

GE/RT8000 - AC1
Rule Book

Module AC1

AC electrified lines

Part A Dangers of the system,
description of equipment, personal
safety and communications

Part B Emergency procedures

Issue 1

June 2003

Comes into force 6 December 2003



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1	June 2003	Initial issue	6 December 2003



You will need this module if you carry out
duties in AC electrified line areas.

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1 Part A Dangers of the system, description of equipment, personal safety and communications

Dangers of the system

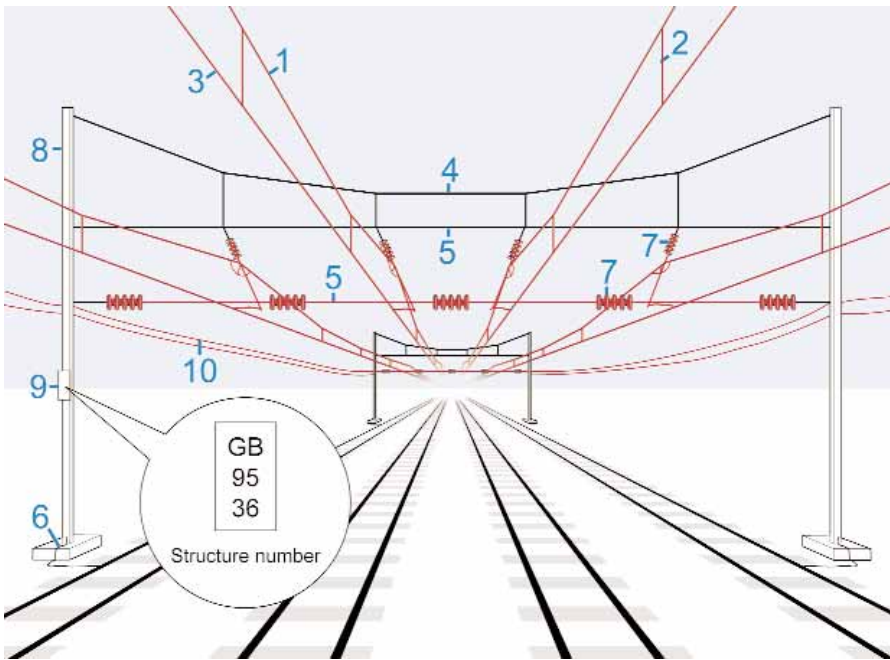
The people responsible: all concerned

Overhead line equipment (OLE), pantographs and roof-mounted electrical equipment on trains are extremely dangerous to:

- touch
- go near to
- allow anything to touch
- allow anything to go near to.

You must treat these items as being as **live** at all times until they have been made safe as shown in the instructions in this module or in modules AC2 *AC electrified lines: Working on or near to the OLE* and AC3 *AC electrified lines: Working of trains*.

Part A 1 section



- | | |
|--------------------|---------------------------|
| 1 Catenary wire | 6 Structure bond |
| 2 Dropper | 7 Insulators |
| 3 Contact wire | 8 Headspan-type structure |
| 4 Headspan wire | 9 Structure number |
| 5 Cross span wires | 10 Return conductors |

Diagram AC1.1
Typical headspan construction

2 Description of the system and definitions

The people responsible: all concerned

2.1 The electrification system

**all
concerned**

The electrification system uses overhead conductors to carry electricity at 25,000 volts (25kV), 50 hertz alternating current (ac).

The diagram AC1.1 on page 5 shows the details of the components that form the overhead structures.

2.2 How electrified lines and neutral sections are identified

**all
concerned**

Table A of the *Sectional Appendix* will show which lines are electrified by the 25kV overhead system and where neutral sections are located.

A typical neutral section is shown in diagram AC1.3 on page 15 and the signs and track equipment are shown in diagram AC1.2 on page 14.

Notice boards also warn you that you are about to enter an electrified area.

