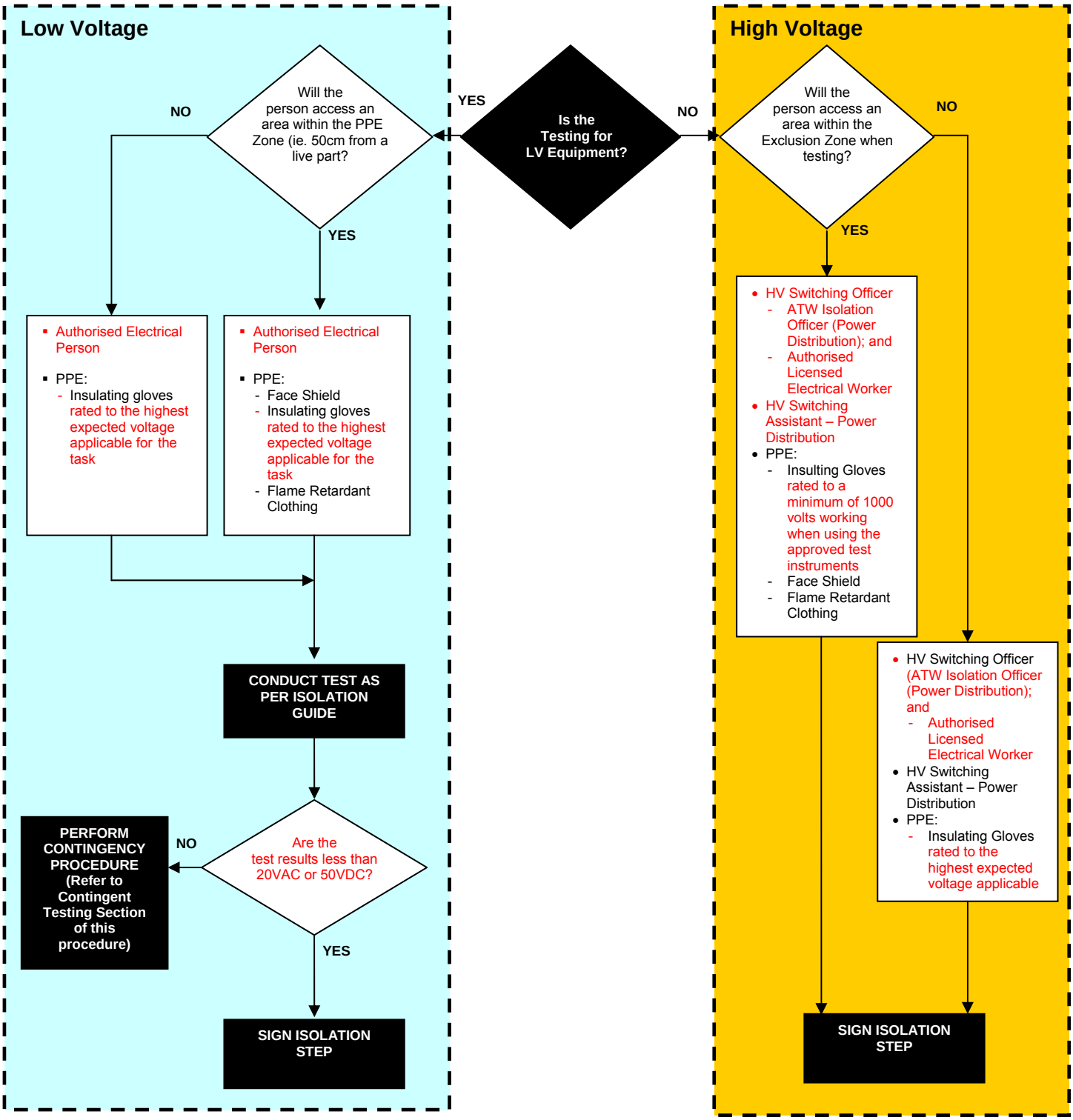
Content

Functional Flowchart



Objective

To describe SCL's requirements relating to electrical testing to prove de-energised.

