


Inspection and Testing of Insulated Sticks, Tools and Equipment used for work On or Near Exposed 1500V OHW or Equipment

Document no.	Work description		
D2013/80872	Insulated sticks, tools and equipment used for work on or near 1500 Volt DC Overhead Wiring or Equipment are required to comply with routine inspections and tests to verify their electrical integrity.		
	Scope This document describes the inspection and test requirements for all insulated sticks, tools and equipment used for work on or near 1500 Volt OHW or equipment, such as but not limited to, the following: <ul style="list-style-type: none"> • Dedicated 1500V DC Operating Sticks, • 1500V DC 2-Pole Hollow Tube Conduit (HTC) Testers • Telescopic Height Measuring Sticks • Survey staves, • Cleaning poles, and • Non-conductive measuring tapes. 		
Review date	References		
02/08/2021	<ul style="list-style-type: none"> • PR D 78107 Insulated Sticks, Tools and Equipment used for work On or Near Exposed Electrical Equipment – Inspection, Testing, Care and Maintenance • PR D 78107 FM 01 Test Sheet for Insulated Sticks, Tools and Equipment used On or Near Exposed 1500V • PR D 78700 Working around Electrical Equipment • D2013/80874 PPE for Electrical Work • “Tests of 1500V DC overhead line Survey Staves” – report prepared in June 2004 by T.R. Blackburn and M. Phillip of the School of Electrical Engineering & Telecommunications University of NSW 		
PPE and precautions		Competencies or qualifications	Licences or permits required
PPE	D2013/80874 PPE for Electrical Work	Insulation resistance tests can be performed by a NATA accredited laboratory/calibration provider or a competent electrical person utilising test equipment that is “in calibration” and traceable back to national standards.	N/A
Precaution	Maintain clearance from terminals of live test instruments and equipment under test.		
Tools and equipment required			
<ul style="list-style-type: none"> • Insulation resistance tester (e.g., a Megger) with a 5kV DC output voltage Note: Tester is to be “in calibration” and traceable back to national standards • Timer - stopwatch or clock for time measurement • Lengths of 25mm width copper braid or aluminium foil • Plastic electrical cable ties or suitable rubber bands • Alligator clips for connection of insulation resistance tester leads to the copper braid or aluminium foil. • Cloth 			

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Definitions

These definitions are extracted from [PR D 78700 Working around Electrical Equipment](#).

Term	Means
Work on (exposed electrical equipment)	Work that requires contact with the normally live parts of the electrical equipment, either directly or indirectly.
Work near (exposed electrical equipment)	Work within or potentially within the Safe Approach Distance (SAD). Note: The work near distance varies with the competence of the people performing the work.
 <p>NOTE There is no single specified outer boundary of the area that is “in the vicinity of” as the boundary varies according to each situation and the work method, materials and tools to be used.</p>	
Safe Approach Distance (SAD)	The minimum separation, in air, from an exposed conductor or exposed electrical equipment that must be maintained by a person, or any object held by or in contact with that person (other than insulated objects designed for contact with live conductors), or any mobile plant operated or controlled by that person.

[PR D 78700 Working around Electrical Equipment](#) section 7 contains diagrams to assist in understanding of the distinction between “on” and “near”.

Inspection and Test Philosophy

The Inspection and Test Requirements below are based upon where and how the insulated stick, tool or equipment (the tools or equipment) shall be used, or is likely to be used, and whether the electrically Safe Approach Distance (SAD) from live exposed 1500V Dc OHW or equipment is likely to be infringed, both intentionally and inadvertently.

A risk assessment shall be completed to determine whether a tool or equipment is used for work on or near exposed 1500 Volt DC Overhead Wiring or Equipment. Accordingly “*Electrically Authorised Persons are to assess the risks associated with any work that:*

- *brings a person or work party close to electrical equipment, or*
- *might put them in a position to inadvertently come within the SAD of electrical equipment.”* ([PR D 78700 Working around Electrical Equipment](#) section 5.1)

A risk assessment should include the review of the documented work specific SWI.

A work specific SWI would identify, amongst other things, appropriate PPE, precautions, personal competencies or qualifications, required licences or permits, and provide detailed work instructions on how the tool or equipment should be used to ensure compliance with appropriate electrically Safe Approach Distances. It should of course also document the SAD for that specific work task.

