after the Switching operation. For Isolation Points in open air the effectiveness of isolation can be confirmed by visual inspection.

3.4.4 LV Isolation of Distribution Transformers for HV Work

The work area to be placed under access Shall be Isolated from all known sources of LV Supply capable of back energising the HV system such that:

(a) for transformers with a known LV source of Supply, the LV Shall be Isolated; and

(b) for transformers without a known LV source of Supply, LV isolation is not required*.

* LV Isolation Shall always be performed for Work at a Distribution Transformer.

For the purpose of LV Isolation, examples of known LV sources of Supply include network ties and mobile generation.

3.4.5 Distribution Transformers

When performing Work at any Distribution Transformer, the LV Shall be Isolated, irrespective of any known LV sources of Supply or not. The intent of this is to eliminate any possible backfeed whilst under HV access.

All Distribution Transformers at which Work is to be performed Shall be noted on the Application and associated Permits.

3.4.6 Voltage Transformers Associated with Pole Mounted Switchgear

Where a Voltage Transformer associated with pole mounted switchgear is within the Isolated area, there is no requirement for it to be Isolated as it is not considered as a source of backfeed.

3.4.7 Combination Isolation/Earthing

Some types of switchgear incorporate isolation and earthing in a combination three-position switch or have configurations that require physical removal of a DNOB from an Isolation Point to place an Operator Earth. In these situations, only one DNOB is required, and it Shall be placed and removed as operations on a Switching Sheet for the full sequence of Switching.

3.5 Earthing & Short-Circuiting of HV Electrical Apparatus

3.5.1 General

The purpose of earthing and short-circuiting is to:

(a) enable protection equipment to operate and to limit the rise in potential difference at the work area, in the event that Supply is inadvertently restored; and

(b) safely discharge induced or residual voltage.

Earthing and short-circuiting of Electrical Apparatus to be worked on or Near is achieved by the application of two categories of earthing and short-circuiting equipment:

(c) Operator Earths are applied as a requirement for the issue of an Access/Test Permit, to ensure the Electrical Apparatus is Earthed; and

(d) Working Earths are applied additional to Operator Earths following the issue of an Access/Test Permit.

3.5.1.1 Hierarchy of Earthing Device & Connection

To limit the potential rise resulting from and to combat body exposure to, hazardous current, the use of Earth Connections with the least resistance available is critical.

The following hierarchy of earthing device and connection preference Should be followed when placing any earth:

1. Earthing Switch*
2. Portable Earth connected to a PEP – Substation Earth Grid or CMEN**
3. Portable Earth connected to a PEP – HV Earth of a Separate Earthing System
4. Portable Earth connected to a Temporary Earth Electrode***

* There may be scenarios where an Earthing Switch is connected to a PEP in a Separate Earthing System (an RMU for example). In such cases a more effective earth may be achievable via use of portable Earths connected to a Substation Earth Grid or CMEN.

** The earthing system Shall be verified as a CMEN system by confirming the Distribution Transformer supplying the associated LV network is common Earthed. Furthermore, if connecting to the LV neutral Conductor, it Shall be identified at the site where Earths are to be applied via electrical testing of the LV network with an Approved test device.

*** Temporary earth electrodes Shall not be used where PEPs are available. At least one Operator Earth between the HV system and the work area Should be connected to a PEP. Where this cannot be achieved, consideration Should be given to extending the area to be Isolated to incorporate a PEP, however, this Should only be considered where it does not introduce new hazards such as excessive travel.

Approved temporary earth electrodes Shall be cleaned of oxidation prior to each use and driven 600 mm deep, avoiding loose soil where possible.

Note: Shallow installation of the temporary earth electrode is unlikely to achieve a low resistance.

During the discharging and earthing operation, special precautions Shall be taken to mitigate the impact of step and touch voltages such that no person other than the one applying the earth Shall approach within 6 m of any temporary earth electrode or its connections, ladders, poles or structures from which an earthing device is applied.

All earthing devices are to be tested, Approved for use and rated to the prospective Fault Level at the work area.

More than one set of PEDs may be required to achieve the Fault Level rating at the work area.

A PED Shall be withdrawn from service, tagged out of service and sent for testing if:

(a) the test date has expired

(b) there is any mechanical damage

(c) it has been Exposed to any Fault current.

Where PEDs are already in place from previous Work, the test date and condition Shall be checked and if out of date or not fit for service, the Switching Coordinator Shall be contacted to have them replaced or removed.

3.5.2 Earthing & Short-Circuiting Process

3.5.2.1 Qualifications

Application of Earths is considered electrical Work and Shall only be performed by persons with an appropriate electrical licence. Apprentices may apply Earths in accordance with Approved provisions.

3.5.2.2 Testing to Prove De-energised

Where possible or practicable (providing this does not introduce a hazardous situation) HV Electrical Apparatus Shall be proved De-energised at the proposed point of application of Earths.

All phases Shall be proved De-energised using an Approved voltage detector before Earths are applied. Correct operation of the voltage detector Shall be verified immediately before and after proving De-energised. Note that the voltage detector may indicate the presence of voltage due to induction. If voltage is detected, cease Work immediately and contact the Switching Coordinator.

Where the design of Electrical Apparatus does not allow the testing to prove De-energised, then Electrical Apparatus with Fault make earthing capability Shall be used after first checking other voltage or mechanical indicating devices that the Electrical Apparatus is De-energised. Where both voltage and mechanical indicating devices are available, both Shall be checked that they indicate the Electrical Apparatus is De-energised prior to earthing. Where these requirements are unable to be met, procedures Approved by an appropriately qualified RPEQ Shall be followed.

3.5.2.3 Application of Earths

Work on HV Exposed Electrical Apparatus Shall be carried out between Earths where Reasonably Practicable.

Earths Shall be applied as close as practicable to any persons required to Work on the Isolated system so that the Earths, where possible, are within sight of such persons.

Earths Shall be applied immediately after proving De-energised and all De-energised phases Shall have Earths applied.

Tails of portable Earths Shall be connected to the Earth Connection before application to the Electrical Apparatus. When removing portable Earths, tails of the portable Earths Shall be the last connection removed.

Where practicable, the Conductor surfaces where the portable Earths are to be connected Shall be cleaned prior to connection. The removal of oxidation layers will lower resistance and improve the effectiveness of the earth. This will often be practicable for the tail connection but impracticable for connection to overhead mains.

Where a set of single-phase PEDs is installed at the work area, all phases of the PEDs Shall be connected individually to a common Earthing Point.

Where an Earthing Switch is available, it is preferable to close the Earthing Switch prior to applying or removing portable Earths. This is particularly relevant to discharging stored energy in Cables prior to manually applying Earths.

PEDs Should not be handled during the application or removal from HV Conductors. Where this cannot be avoided, appropriate insulating gloves Shall be worn during the application and removal process. Any related Approved procedure Shall contain this control measure.

3.5.3 Operator Earths

Operator Earths Shall be connected to HV Conductors at locations that Shall enable the work area to be De-energised by the operation of a relevant HV protection scheme in the event of inadvertent energisation through an Isolation Point. To achieve this, Operator Earths Shall be placed between all HV Isolation Points and the work area such that no open points or operable protective devices exist between a HV Isolation Point and Operator Earths (electrically adjacent).

Where these Rules specify, Operator Earths Shall also be connected to HV Conductors at locations that will limit the rise in potential difference at the work area in the event of back energisation from known LV sources of Supply.

3.5.3.1 Earthing Continuity

Prior to the issue of an Access/Test Permit, all of the following requirements Shall be met:

(a) Operator Earths Shall be applied to ensure all Electrical Apparatus in the proposed work area is Earthed

(b) Electrical Apparatus Shall not be Earthed through fuses or Circuit Breakers that are able to open/trip in the event of inadvertent energisation

(c) if using a Circuit Breaker in the closed position to earth Electrical Apparatus, the Circuit Breaker Shall be made Inoperable with a DNOB placed*

(d) A Remote Controlled Earth Switch used as an Operator Earth Shall have Remote Controls isolated / disabled if applicable.

* Typically, only withdrawable Circuit Breakers with Integral Earthing facilities (for example Reyrolle LMT) and fixed pattern switchgear with a combination Circuit Breaker and three-position Disconnector/Earthing Switch in series (for example Siemens 8DA10) can be made Inoperable for the purpose of earthing.

Care must be taken during Switching where open points are created in the proposed work area for de-loading purposes; here subsequent Switching operations Shall ensure both sides of an open point are tested to prove De-energised and Earthed. When performing Switching prior to the issue of an Access/Test Permit, earthing through any Circuit Breaker is permissible without making the Circuit Breaker Inoperable. For example, it is permissible to close a Circuit Breaker without making it Inoperable in order to discharge the stored energy in Cables prior to applying portable Earths.

Circuit components Shall be considered when assessing earthing continuity, understanding that:

(e) autotransformers and voltage regulators are considered to have a continuous circuit

(f) the primary Conductor of a current transformer is considered continuous

(g) the windings of Power Transformers and isolating transformers are magnetically coupled only and not considered continuous

(h) capacitors are not considered continuous for the purpose of earthing.

3.5.3.2 Application of Operator Earths

An Operator Earth Shall be clearly identified by the attachment of a DNOB in a prominent position such that:

(a) for a set of three-phase PEDs (trifurcated earth), one DNOB Shall be attached at the point of common connection of the 3 phases of the PEDs to the earth tail

(b) for single-phase PEDs, a DNOB Shall be attached in a prominent position to each phase.

The placement or removal of an Operator Earth Shall only be carried out if one of the following occurs:

(c) under the direction of a Switching Sheet with the approval of a Switching Coordinator

(d) under the direction of a Recipient of a Test Permit

(e) under the direction of a Recipient of an Access Permit with the approval of a Switching Coordinator in accordance with the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus*.

Operator Earths applied for an Access Permit Shall remain in place as required under the Access Permit except when required to be temporarily removed to allow testing involving non-lethal current or the progress of Work in accordance with the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus - Section 9.5*. They Shall be replaced as soon as possible on the completion of the Work or testing involving non-lethal current.

Where possible, Operator Earths associated with an Access/Test Permit Shall be restored before an Access/Test Permit is surrendered.

When restoration of Operator Earths is not practical, the Recipient Shall obtain approval from the Switching Coordinator to leave nominated Operator Earths removed. On approval, the Recipient Shall record details of all Operator Earths not replaced in the Abnormalities Section of the Access/Test Permit.

If the location of Operator Earths changes or is to be changed during the course of Work under an Access/Test Permit, then prior to the Operator Earth being changed, all current relevant Access/Test Permits Shall be surrendered and cancelled and new Access/Test Permits issued to reflect the new location of Operator Earths.

3.5.4 Working Earths

Working Earths Shall be connected to HV Conductors to:

(a) safely discharge induced voltage at the work area

(b) limit the induced voltage at the work area created by Nearby circuits

(c) limit the effect of transfer voltages from Earth Potential Rises at connected remote locations

(d) maintain equipotential conditions for Conductors being worked on

(e) maintain earthing continuity when creating open points or working downstream of protective devices where Operator Earths are not placed

(f) ensure Earths are as close as possible to, and visible from, the work area.

Where Operator Earths are not visible from the work area, where possible, Working Earths Shall be applied.

3.5.4.1 Application of Working Earths

Working Earths do not have a DNOB attached; this is the prime visible distinction between an Operator Earth and a Working Earth.

The Recipient Shall coordinate the placement and removal of Working Earths. Only the Recipient or an Individual of Work Group under the direction of the Recipient may place or remove Working Earths. Non-electrical Workers are not authorised to apply or remove Earths.

The placement and removal of Working Earths Shall be recorded on the Access/Test Permit in the Working Earth schedule.

All Working Earths associated with an Access/Test Permit Shall, where practical, be removed before an Access/Test Permit is surrendered. When removal of all Working Earths is not practical (for example, they are required for the subsequent issue of a new Access/Test Permit), the Recipient Shall obtain approval from the Switching Coordinator to leave the nominated Working Earths connected. On approval, the Recipient Shall record details of all Working Earths not removed in the Abnormalities Section of the Access/Test Permit.

Where a Switching Operator identifies Working Earths are still applied in a work area and the Recipient is not on site, the Switching Operator Shall make a reasonable effort to contact the Recipient. If the Recipient is not contactable, the Switching Operator Shall investigate the situation to ensure that no person will be endangered by the removal of the Working Earths and ask the Switching Coordinator for approval to remove these Earths.

3.5.4.2 Bonding at Open Points

Where Reasonably Practicable, continuity of earthing Shall be confirmed and maintained for the duration of Work on any HV Exposed Electrical Apparatus. Most importantly, no Worker Shall contact two different potentials at the same time.

The four main hazards to effectively manage when creating open points in the work area include:

(a) Workers becoming a series current path between Earths in the event of inadvertent energisation

(b) differences in induced potential created by Fault or load current in a Nearby circuit

(c) transferred earth voltage from a network earth Fault

(d) compromising earthing continuity of neighbouring work areas.

Where the Work under an Access/Test Permit involves the connection, cutting or disconnection of HV Conductors (including opening switches), one of the following control measures Shall be implemented to manage the hazard, where it is Reasonably Practicable to do so:

(e) Earths Shall be applied each side of (and as close as practicable to) the proposed break and individually connected to a common Earthing Point before the break is created

(f) Earths Shall be applied each side of (and as close as practicable to) the existing break and individually connected to a common Earthing Point before a new connection is made

(g) Approved bridging leads, appropriate for the task being performed, Shall be applied across the proposed Conductor break before the break is created, or prior to an existing break being reconnected. Bridging lead approval Shall be provided by an appropriately qualified RPEQ.

Failure to effectively implement the above control measures may lead to serious injury or death.

Where multiple Access Permits are issued within the same Isolated area, the Recipient of each Permit, when conducting their risk assessment to determine Working Earth requirements, Shall consider the potential of earthing continuity being compromised by all Work tasks being performed by the other work groups.

3.5.5 Earthing of Overhead Apparatus

3.5.5.1 HV Work Areas with Pole Mounted Distribution Transformers

Where an overhead distribution line is placed under access, Operator Earths Shall be applied between all HV Isolation Points and the work area.

Where Work is to be performed on pole mounted Distribution Transformers within the Isolated area, the following Earths Shall be applied below the HV EDOs:

(a) for transformers with a known LV source of Supply, an Operator Earth Shall be applied; or

(b) for transformers without a known LV source of Supply, a Working Earth Shall be applied.

For the purpose of earthing HV Electrical Apparatus below Distribution Transformer HV EDOs, a known LV source of Supply includes network ties and mobile generation.

Before commencing Work at any pole mounted Distribution Transformer, the Recipient Shall verify the placement of Earths below the EDOs. If no Operator Earths are in place below the EDOs, Working Earths Shall be applied.

3.5.5.2 Pole Mounted Distribution Transformers

In all cases where Live Line Leads or HV EDOs are used as an Isolation Point for access to a pole mounted Distribution Transformer, an Operator Earth Shall be applied below the EDOs.

3.5.5.3 Radial Distribution Lines with ACRs, Sectionalisers, Line Fuses & Fuse Protectors

In addition to the Operator Earths applied electrically adjacent to the HV Isolation Point, unless otherwise stated in these Rules, earthing beyond ACRs, Sectionalisers, line fuses and fuse protectors on radial distribution lines can be managed with Working Earths under the direction of the Recipient. Under this arrangement, Switching devices Shall be closed to ensure all Electrical Apparatus in the proposed work area is Earthed prior to the issue of an Access/Test Permit.

3.5.5.4 Single Wire Earth Return (SWER) System

Each isolating transformer, Distribution Transformer, ACR and voltage regulator site on a SWER system has a low resistance HV Permanent Earthing Point installed. These Permanent Earthing Points are regularly tested to confirm low resistance connections. When placing a SWER system under access, Operator Earths between the HV system and the work area Shall be connected to these Permanent Earthing Points where possible.

Like a Power Transformer, the windings of a SWER isolating transformer are magnetically coupled and not electrically interconnected. Where the EDOs of a SWER isolating transformer are used as an Isolation Point, Operator Earths Shall be placed on both sides of the isolating transformer.

Prior to leaving each site, the Recipient Shall visually confirm the status of the SWER earthing system is intact such that there are no breaks or disconnections.

3.5.5.5 ACRs with Insulated Conductor

Where open Disconnect Links of an ACR construction form an Isolation Point for access Work, the following configurations Shall apply:

(a) where Disconnect Links have earthing provisions such as a stirrup or bare Conductor connection to the ACR, an Operator Earth Shall be applied and the ACR is to remain open for the duration of the Work. An additional Operator Earth Shall be applied on the work side of the open ACR. In this configuration, the loss of isolation will operate protection, and the work area will remain De-energised (given the ACR is fit for service)

(b) where there is no provision for earthing due to Insulated Conductor or other design constraints, the ACR Shall remain open for the duration of the Work and only the Operator Earth on the work side of the open ACR needs to be applied in relation to that source of Supply. In this configuration, the loss of isolation will not operate protection, however, the work area will remain De-energised (given the ACR is fit for service). The Recipient Shall advise all Workers of this configuration and the Exclusion Zone for the unearthed section Shall be maintained.

