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## Level 3

# Working On or About 25 kV A.C. Electrified Lines

## Module 7 Isolation and Earthing of Overhead Line Equipment

(This module is one of a suite of modules forming Network Rail standard NR/L3/ELP/29987 'Working On or About 25 kV A.C. Electrified Lines')

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## 1 Purpose

This module will promote safe operation of the 25 kV a.c. electrification system and produce consistent implementation of secure isolation procedures. Further requirements for working on or about the electrified lines and for communication are contained in the Rule Book Modules AC and G1 (GE/RT8000/AC and GE/RT8000/G1).

## 2 Scope

This module states the requirements for the isolation, testing and earthing of overhead line equipment and the issue of overhead line permits on 25 kV a.c. electrified lines.

It is applicable to Network Rail personnel and to Network Rail's contractors. It is also applicable in relevant part to Train Operating Companies having locally controlled 25 kV a.c. overhead lines which abut those controlled by Network Rail.

To provide a consistent approach to working on or about 25 kV a.c. electrified lines, Train Operating Companies may, as best practice, apply this standard in full on infrastructure they control.

## 3 Communication with the Electrical Control Operator

### 3.1 General

The means of communicating with the ECO are stated in Module 1.

### 3.2 Numbering of Formal Communications to and from the Electrical Control Operator

The method of numbering messages is stated in Module 1.

### 3.3 Identification of Locations used in Communications with the Electrical Control Operator

All formal communications to or from the ECO dealing with limits of overhead line permits, position of earths, etc. shall state the number(s) of the OLE structure(s) together with the name of the line(s) concerned.

## 4 Types of Isolation

### 4.1 General

An isolation shall be undertaken in one of the following three ways.

- a) By the pre-arranged blockage of the line to electric trains, switching off and securing of circuit breakers and section switches to isolate the OLE, the subsequent testing and earthing of the OLE and the issue of an overhead line permit;

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*Note 1: The procedure to be followed for the isolation and earthing of OLE and the issue of overhead line permits is stated in this module.*

**or**

- b) by adopting the requirements stated in Module 8 where a blockage of the line to electric trains and isolation and earthing of OLE is carried out locally by a person having local control over train movements and implemented by means of locking off instead of the issue of an overhead line permit;

*Note 2: The procedure to be followed is stated in local isolation instructions appropriate to the particular location and is stated in Module 8.*

**or**

- c) by laid-down emergency procedures in accordance with Rule Book Module AC (GE/RT8000/AC) and the electrical control instructions.

*Note 3: This is termed an 'emergency switch-off'. The requirement for the attendance of a Nominated Person is stated in Module 5. The procedure for subsequent isolation and earthing of the OLE affected and the issue of overhead line permits is stated in this module.*

## 4.2 Overhead Line Equipment to be Treated as Live

When OLE has been switched off, it shall still be treated as being live until:

- a) it has been earthed and an overhead line permit has been received; **or**
- b) where local isolation is allowed, the OLE has been switched off and earthed in accordance with Module 8 and an assurance received in accordance with the local isolation instructions.

**Warning: The granting of an 'isolation' or 'emergency switch-off' does not mean that train movements are stopped.** Where necessary, such arrangements shall be made in accordance with Rule Book (GE/RT8000).

*Note: In certain cases it is necessary only to switch off the supply of electricity to a section of OLE temporarily for other purposes. Such switching off is referred to as 'de-energisation' and is implemented by the ECO. This does not constitute an isolation or emergency switch-off and the overhead line equipment shall be treated as live.*

## 5 Blocking Lines to Electric Trains

### 5.1 General Instructions

The ECO shall receive an assurance that the lines have been blocked to electric trains before isolating any section of the OLE.

In every case where a pre-arranged isolation is to be carried out, the ECO shall contact Operations Control or the signal box Supervisor or the Signaller (whichever is appropriate at the locations for the control of signals) and shall:

- a) give a numbered message and details of the isolation;
- b) state the electrical sections or sub-sections to be isolated as shown in the isolation instructions together with the agreed time of the isolation;
- c) enter this information on Form AE (Blocking Of Lines For Electric Traction Purposes); and

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- d) if the location of an electrical section or sub-section or OLE feature requiring to be blocked to electric trains cannot be described by a number as shown in the isolation instructions, describe precisely the limit of the blockage.

The signal box Supervisor shall:

- e) enter this information on Form AT with the use of isolation diagrams and instructions (Blocking of Lines for Electric Traction Purposes); **or**
- f) enter this information on Form AS (Blocking of Lines for Electric Traction Purposes), whichever is appropriate.

