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Level 3

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

Module 1 General Requirements

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

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Ref:	NR/L3/ELP/29987/01
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Contents

1 Purpose	3
2 Scope	3
3 Roles and Responsibilities	3
3.1 Responsibilities of Employers	3
3.2 Responsibilities of Persons Working on or about the Electrified Lines	4
3.3 Responsibilities of Electrical Control Operators	4
4 Description of the Electrification System	4
4.1 System of Electrification	4
4.2 Supply of Electricity	4
4.3 The Electric Circuit	4
4.4 Switching Stations	5
4.5 System of Electrical Control	6
4.6 Overhead Line Equipment	6
4.7 Sectioning of the Overhead Line Equipment	7
4.8 Isolation Diagrams and Isolation Instructions	8
4.9 Locations of Neutral Sections	8
4.10 Remotely Controlled Earthing Devices	8
4.11 Identification of Electrified Areas	9
5 Danger from Live Overhead Line Equipment	9
5.1 General	9
5.2 Train Equipment	9
5.3 Minimum Safe Clearance	9
5.4 Broken or Displaced Equipment	10
5.5 Return Conductors	10
5.6 Autotransformer Feeders	10
5.7 Rail Return Circuits	11
5.8 Signals	11
5.9 Other Equipment	11
6 Communication with the Electrical Control Operator	11
6.1 General	11
6.2 Numbering of Formal Communications to and from the Electrical Control Operator	12
Appendix A Contact Numbers for Electrical Control Operators	13

Ref:	NR/L3/ELP/29987/01
Issue:	4
Date:	05/09/2015
Compliance date:	11/01/2016

1 Purpose

This module will produce a consistent understanding of 25 kV a.c. electrification and application of the general requirements for working on or about 25 kV a.c. electrified lines. Further requirements for working on or about the electrified lines and for communication are contained in the Rule Book Modules AC and G1 (GE/RT8000/AC and GE/RT8000/G1).

2 Scope

This module states the general requirements for working on or about 25 kV a.c. electrified lines including responsibilities, a description of the electrification systems, the danger that can arise from live overhead line equipment and how to communicate with the Electrical Control Operator.

It is applicable to Network Rail personnel and to Network Rail's contractors.

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 to infrastructure they control.

3 Roles and Responsibilities

3.1 Responsibilities of Employers

Employers are responsible for arranging that persons under their supervision who are required to work on electrified lines, or so near that danger could arise, are supplied with, trained and where required certificated in meeting the requirements contained within, the relevant modules forming this standard and that all such persons:

- a) fully understand the requirements relating to their personal safety;
- b) fully understand the requirements relating to obtaining an emergency switch-off;
- c) understand the requirements which apply specifically to them and that they shall make themselves acquainted with, and will be held responsible for the observance of, all such requirements.

Employers shall arrange for their staff who are required to operate overhead line switches to be trained and authorised for this purpose in accordance with the relevant Network Rail standard.

Employers shall arrange for their staff who are required to use voltage testing devices, live line tools, live line measuring devices and portable earthing equipment to be specially trained, assessed as competent and authorised for this purpose in accordance with the relevant Network Rail standard.

Ref:	NR/L3/ELP/29987/01
Issue:	4
Date:	05/09/2015
Compliance date:	11/01/2016

3.2 Responsibilities of Persons Working on or about the Electrified Lines

All persons required to work on or about the electrified lines shall make themselves acquainted with, and will be held responsible for the observance of, all requirements stated in this standard so far as they concern them.

3.3 Responsibilities of Electrical Control Operators

The Electrical Control Operator is responsible for the safe operation of the electric traction system and, in conjunction with others, for:

- a) maintaining the continuity of the electrical supply;
- b) the operation of switching station equipment;
- c) the operation of overhead line switches.

4 Description of the Electrification System

4.1 System of Electrification

The system of electrification employs overhead conductors carrying electricity at 25,000 volts (25 kV), 50 hertz, alternating current (a.c.).

4.2 Supply of Electricity

Electricity is supplied to Network Rail feeder stations at 25 kV by the electricity supply industry by means of transformers connected to its high-voltage distribution network.

4.3 The Electric Circuit

From the feeder stations, electrical supplies are taken to the overhead line equipment by means of feeders which are either bare overhead conductors or insulated cables. Bare overhead conductors from the feeder stations are terminated on or adjacent to feeder switches mounted on the OLE supporting structures. Cables from the feeder stations are generally buried in the ground or laid in troughing at ground level, run to the OLE supporting structures and then continue up the structures and terminate in sealing ends adjacent to the overhead line feeder switches.

Short jumpers are usually installed between the termination of the bare conductors or the sealing ends of the cables and the switches and also between the switches and the OLE. In some cases, however, a cable terminates in a sealing end mounted on a structure and the sealing end is connected to a bare feeder which is supported on the overhead line structures and terminates adjacent to a feeder switch.

At feeder stations equipped with SMOS, the principle is similar except that the circuit breakers are not located within a building or enclosure.

Ref:	NR/L3/ELP/29987/01
Issue:	4
Date:	05/09/2015
Compliance date:	11/01/2016

Where an autotransformer feeding system is provided, the autotransformer feeders are similarly installed except that an autotransformer might be included in the circuit prior to the final connection to the OLE.

The current is collected from the OLE by the train pantograph and taken to the train equipment. Having passed through the equipment on the train, the current passes through the axles and wheels of the traction unit to the running rails. The current is returned to the feeder station by the traction return running rails which are connected to the feeder station with cables, by return conductors or by autotransformer feeders as explained below. In addition, a part of the current is returned to the feeder station through the general mass of earth.

In some areas, return conductors, connected to the rails at regular intervals, are electrically connected to the masts on which they are supported and can also fulfil the function of an earth wire. However in areas where electrical interference with telecommunications cables and other circuits is likely and there is no autotransformer system installed, return conductors electrically insulated from the masts, normally with booster transformers, are provided to control stray return current and voltage induction in neighbouring circuits.

Where booster transformers and return conductors electrically insulated from structures are provided, the return conductors are connected to the traction return running rails at approximately the mid-point between booster transformers. The current taken by any train situated between a booster transformer and the nearest mid-point connection flows in the traction return running rails to the mid-point connection and from that point on is forced by the booster transformers to flow in the return conductor, the proportion of the current remaining in the rails and earth being very small.

Where the autotransformer feeding system is used, the autotransformer feeders control the effects of electrical interference by taking return current from the running rails at the connections to the autotransformers.

Also, in areas where the autotransformer feeding system is used, and elsewhere, a return screening conductor is installed close to vulnerable telecommunications cables or other circuits. The return screening conductor is connected to the rails at regular intervals and mitigates the adverse effects of the traction current.

4.4 Switching Stations

Switching stations are situated at intervals alongside the electrified lines. They include feeder stations, where the electricity from the electricity supply industry is provided to the railway system, track sectioning cabins and track sectioning locations, which perform the function of switching, sectioning, paralleling and electrical protection.

In areas equipped with an autotransformer feeding system, autotransformer feeder stations and autotransformer sites are provided, which can combine the functions of electrical supply, switching, sectioning, paralleling and electrical protection of the OLE with that of connecting autotransformers to the system.

Switching stations are unattended and are kept closed, locked and alarmed for security. The switchgear is remotely controlled by supervisory control from the