3.5.5.6 Voltage Transformers Associated with Pole Mounted Switchgear

Where Live Line Leads or HV EDOs of a VT associated with pole mounted switchgear are not used as an Isolation Point, earthing below the EDOs of the VT can be managed with Working Earths under the direction of the Recipient.

3.5.6 Earthing of Underground Network Apparatus

3.5.6.1 Ring Main Units

For access to a complete RMU, it Shall be Isolated at all remote ends, regardless of network interconnectivity. Operator Earths Shall be applied at remote locations, electrically adjacent to each HV Isolation Point.

When performing Work at any RMU, LV isolation Shall always be performed at any transformer supplied by an RMU switch-fuse, irrespective of the transformer having Interconnected LV or not.

Any spare switch or Cables attached to that spare switch, Shall be considered part of the Commissioned network.

All switches (including spare switches) of the RMU to be placed under access Shall be closed or checked closed prior to Operator Earths being applied to ensure all parts of the RMU are Earthed prior to the issue of the Permit.

Upon receipt of a Permit and prior to any Work commencing, all switch-fuses on the RMU Shall be opened, tested De-energised and closed into the earth position. This earth is to further safeguard against any possible LV backfeed and Shall be recorded in the Working Earth Schedule of the Permit.

Where possible, a minimum of one RMU Switch-Disconnector (isolator) Shall be in the closed position to ensure the Busbar of the RMU remains Earthed. Where the Work cannot facilitate this requirement, the Recipient Shall advise all Workers of this configuration.

3.5.6.2 Multiple Ring Main Unit Access

Where multiple Permits are in receipt for Work on adjacent RMUs within the same Isolated area, each Recipient Shall coordinate any alteration of the earthing configuration with all other affected Recipients. This control measure prevents earthing continuity from being compromised by the operation of switches at neighbouring work areas.

3.5.6.3 Cable Connected Distribution Transformers

All padmounted and ground mounted Distribution Transformers Shall have an Operator earth applied at the HV Isolation Point.

3.5.6.4 Application of Portable Earths Involving High Voltage Cables

In order to safely discharge any stored energy remaining in a Cable upon de-energisation, it is preferable to apply an earth via a Switching device using any of the following methods prior to the direct application of portable Earths:

(a) close an Earthing Switch directly onto the Cable

(b) apply portable Earths past an open device (Circuit Breaker or ACR) then close that device

(c) for withdrawable switchgear with Integral Earthing facilities (Reyrolle LMT for example), rack the Circuit Breaker truck into the circuit earth position and close the Circuit Breaker. Portable Earths may then by applied to the Cable Orifice if Work is to be performed on the truck or the Circuit Breaker is not able to be made inoperable.

3.5.7 Earthing of Substation Apparatus

3.5.7.1 Transfer Earth Voltage Hazards

Care must be taken when Earths are placed outside of the substation within which Work is to be performed. For such configurations the following hazards exist:

(a) any EPR at a Remote Earthing Point will be transferred to the work area; and

(b) any EPR at the substation will create a difference in potential to Conductors Earthed remotely and not Earthed to the Substation Earth Grid (Figure 9 (b)).

When performing Work within a substation, all Conductors under access Shall be Earthed to the Substation Earth Grid.

3.5.7.2 Withdrawable Switchgear

For withdrawable switchgear with Integral Earthing facilities (Reyrolle LMT for example), the preferred method of applying Earths is by racking the Circuit Breaker truck into the Busbar/circuit earth position, closing the Circuit Breaker and making it inoperable.

For withdrawable switchgear without Integral Earthing facilities (GEC SBV for example), the earthing devices supplied by the manufacturer or those procured and Approved for use, Shall be used; these earthing devices include Earthing Switches and portable Earths (also known as hand Earths).

Where there is duplicate (double) Busbar metal clad HV switchgear, all Orifice Shutters not requiring access Shall be closed, locked and have a DNOB attached. The Orifice requiring access may then be tested to prove De-energised and Earthed.

Care must be taken to connect the earth tail of PEDs to the correct Earth Connection; connection to the switchgear frame may lead to inadvertent tripping of the Busbar/frame leakage protection.

3.5.7.3 Busbar Access – Withdrawable Switchgear

For access to a HV metal clad withdrawable switchgear Busbar, only one Operator Earth is required provided the following requirements are met:

(a) the Operator Earth Shall be connected to the Substation Earth Grid

(b) all withdrawable Circuit Breaker trucks not used for earthing purposes Shall be completely withdrawn (racked out)

(c) all VTs Shall be either completely withdrawn or LV Isolated

(d) all Cable/circuit Shutters Shall be closed and locked with a DNOB placed.

Where specific switchgear design does not allow Shutters to be locked with DNOB placement, a DNOB Shall be placed and secured in a prominent position such that the Shutters cannot be accessed or disturbed without encountering the DNOB; this option Shall only be used when (d) above cannot be met.

3.5.7.4 Power Transformers

All Power Transformers Shall have Operator Earths applied to all HV windings.

Where there is a protective device between a HV Isolation Point and the transformer, the protective device Shall create an open point and Operator Earths Shall be placed on both sides of this open point. For the case of HV fuses which cannot be opened, Operator Earths Shall be placed on both sides of the fuses.

3.5.7.5 Power Transformer Ended Feeders

When Work is to be performed on a Power Transformer at the end of a feeder, Operator Earths Shall be applied to earth all HV windings to the local Substation Earth Grid.

Where this cannot be achieved due to the absence of Exposed Conductors, Working Earths Shall be applied to earth the HV windings to the local Substation Earth Grid prior to any Work commencing. In this situation, Working Earths do not need to be Fault rated provided there is an Operator Earth at the remote HV Isolation Point that is connected to a Substation Earth Grid or CMEN (known low resistance Earth Connection).

3.5.7.6 Electrical Apparatus with High Voltage Capacitors

Caution Shall be taken when working on or Near Electrical Apparatus containing HV capacitors including capacitor banks, Audio Frequency Load Control (AFLC) units (also referred to as Coupling Cells or Load Control Units), Static VAR Compensator (SVC) and Static Synchronous Compensator (STATCOM) units. Although discharged prior to Work, capacitors have the potential to recharge during the course of Work.

Capacitors Shall be discharged and Earthed by:

1. Observing the minimum wait period following de-energisation to allow discharging via internal discharge resistors; then
2. Testing to prove De-energised and applying Earths on both sides of capacitor arrangements, including star points.

Individual capacitor cans Shall be discharged and have shorting bridges placed across the terminals before touching connections or supporting members, removing individual capacitor cans or disconnecting primary Conductors or Earths.

The Recipient Shall record all connections (including bridging) in the Working Earth Schedule of the Permit to ensure all connections are removed prior to re-energisation.

The Recipient Shall ensure capacitor cans are not shorted when test currents are applied.

Capacitor Banks

A minimum wait period of ten minutes Shall be observed before testing to prove De-energised and applying any Earths to allow capacitors to discharge. For the required duration refer to the relevant operating instructions, signage or Approved procedure.

Earths Shall be placed between the HV Isolation Point and the capacitor bank prior to opening doors to any enclosure where possible. Testing to prove De-energised and applying Earths via enclosure doors that open outwards or within fenced enclosures is permitted when performing Switching prior to the issue of a Permit. Portable Earths may need to be applied as Working Earths where confined enclosures prevent the Safe application of Earths prior to issuing a Permit.

Due to the design of some capacitor bank installations, earthing of the capacitors prior to the issue of a Permit can only be achieved by earthing through fuses and/or closed contactors that cannot be made inoperable. Upon receipt of a Permit, the Recipient Shall ensure Working Earths are applied such that equipotential conditions are established prior to any Work commencing. Fuses may need to be bridged to achieve this.

When Work is to be performed on a capacitor bank supplied by a multi-leg Circuit Breaker or tee-joint, only an Operator Earth at the Circuit Breaker is required; additional Operator Earths are not required at Isolation Points outside of the substation.

Audio Frequency Load Control Units

A minimum wait period of ten minutes Shall be observed before testing to prove De-energised and applying any Earths to allow coupling capacitors to discharge. For the required duration refer to the relevant operating instructions, signage or Approved procedure.

Earths Shall be placed between the HV Isolation Point and the AFLC apparatus prior to opening doors to any enclosure. Earthing of the AFLC apparatus Shall be through apertures in the enclosure where installed. Where apertures are not installed, entry into the enclosure for the purpose of testing to prove De-energised and applying Earths is permitted when performing Switching prior to the issue of a Permit.

Prior to the issue of a Permit, portable Earths Shall be placed on both sides of the coupling capacitor arrangements such that the HV source side terminals of the coupling capacitors are Earthed first, followed by the second set of Earths, in order of preference, at:

(a) Exposed Conductors between the coupling capacitors and the Isolating Transformer (typically available at 33 kV and 66 kV installations); or

(b) the HV terminals of the Isolating Transformer; or

(c) the coupling capacitor terminals on the Isolating Transformer side.

Note: Some installations may house the Tuning Coils/Reactor and Isolating Transformer in a common tank (this is common for 33 kV and 66 kV installations).

Where installed, the earth link contained in the AFLC enclosure Shall be tested to prove De-energised and closed.

3.5.7.7 Skid Substations

Due to the Insulated construction of Skid Substations, access conditions can only be achieved via earthing through an ACR in the closed position. In this scenario, Operator Earths Shall only be installed within the substation and an Approved procedure Shall be followed to:

(a) restrict operation of the ACR as far as Reasonably Practicable to provide earthing continuity for the issue of the Permit; and

(b) install Working Earths upon receipt of the Permit and prior to any further Work commencing.

3.5.7.8 Neutral Earthing Resistors & Neutral Earthing Reactors

Prior to earthing a Neutral Earthing Resistor (NER) that is common to more than one Power Transformer, the NER Shall be bypassed and Isolated from the connected Power Transformers.

Prior to an NER being bypassed for access Work, a review of the network configuration and protection Shall be undertaken by Protection Engineering Department.

Bypass disconnect links cannot be used as an Operator Earth; dedicated PEDs Shall be used as Operator Earths when performing Work under access.

Operator Earths Shall be placed in parallel to the bypass disconnect links. One Operator Earth Shall be placed for each closed bypass disconnect link; it is desirable to connect PEDs to the earth grid at separate connection points.

All Earths Shall be rated to the maximum Fault current without the NER in service.

The Recipient Shall ensure additional equipotential bonding is installed as per Approved procedures.

Access to a standalone NER or Neutral Earthing Reactor will meet the same access conditions of the associated Power Transformer.

3.5.7.9 Voltage Transformers Protected by In-Line Fuses

Where a VT is protected by in-line fuses and there is no provision to apply Operator Earths, upon receipt of a Permit, the Recipient Shall ensure Working Earths are applied to the VT or bridging is applied across the fuse prior to any further Work commencing.

3.5.8 Abnormal Access Scenarios

Where the requirements for earthing cannot be met as per these Rules, the Work Shall not proceed until a method of earthing has been developed, risk assessed and Approved by an appropriately experienced RPEQ. Such approval Shall be documented unless under emergency conditions. Any approval Shall be job-specific and not extend to general use unless specified in the approval.

3.6 Work Involving Electrical Testing

A Test Permit Shall be used where electrical testing may produce Lethal Current. Where test instruments do not produce lethal current, testing may be performed under an Access Permit.

Some devices used to provide HV for testing purposes may only produce small currents that are not lethal to the human body. If such devices are used to charge a length of Cable or capacitor bank to a High Voltage, sufficient charge can be stored to produce Lethal Current. Where such lethal conditions are created, a Test Permit Shall be used. If there is any doubt as to whether Lethal Current can be created, a Test Permit Shall be used.

A Test Permit and Access Permit Shall not be on issue for the same Electrical Apparatus at the same time.

3.6.1.1 Clearances for Testing

Isolation Points used for Work under an Access Permit may not always be adequate for testing. For example, a HV withstand test performed on 33 kV plant can apply voltages up to 43 kV for

which typical 33 kV isolation may not be suitable. In such circumstances Clearances applicable to the applied test voltage Shall be used.

The relevant Clearances to adjacent plant Shall also be confirmed as adequate for the applied test voltage.

3.6.1.2 Removal of Earths & Application of Test Leads

While under a Test Permit, Operator Earths may be removed and replaced under the direction of the Recipient. When Earths are removed, the Electrical Apparatus covered by the Test Permit Shall be considered Live and all persons Shall maintain the relevant Exclusion Zone until Earths have been reinstated.

Earths Shall be in place on Electrical Apparatus prior to and during the placement and removal of test leads. Where this cannot be achieved, appropriate insulating gloves Shall be worn during the placement and removal process. Any related Approved procedure Shall contain this control measure.

Following the completion of testing, the Recipient Shall ensure all Electrical Apparatus is fully discharged. Earths that have not been reinstated are to be listed in the abnormalities section of the applicable permit.

3.7 Third Party Work Near High Voltage Exposed Conductors

Where a third party requests to perform Work Near HV Exposed Conductors of the Ergon Energy Network or Energex networks, one of the following options Shall be used to allow the Work:

(a) issue an Access Permit for the relevant section of the HV network and an authorised Recipient Shall remain at the work area for the duration of the Work

(b) make the relevant section of the HV network Not Electrically Connected (NEC) and issue a Third Party Non-Contact Notice to a Third Party Representative.

Neither option is required for excavation around undamaged Cables.

A Third Party Non-Contact Notice is also applicable for third party Work Near LV Exposed Conductors (refer to *Section* 10.4).

3.7.1 Third Party Non-Contact Notice

Where a Third Party Non-Contact Notice is to be utilised, Disconnection Points Shall be created (refer to *Section* 8) and the NEC HV Exposed Conductors Shall be tested to prove De-energised and subsequently Earthed and short-circuited prior to the issue of the Notice.

Earths applied to the NEC HV Exposed Conductors Shall not have a DNOB attached and Shall only be applied and removed under the direction of a Switching Sheet.

3.7.1.1 Issue & Receipt of Third Party Non-Contact Notice

The Switching Coordinator Shall approve the issue of a Third Party Non-Contact Notice as an item in the Switching Sheet.

The Switching Operator or other Ergon Energy Network/Energex Representative Shall explain all sections of the Third Party Non-Contact Notice directly to the Third Party Representative and issue the Notice to that representative. The Third Party Representative Shall be on site to receive a Third Party Non-Contact Notice.

The Third Party Representative Shall sign and date the Notice to acknowledge receipt of the Notice and its conditions, including their responsibilities.

The Switching Coordinator Shall record the issue of the Notice as an item in the Switching Sheet.

3.7.1.2 Surrender & Cancellation of Third Party Non-Contact Notice

The Third Party Representative Shall sign and date the Third Party Non-Contact Notice upon surrender and acknowledge that all persons under their responsibility no longer have permission to perform Work.

The Switching Operator or other Ergon Energy Network/Energex Representative Shall recover the surrendered and cancelled Third Party Non-Contact Notice from the Third Party Representative.

If the original Third Party Non-Contact Notice has been lost or destroyed, a new Notice Shall be generated detailing the original Disconnection Points and earthing. The replacement Notice Shall be clearly marked and initialled as a replacement, stating the reason for its re-issue. This replacement Shall be endorsed/surrendered by the Third Party Representative before any Switching is performed to reinstate the network.

Section 4

WORK INVOLVING HIGH VOLTAGE CABLES

4 WORK INVOLVING HIGH VOLTAGE CABLES

4.1 General Cable Safety

Cables with an Earthed metallic sheath (screened Cables) and intact over-sheath (outer covering) are not considered Exposed Electrical Apparatus and therefore prescribed Exclusion Zones are not applicable.

Where a metallic sheath is absent, has been removed or is damaged, the unscreened section of Cable Shall be treated as Exposed Electrical Apparatus and the Exclusion Zones tabulated in *Section* 1.2 Exclusion Zones apply. The application of an Exclusion Zone is to safeguard against inadvertent encroachment into the unscreened area.

Exposed metallic sheaths and associated connections Shall not be touched unless under an appropriate Work Approval.

4.2 Hazards

Further to the inadvertent energisation and induction hazards described in *Section* 3, Work on HV Cables is susceptible to misidentification of Cables, metallic sheath, Earth Potential Rise and Transferred Earth Voltage hazards.

4.2.1 Misidentification of Cables

Cables can be easily misidentified when they are not visibly traceable from the termination to the work area. Work Shall not commence on any Cable unless it has been positively identified and proved De-energised beyond doubt.

4.2.2 Metallic Sheath Hazards

Metallic sheaths can be subject to hazardous voltage and current at any time while in service and may carry Fault current during network Faults. Furthermore, where closed loops exist with sheath bonding arrangements (solid bonding and cross-bonding) the metallic sheath carries circulating currents under load conditions.

Except for solidly bonded Cables where metallic sheaths are Earthed at both ends, the sheath bonding arrangement (single point, mid-point sheath break and cross-bonding) of current carrying Cables gives rise to induced voltages on the sheath at the floating ends (Link Box, structure and equipment terminations). Here the source of the induced voltage is the magnetic field from the current in the core and Nearby Conductors, making such voltages particularly hazardous under high load and Fault conditions.

An Energised Cable with no connections between the metallic sheath and earth has the potential to capacitively induce High Voltages on the metallic sheath of that Cable.

Earth Connections Shall not be removed from the sheaths of Energised Cables.

