

## High Voltage Operating Rods

### Summary

This work instruction supports the Power System Safety Rules and its requirements assembled under

- > Making High Voltage Apparatus Safe for Work – Category 5.5; and
- > Making Overhead Lines Safe for Work – Categories 6.4, 6.5.

It describes equipment which has been approved for use as operating rods on high voltage electrical conductors and the manner in which this equipment shall be used. This work instruction also includes methods for checking equipment along with inspection and maintenance procedures.

### Document Control

<b>Revision no:</b>	4	<b>HP TRIM no:</b>	D2003/1793	<b>Approval/ Review date:</b>	29 September 2020
<b>Business function:</b>	Manage Health And Safety			<b>Document type:</b>	Corporate Work Instruction
<b>Process owner:</b>	Head of Health, Safety and Environment				
<b>Related Procedure/s:</b>	Power System Safety Rules				
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# 1. Purpose

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High voltage operating rods are devices that have been proven safe for a person to remotely perform work on energised HV conductors while maintaining safe working distances. The High voltage operating rod sections are assembled to a length which ensures a safe working distance for the voltage of intended use.

This work instruction shall be used to manage the use and maintenance of high voltage operating rods.

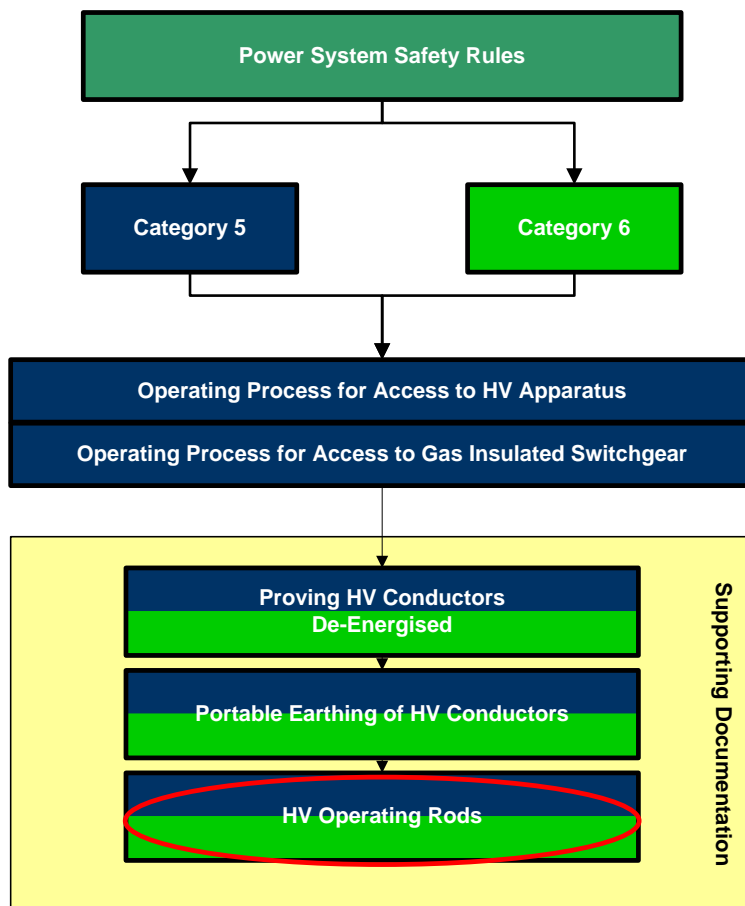
# 2. Scope

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This work instruction provides a general description of approved high voltage operating rods used by TransGrid as well as instructions for their use. Routine testing, maintenance and procurement details are also included.

## 2.1 Document Location

The following block diagram shows the location of this document in relation to other PSSR procedures and work instruction.



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### 3. Definitions

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Key terms and definitions relating to the work instruction

Term	Definition
<b>Effective Length</b>	The length of operating rod from the hand guard to the metal head of the rod.
<b>Extension Section</b>	The component sections of an operating rod set which are assembled, together with the handle, to provide the required insulating length for the particular voltage application.
<b>Handle Section</b>	The component of an operating rod set that includes the hand guard, earth connection point and name plate with assembly information.
<b>Head Section</b>	The component of an operating rod set to which a proving de-energised tester or other fitting is attached.
<b>Operating Rod</b>	A device that has been proven to be safe for a person to remotely perform work on energised HV conductors while maintaining safe working distances. The sections are assembled to a length which provides adequate safety clearance for the voltage of intended use.
<b>Proving De-energised</b>	The act of ensuring a HV conductor is de-energised

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## 4. High Voltage Operating Rods

High voltage operating rods have been approved for contact use at a nominal voltage of 330kV or below and for non-contact use up to 500kV. For all approved applications the effective length of the operating rod must be appropriate for the nominal voltage of the high voltage conductors.

