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CS ENERGY PROCEDURE

HIGH VOLTAGE ELECTRICAL ISOLATION AND ACCESS CS-OHS-53

Responsible Officer: Electrical Services Engineering Manager
Responsible Manager: Head of Operations Performance
Responsible Executive: Executive General Manager Plant Operations

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CONTENTS

1 INTRODUCTION 5
1.1 Purpose 5
1.2 Permit to Work Procedure 5
1.3 Scope 5
1.4 Exclusions 5
2 RESPONSIBILITIES 6
2.1 Responsibilities of Management 6
2.1.1 Competency 6
2.2 Responsibilities of Switching Sheet Authoriser 6
2.3 Switching Co-ordinator 6
2.3.1 Responsibilities 6
2.4 Switching Sheet Writer/Drafter 7
2.4.1 Responsibilities 7
2.4.2 Switching Sheet Preparation 7
2.4.3 Preparation 7
2.5 Switching Sheet Checker 8
2.5.1 Responsibility 8
2.6 Permit to Work Officer 8
2.6.1 System Requirements 8
2.6.2 Link to WCD 8
2.6.3 Danger Tags 8
2.6.4 Other Requirements before issuing WCD 8
2.7 Switching Officers 9
2.7.1 Amendment of Switching Sheets 9
2.7.2 Switching Sheet Errors 9
2.7.3 Before Commencing 9
2.7.4 Electrical Apparatus 9
2.7.5 Precautions 9
2.7.6 Recording and Reporting 10
2.7.7 Confirm Apparatus and Actions 10
2.8 Responsibilities of Switching Officer Assistant 10
2.9 HV Officer In Charge of PTW – Issued for Work 10
2.9.1 Pre-Work Obligations 10
2.9.2 Supervision 10
2.9.3 Finalising the Work 10
2.10 HV Officer In Charge of PTW – Issued for Test 11
2.10.1 Pre Test 11
2.10.2 Post Test 11
2.11 Individuals of a Work Party 11
3 SWITCHING OPERATIONAL BEHAVIOUR 11
3.1 Emergency Switching 11
3.2 Prior to Operating 12
3.3 Be Aware 12
3.4 Switching Sheet / Assistant 12
3.5 Communication and Team Work 12
3.6 Wearing PPE 12
3.7 Verifying Results 13
4 ISOLATION AND EARTHING 13
4.1 Isolation for Switching 13
4.1.1 Switching Sheet Requirements 13

4.1.2 Exemptions for use of switching sheet 13
4.1.3 High Voltage (HV) motor feed isolations for access to Exclusion Zones can be performed as follows: 14
4.1.4 Confirming Isolation 14
4.1.5 Lock and Tag 14
4.1.6 Application of the Switching Lock (Black Lock) 14
4.2 SWITCHING SHEET ISOLATIONS – OPERATIONAL RISK ASSESSMENTS 15
4.2.1 Switching activities for HV and multiple feed isolations 15
4.2.2 Development – Operational Risk Assessment 15
4.2.3 Approvals – Operational Risk Assessment 15
4.2.4 Authorisation - Switching Sheet 16
4.2.5 Powerlink Switching Programs 16
4.3 Testing and Earthing 16
4.3.1 Purpose 16
4.3.2 Test to Prove De-energised 16
4.3.3 Inbuilt Components 17
4.3.4 Control Risk 17
4.3.5 Removing Operator Earths 17
4.3.6 Risk Assessment 17
4.3.7 Applying Earths Timing 17
4.3.8 Single Phase Earths 17
4.3.9 Circuit Breakers and Fuses 18
4.3.10 Operator Earths 18
4.3.11 Identification 18
4.3.12 Current Capacity 18
4.3.13 Working Earths 18
4.3.14 Placement and Removal 18
4.4 Secondary Source Isolations 18
5 OTHER PRECAUTIONS 19
5.1 Testing and Earthing 19
5.1.1 Safety Precautions 19
5.2 Taping / Roping Off 19
5.2.1 Work Area Definition 19
5.2.2 Permissible Methods 19
5.2.3 Permission Mandatory 19
5.3 Clearly Defined Safety Signs 20
5.4 Physical Barriers 20
6 PERMIT TO WORK 20
6.1 HV Decision Tree for Permit Isolation Type 21
7 DEFINITIONS 22
8 REFERENCES 28
9 RECORDS MANAGEMENT 28
10 ATTACHMENTS 29
10.1 Attachment 1 - CS Energy Accepted Switching Abbreviations 29
10.1.1 Definitions and Abbreviations 29
10.2 Attachment 2 - CS Energy / SAHVEA Equivalent Terms 29
10.3 Attachment 3 - Minimum Standard of Information for High Voltage Switching Cover Sheet 30
10.4 Attachment 4 - Minimum Standard of Information for High Voltage Switching Operations 30
10.5 Attachment 5 - Minimum Standard for Switching Sheet Sequencing 31
10.5.1 Forward Switching (Isolation Switching) 31
10.5.2 Reverse Switching (Restoration Switching) 31

CONVENTIONS USED IN THIS DOCUMENT

The following conventions and icons are used throughout this document to draw attention to critical information.

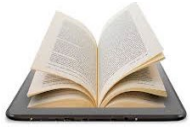
Note – Highlight or Emphasis

Include short note to highlight important information.

Note – High Priority Focus

Important Note – Insert key information requiring high priority focus.

Note – Reference Priority



Refer to – XYZ external or internal reference document for further direction.

Note – Required Competency / Qualification Level

Competency Level – Insert competency / qualification level.

Note – Rule or Requirement

Requirement – Insert Business Rule or Industry Requirement

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to describe the procedures required to provide a safe working environment for all persons accessing High Voltage electrical equipment or where access to isolate multiple low voltage isolation points in secondary systems have the potential to impact the HV primary system/equipment (e.g. DC battery protection for Generator/Turbine).

1.2 Permit to Work Procedure

CS Energy Permit to Work procedures apply to all work carried out on electrical equipment as detailed in Permit to Work Procedure - CS-PTW-01.

This document is intended to clarify the specific requirements of HV electrical equipment isolation including multiple low voltage isolation points as prescribed in this document, and access, and to ensure suitable authorised personnel are used to perform this work.

1.3 Scope

A safe working environment is achieved by the following:

- the isolation of the effected apparatus
- testing or otherwise confirming de-energised on HV apparatus and equipment
- the application of Operator Earths and Working Earths (HV only)
- the documenting of the approved isolation and access procedure and the issuing of a permit prior to entering the exclusion zone.
- High Voltage isolations shall also be completed in compliance with the Electrical Safety Management Procedure CS-OHS-31Exclusions.

1.4 Exclusions

They do NOT apply to:

- non-commissioned or de-commissioned lines and apparatus
- work on electrical equipment where the Exclusion Zones cannot be encroached upon by the use of barriers
- during functional switching e.g. when control operators need to balance loads by remote switching from the control room or in some cases local switching of circuit breakers as defined by procedure (to be developed).

Important Note – A PTW for access to electrical lines and apparatus shall only be issued to suitably trained, assessed and authorised persons. All requirements of CS Energy Procedures apply to any work carried out on CS Energy Sites. This Procedure does not absolve anyone of their responsibilities under those Procedures.

2 RESPONSIBILITIES

The responsibilities for persons mentioned in this procedure are outlined in the following pages. Specific roles hold specific responsibilities which must be adhered to. The responsibilities for each role are clearly defined in this section.

2.1 Responsibilities of Management

2.1.1 Competency

Management is responsible for ensuring that all persons who are involved in the preparation of HV Switching Sheets have been trained and assessed as competent to perform the roles for which they are responsible, and authorised.