Upon discovery of a metallic sheath that appears damaged (i.e. visible insulation screen, significant corrosion, pitting or damaged Earth Connection), the asset ID and location Shall be reported.

4.2.3 Earth Potential Rise & Transferred Earth Voltage Hazards

The Earth Potential Rise and Transferred Earth Voltage hazards are described in *Section* 3.2.3.

For Cable Work inside a substation, this hazard can be managed by ensuring the core or metallic sheath being Work on is Earthed to the Substation Earth Grid.

This hazard is more difficult to manage for Cable Work outside of a substation for which Earths are placed remote to the work area. Working on Earthed Conductors connected to a remote Substation Earth Grid presents the most likely hazard (transferred earth voltage) and can impact Cable Work on cores and metallic sheaths while working from the ground (Figure 9 (a)).

While working uninsulated from the ground, management of these hazards Shall be in accordance with Approved procedures. These procedures Shall consider the use of control measures such as equipotential bonding or insulation where practicable and minimising uninsulated contact with Earthed Conductors (cores and sheaths) where these controls cannot be practically implemented.

4.3 Electrical Work on Cables

4.3.1 Positive Identification of Cables

Work Shall not commence on any Cable unless it has been positively identified and proved De-energised beyond doubt.

All Cables (including abandoned Cables) Shall be positively identified in accordance with Approved procedures using Cable identification equipment in conjunction with up to date Cable records. Where it is not possible to positively identify damaged or abandoned Cables using Cable identification equipment, other Approved procedures Shall be followed.

Labelling and drawings Shall not be solely relied upon for means of positive identification.

Identified Cables Shall be marked at the work area immediately after positive identification.

Any incorrectly labelled Cables Shall be reported.

4.3.2 Cutting/Spiking of Cables

Where possible, Cables Shall be Isolated and Earthed on each side of the proposed break prior to cutting/spiking.

The identified Cables Shall be proved De-energised by cutting/spiking with an Approved remote cutting/spiking device while all persons are clear from the Cables. This rule is not applicable for:

(a) Work not being performed on the cores such as metallic sheath and over-sheath repairs; and

(b) Cables entirely Exposed and tested to prove De-energised at the worksite (e.g. termination Work).

Note: Where only one core of a triplex or single core Cable circuit requires Work, only that individual Cable needs to be cut/spiked.

Other scenarios may be exempt from cutting/spiking where Approved by an appropriately experienced RPEQ. Examples of such scenarios include Work on:

(c) pressurised Cables; and

(d) Cables of 66 kV and above where it is not practical to cut/spike Cables due to factors such as the cost and availability of repair materials, the cost and time of civil Work, as well as the duration of jointing Work.

Where proving Cables De-energised by cutting/spiking is not performed, positive identification Shall still be performed.

Where Earths were unable to be placed at each side of the Cable break, one side of the break will be unearthed. The Recipient Shall apply other precautions in accordance with Approved procedures where applicable and advise all Workers of the work area configuration. The Recipient Shall ensure earthing continuity is restored as soon as Reasonably Practicable.

4.3.3 Unidentifiable & Suspected Abandoned Cables

When cutting/spiking unidentifiable and suspected abandoned Cables where records indicate other Commissioned Cables exist in the Vicinity of the subject Cables, an application for Work and corresponding Switching Sheet Shall be used.

The following Safety Controls Shall be implemented prior to and during the cutting/spiking activity:

(a) disable Auto-Reclose and tag protective devices for all Cables in the Vicinity as nominated by the Applicant

(b) stand down all Workers on all disabled and tagged feeders prior to cutting/spiking

(c) phone contact Shall be maintained with the Switching Coordinator during the cutting/ spiking to ensure any resulting alarms or protection operations are identified.

4.3.4 Work Approval

All electrical Work on HV Cables Shall be performed under an Access/Test Permit with the exception of Work on the metallic sheath or over-sheath which is permissible under a Non-Access Work Authority.

Work Shall only be performed under a Non-Access Work Authority when the following conditions are met:

(a) the Cable, or portion of Cable, is inside a substation; and

(b) the metallic sheath is undamaged and bonded to that substation’s earth grid.

If the metallic sheath appears damaged (visible insulation screen or significant corrosion/pitting for example) engineering advice Shall be sought and further controls implemented for Safe Work.

Where Work on a Cable is performed under a Non-Access Work Authority, the Work Shall not be within Exclusion Zones of any HV Exposed Electrical Apparatus.

If inadvertent energisation of the Cable poses a hazard, Work Shall be performed under access via an Access/Test Permit.

4.3.4.1 Work Inside a Substation

For Cable Work inside a substation, the core and/or the metallic sheath being worked on Shall be Earthed to that substation's earth grid where possible.

Where Cable Work is performed inside a substation under a Non-Access Work Authority, the metallic sheath Shall be bonded and remain bonded to that substation's earth grid for the duration of the Work. For such non-access Work, de-energisation and Remote Control inhibits may be used as the Safety Controls, however, isolation is the preferred Safety Control.

4.3.4.2 Work Outside a Substation

Where Cable Work is performed outside a substation, Work Shall be in accordance with Approved procedures where practicable and available (where controls such as equipotential bonding or insulation allow) to protect against induced voltages, EPR and transferred earth voltages. Uninsulated contact with the metallic sheath while working uninsulated from the ground Shall be minimised.

4.3.4.3 Work Inside Link Boxes

Due to the potential for dangerous voltages being present on metallic sheaths and associated connections, all Work inside Link Boxes, including the lifting of Link Box covers, Shall be performed under a Work Approval.

4.3.5 Abandoning Cables

When abandoning Cables that have been de-commissioned from the network, the following actions Shall be taken:

(a) Bond all cores and sheaths together

(b) earth the metallic components (laid in direct contact with general mass of earth)

(c) cap and label the Cable ends

(d) update the relevant Cable records

(e) update the HV operating diagram as appropriate.

4.4 Excavation Around Cables

All excavation Work Shall be performed in accordance with Approved procedures to prevent any damage to Cables. If Cables are damaged or struck during excavation, the incident Shall be reported to the relevant Control Centre.

The approval requirements for excavation Work around buried Cables (direct buried and Cables installed in conduits) is dependent on the voltage class and suspected condition of the Cables.

In all instances, no excavation Shall commence without the assessment of up to date Cable records and Dial Before You Dig information.

Where the disabling of Auto-Reclose (if enabled) is requested as a safety precaution for the excavation Work, a Vicinity Work Authority is not required, however, the Switching Coordinator Shall tag the device on the HV Operating Diagram and place a note regarding the civil excavation.

4.4.1 Undamaged Cables

Where there is no reason to suspect Cables are damaged, a Work Approval is not required to excavate and expose the Cables.

Following excavation, all electrical Work Shall be performed under the appropriate Work Approval.

4.4.2 Defective Cables

Where testing identifies a defect, excavation can be performed down to the Cable cover strips. Before proceeding with further excavation, the Cables Shall be Isolated and Earthed as a safety precaution. An Access/Test Permit is not required until the Cables are Exposed and electrical Work is required.

4.4.3 Faulted Cables

All faulted distribution Cables Shall be under access prior to any excavation commencing.

Sub-transmission and Transmission Cables are typically installed with increased cover and often with rigid encasement such as flowable fill. No Permit is required to excavate down to the cable cover strips, however, the Cables Shall be Isolated and Earthed prior to the commencement of any excavation. An Access Permit Shall be in receipt prior to further excavation below the cable cover strips.

For all faulted Cables, the receipt of an Access Permit serves the following purposes:

(a) an approval from the relevant Control Centre for Work to be performed on or Near the faulted Cable; and

(b) ensures there is adequate electrical supervision by an authorised Recipient at the faulted Cable site.

4.4.4 Responding to Cable Damage During Excavation

Where internal or third party excavation results in inadvertent damage to a Cable, all persons Shall be kept clear of the excavated area until the Cable is under access.

Section 5

HIGH VOLTAGE SWITCHING

5 HIGH VOLTAGE SWITCHING

Switching is recognised as a serious hazard frequently encountered while operating the electricity supply networks. The following Rules governing Switching operations are focused on safeguarding field personnel during Switching activities. These Rules are applicable to all HV Switching and are to be used in conjunction with those set out in the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus* governing the preparation and use of Switching Sheets as well as the roles and responsibilities integral to the Switching process.

5.1 General

All Switching of the Commissioned network Shall be under the direction of the relevant Control Centre and the execution of Switching operations Shall only be performed by suitably Authorised Persons.

All connections of HV Generation to the Commissioned network Shall be performed under the direction of the relevant Control Centre via a Switching Sheet.

All planned Switching Sheets Shall be written, checked and authorised but Shall not be written and checked by the same person.

With the exception of unforeseen priority Work, planned HV Switching Sheets Shall be available for distribution two days prior to the commencement of Switching to allow all persons involved in the Switching to review, understand the intent of the Switching and make the necessary preparations for Switching.

The sequence of the Switching, including forward and reverse Switching, is critical and the sequence of the Switching Sheet Shall be adhered to at all times. If there are any perceived errors in the Switching Sheet, the relevant Control Centre Shall be contacted for clarification prior to the Switching operation being actioned.

A pre-control check of all planned HV Switching Shall be performed by a Switching Coordinator within 24 hours prior to the commencement of Switching. The pre-control is undertaken to assess whether the Switching can proceed as planned based on the status of the network, clash detection and any other factors relevant to the Work.

5.2 Safety in Switching

Remote Switching Shall be used in preference to Manual Switching where possible.

To prevent serious injury, personnel Shall stand clear of HV equipment being operated (manually or remotely) where possible. Prior to remotely operating switchgear, Switching Coordinators Shall advise all known personnel at the location to stand clear. Where field-based crews request the remote operation of a Switching device with ‘crews clear’ status in Mobile Switching, the Switching Operator is responsible for ensuring all persons are clear at their location.

All persons entering a Bulk Supply or Zone Substation for any reason Shall log their attendance into the corporate system to ensure visibility when remote Switching is being performed.

Field-based Switching Shall not be performed by single person crews. Furthermore, all Switching Shall be performed in accordance with standard Switching communications protocols.

Prior to Switching any device, Switching Coordinators and Switching Operators/Assistants Shall understand and adhere to any operating restrictions in place for that device.

All field-based Switching Shall be performed with the appropriate use of tools, equipment and PPE and performed in accordance with training and Approved procedures.

Prior to Switching any Oil or SF_6 devices, Switching Operators Shall verify the appropriate oil level or gas pressure (where available); if insufficient oil or gas pressure is present, the device Shall not be switched.

When performing field-based Switching, personnel Shall adhere to Approved procedures for the Safe approach to structures to safeguard against step and touch voltages, leakage and disconnected earthing systems.

5.3 Disabling Auto-Reclose

Auto-Reclose has the potential to re-energise a Fault that occurs while performing Switching, consequently placing field personnel at risk, e.g. switchgear failure or a Switching Fault (phasing error, Earths applied prematurely or not removed).

Auto-Reclose Shall be disabled prior to any Manual Switching activities with the following exclusions:

(a) devices that cannot be disabled remotely (non-telecontrolled devices including telecontrolled devices with a communications link failure); and

(b) closing fused switches when restoring Supply to a Distribution Transformer outage.

The disabling of Auto-Reclose is mandatory for particular planned Switching and the above exclusions do not apply when:

(c) HV Live Work Switching operations are to be performed; and

(d) disabling of Auto-Reclose is required as part of a Work Approval (HV Live Work Authority and Vicinity Work Authority for example); and

(e) disabling of Auto-Reclose is required as part of an operating restriction.

Auto-Reclose is only required to be disabled when Switching is being carried out and there is no requirement to have Auto-Reclose disabled for the entire duration of the Work.

5.4 Switch Ratings

Using Switching devices to interrupt current in excess of their rated Breaking Capacity can result in flashover, posing a significant hazard to personnel. To safeguard against serious injury and asset damage, Switching devices Shall only be switched in accordance with their rated load, inductive and capacitive make and break capacities.

Typically, a Switching device's load Breaking Capacity far outweighs its inductive and capacitive current Breaking Capacity. Breaking inductive or capacitive current is more onerous than load current due to the out of phase relationship with the Supply voltage. Care must be taken to select the appropriate devices to switch de-loaded Power Transformers, SWER shunt reactors, capacitor banks, Load Control Units and sections of de-loaded lines and Cables.

Where Reasonably Practicable, Circuit Breakers Should be used to switch inductive or capacitive current.

Where Reasonably Practicable, Disconnectors (also referred to as isolators/air-break switches) and HV Disconnect Links/fuses Should not be used to re-energise Power Transformers; a series of pre-strikes and subsequent interruptions experienced on a Disconnector close operation (in air and SF_6) results in undesired transient voltage stress being applied to the winding insulation. This rule is not applicable to high-speed GIS specifically designed for transformer Switching.

Disconnect Links and EDOs without interruption aids (such as flicker blades or load break tools) Shall not be used to de-energise SWER Shunt Reactors greater than 10 kVAR as they are not rated for the inductive current involved. These devices can, however, be used to de-energise de-loaded pole mounted Distribution Transformers.

RMUs are typically rated to switch minor charging currents associated with de-energising Cables. RMUs Shall not be used to switch capacitor banks due to the large capacitive currents involved.

5.5 Confirming Network & Device Status

To avoid dangerous Switching incidents or inadvertent loss of Supply, all Switching actions need to be successfully completed and status confirmed prior to progressing to the next Switching operation.

Following remote Switching operations, the Switching Coordinator Shall confirm successful Switching operation by:

(a) observing change in device status (via DMS/SCADA) and associated alarms where applicable; and

(b) observing current and voltage changes to reflect the desired network configuration.

Where a Switching device has been remotely operated and further Manual Switching is to be performed at the same location that relies on the status of that remotely operated switch, the Switching Operator/Assistant Shall disable remote supervisory control on that switch and confirm the successful operation. These Shall be items in the Switching Sheet (such as ‘Check Open’).

Following Manual Switching operations, the Switching Operator Shall confirm successful operation as per training and equipment operating instruction resources.

5.6 Switching in Open Air

The following precautionary measures are implemented to prevent Air-Break Switchgear attempting to break current beyond their Breaking Capacity, placing field personnel at risk.

HV Substation Disconnectors up to and including 66 kV with negligible Breaking Capacity, Shall not be used to break load current. Whilst switches may be operated Energised, the Breaking Capacity Shall be restricted to 0.5 A.

These restrictions apply to breaking bus transfer loop and closed ring bus configurations, as well as de-energising radial circuits within a substation, unless there is documented information to the contrary.

5.6.1 Closed Bus Configurations

Breaking of bus transfer loop and closed ring bus configurations using substation Disconnectors with negligible Breaking Capacity is permitted when Bus Zone Protection is active, or when the Disconnectors are located just outside the Bus Zone but are still covered by instantaneous protection.

Prior to using manual Air-Break Switchgear to break either of these closed bus configurations, the on-site status of all switches (including bus section Circuit Breakers) Shall be confirmed, i.e. continuity of all three phases Shall be confirmed. Any open point in the circuit will result in the Air-Break Switchgear attempting to break load and any poor connection (high resistance) will prolong the arcing duration upon opening and therefore increase the likelihood of flashover (phase to earth or phase to phase).

For bus transfer configurations, the Switching Operator Shall walk the circuit to confirm there is a parallel current path prior to the operation of the switch.

For a closed ring bus configuration, the Switching Operator Shall walk the perimeter of the ring bus to confirm a closed ring prior to the operation of the switch.

Consideration Shall be given to protective devices tripping due to the creation of zero-sequence current when making and breaking closed bus configurations. Further advice Should be sought from the Protection Engineering Department or Network Operations Engineers as appropriate.

5.6.2 Radials

Where the manual operation of Air-Break Switchgear within a substation is to follow a remote Switching operation and there is no means of confirming a successful remote operation (there is no Circuit Breaker local to the site for example), the Electrical Apparatus Shall be either tested to prove De-energised on both sides or tested for current within the Breaking Capacity prior to the switch being operated.

5.6.3 Switchgear with Interruption Aids

The status of interruption aids associated with Air-Break Switchgear (such as flicker blades) Shall be visually inspected and confirmed intact and engaged (where appropriate) prior to any Switching operation.

5.7 Single-Phase Switching

Single-phase Switching can introduce safety and network hazards including:

(a) Ferroresonance; and

(b) the tripping of protective devices due to the creation of zero-sequence currents.

5.7.1 Ferroresonance

Ferroresonance is a resonant condition between series inductive and capacitive components of a three-phase network resulting in unstable overvoltage.

Typically, a de-loaded or lightly loaded transformer (inductance L) combined with a significant length of Cable (capacitance C) are the LC components that give rise to ferroresonance in a three-

phase distribution network. It can result in voltages up to several times nominal system voltage appearing on both the HV and LV side of the transformer and within HV Cables.

Ferroresonance can occur during Switching on a three-phase network wherever a significant length of Cable and an unloaded (or lightly loaded) transformer are De-energised or Energised via single-phase Switching devices such as Disconnect Links, EDOs, temporary in-line isolation devices or Magnefix MD4 switches (also referred to as Hazemeyer).