Reviewing the SWI will assist in identifying how a tool or equipment should be used in relation to an electrically Safe Approach Distance (SAD) for that work function.

Knowing the particular work function and the associated SAD, a determination is made as to whether a tool or equipment is used for work “on” or “near” exposed 1500 Volt DC Overhead Wiring or Equipment.

Having determined the category of the tool in relation to the work “on” or “near” exposed electrical equipment definitions, you can then apply the Inspection and Testing Requirements detailed below.

Given the above philosophy some examples of tools or equipment and their application for work on or near “category” are given as follows:

- Dedicated 1500V DC Operating stick – used for work “on”,
- Survey staves – used for work “on”,
- Fibreglass cleaning pole – could be used for work “near” – refer to the work activity described in the work specific SWI to assist in determination,
- Non-conductive measuring tape – should only be used for work “near”.

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Inspection and Test Requirements

Insulated sticks, tools and equipment used for work on or near exposed 1500 Volt DC Overhead Wiring or Equipment, (the tools or equipment) are to be subjected to an inspection and insulation resistance (IR) test in accordance with the guidelines and tables below.

Inspection

Inspections are to be conducted before use, prior to any IR test and in accordance with the following table:

Use of tool or equipment used in relation to exposed 1500V	Inspection in accordance with PR D 78107 Insulated Sticks, Tools and Equipment used for work On or Near Exposed Electrical Equipment - Inspection, Testing, Care and Maintenance	
	Section 9.1 i.e. Before Use & Annually	Section 9.2 i.e. ≤ 3 monthly
On	✓	✓
Near	✓	x

Insulation resistance (IR) test

IR test(s) are to be conducted with the tool or equipment in a wet or dry condition in accordance with the following tables.

IR tests to be conducted as part of an **acceptance** (i.e. new to Sydney Trains) procedure:

Use of tool or equipment in relation to exposed 1500V	Dry condition IR test	Wet condition IR test
On	n/a – See Note below	n/a – See Note below
Near	✓	✓

Note: In relation to tools or equipment to be used **on** exposed 1500 Volt OHW or equipment, a separate acceptance procedure which shall include the supply and review of a full type test report shall be completed.

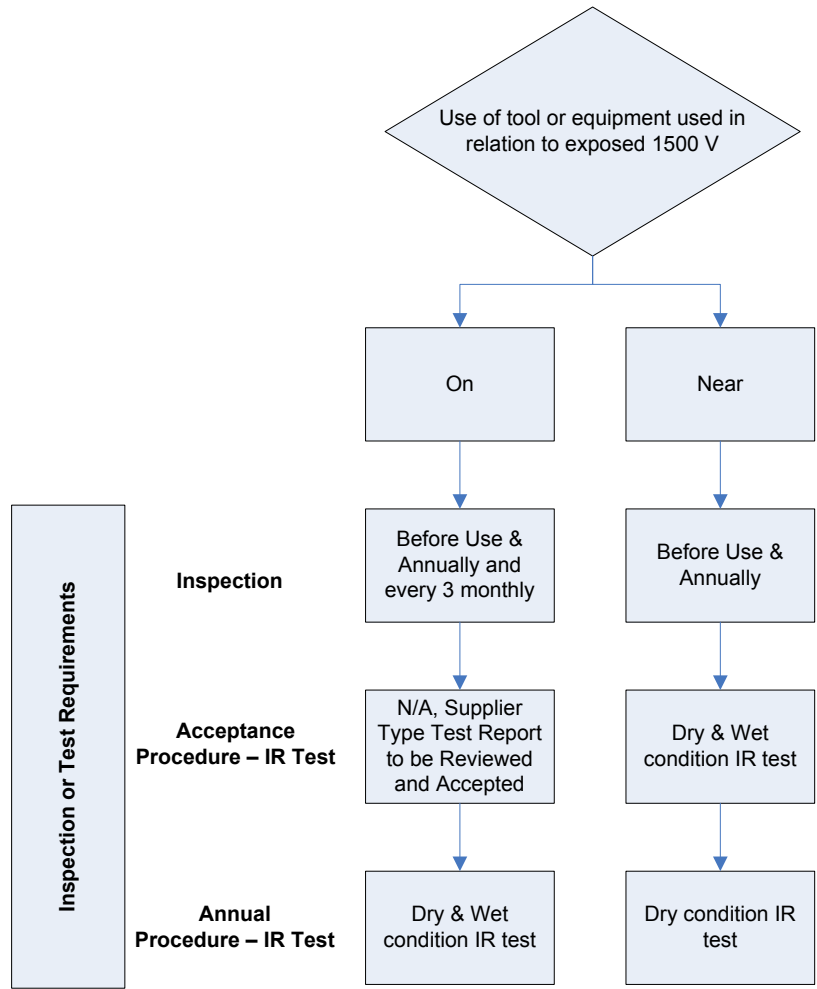
Compliance with this SWI does not satisfy acceptance requirements for tools or equipment used for work on exposed 1500 Volt OHW or equipment.

