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CS ENERGY PROCEDURE

ELECTRICAL SAFETY EQUIPMENT AND PERSONAL PROTECTIVE EQUIPMENT
CS-OHS-34

Responsible Officer: Principal Electrical Engineer
Responsible Manager: Head of Operations Services
Responsible Executive: Chief Operating Officer

DOCUMENT HISTORY

Key Changes	Prepared By	Checked By	Approved By	Date
Original Release	AM Team	AM Team	GM AM	08/11/2005
Changes issued to include PPE for electrical shock hazards	AM Team	AM Team	GM AM	06/04/2013
Changes made to the arc flash chart and arc flash rated switchgear cubicles	AM Team	AM Team	GM AM	06/06/2010
Removal of out of date tables with updated Australian Standard references	D Kendrick	D Bell K Ussher	D Bell (AM) K Ussher (H&S)	11/09/2013
Alignment with new Electrical Safety Regulations, and general updates	J Culberg	C Tema F Keyte B Wills E Schoenfisch	K Lines	06/08/2015
Updated with CSE standard Arc Flash Labels – Section 7.3. & 7.4	C Tema	D. Standen E Schoenfisch G Armitage W Bosman	G Schumacher	20/03/2020
Alignment with new Electrical Safety Regulations, and general updates refer to Log of changes B/D/25/8336	J Newkirk	G Isaac	P Matha	30/07/2025

CONTENTS

1 INTRODUCTION

1.1 Purpose

The purpose of this procedure is to detail the use, inspection, testing and maintenance requirements of:

- insulated tools and test devices
- insulated mats, covers and barriers
- electrical safety personal protective equipment and clothing

1.2 Scope

This procedure applies to electrical safety equipment and personal protective equipment used at CS Energy workplaces. It details the inspection, testing, maintenance, and requirements for use by CS Energy employees and other persons.

This procedure does not apply to the maintenance of electrical installations and as such, *CS-OHS-32 Maintaining Electrical Installations Procedure* should be referred to for specific electrical installation information.

2 ELECTRICAL SAFETY EQUIPMENT AND TOOLS

2.1 General

Term	Description
Mandatory PPE	CS-OHS-50 Personal Protective Equipment stipulates the PPE to be worn at all times whilst working at the power station sites.
Additional PPE	Personal protective equipment (PPE) additional to the items listed in CS-OHS-50 is to be used and selected in accordance with a JSEA developed for the activity. Working near energised exposed parts requires specialised PPE to be worn. Protective clothing worn by electrical workers when working live and/or others in proximity to exposed energised conductors shall be appropriate for the purpose, fit correctly and be in good condition while the work is being performed. Guidance on the correct personal protective equipment to be worn when working on electrical equipment is provided in Section 8.4 Attachment 4 - Electrical Safety Personal Protective Equipment and special instructions for the care of the clothing is provided in Section 8.5 Attachment 5 - Care and Use of Arc Rated Clothing Care (TecaSafe material)
Arc Rated / Arc Flash Contained Equipment	Equipment which has been designed and type tested to contain the arc flash energy to protect users, when installed and used in accordance with the manufacturer's instructions.
Power Station Obligations	To protect personnel from electrical hazards, each Power Station is to provide a supply of personal protective equipment that is maintained and tested in accordance with the Australian Standards.
No Modifications	Personnel required to wear items of PPE are not to modify, damage or use PPE in a way contrary to manufacturer's instructions or the training provided for that particular item of PPE.
Defective PPE	Items of PPE that are defective or out of test date are to be immediately withdrawn from service and tagged as out of service until repaired and / or tested by a competent person.
Personal Items	During the performance of live electrical work, testing de-energised, fault finding or when in close proximity to energised exposed parts, personnel are not to wear or carry conductive items such as pens, mobile phones, radios, tools (unless suitably insulated), metal belt buckles, buttons, chains, studs, jewellery, body piercing, metal rimmed glasses, bracelets, rings, neck chains, exposed metal zips, watches, etc.

Wedding rings may be worn provided they do not have sharp edges or protrusions and are suitably insulated by wearing insulated gloves.

Important Note – When working live, testing to prove de-energised, testing energised electrical equipment, fault finding, commissioning, working as a safety observer or in proximity to energised conductors electrical workers and others are to wear suitable arc rated/arc flash protective PPE.

2.1.1 Other Measures

Arc flash energies are to be managed for electrical work and the selection of correct PPE is to be addressed based on the identified arc flash energies (ATPV) for the electrical equipment being isolated, tested or worked on.

