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Module 7

Isolation and Earthing of Overhead Line Equipment

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1 Purpose

Compliance with this module will promote safe operation of the 25 kV a.c. electrification system and produce consistent implementation of secure isolation procedures.

NOTE: Further requirements for working on or about the electrified lines and for communication are contained in the Rule Book Modules AC, Handbook HB16 and G1 (GE/RT8000/AC, GE/RT8000/HB16 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.

This Standard also includes:

- Work on or about any future sections of electrification on Network Rail controlled infrastructure and areas required to adopt a process for securing points of disconnection to form points of isolation to use the Supplementary Isolation Process (Module X).
- Planning of isolations, testing and earthing of overhead line equipment on Network Rail controlled infrastructure equipped with 750V d.c. overhead line system (Sheffield Tram Train - Module Y).
- Planning of isolations, testing and earthing of overhead line equipment on Network Rail controlled infrastructure equipped with 1500V d.c. overhead line system (Sunderland Metro Systems Operating Area – Module Z).

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 planned blockage of the line to electric trains, switching off and securing of circuit breakers and section disconnectors to isolate the OLE, the subsequent testing and earthing of the OLE and the issue of an overhead line permit;

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), Handbook HB16 (GE/RT8000/HB16) 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.

The granting of an 'isolation' or 'emergency switch-off' does not mean that train movements are stopped.

These arrangements shall be made in accordance with Rule Book (GE/RT8000) and NR/L2/OHS/019.

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 planned isolation is to be carried out, the ECO shall contact Route 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

d) describe precisely the limit of the blockage 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.

The signal box Supervisor shall:

a) enter this information on Form AT with the use of isolation diagrams and instructions (Blocking of Lines for Electric Traction Purposes); **or**

b) enter this information on Form AS (Blocking of Lines for Electric Traction Purposes), whichever is appropriate.

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:

a) place a reminder appliance on the appropriate lever, button, switch or workstation concerned with reference to the isolation instructions and diagrams;

b) make an entry in Part 3 of Form AT;

c) return Form AT to the Supervisor; and

d) make a suitable entry in the train register or occurrence book.

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:

a) place reminder appliances on the appropriate levers or devices and complete Part 2 of Form AS with reference to the isolation instructions and diagrams;

b) make a suitable entry in the train register or occurrence book or other authorised document and attach Form AS to it; and

c) tell the signal box Supervisor.

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

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 Route 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:

a) place a reminder appliance on the appropriate lever or devices with reference to the isolation instructions and diagrams;

b) make an entry in Part 2 of Form AS;

c) tell Route Operations Control when this has been done and quote the message number;

d) get Form AS countersigned by any other Signaller involved; and

e) make a suitable entry in the train register or occurrence book or other authorised document and attach Form AS to it.

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

When the Route 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 apply to all locations where non-electrified lines join the line to be blocked to electric trains.

5.4.2 When the line will remain open to Bi-Mode and non-electric trains

When the line stays open to bi-mode and non-electric trains, the Signaller shall not clear the signal controlling the entrance to the section of line concerned or give a Movement Authority until they have made sure the train is a bi-mode train is in diesel mode or confirmed 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 Route Control Operations Control, to understand the requirements for blocking the line (as prescribed at that signal box), and

b) carry out the instructions in 5.2 or 5.3 (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 and until arrangements have been made to extend the blockage.

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 Route Operations Controller or Signaller to:

a) block to electric trains the sub-section which will stay isolated when the switching is completed;

b) then switch off the electricity from the complete section without blocking the section; and

c) 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:

a) beyond the signal or block marker protecting an isolated section or sub-section towards the limiting point (as shown in the isolation instructions); or

b) 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/Bi-Mode

When a section of overhead line is blocked to electric trains, the following procedure shall be followed before a bi-mode train is allowed to pass through the affected section:

a) the train shall be brought to a stand at the protecting signal; and

b) the driver shall be advised that the line ahead has been blocked to a.c. electric trains, giving the limits of the block; including the location where normal a.c. operation may be resumed, and

c) an assurance obtained from the driver that the pantograph has been and will remain lowered, and

d) the automatic power change over (APCO) system has been isolated/disabled until the entire train is clear of the area affected.

5.6.3 Dual Voltage A.C/D.C. traction

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:

a) the train shall be brought to a stand at the protecting signal; and

b) the driver shall be advised that the line ahead has been blocked to a.c. electric trains, giving the limits of the blockage; and

c) an assurance obtained from the driver that the pantograph has been and will 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 assessed at the planning stage of the work and published in the IPF.

NOTE: BTET details to be published in the Weekly Operating Notice.

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.

When the signal box Supervisor, or Route 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 Route 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 occurrence book or other authorised document.

5.9 Signal boxes or sidings nominated in the signal box special instructions

5.9.1 Procedure for All Other Locations

When the Route 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.

When the Route 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 occurrence book or other authorised document.

5.10 Dealing with Completed Forms

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

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 on behalf of the ECO in accordance with clause 8.

At those locations where Supplementary Isolation Process (SIP) are required, the procedure for creating a point disconnection and securing each point of disconnection so that a Point of Isolation are established shall be carried out in accordance with Module X.

7 Facilities for Isolating and Earthing the Overhead Line Equipment

The sectioning and disconnector facilities for isolating the overhead line equipment are described in Module 1, clause 4.7.

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

A Form SDF (Electrical Control Room Switching Details Form) may be used by the ECO to record details of the switching.

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

At those locations where SIP isolations are required, the procedure for isolation and earthing shall be carried out in accordance with Module X.

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 disconnectors 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.

A Form SDF (Electrical Control Room Switching Details Form) may be used by the ECO to record details of the switching.

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:

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 disconnector(s) 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 switching without first opening the circuit breaker(s) feeding the section concerned in those cases where:

a) due to the specific location of the disconnector(s), traffic considerations or other reasons, the disconnector(s) concerned will not be carrying load current at the time of operation; **or**

b) the disconnector is of the load breaking type.

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

For a planned isolation the person(s) authorised to carry out switching shall be briefed and given written instruction on the particular disconnectors to be operated by the Nominated Person, prior to the ECO authorising the operation of any particular disconnector. 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. The need to reissue the Form STED to the authorised person shall be considered.

The person(s) authorised to carry out overhead line switching shall operate and lock in the instructed position the disconnector(s) using the unique key(s) kept in the relevant key box, and affix a caution notice to the disconnector 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 disconnector(s) shall be operated only on the direct instructions of the ECO.

When the overhead line disconnector(s) 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.

At those locations where SIP isolations are required, the procedure for isolation and earthing shall be carried out in accordance with Module X.

NOTE: Module X provides additional requirements for the legacy area of Western Route.

8.2 Shared Disconnectors

Where a single overhead line disconnector is used as a shared point of isolation for abutting isolations, the disconnector 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 disconnector when applying the isolation AND one identified to operate the shared disconnector when restoring the isolation. This detail shall be published in the weekly isolation plan.

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

At those locations where SIP isolations are required, the procedure for isolation and earthing shall be carried out in accordance with Module X.

Any abutting isolations that share an overhead line disconnector as a point of isolation should be avoided so far as is reasonably practicable.

NOTE: Where conditions allow and there is prior agreement, it is preferable for the isolation provider that will carry out the switching to implement and/or restore the isolation.

8.3 Alternative Feed Disconnectors

When an alternative feed disconnector is required to be operated as part of the isolation, the person(s) authorised to carry out overhead line switching shall on the instruction of the ECO operate and lock the disconnector 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.

At those locations where SIP isolations are required, the procedure for isolation and earthing shall be carried out in accordance with Module X.

8.4 Normally Open Disconnectors

When a 'normally open' disconnector is required to be operated, for whatever reason, the person(s) authorised to carry out overhead line switching shall, on the instruction of the ECO, first remove the permanent caution notice fixed to such disconnectors , operate and lock the disconnector in the instructed position and then tag the key and return the key and the caution notice to the designated place in the key box, except where an alternative place of safekeeping is authorised by the DUE&PME.

At those locations where SIP isolations are required, the procedure for isolation and earthing shall be carried out in accordance with Module X.

8.5 Isolating Equipment at Feeder Stations

Certain equipment at feeder stations is under joint control with the electricity supply company, and shall be operated in accordance with the specific Operation and Maintenance procedures for that location.

8.6 Isolating Risers, Bushings and Cable Sealing Ends

8.6.1 General

When work is to be carried out on risers or in proximity to bushings or cable sealing ends, these shall be isolated and earthed in accordance with this module.

Except where specified in the clauses 8.6.3 and 8.8, the isolating and earthing of bushings at switching stations and the sealing ends of track feeder cables, overhead line continuity cables and autotransformer feeder cables shall be carried out in accordance with Network Rail standard NR/L3/ELP/21067.

8.6.2 Where a Permit-to-Work on High Voltage Electrical Equipment (Form 21067/P) is Required

Except where specified in the clauses 8.6.3 and 8.8, where work is required to be carried out on, or within 600 millimetres (2 feet) of, the connections of risers or bare feeders to bushings, roof bushings or cable sealing ends, a Permit-to-Work on High Voltage Electrical Equipment (Form 21067/P), issued in accordance with Network Rail standard NR/L3/ELP/21067, shall first be issued to the Nominated Person in respect of the bushing(s) or cable sealing end(s) concerned.

The Nominated Person shall then notify the ECO quoting the serial number of the Form 21067/P and the apparatus which has been earthed, which both persons shall endorse on Part 1 of their Forms B. The Nominated Person shall retain the Form 21067/P with their Form B.

When the Nominated Person is satisfied that all necessary testing and earthing procedures have been completed, they shall issue to the person(s) in charge of the work a Form C for the OLE, including the riser(s) or bare feeders and the connection(s) to the bushings or cable sealing end(s) concerned, in accordance with clause 19.

