

Engineering Procedure  
Electrical Distribution Unit

PR D 78306

# 1500 Volt DC Overhead Wiring Structure to Rail Voltage Test

Version 1.1

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# Procedure



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## 1. Purpose and scope

This document describes the 1500 Volt DC Overhead Wiring (OHW) structure to rail voltage test and the circumstances under which it shall be carried out before work is performed on rail-connected 1500 Volt DC OHW. This document describes:

- Situations that require such a voltage test to be carried out, and
- The equipment that shall be used to perform the voltage test, and
- The procedure to be used to carry out the voltage test.

## 2. Definitions

- "Overhead Wiring structure" means any conductive metal forming a fitting, mast, portal, overline bridge, footbridge, or over track development that is attached to the dead side of 1500 Volt DC insulators and which under the previous spark gap policy would have been bonded to rail via a spark gap.
- "Rail connected Overhead Wiring" means any 1500 Volt DC OHW which has been connected to the negative return rail (traction rail) in the approved manner, and using the Approved permanent, temporary or portable rail connections.
- 'Rail vehicle' means any Approved wiring train or rail mounted road/rail vehicle.

## 3. Background

A previous investigation/risk management study carried out led to the general removal of spark gaps throughout the electrified system and identified that 1500 Volt DC OHW maintenance staff were potentially exposed to an unacceptable level of risk of electric shock, as a result of the removal of the spark gaps and this risk required mitigation.

The study identified that:

- 1500 Volt DC OHW maintenance staff working on rail-connected 1500 Volt DC OHW frequently make simultaneous contact with the rail-connected OHW and their supporting structures.
- 1500 Volt DC OHW structures supporting live 1500 Volt DC OHW are at risk of being livened up at 1500 Volt DC through the failure of an insulator connected to the structure and supporting the live 1500 Volt DC conductors. In such an instance, a spark gap fitted to the structure would operate and allow the associated DC Circuit Breakers to trip and de-energise the live 1500 Volt DC OHW concerned. Should a spark gap not be fitted to the structure, then a hazardous potential would exist between the structure and rail connected equipment.
- Consequently, 1500 Volt DC OHW maintenance staff when working on rail connected 1500 Volt DC OHW at a structure that is also supporting live 1500 Volt DC conductors, are at an unacceptable risk of receiving an electric shock.
- Due to vandalism, theft and unauthorised disconnection of spark gaps, this unacceptable level of risk existed prior to the decision being made to generally remove spark gaps and would not be cost-effectively remedied by system wide re-instatement of the spark gaps.
- The most cost-effective solution to this problem has been identified as being "the implementation of a test procedure prior to hands-on examination work by 1500 Volt DC OHW maintenance staff".

#### 4. Situations that require the 1500 Volt DC OHW structure to rail voltage test

A 1500 Volt DC OHW structure to rail voltage test shall be carried out before work is performed by persons authorised to work on the 1500 Volt DC OHW and where the work to be performed involves:

1. Working at an 1500 V DC OHW structure that supports live 1500 Volt DC conductors, including any structure supporting both live and dead circuits (with work to be carried out on the rail-connected 1500 Volt DC OHW circuit only), **and**
2. Working at an 1500 Volt DC OHW structure that is not fitted with a spark gap, **and**
3. Simultaneous contact being made between the 1500 Volt DC OHW structure **and** rail connected equipment such as either an Approved rail mounted Elevating Work Platforms (EWP's) or rail connected 1500 Volt DC OHW.

The following example is a situation in which all 3 of the above dot points are satisfied and thus you shall conduct a structure to rail voltage test before commencing the work.

Under an Authority, OHW work is being performed at a 4 track portal structure that is not fitted with a spark gap.	<i>Clause 4. Item 2</i>
The structure supports the OHW over all 4 tracks. The OHW on all 4 tracks is isolated under more than 1 Authority but the Permit you are working on covers only the OHW over the track that you are working on.	<i>Clause 4. Item 1</i>
You are planning to work out of a rail mounted EWP and the work will require making simultaneous contact between this structure and the EWP.	<i>Clause 4. Item 3</i>

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## 5. Equipment to be used for the 1500 Volt DC OHW structure to rail voltage test

Two testers may be utilised to undertake the required 1500 Volt DC OHW structure to rail voltage tests:

- (a) The Test Kit comprising the 'Fluke' multimeter and accessories (hereafter abridged as the 'Fluke Tester'); or
- (b) The Hivotech 1500 Volt DC OHW Tester (hereafter abridged as the 'Hivotech Tester').

### 5.1. The Fluke Tester



The equipment to be used comprises of the following:

- ① Fluke series 170 digital multimeter



#### **Note**

*Previous model series 70 is no longer available for purchase but is still suitable for use.*

- ② Fluke C70Y yellow holster.
- ③ Fluke 80K-6 high voltage probe (earth lead lengthened to 5 m).
- ④ 5 m extension earth lead.
- ⑤ Rail clip with 300 mm earth lead tail.
- ⑥ 300 mm earth lead tail with 10 mm termination eye for attachment to rail vehicles.
- ⑦ An uncontrolled copy of this Procedure (not shown in photo).
- ⑧ 9V Battery (Eveready No. 216 6F22 or similar).
- ⑨ Plastic tool box for storage of the test equipment.