Other measures to control the risk may include working at a greater distance from the incident arc source, using longer handles to rack out equipment, using remote isolation or test equipment and modifying protection settings by engineering to reduce the arc flash potential energy. These options are to be addressed in the JSEA for the work involved.

2.1.2 Arc Flash Incidents

An electrical arc fault is often referred to as an Arc Flash. It is a release of electrical energy when current flows through the air between conductors. The arc can reach temperatures of up to 20,000 degrees Celsius.

Common causes of arc flash include:

- unsafe work practices and procedures
- foreign materials
- breakdown of busbar insulation
- electrical equipment failure such as a switch, circuit breaker or loose cables
- contacting energised equipment with uninsulated tools
- using test equipment not designed or rated for the job.

It is possible to work on arc flash contained equipment and other arc flash rated equipment like Gas Insulated Switchgear (GIS) with minimal PPE. The arc flash labels provided in the power plants provide details for the selection of the appropriate Arc Flash PPE.

2.2 Insulated Tools & Materials

2.2.1 Tools

Insulated tools provide protection against shock hazard. They are to be of an approved electrically rated type, kept clean, maintained and tested at intervals in line with manufacturer's guidelines. Where doubt exists about the insulation of a tool, it is not to be used until it is tested to ensure appropriate insulation.

Insulated tools are to be marked on the handle with the voltage rating and the low voltage insulated tools are to be rated to at least 1000 volts r.m.s.

Insulated tools are to be stored in a way that will protect the insulation from being damaged. Prior to use insulated tools are to be visually inspected for any sign of damage or deterioration of the insulation.

Sites are to provide a number of insulated tool sets, which are to be controlled / issued from the stores (or if not through store then controlled and managed to ensure condition and required test dates are maintained), and are to be returned after use, including Insulated Mats, Covers and Barriers.

2.2.2 Insulated Barriers

Insulated barriers are to be of a suitable material to effectively insulate and separate the user from adjacent energised equipment.

2.2.3 Insulating Mats

Electrical insulating matting made of elastomer for use as a floor covering for the electrical protection of workers on electrical installations shall meet the requirements of AS/NZS IEC 61111 Live working - Electrical insulating matting.

Electrical insulating matting shall not have length and width less than 600 mm. The maximum and minimum thicknesses of matting shall be as given in the standard AS/NZS IEC 61111.

2.2.4 Insulating Covers

Insulating covers used with equipment rated at voltages less than 650 volts are to be in accordance with AS 4202 Insulating Covers for Electrical Purposes.

Insulating covers are to be provided with a securing means to effectively prevent it dislodging from the protected area. The means by which it is secured is to be non-conductive and is not to reduce the mechanical strength of the cover. The insulating cover may be a pipe or tube drape, blanket, cover or wrapping of insulating non-hygroscopic material applied on or around conducting mains, apparatus, surfaces, and pipes so as to prevent inadvertent contact and provide an electrically safe barrier for personnel or equipment in the vicinity.

2.2.5 Pre and Post Use

Prior to and after each use, insulating mats, covers and barriers are to be visually inspected for the following defects:

- blisters, cracks, cuts. tears, perishing, patches, protuberances, cracking and holes in the insulation material
- signs of damage or physical deterioration
- embedded foreign matter
- defective fastenings

2.2.6 Labelling

Insulating mats, covers and barriers are to be individually labelled or marked with the details specified by the corresponding Australian Standard and also with a means of establishing the last test date and next test date due. They are to be stored and handled carefully, away from sharp objects, tools, chemicals or other equipment, which might cause damage.

2.2.7 Washing and Testing

Insulating mats, covers and barriers are to be cleaned at intervals not more than six months or more frequently, if required, and tested at intervals specified in the Australian Standards. No electrical insulating matting, even those held in storage, should be used unless they have been inspected and/or electrically tested within the previous 12 months.

2.2.8 Tagging Items

Mats, covers or barriers that are cut down are to be individually marked, or tagged (legible and durable) with electrically non-conductive material for identification. The tag is to be securely attached. The following

information is to be marked on the item or tag: name of the manufacturer, year and month of manufacture, the classification and provision for a re-test date.

2.3 Insulating Gloves

2.3.1 Minimum Requirements

All personnel are to ensure insulating gloves are marked in accordance with AS 60903– Live working - Electrical insulating gloves and also with a means of establishing the last test date and next test date due.

Insulating gloves shall comply with AS 60903 Live working - Electrical insulating gloves for use and testing.

2.3.2 Prior to Use

Immediately prior to use, insulating gloves are to be visually examined for any sign of damage or deterioration and for legibility of marking. Users are to stretch the gloves by hand to ensure the mechanical strength is adequate and then test the glove by rolling it from the cuff to force air into it.