The instructions for closing signal boxes shall not apply to the blockage unless it forms part of a through route which is left open for traffic when the signal box is closed.

The Signaller shall carry out the appropriate rules and regulations when lines need to be blocked to all trains.

## 5.2 Procedure at Locations Where Signal Box Supervisor Deals Directly with the ECO

### 5.2.1 General

This procedure shall only be used when authorised in the Signal Box Special Instructions. If there is no Supervisor, the Signaller shall carry out the duties of the Supervisor.

### 5.2.2 Procedure Within the Signal Box

When the signal box Supervisor receives the numbered message from the ECO, they shall:

- a) record the message in Part 1 of Form AT;
- b) tell each Signaller to block each line concerned by the agreed time; and
- c) complete Part 2 of Form AT and hand it to each Signaller concerned with reference to the isolation instructions and diagrams.

When the lines concerned have been blocked, the Signaller shall:

- d) place a reminder appliance on the appropriate lever, button, switch or workstation concerned with reference to the isolation instructions and diagrams;
- e) make an entry in Part 3 of Form AT;
- f) return Form AT to the Supervisor; and
- g) make a suitable entry in the train register.

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### 5.2.3 Signal Boxes or Sidings Nominated in the Signal Box Special Instructions

The signal box Supervisor shall contact each signal box or sidings which controls the access to the lines concerned and tell the Signaller or person in charge of the sidings:

- a) the numbered message;
- b) the electrical sections or sub-sections which need to be blocked as shown in the isolation instructions; and
- c) the agreed time of the isolation.

The signal box Supervisor shall then record the message in Part 2 of Form AT.

The Signaller or person in charge of sidings shall record the message in Part 1 of Form AS.

When the Signaller or person in charge of sidings has blocked the lines or sidings concerned, they shall:

- d) place reminder appliances on the appropriate levers or devices and complete Part 2 of Form AS with reference to the isolation instructions and diagrams;
- e) make a suitable entry in the train register or other authorised document and attach Form AS to it; and
- f) tell the signal box Supervisor.

The signal box Supervisor shall record the acknowledgement in Part 3.

When the signal box Supervisor has received confirmation that the lines or sidings have been blocked, they shall tell the ECO quoting the message number and then complete Part 4 of Form AT.

### 5.3 Procedure for All Other Locations

The Operations Controller shall record the numbered message received from the ECO in Part 1 of Form AT and then:

- a) tell each Signaller controlling access to the lines or person in charge of sidings controlling access to sidings the lines or sidings that are to be blocked; and
- b) give the Signaller or person in charge of sidings the numbered message and record the message in Part 2 of Form AT.

The Signaller or person in charge of sidings shall record the message in Part 1 of Form AS.

When the Signaller or person in charge of sidings has blocked the lines or sidings, they shall:

- c) place a reminder appliance on the appropriate lever or devices with reference to the isolation instructions and diagrams;
- d) make an entry in Part 2 of Form AS;
- e) tell operations control when this has been done and quote the message number;

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- f) get Form AS countersigned by any other Signaller involved; and
- g) make a suitable entry in the train register or other authorised document and attach Form AS to it.

The Operations Controller shall then record the acknowledgement in Part 3 of Form AT.

When the Operations Controller has been told that the lines or sidings have been blocked, they shall tell the ECO, quoting the message number and then complete Part 4 of Form AT.

## 5.4 During the Blockage

### 5.4.1 General

These instructions shall apply to all locations no matter which procedure was used to block the line or sidings to electric trains.

### 5.4.2 When the Line will Stay Open to Non-Electric Trains

When the line stays open to non-electric trains, the Signaller shall not clear the signal controlling the entrance to the section of line concerned until they are certain that the train is not an electric train.

### 5.4.3 Change of Personnel

All concerned shall countersign the appropriate form when taking up duty.

*Note: This is to show that they fully understand the arrangements that are in place and the extent of the blockage.*

### 5.4.4 Opening Signal Boxes

If a Signaller opens a signal box during the time the line is blocked to electric trains, they shall, depending on which procedure was used to block the line:

- a) immediately contact the signal box Supervisor or operations control;
- b) carry out the instructions in 5.2 or 5.3 of this section (whichever is appropriate); and
- c) tell the ECO if the blockage needs to be adjusted.

### 5.4.5 Closing Signal Boxes

The Signaller shall not close a signal box unless arrangements have been made to extend the blockage.

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## 5.5 Special Switching Arrangements

When the switching arrangements need the electricity to be switched off from the whole section to isolate a sub-section, the ECO shall arrange with the signal box Supervisor or Operations Controller or Signaller to:

- block to electric trains the sub-section which will stay isolated when the switching is completed;
- then switch off the electricity from the complete section without blocking the section; and
- restore the electricity to the unblocked sub-section(s) as quickly as possible.