Important Note – In all stages of development of the Switching Sheet, the Switching Sheet Drafter and Checker shall be different people. The Switching Sheet Authoriser at each site is appointed by the Site General Manager (GM).

2.2 Responsibilities of Switching Sheet Authoriser

The Switching Sheet Authoriser is responsible to:

- confirm writer and checker of the Switching Sheet are not the same person (excluding Emergency Switching)
- confirm the switching can proceed on the nominated time and date after assessing the impact of the switching on the network
- endorse the Switching Sheet as authorised
- direct any or all switching to cease if advised of any danger arising to personnel, Electrical Apparatus or network security
- on advice of any abnormalities, take appropriate action for reverse switching to be carried out safely.
- Maintain up-to-date record of network configuration and status, including isolations and equipment availabilities.

Note: These are the relevant points out of the SAHVEA Manual.

2.3 Switching Co-ordinator

At times when there are multiple switching activities occurring with the possibility interaction, a Switching Co-ordinator may be nominated at the site PTW administrator's discretion.

2.3.1 Responsibilities

The Switching Co-ordinator is responsible for:

- identifying overall scope of switching activities for the nominated period
- plan and schedule the timing of switching activities
- liaise with relevant parties to ensure that Switching Sheets are drafted to suitably achieve the overall scope
- instruct switching officers to conduct switching when required
- verbally Approve with the PTW office the issue of Work Permits and Test Permits related directly to the HV switching isolations.

2.4 Switching Sheet Writer/Drafter

Competency Level – This must be conducted by a SAHVEA (formerly HVIA) trained and competent person as per Authorised roles procedure CS-PTW-SOP-02

2.4.1 Responsibilities

The Switching Sheet Writer/Drafter is responsible for:

- liaising with person responsible for the work scope to ensure switching and isolation meets their WCA requirements
- determining extent of isolation required to accommodate work scope requirement
- liaising with person responsible for testing to ensure switching and isolation meets their requirements
- determining workflow (sequence of jobs)
- determining and accommodating any continuity of Supply Requirements.

2.4.2 Switching Sheet Preparation

The Writer shall prepare the switching sheet ensuring the following information is provided:

- lines and apparatus to be worked on
- location of work
- work details
- time / date and duration of access
- special requirement
    - commissioning / de-commissioning, provide drawing alteration if possible
    - phasing requirements.
    - work boundaries and energised apparatus in the work area
    - work / Test permits required
- Identify if emergency restoration may be required and if so, the time it will take to complete
    - physically walk the Switching Sheet and confirm the equipment existence, labelling consistency and functionality
- each site should maintain a Switching Sheet Register to ensure the switching sheet does not clash with other switching sheets
- enter the Switching Sheet Number and Trim Document Number in the Long Text Window of the WCA.

2.4.3 Preparation

In the preparation of the switching sheet the writer and checker shall ensure the following on the Switching Sheet:

- identify all Danger Tags required and each operation requiring danger tags is to have space to include the WCD and the tag number applicable to this operation.

2.5 Switching Sheet Checker

Competency Level – This must be conducted by a SAHVEA (formally HVIA) trained and competent person as defined by CS-PTW-SOP-02

2.5.1 Responsibility

The Checker is responsible for thoroughly checking all the documentation. Attention should be given to the switching sheet to ensure it is safe, functionally correct and will meet the needs of the Scope of Work as detailed on the Work Clearance Application (WCA).

The Switching Sheet Checker must:

- check the sequence of switching operations
- physically walk the Switching Sheet and confirm the equipment existence, labelling consistency and functionality
- any required changes found during checking the Switching Sheet shall be discussed with the drafter/writer
- confirm work and test permits are correct for the operation.

Important Note – If multiple switching sheets are required, they shall be written in such a way that the order in which the Switching Sheets shall be applied or reversed is clear to the Switching Officers. The insertion of an item in forward or reverse switching referring to the other switching sheet may indicate this.

2.6 Permit to Work Officer

2.6.1 System Requirements

The PTW Officer is responsible for creating the Work Clearance Documents in SAP. The PTW Officer shall enter relevant step data from switching sheets into SAP and:

- assign locks
- print tags.

2.6.2 Link to WCD

- enter the Job description in the Short Text Window
- enter the Switching Sheets Number and Trim Document Number in the Long Text window.

2.6.3 Danger Tags

- copy precisely every switching sheet item that requires placement of a Danger Tag as a WCD step

2.6.4 Other Requirements before issuing WCD

- record WCD step number in the space provided for the Danger Tag Number
- initiate the handover between Switching Officers and OIC in accordance with Section 4.1.5 Application of the Switching Lock (Black Lock) in this procedure
- normal functions associated with application and issuing of WCDs and WCAs as outlined in the PTW Procedure (CS-PTW-01).

2.7 Switching Officers

Competency Level – This must be conducted by a SAHVEA (formally HVIA) trained and competent person as defined by CS-PTW-SOP-02

2.7.1 Amendment of Switching Sheets

Minor amendments (e.g. typo) are permitted to switching sheets when:

- The Switching Sheet Authoriser and the Switching Officer are both satisfied that safety shall not be compromised.

Where any other alterations (except for simple typos) to the switching sheet are required, the switching sheet shall be cancelled and a new switching sheet prepared checked and authorised (e.g. change of isolation point, sequencing of sheets).

2.7.2 Switching Sheet Errors

The Switching Officer is responsible for the following:

- advising the Switching Sheet Checker of any switching sheet errors or anomalies found before commencing switching, the Switching Sheet Checker shall correct these errors before commencing switching
- if the Switching Sheet Checker is not available another authorised Switching Sheet Writer/Checker may make the alterations after checking the complete switching sheet.

2.7.3 Before Commencing

Prior to commencing, the Switching Officer should:

- confirm that they are in possession of the appropriate switching sheet (check switching sheet, WCD's and PTW's have the unique numbers, time, day, date and details of work)
- familiarise themselves with the intent of the switching and understanding the consequences of each operation before commencing any switching sheet
- obtain approval from the Shift Supervisor before switching is commenced.

2.7.4 Electrical Apparatus

The Switching Officer is also responsible for:

- ensuring the Electrical Apparatus is correctly identified (for Switchroom / location and equipment designation) before performing each operation
- ensuring any Electrical Apparatus being isolated for access to exclusion zones is only operated as an item on a Switching Sheet.

2.7.5 Precautions

- ensuring Operator Earths are only applied or removed as an item on a Switching Sheet
- existing isolation points with locks and tags attached are not to be compromised during application of a separate switching sheet
- placing Other Precautions if required
- notifying the Shift supervisor when switching is completed
- ensure switching is carried out using approved operating equipment in current test date

- discussing scope of isolations with the HV OIC prior to issue of the work permit and upon return of the permit.

2.7.6 Recording and Reporting

- recording and reading back directions issued to the Switching Officer's Assistant for verification
- recording the time of each switching operation performed
- reporting any switching performed in error, or any problem / anomaly encountered during switching, immediately to the Switching Sheet Authoriser for evaluation before proceeding further, where required.

2.7.7 Confirm Apparatus and Actions

- prior to commencing switching compare Danger Tags and WCD's provided with the Switching Sheet to confirm apparatus and actions match.

2.8 Responsibilities of Switching Officer Assistant

The Switching Officer Assistant is responsible for:

- understanding the consequences of each operation when performing tasks as directed by the Switching Officer in accordance with the Switching Sheet
- consulting with the Switching Officer to become familiar with the basic intent of the switching sheet
- assisting the Switching Officer in carrying out switching operations
- verifying each switching sheet item with the Switching Officer before it is actioned
- advising the Switching Officer of any abnormality observed during switching operations (e.g. dangerous situations, switch malfunctions).