Operation Voltage	Sections	Overall Length
1 kV – 33 kV	2 Handle + one extension	2.5m
66 kV – 132 kV	3 Handle + two extensions	3.7m
220 kV – 330 kV	4 Handle + three extensions	5.0m

It is permissible to use extra rod sections to reach a link or conductor. Provided it is from the same kit. For high conductors the extended kit referred to in section 5.1 shall be used.

### 4.1 Safety

When handling high voltage operating rods in substations or near transmission lines:

- Assemble, extend or otherwise prepare any operating rods on the ground;
- Always carry operating rods below shoulder level;
- Maintain safety clearances when manoeuvring the operating rod past insulator stacks, metal structures etc.; and
- Avoid shorting out the effective length of the operating rod to earth or other HV conductors.

When not in use operating rods are to be stored in their protective covers.

### 4.2 Approved application table

Situation	Notes
Proving HV conductors de-energised	The proving de-energised tester is attached to the end of the assembled operating rod, the length of the operating rod being appropriate for the voltage of the conductors to be proved de-energised.
Earthing	With a link fitting attached to the end of the operating rod, a haulage cord can be fed through an earthing stirrup when applying snap action earthing clamps.
Operating HV links	With a link fitting attached to the end of the operating rod, live operation of link switches, link fuses, etc. is permissible.
Placement of instruments on or near HV conductors	Instruments such as ammeters may be attached to the end of operating rods and raised onto or near live conductors.
Manipulating contacts of disconnectors and earthing switches	If the contacts of a disconnector or earth switch fail to fully close, or remain closed when attempts are made to open the device, a HV operating rod may be used to apply pressure to the contact blade in order to assist the operation.

### 4.3 Assembly

Before assembling the handle and the various extension rods, all components must be examined to ensure the rods are clean and that the surface finish is not damaged.

### 4.4 Protective earth lead

When an operating rod is to be used for any purpose on a 330 kV conductor, the earth lead must always be attached to the stud on the hand piece ferrule and the remote end connected to earth. **The earth lead must be used at all times for 330 kV and in wet weather for 1kV to 220 kV.**

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## 4.5 Wet weather

Whilst HV operating rods provide adequate insulation levels even in wet weather, to further reduce the surface leakage in conditions of rain, mist or fog, an approved silicone impregnated cloth or water displacing wax is to be applied to the length of the rod leaving a water displacing film on the surface.



## 5. Approved equipment

TransGrid's standard High Voltage (HV) operating rod set is a TMAC E3212YW. It consists of four sections, each approximately 1.2 metres in effective length and 32 mm in diameter. Each section comprises a fibreglass tube with an injected foam core. The handle is provided with a hand guard which is located 1 metre from the base of the handle. A brass earthing stud is located 50 mm above the hand guard for attachment of the earth lead. Each extension is added by means of a slide fit action and is held securely in place by a spring operated lock button.

For stowage the components of the rod are packaged in a carry bag as shown below.



### 5.1 Special operating rod sets

For locations with unusually high busbars, such as power station switchyards, special operating rod sets have been obtained.

These special sets consist of standard handle and head sections (1 and 4) with extension sections (2 and 3) that are 1.6 metres in length. In all other aspects the special sections are identical to the standard operating rod sections. Despite being longer, voltage ratings of special sets are the same as those for the standard HV operating rod.

