OPERATING PRACTICES MANUAL

Foreword

The Operating Practices Manual contains policy and work practices associated with the operation of the ENERGEX transmission and distribution networks.

Key Amendments in **Version 4.9d**

All sections: Major change – New Earthing Document:

- References to earthing in this document now superseded by RED 01732 – Earthing of High Voltage Electrical Apparatus for the Protection of Personnel.

Section 2: Minor changes:

- Section 2.14.2 modified to reflect changes to bypassing PMRs with ABS. The likelihood of EF trip occurring due to downstream loads was evaluated. This resulted in the risk based decision to disable <u>only SEF</u> where a bypass switch is present. This also removes the need for PMPOs to be on site to disable EF. This should be reflected by the paralleling box (SE only).

Key Amendments in **Version 4.9c**

Section 6: Minor changes:

- Section 6.2 Not current, see RED 01274 Operating Practices – Manual Reclosing.

Key Amendments in **Version 4.9b**

Section 2: Minor changes:

- Section 2.28 Not current, see RED 01455 Operating Practices – Works Involving the Energex Low Voltage Network.

Section 15: Major Change - entire section removed.

- Not current, see RED 01455 Operating Practices – Works Involving the Energex Low Voltage Network.

Key Amendments in **Version 4.9a**

Contents: New preamble added to contents page.
Section 2: Minor changes:

- Section 2.8 incorporated into S2.5. S 2.8 removed as redundant.
- Requirement to check switches within work area only. (2.5).
- Phasing requirements clarified. Use of VTs and secondary measurement devices approved in certain circumstances. (2.10).
- Disable SEF on single phase UG switching over 1km. (2.13).
- Ferroresonance section updated to include reference to single phase OH links (Flying Shackles) (2.17).
- Switching of VTs to prefer LV isolation. (2.24).
- New section on VTs Associated with ACRs (2.24.1)

- New section on Combined HV and LV Switching (2.28)
- New section on Maintaining the Integrity of Isolation Points (2.29)

Section 12: Major Change - entire section updated.

Key changes include:

- Introduction of Isolation Notice and Proximity Clearance
- Energex permits no longer issued to non-Energex personnel.
- Customer responsible for own isolation and safe system of work.

Operating Practices Manual

Approved by: Manager Network Operations Standards

Amendment Record:

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8 June 2018
Version 4.9d

All sections: Major change – New Earthing Document:
References to earthing in this document now superseded by RED 01732 – Earthing of High Voltage Electrical Apparatus for the Protection of Personnel.

Section 2: Minor changes:
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14 February 2017
Version 4.9c

Section 6: Minor changes:
Section 6.2 Not current, see RED 01274 Operating Practices – Manual Reclosing.

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02 January 2017
Version 4.9b

Section 2: Minor changes:
Section 2.28 Not current, see RED 01455 Operating Practices – Works Involving the Energex Low Voltage Network.

Section 15: Major Change - entire section removed.
Not current, see RED 01455 Operating Practices – Works Involving the Energex Low Voltage Network.

30 July 2014
Version 4.9a

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Switching of VTs to prefer LV isolation. (2.24).
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Section 12: Major Change - entire section updated.
Key changes include:
Introduction of Isolation Notice and Proximity Clearance
Energex permits no longer issued to non Energex personnel.
Customer responsible for own isolation and safe system of work.

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19 August 2011
Version 4.9

Section 0: Additions to responsibilities of Commissioning Coordinator role.
Additions to responsibilities of Applicant and LV Outage Officer role.
Introduce new definition and responsibility for LV Outage Coordinators.
Introduce new definition for ENC.

Section 2: Correction to Figure 2.18.12
Remove SSNSD Non Withdrawable Circuit breakers as special case Approved Isolation Points (Table 2.1)
Clarified the work restrictions when performing work on a NER (2.28)

Section 6: Updated Patrolling Faulted Feeders (6.4) to include patrolling procedures following the operation of a protective device (6.4.2 & 6.4.9).
Minor Formatting Changes

Section 11: Introduce requirement for plant to be correctly labelled before Commissioning. (11.4.5)
Modify Diagram 11.2 to reflect requirement for AE when commissioning plant with Control Box.

Section 15: Entire section updated and reworded.

05 November 2010
Version 4.8

Section 0: Remove reference to “Live and Dead Board” in Definitions section. (0.2)
Changed the definition for Cursory Patrol and Operational Patrol in Definitions section. (0.2)

Section 2: Reference for Checking Switches after Remote Operations (2.6) modified.
Wording change under Actions to Avoid Ferroresonance (2.18.3.1)
Added a new device in the Switch Break Rating table (2.23)

Section 4: Added a new pin item in the Operating Pin Codes, The Code table (4.1.1)

Section 6: Changed the definition of Cursory Patrol and Operational Patrol throughout the section.

Section 11: Re-introduce commissioning using an Access Permit in certain circumstances. (11.4.3.4)

Section 12: Section numbering updated.

1 June 2010
Version 4.7

Section 0:	Responsibilities and Definitions updated to reflect changes to Section 11.
Section 2:	Temporary Isolation Points Installed by Live Line (2.1.3) modified. Modifications to remote control switching for switching Coordinators (2.5.3)
Section 4:	Black Pin definition modified to display Not Electrically Connected electrical apparatus. Reformat section Additional section titled the play pin code.
Section 6:	Amendment made to Notes for Fig 6.1.1 (Forward Scopers)
Section 7:	Projects Involving new secondary systems work and commissioned plant (7.10.1). A new Work Activity and Work Clearance Method table included.
Section 10:	Remove Section Disconnecting and Recovering Electrical Apparatus using an Access Permit (included in Section 11) and modify Requirements to isolate a RMU (10.2.1).
Section 11:	A Complete rewrite for Commissioning / Decommissioning procedures. Introduce the term Not Electrically Connected into the OPM.
Section 14:	Update section14.4.2, 14.5 1and 14.6 Emergency Work. Reinforce the requirement to confirm the recipient of the RB work authority has the appropriate authorisation.
Section 15:	Modifications made to section 15.2.4 required conditions when energising new LV electrical apparatus associated with Not Electrically Connected HV electrical apparatus.
Appendix A:	A Complete rewrite for Commissioning / Decommissioning examples Examples of forms modified. New Decommissioning Notice attachment A form.
Appendix B:	New Section – Commissioning Programs.
Appendix C:	New Section - Typical Examples for LV electrical apparatus associated with HV Not Electrically Connected Electrical Apparatus.

14 June 2009
Version 4.6

Section 1: 110/132kV Siemens Type 8DN8 GIS added.

Section 2: Live Line Temp Isolation Points not in the same span as work area added (2.1.3).

Section 10: Disconnecting and Recovering Electrical Apparatus Using an Access Permit.
Oil RMU Fuse Replacement Procedures added (10.2.3). This section will replace Safety Alert 20-08
Requirements to isolate a RMU added (10.2.2). This section will replace Safety Alert 16C-07

Section 15: Complete rewrite due to the introduction of Low Voltage De-energisation Permit.

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5 August 2008
Version 4.5

Section 3: Update to Training requirements for SOA

Section 7: Clarify the requirements when working on Non commissioned protection schemes (Section 7.8)

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19 June 2008
Version 4.4

General Entire document modified to comply with release of SAHV including:

- References to HVIA replaced by SAHV
- References to Test Dead replaced by Test De-energised
- References to Form 1174 removed

Section 6: Area Troubles fig 6.3 and 6.4 added.

Section 9: This Section Removed from OPM (replaced by Equipment Operating Manual).

Section 10: Work on a PT using form 1174 removed.

Section 11: Commissioning with Form 1174 removed.

28 June 2006
Version 4.3

Section 9: Date for JKSS removed from service changed.
Additional operating instructions regarding earthing of switch fuse cable for:

- Reyrolle JKSS
- M.I. Type VL/OD
- L & C R/ETV2 and Type J
- L & C O/ETV2
- Reyrolle TO1X5B

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6 March 2006
Version 4.2

Section 3: Addition of Switching Authorisation Flow Chart

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07 December 2005
Version 4.1

Section 4: Revised operating panel designations
Section 6: Updates to Wires Down and Manual Reclose Policy
Section 9: Clarification of which RMUs require test probes
Section 10: Update to 11 kV Mobile Generator connection practice

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26 August 2005
Version 4.0

Section 9:
• New page layout
• Addition of "Accessing Feeder Cable Test Points" section
• Updated operating instructions for Brown Boveri and Reyrolle JKSS
• Addition of photographs of various test probes.

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12 November 2004
Version 3.0

Section 3: Reauthorisation period extended to three years.

Section 4: 'B' added to pink pins to help differentiate them from faded red pins

Section 9: Corrections to operating instructions for ABB SDAF ring main units and switch fuse units.

Section 10: Section 10.6 updated to cover new 11 kV mobile generators.

Section 11: A switching sheet is now required for all verbal commissioning and decommissioning.

Section 15: Clarification of Low voltage switching sheet requirements. A switching sheet is required for working on and commissioning of streetlight circuits.

19 April 2004
Version 2.0

Section 6: Minor text edits. References to notes 4 and 5 corrected on Figure 6.2.1.

Section 10: Connection/Disconnection requirements for 11 kV mobile generator included.

Section 11: Additional commissioning and de-commissioning methods included.

Section 14: Minor text edits. Incorrect references in section 14.5 fixed. All references to section 14.3 changed to 14.4.

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11 September 2003
Version 1.0

Initial issue of Operating Practices Manual as a BMS document. The main changes from the previously issued (A5 format) document are:

Section 2: Revisions to operating practices associated with 110/132 kV Air Break Disconnectors.

Section 5: Changes to auditing and document retention requirements.

Section 6: Urgent rescue procedures associated with life threatening situations reviewed.
All isolation to be via an approved isolation point.
MDO procedures and associated flowchart reviewed.

Section 7: Completely revised as a result of recent secondary systems incidents.

Section 8
Clarification provided on:

- the application of portable earths to the bottom of expulsion drop-out fuses
- the handling of portable earths
- the application and removal of test leads.

Section 11: Commissioning/Decommissioning procedures reviewed. An Authority to Energise “AE” is now required for all commissioning (except for pole transformers under existing mains).

Section 14: Changes to auto-reclose suppression requirements particularly in relation to PMRs.

Section 15: General review of section to incorporate changes suggested by users.

INTRODUCTION

The ***Operating Practices Manual (BMS01611 / RED0301)*** contains policies and requirements associated with the practical operation of the Energex transmission and distribution networks.

The OPM is a living document which reflects progress in legislation, technology and systems.

To maintain currency, this document is continually reviewed and where appropriate new versions are released. The release of versions and amendments will be deployed and be made available on the Network Operations Standards intranet site.

This document is UNCONTROLLED when printed or downloaded. It is important that users assure themselves they are using the current version, including reference to any amendments when appropriate.

Network Operations Standards welcomes suggestions for improvement in this document and encourages users to notify us of any apparent inaccuracies or ambiguities. Please direct any comments to the Network Operations Standards email address netopsstandards@energyq.com.au.

Interpretation

If any user considers the content uncertain, ambiguous or otherwise in need of interpretation, in the interests of consistency they should seek advice from the Network Operations Standards department.

* *Modified in this release*

External Related Documents

Doc #	Title	Date
RED 01274	Operating Practices – Manual Reclosing	18/07/2017
RED 01455	Operating Practices – Works Involving the Energex Low Voltage Network	16/01/2017
RED 01732	Earthing of High Voltage Electrical Apparatus for the Protection of Personnel	02/02/2018

0 Responsibilities and Definitions

For definitions of "Responsibility" and "Delegation" see section 0.2.

0.1 Responsibilities

0.1.1 Restricted Recipient - Authorisation Code RR

- receive an access permit
- supervise electrical safety at the work area
- surrender an access permit

This authorisation is specifically for persons such as tree trimmers, civil engineers, painters in substations etc.

Persons with this authorisation do not:
- direct the placement of earths
- direct the removal of earths
- receive a test permit

0.1.2 Recipient - Authorisation Code SR

(To be read in conjunction with Orange Book S9.7.2/3)
- receive an access/test permit
- direct placement and removal of working earths
- direct removal and replacement of operator earths where a test permit is on issue
- direct removal and replacement of operator earths where an access permit is on issue.
- supervise electrical safety at the work area
- surrender an access/test permit

0.1.3 Switching Operator’s Assistant - Authorisation Code SOA

(To be read in conjunction with Orange Book S8.4)
- perform tasks as directed by the Switching Operator
- advise the Switching Operator of any abnormality observed during switching operations

0.1.4 Area Troubles Operator - Authorisation Code ATO

- use a portable operating stick
- test, replace, and operate 11 kV drop-out fuses (not including MDOs).
- test, replace, and operate LV fuses/links

0.1.5 Overhead Network Switching Operator - Authorisation Code OSO

(To be read in conjunction with Orange Book S8.5)
- carry out operating work on the overhead HV network
- issue access/test Permits for the overhead HV network
- perform phasing out operations on the overhead HV network
- authorise a decommissioning notice "DN" on behalf of the Switching Coordinator

0.1.6 Underground Network Switching Operator - Authorisation Code USO

(To be read in conjunction with Orange Book S8.5)
- carry out operating work on the underground HV network
- issue access/test permits for the underground HV network
- perform phasing out operations on underground HV network
- authorise a decommissioning notice "DN" on behalf of the Switching Coordinator

0.1.7 Secondary Systems Checker - Authorisation Code SSC

- check secondary systems works programmes, trip isolation sheets, and protection alteration sheets

0.1.8 Substation Panel Operator - Authorisation Code SPO

- operate control panel switches in substations

0.1.9 Substation Switching Operator - Authorisation Code S33

(To be read in conjunction with Orange Book S8.5)

- carry out operating work on substation electrical apparatus (rated to 33 kV)
- issue access/test permits for substation electrical apparatus (rated to 33 kV)
- perform phasing out operations on substation electrical apparatus (rated to 33 kV)
- authorise a decommissioning notice "DN" on behalf of the Switching Coordinator

0.1.10 Substation Switching Operator - Authorisation Code S132

(To be read in conjunction with Orange Book S8.5)

- carry out operating work on substation electrical apparatus (rated to 132 kV)
- issue access/test Permits for substation electrical apparatus (rated to 132 kV)
- perform phasing out operations on substation electrical apparatus (rated to 132 kV)
- authorise a decommissioning notice "DN" on behalf of the Switching Coordinator

0.1.11 Restricted Operator - Authorisation Code XR

- perform switching work as specified

0.1.12 Outage Coordinator - Authorisation Codes A11, A33, A132

(To be read in conjunction with Orange Book S7.5/6/7/8)

- negotiate outage requirements with the applicant
- negotiate secondary systems requirements with the secondary systems applicant
- negotiate commissioning/decommissioning requirements with the Commissioning Coordinator
- determine access/test permit requirements
- check switching sheets for correctness
- authorise switching sheets for a nominated date and time
- authorise secondary systems works programmes and/or trip isolation sheets for a nominate time and date, and verify the preparer and checker are **not** the same person
- provide switching sheets
- archive switching sheets, access/test permits, construction/test authorities, authority to energise forms, secondary systems works programmes, trip isolation sheets and associated documentation
- ensure network security aspects associated with the work are considered and appropriate actions taken, e.g. contingency plans prepared
- negotiate non-access high voltage work requirements with the applicant

0.1.13 Switching Coordinator - Authorisation Codes C11, C33, C132

(To be read in conjunction with Orange Book S8.3)

- direct all switching on ENERGEX's HV network
- approve the issue of access/test permits
- perform switching by remote control
- maintain an up-to-date record of the state of the HV network
- record outages
- coordinate work on secondary systems
- give approval to issue the decommissioning notice "DN"
- issue authorities to work for non-access high voltage work

0.1.14 Commissioning Coordinator - Authorisation Code CC

0.1.14.1 Commissioning

Where applicable the Commissioning Coordinator will:

- ensure that Not Electrically Connected electrical apparatus is disconnected from the commissioned system by an approved method.
- ensure where appropriate, that Not Electrically Connected electrical apparatus is suitably earthed and appropriate other precautions are in place prior to the issue of any Construction Authorities or Test Authorities.
- negotiate commissioning requirements with the Outage Coordinator and all work/test groups
- ensure the System Alteration Advice is prepared in advance of the commissioning. (forms 205 & 206)
- prepare the Authority to Energise and record on that AE all Construction Authorities and/or Test Authorities and/or Access Permits and/or Test Permits associated with that AE
- prepare and issue the Commissioning Programme
- determine Construction/Test authority and/or Access/Test Permit requirements
- ensure all relevant tests on electrical apparatus have been completed prior to authorisation of the Authority to Energise (AE). eg (a)the correct Relay Setting Requirements (RSRs) and associated protection relays have been installed and applied, (b) required cable earthing, transformers, and HV switchgear tests
- ensure other precautions not required are removed prior to the issue of the authority to energise AE
- ensure earths not required are removed, and record condition of earthing the Authority to Energise.
- endorse the Authority to Energise AE form (or appoint a delegate to do so)
- ensure that all necessary operating, office and computer records associated with the commissioning are updated.

0.1.14.2 Decommissioning

- negotiate decommissioning requirements with the Outage Coordinator
- programme the decommissioning of the electrical apparatus
- prepare and distribute a Decommissioning Notice "DN"
- prepare and distribute a Decommissioning Notice Attachment A as required
- ensure where applicable, that Not Electrically Connected electrical apparatus is suitably earthed and other precautions are in place prior to the issue of Decommissioning Notice Attachment
- ensure that all necessary operating, office and computer records associated with the decommissioning are updated

0.1.15 Applicant

For HV work

(To be read in conjunction with Orange Book S7.4)

- define the scope of outage work
- negotiate outage requirements with the Outage Coordinator
- negotiate non-access high voltage work requirements with the Outage Coordinator

For LV work

- define the scope of outage work
- write and field check the switching sheet

0.1.16 Secondary Systems Applicant

- advise the Outage Coordinator what protection, data, control or communications systems will be affected
- arrange for the preparation, checking, authorisation, and distribution of trip isolation sheet(s) and/or secondary systems works programme(s)

0.1.17 On-Site Supervisor

0.1.17.1 Non-Access High Voltage Work

- obtain an authority to work from the Switching Coordinator before work commences, and advise the Switching Coordinator immediately upon completion of the work
- supervise electrical safety at the work area

0.1.17.2 Commissioning/Decommissioning

- receive a construction authority "CA" or test authority "TA"
- direct the placement and removal of earths on Not Electrically Connected electrical apparatus
- direct the placement and removal of Other Precautions as required
- supervise electrical safety at the work area
- surrender a construction authority "CA" or test authority "TA"
- receive and surrender Decommissioning Notice Attachment A as required

An On-Site Supervisor shall ensure

- the Construction Authority/ Test Authority is appropriate for the work / test to be undertaken
- the Construction Authority / Test Authority remains on site for the duration of the work / test
- the Commissioning Coordinator shall be notified if a Construction Authority is transferred to another On-Site Supervisor.

0.1.18 Liaison Officer

- negotiate supply/outage requirements with the customer
- negotiate on behalf of the customer, supply/outage requirements with the Outage Coordinator
- receive written clearance from the customer, prior to the energisation of their new electrical apparatus
- authorise an authority to energise "AE" form for the customer's new electrical apparatus

0.1.19 LV Outage Officer

Normal / After Hours Switching Sheets in SMS

- check switching sheets for correctness
- check de-energisation permit for correctness
- authorise LV switching sheets not meeting the three business day requirement

Switching Sheets not in SMS

- check switching sheets for correctness
- check de-energisation permit for correctness
- authorise switching sheets for a nominated date and time
- activate the switching sheet for the nominated date and time
- coordinate the LV planned switching sheet if the switching sheet is not faxed to Network Control Centre.

Level 2 Emergency Event (Orange Alert)

- check switching sheets for correctness
- check de-energisation permit for correctness
- authorise switching sheets for a nominated date and time
- activate the switching sheet for the nominated date and time
- coordinate the LV switching sheet

0.1.20 LV Outage Coordinator

Normal / After Hours Switching Sheets in SMS

- authorise switching sheets for a nominated date and time
- activate the switching sheet for the nominated date and time
- coordinate the LV planned switching sheet

Emergencies Events

- check switching sheets for correctness
- check de-energisation permit for correctness
- authorise switching sheets for a nominated date and time
- activate the switching sheet for the nominated date and time
- coordinate the LV planned switching sheet

0.2 Definitions

In this manual, the following definitions apply:

Access
Authorisation to approach commissioned HV electrical apparatus to within distances prescribed in the relevant exclusion zone. .

Access Permit (AP)

A document that forms part of a safe system to work, to provide electrically safe access to *High Voltage Electrical Apparatus*. (Definition from Orange Book")

Active Power
See "Real Power".

Acoustic Test Stick
See "Test Device - Proximity Type".

AF Switch
See "Coupling Cell Switch".

Air Break Switch (ABS)
An air insulated, ganged switch; pole mounted on the overhead network, or used in substations on outdoor exposed busbars.

Air Circuit Breaker (ACB)
A circuit breaker in which the contacts open and close in air at atmospheric pressure.

Alarm
A device to draw attention visually and/or audibly to a predetermined condition or *event*.

ALITS
See "Analog Limit Initiated Trip Sequence".

Alive
Term not used -see "Live"

Ampstik
A non-clamp type tong ammeter rated for high voltages (up to 300 kV); used as an approved device for the measurement of negligible current.

Analogue
Used to describe a physical quantity such as voltage or current that normally varies in a continuous manner.

Analogue Limit Initiated Trip Scheme (ALITS)
A software application developed for the SACS and Mini SACS platform control system that monitors one or more *analogue* signals. If the analogue(s) exceed the acceptable limits, a circuit breaker is tripped. Each ALITS application trips one circuit breaker only, however, in some substations two circuit breakers are tripped, because there are two ALITS in that substation. There is a maximum of two ALITS applications in any one substation.

Anti-Pumping Relay
A device which prevents a circuit breaker being repeatedly opened and closed when both open and close signals are applied at the same time.

Applicant
A person trained to convey outage information to the Outage Coordinator and the Low Voltage Outage Officer.

Application Form
A form (1201) requesting that specified electrical apparatus be taken out of service for work or tests to be performed on or near them.

Approach Limits
Term no Longer used See "**Exclusion Zone"**

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

Area Trouble
Electrical problem affecting the area supplied from one distribution transformer.

Audio Frequency Injection Equipment
Apparatus which generates the appropriate coded signals to cause operation of audio-frequency relays. The apparatus consists of the following major sub-components:

- Motor-generator set (MG) or Static Frequency Unit (SFU).
- Isolation Transformer } These components
- Tuning Coils } together are called
- Coupling Capacitors } the Coupling Cell.
- Absorption Chokes - (not required with Static Frequency Units).

Authorised Person
A person with technical knowledge or sufficient experience who has been approved, or has the delegated authority to act on behalf of ENERGEX, to perform the duty concerned

Authorised Work
Work associated with electrical apparatus carried out with approval. Also see "Work Authority".

Authority to Energise (AE) Form
A form (form 282) used as authorisation from the Commissioning Coordinator to the Switching Coordinator signifying that new, altered or previously Not Electrically Connected electrical apparatus may now be energised.

Authority to Work
See "Work Authority".

Auto-Changeover
When a loss of supply is detected, the auto-changeover will, after appropriate checks and time-outs, automatically reconfigure the substation to restore supply from an alternative source.

Auto-Reclose
The automatic reclosure (without manual intervention) of a switch that has tripped.

Auto-Restore
When a loss of supply from a transformer-ended feeder is detected, the auto-restore waits for a successful reclose of the HV feeder before closing the LV CB to return the substation to its original configuration. If the HV supply is not successfully returned, then an auto-changeover may occur.

Auto-Transformer
A transformer of which at least two windings have a common part.

Automatic Voltage Regulator (AVR)
A device or software that continuously monitors the voltage at a voltage regulating point on the system (transformer, regulator etc.) and automatically initiates corrective action to maintain that voltage within pre-set limits (also see "Volt VarVAR Regulation").

Auxiliary Switch
A small switch operated mechanically from a contactor, main switch or circuit breaker; used for operating such auxiliary devices as alarms, indicators etc.

Backup Protection
Protection that can act as a substitute for the main or primary protection in the event of a failure or inability of the latter to perform its intended function.

Balanced Current Differential Scheme
See "Circulating Current Protection Scheme".

Balanced Protection System
A protection system used on electric-power networks, in which the current entering a section of the network is balanced against that leaving it. If a fault occurs on the section this balance is upset, and a relay is caused to operate and trip circuit breakers to clear the faulty section from the network.

Balanced Voltage Differential Scheme
See "Opposed-Voltage Protection Scheme".

Barrier
A rope, tape, barricade or alternative erected in accordance with these procedures.

Barrier Board
An insulating partition that separates the tap changer and transformer tanks.

Blind Spot
The area between a circuit breaker and its associated current transformer which is not effectively "seen" by protection.

Blind Spot Protection
A Protection System used to protect a Blind Spot.

Blocking
A relaying function which prevents action that would otherwise be initiated by the protective system.

Breather
A device fitted to the wall of a transformer (or other apparatus), or connected by piping that permits the relatively free passage of air through it, but will not permit the passage of moisture.

Bridges
Connections between two conductors of the same phase on a pole.

Buchholz Relay
A protective relay (gas relay) for use with transformers or other oil-immersed apparatus; responsive either to the collection of gas produced by incipient faults or to oil surges caused by explosive faults within the apparatus tank; arranged to operate an alarm and/or to trip the apparatus out of service.

Bus
See "Busbar".

Busbar
A common low impedance conductor where incoming and outgoing feeders of the same voltage are joined.

Bus Blocking Scheme
A blocking scheme used in place of bus zone protection. The incoming circuit's OC/EF protection will see all faults and has dual (high/low) settings, which defaults to the low setting unless blocked. If a fault is from the outgoing circuit, then the blocking signal inhibits the low setting and the high setting acts as a backup, otherwise, it assumes it is a Bus Fault and the low setting of the incoming OC/EF relay trips the incoming CB only.

Bushing
An insulator which enables a live conductor to pass through an earthed wall or tank (e.g. a transformer tank).

Bus Overcurrent and/or Bus Earth Fault Protection
An overcurrent protection and/or earth fault protection scheme used on busbars.

Bus Section
The part of a bus located between two switches or between a switch and the end of the bus.

Bus Section Circuit Breaker
A circuit breaker used to connect two bus sections; used to sectionalise bus sections during a fault.

Bus Shutter
See "Shutter"

Bus Zone (B/Z)
Zones of protection created when busbars are divided into bus sections, and used for fault clearing purposes. These bus zones are bounded by circuit breakers.

Bus Zone Protection
A scheme of one or more sets of differential relays connected to the current transformers at the boundary of a bus (either one three-phase or three single-phase relays per zone). The protection detects faults within the zone and trips all the circuit breakers connected with that bus zone.

Bypassing
The short circuit of switches or apparatus in the network. An example is the closing of a bypass air break switch where the total impedance of the circuit is very close to zero ohms.

Cable
An insulated conductor, or two or more such conductors, laid together, whether with or without fillings, reinforcements or protective coverings. (Includes Aerial Bundles Cables)

Cable Termination
A device which provides an insulated outlet for cables to connect to other conductors. See "Pothead".

Cancelled Access / Test Permit

A surrendered Access Permit / Test Permit that has been cancelled thereby terminating authorisation for access to work on or near, or to test the specified electrical.

Capacitor
An item of apparatus used to make the power factor more leading (and boost the voltage) at a particular point in the network.

Capacitor Bank
An assembly at one location of capacitors and all necessary accessories, such as protection equipment and controls, required for a complete operating installation.

Capacitor Rack
An assembly of capacitor units connected in parallel, which form part of a capacitor bank.

Capacitor Discharge Device
A device connected across the capacitor terminals or busbars or built into a capacitor unit, capable of reducing the residual voltage to a safe value within a prescribed time after the capacitor has been disconnected from the energised network.

Capped Cable
A cable whose end is sealed; used to stop the leaking out of the insulating medium and/or the ingress of moisture and foreign material.

C&I Substation
A commercial and industrial distribution substation.

Circuit (Communication)
A communication link used for transmitting speech, data, control, and/or protection signals.

Circuit (Electrical)
Arrangement of conductors and passive and active components forming a path, or paths, for electric current.

Circuit Breaker (CB)
An enclosed mechanical switch at a substation, which satisfactorily makes and breaks a circuit under rated load and trips automatically under fault conditions.

Circulating Current Protection Scheme
A form of Balanced Protection System in which the current transformers (CT's) at the two ends of the circuit to be protected are arranged to circulate current through the pilots, with no current flowing through the relay operating coils (neglecting any unbalance between CT outputs, and provided the feeder is healthy).

Clearance (Between Objects) {Not a preferred term}
The clear distance between two objects measured surface to surface.
See “Exclusion Zone", which is the preferred term.

Clearance (For Work) {Not a preferred term}
Authorisation to perform specified work or permission to enter a restricted area.
See "Access or Test Permit", "Construction or Test Authority" or "Work Authority", which are the preferred terms.

Close (Electrical)
To operate a switch, circuit breaker, isolators etc. so as to cause or permit the flow of an electric current.

Closed (Electrical)
The operational state of a switch, circuit breaker, isolator etc. which will permit the flow of an electric current.

Close Proximity
Close enough to reach, fall on to, into, or otherwise accidentally contact.
Also see "In Proximity to" (LV) and “near” (HV).

Combined Links (CL)
A combination of links that operate by closing the through circuit and then isolating the HV electrical apparatus in one sequenced action; e.g. to live bypass 11 kV single phase regulators.

Commissioned
HV electrical apparatus is commissioned when:

- Switching Coordinator receives an Authority to Energise form from the Commissioning Coordinator (refer Section 11.4.3.1) or
- Switching Coordinator receives authority from on-site supervisor to energise a pole transformer (refer Section 11.4.3.2) or
- Switching Coordinator receives authority from Live Line on-site supervisor that reclose block/switching sheet has been revoked following the installation of electrical apparatus as per Section 11.4.3.3.

Commissioning (Process)
The process of bringing new or previously Not Electrically Connected electrical apparatus into operation. This includes:

- all pre-energisation checks/tests completed
- the transfer of responsibility from a Commissioning Coordinator to a Switching Coordinator; and when required:

- electrical apparatus being energised
- completion of all post-energisation checks/tests.

Commissioning Coordinator
A person who is authorised to coordinate commissioning.

Commissioning Date
The date on which electrical apparatus is, or is planned to be, connected to the network for the first time.

Commissioning Programme
A document prepared by the Commissioning Coordinator which contains the individual activities to be carried out on a step by step basis to commission the electrical apparatus. The programme includes the names and roles of all groups involved, timing, permits and switching, as well as any decommissioning that is required.

Communications Bearer
The medium used between points for the transmission of a number of circuits or channels simultaneously; can be a pilot cable, telephone line, radio link, microwave link, catenary earth wire carrier, optical fibre cable, etc.

Competent

Having the skills, knowledge and attributes a person needs to complete a task.

Competent Assistant
An assistant, competent to:

- assist a person working on or near electrical apparatus
- rescue that person
- provide resuscitation if that person has stopped breathing or is unconscious as a result of electric shock

Component
ENERGEX Equipment either plant or non-plant item installed at a site.

Component ID
The identification by which the component is known within the site; standard codes for components are: TR, IS, DO etc (refer to the Operational Designation Scheme).

Conductor
A wire, cable or form of metal designed for carrying electric current.

Confidence Checks
Checks carried out pole mounted reclosers (PMRs) to confirm correct operation.

Conservator
A conservator of a transformer or other oil immersed apparatus, is a tank of oil fitted above, and connected to, the apparatus to ensure that there is always enough oil in the apparatus to cover the core and coils.

Conservator Alarm
See "Low Oil Level Alarm".

Construction Authority (CA) Form
A form (1666) which is used for:

- authorisation to work from the Commissioning Coordinator to the On-site Supervisor of each construction group showing the terminals and disconnection of the Not Electrically Connected electrical apparatus. A detailed description of work tasks for each construction group is required.
- authorisation from the On-site Supervisor of each construction group to the Commissioning Coordinator that all construction work is completed, and all persons associated with the electrical apparatus have been instructed to treat them as alive.

Construction Group
A department, branch, section, field services group or contractor who is responsible for the construction, and dismantling, of HV electrical apparatus.

Coppers
See "Droppers".

Coupling Cell Switch
A switch that inhibits the control signal to the paralleling and impulse contactors for that audio frequency (Zellweger set) coupling cell.

Cross Bridging
Refers to the bridging arrangement at a pole location, where the bridges cross over one another due to line transposition.

Current Transformer (CT)
A current transformer is used with electrical measuring instruments and/or electrical protection devices for the transformation of current in which the current in the secondary winding is, within prescribed error limits, proportional to, and in phase with, the current in the primary winding.

Cursory Patrol
The purpose of a cursory patrol is to conduct a quick inspection to identify unsafe situations, obvious faults and abnormalities such as wildlife, vegetation, plant failures, wires down …etc in the accessible areas after a feeder lockout or operation.

Curtailable Load
A load which can be reduced either automatically, or at ENERGEX's request to reduce load. Typically there would be a Curtailable Load Agreement with the customer which details the amount of load and the conditions under which ENERGEX would be entitled to curtail the customer's load. For participating and complying with the agreement, the customer receives reduced cost electricity. Also referred as an "Interruptible" load tariff/agreement.

Curtailable Load Schemes
See "Analogue Limit Initiated Trip Scheme" (ALITS).

Customer
A user of ENERGEX's products and services.

Cyclo (Cyclometer Register)
See "Operation Counter".

DAS
See "Distributed Automatic Sequencer".

Dead
Term No Longer Used (See “De-energised”)

Dead Time
The time between the tripping and automatic reclosing of the circuit breaker or recloser during which no current flows.

Dead Zone
See "Blind Spot".

Decommissioned – (past tense) Refer to Not Electrically Connected

Decommissioning (Process)
The process of isolating and disconnecting (by an approved method) electrical apparatus from the commissioned network, and the transferring of responsibility for the electrical apparatus from a Switching Coordinator to a Commissioning Coordinator.

Decommissioning Notice (DN)
A form (1667) used as authorisation from a Switching Coordinator to a Commissioning Coordinator, signifying that specific electrical apparatus has been disconnected by an approved method and Not Electrically Connected

Decommissioning Notice Attachment Form
A form (2154) used for:

- authorisation to work on Decommissioned electrical apparatus from the Commissioning Coordinator to the On-site Supervisor of a work group. This form is attached to the associated Decommissioning Notice which specifies the electrical apparatus has been disconnected by approved methods and considered Not Electrically Connected.
- authorisation from the on-site supervisor of a work group to the Commissioning Coordinator that all work is completed

De-energised
Not connected to any source of electrical energy but not necessarily isolated. De-energised does not mean isolated or discharged, or both.

Definite Time Sensitive Earth Fault (DTSEF) Relay
The DTSEF relay is the time delay relay which monitors current in the earth return of the transformer i.e. neutral.

Delegation
The process of instructing or allowing a person to act on your behalf, and involves two distinct parts. authority (to act) and responsibility (for actions). Authority to act on your behalf is what delegation is, however, responsibility for the consequences of the authority delegated cannot be delegated. When authority is delegated the limits of the authority must be defined before hand. Authority can only be re-delegated by the responsible person. There must be complete confidence in the person to whom the authority is being delegated

Delegate
A person chosen to represent or act as a deputy for and on behalf of another person; responsibility for the consequences always remains with the original person. See "Delegation".

Delta Connected Winding
The winding connection so arranged that the phase-windings of a three-phase transformer, or the windings for the same rated voltage of single-phase transformers associated in a three-phase bank, are connected in series to form a closed circuit.

Demand
See "Maximum Demand".

Detailed Patrol
See “Operational Patrol”.

Differential Protection
A protection system which measures the sum of the currents at the boundaries of the protected zone. The sum is zero if the protected zone is healthy and a fault inside the protected zone will result in the sum not being zero and will cause a protection operation. See also "Balanced Protection System".

Direct Intertripping (DIT)
A protection function in which tripping of the circuit breaker at one end of the circuit is initiated by a signal transmitted from the protection at the other end and effected without any form of checking.

Directional Overcurrent / Earth Fault Protection
Two-element protection, so arranged that the overcurrent/earth fault element is only made operative when the fault current is in the direction for tripping as determined by the directional element.

Directional Relay
A relay used for directional overcurrent/earth fault protection that responds only to a particular direction of power flow.

Discharged
Having been connected to the general mass of earth in such a manner as to remove any residual electrical energy in a conductor or conducting object; or the release of stored energy in a closing spring, battery etc.

Disconnect Link (DL)
A Link used to isolate electrical apparatus from the network.

Disconnected
Means that the parts are not connected to an electrical source. Disconnection may be achieved by de-energising, isolating, separating or breaking connections, or through all of these methods. A part that is Disconnected may still require discharging to remove all electric and other energy

Disconnector
A switch that, in the open position, provides isolation in accordance with specified requirements.

Discrimination
The grading of a protection system where it distinguishes between those conditions for which it is intended to operate and those for which it shall not operate.

Distance Protection
Protection of which the operation depends upon the impedance between the relaying point and the point of fault being less than a set value.

Distributed Automatic Sequencer (DAS)
An ENERGEX computer language developed to allow inter- and intra-substation load transfer schemes and specific auto-changeover schemes to be performed automatically.

Distributed Automatic Sequencer (DAS) Scheme
A scheme implemented in ENERGEX's control system which automatically reconfigures the network after an initiating event such as a fault in a transformer (e.g. the scheme between New Farm and MacLauchlan Street substations which upon loss of a transformer, closes the tie feeder between the substations to allow the load to be shared by the remaining transformers).

Distribution Substation
A substation that transforms or converts electrical energy from high voltage to low voltage.

Distribution Transformer
A transformer whose primary function is to supply low voltage.

DNOB (Do Not Operate Board/Tag)
A safety sign bearing the words "Do Not Operate" signifying that the electrical apparatus to which is attached shall not be operated except as a switching sheet item, as required under a test permit or with the approval of a Switching Coordinator.

Dropout Fuse (DO)
A fuse in which the fuse carrier drops into an open position after the fuse has interrupted the current. This also provides an isolating distance and phase indication. Also see "Limited Expulsion Dropout Fuse".

Droppers
A connection between busbars or mains to other electrical apparatus.

DSA
Distribution System Automation.

DTSEF Relay
See "Definite Time Sensitive Earth Fault (DTSEF) Relay".

Ductor
A device which measures very low impedance.

Earthed
Earthed means phases are short-circuited and electrically connected to the general mass of earth by a conductor to ensure and maintain the effective dissipation of electrical energy

Earth Fault Protection
Protection which operates when the residual current exceeds a predetermined value.

Earth Fault Relay
A relay used for earth fault protection.

Earthing (Protective Earths)
The process and means of connecting electrical apparatus of the electricity supply network to earth (ground) to prevent dangerous voltages occurring on electrical apparatus which may be contacted by persons, or which may be damaged by the voltages.

Earthing Switch (ES)
A mechanical device for earthing parts of a circuit. It is capable of withstanding, for a specified time, currents under abnormal conditions, such as those of short-circuit, but it is not required to carry current under normal conditions of the circuit. Oil immersed earthing switches have a rated short-circuit making current. Earthing switches in air may have a rated short-circuit making current.

Earthing Transformer (ET)
A three-phase transformer intended essentially to provide a neutral point to a delta connected power system.

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

Electrical Apparatus
Any electrical equipment, including overhead lines and underground cables, the conductors of which are live or can be made live.

Electrical Work
Work involving the installation, maintenance or repair of electrical apparatus.

Electrical Worker
Any person who, pursuant to the Electricity Act, is qualified to perform any such work in whole or part as is specified in any of the definitions of electrical fitter, electrical jointer, electrical linesman and electrical mechanic in the Act.

Electric Induction
Induction caused by the presence of voltage on another conductor. Induction can produce very high voltages in out-of-service conductors (also referred to as Electrostatic Induction).

Electricity Authority
An Electricity Authority constituted under the Electricity Act.

Electricity Entity
As per Queensland Electricity Safety Act 2002.

a. a generation entity, transmission entity or distribution entity or
b. a special approval holder that is authorised under the Electricity Act to do something that a generation entity, transmission entity or distribution entity may do under that act or
c. Queensland Rail

Electromagnetic Induction
Induction caused by the passage of electric current in another conductor. Induction can produce very high voltages in out-of-service conductors.

Emergency Switching
Unplanned switching for safeguarding personnel, preventing damage to electrical apparatus, restoring supply or providing access for unplanned repair of electrical apparatus.

ENC
See "ENERGEX Newstead Control".

ENERGEX
ENERGEX Limited, ABN 40 078 849 055

ENERGEX Automated Control System (SACS)
An ENERGEX in-house developed control system technology comprising both hardware and software for local and remote alarms, status indication and control; local and remote instrumentation; voltage regulation; auto-reclosing; automatic VAR and time-of-day based capacitor control; load group

management; audio-frequency load control and auto-changeover. A number of generations of SACS equipment have been produced, including SACS, MiniSACS, PCSACS, and MicroSACS.

ENERGEX Newstead Control (ENC)
The main control centre responsible for the control of the interconnected distribution system in South East Queensland.

Energised
Connected to any source of electrical energy.

Equipment Designation
Individual labelling of electrical apparatus to provide positive identification during switching operations.

Established Earth
See “Permanent Earthing Point”

Event
An incident which causes the condition or situation of electrical apparatus to change.

Exclusion Zone
The “Exclusion Zone” for electrical apparatus applying to a person or to mobile plant or to a vehicle, means the distance from the electrical apparatus stated for that person, mobile plant or vehicle in the Electrical Safety Regulation 2002 Part 4 Section 61

Explosion Vent
The means provided to reduce the pressure build up in a transformer (or other oil apparatus) tank during an internal fault. The opening is above the conservator oil level and is usually sealed by a shim of copper, brass, glass etc. which ruptures under a predetermined pressure. The transformer windings are open to moisture ingress because the vent does not reseal.

Expulsion Fuse
A fuse in which the arc is extinguished by expulsion of the gases produced by the arc.

External Fault
A fault outside the defined zone of protection.

Fault (Electrical)
A general 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, a broken wire, an intermittent condition, and generally leads to an outage.

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

Fault Throw Switch (FTS)
A mechanical switch for deliberately applying an earth (fault) to an incoming feeder; should close onto a de-energised bus if used for backup protection. Also used as a form of forced intertripping on an energised feeder, thereby causing a protection initiated tripping of the circuit breaker(s) controlling that feeder.

Feeder
An overhead line or underground cable, of full load current carrying capacity, used in the transmission of electric power; it serves to interconnect generating stations, substations, and feeding points, usually without intermediate connections.

Feeder Differential Protection
A Differential Protection or Balanced Protection System used on tie or ring feeders.

Ferroresonance
A phenomenon usually characterised by overvoltages and very irregular wave shapes and associated with the excitation of one or more saturable inductors through capacitance in series with an inductor; e.g. a resonant condition between a length of underground cable and an unloaded transformer. It can result in voltages of up to 4 times normal.

First Property Pole
The pole owned by the customer to which the service from ENERGEX's distribution mains is attached. Also see "Property Pole".

Forced Interruption
An interruption caused by a forced outage.

Forced Outage
The automatic or urgent removal of electrical apparatus from service.

Fuse
A device that, by melting of one or more of its specially designed and proportioned components, opens a circuit in which it is inserted. The fuse comprises all parts that form the complete device.

Gas Circuit Breaker
A circuit breaker in which the contacts open and close in a gas; e.g. "SF_6 circuit breaker".

Gas-Insulated Switchgear (GIS)
Metal-enclosed switchgear in which the insulation and arc extinction is obtained by an insulating gas, usually SF_6.

GEC (DSF7)
A type of opposed-voltage protection system.

Gloves
See "Insulating Gloves" or "Work Gloves".

Ground Transformer (SG site)
A distribution substation that has the transformer(s) and any other apparatus located at floor level and is enclosed by a fence, or located in a building etc (abbreviation GT).

Hazardous Condition Warning Tag
A warning sign indicating a particular hazard or hazardous condition. Operation of a device with this tag affixed is not likely to be life threatening although it may result in injury, equipment damage or an outage. Refer “Orange Book” Clause 3.10.2 and Appendix B.

High Voltage (HV)
A nominal voltage exceeding 1,000V alternating current or exceeding 1,500 V direct current.

High Voltage Network (System)
All electrical apparatus used in the supply of electricity normally energised at high voltage. *[Note: While in circuit, neutral earthing resistors and reactors form part of the high voltage system. When bypassed and isolated by approved means they become part of the earthing system and exclusion zones no longer apply]*

High Voltage Testing Board
A safety sign bearing the words "High Voltage Testing Keep Clear" signifying that electrical apparatus under test are energised at high voltage.

Hot Spot
An area of localised heating in electrical apparatus.

Hot Stick
A rated and tested HV operating stick.

Inadvertent Switching Operation
An unauthorised or accidental switching operation.

Independent Earth
A separate earthing electrode temporarily inserted into the ground, used for testing purposes.

Individual of Work Group
A person authorised to carry out work under an *Access / Test Permit.*

Induction
Electrostatic (electric) see "Electric Induction".
Electromagnetic (magnetic) see "Electromagnetic Induction".

In Proximity to
Means within reach of an exposed low voltage conductor or exposed part of a low voltage electrical article. For HV see "near".

In Service
The operational state of electrical apparatus when it is performing its required function, with no abnormal limitation on output or performance.

Instantaneous Sensitive Earth Fault (ISEF) Relay
An instantaneous relay installed on a feeder that responds to a low residual current.

Instructed Person
A person adequately advised and supervised by an Authorised Person to enable them to avoid the hazards which may be present

Insulator
Material which hinders the free passage of electrons. Some typical insulators used are porcelain, glass, PVC, rubber, paper, bitumen and oil.

Integral Earths
The facility in which a circuit breaker is used to earth a circuit or a bus of metalclad switchgear; the circuit breaker can only be opened mechanically.

Internal Fault
A fault within the defined zone of protection.

Interruption
An event which results in the loss of electricity supply to customers.

Interruptible Load
See "Curtailable Load".

Instrument Transformer
A general term for a transformer that provides input to electrical instruments of various types; see also "Current Transformer" or "Voltage Transformer".

Insulating Glove
A type of glove that protects (insulates) the person using it against electric shock.

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

Interlock or Interlocking Device
A method or device which makes the operation, or removal, of an item of apparatus dependent upon the status (e.g. open or closed) of one or more other items of apparatus. *Note: Interlocks may be either electrical or mechanical.*

ISEF Relay
See "Instantaneous Sensitive Earth Fault (ISEF) Relay".

Isolated
Disconnected from all possible sources of energy by means that prevent unintentional energisation of the Electrical Apparatus and that are assessed as a suitable step in the process of making safe for access purposes.

Isolated Area
An area of the network that is isolated.

Isolation
The process of making electrical apparatus isolated.

Isolation Point
An adequate break that prevents any inadvertent energisation, for example from lightning, Switching or back energisation. (A DNOB shall be attached at the Isolation Point.) See section 2.1 for approved isolation points in ENERGEX.

Isolator (IS)
A non-air insulated, ganged switch. May possess either:

- a full load-break capability (RMU isolator); or
- zero load-break capability (110kV SF_6 isolator).

Note 1: Single-phase RMU switches (Hazemeyer, Krone), are also generally referred to as Isolators, rather than links, since many of them are fitted with ganged links.
Note 2: Powerlink and ENERGEX have some 110/132 kV air break switches labelled as Isolators.

Lethal Current
Current in excess of 40 mA alternating current or 150 mA direct current through the human body. As specified in Australian Standard AS60479.1:2002

Liaison Officer
ENERGEX's representative for negotiating outage requirements (switching and/or access) and commissioning details with a customer. May also act as the applicant and/or Commissioning Coordinator on behalf of the customer.

Limited Expulsion Dropout Fuse
An expulsion fuse that has a fuse limiter whose integral exhaust control obstructs fuse cartridge parts from being expelled during a fault clearing operation.

Lines and Apparatus
See “Electrical Apparatus”.

Line Fault Indicator (LFI)
A device which can be strategically placed along distribution feeders at nominal voltages of 11 kV to 33 kV to assist power system fault location identification.

Line Drop Compensation (LDC)
Apparatus that images the feeder impedances and controls the 11 kV (or 33 kV) bus voltage by adjustment of the substation transformer's OLTC (on load tap changer); it maintains an 11kV (or 33 kV) voltage at a predetermined load centre.

Link
An air-insulated, single-phase switch.

Live
Energised or subject to hazardous induced or capacitive voltages.

Live HV Conductors Above or Beyond Board
A safety sign bearing the words "Live Conductors Above or Beyond" signifying that energised conductors exist above or beyond the work area and that care should be exercised to maintain exclusion zones. Typically used in system of barriers and signs defining work areas for Access / Test Permits in substations.

Load
(1) Electrical impedance connected to a source. The source may be an electrical generator or transformer etc.
(2) The total demand for electrical power on a supply. The supply may be an electrical generator or the network.

Load Shift (Transfer)
When the load from one source is transferred to another source.

Load Transfer Switch (LTS)
A non-air insulated pole mounted switch with full load break capability which does not open automatically.

Local Control
Control of an operation at a point on, or adjacent to, the controlled device.

Lockout
The state which exists when a switch is automatically tripped, but where it can only be subsequently closed by a manual operation.

Loop
See "Mesh".

Low Oil Level Alarm
An alarm fitted to the conservator of a transformer, or other oil immersed apparatus, that raises an alarm when the oil in the conservator reaches an unacceptably low level.

Low Voltage (LV)
A nominal voltage exceeding 50 V alternating current or 120 V direct current, but not exceeding 1000 V alternating current or 1500 V direct current.

Low Voltage (LV) De-energisation Permit (Form 1074)
A document of authorisation to ensure the safety of persons by documenting control measures to ensure the work area has been de-energised, tested and not inadvertently re-energised.
A LV De-energisation Permit is used by ENERGEX staff and contractors who need to work on or near the de-energised LV electrical apparatus.

Low Voltage (LV) Fault Finding Permit (Form 1174)
A document of authorisation that allows access to LV electrical apparatus for testing which may produce lethal currents.

Low Voltage Outage Coordinator
A person authorised to coordinate LV switching and approve the issue of Low Voltage De-energisation Permit/ Fault Finding Permit.

Refer to LV Outage Coordinator Responsibilities in section 0.1.20

Low Voltage Outage Officer
A person authorised to check LV switching sheets from the Applicant and to authorise, activate and coordinate LV switching sheets in certain situations.

Refer to LV Outage Officer Responsibilities in section 0.1.19

Magnetising Current
The phase current in amperes which flows into the winding of a transformer when it is de-loaded.

Magnetising Inrush Current
A transient phase current in amperes that flows into the winding of a transformer upon energising.

Main Bus
In a multiple-busbar substation, the busbar mainly used under normal conditions.

Main Protection
See "Primary Protection".

Mains
A term used to describe a particular classification of the overhead and underground feeder network, e.g. 11 kV mains, LV mains.

Maintenance Work
See "Repair and Maintenance Work".

Manual Control
Control of an operation by human intervention.

Manual Switching
All Switching not performed via Remote Control

Maximum Demand
The maximum load taken by an electrical installation during a given period. It may be expressed in kW, KVA, or Amperes.

Maximum Demand Indicator (MDI)
An instrument for indicating the maximum demand which has occurred on a circuit within a given period.

Megger
1. The proprietary name for a common make of portable, hand operated test instrument used for high voltage insulation resistance tests; or
2. To carry out insulation resistance or continuity tests using a Megger.

Mesh
A set of feeders forming a closed path in a network. *Note: The term loop is sometimes used instead of mesh.*

Metalclad Switchgear
High voltage switchgear of a type that has its associated buswork totally enclosed in metal chambers or trunking.

Micro-Controller (Micro-SACS)
A type of SACS unit located on substation circuit breakers or pole mounted reclosers etc.

Multiple Earthed Neutral (MEN) System
A system in which the Electricity Authority's low voltage neutral conductor is connected to earths at points along its length, at the neutral terminal of the distribution transformer, and to the earths of customers' installations.

Must
See "Will".

Near
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
Means beyond near but close to the work area. This refers to cases where electrical apparatus may be beyond near, but identified by the Switching Operator as a potential hazard at the work area e.g. adjacent HV overhead strung bus

Negligible Current
A current not exceeding 0.5 A at rated voltages up to 362 kV as per Australian Standard AS1306.

Network
A term used to describe the high voltage or low voltage delivery systems.

Network Protection Scheme (NPS)
A scheme installed to protect the network, or certain items of plant in the network, from operating outside of operating limits. Examples include:

- Analog Limit Initiated Trip Sequence (ALITS)
- Plant Overload Protection Software (POPS)
- Distributed Automatic Sequencer (DAS) Schemes
- Curtailable Load Schemes

Network Security
Establishment and application of safeguards to protect the network from accidental interruptions during planned network modifications or contingencies.

Network Switching Centre
The control centre responsible for the control of the interconnected transmission system in South East Queensland.

Neutral Conductor
The wire of an LV (polyphase) distribution network which is connected to the neutral point of a supply transformer or alternator.

Neutral Earthing Reactor
A reactor placed between a transformer neutral point and earth to limit fault currents.

Neutral Earthing Resistor
A resistor placed between a transformer neutral point and earth to limit fault currents.

Neutral Point
The point the windings of a polyphase star connected system of windings are connected together; also the point of a symmetrical system which is normally at zero voltage.

Non-Access High Voltage Overhead Line Work
High voltage overhead line work that does not require high voltage isolation and access. This work includes:

- Live line work
- High loads
- Rebutting of poles carrying energised HV electrical apparatus
- Work in the vicinity of energised HV electrical apparatus
- Clearing of trees or branches in the vicinity of energised HV electrical apparatus
- Reconductoring or erecting conductors beneath energised HV electrical apparatus

Non-Access High Voltage Underground Work
High voltage underground work that does not require high voltage isolation and access. This work includes:

- inspections to underground cables
- topping up oil/gas underground cables
- calibration of gauges for oil/gas underground cables
- temporary oil/gas leak repairs

Non-Commissioned - (future tense) Refer to Not Electrically Connected

Non-Electrical Worker
A person not authorised in writing to perform electrical work; may be granted special authorisation (RR) by ENERGEX to access HV electrical apparatus to carry out non-electrical work, e.g. tree trimming.

Non-Plant Item
An item of ENERGEX apparatus without an ENERGEX identification number.

Normal Feed Isolation Point
This is the switch that normally supplies the area in question; it is generally the switch between the area in question and the supply network.

Normal (Routine) Switching Operation
A switching operation, performed under the direction of a Switching Coordinator/switching sheet.

Not Electrically Connected
Electrical Apparatus disconnected from all sources of supply by the total 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.

NPS
See "Network Protection Scheme".

NSC
See "Network Switching Centre".

Off Load Tapchanger
A device for changing the tapping connections of a transformer winding (which alters the turns ratio thus varying the voltage) and is not suitable for operation whilst the transformer is energised.

Oil Circuit Breaker
A circuit breaker in which the contacts open and close in insulating oil.

Oil Temperature Indicator (OTI)
An indicating gauge, with a maximum temperature indicator, which operates an alarm and/or trip relay when the temperature of the insulating oil (top oil) exceeds a predetermined value.

On Load Tapchanger (OLTC)
A device for changing the tapping connections of a transformer winding (which alters the turns ratio thus varying the voltage) and suitable for operation whilst the transformer is energised or on load.

On-Site Supervisor
An individual of a work group responsible for electrical safety at the work area in situations where:
- non-access high voltage (underground or overhead line) work is required that does not require high voltage isolation and access
- access is required on commissioned electrical apparatus and no access or test permit is on issue or
- work is required on Not Electrically Connected electrical apparatus

Refer to On-Site Supervisor responsibilities in section 0.1.17.2

Open (Electrical)
1. The operational state of a switch that will prevent the flow of an electric current.
2. To operate a switch, circuit breaker, isolator, etc. so as to interrupt the flow of an electric current.

Open Circuit
A break in the continuity of an electric circuit. May be one or more phases.

Open Point
See "Paralleler".

Operating Standard
A document specifying procedures and standards to be followed by ENERGEX operating personnel and Contractors.

Operating Time
The time a protective device takes to operate.

Operating Work
Work involving the operation of switching devices, links or other connections intended for ready removal, the removal or replacement of fuses, proving electrical conductors de-energised, earthing and short circuiting, locking and/or tagging of electrical apparatus and erection of barriers and/or notices.

Operation
A successful auto-reclos.

Operation Counter
A counter (electrical or mechanical) which records the number of times an item of apparatus opens or closes.

Operational Authorisation
An authorisation issued to an individual to perform operating work or gain access to ENERGEX's network.

Operational Patrol
The purpose of an operational patrol is to determine the location and nature of a fault. The patrols encompass areas identified as possibly being where the initiating event occurred. This can be based on protection indications, reports or based on local knowledge. Extensive efforts should be given to operational patrols to ensure that the fault cause is found.

Operating Number
A number allocated to specific electrical apparatus as a reference number for operational purposes, e.g. F323 or CB3232.

Operator Earths
Approved earthing and short circuiting equipment (having a DNOB attached) applied to electrical apparatus, to ensure the electrical apparatus is effectively earthed as a requirement for the issue of an access/test permit.

Opposed-Voltage Protection System
A form of balanced protection system in which the secondary voltages of the current transformers, situated at each end of the circuit to be protected, are balanced against each other, so that there is normally no current on the pilots connecting them.

Orange Book
A more convenient reference to "The Queensland Electricity Entity Procedures for Safe Access to High Voltage Electrical Apparatus", (QEEPSAHVEA) This document is provided to ensure a safe system for work on or near high voltage electrical apparatus associated with the transmission and distribution of electricity.

Orifice
An opening in which withdrawable equipment connects to a bus or circuit.

Orifice Shutter
See "Shutter".

Other Precautions
Safety Signs, Barriers and other approved measures applied at the work area prior to or after the issue of an Access / Test Permit, Construction / Test Authority and Decommissioning Notice Attachment, to contribute to the electrical safety of the work group.

Outage Coordinator
A person authorised to negotiate with and receive information from an applicant and/or Commissioning Coordinator, authorise secondary system works programmes and trip isolation sheets, produce and distribute switching sheets and audit/archive switching sheets, Access / Test permits and any other associated documentation. (See also Section 0.1.12)

Outage
The state of electrical apparatus and/or secondary systems which are not available to perform their intended function due to some event directly associated with the electrical apparatus and/or secondary systems; may be planned, forced, etc.

Out-Of-Service
The operational state of electrical apparatus when not live or running, or not connected to the power system.

Overcurrent Protection
Protection which operates when the phase current exceeds a predetermined value.

Overhead Feeder
A feeder where the underground length is shorter than 1km, and less than 30% of the total length of the feeder.

Overhead HV Network
Electrical apparatus such as overhead conductors, air break switches, expulsion drop out fuses, master drop outs, links, pole mounted reclosers, voltage regulators, and sectionalisers.

Overload
A load greater than the relevant rating.

Overvoltage Protection
Protection that operates when the voltage exceeds a predetermined value.

Padmount Transformer (SC site)
A distribution substation that usually has the transformer and associated apparatus housed in a cubicle (abbreviation PMT).

Pallet Switch
An auxiliary switch located in a circuit breaker.

Paralleler
A point in a circuit or between circuits that is normally left open. It can be used for interconnection.

Paralleling
The closing of switches to connect various parts of the network where the impedance involved in the total circuit is significant. Examples of such are closing air break switches or circuit breakers that are normally open between various substations.

Parallel Operation
1. The operation of interconnected power systems in synchronism; or

2. The operation of network electrical apparatus (e.g. feeders, transformers, generators) connected in parallel.

Permanent Earthing Point
a permanent earth connection such as a Substation earthing grid, steel tower, High Voltage earth or Low Voltage neutral on a bonded earth network

Phase
A term used to identify the active (live) conductors on the network. There are three phases usually denoted as U phase, V phase and W phase.

Phase Rotation
Phase rotation (phase sequence) checks that the phases are connected in the correct sequence, i.e. f1-f2-f3, not f1-f3-f2.

Phasing Out
Phasing out is a test to determine whether energised conductors may be satisfactorily connected, i.e. A-A, B-B and C-C.

Phase-to-Phase Fault
A defect in a multi-phase circuit that results in a current flow between two or more phases at the point of the defect.

Pilot Cable (PC or PIL)
A conductor used for auxiliary purposes between various sites in the network, and not for the transmission of energy.

Pilot Isolating Transformer
A transformer for isolating pilot wires from the terminal relay apparatus to provide protection against the effects of any longitudinal voltages induced in the pilot wires.

Pilot Protection
See "Pilot Wire Protection".

Pilot Supervision
A method for monitoring the integrity of pilot wire protection circuits.

Pilot Wire Protection
A type of feeder differential protection using a pilot cable as the means of communication between the relays.

Plant
Any piece of apparatus which has an ENERGEX number is regarded as plant.

Plant Overload Protection Software (POPS)
Software developed for ENERGEX's PCSACS control system that automatically and continuously monitors the condition of items of plant (egg transformers, cables, etc) and will automatically take action(s) to bring the plant back within acceptable operating limits. POPS provides far greater security than ALITS.

PMR
Pole mounted recloser.

Polarity Test
A test to demonstrate that the relative polarities of conductors are correct (i.e. active and neutral).

Polarity Tester
An instrument used to perform a polarity test (egg. test lamps, PST, voltmeter).

Polarity Service Tester (PST)
An approved device used to perform service polarity tests.

Pole
A column of wood, steel or concrete, or some other material, supporting overhead conductors, or other electrical apparatus, usually by means of arms or brackets.

Pole Transformer (SP site)
A distribution substation that has the transformer erected on a pole (abbreviation PT).

POPS
See "Plant Overload Protection Software".

Post-Energisation Checks/Tests
Checks/tests applied to Electrical apparatus under normal service conditions to show that those electrical apparatus have been connected in a correct manner and are able to work satisfactorily, (e.g. phasing-out, phase rotation, voltage, current, on-load etc.).

Pothead
A device that seals the end of a cable and provides insulated outlet for the conductor or conductors (see Cable Termination).

Power Factor
A relationship between real power and reactive power.

Power Station
Any building or enclosure where electricity energy is generated at high voltage or at low voltage where the output is transformed to high voltage.

Power Transformer
A transformer that transfers electric energy in any part of the circuit between the generator and the distribution network (i.e. 11 kV).

Pre-Energisation Checks/Tests
Checks/tests carried out on electrical apparatus prior to energisation, (e.g. insulation, continuity, ratio, polarity, correct connection, etc.). In many situations this may simply be a visual inspection.

Pre-Insertion Resistor
A resistor automatically connected into the circuit when a circuit breaker is opened or closed. The purpose of the resistor is to reduce switching and restrike transients that are harmful to the circuit breaker and other system apparatus. Usually the resistor is an integral part of the circuit breaker.

Pressure Relief Device
A device used as a means of relieving internal pressure that may be either:

1. part of a surge diverter (lightning arrester) which prevents the explosive shattering of the housing or
2. an explosion vent or pressure relief valve (PRV) of a transformer

Pressure Relief Valve (PRV)
A spring loaded valve, which can reduce the pressure build up in the transformer (or other apparatus) tank and then usually closes to seal the tank from moisture ingress; a switch is usually incorporated into the pressure relief valve unit to de-energise the transformer.

Primary Protection
Protection normally expected to operate first, in case of a fault in the protected zone.

Primary Systems
See "Network".

Priority Customer
A customer who either:
1. has preference during emergencies; or
2. Who, by circumstances, warrants attention prior to another.

Property Pole
A pole owned by the customer that is part of the customer's electrical installation. Also see "First Property Pole".

Protection
See "Protection System".

Protection Signalling
Signals transmitted between the protection relays at each end of a transmission circuit.
(also see "Direct Intertripping").

Protective Devices
Items of plant that are designed to interrupt fault current, e.g. circuit breakers and reclosers.

Protection Equipment
The apparatus, including protection relays, transformers, auxiliary equipment, for use in a protection system.

Protection Stability
The quality of a protective system whereby it remains inoperative for faults outside the defined zone of protection.

Protection System
A combination of protection equipment designed to secure, under predetermined abnormal conditions, the disconnection of electrical apparatus of a power system.

Proximity
See "Near".

QEEPSAHVEA
See “Orange Book”

Qualitrol
See "Pressure Relief Valve".

Rack In/Out or Up/Down or Withdraw/Replace
Move withdrawable type apparatus, into or out of, its operating position (e.g. CB, VT, etc).

Radial Feeder
A feeder supplying electric energy to a substation or a feeding point that receives energy by no other means. Note: The normal flow of energy in such a feeder is in one direction only.

Radial Network
A network in which independent feeders branch out radially from a common source of supply.

Rated Power
The maximum amount of power that can be passed through electrical apparatus under specific operating conditions.

Rating
The designated limit(s) of the rated operating characteristic(s) of electrical apparatus. *Note: Such operating characteristics as current, voltage, frequency, etc, may be given in the rating.*

Reactive Power
The reactive volt-amperes, i.e. the product of a voltage of a circuit and the reactive component of the current. Unit: VAR, KVAR or MVAR (volt-amperes-reactive).

Reactor
An inductive impedance used in the network for voltage and current control. May be connected in shunt or series.

Real Power
Product of the active voltage and current in a circuit, or of the active current and voltage in a circuit; Unit: W or MW (watts).

Recipient
An authorised person to whom an access/test permit has been issued and responsible for compliance with the requirements of the access/test permit.

Reclaim Time
The time that must elapse after a successful auto-reclose of a circuit breaker or recloser, in order that another auto-reclosing sequence can be initiated.

Recloser
A non air-insulated pole mounted switch installed outside of a substation that trips automatically to clear faults, and then recloses after a predetermined time interval.

Reclosing
Re-energising of electrical apparatus after a fault; can be automatic or manual.

Reclosing Relay
A relay designed to close a circuit breaker in accordance with a predetermined sequence after the circuit breaker is opened by the operation of protective equipment.

Recover (Permit or Authority)
Recover is the obtaining of a surrendered permit or authority.

Regulator (Step-Voltage)
A regulating transformer in which the voltage of the regulated circuit is controlled in steps by means of taps and without interrupting the load. It has the same nominal voltage on the primary and secondary sides (e.g. 11 kV – 11 kV).

Relay
A device which responds to a certain change in an electrical circuit with the object of causing given changes in the same or in another electrical circuit; the circuit directly acted upon being a control or signalling circuit.

Relay Setting Requirement (RSR)
Protection relay setting requirements

Reliability (Network)
A measure of how the supply network performs (indices such as "System Minutes Lost" are used).

Reliability (Protection)
The quality of a protective system that ensures it will operate whenever the specific conditions required for it to operate are present.

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

Remote Supervisory Control
Remote control of apparatus via SCADA or SACS.

Repair and Maintenance Work
Repair & Maintenance Work is those activities that are carried out to ensure the continued operation of the existing supply network. Where access is required, isolation points do not change for the duration of the job and all such work is carried out solely under Orange Book procedures.

Residual Current
The vectorial sum, in a multi-phase system, of all the line currents.

Residual Voltage
The vectorial sum, in a multi-phase system, of all the line to-earth voltages.

Responsibility
Being accountable for your own actions, or any persons under your authority. See "Delegation".

Ring
See "Mesh".

Ring Bus Arrangement
The busbar arrangement that forms a complete ring.

Ring Main Unit (RMU)
An item of apparatus used for switching of underground feeders and protection of distribution substations.

SACS
See "ENERGEX Automated Control System".

Safe Approach Distances
The minimum distances that shall be maintained by a person when performing work, requiring approach to live electrical apparatus.

Safety Barrier
Suitable barriers or earthed metal shields installed between the person and the conductors or electrical articles as defined in the Electricity Regulations.

Safety Observer
A person competent for the task and specifically assigned the duty of observing and warning against unsafe approach to electrical apparatus or other unsafe conditions.

Safety Precautions
Concerning HV work, this means isolation points, disconnection points and operator earths provided to guard against and reduce the effects of inadvertent re-energisation while working under an access / test permit and identified on the switching sheet and access / test permit by a unique alphabetic character.

SCADA
See "Supervisory Control and Data "Acquisition".

Sealing End
See "Pothead".

Schlumberger (DPDL 120)
A type of opposed-voltage protection system.

Secondary Systems
A general term used to describe all protection, data, control and communication bearer systems.

Secondary Systems Applicant
A person trained to convey secondary systems information to the Outage Coordinator and, arranges for the preparation, checking, authorisation and distribution of trip isolation sheets and/or secondary systems works programmes.

Secondary Systems Works Programme (SSWP)
The secondary systems works programme consists of a SSWP summary sheet (form 495) and a SSWP sheet (form 1770) or an electronic version which contains the same information and format of each, which are used to coordinate all activities when work on secondary systems is required. It may include trip isolation sheet(s) and items detailed on switching sheets.

Sectionaliser
A pole mounted switch used to open automatically in the (second or more) dead time of the feeder.

Sectionalising
Restoring power to one section of a feeder at a time after lockout to isolate the cause of the fault.

Security (Protection)
The quality of a protective system that ensures it will not operate unless the specific conditions require for it to operate are present.

Sensitive Earth Fault (SEF) Protection
A scheme used to detect low earth fault currents on O/H feeders; uses an sensitive earth fault relay connected in the CT circuit in series with a standard IDMT earth fault relay and, except for a Pole Mounted Recloser (PMR), it's trip output is in series with a sensitive earth fault check (SEFCK) relay, which detects the transformer neutral current.

Sensitive Earth Fault Relay
Usually an "Instantaneous Sensitive Earth Fault (ISEF) Relay" or, in some situations a "Definite Time Sensitive Earth Fault (DTSEF) Relay".

Sensitive Earth Fault Check (SEFCK) Relay
A relay which has the same sensitivity as the ISEF relay, but is provided with a definite time delay and is used to prevent the possibility of unnecessary feeder operations by the instantaneous sensitive earth fault relay; the SEFCK relay is connected to a CT in the 11kV neutral of the substation.

SF_6 Circuit Breaker
A circuit breaker in which the contacts open and close in sulphur hexafluoride gas.

Shall
Means mandatory.

Short-Circuit
A short-circuit occurs when two live conductors, or a live conductor and ground, are joined.

Should
Means advisory or discretionary.

Shutters
Lockable barriers to prevent access into the orifice of metalclad switchgear.

Siemens (RN27b)
A type of opposed-voltage protection system.

Sign
A board, label, tag or other delineated space used to convey a message

Site
A geographical location at which ENERGEX electrical apparatus is installed.

Site Address
The actual address of the site within a street and suburb.

Site ID
The identification by which the site is known within the network, e.g. pole number, substation number, joint number. There is an order of preference when two sites occur together, e.g. a pole mounted substation will be classified as a substation and not a pole.

Site ID Code
Standard codes for sites (e.g. SC, SG, SP, SR, SS, X etc).

Site Name
The name by which the site is commonly known, e.g. a substation in a building, is commonly known by the name of the building in which it exists.

Solkor (R & Rf)
A type of a circulating current protection scheme.

Spiking
The method for proving a cable is de-energised (after isolation, testing to prove de-energised and earthing).

Spouts
The internal female connections of plug in (withdrawable) apparatus located at the base of an orifice.

Stability
See "Protection Stability" or "System Stability".

Staged Access Permits
The procedure when an access permit on issue has the isolation points changed, either physically or in name during the job, is surrendered and a new access permit, with the altered isolation points, is issued.

Star Connected Winding
A winding connection so arranged that one end of each of the phase-windings of a polyphase transformer, or of each of the windings for the same rating voltage of single phase transformers associated in a polyphase bank, is connected to a common point (neutral point) and the other end to its appropriate line terminal.

Static Frequency Unit (SFU)
Used to generate a signal at other than mains frequency (typically 1050Hz in ENERGEX's supply area). Uses power electronic components.

Substation
A switchyard, terminal station or place, at which High Voltage Supply is switched, converted or transformed.
(See Transmission Substation, Zone Substation or Distribution Substation).

Substation Lines and Apparatus
Electrical apparatus such as busbars, circuit breakers, isolators/ABSs, AF equipment, capacitor banks, transformer tapchanger controls, neutral earth resistors, and voltage transformers.

Supervisory Control and Data Acquisition (SCADA)
An arrangement for selective control and supervision of remotely located apparatus.

Supply
Supply of electricity.

Surge
A transient wave of current, voltage, or power in an electric circuit.

Surge Arrester
A device designed to protect electrical apparatus from high transient voltage and to limit the duration, frequency, and the amplitude of the surge current.

Surrender
Documenting by the person to whom the authorisation is issued that all persons signed on the Access / Test Permit, Authority to Energise (AE), Construction Authority (CA), Test Authority (TA), Decommissioning Notice Attachment, LV De-energisation Permit or a LV Fault Finding Permit have ceased work and have signed off the document as recognition that their access to or control of the Electrical Apparatus has been relinquished (access shall not be restored on a surrendered document).

Suspension of an Access Permit
Documenting by the recipient that all persons signed on an Access Permit have ceased work and have signed off the Access Permit as recognition that their work is suspended and shall not recommence until access is granted by the Control Authority and they have re-signed on the Access Permit.

Switch
- Any device which can be operated to make or break an electrical circuit.
- To operate switchgear.

Switch Fuse (SF)
A combination switch and fuse unit that connects the ring main unit (RMU) to the transformer cable.

Switchgear
The generic name for that class of electrical apparatus whose sole function is to open and close electric circuits.

Switching
Work involving the operating of switching devices, links, fuses or other connections intended for ready removal or replacement, proving electrical conductors de-energised, earthing and short-circuiting, locking and tagging of electrical apparatus and erection of barriers and signs

Switching Coordinator
A person authorised to coordinate switching and to perform switching by remote control and approve the issue of *Access / Test Permits.*

Switching Operator
A person authorised to carry out field switching and issue / surrender *Access / Test Permits*.

Switching Operator's Assistant
A competent assistant authorised to assist a Switching Operator in performing switching operations.

Switching Sheet
A document, which has a unique identifying number for each electricity entity, listing operations of switching in a step by step process.

Switching Sheet Item
An item on a switching sheet.

Switching Sheet Authoriser
A trained person who authorises a switching sheet for a nominated date and time.

Switching Sheet Checker
A person who checks a switching sheet for correct isolation and access to electrical apparatus.

Switching Sheet Writer
A trained person who writes a switching sheet to provide isolation and access to electrical apparatus.

Switchroom
That part of a building that restricts unauthorised access, which houses switchgear.

Switchyard
An area enclosed by a security fence containing exposed live electrical apparatus.

System
See "Network".

System Instability
The condition of a power system (network) when the stability limits are exceeded.

System Lock
An ENERGEX approved lock (e.g. "S" series) used to restrict the unauthorised operation of ENERGEX's network.

System Maintenance
See "Repair and Maintenance".

System Security
See "Network Security".

System Stability
A property of an electrical circuit or network whereby changes, usually sudden, in operational conditions (e.g. electrical load) can be coped with by the electrical circuit or network, without loss of controlled operation within the designed range.

Tapchanger
A device, normally integral with a transformer, used to change the ratio of a transformer. See also "On Load Tapchanger (OLTC)" and "Off Load Tapchanger".

Taplin Test Stick
See "Test Device - Contact Type".

TCC
See "Transmission Control Centre".

Terminal
A point in an electrical circuit at which any electrical element may be connected.

Test Authority Form (TA)
A documented form of authorisation that allows access to HV Not Electrically Connected electrical apparatus for testing which may produce lethal currents, and minor works associated with testing. A detailed description of work tasks for each construction group is required.

Test Device - Proximity Type
An electronic amplifier type voltage tester used to detect the electric field near energised HV electrical apparatus. They are used in direct contact or close proximity with the line or apparatus under test. These instruments have internal batteries and use another device for proving correct operation.

Test Device - Contact Type
A single probe tester requiring direct contact with the HV electrical apparatus under test. It is used to detect the presence of a high voltage by using a series resistance and earth capacitance circuit to power an analog meter. The voltage range is selective (e.g. 11 kV, 33 kV, 132 kV etc) and has a built-in proving device.

Test Device - Phasing Type
A two probe HV tester requiring direct contact with the HV electrical apparatus under test. It detects the presence of a high voltage using a meter and two high voltage resistor stacks in series. The voltage range is fixed and uses an analog meter to indicate the presence of voltage. The proving method is from a known live source.

Test Permit (TP)
A document (form 173) of authorisation that allows access to HV electrical apparatus for testing which may produce lethal currents and minor works associated with testing and the removal of operator earths.

Test Point
A designated point on electrical apparatus, where the presence or absence of voltage can be detected.

Tie Feeder
A designated feeder, used for purpose of joining substations or transferring load between substations. See also "Mesh".

Transducer
A device which accepts a signal of one form and converts into another form.

Transformer (TR)
A static piece of apparatus which by electromagnetic induction, transforms alternating voltage and current between two or more windings at the same frequency and at different values of voltage and current.

Transformer Differential Protection
Differential protection that is used on a transformer.

Translay
A type of opposed-voltage protection system.

Translay S
A type of circulating current protection scheme.

Transmission Control Centre (TCC)
See “Network Switching Centre”.

Transmission Substation
A substation with multiple relay controlled switchgear, used for switching and/or transforming a high voltage (e.g. 132 kV or 110 kV) to a sub-transmission voltage (e.g. 33 kV) or a distribution voltage (e.g. 11 kV).

Trip (Tripping)
Change operational status (usually from closed to open) by means of an auxiliary activating mechanism; unlatch.

Trip Circuit Monitoring (TCM)
See "Trip Circuit Supervision".

Trip Circuit Supervision
A method for monitoring the continuity of a circuit breaker trip circuit.

Trip Coil (TC)
A coil on a circuit breaker that, when energised, automatically opens the circuit breaker.

Under Frequency Load Shed (UFLS)
A network protection that operates at a predetermined frequency level which is less than 50 Hz.

Underground HV Network
Electrical apparatus such as underground cables, ring main units, ring disconnect units, and switch fuse units.

Undervoltage Protection
Protection that operates at a predetermined voltage level which is less than normal.

Unit Protection
A protective system designed to operate for abnormal conditions inside and remain stable for abnormal conditions outside a specified zone of the power system.

Vacuum Circuit Breaker
A circuit breaker in which the contacts open and close within a vacuum.

VAR
Volt-amperes-reactive.

Veeder
See "Operation Counter".

Vent
See "Pressure Relief Device".

Vicinity
See “Near”.

Voltage
The effective (rms) electrical potential difference (emf or potential difference) between any two conductors or between a conductor and earth. Voltages (volts) are expressed in nominal values unless otherwise indicated.

Voltage Balanced Differential Protection
See "Opposed-Voltage Protection System".

Voltage Detector
An approved (voltage indicating) device used to prove that electrical apparatus is de-energised prior to earthing.

Voltage Transformer (VT)
An instrument transformer for obtaining measurements of high voltages suitable for metering and protection purposes.

Volt VarVAR Regulation (VVR)
Software that provides coordinated control of the transformer tapchangers and substation capacitors to optimise the voltage level and VAR requirements for the substation.

Watt (W)
A unit of electrical power.

Will
In the context of this operating standard, always means "Mandatory". See also “Shall”

Winding Temperature Indicator (WTI)
An indicating gauge, with a maximum temperature indicator, which operates an alarm and/or trip relay when the temperature of the transformer windings (hot spot) exceeds a predetermined value.

Withdrawable Equipment
Apparatus (e.g. circuit breaker, voltage transformer) that can be withdrawn. 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 Area
The area where work may be carried out under an *Access / Test Permit*

Work Area Sign
A sign bearing the words "Work Area" which shall be clearly and prominently displayed at all entry points to a delineated work area.

Work Authority
Authority issued by an authorised person (e.g. Switching Coordinator, Commissioning Coordinator) for electrical work to commence on electrical apparatus. Note: A work authority is not required for operating work.

Work Glove
A type of glove that protects the user against mechanical injuries (not to be used as an insulating glove unless approved).

Work Practice
A detailed set of written work instructions for use at a particular work area or for a particular type of electrical apparatus.

Work Group
A group of persons working under either:
- one access permit, who are within sight and hearing distance of each other
- one test permit
- one construction authority, with one person designated the on-site supervisor
- a non-access high voltage work authority, with one person designated the on-site supervisor

Working Earths
Approved earthing equipment, additional to operator earths, applied to electrical apparatus following the issue of an access authority. Working earths are applied to limit the rise in potential difference at the work area.

Zellweger (Set)
See "Audio Frequency Injection Equipment".

Zone Substation
An intermediate substation, with multiple relay controlled switchgear, used for switching and/or transforming a high voltage (e.g. 132 kV, 110 kV or 33 kV) to the primary distribution voltage (e.g. 11 kV).

1 Switching Logic

1.1 OLTC Transformers

1.1.1 Non SACS Control - Normally in Parallel

(Refer to figure 1.1.1)

Incorporates optional items to cover 11 kV capacitors under SACS control installed in the substation.

Forward Switching

1. Check Loads.
2. Make all CAP Controllers MANUAL.
3. Assign Transf to "Nil (-)" CAP Controller.
4. Check Transfs in parallel.
5. Make all Transfs NON-AUTO.
6. Make all Transfs IND; or One Master, rest Follower.
7. Open and isolate on LV Side.
8. Alter compensation.
9. Make remaining Transfs AUTO (or MASTER/AUTO, FOLL/AUTO).
10. Open and isolate on HV Side.
11. Complete Isolation (VT, NER etc).
12. Make CAP Controller assoc with remaining Transf AUTO.

Reverse Switching

13. Reverse Isolation (VT, NER, etc).
14. Close HV Supply to Transf.
15. Make all CAP Controllers MANUAL.
16. Make all Transfs NON-AUTO, place on suitable/same tap.
17. Make all Transfs IND (if required).
18. Close LV Side of Transf.
19. Alter compensation.
20. Make Transfs MASTER/FOLL.
21. Make all Transfs AUTO.
22. Assign transf to CAP Controller assoc with other Transf.
23. Make all active CAP Controllers AUTO.

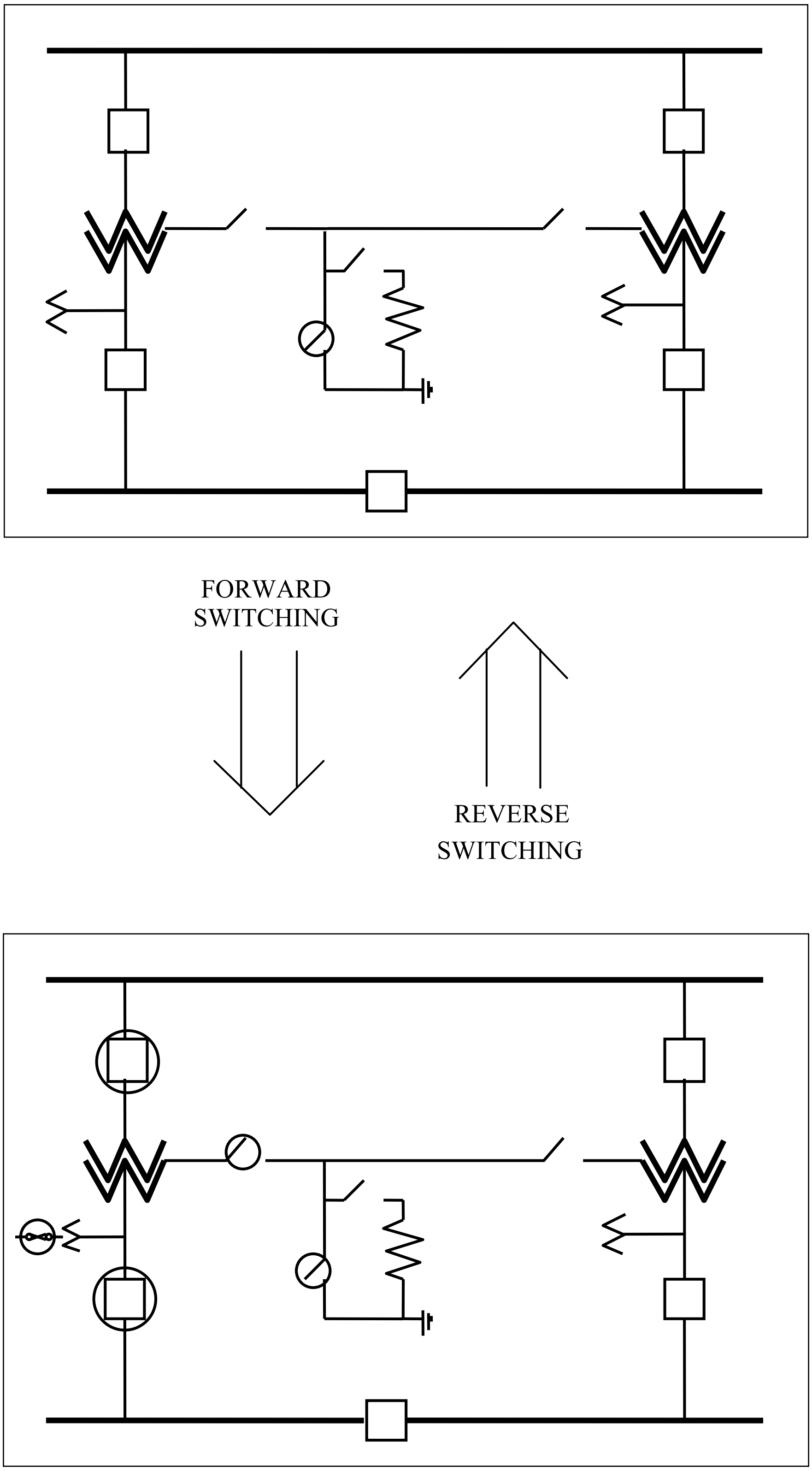

figure 1.1.1

Note: VVR Switching Logic can be done various ways, the following logic is the MINIMUM logic required.

Capacitor switching operations use the "NAV" facility that utilises protection requirements. The vast majority of the main switching logic has been proven.

1.1.2 SACS VVR Control - Normally In Parallel

(Refer to figure 1.1.1)

Method 1 - Using Auto Configure

Forward Switching

1. Check Loads.
2. Auto Configure - "Check ON"
3. Make Controller "MANUAL"
4. Place Controller on Suitable "TRG"
5. Make all Assigned Capacitors "NAV".
6. Open LV Circuit Breaker.
7. Open HV Circuit Breaker.
8. Make all Assigned Capacitors "AVL".
9. Make Controller "VVR"
10. Auto Configure "Turn OFF"
11. Complete Isolation (CBs, VT, NER, etc).

Reverse Switching

12. Reverse Isolation (CBs, VT, NER, etc).
13. Make Controller "MANUAL"
14. Place Controller on Suitable "TRG"
15. Transf (Coming back into Service) Place on Suitable Tap.
16. Make Tapchanger "AVL"
17. Make all Assigned Capacitors "NAV".
18. Close LV Circuit Breaker.
19. Make all Assigned Capacitors "AVL".
20. Auto Configure "Turn ON"
21. Make Controller "VVR"

Method 2 - Manual Configuration

Forward Switching

1. Check Loads.
2. Record all assignments or print VVR page.
3. Auto Configure "Turn OFF".
4. Make Controller "MANUAL".

5. Make all Assigned Capacitors "NAV".

6. Transf (coming OOS) Set Tapchanger to "0" Cnt.
7. Transf (coming OOS) Set Analogs to "0" Cnt.
8. Place Controller on Suitable "TRG".
9. Open LV Circuit Breaker.
10. Open HV Circuit Breaker.

11. Make all Assigned Capacitors "AVL".

12. Make Controller "VVR".
13. Complete Isolation (CBs, VT, NER, etc).

Reverse Switching

14. Reverse Isolation (CBs, VT, NER, etc).

15. Make all Assigned Capacitors "NAV".

16. Make Controller "MANUAL".
17. Place Controller on Suitable "TRG".
18. Transf (Coming back into Service) Place on suitable tap.
19. Make Tapchanger "AVL".
20. Close LV Circuit Breaker.
21. Assign all Tapchangers to Original Controller.
22. Assign all Analogs to Original Controller.

23. Make all Assigned Capacitors "AVL".

24. Auto Configure "Turn ON".
25. Make Controller "VVR".

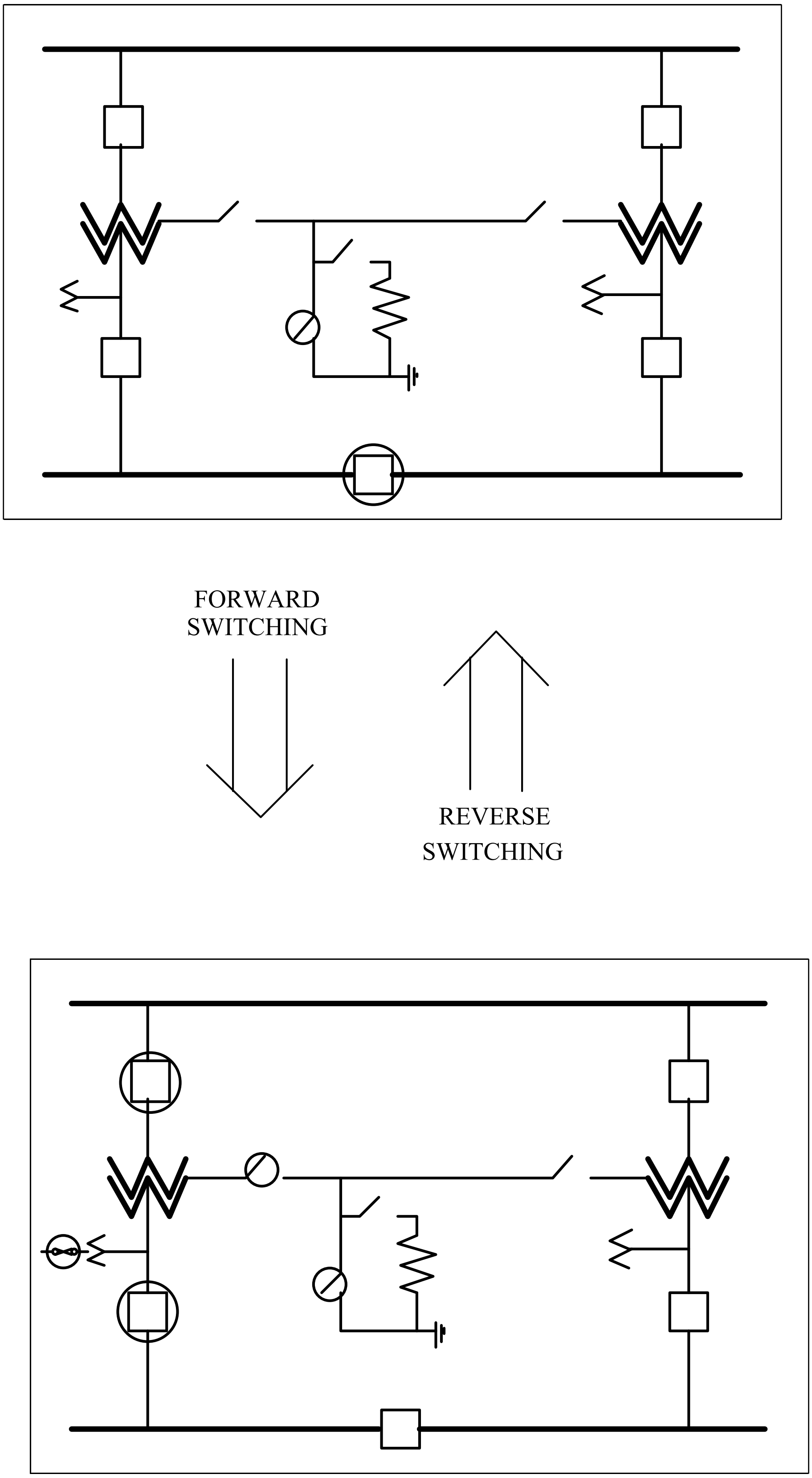

figure 1.1.2

1.1.3 Non SACS Control - Normally Not in Parallel

(Refer to figure 1.1.2)

Incorporates optional items to cover 11 kV capacitors under SACS control installed in the substation.