8.6.3 Where a Permit-to-Work on High Voltage Electrical Equipment (Form 21067/P) is NOT Required

Where an overhead line continuity cable, autotransformer feeder cable or switching station busbar isolated from all points of supply is used to form the electrical continuity between successive earths, the associated bushing(s) or cable sealing end(s) may be considered to be part of the OLE and a Form C issued for the OLE and the connection(s) to the bushings or cable sealing end(s) concerned in accordance with clause 19. In this case a Form 21067/P need not be issued or obtained.

Where work is to be carried out on, or in proximity to, isolated and earthed OLE, including feeder disconnectors, within 600 millimetres (2 feet) of an isolated cable sealing end or switching station roof and/or wall bushing, and one or more of the points of isolation is a circuit breaker connected to a live busbar, provided that a Circuit Main Earth (CME) is applied to each affected bushing and/or sealing end between the isolating circuit breaker(s) and the working area, then a Form 21067/P need not be issued or obtained.

A Form C shall be issued for the OLE in accordance with clause 19.

Overhead line isolation conditions shall apply where work is required to be carried out on, or in proximity to, a riser at a position 600 millimetres (2 feet) or more from any cable sealing end or switching station roof or wall bushing and portable earths can be applied each side of the work, and the work carried out under a Form C.

If the associated OLE subsection is to remain live and available to electric trains, a Form AE will not be required to be obtained by the ECO.

The limits to be quoted shall be the position of the earths on each side of the work. When the Nominated Person is satisfied that all necessary testing and earthing procedures have been completed they shall issue to the person(s) in charge of the work a Form C for the riser(s) concerned in accordance with clause 19.

8.7 Isolating Bare Feeders

Bare feeders are part of the OLE and shall be isolated and earthed accordingly.

Some bare feeders may be isolated and earthed separately from their associated electrical subsections which remain live and available for electric trains. In these circumstances, the bare feeders shall be isolated and earthed in accordance with this module.

The requirements of Modules 2, 3, 6 and the electrical control instructions shall be met.

8.8 Isolating SMOS Switching Stations

In certain locations where structure mounted outdoor switchgear (SMOS) is installed, isolation and earthing may be subject to other requirements as defined in Network Rail instructions. Where the switchgear is mounted in such a way as to be within

2.75 metres (9 feet) of OLE, then the requirements of this standard, instead of Network Rail standard NR/L3/ELP/21067 apply.

8.9 Isolating Autotransformer Feeding Systems

Autotransformers feeders are part of the OLE and shall be tested, isolated and earthed accordingly.

Equipment at autotransformer switching stations shall be isolated and earthed in accordance with the instructions contained in this module.

NOTE: If there is any doubt as to how to isolate any feature of the autotransformer feeder system related OLE or associated equipment, seek further advice from the DUE&PME or other competent authority appointed in writing by the DUE&PME.

8.10 Isolating Structure Mounted 25 kV Auxiliary Supplies Transformers and Associated Voltage Regulators

8.10.1 Minor work

Infrastructure Maintainer's staff are authorised to undertake minor external work, such as oil sampling and painting within certain specified limits, with the transformer live and, if required, on load, in accordance with Modules 2, 3 and 5.

Where this work is required to be carried out by other than the Infrastructure Maintainer, the limits shall be specified by the DUE&PME.

8.10.2 Other Work

When any other external work is to be done beyond the above limits, or where any internal work is to be done on the transformer or the voltage regulator, it shall be performed under a Permit-to-Work or Sanction-for-Test on High Voltage Electrical Equipment issued in accordance with Network Rail standard NR/L3/ELP/21067, irrespective of whether the OLE is isolated or not.

The secondary winding main switch and the primary winding isolator shall be opened in that order.

NOTE: The voltage regulator, where installed, is between the transformer secondary winding and the main switch on the secondary side.

The requirements of Modules 2 and 3 shall be complied with and, where necessary, the adjacent OLE and bare connections shall be isolated and earthed and an overhead line permit additionally obtained, or issued, for such equipment.

8.11 Isolating Structure Mounted Earthing Devices

Structure mounted earthing devices shall be treated as part of the OLE.

Where work is to be carried out on, or adjacent to, an earthing device, the OLE to which it is connected shall be isolated and earthed.

CMEs shall be applied to the OLE on both sides of, and as close as practicable to, the earthing device.

NOTE 1: Many fixed earthing devices are supported on the same structures as HV Cable Sealing Ends, and a HV Permit to Work (Form 21067/P) in addition to the Form C may therefore be required prior to undertaking work on or near the equipment.

NOTE 2: A fixed earthing device located inside a substation compound is classed as 25kV distribution apparatus and is therefore isolated and earthed in accordance with NR/L3/ELP/21067.

The requirements of Modules 2 and 3 shall be complied with and any other live equipment not at a safe working distance shall also be isolated and earthed.

When the Nominated Person is satisfied that the isolation and earthing procedure has been carried out, a Form C shall be issued for the earthing device, the overhead line to which it is connected and any other equipment not at a safe working distance.

8.12 Isolating Structure Mounted Harmonic Dampers

8.12.1 General

The procedure for isolating and earthing structure mounted harmonic dampers depends on whether the damper is:

a) connected **INDIRECTLY** to the OLE by a track feeder cable, roof bushing, circuit breaker or a busbar at a switching station; **or**

b) connected **DIRECTLY** to the OLE.

8.12.2 Where Connected INDIRECTLY to the OLE at a Switching Station

Except where stated otherwise in clause 8.8, where work is to be carried out on, or adjacent to, a harmonic damper connected indirectly to the OLE at a switching station, isolation and earthing shall be in accordance with Network Rail standard NR/L3/ELP/21067 and Network Rail instructions. A Permit-to-Work on High Voltage Electrical Equipment (Form 21067P) shall first be issued or obtained.

The requirements of Modules 2 and 3 shall be complied with and any other live equipment not at a safe working distance shall also be isolated and earthed.

8.12.3 Where connected DIRECTLY to the OLE

Structure mounted harmonic dampers connected directly to the OLE shall be treated as part of the OLE.

Where work is to be carried out on, or adjacent to, a harmonic damper connected directly to the OLE, the OLE to which it is connected shall be isolated and earthed.

CMEs shall be applied to the OLE on both sides of, and as close as practicable to, the damper.

The requirements of Modules 2 and 3 shall be complied with and any other live equipment not at a safe working distance shall also be earthed.

When the Nominated Person is satisfied that the isolation and earthing procedure has been carried out, a Form C shall be issued for the damper, the overhead line to which it is connected and any other equipment not at a safe working distance.

8.13 Responsibilities under Combined Isolations of Sidings, Electric Traction Depots, Electric Inspection and Cleaning Sheds, etc.

8.13.1 Electrical Subsections in Sidings and Abutting Subsections

The local isolation procedure specified in Module 8 shall be suspended when it is required for an isolation of electrical subsection(s) in sidings, where local isolation is not allowed, to be combined with an isolation of abutting electrical section(s).

The combined isolation and earthing procedure shall be carried out by a Nominated Person and an overhead line permit issued.

Any abutting isolations that share an overhead line disconnector as a point of isolation should be avoided so far as is reasonably practicable.

8.13.2 Electrical Subsections at Electric Traction Depots, Electric Inspection and Cleaning Sheds, etc. and Abutting Subsections

All work in Electric Traction Depots, Electric Inspection and Cleaning Sheds, etc., where there is a local isolation procedure available, shall be carried out in accordance with, and within the safe working limits specified in, the local isolation instructions.

When it is required for an isolation of electrical subsection(s) in Electric Traction Depots, Electric Inspection and Cleaning Sheds, etc. to be combined with an isolation of abutting electrical subsection(s), the local isolation procedure shall be suspended. The combined isolation and earthing and the limits thereof shall be agreed between the parties concerned and shall be carried out by a Nominated Person and an overhead line permit issued.

Any abutting isolations that share an overhead line disconnector as a point of isolation should be avoided so far as is reasonably practicable.

9 Issue and Receipt of Form B

9.1 General

The authority from the ECO to the Nominated Person is in the form of a numbered message which they both record on their own copy of an identical Form B 'Authority to Test' (*as shown in Appendix B*). Before issue of a numbered message, the ECO and Nominated Person shall confirm details are correct of the electrical section(s) or subsection(s) switched off, the lines concerned, the limits of isolation, switching requirements and the time by which the authority is to be cancelled, reading from the electrical control copy of Form B.

When the ECO is satisfied that all the switching detailed on the Form B is completed, they shall authorise testing of the OLE by the Nominated Person, giving a numbered message which both persons shall enter in Part 1 of their own copy of Form B. Each separately issued Form B shall have a unique message number, recorded on both the ECO and Nominated Person copy.

The issue of multiple Forms B within one isolation shall be managed in accordance with electrical control instructions.

If in unusual circumstances there is an overhead line disconnector(s) within the isolation which is not in the normal position, the ECO shall advise the Nominated Person and both shall record the number(s) and the position of the disconnector(s) concerned in Part 1 of their copy of Form B.

The Nominated Person shall then carry out, or arrange to have carried out by person(s) authorised to carry out overhead line testing and earthing operations, the procedures detailed in clauses 10 and 11.

The Nominated Person shall retain the Form B in their possession and remain on duty, readily contactable and available at all times, until the Form B is cancelled or they are relieved.

9.2 Issue of Form B Spanning a Neutral Section Forming the Boundary between Electrical Controls

Where a neutral section forms the boundary between electrical controls, one of the control rooms is designated to be responsible for isolations spanning the neutral section. At electrical control boundaries, either control may be designated responsible depending on who requests the isolation. The boundary neutral sections and the designated electrical controls are listed in Appendix A.

The ECOs shall arrange for the isolation of the section(s) or subsection(s) of OLE for which they are responsible in accordance with the electrical control instructions and clause 8. When they are satisfied that the OLE for which they are responsible has been isolated, the non-designated electrical control shall issue a declaration to this effect to the designated electrical control which both record on an identical form, the Form N (as shown in Appendix B).

At the Network Rail–Network Rail (High Speed 1 Ltd) interface, the ECO or EMMIS controller shall arrange for the isolation of the section(s) or subsection(s) of OLE for which they are responsible in accordance with the electrical control instructions. When they are satisfied that the OLE for which they are responsible has been isolated, the non-designated electrical control shall issue a declaration to this effect to the designated electrical control, which both persons record on an identical form, the Form NC (as shown in Appendix B).

