



# CS ENERGY OPERATIONS PROCEDURE FOR SELECTION, MAINTENANCE AND USE OF ELECTRICAL SAFETY EQUIPMENT AND PERSONAL PROTECTIVE EQUIPMENT CS-OHS-34

Responsible Officer: Electrical Services Engineering Manager  
Responsible Manager: Group Manager Asset Manager  
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## DOCUMENT HISTORY

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## CONVENTIONS USED IN THIS DOCUMENT

### Overview

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



### Warnings

This displays critical information and must be followed.



### Note

Additional information or tips.



### Business Rules or Requirements

Highlights specific rules or requirements.



## 1 INTRODUCTION

**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

**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

**Contents**

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### 2.1 General

**Mandatory PPE**

CS-OHS-50 Personal Protective Equipment stipulates the PPE to be worn at all



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times whilst working at the power station sites.

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**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 7.4 – Electrical Safety Personal Protective Equipment.

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**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.

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**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.

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**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.

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**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.

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**Note**

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



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



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**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.

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**Arc Flash Incidents**

In some instances design of switchboard cubicles may include enclosed switchgear that has been rated for arc flash incidents. In those instances where the switchgear cubicle is designed and rated for arc flash energies is work on the cubicles with the doors closed would only require Level 0 rated PPE – refer to Section 7.2

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**2.2 Insulated Tools**

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**Rules**

Insulated tools 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 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.

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**Site Obligations**

Sites are to provide a number of insulated tool sets, which are to be controlled / issued from the stores, and are to be returned after use, such as Insulated Mats, Covers and Barriers

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**Insulated Barriers**

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

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**Insulating Mats**

Insulating mats used with equipment rated at voltages less than 650 volts are to be used and tested in accordance with AS/NZS 2978 – Insulating Mats for Electrical Purposes.

Insulating mats are to be a minimum thickness of 6mm for general-purpose use or 3mm for restricted use indoors on surfaces free from projections.

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**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



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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.

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**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
- 

**Labelling**

Insulating mats, covers and barriers are to be individually labelled or marked 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.

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**Washing & Testing**

Insulating mats, covers and barriers are to be washed at intervals not more than six months. Insulating mats are to be tested as specified by AS 2978 at intervals not more than six months.

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**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.

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## 2.3 Insulating Gloves

**Minimum Requirements**

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CS Energy personnel are to ensure insulating gloves are marked in accordance with AS 2225 – Insulating Gloves for Electrical Purposes.

Insulating gloves are to be a minimum length of 360mm and are to be individually labelled or marked with a means of establishing the last test date and next test date due.

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**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.

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**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.

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**Cleaning and Storage of Gloves**

Insulating gloves are to be washed and tested at intervals not less 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.

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**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.

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## 2.4 Face Shields & Goggles

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**AS/NZS 1336**

Personnel are to wear eye protection on site in accordance with AS/NZS 1336 – Recommended Practices for Occupational Eye Protection.

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
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**Eye Protection**

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

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**Face Shields**

Face shields that provide protection from flash burns are to be worn on site when undertaking the following:

- when conducting live electrical work with arc flash hazards
  - when isolating electrical equipment where arc flash energy potential hazards have been identified
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## 2.5 Arc Rated Clothing

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**Minimum Standards**

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:

- in line with the requirements of Section 7.1 Selection of Arc Rated Clothing and PPE
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- for arc flash rating locations  $>1.2 \text{ cal/cm}^2$  be a minimum of category 2 arc flash rated clothing
  - 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 see Section 7.5 – Care and Use of Arc Rated Clothing Care (TecaSafe material)
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**Pre Use**

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.

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**JSEAs & 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
- the availability of drinking water
- rotating personnel through the work

They must also take into account the requirements of Section 7.1 Requirements for Electrical Safety and Section 7.2 Selection of Arc Rated Clothing and PPE.