2.9 HV Officer In Charge of PTW – Issued for Work

2.9.1 Pre-Work Obligations

Along with normal OIC responsibilities as per CS-PTW-01 – Permit to Work Procedure, the HV OIC of a PTW – Issued for Work shall be responsible for erecting and altering Other Precautions in addition to those provided by the Switching Officer and initialling the changes. Where work is required on systems or plant that require access in or around HV components and HV isolations are in place an HV OIC must hold the PTW to ensure the HV isolations are controlled by an authorised HV OIC. Examples would be opening the covers on the generator or replacing a HV motor.

2.9.2 Supervision

- directing the placement and removal of Working Earths
- ensuring all Work Party Members sign on / off the PTW and lock on / off
- supervising electrical safety at the work area
- delegating a Safety Observer during work if required
- ensuring equipment is in a safe condition to reenergise when Permit is surrendered and/or communicated to the Switching Officer and or the SPTWO.

2.9.3 Finalising the Work

- surrendering the PTW

- recording the placement and removal of Working Earths on “Form S1976 – Working Earth Register”

2.10 HV Officer In Charge of PTW – Issued for Test

2.10.1 Pre Test

The HV OIC of a PTW – Issued for Test shall be responsible for:

- receiving a Test PTW
- confirm correct PTW (location of Work Area, day and date of access, specified work / test details)
- understand the limits of the Work / Test Permit including location of Nearby Exposed Live HV/LV at the work area
- communicate the PTW boundaries to the work party
- directing the removal and placement of Working Earths for Testing
- directing removal and replacement of Operator Earths which have a Test Tag attached
- recording the placement and removal of working Earths on “Form S1976 – Working Earth Register” supervising electrical safety at the work area
- delegating a Safety Observer during testing if required.

2.10.2 Post Test

- ensuring equipment is in a safe condition to reenergise when Permit is surrendered and/or communicated to the Switching Officer and\or the SPTWO. All operator earths are to be in the earthed state when permit is surrendered
- surrendering or suspending the Test PTW
- maintaining working earth register.

2.11 Individuals of a Work Party

The Individuals of a Work Party shall be responsible for:

- carrying out work / Test requirements as directed by the HV Officer In Charge
- making themselves aware of all safety precautions to be observed whilst performing the work
- understand the boundaries of the PTW, including location of Nearby Exposed Live HV/LV at the Work Area
- understand the safety precautions in place.

3 SWITCHING OPERATIONAL BEHAVIOUR

3.1 Emergency Switching

Switching can only be done without a switching sheet in exceptional circumstances:

- For the safeguarding of personnel
- To prevent damage to electrical apparatus
- To restore supply in an emergency.

All emergency switching must be done by a Switching Officer and assistant, and only when they are both satisfied that safety shall not be compromised. All emergency switching performed shall be recorded by the Switching Officer and assistant.

3.2 Prior to Operating

Prior to operating, make yourself familiar with the equipment to be operated, determine the direction of movement of any operating handle prior to operation.

Be prepared for the fact that some mechanisms may be stiff or tight and consider the outcome of the operation.

3.3 Be Aware

The following points should be observed while carrying out switching operations:

- always act in a thoroughly professional manner. Never fool around or take switching lightly
- never assume anything, always check to make sure
- try not to become distracted: if this does occur, always go back to the previous step and start again.

Important Note – Only suitably trained, assessed and authorised persons shall work on electrical lines and apparatus.
All requirements of CS Energy Procedures apply to any work carried out on CS Energy Sites. This procedure does not absolve anyone of their responsibilities under those procedures.

3.4 Switching Sheet / Assistant

- always use a Switching Officer's assistant when carrying out switching operations
- follow the sequence of the Switching sheet.

3.5 Communication and Team Work

- Work as a team, checking each other constantly
- Constantly communicate with each other. Repeat back any instructions given by your partner
- make all physical actions definite, do not hesitate (applying earths or operating isolators)
- although time should not be wasted, avoid undue haste, take care to double check. This will reduce the likelihood of errors
- wherever possible have the plant operated remotely. This reduces the risk of exposure to Switching Officers
- be conscious of step and touch potential
- do not sign any item off until it is finished.

3.6 Wearing PPE

- Wear the defined safety clothing and use appropriate safety equipment, e.g. insulating gloves when using an operating handle.
- Refer to CS-OHS-34 - Selection, Maintenance and Use of Electrical Safety Equipment and PPE.

3.7 Verifying Results

- Verify the results of all actions e.g. feeder has load, CB indicated closed, load has transferred, voltage indication correct, isolator has operated fully on all three phases. Never operate merely by ear.

Important Note – If in doubt, do NOT proceed until certain that the operation can be performed safely.

4 ISOLATION AND EARTHING

The isolation process for High Voltage (HV) systems requires a rigorous process. The practical steps in achieving those isolations are detailed in this section.

4.1 Isolation for Switching

4.1.1 Switching Sheet Requirements

If any of the following are applicable, a switching sheet is required unless exempted by section 4.1.2.

1. When performing HV switching for purposes of HV Apparatus isolations and earthing and where access is required within the exclusion zone of any HV apparatus.
2. When the protection or control of a HV system is impaired and the associated operational risk assessment requires the HV primary circuit to be deenergised or isolated during the impairment.
3. When reconfiguration or load transfer of the main HV, LV or DC switchboards is required as part of the isolation.
4. When an isolation, reconfiguration or load transfer has the potential to impact the 220VDC and 48VDC protection systems for Generator, Turbine, XY protection, GCB protection, AVR excitation and 275KV systems a Switching Sheet is required. When the configuration of the switchboard does not allow for redundancy to maintain the bus load during the switching process, no switching will proceed unless the unit is brought offline (desynched). All switching on these systems must have Site GM approval through the Operational Risk Assessment process (ORA).

4.1.2 Exemptions for use of switching sheet

- High Voltage HV motor feed isolations for non-electrical work do not require a Switching Sheet if they are done with an approved SWI or Plant instruction.
- High Voltage (HV) motor feed isolations for access to Exclusion Zones (e.g. for inspection/changeout of a HV motor) Refer to section 4.1.3.
- only people trained in the Permit to Work system and are deemed competent on that switchgear for HV motor feed isolation may perform the isolation.
- Dual supplied LV switchboards and equipment which meet none of the criteria in section 4.1.1 are exempt. For example, dual supplied light and power distribution boards; dual supplied hydraulic packs; 415V sootblower switchboards on Callide C. Multiple supplied LV switchboards and equipment that are not main HV, LV or DC switchboards are exempt. For example, Multiple supplied light and power distribution boards; multiple supplied hydraulic packs; 415V soot blower switchboards on Callide C or station switchboards, Coal switch room battery chargers, ADG fuel pod at Kogan Creek.

4.1.3 High Voltage (HV) motor feed isolations for access to Exclusion Zones can be performed as follows:

- with Standard Work Instruction (SWI)/Plant Instruction and an approved Isolation Template
- HV equipment shall be isolated and earthed (earthing is not required for mechanical work). Consider requirements for earth point test tags during return to service to allow for electrical testing.
- The HV motor feed isolation process can be applied where there is a single HV isolation point and earth used for each HV circuit – even if part of a more complex combination of LV and mechanical isolations. This includes the dual motors on Callide Electric Feed Pumps (EFP) where each motor has an electrically separate circuit with a single HV isolation and single earth.
- All other type HV isolations including all HV transformer and switchboard isolations follow the Switching Sheet process. Where an approved SWI is not in place then a Switching Sheet process will need to be followed.