At the Network Rail-Rail For London Infrastructure Limited (Elizabeth Line) interfaces, the NR ECO or RFLI ECO shall arrange for the isolation of the section(s) or subsection(s) of OLE for which they are responsible in accordance with the electrical control instructions. When they are satisfied that the OLE for which they are responsible has been isolated, the non-designated electrical control shall issue a declaration to this effect to the designated electrical control, which both persons record on an identical form, the Form NC (as shown in Appendix B).

The busbar of the switching station at which the neutral section is located shall not be used for electrical continuity between successive earths but the neutral section shall be treated as a discontinuity and CMEs shall be applied on each side in accordance with the requirements of clause 11.3.4.

When the ECO at the designated electrical control is satisfied that the OLE on both sides of the neutral section has been isolated, they shall issue to a Nominated

Person a Form B authority spanning the neutral section to the limits of isolation declared on the Form N or Form NC.

The Nominated Person shall then carry out the requirements of the clauses 10, 11 and 19 for the issue of a Form C spanning the neutral section, together with any other overhead line permits within the limits of the Form B so issued.

9.3 Issue of Form B Spanning a Coast-Through Section Insulator Forming the Boundary between Electrical Controls

Where a coast-through section insulator forms the boundary between Electrical Controls (EC), one of the controls is designated to be responsible for isolations spanning the section insulator.

At South Yorkshire Supertram Limited (Sheffield Supertram) electrical control boundary, York EC is the designated EC for cross-boundary isolations. Module Y describes the cross-boundary procedure.

At Sunderland Metro System Operating Area electrical control boundary, York EC is the designated EC for cross-boundary isolations. Module Z describes the cross-boundary procedure.

9.4 Two or More Nominated Persons Within the Same Isolation

Where more than one Form B shall be issued with the same electrical sections, this shall have been planned in advance and detailed on the IPF. The Route Isolation Planner shall check the safe working limits stated on the IPF for each Form B to be issued do not overlap.

The ECO shall check that the safe working limits stated for each isolation on the IPF and each IDF do not overlap.

In all cases, each Nominated Person issuing overhead line permits shall arrange for the necessary earthing to be applied as stated on the IDF. The same earths shall not be used for the protection of overhead line permits issued under separate Forms B.

The ECO shall keep together all Forms B within that isolation and only when all Forms B are cancelled shall they take action to make the section(s) or subsection(s) concerned live in accordance with electrical control instructions.

Part 1 of the Form B shall not be endorsed with details of the same isolation limits that overlap the isolation limits stated on a separate Form B, except for the specific circumstances of one Form B superseding another for the purpose of altering the extent of an existing isolation, when the procedure described in clause 21 shall be followed.

10 Testing the Overhead Line Equipment

NOTE: For the purpose of this clause, use of the term 'overhead line equipment' (or the abbreviation 'OLE') refers to those parts of the overhead line equipment normally live at 25 kV. This includes autotransformer feeders but not return conductors.

After the authority from the ECO, advising that the OLE has been Disconnected, has been received, the Nominated Person shall then carry out the following procedure

Another person(s) so authorised to carry out overhead line testing and earthing operations, and acting on their instructions, may on their behalf test and apply portable earths.

The Nominated Person shall issue and brief a Form STED to the person authorised to test and apply earths on their behalf. The Form STED shall state the location(s) at which, and the line(s) on which, the OLE is to be tested and the earths are to be applied and whether CME's or Additional Earths are to be applied. The locations of such testing and earths shall have been pre-determined in accordance with the requirements of clause 11 and Module 6, and included on an isolation details form.

The OLE to which earths are to be applied shall be tested with an approved voltage testing device in accordance with Module 10 prior to the application of the earths, so that earths are not applied to overhead line equipment live at 25 kV.

When the authorised person(s) has tested the OLE and applied the earth(s), they shall confirm this to the Nominated Person, quoting the location(s) at which, and the line(s) on which, they have applied the earth(s) and whether CMEs or Additional Earths have been applied. The Nominated Person shall then record the relevant information in Part 2 of the Form B.

11 Earthing the Overhead Line Equipment

NOTE: For the purpose of this clause, use of the term 'overhead line equipment' (or the abbreviation 'OLE') refers to those parts of the overhead line equipment normally live at 25 kV. This includes autotransformer feeders but not return conductors.

11.1 Requirements for Earths

11.1.1 Circuit Main Earths (CMEs)

CMEs are primarily used to mitigate the risk of inadvertent energisation of the system

A CME shall be either:

a) duplicate portable earths manually applied to the OLE; or

b) an Fixed Earthing Device specifically installed and rated for the purpose.

Currently fixed earthing devices are only permitted to be used as CMEs in accordance with the requirements detailed in Module X.

11.1.2 Additional Earths

Additional Earths are primarily used to mitigate the risks associated with residual or induced voltage, and to provide continuity.

An Additional Earth shall be either:

a) A single portable earth manually applied to the OLE; or

b) an Fixed Earthing Device specifically installed and rated for the purpose.

Currently fixed earthing devices are only permitted to be used as CMEs in accordance with the requirements detailed in Module X.

11.2 Earths at the Isolation Limits

When the OLE has been proved to be switched off by the use of an approved voltage testing device, CMEs shall be applied using approved portable earthing equipment, in accordance with Module 10, to each separately isolated electrical section, or subsection, to be covered by the overhead line permit, on each side of, and in proximity to or at the isolation limits of the working party.

Where there is more than one working party requiring to be issued with an overhead line permit within the same isolation and their portable earths and Forms C are to be recorded on the same Form B, the CMEs may, if so required, only be applied for the extremities of the combined isolation or safe working limits of the working parties, provided that sufficient Additional Earths are also applied in accordance with clause 11.3.

NOTE: The planning of combined isolation or safe working limits of the working parties should be considered at the planning stage of the work and published in the IPF.

11.3 Additional Earths and Temporary Continuity Jumpers

11.3.1 Examples

Examples of typical locations for the application of earths and temporary continuity jumpers are provided within Network Rail standard NR/L3/ELP/27237 Module NR/OLE F05.

11.3.2 Additional Earths

Sufficient additional earths shall be applied at and/or within the safe working limits such that the distance between portable earths within the safe working limits does not exceed 400 metres (¼ mile) EXCEPT when ALL the following conditions apply:

a) all adjacent OLE is isolated; **and**

b) there are no adjacent overhead transmission power lines; **and**

c) there are no tee-feeds; **and**

d) there are no intermediate points of possible inadvertent energisation,

in which case Additional Earths shall be applied at a maximum spacing of 3200 metres (2 miles).

NOTE 1: The term 'adjacent overhead transmission power line' is defined as an overhead transmission power line which operates at a nominal phase-to-phase voltage exceeding 33,000 volts (33 kV), the location of which is indicated by overhead line structure numbers on the isolation diagrams or specified in the isolation instructions.

Where an adjacent overhead transmission power line exists, the spacing of Additional Earths between the overhead line structure numbers shown on the isolation diagram or specified in the isolation instructions shall not exceed 400 metres (¼ mile).

NOTE 2: The overhead line structure numbers are those of the nearest designated earthing points at, or outside, the extremities between which the 400 metre maximum spacing applies. The extremities are set to include those power lines which:

*a) run or approach within a distance of 100 metres from the railway; **or***

b) cross the railway at an included angle of 0° to 70°. In this case the extremities are set to include the area where the power line is within 100 metres of the overhead line equipment.

Where it is necessary to isolate adjacent OLE, either because of its proximity to the equipment on which work is to be carried out or for the purpose of allowing portable earths to be applied at 3200 metres (2 miles) maximum where no adjacent overhead power lines exist, the adjacent equipment shall be isolated and tested in accordance with the clauses 8 and 10. Earths shall be applied to the adjacent equipment in accordance with this clause, and Part 1 of the Form B endorsed accordingly. Details of the adjacent equipment that has been isolated and earthed shall not be included within the safe working limits specified on the overhead line permit.

NOTE 3: Adjacent equipment may include adjacent lines (i.e. contact & catenary wires), adjacent auto-transformer feeders.

11.3.3 Terminal End

In the case of a terminal end when all adjacent OLE is isolated and where no adjacent overhead transmission power line exists, CMEs shall be applied to each electrical section at no greater distance than 3200 metres (2 miles) from the terminal end, and so that earths are applied between the terminal end and any tee-feed or intermediate point of inadvertent energisation.

NOTE: The term 'adjacent overhead transmission power line' is defined as an overhead transmission power line which operates at a nominal phase to phase voltage exceeding 33,000 volts (33 kV), the locations of which are indicated on the isolation diagrams or specified in the isolation instructions.

11.3.4 Neutral Section

A neutral section may be treated as a terminal end, provided that additionally CMEs are applied within a distance of 75 metres (80 yards) from the connection to the OLE of any point of electrical supply within the isolated and earthed area.

11.3.5 Earthing Pantographs on Overhead Line Equipment Access Vehicles

When an overhead line works train fitted with an earthed pantograph at each end is planned to be used, work may be carried out on or near the OLE between the raised earthed pantographs without Additional Earths being applied.

However, if one or both pantographs are to be lowered, the earthing of the OLE shall comply with clause 11.3.2.

When an on-track overhead line access vehicle is planned to be used and an earthed pantograph is provided on the vehicle, the earthed pantograph shall be raised before the working platform is raised. Work may then be carried out on or near the OLE from the vehicle without Additional Earths being applied, provided that the earthed pantograph continuously and effectively earths all the equipment being worked on or being approached within 600 millimetres (2 feet).

11.4 Continuity of Overhead Line Equipment between Earths

11.4.1 General

The electrical continuity of the OLE shall be maintained uninterrupted between successive earths. If the OLE is not electrically continuous between successive earths, the OLE on each side of the electrical discontinuity shall be separately earthed. CMEs shall be applied at each side within a distance of 75 metres (80 yards) from the discontinuity.