2.3.3 Additional Gloves

Outer leather protective gloves are to be worn where there is a risk of damage due to the type of work being performed, the proximity of plant, equipment or other substances that may cut, penetrate, melt, pierce or catch onto the insulating glove.

2.3.4 Cleaning and Storage of Gloves

Insulating gloves are to be washed and tested at intervals not more than six months.

Insulating gloves are to be stored unfolded in clean containers and in a cool, dry place away from direct sunlight.

Insulating gloves are to be carried in a durable protective bag. Treated canvas is not to be used, as it is detrimental to the insulation rubber of the gloves.

2.3.5 Unsuitable for Use

Where gloves fail testing requirements or are identified as being damaged such that they would not provide adequate insulation, they are to be removed from service and discarded.

2.4 Face Shields & Goggles

2.4.1 Minimum Requirements

Personnel are to wear eye protection on site in accordance with AS/NZS 1336 Eye and face protection - Guidelines.

The following issues must be considered and implemented as required by the JSEA for the activity:

- the use of lenses to assist in minimising the effects of arc and flash
- the use of suitable face shields to protect from flying fragments, particles or radiation
- the use of face and eye protection when undertaking electrical work where there is an increased risk of arc or flash burn injuries

2.4.2 Eye Protection

Eye protection used during electrical related tasks is to be constructed of non-conductive materials.

2.4.3 Face Shields

Arc rated face shields (complete with chin straps that provide protection from facial burns) are to be worn on site when undertaking the following:

- when conducting live electrical work with arc flash hazards

- when isolating or switching electrical equipment where arc flash energy potential hazards have been identified
- where an arc flash hazard has been identified the arc rated face shield type requirement takes precedence.

2.5 Arc Rated Clothing

2.5.1 Minimum Requirements

Arc rated clothing worn for the performance of specific electrical activities (working live, commissioning, safety observer role, testing to prove de-energised, fault finding etc.) :

- is to be in line with the requirements of Section 8.1 Attachment 1 - Selection of Arc Rated Clothing and PPE
- for arc flash rating locations >1.2 cal/cm^2 shall be a minimum of category 2 arc flash rated clothing
- shall cover the whole body from neck to wrist to ankle
- have non-metallic fasteners or fasteners that are protected by a layer of the same material as that of the garment on both the top and underside

be laundered and used in accordance with manufacturer requirements. (Refer Section 8.5 Attachment 5 - Care and Use of Arc Rated Clothing Care (TecaSafe material))

Prior to use, clothing is to be visually inspected for signs of damage, deterioration and areas where sections of the body may not be adequately covered.

2.5.2 JSEAs and Requirements

The JSEAs developed for work in arc rated clothing shall take into account the hazards and control measures associated with heat stress and perspiration. Some control measures that may be used include:

- the use of fans and forced ventilation
- the availability of drinking water
- rotating personnel through the work

The JSEA must also take into account the requirements of Section 8.1 Attachment 1 - Selection of Arc Rated Clothing and PPE.

2.6 Safety Footwear

2.6.1 Mandatory Requirements

Standard industry safety boots meeting the requirements of *AS 2210.3 Personal protective equipment, Part 3: Safety footwear* and *EN 50321: Electrically Insulating Shoes For Working On Low Voltage Installations* only shall be worn when undertaking electrical work.

Shoes or Over-shoes providing additional protection against high voltage electrical hazards and/or arc flashes may be required, as identified in JSEA or SWMS, for electrical work. Non-conductive footwear will not provide 100% protection from the hazards of electric shock in all working conditions and persons exposed to live low voltage risk need to have additional control measures in place to prevent electrical shock.

2.6.2 Labelling / marking

The electrically non-conductive (insulating) footwear shall be tested and comply with Class '0' footwear of EN 50321 Part 6.3. This is marked with the symbol 'I'.

2.6.3 Prior to Use

The user should conduct a thorough examination of the footwear for any evidence of physical damage or chemical contamination. Any footwear showing evidence of damage or contamination should not be used with an electrically hazardous area.

2.7 Portable Earthing Devices (PED)

2.7.1 Mandatory Requirements

Fixed earthing devices are to be the preference for earthing on CS Energy sites, however this is not always possible resulting in the use of Portable Earthing Devices (PED). Portable equipment for earthing and short-circuiting shall comply to the requirements of IEC Standard 61230: Live working - Portable equipment for earthing or earthing and short-circuiting.