4.1.4 Confirming Isolation

Lines and apparatus are deemed isolated only if all the following requirements are met:

- The lines and apparatus are isolated
- Tested or otherwise confirmed de-energised
- Earthed
- Secondary sources are isolated. These control, instrumentation, and protection circuits should remain active during isolation and earthing to allow correct switching operation.
- A PTW (issued for Work or Test) for the electrical apparatus is issued.

4.1.5 Lock and Tag

Isolation Points shall clearly display a Lock and Tag. All Isolation points will be physically locked where the hardware allows it.

4.1.6 Application of the Switching Lock (Black Lock)

The Black switching lock is used to ensure that a conversation is held with an authorised HV switching officer prior to any changes being made to a WCD that includes steps on a Switching Sheet. This ensures changes made are reflected on the Switching Sheets and the switching activities are carried out by an authorised HV Switching Officer.

Each authorised HV Switching Officer will be issued a black switching lock key and any authorised switching officer for the site where the switching is being performed can remove the black lock.

The switching lock is to be applied to the grid board that contains the red lock keys for the WCD that contains the switching steps only.

Steps at issue and surrender are as follows:

- The forward Switching Sheet shall contain a forward step to ‘place a black switching lock to the isolation grid red lock hasp once the red isolation lock keys are contained on the grid lock hasp.
- The reversal Switching Sheet shall contain a reverse step to ‘remove the black switching lock from the isolation grid red lock key hasp on surrender of the PTW.

Steps for suspension to alter after the OIC has returned the PTW for alteration or test are as follows:

- PTWO contacts an authorised switching officer

- PTWO discusses the isolation alteration requirements
- If the alteration requires changes that affect the switching steps the sheets and ORA are amended, approved and the black lock can be removed as per the first step of the reverse Switching Sheet
- The isolation alterations are performed in the field as per the Switching Sheet
- Once the changes are made an authorised switching officer re-attaches a switching lock
- The PTWO can then re-issue the PTW to the OIC

4.2 SWITCHING SHEET ISOLATIONS – OPERATIONAL RISK ASSESSMENTS

4.2.1 Switching activities for HV and multiple feed isolations

Any switching activities require an Operational Risk Assessment to be conducted. The Operational Risk Assessment is to be an overview of the switching activity and its impacts upon people, plant and operations. Under no circumstances is this to be negated.

The following Operational risk assessment template is to be used –

- Template - B/D/13/15225 - Form - S2122 - Operations Plant Risk Assessment

Completed Risk Assessments are to be saved into the relevant Site switching risk assessment Folder –

- Callide B - F/21/1687 - CALB - Switching Sheets - Risk Assessments
- Callide C - F/21/1688 - CALC - Switching Sheets - Risk Assessments
- Kogan A - F/21/1731 - KOGA - Switching Sheets - Risk Assessments

4.2.2 Development – Operational Risk Assessment

The Operational Risk Assessment is expected to commence during the writing and development stage of the switching sheet and should be completed before the switching sheet is authorised. It is imperative that this involves the people writing and checking the switching sheet as to maintain a continuous flow of information.

The Operational Risk Assessment will be developed by the following:

- Switching Sheet Writer
- Switching Sheet Checker
- Switching Authoriser
- Shift Supervisor (or delegate e.g. for Callide a minimum Level 13.0 Operator or for Kogan a minimum PCO level 2)
- OIC or Electrical Supervisor
- Where the ORA identifies a planned risk of moderate or above an Electrical Engineer (RPEQ) will be involved in the development process

4.2.3 Approvals – Operational Risk Assessment

The completed Operational Risk Assessment for the switching activity must be approved by the following before commencing the switching:

- Manager Production
  - Callide
  - Kogan Creek

If the switching operations have the potential to impact critical equipment systems, uninterruptible power supplies, inverters, or emergency diesel generators, final approval must be given by the following:

- Site General Manager
  - Callide
  - Kogan Creek

Where switching activity has the potential to impact the 220VDC and 48VDC protection systems for Generator, Turbine, XY protection, GCB protection, AVR excitation and 275KV systems the following criteria must be managed and approved within the ORA:

- When the configuration of the switchboard does not allow for redundancy to maintain the bus load during the switching process, no switching will proceed unless the unit is brought offline (desynched) and;
- All switching on these systems must have Site GM Approval through the operational risk assessment process (ORA).

4.2.4 Authorisation - Switching Sheet

The approved Operational Risk Assessment and the checked switching sheet must then be provided to the following for Switching Sheet Authorisation:

- Callide – Switching Sheet Authoriser as nominated by the Site GM
- Kogan Creek – Switching Sheet Authoriser as nominated by the Site GM

4.2.5 Powerlink Switching Programs

The same process will be applied to Powerlink switching programs by the Switching Authoriser, who will also review and validate their Switching Sheet.

4.3 Testing and Earthing

4.3.1 Purpose

The purpose of testing and earthing is:

- To safely discharge induced or residual voltage.
- If supply is inadvertently restored:
  - to limit the rise in potential difference at the work area
  - to cause the operation of protection equipment

At least one operator earth must be applied for an isolation for high voltage isolations

Requirement – High Voltage lines and apparatus under any PTW shall ALWAYS be earthed while any individual is within Exclusion Zones.

4.3.2 Test to Prove De-energised

Any requirements for testing to prove de-energised must be itemised in the Switching Sheet.

Only those testing devices maintained in accordance with CS Energy's CS-OHS-34 Maintenance of Electrical Safety Equipment and Clothing (PPE) Procedure are to be used.

Correct operation of the testing device is to be verified immediately before and after proving de-energised. All phases of high voltage equipment are to be proven de-energised using an approved high voltage detector before earthing equipment is applied. Care is to be taken for circuits without earth

reference bonding such as isolated Delta circuits. One method is to retest a second phase after the first phase has been earthed.

Testing to prove de-energised is to be repeated following any alteration in the PTW, or when the plant is left idle for a period. Further, all relevant factors, including the nature of the conductor, the nature of the isolation and the nature of the work must be taken into consideration.

4.3.3 Inbuilt Components

Where switchgear contains inbuilt component/s as a part of their design to prove de-energised, such as visible breaks, mechanical interlocks or LED indicators, earthing switches can be closed without a test to prove de-energised.

4.3.4 Control Risk

Where the design of lines and apparatus does not allow testing to prove de-energised, then the Switching Officer and Switching Officer's Assistant will agree on indicating device/s available that confirm isolation and adequately control this risk.

4.3.5 Removing Operator Earths

High Voltage lines and apparatus under a PTW – Issued for Test may have Operator Earths removed during Testing, provided:

- test equipment is only connected and removed while the earths are in place
- test tag and WCD list point
- earths are only removed immediately before application of test voltages
- earths are replaced as soon as possible after removal of test voltages
- the Work Group is kept informed of the state of earthing.

Important Note – Non-electrical workers are NOT authorised to test and prove de-energised within CS Energy

4.3.6 Risk Assessment

Where these design features as in 4.3.3 are not in place, a risk assessment must be conducted before undertaking a test to prove de-energised. A test to prove de-energised can only be undertaken when the risk assessed for the task is low.

The voltage indicating device/s should be checked as indicating voltage prior to de-energising.

4.3.7 Applying Earths Timing

Earthing shall take place immediately after testing and should be at the same location.

Before connecting portable earths to lines and apparatus, the tail(s) of portable earths shall be connected to a permanently established earthing point such as substation earthing grid or permanently installed HV earth if available before connecting earths to lines and apparatus.

Portable earths shall be visually checked for serviceability before use.

4.3.8 Single Phase Earths

Where a set of single phase earths is installed at the work area, all phases of earths shall be bonded together and connected to earth or connected individually to a common earth to limit the rise in potential difference at the work area.