NOTE: Example of a circumstance where it is not electrically continuous is where a disconnector is in the open position for the purpose of altering the extent of an existing isolation in accordance with clause 21.

The electrical continuity of the OLE between successive earths may be carried through a busbar at a Switching Station, provided that the busbar is isolated and locked off from all sources of electrical supply by means of isolators or overhead line disconnectors.

The ECO shall maintain all circuit breakers which are providing the electrical continuity in the 'closed' position.

11.4.2 Continuity Jumpers

When it is necessary to apply continuity jumpers after the equipment has been earthed, but before an overhead line permit has been issued, such jumpers shall have been planned in advance and included on the IDF. The jumpers shall be applied and subsequently removed as identified on the Form STED using approved portable earthing equipment in accordance with Module 10 by a person(s) authorised for such activities, and only on the instruction of the Nominated Person. Part 2 of the Form B shall be endorsed with the details of the continuity jumpers.

Examples of typical locations for the application of temporary continuity jumpers are provided within Network Rail standard NR/L3/ELP/27237 Module NR/OLE F05.

11.5 Altering the Location of Earths

Where it is unavoidable (e.g. work of an urgent nature) that a working party is required to move to a new position outside the original safe working limits, the Nominated Person shall agree with the ECO the location(s) of the earths and lines concerned for the new position. The ECO and Nominated Person shall complete a new isolation details form. The OLE shall be tested at the new position and portable earths then applied in accordance with clause 11.3.2.

NOTE 1: If there is a need to alter the extent of an existing isolation this should be considered at the planning stage.

The application of the earths shall only be done by a person(s) authorised for such activities, and then only on the instruction of the Nominated Person, who shall record the details on their Form B. A new overhead line permit shall be issued before any work is allowed to commence at the new position.

NOTE 2: Module 5, clause 6 and Module 6, clause 5.6 state the requirements for subsequent isolation and earthing of the OLE.

11.6 Disturbance, Interference or Removal of Earths

Earths shall not be disturbed or interfered with whilst the overhead line permit(s) are in force and not finally removed until all overhead line permits are cancelled.

Where this is unavoidable, Additional Earths may be disconnected or removed only after sufficient supplementary Additional Earths of suitable current rating have been applied to the OLE such that the spacing between successive earths does not exceed that specified in clause 11.3.

Such removal and application of earths shall only be done by a person(s) authorised for such activities, and then only on the instruction of the Nominated Person, who shall record the details on their Form B and inform the ECO.

If OLE work is required at the structures at which the CMEs are applied forming the safe working limits of the Form C, and this work would disturb the earths, then further isolation and/or earthing shall be carried out as necessary to extend the Form C safe working limits before work commences at that location.

NOTE: Module 5, clause 6 and Module 6, clause 5.6 state the requirements for subsequent isolation and earthing of the OLE.

11.7 Bare Feeders

When a bare feeder is isolated and earthed separately from its associated electrical subsection which remains **live** and available for electric trains, and the bare feeder has no separate identification, the bare feeder description 'Bare feeder for subsection number …' shall be entered on the Form B concerned, otherwise the bare feeder subsection identifier as shown on the isolation diagram shall be used.

12 Earthing of Earth Wires, Return Conductors and Booster Transformers

NOTE: For the purpose of this clause, use of the term 'overhead line equipment' (or the abbreviation 'OLE') refers to those parts of the overhead line equipment normally live at 25 kV.

12.1 General

The following arrangements of earth wires, return conductors and booster transformers are installed.

a) Return conductors electrically connected to structures
These are in electrical contact with the supporting structures and additionally can act as earth wires. They do not have booster transformers. See clause 12.4.

b) Return conductors carried on insulators
These are insulated from the supporting structures and may or may not have booster transformers. At certain locations the conductors are sheathed with insulating material. See clauses 12.5 to 12.10.

c) Earth wires
These are in electrical contact with the supporting structures. See clause 12.4.

12.2 Application of Earths

When earths are to be applied to return conductors, they shall be applied by the Nominated Person, or other person(s) so authorised to carry out overhead line testing and earthing operations.

Portable earths shall be of the short type, except that long portable earths may be used in unavoidable circumstances when their use is justified in accordance with Module 10, clause 7.5. With the exception of Return Conductor only earthing where the use of long portable earths shall be applied using approved earthing poles in accordance with Module 10, clause 9.

NOTE 1: for instance unavoidable circumstances:

a) when a broken conductor has to be earthed and there are no suitably located designated earthing points; or

b) where a designated earthing point is found to be defective and there is no other suitably located designated earthing point.

Where portable earths are required to pass continuous or traction current, the clamps shall be of the screw type.

NOTE 2: Snap-on clamps are unsuitable for these conditions.

Only product approved equipment shall be used for applying portable earths in accordance with Module 10 clause 7.

Duplicate Additional Earths shall be applied to each return conductor to be covered by the overhead line permit on each side of, and in proximity to or at the isolation limits of, the working party, and sufficient Additional Earths shall be applied as required by the instructions in this module.

Where there is more than one working party requiring to be issued with an overhead line permit for the return conductor(s) and their portable earths and Forms C are recorded on the same Form B, the duplicate Additional Earths may, if so required, only be applied for the extremities of the combined isolation or safe working limits of the working parties, provided that sufficient Additional Earths are also applied in accordance with clause 11.3.

NOTE 3: The planning of combined isolation or safe working limits of the working parties should be considered at the planning stage of the work and published in the IPF.

The Nominated Person shall, when instructing the person(s) authorised to apply earths on their behalf, state the location(s) at which, and the return conductors on which, the earths are to be applied and whether duplicate Additional Earths or single Additional Earths are to be applied. The locations of earths shall have been pre-determined in accordance with the requirements of Module 6 and included on an isolation details form.

When the person(s) has applied the earths, they shall confirm this to the Nominated Person, quoting the location(s) at which, and the return conductors on which, they have applied the earths and whether duplicate Additional Earths or single Additional

Earths have been applied. The Nominated Person shall then record the relevant information in Part 2 of the Form B.

Examples of typical locations for the application of earths are provided within Network Rail standard NR/L3/ELP/27237 Module NR/OLE F05.

12.3 General Precautions to be Taken on Return Conductors and Earth Wires

Where work is required to be carried out on or close to return conductors and earth wires, and live OLE is not at a safe working distance, this shall be isolated and earthed in accordance with the clauses 8, 10 and 11 and an overhead line permit issued for such equipment.

NOTE: Modules 2 and 3 state the requirements to determine a safe method of working.

12.4 Bare Earth Wires and Return Conductors Electrically Connected to Structures

An overhead line permit is not required to be issued for work on or close to earth wires or return conductors electrically connected to structures provided that the OLE is at a safe working distance.

NOTE: Modules 2 and 3 state the requirements to determine a safe method of working.

12.5 Return Conductors Carried on Insulators

12.5.1 General

The arrangements for work on return conductors carried on insulators with or without booster transformers between successive earths are set out in the following cases, A and B.

12.5.2 Case A – Where an OLE Isolation is Required

Where work is required to be carried out on or close to the return conductor, or where there are two or more return conductors in close proximity; and either

a) the adjacent OLE **IS NOT** at a safe working distance; **or**

b) a booster transformer **IS** between successive earths,

the following procedure shall be followed.

The OLE shall be isolated and earthed in accordance with clauses 8, 10 and 11 and the overhead line permit to be issued shall include the isolated OLE. Duplicate Additional Earths shall be applied to the return conductor(s) on each side of the working party at the isolation limits. Additional Earths shall be applied at the same spacing as that applicable to the isolated and earthed OLE.

Where the return conductor(s) runs past a neutral section which is regarded as a terminal end in accordance with clauses 11.3.3 and 11.3.4, Duplicate Additional Earths shall be applied to the return conductor(s) on each side of the working party.

Where there are two or more return conductors in close proximity, earths shall be similarly applied to each.

When the ECO issues the Form B authority for the OLE concerned, they shall at the same time authorise the earthing of the return conductor(s) by the Nominated Person giving a numbered message, which both persons shall enter in Part 1 of their copy of Form B, together with the relevant details of the OLE and the return conductor(s).

The procedure specified in the clauses 8, 10 and 11 shall be followed, the Nominated Person, or other persons so authorised, also applying earths to the return conductor(s) as specified above. In addition, the relevant details in respect of the return conductor(s) shall be entered in Part 2 of Form B and in Part 1 of the Form C.

If the Nominated Person who received authority to earth the return conductor(s) or the person holding the Form C is relieved, the procedure in clause 20 shall be followed.

The procedure in clause 22 shall be followed in respect of the return conductor(s) concerned.

12.5.3 Case B – Where an OLE Isolation is NOT Required

Where work is required to be carried out on or close to the return conductor, or where there are two or more return conductors in close proximity; and

a) the adjacent OLE **IS** at a safe working distance; **and**

b) **NO** booster transformer is between successive earths,

the following procedure shall be followed.

The return conductor(s) shall be earthed with duplicate Additional Earths applied on each side of the working party at the limits for return conductor earthing.

At each of the designated earthing points at the limits for return conductor earthing, a single long portable earth shall be applied between the traction return rail and the return conductor in addition to duplicate Additional Earths. Further Additional Earths shall be applied within the limits such that the distance between earths does not exceed 400 metres (¼ mile).

Where there are two or more return conductors in close proximity, earths shall be similarly applied to each.

The ECO shall authorise the earthing of the return conductor(s) by the Nominated Person giving a numbered message which both shall enter in Part 1 of their copy of Form B together with the relevant details of the return conductor(s).

A Form AE will not be required to be obtained by the ECO.

The Nominated Person, or other persons so authorised, shall then apply earths to the return conductor(s) as specified above. When they are satisfied that this has been carried out, they shall then issue to the COSS(s) concerned a Form C in respect of the return conductor(s) in accordance with clause 19.

If the Nominated Person who received authority to earth the return conductor(s) or the person holding the Form C is relieved, the procedure in clause 20 shall be followed.