Forward Switching

1. Check Loads.
2. Make all CAP Controllers MANUAL.
3. Assign Transf to Nil CAP Controller.
4. Assign Capacitor to CAP Controller assoc with remaining Transf.
5. Place Transfs on NON-AUTO and a suitable tap.
6. Place Transfs in parallel.
7. Open and isolate on LV Side.
8. Alter compensation if necessary.
9. Make remaining Transfs on AUTO.
10. Open and isolate on HV Side.
11. Complete Isolation (VT, NER, etc).
12. Make CAP Controller assoc with remaining Transf AUTO.

Reverse Switching

13. Reverse Isolation (VT, NER, etc).
14. Close HV Supply to Transf.
15. Make all CAP Controllers MANUAL.
16. Place Transfs on NON-AUTO and a suitable tap.
17. Close LV Side of Transf.
18. Switch Transfs out of parallel.
19. Alter compensation if necessary.
20. Place Transfs on AUTO.
21. Assign transf to CAP Controller.
22. Make all active CAP Controllers AUTO.

1.1.4 SACS VVR Control - Normally Not in Parallel

(Refer to figure 1.1.2)

Assumes volt controller 3 is set up for 1 transformer supplying total sub load.

Forward Switching

1. Check Loads.
2. Record all Assignments or Print VVR page.
3. Auto Configure "Turn OFF".
4. Make all Controllers "MANUAL".
5. Place Controller/s on Suitable "TRG".
6. Make All Assigned Capacitors "NAV".
7. Close & Open Appropriate LV Circuit Breakers.
8. Open HV Side.
9. Place Controller (3) on Suitable "TRG".
10. Transf (Remaining) Assign Tapchanger to Controller (3).
11. Transf (Remaining) Assign Analogs to Controller (3).
12. Assign Capacitors to Controller (3).
13. Make all Assigned Capacitors "AVL".
14. Make Controller (3) "VVR".
15. Complete Isolation (CBs, VT, NER etc).

Reverse Switching

16. Reverse Isolation (CBs, VT, NER, etc).
17. Make all Controllers "MANUAL".
18. Place Original Controllers on Suitable "TRG".
19. Make all Assigned Capacitors "NAV".
20. Assign Tapchangers to Original Controllers (1 & 2).
21. Assign Analogs to Original Controllers (1 & 2).
22. Make Tapchangers "AVL".
23. Close and Open Appropriate LV Circuit Breakers.
24. All Assigned Cap Banks SET to Original Controllers.
25. Make all Assigned Capacitors "AVL".
26. Auto Configure "Turn ON".
27. Make Controllers (1 & 2) "VVR".
28. Restore Auto-Changeover and/or Auto-Restore.

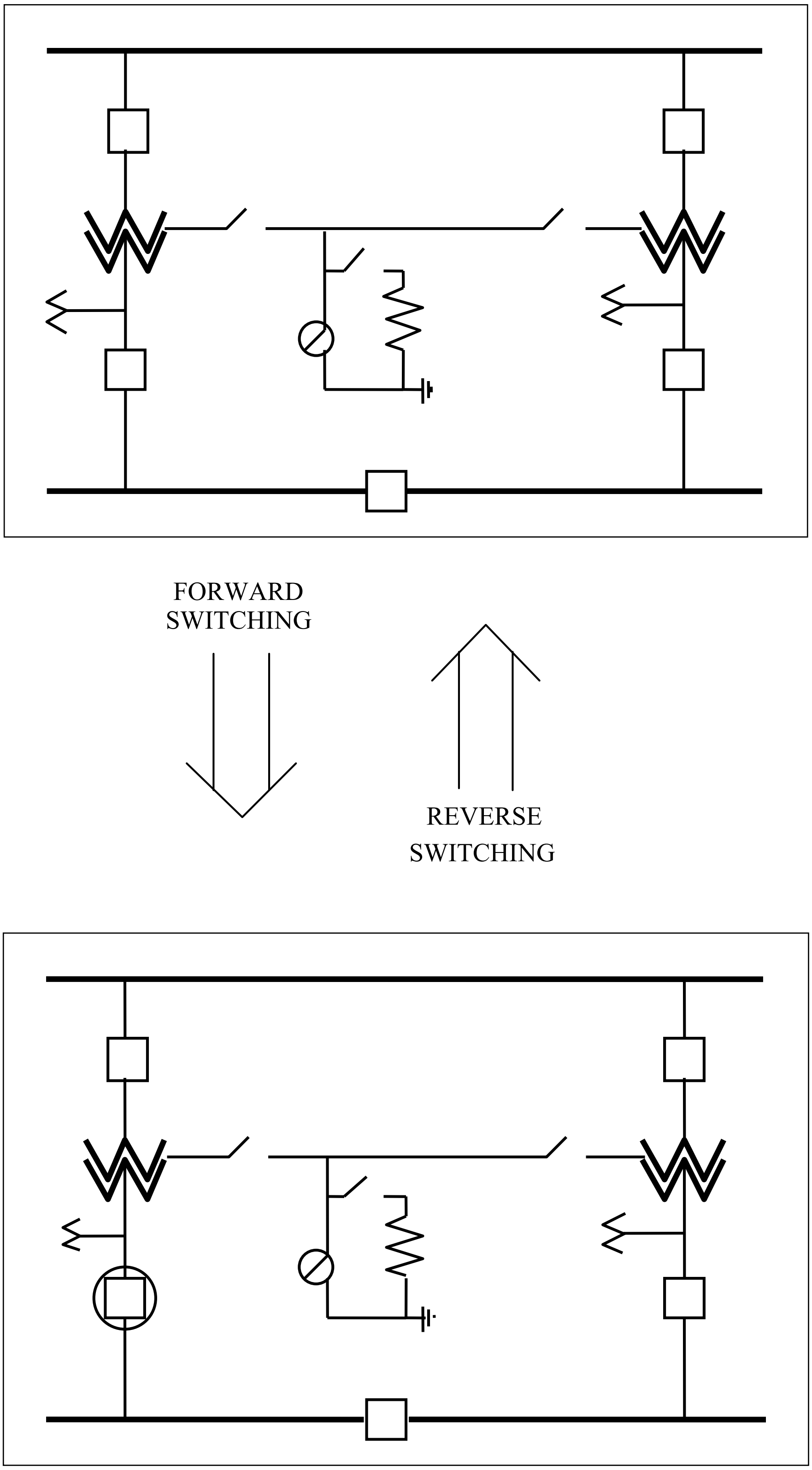

figure 1.1.3

1.1.5 To Deload - Non SACS Control - Prior to Excess Fault Level Paralleling - Normally in Parallel

(Refer to figure 1.1.3)

Forward Switching

1. Check Loads.

2. Record Capacitor Assignments. 3. Assign Capacitors to "Nil (-)" CAP Controller.

4. Check Transfs in Parallel.
5. Make all Transfs NON-AUTO.
6. Make all Transfs INDEPENDENT.
7. Open LV Circuit Breaker.
8. Alter Compensation.
9. Make Remaining Transf AUTO (or MASTER/AUTO, FOLLOWER/AUTO).

Reverse Switching

10. Make All Transfs NON-AUTO, Place on Suitable Tap.
11. Make All Transfs INDEPENDENT.
12. Close LV Circuit Breaker.
13. Alter Compensation.
14. Make Transfs MASTER/FOLLOWER.
15. Make All Transfs AUTO.

16. Re-assign Capacitors to Original CAP Controllers.

1.1.6 To Deload - SACS VVR Control - Prior to Excess Fault Level Paralleling - Normally in Parallel

(Refer to figure 1.1.3)

Method 1 - Using Auto Configure

Forward Switching

1. Check Loads.
2. Auto Configure "Check ON".
3. Make Controller "MANUAL".
4. Place Controller on Suitable "TRG".
5. MAKE all Assigned Capacitors "NAV".
6. Open LV Circuit Breaker.
7. Make Controller "VVR".

Reverse Switching

8. Make Controller "MANUAL".
9. Place Controller on Suitable "TRG".
10. Close LV Circuit Breaker.
11. MAKE all Assigned Capacitors "AVL".
12. Make Controller "VVR".

Method 2 - Manual Configuration

Forward Switching

1. Check Loads.
2. Record all assignments or print VVR page.
3. Auto Configure "Turn OFF".
4. Make Controller "MANUAL".
5. Make All Assigned Capacitors "NAV".
6. Transf (coming OOS) Set Tapchanger to "0" Cnt.
7. Transf (coming OOS) Set Analogs to "0" Cnt.
8. Place Controller on Suitable "TRG".
9. Open LV Circuit Breaker.
10. Make Controller "VVR".

Reverse Switching

11. Make Controller "MANUAL".
12. Place Controller on Suitable "TRG".
13. Transf (Coming back into Service) Place on suitable tap.
14. Close LV Circuit Breaker.
15. Assign all Tapchangers to Original Controller.
16. Assign all Analogs to Original Controller.
17. Make all Assigned Capacitors "AVL".
18. Auto Configure "Turn ON".
19. Make Controller "VVR".

1.1.7 To Switch Bus Section CB(s) - SACS VVR Control OLTCs – In Parallel

Method 1 - Using Auto Configure

Forward Switching

1. Check system configuration - Split External Rings.

2. Run All Zellweger Channels on "ON" and Block If Necessary.

3. Auto Configure "Check ON".
4. Make Controllers "MANUAL".
5. Place Controllers on Suitable "TRG".

6. Make All Assigned Capacitors "NAV".

7. Open Bus Section CB.
8. Check Auto Configure Assignments Completed.
9. Auto Configure "Turn OFF".

10. Make all Assigned Capacitors "AVL".	389

11. Make Assigned Controllers "VVR".
12. Isolate Both Sides of Bus Section CB.

Reverse Switching

13. Reverse Isolation of Bus Section CB.
14. Make Controllers "MANUAL".
15. Place all Controllers on Suitable "TRG".

16. Make All Assigned Capacitors "NAV".	1018

17. Close Bus Section CB.
18. Auto Configure "Turn ON".
19. Check Auto Configure Assignments Completed.

20. Make all Assigned Capacitors "AVL".

21. Make Assigned Controllers "VVR".

22. Unblock Zellweger & Check Run If Necessary.

23. Close Up External Rings.

Method 2 - Manual Configuration

Refer to section 1.1.2.

1.1.8 To Switch Bus Section CB(s) - SACS VVR Control OLTCs – Not in Parallel

Method 1 - Using Auto Configure

Forward Switching

1. Check Loads.
2. Auto Configure "Check ON".
3. Make Controllers "MANUAL".
4. Place Controllers on Suitable "TRG".
5. Make All Assigned Capacitors "NAV".
6. Close Bus Section CB.
7. Open LV Circuit Breaker.
8. Check Auto Configure Assignments Completed.
9. Make All Assigned Capacitors "AVL".
10. Make Assigned Controllers "VVR".
11. Auto Configure "Turn OFF".
12. Isolate LV and HV if required.

Reverse Switching

13. Reverse Isolation of LV and HV if required.
14. Make Controllers "MANUAL".
15. Place Controllers on Suitable "TRG".
16. Make All Assigned Capacitors "NAV".
17. Close LV Circuit Breaker.
18. Open Bus Section Circuit Breaker.
19. Auto Configure "Turn ON".
20. Check Auto Configure Assignments Completed.
21. Make All Assigned Capacitors "AVL".
22. Make Assigned Controllers "VVR".

Method 2 - Manual Configuration

Refer to section 1.1.4.

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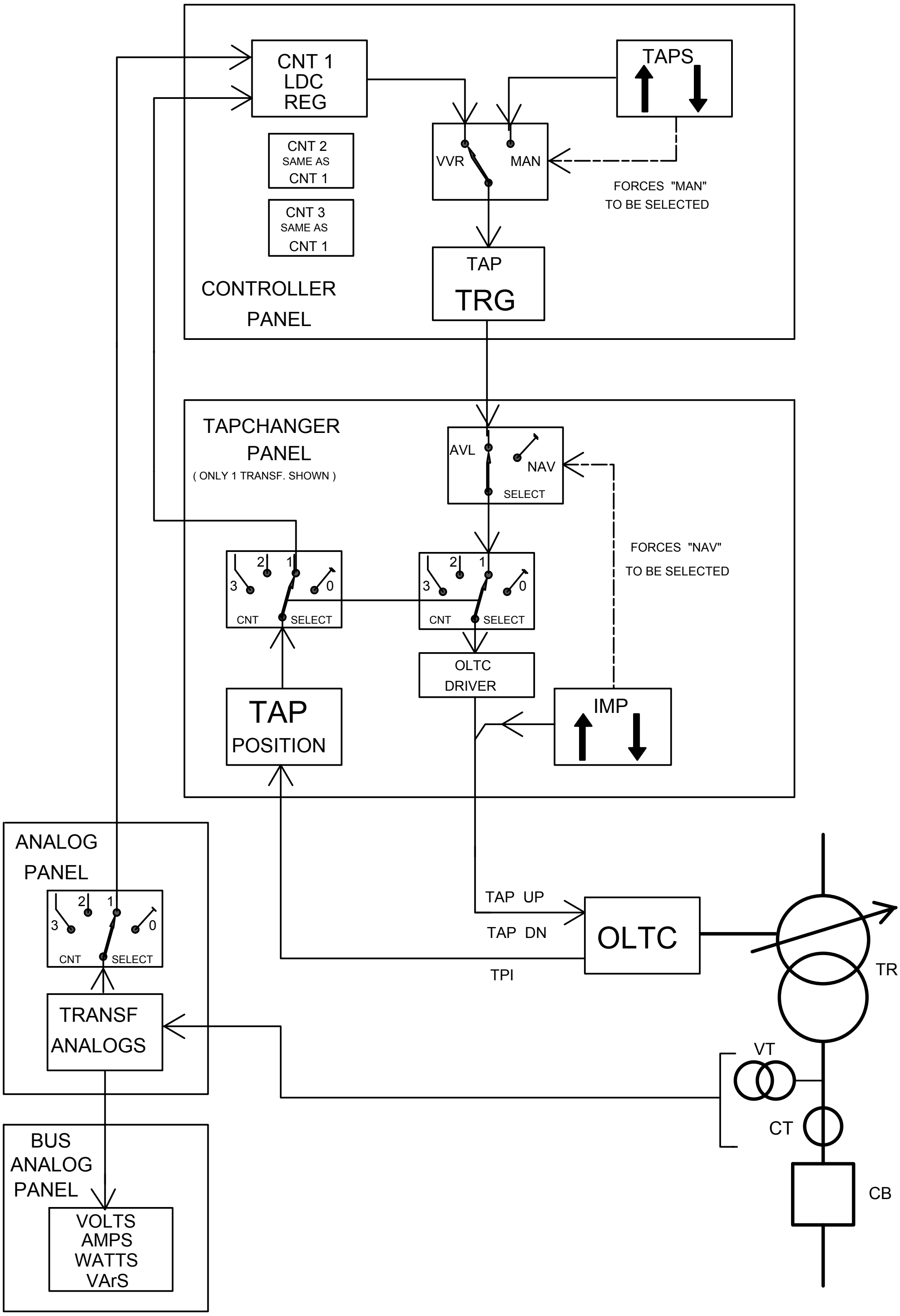
CNT 1
LDC
REG
TAPS
CNT 2
SAME AS
CNT 1
VVR
MAN
FORCES "MAN"
TO BE SELECTED
CNT 3
SAME AS
CNT 1
TAP
TRG
CONTROLLER
PANEL
TAPCHANGER
PANEL
(ONLY 1 TRANSF. SHOWN)
AVL
NAV
SELECT
FORCES "NAV"
TO BE SELECTED
3
2
1
0
CNT
SELECT
OLTC
DRIVER
IMP
TAP
POSITION
ANALOG
PANEL
TAP UP
TAP DN
TPI
OLTC
TR
TRANSF
ANALOGS
VT
CT
CB
BUS
ANALOG
PANEL
VOLTS
AMPS
WATTS
VArS

figure 1.1.4

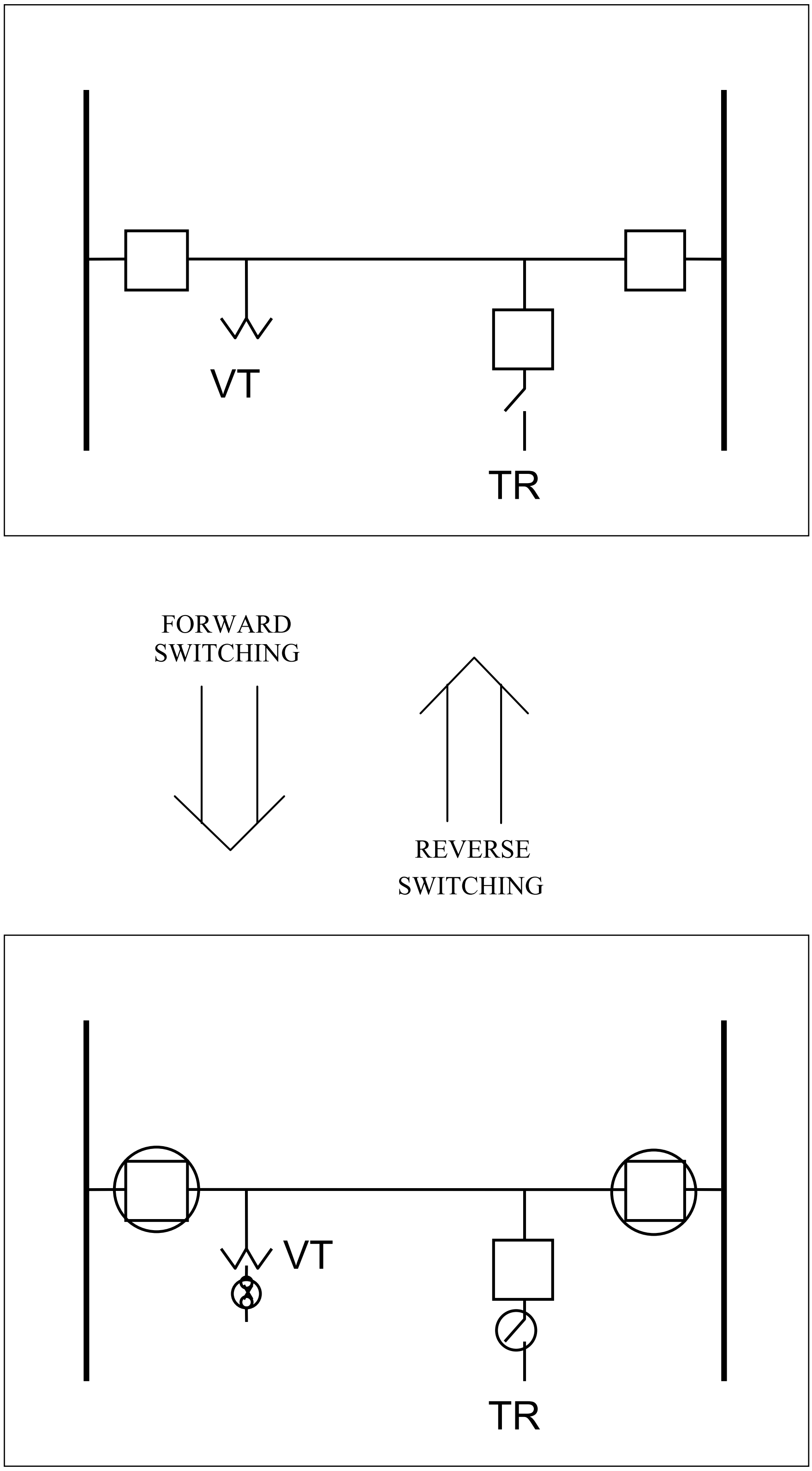

figure 1.2

1.2 To Switch a 33 kV Tie Feeder

(Refer to figure 1.2)

Forward Switching

1. Check Loads.
2. Substation A - Isolate Local Supply Transf (if fitted).
3. Substation A - Close Alternative HV Supply (if required).
4. Substation A - Open and Isolate Feeder.
5. Substation B - Isolate Local Supply Transf (if fitted).
6. Substation B - Close Alternative HV Supply (if required).
7. Substation B - Open and Isolate Feeder.
8. Isolate VT's at each Substation (if fitted).

Reverse Switching

9. Reverse Isolation of VT's at each Substation (if fitted).
10. Substation A - Check switches in correct state and Relays reset.
11. Substation A - Reverse Isolation and Close Feeder.
12. Substation A - Open Alternative HV Supply (if required).
13. Substation A - Close Local Supply Transf (if fitted).
14. Substation B - Check switches in correct state and Relays reset.
15. Substation B - Reverse Isolation and Close Feeder.
16. Substation B - Open Alternative HV Supply (if required).
17. Substation B - Close Local Supply Transf (if fitted).

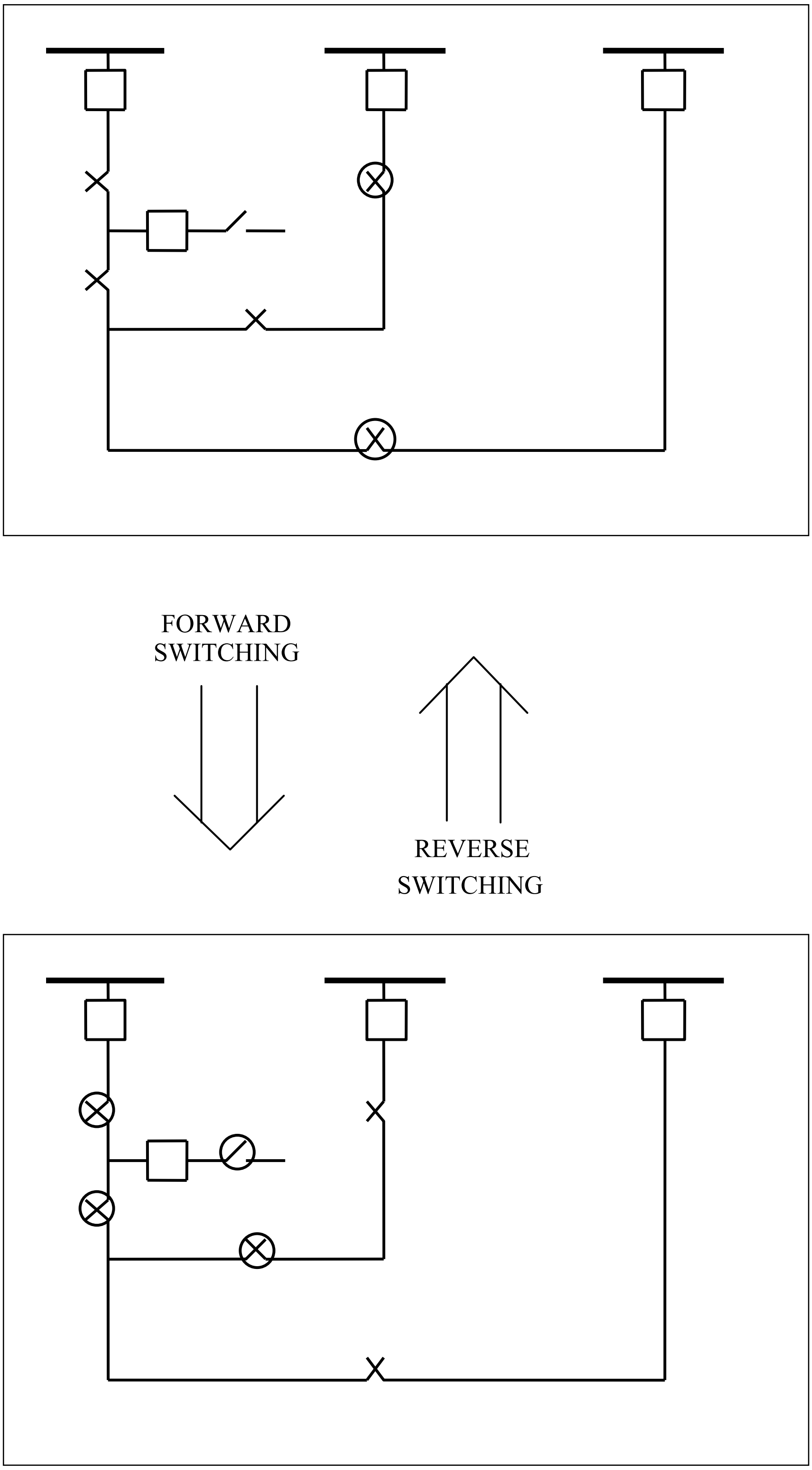

figure 1.3

1.3 To Switch an 11 kV Radial Feeder

(Refer to figure 1.3)

Note: Some items may not be necessary

Forward Switching

1. Check Loads.
2. All HV Load Shifts.
3. All HV Paralleling.
4. Transformers with Ties.
5. Isolated-area Transformers.
6. Open and Isolate "Normal-feed" HV Isolation Point.

Reverse Switching

7. Reverse Isolation of "Normal-feed" HV Isolation Point and Close.
8. Isolated-area Transformers.
9. Transformers with Ties.
10. All HV Paralleling.
11. All HV Load Shifts.

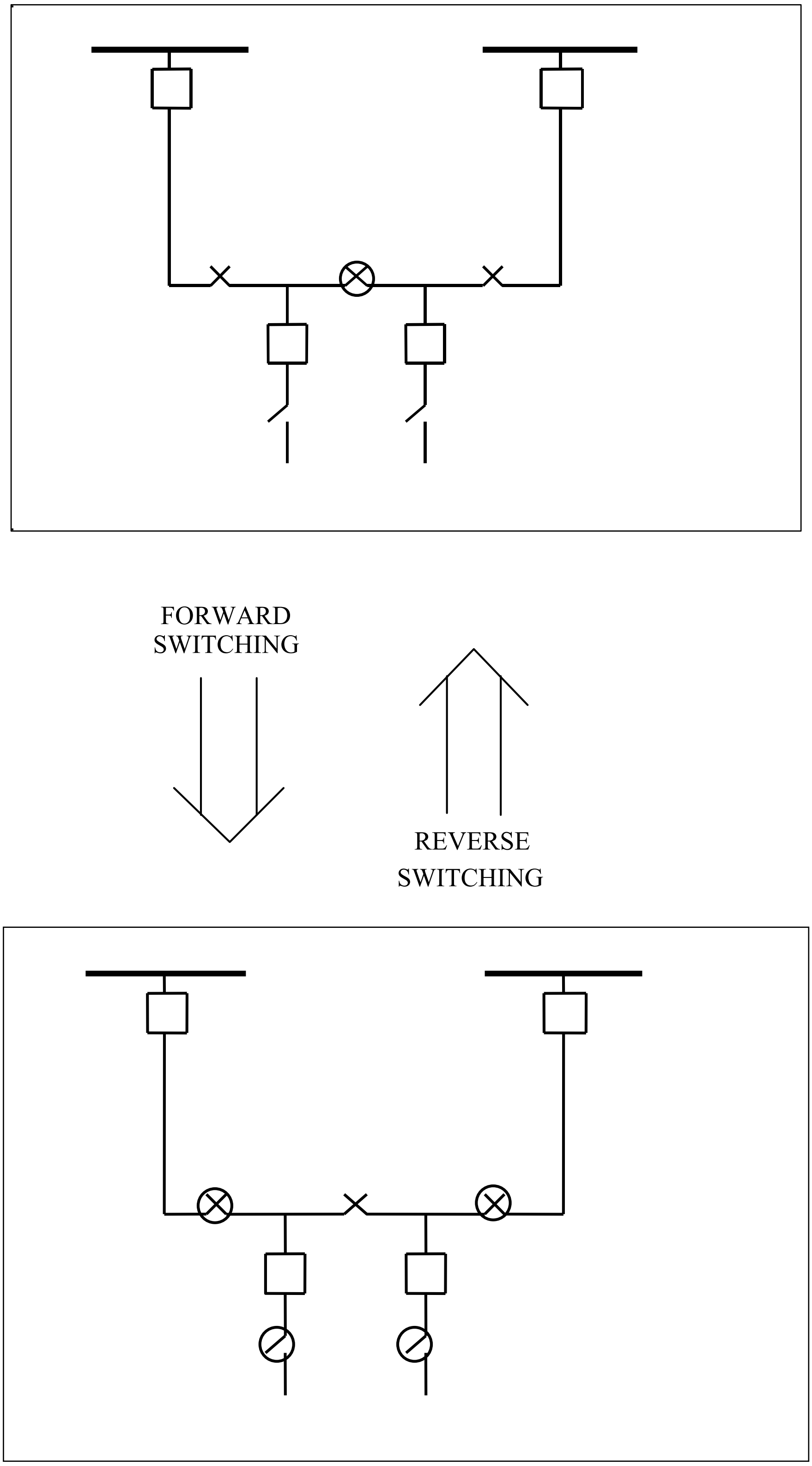

figure 1.4

1.4 To Switch an 11 kV Paralleler Out of Service

(Refer to figure 1.4)

Note: Some items may not be necessary.

Forward Switching

1. Check Loads.
2. All HV Load Shifts.
3. All HV Paralleling.
4. L/H Side - Transformers with Ties.
5. L/H Side - Isolated-area Transformers.
6. L/H Side - Open and Isolate "Normal-feed" HV Isolation Point.
7. R/H Side - Transformers with Ties.
8. R/H Side - Isolated-area Transformers.
9. R/H Side - Open and Isolate "Normal-feed" HV Isolation Point.

Reverse Switching

10. Check Paralleler Open
11. L/H Side - Reverse Isolation of "Normal-feed" HV Isolation Point and Close.
12. L/H Side - Isolated-area Transformers.
13. L/H Side - Transformers with Ties.
14. R/H Side - Reverse Isolation of "Normal-feed" HV Isolation Point and Close.
15. R/H Side - Isolated-area Transformers.
16. R/H Side - Transformers with Ties.
17. All HV Paralleling.
18. All HV Load Shifts.

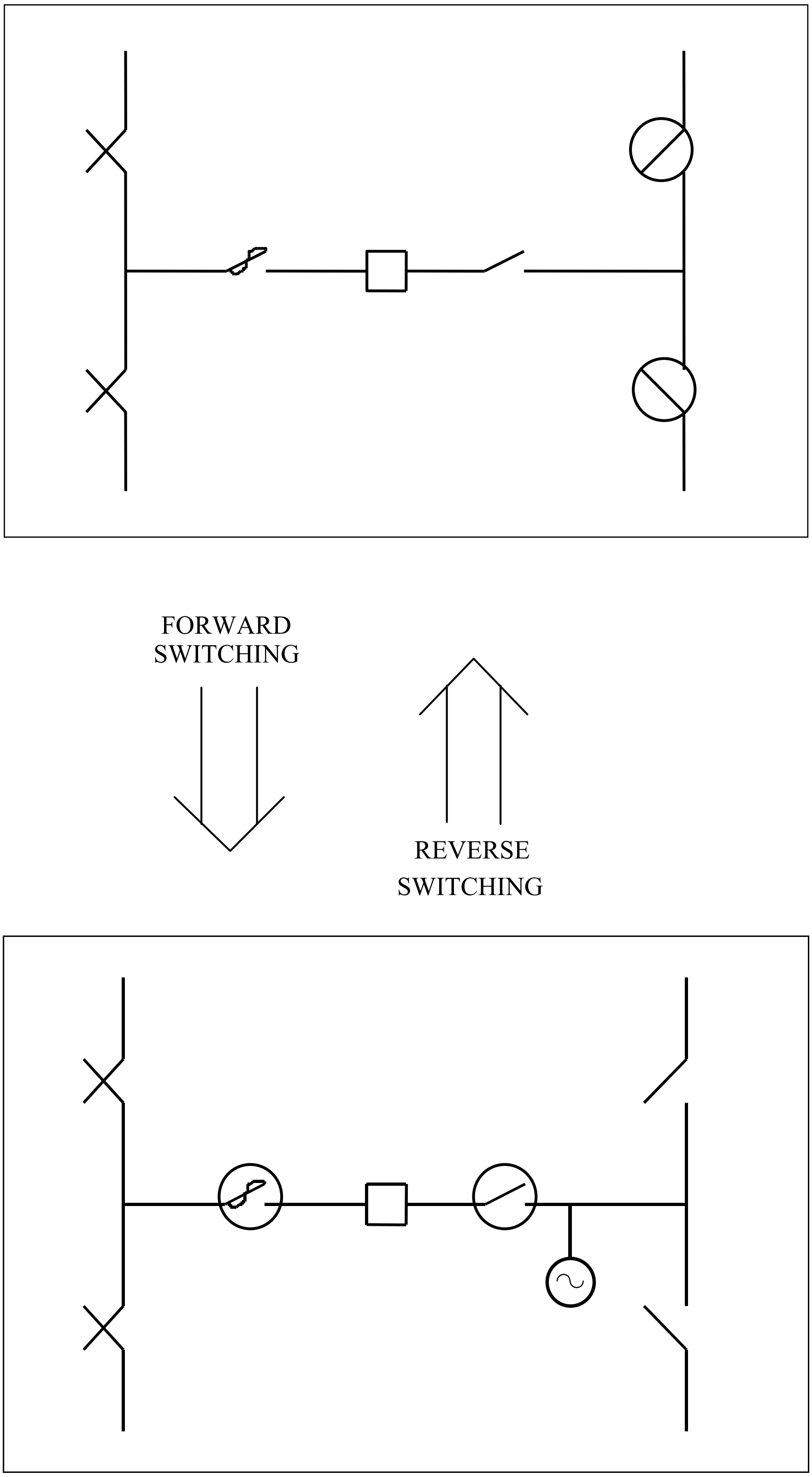

figure 1.5

1.5 To Switch Distribution Transformers

(Refer to figure 1.5)

1.5.1 Where LV area is to be tied in

Note: Some items may not be necessary.

Forward Switching

1. Sync. and Close Alternator's LV Switch (if required).
2. Close LV Ties (if required).
3. Open and Isolate Transformer's LV Switch.
4. Mark Phase Rotation at Transformer's LV Switch.
5. Isolate HV Side.

Reverse Switching

6. Check HV Fuses Closed.
7. Reverse HV Isolation and Close
8. Phase out at Transformer's LV Switch.
9. Close Transformer's LV Switch.
10. Open Alternator's LV Switch (if required).
11. Untie Transformers LV Area (if required).

1.5.2 Where LV area is not to be tied in

Note: Some items may not be necessary.

Forward Switching

1. Sync. and Close Alternator's LV Switch (if required).
2. Open and Isolate Transformer's LV Switch.
3. Mark Phase Rotation at Transformer's LV Switch.
4. Isolate HV Side.

Reverse Switching

5. Check HV Fuses Closed.
6. Reverse HV Isolation and Close
7. Check Phase Rotation at Transformer's LV Switch or Phase Out at Boundary of Transformer's LV Area.
8. Open Alternator's LV Switch (if required).
9. Close Transformer's LV Switch.

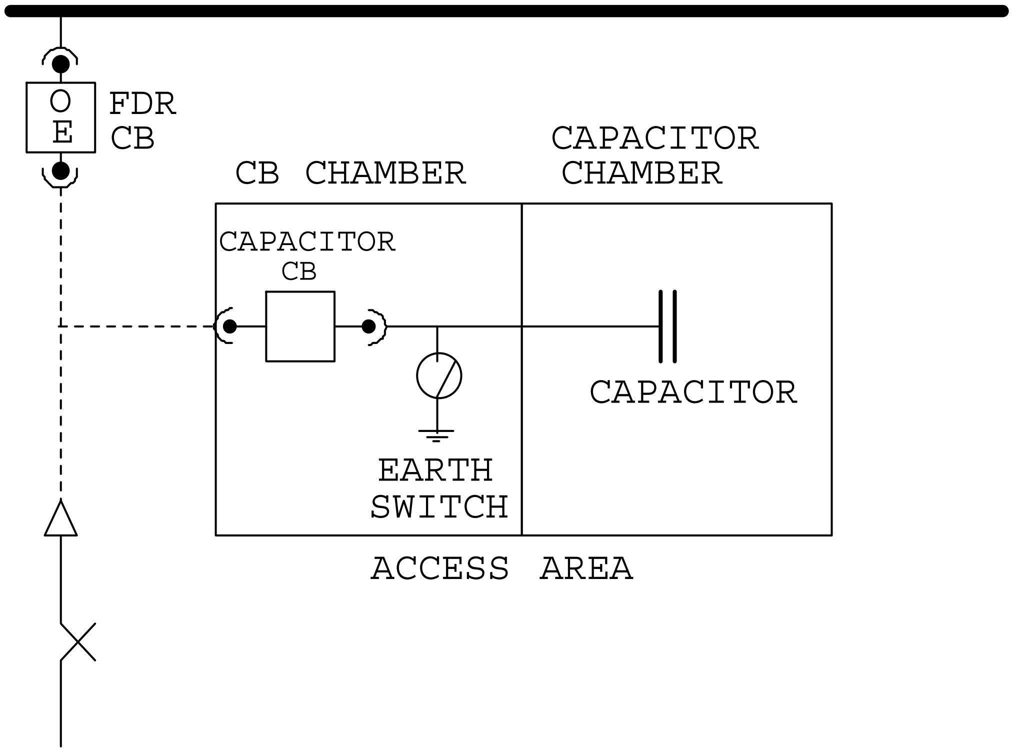
O
E
FDR
CB
CB CHAMBER
CAPACITOR
CHAMBER
CAPACITOR
CB
CAPACITOR
EARTH
SWITCH
ACCESS AREA

figure 1.6.1

1.6 To Switch 11 kV Capacitors

1.6.1 Cubicle Type Capacitor Bank Only - Withdrawable CB

(Refer to figure 1.6.1)

Forward Switching

1. Advise "AREA" Control that Switching to Commence.
2. Record CAP Controller to which Capacitor Assigned.
3. Assign Capacitor to "NAV".
4. Open Capacitor CB.
5. Disable Remote Control on Capacitor CB.
6. Isolate Capacitor CB.
7. Wait 5 minutes to allow Capacitors to Discharge.
8. Test, Prove De-energised and Earth in "Capacitor" Orifice of Capacitor CB.

Reverse Switching

9. Check Capacitor Bridge Removed.
10. Check all Earths Removed.
11. Check all Relays Reset.
12. Connect Capacitor CB to Bus.
13. Restore Remote Control to Capacitor CB.
14. Assign Capacitor to "AVL".
15. Capacitor CB will be Closed Auto as Required.
16. Advise "AREA" Control that Switching Complete.

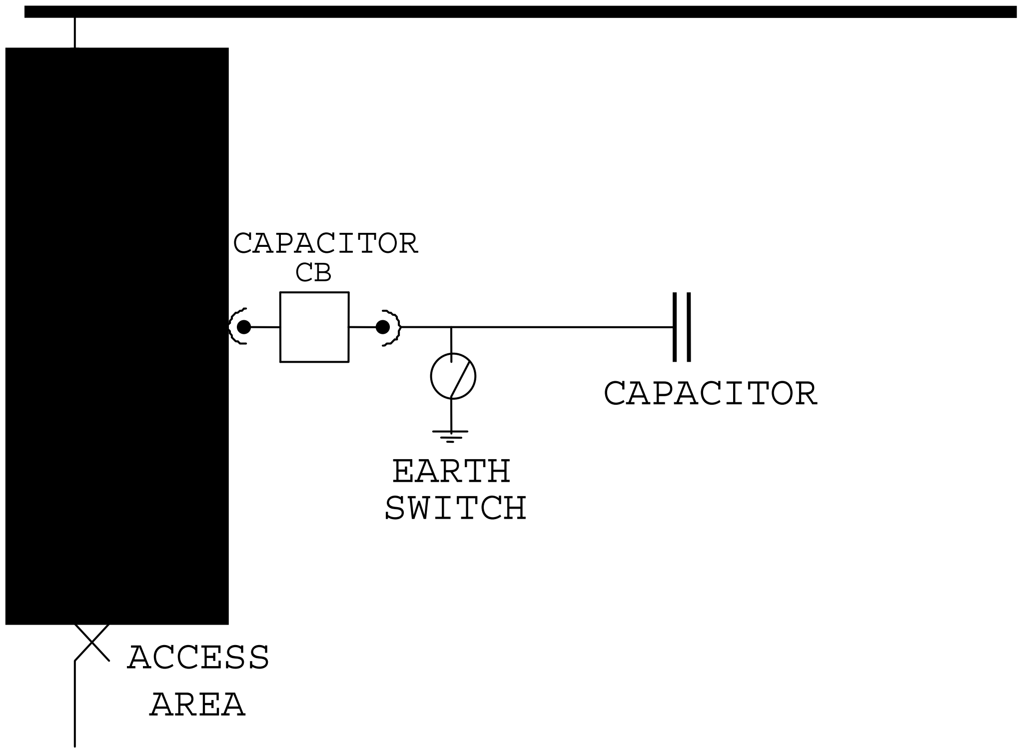

figure 1.6.2

1.6.2 Feeder Tail Incorporating Cubicle Type Capacitor Bank - Withdrawable CB

(Refer to figure 1.6.2)

Note: The isolation points created by this switching do not include the capacitor bank.

Forward Switching

1. Advise "AREA" Control that Switching to Commence.
2. Record CAP Controller to which Capacitor Assigned.
3. Assign Capacitor to "NAV".
4. Open Capacitor CB.
5. Disable Remote Control on Capacitor CB.
6. Isolate Capacitor CB.
7. De-energise Feeder Tail and Isolate.
8. Test, Prove De-energised and Earth Feeder Tail.

Reverse Switching

9. Check all Earths Removed.
10. Check all Feeder Relays Reset.
11. Reverse Isolation and Re-energise Feeder Tail.
12. Check all Capacitor Relays Reset.
13. Connect Capacitor CB to Bus.
14. Restore Remote Control to Capacitor CB.
15. Assign Capacitor to "AVL".
16. Capacitor CB will be Closed AUTO as Required.
17. Advise "AREA" Control that Switching Complete.

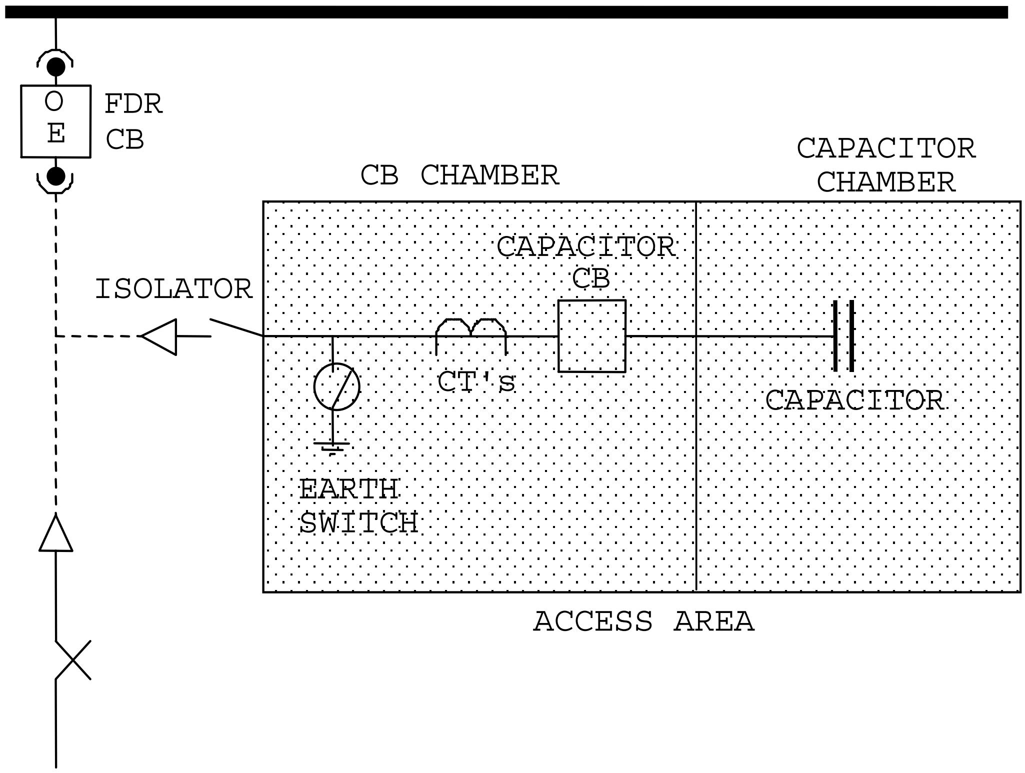
O
E
FDR
CB
CB CHAMBER
CAPACITOR
CHAMBER
CAPACITOR
CB
ISOLATOR
CT's
CAPACITOR
EARTH
SWITCH
ACCESS AREA

figure 1.6.3

1.6.3 Cubicle Type Capacitor Bank Only - Non-Withdrawable CB

(Refer to figure 1.6.3)

Forward Switching

1. Advise "AREA" Control that Switching to Commence.
2. Record CAP Controller to which Capacitor Assigned.
3. Assign Capacitor to "NAV".
4. Open Capacitor CB.
5. Disable Remote Control on Capacitor CB.
6. Open Capacitor Isolator.
7. Wait 5 minutes to allow Capacitors to Discharge.
8. Test, Prove De-energised and Close Capacitor Earth Switch.
9. Close Capacitor CB - To Earth Capacitor Bank.

Reverse Switching

10. Open Capacitor CB – To Remove Earth from Capacitor Bank.
11. Open Capacitor Earth Switch.
12. Check all Relays Reset.
13. Close Capacitor Isolator.
14. Restore Remote Control to Capacitor CB.
15. Assign Capacitor to "AVL".
16. Capacitor CB will be Closed Auto or as required.
17. Advise "AREA" Control that Switching Complete.

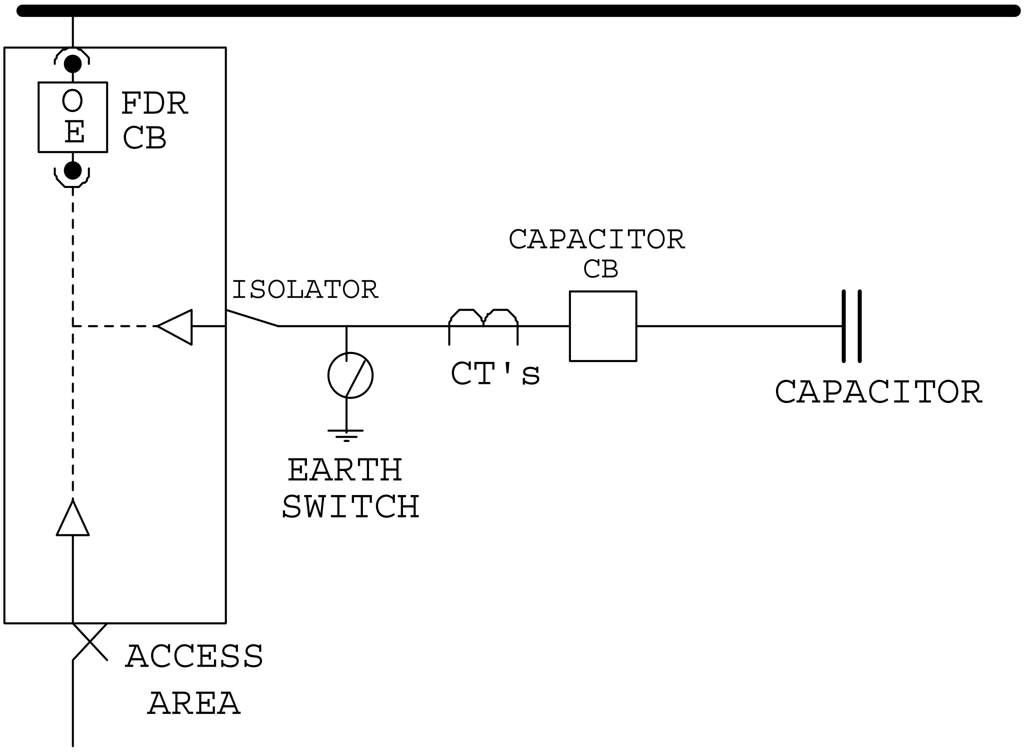

figure 1.6.4

1.6.4 Feeder Tail Incorporating Cubicle Type Cap. Bank - Non-Withdrawable CB

(Refer to figure 1.6.4)

Note: The isolation points created by this switching do not include the capacitor bank.

Forward Switching

1. Advise "AREA" Control that Switching to Commence.
2. Record CAP Controller to which Capacitor Assigned.
3. Assign Capacitor to "NAV".
4. Open Capacitor CB.
5. Disable Remote Control on Capacitor CB.
6. Open Capacitor Isolator.
7. De-energise Feeder Tail and Isolate.
8. Test, Prove De-energised and Earth Feeder Tail.

Reverse Switching

9. Check all Earths Removed.
10. Check all Feeder Relays Reset.
11. Reverse Isolation and Re-energise Feeder Tail.
12. Check all Capacitor Relays Reset.
13. Close Capacitor Isolator.
14. Restore Remote Control to Capacitor CB.
15. Assign Capacitor to "AVL".
16. Capacitor CB will be Closed AUTO as required.
17. Advise "AREA" Control that Switching Complete.

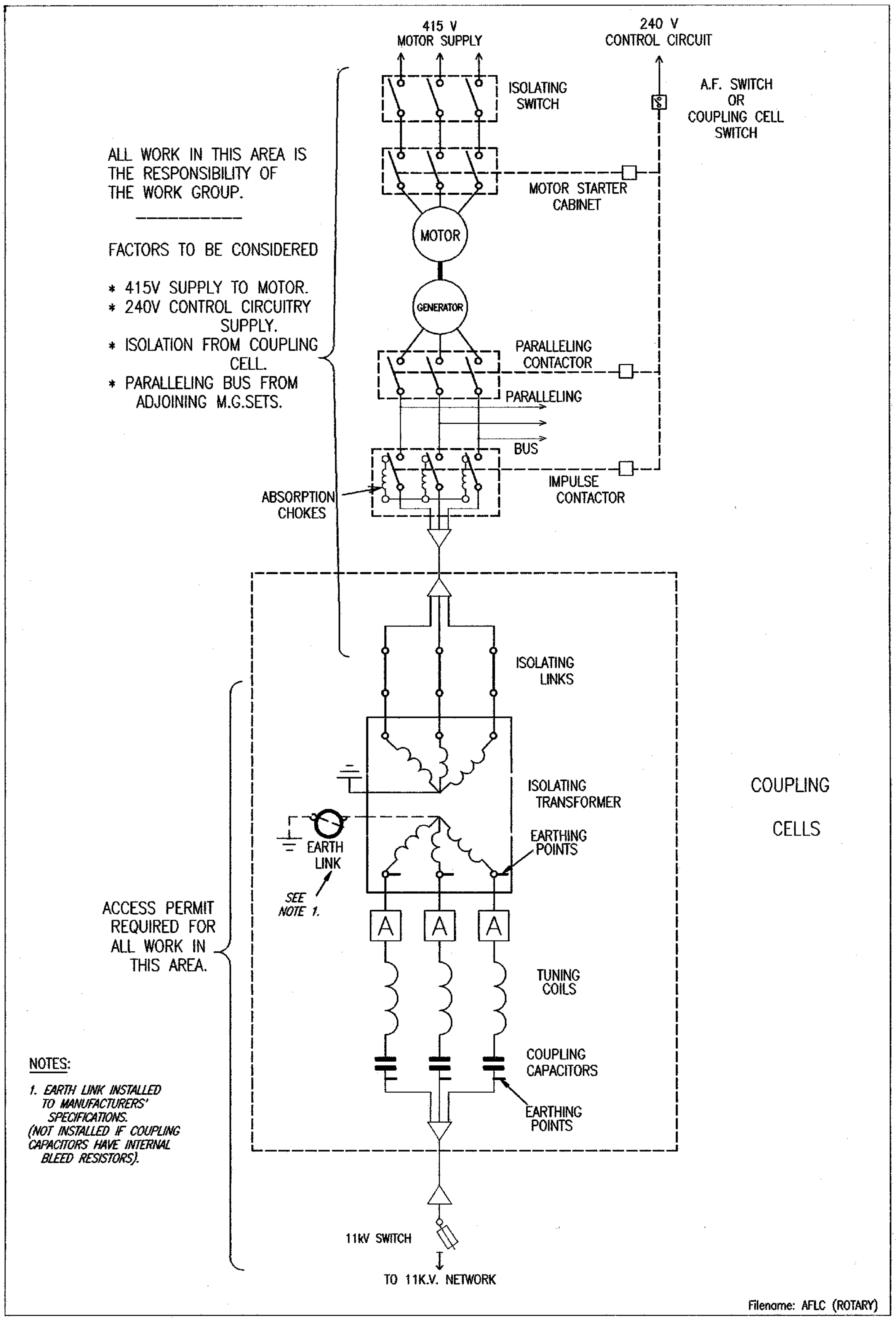

figure 1.7.1

1.7 To Switch AF Coupling Cell Only

Refer to figure 1.7.1 for Motor-Generator (M-G) type installations; and figure 1.7.2 for Static Frequency Converter (SFUG) type installations.

Note: If required, isolation of the M-G or SFUG set and/or circuitry is the responsibility of the work group.

1.7.1 Switch Room Type - AF Coupling Cell Installations

Forward Switching

1. Advise "AREA" Control that Switching to Commence.
2. Open 11kV Switch/Fuse and place DNOB.
3. Open AF Injection Switch (Non-SACS); or Open Coupling Cell Switch (SACS).
4. Test, Prove De-energised and Close Earth Link (where installed).
5. Open AF Isolating Links and place DNOB.
6. Test, Prove De-energised and Earth AF Switch/Fuse unit[1], place DNOB
7. Test, Prove De-energised and Earth at Isolation Transformer, place DNOB

Note: The recipient may place working earths on the 11 kV cable side of the coupling capacitors, if required.

Reverse Switching

8. Remove DNOB and remove Earths from Isolation Transformer
9. Remove DNOB and remove Earth at AF Switch/Fuse unit
9. Remove DNOB and Close AF Isolating Links
10. Open Earth Link (where installed)
11. Close AF Injection Switch (Non-SACS); or Close Coupling Cell Switch (SACS).
12. Remove DNOB and Close 11kV Switch/Fuse.
13. Advise "AREA" Control that Switching Complete.

[1] The fault rated earth switch at the switch fuse unit should be used instead of hand earths at the coupling capacitors. This earth should be applied first to discharge the capacitors.

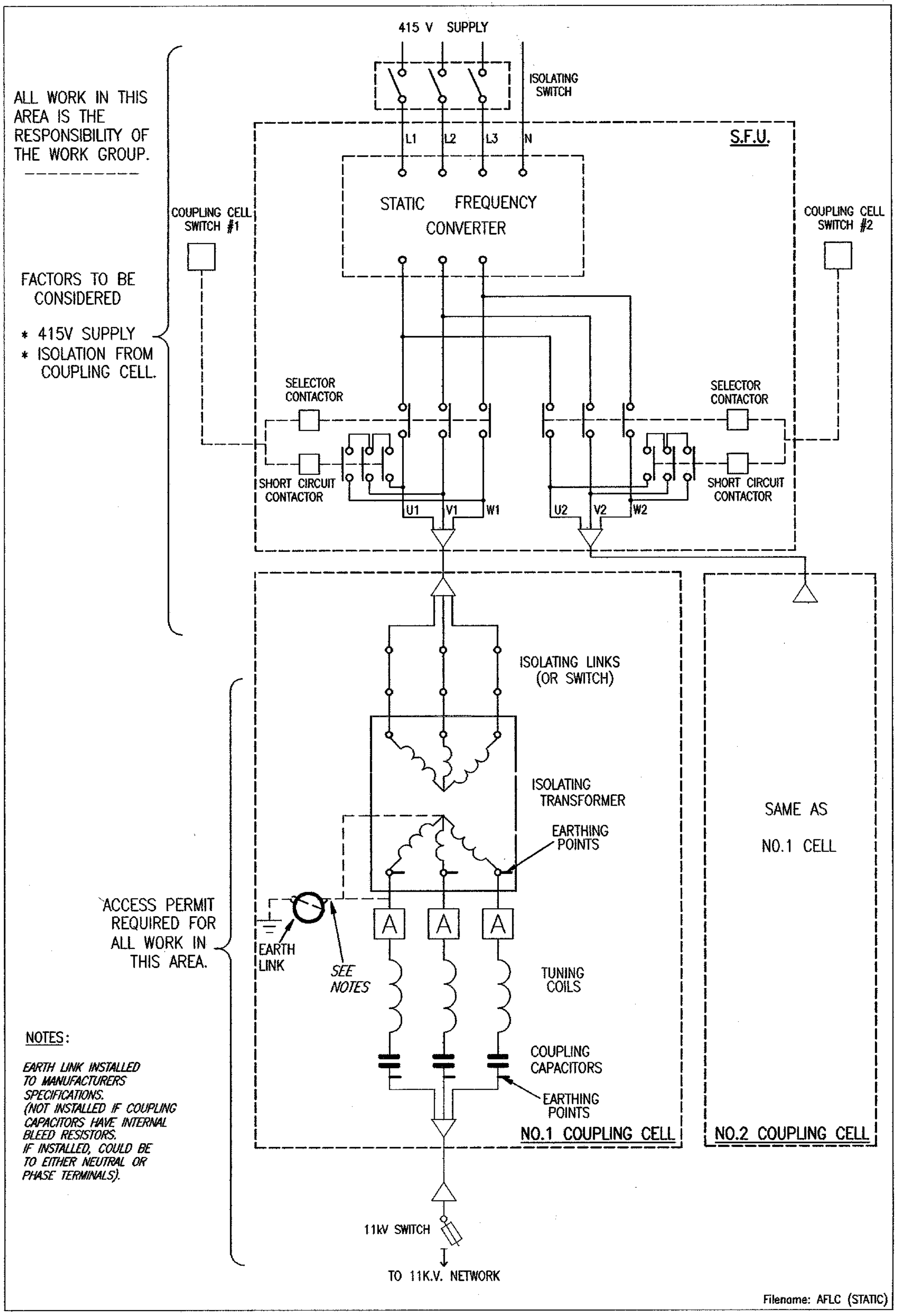
415 V SUPPLY
ISOLATING SWITCH
ALL WORK IN THIS AREA IS THE RESPONSIBILITY OF THE WORK GROUP.
L1
L2
L3
N
S.F.U.
STATIC FREQUENCY CONVERTER
COUPLING CELL SWITCH #1
COUPLING CELL SWITCH #2
FACTORS TO BE CONSIDERED
* 415V SUPPLY
* ISOLATION FROM COUPLING CELL.
SELECTOR CONTACTOR
SELECTOR CONTACTOR
SHORT CIRCUIT CONTACTOR
SHORT CIRCUIT CONTACTOR
U1
V1
W1
U2
V2
W2
ISOLATING LINKS (OR SWITCH)
ISOLATING TRANSFORMER
EARTHING POINTS
SAME AS NO.1 CELL
ACCESS PERMIT REQUIRED FOR ALL WORK IN THIS AREA.
EARTH LINK
SEE NOTES
A
A
A
TUNING COILS
COUPLING CAPACITORS
EARTHING POINTS
NOTES:
EARTH LINK INSTALLED TO MANUFACTURERS SPECIFICATIONS. (NOT INSTALLED IF COUPLING CAPACITORS HAVE INTERNAL BLEED RESISTORS. IF INSTALLED, COULD BE TO EITHER NEUTRAL OR PHASE TERMINALS).
NO.1 COUPLING CELL
NO.2 COUPLING CELL
11kV SWITCH
TO 11K.V. NETWORK
Filename: AFLC (STATIC)

figure 1.7.2

1.7.2 Kiosk Cubicle Type - AF Coupling Cell Installations

Note: If required, isolation of the M-G or SFUG set and/or circuitry is the responsibility of the work group.

Forward Switching

1. Advise "AREA" Control that Switching to Commence.
2. Open 11kV Switch/Fuse and place DNOB.
3. Place Micro in HALT Mode (M4 Controller); or Open Coupling Cell Switch (SACS).
4. Test, Prove De-energised and Close Earth Link (where installed).
5. Open AF Isolating Links/Switch and place DNOB.
6. Test, Prove De-energised and Earth AF Switch/Fuse unit[2], place DNOB

10\. Test, Prove De-energised and Earth on Other Side of Capacitors, place DNOB

Note: The recipient may place working earths on the 11 kV cable side of the coupling capacitors, if required.

Reverse Switching

11\. Remove DNOB and remove Earths from Other Side of Capacitors

8\. Remove DNOB and remove Earth at AF Switch/Fuse unit

9\. Remove DNOB and Close AF Isolating Links/Switch

10\. Open Earth Link (where installed)

11\. Take Micro out of HALT MODE (M4 Controller); or Close Coupling Cell Switch (SACS)

12\. Remove DNOB and Close 11kV Switch/Fuse

13\. Advise "AREA" Control that Switching Complete

[2] The fault rated earth switch at the switch fuse unit should be used instead of hand earths at the coupling capacitors. This earth should be applied first to discharge the capacitors.

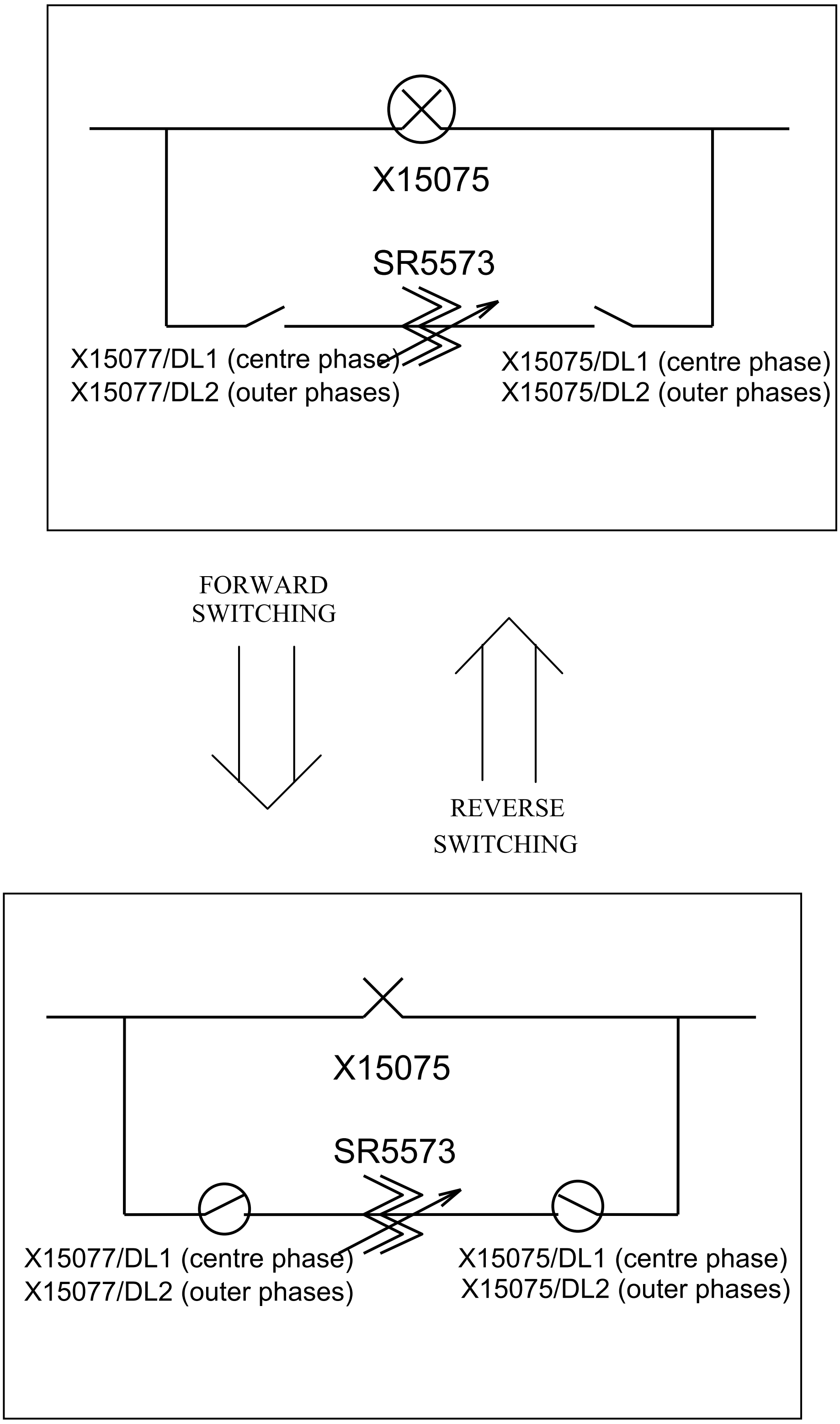
X15075
SR5573
X15077/DL1 (centre phase)
X15077/DL2 (outer phases)
X15075/DL1 (centre phase)
X15075/DL2 (outer phases)
FORWARD SWITCHING
REVERSE SWITCHING
X15075
SR5573
X15077/DL1 (centre phase)
X15077/DL2 (outer phases)
X15075/DL1 (centre phase)
X15075/DL2 (outer phases)

figure 1.8.1

1.8 To Switch Voltage Regulators

1.8.1 Live Bypassing – GE, Bypass Switch and Isolation Links not Combined

(Refer to figure 1.8.1)

Forward Switching

1. Record Tap Position of Each Unit.
2. Turn Control Switch on Each Unit to OFF.
3. Place Each Unit on Neutral Tap.
4. Carry out Neutral Check Routine on Each Unit.

Danger: Do not proceed unless previous items indicate Neutral Tap.

5. Carry out Park Routine on Each Unit.
6. Remove Special DNOB and close Bypass Switch.
7. Open both Load-Side Outer-Phase Links.
8. *Open and place DNOB on Load-Side Centre-Phase Link (if fitted)*.
9. Open both Source-Side Outer-Phase Links.
10. Open and place DNOB on Source-Side Centre-Phase Link.
11. Test, Prove De-energised and Earth.

Reverse Switching

12. Check All Earths Removed.
13. Check Position Indicator of Each Unit on Neutral Tap.
14. Check Control Switch on Each Unit is OFF.
15. Check Control Power Switch on Each Unit is OFF.
16. Remove DNOB and Close Source-Side Centre-Phase Link.
17. Close both Source-Side Outer-Phase Links.
18. Check Power Supply on Each Unit on INTERNAL.
19. Turn Control Power Switch on Each Unit to ON.
20. Carry out Neutral Check Routine on Each Unit.

Danger: Do not proceed unless previous items indicate Neutral Tap

21. Carry out Park Routine on each unit
22. *Remove DNOB and close load-side centre-phase link (if fitted)*
23. Close both load-side outer-phase links
24. Open and place Special DNOB on Bypass Switch
25. Turn Control Power Switch on each unit to ON
26. Turn Control Switch on each unit to AUTO
27. Check normal operation of each unit
28. Record tap position of each unit (discrepancy normal)

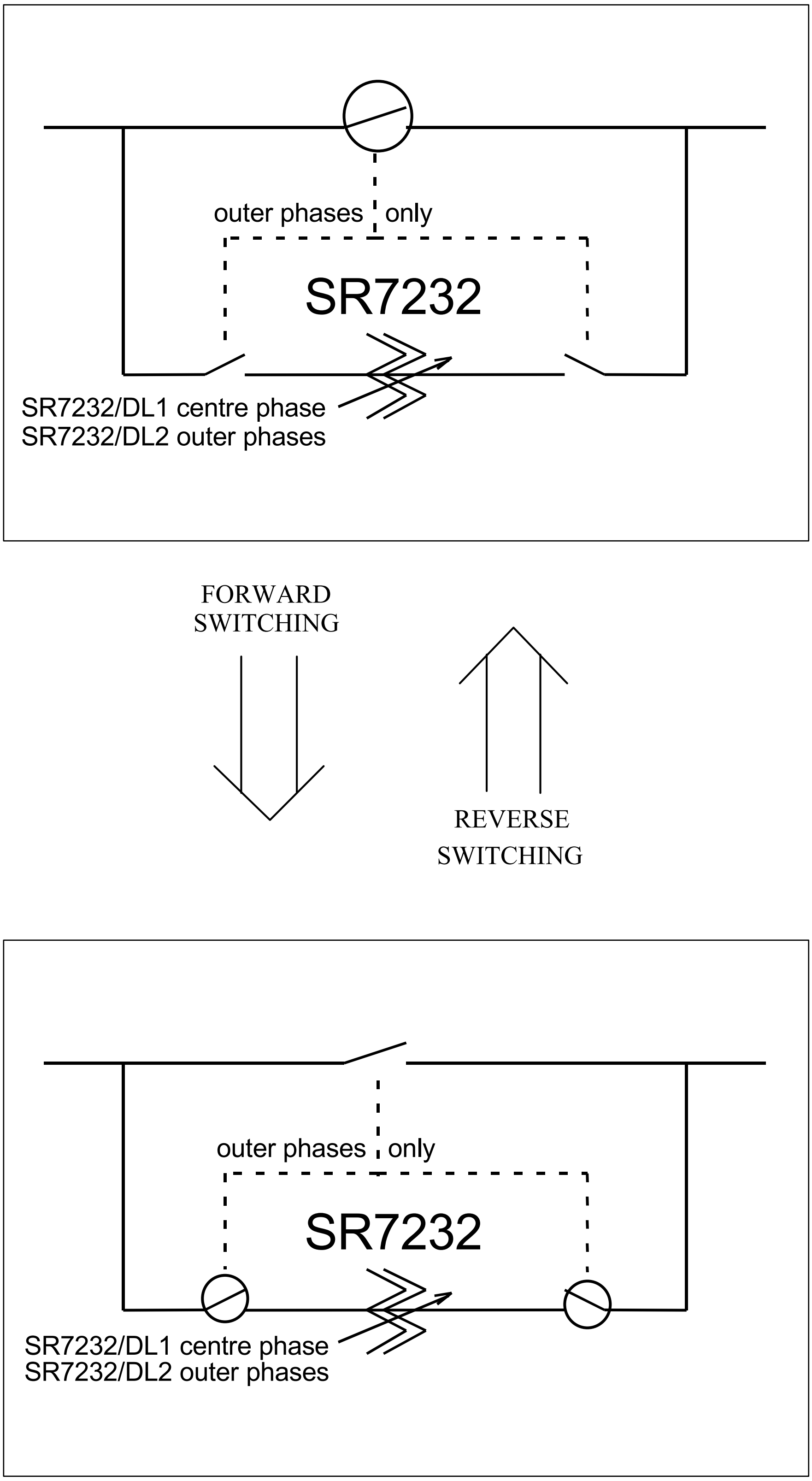
outer phases only
SR7232
SR7232/DL1 centre phase
SR7232/DL2 outer phases
FORWARD SWITCHING
REVERSE SWITCHING
outer phases only
SR7232
SR7232/DL1 centre phase
SR7232/DL2 outer phases

figure 1.8.2

1.8.2 Live Bypassing – GE, Combined Bypass Switch and Isolation Links

(Refer to figure 1.8.2 or figure 1.8.3)

Forward Switching

1. Record Tap Position of Each Unit.
2. Turn Control Switch on Each Unit to OFF.
3. Place Each Unit on Neutral Tap.
4. Carry out Neutral Check Routine on Each Unit.

Danger: Do not proceed unless previous items indicate Neutral Tap.

5. Carry out Park Routine on Each Unit.
6. Open both Outer-Phase Links.
7. Open and place DNOB on Centre-Phase Link.
8. Test, Prove De-energised and Earth.

Reverse Switching

9. Check All Earths Removed.
10. Check Position Indicator of Each Unit on Neutral Tap.

Danger: Do not proceed unless previous items indicate Neutral Tap.

11. Check Control Switch on Each Unit is OFF.
12. Check Control Power Switch on Each Unit is OFF.
13. Remove DNOB and Close Centre-Phase Link.
14. Close both Outer-Phase Links.
15. Check Power Supply on Each Unit on INTERNAL.
16. Turn Control Power Switch on Each Unit to ON.
17. Turn Control Switch on Each Unit to AUTO.
18. Check Normal Operation of Each Unit.
19. Record Tap Position of Each Unit (discrepancy normal).

1.8.3 Live Bypassing – McGraw-Ed, Bypass Switch and Isolation Links not Combined

(Refer to figure 1.8.1)

Forward Switching

1. Record Tap Position of Each Unit.
2. Turn Control Switch on Each Unit to OFF.
3. Place Each Unit on Neutral Tap.
4. Carry out Neutral Check Routine on Each Unit.

Danger: Do not proceed unless previous items indicate Neutral Tap.

5. Carry out Park Routine on Each Unit.
6. Remove Special DNOB and Close Bypass Switch.
7. Open both Load-Side Outer-Phase Links.
8. *Open and place DNOB on Load-Side Centre-Phase Link (if fitted)*.
9. Open both Source-Side Outer-Phase Links.
10. Open and place DNOB on Source-Side Centre-Phase Link.
11. Test, Prove De-energised and Earth.

Reverse Switching

12. Check All Earths Removed.
13. Check Position Indicator of Each Unit on Neutral Tap.
14. Check Control Switch on Each Unit is OFF.
15. Check Power Switch on Each Unit is OFF.
16. Remove DNOB and Close Source-Side Centre-Phase Link.
17. Close both Source-Side Outer-Phase Links.
18. Turn Power Switch on Each Unit to INTERNAL.
19. Carry out Neutral Check Routine on Each Unit.

Danger: Do not proceed unless previous items indicate Neutral Tap.

20. Carry out Park Routine on Each Unit.
21. *Remove DNOB and Close Load-Side Centre-Phase Link (if fitted)*.
22. Close both Load-Side Outer-Phase Links.
23. Open and place Special DNOB on Bypass Switch.
24. Turn Power Switch on Each Unit to INTERNAL.
25. Turn Control Switch on Each Unit to AUTO.
26. Check Normal Operation of Each Unit.
27. Record Tap Position of Each Unit (discrepancy normal).

1.8.4 Live Bypassing – McGraw-Ed, Combined Bypass Switch and Isolation Links

(Refer to figure 1.8.2 or figure 1.8.3)

Forward Switching

1. Record Tap Position of Each Unit.
2. Turn Control Switch on Each Unit to OFF.
3. Place Each Unit on Neutral Tap.
4. Carry out Neutral Check Routine on Each Unit.

Danger: Do not proceed unless previous items indicate Neutral Tap.

5. Carry out Park Routine on Each Unit.
6. Open both Outer-Phase Links.
7. Open and place DNOB on Centre-Phase Link.
8. Test, Prove De-energised and Earth.

Reverse Switching

9. Check All Earths Removed.
10. Check Position Indicator of Each Unit on Neutral Tap.

Danger: Do not proceed unless previous items indicate Neutral Tap.

11. Check Control Switch on Each Unit is OFF.
12. Check Power Switch on Each Unit is OFF.
13. Remove DNOB and Close Centre-Phase Link.
14. Close both Outer-Phase Links.
15. Turn Power Switch on Each Unit to INTERNAL.
16. Turn Control Switch on Each Unit to AUTO.
17. Check Normal Operation of Each Unit.
18. Record Tap Position of Each Unit (discrepancy normal).

1.8.5 LIVE Bypassing - Abbreviated Method – Combined Links

(Refer to figure 1.8.3)

Forward Switching

1. Record Tap Position of Each Unit.
2. Carry Out NEUTRAL Check and PARK Routines.

Danger: Do not proceed unless previous items indicate Neutral Tap.

3. Open both Outer-Phase Links.
4. Open and place DNOB on Centre-Phase Link.
5. Test, Prove De-energised and Earth.

Reverse Switching

6. Check Earths Removed.
7. Check Position Indicator of Each Unit on Neutral Tap.

Danger: Do not proceed unless previous items indicate Neutral Tap.

8. Remove DNOB and Close Centre-Phase Link.
9. Close both Outer-Phase Links.
10. Enable POWER SUPPLY, make AUTO.
11. Check Normal Operation of Each Unit.
12. Record Tap Position of Each Unit (discrepancy normal).

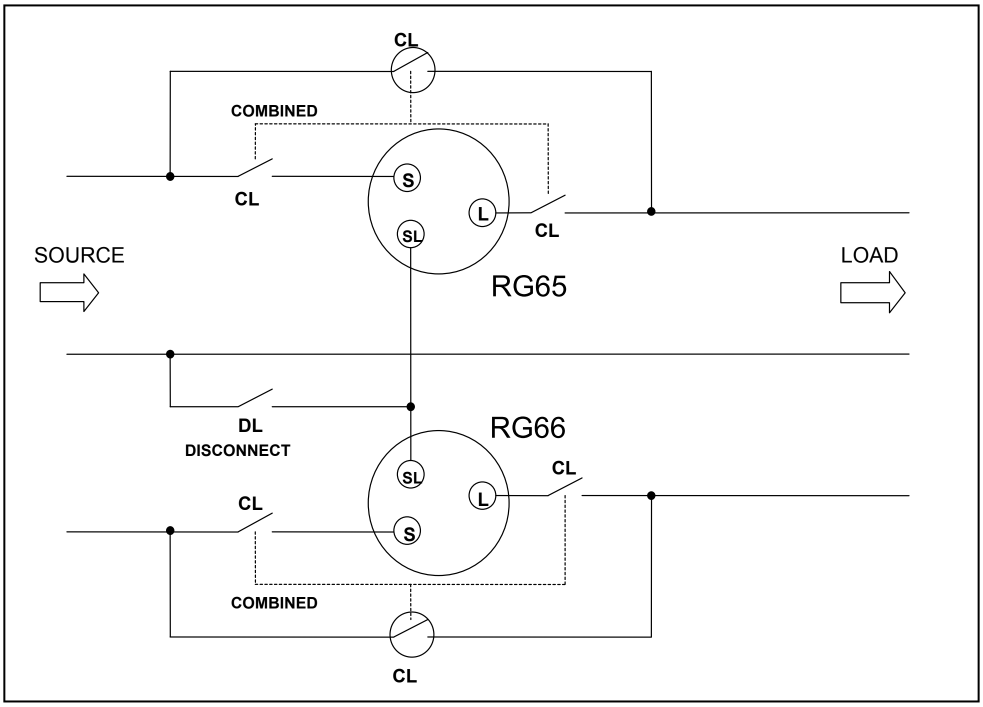

figure 1.8.3

1.8.6 De-energised Bypassing – All Models; Remove from Service

Forward Switching

1. Record Tap Position of Each Unit.
2. Turn Control Switch on Each Unit to OFF.
3. Place Each Unit on Neutral Tap.
4. Carry out Neutral Check Routine on Each Unit.

Warning: Report if previous items do not indicate Neutral Tap.

5. Carry out Park Routine on Each Unit.
6. Isolate the Section of Line containing the Regulator.
7. Test, Prove De-energised and Earth.
8. Issue AP (to disconnect the regulator and fit bypass bridges).

Reverse Switching

9. Recover Surrendered AP.
10. Check All Earths Removed.
11. Re-energise the Line.

1.8.7 De-energised Bypassing – McGraw-Edison Models; Return to Service

Forward Switching

1. Isolate the Section of Line containing the Regulator.
2. Test, Prove De-energised and Earth.
3. Issue AP (to remove bypass bridges & reconnect the regulator).

Reverse Switching

4. Recover Surrendered AP.
5. Check All Earths Removed.
6. Check Position Indicator of Each Unit on Neutral Tap.
7. Check Control Switch on Each Unit is OFF.
8. Check Power Switch on Each Unit is OFF.
9. Re-energise the Line.
10. Turn Power Switch on Each Unit to INTERNAL.
11. Turn Control Switch on Each Unit to AUTO.
12. Check Normal Operation of Each Unit.
13. Record Tap Position of Each Unit (discrepancy normal).

1.8.8 De-energised Bypassing – GE Models; Return to Service

Forward Switching

1. Isolate the Section of Line containing the Regulator.
2. Test, Prove De-energised and Earth.
3. Issue AP (to remove bypass bridges & reconnect the regulator).

Reverse Switching

4. Recover Surrendered AP.
5. Check All Earths Removed.
6. Check Position Indicator of Each Unit on Neutral Tap.
7. Check Control Switch on Each Unit is OFF.
8. Check Power Switch on Each Unit is OFF.
9. Re-energise the Line.
10. Turn Power Switch on Each Unit to INTERNAL.
11. Turn Control Power Switch on Each Unit to ON.
12. Turn Control Switch on Each Unit to AUTO.
13. Check Normal Operation of Each Unit.
14. Record Tap Position of Each Unit (discrepancy normal).

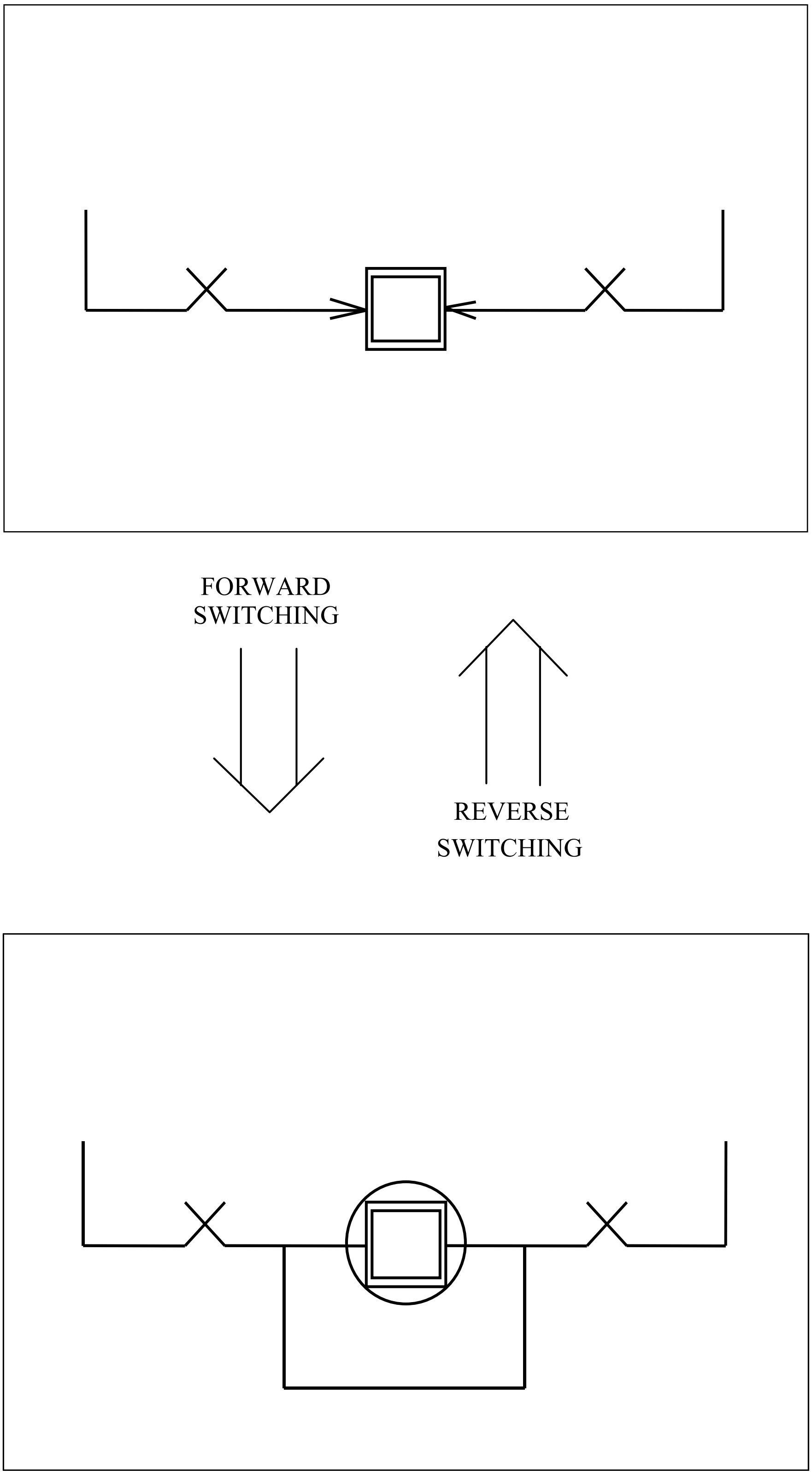

figure 1.9.1

1.9 To Switch a Brush PMR Recloser

1.9.1 Live Bypassing a Brush Recloser - No Bypass Switch - Full Access

(Refer to figure 1.9.1)

Applies where Recloser is installed with:

- no bypass switch
- dropper clamps or links on source-side
- dropper clamps on load-side

Note: Isolation achieved by using L-L gang to bridge out the recloser and disconnect the droppers.

Forward Switching

1. Disable A-R (Feeder CB and Recloser/s).
2. Disable Recloser A-R.
3. Disable Recloser Protection.
4. Check Recloser Closed.
5. Apply and Close Bypass Bridges (L-L item).
6. Open Recloser.
7. Place MANUAL Lever in DOWN Position.
8. Disconnect 11kV Load-Side Droppers, place DNOB (L-L item).
9. Open 11kV Source-Side Links, place DNOB; or Disconnect 11kV Source-Side Droppers, place DNOB (L-L item).
10. Test, Prove De-energised and Earth.
11. Advise Work Group that Work may Commence.
12. Restore A-R (Feeder CB and other Recloser/s).

Reverse Switching

13. Obtain Clearance that Work is Complete.
14. Disable A-R (Feeder CB and Recloser/s).
15. Check Recloser is Open.
16. Check that MANUAL Lever is in DOWN Position.
17. Remove DNOB, Close 11kV Source-Side Links; or Remove DNOB, Connect 11kV Source-Side Droppers (L-L item).
18. Remove DNOB, Connect 11kV Load-Side Droppers (L-L item).
19. Check Recloser A-R is Disabled.
20. Check Recloser Protection is Disabled.
21. Place MANUAL Lever into UP Position.
22. Close Recloser.
23. Remove Bypass Bridges (L-L item).
24. Restore Recloser Protection.
25. Restore Recloser A-R.
26. Restore A-R (Feeder CB and other Recloser/s).

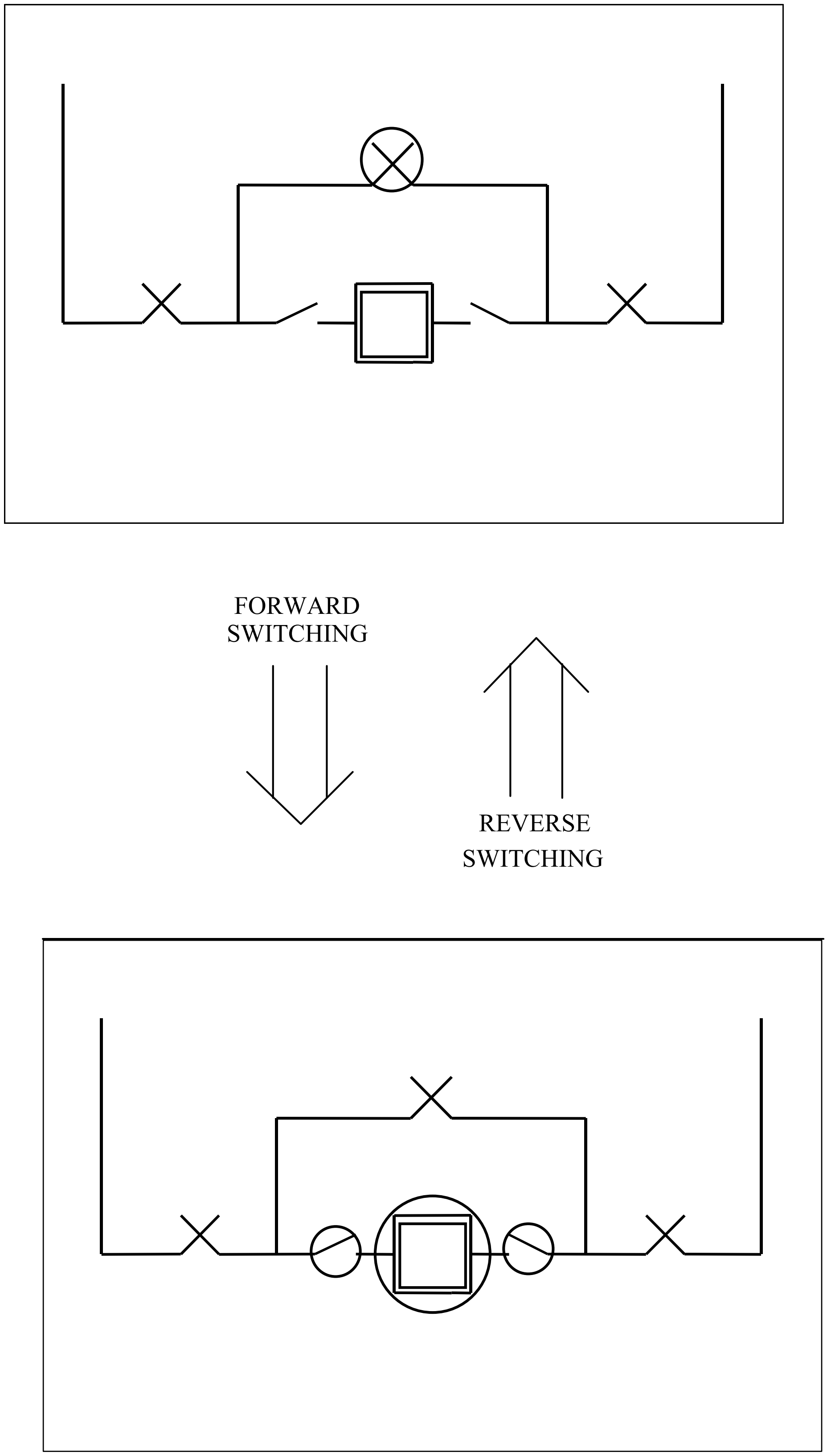

figure 1.9.2

1.9.2 Live Bypassing a Brush Recloser - Bypass Switch - Full Access

(Refer to figure 1.9.2)

Applies where recloser is installed with:

- bypass switch fitted
- links on both source and load sides

Forward Switching

1. Disable Recloser A-R.
2. Disable Recloser Protection.
3. Close By-pass Switch.
4. Open Recloser.
5. Place MANUAL Lever into DOWN Position.
6. Open 11kV Load-Side Links, place DNOB.
7. Open 11kV Source-Side Links, place DNOB.
8. Test, Prove De-energised and Earth at recloser (both sides).
9. Issue AP or Advise Work Group that work may commence.

Reverse Switching

10. Recover Surrendered AP or Obtain Clearance that Work is Complete.
11. Check all Earths Removed.
12. Check Recloser Open.
13. Check that MANUAL Lever is in DOWN Position.
14. Check Recloser Protection is Disabled.
15. Check Recloser A-R is Disabled.
16. Remove DNOB, Close 11kV Source-Side Links.
17. Remove DNOB, Close 11kV Load-Side Links.
18. Place MANUAL lever in UP Position.
19. Close Recloser.
20. Open By-pass Switch.
21. Restore Recloser Protection.
22. Restore Recloser A-R.