4.3.9 Circuit Breakers and Fuses

Lines and apparatus shall not be earthed through fuses or circuit breakers which may trip in the event of inadvertent energisation.

Where circumstances make it necessary to use a circuit breaker for earthing then both the electrical and mechanical trip mechanisms shall be disabled.

4.3.10 Operator Earths

Operator Earths shall be placed at a location(s) which will cause the work area to be de-energised by the operation of protection in the event of inadvertent energisation.

Operator Earths are applied as part of a Switching Sheet.

4.3.11 Identification

- They are specifically identified by an attached Red Isolation Lock and Tag\DNOB.
- Operator Earths shall be installed on all possible points of supply to the work area.
- The location of the Operator Earths shall typically define the extent of the isolation.

4.3.12 Current Capacity

The current carrying capacity of an Operator Earth shall be adequate for the fault current at the location where it is placed until cleared by protection.

Requirement – Operator Earths shall be placed and removed only under the direction of a Switching Sheet, or as required under a PTW issued for Test, or under a HV Isolation Sheet when isolating HV motor drives.

4.3.13 Working Earths

Working Earths shall only be applied to lines and apparatus within the isolation points listed on the PTW.

Working Earths are placed\removed under the direction of the HV Officer In Charge.

4.3.14 Placement and Removal

Working Earths can only be placed\removed by members of the Work Party who have signed on to the PTW.

The placement and removal of Working Earths shall be recorded on- “Form S1976 – Working Earth Register”

A PTW shall not be surrendered until all Working Earths have been removed.

Working Earths shall be installed as close as practicable to any persons required to work on the isolated system so that the earths, where possible, are within sight of such persons.

4.4 Secondary Source Isolations

Control, instrumentation, and protection supplies are required for correct operation during primary switching.

- Control supplies enable the operation of the primary switchgear and may supply interlock circuits, including earthing interlocks.
- Instrument transformers and protection supplies give critical feedback on voltage changes during switching and may provide protective operation during a maloperation event.

- For the reasons above, secondary systems must remain energised until primary isolation and earthing has been completed and must be restored prior to reverse switching.

5 OTHER PRECAUTIONS

Once an isolation is in place, the worksite may need to be controlled to prevent inadvertent access. The processes used to affect those controls are detailed in this section.

5.1 Testing and Earthing

5.1.1 Safety Precautions

Safety precautions in addition to isolation and earthing shall be provided at the work area to contribute to the electrical safety of the Work Party.

These precautions shall be listed as items with the PTW and placed by the Switching Officer or HV OIC where practicable.

Safety precautions provided shall be recorded in the hazards section of a PTW and in the relevant JSEA for the work being conducted.

Requirement – The High Voltage Officer in Charge shall be responsible for ensuring that adequate safety precautions are in place and maintained at the work area to suit the progress of work.

5.2 Taping / Roping Off

5.2.1 Work Area Definition

The work area within a substation or switchyard shall be defined by taping/roping off with danger tape (red and white).

5.2.2 Permissible Methods

Permissible method of taping/roping off is:

- use of danger taping which surrounds the work area which shall be positively identified by Work Area Signs placed in conspicuous positions
- located approximately 1.3m above the ground
- have an opening of approximately 2m to allow safe entry and exit of the work area with a yellow Work Area sign placed at this point
- have the appropriate signs associated with the danger tape being used.

5.2.3 Permission Mandatory

- No individual shall pass under or over any tape/rope without the permission and supervision of the HV OIC.
- The tape/rope shall be placed so that work may be carried out without encroaching Exclusion Zones.
- Walls, fences or other impassable permanent barriers can be used as a boundary for the work area.

5.3 Clearly Defined Safety Signs

Safety signs shall be used to clearly identify the work area and to warn the group of adjacent energised lines and apparatus.

5.4 Physical Barriers

Physical barriers of appropriate design may be used to eliminate exposure of the Work Party to live lines and apparatus which may otherwise be within Exclusion Zones.

Barriers may be either a fixed:

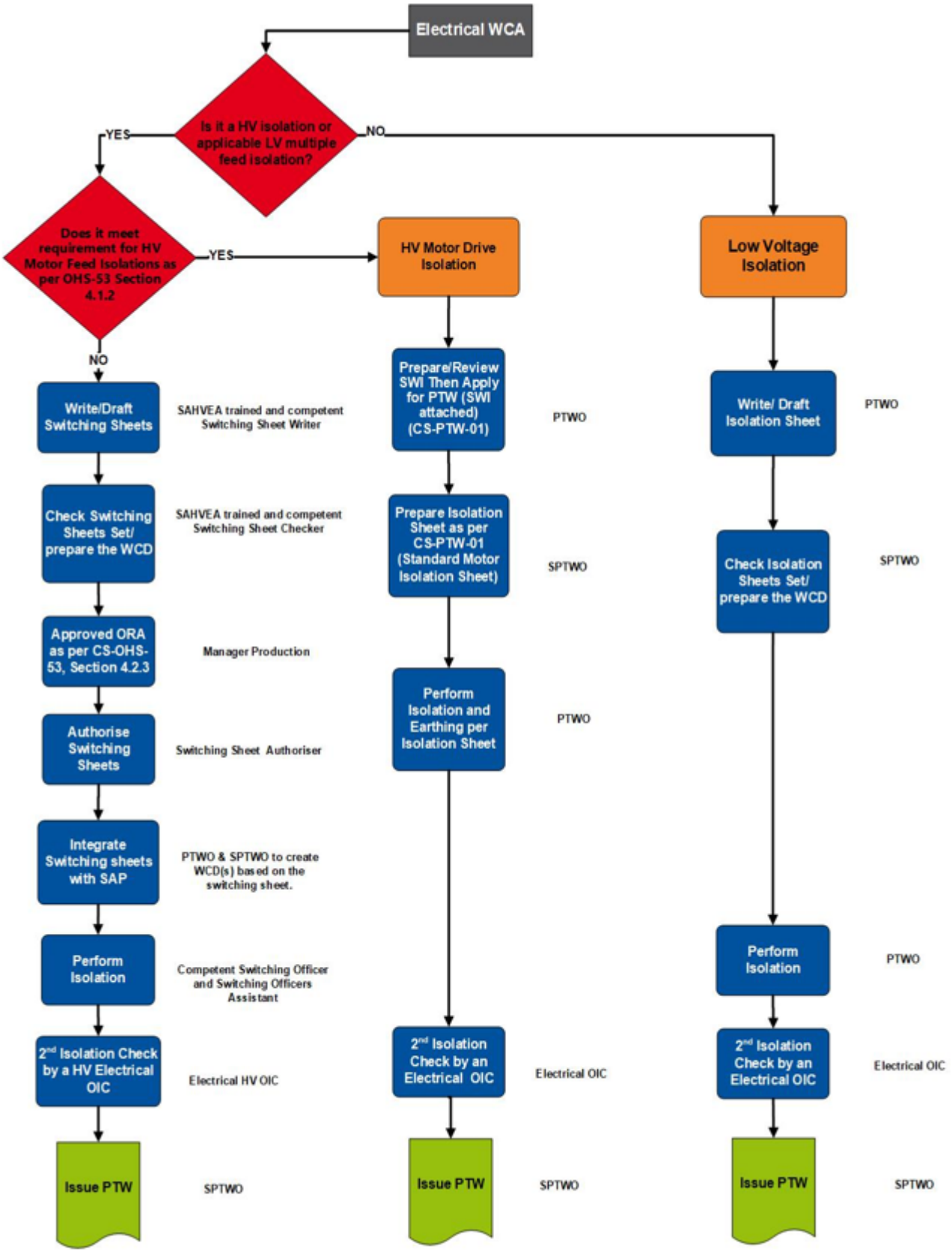
- screen or shield of suitable insulating material
- metal screen or shield which is permanently earthed.