Ferroresonance can also occur during unplanned events when Supply is interrupted on one or two phases of a Cable and lightly loaded transformer (non-ganged HV fuses blow).

Figure 11 depicts some ferroresonance scenarios encountered during Switching on the overhead and underground distribution networks. The scenarios depicted highlight the key elements giving rise to ferroresonance and the magnetising and cable charging current path with one or two phases not connected during single-phase Switching.

The Cable capacitance (core to sheath) is a major contributing factor to the occurrence of ferroresonance and is influenced by system voltage, Cable size and notably by Cable length. Look-up tables can be utilised to determine the critical cable length when the Cable type is known, otherwise the measures below Shall be used to avoid the occurrence of ferroresonance.

The most effective measures to avoid ferroresonance are:

(a) utilise three-phase Switching devices

(b) limit the length of Cable being switched where possible

(c) load the transformer to at least 3% of its rated load (load boxes connected to transformer terminals)

(d) single-phase switch the transformer and Cable* separately where possible, i.e. split the L and C components. Transformer HV fuses often serve as a practicable solution.

* Care must be taken not to exceed the rated capacitive breaking capability of the Switching device when de-energising Cables (capacitive charging current).

5.7.2 Disabling Sensitive Earth Fault Protection

When single-phase Switching is performed on a radial section of the network containing a significant underground component, the length and size of the Cable involved may create an imbalance in capacitive current when one or two phases are opened. For large enough Cable capacitance, this imbalance is enough to trigger Sensitive Earth Fault (SEF) protection.

When single-phase Switching is used to energise/de-energise any part of the HV network containing an underground component of greater than 1 km, SEF protection Shall be disabled.

5.7.3 Disabling Earth Fault Protection

Consideration Shall be given to protective devices tripping due to the creation of zero-sequence current when making and breaking closed loop configurations. Earth Fault protection (including SEF) Should be disabled when bypassing protective devices such as pole mounted ACRs.

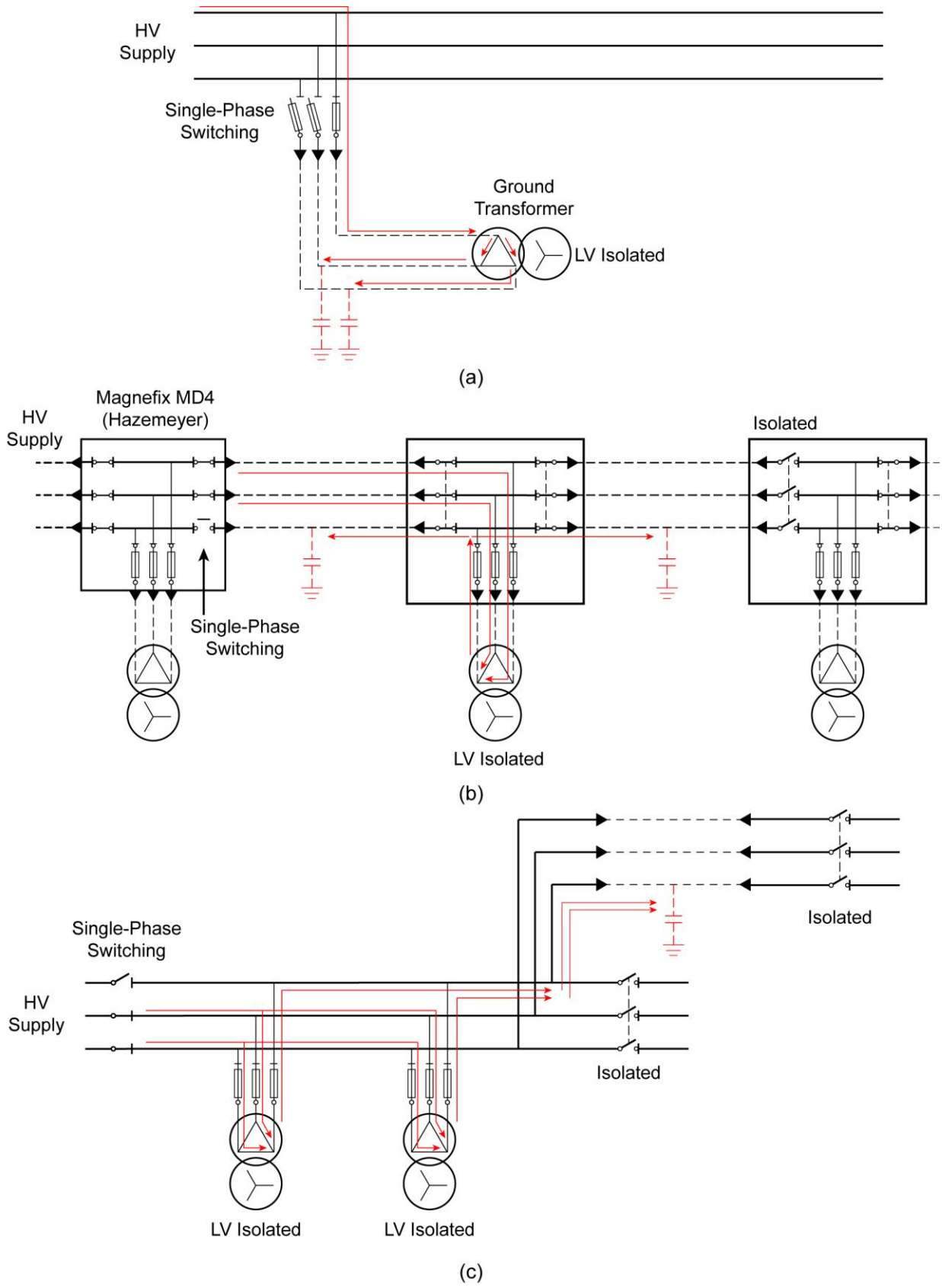


Figure 11: Ferroresonance Scenarios Encountered During Switching

5.8 Minimum Delay Switching

Minimum delay Switching is a technique used to control the timing of specific Switching operations.

Minimum delay Switching is predominantly used for paralleling where protective devices can trip during paralleled conditions, consequently disrupting Supply and potentially placing Switching crews at risk.

Minimum delay Switching operations Shall be performed via voice communications and not via Mobile Switching interaction.

5.8.1 Minimum Delay – Call Before Open

Where 'Minimum Delay – Call Before Open' Switching is stipulated in a Switching Sheet, the Switching Operator Shall call the Switching Coordinator when in position to execute the next 'open' operation (with the appropriate PPE on and locks off). Here the intent of the minimum delay Switching is for the Switching Coordinator to confirm network status and that no protective devices have operated, thus allowing the next 'open' operation to proceed.

5.8.2 Minimum Delay – Two Unit

Where 'Minimum Delay – Two Unit' Switching is stipulated in the Switching Sheet, both units (field-based crews) Shall contact the Switching Coordinator when in position and ready to execute the next Switching operations. Here the intent of the minimum delay Switching is for multiple Switching operations to be performed within a few seconds. A three-way group call Shall be established between the Switching Coordinator and the two Switching crews prior to, and for the duration of, the minimum delay Switching operations.

When performing paralleling, the following sequence Shall be carried out:

(a) the Switching Coordinator Shall instruct the first Switching Operator to perform the 'close' operation

(b) as soon as the first Switching Operator confirms the 'close' has been successfully completed, the Switching Coordinator Shall instruct the second Switching Operator to perform the 'open' operation.

During the time between the 'close' instruction and confirmation of successful operation from the first Switching Operator, the Switching Coordinator Shall monitor the status of the associated protective devices. If a protective device trips during this time, the Switching Coordinator Shall abort the next 'open' instruction. If there has been no trip, the Switching Coordinator Shall not wait after receiving confirmation of successful closure before instructing the 'open' operation. Any extra time taken to monitor protective device status following the 'close' operation increases the risk of a trip, and the chances of the second Switching Operator opening under load.

Minimum Delay – Two Unit Switching may also be used to perform phase rotation checks where one crew is ready in position and setup to carry out the testing within minimal time and the other crew executes the Switching and remains at the Switching point.

5.9 HV Live Work Switching Operations

This section and sub-sections relating to making and breaking connections via HV Live Work Switching operations are only applicable whilst Approved HV Live Work procedures and manuals permit.

The Live Work methods used for making and breaking HV bridges are not suitable for Switching load or large charging current and if attempted, pose a safety hazard to the people involved. Switching operations Shall be taken to ensure the least amount of Electrical Apparatus is Energised/De-energised via Live Work methods.

When Live Work methods are to be used to make or break HV bridges under the direction of a Switching Sheet, Switching operations Shall ensure all of the following:

(a) Auto-Reclose is disabled and protective devices tagged

(b) load current is not present (apparatus is de-loaded)

(c) magnetising current is not present (transformer EDOs are open)

(d) no ferroresonance scenario is present

(e) cable charging current is not too large (assess Cable length)*.

* Refer to HV Live Work Manuals for guidance on maximum Cable lengths.

5.9.1 Making & Breaking Underground Network

Where underground Cables will be Energised/De-energised via Live Work methods, the following caution Shall be included on the Switching Sheet immediately beforehand:

Caution: HV UG Cable(s) will be Energised/De-energised

In addition to this Switching Sheet caution, the Switching Operator Shall advise the HV Live work crew of the presence of underground network.

5.9.2 Making & Breaking Pole Mounted Switchgear Bridging

The following precautions Shall be taken to ensure HV bridges do not make or break load when making or breaking pole mounted switchgear bridging via Live Work methods:

(a) disable Auto-Reclose

(b) disable any Remote Control of the switchgear

(c) disable any protection/detection functionality of an ACR or Sectionaliser.

The above precautions Shall be items in a Switching Sheet to serve as confirmation for the HV Live work crew.

5.10 Switching During HV Live Work

No Switching Shall be performed on any Electrical Apparatus subject to Work under a HV Live Work Authority. The Switching Coordinator Shall direct the Authority Holder of the HV Live Work Authority to stand down all Workers and move clear of the Electrical Apparatus prior to any Switching being performing.

5.11 Switching Involving Voltage Transformers

Isolation at a Voltage Transformer (VT) Should, where Reasonably Practicable, be performed at the LV side of the VT and after the connected Electrical Apparatus has been De-energised.

In cases where efficiency of Switching may be improved, isolation at VTs may be performed at any suitable stage of the Switching with the following restrictions:

(a) when Switching affects a feeder or equipment with a protection scheme relying on input from a VT, that VT Shall not be removed from service until the feeder or equipment is De-energised or until the relevant protection scheme has been suitably configured to permit the removal of the VT; and

(b) a VT Shall not be removed from service where the removal of that VT will affect functions (other than protection) such as voltage regulation, metering or other functions, without due consideration being given to the consequences of that removal.

5.11.1 Energising Voltage Transformers

Energising a VT, either the initial commissioning or re-energisation following an outage, has previously resulted in catastrophic failures. The below process Shall be followed for the energisation of VTs within substations and at pole mounted installations.

The preferred method of energising a VT is from a remote location or via Remote Control. During the Switching operation and for a period of 10 minutes post energisation, all persons at an associated worksite Shall maintain a Safe distance from the VT as appropriate to the site.

If remote energisation of a VT is not practicable, the following actions Shall be performed:

1. Energise the VT manually (from the ground where possible to maximise Clearance).
2. All persons Shall then maintain a Safe distance appropriate to the site for 10 minutes post energisation.

5.12 Bypassing Voltage Regulators

A bypass is a short-circuit across the voltage regulator and provides means for removing the unit from service while still maintaining Supply to the downstream network.

When an in-circuit voltage regulator is bypassed while off neutral tap, hazardous circulating currents can flow through the unit and the associated bypass (Figure 12). Currents of up to 300 times the full load current can result. It is therefore critical that an in-circuit voltage regulator is bypassed only when on neutral tap and that it remains on neutral tap for the duration of the bypass.

Bypassing an in-circuit voltage regulator off neutral tap risks serious injury to people and damage to the voltage regulator.

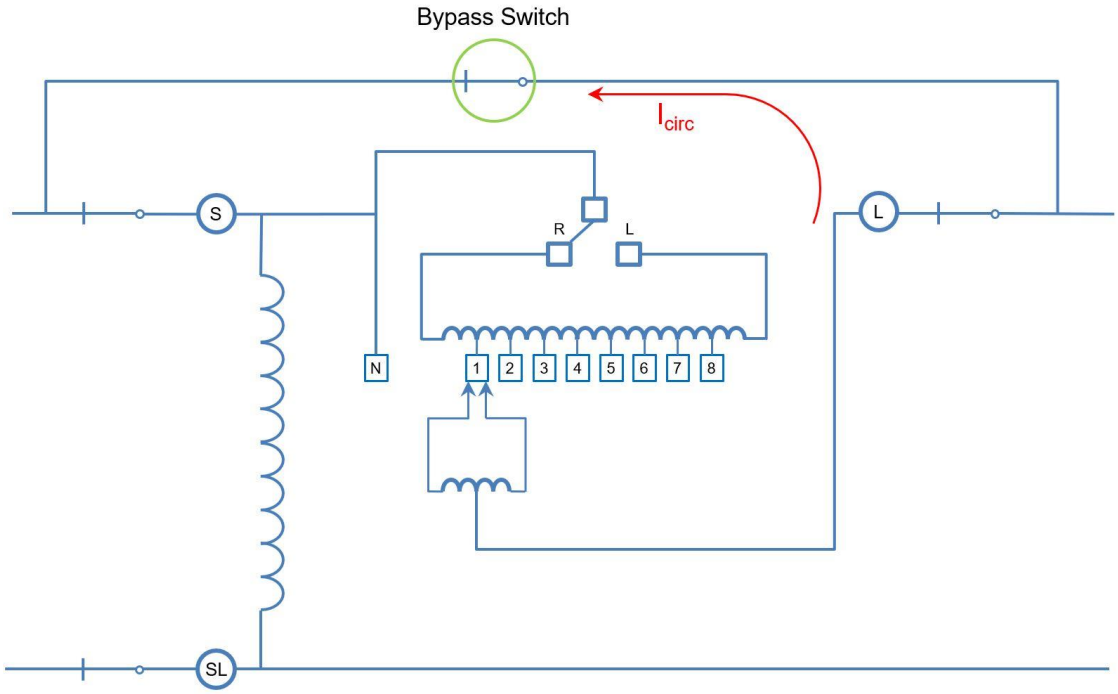


Figure 12: Hazardous Circulating Current of In-Circuit Bypassed Voltage Regulator

5.12.1 In-Circuit Bypassing Voltage Regulators

Large circulating currents are not generated when a voltage regulator is bypassed on neutral tap.

To ensure a voltage regulator is not bypassed off neutral tap, two independent means of neutral tap indication Shall be used; this is known as the neutral check routine. This routine Shall verify the unit to be bypassed is on neutral tap by means of:

(a) a mechanical indicator (the tap position indicator); and

(b) an electrical indicator (neutral light or voltage indicator).

Further to the neutral check routine, remote supervisory control Shall be disabled along with any other necessary precautions to ensure the voltage regulator cannot inadvertently move off neutral tap; the voltage regulator is considered ‘parked’ under this condition.

Typically, in-circuit bypassing of voltage regulators is considered an activity that occurs at the voltage regulator structure itself, however, there are circumstances where voltage regulators can be bypassed via switches remotely located from the voltage regulator site. In situations where three-phase voltage regulators are to be bypassed via a normally open point, Engineering advice Shall be sought to confirm adequate impedance exists within the bypass loop.

5.12.2 De-energised Bypassing Voltage Regulators

Units without two methods of neutral indication are not suitable for in-circuit bypassing. Such units Shall only be bypassed De-energised.

5.13 Changing Taps on Distribution Transformers

Distribution Transformers have De-energised Tap-Changers (DETC) which as the name suggests can only change taps while De-energised.

Prior to performing a tap change operation, Distribution Transformers Shall be Isolated and proved De-energised by Approved means.

Where Exclusion Zones will not be encroached, changing taps is considered a Switching operation and can be performed under the direction of a Switching Sheet. Where Exclusion Zones will be encroached, an Access Permit is required.

5.14 Switching Involving Pressurised Cables

When a cable pressure alarm or a request for emergency Work is received, the Switching Coordinator Shall immediately notify the relevant engineering support representative to determine whether the Cable needs to be De-energised.

In the circumstances where the Cable is De-energised and no further Switching is to be performed for associated Work on the Cable, the Switching Coordinator Shall place notes on the HV Operating Diagram advising of its availability for service in a network emergency. This direction Shall be advised by engineering support.

If the Cable is not available for service, the Switching Coordinator Shall ensure the following additional actions are carried out to ensure the Cable will not be re-energised locally or remotely:

(a) disable remote supervisory control (if available)

(b) inhibit the operation of the relevant Circuit Breaker/Switch and place DNOBs

(c) place a Control Inhibit and an Out of Service document on the relevant DMS/SCADA points.

5.15 Pre-energisation Checks & Abnormalities

5.15.1 Pre-Energisation Checks/Tests

HV Electrical Apparatus that has been subject to Work activity Shall not be Energised until all required pre-energisation checks/tests (in accordance with standard Work, test and commissioning procedures) have been successfully completed and recorded. In the absence of network plant (transformers or Switchgear for example), this may simply be a visual inspection.

