6.10 Substation Insulator Spray-Washing

Purpose

This field instruction provides guidance to all Horizon Power Workers on the safe use of spray-washing equipment when washing substation primary plant insulators, either in a live or de-energised state.

Scope

This field instruction applies to all certified Horizon Power Workers engaged in insulator washing work on:

- Live or de-energised HV apparatus from 6.6 kV up to and including 132 kV
- De-energised washing of 220 kV terminal station equipment.

Safety

Before commencement of work, a risk assessment must be carried out using the Risk Analysis Procedure (OSH-3.6-1-02), to identify and document the hazards and risks associated with the task and ensure appropriate control measures are implemented.

It is important that, appropriate control measures must be identified, documented and implemented in order to control hazards to As Low as Reasonable Practicable (ALARP).

Safety Aspects and Implications

Any Horizon Power Workers performing this task must observe Horizon Power’s general safety requirements.

Proper risk assessment and risk control measures must be implemented.

A Vicinity Authority (VA) permit (auto-reclose set to single shot) must be used for live apparatus.

De-energised apparatus must be treated as live.

A VA is also required for de-energised (but not earthed) apparatus.

Worksite personal protective equipment (PPE) requirements

Approved PPE (Level 1) must be worn at all times when washing high voltage (HV) insulators. For more on this see FI 2.6 Worksite Clothing / PPE Requirements.

Do not use gloves while using:

- HV live line sticks (hot sticks)
- HV insulated washing wand.
Training and authorisation

To perform live substation insulator washing, personnel must:

- have completed a training course from a HP recognised RTO in ‘Electrical substation insulator washing’
- hold a valid Horizon Power authorisation for the task

Non-trade people and electrical apprentices:

- **Must not** perform live substation insulator washing, and are restricted to providing assistance only in performing the task.
- Who have successfully completed a training course from a HP recognised RTO in ‘Electrical substation insulator washing’ and is competent and accredited, may wash in substations that are in a de-energised state.

Instructions

Test and equipment criteria

Testing of insulated sticks associated with the washing wand:

- Dry test every six months.
- See FI 5.4 Testing and Use High Voltage Insulated Equipment in this manual for testing methods and requirements. However, ignore the dry test frequency described in FI 5.4 and keep to the six-monthly testing frequency mentioned above.
- Do not use insulated sticks if the six-monthly due date for the next test has expired.

Earthing:

- Earthing leads must be within their inspection dates. For more on this see FI 8.1 Portable Earthing/Shorting Equipment, in this manual.
- Earth the spray-washing unit and/or vehicle on which it is mounted to the substation earthing system.

The washing environment

Spray washing on energised apparatus must not continue in adverse weather conditions such as rain, heavy mist and fog or in thunderstorm activity.

Work with caution when winds exceed 30 km/h.

Work must not be done when winds exceed 45 km/h.

Water and pump criteria

Ensure that the water container is free of contamination and flush out with low conductivity water before use.

Water must be tested using a conductivity meter. Conductivity must be no higher than two millisiemens / metre.
Before washing commences check the following:

- All hoses are connected and there are no leaks.
- Working pressure on high-pressure wand is suitable (max 2,800 Kpa).
- There is sufficient water in the tank to complete the task.

**Insulators that may be high pressure washed live**

Only certain porcelain/ceramic insulators can be high pressure washed, including:

- Circuit breaker lower insulators (non-circuit interrupting portions).
- Upper (circuit interrupter) portions – this offers a marginally increased risk in relation to safety and asset integrity.
- Post insulators.
- Isolator insulators.
- Current transformer and voltage transformer porcelain sections.

**Limitations:**

- Circuit breaker breathers, site glasses, gauges, seals, insulator section gaskets/flanges or other perforations must not be subjected to pressurised water.
- The insulator must be free of cracks, chips, deteriorated glazing or other surface defects (perform visual check and record on risk assessment).

**Insulators that must be de-energised before high pressure washing**

- 220 kV terminal station equipment.
- Some insulators such as older designed ‘stacked’ insulators or surge arrestor insulators.
- Older designed circuit breakers (typically ones rated 33 kV and below) with arcing horns installed across the lower and upper insulators.

**Note:** At sites that encounter a high rate of surface pollution, the upper portion of the breaker can still be washed live by accredited operators, staying well clear of the head section. However, it is recommended that this washing be done while de-energised.

**Insulators that MUST NOT be high pressure washed**

Irrespective of the type of equipment (e.g. isolators, circuit breakers, transformer bushings, instrument transformers), the following insulator types **must not** be high pressure washed:

- Silicon-coated porcelain insulators.
- Composite (polymeric) insulators.
- Epoxy design insulators – (prone to deep surface cracking).

**Note:** Circuit breaker pole insulator assembly flanges must be avoided, with washing beginning and terminating one full skirt away from any flange or gasket.
Washing the insulators

1. Obtain a VA permit. The location of the spray washing needs to be clearly recorded on the VA permit.

2. At least two people, both trained in the correct washing techniques and procedures, are required per washing unit.

3. Conduct a risk assessment.

4. Ensure that equipment which has automatic reclosing facilities is made inoperative for the duration of the work (i.e. so no reclose is possible).

5. Perform pre-use inspections on insulated sticks, earth leads and other equipment to be used. Damaged items must be tagged with an “Out of Service” warning tag.

6. Clean the fibreglass washing wand with a silicone-impregnated cloth.

7. Maintain a clearance of 450 mm between the nozzle of the wand and the live apparatus and ensure that water pressure does not exceed 2,800 kPa.

8. During washing, one of the team must fulfil the role of safety observer to monitor and warn of:
   - Breaches of minimum clearances.
   - Change in wind direction.
   - Any other hazards.

References

- Occupational Safety & Heath Act 1984
- Occupational Safety & Health Regulations 1996
- SHMS OSH-3.6-1-02 Job Risk Analysis (JRA) Procedure
- SHMS OSH-3.6-1-26 Personal Protective Equipment
- Field Instruction 2.5 Other Personal Protective Equipment
- Field Instruction 2.6 Worksite Clothing / Personal Protective Equipment Requirements
- Field Instruction 2.23 Job Hazard and Risk Management (JRA)
- Field Instruction 4.3 Substation Clearances
- Field Instruction 4.14 Substation Permits
- Field Instruction 5.4 Testing and Use of High Voltage Insulated equipment
- Field Instruction 8.1 Portable Earthing/Shorting Equipment
- Field Instruction 8.21 Work Permits
- Field Instruction 8.24 Network Tag
- IEEE 957 – Guide for cleaning insulators