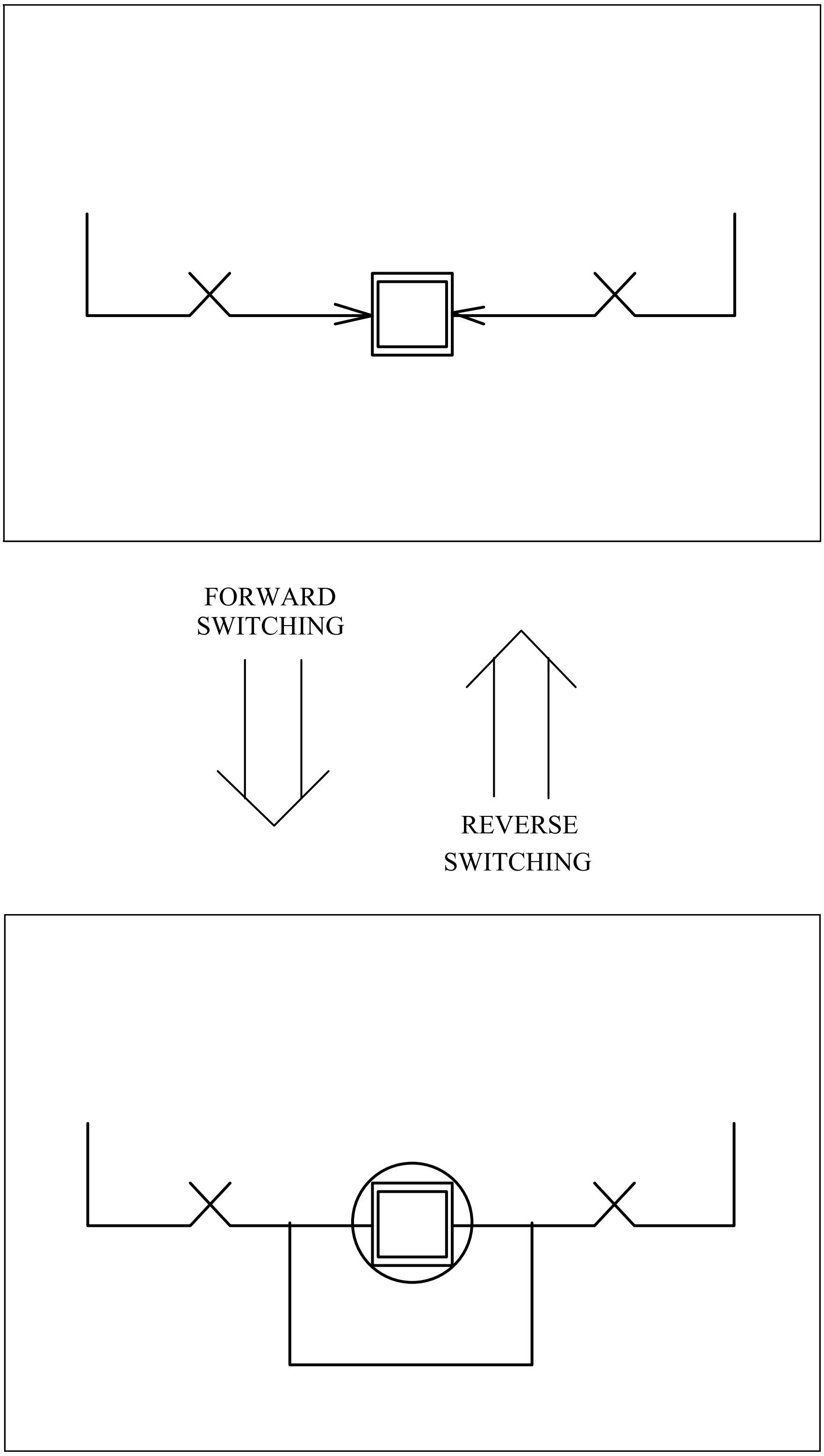

figure 1.9.3

1.9.3 Live Bypassing a Brush Recloser – No Bypass Switch - Control Box Access

(Refer to figure 1.9.3)

Applies where recloser is installed with:

- no bypass switch
- dropper clamps or links on source-side
- dropper clamps on load-side

Note: Isolation achieved by using L-L gang to bridge out the recloser and disconnect the droppers.

Forward Switching

1. Disable A-R (Feeder CB and Recloser/s).
2. Disable Recloser A-R.
3. Disable Recloser Protection.
4. Check Recloser Closed.
5. Apply and Close Bypass Bridges (L-L item).
6. Open Recloser.
7. Place MANUAL Lever in DOWN Position.
8. Advise Work Group that work may commence.
9. Restore A-R (Feeder CB and other Recloser/s).

Reverse Switching

10. Obtain Clearance that Work is Complete.
11. Disable A-R (Feeder CB and Recloser/s).
12. Check Recloser is Open.
13. Check that MANUAL Lever is in DOWN Position.
14. Check Recloser A-R is Disabled.
15. Check Recloser Protection is Disabled.
16. Check Source-Side Links Closed (if fitted).
17. Place MANUAL Lever into UP Position.
18. Close Recloser.
19. Remove Bypass Bridges (L-L item).
20. Restore Recloser Protection.
21. Restore Recloser A-R.
22. Restore A-R (Feeder CB and other Recloser/s).

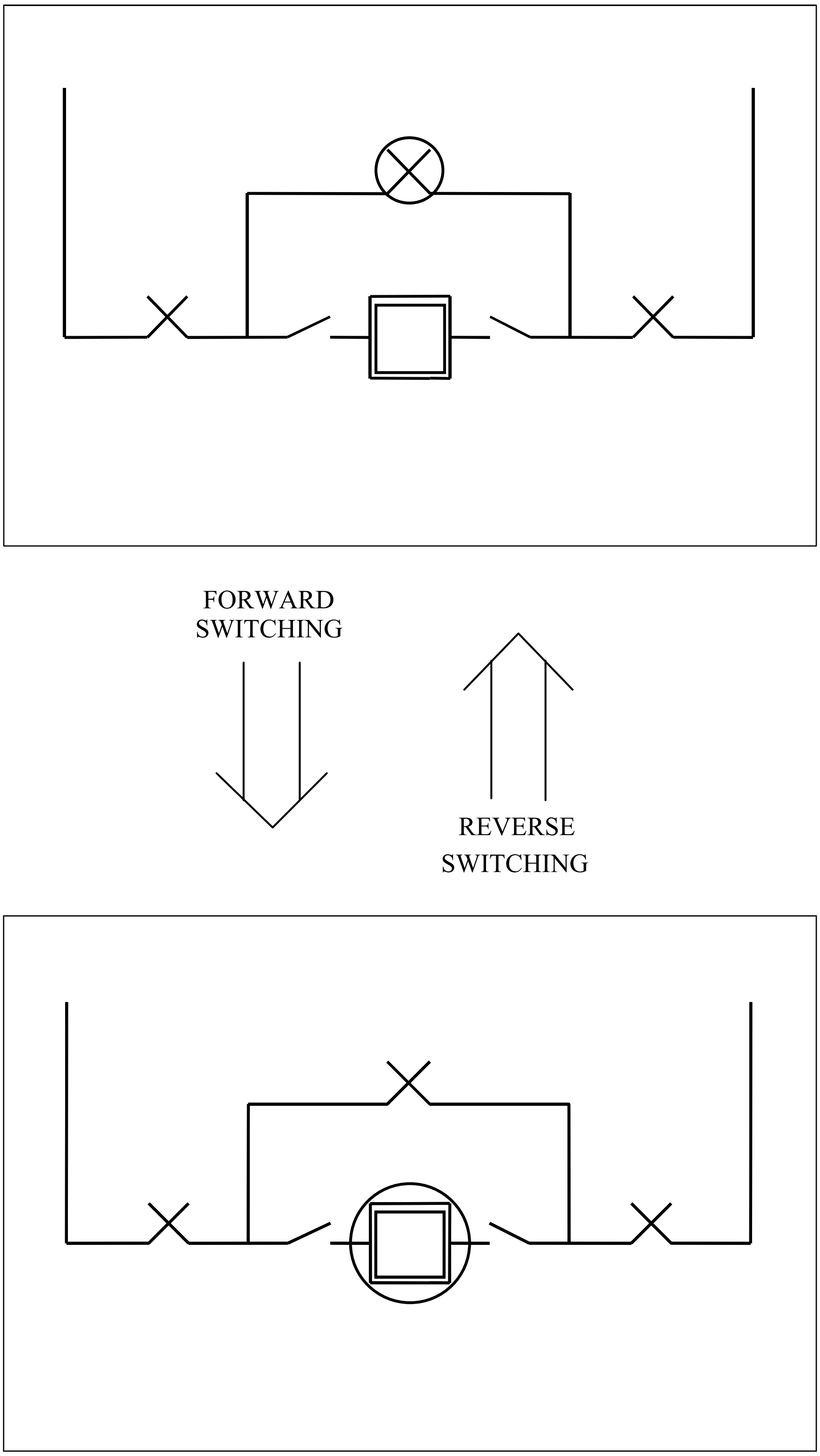

figure 1.9.4

1.9.4 Live Bypassing a Brush Recloser - Bypass Switch - Control Box Access

(Refer to figure 1.9.4)

Applies where recloser is installed with:

- bypass switch fitted
- links on both source and load sides

Forward Switching

1. Disable Recloser A-R.
2. Disable Recloser Protection.
3. Close By-pass Switch.
4. Open Recloser.
5. Place MANUAL Lever into DOWN Position.
6. Advise Work Group that Work may Commence.

Reverse Switching

7. Obtain Clearance that Work is Complete.
8. Check Recloser Open.
9. Check Source-Side Links Closed.
10. Check Load-Side Links Closed.
11. Close Recloser.
12. Open By-pass Switch.
13. Restore Recloser Protection.
14. Restore Recloser A-R.

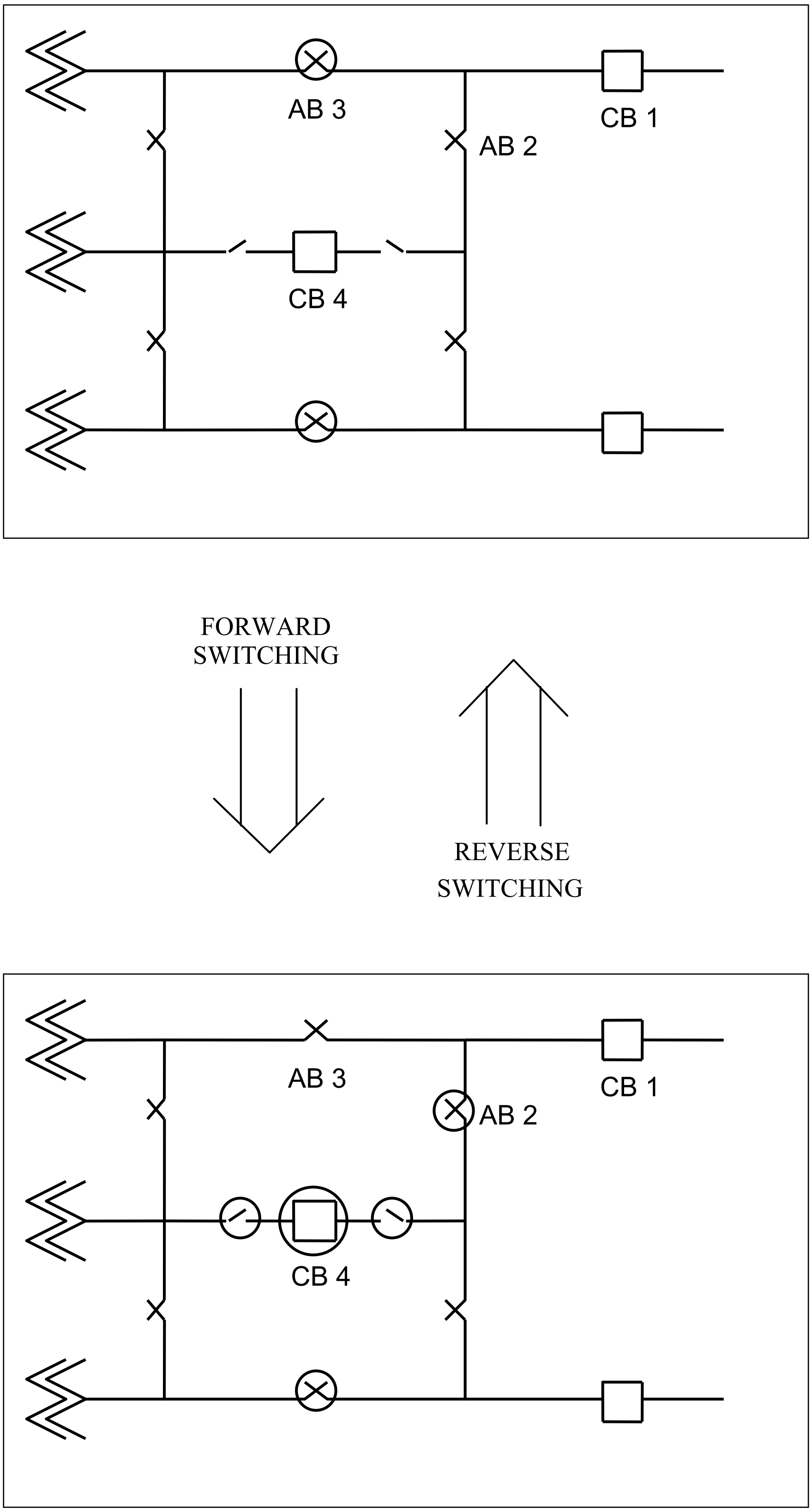
AB 3
CB 1
AB 2
CB 4
FORWARD SWITCHING
REVERSE SWITCHING
AB 3
CB 1
AB 2
CB 4

figure 1.10.1

1.10 To Switch a 33kV CB Feeding Multiple Transformers

1.10.1 Substations Fed as Part of a Ring

(Refer to figure 1.10.1)

Forward Switching

1. Check Feeder Loads.
2. Open Incoming Feeder CB (CB 1).
3. Change Protection Settings on Incoming Feeder CB (CB 1).
4. Open Feeder-Side Bus AB (AB 2).
5. Close Bypass AB (AB 3).
6. Close Incoming Feeder CB (CB 1).
7. Trip Transformer CB (CB 4).
8. Isolate Transformer CB (CB 4).

Reverse Switching

9. Check Feeder-Side Bus AB Open (AB 2).
10. Check Transformer CB Open (CB 4).
11. Remove DNOBs and Restore Supply to Both Sides of Transformer CB.
12. Close Transformer CB (CB 4).
13. Trip Incoming Feeder CB (CB 1).
14. Open Bypass AB (AB 3).
15. Close Feeder-Side Bus AB (AB 2).
16. Change Protection Settings on Incoming Feeder CB (CB 1).
17. Close Incoming Feeder CB (CB 1).

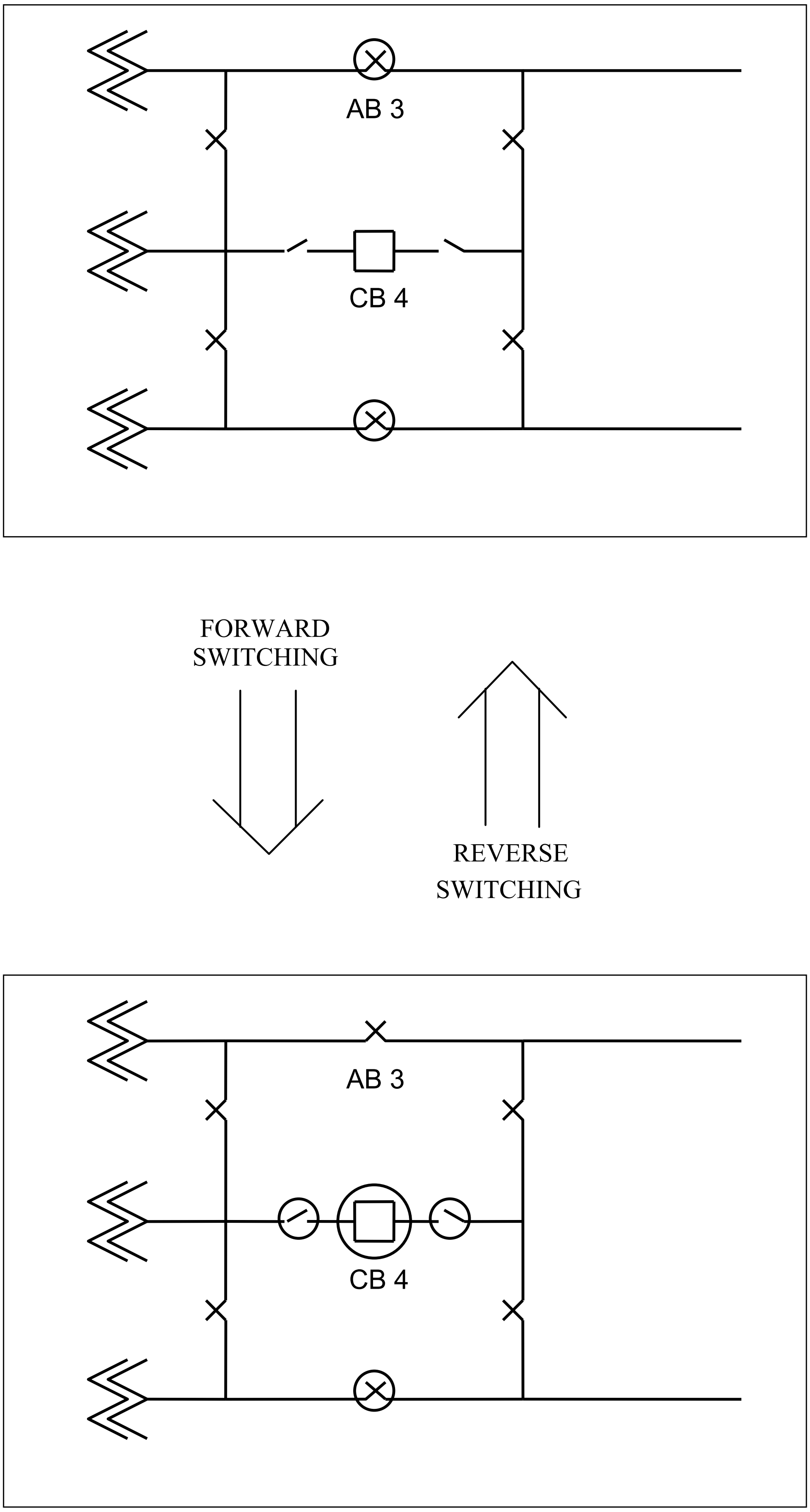

figure 1.10.2

1.10.2 Substations Fed as a Radial

(Refer to figure 1.10.2)

For substations fed as a radial, or where load is teed off the incoming feeder, then trip isolation of the EF protection fitted to the transformer should be carried out before the bypass AB is closed (in practice OC protection will have to be isolated as well). Refer to section 7 "Work Involving Secondary Systems."

Forward Switching

1. Change Protection Settings on a Feeder CB (if required).
2. Carry out Trip Isolation of OC & EF Protection Fitted to Transformer CB.
3. Close Bypass AB (AB 3).
4. Open Transformer CB (CB 4).
5. Isolate Transformer CB.

Reverse Switching

6. Check Transformer CB Open (CB 4).
7. Remove DNOBs and Restore Supply to Both Sides of Transformer CB.
8. Close Transformer CB (CB 4).
9. Open Bypass AB (AB 3).
10. Reverse Trip Isolation of OC & EF Protection Fitted to Transformer CB.
11. Restore Original Protection Settings on a Feeder CB (if altered).

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1.11 110/132kV Switching

1.11.1 Siemens Type 8DN8 GIS

1.11.1.1 To switch the Siemens end of an 110/132kV Feeder

(Refer to figure 1.11.1)

Forward switching

(Carry out any pre-contingent switching required)

1. U/G Feeder (only) Prove Test points [PTD]
2. CB9042 From ENERGEX Control Trip [FCT]
3. CB9042 Disable remote supervisory control [DRC]
4. CB9042 Check open at the circuit breaker [COCB]
5. IS9048 Open [O]
6. IS9048 Make incapable of normal operation place DNOB [MINOPD]

(Open and isolate remote end of feeder)

7. O/H Landing Span/UG Test prove de-energised [TPE]
8. ES9040 Close [C]
9. ES9040 Make incapable of normal operation place DNOB [MINOPD]

(Place earths in other areas if required)

Reverse switching

10. ES9040 Remove DNOB make capable of normal operation [RDMCNO]
11. ES9040 Open [O]

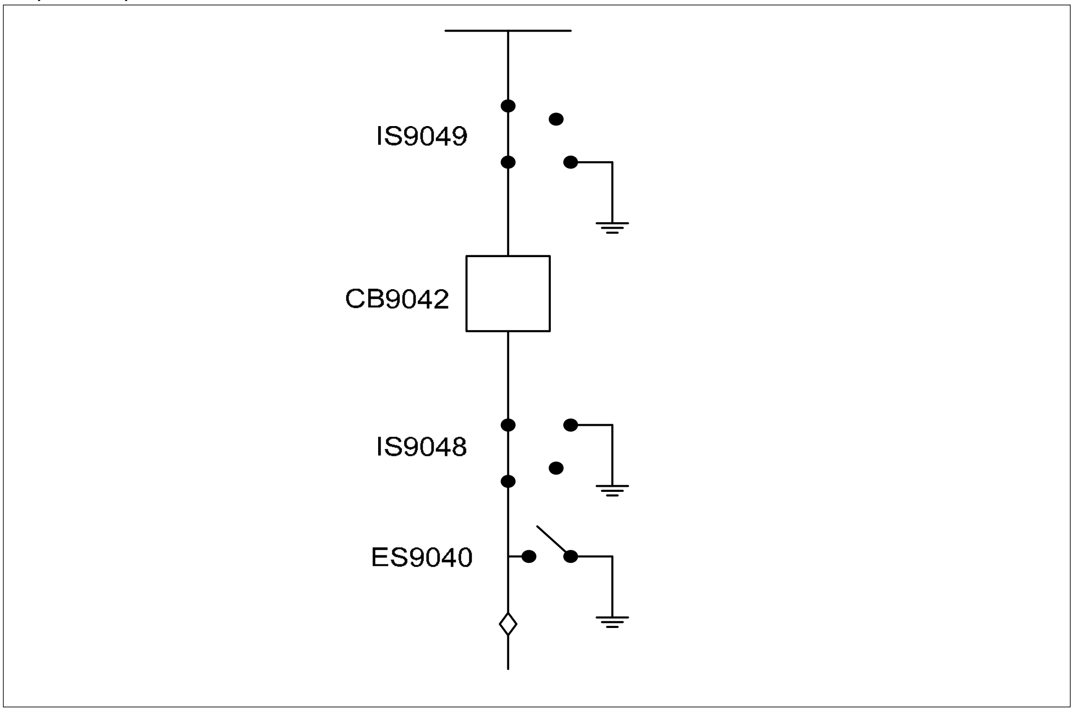
(Remove all earths from remote end)

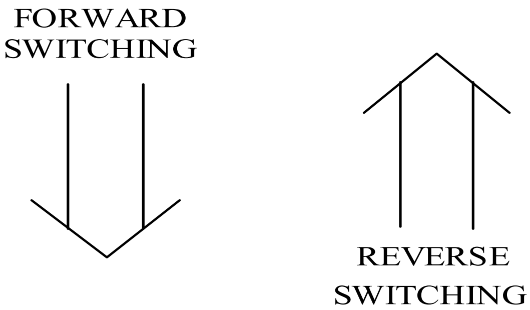
12. Switching Operator Check all earths removed Per AP'S/TP'S/AE'S [CAER]
13. CB9042 Check open at the Circuit Breaker [COCB]
14. IS9048 Check not earthed [CNE]
15. IS9048 Remove DNOB make capable of normal operation [RDMCNO]
16. IS9048 Close [C]
17. CB9042 Check all relays reset [CRR]
18. CB9042 Restore remote supervisory control [RRC]
19. CB9042 From ENERGEX Control Close [FCC]

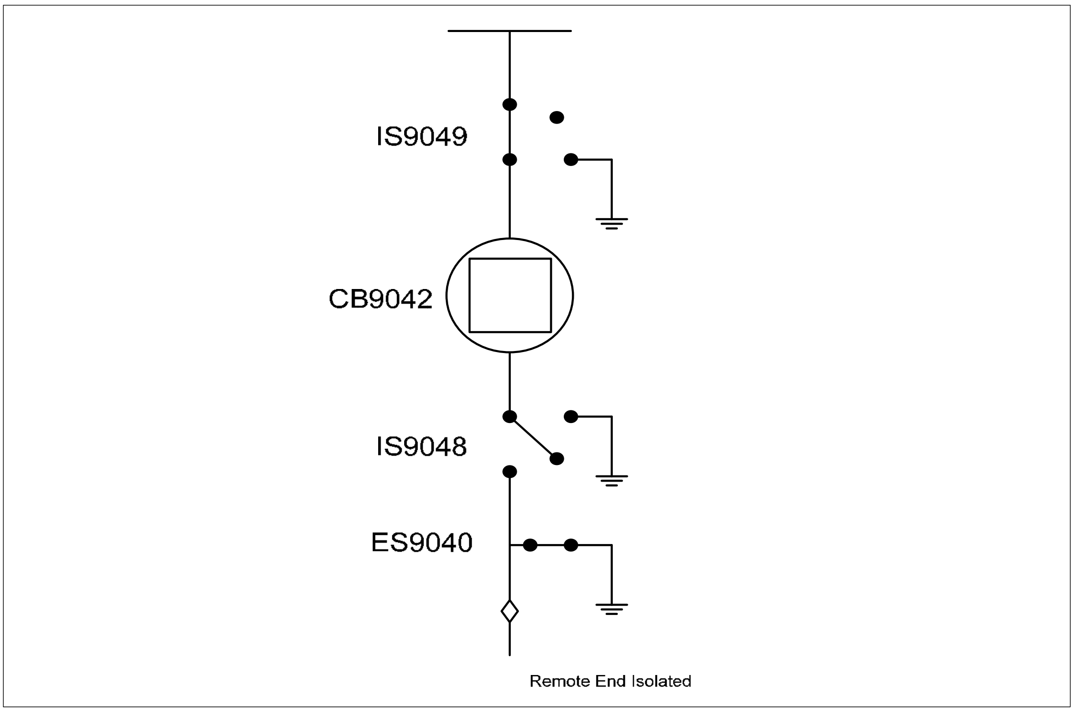
(Close remote end of feeder)

(Carry out any post contingent switching required)

Diagram (1.11.1)







1.11.1.2 **To switch the Siemens end to maintain 110/132kV feeder isolator**
(Refer to figure 1.11.2)

Forward switching

(Carry out any pre-contingent switching required)
1. U/G Feeder (only) Prove Test points[PTD]
2. CB9042 From ENERGEX Control Trip [FCT]
3. CB9042 Disable remote supervisory control [DRC]
4. CB9042 Check open at the circuit breaker [COCB]
5. IS9049 Open [O]
6. IS9049 Make incapable of normal operation place DNOB [MINOPD]

(Open and isolate remote end of feeder)

7. CB9042 Close [C]
8. Feeder- O/H Landing Span/UG Test prove de-energised [TPE]
9. CB9042 Trip [T]
10. IS9048 Open[O]
11. ES9040 Close [C]
12. ES9040 Make incapable of normal operation place DNOB [MINOPD]
13. IS9049 Remove DNOB make capable of normal operation [RDMCNO]
14. IS9049 Place in Earth Position [PIEP]
15. IS9049 Make incapable of normal operation place DNOB [MINOPD]

Reverse switching

16. IS9048 Check not Earthed [CNE]
17. IS9048 Check Open [CO]
18. ES9040 Remove DNOB make capable of normal operation [RDMCNO]
19. ES9040 Open [O]
20. IS9049 Remove DNOB make capable of normal operation [RDMCNO]
21. IS9049 Remove from earth position [RFEP]

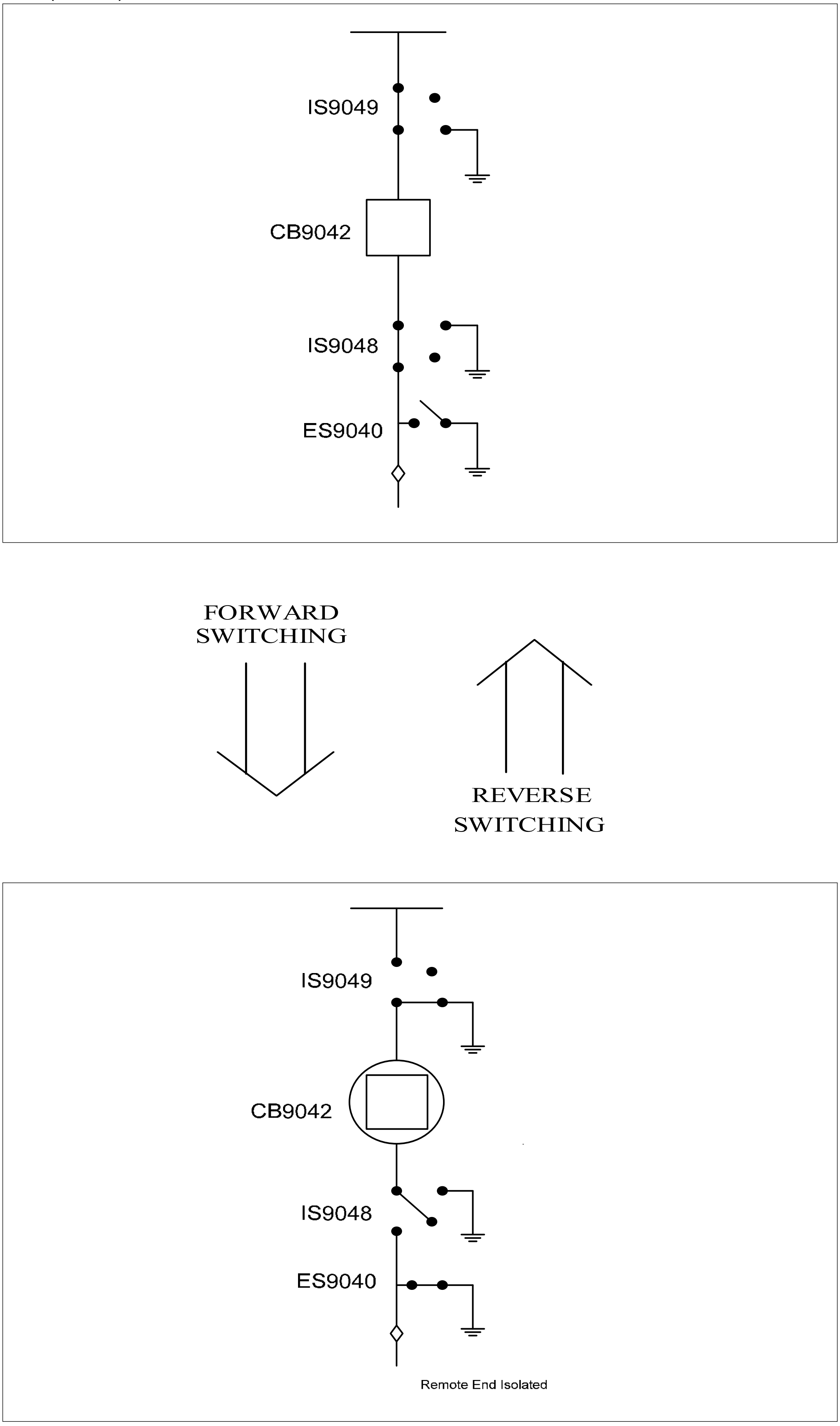
(Check all earths removed at local and remote ends of feeder)

22. Switching Operator Check all earths removed Per AP'S/TP'S/AE'S [CAER]
23. CB9042 Check open at the Circuit Breaker [COCB]
24. IS9048 Close [C]
25. IS9049 Close [C]
26. CB9042 Check all relays reset [CRR]
27. CB9042 Restore remote supervisory control [RRC]

(Reverse switching at remote end of feeder)

28. CB9042 From ENERGEX Control Close [FCC] (Carry out any post contingent switching required)

Diagram (1.11.2)



1.11.1.3 **To switch the Siemens end to maintain 110/132kV Circuit breaker**

(Refer to figure 1.11.3)

Forward switching

(Carry out any pre-contingent switching required)

1. U/G Feeder (only)		Prove Test points [PTD]
2. CB9042		From ENERGEX Control Trip [FCT]
3. CB9042		Disable remote supervisory control [DRC]
4. CB9042		Check open at the circuit breaker [COCB]
5. IS9049	Open	[O]
6. IS9049		Make incapable of normal operation place DNOB [MINOPD]

(Trip remote end of feeder)

7. CB9042	Close	[C]
8. Feeder - O/H Landing Span/UG		Test prove de-energised [TPE]
9. CB9042	Trip	[T]
10. IS9048	Open	[O]
11. IS9048		Place in Earth Position [PIEP]
12. IS9048		Make incapable of normal operation place DNOB [MINOPD]

(Next Item for Alpha character to be placed onto Permit)

13. IS9048		Check open DNOB placed [CODP]
14. IS9049		Remove DNOB make capable of normal operation [RDMCNO]
15. IS9049		Place in Earth Position [PIEP]
16. IS9049		Make incapable of normal operation place DNOB [MINOPD]

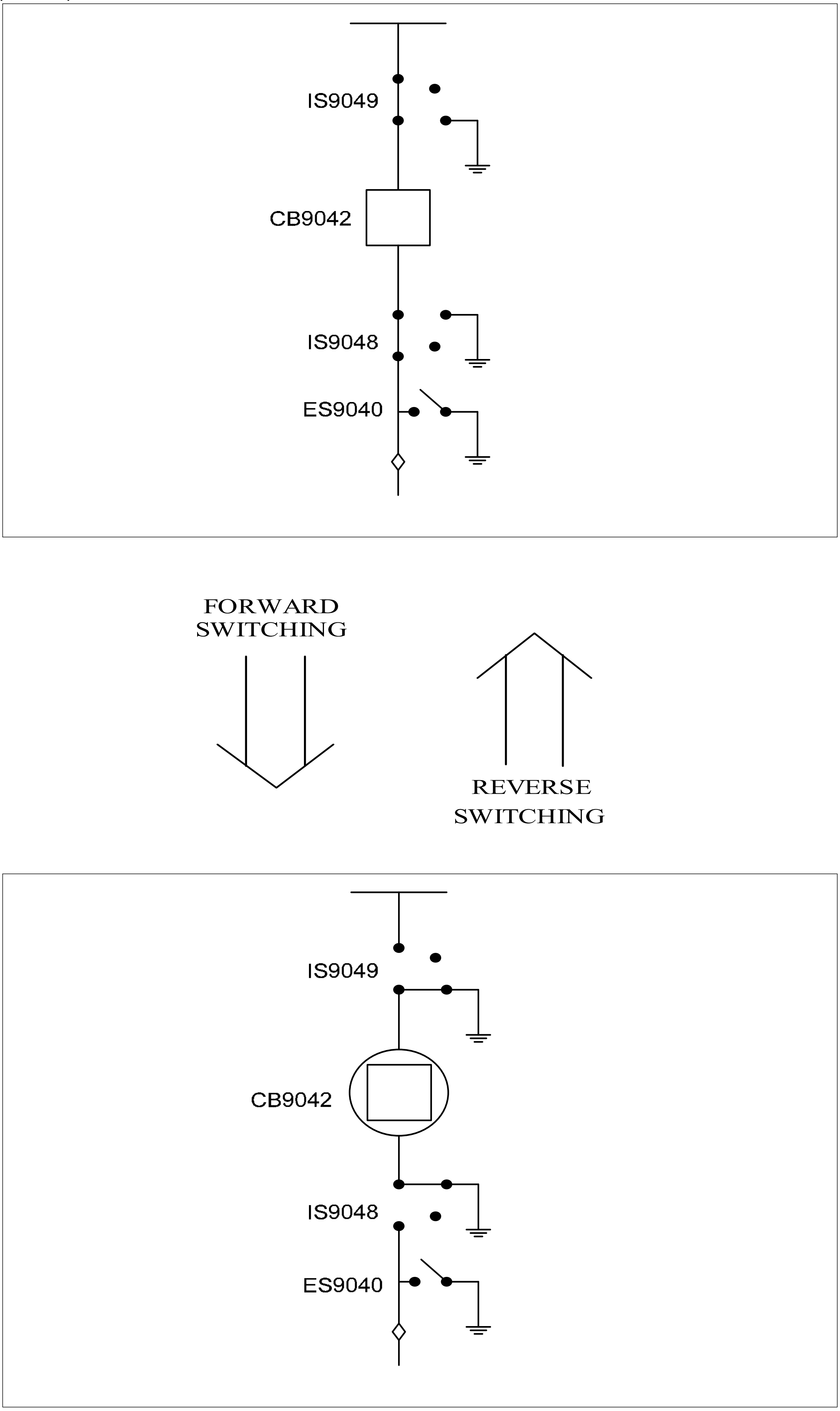
(Remote end of feeder reverse re-energise)

Reverse switching

17. IS9049		Remove DNOB make capable of normal operation [RDMCNO]
18. IS9049		Remove from Earth Position [RFEP]
19. IS9048		Remove DNOB make capable of normal operation [RDMCNO]
20. IS9048		Remove from Earth Position [RFEP]
21. Switching Operator		Check all earths removed Per AP'S/TP'S/AE'S [CAER]
22. CB9042		Check open at the Circuit Breaker [COCB]
23. IS9048	Close	[C]
24. IS9049	Close	[C]
25. CB9042		Check all relays reset [CRR]
26. CB9042		Restore remote supervisory control [RRC]
27. CB9042		From ENERGEX Control Close [FCC]

(Carry out any post contingent switching required)

Diagram (1.11.3)



1.11.1.4 **To switch the Siemens 110/132kV Bus Section Circuit breaker**
(Refer to figure 1.11.4a - Forward Switching)

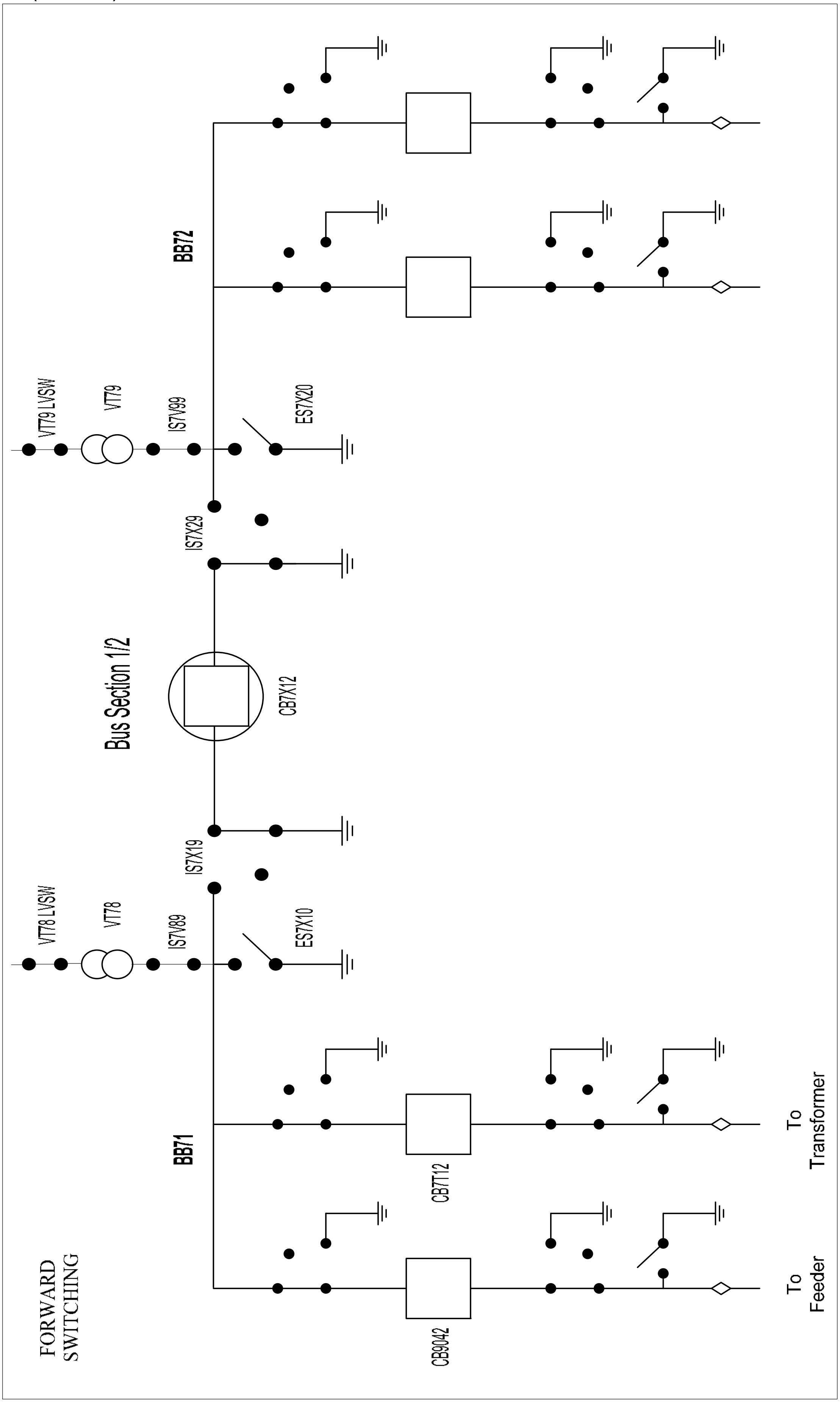
Forward switching

(Carry out any pre-contingent switching required)

1. Carry out de-load switching for TR1 and switching for 110/132kV feeder[3]
2. CB7T12 From ENERGEX Control Trip [FCT]
3. CB9042 From ENERGEX Control Trip [FCT]
4. CB7X12 From ENERGEX Control Trip [FCT]
5. CB9042 Disable remote supervisory control [DRC]
6. CB9042 Check open at the circuit breaker [COCB]
7. CB7T12 Disable remote supervisory control [DRC]
8. CB7T12 Check open at the circuit breaker [COCB]
9. CB7X12 Disable remote supervisory control [DRC]
10. CB7X12 Check open at the circuit breaker [COCB]
11. IS7X29 Open [O]
12. IS7X29 Make incapable of normal operation place DNOB [MINOPD]
13. CB7X12 Close [C]
14. VT78 LVSW Test prove de-energise [TPE]
15. CB7X12 Trip [T]
16. IS7X19 Open [O]
17. IS7X19 Place in Earth Position [PIEP]
18. IS7X19 Make incapable of normal operation place DNOB [MINOPD]
19. IS7X29 Remove DNOB make capable of normal operation [RDMCNO]
20. IS7X29 Place in Earth Position [PIEP]
21. IS7X29 Make incapable of normal operation place DNOB [MINOPD]
22. CB7T12 Check open at the circuit breaker [COCB]
23. CB9042 Check open at the circuit breaker [COCB]
24. CB9042 Check relays reset [CRR]
25. CB9042 Restore remote supervisory control [RRC]
26. CB7T12 Check relays reset [CRR]
27. CB7T12 Restore remote supervisory control [RRC]
28. CB9042 From ENERGEX Control Close [FCC]
29. CB7T12 From ENERGEX Control Close [FCC]
30. Carry out reverse switching to restore TR1 & 110/132kV system

[3] Note: Interlocking between 11kV transformer CB and 110/132kV switchgear on different substations refer to notes on DMS.

Diagram (1.11.4a)



To switch the Siemens 110/132kV Bus Section Circuit breaker
(Refer to figure 1.11.4b - Reverse Switching)
Reverse switching

31. Carry out de-load switching for TR1 and switching for 110/132kV feeder[4]

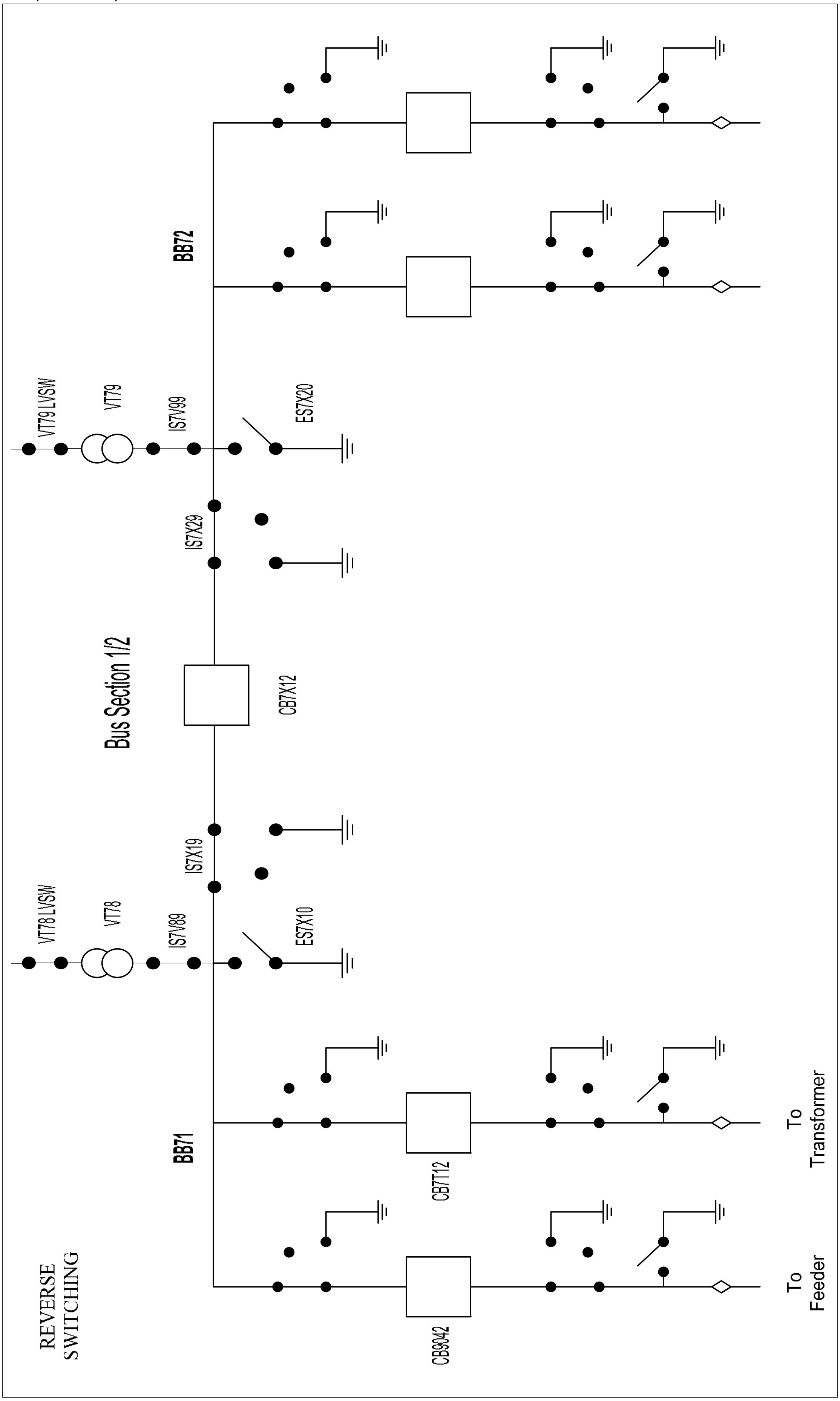
32. CB7T12		From ENERGEX Control Trip [FCT]
33. CB9042		From ENERGEX Control Trip [FCT]
34. CB9042		Disable remote supervisory control [DRC]
35. CB9042		Check open at the circuit breaker [COCB]
36. CB7T12		Disable remote supervisory control [DRC]
37. CB7T12		Check open at the circuit breaker [COCB]
38. CB7X12		Check open at the circuit breaker [COCB]
39. IS7X29		Remove DNOB make capable of normal operation [RDMCNO]
40. IS7X29		Remove from Earth Position [RFEP]
41. IS7X19		Remove DNOB make capable of normal operation [RDMCNO]
42. IS7X19		Remove from Earth Position [RFEP]
43. Switching Operator		Check all earths remove per A/Ps, T/Ps [CAER]
44. IS7X19	Close	[C]
45. IS7X29	Close	[C]
46. CB7X12		Check relays reset [CRR]
47. CB7X12		Check relays reset [CRR]
48. CB9042		Restore remote supervisory control [RRC]
49. CB7T12		Check relays reset [CRR]
50. CB7T12		Restore remote supervisory control [RRC]
51. CB7X12		From ENERGEX Control Close [FCC]
52. CB9042		From ENERGEX Control Close [FCC]
53. CB7T12		From ENERGEX Control Close [FCC]

54. Carry out reverse switching to restore TR1 & 110/132kV network

(Carry out any post contingent switching required)

[4] Note: Interlocking between 11kV transformer CB and 110/132kV switchgear on different substations refer to notes on DMS.

Diagram (1.11.4b)



1.11.1.5 **To switch the Siemens 110/132kV Bus Section VT**

(Refer to figure 1.11.5a)

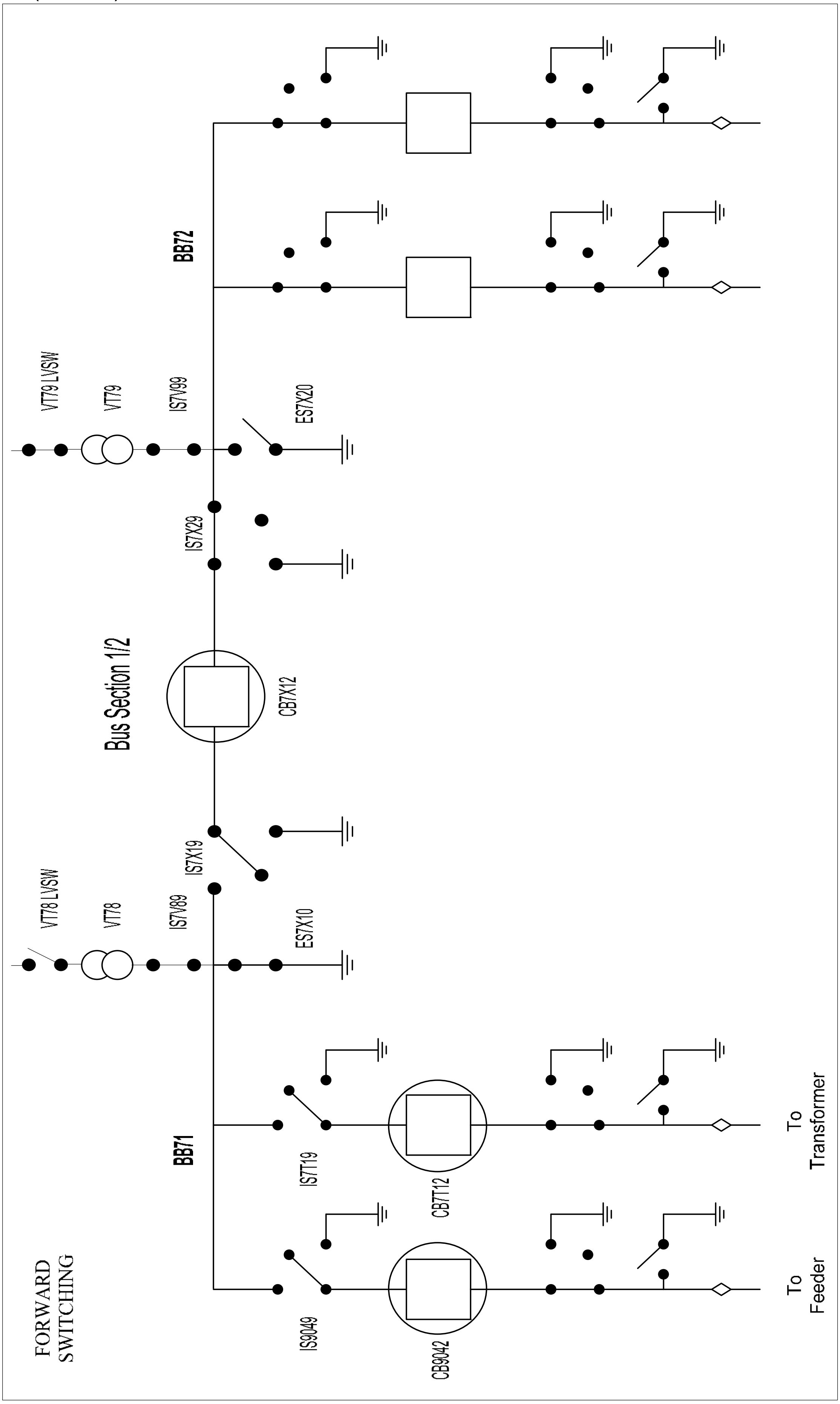
Forward switching

(Carry out any pre-contingent switching required)

1. Carry out de-load switching for TR1 and switching for 110/132kV feeders[5]
2. CB7T12 From ENERGEX Control Trip [FCT]
3. CB9042 From ENERGEX Control Trip [FCT]
4. CB7X12 From ENERGEX Control Trip [FCT]
5. CB9042 Disable remote supervisory control [DRC]
6. CB9042 Check open at the circuit breaker [COCB]
7. CB7T12 Disable remote supervisory control [DRC]
8. CB7T12 Check open at the circuit breaker [COCB]
9. CB7X12 Disable remote supervisory control [DRC]
10. CB7X12 Check open at the circuit breaker [COCB]
11. IS7T19 Open [O]
12. IS7T19 Make incapable of normal operation place DNOB [MINOPD]
13. IS7X19 Open [O]
14. IS7X19 Make incapable of normal operation place DNOB [MINOPD]
15. IS9049 Open [O]
16. IS9049 Make incapable of normal operation place DNOB [MINOPD]
17. VT78 LVSW Open Place DNOB [OPD]
18. VT78 LVSW Test prove de-energise [TPE]
19. ES7X10 Close [C]
20. ES7X10 Make incapable of normal operation place DNOB [MINOPD]

[5] Note: Interlocking between 11kV transformer CB and 110/132kV switchgear on different substations refer to notes on DMS.

Diagram (1.11.5a)



To switch the Siemens 110/132kV Bus Section VT
(Refer to figure 1.11.5b)

Reverse switching

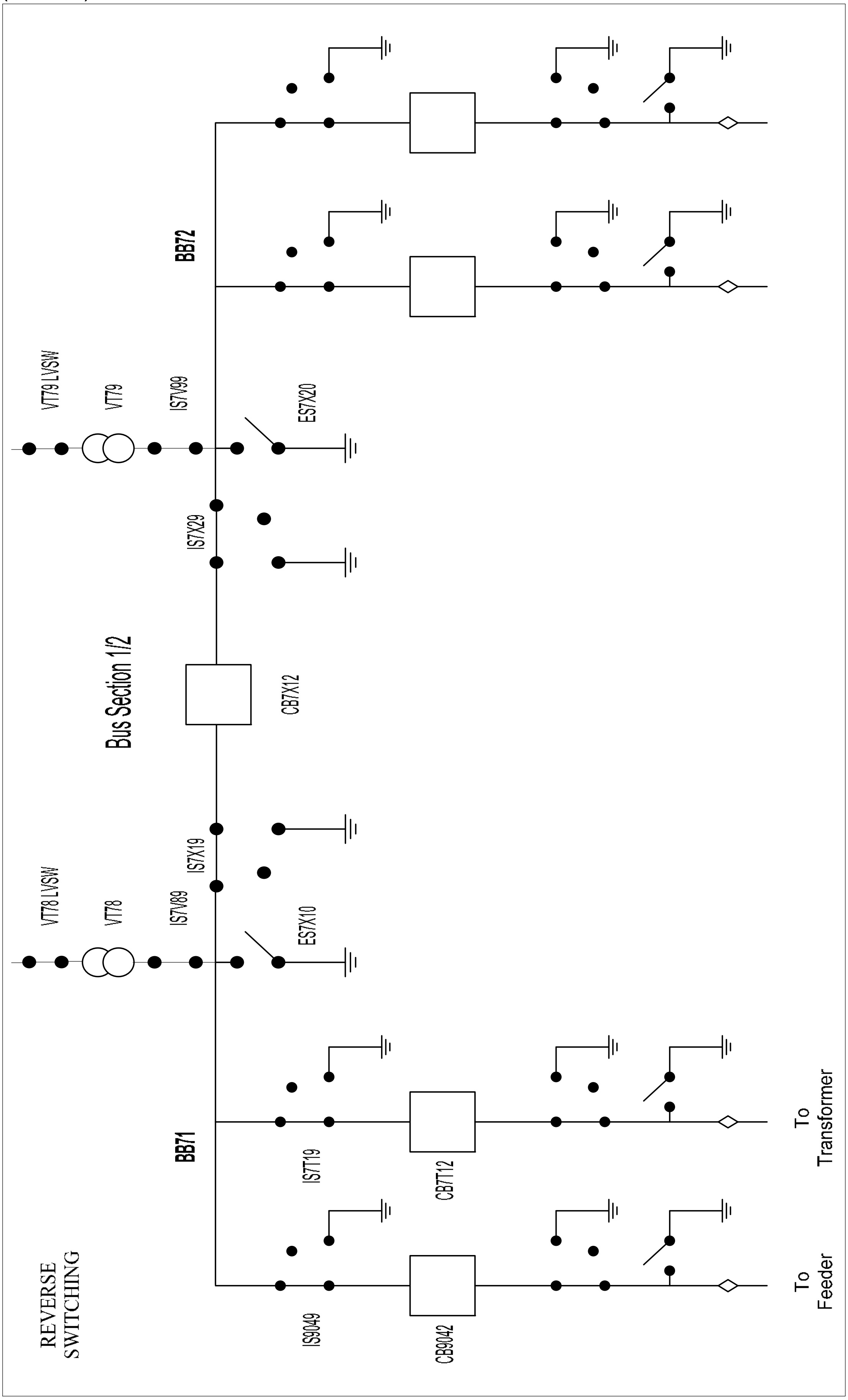
21. IS7V89	Check	Closed [CC]
22. ES7X10		Remove DNOB make capable of normal operation [RDMCNO]
23. ES7X10	Open	[O]
24. IS7X19		Check Not Earthed [CNE]
25. IS7T19		Check Not Earthed [CNE]
26. IS9049		Check Not Earthed [CNE]
27. Switching Operator		Check all earths remove per A/Ps, T/Ps [CAER]
28. VT78 LVSW		Remove DNOB Close [RDC]
29. CB7X12		Check open at the circuit breaker [COCB]
30. IS7X19		Remove DNOB make capable of normal operation [RDMCNO]
31. IS7X19	Close	[C]
32. CB9042		Check open at the circuit breaker [COCB]
33. IS9049		Remove DNOB make capable of normal operation [RDMCNO]
34. IS9049	Close	[C]
35. CB7T12		Check open at the circuit breaker [COCB]
36. IS7T19		Remove DNOB make capable of normal operation [RDMCNO]
37. IS7T19	Close	[C]
38. CB7T12		Check relays reset [CRR]
39. CB7T12		Restore remote supervisory control [RRC]
40. CB7X12		Check relays reset [CRR]
41. CB7X12		Restore remote supervisory control [RRC]
42. CB9042		Check relays reset [CRR]
43. CB9042		Restore remote supervisory control [RRC]
44. CB7X12		From ENERGEX Control Close [FCC]
45. CB9042		From ENERGEX Control Close [FCC]
46. CB7T12		From ENERGEX Control Close [FCC]

47. Carry out reverse switching to restore TR1 & 110/132kV network[6]

(Carry out any post contingent switching required)

[6] Note: Interlocking between 11kV transformer CB and 110/132kV switchgear on different substations refer to notes on DMS.

Diagram (1.11.5b)



Contents

Section 2.28 Not Current - see RED 01455 Operating Practices - Works Involving the Energex Low Voltage Network

2 SWITCHING PROCEDURES

2.1 Approved Isolation Points

The table referring to brand and model specific approved high voltage isolation methods has been removed from this release.

Energex's policy of sourcing equipment of varying styles and from a variety of manufacturers meant that the table was often out of date or incomplete.

As a general rule equipment using vacuum interrupters as the sole method of disconnection is not approved for use as an isolation point for the purpose of issuing permits under the SAHV. Fault break devices usually employ vacuum interrupters. Examples are protective devices designed to open under fault conditions (ACR/PMR), circuit breakers etc.

Equipment with a substantial gap in the interrupter which is designed to be operated either with minimal current or under normal load (e.g. ABS, Sectionalisers, LBS) are generally approved for use as isolation points for the purpose of issuing permits under the SAHV.

THIS IS A GENERAL GUIDE ONLY. For the approved function of a specific type / model of equipment contact Network Design Department.

2.2 Minimum Fixed Clearances for High Voltage Isolation (e.g. Bridges)

For high voltage electrical apparatus to be deemed adequately isolated, it must be separated from live exposed conductors by at least the minimum fixed clearances given in table 2.2 below.

Note: This clause does not apply to commercially manufactured switchgear complying with Australian or International standards (refer AS2650, AS2067 & AS1306).

Nominal Voltage	Minimum Fixed Clearance
HV up to and including 11 kV	320 mm
33 kV	380 mm
110 kV	1100 mm
132 kV	1300 mm

table 2.2 – Minimum Fixed Clearances

2.3 Temporary Isolation Points

The following devices possess adequate dielectric characteristics and are approved as isolation points for access:

- The "Flying Shackle" - two 11 kV synthetic insulators connected in series, installed in a span of conductor.
- The S&C "Loadbuster Disconnect" - a link in parallel with an insulator connected either in a span of overhead conductor or at a pole, which may be opened to provide an isolation point.
- The Chance "Line Tension Disconnect Switch" - a link in parallel with an insulator connected either in a span of overhead conductor or at a pole, which may be opened to provide an isolation point.

When using HV/LV flying shackles/links as isolation points to isolate the work area, they shall not be installed in the same span where the work involves conductor displacement from their attachment point (e.g. changing crossarms, pole replacement, pin/disc insulator replacement). In situations where the conductor will be displaced from its permanent attachment point at one end due to the work being carried, out a sound attachment point must be maintained between the work area and the temporary HV/LV flying shackles or links.

2.4 Checking Ring Bus Closed

Before manually opening the first switch in a normally closed ring bus, the ring bus shall be checked closed on site.

2.5 Checking Switches and Earthing within Isolation Points

Prior to the re-energisation of any portion of the network that has been de-energised to provide isolation for work, the state of all switches at each worksite shall be checked in a suitable position for reverse switching to proceed. These checks shall be instructed as part of the switching sheet prior to the re-energisation of the worksite.

The application and removal of working earths is recorded on the Access / Test Permit. The indication on a surrendered and signed Permit that a working earth has been removed is sufficient for the Switching Operator to confirm that earth as removed.

Note: as the workgroup has access to the nominated worksite/s only and no other lines or apparatus, there is no requirement to check the condition of equipment outside that scope.

2.6 Remote Supervisory Control on Switches within Isolation Points

Any switch within the work area that is fitted with remote supervisory control shall have this remote supervisory control disabled before an Access/Test Permit is issued. If the state of the remote supervisory control is required to be changed whilst under access as part of the work being carried out, the recipient of the Access/Test permit shall obtain approval to do so from the Switching Coordinator.

The isolation of local remote control (i.e. between the substation control panel or SACS and the switch), LV supply to such switches and the dissipation of any stored mechanical energy (e.g. springs, compressed air) shall be the responsibility of the work group.

2.7 SCADA Switching

2.7.1 Between Zones Switching

When between zones switching is being conducted, variation in the system voltage angles may result in significant load transfer from one zone to another. In some cases this may result in currents exceeding the overcurrent settings on protective relays in the circuit.

Before permitting between zones switching to proceed, the switching coordinator shall check which feeders and substations with overcurrent relays may operate.

Note: Only overcurrent relays either side of the paralleling need to be checked, as relay coordination and discrimination should limit the affected area.

Once the affected relays have been determined, the switching coordinator shall monitor the load of each feeder and proceed with the paralleling provided no abnormalities exist.

2.7.2 Loading of Transformer Ended Feeders

The Switching Coordinator shall monitor the substation where the primary side CB is located as well as the substation where the secondary side CB is located before loading the transformer (i.e. closing the LV CB).

2.7.3 Remote Control Switching

To carry out SCADA switching, Switching Coordinators are to follow the "PLACE" regime.

Firstly, two DMS windows are required, with one DMS window configured such that an overview of the affected network is clearly visible and the device to be switched is clearly visible in another new window or magnified view window.

Pre-check	Read the switching sheet item, locate screen and cross check - Location, Circuit & Action *(Paper Sheets- Tick off each column on switching sheet to confirm)*
Load Check	What affect will switching operation have on load?
Action Sheet	Select action point on screen or item in switching sheet
Cross Check	Check screen action against text against switching - Location, Circuit, Action
Execute	Execute action

Before closing/opening a device by remote control, the analogues of all devices involved should be observed. After the close/open command has been executed and prior to executing the next switching item, it is important to:

- Observe a status change on DMS Screen of the device that has just been switched
- Observe a Field return Command in the Events - My Events window
- Observe currents change to reflect altered configuration
- The analogues of all devices involved should be checked after the switching has been completed to ascertain that the load has been transferred appropriately

2.7.4 Checking Switches After Remote Operation

When a switch is operated remotely, (e.g. via DMS or from the substation control panel), and a Switching Operator is to manually operate equipment in that substation (i.e. at the same site), that relies on the condition of that remotely operated switch, then switch which was opened remotely shall have its remote control disabled and be checked open on-site.

When a 33 kV switch in a given substation is opened remotely and the next action is to open a 33 kV air break switch or link in another substation (i.e. at a different site), then the 33 kV air break switch or link to be opened shall be either tested de-energised or tested for current within switch break rating (refer section 2.23) before being operated. This condition does not apply to Air Break Switches along the length of the feeder.

2.8 Checking Relays Reset

Following work associated with a circuit breaker, all associated relays shall be checked reset before the CB is closed.

2.9 Checking Status of Auto Reclose

When the Auto Reclose function is fitted to a circuit breaker, the status of that Auto Reclose shall be checked for normal operating condition (i.e. enabled or disabled) during reverse switching following CB maintenance.

2.10 Phasing

The performance of certain tasks on the network allow for the possibility of incorrect connections and consequently a mismatching of the phase relationship between conductors across an open point.

An incorrect phase relationship across the poles of a switch will result in a direct phase to phase fault when the switch is closed. This typically results in damage to the switch, the possibility of further damage to the network and a risk of injury to the public and the staff performing the switching.

"*Phasing out*" is the term used to describe the process of *proving* the correct phase relationship exists across the poles of any open point. That is to say:

A Ø matches to A^1 Ø, and

B Ø matches to B^1 Ø and

C Ø matches to C^1 Ø.

While the application and indication of a test device (checking) is an important part of the phasing out process, "phasing out" is not complete until the two sources of supply have been connected across the switch or other suitable point and the connections are proven correct beyond doubt.

2.10.1 Policy

In circumstances where work has been performed and there is a risk of phasing being incorrect across a switch (or any open point) as a result of that work, then the correct phasing shall be proven by phasing out. Examples of such circumstances may include work:

- where two or more conductor connections have been broken at the same time , or
- where new equipment has been connected to the network.

Note that there is no requirement to prove phasing where the correctness of phasing is clearly apparent, such as (but not limited to) breaking / making straight through bridges, installing / replacing an air break switch or installing / replacing a load break switch.

Regardless of the content of the above paragraph if, due to the individual construction or other site specific details there the is a concern that phasing may be incorrect following work then the maxim **"IF IN DOUBT - PHASE OUT"** shall apply.

Whenever phasing is to be proven, consideration should be given to utilising a low voltage switch where practicable.

If phasing is to be proven using a high voltage switch, any Auto Reclosing function which may re-energise a potential fault caused by closing that switch with incorrect phasing shall be disabled.

2.10.2 Methods of Checking Phasing

Low voltage phasing may be checked using devices approved for the purpose.

High voltage phasing may be checked using phasing sticks designed for the purpose, applied directly to the conductors or by other approved devices designed to operate from the secondary output terminals fitted to most modern switchgear.

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*.

In some cases the use of voltage or power transformer secondary terminals may permit checking of high voltage phasing correctness. Care must be taken to ensure that the secondaries of any transformer are themselves correct and suitable for the task. Phasing shall not be checked using a transformer if there is any doubt as to the suitability of that transformer for the task.

2.10.3 Phase Rotation

Phasing out is only possible where there are two voltages to phase out across. If this is not possible (such as with a radial feed) and there is the risk of incorrect connections, then a phase rotation check shall be carried out. A phase rotation check will confirm that the phases are connected in the correct sequence.

Low voltage phase rotation may be checked using devices approved for the purpose.

High voltage phase rotation may be checked using phasing sticks designed for the purpose, applied directly to the conductors or by other approved devices designed to operate from the secondary output terminals fitted to most modern switchgear

In some cases the use of voltage or power transformer secondary terminals may permit checking of correct high voltage phase rotation. Care must be taken to ensure that the secondaries of any transformer used are themselves correct and suitable for the task. Phase rotation shall not be checked using a transformer if there is any doubt as to the suitability of that transformer for the task.

In order to confirm phase rotation supply must sometimes be restored to multiple installations to enable the rotation check to take place. (e.g. radial HV feeds with several distribution transformers downstream.) It is important that the performance of the phase rotation check is coordinated in such a manner as to minimise the possibility of damage to customers' installations.

Consideration shall be given to risk management strategies, for example:

- Energising as small a segment of the network as possible while checks are performed. e.g. open the next HV switch downstream.
- Utilising two crews –one at the switching site and another at the check site. This will remove the risk involved damage occurring while the switching crew travel to the check site.

SPECIAL NOTE:
If phasing is proven correct then phase rotation must also be correct. However checking that phase rotation is correct on both sides of an open point does not confirm correct phasing. (see Fig 2.10.3)

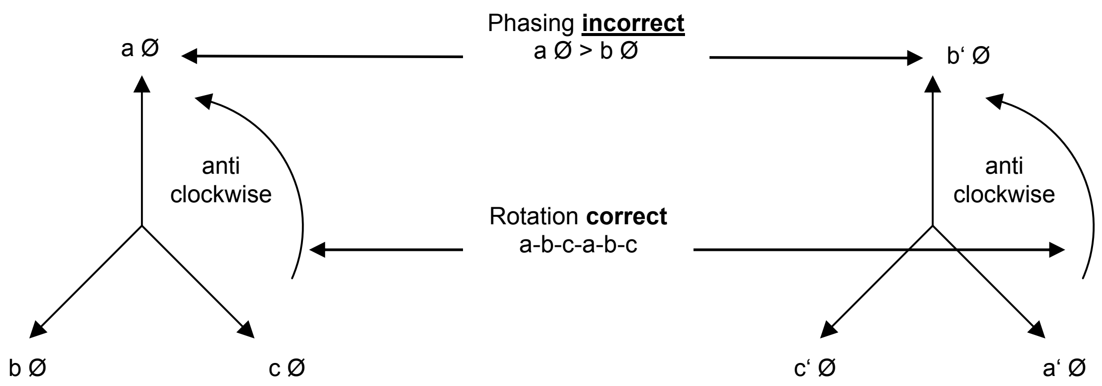


Fig 2.10.3

2.11 Transformer Energisation Current

Older transformer protection relays are susceptible to mal-operation due to high transformer inrush current. Transformer inrush current can be minimised by placing a transformer on its "maximum turns" ratio creating maximum back EMF.

2.12 Back-energising Transformers

There are a number of problems associated with the back-energising of transformers to supply load. Some are:

(a) The protection system may not be capable of detecting all faults and may no longer discriminate with other protection systems in this configuration.

(b) Energising a transformer from the low voltage side produces much higher in-rush current than energising from the high voltage side. This may cause unwanted protection operations

(c) If the transformer is back-energised from star to delta (e.g. 415 V to 11 kV or 11 kV to 33 kV), there is no longer an earth reference on the high voltage side. Earth faults (for example a wire down) on the high voltage will not be seen by conventional protection.

For these reasons, as a general rule transformers should not be back-energised unless approval is obtained from either Protection Department or Network Operations Engineers. (Ferroresonance transformers are an exception to this rule - refer to section 2.17***)***.

2.13 Switching SEF Protection

The following sections discuss problems that can be encountered whilst switching feeders with Sensitive Earth Fault (SEF) protection and the methods used to disable SEF during switching.

2.13.1 Paralleling

Sensitive Earth Fault (SEF) protection shall be disabled in the following circumstances:

- When paralleling 11kV feeders supplied from different substations, disable the SEF protection at both substations (see example 1 figure 2.13.1).
- If paralleling is done that has recloser(s) in the circuit, then the SEF at the recloser(s) shall be disabled (see example 2 figure 2.13.2)

Example 1 - Paralleling Between Different Substations

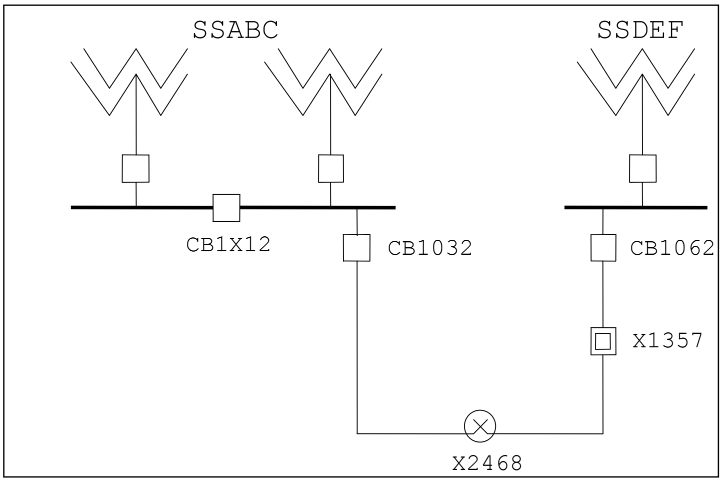


figure 2.13.1

Before closing X2468 - Disable SEF at SSABC, SSDEF, and X1357.

Example 2 - Paralleling Out of the Same Substation

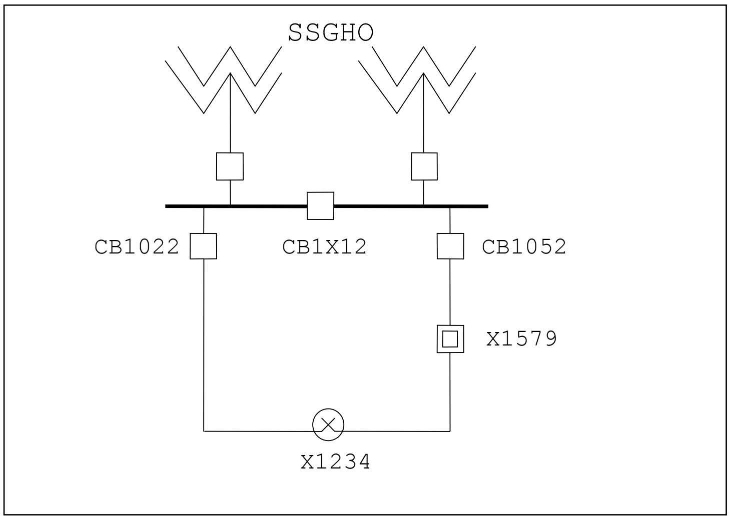


figure 2.13.2

Before closing X1234 - If the CBs are not Reclosers, then disable SEF on X1579 only.

If the CBs are Reclosers, then disable SEF at SSGHO and X1579.

2.13.2 Single Phase Switching of Load in a Radial Configuration

There are circumstances where single phase switching of a radial section of the network contains a significant underground component. The length and size of this cable may contribute to an imbalance in capacitive current when one or two conductors are opened. Under some conditions this imbalance may be sufficient to be detected as an SEF fault. (Note: Caution should be taken not to introduce Ferroresonance).

Consequently, if the single phase energisation or de-energisation of any part of the HV network is directed as part of switching and the part of the HV network being energised or de-energised contains an underground Component of greater than one kilometre, then SEF protection shall be disabled for the appropriate feeder.

2.13.3 Disabling SEF Protection

There are a number of standards covering the installation of SEF relays:

One SEF keyboard switch controlling all relays in some PCSACS substations. The SEF can be switched remotely.

An SEF keyboard switch for each feeder in some substations with micro-SACS. The SEF can be switched remotely.

One SEF switch controlling all relays in a non-SACS substation.

No SEF switch at all. Links on each panel must be used to isolate the SEF protection on that panel.

2.14 Bridging Out or Bypassing Reclosers and Sectionalisers

2.14.1 Bridging Out Using Live Line Techniques

In addition to the auto-reclosing being disabled, the bridging out of a recloser or sectionaliser using live line techniques shall only be permitted if the following criteria are first met:

Bridging Out a Recloser:

- Any remote control on the recloser is disabled; and
- Any protection on the recloser is disabled.

Bridging Out a Sectionaliser:

- Any remote control on the sectionaliser is disabled; and
- The sensing function of the sectionaliser is disabled .

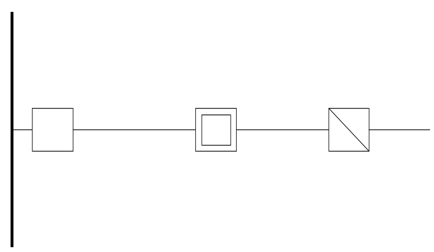


figure 2.15.1 - Example of a Typical Feeder

2.14.2 Bypassing a Recloser with an Air Break Switch

SEF protection fitted to an 11 kV Recloser shall be disabled before the Recloser is bypassed using an air break switch. A paralleling code will reflect this.

Normally Open 11 kV Reclosers with bypass air break switches shall only have a single paralleling box to reflect the paralleling conditions at the Recloser itself.

<u>Example</u> – Normally Closed 11 kV Recloser with bypass air break switch

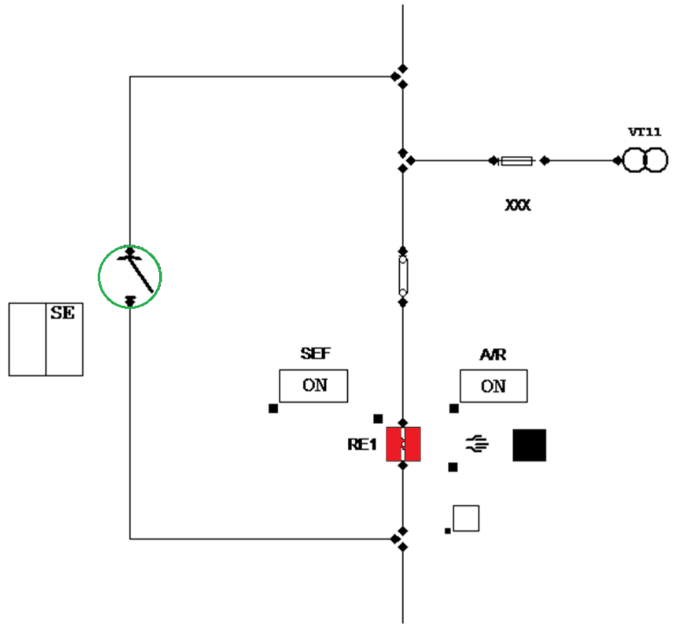


Figure 2.14.2.1

<u>Example</u> – Normally Open 11 kV Recloser with bypass air break switch

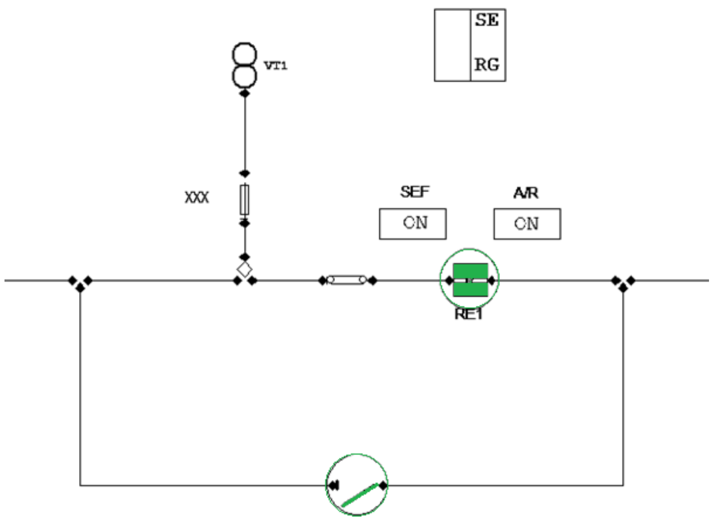


Figure 2.14.2.2

2.15 Bypassing of Voltage Regulators

It is imperative that an energised regulator is bypassed only when on neutral tap and that it remains on neutral tap for the duration of the bypass.

A bypass is a short circuit across the regulator. When an energised regulator is off neutral tap, large circulating currents can flow through the regulator and the associated bypass. Currents of up to 300 times regulator full load current can result.

BYPASSING A LIVE REGULATOR OFF NEUTRAL TAP RISKS SERIOUS INJURY TO THE SWITCHING OPERATOR AND DAMAGE TO THE REGULATOR.

No large circulating currents are generated if a regulator is bypassed on neutral tap. To ensure a regulator is not live bypassed off neutral, two independent means of neutral tap indication will be used.

In practice this means a mechanical indicator (e.g. the tap position indicator) and an electrical indicator (e.g. neutral light/voltage indicator) must both indicate that the unit is on neutral tap before live bypassing.

2.15.1 Neutral Check & Park Routines

The procedure for verifying neutral tap is known as the neutral check routine. The park routine is used to ensure that a regulator cannot accidentally move off neutral. The neutral check routine, then park routine must be carried out prior to bypassing. Section 8.2 of this manual details the above procedures.

2.15.2 De-energised Bypassing

Units without two methods of neutral indication are not suitable for live bypassing. For example some 33 kV three phase units only have tap position indicators. Such units shall only be bypassed de-energised.

2.16 Paralleling Feeders Through Voltage Regulators

Adjusting the tap position of a regulator(s) can control the magnitudes of the currents that flow through the paralleled circuit. Prior to paralleling, the regulator(s) should be placed on an appropriate tap that keeps the load current through the paralleled circuit below overcurrent settings and plant ratings.

Another problem when paralleling through two single phase regulators connected in an open delta configuration is a resultant zero sequence current flowing in the circuit or loop created by the paralleled feeders. The magnitude of this current is dependent on the tap position and the total circuit loop impedance. This current has the potential to exceed earth fault protection settings and therefore a qualified person is required to calculate the maximum or minimum allowable tap position for the regulator before paralleling can occur.

If there is any doubt as to what the appropriate tap(s) should be, then all units shall be made non-auto and placed on neutral tap for the duration of the paralleling. Two unit minimum delay switching may be used to avoid the parking of regulators on neutral taps to avoid quality of supply problems and excessive network switching.

2.16.1 Neutral Tap Indication when Paralleling

When placing a regulator on neutral tap for paralleling purposes a single indication of neutral tap is sufficient.

2.16.2 Single Phase Regulators

Single phase regulators are connected in an "open delta" configuration. At each site there are two units, one is connected between two phases, and the other is connected between two other phases. Thus one phase at the site is common. Both units at one site regulate independently.
Unless all units are placed on neutral tap during paralleling, an unbalance current can flow. However, putting all units on neutral tap can cause low system voltages during the paralleling.

The resulting unbalance current can be of sufficient magnitude to operate sensitive earth fault and/or earth fault protection. However, the magnitude of this unbalance current can be controlled.

<u>Additional Paralleling Requirements</u>
In addition to those specified above, the following conditions must be met before paralleling feeders containing single phase voltage regulators:

- SEF protection must be disabled on associated feeders (refer section 2.13.1).
- Any uni-directional units that will be fed from the wrong direction after the paralleling operation, must be made non-auto and placed on an appropriate tap until the switching has been reversed.
- Any definite time neutral earth fault protection at substation(s) must be considered, and disabled if required.

<u>All Units not on Neutral Tap</u>
Feeders with single phase regulators may be paralleled without placing all units on neutral tap. The magnitude of the unbalance current that will flow is the major determining factor when considering this option and must therefore be determined.

If the unbalance current is below the earth fault settings of the feeders concerned then the paralleling may be carried out.

If the unbalance current is above the earth fault settings of the feeders concerned then other actions need to be taken. Altering the taps on the units involved may reduce the current. If altering taps cannot reduce the current, then disabling earth fault during the paralleling operation may be an option.

The paralleling must be performed as a minimum delay operation (refer section 8.4.4). When the paralleling will be performed by field switching an item similar to the following shall be included in the switching sheet to indicate this requirement:

**** "Paralleling through SVR" ***
Call Sw. Co-Ord Before Next "Open" Item *

<u>Appropriate Regulator Unit Taps</u>
The following formula can be used to determine the magnitude of unbalance current that will flow and maximum tap difference allowable during paralleling.

The formula assumes the following conditions:

1 The feeders being paralleled do not run together on the same structure for more than two kilometres.

2 The common phase at every regulator site has been proven to be the same phase throughout the paralleled circuit (by testing and/or visual checks).

IU = 85TA / (L1 + L2)

Where: I_U = unbalance current (A)
T_A = actual tap difference (taps)
L_1 = length of feeder 1 to paralleling point (km)
L_2 = length of feeder 2 to paralleling point (km)

Notes:

In the case of condition 1 not being true, the paralleling must be performed with all units non-auto and placed on neutral tap.

In the case of condition 2 not being true, the magnitude of residual current given must be doubled. That is IU = 170TA / (L1 + L2).

When the regulators are all in the same phases and there is no difference in the sum of the taps on each feeder, OR when all units are on neutral tap, residual current is (approximately) zero.

The constant of 85 used in the above formula is derived from the standard voltage per tap (70 V) and a standard impedance per km (1.4 Ω), i.e. √3 x 70 / 1.4.

<u>Example</u> - Calculation of unbalance current & appropriate regulator unit taps

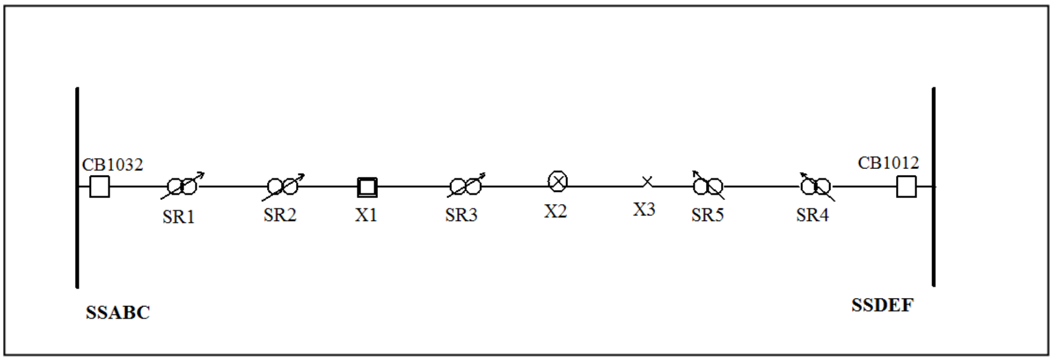


figure 2.17.1

Feeder ABC3-Distance from Busbar to X2 – 17 km
Feeder DEF1-Distance from Busbar to X2 – 35 km

Earth Fault Settings -	CB1032	40 A
	CB1012	40 A
	X1	20 A

	Site	Unit 1 Tap Position	Unit 2 Tap Position
	SR1	-2 }	-1 }
As found prior to paralleling	SR2	2 } 10	2 } 1
	SR3	10}	0 }
	SR4	-2 } 10	-2 } 8
	SR5	12 }	10 }

Unbalance current must be limited to 20 A during paralleling (lowest E/F setting at X1).

Case 1 - All units proven to be in same phases.
The maximum tap difference between these two feeders is (8 - 1) = 7 taps

$$
\begin{aligned}
IU &= 85TA / (L1 + L2) \\
&= 85 \times 7 / (17 + 35) \\
&= 595 / 52 \\
&= 11.4 \text{ A}
\end{aligned}
$$

Case 2 - All units not proven to be in same phases.
The maximum tap difference between these two feeders is 10 taps

$$IU = 32.7 \text{ A}$$

In case 1, the feeders may be paralleled by disabling SEF, E/F will not operate at X1.
In case 2, the feeders may be paralleled by disabling SEF, making all units non-auto, and adjusting the taps to reduce the unbalance current: Or, by disabling SEF and E/F at X1.

Caution: Consideration should be given to both the forward and reverse switching situations. The tap difference during the reversal may be far different to that of the original forward switching case.

2.17 Ferroresonance

2.17.1 What is Ferroresonance?

Ferroresonance is a term used to describe a resonant condition between a length of underground cable and an unloaded transformer. It can result in voltages of up to 4 times normal.

These voltages appear on both the HV and LV side of the transformer, and within the HV cable.

2.17.2 Conditions Causing Ferroresonance

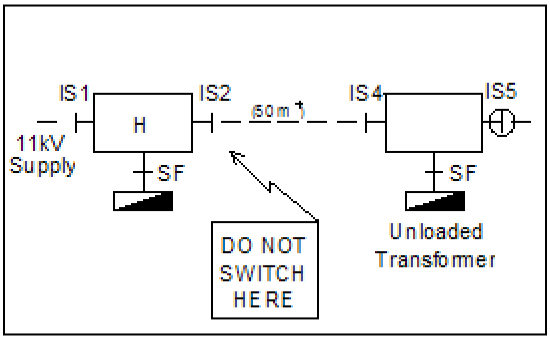
Ferroresonance can occur when 11kV supply is interrupted on 1 or 2 phases to:

a transformer with little or no load; and

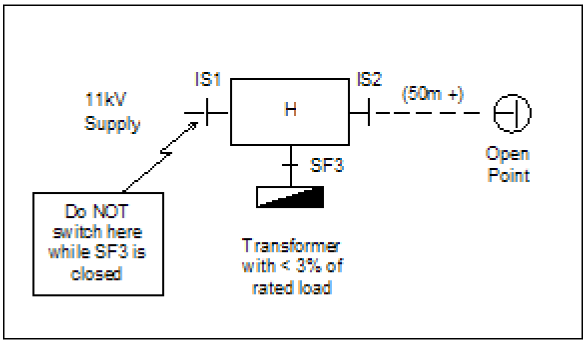
a length (50 m +) of underground cable.

2.17.3 Ferroresonance Caused By Feeder Switching

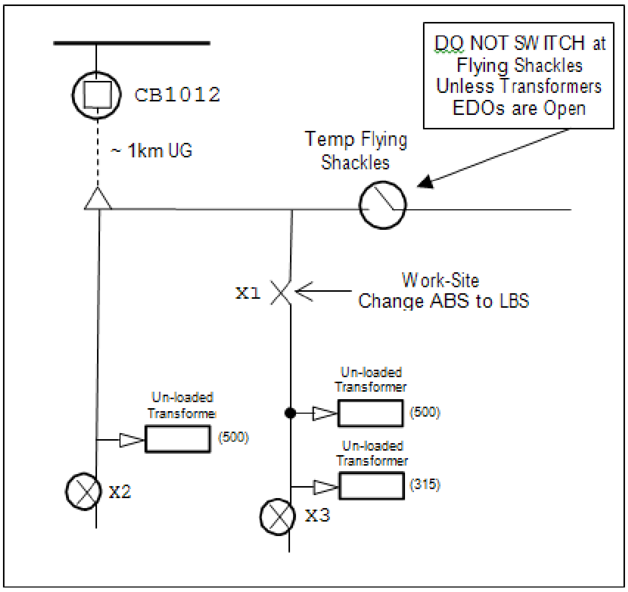
Ferroresonance can be caused during switching wherever a cable, and an unloaded transformer, are de-energised or energised by a non-ganged switch, e.g. Hazemeyer or Temp O/H single phase links, e.g. Flying Shackles/Links.