The overall weight and frequency of use of any portable earthing device shall decide the choice of configuration and components used.

2.7.2 Approved Design

The design of complete portable earth systems including the cable, lugs, clamps, and other connectors, are to be of an approved design in compliance with IEC 61230 and suitable for conditions at the particular work locations in which they are used. Additional to this, portable earthing devices:

- joints are not to be interfered with,
- tails are not to be extended, and
- are to be marked with the following:
  - fault current rating,
  - due date for test,
  - manufacturer, and
  - unique identifier.

2.7.3 Minimum Rating

PEDs used as ‘operator earths' shall have a rating in excess of the fault current rating of the location and shall be capable of carrying the fault current, without sustaining damage or deterioration, till the fault is cleared by the electrical protection system. The overall fault current rating of a complete portable earth is determined by the component with the lowest fault rating used in it.

PEDs used as 'work party earths' or 'equipotential bonds' are intended to limit the potential voltage rise in the vicinity of the worksite due to electrical testing or from a short circuit event. The rating of these PEDs shall be matched to other equipotential bonding available at the location.

ENA EG1-2006: Substation Earthing Guide and the *Institute of Electrical and Electronics Engineers Guide for Safety in AC Substation Grounding – IME Std. No. 80. Earthing of Works other than distribution centres* may be referred for guidance.

2.7.4 Prior to Use

Prior to use each PED is to be visually inspected for signs of damage and currency of test date. If out of test date or damaged the PED is not to be used and is to be marked out of service.

2.7.5 Regular Inspections

At a period of no greater than 6 monthly each PED is to be inspected, cleaned and electrically tested to confirm its resistance. Records of the inspection and testing are to be maintained.

2.8 Low Voltage Rescue Kits

2.8.1 Low Voltage Rescue Kits

Specific low voltage rescue kits are to include, but not be limited to, the following:

- Container
- Insulated crook
- Insulated gloves in a protective covering
- “Isolate Here In Emergency” sign
- Fire blanket
- Non-conductive torch
- Burns dressing
- An insulated mat
- List of rescue kit contents
- Date of last inspection

Important Note – Low voltage rescue containers are to be large enough to accommodate the required contents and be labelled in 60 mm high writing “LV Rescue Kit”.

2.8.2 Emergency Sign

“Isolate Here in Emergency” signs are to be approximately 250mm x 150mm with ‘Isolate Here in Emergency’ printed in red writing at least 40mm high. The signs are to be durable, and lettering is to be permanent.

2.8.3 Fire Blankets

Fire blankets are to be in accordance with AS/NZS 3504 Fire Blankets and approximately 1800mm x 1200mm in size. If used, the fire blanket is to be replaced with a new blanket.

2.8.4 Contents Listing

Low voltage rescue kit contents listings are to include the test dates and next test dates due for all applicable items.

2.8.5 Regular Inspections

Prior to the commencement of electrical work in the vicinity exposed parts or live work, the contents of low voltage rescue kits are to be checked to ensure they are in good condition and are suitable for the work situation.

Prior to use, the due date for tests is to be checked to ensure currency.

2.8.6 Regular Testing

On at least six-monthly intervals low voltage rescue kits are to be fully inspected and items are to be tested in accordance with manufacturer requirements.

2.8.7 Defective or Faulty

Items that are defective, faulty, or out of date are to be immediately removed, replaced by a compliant item, and tagged out of service until repaired and/or tested by a competent person.

2.8.8 Type Testing

Insulated crooks are to be type tested to withstand 5kV between the handle and hook and be constructed of such material as solid PVC or fibreglass rod of 25mm in diameter.

3 TRAINING

3.1 Mandatory Requirements

All personnel required to use the following items are to undertake specific Authorisation for Electrical Work Training in accordance with CS Energy's Electrical Safety Procedure:

- electrical testing devices
- insulated electrical tools
- insulating mats, covers and barriers
- insulated gloves
- arc rated clothing.

Competency Level – Additional training details in relation to the competency of personnel who perform electrical work, or work as safety observers, etc, are detailed within CS Energy Procedure CS-OHS-31 Electrical Safety Management.