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**2.6 Safety Footwear**

**Mandatory requirements**

Electrically rated safety footwear is to be worn by persons involved in high voltage electrical work.

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**2.7 Portable Earthing Devices (PED)**

**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).

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**Approved Design**

PEDs are to be of an approved design 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,
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- due date for test,
  - manufacturer, and
  - unique identifier.
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**Minimum Rating**

PEDs used as 'operator' earths shall have a rating in excess of the fault current rating of the location.

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**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.

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**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.

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**2.8 Low Voltage Rescue Kits**

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**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.

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**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.

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**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.

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**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
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- List of rescue kit contents
  - Date of last inspection
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**Note**

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

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**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.

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**Required Signage**

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

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**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.

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**Contents Listing**

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

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### 3 TRAINING

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**Purpose**

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.
-



**Note**

Additional training details in relation to what personnel may perform what types of electrical work, safety observers, etc is detailed within CS Energy's Electrical Safety Procedure.

## 4 DEFINITIONS

Term	Definition
<b>ATPV</b>	Arc Thermal Performance Value
<b>Competent Person</b>	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.
	<p><b>Note</b></p> <p><i>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.</i></p>
<b>Electrical Equipment</b>	<p>Is any apparatus, appliance, cable, conductor, fitting, insulator, material, meter or wire:</p> <ul style="list-style-type: none"> <li>used for controlling, generating, supplying, transforming or transmitting electricity at a voltage greater than extra low voltage, or</li> <li>operated by electricity at a voltage greater than extra low voltage, or</li> <li>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</li> <li>is, or is part of, a cathodic protection system.</li> </ul>
	<p><b>Note</b></p> <p><i>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</i></p>
<b>Electrical Installation</b>	<p>Is a group of items of electrical equipment that-</p> <ul style="list-style-type: none"> <li>are permanently electrically connected together, and</li> <li>do not include items that are works of an electricity entity, and</li> <li>can be supplied with electricity from the works of an electricity entity or from a generating source.</li> </ul>
	<p><b>Note</b></p> <p><i>An item of "electrical equipment" may be part of more than 1 electrical installation and for item one above:</i></p> <ul style="list-style-type: none"> <li><i>an item of electrical equipment connected to electricity by a plug and socket outlet is not permanently electrically connected, and connection achieved through using works of an electricity entity is not a consideration in determining whether or not electrical equipment is electrically connected.</i></li> </ul>
<b>Insulating Cover</b>	cover of insulating and non-hygroscopic material intended to effectively prevent contact with any conductive material adjacent to the work position.
<b>Insulated Crook</b>	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.
<b>Insulating Mat</b>	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.
<b>Insulating Operating Gloves</b>	a natural, all-rubber glove or of equivalent material for indirect contact with energised high voltage conductors. Referred to as Class "O" or "1000V working gloves".
<b>Insulating Tool</b>	a tool, which is constructed and insulated for use on, energised low voltage apparatus.
<b>Insulating Working Glove</b>	a natural, all-rubber glove or glove of equivalent material for direct contact with energised low voltage conductors. Referred to as Class "O" or "650V working gloves".
<b>Low Voltage Rescue Kit</b>	assembly of equipment intended for carrying out a rescue from low voltage switchboards, substations, pillars and confined space locations.