## 5.6 Movement of Electric Trains Towards an Isolated Section

### 5.6.1 General

The Signaller may authorise the movement if it becomes necessary to make a movement with an electric train:

- beyond the signal protecting an isolated section or sub-section towards the limiting point (as shown in the isolation instructions); or
- an unsignalled movement towards the limiting point.

Such movements shall only be authorised where the risk of the electric train running into the isolated section can be controlled effectively.

### 5.6.2 Dual Voltage (A.C./D.C.) Electrified Lines

When a section of overhead line is blocked to electric trains, the following procedure shall be followed before a dual voltage electric train running in d.c. mode is allowed to pass through the affected section of railway line:

- the train shall be brought to a stand at the protecting signal; and
- the driver shall be advised that the line ahead has been blocked to a.c. electric trains, giving the limits of the blockage; and
- confirmation shall be obtained from the driver that the pantograph has been and shall remain lowered until the entire train is clear of the area affected.

## 5.7 Altering the Extent of an Existing Isolation

### 5.7.1 Alteration to be Planned in Advance

If there is a need to alter the extent of an existing isolation, either to increase or decrease it, this shall be considered at the planning stage of the work.

### 5.7.2 Procedure to Alter the Extent of an Existing Isolation

If another blockage to electric trains is to be carried out to lengthen or shorten an existing isolation, the ECO shall arrange for this blockage to electric trains to be carried out before the initial blockage to electric trains is cancelled.

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When the signal box Supervisor, or Operations Controller, or Signaller has been told about the alteration to the isolation, they shall make appropriate entries in Form AS or AT (whichever is appropriate).

## 5.8 Procedure for Cancelling the Blockage of Lines or Sidings to Electric Trains

### 5.8.1 ECO Procedure

When the ECO has made sure the OLE is again live and, as far as the ECO is concerned, electric train working can restart, the ECO shall give the signal box Supervisor, or Operations Controller, or Signaller a numbered message and record it in Part 3 of Form AE.

### 5.8.2 Procedure at Signal Boxes Authorised in the Signal Box Special Instructions

This procedure shall only be used when authorised in the Signal Box Special Instructions. If there is no Supervisor, then the Signaller shall carry out the duties of the Supervisor.

When the ECO has given the signal box Supervisor the numbered message, the signal box Supervisor shall:

- a) record the message in Part 5 of Form AT; and
- b) tell each Signaller or person in charge of sidings that the blockage has been cancelled.

When the signal box Supervisor has told the Signaller, or person in charge of sidings, that the blockage has been cancelled and the line or sidings are clear and fit for traffic, the Signaller, or person in charge of sidings, shall:

- c) remove any reminder appliance from the appropriate lever, switch, button, workstation control or other device;
- d) resume normal working;
- e) complete Part 6 of Form AT or Part 3 of Form AS (whichever is appropriate); and
- f) make a suitable entry in the train register or other authorised document.

### 5.8.3 Procedure for All Other Locations

When the Operations Controller has received the numbered message from the ECO, they shall:

- a) record the message in Part 5 of Form AT; and
- b) tell the Signaller at each signal box, or person in charge of sidings, that the blockage has been cancelled.

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When the Operations Controller has told the Signaller, or person in charge of sidings, that the blockage has been cancelled and the line or sidings are clear and fit for traffic, they shall:

- c) remove any reminder appliance from the appropriate levers or devices;
- d) resume normal working;
- e) complete Part 3 of Form AS; and
- f) make a suitable entry in the train register or other authorised document.

## 5.9 Dealing with Completed Forms

All concerned shall keep their copies of Form AT or AS (as appropriate) as shown in local instructions.

## 6 Planning Isolations of Overhead Line Equipment

Isolations shall be planned in advance and isolation planning forms and isolation details forms completed in accordance with Module 6. The Nominated Person(s) concerned shall arrange for person(s) authorised to carry out overhead line switching operations on behalf of the ECO in accordance with clause 8 entitled 'Switching Off the Overhead Line Equipment'.

## 7 Facilities for Isolating and Earthing the Overhead Line Equipment

The sectioning and switching facilities for isolating the overhead line equipment are described in Module 1, clause entitled 'Sectioning of the Overhead Line Equipment'.

The isolation of overhead line equipment is effected by the opening of circuit breakers and overhead line switches. Manually operated and locally controlled switches are operated only by staff who have been trained and authorised for this purpose and then only on the direct instructions of the ECO.