4 DEFINITIONS

Term	Definition
ATPV	Arc Thermal Performance Value
Competent Person	Is a person who has acquired, through training, qualifications, experience or a combination of these, the knowledge and skill to carry out the 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. A competent person should also be authorised by a person in control of the electrical equipment before performing any task.
Electrical Equipment	Is any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that: • is used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage, or • is operated by electricity at a voltage greater than extra low voltage, or • is part of an electrical installation located in an area in which the atmosphere presents a risk to health and safety from fire or explosion, or • is, or is part of, a cathodic protection system or • is prescribed electrical equipment. **Note:** *Electrical equipment does not include any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that is part of a vehicle if the equipment is part of a unit of the vehicle that provides propulsion for the vehicle, or the electricity source for the equipment is a unit of the vehicle that provides propulsion to the vehicle and is not a prescribed equipment.*

Term	Definition
Electrical Installation	Is a group of items of electrical equipment that- a) are permanently electrically connected together; and b) are used to generate electricity at a voltage greater than extra low voltage; or can be supplied with electricity from - i. the works of an electricity entity; or ii. a generating source; or iii. a battery or other storage technology; and (c) do not include items that are works of an electricity entity. **Note** *An item of "electrical equipment" may be part of more than 1 electrical installation.* • An item of electrical equipment connected to electricity by a plug and socket outlet is not permanently electrically connected, and the connection achieved through using works of an electricity entity is not a consideration in determining whether or not electrical equipment is electrically connected.
Insulating Cover	Cover of insulating and non-hygroscopic material intended to effectively prevent contact with any conductive material adjacent to the work position.
Insulated Crook	A device with a handle at one end and a hook at the other for the purpose of removing a person from a live low voltage supply.
Insulating Mat	A mat of insulating and non-hygroscopic material intended to effectively provide an electrically safe barrier on which a person can stand, kneel or be otherwise supported.
Insulating Operating Gloves	A natural, all-rubber glove or of equivalent material for indirect contact with energised high voltage conductors. Referred to as class "0" or "1000 v working gloves".
Insulating Tool	A tool, which is constructed and insulated for use on, energised low voltage apparatus.
Insulating Working Glove	A natural, all-rubber glove or glove of equivalent material for direct contact with energised low voltage conductors. Referred to as Class "0" or "650V working gloves".
Low Voltage Rescue Kit	assembly of equipment intended for carrying out a rescue from low voltage switchboards, substations, pillars and confined space locations.
Prescribed Electrical Equipment	Is any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire that - a) is - i. used for controlling, generating, supplying, transforming or transmitting electricity at extra low voltage; or ii. operated by electricity at extra low voltage; and b) (b) is placing, or may place, persons or property at electrical risk; and c) (c) is prescribed by regulation.
Personal Protective Equipment (PPE)	Any clothing, equipment or substance designed to be worn by a person to protect the person from risks of injury or illness.

5 REFERENCES

Reference No	Reference Title	Author
Link to Act	Electrical Safety Act (Qld)	Qld Govt
Link to Regulation	Electrical Safety Regulation (Qld)	Qld Govt
Link to CoP	Electrical safety Code of Practice– Managing electrical risks in the workplace	Qld Govt
Link to CoP	Electrical safety Code of Practice– Working near overhead and underground electric lines	Qld Govt
Link to CoP	Electrical safety Code of Practice - Works	
AS/NZS 1336	Eye and face protection - Guidelines	Standards Aust
EN 50321	Electrically Insulating Shoes for Working On Low Voltage Installations	Standards Aust
AS 2210.3	Personal protective equipment, Part 3: Safety footwear	Standards Aust
AS/NZS IEC 61111	Live working - Electrical insulating matting	Standards Aust
IEC 61230	Live working - Portable equipment for earthing or earthing and short-circuiting	Standards Aust
AS 60903	Live working - Electrical insulating gloves for use and testing	Standards Aust
AS 4202	Insulating Covers for Electrical Purposes	Standards Aust
ENA EG1	Substation Earthing Guide	
IEEE 80	IEEE Guide for Safety in AC Substation Grounding	
ENA NENS 09	National Guidelines for the Selection, Use and Maintenance of Personal Protective Equipment for Electrical Hazards	ESAA
"B/D/11/30957"	Procedure - CS-OHS-31 - Electrical Safety Management	CS Energy
"B/D/11/30958"	Procedure - CS-OHS-32 - Maintenance and Testing of Entity Works, Electrical Installations and Equipment	CS Energy
"B/D/11/30939"	Procedure - CS-OHS-11 - Job Safety and Environmental Analysis	CS Energy
"B/D/15/4005"	NFPA 70E 2015	NFPA

6 RECORDS MANAGEMENT

In order 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.

7 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

8 ATTACHMENTS

8.1 Attachment 1 - Selection of Arc Rated Clothing and PPE

8.1.1 Selection Considerations

The selection of arc/flash-protective clothing depends on what thermal energy a worker could be exposed. See Section 7.5.

