1 PURPOSE
The purpose of this procedure is to specify requirements relating to Earthing, HV switching and to standardise practices when undertaking this work.

2 SCOPE
This procedure applies to personnel that are assessed competent and authorised to apply Earths and HV Switch Snowy Hydro Operational Equipment.

3 PROCESS

3.1 Earthing
Earthing is the task of maintaining apparatus at earth potential.

All work associated with Earthing shall be undertaken by authorised personnel.

Earthing equipment shall be suitably rated for the fault level at the earthing point.

Types of Earths

Operational Earths
Operational Earths are used by authorised operators to maintain the isolated apparatus at Earth potential.

Indicative Earths
Indicative Earths are connected to apparatus which will not be worked on, but is earthed because work near the apparatus may encroach upon Safe Approach Distance.

An authorised operator applies & removes Indicative Earths.

Working Earths
Working Earths may be used where the Operational Earth is remote or whenever there is the possibility that the apparatus could be energised by lightning, induction, etc, and there is a possibility that the Operational Earths may not effectively maintain the apparatus at earth potential.

An authorised person can apply Working Earths, or the work party may request an authorised operator to apply them.

Working Earths are applied as close as possible to the apparatus to be worked on. Working Earths as a control measure is the responsibility of the work party.
3.1.1 Proving De-energised

Safe Approach Distances shall always be maintained when proving de-energised.

The approved “de-energised” testing device shall be checked to ensure correct operation immediately before and after proving de-energised.

In a circumstance where the proving de-energised indicates apparatus is at nominal voltage (alive), do not proceed. A second operator shall confirm the isolations to ensure that all sources of supply are isolated. Earths may only be connected after confirmation of isolation.

3.1.2 Application of Earths

Before applying an earth, the identity of the apparatus and the physical state of the points of isolation shall be visually confirmed.

The apparatus shall be proved de-energised using an approved device as near as practicable to the point to be earthed.

Earths are connected to the system earth before it is connected to the apparatus and shall be disconnected from the apparatus before it is disconnected from the system earth.

Earths shall be tagged with an earth tag. The tie-on section of the earth tag shall be attached to each earth prior to application. The tear-off section of the tag shall be attached to the isolation program or permit or lock box. The two sections shall be matched before restoration of the circuit. Only trailing earths on vehicles, and earths used on spare disconnected high voltage apparatus, are exempt from this requirement.

Earth tag is to be retrieved from the earth when it is removed from the plant and restored to the storage location – it is not to be removed before the earth is removed from plant.

3.1.3 Earthing Points

Permanently installed earthing switches shall be used for the initial earthing of apparatus if possible, even if they will not be part of the final earthing arrangements.

If high voltage apparatus can be energised from a low voltage source (e.g. voltage transformers), the apparatus shall be earthed either on the high voltage or low voltage side.

3.1.4 Visibility of Earth Switch Contacts

When an earth switch is used for earthing apparatus the contacts of the permanently installed earth switch are to be visually checked, where possible, to ensure correct operation.

For fully enclosed earth switches where it is not possible to check the contacts, a positive mechanical indication is necessary to demonstrate it is closed.

3.1.5 Bridges and Bonds

Working on or near conductive apparatus or materials may result in dangerous conditions. These dangerous conditions may be caused from energisation by induction or due to a break in conduction. To alleviate this problem it is necessary to install bridges or bonds to ensure earth conditions are maintained.
3.1.6 Attachment and Removal of Portable Earths within Safe Approach Distance

Where it is not possible to attach a portable earth to high voltage apparatus without part of a person's body maintaining the Safe approach distance (including application of Earth by hand) to the conductor to be earthed the following procedure is used:

- the attachment of an earth may only be performed by an operator when another authorised person is present to assist in the Earthing procedure, and
- all conductors required to be Earthed shall be discharged prior to applying Earths using an approved device by an authorised person maintaining Safe Approach Distance, and
- the approved device used for discharging shall be kept in contact with each conductor, close to the point being earthed before and until such time as the earth is secured. The application of the Earth may be by hand or approved portable earth device.