Situation 1 - figure 2.17.1



Situation 2 - figure 2.17.2



Situation 3 - figure 2.17.3

<u>Actions to Avoid Ferroresonance</u>:

- Switch with a 3-phase switch; or
- Load the transformer to at least 3% of its rated load; or
- Open the HV switch fuses at all transformers, and switch the transformer and cable separately.
-

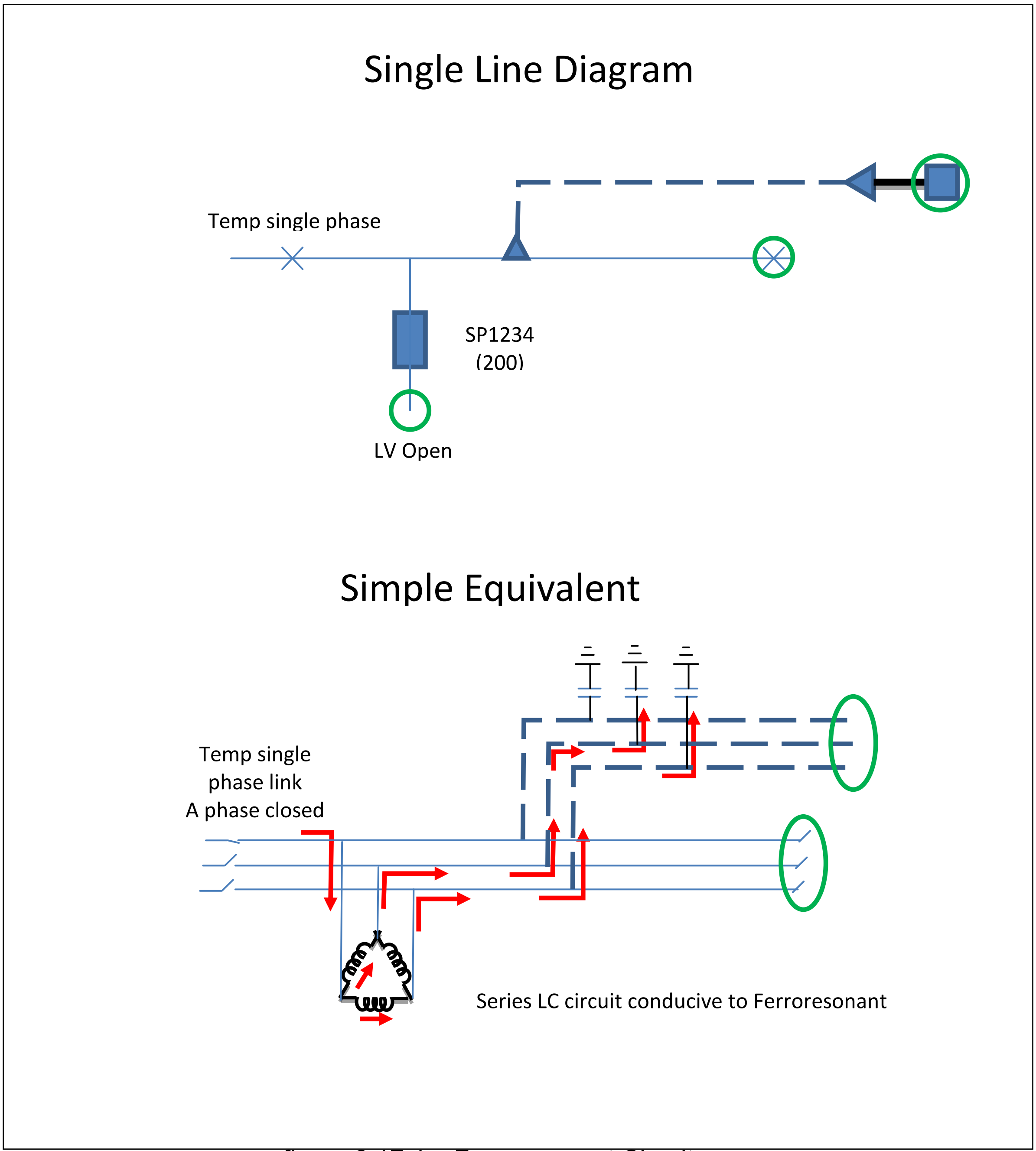


figure 2.17.4 – Ferroresonant Circuit

2.17.4 Ferroresonance Caused by Blown Fuses

These situations occur when the transformer is separated from the HV fuses by a significant length of cable (50 metres +). Known Ferroresonance should be marked on the operating diagram.

Blown Dropout Fuses (Non-Ganged)

Note: These situations should be rare. Any found are usually programmed for conversion to ganged dropouts - refer section 2.17.4.2.

1. Leave the transformer LV switch closed
2. De-energise the transformer at a 3-phase switch, e.g. ABS
3. Open the transformer LV switch
4. Replace the fuses
5. Energise the transformer at the 3-phase switch
6. Close the transformer LV switch

Blown Dropout Fuses (Ganged)

Note: Ganged dropouts can only be closed one phase at a time.

1. De-energise the transformer at a 3-phase switch, e.g. ABS
2. Open the transformer LV switch
3. Replace the fuses
4. Energise the transformer at the 3-phase switch
5. Close the transformer LV switch

Blown Hazemeyer Fuses

1. Leave the transformer LV switch closed
2. De-energise the transformer at a 3-phase switch, e.g. ABS
3. Open the transformer LV switch
4. Replace the fuses
5. Energise the transformer at the 3-phase switch
6. Close the transformer LV switch

Blown Andelect Fuses

1. Leave the transformer LV switch closed
2. De-energise the transformer at the Andelect switch fuse
3. Open the transformer LV switch
4. Replace the fuses
5. Energise the transformer at the Andelect switch fuse
6. Close the transformer LV switch

2.18 Manual Operation of 110/132kV Air Break Disconnectors

2.18.1 Scope

These procedures apply to all ENERGEX authorised switching operators manually operating 110/132kV disconnectors. They also apply to Powerlink and Qld Railways operators switching in ENERGEX substations.

2.18.2 Background

Using a disconnector to interrupt a known current within its assigned rating involves negligible risk. Using a disconnector to interrupt current in excess of its rating can result in flashover, which may pose a significant risk to the switching operator.

There have been incidents where air break disconnectors have been operated under load by mistake. To ensure that no disconnector is mistakenly operated, the absence of load current must be confirmed prior to operation.

Air break disconnectors are not capable of interrupting load current; however, they may be safely used to break/make:

- charging currents associated with short lengths of busbar and transmission lines
- transformer energisation current
- low impedance ring circuits, provided there will be no significant change in voltage across the switch

2.18.3 Additional PPE

In addition to normal PPE requirements, a full face shield and class II gloves must be worn.

2.18.4 Making or Breaking Radial Circuits

Before opening a radial circuit the disconnector must be correctly identified from the switching sheet and by confirming the absence of load current on all phases. The absence of load current must be confirmed by:

- proving both sides of the switch de-energised, or
- obtaining Ampstik readings of 2.0 A or less, on all phases

A typical switching sheet action item would be:

“Confirm absence of load current”.

The disconnector must be opened quickly and smoothly. If the arc does not extinguish by the time the disconnector is fully open, it must be reclosed immediately to prevent flashover. If the disconnector has to be reclosed, the action may be performed without prior approval of the switching coordinator; however, the problem must be reported to the switching coordinator immediately on completion of the action.

Reverse switching must be written to ensure that only the same apparatus that was de-energised will be re-energised. On-site checks of load-side circuit breaker open status will be required. The disconnector must be closed quickly and smoothly. If the disconnector fails to close properly do not attempt to reopen it, report the problem to the switching coordinator and wait for instructions.

2.18.5 Making or Breaking Low Impedance Rings

Operation of the disconnector must not cause a significant change in voltage across it. To ensure safe operation, the switching must include an on-site status check of the other 110/132 kV switches in the circuit. The status check must confirm there is a parallel current path prior to the operation of the disconnector.

Disconnector operation is similar to that required for making and breaking radial circuits, problems with opening and closing must be handled in the same way.

Example - Isolating 110kV TR1 @ SST29 (see figure 2.19.1)

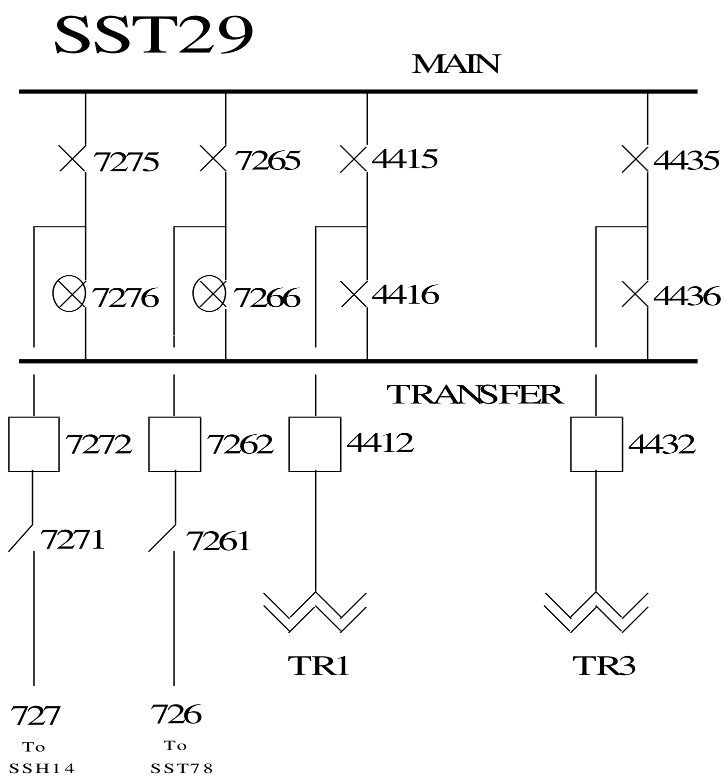


figure 2.19.1

Typical Forward Switching

1. De-load TR1 and Isolate on 33kV side
2. Open 110kV CB4412
3. Check on-site status of 110kV switches
   (to confirm there is a parallel path for AB4415)
4. Open 110kV AB4415 and place DNOB
5. 110kV AB4416 confirm absence of load current
6. Open 110kV AB4416 and place DNOB

Typical Reverse Switching

7. Check on-site status of 110kV switches
   (to confirm that there is a tie between buses)
8. Check Open 110kV CB4412 (at the CB)
9. Remove DNOB and Close 110kV AB4416
10. Remove DNOB and Close 110kV AB4415
11. Close 110kV CB 4412
12. Reverse isolation on 33kV side & Load TR1

2.19 Operation of 110/132 kV Motorised Air Break Disconnectors

Unless documented otherwise, the rated breaking/making capacity of all motorised 110/132 kV air break disconnectors is 2.0 A.

2.19.1 Disconnectors fitted with high speed flicker blades

Each device shall be inspected on-site immediately before and immediately after every operation.

Before Opening and after Closing, the operator must confirm that the flicker blades are correctly engaged.

After Opening and before Closing, the operator must confirm that all flicker blades are intact.

Note. The above requirements do not apply, if urgent remote emergency switching is required.

Westralian brand
These switches are suitable for breaking/making up to 5 A of line charging/transformer energisation current. For example they may be used to switch an unloaded 60 MVA transformer, or up to 20 km of unloaded transmission line.

AEM Type DB145 (with 400mm flicker blades)
These switches are suitable for breaking/making up to 3 A of line charging/transformer energisation current. For example they may be used to switch an unloaded 30 MVA transformer, or up to 12 km of unloaded transmission line.

2.20 11 kV Air Break Switch Rated Closing Capacity

An 11 kV ABS with arcing horns may be used to energise a total load not exceeding the full load rating of the switch. For example, a 630 A (full load rated) ABS may be used to energise up to 630 A of load.

2.21 Single Phase Paralleling

Single phase paralleling (either the close action or the subsequent open action) should be avoided wherever possible, i.e. use a 3-phase switch.

If single phase paralleling with a Hazemeyer isolator is necessary, then a "Use 3 Handles - Minimum Delay" switching action is required.

Note: If this type of switching is required, it is to be carried out by one person only; the switching operator’s assistant is to stand clear.

2.22 Switch Break Rating

Unless there is documented information to the contrary, the values shown in table 2.23 will be used when determining the rated breaking capacity of switches.

Switch Type	Breaking a Radial Circuit
Circuit Breaker	Name Plate Rating
Recloser	Name Plate Rating
Load Transfer Switch	Name Plate Rating
RMU Isolators - 3 Phase Operation	Name Plate Rating
RMU Isolators - Single Phase Operation	Name Plate Rating (note 1)
RMU Switch Fuse	Name Plate Rating
Air Break Switch with Load Interrupter	Name Plate Rating
110/132 kV Air Break Disconnector (Manual & Motorised operation)	2.0 A
110/132 kV GIS Disconnector	Name Plate Rating
11kV/33kV Air Break Switch without Flicker Blades	0.5 A (note 2)
11kV/33kV ABS with Flicker Blades	20 A (note 3)
Dropout Fuse with Load Interrupter	No Restrictions
Dropout Fuse without Load Interrupter (note 4)	10 A - Wood Crossarm 10 A - Steel Crossarm (unearthed) 3 A - Steel Crossarm (earthed)
Links (note 4) ***Caution: Single phase switching where UG cable is part of the circuit may cause Ferroresonance*** Links Fitted with ArcChute Interrupter (note 5)	10 A - Wood Crossarm 10 A - Steel Crossarm (unearthed) 3 A - Steel Crossarm (earthed) 100 A

table 2.22- Switch Break Rating

Notes:
1. Although these are load break switches, beware of ferroresonance and SEF trips.
2. A 5 MVA 33/11 kV transformer has a magnetising current of approximately 0.5 A (on tap 1).
   The charging current of an unloaded busbar is less than 0.5 A.
3. A maximum of 50 km of unloaded 33 kV overhead feeder may be de-energised
4. These devices can be opened under greater load if a load break tool is used
5. There are operating restrictions on this device, refer to WP-1070 'Operate 11kV Single Phase In Line Disconnect Switch/Link' for the restrictions before use

2.23 Earthing Underground Feeders

Where a feeder is predominantly underground, the capacitive charge in the cable can be considerable. When such a feeder is terminated at a circuit breaker and portable hand earths are required, then these steps should be followed:

Using a Fault Make Earth Switch

1. Test and prove De-energised the feeder cable
2. Close the fault make earth switch
3. Test and prove De-energised where the portable hand earths are being applied
4. Apply portable hand earths (attach DNOB if used as an Operator Earth)
5. Open the fault make earth switch

Using a Circuit Breaker in the Integral Earth Position

1. Test and prove De-energised the feeder cable
2. Connect the circuit breaker in the cable earth position and close the CB
3. Open and disconnect the circuit breaker
4. Test and prove De-energised where the portable hand earths are being applied
5. Apply portable hand earths (attach DNOB if used as an Operator Earth)

Using a Circuit Breaker with Portable Hand Earths

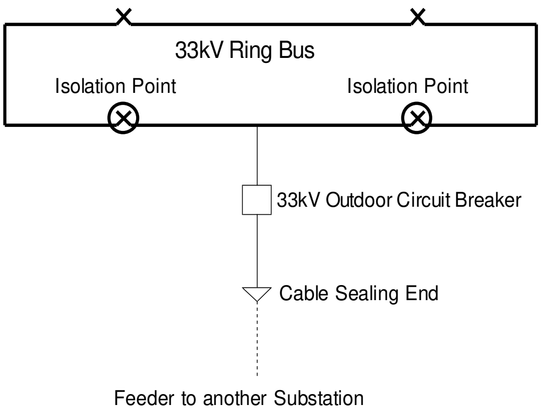


figure 2.23.1

1 Check circuit breaker open
2 Test, prove De-energised and apply portable hand earths on the bus side of the open circuit breaker (attach DNOB if used as an Operator Earth)
3 Test and prove De-energised only, between the circuit breaker and the U/G sealing end
4 Close the circuit breaker
5 Test, prove De-energised and apply portable hand earths between the circuit breaker and the U/G sealing end (attach DNOB if used as an Operator Earth)
6 If two sets of portable hand earths are not available, the first set can be repositioned to earth the cable directly. This procedure is required at one end of the cable only.

Approved by S.Kerr (RPEQ)

2.24 Switching Voltage Transformers

Voltage transformers (VTs) exist throughout the Energex network and are typically used for metering and protection functions.

Voltage transformers are often used as isolation points for access under SAHV. To reduce risk to operators and equipment, isolation at a VT should, where practicable, be performed at the low voltage side of the VT and after the feeder or equipment has been de-energised.

As a general rule, isolation at a VT should occur while the VT is 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:

- 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

- 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 etc. without due consideration being given to the consequences of that removal.

2.24.1 VTs Associated with ACRs

Automatic Circuit Reclosers – ACRs (previously referred to as PMRs) by design require a VT on the High Voltage side to provide monitoring, and in some cases power to control circuitry, and supply for battery charging facilities.

These VTs may be located internally or externally on a particular device depending on the device design, purpose of the VT, its size, etc.

In some cases these VTs have external HV protection such as EDOs. When these EDOs are present they are indicated on the 11kV Operating Panels. When these VTs are internal to the ACR or not protected by an external device they do not appear on the Operating Diagrams.

- For the purposes of Live Line work, VTs on ACRs shall be dealt with in accordance with established Live Line work practices and need not be mentioned in switching sheets.
- For the purposes of isolation to provide access, VTs on ACRs shall not be considered as a source of energisation and therefore there is no requirement to open and tag their EDOs as part of the isolation process.
- Specific cases which may require variation from this process shall be raised with Network Operations Standards Department for clarification.

2.25 Underground Transmission Cable Procedures

The following procedures shall be adopted when cables are taken out of service for either planned and emergency work, or the investigation of cable pressure alarms:

1. When a request for planned work is received, the outage coordinator shall enter the work details into that days job schedule and should prepare a switching sheet and contingency plan (if required), and advise the applicant if the work requires secondary systems isolation (refer section 7).

2. When a cable pressure alarm or a request for emergency work is received, the switching coordinator shall immediately notify the relevant field services (underground) coordinator, and upon advice, determine if the feeder is to be de-energised. Following de-energisation, the following shall be determined:

(a) Access Is Required:
Cable to be isolated for testing or repairs - SAHV Procedures shall be followed.

(b) Cable To Be Left De-energised, Available For Emergency Service:
The relevant (Underground) Work Group Leader/Coordinator shall confirm that the cable is available for emergency service, and that re-energisation in an emergency will not damage the cable. If the cable is returned to service in an emergency, then as soon as practicable after restoration, The relevant (Underground) Work Group Leader/ Coordinator shall be advised of the fact.

(c) Cable To Be Left De-energised, NOT Available For Service:
The Switching Coordinator shall take appropriate action to ensure that the cable will not be accidentally re-energised. The following additional switching shall be carried out to ensure that the switches used to de-energise the cable will not be operated remotely or from the substation panel:

- disable remote supervisory control (if available)
- place a EOR (Equipment Operating Restriction) document and a Control Inhibit on the DMS SCADA points
- remove those switches' closing and control fuses and place DNOBs

2.26 Live Line Breaking/Making HV Bridges

The following measure shall be adopted when bridges are to be broken or made, as an item on a switching sheet, using live line techniques.

The switching sheet writer will assess the system configuration to determine if any underground cables will be energised/de-energised by the action. If this is the case, then the following notation will be included immediately before the switching item.

Caution: HV UG cable(s) will be energised/de-energised

The above requirements do not apply when the works are actually bridging/de-bridging an underground cable (as the situation will be obvious).

Refer also to S2.13.2 regarding single phase switching involving UG cable.

2.27 Work on NER Cubicles

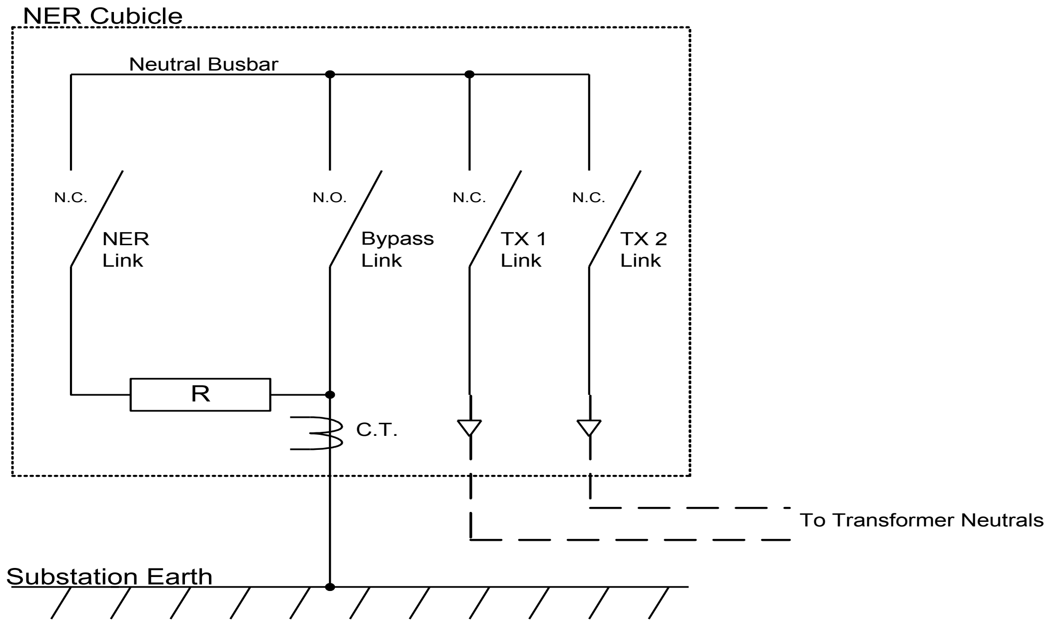


figure 2.27.1

The following procedures shall apply when working on equipment located within a Neutral Earthing Resistor (NER) cubicle.

An application for switching is required for all work within NER cubicles. The applicant shall request that a Work Authority be issued for the NER cubicle at the relevant substation.

A Protection Permit will also be required and the only work that can be performed within the substation during NER maintenance must be as per the Protection Permit. No other work shall be performed outside the substation on any part of the 11kV system where a fault or incident could cause fault current to flow through the by-passed NER configuration.

The Switching Sheet is to be generally as follows:

<u>Forward Switching</u>

1.	Carry out Protection Permit	
2.	TX 1 link	Check Closed, Place DNOB
3.	TX 2 link	Check Closed, Place DNOB
4.	Bypass link (both sides)	Test Prove De-energised
5.	Bypass link	Close, Place DNOB
6.	NER link	Open, Place DNOB
7.	Neutral Busbar	Test Prove De-energised, Earth & Place DNOB
8.	Issue Work Authority	

<u>Reverse Switching</u>

9.	Revoke Work Authority	
10.	Neutral Busbar	Remove DNOB, Remove Earth
11.	TX 1 link	Check Closed, Remove DNOB
12.	TX 2 link	Check Closed, Remove DNOB
13.	NER link	Remove DNOB, Close
14.	Bypass link	Remove DNOB, Open
15.	Reverse Protection Permit	

Notes:
While the NER link remains closed all apparatus on the line (transformer) side of the NER, including the NER, is considered to be part of the HV system.

When the bypass link is closed and the NER link is open, all apparatus within the cubicle becomes an integral part of the earthing system, minimum approach limits no longer apply.

CAUTION!
The continuity of the circuit between the transformer neutral(s) and the substation earth must be maintained at all times. If the circuit is to be opened then it shall first be bypassed with a suitable bridge, capable of handling any potential fault current.

Before commencing works, the workgroup shall prove the integrity/continuity of the substation earthing point to be used for the earth tail in item 7 above.

2.28 Work involving both HV and LV Switching for Isolation

NOTE: This section is to be read in conjunction with Section 15.5 and 15.6

2.28.1 Isolation Involving HV Switching

Section 2.28 Not Current - see RED 01455 Operating Practices - Works Involving the Energex Low Voltage Network

~~Regardless of the sw~~ … ~~isolation for work, the permit issued to a workgrou~~ … ~~s of the of highest voltage that the workgroup w~~ …

~~If the task involves w~~ … ~~ystems - that requires encroachment within the exclusion zone of exposed high voltage equipment then an Access Permit shall be issued. (e.g. changing LV arrestors on a pole mounted distribution transformer or changing a circuit board on a pole mounted ACR unit))~~

~~If the task involves work which is on or near exposed low voltage equipment only and does not encroach on high voltage exclusion zones then a LV De-energisation Permit shall be issued. (e.g. changing LV arrestors on a padmount distribution transformer.)~~

~~It is irrelevant whether or not high voltage switches have been used to provide all or part of the isolation~~

~~For a single workgroup working on HV and LV at a single worksite, the issue of a single Access permit is sufficient to cover work on all equipment at that site – a separate LVDP is not required.~~

~~Regardless of which type of permit is to be issued, all LV equipment inside the work area shall be tested to confirm it is de-energised prior to the issue of the permit. This is in addition to the normal testing, proving de-energised and earthing of HV equipment inside the work area. This requirement shall be included on the switching sheet before approval is given to issue the Permit.~~

2.28.2 HV and LV Switching Sheets

Section 2.28 Not Current - see RED 01455 Operating Practices - Works Involving the Energex Low Voltage Network

~~A separate LV sheet may be required to configure the LV network in preparation for the HV isolation and Permit~~ … ~~provide other than basic LV configuration.~~

~~NOTE: Typically only C~~ … *~~e DNOB items will be included on the HV swi~~* … *~~and LV load shifts will not be controlled by an HV sheet.~~*

~~When an LV switching sheet and HV switching sheet are run in close association with each other, (i.e. all or part/s of one switching sheet must be complete before all or part/s of the other sheet can proceed), both switching sheets shall have adequate notation at the relevant stage referencing the related sheet.~~

2.28.3 Checking Accuracy of LV Switching Sites

~~An application (HV or LV) referencing LV switching points shall not be submitted to Network Operations for processing unless the correctness of those LV points has been checked in the field. When the correctness of those points has been confirmed the application state shall be changed to "FIELD CHECKED" in the case of LV applications and in the case of HV applications a confirmation of the check and the name of the person confirming the check shall be made in the 'notes" section . The Application may then be submitted for the attention of the Outage Coordinator.~~

~~An Outage Coordinator shall not continue to process an application unless the LV points mentioned on that application have been confirmed as checked.~~

~~The HV Outage Coordinator will determine the number and format of switching sheets when assessing switching requirements (that is, separate HV and LV switching sheets or a combined HV/LV switching sheet).~~

2.28.4 Common Isolation Points

~~Where a common isolation point is used for separate HV and LV permits (for example, a transformer LV switch) a separate DNOB is to be placed for each permit.~~

END OF SECTION 2

3 ENERGEX Operational Authorisation Scheme

3.1 Policy

All roles listed in section 3.3 shall be authorised.

ENERGEX shall maintain a register of all persons who are authorised to perform operating work or gain access to ENERGEX's network.

The awarding of operational authorisation(s) to individuals shall be at the sole discretion of the Work Practices Manager.

Operational authorisations shall last for a period of three years and all individuals will be re-assessed as competent before being re-authorised. It is the responsibility of the work group manager to make arrangements to ensure operational authorisations are maintained.

The Work Practices Manager will approve assessors. They will have extensive experience in the role they are assessing; and where practical assessment is required, have successfully completed the workplace assessor's course.

The following roles shall receive training in the Safe Access for High Voltage (SAHV) Procedures:

- Applicant
- Switching Sheet Writer
- Switching Sheet Checker
- Switching Sheet Authoriser
- Individual of Work Group

In ENERGEX, the switching sheet checker, switching sheet authoriser and outage coordinator roles are combined into one authorisation - the outage coordinator.

Switching operator and recipient authorisations are issued on the basis of the asset owner. For example, if a person carries out 132kV switching at an ENERGEX substation under the direction of the network switching centre (NSC), they require ENERGEX "S132" authorisation.

Authorisations issued to ENERGEX personnel by Powerlink and Queensland Rail are recorded in the ENERGEX authorisation register as "XR", and are restricted on the basis of location, voltage and possibly type of apparatus.

3.2 Responsibilities

Basic responsibilities for roles are specified in the SAHV procedures manual (Orange Book). However, ENERGEX requires further responsibilities that are detailed in section 0 of this manual.

3.3 ENERGEX Authorisations

The following roles are authorised in ENERGEX.

Authorisation Code	Role
RR	Restricted Recipient
SR	Recipient
SOA	Switching Operator's Assistant
ATO	Area Troubles Operator
OSO	Overhead Network Switching Operator
USO	Underground Network Switching Operator
SSC	Secondary Systems Checker
SPO	Substation Panel Operator
S33	Substation Switching Operator (to 33kV)
S132	Substation Switching Operator (to 132kV)
XR	Restricted Operator
A11	Outage Coordinator 11kV
A33	Outage Coordinator 11-33kV
A132	Outage Coordinator 11-132kV
C11	Switching Coordinator 11kV
C33	Switching Coordinator 11-33kV
C132	Switching Coordinator 11-132kV
CC	Commissioning Coordinator

3.3.1 Low Voltage Switching

No specific authorisations are issued for LV switching. The only requirements for individuals undertaking LV switching are:

- the person is an electrical worker
- the person is competent to undertake the task

3.4 Issue of New Authorisation(s)

The criteria for the issue of new operational authorisations are specified in this section 3.5. These are typically a combination of several requirements that may include:

- holding a current authorisation of some form
- completion of training modules (typically administered by Esitrain)
- completion of a practical component and assessment

The approval of operational authorisations is at the sole discretion of the Work Practices Manager, not simply on completion of training modules conducted by Esitrain.

For example, the process for attaining a new operational authorisation for overhead (OSO), underground (USO) and substations (S33/S132) authorisations is as follows:

- completion of required training modules as specified in section 3.5 (notes 1 & 4)
- practical field competency assessment (note 2 & 3)
- approval of authorisation by the Operating Standards & Compliance Manager (note 5)

Notes:

1. *Prerequisite requirements (eg. current recipient (SR) authorisation) will be mandated prior to enrolment in Esitrain training courses.*

2. *Prerequisite practical experience is mandated prior to field competency assessment.*

   It is the responsibility of coordinators to ensure that staff recommended for field competency assessment have sufficient practical experience and have an appropriate understanding of field switching practices (eg. assisted in an appropriate number of switching sheets for the role being assessed).

3. *Field competency assessment will be scheduled based on completion of required training by Esitrain and the requirements specified in note 2 above.*

   For those personnel with the prerequisite practical experience, on conclusion of required training, competency assessment will be scheduled by Esitrain and conducted by them immediately following completion of the training course.

   For those personnel not having the prerequisite practical experience, on conclusion of required training, a field competency assessment should be scheduled by the participant's coordinator in consultation with Esitrain.

   Field Competency Assessors will not be recommending participants they do not consider fully competent or who they believe have insufficient practical experience.

4. *Statements/certificates from any course involving ENERGEX Operational Authorisations will not be released until the participant has successfully completed a field competency assessment.*

5. *On successful completion of training and field competency assessment, a request for operational authorisation (form 2045) shall be forwarded by Esitrain to the Operating Standards Officer.*

3.5 Criteria for Issue of New Authorisations

The following criteria shall be applied (as a minimum) when assessing candidates for the issue of operational authorisations. The candidate must satisfy ENERGEX by providing sufficient evidence to prove that the criteria have been meet. No authorisation, other than switching operator's assistant (SOA) shall be issued to trainees.

3.5.1 Restricted Recipient (RR)

Criteria 1 - ENERGEX & Distribution System Awareness
Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).

Criteria 2 - Operating Practices
Successfully complete the following training:

- HV Access Procedures for Non-Electrical Personnel (M171).

3.5.2 Recipient (SR)

Criteria 1 - Qualifications\Certifications

- Hold a current Queensland electrical workers licence or equivalent.
- Hold current rescue and resuscitation certification.

Criteria 2 – Safety
Successfully complete the following training:

- Introduction to Electrical Safety Practices (M41).

Criteria 3 - ENERGEX & Distribution System Awareness
Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).

Criteria 4 - Operating Practices
Successfully complete the following training:

- SAHV Procedures (M42).
- Test & Earth HV Mains (M169).

3.5.3 Switching Operator's Assistant (SOA)

Note. A trainee who has not completed at least six months of an apprenticeship or training program shall not be eligible for authorisation as a switching operator's assistant.

Criteria 1 - Qualifications\Certifications

- Hold current rescue and resuscitation certification.

Criteria 2 – Safety

Successfully complete the following training:

- Introduction to Electrical Safety Practices (M41).

Criteria 3 - ENERGEX & Distribution System Awareness

Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).

Criteria 4 - Operating Practices

Successfully complete the following training:

- Teamwork in Switching.

Criteria 5 – Working Live

Successfully complete the following training (* or equivalent):

- Working on Energised LV Equipment (M340)
- Working on Energised LV Overhead Conductors (M341)
- Working on Energised LV Underground cables and equipment (M342)
- Working on Energised LV Electrical Installations (M343)
  (* does not apply to non electrical personnel)

3.5.4 Area Troubles Operator (ATO)

Criteria 1 - Qualifications\Certifications

Hold a current Queensland electrical workers licence or equivalent.

Criteria 2 – Safety

Successfully complete the following training:

- Introduction to Electrical Safety Practices (M41).

Criteria 3 - ENERGEX & Distribution System Awareness

Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).

Criteria 4 - Operating Practices

Successfully complete the following training:

- Resolving Area Troubles (M843)

3.5.5 Overhead Network Switching Operator (OSO)

Criteria 1 – Recipient Authorisation

- Hold current Recipient (SR) authorisation.

Criteria 2 - Operating Practices

Successfully complete the following training:

- Teamwork in Switching.
- Resolving Area Troubles (M843).
- Switching Operator Overhead (M845).

3.5.6 Underground Network Switching Operator (USO)

Criteria 1 – Recipient Authorisation

- Hold current Recipient (SR) authorisation.

Criteria 2 - Operating Practices

Successfully complete the following training:

- Teamwork in Switching.
- Switching Operator Underground (M846).

3.5.7 Secondary Systems Checker (SSC)

Criteria 1 - Operating Practices

Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).
- Isolate Secondary Systems (M847).

3.5.8 Substation Panel Operator (SPO)

Criteria 1 - Operating Practices

Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).
- Substation Awareness (M204).
- Teamwork in Switching.

3.5.9 Substation Switching Operator (S33)

Criteria 1 – Recipient Authorisation

- Hold current Recipient (SR) authorisation.

Criteria 2 – UG Competencies

- Satisfy all criteria required for the issue of Underground Switching Operator (USO) authorisation.

Criteria 3 - Operating Practices

Successfully complete the following training:

- Substation Switching Operator Theory (M848).
- Substation Operator Practical 11 – 33kV (M849).

Substation Switching Operator (S132)

Criteria 1 – S33 Competencies

- Satisfy all criteria required for the issue of Substation Switching Operator (S33) authorisation.

Criteria 2 - Operating Practices

Successfully complete the following:

- Substation Operator Practical Assessment – 110/132kV

3.5.10 Restricted Operator (XR)

Criteria 1 – Recipient Authorisation

- Hold current Recipient (SR) authorisation.

Criteria 2 - Operating Practices

- Undertake site/equipment specific training and be assessed as competent, applicable training to be determined by the Operating Standards Officer.

3.5.11 Outage Coordinator 11kV (A11)

Criteria 1 – Qualifications/Certifications

- Hold a current Queensland electrical workers licence or equivalent; or
- Hold a Degree, Diploma, Associate Diploma/Degree, or Certificate in Electrical Engineering.

Criteria 2 – Safety

Successfully complete the following training:

- Introduction to Electrical Safety Practices (M41).

Criteria 3 - ENERGEX & Distribution System Awareness

Successfully complete the following training:

- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).

Criteria 4 - Operating Practices

Successfully complete the following training:

- SAHV Procedures (M42).
- Interpret Protection Operations (NO10)
- 11kV Manual Switching Preparation (NO46).
- Write Switching Using DMS (NO35).
- Commissioning/Decommissioning Procedures (M47).
- Operate Delivery System Process (NO13).
- Manage Operational Support Computer Systems (NO14).
- Manage Storms (NO16).
- Operate Service Call Management System (NO38).

3.5.12 Outage Coordinator 11 - 33kV (A33)

Criteria 1 – A1 Authorisation

- Hold current Outage Coordinator 11kV (A11) authorisation.

Criteria 2 - Operating Practices

Successfully complete the following training:

- 33kV Switching (NO40).
- Manage Secondary Systems (NO23).
- Plan for Contingencies (NO24).
- Manage Network Risks (NO25).
- Use a Loadflow Program (NO26).

3.5.13 Outage Coordinator 11 - 132kV (A132)

Criteria 1 – A1 Authorisation

- Hold current Outage Coordinator 11- 33 kV (A33) authorisation.

Criteria 2 - Operating Practices

Successfully complete the following training:

- Write 110/132kV Switching (NO33).
- Distance Protection & Protection Signalling Systems (NO47).
- Work On Secondary Systems (NO22).

3.5.14 Switching Coordinator 11kV (C11)

Criteria 1 – A1 Authorisation

- Hold current Outage Coordinator 11 kV (A11) authorisation.

Criteria 2 - Operating Practices

Successfully complete the following training:

- Control 11kV Faults (M39).
- Manage Feeders, Transformers & Other Plant (NO17).
- Report Incidents & Faults (NO18).
- Manage 11kV Real Time Computer Systems (NO19).
- Manage Housekeeping Issues (NO20)
- Manage Alarms (NO21).
- Handle Customer Calls (NO41).

3.5.15 Switching Coordinator 11 – 33kV (C33)

Criteria 1 – A33 Authorisation

- Hold current Outage Coordinator 11 – 33kV (A33) authorisation.

Criteria 2 – C11 Authorisation

- Hold current Switching Coordinator 11kV (C11) authorisation.

Criteria 3 - Operating Practices

Successfully complete the following training:

- Manage Complex Network Faults – 33kV (N027).
- Manage Capacitors (NO29).
- Manage Under Frequency Emergencies (NO30).
- Manage Rotational Load Shedding (NO31).
- Manage POPS & VVR (NO32).

3.5.16 Switching Coordinator 11 – 132kV (C132)

Criteria 1 – A132 Authorisation

- Hold current Outage Coordinator 11 – 132kV (A132) authorisation.

Criteria 2 – C33 Authorisation

- Hold current Switching Coordinator 11 – 33kV (C33) authorisation.

Criteria 3 - Operating Practices

Successfully complete the following training:

- Manage Complex Network Faults – 110/132kV (N034).

3.5.17 Commissioning Coordinator (CC)

Criteria 1 - Qualifications

- Hold a current Queensland electrical workers licence or equivalent; or
- Hold a Degree, Diploma, Associate Diploma/Degree, or Certificate in Electrical Engineering.

Criteria 2 – Safety

Successfully complete the following training:

- Introduction to Electrical Safety Practices (M41).

Criteria 3 - ENERGEX & Distribution System Awareness

Successfully complete the following training:

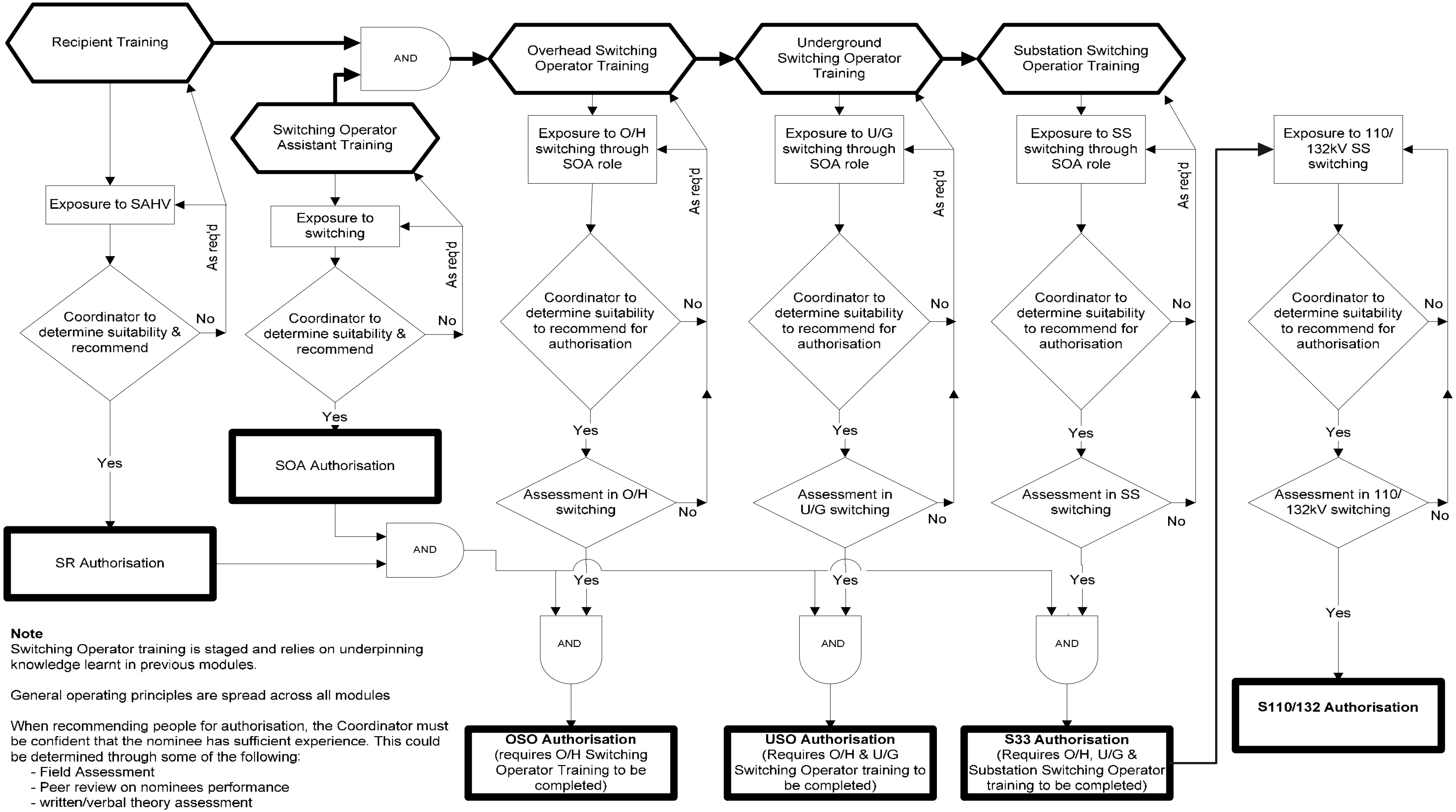
- Operating the ENERGEX Network – An Introduction (M841).
- Introduction to the Distribution Network (M842).

Criteria 4 - Operating Practices

Successfully complete the following training:

- SAHV Procedures (M42)
- Commissioning/Decommissioning Procedures (M47)

3.5.18 Switching Authorisation Flow Chart



Note
Switching Operator training is staged and relies on underpinning knowledge learnt in previous modules.

General operating principles are spread across all modules

When recommending people for authorisation, the Coordinator must be confident that the nominee has sufficient experience. This could be determined through some of the following:
- Field Assessment
- Peer review on nominees performance
- written/verbal theory assessment
- amount of exposure to equipment for authorisation

Prerequisites are strictly enforced for authorisations

Switching Authorisation Flow Chart

For ENERGEX employees

20 May 2005

3.6 Recognised Prior Learning/Skills

Applicants for new authorisations who consider that they have already successfully completed equivalent training (or have the necessary skills) may apply to the Operating Standards Officer for a full or partial exemption from the relevant criteria. Training completed not more than 12 months previously will generally be recognised.

Training completed more than 12 months prior to application will require a demonstration of skills/competency maintenance. The onus is on the applicant to provide sufficient evidence (for example a switching log) to satisfy the Operating Standards Officer. A competency assessment may be carried out.

3.7 Re-authorisation

3.7.1 General

Each person shall have carried out the duties of each of their roles. Specifically, persons within the three years (preferably at equal intervals) shall have, as a minimum performed duties as detailed in table 3.7.1.

All personnel shall submit a written statement, signed by their manager/department head. The statement shall verify that person is competent to be re-authorised and that practical experience equivalent to that listed in table 3.7.1 has been achieved. Form TS41 should be used for this purpose.

3.7.2 Examination

All personnel will be examined in SAHV/OPM theory before being reauthorised. A result of 90% or better shall be achieved before re-authorisation.

Authorisation	Practical Experience for Re-authorisation
SR, RR	Received five Access or Test permits for different jobs.
SOA	Assisted with five Switching Sheets.
ATO	Attended five Area Troubles.
SSC	Checked five Trip Isolation Sheets.
XR	As determined by the Network Operations Development Engineer
OSO, USO, SPO, S33, S132	Carried out five Switching Sheets of varying complexity, forward and reverse, for **any** of the authorisations held.
	Issued five Access/Test Permits (except SPO).
A11, A33, A132	Checked and authorised five Switching Sheets of varying complexity for **each** voltage for which they are authorised.
C11, C33, C132	Coordinated planned switching for five Switching Sheets of varying complexity for **each** voltage for which they are authorised
	Coordinated emergency switching on one occasion for **each** voltage for which they are authorised.
CC	Acted as the Commissioning Coordinator for five commissioning jobs

Table 3.7.1

A person being re-authorised as SR, OSO, USO, S33, A33 should have, during the three years:

- carried out five switching sheets
- issued five access or test Permits
- received five access or test permits for different jobs
- checked & authorised five 11kV switching sheets
- checked & authorised five 33kV switching sheets
- passed the SAHV/OPM theory examination

3.7.3 Practical Experience Not Achieved

If a person does not have the opportunity to comply with the requirements of section 3.6.1 during the three year period, then Operating Standards Officer will determine whether the person is re-assessed:

- for competence as for a new authorisation (section 3.4); or
- with supplementary testing (theory and/or practical).

3.7 Authorisation and the Authorisation Register

Requests for operational authorisation (form 2405NW) shall be forwarded to the Operating Standards Officer. Copies of all evidence gathered to satisfy the criteria for authorisation will be attached. The network operations development engineer will confirm that the requirements have been met, and then arrange for the update of the works authorisation management system (WAMS). All documentation received will be filed in a secure place for the duration of any authorisation.

ENERGEX HV Operating Symbols

ENERGEX HV operating symbols are explained in drawing 2170 A2, with each normally open paralleler indicated as a switch with a circle around it.

There are problems associated with using some parallelers, therefore, the actions to be taken before operating a paralleler are indicated in boxes adjacent to the paralleler on the operating diagram.

The following are possible:

A standard paralleler with no conditions.

SE	

SEF protection fitted to one or both feeders.

	X

<u>Minimum Delay</u>

The Switching Operator to call the switching coordinator before the next open item to check that one of the feeder CBs or PMRs has not tripped. This can happen as a result of large phase angle difference each side of the open point.

	2

<u>2 Unit Switching required</u>

A paralleler which requires 2 units during operation either due to a history of paralleling problems or because of an absence of a fast means of monitoring feeder operations.

To be used in conjunction with other codes such as “T”, “P”, “F” & “A” etc

	A

<u>After Hours</u>

Switching operations should be restricted to outside of normal hours when the loads are reduced for the following reasons:

- To minimise the load at risk
- Phase angle differences are minimised

The allowable switching times shall be determined according to the load characteristics of the network affected.

To be used in conjunction with other codes such as “T”, “X” or “2” etc

	T	Upstream transformer switching required A paralleler which requires upstream transformers to be switched prior to operation. The switching of transformers is required to keep fault levels to within plant limitations or to correct phase angle differences during paralleling. For fault level reduction transformers may be either deloaded (switched out) or just separated from the buses to be paralleled (split bus etc). This code **MUST** be used in conjunction with other codes such as “P” and “F”.
	V	Equalise voltage A paralleler close to the source substation, where the feeders either side are fed from different transformers which are not in parallel. These transformers tap-changer controller shall be made MANUAL and the bus voltages equalised, before the paralleler is closed.
	RG	Voltage Regulators in Circuit A paralleler where one or both of the associated feeders contains a voltage regulator.
C		Capacitors made non-auto
Z		Requires the zellweger(s) to be disabled under certain circumstances.
~		Requires generation to be taken off line (private or ENERGEX)
P		Large phase-angle difference each side of the paralleler. To be used in conjunction with the “T”, “A”, “2” or “X” codes.
F		High fault level issues during paralleling. To be used in conjunction with the “T” or “2” codes etc
*		Special paralleling requirements other than those listed above. e.g. Remove intertrips to customer CB or protection permits required.

DMS displays use a note instead of the codes shown above. The note is displayed by clicking on the paralleling box.

Operating Pin Code

The operating pin code applies to operating diagrams from LV to 132 kV.

These pins are used to indicate real-time status.

4.1.1 The Code

Pin Colour	Pin Indication	Pin Definition
Red	Closed	A normally open switch (paralleler) which has been closed.
Green	Open - Load Shift	A normally closed switch which has been opened to effect a load shift. Such a switch is, subject to routine checks, available for use at any time.
Green-D	Open with DNOB	Open with DNOB - Check Before Use, generally associated with a spare switch denoting end of commissioned network
Green-A	Open - Access Permit Involved (with DNOB)	An open switch which forms an isolation point for an Access / Test Permit. If placed on a rackable circuit breaker, means that the CB has been racked down and all associated bus / cable shutters have been locked.
Pink-B	Bridges Off	Bridges are broken/off for isolation
Light Blue	LV Tied In	A transformer with its LV area tied to adjacent transformers for the purpose of de-energising one transformer. All the transformers which are tied together are marked with blue pins. The one which is de-energised also carries an OPEN pin.
Light Blue-V	LV Tied In to Improve Voltage	A transformer with its LV area tied to one or more adjacent transformers for the purpose of boosting voltage. All the transformers which are tied together are marked with blue V pins.
Black	Not Electrically Connected	Apparatus which is Not Electrically Connected
Purple-OO	Out of Order	Apparatus which is out of order, usually a Hazardous Condition Warning Tag is also placed. Typically used to indicate faulty ABS's (perhaps in association with an OPEN pin).
Purple-~	ENERGEX Alternator	An ENERGEX mobile alternator connected to the system.
Yellow-Green E	Operator Earth	Operator Earths applied and removed as switching items in a switching sheet
Dark Blue-LL	Live Line or other non-access HV overhead work in progress	This is associated with work groups that do not require access to, but work in the vicinity of, HV overhead conductors.
White - Black X	Temporary Air Break Switch/Link	Indicates the position of a temporary air break switch/link (usually installed by live line). Use a small shipping tag or sticker for numbering the temporary switch. Note: *A temporary air break switch/link that remains installed for long periods (i.e. more than 3-4 weeks) should have a system alteration sketch issued.*
White - Square Shaped pin	Temporary Load Break Links Fitted with an Arc Chute Interrupter	Indicates the position of a temporary load break link fitted with an arc chute interrupter (usually installed by live line). Use a small shipping tag or sticker for numbering the temporary switch. Note: *A temporary load break link fitted with an arc chute interrupter that remains installed for long periods (i.e. more than 3-4 weeks) should have a system alteration sketch issued.*

Play Pin Code

The play pin code applies to operating panels and DMS from LV to 132 kV.

This code shall be used as part of the Outage Coordination process when writing and checking switching sheets.

All switching items within switching sheet must be pinned. A pin must be placed in the appropriate device and/or a representation of the device.

4.1.2 The Code

Pin Colour	Pin Indication	Pin Definition
Red	Closed	A normally open switch (paralleler) which has been closed.
Light Green	Open - Load Shift	A normally closed switch which has been opened to affect a load shift. Such a switch is, subject to routine checks, available for use at any time.
Dark Green	Open - Access Permit Involved (with DNOB)	An open switch which forms an isolation point for an Access / Test Permit.
Light Blue	LV Tied In and/or Disable Remote Control	A transformer with its LV area tied to adjacent transformers for the purpose of de-energising one transformer and/or remote control disabled for switching purposes.
Pink	Bridges Off and/or Phase Rotation Marked	Bridges are broken/off for isolation and/or phase rotation marked
Dark Blue	Auto Reclose Disabled for Live Line and/or Operating Requirements and Manual Trip Disabled for Earthing	Auto Reclose Disabled for Live Line works and/or operating requirement (e.g. restricted RMU) and Manual Trip disabled for the purpose of earthing, this may also include placement of an DNOB (e.g. Hitachi switchgear).
Purple	ENERGEX Alternator and/or SEF Disabled	An ENERGEX mobile alternator connected to the system and/or SEF disabled for paralleling
Yellow	Operator Earth	Operator Earths applied and removed as switching items in a switching sheet, and therefore, shall be pinned on the operating panel.
Orange	Capacitor Banks NAV and/or Regulators Parked	Capacitor bank/s made unavailable (NAV) and/or Regulators Parked for paralleling

5 Operational Audit/Assessment

5.1 Introduction

Audits shall be carried out in accordance with ENERGEX's audit procedure (BMS 499).

5.1.1 Purpose

The purpose of operational audits is to:
Ensure compliance with safety procedures
Ensure compliance to operating practices and procedures in ENERGEX
Identify improvement opportunities
Provide coaching opportunities

5.1.2 Scope

Operational audits apply to all personnel who hold ENERGEX operational authorisations.

Two types of audits will be carried out:

- paperwork audits
- field audits

These audits may be carried out in combination and or in conjunction with other level 3 safety audits.

5.2 Paperwork Audits

These audits examine the documentation used during the switching and isolation processes. Typically, switching sheets, access/test permits, authority to energise forms (including construction/test authorities), secondary systems works programmes and trip isolation sheets. Both field and control centre documentation will be audited.

Switching coordinators shall file all control centre documentation, switching operators shall return all field documentation to the relevant asset services location for filing.

The Operating Standards Officer* will regularly visit each asset services location and select random samples of documentation for audit.

These audits examine the competence levels of field based operators. Typically they would involve switching operators, recipients, and commissioning coordinators. They are used to ensure procedural compliance and may include coaching where warranted. *Note. A paperwork audit may be conducted at the same time.*

The Operating Standards Officer* will select a mixture of job types at random from the various asset services location for audit every month.

5.3 Sampling Rates

Sampling rates will be based on the level of non-conformance detected and will be revised on an annual basis (or earlier if warranted).

5.4 Actions Required on Audits

When an audit has been completed, the Operating Standards Officer* will discuss his findings with the work group. Non-conformances that have been actioned or require further action will be recorded on the audit form.

If further action is required to address non-conformance issues, the original of the form will be sent to the relevant work group manager. The work group manager will provide written advice to the Operating Standards Officer of action taken to rectify the area(s) of non-conformance.

Procedure 824 will be applied where breaches of electrical safety rules/procedures are detected by the audit.

**Note: The Operating Standards Officer may delegate auditing responsibilities to other suitably trained individuals.*

5.5 Retention of Documentation

All documentation shall be retained at the various asset services locations for at least six months. Documentation selected for audit shall be retained by the Operating Standards Officer for at least two years.

6 Fault Management

6.1 Wires down

6.1.1 Background

Fallen wires may be alive. Even if they are de-energised, it is possible that they may become inadvertently re-energised. There are documented incidents where fallen wires have been re-energised by:

- incorrect isolation being issued (incorrect records)
- incorrect isolation being carried out (wrong switch operated, incorrect labelling)
- insufficient isolation being carried out (backfeeds through LV, arcing horns being left in)

6.1.2 Policy

Fallen wires that are either on the ground, or hanging at a low height such that they may be contacted by persons or vehicles can pose a hazard.

Actions shall be taken to make safe all fallen wires.

Make safe means to cut clear, break bridges or isolate the fallen wire in such a manner that there is no possibility of the wire being inadvertently re-energised from any source of supply, thereby placing the safety of any person at risk of receiving electric shocks should they accidentally come in contact with that wire. In addition, the wire must be made safe in such a manner that it visually appears safe to untrained personnel (i.e. the public).

6.1.3 Procedure

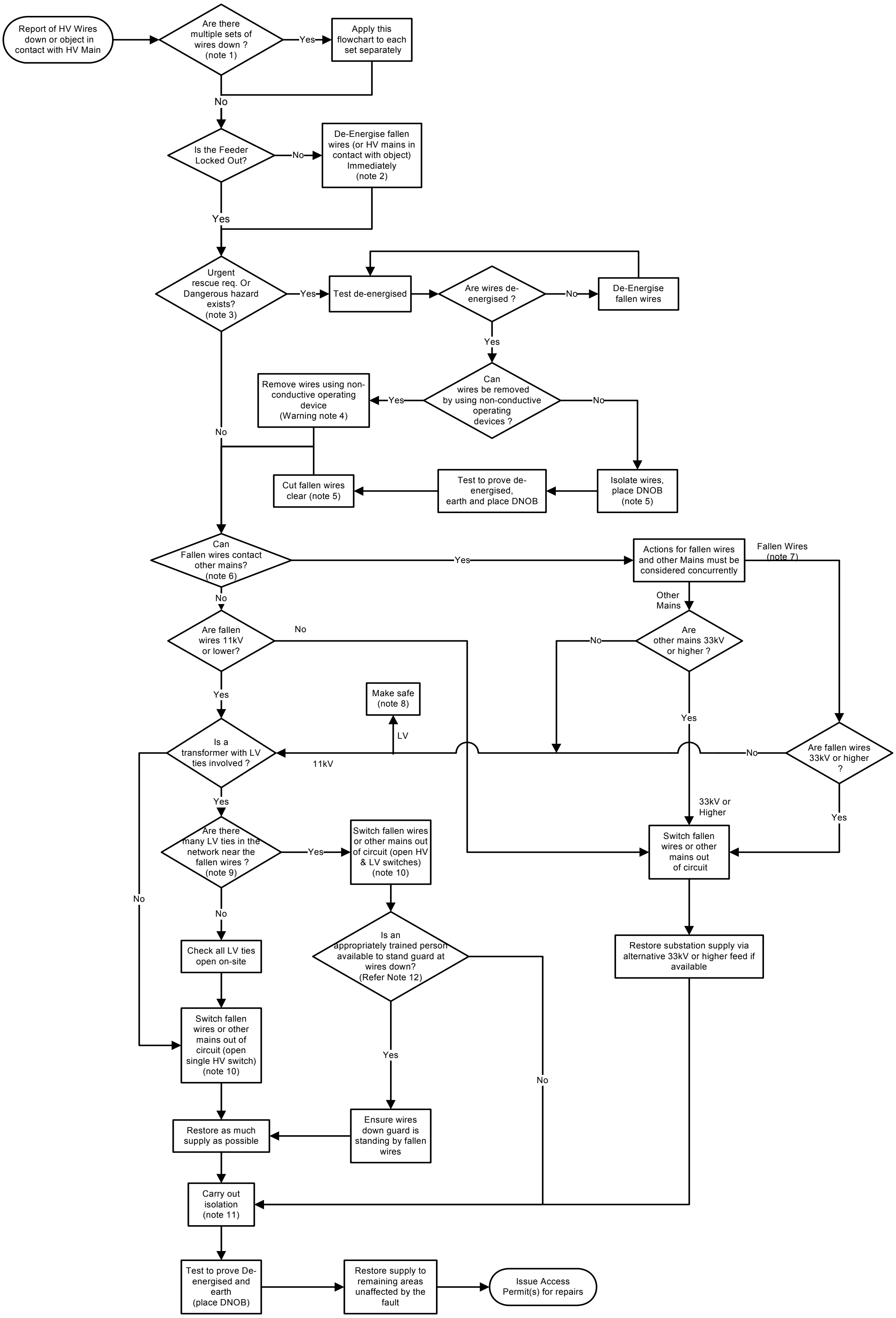
Following a report of wires down, checks shall be carried out to determine whether the wires are LV, HV, or some other type e.g. BBCC, TELSTRA.

If LV, then fallen wires should be made safe before supply is restored.

If HV, then the flowchart shown in figure 6.1.1 should be followed.

If "Other", take appropriate action to make safe, and contact the relevant authority.

Figure 6.1.1 Action Following Report of Wires Down or Object in Contact with Mains



Notes for Figure 6.1.1

1. No supply shall be restored until all sets of fallen wires on the feeder are considered.

2. The fallen wires should be de-energised as quickly as possible. If field switching is delayed, the feeder should be tripped remotely.

3. This applies to extreme emergency conditions where human life is at risk if rescue is delayed, e.g.. People are trapped in a crashed vehicle and urgent medical attention is required to save lives, or a dangerous hazard exists, e.g. Wires are down on a road and police/emergency services request immediate removal.

4. Exclusion zones shall be maintained at all times. The presence of other mains on site shall also be taken into account.

5. Ensure fallen wires are isolated by an approved isolation point.

6. Where possible, the presence of other mains should be determined by an on site visit. In situations where access is difficult, or protracted, and if accurate information is available, then system records may be used.

7. If the fallen wire is an overhead earth wire, then all wires in close proximity are to be treated as fallen wires.

8. For neutral mains on the ground the act of cutting clear requires the neutral network to be configured so that a path exists for a return via a ring system(s) to the source of supply (i.e. the distribution transformer neutral). If this can not be achieved then an LV tie is to be closed, thus ensuring continuity of the neutral conductor. If neither of these can be done, all supply past the fallen neutral wire needs to be isolated until the neutral conductor is made solid again.

9. Select the most efficient approach based on assessment of time required to check all LV ties open.

10. If an air break switch is used, the Switching Coordinator shall ask the Switching Operator to double check that all the arcing horns are clear.
    Verify that LV area where the HV wire is down will not be energised during restoration.

11. Ensure that DNOBs are placed on approved isolation points that have already been used in the switching.

12. In situations where extensive damage has been experienced, a forward scoper(s) may be utilised to determine the extent of damage.

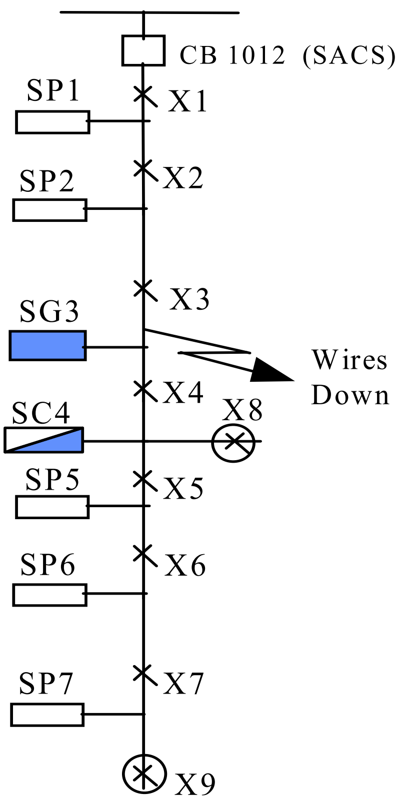
Prior to attempting any re-energisation, the Switching Coordinator shall determine the likelihood of the risk of electrical apparatus being energised

Consideration should be given to geographic locations where access is difficult or limited.

6.1.4 Examples of Application of Wires Down Procedure

<table>
<tr><th>EXAMPLE 1</th><th colspan="2"><u>TYPICAL SWITCHING</u></th></tr>
<tr><td></td><td><u>OPTION 1</u>
(GUARD AVAILABLE)</td><td><u>OPTION 2</u></td></tr>
<tr><td>

- 11 kV wires down at 1 location
- Feeder locked out
- Many LV ties involved
- 11 kV main in contact with LV mains supplied from SG3



</td><td>

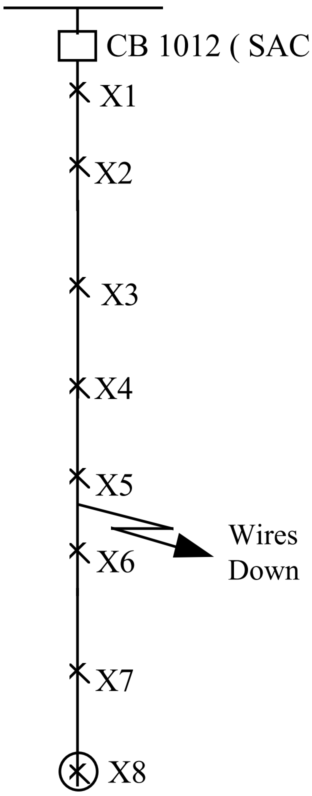
1. Open X3 & Place DNOB (confirm arcing horns clear)
2. Open X4 & Place DNOB (confirm arcing horns clear)
3. Open LV Switch SG3 & Place DNOB
4. Ensure affected LV mains are switched out of circuit
5. Whilst in communication with appropriately trained person guarding wires down site,
Close CB1012
6. Whilst in communication with appropriately trained person guarding wires down site,
Close X8
7. Test to Prove De-energised & Earth fallen wires & Place DNOB
8. Issue Access Permit

</td><td>

1. Open X3 & Place DNOB (confirm arcing horns clear)
2. Open X4 & Place DNOB (confirm arcing horns clear)
3. Open LV Switch SG3 & Place DNOB
4. Ensure affected LV mains are switched out of circuit
5. Test to Prove De-energised & Earth fallen wires & Place DNOB
6. Close CB1012
7. Close X8
8. Issue Access Permit

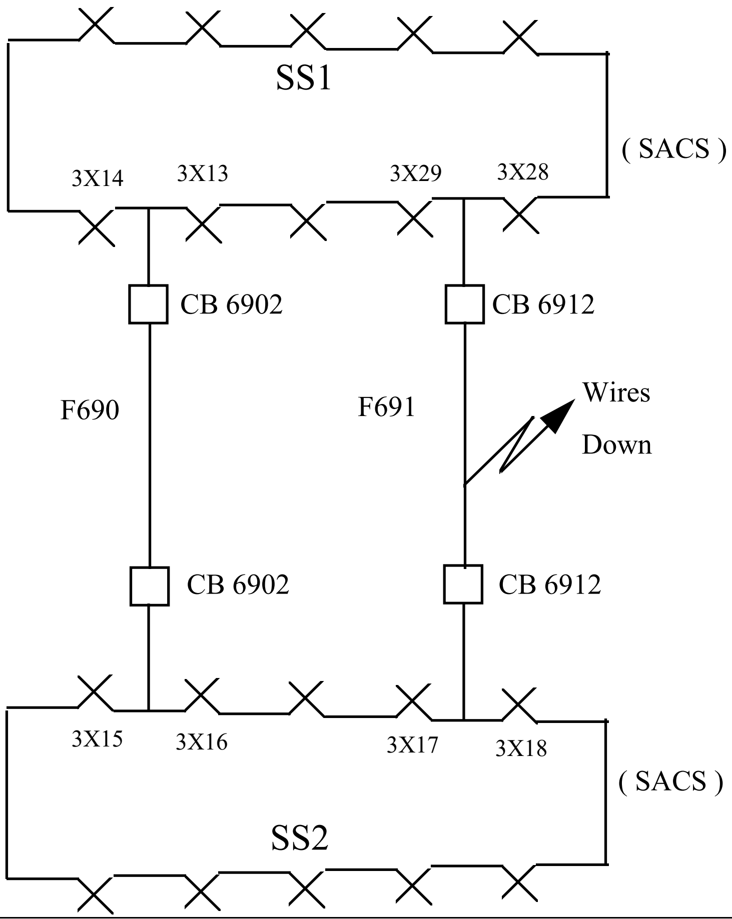
</td></tr>
</table>

Note: ***The above example also pertains to double cable box 11 kV CB's (dual 11 kV feeders for 1 CB). The wire down on the faulted feeder (leg.) must be attended to in one of the above manners prior to restoring supply to the healthy feeder (leg.).***

Example 2	**<u>Typical Switching</u>** *(Single HV Switch Isolation)*
• 11 kV wires down • Feeder Locked out • No other mains can contact the fallen wires • Many small transformers on the feeder • One LV tie exists between transformers on either side of X5 • No LV ties exist between transformers on either side of X6 	1. Check open on site LV tie across X5 and Place DNOB 2. Open X5 and Place DNOB 3. Confirm all arcing horns clear on X5 4. Close CB 1012 5. Check no LV ties exist across X6 6. Open X6 and Place DNOB 7. Confirm all arcing horns clear on X6 8. Close X8 9. Test to prove De-energised, Earth & Place DNOB on fallen wires 10. Issue Access Permit

<table>
<tr>
<th>EXAMPLE 3</th>
<th><u>TYPICAL SWITCHING</u>
(Total Loss of Substation Supply)</th>
</tr>
<tr>
<td>

- 33 kV wires down
- 2 x 33 kV feeders locked out
- Total loss of supply to SS2
- No other mains can contact the fallen wires
- F690 is healthy to restore



</td>
<td>

1. SS1 CB 6912 Check Open (via SCADA)
2. SS2 CB 6912 Check Open (via SCADA)
3. SS1 CB 6902 Close
4. SS2 CB 6902 Close
5. SS1 ABS 3X29 Open & Place DNOB
6. SS1 ABS 3X28 Open & Place DNOB
7. SS2 ABS 3X17 Open & Place DNOB
8. SS2 ABS 3X18 Open & Place DNOB
9. Test to prove De-energised, Earth & Place DNOB at SS1 or SS2 end of F691
10. Issue Access Permit

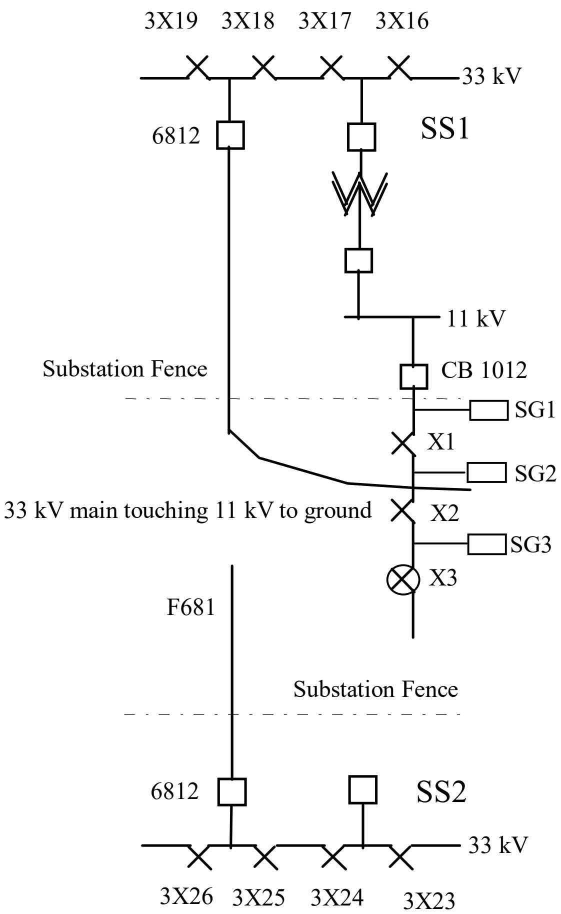
</td>
</tr>
</table>

EXAMPLE 4

TYPICAL SWITCHING

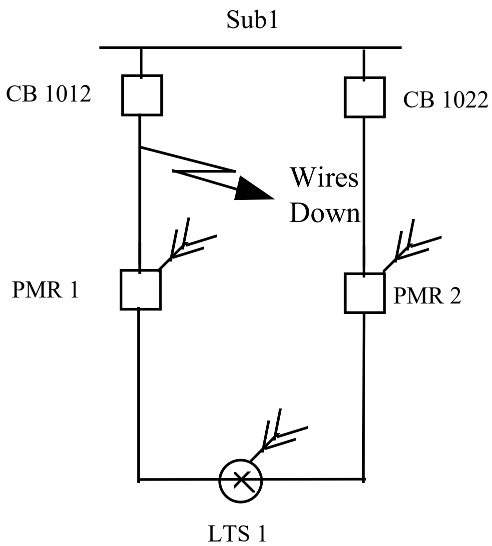
(GUARD AVAILABLE)

- 33 kV wire down touching 11 kV mains
- 33 kV feeder locked out
- 11 kV feeder locked out
- Many LV ties involved



1. SS1 CB6812 Check Open (via SCADA)
2. SS2 CB6812 Check Open (via SCADA)
3. SS1 CB1012 Check Open (via SCADA)
4. 11 kV ABS X1 Open Place DNOB (confirm arcing horns clear)
5. 11 kV ABS X2 Open Place DNOB (confirm arcing horns clear)
6. Open LV Switch SG2 & Place DNOB
7. Whilst in communication with appropriately trained person guarding wires down site,
   Close CB1012
8. Whilst in communication with appropriately trained person guarding wires down site,
   Close X3
9. SS1 33 kV ABS 3X19 Open Place DNOB
10. SS1 33 kV ABS 3X18 Open Place DNOB
11. SS2 33 kV ABS 3X26 Open Place DNOB
12. SS2 33 kV ABS 3X25 Open Place DNOB
13. Test to Prove De-energised, Earth, Place DNOB at SS1 and/or SS2 end(s) of F681
14. Test to Prove De-energised, Earth, Place DNOB 11 kV mains
15. Test to Prove De-energised, Earth, Place DNOB 33 kV mains
16. Issue Access Permit

Note: Items 4 through 8 & 9 through 12 inclusive can be carried out concurrently.

EXAMPLE 5	**<u>TYPICAL SWITCHING</u>** ***(DSA Scheme)***
• 11 kV wire down between CB 1012 and PMR1 • No ties across PMR1 • SCADA control of remote switches • Refer to Table 2.1 Section 2 Sheet 1 OPM for approved isolation points  	1. Check 11 kV CB 1012 Open (via SCADA) 2. Trip PMR 1 (via SCADA) 3. Confirm PMR1 Open (via SCADA) 4. Make PMR2 non-auto 5. Close LTS1 (via SCADA) 6. Make PMR2 auto 7. Carry out isolation for access to repair fallen main

~~6.2 Manual Reclosing of ENERGEX Feeders~~

~~Following the lockout of a HV protective device (e.g. feeder CB, PMR, etc) on a feeder, the risks involved in attempting a manual reclose shall be considered.~~

~~6.2.1 Initial Manual Reclose~~

~~6.2.1.1 Policy~~

~~Where the risks to people and plant are considered low, then one manual reclose is permitted.~~

~~6.2.1.2 Procedure~~

~~The flowchart shown in Figure 6.2.1 should be followed prior to the application of the initial manual reclose of a locked out protective device.~~

~~If a wire down is reported or found during the procedure, Section 6.1 - Wires Down procedure takes precedent.~~

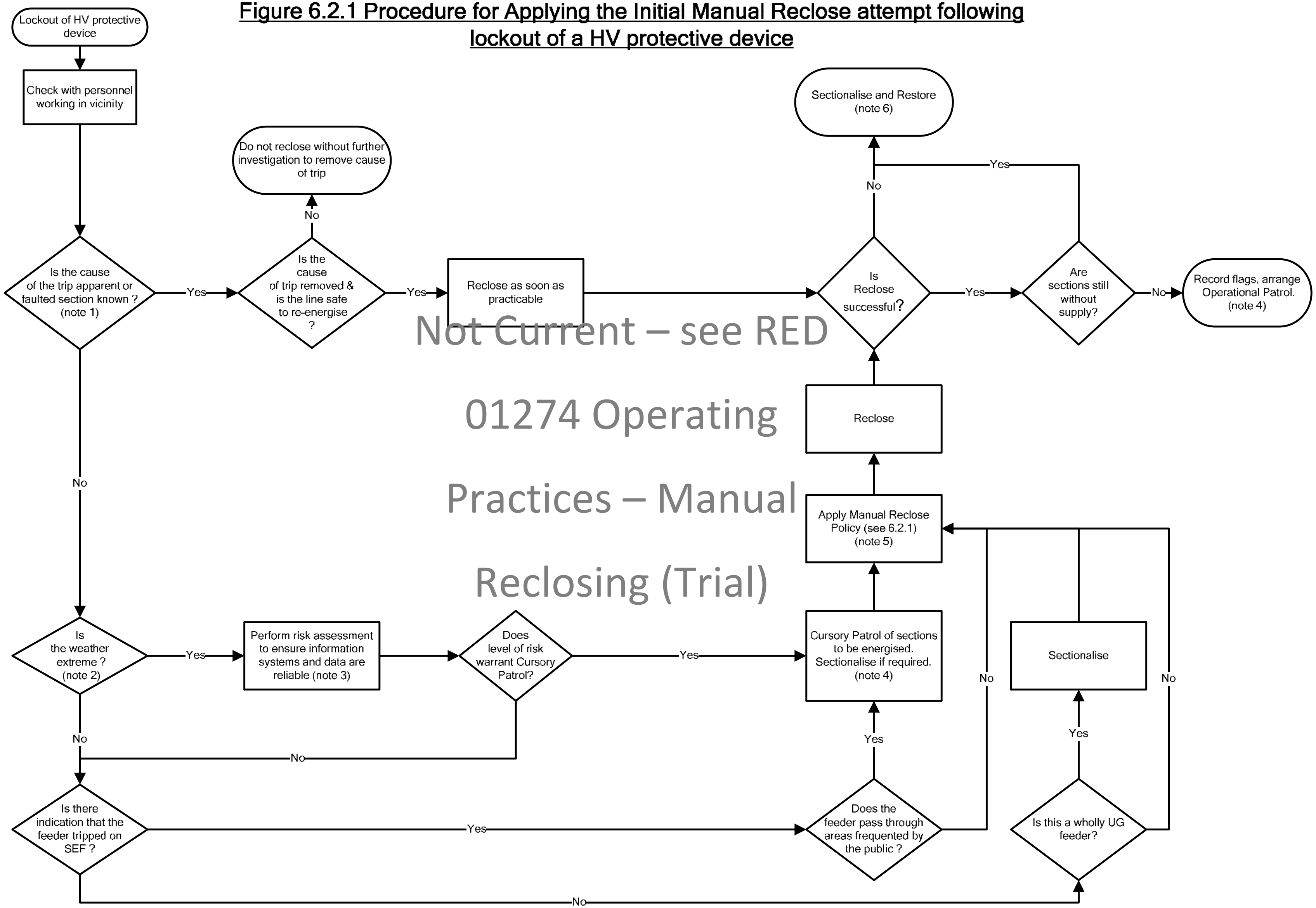
~~6.2.1.3 Manual Reclose Policy~~

~~Before attempting one manual reclose, the switching coordinator shall:~~

- ~~Check with staff responsible for receiving damage reports that no damage has been reported in the general area supplied by the feeder~~
- ~~Have Line Fault Indicators checked at appropriate locations where this does not cause more than a 15-minute delay~~
- ~~Ensure that all relay operations have been logged and relays reset (not required for CB's or reclosers under remote control)~~
- ~~Ensure that the auto-reclosing is disabled on any protective device that could reclose onto the section of the feeder being energised~~
- ~~Check that a minimum of 15 minutes has elapsed.~~
- ~~Advise all staff associated with the fault, that supply is about to be restored. If any work group involved, no manual reclose attempt shall be commenced until all members of the work group have confirmed that they are clear of the line to be energised.~~
- ~~If feasible*, advise major customers sensitive to supply disruptions regarding the pending reclose/fault location process.~~

~~*~~ ~~*During normal working hours, under non-urgent circumstances (i.e. not during storms or major emergencies).*~~

Figure 6.2.1 Procedure for Applying the Initial Manual Reclose attempt following lockout of a HV protective device



~~Notes for figure 6.2.1~~

1. ~~When the cause of the trip is apparent or faulted section known includes:~~
    - ~~an inadvertent trip by staff.~~
    - ~~a fault on mains observed by field staff.~~
    - ~~circulating currents caused by between zones switching.~~
      ~~(no Earth Fault protection indication present).~~
    - ~~protection indications (e.g. identifying a fault on one leg. of a double leg. 11kV CB)~~
    - ~~SCADA indications (e.g. status, analogs, event logs)~~
    - ~~line fault indicators~~

2. ~~Extreme weather conditions include:~~
    - ~~cyclone~~
    - ~~flood~~
    - ~~fire~~
    - ~~earthquake~~
    - ~~very severe storm with extensive damage. Typical indications include; many wires down within that substation area. The damage may be localised, or cover an extensive area.~~

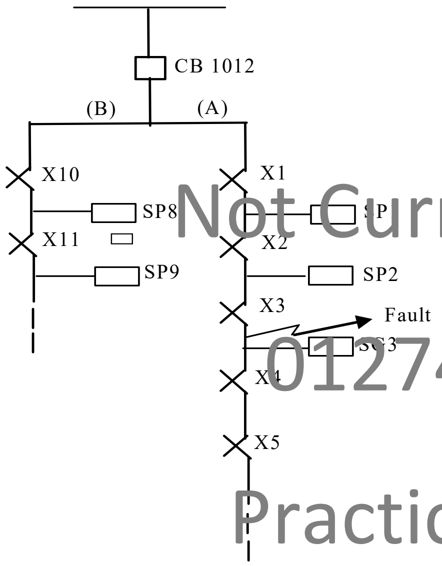
3. ~~Before attempting an initial manual reclose during extreme weather, a risk assessment shall be undertaken, including, but not limited to consideration of:~~
    - ~~Congestion in the wires down telephone queue.~~
    - ~~Number of active wires down in that substation area.~~
    - ~~Damage reports with no Network Attachment Points relevant to that area.~~
    - ~~Crew locations.~~
    - ~~Damage in the immediate vicinity of the feeder(s).~~
    - ~~Current weather conditions (e.g. if storm has travelled or is travelling through the area.)~~
    - ~~Time of day/visibility.~~

4. ~~Refer Section 0 and Section 6.4 for patrolling faulted feeders.~~

5. ~~For a wholly underground feeder, sectionalise prior to application of Manual Reclose policy.~~

6. ~~Following failure of an initial manual reclose, refer section 6.2.2 and figure 6.2.2.~~

~~6.2.1.4 Examples of Application of Manual Reclose Policy~~

~~EXAMPLE 1~~	~~TYPICAL SWITCHING~~ ***~~(Double Cable Box 11kV CB)~~***
• ~~No wires down~~ • ~~Feeder locked out~~ • ~~Faulted feeder (leg. A) apparent through SCADA indications, public or other~~ • ~~Many LV ties involved~~ 	~~1. Open X1 (Switch out faulted feeder - leg. A)~~ ~~2. Close CB 1012 (restore supply to healthy feeder – leg. B)~~ ~~3. Transfer healthy feeder (leg. B) to adjacent feeders~~ ~~4. Sectionalise faulted feeder (leg. A) using CB 1012~~

6.2.2 Sectionalising and Progressive Restoration

6.2.2.1 Policy

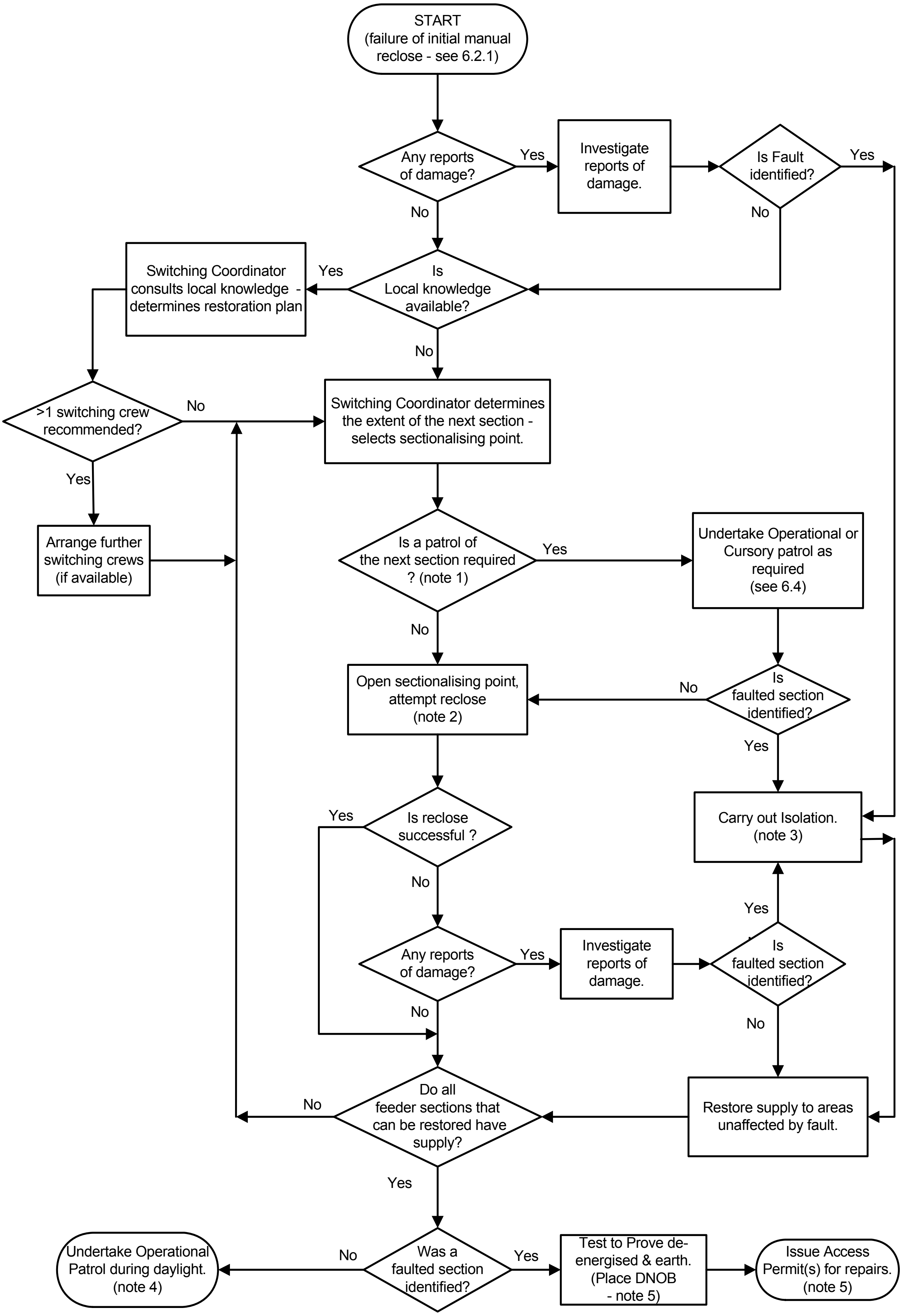
Following the failure of an initial manual reclose, in the absence of specific instructions, sectionalising is undertaken by dividing the original line section approximately in half. The process is repeated until the fault is found, or until the switching coordinator deems the section appropriate to apply a detailed patrol.

6.2.2.2 Procedure

The flowchart shown in Figure 6.2.2 should be followed for restoring supply to a HV feeder following failure of an initial manual reclose (Section 6.2.1). This process applies to lockouts of all protective devices including CB's, PMRs and MDOs. It defines the process for progressive restoration of supply by sectionalising. Faults are located through a process of eliminating non-faulted sections. Supply is restored to non-faulted sections as they are established.

Note: If a wire down is reported or found during the procedure, Section 6.1 - Wires Down procedure takes precedent.

Figure 6.2.2 Sectionalising and Progressive Restoration



Notes for figure 6.2.2

1. A cursory Patrol should be undertaken of all underground feeder sections, or if SEF protection has operated.

   With underground feeders, the purpose of this patrol is to quickly inspect underground cable terminations, and to identify sites where cable or equipment damage may have occurred.

   Where SEF protection has operated, the purpose of this patrol is to check for wires down & to identify safety hazards in areas frequented by the public.

2. For manual reclose of MDOs refer section 6.5.

3. Test to Prove de-energised (place DNOB) and the issue of an Access Permit does not have to be undertaken immediately following isolation. Repair should be commenced after supply is restored to all customers unaffected by the fault.

4. Record and reset all protection indications. If applicable, advise major customers supply is returned to normal.

5. If not already undertaken.

6.2.3 Local Knowledge

For feeders in which a special approach is required for the supply restoration process to be undertaken efficiently, the 'local knowledge' system can be used for reference. In some, typically rural situations, neglecting the geography and electrical layout of the feeder may result in the outage being unnecessarily protracted.

6.2.4 Checking for Three Healthy Phases - meshed supply systems

A check for three healthy phases shall be done when restoring supply to an overhead feeder that forms part of an interconnected supply system to identify the presence of a bridge off condition.

6.3 Area Troubles

6.3.1 Introduction

6.3.1.1 Objective

The objective of these procedures is to ensure the safety of all persons who are required to attend area troubles. Some of the hazards that are present when restoring supply to an area trouble are:

- expulsions from dropouts blowing
- surge diverter shattering explosively
- transformers rupturing with a fireball or boiling oil
- broken/burnt off dropper leads or faulty dropout bases/carriers

ENERGEX's Network Operating Philosophy is:

1. SAFETY OF PEOPLE

2. PROTECT PLANT FROM DAMAGE

3. RESTORATION OF SUPPLY

6.3.1.2 Scope

These procedures shall apply to all ENERGEX personnel and contractors.

6.3.1.3 Policy

Before re-energising plant, the switching operator must be satisfied that it is safe to do so. In particular, distribution transformers and surge diverters that are suspected to be faulty **shall not** be re-energised while the Switching Operator is in close proximity to them.

6.3.1.4 Symptoms and System Status

Transformer	Symptoms	Network Status
Single Phase	No Supply	HV Bridge(s) off to Transformer
		HV Fuse(s) Open
		LV Fuse Blown
		LV Bridge Off
	Dim Lights	Neutral Bridge Off or Faulty Fuse Base / Cartridge
Three Phase	No Supply	HV Bridge(s) off to Transformer
		Two or Three HV Fuses Open
		LV Fuse Blown
		LV Bridge Off
	Dim Lights	HV Bridge off to Transformer
		One HV Fuse Open
		Neutral Bridge Off or Faulty Fuse Base / Cartridge

Table 6.3.1 - Symptoms and System Status

6.3.1.5 Procedures

1. Determine the status of the network - e.g. bridge off, drop-out fuse blown
2. Determine the cause of the problem - e.g. tree in LV, wildlife on pole
3. Isolate, and if exclusion zones are to be encroached, test to prove de-energised and earth
4. Remove the cause of the problem
5. Restore supply if possible
6. Repair/replace faulty lines and apparatus if required
7. Restore network to normal status

6.3.2 Blown Dropout Fuse(s) to a Pole Transformer

In the case of area troubles involving blown drop-out fuses to a pole transformer, the flow chart in Figure 6.3.2 should be followed.

6.3.3 Blown Dropout Fuse(s) to a Ground Transformer

In the case of area troubles involving blown drop-out fuses to a ground transformer, the flow chart in Figure 6.3.3 should be followed.

6.3.4 Blown Switch Fuse(s) on a Ring Main Unit

In the case of area troubles involving blown drop-out fuses on a ring main unit, the flow chart in Figure 6.3.4 should be followed.