8.1.2 Electrical Thermal Energy

Electrical thermal energy is determined by the following parameters:

- fault current availability, amps (3 phase, phase-to-ground or phase-to-phase)
- duration of the arc, cycles
- arc length potential – based on bus spacing and voltages
- breaker clearing times
- conducting materials
- enclosures around the arc gap that can increase the exposure energy
- distance from the arc
- source voltage – which only affects the maximum length of the arc

8.1.3 Determining Protection Performance

Clothing performance, in terms of worker protection, is determined by the following factors:

- ease of ignition
- degree and ease of flame spread, both outside and under the clothing
- heat produced during burning
- rate of heat transfer
- ease of extinguishing the flame
- other effects such as melting

8.1.4 JSEA Risk Assessment

A JSEA risk assessment is to be conducted prior to commencing work to identify electrical hazards and suitable control measures.

The risk assessment is to determine the type of protective clothing that gives protection from electrical shock and arc/flash and consider environmental conditions such as temperature and the effects of heat stress.

8.1.5 Arc Flash Risk

The risk of an arc flash should be considered possible if:

- direct contact is made to live conductors (including tools and test instruments)
- working near exposed live conductors (Not IP2X)
- interacting with the plant (e.g. fuse removal)

8.1.6 Calculating the Heat Flux

The thermal arc/flash (heat flux) energy may be calculated with assistance from the Site Electrical Engineer or arc flash studies provided for the electrical plant.

8.1.7 PPE

Personnel must wear the appropriate PPE for the determined Arc Flash Hazard exposure (the PPE is required to protect personnel from injuries greater than 2nd degree burns - (i.e. > 1.2 cal/cm2).

8.2 Attachment 2 - Shock and Arc Flash Hazard Labels and Definitions

Arc flash labels shall be affixed to switchboard panels where arc flash hazard exceeds Category 0 to indicate electrical shock and arc flash hazards when switching or accessing electrical equipment within the panel.

Arc flash labels shall have the following information:

- Shock Hazard Information:
  - Nominal voltage; Restricted Approach Boundary; Limited Approach Boundary
- Arc Flash Hazard information:
  - PPE Category (open panel), PPE Category (closed panel); Incident Energy at Working Distance; Working Distance; Arc Flash Boundary distance

"Electrical Safety Personal Protective Equipment" signage shall be affixed adjacent to a switch room entrance for reference of personnel switching or working on switchboards within the switch room.