Scope

This procedure applies to electrical testing to prove de-energised practices undertaken as part of isolations performed on low voltage and high voltage circuits to allow the performance of electrical work across all SCL operated and/or maintained sites.

Definitions

AC: Alternating current.

Authorised Electrical Person: A person with the knowledge and skills enabling that person to perform work on or near a low voltage exposed live part. Authorised Electrical Persons must successfully complete and be current in the following training modules: HS073 Authorised Electrical Persons and Electrical Safety Observers, HS069 Rescue from Low Voltage Equipment and HS026 Resuscitation.

Authorised Licensed Electrical Worker: A person who is the holder of a Queensland electrical workers license (or equivalent). Authorised Licensed Electrical Workers must successfully complete and be current in the following training modules: HS073 Authorised Electrical Persons and Electrical Safety Observers, HS074 Specific Requirements for Electrical Work, HS069 Rescue from Low Voltage Equipment and Resuscitation.

Competent: Having acquired the knowledge and skills enabling that person to perform the task required, in a safe and effective manner. For example, for undertaking electrical work the person is a Licensed Electrical Worker and has undertaken specific SCL Electrical Authorisation Training.

DC: Direct current.

Electrical Equipment: Any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire:

- Used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage:
- Operated by electricity at a voltage greater than extra low voltage;
- That is or forms part of, a cathodic protection system.

Electrical Part: The specific piece of electrical equipment that is the subject of the work.

Extra Low Voltage: Voltage of 50V or less AC RMS, or 120V or less ripple-free DC "(QLD Electrical Act 2002. schedule 2)".

Exposed Part: is any terminal, connection, conductor or electrical part that can be contacted with a standard test finger.

Flame Retardant Clothing: Clothing that has properties which suppress or delay the combustion or propagation of flame.

High Voltage: Voltage exceeding 1000 volts AC or 1500 volts ripple-free DC.

Induced Voltage: A voltage due to electromagnetic or capacitive coupling that may be present in an isolated conductor if it is located near to or run in parallel with an energised conductor.

Low Voltage: Voltage exceeding 50 volts AC or 120 volts ripple-free DC but not exceeding 1000 volts AC or 1500 volts ripple-free DC.

Ω: Symbol representing ohms, a unit of measure of electrical resistance.

Person in Control: The person who is in control of the electrical equipment at a particular location. For SCL this is the site manager.

PPE: Personal protective equipment

PPE Zone: The area totalling 500mm in any direction from live exposed parts within which an Authorised Electrical Person has approval to perform work using PPE control measures.

RPEQ Electrical: Registered Professional Engineer Queensland Electrical

Standard Test Finger: A device used to determine minimum clearances around electrical parts as per the dimensions set out in the IEC Standard 61010.

Test Before Touching: An electrical test performed by an Authorised Licensed Electrical Worker immediately prior to working on a de-energised electrical part.

Test to Prove De-energised: A process that involves the testing of electrical circuitry with a voltage measurement device to determine the electrical status, and confirm that the circuitry is de-energised as a result of isolation protocols.

Responsibilities

Corporate Electrical Safety Advisor:

- Maintain the currency and accuracy of the Electrical Safety Corporate Standard reflective of legislative and corporate change.

Station/Site Manager:

- Monitor the implementation of the Electrical Safety Corporate Standard
- Allocate responsibilities and resources to ensure specific practices/procedures are developed to satisfy the Corporate Standard.

Employees and Contractors:

- Comply at all times with the requirements specified within this Corporate Standard for Electrical Safety
- Comply with any specific procedures.

Hazards

In relation to testing to prove de-energised, SCL has implemented a safe system to control risks to health and safety arising from hazards and issues such as, but not limited to:

- Use of non-rated equipment in classified hazardous areas;
- Use of poorly maintained test instruments;
- Exposure to live exposed parts..

Risk Assessment

Hazards associated with testing to prove de-energised are to be assessed and managed as part of the ATW isolation guide.