For removal the following procedure is used:

- the removal of an earth may only be performed by an operator when another authorised person is present to assist in the Earthing procedure, and
- the approved device used for discharging shall be kept in contact with each conductor, close to the Earth point by an authorised person maintaining Safe Approach Distance before and until such time as the applied earth is removed.

3.1.7 Earthing of Overhead High Voltage Lines

Overhead high voltage lines shall be earthed near the work site. The point to be earthed shall first be proved de-energised. Then the earthing device, which has been connected to a system earth, shall be applied to the conductor by means of an approved insulating rod, operating rod or haulage line.

3.1.8 Earthing of Metal Clad Switchgear

The practice of proving de-energised Metal Clad switchgear should be avoided where practicable, as in most cases the risk of testing de-energised may present an unacceptable safety risk.

If the switchgear provides a low risk method for proving de-energised it may be tested (e.g., Holec equipment with the neon test gear is considered low risk). Testing other switchgear (e.g. LMT switchgear) is a high risk and rigorous controls shall be implemented.

3.1.9 Earthing via Remote Operation of a Circuit Breaker

When Earthing via remote operation of a circuit breaker the Operator need not prove de-energised prior to closing the Circuit Breaker if clause 3.1.8 applies.

3.1.10 Earthing Metal Clad Switchgear with Portable Earths

Prior to this work being undertaken a detailed Work Method Statement/s (WMS) shall be approved as it is considered at least a medium risk.

3.1.11 Opening Shutters of Metal Clad Switchgear

Prior to opening shutters on metal clad switchgear a specific detailed Work Method Statement/s (WMS) shall be approved as it is considered at least a medium risk.

3.1.12 Earthing of Capacitors (LV and HV)
Each individual capacitor shall be discharged to earth before it is touched. Persons applying earths to capacitor banks shall maintain safe approach distances.

High voltage capacitors or apparatus containing high voltage capacitors shall not be discharged or earthed until five minutes after the capacitor has been isolated. All terminals (neutral and active) shall be earthed.

For work on capacitor voltage transformers (CVTs), both the high voltage and low voltage conductors shall be earthed.

3.2 Earth Tags
An individually numbered earth tag shall be attached to each earth including earth switches, such that where possible the tag cannot be removed until the earth is removed.

   Earth tags shall show:
   - the relevant isolation / restoration program number or permit number;
   - the date it was attached

The tear-off section of the tag shall be attached to:
   - the isolation program for isolation and indicative earths; and
   - to the permit for working earths, bridges or bonds.

The isolation program or permit number shall be entered on both sections of the earth tag. The two sections shall be matched prior to cancellation of the permit or restoration of the circuit.
Table 1. Summary of Security of Earthing Apparatus and associated Tagging

<table>
<thead>
<tr>
<th></th>
<th>UNCHANGED DURING PERMIT</th>
<th>ALTERED DURING PERMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational Earth</strong></td>
<td>• earth switch: Danger Tag, Earth Tag &amp; Safety Locked</td>
<td>• earth switch: Warning Tag, Earth Tag &amp; Safety Locked</td>
</tr>
<tr>
<td></td>
<td>• portable earth: Danger Tag &amp; Earth Tag</td>
<td>• portable earth: Warning Tag &amp; Earth Tag</td>
</tr>
<tr>
<td><strong>Indicative Earth</strong></td>
<td>• earth switch: Danger Tag, Earth Tag &amp; Safety Locked</td>
<td>• earth switch: ----</td>
</tr>
<tr>
<td></td>
<td>• portable earth: Danger Tag &amp; Earth Tag</td>
<td>• portable earth: ----</td>
</tr>
<tr>
<td><strong>Working Earth</strong></td>
<td>• earth switch: Earth Tag &amp; Safety Locked</td>
<td>• earth switch: Earth Tag &amp; Safety Locked</td>
</tr>
<tr>
<td></td>
<td>• Operator applied: Earth Tag &amp; Safety Locked</td>
<td>• Operator applied: Earth Tag &amp; Safety Locked</td>
</tr>
<tr>
<td></td>
<td>• Recipient applied: Earth Tag &amp; Safety Locked</td>
<td>• Recipient applied: Earth Tag &amp; Safety Locked</td>
</tr>
<tr>
<td></td>
<td>• portable earth: Earth Tag</td>
<td>• portable earth: Earth Tag</td>
</tr>
</tbody>
</table>

Upon finding damaged or detached tags the finder shall immediately report the find to the Operator or Recipient. The Operator or Recipient shall investigate; suspending permits if necessary, and replace the tag on the apparatus that it was securing.