The procedure in clause 22 shall be followed in respect of the return conductor(s) concerned.

Where portable earths are required to pass continuous or traction current, the clamps shall be of the screw type.

NOTE: Snap-on clamps are unsuitable for these conditions.

12.6 Sheathed Return Conductors

The arrangements for work on return conductors carried on insulators and sheathed with insulating material shall be as follows:

a) where the adjacent OLE **IS NOT** at a safe working distance, an overhead line permit shall be issued for the overhead line equipment;

b) where the work involves the removal or cutting of the sheathing or the insulating material is damaged, an overhead line permit shall be issued in accordance with clause 12.5, Case A or Case B, as appropriate.

Where the adjacent OLE IS at a safe working distance and the insulating material remains continuous and undamaged, and is not to be removed, an overhead line permit is not required for work on or close to the sheathed return conductor.

Where the extent of the sheathing prevents the application of earths to meet the requirements of clause 12.5, Case A or Case B, as appropriate, all the OLE associated with all return conductors on both sides of the track shall be isolated and duplicate Additional Earths shall be applied to the return conductor(s) at the extremities of the insulation.

The work may be performed under these conditions, with details of the isolated OLE being included on the Form B.

Alternatively, under the authority of this Form B, sufficient sheathing may be removed to enable additional earths to be applied at a DEP location such that the spacing of the earths does not exceed 400 metres (¼ mile).

NOTE: Any DEP locations where sheathing is removed should not be at a public accessible location.

In this case the initial Form B shall be cancelled, to allow energisation of the OLE concerned, and a new Form B, for the return conductors only, shall be issued in accordance with clause 12.5, Case A or Case B, as appropriate.

Where there are two or more return conductors in close proximity, duplicate Additional Earths shall be applied to each conductor at the extremities of the insulation.

This applies even when work has to be done on only one of them.

When work has been completed, if it is necessary to restore the sheathing, all the OLE shall again be isolated whilst the Additional Earths within the sheathed section are removed and the insulation restored.

12.7 Broken Bare Return Conductor Carried on Insulators

If a broken return conductor is to be repaired, a Form C shall be issued in accordance with clause 12.5, Case A or Case B, as appropriate. Duplicate Additional Earths shall be applied to the return conductor on both sides of the break. The earths shall be applied at no greater distance than 75 metres (80 yards) from the break.

One set of duplicate Additional Earths shall be situated between the break and any booster transformer. Where there are other return conductors in close proximity, earths shall be similarly applied to each.

12.8 Broken Return Conductor Carried on Insulators and Broken Earth Wire where Both are Installed

Where an earth wire is installed in addition to the return conductor and both the earth wire and return conductor(s) are broken, no attempt to repair the return conductor(s) shall be made until the earth wire has been made continuous, either by repair or the fitting of a temporary continuity jumper. A Form C for all OLE, including the return conductors, shall be issued before any repair work is commenced.

With the earth wire continuity re-established, the Form C shall be cancelled and arrangements made to repair the return conductor(s) in accordance with clause 12.7.

12.9 Broken Earth Wire or Return Conductor Electrically Connected to Structures

If a broken earth wire or return conductor electrically connected to structures is to be repaired, or in the case referred to in clause 12.8 where only the earth wire is broken, an overhead line permit is not required to be issued unless the conditions of clause 12.5 Case A apply.

12.10 Broken Sheathed Return Conductor Carried on Insulators

Where the return conductor is sheathed and is to be repaired it shall be treated as a broken return conductor in accordance with clause 12.7.

Where the extent of the sheathing prevents the application of earths at or within 75 metres (80 yards), one of the following two procedures shall be followed:

a) the OLE associated with all return conductors on that side of the track shall be isolated and duplicate Additional Earths applied to the return conductor at the extremities of the insulation at both sides of the break. The repair shall then be performed under these conditions, details of the isolated OLE being included on the Form B; or

b) alternatively, under the authority of this Form B, sufficient insulation shall be removed to enable duplicate Additional Earths to be applied at or within the 75 metres (80 yards) distance.

   In this case, the initial Form B shall be cancelled and a new Form B issued in accordance with clause 12.5, Case A or Case B as appropriate.

Under the authority of a Form B, sufficient sheathing may be removed to enable additional earths to be applied at DEP locations in accordance with the requirements in clause 11.3.2.

Where there are two or more return conductors in close proximity, duplicate Additional Earths shall be applied to each at the extremities of the insulation specified on the Form B, even when work has to be done on only one of them.

When the repair has been completed, if it is necessary to restore the sheathing, the associated OLE shall again be isolated whilst any earths within the sheathed section are removed and the sheathing restored.

12.11 Connections between Return Conductors Carried on Insulators and Rail or a Return Current Busbar

12.11.1 General

When it is necessary to repair a broken connection, or detach a connection between the return conductor and rail or return current busbar, the procedures in 12.11.2 or 12.11.3 shall be followed.

12.11.2 Where Spider Plates are fitted

Where a spider plate is fitted, and there is an intact electrical connection remaining between the return conductor and its associated traction return rail via the spider plate; then work may be undertaken to repair the other broken connection, or to disconnect it completely from the spider plate or traction return rail, without the need for an overhead line permit to be issued for the work.

The integrity of the remaining electrical connection shall be verified before undertaking the work. However, if the remaining electrical connections cannot be verified, they shall not be touched until the requirements of Module 4 are met. During the course of the work do not attempt to disturb, or interfere with, the remaining electrical connection between the return conductor and its associated traction return rail.

12.11.3 Where Spider Plates are NOT fitted

Where spider plates are NOT fitted, then an overhead line permit shall be issued for the work in accordance with clause 12.5, Case A or Case B as appropriate.

Temporary duplicate connections shall be installed between the return conductor and the nearest suitable traction return rail. The temporary connection shall not be removed until the original connection is again electrically continuous.

Where a connection to the return current busbar is installed, the return current busbar-to-rail connections shall be electrically continuous before commencing work on the return current busbar-to-return conductor connection.

12.12 Booster Transformers

When it is necessary to render a booster transformer ineffective, e.g. by disconnection or by the jumpering out of windings, the requirements of Network Rail standard NR/L2/ELP/24011 shall be complied with.

Where work is to be carried out on or adjacent to a booster transformer, the OLE associated with the booster transformer shall be isolated and earthed, the portable earths being applied on both sides of, and as close as practicable to, the booster transformer.

Any other OLE not at a safe working distance shall also be isolated and earthed.

When the ECO issues the Form B authority for the OLE, they shall at the same time authorise the earthing of the associated return conductors by the Nominated Person, giving a numbered message which both shall enter in Part 1 of their copy of Form B together with the relevant details of the OLE and the associated return conductors.

Any other booster transformer or return conductor not at a safe working distance shall also be earthed.

The Nominated Person shall then apply duplicate Additional Earths to the associated return conductor on both sides of the booster transformer.

When the Nominated Person is satisfied that the procedure specified above has been carried out, a Form C shall be issued in respect of the OLE, the booster transformer and return conductors. The procedures in clause 19 shall be followed.

Where the work necessitates the disconnection of either the primary or secondary connections of the booster transformer, one of the following procedures shall be followed:

a) a temporary continuity jumper fitted with screw clamps shall be applied both between the OLE connected to each side of the booster transformer and also between the return conductors connected to each side of the booster transformer before making the disconnection.

   If this procedure is followed, the jumpers shall not be removed until all the connections to the booster transformer are again electrically continuous; **or**

b) alternatively, the booster transformer shall be completely disconnected. Work may then be performed on the booster transformer with the OLE live, provided the requirements of Modules 2 and 3 are met. The work may, if necessary, extend over more than one working period without the restoration of the transformer to service between working periods.

13 Earthing of Tie Wire Anchors

When a tie wire anchor is to be disconnected from its anchoring structure and where the adjacent OLE is live or where there is an adjacent overhead transmission power line, duplicate Additional Earths shall be applied between the tie wire and the structure, prior to disconnection.

In the case where all adjacent OLE is isolated and where there are no adjacent overhead transmission power lines or, if there are, where they are confirmed de-

energised, there is no requirement to apply earths between the tie wire being disconnected and its supporting structure.

14 Disconnection of Wires or Cables

When wires or cables on infrastructure connected to or adjacent to 25 kV overhead line equipment are planned to be disconnected, a full risk assessment shall be carried out in accordance with Module 2.

NOTE: This risk assessment is necessary to identify the conditions where voltage is likely to be induced into a wire or cable being disconnected, so that mitigation against this risk can be carried out.

15 Earthing Overhead Line Isolating Sections

15.1 General Principles

The following sub-clauses state the general principles to be employed when work is to be carried out at, or adjacent to, OLE isolating sections. These clauses supplement or amend stated requirements within this standard as appropriate.

Network Rail instructions for isolating sections shall be in place to identify the locations where the special arrangements apply.

When portable earths and/or continuity jumpers are to be applied to the OLE forming an isolating section, these shall be applied in such a manner that the electric traction return circuit beyond one end of the isolating section remains electrically separated from that beyond the other end of the isolating section.

Where necessary, additional arrangements shall be made so that the electrical separation provided by the isolating section is not bridged out by trains, rail-borne plant, by the work itself or by any other means.

Details for the isolation and earthing of OLE forming an isolating section are recorded in the relevant electrical control instructions.

15.2 Isolating Transformers

Whenever an isolating transformer is taken out of service for maintenance or other reasons, the isolating section concerned shall be blocked to electric trains by the ECO, in accordance with the electrical control instructions.

15.3 Isolating Neutral Sections and Section Insulators and/or Overlaps

Isolating neutral sections have three sets of beaded insulators and two sets of intermediate earthed sections. Work on an isolating neutral section requires that they shall be treated as a discontinuity in accordance with clause 11.4. Additionally, continuity jumpers shall be applied across all sections of the neutral section. The section insulators and/or overlaps at each end of the same isolating section, or the neutral section at one end and the section insulator and/or overlap at the other end shall, however, not be jumpered out simultaneously by any means. CMEs shall be applied on each side in accordance with the requirements of clause 11.3.4.