Figure 6.3.2 Procedure - Blown Dropout Fuse(s) on a Pole Transformer

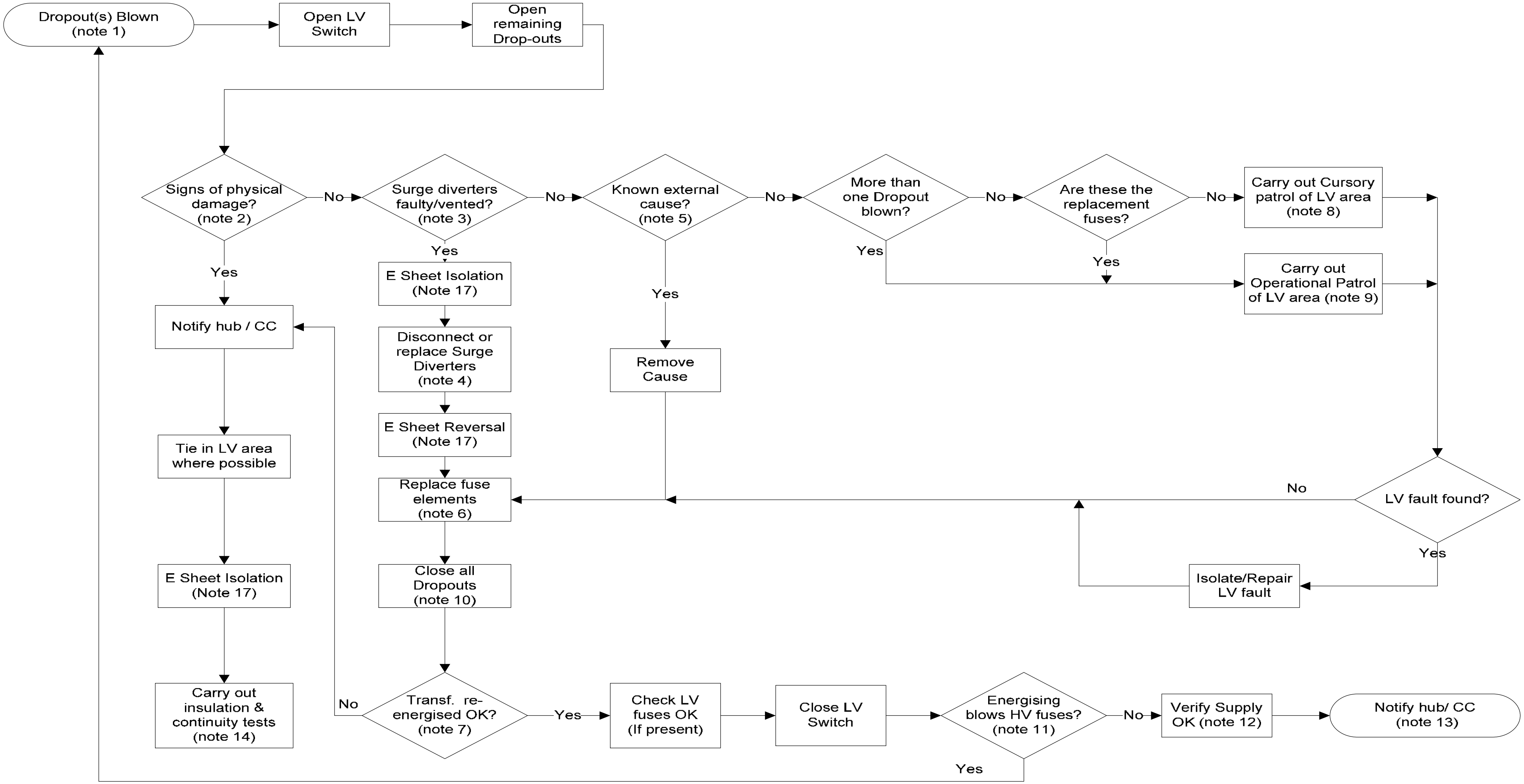


Figure 6.3.3 Procedure - Blown Dropout Fuse(s) on a Ground Transformer

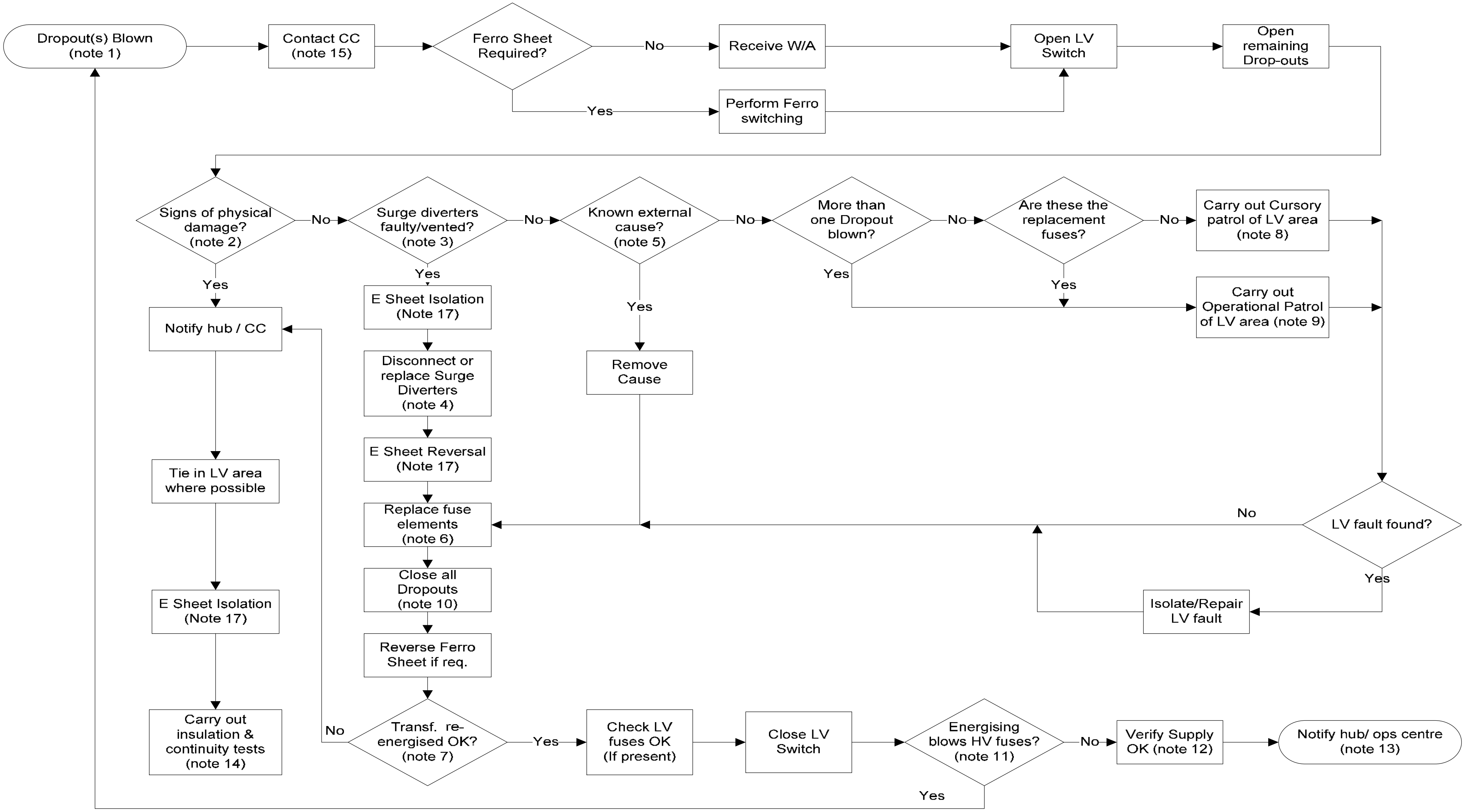
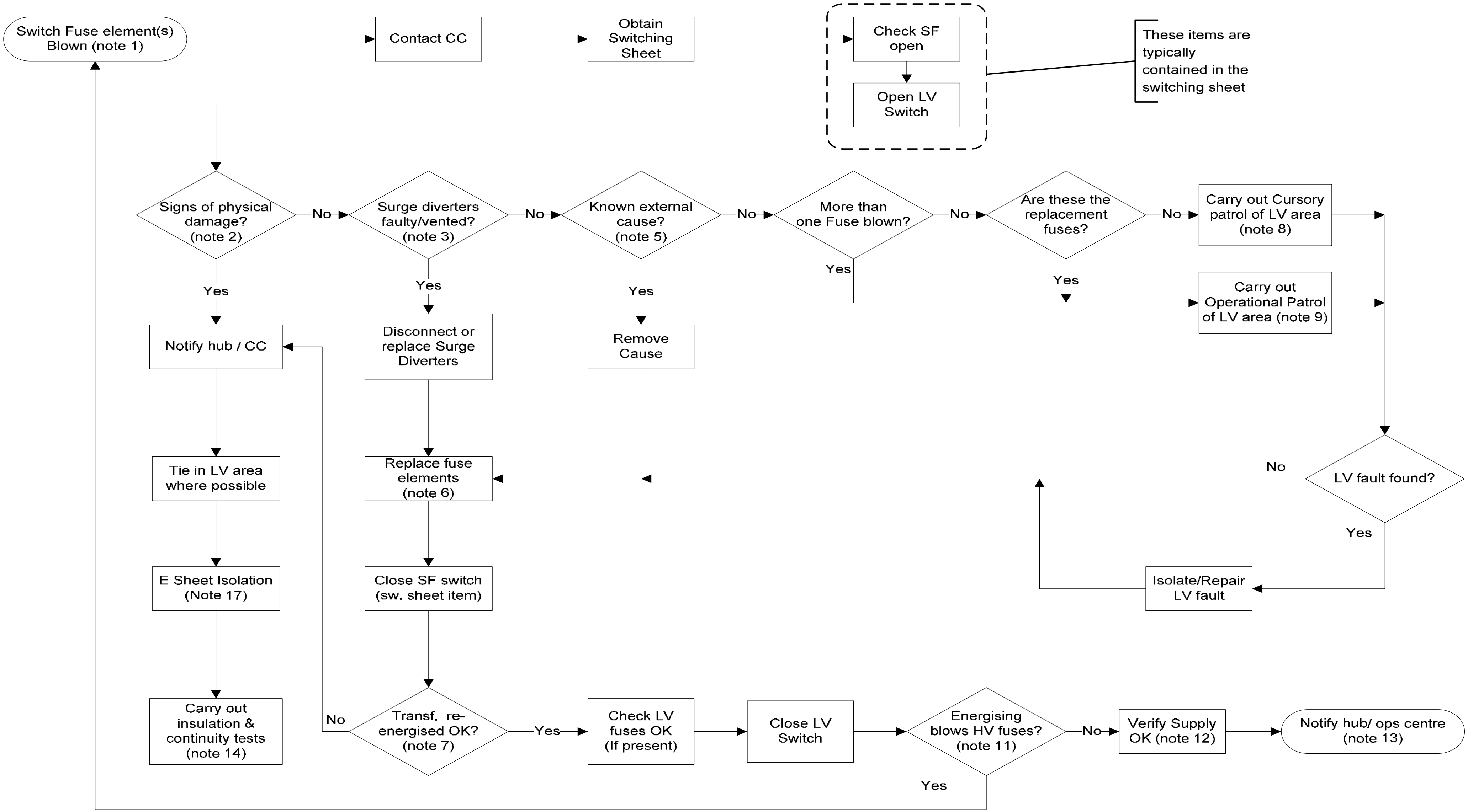


Figure 6.3.4 Procedure - Blown Fuse(s) on an RMU Switch Fuse Unit



Notes for figure 6.3.2 / 6.3.3 / 6.3.4

1. Blown Drop-out Fuses / Switch Fuses
   In some instances, High Voltage fuses can blow but the carrier may not drop or the Switch Fuse may not trip. In these circumstances a check of LV voltages will reveal an unbalance caused by the drop-out fuse / switch fuse being open-circuit. The blown phase(s) should be recorded.

2. Physical Signs of a Faulty Transformer include:
   - tank abnormally hot or deformed
   - evidence of recent oil spillage (especially black)
   - strange noises from the transformer

3. Checking for faulty Surge Diverters
   Applies to HV surge diverters that are mounted below the drop-out fuses, and to LV surge diverters that are attached to LV terminals. (Note: On feeders with limited fault current, visible damage may not be evident.)

   If HV exclusion zones are to be encroached for a close inspection for the disconnection or replacement of surge diverters, then SAHV Procedures shall be followed and an Access Permit obtained.

4. HV Surge Diverter Replacement
   - Vented - In general, it is sufficient to replace only the failed surge diverter.
   - Non-vented - All non-vented surge diverters in the set shall be replaced with vented types. Replace 10 kV in coastal areas with 12 kV surge diverters.

   (If a Live Line crew is to replace the surge diverter(s) at a later time, the surge diverters should be disconnected rather than cut clear for ease of replacement).

5. External Cause of Fault Known
   A high percentage of faults are caused by wildlife and vegetation. Inspection around the pole base (SP) as well as the terminals and mains of the transformer is advised. Information about the fault can often be obtained by looking up and down for the obvious (e.g. dead animals). Other possible causes of faults are from broken/burnt off dropper leads, faulty dropout bases and carriers, or when higher voltage mains come in contact with the 11 kV mains.

   If HV exclusion zones are encroached for removal of wildlife, vegetation or repairs then SAHV procedures shall be followed and an Access Permit obtained.

6. Fuse Replacement
   The drop-out fuse elements (or in the case of an RMU - switch fuses) on all phases should be replaced, as even those that did not blow could be deteriorated due to through fault current. All elements shall be checked to ensure they are correctly rated.

7. Transformer Re-energised
   After the transformer is re-energised, the switching operator should wait at least two minutes to confirm that the transformer is healthy.

8. Cursory Patrol
   The purpose of a cursory patrol is to conduct a quick inspection to identify unsafe situations, obvious faults and abnormalities such as wildlife, vegetation, plant failures, wires down …etc in the accessible area after a feeder lockout or operation.

9. Operational Patrol

The purpose of an operational patrol is to determine the location and nature of a fault. The patrols encompass areas identified as possibly being where the initiating event occurred. This can be based on protection indications, reports or based on local knowledge. Extensive efforts should be given to operational patrols to ensure that the fault cause is found.

10. Closing Drop-out Fuses
Personal protection equipment shall be used when operating drop-out fuses as per ENERGEX's Safety Management System.

    Close all drop-outs by hooking the link stick behind the eye of the carrier. Line up the stick for the closing, ensure face shield is correctly fitted, and close smartly.

    The drop-out fuses should not be closed with the hook of the stick in the eye of the drop-out. Since the natural reaction when the drop-out fuses blow is to pull the stick away, therefore leaving the hook of the stick in the eye of the drop-out will mean opening the drop-out under fault, which may cause a flashover and a hazardous situation.

    If a transformer starts to make strange noises after the drop-outs are closed, do not attempt to re-open the drop-outs as you could be breaking fault current, which may cause a flashover.

11. Closing LV Switch
If upon closing the LV switch, the drop-out fuse(s) / switch fuse(s) blow, then the cause is most likely to be a fault in the LV area.

12. Verify Supply OK
Check all voltages and loads are within acceptable limits. When this is not possible, check surrounding premises to verify that all supply has been restored.

13. Notification
When supply restored, the following information shall be recorded and should be reported to the Hub or Control Centre when convenient:
    - cause and location of fault
    - damage and action taken
    - further action required
    - load current (tong) and LV voltage readings
    - read and reset the MDIs (if fitted)
    - time supply restored

14. Insulation and Continuity Tests
Figures outside the following ranges indicate that the transformer may be faulty. Instrumentation must be within calibration.

Distribution Transformer Rating in kVA	Winding Resistance (Ω)		Insulation Resistance (MΩ)	
	L.V. Ø-N	H.V. Ø-Ø	L.V.Ø-E @ 500 V	H.V.Ø-E @ 1000 V
10 – 1500	1 or less	200 or less	100 or greater	1000 or greater

Table 6.3.5 - Typical Insulation & Continuity Measurements

Insulation resistance is subject to wide variation due to design, temperature, humidity and cleanliness. Where insulation resistance falls below prescribed values, it can (where no defect exists) be brought up to the required standard by cleaning and drying the insulation.

The continuity measurement is performed to ensure that neither the HV nor LV circuit is open circuit. The circuit resistance is subject to wide variation due to rating, design, temperature and tap position (HV only). The following notes may be of assistance:

T-T (Tee Tee) Winding Configuration in 3 phase distribution transformers with ratings of 25/50/63 kVA may have the continuity measurements vary between each phase, due to their unique design.

DY (Delta Star) Winding Configuration continuity measurements on the LV winding are straight forward being either open circuit or as in the table above. Continuity measurements on the HV are normally the same between phases. An open circuit may also be characterised by one measurement being approximately twice that of the other two measurements.

15. E Sheet Isolation of a Ground Transformer (GT)
    The Switching Coordinator shall produce a switching sheet. It may be necessary – due to potential ferroresonance - to isolate the Ground Transformer using a 3 phase switch or switches upstream of the GT before the LV switch is opened. In this case the line should be proved de-energised before opening the LV switch.

    Rationale
    Energex has decided that the risk in operating single phase switches should be managed where there is a risk of ferroresonance causing injury to staff or plant. Field staff may be unaware of the specific conditions permitting ferroresonance. Network Operations maintains a record of sites where this could be an issue and have readily at hand the data to perform calculations confirming the presence or otherwise of a potential ferroresonant condition. On this basis it has been decided that approval from a Switching Coordinator shall be obtained before operating any EDOs associated with a GT. As the matter is a safety issue, a switching sheet provides an auditable record of authority being given to field staff to safely work on the apparatus. When there is no risk of ferroresonance, the switching sheet need only give authority to change the blown EDO.

16. E Sheet Isolation Ring Main Unit (RMU)
    The Switching Coordinator shall produce a switching sheet. Access to the switch fuses in an RMU requires the operation of a named HV switch (i.e. SFXXXX) and as such shall be recorded on a switching sheet. Depending on the construction of the RMU the sheet may include earthing the Switch Fuse.

17. If isolation is already complete via a switching sheet the fuse elements can be replaced as per next box in flow chart. If a switching sheet has been reversed and fuse elements are blown, before replacing the fuse elements the Switching Operator shall call control to complete isolation again via a switching sheet.

6.4 Patrolling Faulted Feeders

Policy

Following a fault on the power system, a patrol of the affected network is required to identify the root cause and any damage that may have been incurred to the network. These patrols are defined as either cursory or operational (refer section 0 - definitions), and entail a visual inspection of the network to locate primary (initiating) and secondary faults.

This procedure does not cover maintenance patrols that check the general condition and structural integrity of the network.

Background
Transient faults tend to result in operations of protective devices - with supply fully restored following reclose. Patrols undertaken at the next (daylight) opportunity following an operation of a protective device are important for determining the requirement for follow-up action, but are less critical in terms of their direct impact on customers supply.

Sustained faults (e.g. a "locked out" feeder protective device) require some degree of manual intervention to isolate the fault and enable supply to be restored. For this reason feeder patrolling procedures applied to a ‘locked out’ feeder protective device have a great impact on supply availability, and need to be executed promptly and effectively.

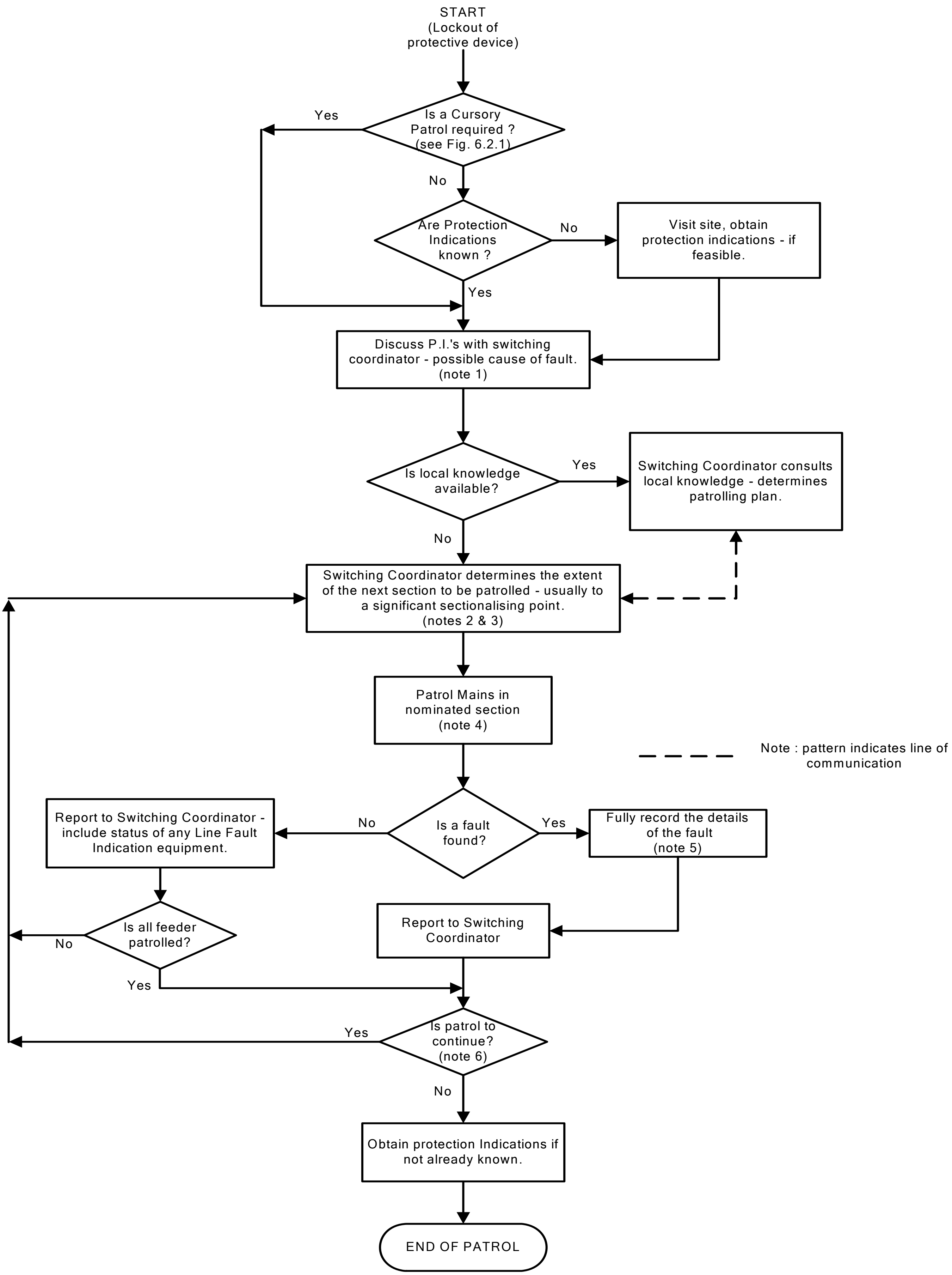
If the feeder protective device is ‘locked-out’, the Switching Coordinator should investigate reports of damage, and/or patrol in conjunction with a plan for restoration. The Switching Coordinator shall indicate where and when the patrol is to commence, and at what point during the patrol next contact should be made with him. Regular contact between the Patrol Officer and the Switching Coordinator is essential in efficient patrolling.

Note: The most important rule of patrolling feeders following fault is that the patrol is to be undertaken strictly in accordance with the Switching Coordinators instructions.

6.4.1 Patrol Procedures Following the Lockout of a Protective Device
The flowchart shown in Figure 6.4.1 should be followed when undertaking patrols following the lockout of a protective device.

6.4.2 Patrol Procedures Following the Operation of a Protective Device
The flowchart shown in Figure 6.4.2 should be followed when undertaking patrols following the operation of a protective device.

Figure 6.4.1 Feeder Lockout Patrol Procedure



Notes for Figure 6.4.1

1. For a summary of protection indications and associated fault causes refer Section 6.6.

2. The Switching Coordinator outlines the full extent of the required patrol, including tee-offs, etc. Ideally the description should be geographically rather than schematically based.

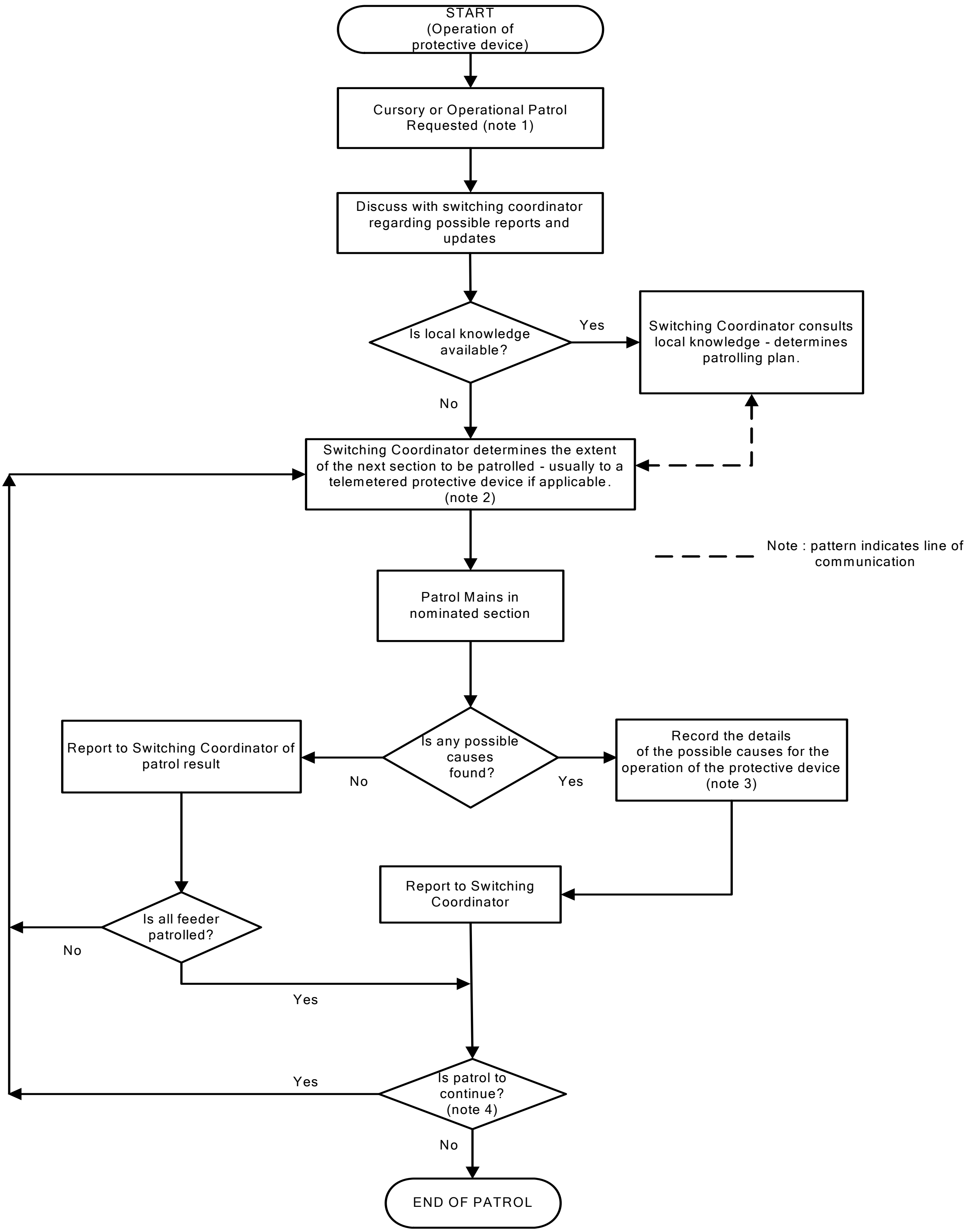
3. The Switching Coordinator may opt at this point to open a sectionalising point and re-energise supply in the patrolled section.

4. Cursory or operational patrol as appropriate.

5. The patrol officer shall record:
    - the location of the fault
    - the nearest isolation points
    - a concise damage report
    - an assessment of likely repair time

6. The Switching Coordinator will decide if more patrolling is further required on the feeder.

<u>Figure 6.4.2 Feeder Operation Patrol Procedure</u>



Notes for Figure 6.4.2

1. The Switching Coordinator will decide on the type of patrol required depending on the number of recurrent operations on the protective device.

2. The Switching Coordinator outlines the full extent of the required patrol, including tee-offs, etc. Ideally the description should be geographically rather than schematically based.

3. The patrol crew shall record:
    - the location where the transient fault initially occurred
    - the possible cause leading to the transient fault e.g trees on mains, lighting…etc
    - the extent of the damage (if any)

4. The Switching Coordinator will decide if more patrolling is further required on the feeder.

6.4.3 General

Patrols can be undertaken by one or more patrol officers in either the same or separate vehicles subject to environmental conditions, geography, access and traffic. They will typically be undertaken by two persons operating from the one vehicle. This both maintains road safety and allows the passenger to completely focus on examining the overhead mains and looking for the cause of the fault. This is particularly important after dark when the person inspecting the mains will be required to hold a spotlight. The minimum requirements for a patrol officer are knowledge of overhead and/or underground distribution network construction.

Timeliness of patrol officer's response is essential. If customers are without supply, a degree of urgency should be applied in the execution of the patrol. Regular contact with the Switching Coordinator maintains the currency of the patrolling instructions.

One important issue that the Switching Coordinator shall consider is that of primary (initiating) and secondary faults. In the case that the initiating fault was between phases, and high fault currents are involved, the through current can disturb the source network and create secondary faults. For example, the forces generated between conductors of the affected phases on the supply side of the fault can cause sufficient movement causing the conductors to make contact - this is the "clashing conductors" phenomena. Another example is a conductor joint failing due to the extra heat produced by the through current, resulting in the main falling down. The Switching Coordinator should not jump to conclusions, and maintain awareness of whether the identified fault is a primary or secondary fault.

6.4.4 Operational Patrols

The purpose of an operational patrol is to determine the location and nature of a fault. The patrols encompass areas identified as possibly being where the initiating event occurred. This can be based on protection indications, reports or based on local knowledge. Extensive efforts should be given to operational patrols to ensure that the fault cause is found.

From the protection indications and the circumstances, the nature of the fault can be inferred, and provide insight to the type of fault expected. For example, an SEF trip may be indicative of a high impedance ground fault, typically caused by conductors down on the road, or trees in the mains.

6.4.5 Cursory Patrols

The purpose of a cursory patrol is to conduct a quick inspection to identify unsafe situations, obvious faults and abnormalities such as wildlife, vegetation, plant failures, wires down…etc in the accessible areas after a feeder lockout or operation.

6.4.6 Patrolling 11 kV Feeders following Lockouts

Undertaking operational patrols of 11 kV overhead feeders requires considerable concentration from both the Patrol Officer and the Switching Coordinator due to the extent and complexity of the network. Apart from looking for the actual fault, the patrol officer must closely follow the connectivity of the feeder. A lack of concentration can lead to the wrong circuit being patrolled, or tee offs from the main circuit being overlooked. As 11 kV lockouts generally involve loss of supply to customers, the patrol officers must focus on promptly completing the current task assigned by the Switching Coordinator, and not be distracted by spurious 'reports' provided by residents.

6.4.7 Patrolling 33 kV Feeders following Lockouts

As 33 kV feeders are relatively simple in terms of their connectivity (usually being point to point without intermediate isolation points), the associated patrol process is simplified. 33 kV feeders often form part of a meshed network, and as a consequence have protection that requires more skill to interpret.

In the absence of specific reports, the patrol should commence from one substation and continue to the next substation or until the fault is located. As loss of one 33 kV feeder does not usually involve loss of supply, the urgency that is a requirement with lockouts of 11 kV protective devices is not present.

6.4.8 Urban and Rural feeders

Feeder Type	Route Length	Access	(SPECIAL) Considerations
11 kV Urban	< 10 km	Primarily street access	Proximity of other circuits and distribution equipment, LV ties, surge arresters, many UG cable terminations
33 kV Urban			OHEW Proximity of other circuits
11 kV Rural	> 10 km	Considerable percentage of feeder through private property.	LFI's, Reclosers, Sectionalisers, Regulators, MDO's
33 kV Rural			OHEW, LFI's, Reclosers

Table 6.4.8 - General Attributes of Urban and Rural Feeders

Rural feeders are typically radial, overhead and less complex electrically, but are considerably longer and often have more constraints associated with access when compared to urban feeders. They often have downstream protection devices or fault indication equipment positioned at critical locations along the feeder route. The status of this equipment should be considered when undertaking feeder patrol/restoration. Any relevant local knowledge should be employed.

Cursory patrols of feeder sections are typically less frequent and not as extensive in rural areas, when compared to urban areas. Fault initiation is typically related to storms, wildlife and trees and is often obvious.

Urban feeders can be part of a radial or meshed network, overhead and underground and typically more complex electrically. They are much shorter in length, and protection systems may be more complex. Access is typically easier.
Cursory patrols of feeder sections are typically required. Fault initiation is more diverse, and can be harder to identify.

6.4.9 Patrol Following Operation of Protective Device

These guidelines shall be followed when undertaking operational patrols following the successful automatic reclose of a feeder protective device.

The purpose of these patrols is to identify the possible initiating event for the operation, and any damage that may have resulted. These patrols are important as they present the opportunity to correct potential faults before they impact on connected customers. The following guidelines optimise the value of patrols for the majority of situations. Some judgement will still apply for situations not covered by the guidelines.

110/132 kV Feeders
In all circumstances, an operational patrol is required immediately or in the next daylight hours.

33 kV Feeders
If a storm and/or high wind (>30 knots) is present, no patrol is required. In cases where the operation of the 33 kV protective device will not result in a loss of supply, an operational patrol is required within three working days. If the operation of the 33 kV protective device will result in a loss of supply then an operational patrol is required immediately.

11 kV Feeders
If a storm and/or high wind (>30 knots) is present, no patrol is required. In all other cases, refer to table 6.4.9.1 and table 6.4.9.2 to determine the type of patrol required.

Notes:

1. *If a report is received from the public (e.g. explosion), then a check is required immediately on the feeder in the vicinity of the report. If nothing is found, follow the above criteria to determine if a full Operational Patrol is required.*

2. *Immediate patrols can be requested under the direction of the Switching Coordinator*

3. *In normal business hours, the Switching Coordinator should consult with the Asset Reliability Officers to obtain local knowledge that may assist in the patrol.*

4. *All protection flags should be reset at the time of the patrol.*

	Urban Feeder			Urban Feeder		
	Daylight			Night time		
Number of Customers	1st Operation	2nd operation	3 or more operations	1st Operation	2nd Operation	3 or more operations
<500	1 crew cursory patrol non-urgent	1 crew operational patrol immediately	2 crew operational patrol immediately. Apply A/R block at discretion	1 crew cursory patrol Non-urgent at first light	1 crew cursory patrol immediately + 1 crew operational patrol daytime (if no fault found)	2 crew cursory patrol immediately + 1 crew operational patrol Daytime (if no fault found) Apply A/R block at discretion
≥ 500 < 2000	1 crew operational patrol non-urgent	1 crew operational patrol immediately	2 crew operational patrol immediately. Apply A/R block at discretion	1 crew operational patrol non-urgent at first light	1 crew cursory patrol Immediately + 1 crew operational patrol daytime (if no fault found)	2 crew cursory patrol immediately + 1 crew operational patrol Daytime (if no fault found) Apply A/R block at discretion
≥ 2000	1 crew operational patrol non-urgent	2 crew operational patrol immediately	2 crew Operational patrol immediately. Apply A/R block at discretion	1 crew operational patrol non-urgent at first light	1 crew cursory patrol Immediately + 1 crew operational patrol daytime (if no fault found)	2 crew cursory patrol immediately + 1 crew operational patrol Daytime (if no fault found) Apply A/R block at discretion

Table 6.4.9.1 – 11kV Urban Feeder Patrol Following Operation of Protective Devices

Non-Urgent means whenever resources are available

	Rural Feeder			Rural Feeder		
	Daylight			Night time		
Number of Customers	1st Operation	2nd operation	3 or more operations	1st Operation	2nd Operation	3 or more operations
<500	1 crew cursory patrol non-urgent	1 crew cursory patrol non-urgent	1 crew operational patrol immediately	1 crew cursory patrol Non-urgent at first light	1 crew cursory patrol Non-urgent at first light	1 crew cursory patrol immediately + 1 crew operational patrol Daytime (if no fault found) Apply A/R block at discretion
≥ 500 < 2000	1 crew cursory patrol non-urgent	1 crew operational patrol immediately	2 crew operational patrol immediately Apply A/R block at discretion	1 crew cursory patrol Non-urgent at first light	1 crew cursory patrol Non-urgent at first light	1 crew cursory patrol immediately + 1 crew operational patrol Daytime (if no fault found) Apply A/R block at discretion
≥ 2000	1 crew operational patrol non-urgent	2 crew operational patrol immediately	2 crew Operational patrol immediately Apply A/R block at discretion	1 crew cursory patrol Non-urgent at first light	1 crew cursory patrol Immediately + 1 crew operational patrol daytime (if no fault found)	1 crew cursory patrol immediately + 1 crew operational patrol Daytime (if no fault found) Apply A/R block at discretion

Table 6.4.9.2 – 11kV Rural Feeder Patrol Following Operation of Protective Devices

Non-Urgent means whenever resources are available

6.5 Master Drop-Out Fuses (MDO's)

6.5.1 Background

Master Drop-out Fuses (MDO's) are high voltage expulsion drop-out fuses used as line protective devices to protect a line and its associated equipment. MDO's are typically located at the start of a spur or tee-off from the feeder backbone, and operate to isolate faults in the spur or tee-off.

Ganged MDO's are master drop-out fuses which are mechanically configured to open all three phases on fault, irrespective of fault type. The faulted phase(s) utilise the fuse element to interrupt the supply, the healthy phase(s) load is broken by the mechanical action of the fuse carrier opening under gravity. Ganged MDO's are typically used in ferroresonant distribution transformer applications for transformers rated up to 315 kVA.

6.5.2 Policy

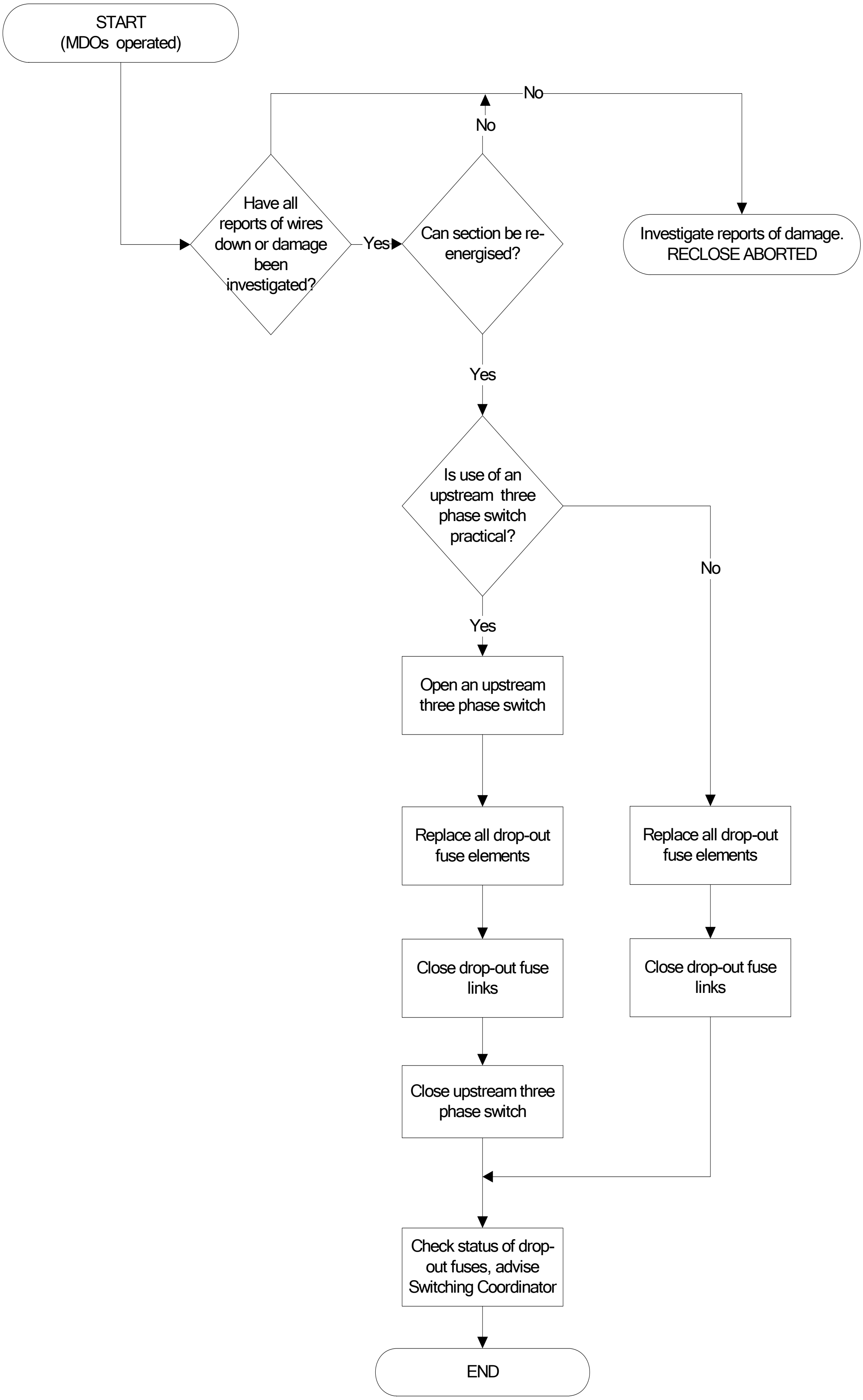
The operation of any MDO assembly shall be treated as per the lockout of any protective device (e.g. CB, PMR, etc). Management of supply restoration is to be undertaken in accordance with SAHV procedures and as detailed in Section 6.

6.5.3 Procedure

Following a report of Master Drop-out fuses blown, the flowchart shown in Figure 6.5.1 shall be followed for attempting manual reclose of the MDO fuses.

All MDO fuse elements should be replaced on operation of any of the elements.

Figure 6.5.1 Manual Reclose Procedure for MDOs



6.6 Faults and Protection Indications

Central to the efficient restoration of supply is fault identification. Often faults will not be as obvious as wires down, and may be difficult to locate. To assist in locating the fault, it is important to understand what type of protection has operated and what causes this type of protection to operate. This is linked with protection indications. The following section details what to expect based on the protection indications.

6.6.1 Basic Fault Types

Table 6.6.1 provides details of fault types and the associated protection operations expected.

Fault Type	Comment	Typical Protection
Single line to ground	Commonly caused by wildlife. This is the most common type of fault on the distribution system. Involves a passage of current from one phase to earth.	E/F, SEF, O/C and E/F, FD
Double line to ground	Needs two phases to contact earth almost simultaneously, occurs infrequently.	E/F, 1 or 2 O/C and E/F, FD
Three phase to ground	Commonly caused by lightning. In the case that the fault is balanced no ground current flows.	2 or 3 O/C and EF, FD
Phase to Phase	Commonly caused by trees. The most common fault type after single line to ground.	1 or 2 O/C, FD
Three Phase	Commonly caused by fires, trees.	2 or 3 O/C, FD

Table 6.6.1 - Basic Fault Types

6.6.2 Inferring Fault Causes from Protection Indications

Table 6.6.2 provides a guide for fault identification given protection indications. This should be used to assist in locating the fault.

Protection Indication	Typical Fault Cause
Earth Fault or Overcurrent & Earth Fault	Failed lightning arrester
	Underground cable fault
	Wires down - good earth connection
	Wildlife bridging out insulators
	Machinery contacting mains
	Trees in mains
	Flicker blade closed between feeders (11 kV)
	Bridge off in parallel feed (33 kV)
Sensitive Earth Fault	Wires down - high impedance (e.g. on road)
	Wires down – away from supply side
	Faulty Pole Transformer
	Flicker blade closed between feeders (11 kV)
	Failed Lightning Arrester
Earth Fault or Sensitive Earth Fault	Wires on stays
	Trees in mains
	pole fires
	damaged insulator strings
One or Two Overcurrents	Broken crossarm
	Wildlife bridging out insulation - e.g. on potheads, birds flying into mains
	Clashing conductors
	Trees in mains
Two Overcurrents	Lightning strike – direct
	Lightning strike – nearby ground strike causing back flashover.
	Closing in on earths
Feeder Differential	No inference can be made, other than the fault was within the zone covered by feeder diff CT's.

Table 6.6.2 - Typical Fault Causes and Protection Indications

7 Work Involving Secondary Systems

7.1 Introduction

7.1.1 Purpose

The purpose of the following procedures is to ensure that:

- advance notice is given when work involving secondary systems is to be undertaken, so that appropriate actions regarding operation of the HV network are taken
- work involving secondary systems is undertaken in a coordinated manner
- inadvertent tripping is avoided
- HV electrical apparatus is always adequately protected
- network security is not compromised

7.1.2 Scope

The following procedures apply to work involving secondary systems that:

- can cause the tripping of energised HV electrical apparatus; or
- can inhibit the tripping of energised HV electrical apparatus; or
- removes from service, communications or control systems that are required for the operation of the HV supply network

7.2 Responsibilities

Refer to Section 0 of this Manual for the responsibilities of the secondary systems applicant, secondary systems checker, Outage Coordinator and Switching Coordinator regarding work involving secondary systems.

7.3 Secondary Systems

"Secondary Systems" is a general term used to describe all protection, control and communication bearer systems.

7.3.1 Typical examples of Trip Circuits

- Protection Circuits (including communications connections to protection relays)
- Local Trip Circuits
- Intertrip Circuits
- Remote Control or Supervisory Circuits
- Under Frequency Circuits
- Voice Frequency Protection Signalling
- Equipment which could activate Protection Circuits, eg Buchholz, WTI's, OTI's, CBF (Circuit Breaker Fail), Cable Pressure (low/high), V/T's, B/Z, Bus Blocking Schemes etc

7.3.2 Typical examples of Control Systems

- Micro-Controllers (Micro-SACS)
- PC Mini-SACS & PC SACS Units
- RDC Units

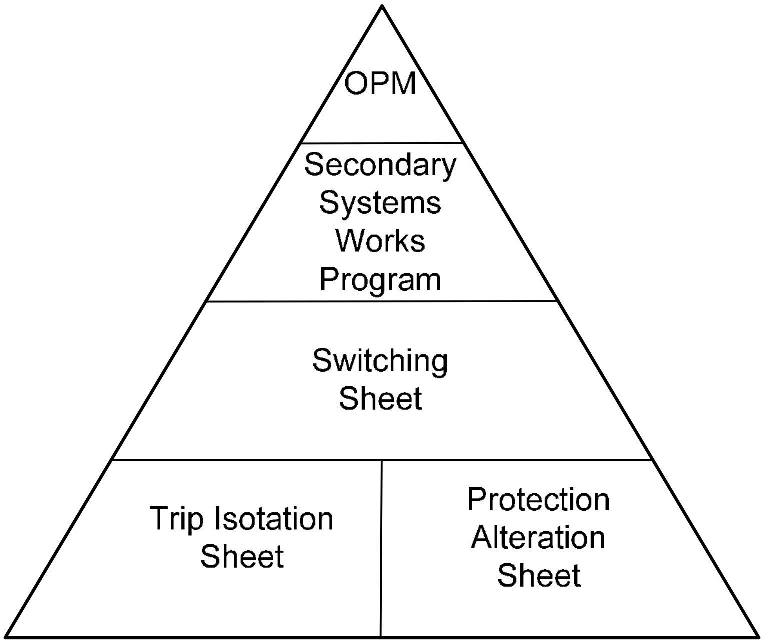
7.3.3 Typical examples of Communication Bearers

- Pilot Cables
- Telephone Lines
- Microwave Bearers
- Optical Fibre Cables

7.4 Secondary Systems Hierarchy

This chart displays the order of hierarchy for secondary systems documentation.

Secondary Systems Hierarchy Chart



7.5 Secondary Systems Works Programmes (SSWP's)

The secondary systems works programme is used to coordinate all activities including those detailed on switching sheets. Its benefits lie in ensuring that all activities are completed in the correct sequence. It may refer to trip isolation sheets, protection alteration sheets, switching sheets and may include items to re-route protection and data circuits.

A secondary system works programme consists of a SSWP summary sheet (Form 495) and a SSWP programme sheet (Form 1770) and associated TIS's/PAS's. The summary and programme sheets shall have the same unique identifying number.

Secondary system works programmes are required in the following situations:

- when secondary systems activities are required to be performed by multiple workgroups at different sites
- when multiple secondary systems activities are required to be performed in a specific order
- when several TIS's/PAS's are required
- circuits on communication bearers are involved
- control systems upgrades and software changes
- when changing the state of protection or communications to pole mounted plant (i.e. reclosers, sectionalisers etc)
- any work of sufficient complexity to warrant a written record to be kept

The Outage Coordinator may decide an SSWP is not necessary, provided there is only one work group and the TIS(s)/PAS(s), if any, are recorded on a switching sheet in the correct sequence.

7.6 Trip Isolation Sheets (TIS's)

A trip isolation sheet (Form 510) is a means of clearly describing each link or isolation point involved in isolating a trip circuit at a particular location. A single trip isolation sheet may be used for a protection scheme, provided the whole scheme is isolated and then subsequently returned to service under that sheet. For other jobs which require trip isolation at more than one location (eg. at more than one substation) or separate protection schemes (eg. dual primary protection), then a separate trip isolation sheet shall be required for each location or protection scheme.

Each trip isolation sheet shall have a unique number.

Except where covered by an approved work practice/instruction (Refer 7.8), trip isolation sheets shall be used or all work involving trip circuits that may cause or inhibit tripping of energised HV electrical apparatus.

7.7 Protection Alteration Sheets (PAS's)

A protection alteration sheet (Form 0505) is a means of clearly describing alterations to protection circuits such as the removal or bypassing of equipment in CT or VT circuits, or the alteration of tripping circuits at a particular location.

Except where covered by an approved work practice/instruction (Refer 7.8), protection alteration sheets shall be used for all alterations to protection circuits including CT and VT circuits[1].

Each protection alteration sheet shall have a unique number.

7.8 Approved Work Practice/Instruction

Approved work practice/instruction developed in consultation with major stakeholders and based on technical risk assessment shall be used to determine if trip isolation or protection alterations are required. Approved work practice/instruction shall indicate the appropriate methods of isolation or alteration.

7.9 Procedures for Planned and Emergency Work

7.9.1 Work Planning

The secondary systems applicant shall contact the Outage Coordinator responsible for that part of the network (ie the highest voltage level affected) and advise what protection, data, control or communications systems will be affected and the duration of the outage.

The Outage Coordinator shall then determine:

(a) if the job can proceed on the date requested
(b) if other parties need to be notified (eg. Outage Coordinators responsible for the lower voltage networks)
(c) if a trip isolation sheet is required (Refer section 7.6)
(d) if a protection alteration sheet is required (Refer section 7.7)
(e) if a secondary systems works programme is required (Refer section 7.5)
(f) if secondary circuits should be re-routed
(g) if automatic Zellweger and capacitors programs are affected
(h) what measures need to be taken to ensure that electrical apparatus remains adequately protected, and network security is maintained, for example:
    - if the affected part of the HV Network is to be de-energised for the work duration

[1] PASs are used for alterations, TISs are used for isolations.

- if the HV Network is to be re-configured for the duration of the job (eg. rings are broken to utilise back-up protection)
- if a protection permit is required

(i) identify any possible changes to control systems parameters, contingency plans, operating standards etc, and trigger appropriate action as required

If the work may proceed, the Outage Coordinator shall advise the secondary systems applicant and, then ensure that the job is entered in that days switching schedule.

For emergency work follow normal work procedures.

7.9.2 Preparing, Checking and Authorising Documentation (TIS/PAS/SSWP)

The secondary systems applicant shall be responsible for arranging the preparation (which should be compared to actual on-site conditions) and checking of each document. Where the secondary systems applicant does not have the expertise, then the document(s) shall be referred to the relevant services group for action. The secondary systems applicant shall then forward the document(s) to the Outage Coordinator responsible for that part of the network for authorisation. The Outage Coordinator shall authorise (preferably by signing) the document(s) and then return them to the secondary Systems applicant.

The correctness of the documents (other than "Effect on Security" issues, see 7.9.1) rests with the person who signs the sheet as checked. TIS's, SSWP's, and PAS's shall only be signed as checked by persons with secondary systems checker (SSC) authorisation.
Note: The checker shall not be the same person who prepared the document.

The responsibility for authorising the document(s) (including the "Effect on Security" issues, see 7.9.1) rests with the Outage Coordinator. (Note: The authoriser verifies the preparer and checker is not the same person and confirms the work can proceed on the nominated time and date).

7.9.3 Coordination

A copy of all TIS's, SSWP's, and PAS's required shall be provided to the Switching Coordinator prior to the commencement of the work.

The Switching Coordinator shall coordinate the TIS's, SSWP's, and PAS's during the progress of work, and ensure any changes to control system parameters are checked at the completion of the job.

7.10 Non-commissioned-Protection-Schemes

Approved work practice/instructions[2] must be used to ensure that non-commissioned-protection-schemes are kept isolated from commissioned protection schemes during installation and pre-commissioning checks.

A non-commissioned-protection-scheme must be effectively isolated from commissioned schemes at all times, (e.g. links removed or wires removed and taped up), except for (where applicable);

- The period of time required by commissioning staff to prove the correct interaction between the non-commissioned and commissioned schemes. (Note: during this period the affected commissioned scheme shall be effectively isolated)

Example: Testing inter-connecting circuitry between CBF (non-commissioned) and BZ Multi-trip (commissioned) scheme.

[2] For example, a work instruction might include the use of a permanent plastic cover bearing the words "Non commissioned" to identify all links related to non-commissioned or decommissioned protection schemes.

Dedicated pre-commissioning check sheets shall be used to commission/re-commission any new or previously decommissioned protection schemes.

7.10.1 Projects Involving New Secondary Systems Work and Commissioned Plant

Requirements for new Secondary Systems work for commissioned plant shall be negotiated between the Outage Coordinator and the Commissioning Coordinator/Applicant

A typical application for this section can be found in Section 11 8.2 - Commissioning Procedures Involving HV Electrical Apparatus with Spare Switches

The Work Activity and Work Clearance Method table listed below shall be utilized for new work on Commissioned Secondary Systems.

Work Activity	**Work Clearance Method**
Wiring Modifications (Not cutting into existing secondary systems)	Advise Control Room that Substations Fitter is on site
Integrity and testing work at one work site, including functional testing and the application of RSRs to protection schemes.	Commissioning Coordinator/ Applicant to apply for switching sheet through the current BMS process. Work conditions may require an Access or Test Permit and/or a SSWP
Wiring Modifications (cutting into existing secondary systems)	Commissioning Coordinator/ Applicant to apply for switching sheet through the current BMS process. Work conditions will require a Work Authority and/or a SSWP.
Ductoring / Meggering	Commissioning Coordinator/ Applicant to apply for switching sheet through the current BMS process An Access / Test Permit or SSWP shall be required; however a Work Authority can be issued for a withdraw-able circuit breaker.
Energise the new electrical apparatus	A switching sheet shall be used, and an AE obtained from Commissioning Coordinator giving clearance to energise new electrical apparatus.

Table 7.1

8 Field Switching Practices

8.1 Switching Problems/Errors

Any problems encountered during switching (human or equipment) must be immediately reported to the responsible switching coordinator before proceeding further (refer SAHV procedures Sections 8.4).

ENERGEX's network operating philosophy (priority) is:

1. SAFETY OF PEOPLE
2. PROTECT PLANT FROM DAMAGE
3. RESTORATION OF SUPPLY

8.2 Voltage Regulators

8.2.1 Neutral Check routine

Successful completion of a neutral check routine proves correct indication of neutral position. It uses two independent indicators (TPI and neutral light) to verify the neutral tap position.

Step	**Action**	**TPI** (must show)	**Neutral Light** (must be)
1	Starting position	0	ON
2	Raise 1 tap	1R	OFF
3	Lower 1 tap	0	ON
4	Lower 1 tap	1L	OFF
5	Raise 1 tap	0	ON

An unsuccessful neutral check routine means that there is a problem with the regulator. Any such units must not be live bypassed.

8.2.2 Park Routine

The park routine is used to ensure that a regulator placed on neutral remains on neutral.

Step Action

1. Turn control switch to OFF
2. Disable power supply
3. TPI must show neutral

If the TPI does not show neutral, reverse the steps, place regulator on neutral, and repeat the park routine.

An unsuccessful park routine means that there is a problem with the regulator. Any such units must not be live bypassed.

8.2.3 Operating 11kV Bypass (Combined and Disconnect) Links

The combined links (CL) installed on 11 kV single phase regulator stations will only be operated by an authorised "OSO" overhead switching operator. The "OSO" switching operator (not the switching operator's assistant) will only operate the combined link directly in front (perpendicular) from an elevating working platform (EWP) vehicle. These combined links are **not** to be operated from a ladder.

Note: Regulators shall be confirmed on neutral tap by performing a neutral check & park routines on each regulator before operating any bypass link. Each combined link should also have a ***visual*** *alignment inspection (while maintaining approach distance) before it is operated.*

Background

In the process of commissioning a new 11kV Regulator site (2 – 11 kV single phase regulators), a problem occurred with the bypass link, resulting in an open circuit. The estimated feeder load through the link was 100 A, which caused an arc resulting in a flash injury to the switching operator. A subsequent investigation identified a possible alignment problem during assembly and when operated from an angle (other than perpendicular) could cause the link to malfunction.

8.3 Teamwork During Switching

It is important that switching be carried out without error. Switching errors can endanger the switching team, a work group, or the public (a video "Teamwork in Switching" is available from EsiTrain it further explains the following procedure).

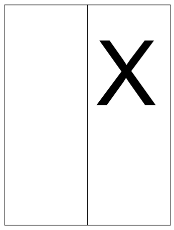
To minimise the risk of a switching error, the switching operator and the switching operator's assistant should work in accordance with the following guidelines:

SWITCHING OPERATOR		SWITCHING OPERATOR'S ASSISTANT
General		
"Looks after the sheet"		"Does the work"
Initially:		
1. Becomes familiar with the sheet		Becomes familiar with the sheet
For Each Item		
2. Reads out location	→	Finds location
3. Reads out apparatus	→	Finds apparatus
4. Reads out action	→	Finds action possible, e.g. switch not already open
5. Checks location and apparatus	→	Confirms location and apparatus
6. Gives authority to carry out action	→	Carries out action
7. Checks action successful (ABS arcing horns clear, CB ammeter reading, etc.)		-
8. If operation unsuccessful, immediately advise the Switching Coordinator of the problem. (**Do Not attempt another operation without permission**)		Stops all actions and awaits further instructions
9. If operation successful, records time on switching sheet		-

The second person should not assist in carrying out the actual action, but stand clear.

8.4 Minimum Delay Items

Some paralleling can cause problems, and these are identified on a switching sheet by a warning notice. There are four different types of minimum delay items that a switching operator may come across, as follows:



8.4.1 Minimum Delay - Between Zones

This applies to paralleling between different bulk supply zones. Circulating current during the period that the feeders are tied together could trip one of the feeder circuit breakers. If the new paralleller is opened under such circumstances it would be breaking a full feeder load, causing danger to the switching operator (if not a load break switch, e.g. air break switch), and blacking out many customers.

The switching operator shall call the switching coordinator **before opening** the new paralleller, to see if a circuit breaker operation has been received from either substation. Before allowing the OPEN operation to proceed, the switching coordinator shall check to confirm that no circuit breakers have operated.

Note: The DMS should be set up to display the protective devices that may trip prior to commencement of the parallelling. The DMS responds to status & analog limit changes in excess of 6.25% of full scale deflection in less than 1 second.

Switching Sheet Example:

```
***** MIN DELAY “Between Zones” ......
Call Sw. Co-ord before next “Open” item *****
```

The following sequence of messages should take place:

Switching Operator:	"................... to 11kV switching coordinator north, switching sheet N12345, item 10 - between zones switching - Clayfield".
Switching Coordinator:	"................... switching sheet N12345, item 10 - between zones switching may proceed".
Switching Operator:	"................... to 11kV switching coordinator north, switching sheet N12345, item 10 - opened OK at... hrs".

In situations where the use of minimum delay – between zones switching proves to be unsuccessful, the use of minimum delay - two units procedures shall be employed, and the network operations performance group notified of the situation.

	2

8.4.2 Minimum Delay - Two Units

This applies in areas when experience has shown that particular paralleling requires two units to be used, because there is a chance of tripping either feeder circuit breaker due to circulating currents.

The aim of this procedure is to perform the CLOSE/OPEN operations before feeder protection operates. With this in mind, the CLOSE/OPEN items should be performed within a few seconds.

When in position and ready for the next operation (with appropriate PPE on and locks off), each unit shall notify the switching coordinator (ie. switching sheet number and item), and wait for further instructions. A party line should be established between the switching coordinator and the two switching units. When all are ready, the switching coordinator shall instruct the first operator to perform the CLOSE item, as soon as the first operator confirms that the CLOSE has been successfully completed, the switching coordinator shall instruct the second operator to OPEN.

During the time between the issue of the CLOSE instruction and confirmation of successful operation from the first operator, the Switching Coordinator shall monitor the status of the two associated feeder circuit breakers. If one of the breakers trips in this time, the switching coordinator shall abort the next OPEN instruction. If there has been no trip, the switching coordinator shall not wait any longer after receiving confirmation of successful closure before issuing the OPEN instruction. Any extra time taken to monitor circuit breaker status after the CLOSE item increases the risk of circuit breaker operation, and the chances of the second operator opening under load.

Switching Sheet Example:

```
***** MIN DELAY "2 Units".
Call Sw. Co-ord before next "Close/Open" items *****
```

The following sequence of messages should take place:

<u>Sw. Coordinator:</u> Close X1234

<u>Sw. Operator 1:</u> X1234 Closed

<u>Sw. Coordinator:</u> Open X5678

<u>Sw. Operator 2:</u> X5678 Opened

Note: The requirements of section 8.7.3, bullet points 2 and 3, do not apply in these circumstances, as they would unnecessarily delay the switching process.

If a trip occurs after the CLOSE operation, the switching coordinator shall abort the process, and determine an appropriate recovery method. This may be for example:

- re-attempt the parallelling if it is suspected that minimum delay operations did not occur during switching.
- trip the other feeder, complete the parallelling & restore supply remotely by closing the tripped protective devices.
- leave the network in an abnormal state if loads do not exceed ratings

Parallelling situations requiring 2 Units for switching may require specific network configurations and the switching to be undertaken at specific times due to the sensitivity involved. These requirements are

typically based on source/system impedances and other network constraints. Outage coordinators should utilise paralleling software available on the network operations intranet pages to determine specific paralleling techniques be adopted.

A

8.4.3 Minimum Delay - Two Units - After Hours

This paralleling is based on experience that, even with two units, there is a reasonable risk that a feeder circuit breaker will trip.

Such paralleling should only be attempted during specific times (typically after-hours), so as to minimise inconvenience to the public and industry. The switching may also incorporate taking upstream transformers off to reduce the circulating current.

The same procedure as described in section 8.4.2 shall apply.

Switching Sheet Example:

```
***** The following paralleling is NOT allowed
between 0600 and 2100 hours on week days *****

***** MIN DELAY "2 Units".
Call Sw. Co-ord before next "Close/Open" items *****
```

8.4.4 Paralleling through SVR

Applies to paralleling between feeders containing single phase voltage regulators, not parked on neutral tap. Unbalance currents can flow during the period that the feeders are tied together. Sufficient unbalance current could flow to trip one of the feeder circuit breakers on earth fault protection. If the new paralleller is opened under such circumstances it would be breaking a full feeder load, endangering the switching operator and blacking out many customers.

The switching operator shall call the switching coordinator **before opening** the new paralleller, to see if a circuit breaker operation has been received from either substation. Before allowing the OPEN operation to proceed, the switching coordinator shall check to confirm that no circuit breakers have operated.

Note: The DMS should be set up to display the protective devices that may trip prior to commencement of the parallelling.

Switching Sheet Example:

```
***** "Paralleling through SVR".....
Call Sw. Co-Ord Before Next "Open" Item *****
```

The following sequence of messages should take place:

Switching Operator:	".................. to 11kV switching coordinator north coast, switching sheet N12345, item 10 – parallelling through SVR – Sunridge road".
Switching Coordinator:	".................. switching sheet N12345, item 10 - parallelling through SVR may proceed".

Switching Operator: "................... to 11kV switching coordinator north coast, switching sheet N12345, item 10 - opened OK at. hrs".

In situations where the use of the above procedure proves to be unsuccessful, the use of minimum delay - two units procedures shall be employed and the network operations performance group notified of the situation.

8.5 Disabling Remote Supervisory Control

Remote Control means operation of apparatus from a location other than the apparatus itself, whereas Remote Supervisory Control means remote control of the apparatus via SCADA or SACS (see section 2.4).

For high voltage isolation and access (SAHV), disabling of the apparatus's remote supervisory control shall be an item on a switching sheet. Disabling remote control between a control panel and the apparatus in the same substation shall be the responsibility of the work group.

The method of disabling remote supervisory control depends on when the substation was built, and the type remote control originally used.

The following are some examples of remote supervisory control switches.

8.5.1 N-L-M Switch or N-L Switch

The most recent substations incorporate either a three-position switch or a two-position switch mounted on the switchgear or the control panel.

The switch allows the following functions:

N - "Normal". In this position all controls and protection-trip functions are operative.

L - "Local". In this position local control and protection-trip functions are operative, but remote supervisory control functions are disabled.

M - "Maintenance" (if fitted). In this position all remote supervisory controls and protection-trip functions are disabled, but local controls remain operative.

The switching item "disable remote supervisory control" means to switch from the "N" to the "L" position.

8.5.2 Trip/Close Links (was referred to as SISS Links)

Circuit breakers that were originally under SISS control (now converted to SACS) should have a Remote Supervisory Interface Panel fitted somewhere on the relevant feeder protection panel (either on top, behind or inside).

On one side of that panel are two (white) links, labelled "trip link" and "close link", and a (black) control fuse.

The switching item "disable remote supervisory control" means to withdraw both the white trip and close links on the Remote Supervisory Interface Panel only. The black control fuse is **not** to be removed.

8.5.3 SACS Control Switch

If a SACS control switch is fitted, turning the switch from "ON" to "OFF" disables the remote supervisory control.

8.5.4 Tele Control

In Powerlink (or ex QEC, QEGB, SEAQ) Substations, the remote supervisory control is normally labelled "Tele Control". Turning the switch from "Tele" to "Sub" disables the remote supervisory control.

8.6 Local Closing of Circuit Breakers

Where it is considered that the possibility of failure is high, or where the extent of damage may be high, it is recommended that the closing of circuit breakers to energise lines and apparatus should not be attempted while the switching operator or the assistant is within vicinity of the switchgear (eg in the switchroom).

Circuit breakers shall never be closed by hand when any portion of the circuit breaker is energised (ie "maintenance", "slow close" and "emergency" operating handles shall be used only for the operation of a de-energised circuit breaker).

The following options should be used:
- remote control facilities (where installed); or
- remote trip/close electrical lead; or
- a lanyard (cord or rope) attached to the trip/close handle/lever; or
- a reclose relay (non-sacs ex BCC Substations).

Reason
The extensive damage caused by a failure of an 11kV circuit breaker to clear a fault at Moorooka Substation has highlighted the need for all Switching Operators to be conversant with the precautions and procedures for HV circuit breakers.

The incidence of failure of circuit breakers is rare and is most likely to occur when attempting to clear a fault or closing on to a fault. The extent of any damage caused will be more pronounced in the case of oil-insulated switchgear and compound filled bus and CT chambers.

8.7 Multiple Switching Operators in Field Switching

8.7.1 Background

When field switching involves more than one switching operator, communication problems can occur during switching. To eliminate the risk of communication breakdown while carrying out planned switching, one of the following procedures will be used. Mutual agreement is to be obtained between the switching coordinator and switching operator(s) before switching is to commence.

Procedure 1 is the preferred method and will always be used during emergency switching.

8.7.2 Procedures

Procedure 1
The switching coordinator directs the specific switching operator(s) to carry out switching actions.

The switching coordinator issues each switching operator a switching item, or group of sequential switching items to carry out. This switching item or group of switching items will only be carried out by the switching operator who receives them.

Procedure 2
The switching coordinator directs a ***designated switching operator*** to take responsibility for carrying out switching actions.

The switching coordinator issues the designated switching operator a switching item, or group of sequential switching items to carry out. This switching item or group of switching items may be carried

out by the designated switching operator directly, or by other switching operators as directed by the designated switching operator.

The designated switching operator shall notify the switching coordinator of the identity, location and contact number for all switching operators that will be involved in the switching.

The designated switching operator shall inform the switching coordinator of the switching items, or group of switching items to be carried out by each specific switching operator(s).

The designated switching operator obtains approval to commence the switching sheet from the switching coordinator. All items will be carried out in sequence according to the switching sheet, unless approved by the switching coordinator. The designated switching operator is responsible for coordinating the execution of a switching item, or group of switching items in sequence.

If a problem eventuates in carrying out a switching item, the designated switching operator will notify the switching coordinator immediately. The designated switching operator relinquishes responsibility for the remaining switching items to the switching coordinator. The switching coordinator directs the specific switching operator(s) to carry out all subsequent switching actions until the problem is resolved. On resolution, and at the discretion of the Switching coordinator, the switching coordinator may direct responsibility for carrying out switching items back to the designated switching operator (ie. revert to pre-problem situation).

8.7.3 Switching Notes

The designated switching operator will record the time of all switching items on their switching sheet.

All switching directions passed between any two parties will confirm the previous completed switching item and time before any other switching directions are given.

All switching directions passed between any two parties will be confirmed by reading back directions.

All switching operators involved in the switching will have a copy of the switching sheet.

A switching team will consist of only one switching operator and one switching operator's assistant (if applicable), regardless of the make up of the team (ie. if a switching team comprises two operators, one would take on the role of operator and one the role of assistant).

8.8 High Voltage Single Phase Links in Substations

High voltage links have no lockable operating handle or mechanism. In a substation environment they are often very close to the work area. Additional control measures must be employed to ensure links are not inadvertently closed.

This procedure has been developed to help protect persons working under access within substations. **It applies when access work is being performed in a substation and high voltage single phase links are used for isolation.**

The following procedure will apply:

- A DNOB will be hung from **each** open link. That is, a set of three single phase links requires three DNOBs.

- Any person entering a substation shall ensure that all operating sticks under their control are secured. Operating sticks will be secured by placing them in a lockable storage bag. The storage bag will be locked closed with a S2 system padlock.

- No person shall remove an operating stick from its secure bag without the recipient's authority.

- On receipt of such authority, a person removing an operating stick from a locked bag will advise the recipient of the action to be performed.

- The stick will only be removed from the storage bag while in use. The stick will be locked back in the storage bag immediately after use.

- The recipient will confirm the security of the stick subsequent to such action.

8.9 Handling of Portable Earthing Devices

Portable earthing devices should not be handled during application or removal from HV conductors. If earths have to be handled then appropriate insulating gloves must be worn. Any related work instruction shall contain this control measure.

8.10 Application and Removal of Test Leads to HV Conductors

Test leads should only be applied to and removed from earthed HV conductors. If an earth cannot be maintained during the application/removal process, then appropriate insulating gloves must be worn. Any related work instruction shall contain this control measure.

8.11 Earthing on the Load Side of 11 kV Expulsion Drop-Out (EDO) Fuses

The safe approach distance of 700 mm cannot be maintained when applying portable earthing devices directly to the bottom of EDOs; however, the Electricity Act allows for this situation provided that:

- the work can be performed safely
- there is an approved work instruction about the work to be performed and the safety precautions (control measures) to be complied with.

9 This Section Intentionally Spare

10 HV Network Repair and Maintenance

10.1 Introduction

ENERGEX's Network Operating Philosophy (priority) is:

1. Safety of People
2. Protect Plant from Damage
3. Restoration of Supply

SAHV procedures provide a safe working environment for all persons accessing the HV network (priority 1). The OPM procedures are intended to protect the plant from damage (priority 2), and the person(s) who energise HV plant that has been maintained, repaired or upgraded (refer section 11 for commissioning / decommissioning electrical apparatus).

Any spare switch, or cables attached to that spare switch, shall be considered commissioned electrical apparatus and under the control of the Switching Coordinator and SAHV procedures shall apply.

10.1.1 Purpose

The purpose of the following procedures is to ensure that:

- All required pre-energisation checks/tests are completed on commissioned HV electrical apparatus after they are repaired, maintained, replaced or upgraded and before they are re-energised.
- All spare switch/s or any repair and maintenance work on commissioned HV electrical apparatus are in the correct (open) state before the HV electrical apparatus is re-energised
- Switching Coordinators are aware of the state of the HV network
- Records related to upgraded or changed electrical apparatus are available before energising

10.1.2 Scope

These procedures are to be used for:

- The replacement, upgrading or repair and maintenance of commissioned electrical and apparatus which require pre-energisation checks/tests
- Fuse replacement at Oil Filled RMU's

Note: These procedures do NOT apply to commissioning or decommissioning of HV electrical apparatus (refer section 11).

10.2 Definition of Repair and Maintenance Work

Repair & maintenance work are those activities that are carried out to ensure the continued operation of the existing supply network. Isolation points do not change for the duration of the job and, where access is required; all such work is carried out solely under SAHV procedures.

Examples include but not limited to:

- Reconductoring mains or cables
- Rerouting mains or cables
- Replacing existing overhead mains with underground cable
- Replacing or upgrading Transformers, Sectionaliser's, Reclosers, ABS's etc.
- Maintenance of an RMU that has a spare switch.

HV Commissioning procedures shall be used in addition to SAHV procedures when HV electrical apparatus is being replaced, re-routed or upgraded where:

- The erection of any new overhead mains or the terminating of any new underground cables or cable joints are carried out prior to the issue of the AP to connect the new electrical apparatus to the existing network.

Refer to section 11 for commissioning / decommissioning electrical apparatus.

10.2.1 Requirements to isolate a RMU

- Prior to access, the complete RMU(s) under maintenance/inspection shall be isolated at all remote ends
- A minimum of one set of operator earths for each U/G cable associated with the isolated RMU(s) shall be applied at remote HV locations. Where an operator earth point is not available, for example: The RMU(s) under maintenance/inspection has a switch fuse connected to a transformer then the switch fuse shall be opened, tested de-energised, then closed into the earth position and recorded as a working earth
- An Access Permit is issued to access the RMU(s) for maintenance/inspection work
- After receipt of the Access Permit and before any work may commence, ALL switches on the RMU (where available) under maintenance/inspection must be tested de-energised and then closed into the earth position (as a working earth) to prove all cables are de-energised
- During maintenance/inspection works, a minimum of one RMU isolator must be closed to ensure the busbar of the RMU is earthed at all times and working earths may then be removed as required by the Recipient.

10.2.2 Oil RMU Fuse Replacement Procedures

Refer to the Equipment Operating Instruction Manual for the operation of oil insulated ring main units.

Workers engaged in the operation of oil insulated ring main units (RMUs) **MUST NOT** for any reason remove the entire fuse carrier from an energised RMU.

This includes that the fuse carrier of an energised RMU **MUST NOT** be removed in order to access the HV fuses or to manually retrieve items (such as broken fuse parts) from within the oil tank.

RMUs may contain live conductors even with isolators in the “OFF” position. As a consequence, the only **operational access** allowed in **any** oil insulated RMU is:

a) The opening of the designated switch fuse access cover in order to gain access to the fuses. This operation is limited to the removal, replacement or insertion of fuses only. The fuse carrier must only be raised from the oil tank in the manner intended by the manufacturer and shall not be removed from the oil tank unless working under an Access / Test Permit.

b) The insertion of cable test probes through a designated test access point in accordance with current procedures.

Both of the above actions must be under the control of the Switching Co-ordinator at Network Operations, via a switching sheet.

Any other access to an oil tank, such as the complete removal of a fuse carrier **for any reason**, or the removal of any cover as required for maintenance is not considered routine operational work. Such activities must only be carried out strictly in accordance with:

- An appropriate document such as a Work Practice or Maintenance Instruction; and
- Safe Access to HV Electrical Apparatus (SAHV) procedures for HV Electrical Apparatus access

10.3 Requirement to Carry Out Pre-Energisation Checks/Tests

HV electrical apparatus that has been repaired or maintained shall not be re-energised until all required pre-energisation checks/tests (to standard ENERGEX work/test procedures) have been successfully completed.

The Switching Operator energising the electrical apparatus is responsible for ensuring all required pre-energisation checks/tests are successfully completed by either:

- Carrying out the checks/tests personally; or
- Obtaining a clearance (written or verbal) from the recipient or on-site supervisor that the required checks/tests have been carried out.

10.4 Confirmation of Pre-Energisation Checks/Tests

The switching sheet (if used) shall have an item to confirm pre-energisation checks/tests successfully completed, for example:

Item	Location	Apparatus	Action	Time
			Confirm Pre-Energisation Checks / Tests Completed and No Abnormalities	

10.4.1 Using an Access/Test Permit

Where an access/test permit has been issued for the repair & maintenance work, the Access/Test Permit shall be endorsed to confirm all required pre-energisation checks/tests have been successfully completed.

10.4.2 Access/Test Permit Not Endorsed

If the access/test permit has not been endorsed to confirm pre-energisation checks/tests, then:

- The Switching Coordinator/Operator shall obtain such confirmation (written or verbal) from the work/test group and record confirmation in Abnormalities section; or

- The Switching Operator shall request an Access/Test Permit (as required) to carry out such required checks/tests before re-energising the electrical apparatus.

10.5 Connection / Disconnection of Mobile 11 kV Generators

ENERGEX has five mobile 11 kV generators, designated MG1 to MG5. All generators have a 1 MVA rating.

10.5.1 MG1

This unit is not fitted with an 11 kV ring main unit and is therefore not suitable for live line connection/disconnection techniques. MG1 must only be connected/disconnected using an access permit.

10.5.2 MG2 to MG5

These units are fitted with an 11 kV ring main unit and synchronising equipment. They are suitable for live line connection/disconnection techniques[1] to the overhead network and can be synchronised with and run in parallel with the 11 kV network.

10.5.3 Basic Schematic

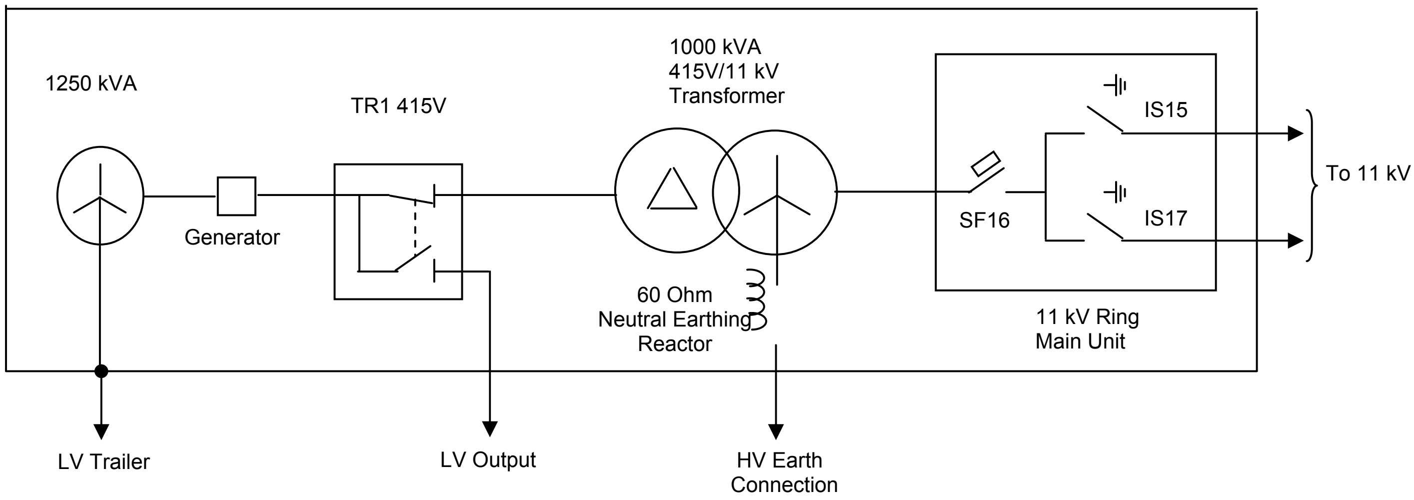


Fig 10.1 Schematic Diagram MG2 to MG5

10.5.4 Connection Options

The connection options for the generators are summarised as follows:

	Overhead Network – De-energised	**Overhead Network - Live**	**Underground Network – De-energised**	**Underground Network - Live**
Connect/disconnect using an access permit	MG1 to MG5		MG1 to MG5	
Connect/disconnect using live line techniques (work authority)	MG2 to MG5	MG2 to MG5		
Not possible		MG1		MG1 to MG5

Standard switching sheets have been prepared to cover these connection options.

1 These techniques do not include connection to and disconnection from an 11 kV RMU.

10.5.5 Connection/Disconnection of Generator Leads

Separate access permits (or work authorities) will be required for the connection and disconnection. The switching will be subject to the following conditions:

- The switching sheet must contain an initial check item to "Confirm with generator operator that all generator pre-energisation checks/tests have been completed".

- The generator LVCB, TR1 LV isolator and 11 kV RMU must be under the control of the switching coordinator.

10.5.6 Site Set-up Requirements

The following items must be considered when selecting a suitable site to place the generator:

- Level ground with adequate space, ensuring safety to traffic and pedestrians.
- Access to established (max 30 ohm) HV earth for connection of 11 kV star point earth.
- Suitable location for the installation of earth stakes for connection of the trailer earth (max 30 ohm). This earthing point is to be located a minimum of 5 metres away from the HV earth.
- Ready access to the 11 kV network.
- Access to a site suitable for confirmation of phase rotation.

For more detailed information refer to the Mobile 11 kV Generator Connection Procedure located under Rapid Response Work Practices on the Work Practices Department Web site.

11.1 Introduction

The following requirements apply to all work involving **Not Electrically Connected** electrical apparatus. This will include all of ENERGEX assets including intended assets.

In this section **Not Electrically Connected** electrical apparatus will also be referred as Non Commissioned and/or Decommissioned electrical apparatus.

ENERGEX's Network Operating Philosophy applies to HV Commissioning / Decommissioning procedures:

1. Safety of People
2. Protect Plant from Damage
3. Restoration of Supply - Safe to Energise New Plant

11.1.1 Purpose

The purpose of the following procedures is to ensure that:

- a safe working environment is achieved when working on Not Electrically Connected electrical apparatus
- Commissioning of electrical apparatus is conducted in a coordinated manner that does not adversely effect network security and/or customer's reliability or quality of supply
- Decommissioning of existing electrical apparatus to make it Not Electrically Connected is conducted in a coordinated manner that does not adversely effect network security and/or customer's reliability or quality of supply
- Not Electrically Connected electrical apparatus is in a acceptable condition before Commissioning / Decommissioning
- all persons are clear before electrical apparatus is energised
- Not Electrically Connected electrical apparatus is disconnected from all energy sources by an approved method
- Switching Coordinators are aware of the state of the HV network during the Commissioning / Decommissioning Process
- records relating to new or altered electrical apparatus are available before commissioning or decommissioning

11.1.2 Scope

These procedures are to be used by the Commissioning Coordinator to provide:

- Authority to work on HV Not Electrically Connected electrical apparatus which in some cases extends to low voltage disconnection points
- Authority to work on HV Not Electrically Connected electrical apparatus involving secondary systems
- Authority to carry out work which is not classified as "Repair & Maintenance" work, refer to Section 10.2

11.1.3 Responsibilities

Refer to Section 0 for the Responsibilities of the Commissioning Coordinator, Outage Coordinator, Switching Coordinator, Switching Operator, On-Site Supervisor and a Delegate, with regard to HV Commissioning/Decommissioning.

11.2 General

The procedures relating to work on Non Electrically Connected electrical apparatus generally reflect those applying to the commissioned network.

Construction and Test Authorities (CAs & TAs) are issued instead of Access and Test Permits (APs & TPs).

A Commissioning Coordinator instead of a Switching Coordinator controls the Not Electrically Connected electrical apparatus.

A Commissioning Coordinator shall be appointed for each job involving commissioning using an Authority to Energise and decommissioning using a Decommissioning Notice. A Commissioning Coordinator/Applicant shall submit an application for switching for all commissioning and de-commissioning work, within the relevant lead times.

Commissioning Coordinators shall maintain total involvement and control of the project from start to finish. If a Commissioning Coordinator is replaced by a second Commissioning Coordinator there shall be a detailed handover of current information and relevant documentation to ensure a safe working environment is maintained for project completion. Alternatively, the second Commissioning Coordinator shall request the existing documentation be revoked and issues new documentation for the works to proceed. This applies to the commissioning and decommissioning process.

11.3 Forms

11.3.1 Construction Authority (CA) Form

A form (1666) used for:

- authorisation to work from the Commissioning Coordinator to the On-site Supervisor of each construction group showing work details and disconnection details of the Not Electrically Connected electrical apparatus. A detailed description of work tasks for each construction group is required
- clearance from the on-site supervisor of each construction group to the Commissioning Coordinator that all construction work is completed, and all persons associated with the electrical apparatus have been instructed to treat them as live.

For a typical example of a Construction Authority refer to Appendix A

11.3.2 Test Authority (TA) Form

A form (1224) used for:

- authority to test (using lethal current) from the Commissioning Coordinator to the On-site Supervisor of each test group showing testing details and disconnection details of the Not Electrically Connected electrical apparatus. A detailed description of test work for each test group is required
- clearance from the On-site Supervisor of the test group to the Commissioning Coordinator that all test work is completed, and all persons associated with the electrical apparatus have been instructed to treat them as live.

For a typical example of a Test Authority refer to Appendix A.

11.3.3 Commissioning Programme

A document prepared by the Commissioning Coordinator which contains the individual activities to be carried out on a step by step basis to commission the Not Electrically Connected electrical apparatus. The programme includes the names and roles of all groups involved, timing, permits and switching, as well as any decommissioning that is required. The requirement for a commissioning programme shall be negotiated between the Outage Coordinator and the Commissioning Coordinator.

For a typical example of a Commissioning Programme refer to Appendix B.

11.3.4 Authority to Energise (AE) Form

A form (282) used as authorisation from the Commissioning Coordinator to the Switching Coordinator signifying that the identified electrical apparatus may now be energised..

For a typical example of a Authority to Energise refer to Appendix A

11.3.5 Decommissioning Notice (DN) Form

A form (1667) used as authorisation from a Switching Coordinator to a Commissioning Coordinator, signifying that specific electrical apparatus has been disconnected by an approved method and now considered Not Electrically Connected.

For a typical example of a Decommissioning Notice refer to Appendix A.

11.3.6 Decommissioning Notice Attachment A Form

A form (2154) used for:

- Authorisation to work on Decommissioned electrical apparatus from the Commissioning Coordinator to the On-site Supervisor of a work group. This form is attached to the associated Decommissioning Notice which specifies the electrical apparatus has been disconnected by approved methods and considered Not Electrically Connected.
- Clearance from the on-site supervisor of a work group to the Commissioning Coordinator that all work is completed

For a typical example of a Decommissioning Notice Attachment A refer to Appendix A.

11.4 Commissioning

11.4.1 Commissioning Process

Commissioning is the process of connecting Not Electrically Connected electrical apparatus to the commissioned network. This includes:

- all pre-energisation checks/tests that have been completed, and
- the transfer of responsibility from a Commissioning Coordinator to a Switching Coordinator, and
- when required:
    - electrical apparatus to be energised, and
    - post-energisation checks/tests to be completed.

11.4.2 HV electrical apparatus is commissioned when:

- Switching Coordinator receives an Authority to Energise form from the Commissioning Coordinator (refer Section 11.4.3.1) or
- On-Site Supervisor receives clearance from Switching Coordinator to energise a pole transformer (refer Section 11.4.3.2) or

- Switching Coordinator revokes Work Authority from Live Line on-site supervisor following the installation of electrical apparatus as per Section 11.4.3.3 or
- Switching Coordinator receives advice from Recipient that Access Permit is surrendered as per Permit as per Section 11.4.3.3

11.4.3 Commissioning Methods

There are four approved commissioning methods:

1. Using an Authority to Energise, preferable for all situations listed in 11.4.3.1
2. Using a Switching Sheet to construct and commission a pole transformer as described in 11.4.3.2
3. Using approved Live Line methods as described in 11.4.3.3.
4. Using an Access Permit (AP) as described in 11.4.3.4

A Commissioning Coordinator shall be appointed for method 1 listed above.

11.4.3.1 Commissioning Using an Authority to Energise (Refer to Fig 11.1)

The Commissioning Coordinator shall:

- submit a switching application to the Outage Coordinator.
- prepare a commissioning programme, refer to Section 11.3.3
- issue each work group with Construction / Test Authorities as required and ensure the application of earths and other precautions, refer to Section 11.8.3
- record the issue and surrender of all related Construction Authorities and Test Authorities on an Authority to Energise form

During the commissioning process SAHV procedures shall take precedence, as follows:

- prior to issue of an Access Permit/Test Permit ensure all Construction Authorities and Test Authorities are to be recovered
- once an Access Permit / Test Permit is issued, no further Construction or Test Authorities may be issued
- an Access Permit / Test Permit and Authority to Energise can be in effect at the same time
- In addition to existing network isolation points, Access / Test Permits shall also list new isolation points that may be created as part of the works.

When electrical apparatus is ready to be commissioned, the Commissioning Coordinator shall:

- ensure all Construction Authorities and Test Authorities on issue have been recovered.
- confirm all pre-energisation checks/tests have been successfully completed. If unable to complete all pre-energisation checks/tests, they shall be recorded in the Abnormalities section on the Authority to Energise
- Ensure all remaining earths are recorded on the related Authority to Energise
- be on site for a final check before authorising the Authority to Energise or appoint a Delegate
- if a Delegate is appointed, a detailed handover of current information and relevant documentation is mandatory.
- endorse the Authority to Energise.

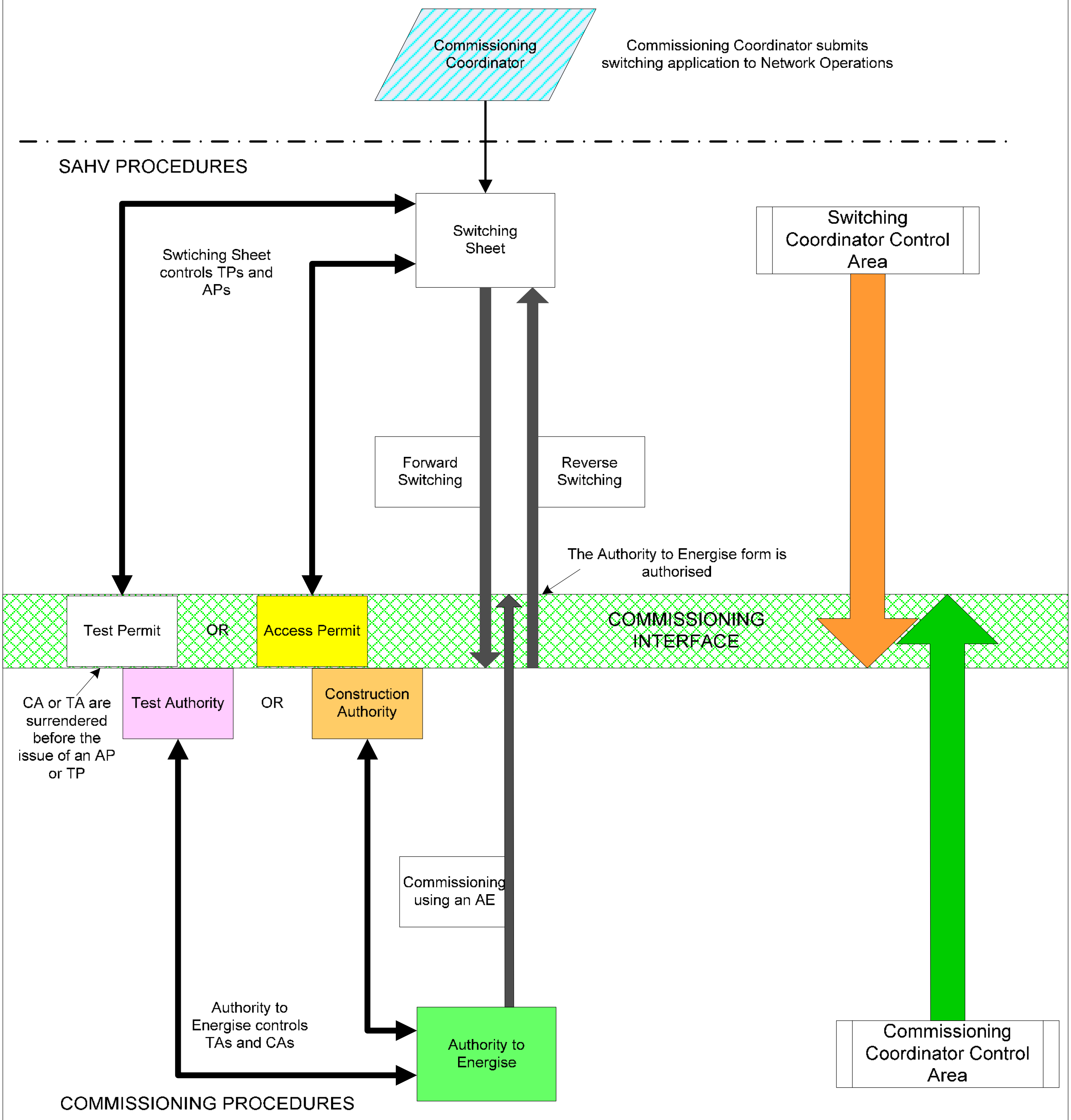
11.4.3.1.1 When a Construction Authority is required for electrical work:

Typical examples where Construction Authorities are required are:

- installation of Transmission, Zone and C& I substation HV electrical equipment
- stringing HV overhead conductors
- jointing / terminating underground cables.

