



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

Responsible Officer: Health and Safety Manager

Approved: General Manager Operations

**Contents**

1.0 Purpose..... 1  
2.0 Scope..... 2  
3.0 Definitions ..... 2  
4.0 Electrical Safety Equipment and Tools ..... 3  
    4.1 General..... 3  
    4.2 Testing Equipment ..... 4  
    4.3 Insulated Tools ..... 4  
    4.4 Insulated Mats, Covers and Barriers ..... 5  
    4.5 Insulating Gloves..... 5  
    4.6 Face Shields & Goggles..... 6  
    4.7 Flame Retardant Clothing ..... 6  
    4.8 Safety Helmet..... 7  
    4.9 Safety Footwear ..... 7  
5.0 Rescue Equipment ..... 7  
    5.1 General..... 7  
    5.2 Low Voltage..... 7  
6.0 Training ..... 8  
7.0 Legislative and CS Energy References ..... 8  
8.0 Associated Documentation..... 9  
    Attachment 1 – Requirements for Electrical Safety – Electrical Safety Equipment..... 9  
    Attachment 2 – Selection of Flame Retardant Clothing and PPE..... 10

Issue Date	Nature of Changes
02/11/2005	Original draft issue
06/04/2010	Changes issued to include ppe for electrical shock hazards
06/06/2010	Changes made to the arc flash chart and arc flash rated switchgear cubicles

**1.0 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, and
- electrical safety personal protective equipment and clothing.

## 2.0 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, the *Maintaining Electrical Installations Procedure* should be referred to for specific electrical installation information.

## 3.0 Definitions

### Competent person

a person who has through a combination of training, education and experience, acquired knowledge and skills enabling that person to perform correctly the specified task.

### Electrical equipment

for the scope of this procedure, means any apparatus or appliance such as a tool, extension lead, portable power board, light, computer equipment, kitchen appliance, etc that is connected to a mains power supply at a CS Energy Power Station or workplace.

### Electrical installation

is a group of items of electrical equipment, if:

- all the items are permanently electrically connected together, and
- the items do not include items that are works of an electricity entity, and
- electricity can be supplied to the group from the works of an electricity entity or from a generating source.

*Note: an item of "electrical equipment" can be part of more than 1 electrical installation and for item one above:*

- *an item of electrical equipment connected to electricity by a plug and socket is not permanently electrically connected, and*
- *connection achieved through using works of an electricity entity must not be taken into consideration for deciding whether items of electrical equipment are 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 "O" or "1000V 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 "O" or "650V working gloves".

**Low voltage rescue kit**

assembly of equipment intended for carrying out a rescue from low voltage switchboards, substations, pillars and similar confined space locations.

**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.

**Safety helmet**

a helmet including all component parts necessary for proper functioning, primarily intended to protect the upper part of the person's head against impact and electric shock.

## 4.0 Electrical Safety Equipment and Tools

### 4.1 General

The following items of PPE are to be worn by all personnel, at all times whilst working in on power station sites, irrespective of whether electrical related hazards are present in the tasks that are being undertaken:

- safety helmet,
- long sleeved high visibility (day visibility) shirt (100% cotton – 185 grams/m<sup>2</sup>),
- long pants (100% cotton - 185 grams/m<sup>2</sup>),
- safety footwear,
- safety glasses in and around plant, and designated workshop areas, and
- ear plugs/muffs in designated hearing protection areas.

Personal protective equipment (PPE) additional to the items listed above 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.

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.

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.

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.

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.

*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 flame retardant/arc flash protective clothing.*

Guidance on the correct personal protective equipment to be worn when working on electrical equipment is provided in Attachment 1 – Electrical Safety Personal Protective Equipment.

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.

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 1 rated ppe – refer to Attachment 2.

#### **4.2 Testing Equipment**

All electrical test instruments supplied at, or used on CS Energy Power Stations are:

- to be designed for and capable of correctly performing the required test,
- not expose users to a risk of electric shock during correct use,
- the terminals of test equipment should be shrouded,
- where appropriate, test leads and testing devices should be provided with over current protection,
- to be clearly and individually labelled with details of the last test date and next test date due, and
- to be in good working order, clean and have no cracked or broken insulation.