IR tests to be conducted **annually**:

Use of tool or equipment in relation to exposed 1500V	Dry condition IR test	Wet condition IR test
On	✓	✓
Near	✓	x

The above information is summarised in the flow chart on the following page.

Inspection and Test Flow Chart



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IR Test Procedure

Test Area

Select a test bed that is covered by an insulating material and not in close proximity to any conductive material such as metal, water etc. A non-conducting (e.g. wooden) bench or tabletop would be suitable. Any surface covered with an insulating sheet of material is also acceptable.

Make sure that the test bed and the testing equipment are clean, dry and tidy before commencing any testing.

Make sure that both the insulation resistance tester clamps and the surface of the tool or equipment are free of any dirt, grease or contaminants by wiping them with a clean cloth.

Open and clean each section of the tool or equipment to prepare them for the test.

Test Preparation

- Successfully complete the Before Use Inspection of the tool or equipment as per [SMS-06-EN-0556 Insulated Sticks, Tools and Equipment used for work On, Near or In the Vicinity of Exposed Electrical Equipment –Inspection, Testing, Care and Maintenance](#)
 1. section 9.1.
 2. Select the section of the tool or equipment to be measured and expose it to its full extent.
 3. Attach securely a copper braid electrode at each end of the section length using a plastic cable tie or rubber band. Ensure that the braid does not move over the surface of the section. (Refer to the braid attachment in Figures 5, 6 and 7 below for more details.)
 4. Place the tool or equipment section on the insulating test bed. Ensure that the tool or equipment base will not move on the test bed area during testing. Insulating tape or a plastic clamp may be used for this purpose.
 5. Check correct operation of the insulation resistance tester in accordance with the manufacturer's instructions.
 6. Check that the insulation resistance tester is in the "OFF" position.


Dry Condition Test:

1. Attach the leads from the insulation resistance tester to the braid electrodes using the alligator clips.
2. Keep at least 0.7m away from the tools or equipment during the test.
3. Set the output test voltage to 5kV.
4. Switch "ON" the insulation resistance tester.
5. Apply the voltage to the test section via the braid electrodes, taking careful note of the time of voltage application.
6. Read the insulation resistance value from the meter display exactly one minute after voltage application and record the result.
7. When the test has been completed, turn "OFF" the insulation resistance tester and remove the leads – remove the positive lead clip first, followed by the negative lead clip.
8. Record the result in the Test Sheet. ([SMS-06-FM-0468 Test Sheet for Insulated Sticks, Tools and Equipment used On, Near or In the Vicinity of Exposed 1500V](#))

Wet Condition Test:

1. Submerge the test portion of the tool or equipment in a container of clean tap water for a minimum of 3 hours.
2. Shake the tool or equipment to remove any excessive moisture from the surface.
3. Attach the leads from the insulation resistance tester to the braid electrodes using the alligator clips.
4. Keep at least 0.7m away from the tools or equipment during the test.
5. Set the output test voltage to 5kV
6. Switch "ON" the insulation resistance tester at 5kV.
7. Apply the voltage to the test section electrodes, taking careful note of the time of voltage application.
8. Read the insulation resistance value from the meter display exactly one minute after voltage application and record the result.
9. When the test has been completed, turn "OFF" the insulation resistance tester and remove the leads – remove the positive lead clip first, followed by the negative lead clip.
10. Record the result in the Test Sheet([SMS-06-FM-0468 Test Sheet for Insulated Sticks, Tools and Equipment used On, Near or In the Vicinity of Exposed 1500V](#))