2.3 Installation of new OLE equipment

If new OLE is being installed, or an electrified area is being extended, the instructions in this module will **not** apply until the equipment has been declared **live**. You will be told about this in an energisation warning notice, which will appear:

all
concerned

- in the *Weekly and Periodical Operating Notice*
- on posters at all the necessary locations
- on individual notices issued on a personal basis (if necessary).

If you are not sure whether the OLE is live, you must treat it as live and dangerous to life.

2.4 Definitions

These terms have the following meanings wherever they are used in modules AC1, AC2 or AC3.

Automatic dropping device (ADD)

The ADD (where provided) will automatically lower the pantograph to minimise damage to the overhead line equipment if the pantograph:

- carbons are displaced
- head becomes damaged or detached
- height limit is exceeded.

Automatic power control (APC) track inductor

An APC track inductor is a magnet that is fixed on sleeper ends before and after a neutral section, to operate the APC system on the train.

Bond

An electrical connection to or in the running rail traction return circuit, or in a signalling track circuit.

Cant rail

The point on a vehicle or traction unit at which the profile between the bodyside and roof changes.

Earthed

When referring to OLE that is normally live, earthed means connected to the traction return running rail either directly or to a structure that is already connected to that rail.

Electric train

An electrically powered train which has a pantograph on the traction unit through which electric current is collected from the OLE.

Electrical Control Operator (ECO)

The person who controls the power supply to the electric traction system and who is responsible for all switching operations and isolations of electrical equipment on that system.

Electrification fixed equipment

All the lineside equipment that is provided for supplying electricity to electric trains. This includes:

- the overhead line equipment and its structures and foundations
- the trackside switching stations
- booster transformers
- bonding arrangements.

Part A 2 section

Emergency isolation

An isolation that has been carried out by the ECO when it is essential to switch off the electrical supply immediately, to remove danger to personnel from live OLE.

An emergency isolation is carried out by the ECO switching off the electrical supply to all lines:

- between neutral sections, or
- between a neutral section and the end of an electrified line.

In certain locations, equipment is provided to shorten the area of the emergency isolation.

Infrastructure maintainer

The organisation responsible for maintaining the infrastructure.

Infrastructure maintainer's personnel

Anyone employed by the infrastructure maintainer who is competent, and certificated where necessary, to carry out specific duties within this module and module AC2.

Isolated

Electrical equipment is isolated when it is disconnected and separated from all sources of electricity supply in a secure way. This does not apply to return conductors which are part of the return current system and cannot be isolated.

Isolation

Isolation **i** is the action of causing electrical sections or sub-sections of the OLE to be isolated.

Isolation instructions

Instructions that state the following for each section or sub-section of OLE:

a) ECO isolation instructions

The electrical switching that has to be carried out to take an isolation and the limits of the isolation in order to issue the Overhead Line Permits.

b) Signaller's isolation instructions

The protecting signals that apply to the isolation limits beyond which electric trains must not proceed.

Local isolation

An isolation performed locally by a person who has local control over train movements and that is permitted in local instructions.

i

Isolation refers to the arrangements for interrupting traction electricity to a particular part of the railway. They include the details of the section or sub-section or group of sections or sub-sections being isolated together with the dates and times, and as shown in the *Weekly Operating Notice*.

It includes the entire process of switching off, securing, testing and earthing and issue of the Overhead Line Permit.

Part A 2 section

Neutral section

A short section of the OLE between two insulators introduced into the OLE and designed to make sure that two sections that must not be connected electrically are kept separated, even during the passage of the pantographs of electric trains.

Nominated person

A person who is on an approved list held in the electrical control room to use particular equipment or for a particular area and is certificated as competent to:

- carry out isolations and earthing
- issue and cancel Overhead Line Permits.

Overhead line equipment (OLE)

Wires, suspended over the railway line for supplying electricity to electric trains. This includes associated:

- fittings
- insulators
- feeders
- switches
- jumpers
- return conductors.