## 5.2. The Hivotech Tester

Refer to Section 7.4 of *PR D 78305 1500 Volt Operating Procedures* for more detailed description of this tester.

## 6. Procedure and 'safety' criterion common for using either tester

### 6.1. Common Procedure

The following shall be complied with for undertaking the 1500 Volt DC OHW structure to rail voltage test, irrespective of which tester is to be used:

- (a) Being hit by train is the most common hazard when working or even walking within the rail corridor. As such, all persons shall at least possess the Rail Industry Safety Induction (RISI) qualification.
- (b) Appropriate protection for working within the rail corridor shall be in place.
- (c) As one probe of the tester is to be attached to the rail, select the traction rail. (Refer to Section 5 of *PR D 78305 '1500 Volt Operating Procedures'* for how to identify the traction rail.)
- (d) Select the traction rail or portion of the traction rail which is reasonably clean and rust-free, otherwise clean the traction rail or remove rust to ensure good contact of the probe, which may be a rail clip or rail clamp.
- (e) Select the spot on the 1500 Volt DC OHW structure which is reasonably clean and rust-free. Otherwise scratch the surface with a long insulated screw driver or other insulated tool, as shown below.



#### **Note**

*Insulated gloves shall be worn if the screw driver or other tool is not insulated.*

### 6.2. Safety Criterion

The 1500 Volt DC OHW structure is considered safe to touch if the measured structure to rail voltage does not exceed 50 Volt DC.



#### **Note**

*If the measured voltage exceeds 50 Volt DC, seek advice from ICON Electrical.*

## 7. Procedure for measuring the 1500 Volt DC OHW structure to rail voltage from a rail vehicle by using the Fluke Tester

### 7.1. Connect the HV probe ③ lead socket to the rail vehicle lead ⑤ plug.

If the distance from the rail vehicle lead ⑤ to the 1500 Volt DC OHW structure is more than 5 m, connect the 5 m extension lead ④ between the rail vehicle lead ⑤ and the HV probe lead ③ socket.

### 7.2. Connect the HV probe lead plug ③ to the multimeter ① and switch the multimeter to the position for measuring DC voltages

This is illustrated below.



The plug pin next to the "GND" lug shall be in the "COM" socket (the bottom hole). The lead plug housing will then be on the outside of the multimeter. The multimeter should show .000 VDC.

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### 7.3. Functional Check of the Fluke Multimeter



Hold the HV probe ③ on to the +ve terminal of the 9V battery ⑧ and the eye of the rail vehicle lead ⑥ on to the -ve terminal of the battery. The multimeter ① shall read between .011 and .007 VDC. The HV probe reduces the voltage 1000 times  
ie. 9 V = .009 VDC on the multimeter.



**Warning**

If the multimeter ① reading is not between .011 and .007 VDC, repeat the test with a new battery ⑧.

If the new reading is still not between .011 and .007 VDC, return the test kit to your supervisor. Obtain another test kit and redo the complete procedure.

### 7.4. Bolt the rail vehicle lead ⑥ to the rail vehicle

All rail vehicles used for 1500 Volt DC OHW maintenance and construction shall have at least one attachment hole, 10 mm stainless steel nut and bolt installed on their work platforms to connect the rail vehicle lead ⑥ to the rail vehicle.

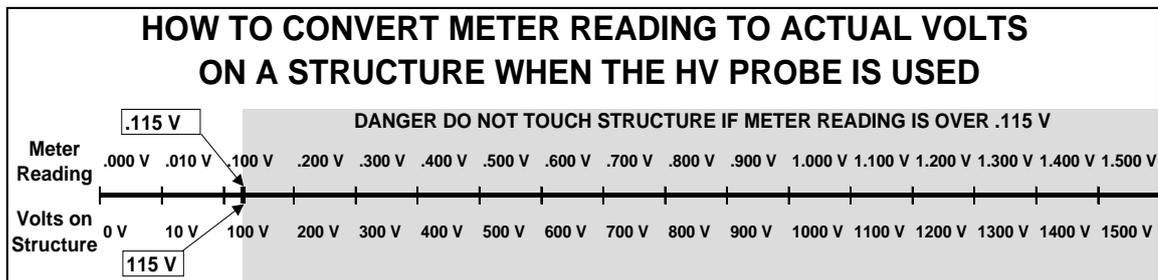
### 7.5. Measure the 1500 Volt DC OHW structure voltage

Select a spot on the 1500 Volt DC OHW structure which is reasonably clean and rust-free. Otherwise, scratch the surface with a screw driver or other tool as described in Section 6.1 (e).

Hold the HV probe ③ by the black handle and touch the point of the HV probe on the 1500 Volt DC OHW structure for at least 3 seconds.

Make sure that no part of the body touches the 1500 Volt DC OHW structure.

Use the conversion scale below to determine the actual voltages between the 1500 Volt DC OHW structure and rail.