Electrical test instruments that are used in hazardous areas (e.g. in or near explosive dusts and atmospheres) must be suitable for the use (intrinsically safe) and be clearly marked for use in such locations.

Calibration and testing frequencies and procedures are to be undertaken in accordance with the manufacturer's requirements for each type of testing device used.

When voltage detectors such as voltage testers are used to prove de-energisation, they shall be tested for correct operation immediately before use, and again immediately after use, particularly if the test result indicates zero voltage, to confirm that the instrument is working correctly.

Each Power Station is to maintain a register or record of electrical testing devices that details the last test date and next test date due for each device. Test instruments are to be tagged to identify the currency of the item.

#### **4.3 Insulated Tools**

Insulated tools are to be of an approved electrically rated type, kept clean, maintained and tested at intervals not exceeding six months. 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.

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. Where insulated tools are required for live electrical work or for work within "authorised zones" only the CS Energy controlled insulated tools are to be used for the work.

#### **4.4 Insulated Mats, Covers and Barriers**

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

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.

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.

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, and
- defective fastenings.

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.

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.

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.

#### **4.5 Insulating Gloves**

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.

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.

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.

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

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.

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.

#### **4.6 Face Shields & Goggles**

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, and
- the use of face and eye protection when undertaking electrical work where there is an increased risk of arc or flash burn injuries.

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

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

- working on or within the safe approach distance to exposed conductors of live/energised electrical apparatus,
- when conducting live electrical work with arc flash hazards, and
- when isolating electrical equipment where arc flash energy potential hazards have been identified.

#### **4.7 Flame Retardant Clothing**

Flame retardant 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 not inferior to 185 gsm cotton drill with flame retardant treatment,
- 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, and
- be laundered and used in accordance with manufacturer requirements.

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. Flame retardant clothing is to be issued and laundered via site stores processes to ensure that it retains its correct protective properties.

The JSEAs developed for work in flame retardant clothing shall take into account the hazards and control measures associated with heat stress and perspiration. They must also take into account the requirements of Attachment 1 Requirements for Electrical Safety and Attachment 2 Selection of Flame Retardant Clothing and PPE.

#### **4.8 Safety Helmet**

Personnel are to wear safety helmets at all times on CS Energy sites.

Prior to use and at least 6 monthly, safety helmets are to be inspected for, but not limited to:

- dents, cracks or other damage,
- discolouration, weathering or loss of glaze,
- straps condition to ensure a secure fit, and
- modifications that could make the helmet weaker.

Where a safety helmet is identified with a defect or damaged to the extent that it can no longer afford adequate head protection, it is to be destroyed and replaced. Safety helmets are to be cleaned regularly using warm water and soap. Safety helmets are not to be stored in hot places such as on hot plant or vehicle dashboards.

Safety helmets in regular use for more than 3 years are to thoroughly inspected for any damage or discolouration and replaced as deemed appropriate or as per manufacture recommendations.

#### **4.9 Safety Footwear**

Safety footwear is to be worn by all persons at CS Energy Power Stations that are required to work in the plant areas or workshops. Electrically rated safety footwear is to be worn by persons involved in high voltage electrical work.

### **5.0 Rescue Equipment**

#### **5.1 General**

Prior to the commencement of electrical work in the vicinity exposed parts or live work, the contents of 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.

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

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.

#### **5.2 Low Voltage**

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, and
- list of rescue kit contents.

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

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.

“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.

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.

Burns dressings are to be on non-stick material and appropriately sized. If used, burns dressings are to be replaced with new dressings.

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

## 6.0 Training

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, and
- flame retardant 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.*

## 7.0 Legislative and CS Energy References

QLD – Electrical Safety Act 2002

QLD – Electrical Safety Regulation 2002

QLD – Code of Practice – Working Near Exposed Live Parts 2002

QLD – Code of Practice – Electrical Work 2002

AS/NZS 1336 – Recommended Practices for Occupational Eye Protection

AS/NZS 1801 – Occupational Protective Helmets

AS/NZS 2210 – Occupational Protective Footwear

AS 2225 – Insulating Gloves for Electrical Purposes

AS/NZS 2978 – Insulating Mats for Electrical Purposes

AS 4202 – Insulating Covers for Electrical Purposes

AS/NZS 4836 – Safe Working on Low Voltage Electrical Installations

ESAA - National Guidelines for Selection, Use & Maintenance of Personal Protective Equipment for Electrical Hazards