Overhead Line Permit

Form C (RT3116 Overhead Line Permit) that is signed and issued by the nominated person and given to a controller of site safety (COSS). This states exactly what equipment is isolated and earthed and upon which, or near to which, it is safe for the specified work to begin but only as far as the electrical equipment is concerned.

PANCHEX

A monitoring device that measures the uplift of pantographs highlighting defects that may damage the OLE.

Pantograph

A device mounted on insulators and fixed to the roof of an electric traction unit. The pantograph head contains carbon strips. When the pantograph is raised and pressed against the underside of the contact wire, electricity is collected from the OLE.

Regional Electrification and Plant Engineer (REPE)

The Network Rail Regional Director's representative competent in Electrification and Plant Engineering, or an appointed agent.

Return conductor

A conductor attached to the overhead line supporting structures which carries traction return current.

Section

A length of OLE between switching stations or a switching station and a terminal end.


Sub-section

Part of a section that can be isolated from all other lengths of OLE by operating overhead line switches.

Part A 2

section

Switched off

Electrical equipment that is disconnected and separated from all sources of supply. 

Terminal end

The point where the OLE is finally terminated both in a physical and electrical sense. In other words it does not butt up to, or overlap with, any other OLE.

Working limits

The limits shown in the isolation instructions or an Overhead Line Permit between which it is safe to work. Structure numbers normally identify the working limits.



It is not possible to switch off return conductors as they are part of the return current system. In these instructions the term switched off refers to the disconnection and separation of those parts of the overhead line equipment normally live at 25kV.

AC electrified lines: Dangers of the system,
description of equipment, personal safety
and communications