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## 5.2 Procurement

HV operating rod related equipment is available from Store:

Description	Stockcode	UOI
HV operating rod set	3181377	KIT
Replacement "Head" section 1200mm	3512969	EA
Replacement "Extension" section 1200mm	3512936	EA
Replacement "Special Extension" section 1600mm	3512944	EA
Fibreglass repair kit	3512910	KIT
Link adaptor fitting	3603354	EA
Water displacing wax for fibreglass line sticks	361019	TIN
Cleaning compound for fibreglass line sticks	361020	BOTTLE
Silicone wiping cloth for fibreglass line sticks	361022	PKT (1)
Silicone wiping cloths for fibreglass line sticks	361021	BOX (50)

## 6. Maintenance of operating rods

### 6.1 Inspection and cleaning

Before each use, visually inspect the handle and the various extension rods to ensure that the surface finish is not damaged by abrasions, blemishes, cracks and surface deterioration. Any defect within a section of rod is cause for rejection as it may impair the dielectric integrity.



If a section of rod is damaged to the point where the foam core in the centre of the rod could be exposed to moisture, the section is to be destroyed and replaced with a new section which has been HV tested within the previous twelve (12) months. The replacement section of the rod shall be indelibly renumbered to match the set to which it has been added.

Spring operated lock buttons and the thread on the head section is to be checked for serviceable operation. Contaminants such as grease and oil are to be removed with an approved cleaning compound applied with a clean soft cloth or sponge before wiping with a silicone impregnated cloth or water displacing wax over the length of the rod.



### 6.2 Repair

Repairs to the surface coating of operating rods may be made by light sanding and re-coating the approved fibreglass repair kit. Rods which have been repaired must be re-tested before being placed back into service.

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### 6.3 Annual testing and recording

At least once per year, each operating rod section shall be given a power frequency voltage withstand test of 45 kV per 300 mm of rod for a period of one minute. The test may be applied over either the whole length of the insulating material between the operating head and the hand guard, or individual lengths of 300 mm. The rods are to be tested as a set. The leakage current must be constant and shall not exceed 100 micro amps (at 45 kV/300 mm).

Each of the sections of an operating rod set has a common serial number engraved on the spigot. An appropriate recording system of HV operating rod test history shall be kept by the user group responsible for the rods. In addition, an indelible tag shall be attached to the handle section. This tag shall state the date last tested and the date the set is next due for test.

## 7. Accountability

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Responsible person	Responsibility
Head of HSE	Ownership of this work instruction
PSSR Manager	Maintenance of this work instruction
Manager – Training	Implementation of training programs associated with this work instruction
Authorised persons	Comply with this work instruction

## 8. Implementation

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This work instruction is to be implemented in conjunction with the implementation of TransGrid’s Power System Safety Rules. It will be available as a resource, published on the Wire.

## 9. Monitoring and review

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The Head of HSE is responsible for the ongoing monitoring and review of the documents associated with the Power System Safety Rules. This can include but is not limited to:

- (a) Requesting regular feedback on the effectiveness of procedures and work instructions. Appropriate feedback tools include focus groups and online assessments;
- (b) Where a change has occurred in our processes; and
- (c) Recommendations arising from incidents.



## 10. Change from previous version

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Revision no	Approved by	Amendment
4	Jeremy Robert, Acting Executive Manager, Works Delivery	<ul style="list-style-type: none"><li>&gt; Updated to New Format</li><li>&gt; Attachments 1 and 2 updated with additional requirements.</li><li>&gt; Purpose and introduction consolidated.</li><li>&gt; Section 4 updated to clarify when additional sections can be used.</li></ul>

## 11. References

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- > Power System Safety Rules
- > Operating Process for Access to High Voltage Apparatus
- > Proving High Voltage Conductors De-energised
- > Portable Earthing of High Voltage Conductors

## 12. Attachments

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Appendix A - Using a HV operating rod to manipulate contacts on HV apparatus

Appendix B - Sequence of events following defective operation of HV apparatus

## Appendix A Using a HV operating rod to manipulate contacts on HV apparatus

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In the event that a disconnecter or earthing switch does not open or close correctly, the switcher requires a consistent and effective procedure to record and manage the problem. This appendix explains the process to be followed when considering manipulating contacts on HV apparatus with a HV operating rod.

The switcher will encounter this issue at step 7 of the 8 step method which states '*check device has operated and all actions completed correctly*'.

Initially the switcher should confirm that the apparatus is in a fit state to operate. If confirmation is received that the apparatus is in a fit state to operate, the switcher should re-perform steps 1-7 of the 8 step method. This can be repeated a number of times until the switcher knows it is unlikely to correctly operate on subsequent attempts.