Prior to energising the Electrical Apparatus, the Switching Coordinator Shall confirm all required pre-energisation checks/tests have been successfully completed. This confirmation Shall be with the Recipient, Authority Holder or the Switching Operator as appropriate and can be verbal confirmation or acknowledgment via Mobile Switching.

If an Access/Test Permit or Non-Access Work Authority was issued for the Work and has not been endorsed to confirm pre-energisation checks/tests, then:

(a) the Switching Operator/Coordinator Shall obtain such confirmation (written or verbal) from the work/test group and record confirmation on the Work Approval; or

(b) another Work Approval Shall be issued (as required) to carry out the required checks/tests before re-energising the Electrical Apparatus.

5.15.2 Abnormalities

Following the completion of any Work, the Authorised Person in Charge Shall identify and record any abnormalities resulting from the Work. Examples of abnormalities include, but are not limited to:

(a) earthing abnormalities

(b) connection abnormalities

(c) testing required

(d) the Electrical Apparatus is unserviceable

(e) Workers not signed off Access/Test Permit.

All abnormalities Shall be reported to the Switching Coordinator. The Switching Coordinator Shall consider the impact of the abnormalities and take the appropriate action with regards to reverse Switching or the status of the network.

5.16 Reverse Switching Checks

5.16.1 Check All Earths Removed

To safeguard against Switching onto short-circuits, following all Switching Sheet items to remove Earths, a check to confirm all Earths have been removed as per the relevant Work Approval and commissioning documentation Shall be included in the Switching Sheet.

The Switching Operator Shall perform this check where the relevant documentation has been physically recovered.

The Switching Coordinator Shall perform this check where verbal permits have been surrendered and cancelled.

5.16.2 Protective Device Checks

To ensure plant is adequately protected, the following Shall be performed as items in the Switching Sheet and prior to plant being returned to service:

(a) reverse any trip isolation performed for the Work; and

(b) check that all relays associated with the Work have been reset*.

* Not applicable where the Work does not affect relays.

To ensure the ability to remotely switch protective devices, remote supervisory control Shall be re-enabled on those devices for which it was disabled for the Work. This Shall be an item in the Switching Sheet and performed before the devices are closed.

5.16.3 Phasing Checks

Within an Interconnected network an incorrect phase relationship across an open point will result in a phase-phase short-circuit upon closing of the open point; such a Fault typically results in damage to the network and presents a risk of injury to the public and personnel performing the Switching.

Certain Work performed on the network creates the possibility of incorrect connections and consequently a mismatching of the phase relationship between Conductors across an open point. This may include Work where:

(a) two or more Conductor connections have been broken at the same time; or

(b) new Electrical Apparatus is Commissioned.

Phasing checks Shall be performed during the reverse Switching and as items on a Switching Sheet.

During all phasing actions, including testing and proving, any Auto-Reclose functionality that could re-energise a Fault on impacted sections Shall be disabled.

The requirement to check phasing is not applicable where the correctness of phasing is clearly apparent, such as but not limited to:

(c) breaking/making straight-through bridges

(d) installing/replacing a Disconnector.

If there is any doubt or concern that phasing may be incorrect following Work, phasing Shall be checked.

5.16.3.1 Phasing Out

Phasing out is the process of checking the correct phase relationship exists across the poles of an open point and is only possible where there is another established network Supply voltage to check against (Figure 13).

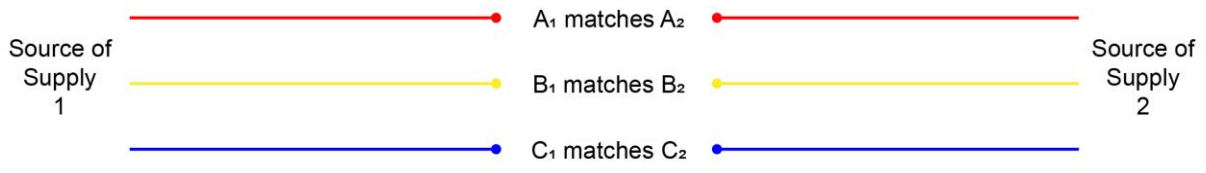


Figure 13: Correct Phase Relationship Across an Open Point

Once the phasing out check has been completed, the phase relationship Should be proved. If the phasing out point is to be left open, the Switching Sheet Should direct close and open operations where practicable.

Whenever phasing is to be proved, consideration Should be given to utilising Fault make rated switches where practicable.

Possible phasing out locations include:

(a) Ring Main Units with phasing facilities

(b) Circuit Breakers

(c) Transformer LV Disconnect Links/Fuses

(d) Disconnectors/Load Break Switches

(e) Disconnect Links

(f) Open LV or HV bridges.

Note: That all manufacturers' test equipment may not operate in the same manner and care Should be taken to correctly follow the operational instructions for the test equipment being used. Staff Shall not perform any test unless they are familiar with and confident in the use of the test equipment being used.

5.16.3.2 Phase Rotation Checks

Phasing out is only possible where there is another established network Supply voltage to check against. If this is not the case (such as for radial feeds and non-interconnected LV areas) and there is a risk of incorrect phasing, a phase rotation check Shall be carried out prior to de-energisation and confirmed upon re-energisation.

Phase rotation tests confirm that phases are connected in the correct sequence, either clockwise or anti-clockwise. Only Approved devices Shall be used, and it is best practice to use the same device to check phase rotation prior to de-energisation and to confirm phase rotation upon re-energisation.

To confirm phase rotation, Supply must sometimes be restored to multiple installations to enable the phase rotation check to take place. An example is depicted in Figure 14 for which Work is performed on a radial feed with several Distribution Transformers located downstream of the work area.

Phase rotation checks Shall be coordinated such as to minimise the possibility of damage to customers' installations. The following Switching approaches may be used:

(a) isolate all downstream three-phase transformer LV links/fuses*

(b) energise as small a segment of the network as possible while checks are performed (open the next downstream HV switch for example)

(c) utilising two crews and adopting a minimum delay approach – one crew located at the Switching site and another crew located at the phase check site. This will remove travel time and reduce the risk of damage.

* If LV isolation is not carried out at downstream transformers and upon re-energising the phase rotation test shows incorrect direction, all pumps, compressors and other directional loads will be operating in reverse direction until De-energised.

Note: If phasing is proved correct, then phase rotation must also be correct, however, checking that phase rotation is correct on both sides of an open point does not prove that phasing is correct.

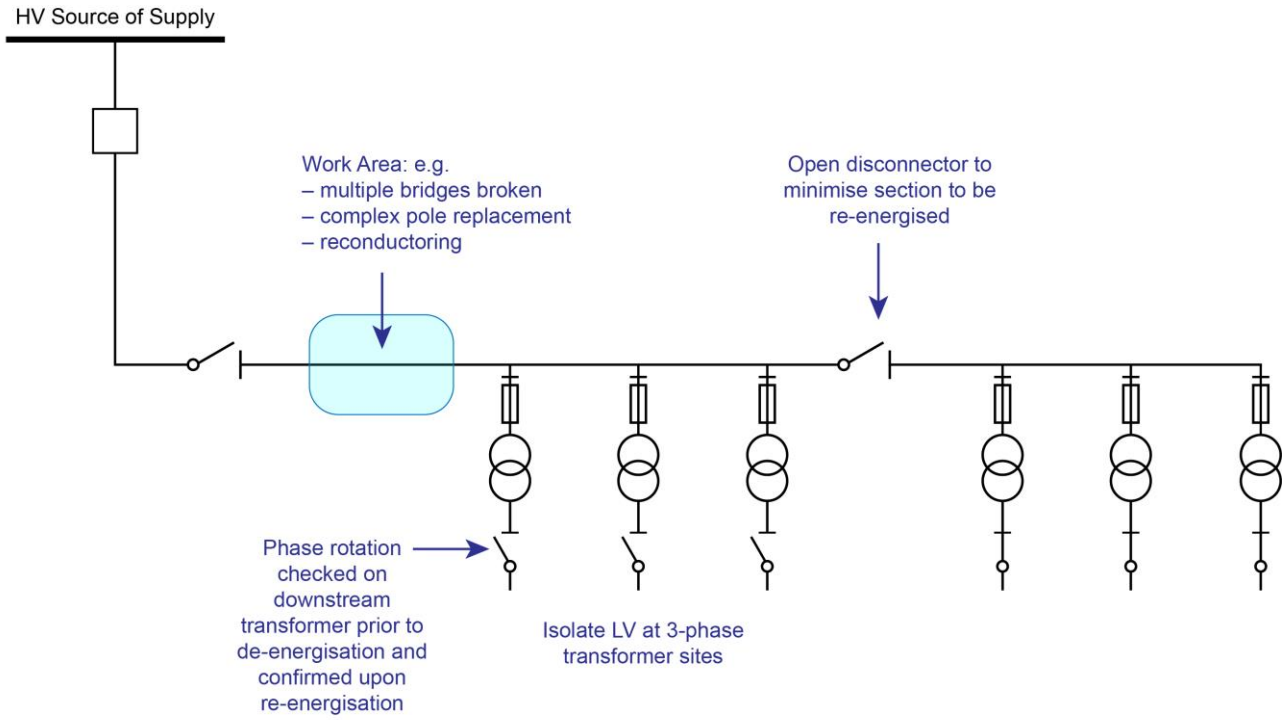


Figure 14: Coordination of Phase Rotation Checks on a Radial Feeder

5.17 Lead Switching Operator & Multiple Crews

When planned HV Switching involves more than one Switching crew, more efficient Switching can be achieved by designating a 'Lead Switching Operator' to assist the Switching Coordinator.

This approach may be utilised where a Switching Operator will have a beneficial awareness of the Switching environment, including the crews' location and progress of Switching operations. The Lead Switching Operator can assist the Switching Coordinator by coordinating the instructed Switching operations between themselves and the other crews involved in the Switching. Each Switching crew Shall consist of a Switching Operator and a Switching Operator's Assistant as per standard Switching procedures.

The Switching Coordinator retains oversight of the Switching coordination by:

(a) controlling the progress of Switching through the controlled allocation of Switching operations instructed at one time

(b) knowing which Switching Operator is performing each Switching operation

(c) confirming the status of instructed and completed Switching operations

(d) monitoring current and voltage changes, alarms and device status on the HV Operating Diagram.

This approach Shall not be used during unplanned Switching, however, is permissible for the reverse Switching component on an unplanned event.

5.17.1 Switching Coordination

Prior to adopting this approach, mutual agreement Shall be obtained between the Switching Coordinator and the Lead Switching Operator prior to Switching commencing. Following mutual agreement, the Lead Switching Operator Shall advise the Switching Coordinator of the name, location and contact number for all Switching Operators that will be involved in the Switching.

The Switching Coordinator issues the Lead Switching Operator a Switching operation, or block of sequential Switching operations to carry out. This Switching operation or block of Switching operations may be carried out by:

(a) the Lead Switching Operator directly; or

(b) other Switching Operators as directed by the Lead Switching Operator.

The Switching Coordinator Shall have knowledge of the Switching operations, or block of Switching operations to be carried out by each specific Switching Operator through either Mobile Switching/DMS functionality or notification by the Lead Switching Operator.

All items Shall be carried out in correct sequencing as per the authorised Switching Sheet, unless Approved by the Switching Coordinator.

If a problem occurs during a Switching operation, including loss of communications/systems or a Switching error, the Switching Operator carrying out the operation Shall notify the Switching Coordinator and Switching Shall cease until further direction is given by the Switching Coordinator.

5.17.2 Switching Communication with Multiple Crews

All Switching instructions passed between any two parties Shall:

(a) confirm the Switching Sheet number and version

(b) confirm the previous completed Switching operation and time before any further Switching instructions are given

(c) be confirmed as per standard Switching communication protocols.

Where Mobile Switching is not utilised, the Lead Switching Operator Shall record the time of all completed Switching operations on their copy of the Switching Sheet (the ‘Master Switching Sheet’). Each Switching Operator involved in the Switching Shall also have a copy of the Switching Sheet and Shall record the time of their completed Switching operations.

5.18 Delegated Switching Operator

Simple Switching for access to defined Electrical Apparatus as well as in remote areas of the network with no effective telecommunications coverage, can be achieved with the use of a trained and authorised ‘Delegated Switching Operator’ role.

This approach Shall only be utilised for the following:

(a) planned Switching and access to pole mounted Distribution Transformers; or

(b) Switching and access in defined areas with no telecommunications coverage*.

* These areas Shall be identifiable as the Delegated Side of an established boundary.

Any Switching performed for HV Live Work Shall be coordinated by the relevant Control Centre and Switching Coordinator.

5.18.1 Switching Coordination

Prior to the commencement of any Switching, the Delegated Switching Operator Shall contact the relevant Control Centre.

The Switching Coordinator Shall:

(a) give approval to the Delegated Switching Operator to commence Switching and record the time of approval

(b) give approval in advance for the Delegated Switching Operator to issue the relevant Permits upon the successful completion of the instructed block of Switching operations

(c) cancel Access/Test Permits and give approval to commence reverse Switching where communications permit

(d) in the case of no effective communications, give approval in advance for the Delegated Switching Operator to commence reverse Switching upon completion of the Work, the necessary pre-energisation checks and the cancellation of the relevant Permits.

Upon approval from Switching Coordinator to commence Switching, the Delegated Switching Operator takes responsibility for the execution of the Switching. The Delegated Switching Operator Shall:

(e) ensure Switching is carried out in the correct sequencing as per the authorised Switching Sheet

(f) carry out Switching operations themselves or instruct a Switching operation or block of sequential Switching operations to other Switching Operators involved in the Switching

(g) record the times of all completed Switching operations on their copy of the Switching Sheet (the 'Master Switching Sheet')

(h) issue Access and Test Permits as per the authorised Switching Sheet

(i) approve the removal of Operator Earths under an Access Permit and record the time of removal and reinstatement on the Master Switching Sheet

(j) approve the suspension of an Access Permit and record the time of suspension and reinstatement on the Master Switching Sheet

(k) obtain approval to commence reverse Switching where communications permit

(l) cancel Access and Test Permits and commence reverse Switching where there is no effective communications with the relevant Control Centre.

If a problem eventuates during Switching, the Delegated Switching Operator Shall direct all Switching to cease and Shall notify the Switching Coordinator of the problem.

On advice of any abnormalities on the Access/Test Permit, the Delegated Switching Operator is responsible for ensuring any identified abnormalities are suitably resolved prior to energisation.

Upon completion of the reverse Switching, the Delegated Switching Operator Shall notify the relevant Control Centre.

5.18.2 Switching Communication with Multiple Crews

Where multiple crews are in involved in the Switching, all Switching instructions passed between any two parties Shall:

(a) confirm the Switching Sheet number and version

(b) confirm the previous completed Switching operation and time before any further Switching instructions are given

(c) be confirmed as per standard Switching communication protocols.

The Delegated Switching Operator Shall record the time of all completed Switching operations on their 'Master Switching Sheet'. Each Switching Operator involved in the Switching Shall also have a copy of the Switching Sheet and Shall record the time of their completed Switching operations.

5.18.3 Switching Sheet Amendments

When it is identified that amendments to the Switching Sheet are required, no further Switching Shall be performed until the amendments are made or a new Switching Sheet is distributed. Minor amendments can be made in consultation with the Switching Coordinator otherwise the Switching Sheet requiring amendments Shall be cancelled and a new Switching Sheet Shall be produced and distributed by the relevant Control Centre.

Amendments Shall be made to all copies of the Switching Sheet.

If Isolation Points or Operator Earth locations require changing during the course of Work, then all Access/Test Permits Shall be surrendered and cancelled prior to any changes and new Access/Test Permits Shall be issued to reflect the changed status.

Section 6

SWITCHING INVOLVING CUSTOMERS

6 SWITCHING INVOLVING CUSTOMERS

These Rules provide a coordinated approach to network Switching involving Customers and Shall be applied when Work is required at the interface between the Ergon Energy or Energex networks and Customer networks. In exceptional circumstances, where the requirements for Switching involving Customers cannot be met as per these Rules, an approved Operating Protocol may be followed. This Operating Protocol Shall be assessed and approved by an appropriately experienced RPEQ.

The intent of this section is to ensure that EQL staff only perform Switching activities using Switching Sheets written by EQL, regardless of who initiates the Work.

Note: As per Section 12 of Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus, suitably authorised EQL staff may be required to switch from a validated PLQ customer Switching Sheets.

In relation to Switching coordination, a Customer is a person, company or relevant body corporate, who receives, or wants to receive, a Supply of electricity for premises or an installation directly from the Ergon Energy or Energex network. It includes their appropriate representative such as contracted Electrician or Switching Coordinator.

In relation to Switching involving Customers, EQL (Energy Queensland Limited) refers to Ergon Energy Network and/or Energex and not any other subsidiary companies part of Energy Queensland Limited.

The following Rules outline a coordinated approach to enable:

(a) HV Switching of a Customer's network for EQL Work

(b) HV Switching of the EQL network for Customer HV Work

(c) Switching of the EQL network for Customer LV Work.

6.1 General

The following key safety principles Shall apply to all Work involving customers:

(a) both EQL and the Customer Shall prepare their own Switching Sheet, irrespective of the work initiator

(b) EQL personnel Shall not operate customer owned Electrical Apparatus*

(c) An EQL Work Approval Shall not be issued for Work on customer owned Electrical Apparatus*

(d) Customers Shall perform Work under their own Safe System of Work.