Term	Definition
<b>Personal Protective Equipment (PPE)</b>	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
<a href="#">Link to Act</a>	Electrical Safety Act 2002 (Qld)	Qld Govt
<a href="#">Link to Regulation</a>	Electrical Safety Regulation 2013 (Qld)	Qld Govt
<a href="#">Link to CoP</a>	Code of Practice – Working Near Exposed Live Parts 2010 (Qld)	Qld Govt
<a href="#">Link to CoP</a>	Code of Practice – Electrical Work 2010 (Qld)	Qld Govt
<a href="#">SAI Global</a>	AS/NZS 1336 – Recommended Practices for Occupational Eye Protection	Standards Aust
<a href="#">SAI Global</a>	AS/NZS 1801 – Occupational Protective Helmets	Standards Aust
<a href="#">SAI Global</a>	AS/NZS 2210 – Occupational Protective Footwear	Standards Aust
<a href="#">SAI Global</a>	AS/NZS 2978 – Insulating Mats for Electrical Purposes	Standards Aust
<a href="#">SAI Global</a>	AS/NZS 4836 – Insulating Mats for Electrical Purposes	Standards Aust
<a href="#">SAI Global</a>	AS 2225 – Insulating Gloves for Electrical Purposes	Standards Aust
<a href="#">SAI Global</a>	AS 4202 – Insulating Covers for Electrical Purposes	Standards Aust
<a href="#">SAI Global</a>	NENS 09-2006 – National Guidelines for the Selection, Use and Maintenance of Personal Protective Equipment for Electrical Hazards	ESAA
<a href="#">"B/D/11/30957"</a>	Procedure - CS-OHS-31 - Electrical Safety Management	CS Energy
<a href="#">"B/D/11/30958"</a>	Procedure - CS-OHS-32 - Maintenance and Testing of Entity Works, Electrical Installations and Equipment	CS Energy
<a href="#">"B/D/11/30939"</a>	Procedure - CS-OHS-11 - Job Safety and Environmental Analysis (JSEA)	CS Energy
<a href="#">"B/D/15/4005"</a>	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 where it has been identified that there are changes in technology, legislation, standards, regulations 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.

CS Energy 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 CS Energy business must be retained in line with minimum retention periods as detailed in legal retention and disposal schedules.



## 7 FURTHER INFORMATION

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## 7.1 Requirements for Electrical Safety – Electrical Safety Equipment

Control measures required for all live electrical work:
Authorised electrical worker only to perform the live electrical work wearing arc rated clothing
Up-to-date electrical drawings are to be referenced prior to commencing work.
OIC, authorised electrical worker, assistants and safety observer are to prepare a JSA and be informed of, and have an understanding of the work to be performed
All isolation points are to be identified by appropriate signage for the purpose of rescue
Rescue kit is to be checked and placed at the isolation point or in close proximity to the work area
Only insulated tested tools and test equipment that have been checked are to be used
All personnel are to remove metal objects ( <i>i.e. jewellery, belt buckles, watches, coins, pens, mobile phones etc.</i> )
An authorised Safety Observer: <ol style="list-style-type: none"> <li>1. is to be in attendance for all live electrical work and wear the correct PPE for the task,</li> <li>2. is to be fully briefed on the nature of the work, potential hazards, as well as the isolation points for the work being performed,</li> <li>3. is to be available for the entire duration in which live electrical work is to be performed, and</li> <li>4. is to understand their role is to continuously observe what the electrical worker is doing, give warnings when hazards are observed, provide assistance in the case of an emergency, perform rescue and resuscitation, control access to the work site and to not be distracted.</li> </ol>
As a minimum, clothing with arc rated properties (no metal threads or studs, etc) covering the full body, arms and legs is to be worn by Electrical Worker(s) and Safety Observer(s) involved with the work. Any other protective devices to be worn or used are not to contain metal.
Electrically rated gloves checked for damage and currency of test date are to be used - <i>Gloves must be insulated to the highest potential voltage expected for the work being undertaken.</i>
Safety glasses without metal frames are to be used
Additional controls to consider depending on the nature of the work:
Live electrical maintenance work <ul style="list-style-type: none"> <li>• <b>mandatory</b> for an authorised and licensed electrical worker to perform the work with a safety observer</li> <li>• <b>mandatory</b> for barriers to be in place to restrict unauthorised access to the work area</li> </ul>
Work involving: 1) high and low voltage isolations, or 2) work in the vicinity of battery banks, or 3) work on low voltage electrical equipment protected by a device >30A, 4) live work, 5) commissioning, 6) fault finding, and 7) testing to prove de-energised it is <b>mandatory for the electrical worker and safety observer to wear arc rated clothing covering full body, arms and legs.</b> <i>The electrical worker has the option to wear arc rated clothing for other electrical work</i>
Work while standing on a conductive surface or work adjacent to live exposed parts <ul style="list-style-type: none"> <li>• <i>electrically rated rubber mats, checked for damage and currency of test date are to be placed on the floor surface</i></li> <li>• <i>insulated barriers or earthed shields to cover live parts are to be put in place</i></li> </ul>
Work involving the need to adopt tight or cramped postures <ul style="list-style-type: none"> <li>• <i>select a body position such that involuntary actions (sneezing/coughing) will not cause contact with exposed parts</i></li> <li>• <i>insulated barriers or earthed shields to cover live parts are to be put in place</i></li> </ul>
Alternate supply sources present <ul style="list-style-type: none"> <li>• <i>isolate alternative supplies, place 'isolate here' signs on alternate supply isolation points and/or place insulated barriers over live parts</i></li> </ul>
Capacitors require discharging <ul style="list-style-type: none"> <li>• <i>use appropriate discharge device</i></li> </ul>