Part A 2 section

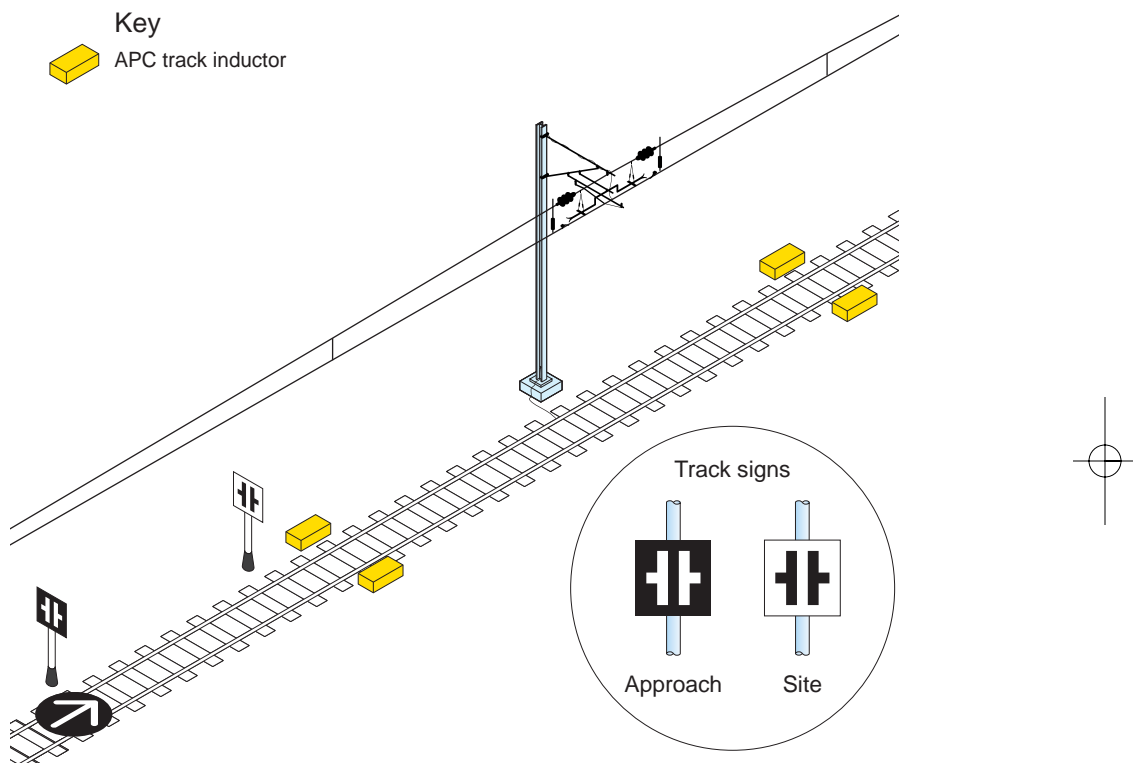
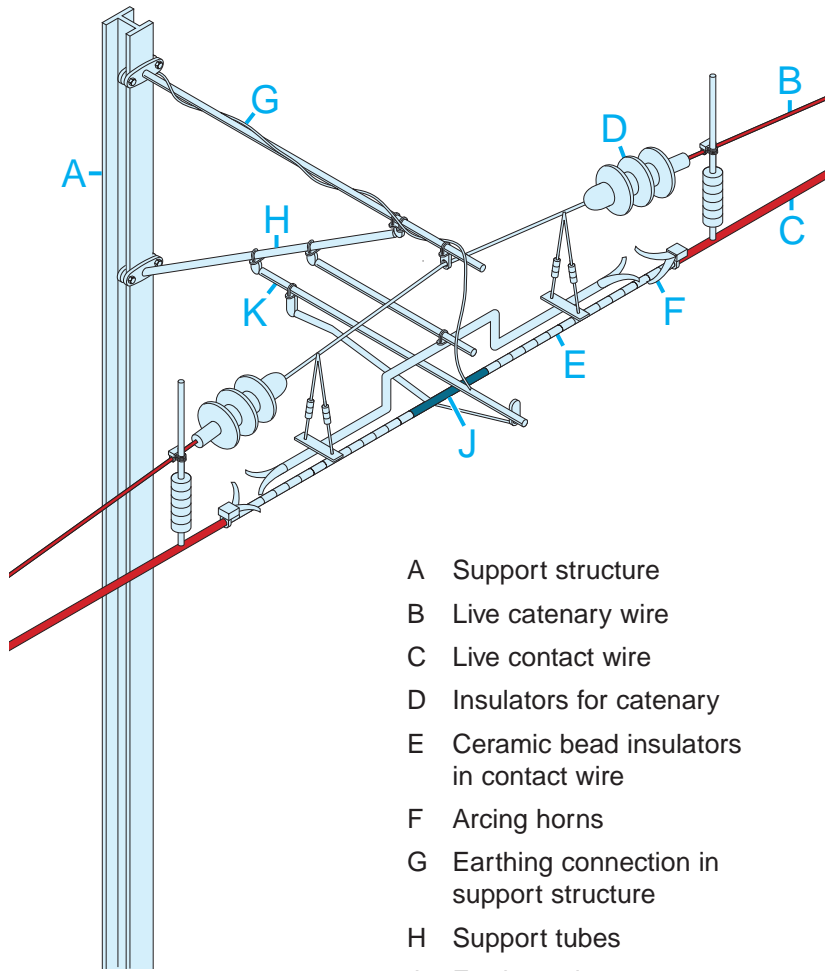


Diagram AC1.2
Typical neutral section

Part A 2 section



- A Support structure
- B Live catenary wire
- C Live contact wire
- D Insulators for catenary
- E Ceramic bead insulators in contact wire
- F Arcing horns
- G Earthing connection in support structure
- H Support tubes
- J Earth section
- K Registration arm

Diagram AC1.3
Neutral section in close-up

3

Safety of personnel working on or near to the OLE

The people responsible: all concerned

3.1 Precautions that must be taken

all concerned

The OLE includes parts such as wires, insulators and conductors that are live and are bare (not having an insulated covering). The live parts are shown in red in diagram AC1.1 on page 5.

Pantographs and other roof-mounted electrical equipment on trains do not have insulated coverings.