Controls

General Testing to Prove De-Energised Requirements

- On low voltage equipment, testing to prove de-energised is to be performed by Authorised Electrical Persons and/or Authorised Licensed Electrical Workers.
- On high voltage equipment, testing to prove de-energised is to be performed by a HV Switching Officer (ATW Isolation Officer – Power Distribution) at each isolation point immediately prior to applying earths
- When testing to prove de-energised on LV circuits, it is important to know the type and level of voltage being tested to ensure that sources of supply have been de-energised i.e. is it AC or DC? Is it low voltage or extra low voltage.
- No hand tools, other than the approved test instruments are to be used during the testing procedure.
- Only approved test instruments that have current test and calibration status and are registered on a site electrical equipment register are to be used (refer also to Suitable Testing Devices).
- Prior to the commencement of testing, the test person is to remove all jewellery and metal objects that are in contact with the skin.
- Where applicable, insulating mats are to be used for working on conductive surfaces.
- On low voltage equipment, tests are to be conducted at the load side of the isolation point/s, by an Authorised Electrical Person during the isolation process and at the electrical part by the Authorised Licenced Electrical Worker before commencing work and at the start of each new shift/day.
- .Assess equipment to be accessed to determine if there are any live exposed parts.. If it is determined that there are no exposed parts, testing on energised parts can be performed with the use of an approved meter using insulating gloves only.
- If the equipment to be worked on has live exposed parts, then apart from the minimal site-specific PPE, the following PPE requirements apply:

  For Low Voltage

  If the person performing the testing has any part of their body within the PPE zone of an energised exposed part, they are to wear the following PPE:

  - Insulating gloves rated to the highest expected voltage applicable for the task
  - Face shield for electrical work
  - Flame retardant clothing covering the full body, arms and legs.

  For High Voltage

  If the person performing testing tasks is required to work within an exclusion zone of an energised part, they are to wear the following PPE:

  - Insulating gloves rated to a minimum of 1000 volts working when using the approved test instruments
  - Face shield
  - Flame retardant clothing covering the full body, arms and legs.

Note: Refer to the Maintaining Electrical Tools, Protective Devices and Clothing Corporate Standard (HB#709585) for specific information regarding flame retardant clothing, insulating gloves and face shields.

- Verification of the test to prove de-energised task is to be recorded within plant isolation control guides as per the Plant Isolation Corporate Standard HB# 569942
- A conclusive test is achieved if the voltage reading is less than 20 Volts AC for alternating current circuits and 50 Volts ripple free DC for direct current circuits.
- If a testing to prove de-energised task cannot be performed as per this corporate procedure, an RPEQ Electrical is to be consulted to determine an alternative test method. Where such a method is used, this process is to be documented within the Work Method Statement that relates to the work task.

Suitable Testing Devices

Approved test instruments are to be inspected for damage prior to each test use.
Test instruments approved for use throughout SCL include the following:

Contact Voltage Testers

- Fluke Digital Multimeter(DMM) – low voltage
- Taplin tester – high voltage
- Fluke T5 – 1000 – low voltage.
  Note: A Fluke Digital Multimeter can be considered as any one of the following Fluke models:
- 787 and 789 Process Meters
- 187 and 189 Digital/Analog Multimeters
- 1577 and 1587 Insulation Meters
- 170 series Digital Multimeters
- 80 series Digital Multimeters includes Fluke 83 and 87 models
- 88 series Automotive Meter
- 27 series Analog/Digital multimeter

Non-contact voltage testers

- Modiewarks – high voltage
- CC-360 series Detex Voltage Detector – high voltage
  Note: The use of testers (non contact type) that detect an electrical field surrounding an energised conductor may not be suitable for cables that are surrounded by a metallic screen or cables carrying direct current. In these cases a contact type tester is to be used.

Specific operational protocols for using the above listed devices are to be followed at all times, as per Attachment A.