* An exemption from 6.1 (b) and (c) above is applicable where the Safe condition of the customer owned Electrical Apparatus can be demonstrated and the Work has been risk assessed and Approved by an appropriately experienced RPEQ.

6.1.1 Choice of Safe System of Work Procedures

The procedure used Shall be the procedure in which the work group is trained.

When Work is performed at the physical interface between the EQL network and the customer's network, the Safe System of Work procedure employed Shall be that of the organisation performing the Work.

The EQL Safe System of Work procedure Shall be used to perform Work on:

(a) an EQL owned Distribution Transformer for which the LV is directly connected to the Customer's service; or

(b) EQL HV Electrical Apparatus which is directly connected to the Customer's HV network or a HV Metering Unit.

The Customer's Safe System of Work procedure Shall be used to perform Work on:

(c) the Customer's service which is directly connected to the LV terminals of an EQL Distribution Transformer or LV fuse switch; or

(d) Customer's HV Electrical Apparatus which is directly connected to EQL HV network or HV Metering Unit.

Where work groups from both organisations are present, both procedures may be applied providing it does not result in one organisation's procedure affecting the procedures required by the other.

6.1.1.1 Separated Work

Where it is Reasonably Practicable to eliminate both work groups performing Work within the same Isolated area at the same time, the following two options, in order of preference, Shall be used:

1. Stage the Work such that only one organisation's Work is carried out at a time; this allows the Work to be carried out independently under each Safe System of Work procedure.

2. Create a common Isolation Point to separate the work areas by disconnecting Cables, braids, bridges or other connections as appropriate to allow the Work to be carried out independently under each Safe System of Work procedure*.

* To create a common HV/LV Isolation Point, an EQL Permit Shall be issued to disconnect and reconnect Cables, braids, bridges or other connections as appropriate.

6.1.1.2 Concurrent Work

Where it is not Reasonably Practicable to eliminate both work groups performing Work within the same Isolated area at the same time, then concurrent Work on either side of the interface that use the same Isolation Points may exist together. This is provided no electrical testing that involves lethal current (or has the ability to create Lethal Current) is carried out by any of the work groups and earthing continuity and Isolation Points are not compromised. The following Rules Shall apply:

(a) electrical testing at the interface can only be carried out by one organisation at any one time; and

(b) during electrical testing, there will be no other Work Approval or similar in receipt by the other organisation; and

(c) the work areas from either organisation will not overlap; and

(d) each organisation Shall use their own Safe System of Work procedure and place their own locks and tags on the other organisation's Electrical Apparatus; and

(e) the EQL Switching Sheet Shall issue an Access Permit to the EQL work group and a Customer Isolation Notice to the Customer's On-site Representative; and

(f) the Customer's Switching Sheet Shall issue the Customer's Access Permit (or equivalent) to the Customer work group where specified by their Safe System of Work procedure.

6.1.2 Switching of Customer Owned High Voltage Electrical Apparatus

To protect personnel from injury and liability, EQL personnel Shall not operate customer owned HV Electrical Apparatus unless an exemption is in place in accordance with *Section* 6.1. Furthermore, EQL Switching Sheets Shall not direct a Customer's Switching Operator (or equivalent) or direct the issue of a Customer's Work Approval (or equivalent).

6.1.3 Switching of Customer Owned Low Voltage Electrical Apparatus

Various Approved procedures require EQL personnel to perform tasks on Customer's LV Electrical Apparatus. These are typically specialised tasks such as checking polarity, phase rotation and insulation tests. Where an Approved procedure exists, then it is permitted to perform these tasks on customer's equipment in accordance with the Approved procedure.

6.1.4 Placement of Customer Locks

The EQL Switching Operator Shall permit the Customer to place locks and tags as required to identify and secure any EQL Isolation Point or earth used for the Customer's Safe System of Work.

Where necessary, the EQL Switching Operator may provide reasonable assistance to the Customer in the placement of their locks and tags. Examples of such assistance include the hanging of a Customer DNOB on EQL EDOs or Disconnect Links.

Note: A Customer's locks and/or tags Shall be in addition to any EQL locks and/or tags which were placed under the EQL Switching Sheet. Where required, callipers (or other multi-lock facility) Shall be used for multiple locks to provide distinct levels of security.

6.2 Application for Work

Prior to a Customer Switching request proceeding, the Customer Shall provide all of the following details at a minimum:

(a) the reason for the Switching (a brief description of the Work)

(b) the EQL Electrical Apparatus required to be switched

(c) the date, time and expected duration of the Work

(d) for HV Switching, the Customer's HV Switching Coordinator's name and contact details

(e) whether EQL Earths will need removal to allow testing

(f) up to date schematics of the Customer's network necessary to complete Validation, including any network alterations resulting from the Work.

If a Switching Sheet is required, the appropriate EQL representative will complete the application and forward it to Network Operations for outage coordination.

The customer Shall provide the final version of the Customer Switching Sheet at an agreed time prior to the commencement of Switching to enable EQL to carry out Validation, clash detection and authorisation of the EQL Switching Sheet.

6.3 Switching Sheets

Separate EQL and Customer Switching Sheets Shall be prepared for all Switching involving Customers.

EQL is responsible for all Switching Sheet preparation and execution of all Switching operations on EQL owned equipment.

The Customer is responsible for all Switching Sheet preparation and execution of all Switching operations on Customer owned equipment.

The name and contact details of the Customer or their representative, together with a brief description of the Work Shall be included on the front page of the Switching Sheet.

6.3.1 HV Operating Diagram Status

The EQL Switching Sheet Should include items to accurately display the status of the Customer's network at both the interface and any Interconnected network.

Note: These items are not directed Switching operations but are solely used for the purpose of updating the HV Operational Diagram.

6.3.2 Switching Sheet Validation

Validation is required for Approved use of Electrical Apparatus owned by another organisation for the purpose of isolation and earthing to safely access or test HV Electrical Apparatus at the interface.

Cross Validation of Switching Sheets Shall verify that isolation and earthing operations are correct for the defined work area.

The EQL Switching Sheet Writer Shall liaise with the Customer's Switching Coordinator (or equivalent) to ensure that both Switching Sheets are in complete alignment for Forward and Reverse Switching.

All Customer Switching operations Shall be coordinated by the Customer's Switching Coordinator via the Customer's Switching Sheet.

The Customer's Switching Sheet and EQL Switching Sheet Shall cross-reference each other and copies Shall be distributed as required.

Once both Switching Sheets have been validated and authorised, any changes Shall be communicated to the other organisation for re-validation and re-authorising to ensure the latest version can be re-distributed to each party.

Upon the commencement of Switching or any time during Switching, if cross-referencing is incorrect or out of sequence, Switching Shall cease immediately.

6.3.3 Switching Sheets for Customer Low Voltage Work

When the operation of more than one LV switch or the operation of any HV switch is required, EQL Shall prepare a Switching Sheet as required to isolate the Customer's LV assets from the EQL network.

A Switching Sheet is not required in situations where isolation can be provided by the operation of a single LV switch (a single Distribution Transformer LV switch for example).

6.4 Isolation & Earthing

Only EQL authorised Switching Operators Shall perform Switching of EQL Electrical Apparatus. All EQL Isolation Points associated with Customer Switching Shall be clearly identified by the placement of a DNOB.

If the Customer requires earthing of EQL network to comply with their Safe System of Work, EQL DNOBs Shall be applied to these Earths. This Shall be an item in the EQL Switching Sheet.

6.4.1 Isolation & Earthing for Customer Low Voltage Work

If there is no LV Isolation Point from the EQL network (a directly connected customer service for example) then an appropriate HV Isolation Point may be used.

Earths may be applied to the HV side of a Distribution Transformer if requested by the Customer. The placement and removal of these Earths Shall be directed by a Switching Sheet and Shall be recorded on any Customer Isolation Notice.

When EQL isolation is complete, the EQL Switching Operator Shall perform the appropriate tests to confirm the LV supplying the Customer has been De-energised. These Shall be items in the Switching Sheet.

6.5 Customer Isolation Notice

A Customer Isolation Notice Shall be issued to a Customer or the Customer's On-site Representative when EQL has carried out Switching to isolate a Customers HV or LV installation for the Customer to perform Work.

A Customer Isolation Notice Shall record the following details:

(a) contact details, work area, location, description of Work

(b) description of the EQL Electrical Apparatus Isolated and where applicable, Earthed

(c) signatures endorsing the Issue, Receipt, Surrender and Cancellation of the Notice.

A Customer Isolation Notice is not a Work Approval; the Customer Shall use their own Safe System of Work.

6.5.1 Issue & Receipt of Customer Isolation Notice

Where the Work requires an EQL Switching Sheet, the EQL Switching Coordinator Shall approve the issue of a Customer Isolation Notice as an item in the EQL Switching Sheet. The EQL Switching Operator Shall explain all sections of the Customer Isolation Notice directly to the Customer's On-site Representative and issue the Notice to that representative.

The Customer's On-site Representative Shall sign and date the Notice to acknowledge receipt of the Notice and its conditions. The EQL Switching Coordinator Shall record the issue of the Notice as an item in the EQL Switching Sheet.

Where there is no Switching Sheet involved in the Work (single LV Switching operation for example), the Customer Isolation Notice can be issued directly to the Customer's On-site Representative by the EQL Switching Operator.

The EQL Switching Operator Shall explain all sections of the Customer Isolation Notice directly to the Customer's On-site Representative and issue the Notice to that representative.

The Customer's On-site Representative Shall sign and date the Notice to acknowledge receipt of the Notice and its conditions.

6.5.2 Surrender & Cancellation of Customer Isolation Notice

The Customer's On-site Representative Shall sign and date the Customer Isolation Notice upon surrender and acknowledge all the conditions have been met before reconnection of Supply.

The EQL Switching Operator Shall recover the surrendered and cancelled Customer Isolation Notice from the Customer's On-site Representative.

If the original Customer Isolation Notice has been lost or destroyed, a new Notice Shall be generated detailing the original Isolation Points and location of Earths where applicable. The replacement Notice Shall be clearly marked and initialled as a replacement, stating the reason for its re-issue. This replacement Shall be endorsed/surrendered by the Customer or their representative before any Supply will be restored to the Customer's installation.

If the Customer Isolation Notice was issued for electrical Work, then the form must be endorsed by a licensed electrician.

6.6 Switching Communication

The coordination of all Switching Shall be through the direct channels depicted in Figure 15 such that the direction and confirmation of all Switching operations Shall only be communicated between an organisation's Switching Coordinator and Switching Operators. Switching Operators Shall not direct Switching operations to another organisation's Switching Operator.

6.7 Switching Sequencing for EQL Work

For EQL initiated Work where it is necessary for a Customer to provide isolation and earthing for Safe Work on EQL Electrical Apparatus, the following Switching sequencing and coordination Should apply.

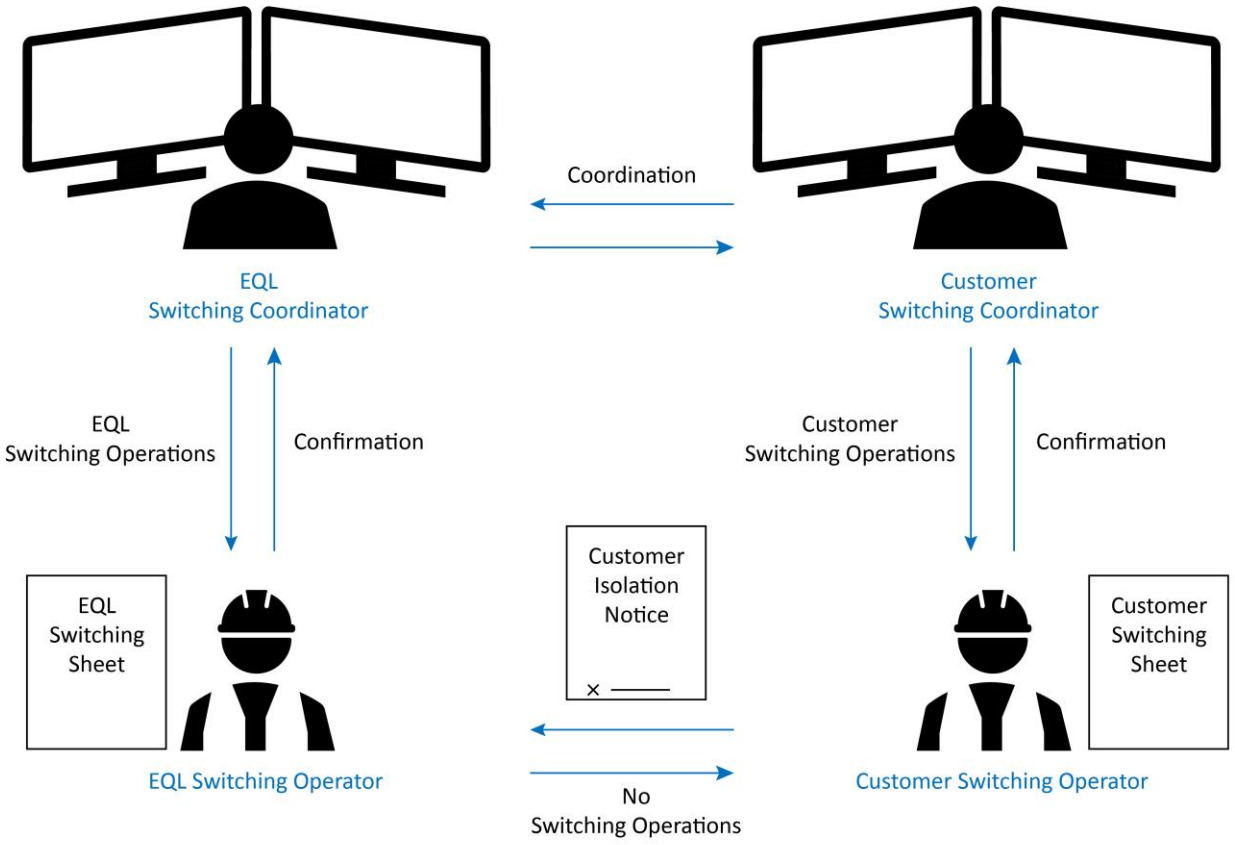


Figure 15: Switching Communication Channels Between Organisations

6.7.1 Forward Switching

The following forward Switching sequencing and coordination Should apply:

1. Switching Coordinators Shall confirm the EQL Switching Sheet and the Customer Switching Sheet version numbers are correct and cross-referenced.
2. Obtain approval from each Switching Coordinator to commence Switching.
3. Customer Switching Operators to de-load the Customer installation.
4. EQL Switching Coordinator Shall:
   (a) receive advice from the Customer Switching Coordinator that the Customer installation is de-loaded; and
   (b) advise the Customer Switching Coordinator that Supply is to be disconnected.
5. EQL Switching Operators to perform isolation on the EQL network in accordance with the EQL Switching Sheet, placing DNOBs at Isolation Points.
6. Customer Switching Operators to perform isolation on the Customer installation in accordance with the Customer Switching Sheet.
7. EQL Switching Coordinator Shall receive advice from the Customer Switching Coordinator that the Customer installation is Isolated.
8. EQL Switching Operators to place EQL locks and DNOBs on Customer Isolation Points.
9. Where required, EQL Switching Operators to test, prove De-energised and earth EQL Electrical Apparatus in accordance with the EQL Switching Sheet and these Rules.
10. Where required, Customer Switching Operators to test, prove De-energised and earth Customer Electrical Apparatus in accordance with the Customer Switching Sheet.
11. EQL Switching Coordinator Shall receive advice from the Customer Switching Coordinator that the Customer installation is Earthed.
12. EQL Switching Operators to place EQL locks and DNOBs on Customer Earthing Points as required.
13. EQL Switching Coordinator to advise all Switching is complete.

6.7.2 Placement of EQL Locks

The EQL Switching Sheet Shall include items for the Switching Operator to field check the correct status of the Customer's Isolation and Earthing Points and in turn, place locks and DNOBs to these points in accordance with EQL procedures.

6.7.3 Reverse Switching

Upon completion of the Work, the following reverse Switching sequencing and coordination Should apply:

1. EQL Switching Coordinator Shall advise the Customer Switching Coordinator that Work is complete and to commence restoration (reverse Switching).
2. EQL Switching Operators to perform pre-energisation checks as appropriate.
3. EQL Switching Operators to remove all EQL Earths.
4. EQL Switching Operators to remove EQL locks and DNOBs from Customer Earthing Points as required.
5. Customer Switching Operators to remove all Customer Earths.
6. EQL Switching Coordinator Shall:
   (a) receive advice from the Customer Switching Coordinator that all Customer Earths have been removed; and
   (b) advise that Supply is to be restored.
7. EQL Switching Operators to perform reverse isolation and restore Supply.
8. EQL Switching Coordinator to advise the Customer Switching Coordinator that Supply is available.
9. EQL Switching Operators to remove EQL locks and DNOBs from Customer Isolation Points as required.