15.4 Protection Wires

Protection wires shall be treated as return conductors carried on insulators, and the requirements of the clauses 12.5 or 12.6 shall be complied with as appropriate, with the exception that the adjacent OLE, normally live at 25 kV, shall always be isolated and earthed, to allow the protection wire to be earthed to the traction return rail.

16 Earthing and Bonding Connections

16.1 Earthing connection between a Return Current Busbar and Rail

At switching station locations, the traction return rails are connected to the return current busbar by a number of separate bonds. These bonds are 'red bonds'. If all the bonds are disconnected, the switching station enclosure, its fencing, the equipment within it and the broken bonds may be at a dangerous voltage.

The ECO shall arrange for the de-energisation of the switching station, by switching off all possible sources of 25 kV electrical supply to it, and of the OLE in accordance with electrical control instructions.

The ECO shall then initiate repairs to be undertaken by authorised staff who shall fit temporary connections between the return current busbar and rail. A Form C shall be issued in accordance with clause 12.5, Case A or Case B as appropriate, the return current busbar being treated as part of the return conductor. The temporary connections shall not be removed until the permanent connections have been re-established.

This procedure shall also apply if only one of the return current busbar to rail bonds is intact.

Where work is to be carried out at these locations, provided that two or more bonds remain intact, work may be carried out without de-energisation.

The person carrying out the work to verify that the connections of existing track cross bonds are intact.

16.2 Earthing connection between a Main Earthing Terminal and Rail

At locations such as stations or similar, connections are made between the main earthing terminal (MET) of the low voltage (LV) network and the traction return circuit. These connections are 'green bonds'. If all bonds are disconnected, the MET and the LV network might not be adequately earthed.

If green bonds are disconnected, the LV equipment or LV circuit might no longer be earthed.

As a consequence, a fault on the LV system, or a broken overhead contact line coming into contact with the LV equipment, might not be detected.

Green bonds found to be broken or defective shall be reported in accordance with Module 4 clause 5.

Where it is not possible to repair the existing connections, a temporary repair may be carried out by competent staff by way of a temporary continuity jumper.

The temporary connection shall be applied across the break or directly between the MET and a confirmed connection to the traction return circuit.

A spider-plate or an overhead line structure with a directly connected earth wire are examples of such connections where a connection to the traction return circuit can be readily established.

17 Earthing the Connections between a Structure carrying a 25 kV Auxiliary Supplies Transformer and Rail

At certain locations, the neutral of the primary winding of a 25 kV single-phase auxiliary supplies transformer is connected directly to the OLE structure on which it is mounted. This structure is then bonded to traction return rail by two separate bonds to two separate rails. One of these connections may be aerial. Both of these bonds are 'red bonds'.

If both of the bonds between a structure carrying a 25 kV single phase auxiliary supplies transformer and rail are broken, the structure and any overhead line disconnector mounted on it and the bonds may be at a dangerous voltage.

Do not touch the structure or transformer until the transformer has been isolated from the OLE. When this has been done, the transformer shall remain isolated until the structure has been re-bonded to the traction return circuit.

Where the overhead line disconnector feeding the transformer is on the same structure as the transformer and therefore shall not be touched, the OLE feeding the transformer shall be isolated and earthed and an overhead line permit issued to enable the disconnector to be operated.

Once the transformer has been isolated, the OLE may be re-energised but it may be necessary for adjacent OLE to remain isolated and earthed if it is not at a safe working distance.

If one of the bonds is intact, work may be carried out on the other bond without isolating the transformer.

18 Earthing the Connections Between a Structure carrying an Earthing Device or a Harmonic Damper and Rail

The earth terminal of an earthing device and the neutral terminal of a harmonic damper are connected directly to the OLE structure on which they are mounted. The structures are bonded to traction return rail by two separate bonds to two separate rails. One of these connections may be aerial. Both of these bonds are 'red bonds'.

If both of the bonds between the structure and rail are broken, the structure and equipment mounted on it may be at a dangerous voltage and shall not be touched until the OLE to which the earthing device or damper is connected has been isolated and earthed. In those cases where a damper is not connected directly to OLE, the equipment to which it is connected shall be isolated and earthed.

When this has been done, the structure may be re-bonded to the traction return circuit and the equipment re-energised.

If one of the bonds is intact and its integrity verified, work may be carried out on the other bond without isolation.

19 Issue of Overhead Line Permits

19.1 General

The Nominated Person shall first confirm that all necessary testing, earthing, etc. to enact the isolation, has been completed.

The Nominated Person shall then issue an overhead line permit (Form C) to the COSS or Designated Person (DP) responsible for the working party requiring the isolation. The name of the COSS or DP and their certificate number shall be recorded by the Nominated Person in Part 1 of the overhead line permit (Form C).

In accordance with the Rule Book Module AC (GE/RT8000/AC) and Handbook HB16 (GE/RT8000/HB16), the COSS or DP shall retain the overhead line permit in their possession and remain on duty and in control of the worksite until the work is completed or terminated and all persons covered by the overhead line permit are clear of the line, or until relieved by another COSS or DP and the overhead line permit transferred in accordance with Module AC (GE/RT8000/AC), Handbook HB16 (GE/RT8000/HB16).

Where there is more than one working party that requires the same OLE section(s) to be isolated, the Nominated Person shall issue, in person, a separate overhead line permit to each COSS or DP of each working party requiring the isolation. Each overhead line permit shall bear a different message number.

Where the work being undertaken has been identified as not requiring an electrical isolation, an overhead line permit shall not be issued to the COSS or DP and shall treat any OLE as live at all times, in accordance with the Rule Book Module AC (GE/RT8000/AC) and Handbook HB16 (GE/RT8000/HB16).

Prior to any person, tool or item of equipment coming within 600mm of any equipment listed on the OLP a test shall be conducted in accordance with NR/L3/ELP/27720.

The Nominated Person shall record particulars of all overhead line permits issued, and the details of portable earths applied, in Part 2 of their copy of Form B. At the earliest opportunity, the Nominated Person shall inform the ECO, who shall also record the relevant information in Part 2 of their copy of Form B.

19.2 Briefing

19.2.1 General

The Nominated Person issuing the overhead line permit (Form C) shall confirm that the COSS or DP fully understands that the issue of the overhead line permit does not mean that train movements are stopped on the lines concerned. If this is required, the COSS or DP shall make such arrangements, as are necessary, in accordance with the Rule Book (GE/RT8000).

The COSS or DP shall sign Part 1 of the overhead line permit and in turn confirm that each person for whom they are responsible fully understands all conditions stated in section 19.2.2 and 19.2.3, before the person commences any of the work for which the isolation is necessary.

19.2.2 Safe Working Limits

The Nominated Person issuing the overhead line permit (Form C) shall confirm that the COSS or DP fully understands the safe working limits stated on the overhead line permit (Form C).

The Nominated Person issuing the overhead line permit (Form C) shall brief the COSS or DP on the type and location of Reminder of Live Exposed (RoLE) Equipment used.

The planning for the use of identical or unique safe working limits is essential for the correct deployment of the RoLE Equipment; this is to reduce the likelihood of multiple/conflicting RoLE Equipment being deployed within the isolation limits, which might cause confusion.

Where there is more than one working party that require overlapping safe working limits the safe working limits shall be either;

a) identical for all overhead line permits (Form C) by default; or

b) unique to the individual work tasks which require an overhead line permit (form C), where using identical safe working limits is not appropriate.

When overlapping safe working limits are present only the outermost safe working limits shall have RoLE Equipment installed and briefed to the recipient of the overhead line permits (Form C).

19.2.3 Residual Electrical Hazards

The Nominated Person issuing the overhead line permit shall make the COSS or DP aware of **live** equipment adjacent to, abutting or crossing over the earthed equipment, which equipment is **live** and which is earthed, and the location of other residual electrical hazards, if any. The details of residual electrical hazards shall be entered onto the Form C.

Where suitable a diagram, sketch, and/or photo should be used to detail the location of residual electrical hazards.

RoLE Equipment may be used to identify residual electrical hazards.

When RoLE Equipment is used to identify a residual electrical hazard, the Nominated Person shall record the location and type on the overhead line permit (Form C) and brief the COSS or DP.

20 Procedure when Staff Changes take Place

20.1 Change of Nominated Person

If the Nominated Person who received authority to test the OLE is relieved, they shall confirm that their relief fully understands the extent of the isolation and the time it is due to be cancelled, and shall hand to their relief their copy of Form B showing all overhead line permits issued for work being done under the isolation. The relief shall at the earliest opportunity inform the ECO that they are taking up the duties, giving their name and that of the person they are relieving. The ECO and the relief shall record the relevant information on their copies of Form B.

The relief shall retain the Form B in their possession and remain on duty, readily contactable and available at all times, until the Form B is cancelled or they are themselves relieved.

20.2 Change of Person Holding the Overhead Line Permit

If the person who has received the Form C is relieved, they shall inform their relief of the conditions set out in clause 19 in accordance with Rule Book Module AC (GE/RT8000/AC) and Handbook HB16 (GE/RT8000/HB16), and confirm that their relief has understood the briefing. They shall then hand to their relief the Form C which both shall sign in Part 2. The person being relieved shall confirm that their relief's name is recorded in Part 2 of the Form C. The relief shall inform the Nominated Person (either directly or via the ECO), who shall record the change in Part 2 of Form B. The Nominated Person shall at the earliest opportunity inform the ECO, who shall record the relevant information on their Form B.

21 Altering the Extent of an Existing Isolation

21.1 General

The requirement for the extent of an existing isolation to be altered whilst it remains in force (either by increasing or shortening it) shall be considered at the planning stage in accordance with Module 6.

The general principle employed is that the superseding Form B shall be put in place before the initial Form B is cancelled.

A superseding Form B shall only be issued to the Nominated Person who currently holds the initial Form B.