6 PERMIT TO WORK

The CS Energy Permit to Work procedures apply to all work carried out on Electrical equipment. This is detailed in the Permit to Work Procedure (CS-PTW-01).

Anyone wishing to perform switching / working / testing on high voltage equipment must obtain a work permit or permission from operations / Person in Control and follow all other requirements of the Permit to Work process.

6.1 HV Decision Tree for Permit Isolation Type



7 DEFINITIONS

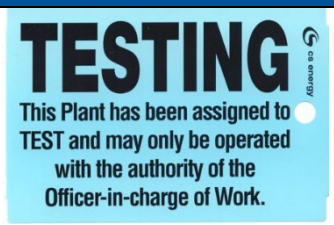
Term	Definition
Access	Is a process of allowing personnel access to live electrical plant or in-service mechanical plant for testing or fault-finding purposes without isolation. Access to live plant is to be undertaken in accordance with the Electrical Safety Procedure CS-OHS-31 and via the use of a PTW Issued for Access.
Access Permit	An Access Permit is the SAHVEA equivalent to a PTW issued for work. These are required on Powerlink Assets.
Alive (or Live)	Plant and apparatus that is not isolated. (E.g. plant that is in service or endorsed to test, operator stand-by or under access).
Apparatus	Is any Electrical Equipment used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage.
Applicant	A person wishing to be issued a HV PTW to work on HV lines & apparatus. They have conveyed this desire by filling out a Work Clearance Application (WCA).
Associated equipment (for an electric line)	Means something ordinarily found in association with the electric line, especially for the purpose of protecting, insulating or supporting the operation of, the electric line. Note: examples include: a bracket, casing, coating, covering, duct, frame, insulator, pillar, pipe, pole, tower, or tube enclosing, surrounding or supporting a wire or conductor; or an air break, circuit breaker, switch, transformer or other apparatus connected to a wire or conductor
Authorised Person (for an electrical part)	Means a competent person who has enough technical knowledge and experience to do work that involves contact with, or being near to, the electrical part; and has been approved by CS Energy to do work that involves contact with, or being near to, the electrical part.
Commissioned plant	Plant that has undertaken final testing and been accepted by the Operator/Maintainer as fit for normal operational service.
Competent person	A person who has, through a combination of training, education and experience, the current knowledge and skill enabling that person to perform correctly a specified task. This person must also meet all the requirements under the Fit for Duty Policy and complies with the relevant training schedule provided in the associated PTW procedures for the specified task undertaken. Note: Prescriptive requirements for a person to be able to undertake a specific task may be found in relevant Australian standards, industry standards, advisory standards, industry codes of practice and other legislation as applicable.
Danger Tag	• Danger Tag – is fixed to a red isolation lock at isolation points. • Provides warning and information to persons involved in plant isolation, access, inspection, maintenance and repair; • Identifies a PTW number and step number corresponding to the associated PTW; • Signifies that the isolation point is not to be interfered with or operated under any circumstances; and • Typically hung by a PTWO or Switching Officer however may also be hung by an authorised person operating under an approved procedure.
Danger Do Not Operate Board (DNOB)	**Do Not Operate Board (DNOB) –** A safety sign bearing the words “Do Not Operate” used to identify isolation points or operator earths in the SAHVEA system (typically use by Powerlink). • Shall only be applied and removed by a Switching Operator as an operation on a Switching Sheet or under the direction of a Switching Co-ordinator.
De-commissioned plant	Plant that has been permanently removed from service and had all energy sources removed.
De-energise	The process of disconnecting lines or apparatus from all conducting sources of electrical energy.

Term	Definition
De-energised	Disconnected from all conducting sources of electrical energy but may be energised by capacitive charge or induction.
Designated area	A clearly identified area for which a risk assessment has been undertaken and approval has been received from the HV OIC stating the area is safe to carry out normal high voltage work. 
Direct contact	Means a person is in direct contact with an electrical part if: • The person is touching the electrical part with the person's bare hands or another bare part of the person's body, or • The person is touching a conductive object with a bare part of the person's body and the conductive object is touching the electrical part, or • An article of clothing worn by the person is touching the electrical part, or • An article of clothing worn by the person is touching a conductive object and the conductive object is touching the electrical part.
Direct contact (Operating Plant)	Operating plant is in direct contact with an electrical part if: • any part of the operating plant is touching the electrical part • anything the operating plant is handling is touching the electrical part
Direct contact (Vehicle)	A vehicle is in direct contact with an electrical part if: • any part of the vehicle is touching the electrical part • anything being carried or otherwise handled by the vehicle is touching the electrical part
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.
Earthed	Earthed means phases are short-circuited and connected to the general mass of earth.
Earths	Earths are fixed or portable devices that connect lines and apparatus to the general mass of earth.
Emergency Switching	Immediate switching for safeguarding personnel, preventing damage to electrical apparatus, restoring supply or providing access for emergency repair of electrical apparatus.
Employer	CS Energy
Equipment Designation	Individual labelling of lines and apparatus to provide positive identification during switching operations.
Exclusion Zones	Exclusion Zones to exposed HV conductors or articles are defined for authorised electrical workers and Instructed persons in Schedule 2 of the *Queensland Electrical Safety Regulations 2013 and Code of Practice Working Near Overhead and Underground Electric Lines*. See Section 12.3 Attachment 3
Extra Low Voltage (ELV)	Means voltage of 50V or less AC RMS, or 120V or less ripple-free DC.
Forward Switching (Isolation)	Is a detailed listing of actions to be performed to **mechanically and\or electrically** isolate, restore or reconfigure the supply of energy to a piece of plant. The initials of the officer performing the step must be entered at the completion of each step. Each isolation sheet must carry the signature of each officer who prepared and checked the isolation sheet. Forward switching is the carrying out of the isolation and operational earthing sections of the Switching Sheet. This is usually the first part of the Switching Sheet up to the point where PTW's are issued. For the correct order to carry out this process *refer* Section 11.5 Attachment 5.
Functional Switching	Is switching that is carried out in the normal course of operation and is not for the purpose of gaining access to live parts. Examples of functional switching are starting a HV motor, isolating a HV motor for mechanical work on the driven element or reconfiguration of plant in the event of plant failures or outages.
High Voltage (HV)	Means voltage greater 1000V AC RMS or 1500 ripple free DC.