Contingent Testing

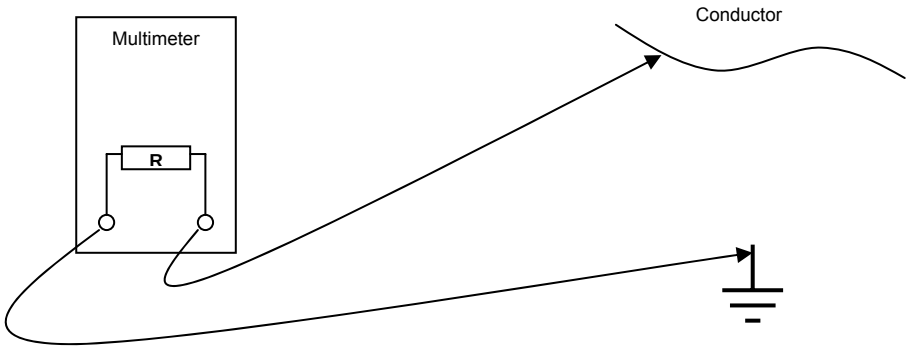
NOTE: This procedure is to be performed by an SCL Authorised Licensed Electrical Worker only.

If a non-conclusive test result is obtained (higher than 20 volts AC or 50 volts DC) when testing to prove de-energised, further testing is to be conducted to determine whether it is from a sustained voltage source. The procedure for measuring sustained voltages is as follows:

The Principle behind this test is to determine if a sustained voltage remains present. Testing is performed between each phase and earth.

1) This method can only be used when the measured voltage is:
   i. 50 volts AC or lower; or
   ii. 120 volts DC or lower.
   Note:If the voltage is greater than these, go to Step 7) below. Otherwise go to Step 2) below.

2) Connect a resistance of 20 kΩ in parallel with the voltmeter when measuring the voltage.
   Note: This is done to place a load in the circuit to check if the source voltage is sustained at this load.



3) If measuring AC voltage, the sustained voltage is above 20 volts, go to Step 5).
4) If measuring DC voltage, the sustained voltage is above 50 volts, go to Step 5).

5) If an acceptable test is not obtained then substitute the resistor connected in Step 2) with one of 3kΩ resistance and repeat the sustained voltage measurement
   Note: This is again done to place a load in the circuit to check if the source voltage is sustained at this load at this lower resistance.

6) If the sustained voltage remains above the values listed in Steps 3) and 4) then the circuit is to be considered as not proven de-energised – go to Step 7).

7) Report any instances of circuits not being able to be proven de-energised to an RPE Electrical immediately so that further investigation can be conducted into the cause.

Training and Competency

Training as described in the Corporate Electrical Safety Standard

Review

This procedure will be reviewed every three years or as necessary due to changes in legislation by the Corporate Electrical Safety Committee.

Links and References

QLD Code of Practice – Electrical Work
AS/NZS 3000: 2007 Electrical Installations

Attachments

Attachment A: Specific Test Instrument Requirements
Attachment B: Amendment History

Attachment A - Specific Test Instrument Requirements

Low Voltage Testing Processes

Fluke DMM and Fluke T5-1000 Tester

1. Follow the *Isolation Control Guide* so that the control supply is de-energised and the power supply isolator is open.
2. Set the Fluke DMM/T5 to AC Volts. Inspect the meter and leads for damage and check the calibration and test due dates. Do not use if it is damaged or past the test due date.
3. Don appropriate PPE.
4. Go to a nearby GPO, check switched off, lift flap, insert meter probes in top left and top right slots. Turn switch on and check that the meter reads > 230 Volts AC. Double check to ensure that you are not reading millivolts.
5. Go to cubicle/switchboard; stand on the hinge side of the door, face away and open door. This is so that in the case of a co-incidental fault, you are not exposed to flame and gas.
6. Check visual position indicator (if there is one) on the isolator, shows the open position.
7. Place test probe on earth (eg earth connection on the door), and place the other probe on red phase connection, then white phase, then blue phase in turn on the load side of the isolator. In each case, check voltage is less than 20Volts AC and 50Volts ripple free DC. Then test in turn between red-white phase connections, red-blue phase connections, and blue-white phase connections. If it is greater than 20Volts AC or 50Volts ripple free DC, stop and use the Contingent Testing process as outlined above.
8. Test between earth and the load side of the control circuit breaker. Voltage measured should be less than 20Volts AC and 50Volts ripple free DC. If it is greater than 20Volts AC or 50Volts ripple free DC, stop and use the Contingent Testing process as outlined above.
9. Close the starter door.
10. Re-test the meter as per Step 4.