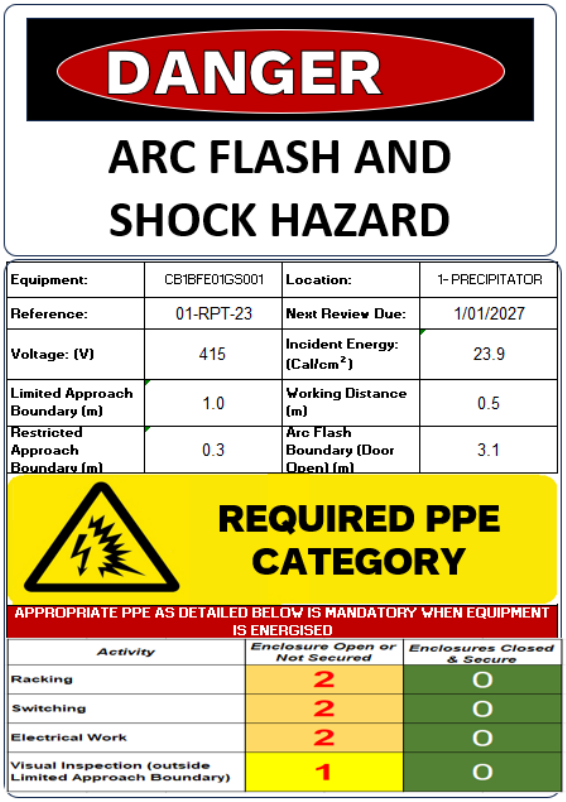

Figure 2 – CS Energy Shock & Arc Flash Hazard panel label example

8.2.1 Arc Flash Hazard Terminology and Definitions

Term	Definition
Arc Flash Boundary	is the minimum safe distance from the source of the electrical arc (exposed energized conductors or circuit parts) where a person without appropriate personal protective equipment (PPE) could receive no burn injury more than a curable second-degree burn from an arc flash, typically defined as 1.2 cal/cm² (5.0 J/cm²) of incident energy.
Limited Approach Boundary	is the distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists. This is the boundary of the exclusion zone for an untrained and unauthorised person. Refer to Schedule 2 of the QLD Electrical Safety Regulations.
Restricted Approach Boundary	is the distance from an exposed energized electrical conductor or circuit part within which even an authorised and trained person should not enter without a competent person completing a risk assessment and having additional controls in place as required. Refer to Schedule 2 of the QLD Electrical Safety Regulations.
IAC	Internal Arc Containment classification of switchboards. For HV (AS62271.200) IAC the switchboard compliance plate will denote IAC to "AS62271.200" or "IEC62271.200", with rating as follows: First Letter – "A" Authorised personnel, and/or "B" general public. Following letters regarding access: "F" Front, "L" lateral (sides), "R" Rear. For LV Arc Containment (AS/NZS3439.1 (superseded) Appendix ZD) the switchboard compliance plate will denote IAC to "AS/NZS3439.1 Appendix ZD"
Working Distance	Working distances are chosen to reflect the length of typical test probes and the operator arm length (IEEE 1584:2002, Table 3). It is defined based on the voltage level.

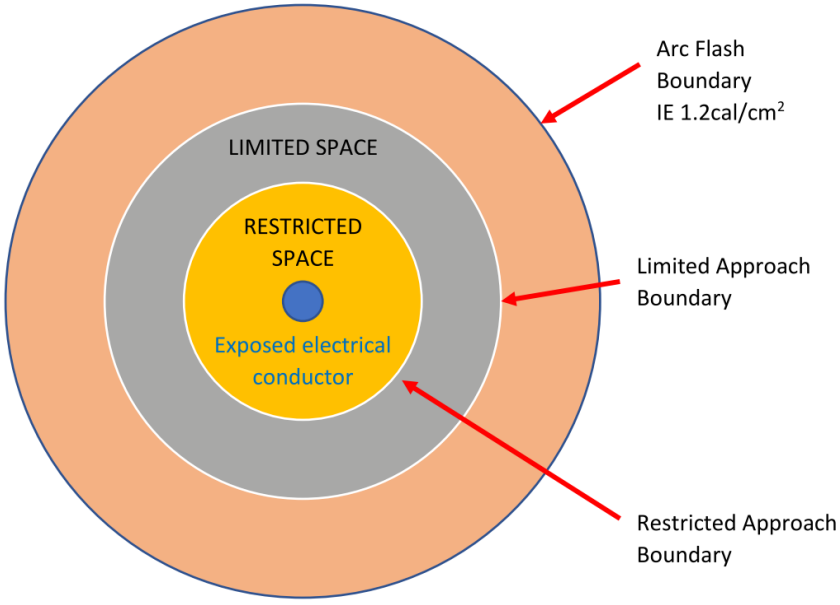

Figure 3 – Limits of Approach Boundaries

8.3 Attachment 3 - Arc Flash Considerations for Direct Current Voltages

Arc flash hazards exist with DC systems. For voltages between 100V and 250V, the Arc Flash PPE Category are as follows (derived from NFPA 70E 2015 Table 130.7 (C) (15) (B)):

Equipment Condition	Arc Flash PPE Category	Arc Flash Boundary
Short circuit current <4kA	1	900mm
4kA ≤ short circuit current < 7kA	2	1.2m
7kA ≤ short circuit current <15kA	3	1.8m

For voltages between 250V and 600V, the Arc Flash PPE Category are as follows (derived from NFPA 70E 2015 Table 130.7 (C) (15) (B)):

Equipment Condition	Arc Flash PPE Category	Arc Flash Boundary
Short circuit current <1.5kA	1	900mm
1.5kA≤ short circuit current <3kA	2	1.2m
3kA ≤ short circuit current <7kA	3	1.8m
7kA ≤ short circuit current <10kA	4	2.5m