Typical examples where Construction Authorities are NOT required are:

- delivery of transformers to site
- civil works such as:
- earthing
- standing poles
- laying conduits
- pulling in cables



COMMISSIONING INTERFACE

During the commissioning process SAHV procedures shall take precedence, as follows:

- prior to issue of an Access Permit/Test Permit ensure all Construction Authorities and Test Authorities are recovered
- once an Access Permit / Test Permit is issued, no further Construction or Test Authorities may be Issued
- an Access Permit / Test Permit and Authority to Energise can be on issue at the same time
- In addition to existing network isolation points, Access / Test Permits shall also list new isolation points that may be created as part of the works.

Fig 11.1 Commissioning Using an Authority to Energise

11.4.3.2 Construct and Commission a Pole Transformer

Construction and commissioning a pole transformer without an Authority to Energise shall only be carried out when all the disconnection points are on the transformer pole. (Fig 11.2)
(Refer to Section 11.8.3 in regard to the application of earths and other precautions.)

The pole transformer may be previously erected but shall remain Not Electrically Connected until the commissioning process takes place.

The following work shall be carried out on the day of commissioning:

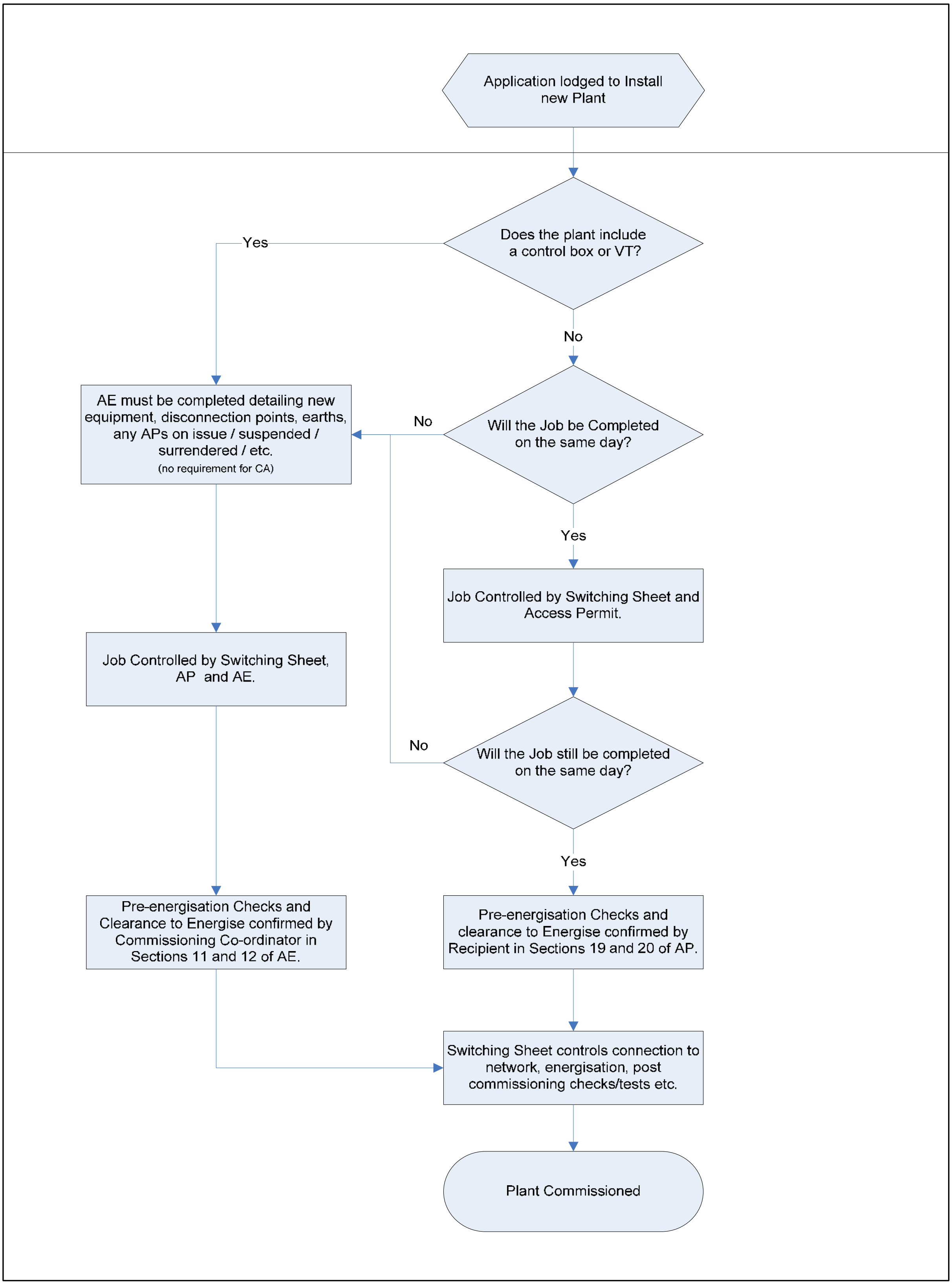
- all the required pre-energisation checks/tests
- make the connection between the energised commissioned network and the Not Electrically Connected electrical apparatus
- energise the new pole transformer and associated equipment
- post – energisation checks/tests are to be completed

A switching sheet shall be used when energising the pole transformer to ensure commissioning is performed in a controlled and coordinated manner.

The following item shall appear on the sheet:

Item	Location	Apparatus	Action	Time
	Switching Coordinator		Receive authority from on-site supervisor – that the new pole transformer and associated equipment may be energised	

Fig 11.2 Commissioning a Pole Transformer



11.4.3.3 Commissioning Using Approved Live Line Methods

Approved Live Line methods can be used to erect and commission the following electrical apparatus via a Work Authority issued under a reclose block or a switching sheet: (Refer to Fig 11.3)

- air break switches
- manually operated gas insulated load break switches
- temporary air break switches
- temporary links
- temporary flying shackles.

Approved Live Line methods can also be used to erect and commission the following using a switching sheet and an Authority to Energise:

- any HV electrical apparatus that includes a control box and/or voltage transformer (the HV electrical apparatus can only be installed with protection disabled)

(Refer to Section 11.4.3.1- Commissioning using an Authority to Energise.)

A Secondary System Works Program is required to apply protection settings for any HV electrical apparatus that includes a control box and/or voltage transformer.

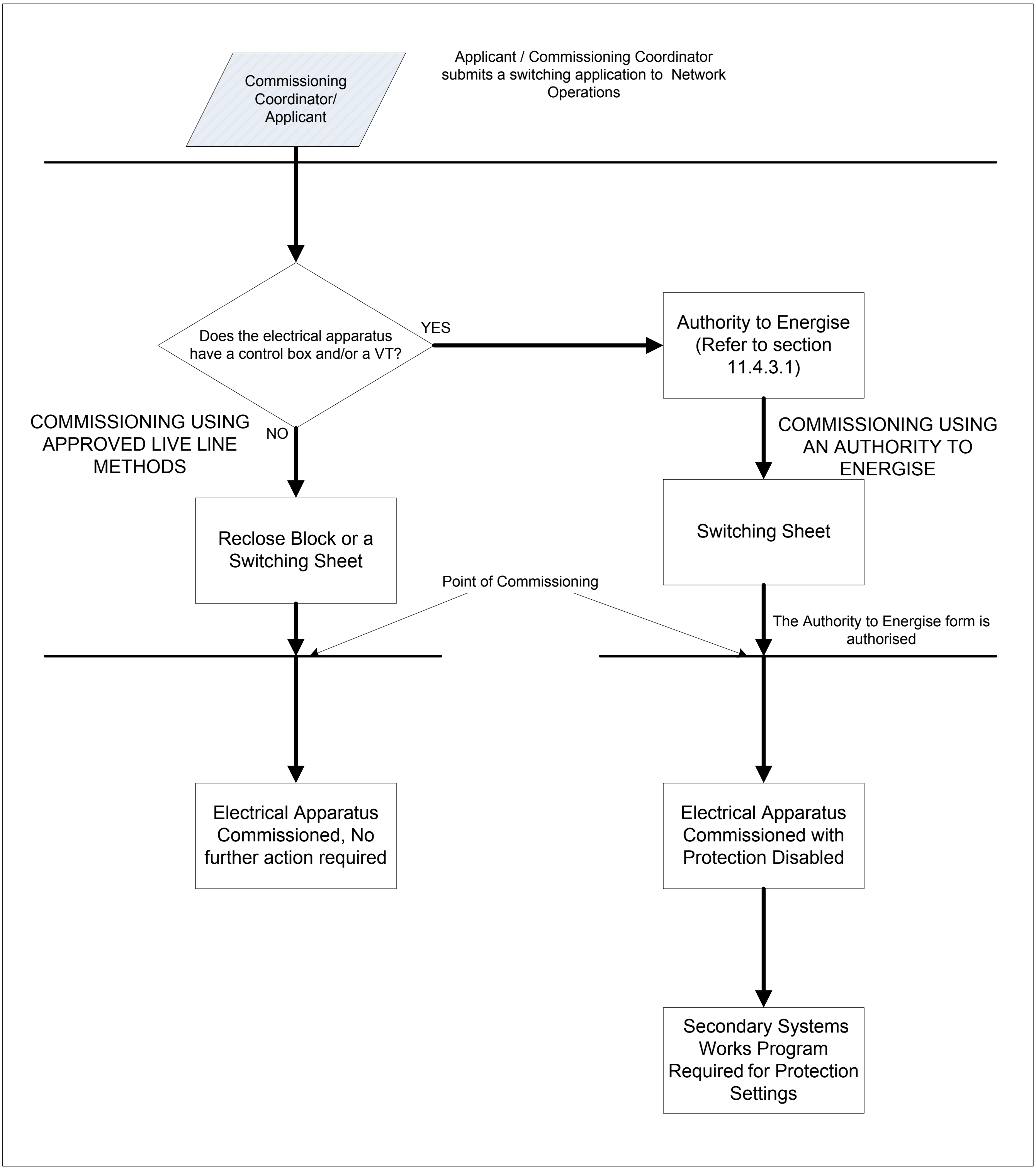


Fig 11.3 Commissioning Using approved Live Line Methods

11.4.3.4 Constructing and Commissioning Overhead Electrical Apparatus using an Access Permit

An Access Permit may be used to control the connection of non-commissioned overhead electrical apparatus (e.g. O/H mains, SP, ABS, etc.) to the commissioned HV network. (Refer Fig 11.4)

The Access Permit may only be used as the authority to commission the electrical apparatus, provided:

- all electrical work (refer Section 11.4.3.1.1) on the non-commissioned overhead electrical apparatus, including connection to the commissioned network and energising is carried out on the same day.

- in addition to existing network isolation points, the Access Permit shall also list new isolation points that may be created as part of the works.

- earths applied to the non-commissioned electrical apparatus shall be recorded in section 16 of the Access Permit as working earths

- section 20 of the Access Permit is endorsed by the recipient to confirm the pre-energisation checks/tests on the non-commissioned electrical apparatus have been successfully completed.

If due to unforeseen circumstances the electrical apparatus cannot be energised on the same day, it shall be left disconnected from the commissioned network using an approved method as per table 11.1 and the Access Permit surrendered . Section 11.4.3.1 - Commissioning using an Authority to Energise shall then apply to complete the work.

For any HV overhead electrical apparatus that includes a control box and/or voltage transformer, refer to section 11.4.3.1 – Commissioning using an Authority to Energise.

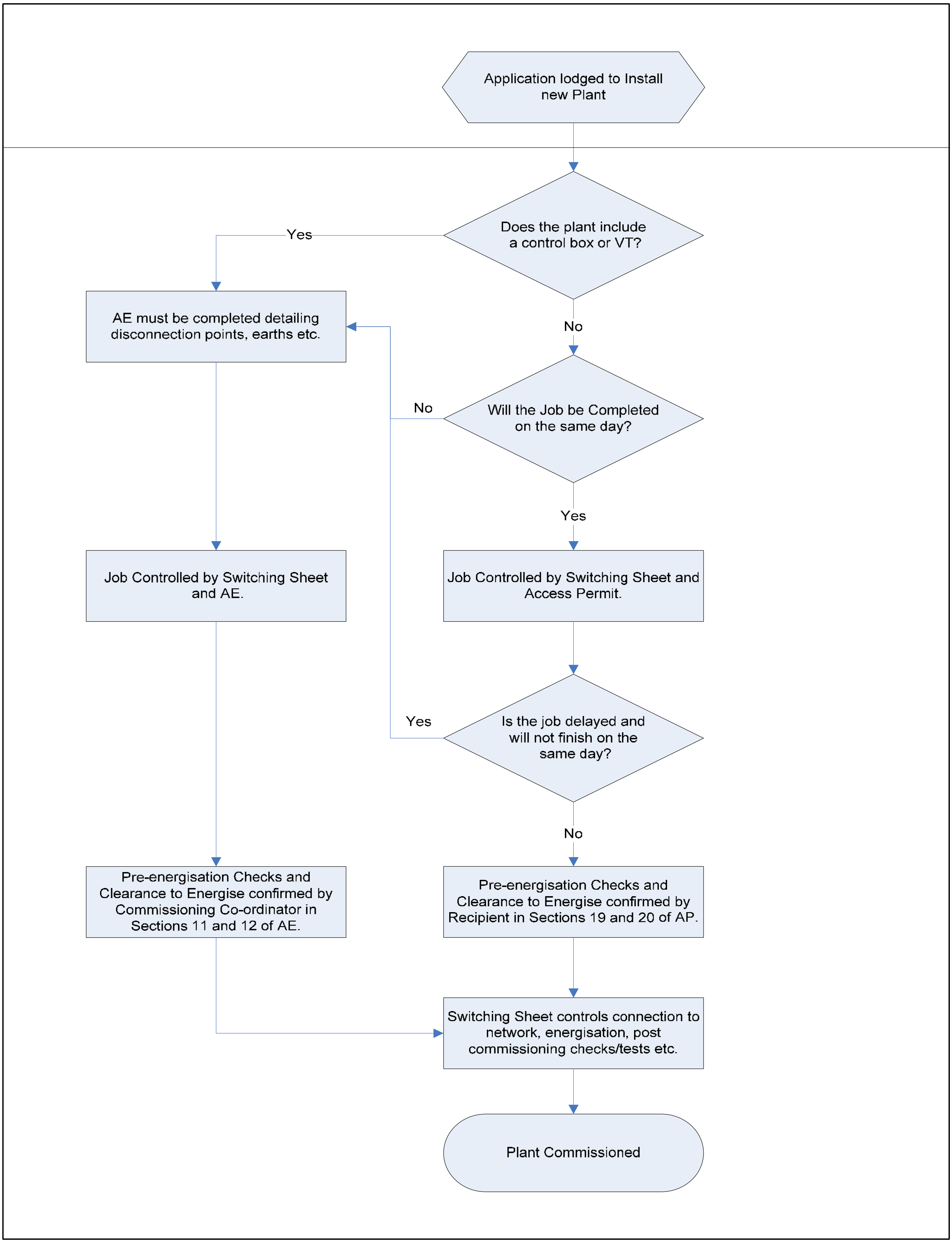


Fig 11.4 Commissioning Using an Access Permit

11.4.4 Connecting to Transmission, Zone or C & I Substations

A Substations Commissioning Coordinator shall be appointed to oversee and authorise the connection of substation electrical apparatus for Transmission, Zone or relay operated C & I Substations..

When connecting an Overhead or Underground feeder to electrical apparatus in Transmission, Zone or relay operated C & I Substations, a Substations Commissioning Coordinator shall be appointed to :

- be responsible for substation works prior to any feeder connection.
- be responsible for the coordination of the connection between the feeder and substation electrical apparatus.

A Commissioning Coordinator from the field workgroup shall:

- consult with the appointed Commissioning Coordinator from Substations within an appropriate lead time prior to the feeder connection..
- be responsible for feeder works prior to connection.

11.4.5 Labelling

The Commissioning Coordinator *will* ensure that all equipment and apparatus referred to in the Authority to Energise and associated Construction and Test Authorities is correctly and permanently labelled.

In the event that permanent labels are not yet available, temporary labels may be used. The text of any temporary labels must be identical to the proposed permanent labels and placed in a manner to correctly and unambiguously indicate the equipment to which it refers.

The Commissioning Coordinator *will* ensure that at the time of endorsing the Authority to Energise, all equipment and apparatus to be Electrically Connected is correctly and permanently labelled in accordance with the Substation Design Standard (BMS2168). Temporary labels should not be used on equipment to be Electrically Connected unless exceptional circumstances exist.

11.5 Decommissioning

11.5.1 Decommissioning Process

Decommissioning is the process of isolating, electrically disconnecting electrical apparatus from the commissioned network by an approved method and where applicable earthing that apparatus, , and the transferring of responsibility for the electrical apparatus from a Switching Coordinator to a Commissioning Coordinator.

There are three approved decommissioning methods:

1. Using a Decommissioning Notice, listed in 11.5.1.1
2. Using an Access Permit (AP) listed in 11.5.1.2
3. Using an Approved Live Line Method listed in 11.5.1.3.

A Commissioning Coordinator shall be appointed for method 1 listed above.

11.5.1.1 Using a Decommissioning Notice

This Decommissioning method is used when electrical apparatus will remain disconnected on site. A Commissioning Coordinator shall be appointed prior to decommissioning (refer to Fig 11.5). The Commissioning Coordinator using an approved method of disconnection as per table 11.1 shall:

- Prepare a Decommissioning Notice and provide it to the Switching Operator

- Submit a switching application with a copy of the Decommissioning Notice to the Outage Coordinator.

When the electrical apparatus is to be decommissioned, the Switching Coordinator shall:

- Confirm disconnection as per Decommissioning Notice
- Approve the authorisation of the Decommissioning Notice.

The Switching Operator on behalf of the Switching Coordinator must then authorise the Decommissioning Notice. More than one copy of the Decommissioning Notice may be required when several locations are involved.
Where practical the Decommissioning Notice should be placed on or near the Not Electrically Connected electrical apparatus.

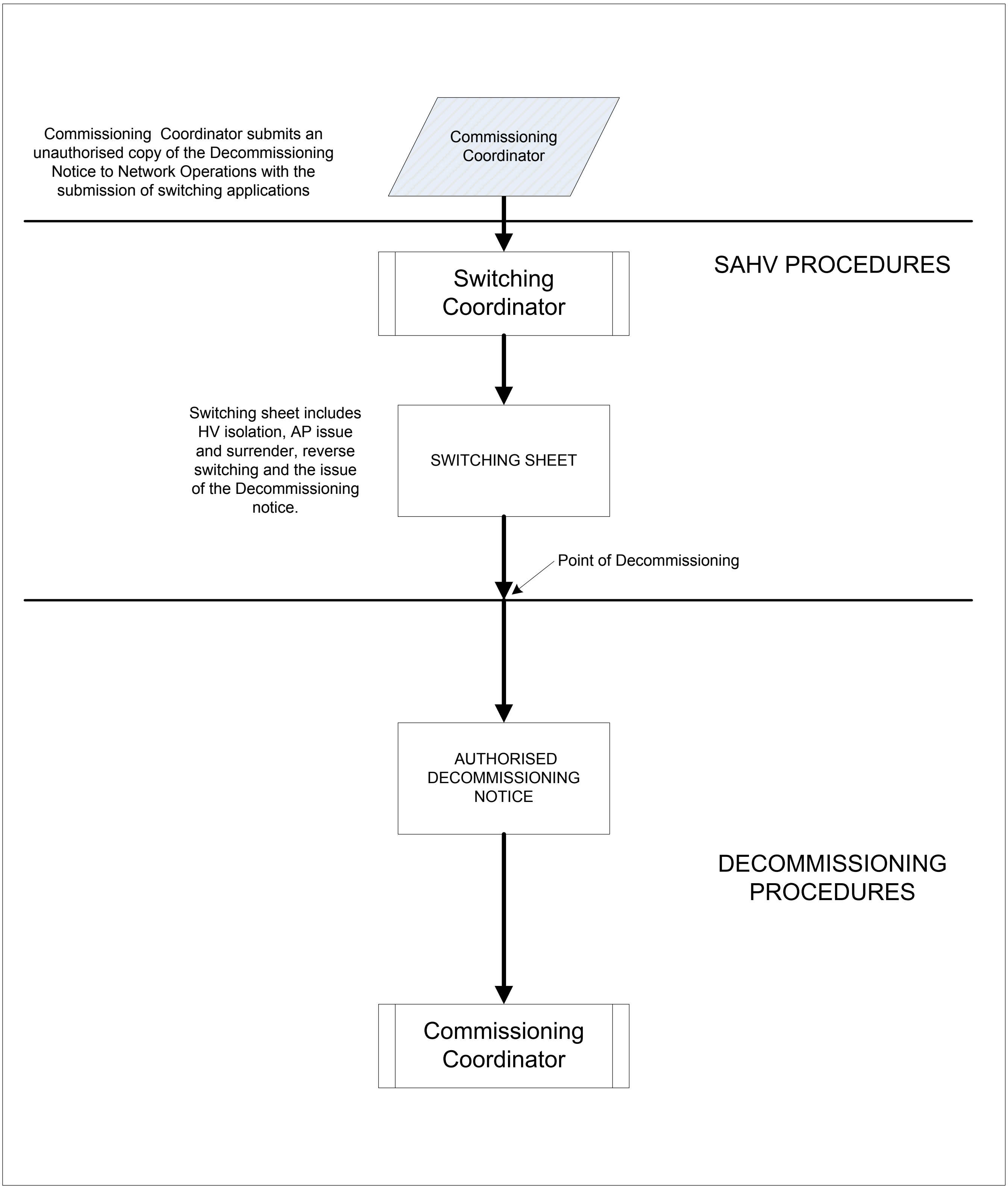


Fig 11.5 Using a Decommissioning Notice (Electrical Apparatus Left on Site)

11.5.1.2 Using an Access Permit.

An Access Permit/s can be used to allow the disconnection and recovery of electrical apparatus on the same day, (Refer to Fig 11.6) The Access Permit may be used as the authority to decommission the electrical apparatus, provided:

- the electrical apparatus is physically removed on the same day
- if operator earths have to be removed from the electrical apparatus to be recovered, approval is obtained from the Switching Coordinator
- the associated switching sheet includes items to check that the electrical apparatus has been suitably removed from service.

If due to unforeseen circumstances the electrical apparatus cannot be removed on the same day, it shall be disconnected from the commissioned network using an approved method as per table 11.1 and the procedures for decommissioning using a Decommissioning Notice shall apply.

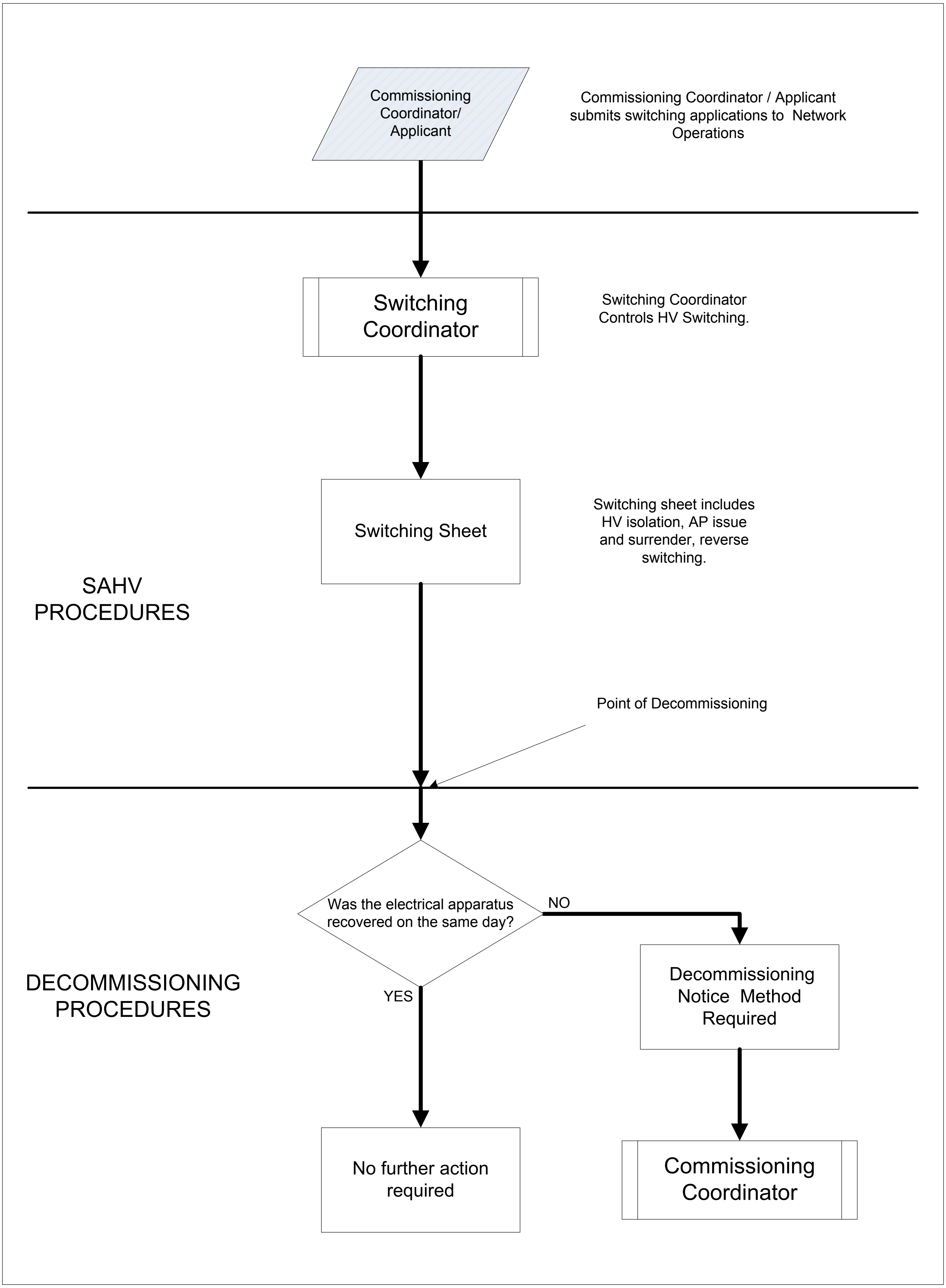


Fig 11.6 Decommissioning Using an Access Permit

11.5.1.3 Using an Approved Live Line Method

Approved Live Line methods may be used to disconnect and recover electrical apparatus on the same day. (Refer to Fig 11.7)

Approved Live Line methods may be used to recover the following electrical apparatus via a Work Authority associated with a reclose block or a switching sheet:

- air break switches
- manually operated gas insulated load break switches
- temporary air break switches
- temporary links
- temporary flying shackles

HV electrical apparatus that includes a control box and/or voltage transformer and is physically removed on the same day by approved Live Line methods may be controlled using a switching sheet.

If due to unforeseen circumstances the electrical apparatus cannot be removed on the day, it shall be disconnected from the commissioned network using an approved method as per table 11.1 and the procedures for decommissioning using a Decommissioning Notice shall apply.

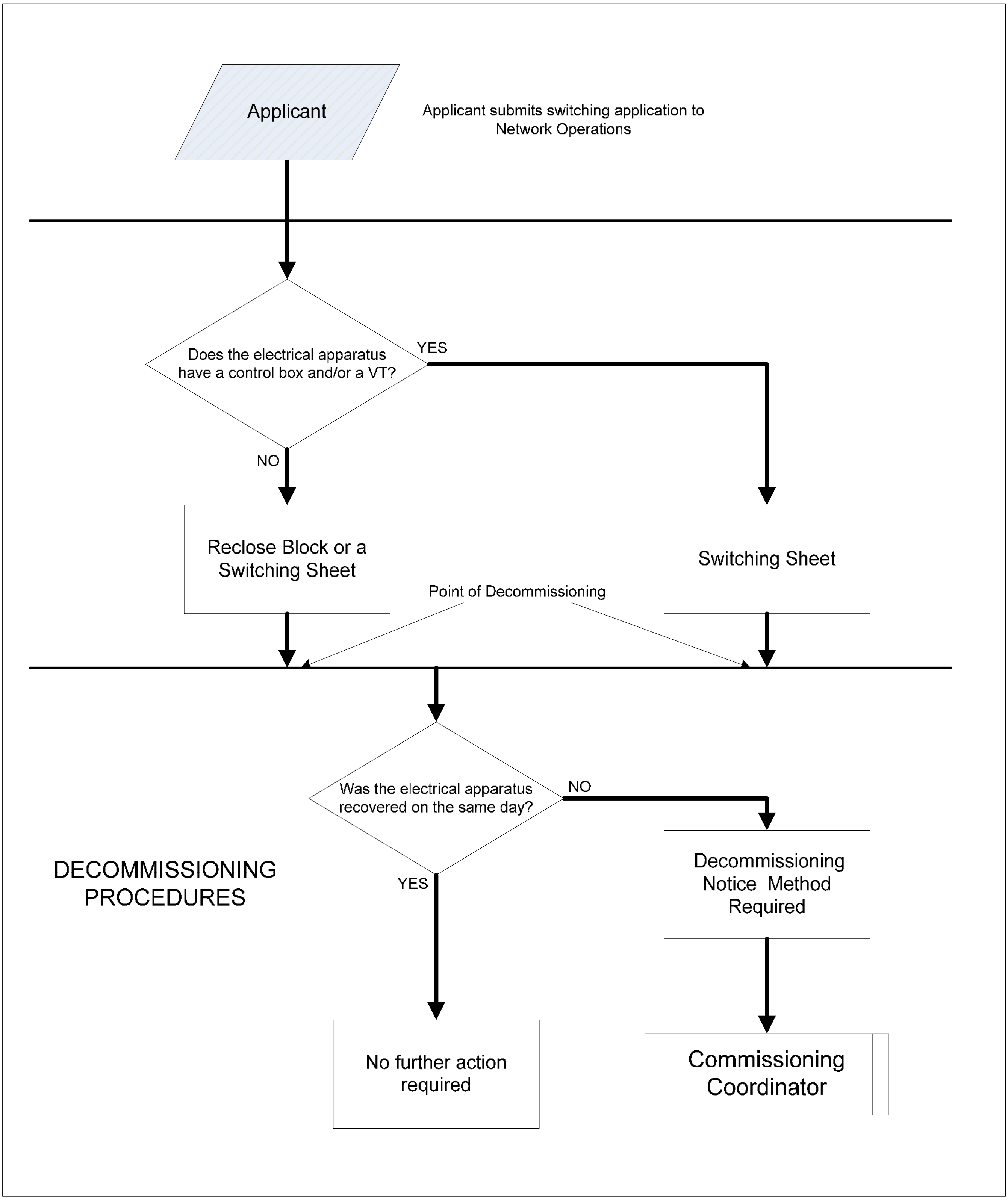


Fig 11.7 Decommissioning Using Approved Live Line Methods

11.5.2 Temporary Decommissioning

Follow procedures for Decommissioning refer to Section 11.5.1.1
The electrical apparatus is not removed from any operating diagrams (but pinned/tagged accordingly)
For Commissioning refer to Section 11.4.3.1

11.6 Working on Decommissioned Electrical Apparatus

A Commissioning Coordinator shall be appointed to coordinate all work on decommissioned apparatus. A Decommissioning Notice and Decommissioning Notice Attachment A are required for all work on Not Electrically Connected apparatus that will not be recommissioned in the foreseeable future.

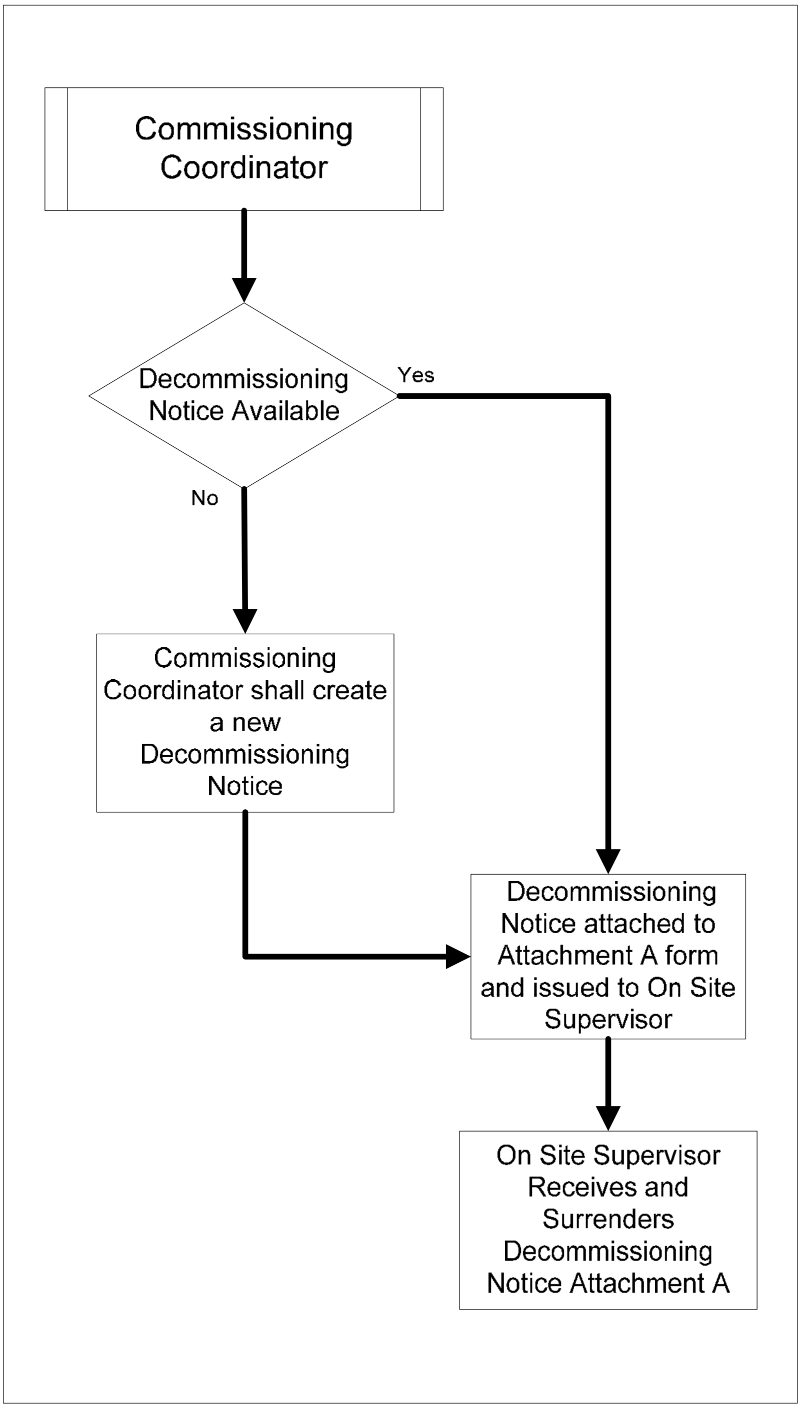


Fig 11.8 Working on Decommissioned Electrical Apparatus

If an existing Decommissioning Notice is available, the Decommissioning Notice is attached to Attachment A form, and shall be issued to an On Site Supervisor (who holds a current electrical licence) for work on the decommissioned network.

If a Decommissioning Notice is not available:

- a Commissioning Coordinator shall issue and endorse a new Decommissioning Notice
- a Switching Coordinator is not required to approve the authorisation of the Decommissioning Notice

The Commissioning Coordinator shall:

- Confirm the electrical apparatus to be worked on is disconnected as per table 11.1
- Confirm the electrical apparatus is disconnected as per Decommissioning Notice
- Refer to Section 11.8.3 in regard to the application of earths and other precautions
- Record earthing on the Decommissioning Notice
- Issue a Decommissioning Notice and Decommissioning Notice Attachment A to the On Site Supervisor

11.6.1 Working on Decommissioned and Commissioned Electrical Apparatus at the same time

Refer to Appendix A14 and A15 for application of this procedure.
For work on commissioned electrical apparatus SAHV procedures apply.
For work on decommissioned electrical apparatus Decommissioning procedures shall apply, refer to Section 11.6
An item on a switching sheet is required to confirm the On Site Supervisor has received a Decommissioning Notice and Decommissioning Notice Attachment A before the Access Permit has been issued.

11.7 Recommissioning of previously decommissioned electrical apparatus

11.7.1 Recommissioning

A Commissioning Coordinator shall be appointed to coordinate the recommissioning of .
The Commissioning Coordinator shall:

- destroy the original Decommissioning Notice
- follow normal commissioning procedures for the electrical apparatus to be recommissioned, refer to Section 11.4.

11.7.2 Partial Recommissioning

If Not Electrically Connected electrical apparatus (for example an O/H transmission line) is to be only partially recommissioned. Refer to Appendix A16 for application of this procedure.
The Commissioning Coordinator shall:

- destroy the original Decommissioning Notice
- prepare a new Decommissioning Notice/s to reflect the changed isolation for the part/s to remain Not Electrically Connected,
- a Commissioning Coordinator shall issue and endorse that new Decommissioning Notice
- a Switching Coordinator is not required to approve the authorisation of that Decommissioning Notice
- follow commissioning procedures for the part(s) to be recommissioned, refer to Section 11.4.

11.8 Other Issues

11.8.1 Disconnected from the Commissioned Network

Not Electrically Connected electrical apparatus shall be disconnected by an approved method as per Table 11.1.

Other precautions must be used, wherever possible.

Apparatus	Approved Disconnection Method
Overhead	• Bridges removed completely • Span(s) of O/H mains removed
Underground	• Cables Disconnected and removed • Cables cut clear
Substation	• Busbars removed • Blades removed completely • Cables disconnected and removed • Cables cut clear • Span(s) of O/H mains removed
Low Voltage	• Bridges removed completely • Cables disconnected • Cables cut clear • Cables/Leads/Flexible connectors removed

Table 11.1

11.8.2 Commissioning Procedures Involving HV Electrical Apparatus with Spare Switches

11.8.2.1 Non Withdrawable HV Electrical Apparatus

A spare switch is considered commissioned and under the control of the Switching Coordinator if any part of the switchgear associated with that spare switch is electrically connected to the network.

Any electrical apparatus that is attached to that spare switch is also considered commissioned.

When connecting electrical apparatus to or disconnecting from that spare switch, or working / testing on electrical apparatus that is attached to that spare switch an Access Permit / Test Permit shall be used.

All Test Authorities and Construction Authorities shall be surrendered before an Access Permit / Test Permit can be issued.

In addition to existing network isolation points, Access Permits / Test Permit shall also list new isolation points that may be created as part of the new works.

A surrendered Access Permit / Test Permit and an authorised Authority to Energise shall be required before new electrical apparatus can be energised.
DNOBs shall be attached to all spare switches, wherever possible

11.8.2.2 Withdrawable HV Electrical Apparatus

The same procedures apply to this section as per Section 11.8.2.1.

11.8.3 Earths and Other Precautions

Not Electrically Connected HV electrical apparatus shall have all phases short-circuited and earthed while work is in progress wherever practicable. Permanent earthing points should be utilised wherever possible.

Where applicable, earths and other precautions placed shall be recorded on the related Construction/Test Authorities, Authority to Energise or Decommissioning Notice.

(Refer to Section 0 for Responsibilities and Definitions for Commissioning Coordinator, On Site Supervisor, Earthing and Other Precautions)

11.8.4 Testing with Lethal Currents on Not Electrically Connected Electrical Apparatus

Before a Test Authority is issued the Commissioning Coordinator shall ensure:

- all construction work on the electrical apparatus under test to cease.
- all Construction Authorities are recovered,.

11.8.5 Numbering

A Commissioning Coordinator shall ensure:

- Each Authority to Energise is uniquely numbered.
- Each Construction Authority and Test Authority associated with that Authority to Energise shall be numerically linked as per example below.

Example:

- Authority to Energise No 123123
- Construction Authority No 123123 - 1
- Test Authority No 123123 - 2

11.8.6 Location of Construction Authorities

A Commissioning Coordinator shall ensure:

- Construction/Test Authorities are on site prior to the commencement of any work
- Construction/Test Authorities remain on site for the duration of work

11.8.7 Staged Access/Test Permits

Where isolation points for a job change, either physically or in name, then staged permits shall be used, for example:

- cutting an RMU (SC, SG, X site) into an existing underground feeder, where both sections of the cut feeder are **not** expected to be re-energised at the same time
- cutting a Substation (SS Site) into an existing underground feeder, since the name of one of the original isolation points and feeder name will change during the course of the job.

A stage 1 permit shall be issued to the work group requiring access to the electrical apparatus in its initial condition. When the isolation points change, the recipient shall surrender the stage 1 Permit, and then be issued with a stage 2 Permit, with the corrected isolation points. As many stages as are necessary must be used.

Note: A change in a feeder destination label is not considered to be a name change.

Staged permits are not required for example:

- cutting an RMU (SC, SG, X site) into an existing underground feeder, where both sections of the cut feeder are expected to be re-energised at the same time

11.8.8 Projects Involving Secondary Systems

Refer to Section 7.10 on work involving Secondary Systems

11.8.9 Projects Involving HV & LV

For projects that involve HV & LV Not Electrically Connected electrical apparatus (for example, a URD subdivision), a Commissioning Coordinator shall be responsible for commissioning both HV and LV electrical apparatus.

A Commissioning Coordinator shall be responsible for decommissioning projects involving HV and LV electrical apparatus.

11.9 Update of Records

The relevant Switching Coordinator must update the appropriate records and notify the Network Data Officer that the changes to the network have been implemented.

12 Switching involving Customers

12.1 Purpose

This section is intended to provide the framework for a safe and efficient system of work in areas where Energex and customer's requirements interface.

In this section, 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 Energex network. It includes their appropriate representative such as contracted electrician or switching coordinator.

12.2 Scope

These procedures shall be used for switching of Energex electrical apparatus for customers and the switching of customer's apparatus for Energex. In exceptional circumstances where it is not practicable to apply these procedures, application shall be made to Network Operations Standards for special consideration.

Examples of suitable application of these procedures include but are not limited to:

- Switching of Energex HV equipment to allow a customer to access their HV equipment
- Switching of Energex HV or LV equipment to allow a customer to access their LV equipment.
- Switching of a customer's equipment to provide Energex access to Energex equipment.

Existing Queensland legislation does not provide for Energex to take responsibility for the safe system of work of non-Energex personnel working on non-Energex equipment. Consequently Energex staff shall not issue Energex Permits or Authorities for customers' work on customers' equipment.

In circumstances where the proposed work does not directly affect Energex equipment and Energex is not able to guarantee control of all isolation points and safety precautions, Energex will isolate the installation from the Energex network and the customer shall carry out the work under the customer's own safe system of work.

When work occurs at the physical interface between Energex and the customer e.g. the terminals of a HV metering cubicle or the LV terminals of an Energex transformer directly connected to customer's mains, then the safe system of work employed shall be that of the worker performing the work.

Examples of these conditions include but are not limited to:

- If Energex staff are working on an Energex distribution transformer which is directly connected to the customers service then the Energex staff shall work under the appropriate Energex permit (AP/TP/DP) or other Energex approved safe system of work (e.g. in the case of Customer Connections Officers)

- If the customer's electrician is performing work on a customers service which is directly connected to the LV terminals of an Energex transformer or to an Energex LV fuse switch then the customer's electrician shall work under the their own safe system of work.

This section also details procedures to facilitate non electrical work near the Energex overhead network or equipment – for example civil construction work which may encroach on mandatory exclusion zones.

12.3 Restrictions

12.3.1 Switching of Customer's High Voltage Equipment

To protect Energex staff from exposure to risk of injury and liability, Energex staff shall not operate any customer's high voltage equipment.

Switching Sheet Writers and Authorisers shall not include items in a switching sheet directing Energex staff to operate customer's equipment. Any exception to this direction shall only be considered if approval has been given in writing by the relevant Asset Manager. It is the responsibility of the Applicant (in the case of smaller jobs) or project supervisor (in the case of larger jobs) to provide a documentary confirmation of this approval to Network Operations with the original Application.

12.3.2 Switching of Customer's Low Voltage Equipment

Various work practices require Energex staff to operate customer's low voltage equipment. These are typically specialised tasks such as checking polarity, phase rotation. Where an approved Work Practice exists to perform a task, it is permitted to operate a customer's equipment only in accordance with that work practice.

12.3.3 Switching Sheets

A Switching Sheet shall not direct a member of Energex staff to operate customer's equipment.

12.4 Application for Switching

A customer who requires switching of the Energex network to enable work on their installation shall make the initial request through the Energex Contact Centre. Appropriate Energex officer/s will be tasked to liaise directly with the customer concerning the appropriate and specific requirements of the job

Before Energex proceeds with the customer's application the customer shall provide Energex with the following details at a minimum:

- the reason for the switching (a brief description of the works),
- the Energex electrical equipment required to be switched,
- the time, date and expected duration of the works,
- in the case of HV work, the customer's HV Switching Coordinator's name and contact details,
- any additional information requested by Energex relevant to Energex's participation,

- any additional information which should reasonably have been passed to Energex relevant to Energex's participation,

If a switching sheet is required the appropriate Energex officer will complete a switching application in A4S based on the above information and forward it to Network Operations for outage coordination. The Energex Outage Coordinator will assess the application to determine if sufficient information has been provided to proceed and may require further detail from the Applicant or customer. The Energex Outage Coordinator may need to negotiate outage requirements directly with the customer or via the Applicant to ensure that Energex network requirements are met.

12.5 HV Switching by Energex for Customer HV Work

A customer may request switching of the Energex HV network so that work may be carried out on their HV installation.

12.5.1 Switching Sheets for HV Work

Energex will prepare an HV switching sheet to isolate the customer's HV installation from the Energex HV network. The name and contact details of the customer or their appropriate representative, together with a brief description of the works (e.g. "Isolation to permit work on customer's HV transformer") shall be included as Switching Coordinator's notes on the front page of the Energex switching sheet.

The Energex Outage Coordinator shall liaise with the customer's switching coordinator to ensure that the Energex switching sheet and the customer's switching sheet are in alignment.

If requested by the customer, the Energex Outage Coordinator may provide the customer with a copy of the authorised Energex HV switching sheet for reference purposes and in order to facilitate coordination of the switching.

In certain cases, e.g. staged or complex switching, Energex may require a copy of the customer's HV switching sheet before proceeding in order to facilitate coordination of the switching.

Energex switching sheets shall include an item to obtain clearance from the customer's switching coordinator before disconnecting the customer from supply.

Energex switching sheets shall include an item to advise the customer's switching coordinator that Energex isolation has been completed.

12.5.2 Isolation for HV Work

Energex authorised Switching Operators will carry out all switching of Energex HV electrical equipment. The Switching Sheet shall direct the placement of Energex "Do Not Operate" boards / tags (DNOBs) at the points of isolation from the Energex network.

When Energex HV switching is complete, advice shall be given by the Energex Switching Coordinator (not the Energex Switching Operator) directly to the customer's switching coordinator. This requirement shall be included as an item on the Energex switching sheet.

The Energex Switching Operator shall permit the customer to place such locks and safety tags as required to identify and secure any Energex electrical equipment that will serve as a an isolation point or earth for the customer's own safe system of work. Where necessary the Energex Switching Operator shall provide reasonable practical assistance to the customer in

the placing of their locks and tags. Examples of such assistance include the hanging of a customer's DNOB on Energex EDOs or substation isolators.

In the event that the customer requires earthing of Energex equipment to comply with their safe system of work then the Energex Switching Operator shall test to prove the Energex equipment is de-energised and apply Energex earths where required. The Energex Switching Operator shall apply an Energex DNOB to these earths. This action, if undertaken, shall be included as an item on the Energex switching sheet.

NOTE 1: the customer's locks and/or tags etc are in addition to any Energex locks and/or tags which were placed under the Energex switching sheet.

NOTE 2: it is strongly recommended that, where practical, callipers designed to accept multiple locks are used to provide distinct levels of security.

12.5.3 Restoration of Customer's HV Supply after Customer's HV Work

At the completion of the customer's work the customer's Switching Coordinator shall provide Energex's Switching Coordinator directly (not the Energex Switching Operator) with a clearance to commence restoration.

It should be recommended to the customer that the customer's switching sheet contain a reciprocal item.

Energex switching sheets shall include an item to obtain this clearance from the customer's switching coordinator before continuing.

After receiving this clearance the Energex Switching Operator shall permit the customer to remove their locks and safety tags from any Energex electrical equipment that served as a customer's isolation point or customer's earth. This requirement shall be included as an item on the Energex switching sheet.

If, during reverse switching the Energex Switching Operator finds a customer's lock or safety tag remaining on any Energex equipment, the Switching Operator shall immediately cease switching and contact the Energex Switching Coordinator for further direction.

Energex switching sheets shall include an item to obtain clearance from the customer's switching coordinator before reconnecting the customer to supply.

12.6 Switching by Energex for Customer LV Work

A customer may request switching of the Energex network so that work may be performed on their LV installation. In cases where isolation may be provided by the operation of a single LV switch e.g. single fuse/switch or single transformer LV switch then a switching sheet is not required. This process is comparable to removing the primary fuse of a smaller installation.

12.6.1 Switching Sheets for LV Work

When the operation of more than one LV switch (e.g. for LV area configuration) or the operation of an HV switch is required, Energex will prepare a switching sheet to isolate the customer's LV installation from the Energex network. The name and contact details of the customer or their appropriate representative together with a brief description of the works (e.g. "isolation for work on customer's main switch") shall be included as Switching Coordinator's notes on the Energex switching sheet.

12.6.2 Isolation/ Disconnection

Energex Switching Operators shall carry out all switching of Energex electrical equipment. The Switching Sheet shall direct the placement of Energex “Do Not Operate Boards” (DNOBs) at the point/s of isolation from the Energex network.

If there is no LV point of isolation from the Energex network (e.g. directly connected customer’s service) then the first available high voltage isolation point shall be used.

If it is necessary to use a high voltage switch to de-energise and isolate a customer’s LV worksite then earths may be applied to the high voltage side of the transformer if requested. These earths are an additional precaution and are not “Operator Earths”. The placement and removal of these earths shall be directed by a switching sheet and shall be recorded on any notice issued to the customer.

When Energex isolation is complete, the Energex Switching Operator shall perform appropriate tests to confirm that the LV conductors feeding the customer have been de-energised. The Energex Switching Operator shall direct the customer to place such locks and safety tags as required to secure any Energex electrical equipment that will serve as a customer’s isolation point. Where necessary the Energex Switching Operator shall provide reasonable practical assistance to the customer in the placing of these locks and tags.

NOTE: the customer’s locks, tags etc are in addition to any Energex locks/DNOBs placed under the direction of the switching sheet.

A “Customers Notice of Isolation from the Energex Network” (form 1668) shall be issued by the Energex Switching Operator directly to the customer, advising that isolation from the Energex network has been completed. The issue of this notice shall be included as an item on the Energex switching sheet.

The customer may then commence under their safe system of work.

12.6.3 Restoration of Supply

At the completion of the customer’s work the customer may request Energex to reconnect the installation to the Energex network by returning an endorsed form 1668.

The Energex Switching Operator tasked with reconnecting the installation shall not reconnect the installation without being in actual possession of an endorsed form 1668. The recovery of the endorsed form 1668 shall be included as an item on the Energex switching sheet.

In the event that the original form 1668 has been lost or destroyed a new form shall be raised detailing the original isolation point/s and safety precautions. The replacement form shall be clearly marked as a replacement for an original form and the reason for its issue e.g. “original lost”. This replacement form must be appropriately endorsed by the customer or their representative before the installation will be reconnected to the Energex network.

If the form 1668 was issued for electrical work then the form must be endorsed by a licensed electrician.

The Energex Switching Operator may then continue with switching to restore the customer’s supply. The Switching Operator shall advise the customer when supply is available / has been restored. This requirement shall be included as an item on the Energex switching sheet.

Note: In certain cases it will be necessary to coordinate the restoration of supply with an ACO / Customer Connections Officer / Metering Staff etc. Certain switching actions will require clearance from the CCO as preparations are made for testing etc. When the switching application advises of such cases switching sheets shall be written to accommodate interaction with the Customer Connections staff employing their safe system of work.

12.6.4 Customers Tags / Locks not Removed

If, during reverse switching the Energex Switching Operator finds a customer's lock or safety tag remaining on any Energex equipment, the Switching Operator shall immediately cease switching and contact the Energex Switching Coordinator for further direction.

12.7 Energisation of Customer's HV Electrical Equipment

When switching is required on the Energex HV network for the purpose of energising a customer's HV electrical equipment for the first time or following significant work, an appropriate Energex officer shall receive a written clearance from the Customer's Switching Coordinator before connecting to Energex supply. This clearance should include but is not limited to:

- *documentation* by an accredited auditor confirming that the customer's electrical installation has been tested to ensure it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying under the Electrical Safety regulations to the electrical installation,
- *documentation* confirming that all relevant persons associated with the customer's works have been advised that the installation is to be connected to supply,
- *documentation* confirming that any site specific or installation specific requirements have been met, e.g. certification of third party metering equipment, equipment labelling.
- particular regard must be paid to *documentation* confirming that all appropriate Customer Connection / requirements have been met.

If Energex works associated with the HV customer connection require a form 0282 "Authority to Energise" (AE) then the Energex Commissioning Coordinator shall attach the received documentation and customer clearances (or copies as appropriate) to that AE. The document/s will then become part of the pre-energisation checks for that AE.

In the event that an AE has not been required to energise Energex equipment and has not been raised for the job, the appropriate Energex officer shall raise and endorse an AE[(1)] (or other suitable document) detailing the equipment to be energised by Energex switching and attach the appropriate clearance/s and any other relevant documentation.

Typically this equipment would only include the customer's switchgear at the point of connection, the customer's transformer or LV switchboard up to the first available isolation point at the installation. Equipment after the initial open point is entirely the responsibility of the customer and as such Energex has no involvement in further switching.

The Energex Switching Coordinator shall not permit the installation to be connected to the Energex network until this documentation is recovered. The recovery of this endorsed document shall be included as an item in the switching sheet

Note 1: This AE form is used by a suitably qualified Energex officer to document that all relevant pre-energisation requirements have been met. The document is not to be used to control customers work and no Authorities shall be issued under this AE. Consequently there is no requirement for this document to be raised or endorsed by a Commissioning Coordinator.

12.8 HV Switching by Energex to Energise Customer's New LV Electrical Equipment.

HV switching by Energex to energise a customer’s new LV installation is controlled by an HV switching Sheet – in all other respects the process is identical to energising by an LV switch.

In these circumstances applicable Customer Connections procedures shall apply

12.9 Switching of Customer’s Equipment to permit Energex Work.

Situations arise when the operation of a customer’s switch is necessary to provide isolation for Energex works on Energex equipment. Examples may include:

- Maintenance of Energex transformers directly connected to the customer’s main switch.
- Maintenance of HV metering cubicles.

In these cases the appropriate Energex officer shall advise the customer of Energex’s requirements and negotiate the details to enable the work to proceed.

When suitable arrangements have been made with the customer, a Switching Application shall be submitted detailing the points of isolation on the Energex Network and the point/s of isolation at the customer’s installation. Typically this would be the customer’s main switch or the customer’s incoming circuit breaker.

A switching sheet shall be written to permit the work to occur and shall incorporate the following requirements:

When the isolation point owned by the customer is to be opened the Energex Switching Operator shall:

- request the customer to OPEN the isolation point, and
- confirm the OPEN state of the isolation point, and
- secure / tag the point in accordance with Energex procedures.

These steps shall be included at the appropriate places in the associated switching sheet. In most cases this wording would be similar to “Customer to OPEN” and “Check OPEN and Place DNOB”.

When the isolation point is to be restored to its normal condition the Switching Operator shall:

- Remove any Energex locks / tags etc. used to secure the customer’s equipment.
- Advise the customer that supply is available and that the customer may close their switch / CB etc.

These steps shall be included at the appropriate places in the associated switching sheet. In most cases this wording would be similar to “Remove DNOB only” and “Customer to Close” or “Advise Customer Supply Available.”

12.10 Switching to enable work in proximity to Energex equipment

A person may request switching of the Energex network so that work may be carried out near Energex equipment. Applications to perform such work will be processed in accordance with Section 12.4. Any application for such switching is subject to evaluation by Energex and approval will be subject to criteria such as (but not limited to) network security, inconvenience or disruption to customers and consideration of alternative options.

Options available in these situations include:

In the case of HV equipment: performing the work under SAHV requirements.

This necessitates the isolation, testing de-energised, earthing of the equipment, the issuing of an Access Permit to an Energex Authorised recipient and full compliance with the relevant sections of the SAHV. In many cases performing work under the SAHV will be impractical (e.g. long term projects) and work may be performed under the “Proximity Clearance” process as detailed in this section.

The appropriate Energex liaison officer shall consult with the person requesting the clearance to determine the process to be implemented, the extent of isolation or disconnection required and suitable disconnection points.

The submitted Application for Switching shall clearly indicate the requirement for an Access Permit or Proximity Clearance as appropriate.

12.10.1 Isolation/Disconnection

Energex Switching Operators shall carry out switching to enable work in proximity to the Energex network under the direction of a switching sheet.

In the case of proposed work near Energex high voltage equipment the equipment shall be made “not electrically connected” to the Energex network as defined in the SAHV.

In the case of proposed work near Energex low voltage equipment it is sufficient that the equipment be isolated and controlled by an approved method.

When disconnection from the Energex network is complete, the Energex Switching Operator shall perform appropriate tests to confirm that the equipment has been de-energised. In the case of high voltage equipment the Energex Switching Operator shall also earth the equipment in an approved manner.

The Energex Switching Operator shall complete and issue a Form 1541 “Clearance to Work in Proximity to the Energex Network” (Proximity Clearance) directly to a suitably authorised person. The issue of this Clearance shall be included as an item on the Energex switching sheet.

The Switching Operator shall provide a copy of Form 1542 (Proximity Clearance Attachment) to the person receiving the Clearance. Provision of the Attachment is deemed to be an integral part of the issuing of the Clearance and must occur at the time the Clearance is issued.

While a Proximity Clearance is on issue consideration shall be given to carrying out periodic inspections of the de-energised Energex equipment to ensure the equipment has not been compromised or damaged.

12.10.2 Restoration of the Energex Network

A suitably authorised person shall advise Energex that work will no longer be taking place near the Energex network and that they intend to surrender the Proximity Clearance. Upon receipt of such information the appropriate Energex officer shall liaise directly with the person intending to surrender the Clearance and confirm that the requirements for restoring the network will be met at the time of switching. The appropriate Energex officer will complete a switching application in A4S based on the above information and forward it to Network Operations for outage coordination.

The Energex Switching Operator tasked with reconnecting the installation shall not reconnect the installation without being in possession of a surrendered Proximity Clearance. The recovery of the Clearance shall be included as an item on the switching sheet.

If the original Proximity Clearance has been lost or destroyed a new form shall be raised detailing the equipment, the isolation/disconnection points, earths and any other safety precautions. The replacement form shall be clearly marked as a replacement for an original form and the reason for its issue e.g. “original lost”. This replacement form must be surrendered by a suitably authorised person before the equipment can be reconnected to the Energex network.

Prior to re-energisation, a suitably qualified Energex officer shall perform a cursory visual check of Energex equipment in the vicinity of the work area for signs of damage or other unsafe condition. This check shall be included as an item on the switching sheet.

Auto reclosing facilities shall be disabled on any protective device/s such that the previously disconnected equipment will not be automatically re-energised in the event of a fault being present upon the reconnected equipment.

END OF SECTION 12

13 Access for Non-Electrical Recipients

13.1 Introduction

These procedures are to be used when non-electrical persons are required to work near (ie. gain access to) commissioned ENERGEX HV electrical apparatus, and an electrical worker is not available to act as the recipient. The option of temporarily decommissioning the electrical apparatus should have been previously considered.

13.1.1 Purpose

The purpose of the following procedures is to ensure that:

- a safe working environment is achieved for non-electrical persons working near commissioned HV electrical apparatus
- all persons are clear before HV electrical apparatus is energised
- all persons remain clear after HV electrical apparatus is energised

13.1.2 Scope

These procedures apply to:

- work by non-electrical persons
- such work is planned to be within safe approach distance of commissioned ENERGEX HV electrical apparatus
- due to the nature of the work, it is likely that the safe approach distance to commissioned ENERGEX HV electrical apparatus may inadvertently be encroached

Examples:

- ENERGEX contract tree trimmers working within safe approach distance
- work by a private crane near HV mains where it is likely that, due to the nature of the work, safe approach distance would be encroached
- construction of a building adjacent to HV mains

Note: These procedures do NOT apply to emergency situations (In emergency situations, an electrical person must act as the recipient).

13.2 Non-Electrical Persons

Examples of persons who fall into this category are as follows:

- Tree trimmers
- Grass cutters
- Painters
- Carpenters
- Crane Operators
- Members of the public

13.3 Responsibilities

Refer to section 0 for the responsibilities of the non-electrical recipient of access permits, applicant and liaison officer, with regard to these procedures.

13.4 Access Permit Requirements

Any work near commissioned ENERGEX HV electrical apparatus requires the issue of an access permit to a person who acts as the recipient.

Test permits must not be issued to restricted recipients.

13.5 Earthing Requirements

Non-electrical persons are not allowed to place or remove earths, and earths must always be visible from the work area. An adequate number of operator earths must therefore be in place before an access permit is issued.

The applicant must scope the job to ensure that an adequate number of operator earths are suitably placed for the duration of the work. All operator earths must be placed as items on the related switching sheet.

To ensure that protection will operate and that a set of operator earths is always visible from the work area, the following earthing requirements apply:

- At least one set of operator earths applied must always be connected to an established earth.
- Additional operator earths should be connected to an established earth where available. If an established earth is not available, then operator earths may be connected to a spike (untested) driven a minimum of 600 mm in the ground.

13.6 Authorisation of Non-Electrical Recipients

13.6.1 ENERGEX Personnel or ENERGEX Contractors

Formal restricted recipient (RR) authorisation, as detailed in section 3, is required.

13.6.2 Other Non-Electrical Persons

Other non-electrical persons who require access to commissioned ENERGEX HV electrical apparatus must receive temporary "RR" authorisation. The following criteria apply to the granting of temporary authorisation:

- the access is for one job only
- the duration of the job is clearly defined
- the scope of the work is clearly defined
- only one access permit is required

13.6.3 Procedure and Competency Assessment for Temporary "RR" Authorisation

For temporary "RR" authorisation, prior to the submission of the application form, ENERGEX's liaison officer will meet on-site with all the persons acting as recipient during the job. The liaison officer will confirm the details of the access, and convey to these persons the safety precautions that will be put in place prior to the issue of the access permit (eg. isolation points, operator earths, other precautions), and the responsibilities of being a recipient. The liaison officer will then confirm that these persons understand these safety precautions (verbal assessment).

The liaison officer will then submit a written request to the Operating Standards Officer for issue of a temporary restricted recipient authorisation. The request will contain the candidates name, candidates full contact details (in case the A/P needs to be surrendered in an emergency), Candidate's employers name, the work site location, and period for which the temporary authorisation is required. The request will also include a statement confirming that the candidate has been instructed in, and understands the conditions of the access.

On completion of the forward switching, ENERGEX's switching operator will issue an access permit to the restricted recipient (who must be on site) and will fulfil the normal duties as to "advise access/test permit details to recipient if on site" (SAHV procedures section 8.4).

14 Non-Access Work

14.1 Introduction

These procedures are to be used by all personnel required to work on ENERGEX assets, or intended ENERGEX's assets.

These procedures are to be read in conjunction with the *Manual for HV Live Line Work.*

14.1.1 Purpose

The purpose of the following procedures is to ensure that:

- Switching Coordinators know where work groups carrying out non-access work are on the network (*except staking (nailing) of poles and level 3 mechanical testing of poles*)
- non-access work groups know which Switching Coordinator is responsible for that part of the network they are working on
- auto-reclosing is blocked (if required) before non-access work commences
- auto-reclosing is blocked (if required) for the duration of non-access work
- auto-reclosing is not restored before work ceases
- auto-reclosing is not left blocked following the completion of non-access work
- manual reclosing is blocked ie. not carried out whilst non-access work is in progress

14.1.2 Scope

These instructions apply to high voltage (overhead and substation) line work and verbal commissioning and de-commissioning, not covered by high voltage isolation and access (SAHV) procedures.

The following work will be carried out with the HV feeder reclosing OFF (Non-Auto):

- live line work (overhead and substation)
- high loads
- rebutting of poles carrying energised HV electrical apparatus
- work near energised HV electrical apparatus
- clearing of trees or branches near energised HV electrical apparatus
- reconductoring, recovering or erecting conductors beneath energised HV electrical apparatus

The following work may be carried out with the HV feeder reclosing ON (Auto):

- staking (nailing) of poles carrying energised HV electrical apparatus
- level 3 mechanical testing of poles carrying energised HV electrical apparatus

The decision to carry out this work with the electrical apparatus energised will only be carried out after a risk assessment of the actual job has been undertaken.

Live line work on feeders under Powerlink's (NET OPS) control will be carried out in accordance with the "Powerlink Queensland System Control Live Line Booklet".

Authority to work will be obtained (except for staking (nailing) of poles and Level 3 mechanical testing of poles) from the Switching Coordinator responsible for that part of the network at the time, before work can commence.

14.2 Reclose Block (RB) Form

14.2.1 General

The reclose block (form 130) is used as a written agreement made by the relevant control centre, with the non-access work group, that specified HV electrical apparatus will not be re-energised either automatically or by manual action.

Figure 14.1 details the process to be followed for “Non-Access HV (Overhead and Substation) Line Work”.

14.2.2 Number Required

A single reclose block form shall only cover one workgroup on one or more feeders. If more than one workgroup is involved, additional reclose block forms will be used.

In the case of multiple feeders, the Outage Coordinator will determine the appropriate number of reclose block forms required. The number of forms required will depend on the potential system impact (ie. a risk assessment). For example, is it an acceptable risk for the auto-reclose on all feeders to be disabled for the duration of the entire work program, or should the auto-reclose be enabled as works on each feeder are completed? If the auto-reclose must be enabled as the works on each feeder are completed, multiple reclose block forms will be required.

14.3 Planned Work - HV Feeder reclosing left ON (Auto)

The following work may be carried out with the HV Feeder reclosing ON (Auto):

- staking (nailing) of poles carrying energised HV electrical apparatus.
- level 3 mechanical testing of poles carrying energised HV electrical apparatus

Provided:

- a site specific risk assessment of the actual job is completed by the work group before the job goes ahead as per SWP 5.3.
- if a situation identified by the specific risk assessment requires switching of the electrical apparatus, then SAHV procedures shall be followed.
- the non-access work group should advise the relevant control centre of a contact name, contact number and work location before work commences and when work is completed.
- Network Operations will be notified of any field problems encountered by the work group (eg. conductor clashing, electrical hazards etc) immediately, by contacting the relevant control centre.
- Network Operations reserves the right to stop or cancel any work being performed on any feeder due to network security risks or requirements. This will be achieved by Network Operations notifying the appropriate Field Services hub or Contract Coordinator to stop or cancel any work being performed on these feeders when this situation arises.

14.4 Planned Work - HV Feeder reclosing Blocked (ie. left OFF or Non-Auto)

14.4.1 Applicant of a Reclose Block

The person who instigates the work will submit an RB request through A4S or complete a reclose block form and forward it to the Outage Coordinator responsible for the high voltage feeder.

The minimum detail required for the RB application is:

- a tick in the appropriate box designating the area team
- the RB applicant’s name, contact number and facsimile number
- the anticipated start and finish time, day and date for the non-access work
- the location of the work site, geographically and electrically (references to easily identifiable sites on the operating panel diagram must be used)
- the HV feeder(s), operating panel and grid reference (if known), and relevant PMR information.

- system alteration information supplied with relevant lead times (refer ENERGEX BMS procedures 618).

14.4.2 Outage Coordinator

The Outage Coordinator will examine the reclose block application and establish:

- the reclosing device/s that must be made non-auto.
- the reclosing device has reclosing, remote control, protection enabled
- the reclosing on the device(s) that protect the section of feeder to be worked on must be made non-auto (ie. one device for a radial feed, two devices for a ring feed). If there is no line PMR between the work site and the feeder CB then the feeder CB reclosing must be made non-auto.
- any known discrimination issues eg Tavrida recloser
- if any automatic changeover schemes are involved.
- if an 11kV generator is the source of supply
- the impact on the work area due to the operation of such schemes shall be assessed (precautions such as disabling the scheme or associated reclosing devices may be warranted)
- if the reclose block may proceed (ie. will it clash with other work?)

Examples.

Figure 14.1 – Radial Feed

R*eclosing to be disabled at X4567 only.*

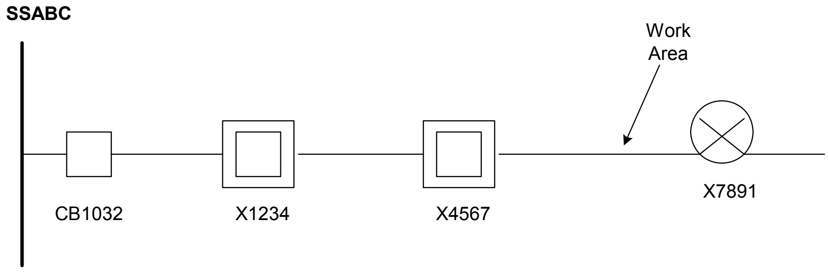
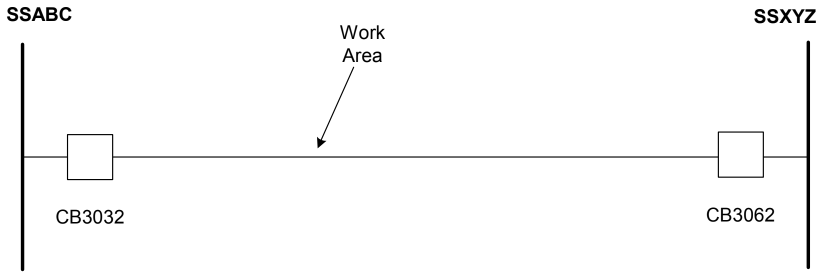


Figure 14.2 – Ring Feed

Reclosing to be disabled at CB3032 and CB3062.



After identifying any corrections to be made the Outage Coordinator will modify and authorise the reclose block for the nominated date and time. Modifications to the reclose block may include:

- inserting another reclosing device
- deleting a reclosing device
- toggling the remote control for the reclosing device
- tagging the reclosing device with "Pin Only" if the device has the reclosing turned off
- turning the auto reclose off manually, placing a tag on site and on the schematic panel if the recloser device has no remote control
- changing the reclose device to the next upstream device closer to the substation or at the substation circuit breaker/recloser, if the original reclose device selected has no protection

- inserting another reclose device after determining what actions to take when discrimination issues arise, that is making reference to notes on DMS and schematic panel diagrams. To help with technical advice refer to the Network Operations Planning Department intranet site “PMR Discrimination Information”.

The reclose block form should be used in the field. The Switching Coordinator will use an authorised reclose block form for non-access work; this includes Commissioning and Decommissioning by Live Line using approved Live Line methods (refer section 11 and for lead times and requirements refer ENERGEX BMS procedures 00618), provided the work does not involve:

- manipulation (switching) of the high voltage network (eg breaking bridges to create an open point for access)
- commissioning using an AE.
- decommissioning using a DN.

Therefore, if it involves any of the above, an application for switching and switching sheet is required.

If a reclose block or a switching sheet is used, the Outage Coordinator will:

- confirm the time and date of the job is acceptable, check and authorise the reclose block form or switching sheet and record the details in that days schedule
- distribute authorised copies of the reclose block form or the switching sheet to the Switching Coordinator responsible for that part of the network at that time
- distribute authorised copies of the reclose block form or the switching sheet to other control authorities requiring this information, eg. Powerlink (NET OPS)
- if auto reclosing is to be manually disabled in a substation or in the field, then the Switching Operator will be issued with a copy of either the authorised reclose block form or the authorised switching sheet

14.4.3 Switching Operator

The disabling/enabling of the auto reclosing (AR) is a switching operation (minimum authorisation required is OSO for PMR’s or SPO for substation CB’s), and will be carried out under the direction of the responsible Switching Coordinator. The disabling and enabling of the auto reclosing will require the recording of times on the Switching Coordinator’s and Switching Operator’s copy of the reclose block form or switching sheet.

14.4.4 Switching Coordinator

Before Issuing Work Authority
The Switching Coordinator will:

- ensure the correct RB form is available
- ensure all non-access pre-control checks (eg. network configuration ok for work to proceed) have been completed.
- confirm that the recipient of the Work Authority has the appropriate authorisation

Mux Sequence Page

- If the auto reclosing is under SCADA control, it will be disabled either by, or on the instruction of, the switching coordinator responsible for that part of the network at the time. The Switching Coordinator will then place a “D” pin (for each RB on that feeder) adjacent to the auto reclose

control point on the Sequence Page. Note: Substation CB/RE auto reclose control points will be pinned on the substation sequence page only, not on a DSA sequence page.

DMS "AR, SEF 11kV" or "AR 33kV" Page

- If the auto reclosing is under SCADA control, it will be disabled either by, or on the instruction of, the Switching Coordinator responsible for that part of the network at the time. The Switching Coordinator will then place a blue "L" Tag (for each RB on that feeder) onto the auto reclose control point (via the ARC BOA, device tagging) on the "AR, SEF 11kV" or "AR 33kV" page.
- For auto reclosing left disabled (either temporally or permanently) the auto reclosing shall be left off and tagged with a "D" tag and reason why

- place a dark blue "LL" pin (for non-access live line work) on the operating panel for non-remote control protection devices or place a blue "L" tag adjacent to the protection devices on the DMS console. If the DMS controls are disabled for that device, then a "D" pin will also be placed adjacent to the protection devices on the relevant MUX page(s).
- record:
  - the time the HV feeder is made non-auto (PMR(s) and/or substation CB).
  - the time and on-site supervisor's name, contact number and the time when the work authority is issued.

Transfer of the Non-Access Work Authority
The Switching Coordinator will record the name of the incoming on-site supervisor, confirm appropriate authorisation, contact number and time of the transfer.

Upon Completion of Work
The Switching Coordinator will:

- ensure the correct RB form is available
- on the reclose block form or switching sheet, record:
  - the time the work authority is revoked from the same on-site supervisor (issued to or transferred to) of the non-access work group.
  - the time the HV feeder is made auto (PMR(s) and/or substation CB).

14.4.5 On-Site Supervisor of the Non-Access Work Group

Before Allowing Work to Commence
The on-site supervisor will:

- deal directly with the control centre (eg. NCC; ENERGEX control, etc) named on the front of the reclose block form or the switching sheet;
- confirm the reclose block form number or switching sheet number and the relevant form details (eg. work description and location) with the responsible Switching Coordinator;
- on the reclose block form or switching sheet, confirm and record the time the work authority is issued.

Transfer of the Work Authority
The outgoing on-site supervisor will advise the Switching Coordinator of the name of the incoming on-site supervisor, contact number and time of transfer.

The incoming on-site supervisor will advise the non-access work group of the change of on-site supervisor.

If the on-site supervisor is absent or unable to transfer the non-access work authority, the incoming on-site supervisor will:

- advise the Switching Coordinator of transfer of work authority with the name of the incoming on-site supervisor, contact number and time of transfer
- advise the non-access work group of change of on-site supervisor, print name and time of the transfer, and become familiar with the conditions of the non-access work

Upon Completion of Work

The on-site supervisor will advise the Switching Coordinator immediately upon completion of the work and record the time the work authority is revoked.

14.4.6 Authorised Reclose Block not Available to Switching Operator

The Switching Operator's copy of the reclose block form must contain the same information as the Switching Coordinator's copy. For planned work involving field switching, the preferred method of operation is to always obtain an authorised copy of the reclose block. In situations where this is impractical the following procedure (similar to that used for a change to a normal switching sheet) will apply:

- the Switching Coordinator will provide details of all applicable reclose block items to the Switching Operator for recording on the Switching Operator's copy of the reclose block form
- the Switching Coordinator will then confirm all reclose block items provided to the Switching Operator by having the Switching Operator read them back

Notes:
The Switching Operator should record the additional details on their unauthorised copy of the reclose block form.

Typical reclose block items to be provided and confirmed by the Switching Coordinator are:

- *RB number (top of form)*
- *work description and location (from section 1)*
- *feeder(s) involved (from section 1)*
- *applicable field switching item(s) (from section 2)*
- *authorising Outage Coordinator's name (from section 2)*

14.5 Unplanned Non-Access Work

The Applicant shall negotiate with the Outage Coordinator to submit a reclose block application for unplanned Non-Access Work.

14.5.1 Reclose Blocks with Non Access Work Postponed

All activated reclose blocks are automatically started on a daily basis. If non-access work has not commenced on the selected day of the application (work postponed), then the reclose block will be completed and a new application will be required for that non-access work.
When non-access work has been postponed then the Applicant shall notify the relevant control centre for auto reclose to be enabled.

14.6 Emergency Non-Access Work

The Coordination of an Emergency Reclose Block shall be as follows:

- the non-access work group will identify the work description and location (electrically and geographically), and request an emergency reclose block from the relevant control centre.
- the emergency reclose block form will be prepared by the Switching Coordinator or Outage Coordinator.
- the process listed in section 14.4.6 for an authorised reclose block not available to Switching Operator shall be followed.
- the emergency reclose block shall follow the same process as described from section 14.4.2 to section 14.4.5

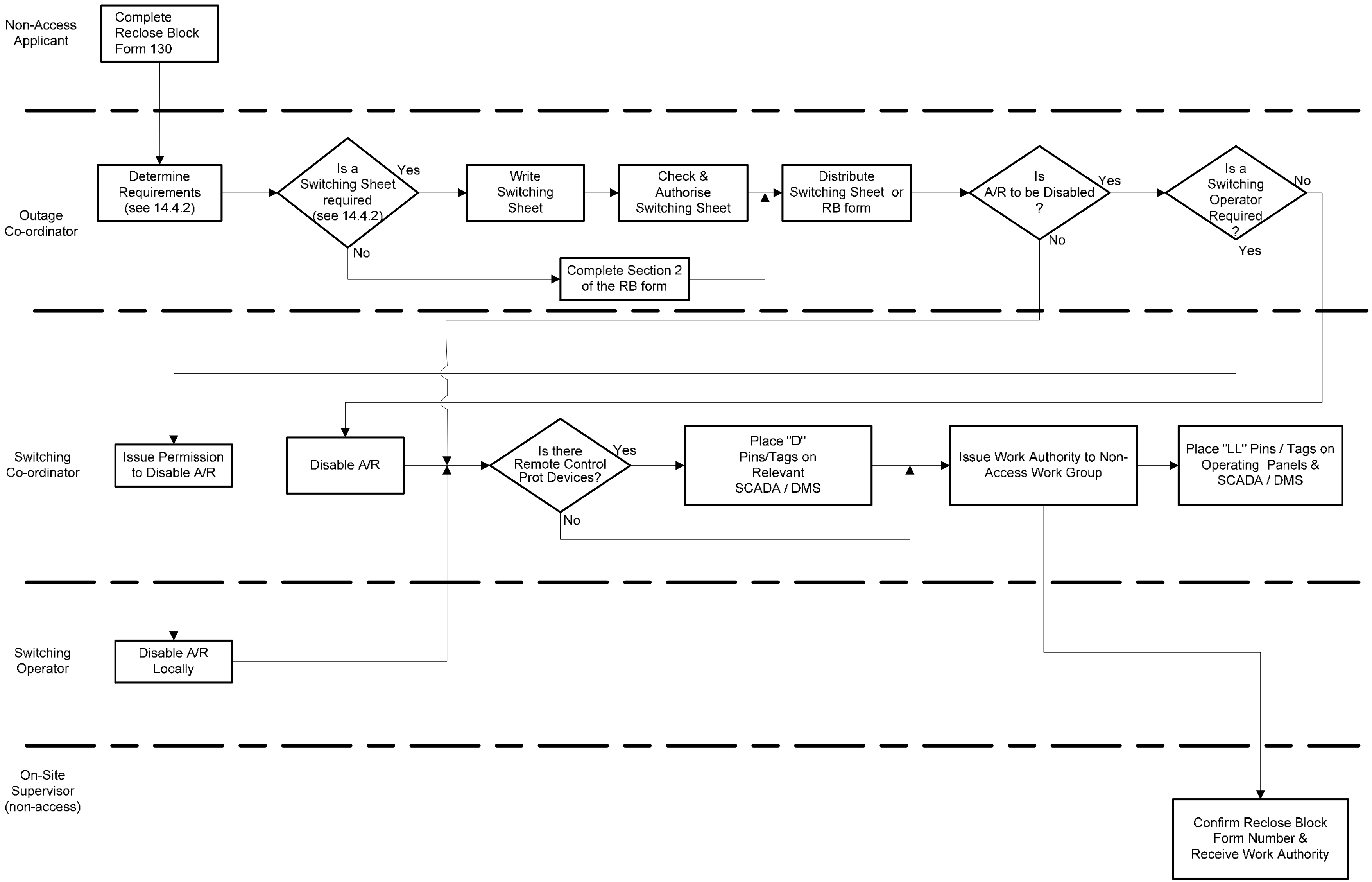


FIGURE 14.1 NON-ACCESS HIGH VOLTAGE (Overhead & Substation) LINE WORK

15 WORKS INVOLVING LOW VOLTAGE

15 Works Involving Low Voltage

15.1 Scope

The following procedures are to be followed for all work on the ENERGEX Low Voltage (LV) network. They apply to ALL existing LV electrical apparatus and electrical apparatus intended to become part of the ENERGEX LV network. They do not apply to work on LV switchboards in Zone Substations.

These procedures are to be applied to both planned and emergency LV switching and must be followed by all persons working on or near the de-energised LV network or energising any new LV electrical apparatus.

The procedure details the requirements to isolate, test to prove de-energised and the issue of De-energisation Permits/Fault Finding Permits and the responsibilities of ALL persons involved in the LV Switching Process

These procedures should be read in conjunction with BMS 618 and BMS 1112.

15.2 Coordination of Low Voltage Switching Sheets

15.2.1 Planned Switching

The coordination of both planned LV switching sheets written in SMS and activated non-SMS switching sheets faxed to ENC (ENERGEX NEWSTEAD CONTROL) 1 day prior to the commencement of switching are the responsibility of the LVOC (Low Voltage Outage Co-ordinator), based at ENC. *The LVOC in this document refers to the Network Ops Evaluation LV Outage Officer.*

Non-SMS sheets (e.g. Contractor sheets) shall be checked, authorised and activated by the LVOO (Low Voltage Outage Officer) based in the relevant hub. If the Non-SMS sheet is not faxed to ENC 1 day prior to the commencement of switching then the switching sheet shall also be coordinated by the LVOO.

- LVOC/LVOO is responsible for giving approval for switching to commence and finish, and approval to issue the De-energisation Permit/Fault Finding Permit.

- LVOC/LVOO has the authority to make minor changes to an authorised and activated switching sheet.

- LVOC/LVOO has the Authority to cancel a sheet if it is found that works greatly exceeds the original scope, or changes to customer's outages e.g. no interruption notice delivered or extended isolation affecting customers who were not notified.

- LVOC/LVOO is required to enter any abnormalities in A4S which may arise from changes in work or uncompleted works. LVOC/LVOO should also advise the HV switching coordinator of LV network abnormalities which may affect the normal operation of the HV network (e.g. LV ties across feeders, distribution transformers tied in etc).

Note: The above responsibilities apply to whoever has given authority for a switching crew to commence switching. This can either be the LVOC, the LVOO or the Standby Resource Coordinator depending on the situation.

~~15.2.2 Emergency Switching~~

~~All Emergency Low Voltage switching sheets are the responsibility of LVOC **excluding Level 2 events**. During Level 2 events the LVOO at the relevant hub should resume these responsibilities. If the LVOO is not available, these responsibilities will default to the standby Resource Coordinator.~~

~~*Note: If deemed necessary during abnormal circumstances, the Network Operations Group Manager can advise the LVOO to assist with coordinating LV switching sheets.*~~

~~15.3 Responsibilities~~

~~15.3.1 Application~~

~~Applicants are responsible for writing switching sheets and confirming that the LV network, as it exists in the field, is correct in regards to diagrams/Energise. If any discrepancies exist between diagrams/Energise and the LV network it shall be bought to the attention of the LVOO. The applicant shall also ensure that the outage details, clash information and isolation points are correct on the switching application.~~

~~The Applicant shall ensure that all details for the De-energisation Permit/ Low Voltage Fault Finding Permit are completed accurately, including a full description of works to be performed, the worksite location and all required isolation points~~

~~A minimum of 5 business days are required from the day the switching sheet is submitted to the LVOO to the day of the switching. The 5 business days will be separated into, 2 business days for the LVOO to check the LV switching sheet and 3 business days for the LVOC to authorise and activate the LV switching sheet.~~

~~*Note: Where the application has been entered by an ENERGEX Authorised Applicant on behalf of an ENERGEX contractor, the responsibility rests with the ENERGEX Authorised Applicant.*~~

~~***A switching sheet shall not be written and checked by the same person, except for emergency switching.***~~

~~15.3.2 Checking~~

~~The LVOO is responsible for verifying all details of the switching application including outage details, clash information and De-energisation Permit/ Low Voltage Fault Finding Permit information. The LVOO is also required to confirm the logic of the switching sheet and that the switching items correctly isolate the requested LV electrical apparatus. The LVOO is to confirm that the intent of the switching sheet is satisfied by checking it against diagrams/Energise.~~

~~After all necessary checks have been completed the switching sheet can be placed into the checked state in A4S ready for authorisation by LVOC.~~

~~Switching sheets not meeting the 3 business day requirement shall be checked and authorised by the LVOO.~~

~~The checking/authorising of the switching sheet can be completed by the same person and that person shall hold an Electrical Licence or electrical equivalence~~.