## 7.2 Selection of Arc Rated Clothing and PPE

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### **Selection Considerations**

The selection of arc/flash-protective clothing depends on what thermal energy a worker could be exposed. See Section 7.4.

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### **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
- 

### **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
- 

### **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.

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### **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 around exposed live conductors (Not IP2x)
  - interacting with the plant (e.g. fuse removal)
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**Proven De-energised**

Where the arc flash risk is category 3 or above, the use of a safety observer is mandatory. The safety observer shall stand outside the arc flash boundary during work.

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**Calculating the Heat Flux**

The thermal arc/flash (heat flux) energy may be calculated with assistance from the Registered Professional Site Electrical Engineer using the equations outlined below or arc flash studies provided for the electrical plant. The heat flux can be compared to the values given in the Table at Section 7.4.

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**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/cm<sup>2</sup>).

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### 7.3 Calculating Arc Thermal Energies – Heat Flux

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**Heat Flux Formula – Single Phase**

The formula used to calculate the heat flux values are:

$$\text{Heat Flux (cal/cm}^2\text{)} = 1.4667 \times 10^{-4} \times t \times I_{\text{rms}}^2 / r^2$$

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**Double Phase**

The formulae for two phase (only) faults can be determined by doubling the result of the single-phase heat flux calculation.

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**Three Phase**

The formula for three phase is:

$$\text{Heat Flux (cal/cm}^2\text{)} = 4.4 \times 10^{-4} \times t \times I_{\text{rms}}^2 / r^2$$

T is the fault duration in seconds,

HF is the heat flux in cal/cm<sup>2</sup>

I<sub>rms</sub> is the prospective fault current in amps, and

r is the distance from the arc source in metres.

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## 7.4 Electrical Safety Personal Protective Equipment