Inspection and Testing of Insulated Sticks, Tools and Equipment used for work On or Near Exposed 1500V OHW or Equipment

Result Criteria	Pass	A PASS is issued if the reading is greater than 50MΩ.
	Fail	A FAIL is issued if the reading is less than or equal to 50MΩ.
		<p>Warning A tool or equipment that fails the test must be removed immediately from service and quarantined from use. Affix a OUT OF SERVICE TAG that clearly states the tool has failed the insulation resistance test to the tool. Quarantine the tool or equipment pending a decision on whether to repair and re-test or destroy the tool or equipment.</p>

Records	For the tools and equipment respectively, test results are to be recorded in the test sheet: SMS-06-FM-0468 Test Sheet for Insulated Sticks, Tools and Equipment used On, Near or In the Vicinity of Exposed 1500V
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Tool or equipment test tag	<p>Place a 'completed' self-adhesive tag, such as that indicated in the sample below on an easily visible location of the insulated tool or equipment that has passed the test.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Tool/Equipment Description</td> </tr> <tr> <td style="padding: 5px;">Asset No.:</td> </tr> <tr> <td style="padding: 5px;"> Tested By: In accordance with SMS-06-SW-0275 <div style="text-align: right; border-bottom: 1px solid black; width: 80%; margin: 0 auto;"></div> (Print Name) </td> </tr> <tr> <td style="padding: 5px;">Date Tested: _____ / _____ / _____</td> </tr> <tr> <td style="padding: 5px;">Date for Re-test: _____ / _____ / _____</td> </tr> </table> </div> <p style="text-align: center;">Sample insulated tool or equipment testing tag</p>	Tool/Equipment Description	Asset No.:	Tested By: In accordance with SMS-06-SW-0275 <div style="text-align: right; border-bottom: 1px solid black; width: 80%; margin: 0 auto;"></div> (Print Name)	Date Tested: _____ / _____ / _____	Date for Re-test: _____ / _____ / _____
Tool/Equipment Description						
Asset No.:						
Tested By: In accordance with SMS-06-SW-0275 <div style="text-align: right; border-bottom: 1px solid black; width: 80%; margin: 0 auto;"></div> (Print Name)						
Date Tested: _____ / _____ / _____						
Date for Re-test: _____ / _____ / _____						



Note

Attach a 'completed' tag only on the tool or equipment that has passed the inspection and test.

Inspection and Testing of Insulated Sticks, Tools and Equipment used for work On or Near Exposed 1500V OHW or Equipment

Examples of common insulated tools used for working on, near, or in the vicinity of 1500V DC OHW or Equipment



Figure 1 Dedicated 1500V DC Operating Sticks - Used for working "On"



Figure 2 Dedicated 1500V DC Telescopic Height Measuring Stick & Dehn PHE/GII 1500V DC Substation Voltage Detector – Used for working "On"

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Figure 3 Only non-conductive tape measures to be used within the rail corridor



Figure 4 Fibreglass cleaning pole - Used for working "Near"



Note

Aluminium foil may be used instead of the copper braid.

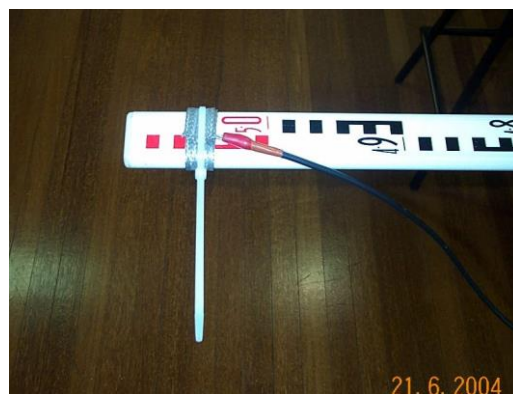


Figure 5 Views of attachment of braid and position of test leads for IR tests on one section of the white telescopic stave.

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Figure 6 Views of attachment of braid to top section of a white three-section telescopic stave