**Warning**

If the multimeter ① reads at or above 0.051 Volt DC (ie. the actual voltage is equal to or above 51 Volt DC) the structure is at a potentially dangerous voltage.

Keep clear of the 1500 Volt DC OHW structure.

Warn every one in the vicinity of the danger.

Arrange for at least one staff member to stay at the 1500 Volt DC OHW structure to warn of the dangerous condition.

Notify your supervisor and the ICON Electrical as soon as practicable.

Do not proceed with work on the 1500 Volt DC OHW structure.

**7.6. Re-test the test arrangement**

Repeat the test as described in section 7.3 to verify that the tester was functioning for the duration of the test.



**Warning**

If the result of retest of the test arrangement is not satisfactory, then the entire procedure shall be repeated.

**8. Procedure for measuring the 1500 Volt DC OHW structure to rail voltage from ground by using the Fluke Tester**

**8.1. Connect the HV probe ③ lead socket to the rail clip lead ⑤ plug**

If the distance from the rail to the 1500 Volt DC OHW structure is more than 5 m connect the 5m extension lead ④ between the rail clip lead ⑤ plug and the HV probe lead ③ socket.

**8.2. Connect the HV probe lead plug ③ to the multimeter ① and switch the multimeter to position for measuring DC voltages**

This is the same as Section 7.2.

### 8.3. Functional Check of the Fluke Multimeter

Refer to Section 7.3 for the same test.

### 8.4. Attach the rail clip ⑤ to the traction rail

Refer section 6.1 (d) for details.

### 8.5. Measure the 1500 Volt DC OHW structure voltage

Select a spot on the 1500 Volt DC OHW structure which is reasonably clean and rust-free. Otherwise, scratch the surface with a screw driver or other tool, as described in Section 6.1 (e).

Hold the HV probe ③ by the black handle and touch the point of the HV probe on the 1500 Volt DC OHW structure for at least 3 seconds.

Make sure that no part of the body touches the 1500 Volt DC OHW structure.

Use the same conversion scale as shown in section 7.5 to determine the actual voltage between the 1500 Volt DC OHW structure and rail.

If the multimeter ① reads below 0.115 VDC, proceed to section 8.6.



#### **Warning**

*If the multimeter ① reads at or above 0.051 Volt DC (ie. the actual voltage is equal to or above 51 Volt DC) the structure is at a potentially dangerous voltage.*

*Keep clear of the 1500 Volt DC OHW structure.*

*Warn every one in the vicinity of the danger.*

*Arrange for at least one staff member to stay at the 1500 Volt DC OHW structure to warn of the dangerous condition.*

*Notify your supervisor and ICON Electrical as soon as practicable.*

*Do not proceed with work on the 1500 Volt DC OHW structure.*

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### 8.6. Re-test the test arrangement

Repeat the test as described in section 7.3 to verify that the tester was functioning for the duration of the test.



#### **Warning**

*If the result of re-test of the test arrangement is not satisfactory then the entire procedure shall be repeated.*

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## 9. Procedure for measuring the 1500 Volt DC OHW structure to rail voltages by using the Hivotech Tester

- (a) Carry out the self-test to ensure that the Tester is ready for use in accordance with Section 7.4.8 of PR D 78305 '1500 Volt Operating Procedures'.

- (b) Put the magnetic rail clamp onto the traction rail which is reasonably clean and rust-free. Refer section 6.1.
- (c) Attach an Approved insulated operating stick to the Tester and ensure that it is always firmly engaged during test.
- (d) Always hold below the hand guard of the Approved operating stick.
- (e) Place the knurled contact to the clean or rust-free spot of the 1500 Volt DC OHW structure.
- (f) Read the voltage reading on the LCD display.
- (g) Carry out the self-test to ensure that the Tester is ready for use in accordance with Section 7.4.8 of *PR D 78305 '1500 Volt Operating Procedures'*.
- (h) Refer to section 6.2 to determine if the 1500 Volt DC OHW structure is safe to touch.



**Note**

*If the Tester is left "ON" for approximately 3 minutes without any testing activity, the tester will switch automatically into "SLEEP" mode. The LCD screen of the tester will then:*

- *Extinguish the backlight i.e. backlight is off*
- *Display a blank screen i.e. no numerals or figures.*

*If a tester is in "SLEEP" mode, the tester shall be switched "OFF" and then "ON" before it can be used. (Refer Section 7.4.2 of PR D 78305 '1500 Volt Operating Procedures' for switching the Tester "ON".)*



**Warning**

*DO NOT touch the 1500 Volt DC OHW structure unless it is safe to touch.*



**Warning**

*If the measured voltage is equal to or above 51 Volt DC), the structure is at a potentially dangerous voltage.*

*Keep clear of the 1500 Volt DC OHW structure.*

*Warn every one in the vicinity of the danger.*

*Arrange for at least one staff member to stay at the 1500 Volt DC OHW structure to warn of the dangerous condition.*

*Notify your supervisor and ICON Electrical as soon as practicable.*

*Do not proceed with work on the 1500 Volt DC OHW structure.*

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## 10. References

T HR EL 0811 ST Overhead Wiring Maintenance Standards

PR D 78305 1500 Volt Operating Procedures

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