6.8 Switching Sequencing for Customer Work

The following Switching sequencing and coordination Should apply when isolating (and earthing where required) the EQL network for Work on a Customer installation:

6.8.1 Forward Switching

The following forward Switching sequencing and coordination Should apply:

1. Switching Coordinators Shall confirm the EQL Switching Sheet and the Customer Switching Sheet version numbers are correct and cross-referenced.
2. Obtain approval from each Switching Coordinator to commence Switching.
3. Customer Switching Operators to de-load the Customer installation.
4. EQL Switching Coordinator Shall:
   (a) receive advice from the Customer Switching Coordinator that the Customer installation is de-loaded; and
   (b) advise the Customer Switching Coordinator that Supply is to be disconnected.
5. EQL Switching Operators to perform isolation on the EQL network in accordance with the EQL Switching Sheet, placing DNOBs at Isolation Points.
6. Customer Switching Coordinator Shall receive advice from the EQL Switching Coordinator that the EQL network is Isolated.
7. Customer Switching Operators to place Customer locks/tags on EQL Isolation Points as required.
8. Customer Switching Operators to perform isolation on the Customer installation in accordance with the Customer Switching Sheet.
9. EQL Switching Coordinator Shall receive advice from the Customer Switching Coordinator that the Customer installation is Isolated.
10. Where required, EQL Switching Operators to test, prove De-energised and earth EQL Electrical Apparatus in accordance with the EQL Switching Sheet and these Rules.
11. Customer Switching Coordinator Shall receive advice from the EQL Switching Coordinator that the EQL network is Earthed.
12. Customer Switching Operators to place Customer locks/tags on EQL Earthing Points as required.
13. EQL Switching Coordinator Shall approve the issue of a Customer Isolation Notice as an Item in the EQL Switching Sheet.
14. EQL Switching Operator Shall explain all sections of the Customer Isolation Notice and issue the Notice directly to the Customer's On-site Representative. The Customer's On-site Representative Shall acknowledge the conditions detailed on the Notice by signing and dating.
15. EQL Switching Coordinator Shall record the time of issue and receipt.
16. Where required, Customer Switching Operators to test, prove De-energised and earth Customer Electrical Apparatus in accordance with the Customer Switching Sheet.
17. Customer Switching Coordinator to advise all Switching is complete.

6.8.2 Reverse Switching

Upon completion of the Customer Work, the following Switching sequencing and coordination Should apply:

1. Customer Switching Coordinator Shall advise the EQL Switching Coordinator that Work is complete and to commence restoration (reverse Switching). Prior to commencing Switching, the Customer Isolation Notice Shall be confirmed as surrendered and cancelled.
2. EQL Switching Coordinator Shall record the time of cancellation.
3. EQL Switching Coordinator Shall obtain confirmation from the Customer Switching Coordinator that all pre-energisation requirements have been met and that Supply can be restored*.
4. Customer Switching Operators to remove Customer locks/tags from EQL Earthing Points as required.
5. EQL Switching Operators to remove all EQL Earths.
6. Customer Switching Operators to remove all Customer Earths.
7. EQL Switching Coordinator Shall:
   (a) receive advice from the Customer Switching Coordinator that all Customer Earths have been removed; and
   (b) advise that Supply is to be restored.
8. Customer Switching Operators to remove Customer locks/tags from EQL Isolation Points as required.
9. EQL Switching Operators to perform reverse isolation and restore Supply.
10. EQL Switching Coordinator to advise the Customer Switching Coordinator that Supply is available.

* For any commissioning of Customer equipment, an Approved procedure Shall be followed that confirms the Customer equipment has been appropriately tested and is Safe to energise; reverse Switching Shall not proceed without sign-off by an EQL Connections Officer.

Section 7

SWITCHING INVOLVING POWERLINK QUEENSLAND

7 SWITCHING INVOLVING POWERLINK QUEENSLAND

In relation to the following Rules, EQL (Energy Queensland Limited) refers to Ergon Energy Network and/or Energex and not any other subsidiary companies part of Energy Queensland Limited.

The following Rules outline a Safe system for coordinating Switching between EQL and Powerlink Queensland (PLQ) and Shall be applied when coordinating Switching at the interface to enable Work to be performed by either entities.

Examples of suitable application of these Rules include, but are not limited to:

(a) Switching of the EQL network to allow PLQ to perform Work on PLQ Primary and Secondary equipment; and

(b) Switching of the PLQ network to allow EQL to perform Work on EQL Primary and Secondary equipment.

7.1 Switching Sheet Preparation and Coordination

Both PLQ and EQL require a minimum of 20 business days notification for all planned Switching requests. All responsibility for Outage and Switching Coordination Should be coordinated by the initiator of the outage, i.e. the entity performing the Work.

As both entities operate under the *Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus*, a single Switching Sheet is permitted to carry out all Switching on both sides of the networks' interface to achieve a single outcome.

When EQL is the initiator of the outage, the EQL Switching Sheet is the 'Master Sheet' for all Switching coordination, Switching operations and field time recording.

When PLQ is the initiator of the outage, the PLQ Switching Sheet is the 'Master Sheet' for all Switching coordination, Switching operations and field time recording.

When the PLQ sheet is the Master Sheet, a separate DMS 'Run Sheet' Shall be prepared by the EQL Outage Coordinator to run in conjunction with the PLQ Switching Sheet. This Run Sheet Shall be written, checked and authorised as per the standard and Shall reference the PLQ Switching Sheet number and version.

The Run Sheet Shall:

(a) reference the PLQ sheet number and version it runs in conjunction with; and

(b) state that its use is solely for the purpose of updating the HV Operational Diagram.

The Run Sheet Shall also include all 'From Control Items', 'Switching Inhibits' and any necessary dress items to accurately display the current state of the network at both the interface and any Interconnected Transmission network.

7.2 Switching Sheet Validation

Validation is required for Approved use of Electrical Apparatus owned by another entity for the purpose of isolation and earthing to safely access/test HV Electrical Apparatus at the interface. The initiator of the outage will write the Switching Sheet, which includes operations on the other entity's assets, and send it to the other entity for Validation a minimum of three business days prior to the commencement of Switching.

This Validation will allow the other entity to verify their operations, make any changes, and add any pre-requisite operations (or references to pre-requisite Switching Sheets) required to allow these operations to proceed. The other entity may modify the terminology used for their operations (to be undertaken by their own personnel) to be consistent with that entity's standard Switching terminology.

The Switching Sheet will then be sent back to the requesting entity to continue the Validation process until both entities are satisfied that the Switching Sheet is correct for the intended purpose.

Following Validation, the Switching Sheet will be distributed to the other entity to use as their own Switching copy as required. Any changes Shall be communicated to the other entity for re-validation and reauthorising to ensure the latest version can be redistributed to each other.

Note: Under Section 12 of Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus, suitably authorised EQL staff may be required to switch from a validated PLQ customer Switching Sheets.

7.3 Switching Operator Requirements

The owner of the asset to be operated Shall provide suitably trained and authorised Switching Operators to complete all required Switching operations.

EQL Switching Operators may operate certain PLQ assets provided they have been suitably trained and have valid authorisations.

Where work groups from both entities are present, both entity's Safe System of Work procedures may be applied providing this does not result in one entity's procedure affecting the procedures required by the other.

7.4 Coordination of Auto-Reclose Disabling

Where a HV Live Work Authority or Vicinity Work Authority is required for EQL Electrical Apparatus for which the upstream protective device is located at a PLQ site, the following process Shall apply:

(a) the Work Approval Shall be prepared by EQL

(b) the Work Shall be verbally scheduled with PLQ with a copy of the Work Approval emailed:

i. 48 hours prior to the commencement of Work for single day Work; and

ii. 28 days prior to the commencement of Work for Work over multiple days.

Note: There is no PLQ requirement for Validation.

The Work Shall be coordinated by an EQL Switching Coordinator with the following sequencing:

1. EQL Switching Coordinator to request the PLQ Switching Coordinator to disable Auto-Reclose on the nominated protective device.
2. PLQ Switching Coordinator to disable Auto-Reclose and tag the relevant protective device.
3. EQL Switching Coordinator Shall issue the HV Live Work Authority or Vicinity Work Authority.
4. Upon completion of the Work, EQL Switching Coordinator Shall cancel the HV Live Work Authority or Vicinity Work Authority.
5. EQL Switching Coordinator to advise the PLQ Switching Coordinator that all Work is complete.
6. PLQ Switching Coordinator to remove tag and enable Auto-Reclose on the relevant protective device.

Where multiple work crews are present on the Electrical Apparatus, the EQL Switching Coordinator Shall confirm all work crews have completed Work and all Work Approvals have been surrendered prior to advising PLQ that Work is complete.

Section 8

NOT ELECTRICALLY CONNECTED HIGH VOLTAGE ELECTRICAL APPARATUS

8 NOT ELECTRICALLY CONNECTED HIGH VOLTAGE ELECTRICAL APPARATUS

The following Rules outline the minimum requirements for performing Work on Not Electrically Connected (NEC) HV Electrical Apparatus to ensure the Work is electrically Safe.

These Rules apply to NEC Work Areas involving the following:

(a) apparatus released from the Commissioned network to allow Work

(b) de-commissioned apparatus

(c) Non-Commissioned apparatus (not previously Commissioned).

Work on NEC Electrical Apparatus Shall not commence until a Work Approval is in receipt and Earths are in place as per the requirements of the Work Approval and these Rules. The Work Approval Shall clearly denote the following:

(d) NEC Electrical Apparatus subject to Work activity

(e) Disconnection Points

(f) Nearby Exposed Live Electrical Apparatus

(g) person responsible for the electrical safety of the Work

(h) location of Earths and any other precautions in place for Safe Work.

8.1 Not Electrically Connected (NEC)

The term NEC describes the connection status of new installations (Non-Commissioned) as well as Electrical Apparatus previously connected to the Commissioned network.

For Electrical Apparatus to be considered NEC to the Commissioned network, the apparatus Shall be:

(a) disconnected from all sources of Supply by the removal or absence of Conductors, appropriate to the voltage and insulating medium; and

(b) not able to be Energised by Switching; and

(c) be identifiable by an Approved means.

8.1.1 Creating a Disconnection Point

For Electrical Apparatus to be considered NEC, Approved Disconnection Points and controls Shall be established and maintained.

Disconnection Points involving the removal of existing connections Shall only be established with the approval of the relevant Control Centre using Safe access or Approved Live Work procedures. Any alteration to such Disconnection Points Shall be performed using Safe access or Approved Live Work procedures.

A Disconnection Point is an adequate break created by the removal or absence of Conductors and deemed no longer a source of inadvertent energisation. The break Shall:

(a) not be able to be re-established by normal Switching operations; and

(b) maintain the Exclusion Zone appropriate to the voltage or maintain the electrical Non-Flashover Distance appropriate to the voltage as defined in Table 6; and

(c) be created in accordance with Approved procedures.

Table 6: Non-Flashover Distances

Nominal System Voltage	Non-Flashover Distance (mm)
HV up to 11 kV	320
22 kV	320
33 kV	420
66 kV	700
110 kV	1210
132 kV	1430
220 kV	2225

Where a Non-Flashover Distance less than the Exclusion Zone is to be utilised in the establishment of a Disconnection Point, it Shall be assessed and Approved by an appropriately experienced RPEQ on a case by case basis. Such approval Shall be documented unless under emergency conditions. Where a Disconnection Point maintains the relevant Exclusion Zone, RPEQ approval is not required.

Caution: where a Disconnection Point is established by maintaining the Non-Flashover Distance, it may not maintain the relevant Exclusion Zone from the Commissioned HV network.

Disconnection Points Shall be applied to any LV sources of Supply capable of back energising the NEC Work Area at HV.

It is considered acceptable for AC or DC control supplies to be made available at the NEC Work Area to allow the operation of electrical appliances (electrical hand tools for example) for the Work to be performed.

8.1.2 Approved Disconnection Points

The following are Approved Disconnection Points from the HV system:

(a) removal or absence of bridges

(b) removal or absence of overhead Conductor span

(c) removal or absence of a section of overhead Conductor (e.g. Temporary In-Line Shackle)

(d) removal or absence of Busbar

(e) removal of moving contacts of Disconnector

(f) Cables cut clear

(g) Cable terminations disconnected and secured in place, achieving the appropriate Exclusion Zone or maintaining the defined electrical Non-Flashover Distance from the Commissioned network.

The following are Approved Disconnection Points from LV sources of Supply:

(h) removal or absence of bridges

(i) removal or absence of overhead Conductor span

(j) removal or absence of a section of overhead Conductor

(k) Cables cut clear

(l) Cables disconnected

(m) Cables/leads/flexible connectors removed.

8.2 Hazards

Although disconnected from all sources of Supply, Electrical Hazards are still present when working on NEC Electrical Apparatus. Electrical Hazards encountered include, but are not limited to:

(a) misidentification of apparatus

(b) contact with Nearby Exposed Live Conductors

(c) Earth Potential Rise

(d) Induction

(e) test voltages, currents and stored energy.

The controls implemented to manage hazards for NEC Work are typically consistent with those implemented for HV access work.

8.2.1 Misidentification of Apparatus

Prior to any Work commencing, the Electrical Apparatus Shall be positively identified as NEC.

Workers Shall apply the Safe Work principle ‘test before you touch’ at all times.

Any incorrect labelling Shall be reported to the relevant Control Centre.

8.2.2 Contact with Nearby Exposed Live Conductors

Where there is a possibility of inadvertent contact with Nearby Exposed Live Conductors above, below or adjacent to the NEC Work Area, controls Shall be implemented to manage the hazards.

Elimination of the hazard by placing Nearby circuits under access is the preferred control. Where this is not Reasonably Practicable, the hazards Shall be risk assessed and managed using all applicable controls in accordance with Approved procedures (refer to *Section* 3.2.1).

8.2.3 Earth Potential Rise (EPR)

Where an earth electrode or grid capable of conducting Fault current exists at the work area, there is a risk of Workers being Exposed to hazardous touch voltages.

This is of particular concern when working within substations; here, any earth fault supplied by the substation will see a rise in potential difference between the earth grid (including bonded metalwork) and unearthed Conductors being worked on (refer to *Section* 3.2.3).

8.2.4 Induction

Work on NEC Electrical Apparatus can be subject to hazardous voltages emanating from Nearby circuits. Site-specific earthing requirements Shall be assessed to manage any magnetic and electrostatic induction hazards present. Refer to *Section* 3.2.2 for information on induction hazards and earthing controls.

8.2.5 Test Voltages & Currents

Electrical testing of NEC apparatus poses the following hazards:

(a) insufficient Clearances for the applied test voltages

(b) production of Lethal Currents

(c) stored energy.

These hazards Shall be managed in accordance with the Rules outlined for testing under access (refer to *Section* 3.6).

8.3 Identifying Not Electrically Connected Electrical Apparatus

For substation NEC Work Areas, any NEC Electrical Apparatus Shall be delineated in accordance with the *Queensland Electrical Supply Industry Substation Barrier Chart*, such that:

(a) a barrier of white tape or flag bunting bearing the words ‘NOT ELECTRICALLY CONNECTED’ in black text is erected at a height of approximately 1.3 m from ground level with a single appropriately sized opening; and

(b) a white sign bearing the words ‘NOT ELECTRICALLY CONNECTED’ in black text is placed at the entrance point to the work area.

Caution Shall be taken not to erect any barrier within the relevant Exclusion Zone of any Energised Electrical Apparatus.

For overhead and underground Electrical Apparatus, where a Disconnection Point is established that creates a NEC section, it Shall be delineated by:

(c) a white sign bearing the words 'NOT ELECTRICALLY CONNECTED' in black text placed at each Disconnection Point; or

(d) a barrier of white tape or flag bunting bearing the words 'NOT ELECTRICALLY CONNECTED' in black text attached around the overhead structure at a height of approximately 1.3 m from ground level at each Disconnection Point; or

(e) a combination of both methods.

8.4 Earthing of Not Electrically Connected Electrical Apparatus

8.4.1 General Earthing Requirements

All Exposed Conductors of NEC Electrical Apparatus Shall remain Earthed and short-circuited until dismantled or removed from site. Where Exposed Conductors will remain NEC indefinitely, the Conductors Shall be Earthed and short-circuited by means of permanent bonding, that is not via portable earthing devices.

Earths Shall be applied at each HV Disconnection Point where practicable. This is not required for Non-Commissioned Electrical Apparatus remote from any source of Supply.

Earths Shall be applied to manage any induction and electrostatic voltage hazards present.

The placement and removal of all Earths Shall comply with the *Hierarchy of Earthing Device and Connection* as well as the *Earthing and Short-Circuiting Process* stipulated for HV access Work (refer to *Section* 3.5).

To avoid misidentification with Operator Earths, Earths applied to NEC Electrical Apparatus Shall not have a DNOB attached.

8.4.2 Earthing Requirements for Safe Work

Prior to any Work commencing on NEC Electrical Apparatus, the site-specific earthing requirements Shall be assessed.

The person responsible for supervising the electrical safety of the Work Shall identify the earthing requirements to all persons required to Work on the NEC Electrical Apparatus.

The placement and removal of all Earths, including their location, Shall be recorded on the appropriate Work Approval or other document governing the electrical safety of the work area such that all Workers understand the earthing controls in place and all Earths can be accounted for prior to energisation (if required).