When a switch has been operated and locked into the instructed position, the key shall be tagged and a caution notice displayed on the switch to indicate that the switch is in the position to secure an isolation. In the case of a 'normally open' switch, the caution notice shall be permanently displayed and removed only when operated from the normally open position.

## 8 Switching Off the Overhead Line Equipment

### 8.1 General Procedure

The ECO shall record in Part 1 of the Authority to Test (Form B) all switches and circuit breakers effecting the isolation, and shall advise the Nominated Person who shall record the information on their own copy of the Form B.

Before a Form B can be issued to a Nominated Person, the ECO shall, in accordance with electrical control instructions, switch off the section(s) or subsection(s) of OLE as follows. They shall:

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- a) block to electric trains the necessary line(s) or route(s); **and**
- b) open, or arrange to open, the circuit breaker(s) necessary to:
  - i) switch off the complete section(s) concerned; **or**
  - ii) arrange that the overhead line switch(es) concerned are not carrying load current at the time of operation; **and**
- c) prevent inadvertent operation of the circuit breaker(s) or associated separating device(s).

The ECO may authorise switch operation without first opening the circuit breaker(s) feeding the section concerned in those cases where:

- a) due to the specific location of the switch(es), traffic considerations or other reasons, the switch(es) concerned will not be carrying load current at the time of operation; **or**
- b) the switch is of the load breaking type.

The ECO shall operate, or instruct a person(s) authorised to carry out overhead line switching operations to operate and lock in the instructed position, the overhead line switch(es) necessary to achieve the isolation. The ECO shall specify the switch(es) to be operated by their identifying number.

For a pre-arranged isolation the person(s) authorised to carry out switching shall be briefed and given written instruction on the particular switches to be operated by the Nominated Person, prior to the ECO authorising the operation of any particular switch. The written instruction shall be on a Form STED. The authorised person shall complete or confirm the contact details shown on the Form STED and sign to confirm receipt and that the briefing is understood. The authorised person shall retain the Form STED for reference.

Where the same authorised person(s) is to carry out the switching, testing or earthing operations to apply and restore the isolation, one Form STED may cover all required actions.

Where a different authorised person(s) is to be used when restoring the isolation, or there is a change to the switching or earthing actions required, the Nominated Person shall use a separate Form STED in each case.

If during any switching, testing or earthing operation the authorised person is unable to carry out or complete the operations as instructed, they shall immediately communicate the problem to the Nominated Person or ECO as appropriate. The Nominated Person shall agree corrective action with the ECO and brief the authorised person accordingly, except where the ECO is directing the authorised person in their switching operations. The need to reissue the Form STED to the authorised person shall be considered.

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The person(s) authorised to carry out overhead line switching operations shall operate and lock in the instructed position the switch(es) using the unique key(s) kept in the relevant key box, and affix a caution notice to the switch handle(s). The authorised person shall then apply a 'tag' (to a design approved by the Delivery Unit Electrification and Plant Maintenance Engineer) to each key and shall return them to the designated place in the key box, except where an alternative place of safekeeping is authorised by the DUE&PME. The switch(es) shall be operated only on the direct instructions of the ECO.

When the overhead line switch(es) has been operated, locked in the instructed position and caution notice(s) applied, the person(s) who has carried out the operation shall confirm this to the ECO.

The ECO shall, as necessary, reclose or arrange to reclose any remote switchgear required to permit re-energisation of the OLE not affected by the isolation.

At those locations where local isolations are allowed, the procedure for isolation and earthing shall be carried out in accordance with Module 8.

## 8.2 Shared Switches

Where a single overhead line switch is used as a shared point of isolation for abutting isolations, the switch number shall be recorded on each Form B. At the earliest opportunity in the planning process, one of the isolation providers shall be identified to operate the shared switch when applying the isolation AND one identified to operate the shared switch when restoring the isolation. This detail shall be published in the weekly isolation plan.

The isolation provider who is identified to operate the switch when applying the isolation shall apply a caution notice and tag immediately after the switch has been operated. The relevant caution notices and tags shall not be removed until their associated Form B has been cancelled. The ECO shall not authorise the switch to be operated until all Forms B that include the shared switch have been cancelled.

## 8.3 Alternative Feed Switches

When, as part of the isolation, an alternative feed switch is required to be operated, the person(s) authorised to carry out overhead line switching operations shall on the instruction of the ECO operate and lock the switch in the instructed position. The authorised person shall affix a caution notice and then apply a tag to the key and return it to the designated place in the key box, except where an alternative place of safekeeping is authorised by the DUE&PME.