~~15.3.3 Authorising~~

~~The LVOC is responsible for authorising LV switching sheets written in SMS meeting the 3 day lead time requirement. The LVOC shall confirm the switching logic and clash details are correct and check if there are any clashes between LV and HV switching sheets.~~

~~If the LV switching sheet cannot be authorised due to inadequate information then the LVOO and Applicant will be contacted by either phone or email. The switching sheet will be placed into the Field Checked state until the LVOO or Applicant contacts the LVOC and provides the requested information.~~

~~15.3.4 Activation~~

~~LV switching sheets should be activated as close as is practical to the requested switching date. This is required to ensure that any new network abnormalities, entered after authorisation, do not impact the switching. The person activating the switching sheet shall check for clashes with any other switching sheet and also confirm that the outage notification details are current and updated if required.~~

~~See Table 15.3.5 for a summary of these responsibilities.~~

~~15.3.5 Summary of Switching Responsibilities~~

~~WHEN~~	~~WRITING~~	~~CHECKING~~	~~AUTHORISING~~	~~ACTIVATING~~	~~COORDINATING~~
~~Normal/After Hrs **SMS** sheet, meeting **3 DAY** LVOC requirement~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Construction Office FCO*~~ ~~*Work Group Leader WGL*~~ ~~*Job Ready Officer JRO)*~~	~~**LVOO**~~	~~**LVOC**~~	~~**LVOC**~~	~~**LVOC**~~
~~Normal/After Hrs **SMS** sheet, **NOT** meeting **3 DAY** LVOC requirement~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Construction Office FCO*~~ ~~*Work Group Leader WGL*~~ ~~*Job Ready Officer JRO)*~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOC**~~	~~**LVOC**~~
~~**NON SMS** sheet **Faxed** to ENC, **1 DAY** prior to commencement of switching~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Construction Office FCO*~~ ~~*Work Group Leader WGL*~~ ~~*Job Ready Officer JRO)*~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOC**~~
~~**NON SMS** sheet **Faxed** to ENC, **NOT** meeting **1 DAY** prior to commencement of switching~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Construction Office FCO*~~ ~~*Work Group Leader WGL*~~ ~~*Job Ready Officer JRO)*~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOO**~~
~~**NON SMS** sheet **NOT Faxed** to ENC~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Construction Office FCO*~~ ~~*Work Group Leader WGL*~~ ~~*Job Ready Officer JRO)*~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOO**~~	~~**LVOO**~~
~~**EMERGENCIES**~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Crew*~~ ~~*Work Group Leader WGL)*~~	~~**LVOC**~~	~~**LVOC**~~	~~**LVOC**~~	~~**LVOC**~~
~~**LEVEL 2 EMERGENCIES (Orange Alert)**~~	~~**Applicant**~~ ~~*(Could include*~~ ~~*Field Crew*~~ ~~*Work Group Leader WGL)*~~	~~**LVOO**~~ ~~*(As per standby roster)*~~	~~**LVOO**~~ ~~*(As per standby roster)*~~	~~**LVOO**~~ ~~*(As per standby roster)*~~	~~**LVOO**~~ ~~*(As per standby roster)*~~

~~15.4 Low Voltage Switching Sheets~~

~~All switching of Low Voltage electrical apparatus including energising new electrical apparatus shall be documented on a switching sheet. Refer to 15.7 for Matrix of when to use LV Sheets and De-energisation/Fault Finding Permits.~~

~~15.4.1 General~~

~~Each switching sheet shall be in a standard format and provide a location, dates/times and a detailed description of the work to be carried out. It shall have a unique reference number and be recorded in A4S. It shall also include the following;~~

~~Forward Switching~~

- ~~An initial item to 'Obtain approval to commence forward switching'.~~
- ~~All switching items to reconfigure/isolate the LV network in a logical and sequential order.~~
- ~~Provision for the recording of the completion of each item.~~
- ~~Isolation points with safety signs attached.~~
- ~~An item to 'Place other precautions at all work areas'.~~
- ~~An item for 'All workgroups to test, prove de-energised LV lines and electrical apparatus at all worksites and report to the onsite supervisor'.~~
- ~~Items for the issue and receipt of any De-energisation/Fault Finding Permit.~~

~~Reverse Switching~~

- ~~Items for the surrender and recovery of any De-energisation/Fault Finding Permit.~~
- ~~An initial item to 'Obtain approval to commence reverse switching'.~~
- ~~An item to 'Confirm pre-energisation checks/tests completed and no abnormalities~~
- ~~An item to 'Check other precautions removed.~~
- ~~All switching items to reconfigure/isolate the LV network in a logical and sequential order.~~
- ~~An item to advise reverse switching is completed.~~

~~15.4.2 Energising New LV Electrical Apparatus~~

~~When energising new LV electrical apparatus, a switching sheet is required and the switching sheet shall clearly define the LV electrical apparatus that is to be energised. Any electrical apparatus that is not ready to be energised shall be isolated and left in a safe condition with appropriate safety signs attached. This isolation shall be reinforced as check items on the switching sheet, e.g. Check Open, Place Authorised Person Tag.~~

~~When energising LV electrical apparatus that is associated with Not Electrically Connected HV electrical apparatus (e.g. SG, SC and SP), the HV electrical apparatus shall remain 'Not Electrically Connected to the energised LV electrical apparatus'. For typical examples refer to Appendix C.~~

~~15.4.3 Phasing and Phase rotation~~

~~Phasing out must be included as an item on a switching sheet when:~~

- ~~Two or more phases are broken on mains that can be paralleled.~~
- ~~During commissioning prior to closing a new ring.~~

~~Note: This includes LV bridging as well as links.~~

~~Phase rotation is required to be checked and marked as an item of forward switching and confirmed during reverse switching when there is a possibility of crossed connections to:~~

- ~~3 phase Customer installations.~~
- ~~3 phase spur lines.~~

~~15.4.4 Common Isolation Points~~

~~Where a common isolation point is used for separate LV switching sheets (for example a LV link) or separate HV and LV switching sheets (for example, a transformers LV switch) a DNOB is required for each switching sheet.~~

~~The HV and LV switching sheets shall be written to allow the placement/ removal of the DNOB that pertains to that switching sheet.~~

~~e.g. '*Check LV switch open, place additional DNOB' or*~~
~~*'Remove one DNOB only, Leave LV switch open'.*~~

~~In situations where an HV switching sheet is used to energise to the LV switch of a transformer and the LV switch is required to remain open with DNOB placed for further work on the LV switchboard/ network, the HV switching sheet shall have an item in reverse switching to Check Open and DNOB placed on the switch. When the LV switchboard/ network are ready to be energised, the DNOB can be removed and the switch closed as an item on an LV switching sheet.~~

~~Please note: In this situation unless directed by the applicant on the switching application to energise up to the LV Switchboard, the HV switching sheet will just energise with DNOB placed on the LV switch of the transformer.~~

~~The switching items on the HV switching sheet will be;~~

~~Forward Switching~~

~~Location~~	~~Apparatus~~	~~Action~~
~~Hooper Rd~~ ~~Carina~~	~~LV Switch~~ ~~SC1468523/TR1~~	~~Check Open~~ ~~Place DNOB~~

~~Reverse Switching~~

~~Location~~	~~Apparatus~~	~~Action~~
~~Hooper Rd~~ ~~Carina~~	~~LV Switch~~ ~~SC1468523/TR1~~	~~Check Open~~ ~~DNOB Placed~~
~~(Text Item)~~ ~~## LV switch to be closed on LV Switching Sheet ##~~		

~~15.4.5 Combined HV and LV Switching~~

~~The outage coordinator will determine the format of switching sheets when assessing outage requirements (that is, separate HV and LV switching sheets or a combined HV/LV switching sheet).~~

~~The order of supply restoration (LV first or HV/LV together) should generally determine the low voltage isolation points nominated on an access permit.~~

~~When separate HV and LV switching sheets are used~~

- ~~They shall be cross-referenced as items on the related switching sheets~~
- ~~A HV Access Permit and a LV De-energisation Permit is required to be issued~~

~~If a combined HV and LV switching sheet is used a LV De-energisation Permit is not required. Typically a combined HV and LV switching sheet can be used when there are no more than 3 LV switching items on the forward switching and the items are only either Check open or open items. That is no LV load shifts included.~~

~~If a combined HV and LV switching sheet is used for access to the HV and LV network, i.e. The HV sheet extends down to isolation points on the LV network, the switching sheet shall also include an item;~~

~~'**Switching Operator** Test, Prove De-energised LV Electrical Apparatus at worksite'~~

~~This item is in addition to the normal Test, Prove De-energised and Earthing of the HV network, before the HV access permit can be issued.~~

~~15.4.6 HV and LV Switching run in conjunction~~

~~When an HV switching sheet and LV switching sheet run in conjunction with each other, e.g. HV switching sheet has to proceed before LV switching sheet can proceed, both the HV and LV switching sheets are to have a notation to advise the order of when the HV and LV switching can proceed. This includes all LV switching sheets which may run in conjunction with other LV switching sheets.~~

~~15.4.7 Emergency Isolation for Repair Work~~

~~There have been documented incidents involving incomplete isolation of LV electrical apparatus during emergency LV switching (due to reduced switching sheet preparation/checking requirements). To ensure similar incidents do not occur, the following additional control measures will be used for emergency switching for isolation purposes:~~

- ~~Emergency repair works shall not commence on electrical apparatus, until all associated switching has been completed to isolate and prove de-energised.~~
- ~~If further HV and/or LV switching is required to restore supply to adjacent areas, all workgroups shall be contacted to remain clear of the electrical apparatus while further switching takes place.~~
- ~~The work group will re-test the electrical apparatus before resuming work.~~

~~15.5 Low Voltage Ties~~

~~When operating LV ties for load shift reasons, the LVOC or LVOO must be informed if the network is to be left in an abnormal state for longer than the proposed time. The person coordinating the switching at the time will need to enter this event in the Network abnormality page.~~

~~Where LV ties are closed as part of the HV forward switching and the system is left in an abnormal state, the HV Switching Coordinator will need to enter this event in the Network Abnormality page.~~

~~For instances where LV ties are closed on the HV switching sheet, a notation must be made on the LV switching sheet to re-check the ties are indeed closed before proceeding forward.~~

~~E.g. 'Confirm all LV ties closed on AS1234567 before commencement'~~

~~Where LV ties are closed on the forward switching of an HV switching sheet but later required as an isolation point on an LV switching sheet, a notation should be made on the switching application of both the HV and LV switching sheets. This is the responsibility of the Applicant.~~

~~15.5.1 Order of Preference~~

~~The following defines and specifies the preferred order of selection for LV tie points.~~

~~(i) Same Feeder LV Ties~~

~~Any LV tie that when closed will tie together the adjacent LV areas of transformers fed via HV supply from the same feeder (e.g. CMV13/CMV13).~~

~~(ii) Between Feeder LV Ties~~

~~Any LV tie that when closed will tie together the adjacent LV areas of transformers fed via HV supply from the same bulk supply zone. Examples include:~~

- ~~LV ties between transformers fed from different HV feeders supplied from the same zone substation (eg CMV13/CMV12)~~
- ~~LV ties between transformers fed from different HV feeders supplied from different zone substations within the same bulk supply zone (e.g. CMV13/ARG5)~~

~~(iii) Between Zones LV Ties~~

~~Any LV tie that when closed will tie together the adjacent LV areas of transformers fed via HV supply from different bulk supply zones (e.g. CMV13/CPL5)~~

~~(iv) LV Ties for Voltage Improvement Purposes~~

~~Any LV tie(s) closed for voltage improvement purposes shall have a 'voltage tie' warning sign attached to the tie point to identify the reason the tie(s) is closed.~~

~~If the LV tie(s) is a 'between feeders' or 'between zones' tie and is to remain closed for more than 48 hours, a LV bundle box with fusing to 200 amps shall be erected to bypass the existing tie point (eg. a DL).~~

~~15.5.2 HV Network reconfiguration~~

~~Any HV network reconfiguration for LV tie purposes should be based on an assessment of risk. The key factors to be taken into consideration being:~~

- ~~Tie types available~~
- ~~Duration that the LV network will remain abnormal~~
- ~~Potential impact (eg. Brisbane CBD)~~
- ~~Amount of HV network configuration potentially required~~

~~There have been situations where LV ties have been left in an abnormal state which following a subsequent fault on the network resulted in equipment damage. Experience has shown that these situations are rare.~~

~~Consequently it is typically not necessary to reconfigure the HV network.~~

~~15.6 Low Voltage De-Energisation Permits~~

~~An LV De-energisation Permit is used by ENERGEX staff and contractors who need to work on or near the de-energised LV electrical apparatus.~~

~~The De-energisation Permit is used to ensure the safety of people by documenting control measures to ensure the work area has been de-energised, tested and will not be inadvertently re-energised.~~

~~Refer to 15.7 Matrix when to use an LV Switching Sheets and/or LV De-energisation Permit.~~

~~15.6.1 Issue of a Low Voltage Fault Finding Permit~~

~~In the event of an LV fault it may be necessary to use Network Technical Services to fault find. Some of the equipment used by Network Technical Services to locate faults has the potential to produce lethal current. If Network Technical Services are required to use any of this test equipment a Low Voltage Fault Finding Permit is to be issued. (Form 1174)~~

~~Before a Low Voltage Fault Finding Permit can be issued, any LV De-energisation Permits issued for the same LV electrical apparatus shall be surrendered.~~

~~No more than one Low Voltage Fault Finding Permit shall be on issue for the same LV electrical apparatus.~~

~~The same conditions that apply to the issue, receipt, transfer and surrender of a De-energisation Permit also apply to the Low Voltage Fault Finding Permit.~~

~~15.6.2 General Requirements of a Low Voltage De-Energisation Permit/Fault Finding Permit~~

~~In the scenario of ENERGEX staff issuing a Low Voltage De-energisation/Low Voltage Fault Finding Permit to ENERGEX staff, the switching operator does not have to be present on site to issue or receive the Permits.~~

~~In the scenario of ENERGEX staff issuing a Low Voltage De-energisation/Low Voltage Fault Finding Permit to a contractor/customer the switching operator and the on-site supervisor shall both be present for the issue, receipt and surrender of the De-energisation Permit/LV Fault Finding Permit.~~

~~As a minimum a LV De-energisation/Low Voltage Fault Finding Permit shall include:~~

- ~~An unique switching sheet number (Switching Sheet Number/ Service Order Number).~~
- ~~Location of work area.~~
- ~~Expected issue/surrender time/day/date.~~
- ~~Provision to issue permit to an individual/workgroup.~~
- ~~A description of work/reason for permit.~~
- ~~Description of the electrical apparatus de-energised.~~
- ~~The point(s) of isolation with safety signs attached.~~
- ~~Details of any 'other precautions' placed to contribute to the electrical safety of the workgroup.~~
- ~~Provision for details of nearby live high/low voltage at the work area.~~
- ~~Provision for LVOO/ Control Centre personnel name and contact details~~
- ~~Provision for issue and receipt of permit.~~
- ~~Provision for workgroup members to sign on/off.~~
- ~~Provision to transfer permit to another on-site supervisor.~~
- ~~An Abnormalities section and indication of any supplementary pages on issue.~~
- ~~Confirmation that all pre-energisation checks/tests have been completed and surrender of permit.~~

~~The issue, receipt, and surrender of the LV De-energisation/Low Voltage Fault Finding Permit shall be recorded on the related switching sheet, (where applicable).~~

~~15.7 Matrix when to use LV Sheets and LV De-Energisation Permits~~

~~Scenario~~	~~Switching Sheet~~	~~De-Energisation Permit~~
~~Individual Customer Service (Erect, replace or maintain) 1 Crew de-energises, does the work and re-energises.~~	~~No~~	~~No~~
~~Individual Customer Service - Crew 1 called away, Crew 2 required to complete work and re-energise. Crew 2 accepts full responsibility for checking isolation is adequate and for testing de-energised.~~	~~No~~	~~No~~
~~Individual Customer Service (Replace or maintain) -Crew 1 de-energises service for work for non ENERGEX crew (Painter, tree cutter).~~	~~No~~	~~Yes~~
~~Individual Street Light - Crew 1 called away, Crew 2 required to complete work and reenergise. Crew 2 accepts full responsibility for checking isolation is adequate and for testing de-energised.~~	~~No~~	~~No~~
~~Individual Street Light - Crew 1 de-energises s/light for work by Crew 2.~~	~~No~~	~~Yes~~
~~Isolate Street Light Circuit.~~	~~Yes~~	~~Yes~~
~~Any low voltage switching to reconfigure the LV network (non access switching).~~	~~Yes~~	~~No~~
~~Isolation to allow work on the de-energised LV network.~~	~~Yes~~	~~Yes~~
~~Energising new low voltage electrical apparatus.~~	~~Yes~~	~~No~~
~~Combined HV/LV switching sheet, i.e. LV isolation points included in the HV sheet.~~	~~No (HV switching sheet used)~~	~~No (Access Permit used)~~
~~Separate HV & LV switching sheets.~~	~~Yes~~	~~Yes~~
~~Use of equipment by Tech Services to locate fault on de-energised LV network.~~	~~Yes~~	~~Yes (LV Fault Finding Permit)~~
~~Work on LV switchboards in Zone Substations~~	~~No~~	~~No~~
~~Electrical Work Request (previously known as Form 2) initiated work from an electrical contractor that requires ENERGEX to isolate and re-energise.~~	~~No~~	~~De-Energisation Permit may be required~~
~~Electricity Customer Report (Form 3) issued by ENERGEX to customer.~~	~~No~~	~~No~~

~~15.8 Switching Operator Responsibilities~~

~~The Switching Operator performing LV switching shall:~~

- ~~Hold a current Electrical Licence and be authorised in LVSO.~~
- ~~Follow the "Team Work in Switching" procedure documented in Section 8.3 of the ENERGEX OPM.~~
- ~~Immediately report any problems encountered dur ing LV switching (human or equipment) to the LVOO/LVOC before proceeding further~~
- ~~The Switching Operator/ENERGEX Representative issuing an LV De-energisation/Low Voltage Fault Finding Permit shall ensure that:~~
    - ~~Approval is gained from the LVOC/LVOO for issue of the permit where an LV Switching sheet is used,~~
    - ~~All relevant sections of the LV De-energisation/Low Voltage Fault Finding Permit are filled out~~
    - ~~The on-site supervisor receiving the LV De-energisation/Low Voltage Fault Finding Permit understands:~~
        - ~~What electrical apparatus has been de-energised and in the case of non electrical personnel that no contact is allowed;~~
        - ~~Point(s) of isolation with safety signs attached~~
        - ~~Any 'other precautions' provided, and~~
        - ~~Details of nearby live high/low voltage apparatus at the work area~~
    - ~~The LV De-energisation/Low Voltage Fault Finding Permit is endorsed as having been issued~~
    - ~~The on-site supervisor endorses the LV De-energisation/Low Voltage Fault Finding Permit as received~~
    - ~~The LVOC/LVOO is informed of the receipt (where applicable), the name and contact number of the on-site supervisor~~
- ~~For non electrical personnel, the switching operator/ENERGEX representative shall test the LV electrical apparatus is de-energised in the presence of the on-site supervisor of the work group before issuing the LV De-energisation Permit.~~

~~15.8.1 Assisting the Switching Operator~~

~~An electrical power worker can assist an LVSO provided they are trained in and follow the rules and procedures for 'Working Live'. The LVSO shall perform all testing and electrical tasks (such as testing de-energised or breaking bridges) whilst the power worker acts as his competent assistant. The Power worker shall be competent in the relevant rescue procedures.~~

~~An electrical apprentice may carry out LV switching operations as instructed by, and under the appropriate level of supervision of the LVSO (see ESM and BMS 1686 Apprenticeship manual), provided they are trained in and follow the rules and procedures for 'Working Live'. The electrical apprentice shall be competent in the relevant rescue procedures.~~

~~15.9 On-Site Supervisor Responsibilities~~

~~15.9.1 Identify Safe Workplace~~

~~The On-Site Supervisor shall ensure all personnel working in the safe area are advised of:~~

- ~~Any significant/special risks and associated controls as identified by the on-site specific risk assessment. For non electrical personnel this would include no contact with LV electrical apparatus.~~
- ~~Isolation points with safety sign attached~~
- ~~System has been tested and proved de-energised~~

~~15.9.2 Working on De-energised LV Electrical Apparatus~~

~~Before working on LV electrical apparatus each person shall:~~

- ~~Satisfy themselves that the mains have been suitably isolated~~
- ~~Test the apparatus is de-energised at each place of work, and immediately before each session of work commences.~~

~~For non electrical personnel, the switching operator/ENERGEX representative shall test the LV electrical apparatus is de-energised in the presence of the on-site supervisor of the work group before issuing the LV De-energisation Permit~~

~~No person shall work on electrical apparatus that contains an isolation point without permission from the on-site supervisor.~~

~~15.9.3 Test to prove De-energised LV Electrical Apparatus~~

~~Personnel shall ensure that all LV electrical apparatus, unless proven to be de-energised, will be regarded as energised.~~

~~415 Volt series test lamps, voltmeters used to prove de-energised shall be of an approved type and tested for correct operation immediately before and after use.~~

~~Personnel shall be competent in the process of proving LV electrical apparatus de-energised and in the use of the testing device.~~

~~For single phase supply:~~
- ~~Test between LV mains neutral and LV mains active~~
- ~~Test between independent earth and LV mains neutral~~
- ~~Test between independent earth and LV mains active~~

~~For three phase supply:~~
- ~~Test between LV mains neutral and each LV mains active~~
- ~~Test between each pair of LV mains active~~

~~15.9.4 Other precautions~~

~~Other Precautions are safety precautions in addition to isolation and testing to prove de-energised, and shall be provided at the work area to contribute to the electrical safety of the work group.~~

~~Some examples of Other Precautions could be LV Mats or Tiger Tails, Testing Sign, Reclose Block issued.~~

~~These precautions shall be listed as items on the LV switching sheet and placed by the switching operator where practicable and recorded on the De-energisation/Fault Finding Permit.~~

~~The on site supervisor may alter or add Other Precautions at the work area to suit the progress of work. These changes shall be recorded on the De-energisation/Fault Finding Permit.~~

~~15.9.5 Sign on~~

~~Ensure all members of the work crew sign on the De-energisation/ Fault Finding Permit and in doing so acknowledge that:~~

- ~~All persons are instructed and understand the limits of the De-energisation/Fault Finding Permit.~~
- ~~Been made aware of all potential job hazards and associated control measures~~

~~Any person leaving and/or returning to the worksite shall notify the on-site supervisor prior to leaving and immediately on return to the worksite.~~

~~15.9.6 Transfer of the De-energisation Permit~~

~~If the De-energisation/Fault Finding Permit is transferred to another on-site supervisor, the LVOC/LVOO must be advised of the name of the incoming on site supervisor and the time of transfer (only applicable if a switching sheet is used).~~ **~~The De-energisation/ Fault Finding Permit shall only be transferred once.~~**

~~If the De-energisation Permit/Fault Finding Permit requires to be transferred more than once, the LVOC/LVOO shall require the De-energisation Permit/Fault Finding Permit to be surrendered and new Permit issued.~~

~~15.9.7 Surrender of the De-energisation Permit~~

~~Before the De-energisation/Fault Finding Permit is surrendered the on-site supervisor shall confirm the following:~~

- ~~Ensure all members of the work crew have signed off the De-energisation/Fault Finding Permit, and inform them to treat electrical apparatus as live~~
- ~~If members of the work group are not present,~~
    - ~~record their absence in the abnormalities section, and~~
    - ~~advise individual(s) as soon as practicable that the De-energisation Permit has been surrendered~~
- ~~List any abnormalities, eg. unserviceable electrical apparatus, absent individuals, all pre-energisation checks/tests not completed.~~
- ~~Ensure all pre-energisation checks/tests completed~~
- ~~Surrender the De-energisation/Fault Finding Permit~~
- ~~Advise LVOC/LVOO switching coordinator that De-energisation/Fault Finding Permit is surrendered (where applicable)~~

~~15.10 LV Network Abnormality~~

~~For any instances where the LV Network is left in an abnormal state, the crew performing the work shall as soon as practicable contact the LVOC/LVOO and advise of this abnormality. The person performing the work shall also provide the timeframe and details of works required before the system is returned back to normal.~~

~~Any change to the state of the normal LV network is classed as an LV Network Abnormality, e.g. voltage ties or any alterations to the LV configuration. All abnormalities should be entered/removed in A4S by the person coordinating the LV switching sheet at the time.~~

~~15.11 Electrical Safety Regulations 2002 Section 20 Requirements~~

~~Where the isolation device is within constant line of sight (e.g. work at same switchboard), no Safety Sign is required at the isolation point.~~

~~Where the isolation point is accessible (but not within line of sight), a lock or equivalent control measure shall be used in conjunction with an appropriate Safety Sign. For example, a main switch locked off or cables disconnected from the circuit protective device with Safety Sign attached.~~

~~Where the isolation point is not accessible through its position (e.g. overhead pole fuse) or location (e.g. an underground pillar or LV end of a Pad Mounted Transformer) an appropriate Safety Sign must be attached.~~

~~Safety Signs or lock out devices must not be removed without the appropriate authorisation.~~

~~15.12 Examples of Safety Signs~~

~~DNOB (Figure 1 and 2)~~
~~A standard ENERGEX Safety Sign that shall be applied to ALL isolation points identified on a LV De-energisation/Low Voltage Fault Finding Permit.~~

~~VOLTAGE TIE (Figure 3)~~
~~Any LV tie(s) closed for voltage improvement purposes shall have a 'voltage tie' warning sign attached to the tie point to identify the reason the tie(s) is closed. An entry shall be made in the LV Network Abnormality when this warning sign is to be used.~~

~~Figure 1~~
~~Standard ENERGEX DNOB Safety Signs~~

~~Figure 2~~
~~Standard ENERGEX Hook With DNOB Safety Sign~~

~~Figure 3~~
~~Voltage Tie Sign~~

~~15.13 Standard Switching Items~~

~~When ever possible the Standard items in A4S shall be used and free text used at an absolute Minimum. If extra training is required in the use of A4S contact the custodian.~~

~~**LV apparatus**~~	~~**Typical Operating Actions**~~
~~LV Cable~~	Connect, ~~Disconnect~~
~~LV Bridges~~	Connect, ~~Disconnect~~
~~LV Bridges toward P#1234~~	~~Close, Open, Connect, Disconnect~~
~~LV Links~~	~~Close, Open, Check Closed, Check Open~~
~~LV Fuses~~	~~Close, Open, Check Closed, Check Open~~
~~LV Circuit Fuses (labelled)~~	~~Close, Open, Check Closed, Check Open~~
~~LV Switch~~	~~Close, Open, Check Closed, Check Open~~
~~LV Alternator~~	~~Sync & Close LV Switch, Sync to Network~~
~~Flying Shackles~~	Connect, ~~Disconnect~~

~~**Miscellaneous**~~

~~**Switching Operator** Advise ENERGEX LV Outage Officer LV switching to Commence~~

~~**Switching Operator** Advise ENERGEX LV Outage Officer LV Fwd Switching Completed~~

~~**Switching Operator** As Required – Place Other Precautions at All Work Areas~~

~~**LV Outage Officer** Confirm Pre-Energisation Checks/Tests Completed & No Abnormalities~~

~~**Switching Operator** Check Other Precautions are Removed~~

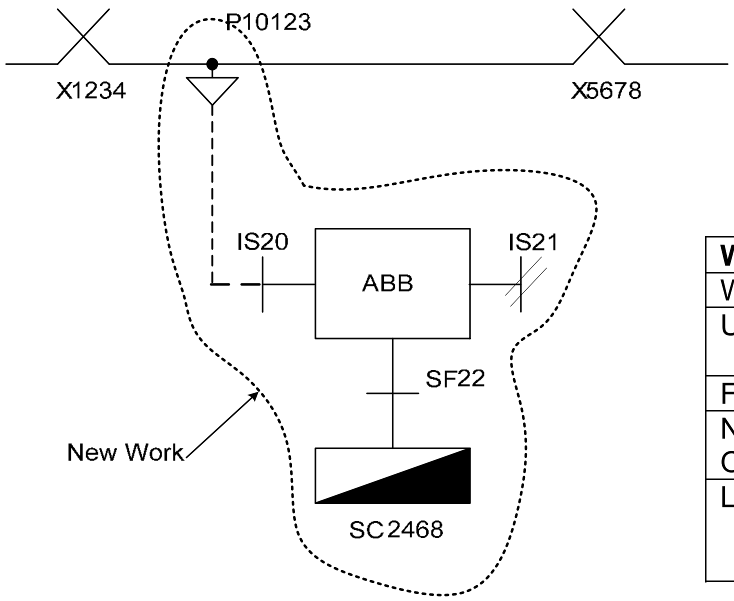
~~All Workgroups Test, Prove Dead LV Electrical Apparatus at all Worksites & Report to On Site Supervisor~~

~~ON Site Supervisor to Instruct All Workgroups at all Worksites, to Treat LV Electrical Apparatus as LIVE~~

~~Phase Out, Check Phase Rotation, Mark Phase Rotation, Place DNOB, Remove DNOB, Remove DNOB Leave Open, Identify Neutral Conductor, Remove All Service Fuses, Replace All Service Fuses, Check Open Place Additional DNOB, Remove one DNOB only, Leave Open~~

A Examples of HV Commissioning / Decommissioning Procedures

A.1 Commissioning a Padmount Transformer using an AE and Energise by Live Line Methods



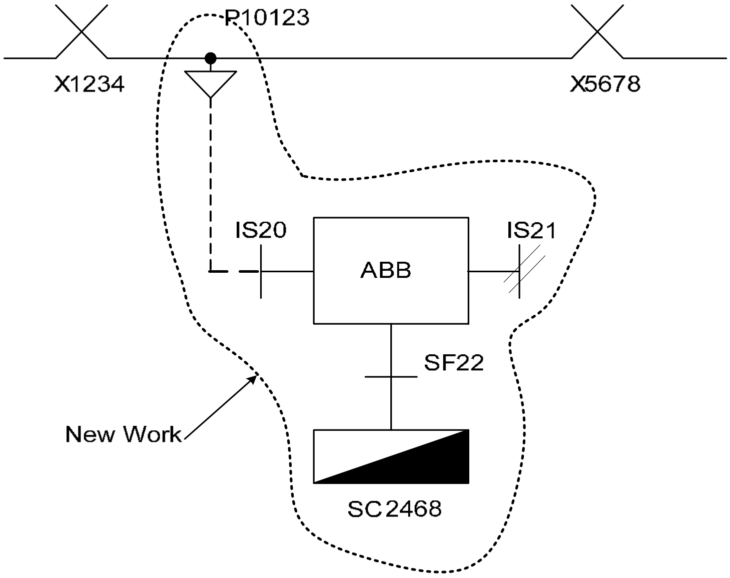
Work Group	Task
W/Group	Install padmount SC2468
Underground	Install and terminate U/G cable
Field Test	HV Cable Test
Network Operations	Forward switching
Live Line	Bridge in U/G pothead to O/H mains to energise SC2468

Typical Procedure

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs padmount[1]
4. Commissioning Coordinator issues CA1 to Underground
5. Underground install and terminate U/G cable at IS20 at SC2468
6. Underground install and terminate U/G cable at P10123 <u>(work is performed outside the exclusion zone)</u>
7. Commissioning Coordinator recovers CA1
8. Commissioning Coordinator issues TA2 to *Field Test*
9. Field Test complete HV cable tests
10. Commissioning coordinator recovers TA2 from *Field Test*
11. Commissioning Coordinator confirms all pre-energisation checks/test complete,
12. Commissioning Coordinator authorises AE for SC2468 and associated U/G cable.
13. Switching Operator carries out switching
14. Switching Operator receives AE from Commissioning Coordinator
15. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
16. Switching Operator checks HV and LV isolators in the open position, including IS21 at SC2468 is secured in the open position, a system lock with DNOB tag placed (switching sheet items)
17. Live Line energises SC2468 using approved Live Line Methods
18. Post-energisation checks completed (as per form 1175)
19. Network Operations update records

[1] A CA is not required for this type of civil work

A.2 Commissioning a Padmount Transformer to the Overhead (using an AE)



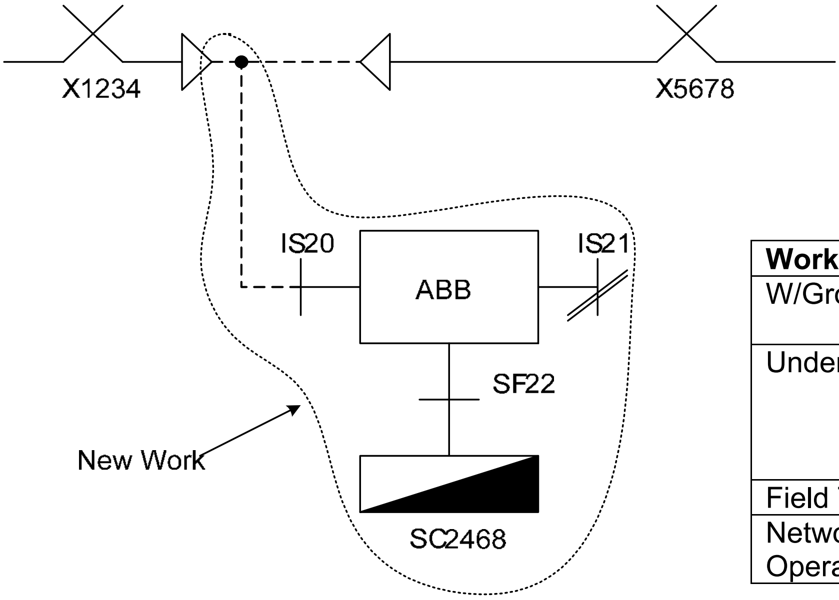
Work Group	Task
W/Group	Install padmount SC2468
Underground	Install and terminate U/G cable
Field Test	HV Cable Test
Network Operations	Forward & Reverse switching
Overhead/ Underground	Bridge in pothead to O/H mains

Typical Procedure
(No LV cables connected to the LV switchboard)

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs padmount[2]
4. Commissioning Coordinator issues CA1 to Underground
5. Underground install and terminates U/G cable at IS20 at SC2468
6. Commissioning Coordinator recovers CA1
7. Commissioning Coordinator checks IS21 at SC2468 open, in earth position, IS21 secured using a system lock with DNOB tag placed
8. Switching Operator carries out forward switching to isolate O/H between X1234 & X5678
9. Isolation points shall include X1234, X5678, SC2468/IS21 and SC2468 LV Switch Check Open and Place DNOB
10. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
11. Switching Operator issues AP1 to Underground to terminate U/G cable and install bridges to connect to the O/H mains at P10123.
12. Underground complete work and surrender AP1
13. .Switching Operator recovers AP1
14. Switching Operator issues TP2 to Field Test
15. Field Test complete HV cable tests
16. Switching Operator recovers TP2
17. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for SC2468 and associated U/G cable.
18. Network Operations receive AE from Commissioning Coordinator
19. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
20. Switching Operator checks the position of HV and LV isolators, including IS21 at SC2468 is secured in the open position, a system lock with DNOB tag placed (switching sheet items)
21. Switching Operator carries out reverse switching (energising new padmount)
22. Post-energisation checks completed (as per form 1175)
23. Network Operations update records

[2] A CA is not required for this type of civil work

A.3 Commissioning a Padmount Transformer to Existing U/G Cable (using an AE)



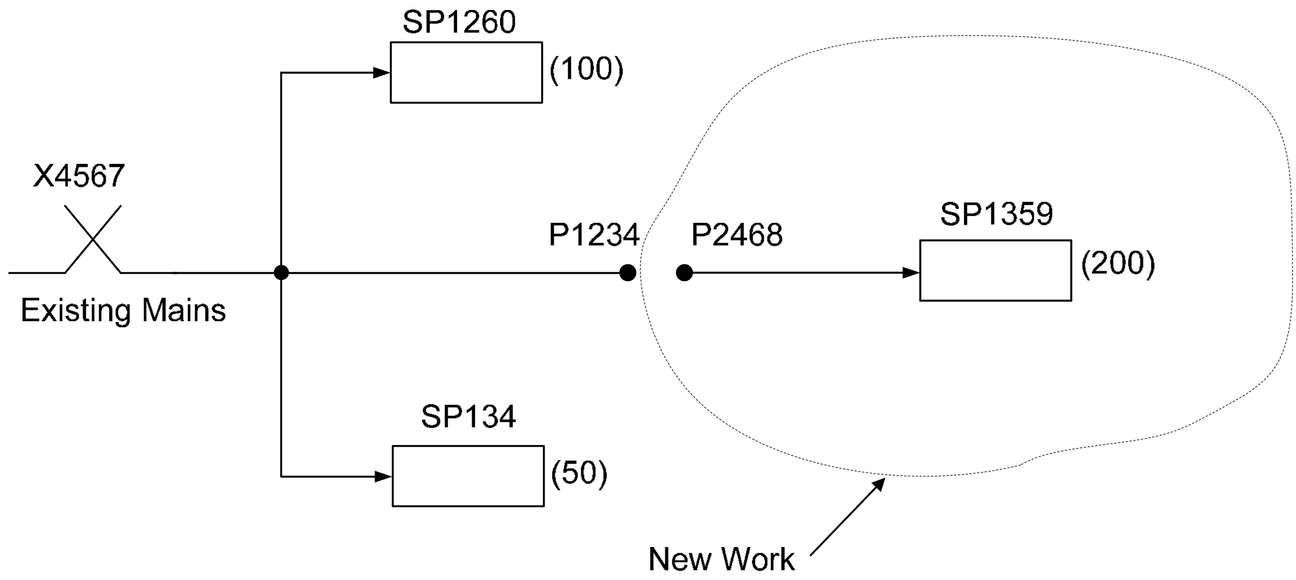
Work Group	Task
W/Group	Install padmount SC2468
Underground	Install and terminate new U/G cable. Tee new U/G cable into existing U/G cable.
Field Test	HV Cable Test
Network Operations	Forward & Reverse switching

Typical Procedure

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs padmount[3]
4. Commissioning Coordinator issues CA1 to Underground to install and terminate U/G cable on IS20 at SC2468
5. Commissioning Coordinator recovers CA1
6. Switching Operator carries out forward switching
7. Isolation points shall include X1234, X5678, SC2468/IS21 and SC2468 LV Switch Check Open and Place DNOB
8. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
9. Switching Operator issues AP1 to Underground to tee in cable to existing U/G network.
10. Underground complete work and surrender AP1
11. Switching operator recovers AP1
12. Switching Operator issues TP2 to Field Test
13. Field Test complete HV cable tests
14. Switching Operator recovers TP2
15. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for SC2468 and associated U/G cable.
16. Network Operations receive AE from Commissioning Coordinator
17. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
18. Switching Operator checks the position of HV and LV isolators, including IS21 at SC2468 is secured in the open position, a system lock with DNOB tag placed (switching sheet items)
19. Switching Operator carries out reverse switching (energising new padmount)
20. Post-energisation checks completed (as per form 1175)
21. Network Operations update records

[3] A CA is not required for this type of civil work

A.4 Commissioning Overhead Mains & Pole Transformer (using an AE)

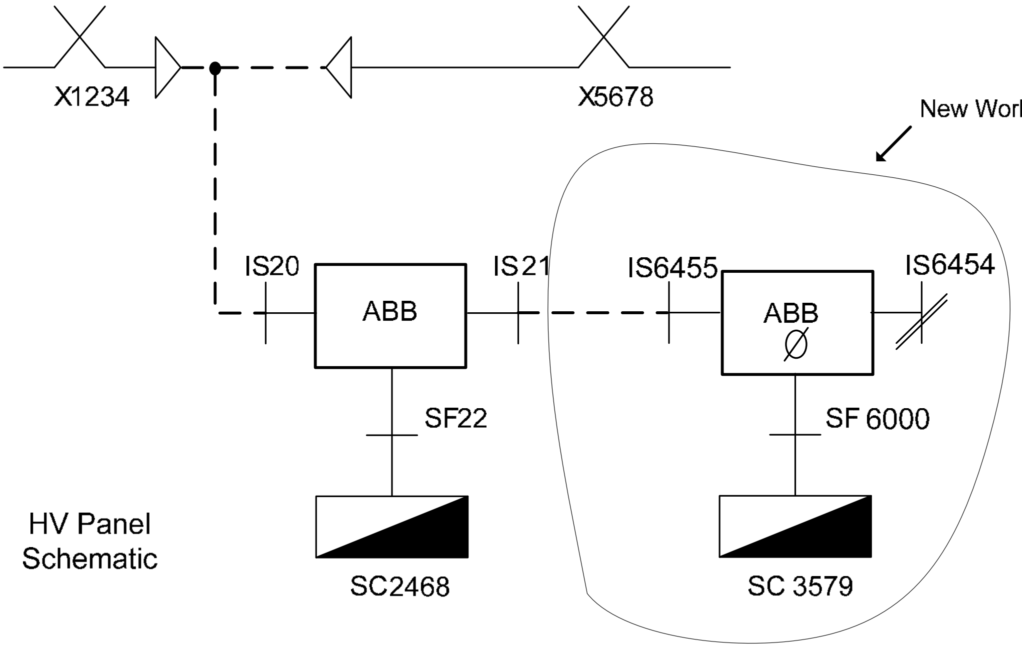


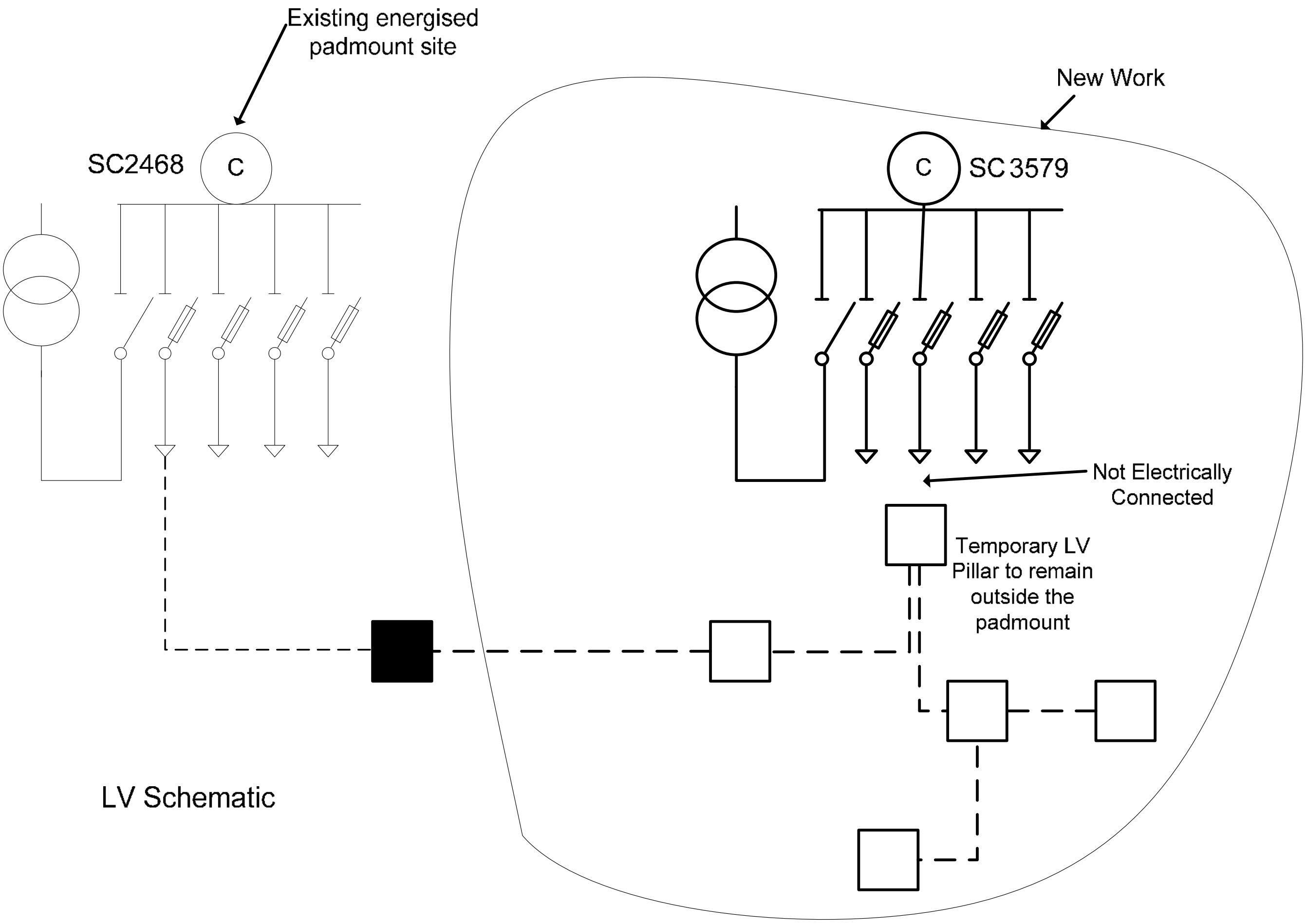
Work Group	Task
Overhead	Erect SP1359 and overhead mains
Network Operations	Forward and Reverse Switching Update records

Typical Procedure

1. Commissioning Coordinator issues CA1 for Overhead to construct new SP1359 and overhead mains (except for last span).
2. Commissioning Coordinator submits switching application to Network Operations.
3. Network Operations arrange switching sheet preparation and authorisation
4. Overhead carries out new construction under CA1(except for last span)
5. Network Operations arrange switching sheet preparation & authorisation
6. Commissioning Coordinator recovers CA1
7. Switching Operator carries out forward switching
8. Isolation points shall include the X4567, SP1260 LV Switch, SP134 LV Switch and SP1359 Check Open and Place DNOB
9. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
10. Switching Operator issues AP1 for Overhead to erect last span of O/H mains
11. Overhead complete work and surrender AP1
12. .Switching Operator recovers AP1
13. Commissioning Coordinator confirms all pre-energisation checks/tests complete, then authorises AE for new construction.
14. Network Operations receive AE from Commissioning Coordinator
15. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
16. Switching Operator completes switching
17. Network Operations update records

A.5 Commissioning a Padmount Transformer with LV Switchboard Not Electrically Connected





A.5 Commissioning a Padmount Transformer with LV Switchboard Not Electrically Connected

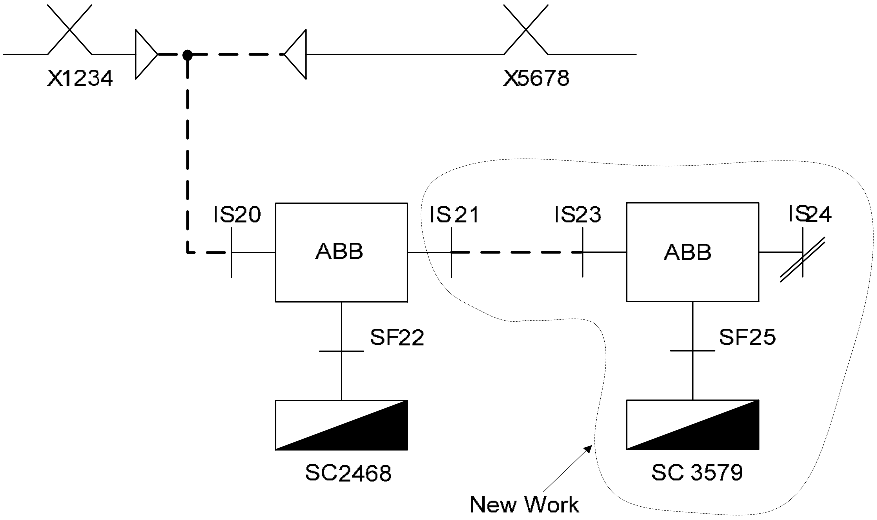
Work Group	Task
W/Group	Install padmount SC3579
Underground	Install and terminate new U/G cable.
Field Test	HV Cable Test
Network Operations	Forward & Reverse switching

Typical Procedure

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs padmount[4]
4. New LV Cables are installed and terminated in LV pillars
5. LV Cables will be connected together in a temporary LV pillar and will remain disconnected from the padmount to comply with Not Electrically Connected definition.
6. LV switching sheet used to connect and energise new LV to the existing LV network
7. Commissioning Coordinator issues CA1 to Underground to install and terminate 11kV U/G cable to IS6455 at SC3579
8. Commissioning Coordinator recovers CA1
9. Switching Operator carries out forward HV switching
10. Isolation points shall include SC2468/IS21, SC3579 LV Switch and SC3579/IS6454 Check Open and Place DNOB
11. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
12. Switching Operator issues AP1 to Underground to terminate U/G cable on IS21 at SC2468.
13. Underground complete work and surrender AP1
14. .Switching Operator recovers AP1
15. Switching Operator issues TP2 to *Field Test*
16. Field Test complete HV cable tests
17. Switching Operator recovers TP2
18. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for SC3579 and associated U/G cable.
19. Network Operations receive AE from Commissioning Coordinator
20. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
21. Switching Operator checks the position of HV and LV isolators, including IS6454 at SC3579 is secured in the open position, a system lock with DNOB tag placed (switching sheet items)
22. Switching Operator carries out reverse switching (energising new padmount)
23. Post-energisation checks completed (as per form 1175)
24. Network Operations update records
25. LV switching is carried to de-energise the temporary LV pillar to allow LV U/G cables to be connected to the LV switchboard for the padmount (LV procedures are followed for LV access)
26. Underground connect LV underground cables to the LV switchboard of the padmount
27. Underground complete LV work and treat LV mains as energised
28. LV switching is carried out to energise the new LV cables and prove phasing

[4] A CA is not required for this type of civil work

A.6 Commissioning a Padmount Transformer to Existing Padmount via Spare Switch (using an AE). No LV Connected to Padmount at the Time of Commissioning



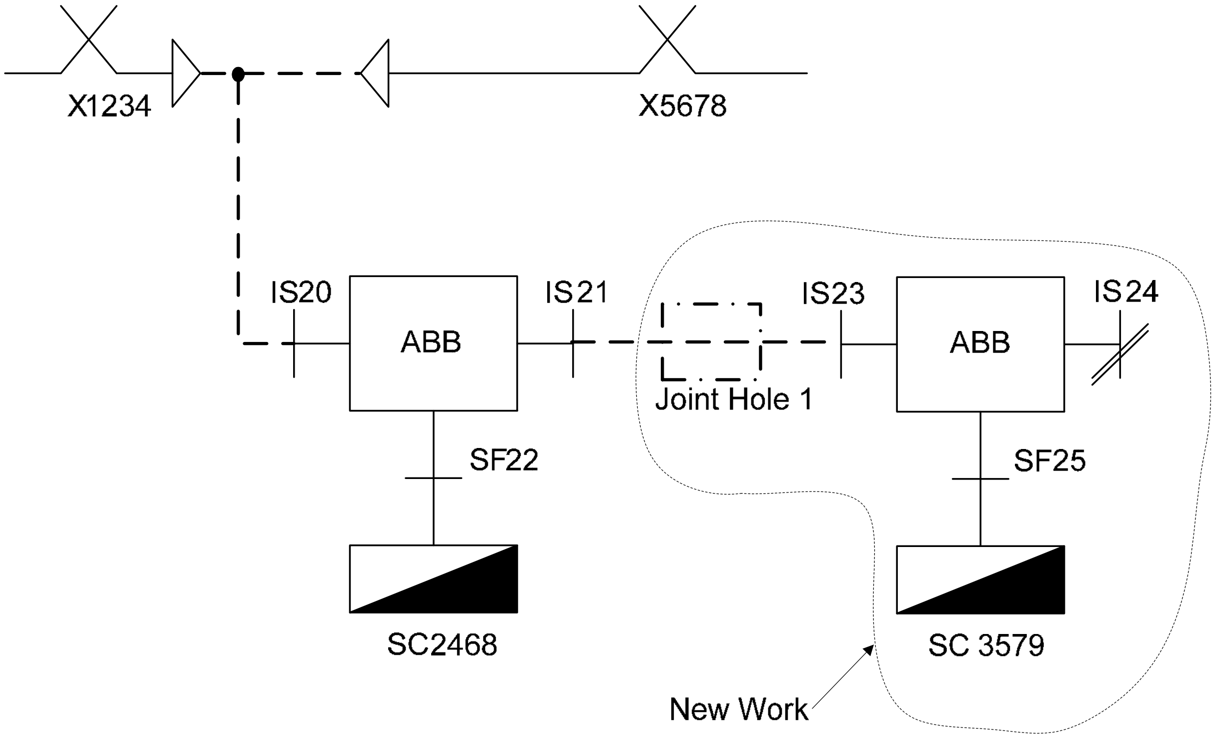
Work Group	Task
W/Group	Install padmount SC3579
Underground	Install and terminate new U/G cable.
Field Test	HV Cable Test
Network Operations	Forward & Reverse switching

Typical Procedure

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs padmount[5]
4. Commissioning Coordinator issues CA1 to Underground to install and terminate U/G cable on IS23 at SC3579
5. Commissioning Coordinator recovers CA1
6. Switching Operator carries out forward switching
7. Isolation points shall include the SC2468/IS21, SC3579 LV Switch and SC3579/IS24 Check Open and Place DNOB
8. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
9. Switching Operator issues AP1 to Underground to terminate U/G cable on IS21 at SC2468.
10. Underground complete work and surrender AP1
11. .Switching Operator recovers AP1
12. Switching Operator issues TP2 to *Field Test*
13. Field Test complete HV cable tests
14. Switching Operator recovers TP2
15. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for SC3579 and associated U/G cable.
16. Network Operations receive AE from Commissioning Coordinator
17. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
18. Switching Operator checks the position of HV and LV isolators, including IS24 at SC3579 is secured in the open position, a system lock with DNOB tag placed (switching sheet items)
19. Switching Operator carries out reverse switching (energising new padmount)
20. Post-energisation checks completed (as per form 1175)
21. Network Operations update records

[5] A CA is not required for this type of civil work

A.7 Commissioning new Cable and SC567 via Spare Cable at Joint Hole 1



Work Group	Task
W/Group	Install padmount SC3579
Underground	Install and Joint new U/G cable.
Field Test	HV Cable Test
Network Operations	Forward & Reverse switching

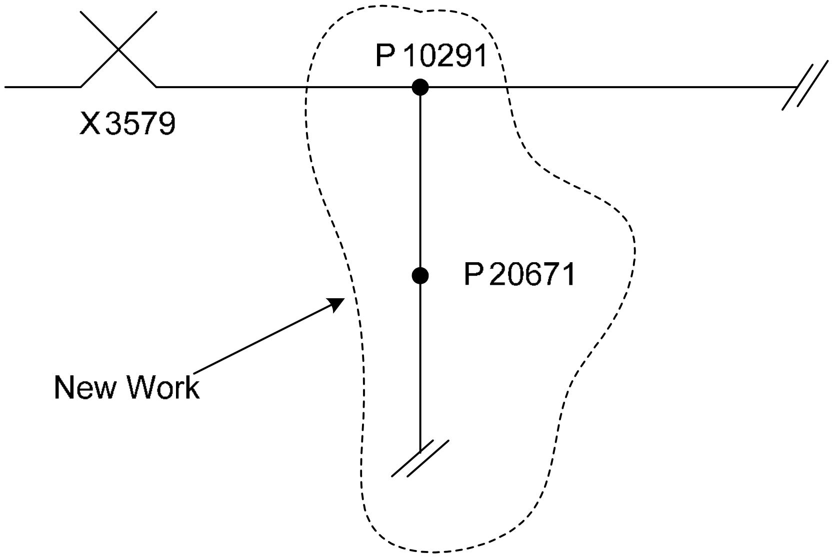
Typical Procedure

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs padmount[6]
4. Commissioning Coordinator issues CA1 to Underground to install and terminate U/G cable on IS23 at SC3579
5. Commissioning Coordinator recovers CA1
6. Switching Operator carries out forward switching
7. Isolation points shall include the SC2468/IS21, SC3579 LV Switch and SC3579/IS24 Check Open and Place DNOB
8. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
9. Switching Operator issues AP1 to Underground to Joint U/G cable in Joint Hole 1.
10. Work in Joint Hole 1 includes Work Practice – Positive Identification & Working on Underground HV Cables

[6] A CA is not required for this type of civil work

11. Underground complete work and surrender AP1
12. .Switching Operator recovers AP1
13. Switching Operator issues TP2 to *Field Test*
14. Field Test complete HV cable tests
15. Switching Operator recovers TP2
16. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for SC3579 and associated U/G cable.
17. Network Operations receive AE from Commissioning Coordinator
18. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
19. Switching Operator checks the position of HV and LV isolators, including IS24 at SC3579 is secured in the open position, a system lock with DNOB tag placed (switching sheet items)
20. Switching Operator carries out reverse switching (energising new padmount)
21. Post-energisation checks completed (as per form 1175)
22. Network Operations update records

A.8 Commissioning an 11 kV Spur Line (using an AE)

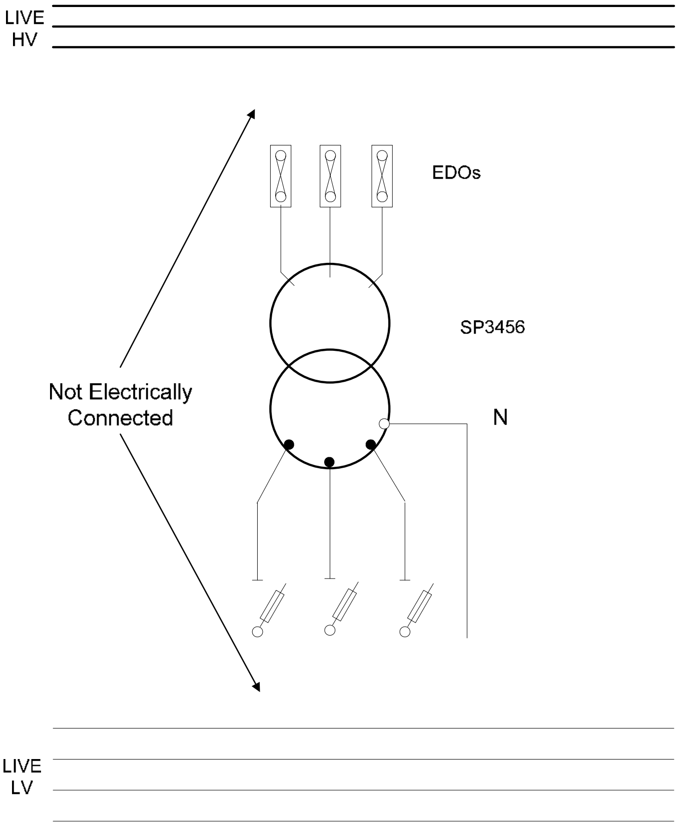


Work Group	Task
Overhead	Construct New 11 kV spur line
Live Line	Bridge in spur line to feeder and energise
Network Operations	Disable/Enable feeder auto-reclose Issue work authority Update records

Typical Procedure

1. Commissioning Coordinator issues CA1 to overhead to construct new spur line.
2. Commissioning Coordinator submits switching application to Network Operations.
3. Network Operations arrange switching sheet preparation and authorisation
4. Overhead carries out new construction under CA1 (new conductors tied around termination pole or attached to temporary cross arm).
5. Commissioning Coordinator recovers CA1 from work group.
6. Network Operations disable auto reclose (switching sheet item).
7. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
8. Network Operations issue WA for Live Line (switching sheet item) to attach new conductors to new termination cross arm.
9. Network Operations revoke WA.
10. Commissioning Coordinator confirms all pre-energisation checks/tests complete, then authorises AE for new spur line.
11. Network Operations receive AE from Commissioning Coordinator
12. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
13. Switching Operator commences reverse switching
14. Live Line Bridge in and energise new conductors (switching sheet item).
15. Network Operations restore auto reclose (switching sheet item).
16. Switching Operator completes switching
17. Network Operations update records

A.9 Construct and Commissioning a Pole Transformer



Work Group	Task
Overhead	Erect pole transformer SP3456 and associated equipment on existing pole. SP3456 remains Not Electrically Connected until day of commissioning
Network Operations	Forward and Reverse switching Update records

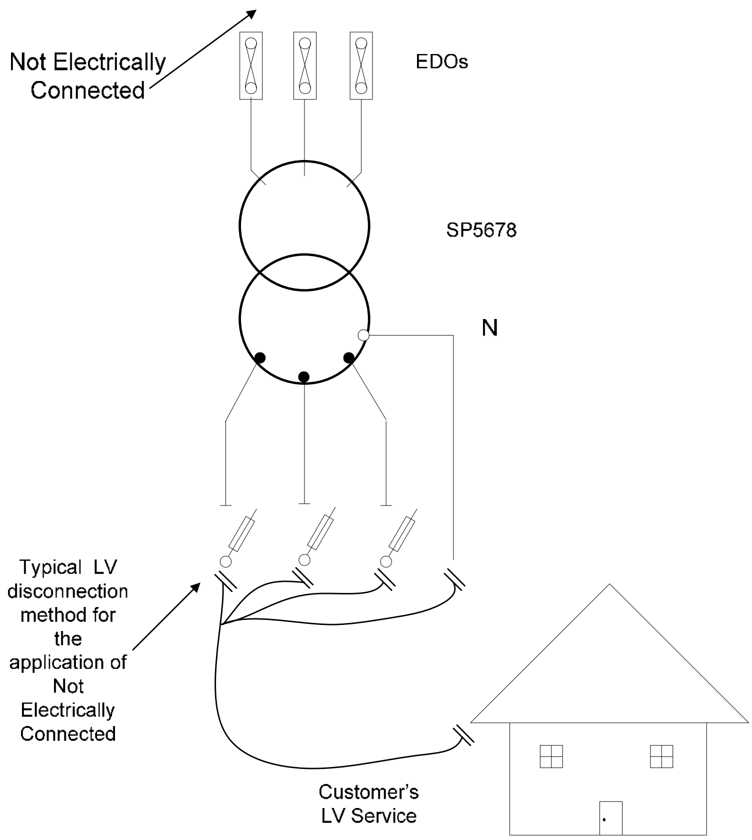
Typical Procedure

1. SP3456 is constructed and remains Not Electrically Connected from the commissioned network until it is required to be commissioned (Refer to Table 11.1 for disconnection methods)
2. Applicant submits switching application to Network Operations
3. Network Operations arrange switching sheet preparation and authorisation
4. Day of commissioning, workgroup checks SP3456 is Not Electrically Connected before commencement of any work
5. Workgroup apply portable earths (section 11.8.3)
6. Switching Operator obtains approval to commence switching
7. Check EDOs open place DNOB and LV fuses in open position and place DNOB (switching sheet items)
8. Issue W/A to work group to carry out next 2 items
9. Live Line leads installed to the top of the EDOs by workgroup (Do not connect to Live HV OHM's)
10. LV leads or bridges installed, including neutral conductor.

11. Revoke W/A from work group
12. Switching Coordinator confirms all pre-energisation checks/test completed (switching sheet item), (Checks/tests completed as per form 1175).
13. Receive authority from on-site supervisor – that the new pole transformer and associated equipment may be energised (switching sheet item)
14. Switching Operator removes all earths on section to be energised (switching sheet item)
15. The 11kV Live Line lead connection is made to the commissioned network (switching sheet item)
16. Remove DNOB close EDO’s (switching sheet item)
17. Post-energisation checks/tests are to be completed(as per form 1175) (switching sheet item)
18. Phasing completed (switching sheet item)
19. Remove DNOB close LV switch/fuses (switching sheet item)
20. The new pole transformer and associated equipment is energised
21. Switching Operator completes switching
22. Network Operations update records

A.10 Construct and Commission a new Single Customer Pole Transformer

LIVE
HV



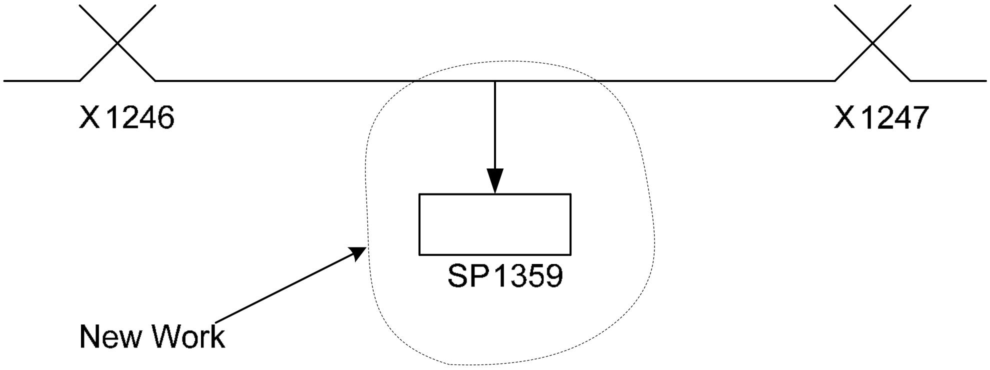
Work Group	Task
Overhead	Erect pole transformer SP5678 and associated equipment on existing pole. SP5678 remains Not Electrically Connected until day of commissioning
Network Operations	Forward and Reverse switching Update records

Typical Procedure

1. SP5678 is constructed and remains Not Electrically Connected from the commissioned network until it is required to be commissioned (Refer to Table 11.1 for disconnection methods)
2. Applicant submits switching application to Network Operations
3. Network Operations arrange switching sheet preparation and authorisation
4. Day of commissioning, workgroup checks SP5678 is Not Electrically Connected before commencement of any work
5. Workgroup apply portable earths (section 11.8.3)
6. Switching Operator obtains approval to commence switching
7. Check LV customers service disconnected from LV fuses (switching sheet item).
8. Check EDOs open place DNOB and LV fuses in open position and place DNOB (switching sheet item).

9. Issue W/A to work group to carry out next 2 items
10. Live Line leads installed to the top of the EDOs by workgroup (Do not connect to Live HV OHM's)
11. If applicable LV leads or bridges installed, including neutral conductor.
12. Revoke W/A from work group
13. Switching Coordinator confirms all pre-energisation checks/test completed (switching sheet item), (Checks/tests completed as per form 1175).
14. Receive authority from on-site supervisor – that the new pole transformer and associated equipment may be energised (switching sheet item)
15. Switching Operator removes all earths on section to be energised (switching sheet item)
16. The 11kV Live Line lead connection is made to the commissioned network (switching sheet item)
17. Remove DNOB close EDO's (switching sheet item)
18. Post-energisation checks/tests are to be completed(as per form 1175) (switching sheet item)
19. Phase Rotation completed (switching sheet item)
20. If applicable remove DNOB leave open (switching sheet item)
21. Switching Operator completes switching
22. Network Operations update records

A.11 Erect and Commissioning a Pole Transformer (11kV Isolation required)

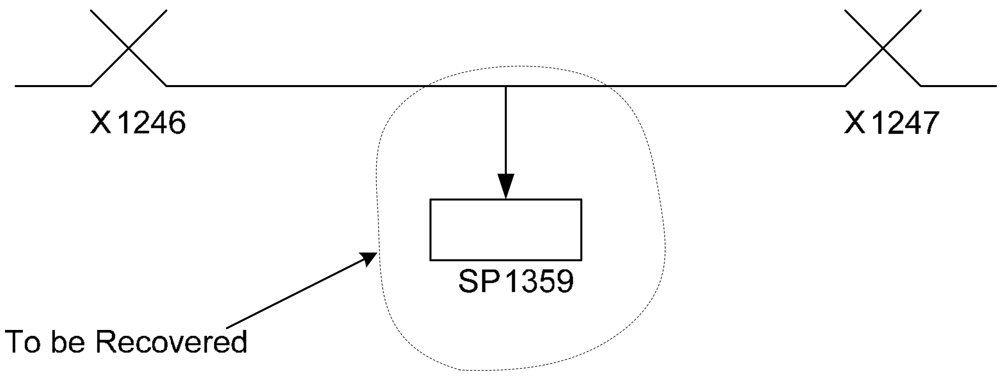


Work Group	Task
Overhead	Erect pole transformer SP1359 and associated equipment on existing pole
Network Operations	Forward and Reverse switching Update records

Typical Procedure

1. Applicant submits switching application to Network Operations
2. Network Operations arrange switching sheet preparation and authorisation
3. Switching Operator carries out forward switching
4. Isolation points shall include the X1246 and X1247and the New SP1359 LV switch
5. Switching Operator issues AP1 to Overhead
6. Overhead complete work including pre-energisation checks/tests and surrender AP1
7. Switching Operator recovers AP1
8. Receive authority from on-site supervisor – that the new pole transformer and associated equipment may be energised (switching sheet item)
9. Switching Coordinator confirms all pre-energisation checks/tests completed on AP, TP, AE (switching sheet item)
10. Switching Operator completes switching
11. Energise the new pole transformer and associated equipment
12. Post energisation checks/tests are to be completed
13. Network Operations update records

A.12 Decommissioning a Pole Transformer using an AP



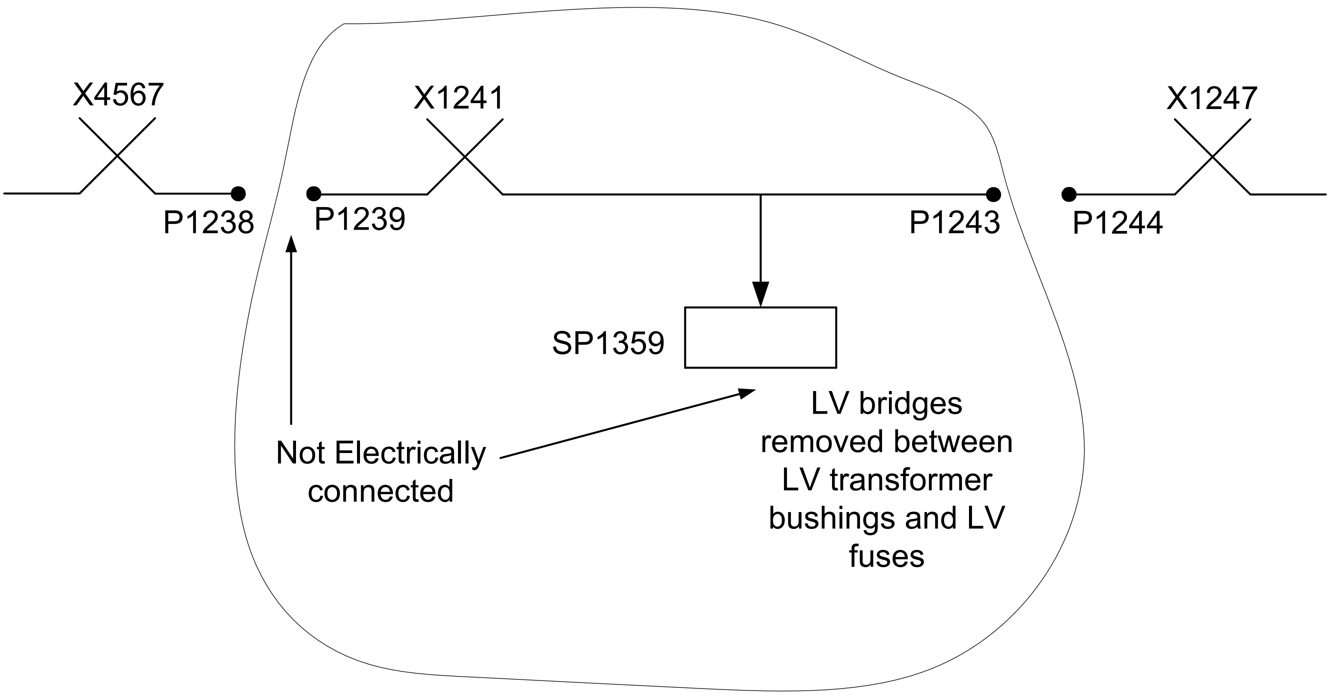
Work Group	Task
Overhead	Carry out switching to isolate SP1359 at that pole. Recover SP1359 and associated apparatus (work must be performed outside the exclusion zone).
Network Operations	Forward and Reverse switching Update records

Typical Procedure

1. Applicant submits switching application to Network Operations
2. Network Operations arrange switching sheet preparation and authorisation
3. Switching Operator carries out forward switching to de-energise and isolate[7] SP1359
4. Isolation points shall include SP1359 live line clamps and SP1359 LV switch
5. Switching Operator issues AP1 to Overhead
6. SP1359 and associated electrical apparatus has been disconnected per Table 11.1 and will now be recovered
7. The Recipient verbally requests from the Switching Coordinator to remove the operator earths, DNOBs from LV switch and live line clamps at SP1359
8. Overhead complete work and surrender AP1
9. Switching Operator recovers AP1
10. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
11. Switching Operator commences switching
12. Switching Operator checks SP1359 and associated electrical apparatus recovered (switching sheet items)
13. Network Operations update records

[7] using an approved isolation method

A.13 Decommissioning a Pole Transformer and ABS using a Decommissioning Notice



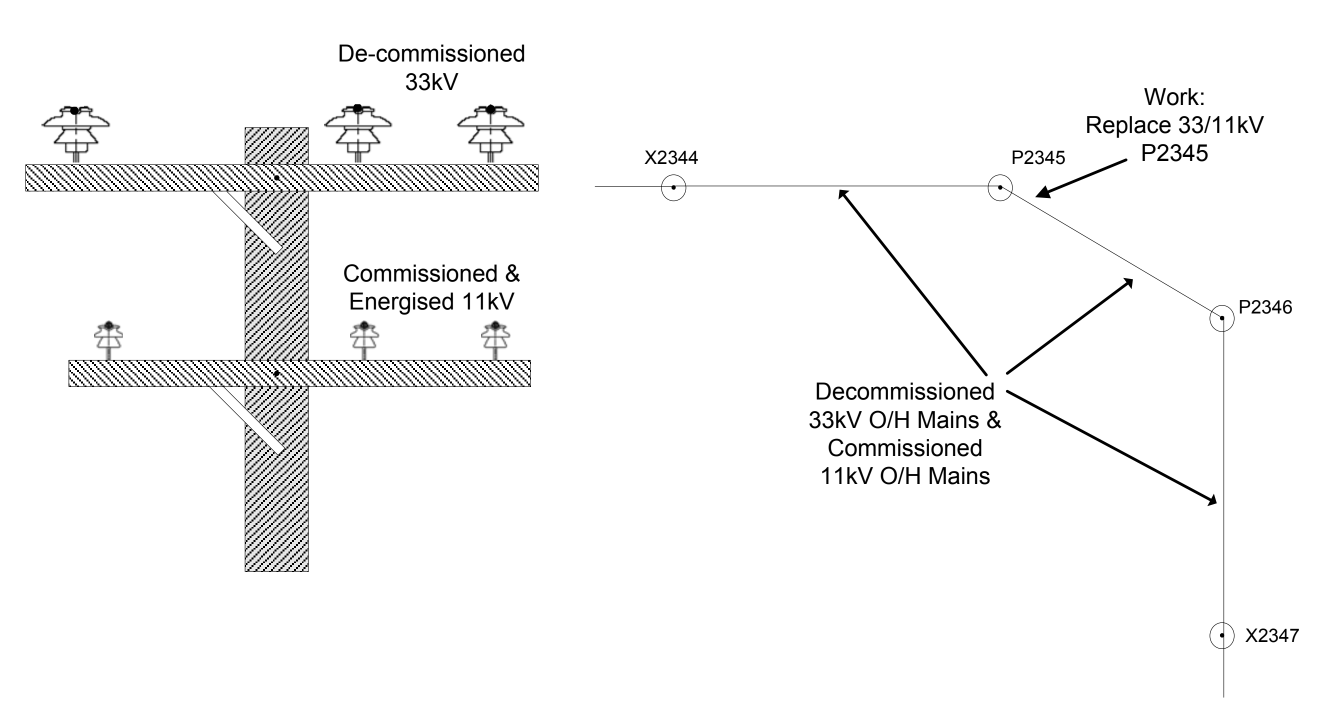
Work Group	Task
Overhead	Carry out switching to isolate SP1359 and X1241. Recover O/H mains and Bridges
Network Operations	Forward and Reverse switching Update records

Typical Procedure

1. Commissioning Coordinator submits switching application and Decommission Notice to Network Operations
2. Network Operations arrange switching sheet preparation and authorisation
3. Switching Operator carries out forward switching to de-energise and isolate SP1359 and X1241
4. Isolation points shall include X4567, X1247 and SP1359 LV switch
5. Switching Operator issues AP1 to Overhead
6. Overhead recover mains between P1238 to P1239, P1243 to P1244 and LV bridges removed between LV transformer bushings and LV fuses
7. Overhead completes work and surrenders AP1
8. Switching Operator recovers AP1
9. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
10. Switching Operator commences switching
11. Switching Operator checks electrical apparatus is disconnected as per Decommissioning Notice
12. Switching Coordinator issues Decommissioning Notice to Commissioning Coordinator
13. Switching Operator completes switching
14. Network Operations update records

A.14 Working on Commissioned and Decommissioned apparatus at the same time

Example: Replace 33/11kV P2345.



Work Group	Task
Overhead	Check Disconnection Methods per Decommissioning Notice Carry out switching to isolate X2344 and X2347. To replace P2345
Network Operations	Forward and Reverse switching

(The Recipient and On Site Supervisor should be the same person for this example)

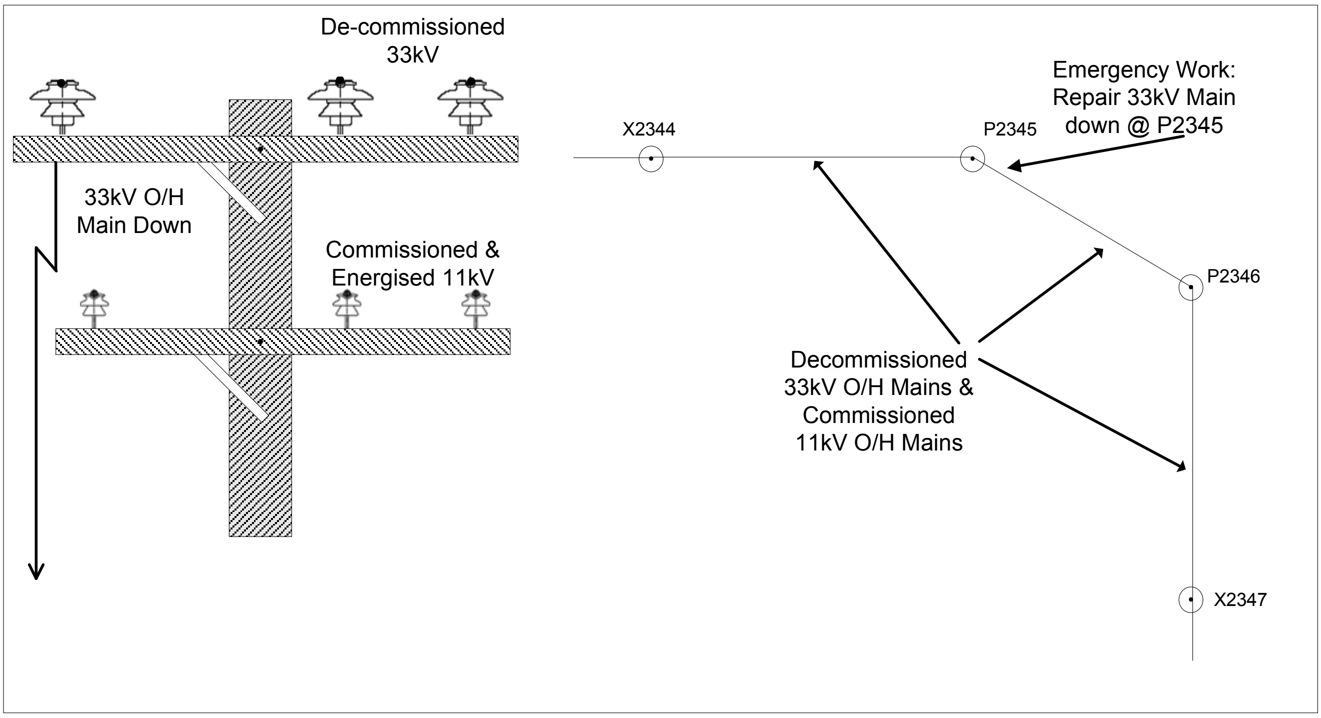
Typical Procedure

1. A Commissioning Coordinator provides a copy of Decommissioned Notice for the 33kV O/H mains to the Switching Coordinator and a copy to the On site Supervisor, in charge of the overhead work crew
2. Network Operations arrange switching sheet preparation and authorisation
3. The Commissioning Coordinator ensures the Not Electrically Connected 33kV O/H mains are disconnected per Decommissioning Notice
4. The Commissioning Coordinator ensures where applicable, that Not Electrically Connected electrical apparatus is suitably earthed and other precautions are in place prior to the issue of Decommissioning Notice Attachment A
5. The Commissioning Coordinator attaches the Decommissioning Notice and Attachment A form together, and issues Attachment A form to the On Site Supervisor for work on the decommissioned 33kV O/H mains
6. Switching Operator carries out 11kV forward switching
7. Switching Operator isolates and earths the commissioned 11kV O/H mains

8. Isolation points for the commissioned 11kV O/H mains shall include X2344 and X2347
9. Items of switching to confirm the On site Supervisor has checked disconnection points as per Decommissioning Notice
10. Items of switching to confirm the On site Supervisor has received a copy of the Decommissioning Notice and Attachment A
11. Operator issues AP1 to Overhead for the commissioned 11kV O/H mains at the work area
12. Recipient receives AP1
13. On Site Supervisor receives the Decommissioning Notice Attachment A
14. Under the direction of the On Site Supervisor the O/H work crew tests and earths the 33kV O/H and places any other precautions required for the work to be carried out.
15. Earths and other precautions are recorded on the Decommissioning Notice and Decommissioning Notice Attachment A Form
16. Overhead complete works
17. 33kV earths and other precautions are removed and recorded on the Decommissioning Notice and Attachment A Form
18. On Site Supervisor Surrenders the Decommissioning Notice Attachment A
19. AP1 is surrendered
20. Switching Operator recovers AP1
21. Switching Coordinator confirms all pre-energisation checks/test completed
22. Switching Operator checks all earths placed by work group are removed as per Decommissioning Notice and AP1
23. Switching Operator checks all other precautions are removed
24. Switching Operator completes 11kV reverse switching

A.15 Emergency Work on De-commissioned Electrical Apparatus with Commissioned Electrical Apparatus Below.

Example: Repair 33kV Main down at P2345



Work Group	Task
Overhead	Check Disconnection Methods per Decommissioning Notice Carry out switching to isolate X2344 and X2347. To replace P2345
Network Operations	Forward and Reverse switching

(The Recipient and On Site Supervisor should be the same person for this example)

Typical Procedure

1. A Commissioning Coordinator provides a copy of Decommissioned Notice for the 33kV O/H mains to the Switching Coordinator and a copy to the On site Supervisor, in charge of the overhead work crew
2. Network Operations arrange switching sheet preparation and authorisation
3. The Commissioning Coordinator ensures the Not Electrically Connected 33kV O/H mains are disconnected per Decommissioning Notice
4. The Commissioning Coordinator ensures where applicable, that Not Electrically Connected electrical apparatus is suitably earthed and other precautions are in place prior to the issue of Decommissioning Notice Attachment A
5. The Commissioning Coordinator attaches the Decommissioning Notice and Attachment A form together, and issues Attachment A form to the On Site Supervisor for work on the decommissioned 33kV O/H mains
6. Switching Operator carries out 11kV forward switching

7. Switching Operator isolates and earths the commissioned 11kV O/H mains
8. Isolation points for the commissioned 11kV O/H mains shall include X2344 and X2347
9. Items of switching to confirm the On site Supervisor has checked disconnection points as per Decommissioning Notice
10. Items of switching to confirm the On site Supervisor has received a copy of the Decommissioning Notice and Attachment A
11. Operator issues AP1 to Overhead for the commissioned 11kV O/H mains at the work area
12. Recipient receives AP1
13. On Site Supervisor receives the Decommissioning Notice Attachment A
14. O/H work crew tests and earths the 33kV O/H and places any other precautions required for the work to be carried out.
15. Earths and other precautions are recorded on the Decommissioning Notice and Attachment A Form
16. Overhead complete works
17. 33kV earths and other precautions are removed and recorded on the Decommissioning Notice and Attachment A Form
18. On Site Supervisor Surrenders the Decommissioning Notice Attachment A
19. AP1 is surrendered
20. Switching Operator recovers AP1
21. Switching Coordinator confirms all pre-energisation checks/test completed
22. Switching Operator checks all earths placed by work group are removed as per Decommissioning Notice and AP1
23. Switching Operator checks all other precautions are removed
24. Switching Operator completes 11kV reverse switching

A.16 Not Electrically Connected Electrical Apparatus to be Only Partially Recommissioned

Fig A16.1

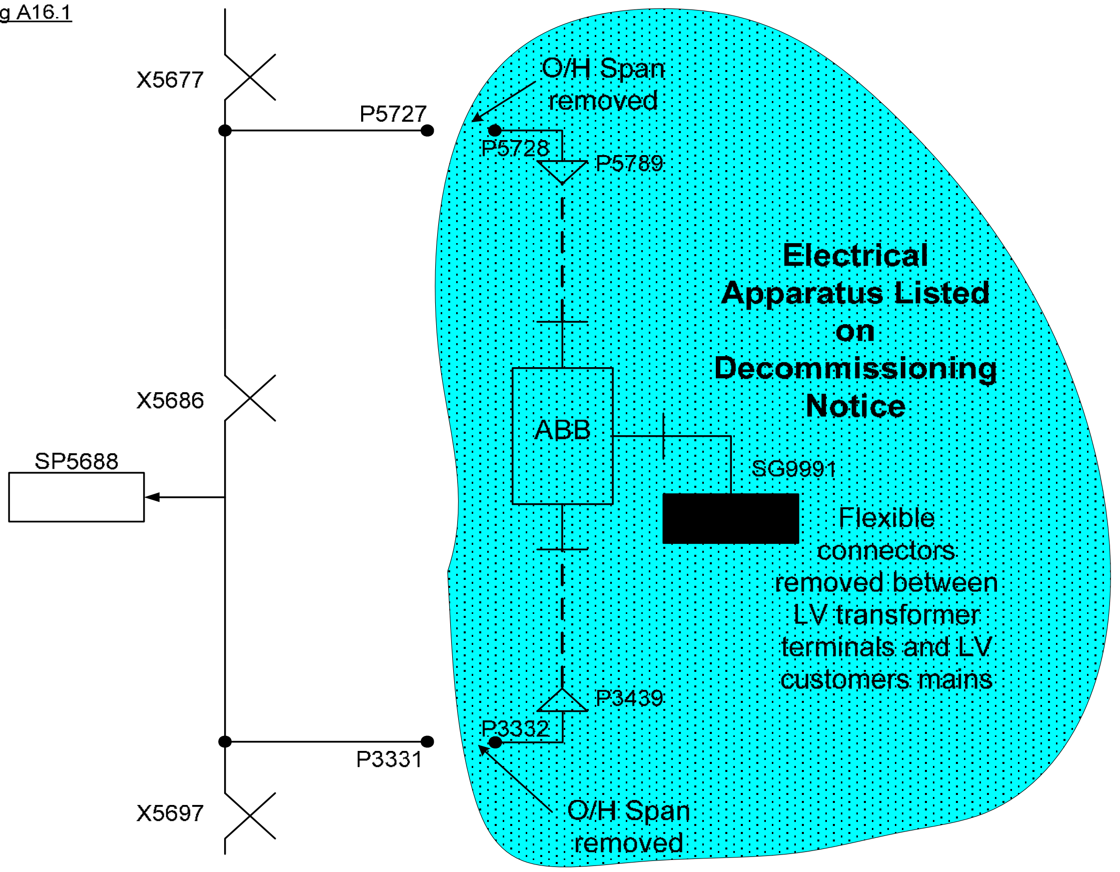
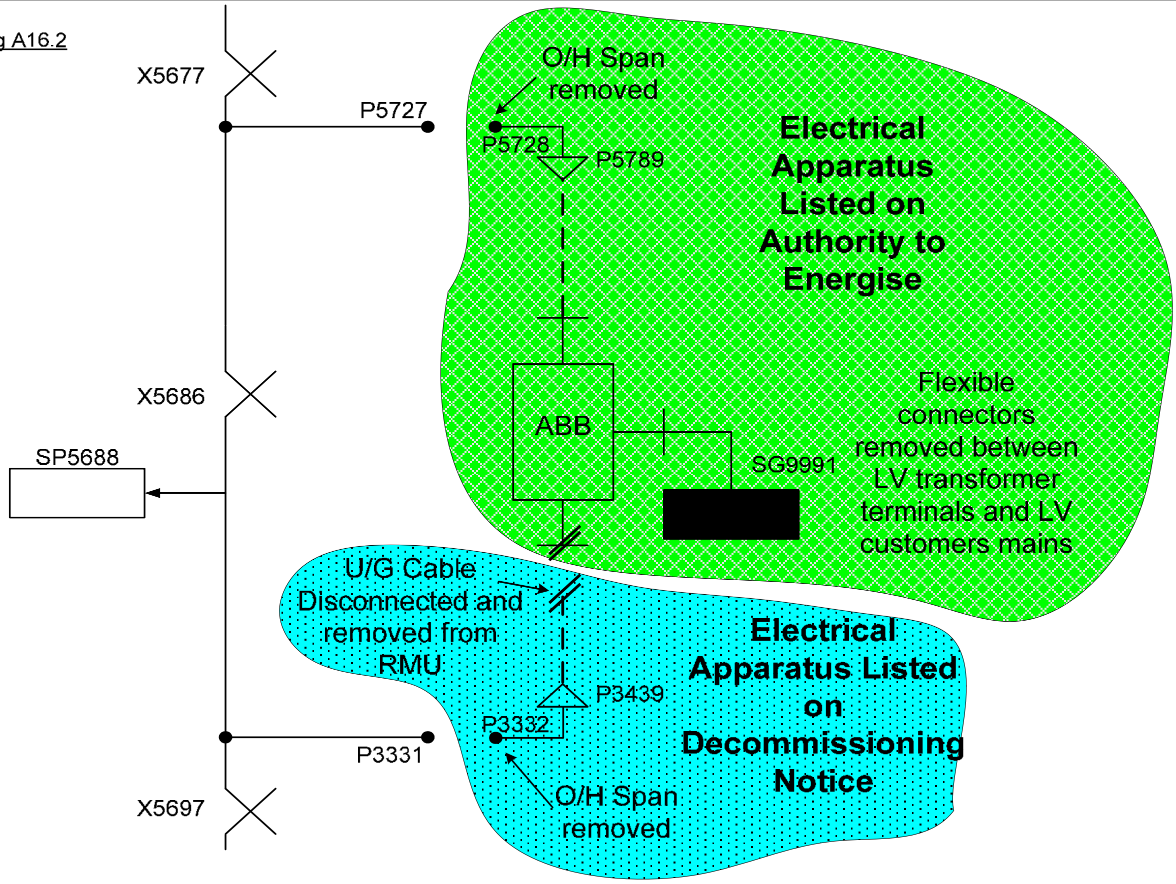


Fig A16.2



A.16:- Not Electrically Connected electrical apparatus to be only partially recommissioned.