Term	Definition
High Voltage System	The HV system includes all lines and apparatus normally energised at high voltage. For the purposes of HV isolation, the HV system shall extend to LV isolation point(s) where necessary. For Rectiformers, from the diodes to the DC isolators are part of the HV system.
HVIA - High Voltage Isolation and Access Procedures (Orange Book)	Outdated procedures intended for use by the Queensland Electricity Supply Corporation for work on transmission and distribution systems.
HV OIC - Officer in Charge of Work	The HV OIC is an authorised person who has successfully completed all appropriate SAHVEA and OIC training and is deemed competent. A person authorised to write and check Switching Sheets and accept a permit to perform work on high voltage equipment. They coordinate the work and where applicable, a workgroup which is operating within a specific PTW. The HV OIC carries the responsibility for the PTW once issued and the HV OIC shall surrender the PTW on completion of the job.
Individual of Work Party	A person trained to carry out specific duties associated with work on lines and apparatus under the PTW System whilst under direction of an Officer In Charge.
Isolation	The process of separating all sources of energy from an item of plant.
Isolation Lock (Red)	Individually keyed and numbered locks that are used to lock High Voltage Isolation Points and Operator Earths. As part of a WCD
Isolation Point	A location or control device that enables a source of energy to be disconnected or physically restricted.
Isolator	A device, when in the open position, is capable of preventing accidental energisation by lightning or switching surge
Instructed person	For an electrical part, means a person who is acting under the supervision of an authorised person for the electrical part.
Lethal Current	Current in excess of 10mA alternating current or 300 mA direct current through the human body as specified in *Australian Standard/ New Zealand AS/ NZS 60479.1-2010 Effects of current on human beings and livestock. SAHVEA SAYS 40mA*
Lines and Apparatus	Those parts of any conductor or articles, such as underground cables, overhead lines or electrical plant and equipment, which are normally energised at a high voltage.
Low Voltage (LV)	Means voltage greater than 50V AC RMS or 120V ripple free DC but not more than 1000V AC RMS or 1500V ripple-free DC.
Multiple Supply	Each piece of equipment (functional location at lowest level) can be energised from multiple sources (e.g. 415V bus tie CB) NOTE: 3 phase circuits with 3 individual fuses shall be considered as 1 source of supply.
Non-commissioned /De-commissioned	Lines and apparatus which cannot be energised by a normal switching operation.
Operator Earths	Operator Earths are earths capable of withstanding prospective fault currents. They are placed under the direction of an Isolating or Switching Sheet by a PTWO, with an isolation lock and Danger Tag/DNOB attached. They may be a designated earth switch, or a portable earthing device connected to a permanent earthing point.
Permit to Work – Issued for Test	A documented form of authorisation that allows access to HV lines and apparatus for Testing and minor works associated with Testing and the removal of Operator Earths. It also allows application of test voltages capable of producing lethal current.
Permit to Work – Issued for Work	A documented form of authorisation that allows access to HV lines and apparatus for work or to apply Test voltages which cannot produce lethal currents provided Operator Earths are not removed.

Term	Definition
Phasing Out (or Phased)	A Test to determine whether energised conductors are the same polarity and may be satisfactorily connected.
Plant	Plant is any: • installations, equipment and pressure vessels directly involved in electricity generation • fixed installations, equipment and machinery • a component of plant • A fitting, connection, accessory or adjunct to plant **(This includes any plant hard-wired, permanently piped or physically connected to an energy source.)**
Portable Earth Lead	An Earthing device that is capable of being moved from one location to another.
PTW (Permit to Work)	A PTW is an authorisation, on the prescribed form, giving approval for work on specified equipment. The three accepted types of PTW allowable under the CS Energy PTW System are: • PTW – Issued for Work • PTW – Issued for Test • PTW – Issued for Access
PTW board	A lockable board that: • is used to house all isolation and PTW documentation once the PTW is issued • is used to secure the key(s) of a PTW Office lock once isolations have been made and locked out • is capable of having an OIC lock and personal locks attached to it to secure access to the PTWO key(s)
PTWO – PTW Officer	The PTWO is an authorised person who has successfully completed all appropriate PTW training and is deemed competent to isolate the plant and issue a PTW allowing work to safely proceed, then on return close the PTW and restore the plant.
Remote Switching	Initiating the operation of electrical apparatus remotely from the electrical apparatus.
Reverse Switching (Restoration)	Reverse switching is the section of the Switching Sheet where operational earths are removed and normal supplies are reinstated. This is usually the section of the Switching Sheet after the PTW's have been surrendered. For the correct order to carry out this process refer See Section 10.5.2 Attachment 1
Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus SAHVEA	Procedures intended for use by the Queensland Electricity Supply Corporation for work on transmission and distribution systems as the replacement for the superseded Queensland Government document - "High Voltage Isolation and Access Basic Principles".
Safety Barrier	Suitable barriers or earthed metal shields installed between the person and the conductors or electrical articles.
Safety Observer - Electrical	In relation to the observing of the performance of electrical work, means a person: • who is competent to help with the electrical work • who is competent to rescue the person performing the electrical work and to provide resuscitation • whose competency in relation to resuscitation has been assessed in the last 12 months
Shall	Indicates that a statement is mandatory
Should	Indicates a recommendation

Term	Definition
Single supply	Each piece of equipment (functional location at lowest level) can be energised from only 1 source (e.g. 415V motor with a heater shall be considers as have 2 single feeds) NOTE: 3 phase circuits with 3 individual fused shall be considered as 1 source of supply.
Supervise (electrical work)	Means technical supervision of electrical work to ensure the requested scope is completed.
Substation	Any location where HV supply is converted, transformed or switched.
Switching Isolation/Restoration	A Switching Sheet is also known as a switching program. A switching program is a detailed listing of actions to be performed to **electrically** isolate, restore or reconfigure the supply of electricity to a piece of plant. Each step must be performed in the order shown. The time and the signature of the officer performing the step must be entered at the completion of each step. Each switching program must carry the signature of each officer who prepared, checked and authorised the program. At CS Energy all Switching Sheets are performed as Isolations lists in SAP with both forward and reverse steps defined. The switching program may be developed on a Switching Sheet outside SAP but must be input into SAP before it is endorsed and then used.
Switching Officer	A person authorised to execute HV Switching procedures and has sufficient electrical qualifications and is SAHVEA trained as defined in CS-PTW-SOP-02. Must be an authorised person to perform HV isolations/switching A person who is authorised to: • operate HV isolators and combined fuse switches • rack in and out HV circuit breakers and contractors • access any high voltage enclosures • operate, test, prove dead and earth HV circuits and buses • including the disarming, rearming and isolating the generator circuit breakers • perform Electrical Switching Programs
Switching Officer's Assistant	A person authorised to execute HV Switching procedure, that is on hand for safety support and to help the Switching Officer carry out his/her duties. It is also acceptable that this role may be filled by someone training to be a Switching Officer.
Switching Sheet	A document that has a unique identifying number and has been checked and authorised, listing electrical switching operations in a step-by-step process. SAP or EXCEL OK
Switching Sheet Authoriser	Refer to Section 2.2
Switching Sheet Checker	A person who checks the Switching Program for correctness of isolation on lines and apparatus that the work is to be performed on. Shall be a Switching Officer, Switching Officer's Assistant or a High Voltage Officer in Charge with competence in Switching Sheet writing and field operations, including SAHVEA training and is authorised.
Switching Sheet Writer/Drafter	A person who writes a Switching Sheet to provide isolation on lines and apparatus. Shall be a Switching Officer, or a Switching Officer's Assistant, or a High Voltage Officer in Charge, or an Electrical Engineer with competence in Switching Sheet writing, including SAHVEA training and is authorised.
System	All electrical lines and apparatus used in transmission, sub-transmission and distribution of electrical energy.
Test Tag	A notice in the form of a blue tag that: • is fixed to points of control for running a test or introducing a hazardous energy source

Term	Definition
	• provides warning and information to persons involved in plant isolation, access, inspection, maintenance and repair • identifies a step number corresponding to the associated PTW issued for Test • signifies that the point of control is not to be interfered with or operated under any circumstances unless authorisation is given by the HV OIC • must only be hung or removed by a PTWO 
Untrained person (electrical part)	Means a person who is not an authorised person or an instructed person for the electrical part.
WCA (Application for PTW)	An electronically generated form specifying the plant item and scope of work.
Work Group / Work party	All persons who perform specific work activities as coordinated by an HV OIC.
Working Earths	Earths placed at the work site under the coordination of an OIC to limit the rise in potential. They are recorded on form S1976 Working Earth Register
WCD	Work clearance document that provides the identification and operations to be performed in carrying out plant isolation. (Also, commonly known as an isolation/restoration sheet)