CS Energy – Electrical Safety Management Procedure

CS Energy – Maintenance and Testing of Entity Works, Electrical Installations and Equipment Procedure

CS Energy – JSEA Procedure

## 8.0 Associated Documentation

To provide the reader with additional information as referred to within this procedure, the following documentation has been attached. This includes:

*Attachment 1 – Requirements for Electrical Equipment*

*Attachment 2 - Selection of Flame Retardant Clothing and PPE.*

### Attachment 1 – Requirements for Electrical Safety – Electrical Safety Equipment

<b>Control measures required for all live electrical work:</b>
Authorised electrical worker only to perform the live electrical work wearing flame retardant 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 flame retardant 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
<b>Additional controls to consider depending on the nature of the work:</b>

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, 7) testing to prove de-energised it is
<ul style="list-style-type: none"> <li>• <b>mandatory</b> for the electrical worker and safety observer to wear flame retardant clothing covering full body, arms and legs</li> <li>• the electrical worker has the option to wear flame retardant clothing for other electrical work</li> </ul>
Work while standing on a conductive surface or work adjacent to live exposed parts
<ul style="list-style-type: none"> <li>• electrically rated rubber mats, checked for damage and currency of test date are to be placed on the floor surface</li> <li>• insulated barriers or earthed shields to cover live parts are to be put in place</li> </ul>
Work involving the need to adopt tight or cramped postures
<ul style="list-style-type: none"> <li>• select a body position such that involuntary actions (sneezing/coughing) will not cause contact with exposed parts</li> <li>• insulated barriers or earthed shields to cover live parts are to be put in place</li> </ul>
Alternate supply sources present
<ul style="list-style-type: none"> <li>• isolate alternative supplies, place 'isolate here' signs on alternate supply isolation points and/or place insulated barriers over live parts</li> </ul>
Capacitors require discharging
<ul style="list-style-type: none"> <li>• use appropriate discharge device</li> </ul>

## Attachment 2 – Selection of Flame Retardant Clothing and PPE

### 1.0 SELECTION OF PPE:

The selection of arc/flash-protective clothing depends on what thermal energy a worker could be exposed. Electrical thermal energy is determined by the following parameters:

- fault current availability, amps (phase-to-ground or phase-to-phase),
- duration of the arc, cycles,
- arc length potential – based on bus spacing and voltages,
- breaker clearing times,
- 3 phase arc potential,
- 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.

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

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

## 2.0 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.

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 tables below.

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

## 3.0 CALCULATING ARC THERMAL ENERGIES – HEAT FLUX

The formula used to calculate the heat flux values are:

- a) Single Phase:

$$\text{Heat Flux (cal/cm}^2\text{)} = 1.4667 \times 10^{-4} \times t \times I_{\text{rms}}^{1.12} / r^2$$

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.

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

- c) Three Phase:

$$\text{Heat Flux (cal/cm}^2\text{)} = 4.4 \times 10^{-4} \times t \times I_{\text{rms}}^{1.12} / r^2$$

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.