8.4 Attachment 4 - Electrical Safety Personal Protective Equipment

Arc Flash Category	Personal Protective Equipment required	Recommended Arc Rated PPE
Category 0 (incident energy up to 1.2 calories/ cm^2)	• Long sleeved shirt and long pants cotton clothing – this level of clothing provides no appreciable protection from arc/flash hazard energies. • Non –conductive safety glasses, safety helmet and safety footwear (leather – AS/NZS 2210.1) or as required by site minimum site personal protective equipment. • Voltage rated insulating gloves where shock hazards exist.	• Untreated cotton clothing minimum 185 grams/m^2 • Cotton is not considered arc rated material
Category 1 (incident energy between 1.2 and 4 cal/cm^2)	• Arc rated long sleeve shirt and arc rated long pants or arc rated coveralls with minimum ATPV rating of 7.8 cal/cm^2 • Hearing protection, safety footwear (leather), safety helmet, non-conductive safety glasses as per category 0, and • Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.	EITHER - • Arc Rated shirt with minimum rating of 7.8 cal/cm^2 ATPV rating • Arc Rated pants with minimum rating of 7.8 cal/cm^2 ATPV rating, OR - • Arc Rated coveralls with a minimum of 7.8 cal/cm^2 ATPV rating
Category 2 (incident energy between 4 and 7.8 cal/cm^2)	• Arc rated long sleeve shirt and arc rated long pants or arc rated coveralls with minimum ATPV rating of 7.8 cal/cm^2 • Hearing protection, safety footwear (leather), safety helmet, arc rated sealed safety glasses, and • Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection. • Arc Rated Face Shield (APTV≥ 7.8 cal/cm^2) • Arc Rated balaclava (APTV ≥7.8cal/cm^2)	EITHER - • Arc Rated shirt with minimum rating of 7.8 cal/cm^2 ATPV rating • Arc Rated pants with minimum rating of 7.8 cal/cm^2 ATPV rating, OR - • Arc Rated coveralls with a minimum of 7.8 cal/cm^2 ATPV rating.

Arc Flash Category	Personal Protective Equipment required	Recommended Arc Rated PPE
Category 3 (incident energy from 7.8 to 25 cal/cm^2)	• Arc Rated Hood (to 25 cal/cm^2) • Hearing protection, Safety footwear (leather),arc rated sealed safety glasses and • Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection. • The combined arc rated clothing is to have a minimum ATPV rating of 25 cal/cm^2 (this may involve multiple layers of arc rated clothing or arc rated flash suit)	EITHER – Two layers consisting of: • First Layer - arc rated long sleeve shirt and arc rated long pants or coveralls with minimum ATPV rating of 7.8 cal/cm^2 • Second Layer - arc rated coveralls with a minimum ATPV rating of 9.6 cal/cm^2 OR • Arc rated switching suit, including leggings, jacket and hood with a minimum ATPV rating of 25 cal/cm^2 with arc rated long pants or leggings.
Category 4 (incident energy from 25 to 40 calories/cm^2)	• The combined arc rated clothing is to have a minimum ATPV rating of 40 cal/cm^2 (this may involve multiple layers of arc rated clothing or arc rated flash suit) • Hearing protection, Safety footwear (leather),arc rated sealed safety glasses and • Arc flash protective hood (incorporating safety helmet) or hood cape rated to (or exceeding) the arc flash rating, • Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.	EITHER – Two layers consisting of: • First Layer - arc rated long sleeve shirt and arc rated long pants with minimum ATPV rating of 7.8 cal/cm^2 • Second Layer - arc rated switching coat and leggings or bib overalls (to protect the lower legs) with a minimum ATPV rating of 38 cal/cm^2 OR • Arc rated flash suit, pants and jacket with a minimum ATPV rating of 40 cal/cm^2
Category 5 (where incident energy is >40 cal/cm^2)	• Arc flash energy levels of greater than 40 cal/cm^2 are considered highly likely to produce an arc blast. The consequences of arc blast cannot be mitigated through PPE. • Live work is not permitted on boards rated greater than 40 cal/cm^2.	Only work on these boards de-energised.

8.5 Attachment 5 - Care and Use of Arc Rated Clothing Care (TecaSafe material)

Special Precaution: Only wash Arc Rated clothing with other Arc Rated clothing.

GENERAL	
Sorting	Sort the washing per colour and/or degree of soiling. When washing dyed and/or printed clothing, wash light and dark colours separately. Wash all flame inhibiting clothing separately from other clothing, in order to avoid the transfer of foreign flammable fibres or other materials.
Detergent for colours	For colours, use a detergent without optical whites, whenever possible.
Dehydration	Press with an adapted low pressure, or for a short period of time.
Drying	Drying in a finisher/tunnel gives a better appearance and less shrinkage than drying in a tumbler. Avoid excessive drying as this can damage the fabric.
Accessories	Hard materials (buttons/zips) can cause wear and tear.
Stain removal	Wash the clothing regularly to avoid fixation of stains.
HEAT- AND FLAME RESISTANT PROPERTIES	
Rinsing heat- and flame-resistant material	Rinse with soft water. Detergent residues can negatively influence the flame-retardant properties.
Negative effect on flammability	Do not allow the clothing to become excessively soiled, as this can have a negative effect on the flammability. It is better to increase the cleaning frequency.
Post-wash treatment	Softeners can negatively affect flame-retardant properties. A softener should only be applied to flame-retardant garments once its effect on the fire-resistant properties of the fabric has been tested.