The continuity of earthing Shall be confirmed and maintained for the duration of Work. Where the Work involves the connection, cutting or disconnection of HV Conductors, the Rules outlined in *Section* 3 for managing open points Shall apply.

For Work within substations where EPR is a hazard, all Conductors Shall be Earthed to the Substation Earth Grid to minimise the difference in potential between a Worker's hands and feet.

8.5 Testing of Not Electrically Connected Electrical Apparatus

Prior to any testing, the Electrical Apparatus Shall be positively identified as NEC.

All electrical testing Shall be conducted in accordance with Approved procedures and all persons performing the testing Shall be competent in performing the test activities and in the use of the test equipment.

To ensure the safety of all persons and adjacent plant, the person in charge of testing Shall ensure all Disconnection Points and any other relevant Clearances are suitable for the applied test voltage.

8.5.1 Removal of Earths & Application of Test Leads

When Earths are removed, the NEC Electrical Apparatus to be tested Shall be considered Live and all persons Shall stand clear until the testing has been completed, the apparatus is fully discharged and Earths have been reinstated.

Where possible, NEC Electrical Apparatus Shall be Earthed during the placement and removal of test leads. Where this cannot be achieved, appropriate insulating gloves Shall be worn during the application and removal process. Any related Approved procedure Shall contain this control measure.

Following the completion of testing, the person in charge of testing Shall ensure all Electrical Apparatus is fully discharged and all Earths removed for testing purposes have been reinstated and recorded on the relevant documentation.

No Work is allowed on the NEC apparatus during the setup and duration of the testing.

8.6 Releasing Electrical Apparatus from the Commissioned Network

When releasing Electrical Apparatus from the Commissioned network to the NEC state, a Notice Shall be issued to formalise the status change.

The issue of this Notice Shall be an item in the Switching Sheet. Upon issue of the Notice, the Electrical Apparatus is no longer under the governance of any Control Centre.

Secondary Systems isolation Shall ensure any protection systems associated with the NEC Electrical Apparatus will have no effect on in-service plant.

8.6.1 Responsibilities of the Switching Coordinator

The Switching Coordinator is responsible for approving the issue of the Notice while dealing directly with the Switching Operator. The Switching Coordinator Shall:

(a) confirm that all Disconnection Points have been created

(b) confirm that earthing is in place (without DNOBs)

(c) approve the issue of the Notice to formally release the Electrical Apparatus from the Commissioned network.

8.6.2 Responsibilities of the Switching Operator

The Switching Operator Shall:

(a) confirm that all Disconnection Points have been created and those maintaining only the Non-Flashover Distance have RPEQ approval

(b) confirm that earthing is in place (without DNOBs)

(c) confirm all NEC barriers and signage are in place

(d) ensure all relevant sections of the Notice have been completed

(e) issue the Not Electrically Connected Notice.

8.7 Commissioning Electrical Apparatus

The transition of Electrical Apparatus from the NEC state to the Commissioned network Shall be performed in accordance with Approved commissioning procedures.

All Electrical Apparatus Shall be confirmed as fit for energisation with the appropriate checks, tests and documentation completed before Switching commences to energise the apparatus.

The connection of NEC Electrical Apparatus to the Commissioned network can be performed under an Access Permit or via Approved Live Work procedures. Figure 16 shows the staged transition from the NEC state to the Commissioned network using an Access Permit.

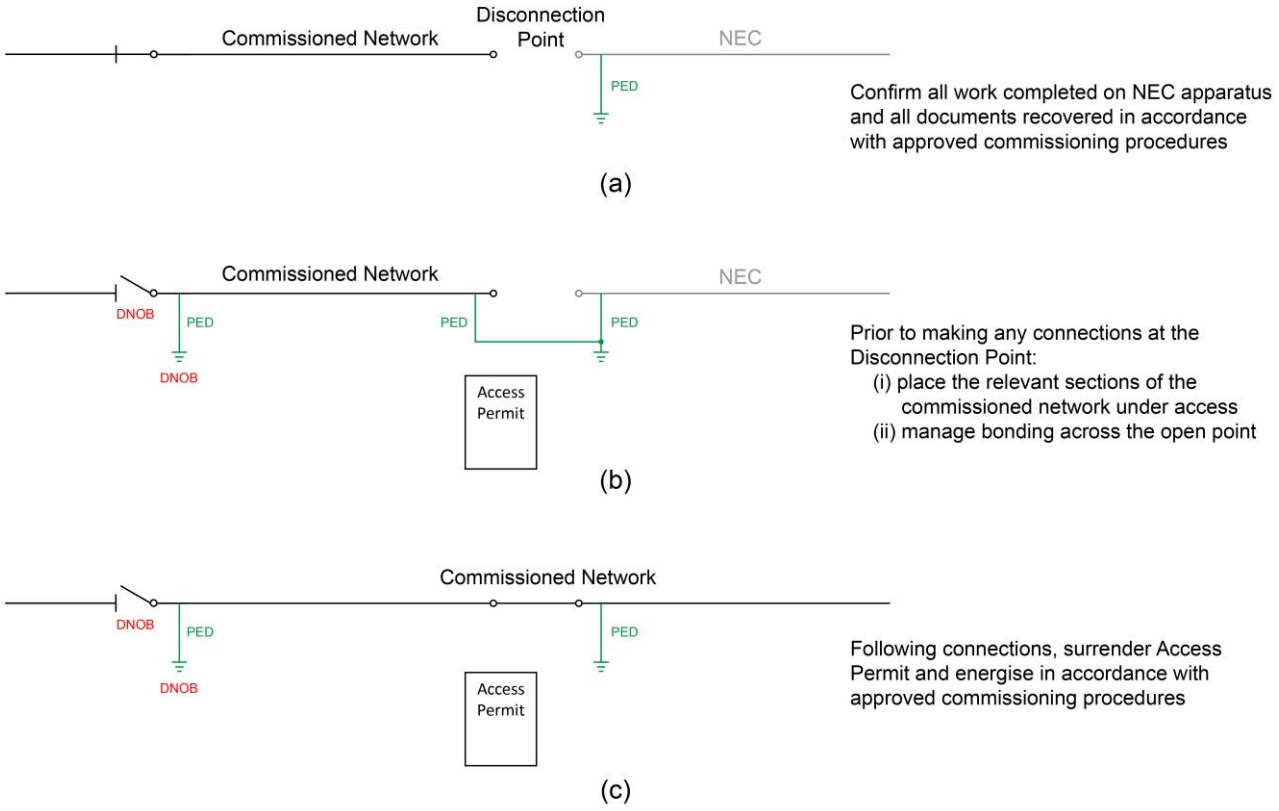


Figure 16: Transitioning to the Commissioned Network via an Access Permit

Section 9

SECONDARY SYSTEMS

9 SECONDARY SYSTEMS

This section outlines the Rules for managing Work involving Secondary Systems. These Rules are designed to:

(a) ensure all Work is performed safely

(b) ensure adequate levels of protection remain operational

(c) prevent the Work from causing unplanned outages through the inadvertent tripping of protective devices.

9.1 Hazards

It is important to be aware of and understand the hazards encountered when working with Secondary Systems. It is equally important to understand how these hazards can be managed to ensure Safe Work.

9.1.1 Isolation

Incorrect isolation or protection out of service may expose Workers and the public to Electrical Hazards, damage network assets or introduce other hazards via unplanned outages.

Where Secondary Systems isolation is required for Work, up-to-date drawings Shall be used to confirm all required Isolation Points and unless otherwise stated in Approved procedures, all isolation Shall be recorded on a Secondary Systems Isolation Sheet.

Prior to Work commencing on a Secondary Systems, appropriate checks or tests to ensure that adequate isolation has been achieved Shall be carried out.

9.1.2 Open Circuit Current Transformers

Workers can be Exposed to hazardous voltages across the open circuit secondary wiring of a current transformer (CT) with current flowing through the primary Conductor (Figure 17).

All CTs in a circuit to be worked on, apart from those terminated, Shall have their cores Isolated, shorted and Earthed. Where this is not possible, Engineering support Shall be contacted for instruction.

Where an open circuit CT secondary is suspected, the CT Shall be safely Isolated. No attempt Shall be made to short-circuit Energised CT secondary circuits in an open circuit condition.

9.1.3 Closed Loop Induction

Fault or load current in Nearby circuits can induce voltages on a De-energised (or Isolated) primary Conductor of a CT and where a ‘closed loop’ exists, an induced circulating current will flow (Figure 18). Workers need to be aware that induced current in the CT primary will create a hazardous voltage across an open circuit secondary.

9.1.4 Misidentification of Cables

The misidentification of Cables can expose Workers to Electrical Hazards, particularly when cutting or disconnecting Cables. Prior to cutting or disconnecting any Secondary Systems Cable (AC, DC, telecommunications), Workers Shall positively identify the Cable by drawings, tracing, testing or a combination thereof.

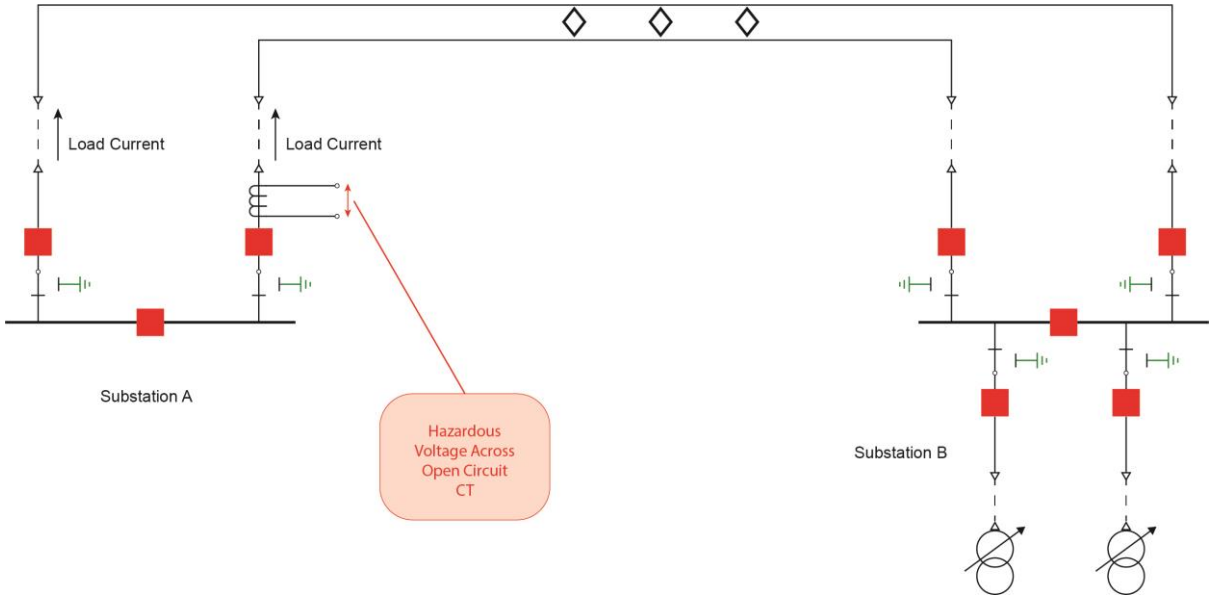


Figure 17: Hazardous Voltage Across Open Circuit CT Due to Load Current

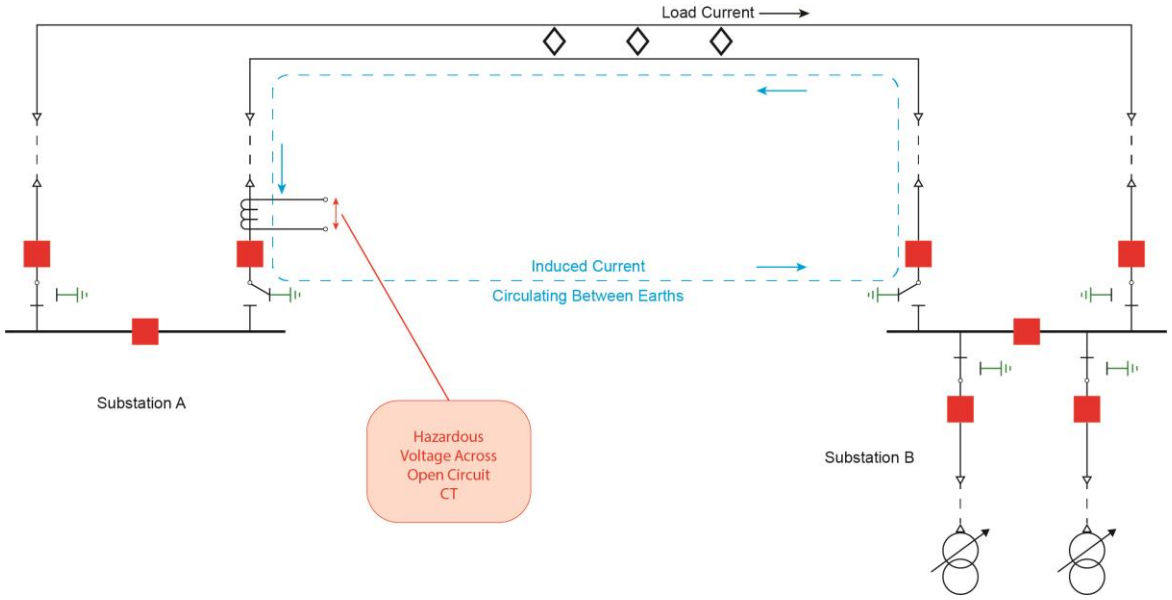


Figure 18: Hazardous Voltage Across Open Circuit CT Due to Induced Current

9.2 Secondary Systems Isolation

Any Work performed on Commissioned Secondary Systems or HV Electrical Apparatus as well as on Not Electrically Connected (NEC) Secondary Systems or HV Electrical Apparatus, Shall ensure correct Secondary Systems isolation to protect Workers from Electrical Hazards and prevent any inadvertent operation of in-service protective devices.

When determining isolation requirements, it Shall be ensured that adequate protection remains operational for all in-service network.

Unless otherwise stated in Approved procedures, all isolation activities Shall be recorded on a Secondary Systems Isolation Sheet with a unique identification number. Complex Secondary Systems isolation can be managed with multiple Secondary Systems Isolation Sheets, each having a unique identification number, and an overarching Secondary Systems Coordination Program.

The following are commonly used methods of isolating Secondary Systems:

(a) fuses, links or switches on control panels or in marshalling boxes

(b) links on CT and VT secondary circuits

(c) removal of wires from terminals via Approved means

(d) alteration of protection schemes.

Normally open series contacts in a tripping circuit are not an acceptable means of isolation.

Where operation of a withdrawable relay could affect in-service plant, effective trip isolation Shall be ensured prior to the removal or insertion of that relay.

Exposed terminals associated with in-service schemes in or Near the work area Shall be covered or labelled to prevent inadvertent operation of those schemes.

9.3 Secondary Systems Coordination Program

A Secondary Systems Coordination Program is used to coordinate all activities associated with performing complex Secondary Systems Work, including HV Switching. Secondary Systems Coordination Programs include reference to all associated Secondary Systems Isolation Sheets, HV Switching Sheets and any other information relevant to the sequencing of Work.

A Secondary Systems Coordination Program Shall be used as per *Working with Secondary Systems Switching*, including when more than one Secondary Systems Isolation Sheet is required under a single application.

Section 10

WORK ON OR NEAR LOW VOLTAGE

10 WORK ON OR NEAR LOW VOLTAGE

Work on or Near LV Electrical Apparatus Shall be performed in accordance with Approved LV standards and procedures.

Work involving Metering or Customer Work Shall be performed in accordance with their own Safe System of Work.

10.1 Work On or Near De-energised Low Voltage Electrical Apparatus

Before commencing De-energised Work on or Near LV Electrical Apparatus it Shall be Isolated, proved De-energised by Approved means and Electrical Hazards Shall be documented and effectively controlled in accordance with Approved procedures.

Alternative sources such as customer generation can backfeed at any time.
Test before you touch and wear Class 00 gloves in accordance with Approved procedures.

10.2 Low Voltage Live Work

All LV Live Work on the LV distribution network Shall be in accordance with Approved procedures and Workers Shall hold a LV Live Authorisation.

10.3 Connection of Mobile Generation

The relevant Control Centre Shall have oversight of any entity-initiated mobile generation connection to the Commissioned LV network to ensure the generation does not impact any HV Work. All entity-initiated connections of LV mobile generation to the Commissioned network Shall be Approved by the relevant Control Centre and connected in accordance with Approved procedures.

10.4 Third Party Work Near Low Voltage Exposed Conductors

Where a third party requests to perform Work Near LV Exposed Conductors of the Ergon Energy Network or Energex networks, the LV Conductors Shall be Isolated, proved De-energised by Approved means and a Third Party Non-Contact Notice Shall be issued via a LV Switching Sheet.

The Ergon Energy Network/Energex Representative Shall explain all sections of a Third Party Non-Contact Notice directly to the Third Party Representative in charge of the worksite and issue that Notice to that Representative at site. The Third Party Representative Shall sign and date the Notice to acknowledge receipt of the Notice and its conditions, including their responsibilities.

The surrender and cancellation of a Third Party Non-Contact Notice Shall be as per *Section* 3.7.1.

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