Work Group	Task
Commissioning Coordinator in Fig A16.1	Decommissioning Notice required to display the Not Electrically Connected Electrical Apparatus that will remain disconnected on site
Commissioning Coordinator in Fig A16.2	Destroy the original Decommissioning Notice Prepare a new Decommissioning Notice to reflect Changes Follow Commissioning Procedures in Section 11.4.3.1, Commissioning Using an Authority to Energise

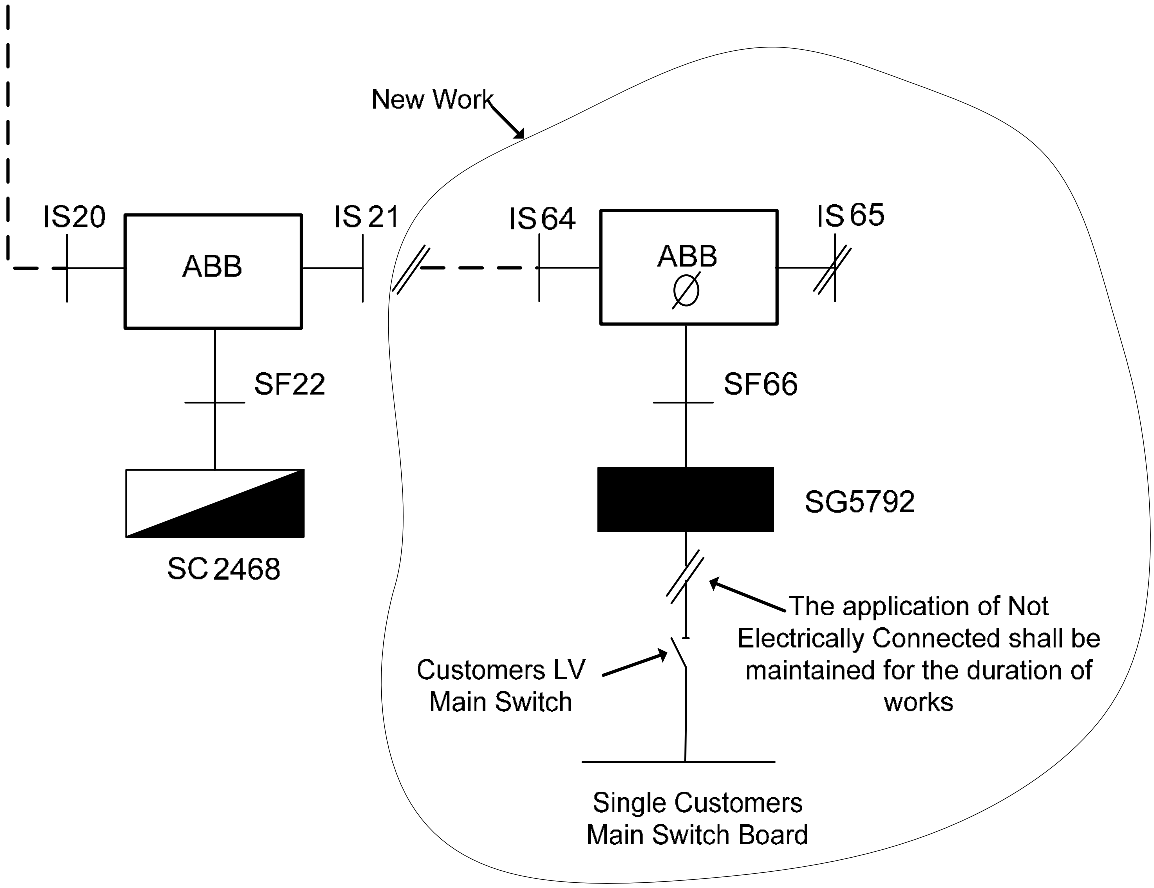
Typical Procedure
Fig A16.1

1. A Commissioning Coordinator should place where practical a copy of Decommissioned Notice on or near the Not Electrically Connected Electrical Apparatus
2. More than one copy of the Decommissioning Notice may be required when several locations are involved

Partial Recommissioning Fig A16.2

1. Destroy the original Decommissioning Notice
2. Prepare a new Decommissioning Notice/s to reflect the changed isolation for the part/s to remain Not Electrically Connected,
3. A Commissioning Coordinator shall issue and endorse that new Decommissioning Notice
4. A Switching Coordinator is not required to approve the authorisation of that Decommissioning Notice
5. Commissioning using an Authority to Energise method shall be used for the Not Electrically Connected electrical apparatus sections to be recommissioned, (Refer to 11.4.3.1)

A.17 Commissioning a New Single Customer SG Site (using an AE)



Work Group	Task
W/Group	Install SG5792
Underground	Install and terminate new U/G cable.
Contractors	LV Works
Field Test	HV Cable Test
Network Operations	Forward & Reverse switching

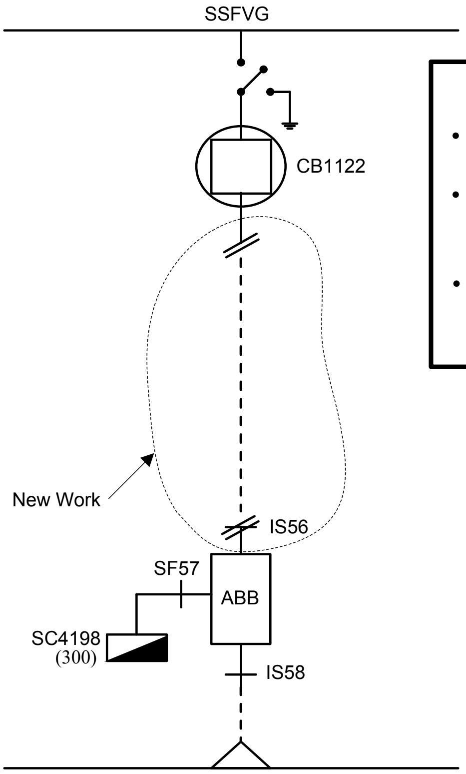
Typical Procedure

1. Commissioning Coordinator submits switching application
2. Network Operations arrange switching sheet preparation & authorisation
3. W/Group installs SG site[8]
4. Commissioning Coordinator issues CA1 to Underground to install and terminate U/G cable on IS64 and U/G cable between the RMU and transformer at SG5792.
5. Commissioning Coordinator issues CA2 to Contractors for LV works.
6. Commissioning Coordinator recovers CA1, CA2
7. Switching Operator carries out forward switching

[8] A CA is not required for this type of civil work

8. Isolation points shall include the SC2468/IS21, SG5792 Customers LV Main Switch and SG5792/IS65 Check Open and Place DNOB
9. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
10. Switching Operator issues AP1 to Workgroup to terminate U/G cable on IS21 at SC2468 and complete LV works.
11. Works completed and AP1 surrendered
12. .Switching Operator recovers AP1
13. Switching Operator issues TP2 to *Field Test*
14. Field Test complete HV cable tests
15. Switching Operator recovers TP2
16. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for SG5792 and associated U/G cable.
17. Network Operations receive AE from Commissioning Coordinator
18. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
19. Switching Operator checks the position of HV, including IS65 at SG5792 is secured in the open position, a system lock with DNOB tag placed
20. Switching Operator carries out reverse switching to energise new SG site
21. Post-energisation checks completed (as per form 1175)
22. Network Operations update records

A.18 Connecting a new 11kV U/G feeder cable to existing Spare CB



Work Activity

- Connect and commission new cable between IS56 and CB1122
- Install relay, RSR, and functional testing of protection system and CB
- Note: CB1122 and SC4198/IS56 will be treated as commissioned pieces of electrical apparatus

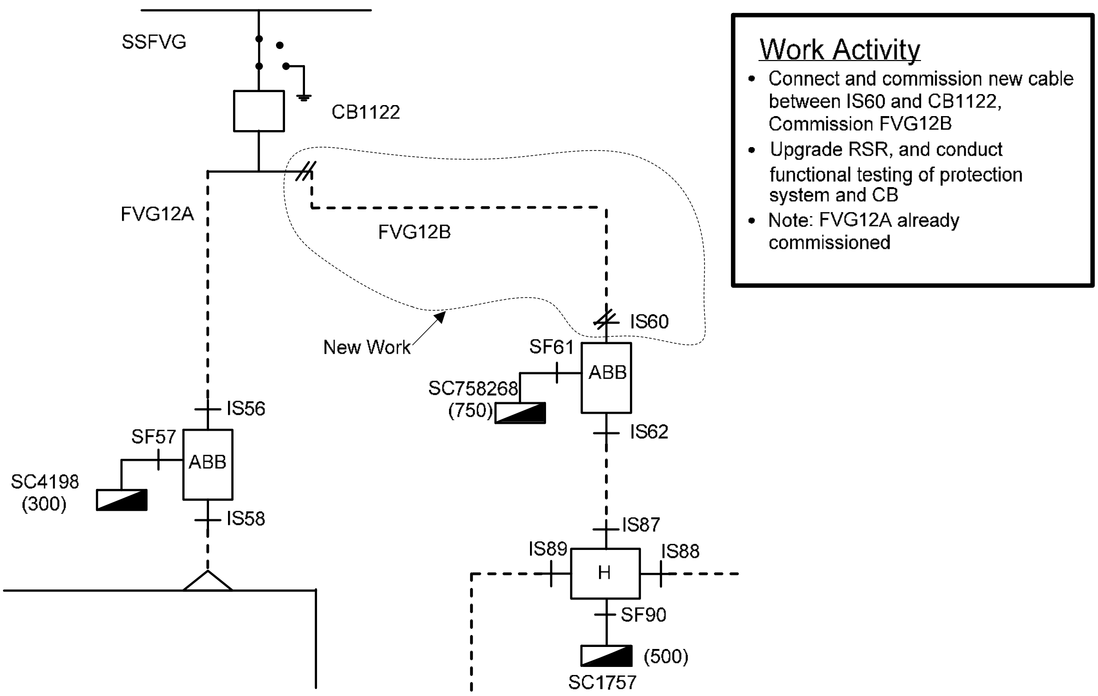
Work Group	Task
Network Operations	Forward and Reverse Switching
Substation Services	Commissioning Coordinator for CB1122
Underground	Install and terminate new U/G cable
Field Test	SSWP, TIS, PAS – testing protection
Protection Department	RSR
Field Test	HV Cable test

Typical Procedure

1. Substation Services appoint a Commissioning Coordinator
2. Commissioning Coordinator submits switching application
3. Network Operations arrange switching sheet preparation & authorisation
4. Substation Services carry out any wiring mods (Not involving cutting in) to the circuitry at SSFVG CB1122. (Note: No testing of the CB is required in this instance)
5. Commissioning Coordinator confirms Protection Department have issued the latest RSR
6. Commissioning Coordinator applies for switching for Field Tests to conduct functional testing of protection system. This may require a SSWP
7. Underground installs new U/G cable
8. Switching Operator carries out forward switching
9. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)

10. Switching Operator issues AP1 to Underground to connect new cable between SC4198/IS56 and CB1122 at SSFVG
11. Underground complete work and surrender AP1
12. Switching Operator recovers AP1
13. Switching Operator issues TP2 to Field Test
14. Field Test complete HV cable tests
15. Switching Operator recovers TP2
16. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for CB1122 and Underground Cable
17. Network Operations receive AE from commissioning coordinator
18. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
19. Switching Operator carries out reverse switching (energising new CB1122 and U/G cable)
20. Network Operations update records

A.19 Commission 11kV feeder FVG12B – between CB1122 and IS60



Work Group	Task
Network Operations	Forward and Reverse Switching
Substation Services	Commissioning Coordinator for CB1122
Underground	Install and terminate new U/G cable
Field Test	SSWP, TIS, PAS – testing protection
Protection Department	RSR
Field Test	HV Cable test

Typical Procedure

1. Substation Services appoint a Commissioning Coordinator
2. Commissioning Coordinator submits switching application
3. Network Operations arrange switching sheet preparation & authorisation
4. Substation Services carry out any wiring mods (Not involving cutting in) to the circuitry at SSFVG CB1122. (Note: No testing of the CB is required in this instance)
5. Commissioning Coordinator confirms Protection Department have issued the latest RSR
6. Commissioning Coordinator applies for switching for Field Tests to conduct functional testing of protection system. This may require a SSWP
7. Underground installs new U/G cable
8. Switching Operator carries out forward switching
9. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
10. Switching Operator issues AP1 to Underground to connect new cable between SC758268/IS60 and CB1122 at SSFVG
11. Underground complete work and surrender AP1

12. Switching Operator recovers AP1
13. Switching Operator issues TP2 to Field Test
14. Field Test complete HV cable tests
15. Switching Operator recovers TP2
16. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for CB1122 and Underground Cable
17. Network Operations receive AE from commissioning coordinator
18. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
19. Switching Operator carries out reverse switching (energising new U/G cable between CB1122 and SC758268/IS60)
20. Network Operations update records

A.20 Commissioning new substation including transformers and 11kV switchboard – no 11kV feeders connected.

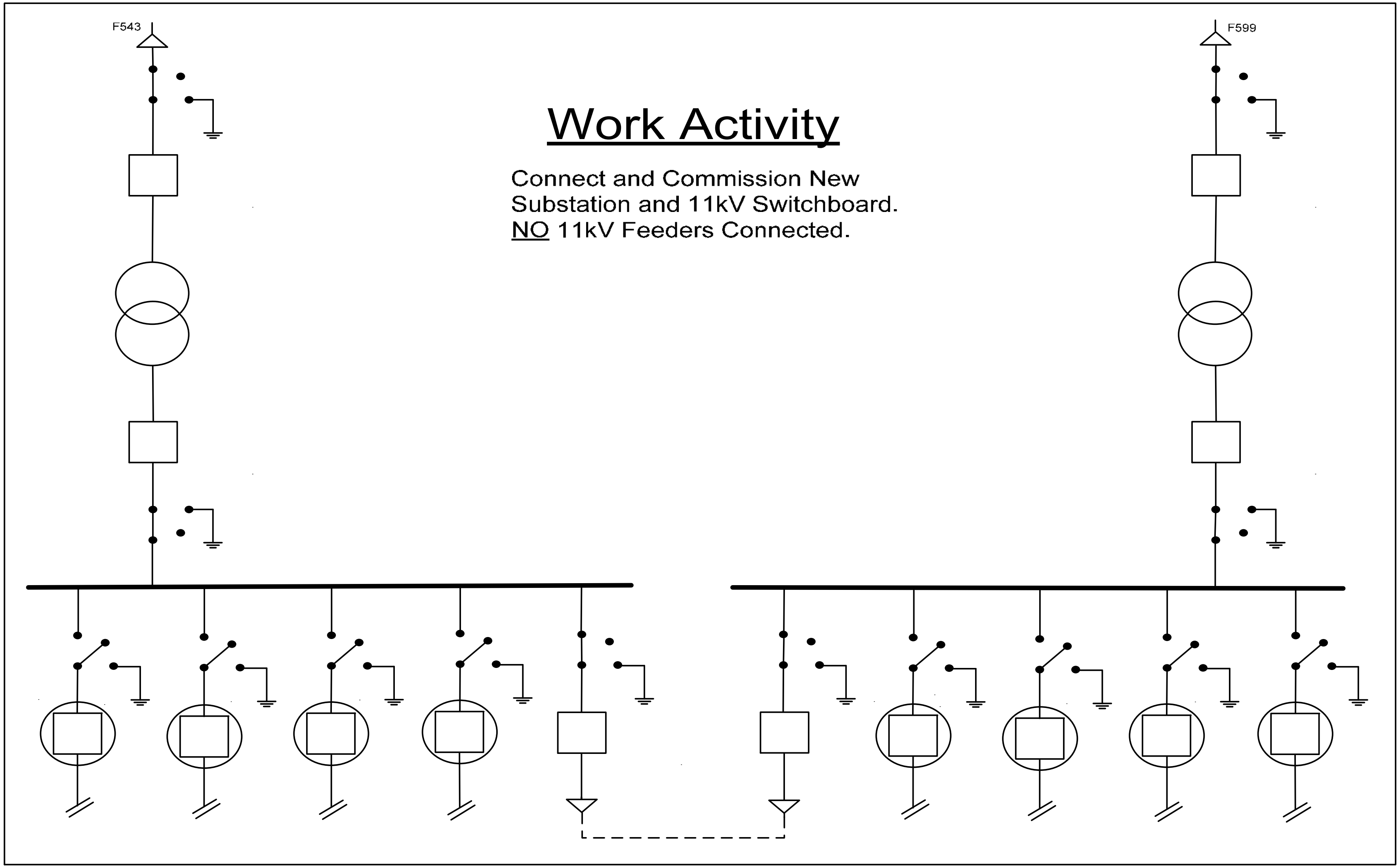
Work Group	Tasks
	Tasks involved using Commissioning Procedures
Substation Services	Commissioning Coordinator for New Substation
Underground	CA -install and terminate new HV U/G cables within substation
Substation Services	CA - installation of all substation equipment and apparatus
Field Test	TA – testing protection and secondary system wiring
Protection Department	RSRs
Field Test	TA - HV Cable tests
SCADA	Installation of hardware and software for SACS
Communications	Comms installation
Meter Services	
Contractors	CA - installation of all substation equipment and apparatus
	Tasks involved using SAHV Procedures
Network Operations	Forward and Reverse Switching
Substation Services	Commissioning Coordinator confirm T/As recovered before the issue of APs
Underground	Connect substation to existing network
Field Test	HV Cable tests
Field Test	Post commissioning tests

Typical Procedure

1. Substation Services appoint a Commissioning Coordinator
2. Commissioning Coordinator submits switching applications and a commissioning program
3. Network Operations arrange switching sheet preparation & authorisation
4. Commissioning Coordinator issues CAs to all workgroups involved to construct substation
5. Underground installs new U/G cables and makes connection to selected new circuit breakers/transformers
6. Commissioning Coordinator confirms Protection Department have issued all RSRs for new Sub
7. Commissioning Coordinator issues CA to Field Test to conduct testing of all substation electrical equipment
8. Commissioning Coordinator recovers all CAs to issue TA for Field Tests to conduct functional testing of protection system (lethal current)
9. Switching Operator carries out forward switching
10. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
11. Switching Operator issues AP1 for Underground to cut into existing cable in two places (e.g. F567)
12. Underground cuts into existing cable (e.g. F567) and surrenders AP1
13. Switching Operator recovers AP1

14. Switching Operator carries out switching to include changed isolation points (& feeder number changes e.g. F599 and F543)
15. Switching Operator issues AP2 (F599) and AP3 (F543) for Underground to joint new cables.
16. Underground complete work and surrender AP2 and AP3
17. Switching Operator recovers AP2 and AP3
18. Switching Operator issues TP4 and TP5 to Field Test
19. Field Test complete HV cable tests
20. Switching Operator recovers TP4 and TP5
21. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for new substation and 33kV underground cables
22. Network Operations receive AE from commissioning coordinator
23. Switching Coordinator confirms all pre-energisation checks/test completed on APs, TPs, AEs (switching sheet item)
24. Switching Operator carries out reverse switching (energising new 33kV feeders and substation)
25. Field Test carry out any post commissioning checks and tests for new substation
26. Network Operations update records

A.20: Commissioning new substation including transformers and 11kV switchboard – no 11kV feeders connected.



A.21 Commission 11kV switchboard via two 11kV feeders – transformers and 33kV switchgear to be energised in the future

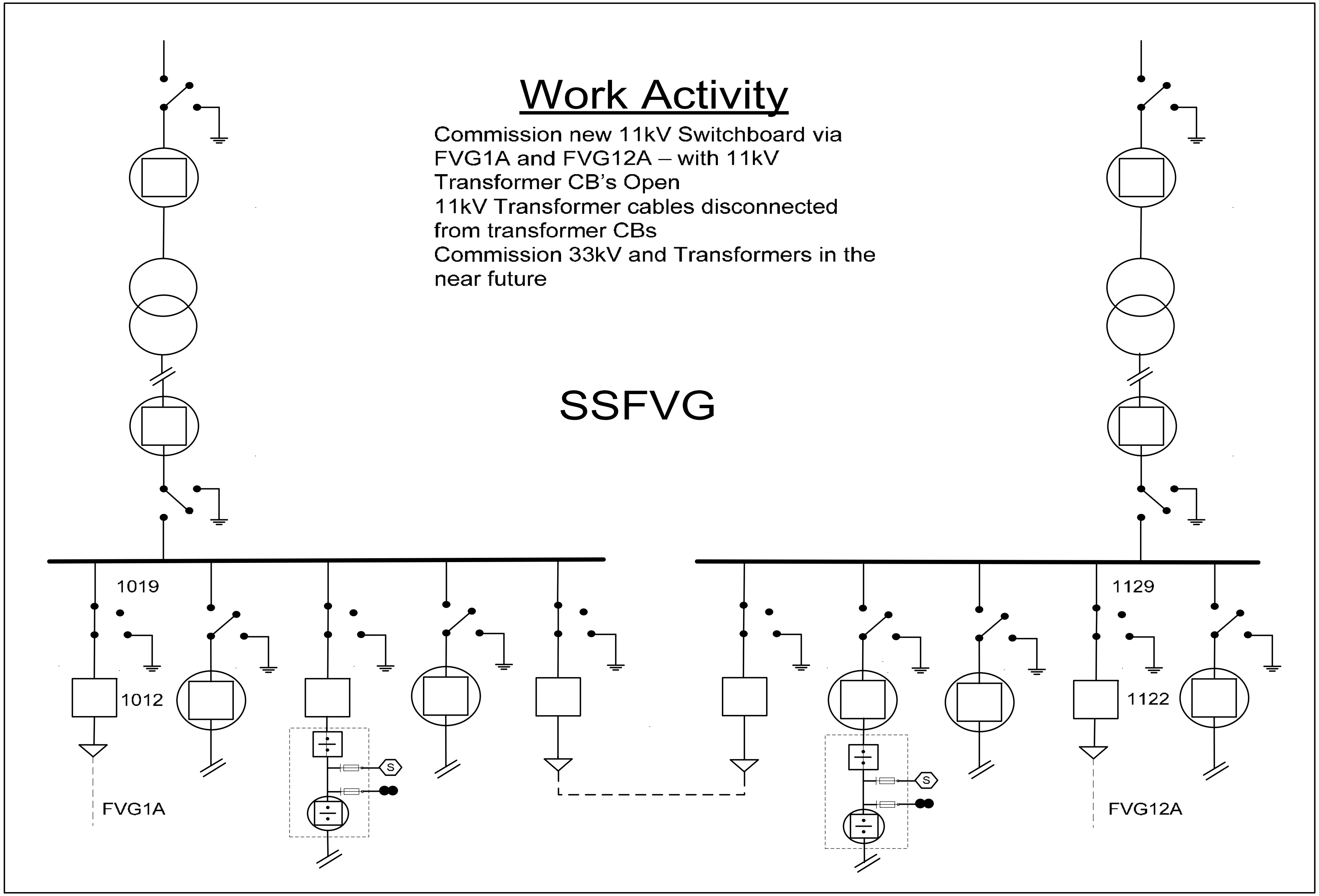
Work Group	Tasks
	Tasks involved using Commissioning Procedures
Substation Services	Commissioning Coordinator for New Substation
Underground	CA -install and terminate new HV U/G cables within substation
Substation Services	CA - installation of all substation equipment and apparatus
Field Test	TA – testing protection and secondary system wiring
Protection Department	RSRs
Field Test	TA - HV Cable tests
SCADA	Installation of hardware and software for SACS
Communications	Comms installation
Meter Services	
Contractors	CA - installation of all substation equipment and apparatus
	Tasks involved using SAHV Procedures
Network Operations	Forward and Reverse Switching
Substation Services	Switching Operator Commissioning Coordinator confirm T/As recovered before the issue of APs
Underground	Connect substation to existing via the 11kV network
Field Test	HV Cable tests
Field Test	Post commissioning tests

Typical Procedure

1. Substation Services appoint a Commissioning Coordinator
2. Commissioning Coordinator submits switching applications and a commissioning program
3. Network Operations arrange switching sheet preparation & authorisation
4. Commissioning Coordinator issues CAs to all workgroups involved to construct substation
5. Underground installs new U/G cables and makes connection to selected new 11kV circuit breakers
6. Commissioning Coordinator confirms Protection Department have issued all RSRs for new Sub
7. Commissioning Coordinator issues CA to Field Test to conduct testing of all substation electrical equipment
8. Commissioning Coordinator recovers all CAs to issue TA for Field Tests to conduct functional testing of protection system (lethal current)
9. Switching Operator carries out forward switching
10. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
11. Switching Operator issues AP1 and AP2 for Underground to cut into existing network for feeders FVG1A and FVG12A
12. Underground completes work and surrenders AP1 and AP2
13. Switching Operator recovers AP1and AP2

14. Switching Operator issues TP3 and TP4 to Field Test
15. Field Test complete HV cable tests
16. Switching Operator recovers TP3 and TP4
17. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for new 11kV bus and 11kV underground cables
18. Network Operations receive AE from commissioning coordinator
19. Switching Coordinator confirms all pre-energisation checks/test completed on APs, TPs, AEs (switching sheet item)
20. Switching Operator carries out reverse switching (energising new 11kV feeders and 11kV bus)
21. Field Test carry out any post commissioning checks and tests for new 11kV bus if required
22. Network Operations update records

A.21: Commission 11kV switchboard via two 11kV feeders – transformers and 33kV switchgear to be energised in the future



A.22 Commissioning ½ new substation including one transformer and ½ 11kV switchboard – One 11kV feeder connected.

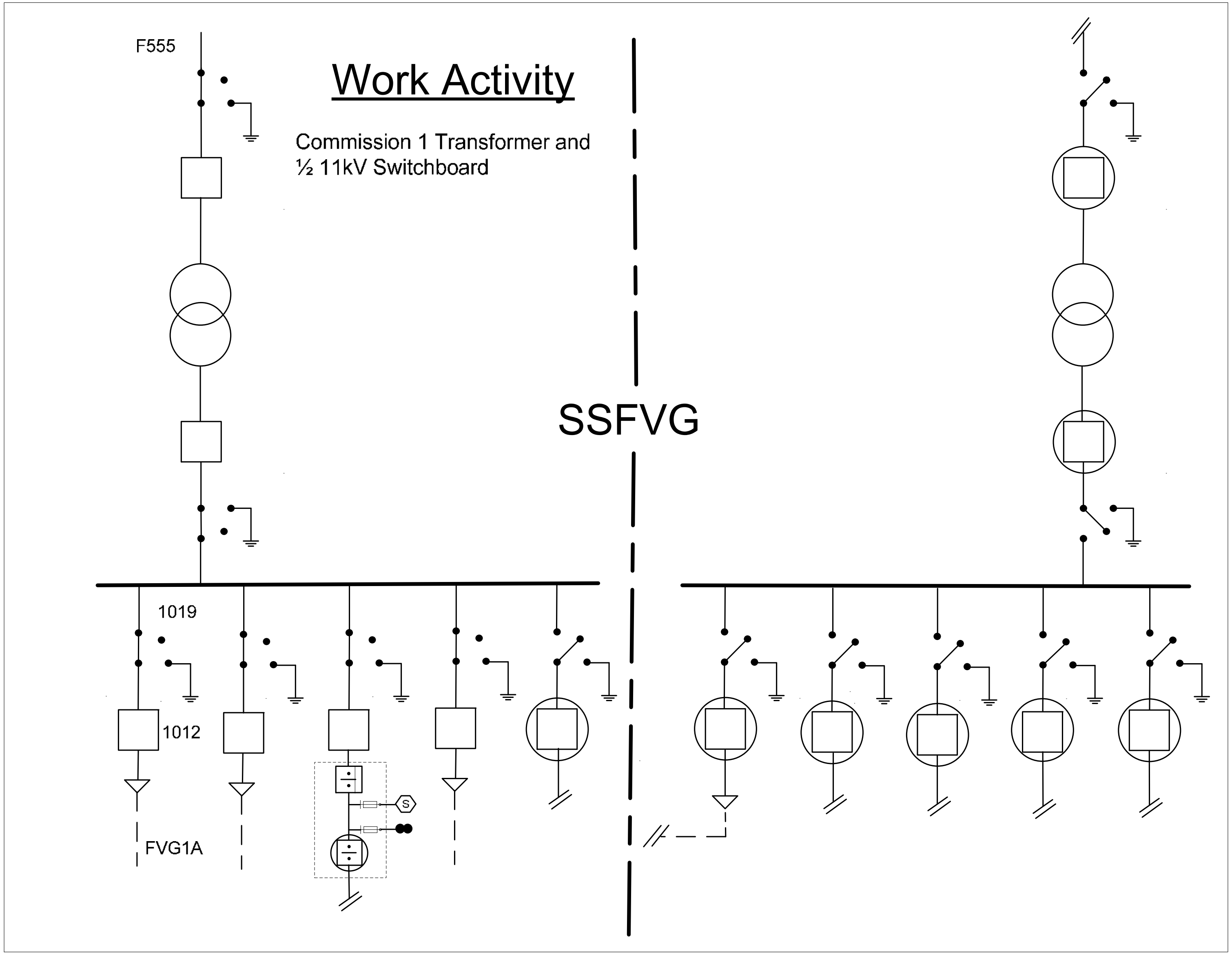
Work Group	Tasks
	Tasks involved using Commissioning Procedures
Substation Services	Commissioning Coordinator for New Substation
Underground	CA -install and terminate new HV U/G cables within substation
Substation Services	CA - installation of all substation equipment and apparatus
Field Test	TA – testing protection and secondary system wiring
Protection Department	RSRs
Field Test	TA - HV Cable tests
SCADA	Installation of hardware and software for SACS
Communications	Comms installation
Meter Services	
Contractors	CA - installation of all substation equipment and apparatus
	Tasks involved using SAHV Procedures
Network Operations	Forward and Reverse Switching
Substation Services	Commissioning Coordinator confirm T/As recovered before the issue of APs
Underground	Connect substation to existing network
Field Test	HV Cable tests
Field Test	Post commissioning tests

Typical Procedure

1. Substation Services appoint a Commissioning Coordinator
2. Commissioning Coordinator submits switching applications and a commissioning program
3. Network Operations arrange switching sheet preparation & authorisation
4. Commissioning Coordinator issues CAs to all workgroups involved to construct substation
5. Underground installs new U/G cables and makes connection to selected new 11kV circuit breaker
6. Commissioning Coordinator confirms Protection Department have issued all RSRs for new Sub
7. Commissioning Coordinator issues CA to Field Test to conduct testing of all substation electrical equipment
8. Commissioning Coordinator recovers all CAs to issue TA for Field Tests to conduct functional testing of protection system (lethal current)
9. Switching Operator carries out forward switching
10. Switching Operator confirms with Commissioning Coordinator that all CAs/TAs are recovered (switching sheet item)
11. Switching Operator issues AP1 and AP2 for Underground to cut into existing network for feeders F555 and FVG1A
12. Underground completes work and surrenders AP1 and AP2
13. Switching Operator recovers AP1 and AP2
14. Switching Operator issues TP3 and TP4 to Field Test

15. Field Test complete HV cable tests
16. Switching Operator recovers TP3 and TP4
17. Commissioning Coordinator confirms all pre-energisation checks/test complete, then authorises AE for new 11kV bus and 11kV underground cables
18. Network Operations receive AE from commissioning coordinator
19. Switching Coordinator confirms all pre-energisation checks/test completed on AP, TP, AE (switching sheet item)
20. Switching Operator carries out switching to energise new 33kV feeder and substation
21. Field Test carry out any post commissioning checks and tests for new substation
22. Switching Operator carries out switching to energise new 11kV bus and new 11kV feeder
23. Field Test carry out any post commissioning checks and tests for new 11kV bus if required
24. Network Operations update records

A22: Commissioning ½ new substation including one transformer and ½ 11kV switchboard –One 11kV feeder connected



A.23 Forms

Switching Application

No. AS1043006

To Area:	South Coast TMR 220, Ph 07 3407 5295;	Highest Voltage:	11kV
Applicant Name:	ARRON SMITH		
Telephone Number:	3426 1633	Received:	18/08/2009
Fax Number:	3426 1632	Job Start:	Friday 20/11/2009 07:00
Service Provider:	South Coast DS	Job End:	Friday 20/11/2009 17:00

1 Access / Test Permits / Work Authority Required / LV Switching Sheet Authorisation

				From			To		
Location	Lines and Apparatus	A/P T/P W/A LV	Work Group	Day	Time	Date	Day	Time	Date
Trial St Southport	11kV Mains	A/P	Southport U/G	Friday	08:00	20/11/2009	Friday	15:00	20/11/2009
Trial St Southport	11kV Mains	T/P	Cable Test	Friday	15:00	20/11/2009	Friday	16:00	20/11/2009

2 Work Details/Description

Bridge in and commission new 11kV U/G cable, ABB RMU and transformer SC2468

Work Location	Trial St Southport						
SUBS	SPO	FDRS	SPO3	Panel	SPO/B	Grid Ref.	D-4

HV System Alteration Required	Yes	EMERG. Rest. Time	(B/hrs) 2	(A/hrs)	0
W/Plan No:	C001234	Contingency Required?	No		

Phasing Required	No	Where	
Phase Rotation Required	Yes	Where	LV Switch SC2468

3 Isolation Points

X1234 (Trial St Southport)
X5678 (Trial St Southport)
SC2468/IS21 (Trial St Southport)
LV Switch @ SC2468/DL1 (Trial St Southport)

Will LV tie(s) be isolation point for HV Access ?	No
LV switching points checked in the field?	Yes

4 HV Operator Earths

P10123 (Trial St Southport)
SC2468/IS21 (Trial St Southport)

5 Secondary System Details

Secondary Systems Required ?		No	Protection Permit Required?		No
Location	Number	Protection Isolated	Location	Number	Protection Isolated

Switching Application

No. AS1043006

6 Commissioning / Decommissioning Details

"AE" Required?	Yes	Commission Coordinator:	Arron Smith
"DN" Required ?	No		
Commissioning Transformer	Yes	Commissioning RMU	Yes
Single Customer Transformer	No	Commissioning FU	No
Generator Connection Suitability	Yes	If yes, RMU/FU/RDU Brand Name	SAFELINK
LV Mains to be Energised	No	Is unit fitted with phasing facilities?	Yes

7 Customer Outage

No. of Customers Interrupted 0

	Outage 1	Outage 2	Outage 3	Outage 4
Supply Off				
Supply On				
Notification Date				
Notification Method				
Notification By				
Suburb/Area				
Streets (incl no's)				
Network Affected				
Priority Consumers				
Location/Phone				
Details				
Arrangements				
Arranged By				

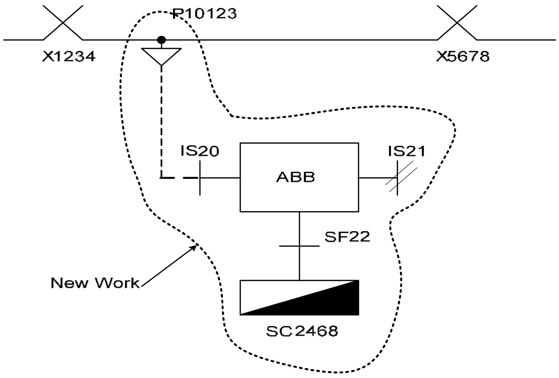
8 LV Details

LV areas to be tied in?	No	Alternator Required?	No
Are LV ties in database?	No	Size:	
		Alt Connection Point:	
LV Switching Sheet Attached?	No	Parallel	No
		Isolated	No

9 Additional Remarks

No LV connected to LV switchboard @ SC2468

No. «AppNumber»



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No.

Construction Authority

1	**Project/Works Order Number**			
2	**Authority to Energise Number**			
3	**Work Area Location**			
4	**Anticipated Surrender**	Time :	Day	Date / /
5	**Issue To**			

6 Detailed description of not electrically connected electrical apparatus to be constructed / worked on.

Install SC2468 padmount and RMU. Install and terminate 11kV underground Cable between P10123 and IS20 at RMU SC2468 Howard St

7 Method of Disconnection of not electrically connected electrical apparatus from the commissioned network

1. No 11kV bridges between Underground Termination and existing 11kV O/H mains @ P10123
2. No LV cables connected at LV switchboard @ SC2468
3. No 11kV Underground Cable connected to IS21 @ SC2468

8 Earths On Electrical Apparatus

	Exact Location	Placed/Checked By Signature, Time and Date	Removed By Signature, Time and Date
a	**11kV Switch IS20 @ SC2468**	Graham Hill	
		10:00 08/12/2009	/ /
b	**11kV Switch SF22 @ SC2468**	Graham Hill	
		10:05 08/12/2009	/ /
c	**11kV U/G Termination @ P10123 Howard St**	Allan Jones	
		12:05 09/12/2009	/ /

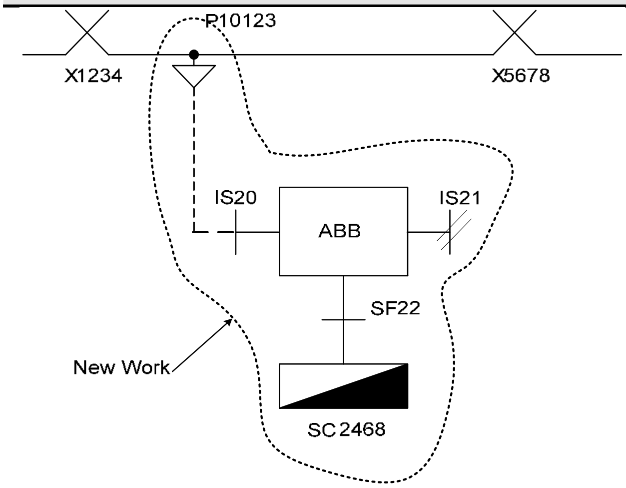
9 Other Precautions Taken

- ☐ Taping/Roping Off
- ☐ Work Area Sign
- ☐ Live HV Lines & Apparatus Above or beyond Board
- ☐ Barriers in Place
- ☐ Other (please specify)

10 Nearby Live HV/LV at the Work Area

Existing 11kV Overhead Mains at P10123 Howard St

11 Diagrams / Remarks



12 Issue of Construction Authority

The electrical apparatus detailed on the front of this Construction Authority will not be energised whilst this form is on issue

Commissioning Co-ordinator	Name (please print)	Signature	Time	Date / /

13 Receipt of Construction Authority

I acknowledge that I only have authority to work on the electrical apparatus listed in section 6 and will have no difficulty in keeping clear of electrical apparatus not covered by this Authority and will not alter disconnection methods listed in section 7

On-Site Supervisor	Name (please print)	Signature	Time	Date / /

14 Transfer of Construction Authority

This Construction Authority with all conditions is hereby transferred

Outgoing On-Site Supervisor	Name (please print)	Signature	Time	Date / /
Incoming On-Site Supervisor	Name (please print)	Signature	Time	Date / /

15 Abnormalities

NIL

16 Surrender of Construction Authority

This Authority is now surrendered, subject to any abnormalities listed in Section 15. All persons for whom I am responsible are clear and have been instructed to treat electrical apparatus listed on Page 1 as live. The condition of earthing is as stated in Section 8

All required pre-energisation checks/tests for electrical apparatus listed on Page 1 have been successfully completed (Tick 3 one box only) ☒ **Yes**	☐ **No**	If "NO", record the checks/tests that were successfully completed under this Authority in Section 15 Abnormalities

On-Site Supervisor	Name (please print)	Signature	Time	Date / /

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Test Authority

No. 778899 - 2

1.	**Project/Works Order Number**	C00678944
2.	**Authority to Energise Number**	778899
3.	**Work Area Location**	Howard St Mt Gravatt
4.	**Anticipated Surrender**	Time 14 : 30 Day Thursday Date 10/12/2009
12	**Issue To**	Cable Test

6. Detailed description of not electrically connected electrical apparatus for testing work.

Test new 11kV underground Cable between P10123 and IS20 at SC2468

Howard St

7. Methods of Disconnection of not electrically connected electrical apparatus from the commissioned network

1. No 11kV bridges between Underground Termination and existing 11kV O/H mains @ P10123
2. No LV cables connected at LV switchboard @ SC2468
3. No 11kV Underground Cable connected to IS21 @ SC2468

8. Earths On Electrical Apparatus

	Exact Location	**Placed / Checked By Signature, Time and Date**	**Removed / Checked By Signature, Time and Date**
A	**11kV Switch IS20 @ SC2468**	Graham Hill	
		10:00 08/12/2009	: / /
B	**11kV Switch SF22 @ SC2468**	Graham Hill	
		10:05 08/12/2009	: / /
C	**11kV U/G Termination @ P10123 Howard St**	Allan Jones	Jackie Stewart
		12:05 09/12/2009	14:25 10/12/2009

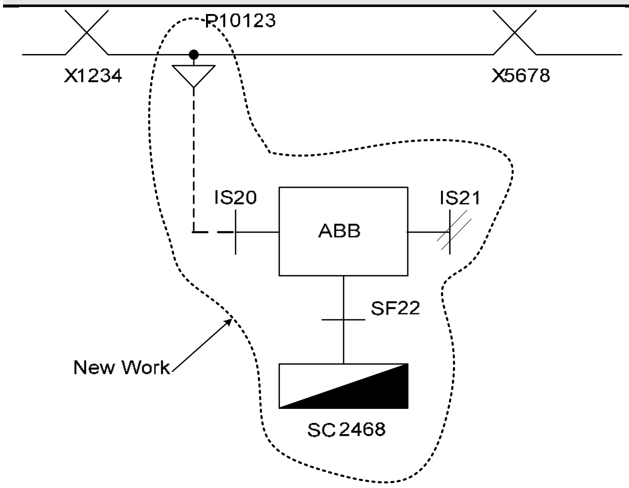
9. Other Precautions Taken

- ☑ Taping / Roping Off
- ☐ Work Area Sign
- ☐ Live HV Lines & Apparatus Above or beyond Board
- ☐ Barriers in Place
- ☑ HV Testing Board
- ☐ Other (please specify)

10. Nearby Live HV/LV at the Work Area

Existing 11kV Overhead Mains at P10123 Howard St

11. Diagrams / Remarks



12. Delegation to Issue

The following delegate may issue this Authority on my behalf, provided the following CA's are recovered -

CA No.	Workgroup	Issued
		/ /
		/ /
		/ /

Delegates Name (please print)

	Name (please print)	Signature	Time	Date
Commissioning Coordinator				/ /

13. Issue of Test Authority

I have recovered all Construction Authorities "CA's" on issue (as per the AE or as stated in Section 12 above) for the electrical apparatus detailed on the front of this Test Authority and the electrical apparatus will not be commissioned whilst this form is on issue

	Name (please print)	Signature	Time	Date
Commissioning Coordinator or Delegate	Graham Hill	Graham Hill	13:30	10/12/2009

14. Receipt of Test Authority

I acknowledge that I only have authority to carry out testing work on the electrical apparatus listed on the front of this form and will have no difficulty in keeping clear of electrical apparatus not covered by this Authority and will not alter disconnection methods listed in section 7. Earths may be varied under my direction to suit testing

	Name (please print)	Signature	Time	Date
On-Site Test Supervisor	Jackie Stewart	Jackie Stewart	13:30	10/12/2009

15. Test Results

The electrical Apparatus detailed on the front of this authority has -

	Details
☑ Passed Test	11kV U/G cable passed test
☐ Failed Test	

16. Surrender of Test Authority

This Authority is now surrendered and Test Results recorded in Section 15. All persons for whom I am responsible are clear and have been instructed to treat the electrical apparatus covered by this Authority as live. The condition of earthing is as stated in Section 8

	Name (please print)	Signature	Time	Date
On-Site Test Supervisor	Jackie Stewart	Jackie Stewart	15:00	10/12/2009

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HV Access Permit

Permit No.	1

1. Switching Sheet No.	G1231231	2. Nominated Issue	*Time*	08:00
			Date	01/06/2010
3. Issue To	Soutport Underground	4. Nominated Surrender	*Time*	15:00
			Date	01/06/2010
5. Work Area Location	Trial St Southport			

6. Access to the following High Voltage Electrical Apparatus

11kV Overhead Mains at P10123

7. Work Details

Erect and terminate 11kV U/G cable at P10123. Bridge in and commission new 11kV U/G cable for new SC2468

8(a). Description of Isolation Points with DNOBs attached (including alpha identifiers)

X1234 (Trial St Southport)
X5678 (Trial St Southport)
SC2468/IS21 (Trial St Southport)
LV Switch @ SC2468/DL1 (Trial St Southport)

8(b). Description of Disconnection Points (If applicable)

9. Location of Operator Earths with DNOBs attached (including alpha identifiers)

11kV O/H mains @ P10123 (Trial St Southport)
SC2468/IS21 (Trial St Southport)

10. Other Precautions

☐ Live HV Conductors Above or Beyond Sign ☐ HV Testing Sign ☐ Work Area Sign
☐ Other (please specify below) – ☐ Additional Barriers in Place ☐ Roping Off ☒ Not Applicable

11. Nearby Exposed Live HV/LV at the Work Area

☒ HV Not Applicable
☒ LV Not Applicable

12. Issue of HV Access Permit

	Name (please print)	Signature	Time	Date
Approval by (Switching Coordinator)	Mark Weber			
Issued by Switching / Operator / Coordinator	Jenson Button	Jenson Button	07:50	01/06/2010

13. Receipt of HV Access Permit

I acknowledge that I only have access to the Electrical Apparatus listed in Section 6 and Shall have no difficulty in keeping clear of Electrical Apparatus not covered by this Permit and Shall not alter Isolation Points. Earths and Other Precautions can be altered as per Qld Electricity Entity Procedures for Safe Access to HV Electrical Apparatus. Any testing performed under this HV Access Permit shall not involve Lethal Current.

	Name (please print)	Signature	Time	Date
Recipient	Lewis Hamilton	Lewis Hamilton	07:55	01/06/2010

HV Access Permit

Permit No.	1

14. Work Group Signatures

Sign On				Sign Off		
I acknowledge that I only have access to the Electrical Apparatus listed in Section 6 of this HV Access Permit while Earthed and I shall have no difficulty in keeping clear of Electrical Apparatus not covered by this HV Access Permit and shall not alter Isolation Points. I acknowledge that only Authorised Individuals of Work Group Shall vary Earths or Other Precautions as directed by the Recipient.				*I acknowledge that I no longer have access to the Electrical Apparatus listed in Section 6 of this HV Access Permit and shall regard the Electrical Apparatus as being Live.*		
Name (please print)	**Signature**	**Time**	**Date**	**Signature**	**Time**	**Date**
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /

15. Transfer of HV Access Permit

This HV Access Permit, with all conditions, is hereby transferred –

	Name (please print)	**Signature**	**Time**	**Date**
Outgoing Recipient				/ /
Incoming Recipient				/ /

16. Suspend / Reinstate HV Access Permit

This HV Access Permit, with all conditions, is hereby suspended / reinstated –

	Name (please print)	**Signature**	**Time**	**Date**
Suspended by Recipient				/ /
Reinstated by Recipient				/ /

17. Working Earth Schedule

Item	Location of each set of Working Earths	On		Off	
		Time	Date	Time	Date
1.			/ /		/ /
2.			/ /		/ /
3.			/ /		/ /
4.			/ /		/ /
5.			/ /		/ /
6.			/ /		/ /

18. Operator Earth Schedule (for temporary removal of Operator Earths)

Item	Location of each set of Operator Earths	Off		On	
		Time	Date	Time	Date
1.			/ /		/ /
2.			/ /		/ /
3.			/ /		/ /
4.			/ /		/ /
5.			/ /		/ /
6.			/ /		/ /

19. Abnormalities (the Switching Coordinator shall be advised of these)

Cable Test Required

Are Supplementary Page(s) on issue for this permit? (select one box only) ☐ Yes. *If yes, Number of Pages:* _____________ ☒ No

20. Surrender of HV Access Permit

All required pre-energisation checks/tests have been successfully completed (select one box only) ☒ **Yes** ☐ **No** If "NO", record the checks/tests not successfully completed under this Permit in Section 19 'Abnormalities'

All Working Earths placed have been removed and Operator Earths replaced except as specified in Section 19 'Abnormalities' and I acknowledge that I no longer have access to the Electrical Apparatus listed in Section 6 and Shall regard the Electrical Apparatus as being Live.

	Name (please print)	**Signature**	**Time**	**Date**
Recipient	Lewis Hamilton	Lewis Hamilton	14:00	01/06/2010

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HV Test Permit

Permit No.	2

1. Switching Sheet No.	G1231231	**2. Nominated Issue**	*Time*	15:00
			Date	01/06/2010
3. Issue To	Cable Test	**4. Nominated Surrender**	*Time*	16:00
			Date	01/06/2010
5. Work Area Location	Trial St Southport			

6. Access to the following High Voltage Electrical Apparatus

11kV Underground Cable between SC2468/IS20 and P10123

7. Test Details

Conduct Cable test on 11kV Underground between SC2468/IS20 and P10123

8(a). Description of Isolation Points with DNOBs attached (including alpha identifiers)

X1234 (Trial St Southport)
X5678 (Trial St Southport)
SC2468/IS21 (Trial St Southport)
LV Switch @ SC2468/DL1 (Trial St Southport)

8(b). Description of Disconnection Points: (If applicable)

9. Location of Operator Earths with DNOBs attached (including alpha identifiers)

11kV O/H mains @ P10123 (Trial St Southport)
SC2468/IS21 (Trial St Southport)

10. Other Precautions

☐ Live HV Conductors Above or Beyond Sign ☒ HV Testing Sign ☐ Work Area Sign
☐ Other (please specify below) ☐ Additional Barriers in Place ☒ Roping Off ☐ Not Applicable

11. Nearby Exposed Live HV/LV at the Work Area

☒ HV Not Applicable
☒ LV Not Applicable

12. Issue of HV Test Permit

	Name (please print)	**Signature**	**Time**	**Date**
Approval by (Switching Coordinator)	Mark Weber			
Issued by Switching / Operator / Coordinator	Jenson Button	Jenson Button	14:30	01/06/2010

13. Receipt of HV Test Permit

I acknowledge that I only have access to the Electrical Apparatus listed in Section 6 and Shall have no difficulty in keeping clear of Electrical Apparatus not covered by this Permit and Shall not alter Isolation Points. Earths and Other Precautions can be altered as per Qld Electricity Entity Procedures for Safe Access to HV Electrical Apparatus.

	Name (please print)	**Signature**	**Time**	**Date**
Recipient	Jackie Stewart	Jackie Stewart	14:35	01/06/2010

Powerlink QUEENSLAND energex ERGON ENERGY

HV Test Permit

Permit No.	2

14. Work Group Signatures

Sign On

I acknowledge that I only have access to the Electrical Apparatus listed in Section 6 of this HV Test Permit while Earthed and I shall have no difficulty in keeping clear of Electrical Apparatus not covered by this HV Test Permit and shall not alter Isolation Points. I acknowledge only Authorised Individuals of Work Group Shall vary Earths or Other Precautions as directed by the Recipient.

Sign Off

I acknowledge that I no longer have access to the Electrical Apparatus listed in Section 6 of this HV Test Permit and shall regard the Electrical Apparatus as being Live.

Name (please print)	Signature	Time	Date	Signature	Time	Date
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /
			/ /			/ /

15. Transfer of HV Test Permit

This HV Test Permit, with all conditions, is hereby transferred –

	Name (please print)	Signature	Time	Date
Outgoing Recipient				/ /
Incoming Recipient				/ /

16. Working Earth Schedule

Item	Location of each set of Working Earths	On		Off	
		Time	Date	Time	Date
1.			/ /		/ /
2.			/ /		/ /
3.			/ /		/ /
4.			/ /		/ /
5.			/ /		/ /
6.			/ /		/ /

17. Operator Earth Schedule (for temporary removal of Operator Earths)

Item	Location of each set of Operator Earths	Off		On	
		Time	Date	Time	Date
1.			/ /		/ /
2.			/ /		/ /
3.			/ /		/ /
4.			/ /		/ /
5.			/ /		/ /
6.			/ /		/ /

18. Abnormalities (the Switching Coordinator shall be advised of these)

NIL

Are Supplementary Page(s) on issue for this permit? (select one box only) ☐ Yes. *If yes, Number of Pages:* ____________ ☒ No

19. Surrender of HV Test Permit

All required pre-energisation checks/tests have been successfully completed (select one box only) ☒ **Yes** ☐ **No** If "NO", record the checks/tests not successfully completed under this Permit in Section 18 'Abnormalities'

All Working Earths placed have been removed and Operator Earths replaced except as specified in Section 18 'Abnormalities' and I acknowledge that I no longer have access to the Electrical Apparatus listed in Section 6 and Shall regard the Electrical Apparatus as being Live.

	Name (please print)	Signature	Time	Date
Recipient	Jackie Stewart	Jackie Stewart	16:05	01/06/2010

No.

Authority to Energise

1	**Commissioning Coordinator**
2	**Project / Works Order No.**
3	**Location / Area**
4	**Project Description**

Commission New ABB RMU and 300kVA padmount transformer SC2468 Howard St

Commission new 11kV cable and between P10123 and SC2468/IS20

5 Detailed description of electrical apparatus to be energised

1. New 11kV ABB safelink RMU @ SC2468
2. New 300kVA padmount type transformer @ SC2468
3. New 11kV U/G cable and between P10123 and SC2468/IS20

6 CA's (Construction Authorities) on Issue

CA No.	Work Group	On-Site Supervisor	Remarks	Issued	Recovered
	Overhead			/ /	/ /
	Underground			/ /	/ /
	Substations			/ /	/ /
	Substation Tests			/ /	/ /
	Customer Service			/ /	/ /
	Contractors			/ /	/ /
	Meter Services			/ /	/ /
				/ /	/ /
				/ /	/ /

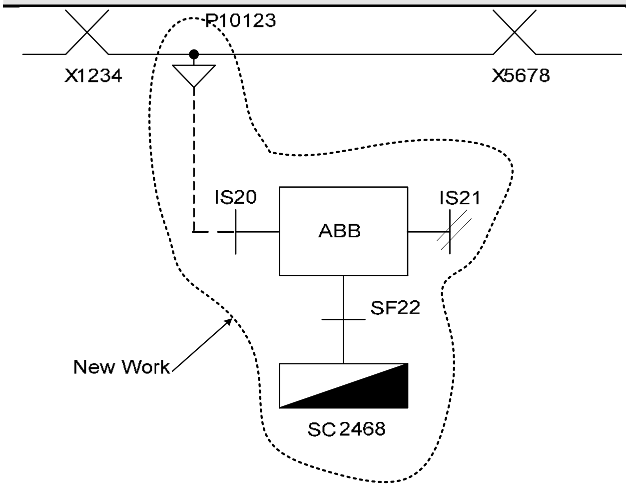
7 TA's (Test Authorities) on Issue

TA No.	Test Group	On-Site Supervisor	Remarks	Issued	Recovered
	Substations			/ /	/ /
	Substation Tests			/ /	/ /
	Cable Tests			/ /	/ /
				/ /	/ /
				/ /	/ /

8 Earths not removed from electrical apparatus

	Exact Location	Removed By		
		Signature	Date	Time
a	**11kV Switch IS20 @ SC2468**	Jenson Button	10/12/2009	15:20
b	**11kV Switch SF22 @ SC2468**	Jenson Button	10/12/2009	15:20
c			/ /	:
d			/ /	:

9 Diagrams / Remarks



10 Delegation to Authorise

The following person may authorise this authority on my behalf (responsibility remains with the Commissioning Coordinator)

Delegate's Name (please print)	**Commissioning Coordinator Signature**	**Time**	**Date**
			/ /

11 Abnormalities

11kV Switch SF22 @ SC2468 left in earth position, refer to section 8 above

11kV Switch IS20 @ SC2468 left in earth position, refer to section 8 above

12 Authorisation

Electrical apparatus listed in section 5 may now be energised, subject to any abnormalities or checks/tests listed in Section 11. All required pre-energisation checks/tests are completed (unless stated in Section 11) and all persons involved in this project are clear and have been instructed to treat the electrical apparatus as live. The condition of earthing is as stated in Section 8.

Commissioning Coordinator / Delegate	**Name** (please print)	**Signature**	**Time**	**Date**
				/ /

Reference AS No. 700023

Decommissioning Notice

1	**Commissioning Co-ordinator**	Name (please print) Ayrton Senna
2	**Project / Works Order No.**	110kV F999 and SSWMR / C005556831
3	**Work Area Location**	Bray Creek Rd Marburg, Cotton Tree HWY Brightbiew, Scotts Rd Mt Walker

4 Detailed description of electrical apparatus to be de-commissioned

Decommission 33kV O/H mains between P777884 Bray Creek Rd Marburg P8997 Cotton Tree HWY and P11134 Scotts Rd Mt Walker.

(Decommission Feeder F333)

5 Earths on de-commissioned electrical apparatus

	Exact Location	Placed / Checked by Signature / Time / Date	Removed by Signature / Time / Date
a	33kV O/H Mains @ P77884 Bray Creek Rd Marburg	Tony Marsh 14:40 17/02/2009	/ /
b	33kV O/H Mains @ P2345 Scott Rd Mt Walker	Dave Scott 08:30 07/12/2009	Dave Scott 15:45 07/12/2009
C		/ /	/ /

6 Method of disconnection

The above electrical apparatus have been disconnected from the commissioned network using the following methods

1. 33kV O/H Landing Span recovered between 33kV bus @ SSMMM and P77884 Bray Creek Rd Marburg
2. 33kV O/H Mains recovered between P8998 and P8997 (One span) Cotton Tree HWY Brightview
3. 33kV O/H Mains recovered between P2346 and P11134 (Three span) Scotts Rd Mt Walker

7 Authorisation

The above electrical apparatus is disconnected, by an approved method, from all sources of supply. No switching to re-energise the electrical apparatus will be approved until an Authority to Energise (AE) Form covering the electrical apparatus is received from a Commissioning Co-ordinator

Switching Coordinator	Name (please print) Harry Merkel	Operations Centre ENERGEX Net OPPS	Time 14:40	Date 17/02/2009
Switching Operator	Name (please print) Tony Marsh	Signature Tony Marsh	Time 14:40	Date 17/02/2009

energex

Decommissioning Notice - Attachment A

Reference AS No 700023 -1

The following sections apply to work on Not Electrically Connected Electrical Apparatus that will not be recommissioned in the foreseeable future

8 Conditions to work

a) Work shall only be carried out on Electrical Apparatus Listed in Section 4

b) The Electrical Apparatus has been disconnected from the commissioned network listed in Section 6

c) The Electrical Apparatus shall have all phases short-circuited and earthed while work is in progress. The placement and removal of earths shall be recorded in section 5

d) The Commissioning Coordinator is responsible for all work carried out under this Decommissioning Notice and ensure where applicable that the Electrical Apparatus listed in section 4 is suitably earthed and other precautions are in place prior to the issue of this Notice

e) The On-Site Supervisor is responsible for the Electrical Safety of the Workgroup under this Notice

9 Other Precautions Taken

☐ Taping/Roping Off ☐ Work Area Sign ☐ Live HV Lines & Apparatus Above Board

☐ Barriers in Place

☐ Other (please specify) NIL

10 Nearby Live HV/LV at the Work Area

NIL

11 Issue of Decommissioning Notice Attachment

The Electrical Apparatus detailed on the front of this Decommissioning Notice can be worked on whilst this form is on issue

	Name (please print)	Signature	Time	Date
Commissioning Coordinator	**Ayrton Senna**	Ayrton Senna	**08:00**	**07/12/2009**

12 Receipt of Decommissioning Notice Attachment

I acknowledge that I only I have authority to work on the Not Electrically Connected Electrical Apparatus listed in Section 4 and will have no difficulty in keeping clear of Electrical Apparatus not covered by this Decommissioning Notice and will not alter disconnection points listed in Section 6

	Name (please print)	Signature	Time	Date
On-Site Supervisor	**Clay Regazzoni**	Clay Regazzoni	**08:00**	**07/12/2009**

13 Abnormalities

NIL

14 Surrender of Decommissioning Notice Attachment

This Decommissioning Notice is now surrendered, subject to any abnormalities listed in Section 13. All persons for whom I am responsible are clear and have been instructed to remain clear of the Electrical Apparatus listed in Section 4. The condition of earthing is as stated in Section 5

	Name (please print)	Signature	Time	Date
On-Site Supervisor	**Clay Regazzoni**	Clay Regazzoni	**16:00**	**07/12/2009**

B Typical examples of HV Commissioning Plans

B.1 Typical Commissioning Plan for a Large Substation Project

Commissioning Plan Version 1 (3/07/2009)

Commission 33kV/11kV Substation @ SSCRB

Work Group	Role	Contact	Contact Number
Network Projects Delivery	Project Manager	Joe Fry	0409 056 003
Substation Services	Commissioning Coordinator for Substation works	Fred Gamble	0409 056 004
Major Works	Construction Manager	Jo Bartner	0409 056 005
Mains Services	33kV Feeder Commissioning Coordinator	Bill Moss	0409 056 006
Mains Services	33kV Feeder Construction	Jackie Steward	0409 056 007
Protection Systems	Field Test	Larry Perkins	0409 056 008
Condition Monitoring	Cable test	Dave Morgan	0409 056 009
SCADA Services	Network automation	Scott Speed	0409 056 010
Telecommunication Engineering	Communications	Jackie Oliver	0409 056 011

Project: C0001234567

SCOPE: Construct new 33kV switching station (future 110/33 bulk supply).Construct 33/11 zone substation and commission. Supply new Tugun desalination at 33kV.

Order of works

Stage 1
Install and commission new 33kV feeder F3755 from SSBHD, bypassing SSCRB initially for supply to MU2, TR2 at SSTUG. (Completed 2/7/2009)

Stage 2 (Wednesday 19th – Thursday 20th August 2009 commissioning)
Commission F3751, BB32, BB33, TR2, BB12, BB13, RM1, RM2, TR8, TR9
(CB3T51, CB3T52, CB3T61, CB3T62. Note: dummy plugged with no cables VT supplies for protection)

Works to be completed prior to Saturday 15th August 2009
U/G Transmission install and terminate F3751 into SSCRB.
U/G Transmission install and terminate11kV station transformer cables at SSCRB
U/G Transmission install and terminate TR2 33 and 11kV cables at SSCRB
U/G Transmission may choose to install TR3 33 and 11kV cables while on site.

Cable test to test F3751 cables. (Fault locations completed)
Cable test to test F3754 cables (completed)

Cable test (or Subs) to test TR2, TR8, TR9 cables
Substations to install Dummy plugs in future 33kV TR5 and TR6 CB orifices.

Communications to complete protection relay communication for BHD to CRB. (Completed)
Network automation to complete SACS installation SSCRB
Field test to complete testing on F3751
Electric fence energisation and alarms back to Vic Park Control.
Fire system commissioned and alarms to Vic Park.
Buildings to be sealed for Argonite system

Stage 3 F3754 (Tugun desal MU1 /TR1)
(Friday 21st August 2009 commissioning)

Works to be completed
U/G Transmission install and terminate F3754 into SSCRB
U/G Transmission to install MU1 to TR1 cables at SSTUG
Cable test to test F3754 (final test)
Field test to test F3754 protection.
Tugun desalination TR1 and Cables
Field test protection F3754 and TR1 SSTUG
Communications to have communication paths ready

Stage 4 F3755 and F3757
(Wednesday 26th August 2009)

Decommission F3755 and TR2 SSTUG. (Pending relay for TR1 @ TUG)
Cut and turn F3755 into SSCRB.
SSBHD to SSCRB to remain F3755
Commission F3755 pending cable test 4th September 2009)

Rename SSCRB to SSTUG F3757
Recommission F3755.
Recommission F3757 and TR2 SSTUG.
Commission F3755 pending cable test 9th September 2009)
Software build at SSBHD to delete SSTUG (F3755 and sub alarms)
Software build at SSCRB to show CRB to TUG final arrangement.

Stage 5
Works to be completed for future TR3
Transfer of all 11kV feeders (Mark Weber Southport distribution)
Decommission and transport CRP transformer.
Substations to wire new transformer.
Field test to retest Transformer
U/G Transmission install 11kV cables to TR3 at SSCRB
U/G Transmission install and terminate 33kV TR3 cables on structure at SSCRB
Cable test to test TR3, cables

After decommissioning SSCRP, then commission CB3931 and CB3932.

Chris Gamble
Substation Commissioning Supervisor

B.2 Typical Commissioning Plan for a City Area Project

C008545712121 – Split Three Feeder Radial Commissioning Plan

Work Group	Role	Contact	Contact Number
Network Projects Delivery	Project Manager	David Coulthard	0409 056 022
Substation Services	Commissioning Coordinator for Substation works and feeder Works	Luke Hamilton	0409 056 023
Field Services	11kV feeder Construction	Damon Hill	0409 056 024
Protection Systems	Field Test	Johnny Herbert	0409 056 026
Condition Monitoring	Cable test	Philippe Addams	0409 056 027

Stage One – AS _______
Split F1220 & TTF77
Cut R.M.U. Clear at SS BAC and Joint Feeder to SS CMC
(Note: Feeder Already Cut and Jointed At SS ATC)
1 x AE for 11kV Feeder 1220
Panel: ATC B (LHS)

Wednesday 19th – Thursday 20th August 2009 commissioning

Open LV Switch TR1 @ SS CSB
Note: SS CSB Customer to Close L.V. Bus Tie (1 x 1500kVA)
Open IS5336 @ SS CSB
Open LV CB TR1 @ SS WKS
Note: SS WKS Solid L.V. Bus (1 x 1000kVA)
Open IS5068 @ SS WKS
Open LV CB TR1 @ SS MIM
Note: SS MIM Customer to Close L.V. Bus Tie (1 x 1000kVA)
Open IS4679 @ SS MIM
Check Open IS5423 @ SS BAC
Open LV CB TR1 @ SS CMC
Note: SS CMC Solid L.V. Bus (1 x 1000kVA)
Open IS5338 @ SS CMC
Open LV CB TR1 @ SS CCB
Note: SS CCB Solid L.V. Bus (1 x 750kVA)
Open IS5149 @ SS CCB
Customer to open LV CB TR1 @ SS EHS
Note: SS EHS Customer to Close L.V. Bus Tie (1 x 1500kVA)
Open IS5242 @ SS EHS
Open LV CB TR1 @ SS ANZ

Note: SS ANZ Solid L.V. Bus (1 x 500kVA)
Open IS5334 @ SS ANZ

Open LV CB TR4 @ SS ANZ
Note: SS ANZ Solid L.V. Bus (1 x 500kVA)
Open IS5335 @ SS ANZ
Open LV CB TR1 @ SS CWO
Note: SS CWO Customer to Close L.V. Bus Tie (1 x 1500kVA)
Open IS4681 @ SS CWO
Trip CB2772 @ SS ATC
Check CB1220 Open @ SS ATC
Earth CB1220 Cable Orifice @ SS ATC
Earth IS5338 @ SS CMC

Earth IS5423 @ SS BAC
Issue AP#1 to Kelvin Grove Underground to ID & Spike in Pit 248 (F1220)
Issue AP#2 to Kelvin Grove Underground to ID & Spike in Pit 249 (F1220)
Issue WA#3 to City Substations for panel modifications @ SS ATC (CB2772 and CB1220)
Issue WA#4 to City Substations for Protection Cutovers @ TTF77 Remote End Substations
Decommission Part of Old F1220 (Including SS BAC R.M.U.)
DN1 – IS5423 at SS BAC to Pit 248 and to Pit 249
Issue AP#5 to Kelvin Grove Underground to Straight Joint in Pit 248 (F1220)
Issue AP#6 to Kelvin Grove Underground to Straight Joint in Pit 249 (F1220)
Revoke WA#3 and WA#4 to City Substations
Issue TP#7 to Cable Test (F1220 Cable Test)
Issue WA#8 to Field Test for functional testing @ SS ATC (CB2772 & CB1220)
Revoke WA#8 to Field Test

Sunday 23rd August 2009

Issue WA#9 to Field Test for functional testing @ SS ATC CB1220 And F1220 Remote End Substations
Issue WA#10 to Field Test for functional testing @ SS ATC CB2772 and TTF77 Remote End Substations
Revoke WA#9 and WA#10 to Field Test
Issue AE
Remove All Operator Earths
Close CB1220 @ SS ATC
Close IS5336 @ SS CSB
Close LV Switch TR1 @ SS CSB
Close IS5068 @ SS WKS

Close LV CB TR1 @ SS WKS
Close IS4679 @ SS MIM
Close LV CB TR1 @ SS MIM
Close IS5338 @ SS CMC
Phase Out Across LV CB TR1 @ SS CMC
Close LV CB TR1 @ SS CMC
Close CB2772 @ SS ATC
Close IS5149 @ SS CCB
Close LV CB TR1 @ SS CCB
Close IS5242 @ SS EHS
Make Customer LV CB TR1 Available @ SS EHS
Close IS5334 @ SS ANZ
Close LV CB TR1 @ SS ANZ
Close IS5335 @ SS ANZ
Close LV CB TR4 @ SS ANZ
Close IS4681 @ SS CWO
Close LV CB TR1 @ SS CWO

Stage Two – AS _______
Split F1221 – Into F1221 and TTF76
Cut F1221 Cable in SS ATC Cable Basement and Live End Seal
Joint Cut Cable from F1221 to Decommissioned Cable From CB2762 / ATC to create TTF76
Cut R.M.U. Clear at SS BAC and Joint Feeder to SS CMC
1 x AE for 11kV Feeder TTF76 (Note: CB2762 Requires H.V. Test)
1 x AE for 11kV Feeder 1221
Panel: ATC B (LHS)

Saturday 29th August 2009

Open LV Switch TR2 @ SS CSB
Note: SS CSB Customer to Close L.V. Bus Tie (1 x 1500kVA)
Open IS5308 @ SS CSB
Open LV CB TR2 @ SS WKS
Note: SS WKS Solid L.V. Bus (1 x 1000kVA)
Open IS5070 @ SS WKS
Open LV CB TR2 @ SS MIM
Note: SS MIM Customer to Close L.V. Bus Tie (1 x 1000kVA)
Open IS4723 @ SS MIM
Check Open IS5424 @ SS BAC
Open LV CB TR2 @ SS CMC
Note: SS CMC Solid L.V. Bus (1 x 1000kVA)
Open IS5376 @ SS CMC
Open LV CB TR2 @ SS CCB
Note: SS CCB Solid L.V. Bus (1 x 750kVA)
Open IS5155 @ SS CCB

Customer to open LV CB TR2 @ SS EHS
Note: SS EHS Customer to Close L.V. Bus Tie (1 x 1500kVA)
Open IS5245 @ SS EHS
Open LV CB TR2 @ SS ANZ
Note: SS ANZ Solid L.V. Bus (1 x 500kVA)

Open IS5374 @ SS ANZ
Open LV CB TR5 @ SS ANZ
Note: SS ANZ Solid L.V. Bus (1 x 500kVA)
Open IS5375 @ SS ANZ
Open LV CB TR2 @ SS CWO
Note: SS CWO Customer to Close L.V. Bus Tie – As Required (1 x 1500kVA)
Open IS4724 @ SS CWO
Trip CB1221 @ SS ATC
Earth CB1221 Cable Orifice @ SS ATC
Earth IS5308 @ SS CSB
Earth IS5155 @ SS CCB
Earth IS5376 @ SS CMC
Earth IS5424 @ SS BAC
Issue AP#1 to Kelvin Grove Underground to ID & Spike in SS ATC Cable Basement (F1221)
Issue AP#2 to Kelvin Grove Underground to ID & Spike in Pit 248 (F1221)
Issue AP#3 to Kelvin Grove Underground to ID & Spike in Pit 249 (F1221)
Issue WA#4 to City Substations for panel modifications @ SS ATC (CB2762 and CB1221)
Issue WA#5 to City Substations for Protection Cutovers @ TTF76 Remote End Substations

Carry Out Label Changes
Note: TTF76 Now Supplies
SS CCB / TR2
SS EHS / TR2
SS ANZ / TR2 / TR5
SS CWO / TR2
Decommission Part of Old F1221 (Including SS BAC R.M.U.)
DN1 – IS5424 at SS BAC to Pit 248 and to Pit 249
Issue AP#6 to Kelvin Grove Underground to Straight Joint in SS ATC Cable Basement (TTF76)
Issue AP#7 to Kelvin Grove Underground to Live End Seal in SS ATC Cable Basement (F1221)
Issue AP#8 to Kelvin Grove Underground to Straight Joint in Pit 248 (F1221)
Issue AP#9 to Kelvin Grove Underground to Straight Joint in Pit 249 (F1221)
Revoke WA#4 and WA#5 to City Substations
Issue TP#10 to Cable Test (TTF76 Cable Test)
Issue TP#11 to Cable Test (F1221 Cable Test)
Issue WA#12 to Field Test for functional testing @ SS ATC

(CB2762 & CB1221)
Revoke WA#12 to Field Test

Sunday 30th August 2009

Issue WA#13 to Field Test for functional testing @ SS ATC
CB1221 and F1221 Remote End Substations
Issue WA#14 to Field Test for functional testing @ SS ATC
CB2762 and TTF76 Remote End Substations
Revoke WA#13 and WA#14 to Field Test
Issue AE's
Remove All Operator Earths
Close CB1221 @ SS ATC

Close IS5308 @ SS CSB
Close LV Switch TR2 @ SS CSB
Close IS5070 @ SS WKS
Close LV CB TR2 @ SS WKS
Close IS4723 @ SS MIM
Close LV CB TR2 @ SS MIM
Close IS5376 @ SS CMC
Phase Out Across LV CB TR2 @ SS CMC
Close LV CB TR2 @ SS CMC
Close CB2762 @ SS ATC
Close IS5155 @ SS CCB
Phase Out Across LV CB TR2 @ SS CCB
Close LV CB TR2 @ SS CCB
Close IS5245 @ SS EHS
Make Customer LV CB TR2 Available @ SS EHS
Close IS5374 @ SS ANZ
Close LV CB TR2 @ SS ANZ
Close IS5375 @ SS ANZ
Close LV CB TR5 @ SS ANZ
Close IS4724 @ SS CWO
Close LV CB TR2 @ SS CWO
(Stage 3 Not Included in example)

B.3 Typical Commissioning Plan for 11kV Feeder Cutovers

Commissioning plan to create new 11kV feeders @ SSCMA.

Work Group	Role	Contact	Contact Number
Field Services	11kV Feeder Commissioning Coordinator	Jenson Button	0409 056 014
Substation Services	Commissioning Coordinator for Substation works	Ruben Barrichello	0409 056 015
Protection Systems	Field Test	Mario Andretti	0409 056 016
Condition Monitoring	Cable test	Dave Morgan	0409 056 009

Project: C0001234123

Tuesday 11th of November 2008 – AS1031650

1. Recover existing branch joint @ U1454341 AP#1.
2. Straight joint existing cable from P762592 to existing cable to IS54 @ SC108592, AP#1.
3. Straight joint new cable from IS30 @ X1083568 to existing cable from P1454340.
4. Authority to Energise No 1234567 for new 11kV cable works

Note: 11kV Network is required to be tied in overnight until completion of tomorrow's sheet.

Wednesday 12th of November 2008 – AS1031672

1. Recover branch joint U1499087 (CMA9B) @ SSCMA AP#1
2. Straight joint existing cable from IS26 @ X1083568 to new cable to CB1192 (new CMA19B), AP#1
3. Straight joint existing cable from IS31 @ X1083568 to new cable to CB1202 (new CMA20A), AP#2
4. Cable Test new 11kV feeders, TP#3
5. Authority to Energise No 1231234 for new 11kV Feeder works
6. Authority to Energise No 1231235 for Substation Works

Note: X90563 to be closed and SC1387910/IS15 to be opened as normally open point between CMA20A and CCY1B. IS13 @ SC475018 and IS26 @ SC560537 to remain normally open between CMA20A and CCY1B. IS20 @ SC474247 and IS53 @ SC1427683 to be left as normally open point between CMA15A and CMA20B. IS29 @ X1083568 to be opened and left as normally open point between CMA19B and CMA20A. (Confirmed with Network Planners)

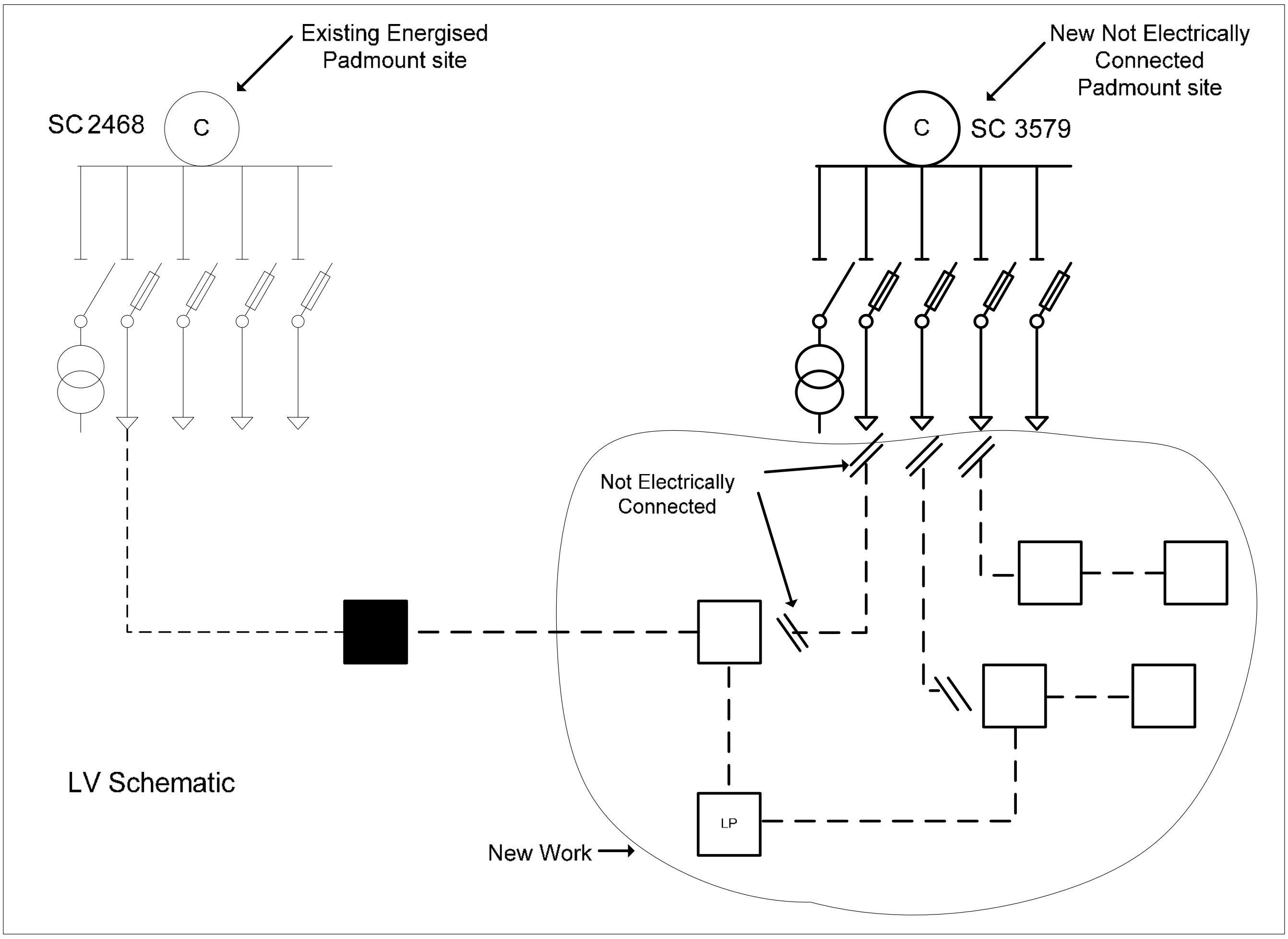
Thursday 13th of November 2008 – AS1031735

1. Commission new cable from IS71 @ SC714361 to CB1152 @ SSCMA (new CMA15A) AP#1
2. Cable Test new 11kV feeders, TP#2
3. Authority to Energise No 231238 for new 11kV Feeder works
4. Authority to Energise No 231237 for Substation Works

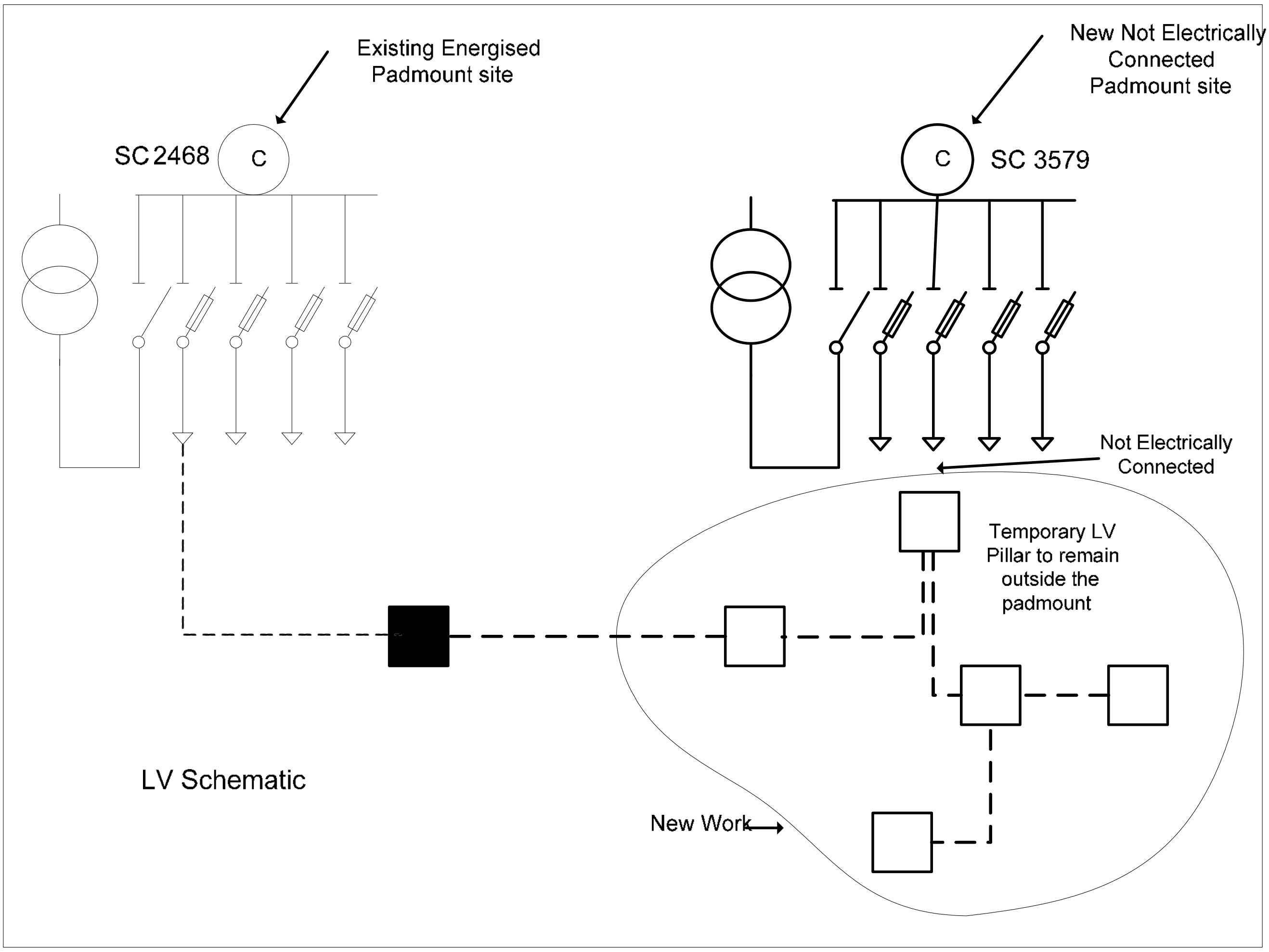
Note: IS60 @ X714362 to be left open as normally open point between CMA8A and CMA15A. X20223 to be left as normally open point between CMA15A and CCY7A

C Typical Examples for LV electrical apparatus associated with HV Not Electrically Connected Electrical Apparatus

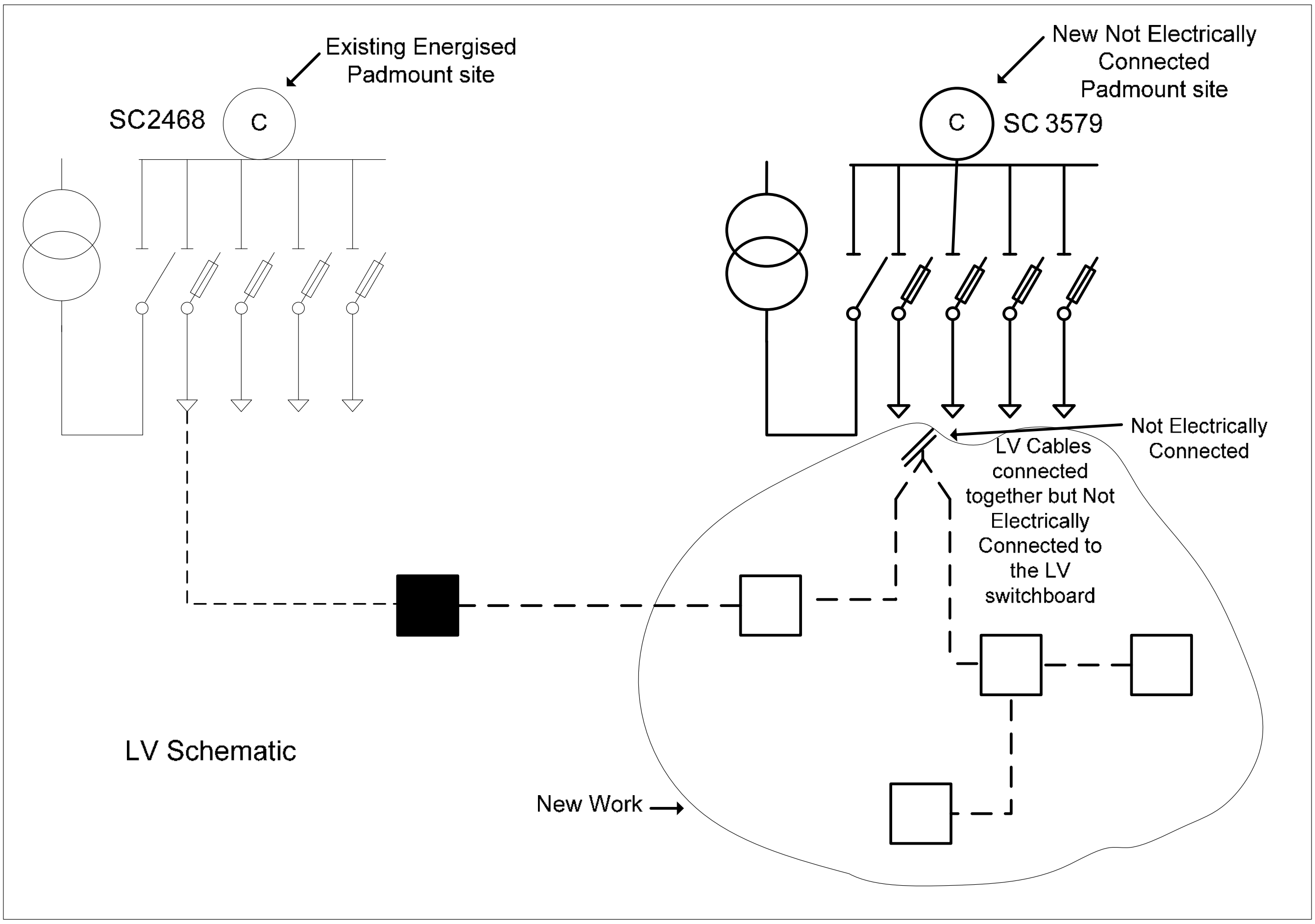
C.1 Typical Example for all Underground LV Cables Disconnected from a LV Switchboard at a Padmount Site



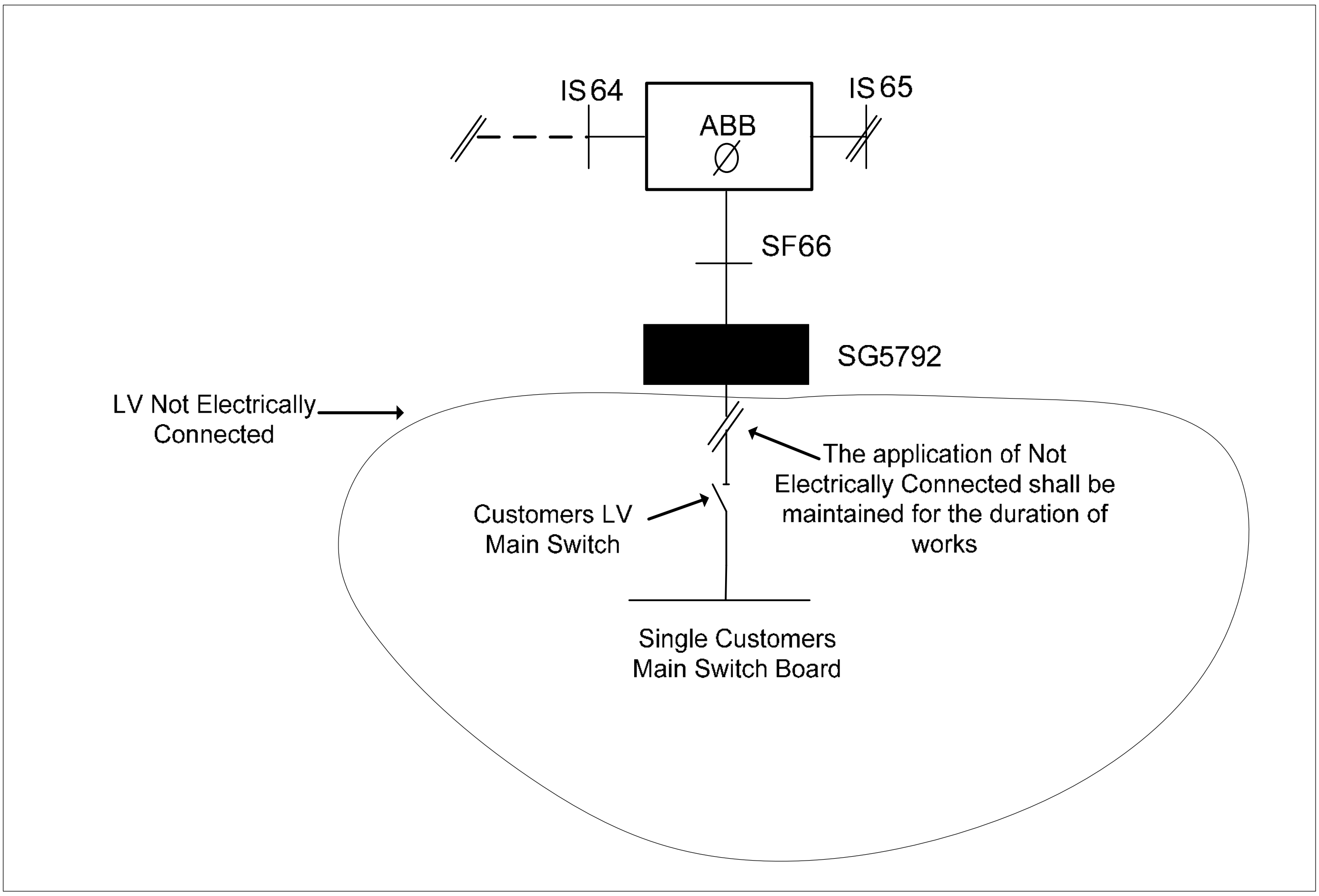
C.2 Typical Example for Underground Cables Disconnected from a LV Switchboard at a Padmount Site and LV cables Connected to a Temporary LV Pillar



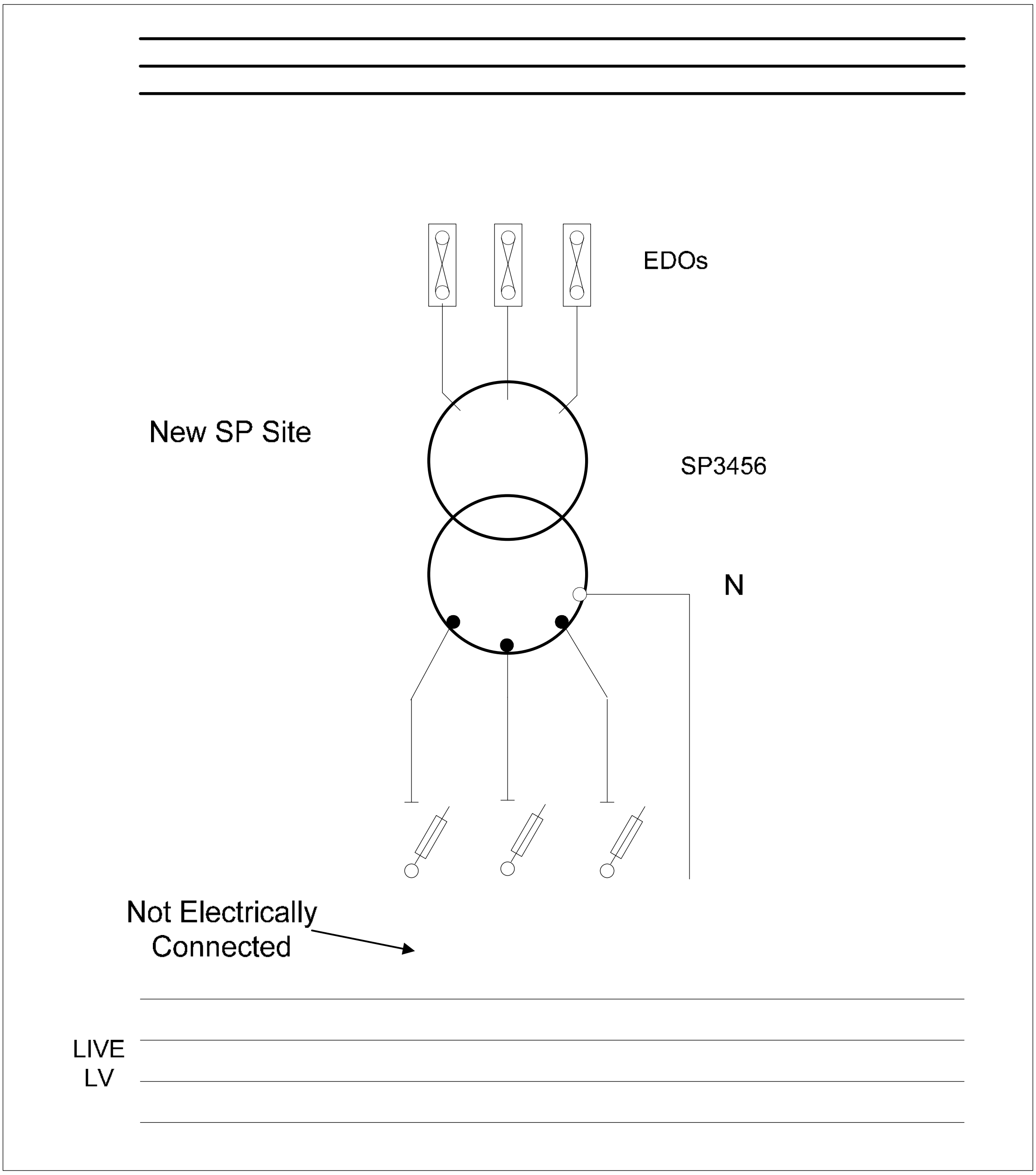
C.3 Typical Example for Underground Cables Disconnected from a LV Switchboard within a Padmount Cubical. The LV Cables are Secured, Connected Together Inside the Padmount Cubical. (Electrical Safety cannot be Compromised for this Temporary Work)



C.4 Typical Example for the Application of LV Not Electrically Connected for a Single Customer SG Site



C.5 Typical Example for the Application of LV Not Electrically Connected for a New SP Site



C.6 Typical Example for the Application of LV Not Electrically Connected for a New Single Customer SP Site