At this point the switcher is unable to perform the step as intended by the HVPRI. The switcher must then contact the controller to advise them of the issue and discuss the agreed resolution. The resolution options may be as follows:

1. Amend the HVPRI for an alternate isolation/earthing point
2. Cancel the outage/work due to the unserviceability of the equipment
3. Use a HV operating rod to manipulate contacts on HV apparatus – This should be considered the last resort only and not a standard operating practice.

Not all of the above resolutions will be suitable and discussion should take place between the switcher and the controller to determine the next action.

Relevant factors to consider when determining the next action are:

- If issues are encountered during the preparation steps, are similar issues likely to occur during restoration steps?
- Is there an alternate point of isolation/earthing which is suitable and will have no effect on proposed works?
- Are there portable earthing points available and accessible?
- Is it practical to apply portable earths with the staff and equipment available on site?
- If the issue is with a motorised device, could its use in manual mode be considered?
- Is the switcher confident that the use of a HV operating rod could resolve the issue?
- Can the manual handling hazards of using operating rod be controlled?
- Does the switcher feel physically able to perform the manual handling task?
- Are there any adjacent obstructions that could prohibit the use of an operating rod?
- Will the effective length on the HV operating rod be compromised due to contact with an adjacent structure or phase?
- What are the risks associated with HV operating rod slipping off the point of contact

### A.1 Use of HV Operating Rod to Manipulate Contacts of a disconnecter or earthing switch

Detailed here are the steps to go through if you think you need to use an operating rod to open or close a disconnecter or earth switch.

- 1. Stop!**
- 2. Consider other options. Using an operating rod should be the last resort. It is a sign that the apparatus is not in a serviceable condition and requires further intervention or repair.**
- 3. Complete a Go/No Go risk assessment addressing the key risks associated with this activity:**
  - i. Hazardous manual handling**
  - ii. Near approach to other apparatus**

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- iii. Force required
  - iv. Ground conditions
  - v. Weather conditions
  - vi. Personal Physical Condition.
  - vii. Personal confidence to perform the activity
  - viii. If any of the following are involved it is an **immediate No-Go**:
    - 500kV apparatus,
    - Requires using more than the standard number of operating rod lengths,
    - The switcher cannot stand on the ground to perform the action
    - You are forcing open a disconnect or forcing closed an earth switch.
4. Discuss your Go/No Go assessment with the local works leader. Discuss any risks or hazards you are not sure of. Obtain their endorsement prior to using the operating rod.
5. Prepare to use the Operating Rod for the task:
- Check the condition of all sections of the operating rod and ensure it is within its testing period.
  - Assemble the operating rod with the appropriate number of lengths for the apparatus voltage.
  - Fit the link attachment to the end of the HV operating rod.
  - Fit the protective earth lead if being used at 330kV or in wet weather.
6. Use the Operating Rod to attempt to close/open the switch:
- Holding the operating rod below the hand marker, place the link attachment of the operating rod on the apparatus ensuring that no part of the rod is contacting any other apparatus, its effective length is not compromised and it is located securely on the apparatus.
  - Use the operating rod to apply firm pressure to the apparatus to assist with opening/closing.
  - Once use of the operating rod is completed, recheck the condition of the operating rod to ensure it has not been damaged. If the device successfully closes/opens complete step 8 of the 8 step method and continue with switching until the next blocking step. Advise the controller at the next blocking step that the actions were able to be successfully performed.
  - Complete the remainder of the switching.
  - If unsuccessful discuss next actions with the controller.
- Note:**
- Do not use the end of the rod as a hammer.
  - Do not apply excessive pressure to the apparatus such that it causes significant bending of the operating rod.
  - Do not apply excessive pressure such that other parts of the apparatus are damaged.
7. Complete the switching and then immediately report an AIM Issue detailing that the disconnect required an operating rod to close or that the switching had to be abandoned/changed due to failure of the disconnect or earth switch.