21.2 Principle When Increasing the Extent of an Isolation

The principle in this case is that disconnectors in the open position creating the points of isolation for the initial Form B shall not be operated, but remain open and treated as discontinuities in accordance with clause 11.4, EXCEPT that continuity

jumpers shall NOT be used. Such disconnectors shall be shown on the superseding Form B as 'Not in Normal Position'.

21.3 Sequence When Increasing the Extent of an Isolation

For the purpose of increasing the extent of an isolation already in force the ECO shall:

a) arrange for a superseding block to electric trains to be effected and cancel the initial block to electric trains;

b) arrange for the operation of the circuit breakers and/or OLE disconnectors in order to effect the isolation of the extended area, in accordance with the requirements of clause 8. Disconnectors in the open position creating the points of isolation for the initial Form B shall not be operated but remain open; **and**

c) issue a superseding Form B to the Nominated Person detailing the new isolation limits and authorise the Nominated Person to test and apply portable earths to the extended area. Disconnectors in the open position creating the points of isolation for the initial Form B shall be shown on the superseding Form B as 'Not In Normal Position'.

The Nominated Person shall:

d) test and apply portable earths to the extended area in accordance with the clauses 10 and 11;

e) treat disconnectors in the open position creating the points of isolation for the initial Form B as discontinuities and apply CMEs on each side in accordance with clause 11.4, noting that continuity jumpers shall NOT be used;

f) inform the ECO when all such portable earths are in place and exchange details of Part 2 of the superseding Form B;

Where overhead line permits and/or earthing arrangements implemented under the initial Form B are to remain in force under the new conditions, all such details shall be transferred to the superseding Form B and the initial Form B endorsed accordingly; **and**

g) issue a numbered message to the ECO and both shall complete Part 3 of their copy of the initial Form B cancelling the authority in accordance with clause 24.

21.4 Principle When Shortening the Extent of an Isolation

The principle in this case is that disconnectors which need to be opened to effect the superseding shortened isolation shall be opened in advance of those which are to effect the initial wider isolation. The superseding shortened isolation shall then be tested to prove the shortened isolation is de-energised prior to implementing the initial wider isolation. The disconnectors effecting the superseding shortened isolation will remain open during the period of the initial wider isolation, and are treated as discontinuities in accordance with clause 11.4, EXCEPT that continuity

jumpers shall NOT be used. Such disconnectors shall be shown on the initial Form B as 'Not in normal position'.

21.5 Sequence When Shortening the Extent of an Isolation

For the purpose of shortening the extent of an isolation already in force the ECO shall:

a) arrange for the operation of the circuit breakers and/or OLE disconnectors required in order to effect the superseding shortened isolation **only**, in accordance with the requirements of clause 8.

The Nominated Person receiving the initial Form B shall then:

b) arrange for the testing of each separately isolated section or subsection(s) in accordance with clause 10 to confirm that the superseding shortened isolation has been de-energised.

The ECO shall then:

c) arrange for the operation of the circuit breakers and/or OLE disconnectors required in order to effect the initial wider isolation, in accordance with the requirements of clause 8, and issue a Form B for the initial wider isolation. Disconnectors operated in order to effect the shortened isolation shall be shown on the initial Form B as 'Not in normal position'.

The Nominated Person receiving the initial Form B shall then:

d) arrange for the testing and application of portable earths to each of the separately isolated sections or subsections in accordance with the clauses 10 and 11;

e) treat disconnectors that are in the open position to effect the shortened isolation as discontinuities and apply CMEs on each side in accordance with clause 11.4, noting that continuity jumpers shall NOT be used; and

f) check that overhead line permits that are to remain within the shortened isolation do not extend beyond the safe working limits of the shortened isolation.

When the initial isolation is in force and is to be shortened, the Nominated Person or their relief holding the initial Form B shall:

g) check that all worksites, overhead line permits and associated portable earths are within the limits of the superseding Form B; and

h) advise the ECO accordingly.

When this assurance has been received, the ECO shall:

i) arrange for a superseding block to electric trains to be imposed; and

j) issue a superseding Form B for the shortened isolation.

The Nominated Person shall then:

k) exchange details of Part 2 of the superseding Form B;

l) arrange for the cancellation of those overhead line permits issued under the initial Form B which are not to remain in force, in accordance with clause 22;

Where overhead line permits and/or earthing arrangements implemented under the initial Form B are to remain in force under the new conditions, all such details shall be transferred to the superseding Form B and the initial Form B endorsed accordingly;

m) carry out, or arrange to have carried out by person(s) authorised to carry out overhead line testing and earthing operations, the removal of all portable earths associated with the overhead line equipment to be energised in accordance with clause 23, and

n) issue a numbered message to the ECO, and both shall complete Part 3 of their copy of the initial Form B cancelling the authority in accordance with clause 24.

The ECO shall then:

o) arrange for the operation of the circuit breakers and/or OLE disconnectors required in order to energise the overhead line equipment of the remaining area, in accordance with the requirements of clause 25; and

p) cancel the initial block to electric trains.

22 Cancellation of Overhead Line Permits

22.1 General

On completion of the work, or at such other stage in the work as may prove necessary and practicable, all persons and materials shall be cleared from proximity to the OLE, and the COSS or DP shall complete Part 3 of their Form C declaring that the OLE is fit for the passage of electric traction or other declaration as necessary and return it to the Nominated Person in accordance with Rule Book Module AC (GE/RT8000/AC) and Handbook HB16 (GE/RT8000/HB16). The Nominated Person shall sign Part 3 of the Form C and enter the time and date of cancellation in Part 2 of their Form B.

The Nominated Person shall forward completed and cancelled Forms C to the organisation providing the isolation. It is that organisation's responsibility to retain the isolation documentation for the purpose of audit and incident review.

22.2 Lost or Misplaced Overhead Line Permits

In the case of a lost or misplaced Form C, the COSS or DP shall advise the Nominated Person immediately its loss or misplacement is discovered. The Nominated Person shall arrange for another Form C, endorsed 'Duplicate', to be issued to that COSS or DP to allow work to continue. If the COSS or DP has difficulty in contacting the Nominated Person, the ECO shall be advised.

23 Removal of Earths

When all issued Forms C are in their possession and cancelled, the Nominated Person shall carry out, or instruct authorised person(s) to carry out, the removal of all earths as identified on the Form STED associated with each Form C using approved portable earthing equipment in accordance with Module 10.

However, where other overhead line permit(s) remains in force, they shall leave in place all earths required to provide the overhead line permit(s) with the necessary protection in accordance with clause 21.

24 Cancellation of Form B

24.1 General

The Nominated Person shall inform the ECO that all Forms C are in their possession and cancelled and that all portable earths have been removed. Where earths and/or continuity jumpers are to be left in position, they shall be identified, agreed to remain with the ECO and indicated as such on the Form B, or other such arrangements made in accordance with clause 21.

The Nominated Person shall then issue a numbered message to the ECO and both persons shall complete Part 3 of their copy of Form B, cancelling the authority and declaring that the OLE is fit for the passage of electric traction, and the block to electric trains can be cancelled by the ECO or other arrangements made as necessary.

The Nominated Person shall forward completed and cancelled Forms B to the appropriate electrical control for retention.

24.2 Risers, Bushings and Cable Sealing Ends

Where a Permit-to-Work on High Voltage Electrical Equipment (Form 21067/P) was issued in accordance with clause 8.6 for work to be undertaken on, or within 600 millimetres (2 feet) of, the OLE and the connection(s) to bushing(s) or cable sealing end(s) concerned, and the work is complete, the Nominated Person shall proceed as specified in clause 24 and additionally surrender the Permit-to-Work on high voltage electrical equipment (Form 21067/P) **after** cancelling the Form B. The ECO shall not allow the Form 21067/P to be cancelled until the associated Form B has been cancelled.

25 Making the Overhead Line Equipment Live

25.1 General

The ECO shall, in accordance with electrical control instructions, open, or arrange to open, the circuit breaker(s) necessary to:

a) switch off the complete section(s) concerned; **or**

b) arrange that the disconnector(s) concerned are not carrying load current at the time of operation.

In certain circumstances, the ECO may authorise switching without first opening the circuit breaker(s) feeding the section concerned, as specified in clause 8.

The ECO shall operate, or instruct a person(s) authorised to carry out overhead line switching to operate and lock in the instructed position, the overhead line disconnector(s) as necessary to achieve the energisation of the OLE. Where an Overhead line disconnector is effecting two or more isolations, the ECO shall not authorise the switching until all associated Forms B are cancelled.

For a planned isolation the person(s) authorised to carry out switching shall be briefed and given written instruction on the particular disconnector(s) to be operated by the Nominated Person, prior to the ECO authorising the operation of any particular disconnector. The written instruction shall be a Form STED.

The person(s) authorised to carry out overhead line switching shall operate and lock in the instructed position the disconnector (s) using the unique key(s) kept in the relevant key box and remove any caution notices affixed to the disconnector handle(s). When the disconnector(s) have been operated to the instructed position(s), the authorised person shall remove any 'tag' attached to the key(s) before returning the key(s) to its designated place in the key box, except where an alternative place of safekeeping is authorised by the DUE&PME.

When the disconnector(s) has been operated, locked in the instructed position and caution notice(s) removed, the person(s) who has carried out the operation shall confirm this to the ECO.

The ECO shall then close, or arrange to close, the appropriate circuit breaker(s) to permit electric train operation and cancel the block to electric trains.

25.2 Normally Open Disconnectors

Where a 'normally open' disconnector is required to be returned to the normally open position, the person(s) authorised to carry out overhead line switching shall, on the instruction of the ECO, first remove the permanent caution notice from the relevant key box, operate and lock the disconnector and then affix the caution notice to its permanent position, removing any 'tag' attached to the key before returning the key to the designated place in the relevant key box, except where an alternative place of safekeeping is authorised by the DUE&PME.

26 Carrier Wire Neutral Sections

When implementing an Earthed Isolation which includes a Carrier Wire Neutral Section (CWNS) within the safe work limits, the electrical (sub)sections on both sides of the CWNS shall be isolated.

The "normally open" disconnectors associated with the CWNS shall be treated as discontinuities and clause 11.4shall apply.