High Voltage Testing Processes

Modiewark (non-contact voltage tester)

1. Follow the isolation control guide/switching sheet steps to de-energise the circuit.
2. Inspect the Modiewark for damage. Do not use if damaged.
3. Switch on the Modiewark and ensure it is operating. When the Modiewark is switched on a visual alarm lamp flashes and the buzzer beeps at approximately one-second intervals, giving clear standby indication that the instrument is operational. Do not use if this indication is not present.
4. Don appropriate PPE if you will be working within the exclusion zone of exposed energised parts.
5. Select the correct voltage range for the circuit being tested.
6. Visually check that the isolator is in the open position.
7. Prove the tester works by holding the test probe near, but not touching one of the connections on the line side of the isolator. Indication that a circuit is energised occurs if the audible and visual alarms change to continuous operation i.e. a steady light and continuous sounding buzzer. If it doesn't change the tester needs to be checked or replaced.
8. Next hold the probe close to each phase in turn on the load side of the isolator. In each case check the tester does not light up. If it does, stop and investigate the cause.
9. Now retest the tester at one of the isolator line side connections. If it doesn't light up, the tester needs to be checked or replaced and all steps repeated.

Taplin Tester

1. Follow the switching sheet steps to de-energise the circuit.
2. Inspect the Taplin Tester for damage. Do not use if damaged.
3. Switch the Taplin Tester to the self test position. Place one hand on the metal of the dial indicator and the other on the test probe of the tester. The dial indicator will deflect indicating that the tester is operating. Do not use if this indication is not present.
4. Don appropriate PPE if you will be working within the exclusion zone of exposed energised parts.
5. Check visual indicator (if there is one) on isolator shows the open position.
6. Select the correct voltage range for the circuit being tested.
7. Prove the tester works by touching the test probe on one of the connections on the line side of the isolator. The dial indicator should deflect indicating voltage of the circuit and proving the tester works. If it doesn't the tester needs to be checked or replaced.
8. Next touch the probe on each phase in turn on the load side of the isolator. In each case check the tester should not indicate voltage on the dial indicator. If it does, stop and investigate the cause.
9. Now retest the tester at one of the isolator line side connections. If it doesn't indicate voltage, the tester needs to be checked or replaced and all steps repeated.

CC-360 series Detex Voltage Detector

1. Follow the isolation control guide/switching sheet steps to de-energise the circuit.
2. Inspect the Detex Voltage Detector and link sticks for damage. Do not use if damaged.
3. Press the red test button on the voltage detector and ensure it is operating. When it is switched on the red diode flashes and there is also an audible signal tone given off. When the test button is released the red diode goes out and the green diode lights up for approximately 2 minutes, the audible tone also ceases. Do not use if this indication is not present.
4. Don appropriate PPE if you will be working within the exclusion zone of exposed energised parts.
5. Visually check that the isolator is in the open position.
6. Prove the tester works by holding the test probe near, but not touching one of the connections on the line side of the isolator. Indication that a circuit is energised occurs if the audible signal activates and the red diode lights up. If the green diode remains lit, then it is indicating the circuit is de-energised. If the green diode stays on when placed near a known or suspected live conductor, the tester either needs to be checked or replaced.
7. Next hold the probe close to each phase in turn on the load side of the isolator. In each case check the green diode stays on. If the red diode comes on, stop and investigate the cause.
8. Now retest the tester at one of the isolator line side connections. If the red diode and audible signal don't activate, the tester needs to be checked or replaced and all steps repeated.

Amd Date 22/11/06

Attachment B – Amendment History

	Amendment Description	Reason	By Who	Date
1.	Contingency procedure revised	SPS Incident #8692 on 1/11/07	S.Hannay	Dec 07
2.	Inclusion to specify both AC and DC Low Voltage circuits to be tested	Decommissioning event at Kareeya 3/12/07	S.Hannay	Dec 07
3.		Reviewed as part of full electrical safety document review and update process	S.Hannay	Apr 08