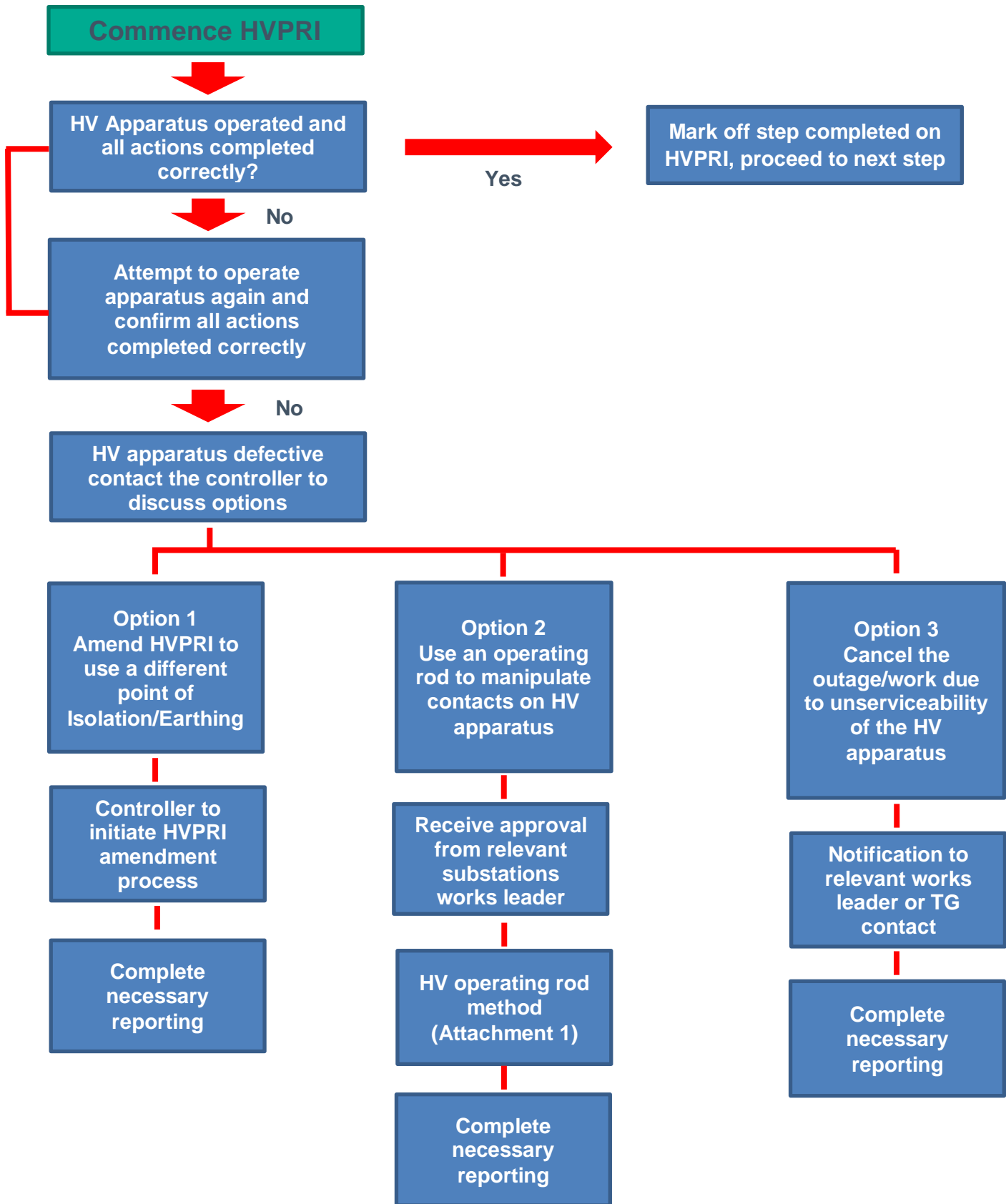
## A.2 Reporting requirements if apparatus does not operate correctly.

HV Apparatus which fails to operate correctly needs to be reported to ensure that the current capability of the network is known and that planning can commence for repair activities. Following the immediate actions to resolve the failure of the apparatus to open or close the following reporting is to take place.

1. The controller is to raise an irregularity report against the defective equipment, this is critical as the switcher may be a 3<sup>rd</sup> party or TG staff unfamiliar with raising issues.
2. The controller is to consider adding a note to the High Voltage Operating Diagram so that future HVPRI's are not affected by the defect.

3. The switcher is to raise an issue in AIM and notify the relevant works leader of the problem. If they are not able to raise the issue they can request the works leader raise it on their behalf. All issues of this nature should have a priority appropriate to the criticality of the plant.

## Appendix B Sequence of events following defective operation of HV apparatus



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