Arc Flash Category	Personal Protective Equipment required	Recommended Arc Rated PPE
<b>Category 0</b> (incident energy up to 1.2 calories/ cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Long sleeved shirt and long pants cotton clothing – this level of clothing provides no appreciable protection from arc/flash hazard energies.</li> <li>Non –conductive safety glasses, safety helmet and safety footwear (leather – AS/NZS 2210.1) or as required by site minimum site personal protective equipment.</li> <li>Voltage rated insulating gloves where shock hazards exist.</li> </ul>	<ul style="list-style-type: none"> <li>Untreated cotton clothing minimum 185 grams/m<sup>2</sup></li> <li>Cotton is not considered arc rated material</li> </ul>
<b>Category 1</b> (incident energy between 1.2 and 4 cal/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Arc rated long sleeve shirt and arc rated long pants or arc rated coveralls with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li>Hearing protection, safety footwear (leather), safety helmet, arc rated sealed safety glasses, and</li> <li>Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.</li> </ul>	EITHER - <ul style="list-style-type: none"> <li>Arc Rated shirt with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating</li> <li>Arc Rated pants with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating,</li> </ul> OR - <ul style="list-style-type: none"> <li>Arc Rated coveralls with a minimum of 7.8 cal/cm<sup>2</sup> ATPV rating</li> </ul>
<b>Category 2</b> (incident energy between 4 and 7.8 cal/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Arc rated long sleeve shirt and arc rated long pants or arc rated coveralls with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li>Hearing protection, safety footwear (leather), safety helmet, arc rated sealed safety glasses, and</li> <li>Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.</li> <li>Arc Rated Face Shield (APTV ≥ 7.8 cal/cm<sup>2</sup>)</li> <li>Arc Rated balaclava (APTV ≥ 7.8 cal/cm<sup>2</sup>)</li> </ul>	EITHER - <ul style="list-style-type: none"> <li>Arc Rated shirt with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating</li> <li>Arc Rated pants with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating,</li> </ul> OR - <ul style="list-style-type: none"> <li>Arc Rated coveralls with a minimum of 7.8 cal/cm<sup>2</sup> ATPV rating.</li> </ul>



Arc Flash Category	Personal Protective Equipment required	Recommended Arc Rated PPE
<b>Category 3</b> (incident energy from 7.8 to 25 cal/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Arc Rated Hood (to 25 cal/cm<sup>2</sup>)</li> <li>Hearing protection, Safety footwear (leather), arc rated sealed safety glasses and</li> <li>Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.</li> <li>The combined arc rated clothing is to have a minimum ATPV rating of 25 cal/cm<sup>2</sup> (this may involve multiple layers of arc rated clothing or arc rated flash suit)</li> </ul>	EITHER – Two layers consisting of: <ul style="list-style-type: none"> <li><u>First Layer</u> - arc rated long sleeve shirt and arc rated long pants or coveralls with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li><u>Second Layer</u> - arc rated coveralls with a minimum ATPV rating of 9.6 cal/cm<sup>2</sup></li> </ul> <u>OR</u> Arc rated switching suit, including leggings, jacket and hood with a minimum ATPV rating of 25 cal/cm <sup>2</sup> with arc rated long pants or leggings.
<b>Category 4</b> (incident energy from 25 to 40 calories/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>The combined arc rated clothing is to have a minimum ATPV rating of 40 cal/cm<sup>2</sup> (this may involve multiple layers of arc rated clothing or arc rated flash suit)</li> <li>Hearing protection, Safety footwear (leather), arc rated sealed safety glasses and</li> <li>Arc flash protective hood (incorporating safety helmet) or hood cape rated to (or exceeding) the arc flash rating,</li> <li>Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.</li> </ul>	EITHER – Two layers consisting of: <ul style="list-style-type: none"> <li><u>First Layer</u> - arc rated long sleeve shirt and arc rated long pants with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li><u>Second Layer</u> - arc rated switching coat and leggings or bib overalls (to protect the lower legs) with a minimum ATPV rating of 38 cal/cm<sup>2</sup></li> </ul> <u>OR</u> <ul style="list-style-type: none"> <li>Arc rated flash suit, pants and jacket with a minimum ATPV rating of 40 cal/cm<sup>2</sup></li> </ul>
<b>Category 5</b> (where incident energy is >40 cal/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Arc flash energy levels of greater than 40 cal/cm<sup>2</sup> are considered highly likely to produce an arc blast. The consequences of arc blast cannot be mitigated through PPE.</li> <li>Live work is not permitted on boards rated greater than 40 cal/cm<sup>2</sup>.</li> </ul>	Only work on these boards de-energised.



## 7.5 Care and Use of Arc Rated Clothing Care (TecaSafe material)

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

<b>GENERAL</b>	
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 fibers 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.
<b>HEAT- AND FLAME RESISTANT PROPERTIES</b>	
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.