If the requirements of clause 11.4cannot be met, then the "normally open" disconnectors associated with the CWNS shall be operated into the 'closed' position to maintain continuity between portable earths. Once the position of the disconnectors is confirmed then the Nominated Person(s), or Authorised Person(s)

acting on behalf of the Nominated Person(s) shall secure the disconnectors and apply caution notices in accordance with Module X, clause 6.3.

A “normally open” disconnector associated with the CWNS shall not be used as a Point of Isolation.

No more than three insulated overlaps within the CWNS shall be connected via OLE disconnectors or continuity jumpers at any time.

All methods of providing continuity of earthing shall be identified on the Form STED.

NOTE: For the purpose of this clause, use of the term ‘normally open’ disconnector(s) refers to Carrier Wire neutral section rescue disconnectors.

27 Reminder of Live Exposed (RoLE) Equipment

27.1 General

Approved Reminder of Live Exposed (RoLE) Equipment shall be applied for all isolation and earthing activities.

Typically, RoLE Equipment consists of a blue warning light and supplementary text.

The RoLE Equipment location shall align with the safe working limits stated on the overhead line permit (Form C), and planned as per Module 6.

Whilst the RoLE Equipment aligns with the safe working limits it does not define between which it is safe to work, the safe working limits remain as those recorded on the overhead line permit (Form C).

27.2 Selection of RoLE Equipment

The type of RoLE Equipment used to identify the safe working limits of the overhead line permit (Form C) shall be selected at the planning stage.

The RoLE Equipment used shall be either:

a) Rail mounted or free standing by default; or

b) Any other type where it is demonstrated that it is more appropriate for the work taking place and remains visible on approach to the limits regardless of plant on site and works taking place.

The selection of the RoLE Equipment should be appropriate to the work taking place and proportionate to the associated electrical risks.

27.3 Installation

The Nominated Person is responsible for the installation of the RoLE Equipment and may delegate to Authorised Persons as required.

RoLE Equipment shall only be installed by a Nominated or Authorised Person.

The RoLE Equipment shall only be installed after the installation of the earths.

NOTE: It is not a requirement for all earths to be installed prior to the installation of RoLE *Equipment in order to avoid excessive traveling between locations of work.*

RoLE Equipment shall not be applied to or within 2.75m of exposed live equipment.

RoLE Equipment shall be installed prior to the issuing of the overhead line permit (form C).

Where overlapping safe working limits are present only the outermost limits shall have RoLE Equipment installed and briefed to the recipient of the overhead line permits (Form C).

27.4 Recording installation

The RoLE Equipment shall be recorded on the Form B and STED to enable the installation and removal at the correct location.

The location and type of RoLE Equipment used shall be recorded on the overhead line permit (Form C) and the Nominated Person shall brief this information to all recipients.

27.5 Removal

RoLE Equipment shall not be removed until **all** overhead line permits (Form C) have been cancelled.

The Nominated Person shall confirm that all RoLE Equipment devices have been removed prior to cancelling the Form B.

27.6 Inspection

RoLE Equipment shall be inspected by the Nominated Person or an Authorised Person acting under their instruction periodically to confirm the installation and functionality. The Nominated Person shall determine the frequency.

Typically the nominal frequency for inspection should be 24 hours, however the frequency of inspections should be determined based on consideration of a range of factors including:

- duration of the work;
- length of site of work;
- typical battery life of device;
- characteristics of the work;
- criticality of control;
- likelihood of disturbance.

In the event that RoLE Equipment is found to be defective, an assessment of follow-up actions shall be made by the Nominated Person.

In the event that RoLE Equipment is found to be missing either;

a) the Nominated or Authorised Person shall remain at the site of the missing device in order to provide a warning to anyone approaching the location until a replacement is installed; or

b) all work associated with the RoLE Equipment shall be suspended until a replacement is installed.

27.7 Temporary Removal

When there is a need to remove RoLE Equipment for the passage of an engineering train or plant; this shall only be undertaken by the Nominated Person, or an Authorised Person acting under their instruction. The person removing the RoLE Equipment shall remain in a position of safety at the location and provide verbal reminders of live exposed equipment until it is replaced.

27.8 Superseding of Isolations / Altering the location of RoLE Equipment

The RoLE Equipment shall remain in situ until the new RoLE Equipment associated with the revised limits have been installed, where isolations are superseded.

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Appendix A
Designated Electrical Controls for Neutral Sections Forming Boundaries

Boundary neutral section	Designated electrical control	Adjacent electrical control
Canonbury	Romford	York
Chathill	York	Cathcart (to be Glasgow)
North London Incline	York	Romford
Nuneaton	Crewe (to be Manchester)	Rugby
Queensville	Crewe (to be Manchester)	Rugby
Shepreth Branch Junction	Romford	York
Great Strickland	Crewe (to be Manchester)	Cathcart (to be Glasgow)
Camden Road	Romford	Rugby
Kentish Town West	Romford	Rugby
Scrubs Lane (North Pole Depot)	Romford (to be Didcot)	Romford (to be Didcot); Lewisham; Rugby
York Way	Rugby	Romford
Harringay Curve	Rugby	York
Up/Down Seven Sisters Chord	Rugby	Romford
South Tottenham (Up & Down T&H)	Romford	Rugby
Tottenham South Curve	Romford	Rugby
Bescot	Crewe (to be Manchester)	Rugby

Boundary neutral section	Designated electrical control	Adjacent electrical control
Pudding Mill Lane	Romford	RFLI Romford RCC
Westbourne Park Eastbound	Didcot ECR	RFLI Romford RCC
Westbourne Park Turnback A	Didcot ECR	RFLI Romford RCC
Westbourne Park Westbound	Didcot ECR	RFLI Romford RCC

NOTE: The Rail For London Infrastructure (RFLI) Romford (RCC) Rail Control Centre is responsible for monitoring and control of the 25kV power supply of the Elizabeth Line.

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Boundary interface	**Designated electrical control**
Network Rail (High Speed 1 Ltd)–North London Incline Connection	* Romford or Ashford
St Pancras–ECML Connection	* Romford or Ashford
Up Ripple Lane Chord	* Romford or Ashford
Down Ripple Lane Chord	* Romford or Ashford

** Either electrical control can be designated, depending on who requests the isolation.*

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Appendix B
List of Forms

Reference	Title
Form AE	Blocking of lines for electric traction purposes (*ECO to and from Operations Control, signal box Supervisor or Signaller*)
Form AT	Blocking of lines for electric traction purposes (*ECO to and from Operations Control, signal box Supervisor or Signaller; Operations Control, signal box Supervisor or Signaller to and from Signaller or Person in charge of sidings*)
Form AS	Blocking of lines for electric traction purposes (*Operations Control, signal box Supervisor or Signaller to and from Signaller or Person in charge of sidings*)
Form SDF	Electrical Control Room Switching Details Form
Form B	Authority to test and apply portable earths and reminder of live exposed equipment to overhead line equipment including return conductors and autotransformer feeders
Form STED	Switching, testing and earthing details
Form C	Overhead Line Permit
Form N	Declaration of switched-off OLE at neutral section forming boundary between electrical controls
Form NC	Declaration of switched-off OLE at neutral section forming boundary at interface between Network Rail and Other Third Party Electrification Systems

General

When it is necessary to revise a form, the form and this index will be updated in accordance with the appropriate change process described in NR/L2/CSG/STP001/02.

Any future re-issue of forms is controlled by the Electrical Power Standards and Controls Steering Group. Any proposed revisions to forms should be forwarded to the Steering Group, who will review the form and pass it to the Standards and Controls Management team for publication at the next available opportunity.

NOTE From time to time it may be necessary to publish a revised version of a form. As a result there may be instances when the version number on Connect is more recent than that identified in the index. The most recent version of the form should be the one used.

For organisations that are not eligible to free of charge standards, there are a number of ways for suppliers, principal contractors and subcontractors to access Network Rail standards and controls: -

- Online: IHS Network Rail Standards Online at: http://uk.ihs.com/products/rail/index.htm Call IHS Customer Services on 01344 328300 for login details.
- Online: SAI Global Network Rail Standards Online Standards Management – i2i | SAI Global Infostore or call SAI Global for more details on 0203 327 3140
- Hard copy: To buy individual standards and controls, call IHS Markit Customer Services on 01344 328300 or emeastore@ihs.com

B1 Form AE

Reference	Issue	Date	Title
NR/L3/ELP/29987/AE	1	05/12/2020	Blocking of lines for electric traction purposes

B2 Form AT

Reference	Issue	Date	Title
NR/L3/ELP/29987/AT	2	01/12/2018	Blocking of lines for electric traction purposes

B3 Form AS

Reference	Issue	Date	Title
NR/L3/ELP/29987/AS	1	05/09/2015	Blocking of lines for electric traction purposes

B4 Form SDF

Reference	Issue	Date	Title
NR/L3/ELP/29987/SDF	2	03/09/2022	Electrical Control Room Switching Details Form

Ref:	NR/L3/ELP/29987/07
Issue:	8
Date:	03 September 2022
Compliance date:	03 September 2022

B5 Form B

Reference	Issue	Date	Title
NR/L3/ELP/29987/B	8	03/09/2022	Authority to test and apply portable earths and reminder of live exposed equipment to overhead line equipment including return conductors and autotransformer feeders

B6 Form STED

Reference	Issue	Date	Title
NR/L3/ELP/29987/STED	6	03/09/2022	Switching, testing and earthing details

B7 Form C

Reference	Issue	Date	Title
NR/L3/ELP/29987/C	7	03/09/2022	Overhead Line Permit

Ref:	**NR/L3/ELP/29987/07**
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B8 Form N

Reference	Issue	Date	Title
NR/L3/ELP/29987/N	4	03/09/2022	Declaration of switched-off OLE at neutral section forming boundary between electrical controls

B9 Form NC

Reference	Issue	Date	Title
NR/L3/ELP/29987/NC	4	03/09/2022	Declaration of switched-off OLE at neutral section forming boundary at interface between Network Rail and Other Third Party Electrification Systems