8 REFERENCES

Reference No	Reference Title	Author
	Electrical Safety Act 2002 (Qld)	Qld Govt
	Electrical Safety Regulation 2013 (Qld)	Qld Govt
	Electrical Safety Code of Practice – Working Near Overhead and Underground Electric Lines 2020 (Qld)	Qld Govt
	Electrical Safety Code of Practice – Managing Electrical Risks in the Workplace 2013 (Qld)	Qld Govt
	Electrical Safety Code of Practice – Works 2020 (Qld)	Qld Govt
	Queensland Electricity Entity Standard for Safe Access to High Voltage Electrical Apparatus SAHVEA	Qld Govt
B/D/11/30957	Procedure - CS-OHS-31 - Electrical Safety Management	CS Energy
B/D/12/11085	Procedure - CS-OHS-36 – Barricades and Signage	CS Energy
B/D/12/84199	Procedure - CS-OHS-57 - Isolation of Electrical Circuits by the Officer in Charge of Work	CS Energy
B/D/11/19583	Procedure - CS-PTW-SOP-02 - Training and Authorisation of Roles in the PTW System	CS Energy
B/D/11/19582	Procedure - CS-PTW-01 - Permit to Work	CS Energy
B/D/11/30960	Procedure - CS-OHS-34 - Selection, Maintenance and Use of Electrical Safety Equipment and PPE	CS Energy
B/D/11/36153	Form - S1885 - Live Electrical Work Checklist Form	CS Energy
B/D/10/21585	Form - S1878 - Job Safety and Environmental Analysis (JSEA) Template	CS Energy

9 RECORDS MANAGEMENT

To maintain continual improvement, suitability, safety and effectiveness of the organisation, registered documents will be reviewed on a two-yearly basis or at intervals specified by legislative or regulatory requirements. Review of controlled documents should occur where it has been identified that there are changes in technology, legislation, standards, regulation or where experience identifies the need for alteration to the content. Registered documents should also be reviewed following an incident, change management process, modification or where directed as part of a risk assessment process. A 'review' can simply mean that it has been identified, confirmed and appropriately recorded that no changes are required and that the existing process remains the same.

Government Owned Corporations must ensure that records are retained according to accountability, legal, administrative, financial, commercial and operational requirements and expectations. In compliance with records retention and disposal, all documentation created in relation to business must be retained in line with minimum retention periods as detailed in legal retention and disposal schedules.

10 ATTACHMENTS

10.1 Attachment 1 - CS Energy Accepted Switching Abbreviations

Abbreviations should not be used in document titles in TRIM

10.1.1 Definitions and Abbreviations

Definitions	Accepted Abbreviations
Auxiliary	AUX
Circuit Breaker	CB
Control	CTRL
Control Selector Switch	CSS
Earth Switch	E/S
Feeder	FDR
High Voltage	HV
Incomer	INC
Integrated Control & Monitoring System	ICMS
Isolate	ISOL
Low Voltage	LV
Miniature Circuit Breaker	MCB
Perform testing or use other approved methods to confirm de-energised (e.g. voltage indication)	Confirm De-energised
Permit to Work	PTW
Plant Control Room	PCR
Switchboard	SWBD
Switchgear	SWGR
Transformer	TRF
Unit Control & Monitoring System	UCMS
Work Clearance Application	WCA
Work Clearance Document	WCD

10.2 Attachment 2 - CS Energy / SAHVEA Equivalent Terms

CS Energy	SAHVEA
Switching Sheet Writer	Switching Sheet Writer
Switching Sheet Checker	Switching Sheet Checker
Switching Sheet Authoriser	Switching Sheet Authoriser
Switching Officer	Switching Operator
Switching Officer's Assistant	Switching Operator's Assistant
High Voltage Officer in Charge	Recipient
Individual of a Workgroup	Individual of a Workgroup
PTW – Issued for Work	Access Permit
PTW – Issued for Test	Test Permit

10.3 Attachment 3 - Minimum Standard of Information for High Voltage Switching Cover Sheet

- Switching Title identification. (Isolation or restoration)
- WCD number
- Work start and finish dates (not the date the sheet was printed)
- Plant Item to be isolated
- Long text description of the work to be performed
- Effects on the system
- Special requirements and Switching Sheet Authoriser notes
- Restoration notes
- Drawing references
- Work and test permits
- Nearest live points
- Lock and tag information
- Writer / checker/authoriser name and date box
- Supply maintenance
- Use of a standard WCA and WCD is suitable for use as a Switching Sheet.

10.4 Attachment 4 - Minimum Standard of Information for High Voltage Switching Operations

- Every operation required to be performed during the isolation or restoration process should be written to the Switching Sheet and key information transferred to the WCD. This shall involve inserting isolation/restoration steps from other procedures (e.g. PAM procedures for the isolation of the GCB) in the isolation/restoration sheets.
- A sequential number shall be given to each operational step
- The correct physical location of the appropriate switchgear shall be identified and titled with the corresponding location number. (This shall be confirmed during walking the isolation).
- The correct description of the apparatus that requires operation/checking shall be identified and titled with the corresponding KKS number. (This shall be confirmed during walking the isolation).
- The operation or action required shall be written in a way that:
  - Confirms the correct status of apparatus to be Switched (e.g. Check CB Closed).
  - Confirms the operation to be performed (e.g. Open CB and rack out).
  - Confirm the operation has been performed correctly (e.g. Check CB open and racked out).
  - Confirm the correct status of apparatus final position (e.g. CB Locked and tagged. WCD Number and Tag Number).
- Initial and insert the time that each step is performed.

10.5 Attachment 5 - Minimum Standard for Switching Sheet Sequencing

10.5.1 Forward Switching (Isolation Switching)

1. Advise the appropriate authorities that forward switching will commence.
2. Arrange load shift/shed
3. De-energise:
    - Use circuit breakers where available:
        - Operate remote from circuit breaker
        - Open low voltage before high voltage
    - Operation of isolators:
        - Operate within known constraints of isolator
        - Minimise load to be interrupted
4. Isolate lines apparatus and control circuits:
    - Provide sufficient HV isolation points with isolation tags attached.
    - Remove VT fuses
    - Disconnect all LV points of supply except where no low voltage ties exist.
5. Earth lines and apparatus
    - Provide sufficient Operator Earths with isolation tags attached.
    - At least one Operator Earth must be applied, and an Operator Earth must be applied between each point of supply and the work area.
    - When portable earths are applied during switching, record the number applied as part of the switching step.
6. Place other electrical safety precautions at the work area (as required)
    - Taping/roping off
    - Work area signage around work area
    - Warning signs in place
    - Physical barriers placed
7. Advise the appropriate authorities that forward switching has been completed
8. Issue Permits to Work
    - Specify work/Apparatus under Access

10.5.2 Reverse Switching (Restoration Switching)

1. Surrender PTW – Issued for Work
    - Ensure all PTW – Issued for Work issued for section under test have been surrendered.
    - Receive clearance from the Switching Sheet Authoriser and issue PTW – Issued for Test.
    - Specify test.
2. Surrender the PTW – Issued for Test.
    - Provide switching items for surrender of the PTW Issued for Test.
    - Receive clearance from the Switching Sheet Authoriser.

3. Removal of other precautions
    - Removal or check removed Other precautions and Working Earths
4. Advise the appropriate authorities that reverse switching will commence.
    - When portable earths are removed during switching restoration, record the number removed as part of the switching step.
5. Reverse the isolation.
6. Perform visual inspection of the plant to be energised to confirm it is safe to energise.
7. Re-energise:
    - Use circuit breakers where available:
        - Operate remote from circuit breaker
        - Close high voltage before low voltage
    - Operation of Isolators:
        - Operate within known constraints of the isolator
        - Minimise load to be energised
    - Test/energise new equipment
    - Phase out
8. Reverse load shift
9. Advise the appropriate authorities that switching has been completed.