#### 4.0 PERSONAL PROTECTIVE EQUIPMENT REQUIRED

Arc Flash Level	Personal Protective Equipment required	Recommended Flame Retardant PPE
<b>Level 0</b> (flame resistant clothing 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 flame retardant material</li> </ul>
<b>Level 1</b> (flame retardant clothing with an ATPV rating from 1.2 up to 4.0 calories/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Flame retardant long sleeve shirt and flame retardant long pants or flame retardant coveralls with minimum ATPV rating of 4.0 cal/cm<sup>2</sup></li> <li>Medium rated safety glasses (AS/NZS1337) with side shields and non-metallic frames or polycarbonate safety goggles,</li> <li>Hearing protection, safety footwear (leather), safety helmet, 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>FR shirt with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating</li> <li>FR pants with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating,</li> </ul> OR - <ul style="list-style-type: none"> <li>FR coveralls with a minimum of 7.8 cal/cm<sup>2</sup> ATPV rating</li> </ul>
<b>Level 2</b> (flame retardant clothing with an ATPV rating from 4.0 up to 7.8 calories/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>Flame retardant long sleeve shirt and flame retardant long pants or flame retardant coveralls with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li>Hearing protection,</li> <li>Impact rated face shield rated to (or exceeding) the arc flash rating</li> <li>Safety footwear (leather) and safety helmet, 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>FR shirt with minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating</li> <li>FR pants minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating,</li> </ul> OR - <ul style="list-style-type: none"> <li>FR coveralls minimum rating of 7.8 cal/cm<sup>2</sup> ATPV rating</li> </ul>
<b>Level 3</b> (flame retardant clothing with an ATPV rating from 7.8 up to 25 calories/cm <sup>2</sup> )	<ul style="list-style-type: none"> <li>The combined flame retardant clothing is to have a minimum ATPV rating of 25 cal/cm<sup>2</sup> (this may involve multiple layers of FR clothing)</li> <li>Hearing protection,</li> <li>Arc flash protective hood (incorporating safety helmet) or hood cape rated to (or exceeding) the arc flash rating,</li> <li>Safety footwear (leather), and</li> <li>Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.</li> </ul>	EITHER – <p>Two layers consisting of:</p> <ul style="list-style-type: none"> <li><u>First Layer</u> - flame retardant long sleeve shirt and flame retardant long pants or coveralls with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li><u>Second Layer</u> - FR coveralls with a minimum ATPV rating of 9.6 cal/cm<sup>2</sup></li> </ul> OR <ul style="list-style-type: none"> <li>Flame retardant switching coat with a minimum ATPV rating of 25 cal/cm<sup>2</sup> with FR long pants or leggings.</li> </ul>

**Comment [p1]:** Not required under NFPA70E for this level.

**Comment [s2]:** I suggest we stick with this, that way a consistent approach is maintained.

<p><b>Level 4</b> (flame retardant clothing with an ATPV rating from 25 up to 40 calories/cm<sup>2</sup>)</p>	<ul style="list-style-type: none"> <li>• The combined flame retardant clothing is to have a minimum ATPV rating of 40 cal/cm<sup>2</sup> (this may involve multiple layers of FR clothing or FR flash suit)</li> <li>• Hearing protection,</li> <li>• Arc flash protective hood (incorporating safety helmet) or hood cape rated to (or exceeding) the arc flash rating,</li> <li>• Safety footwear (leather), and</li> <li>• Arc flash and voltage rated insulating gloves or voltage rated gloves with a leather glove outer protection.</li> </ul>	<p>EITHER –</p> <p>Two layers consisting of:</p> <ul style="list-style-type: none"> <li>• <u>First Layer</u> - flame retardant long sleeve shirt and flame retardant long pants with minimum ATPV rating of 7.8 cal/cm<sup>2</sup></li> <li>• <u>Second Layer</u> - FR 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> <p><u>OR</u></p> <ul style="list-style-type: none"> <li>• Flame retardant flash suit, pants and jacket with a minimum ATPV rating of 40 cal/cm<sup>2</sup></li> </ul>
<p><b>Level 5</b> (flame retardant clothing with an ATPV rating greater than 40 calories/cm<sup>2</sup>)</p>	<ul style="list-style-type: none"> <li>• The combined flame retardant clothing is to have a minimum ATPV rating calculated for the arc flash and thermal energies involved in the task being performed (this may involve multiple layers of FR clothing or FR flash suit),</li> <li>• Hearing protection,</li> <li>• Arc flash protective hood (incorporating safety helmet) or hood cape rated to (or exceeding) the arc flash rating,</li> <li>• Safety footwear (leather), and</li> <li>• Arc flash and voltage rated insulating gloves for the rated voltage.</li> </ul>	<p>Any combination of FR clothing that will give the ATPV rating and thermal energies calculated for the task. (e.g. arc flash suit, jacket and pants)</p>

(Note: ATPV = arc thermal performance value. FR = flame retardant)

Assumptions:

1. The levels of protection are based on the NFPA 70E standard as a guide
2. The PPE being used is based on the Queensland Generator's requirements and may differ from that listed in the NFPA70E standard
3. PPE must be available and functional
4. Calculations and formulae for determining heat flux – ATPV are to be based on recognised current technical standards and assessments.