Once removed, the tags shall be disposed of to prevent confusion with tags that may have become detached.

3.3 Removal of Operational Earths during Currency of a Permit

During the currency of a permit it may be necessary for removal of Operational Earths to conduct tests. In this circumstance, where the Operational Earth is to be temporarily removed is an Operational Earth, it shall only be removed by an operator, upon request of the recipient, and will be replaced by an operator immediately following the completion of the checks.

3.4 Recording of Earths

The tear-off section of the Earth tag shall be attached to the restoration program.

Working earths shall be recorded by the recipient on the recipient’s copy of the permit and the tear-off section of the Earth tag shall be attached to the recipients permit.

3.4.1 Inability to Match Earth Tag Sections

In a circumstance where one or both of the sections of the Earth tag are lost or damaged the following will be done prior to removing the earth:
• the operator will be informed of the situation;  
• the operator and another authorised person will witness the removal of the earth;  
• the operator and another authorised person will check all possible earthing points to ensure all  
exthings are removed from the apparatus under permit; and  
• the operator will conduct any necessary tests to prove all earths are removed.

3.5 Earthing and Work on Earth Switches

Work shall not be carried out on Earth Switches that are being used as an Operational Earth. 

When working on Earth Switches that are not being used as an Operational Earth (i.e. Operational  
earths are applied elsewhere in the circuit) it is important that the recipient shall maintain the  
conductors in an earthed condition at all times, (i.e. use working earths and the working earth shall  
not be removed until the work has been completed and/or the earth switch locked closed) 

Conditions may arise where the earth will have to be applied and removed by the working party under  
the operator's supervision.

3.6 Above Ground Earth Mats

When operating high voltage apparatus equipped with bare metal handles attached to an above 
ground Earth Mat, it is necessary to check that the mat is solidly and visibly connected to the  
operating handle and to the system earth.

3.7 Earths or Earth Switches subjected to Fault Current

Portable earthing equipment or earth switches that have been subjected to fault current shall be 
removed from service and reported to the Manager Asset Performance.

3.8 Inspection and Testing of Portable Earths and Operating Equipment

All portable earths and operating equipment will be inspected prior to use and tested periodically as  
required.
4 Personal Protective Equipment when Earthing or Switching
When proving de-energised, connecting/disconnecting earthing or local HV switching the person shall wear appropriate personal protective equipment namely:

<table>
<thead>
<tr>
<th>PPE</th>
<th>Shall meet Aus/NZ Standard</th>
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<tbody>
<tr>
<td>Arc Rated Hard Helmet</td>
<td>AS1801</td>
</tr>
<tr>
<td>Arc Rated Face Shield</td>
<td>AS/NZS 1337</td>
</tr>
<tr>
<td>Arc Rated Switching Coat</td>
<td></td>
</tr>
<tr>
<td>Hi Viz Wet Weather Parka</td>
<td>NENS 09</td>
</tr>
<tr>
<td>17 kV Rubber Insulated Gloves</td>
<td>AS 2225</td>
</tr>
<tr>
<td>(Not required for switch-stick use.)</td>
<td></td>
</tr>
<tr>
<td>Leather Gauntlets to protect rubber gloves</td>
<td>AS/NZS 2161.4</td>
</tr>
<tr>
<td>17 kV Insulated Mat.</td>
<td>AS/NZS 2978</td>
</tr>
<tr>
<td>(Metal clad or metal handles only)</td>
<td></td>
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