You must treat all parts that do not have any insulated covering as being live at all times and dangerous to life **unless** one of the following applies:

- An Overhead Line Permit has been issued to the COSS.
- The OLE has been isolated and earthed and an assurance has been received as shown in local instructions.
- The OLE has been made safe in an emergency and an assurance has been received from the ECO as shown in Part B section 1.2 a) of this module.

Part A 3

section

Running rails

You may treat the traction return current passing through running rails and the bonding system as not being dangerous to life.

all
concerned

However, if the rails are broken or the bonds become detached, a dangerous voltage may be present.

You must not touch the rails if they are broken or the bonds become detached.

3.2 Carrying out work near to the OLE

**all
concerned**

You must not carry out any work unless a safe system of work has been provided.

If you need to work at any distance above or within 2.75 metres of the OLE in any other direction, the authorised safe system of work must be approved by the REPE or a competent organisation approved by the REPE.

Under this safe system of work, you must not allow any part of your body, clothing or anything being used to come within 600 mm of:

- any live parts of the OLE
- pantographs and other roof-mounted electrical equipment on trains.

You may use approved voltage-testing devices and approved live line appliances but only if you have received training and you are competent to do so.

All signals are positioned so that you may carry out your normal duties safely. Some signals are fitted with fixed protective screens.

Part A 3 section

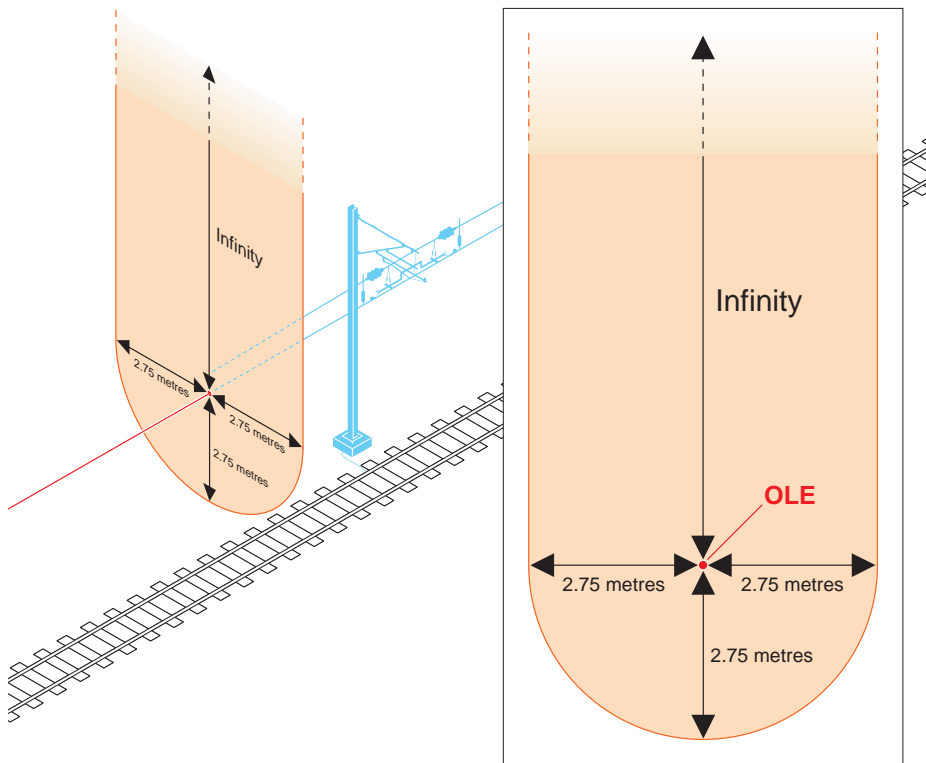


Diagram AC1.4
Carrying out work near to the OLE

3.3 Broken or displaced wires

**all
concerned**

You must not approach broken or displaced wires that are connected to the OLE.

You must immediately report broken or displaced wires to the ECO.

You must treat broken or displaced wires as live and dangerous to life.

3.4 Objects on or near to the live OLE

**all
concerned**

You must not remove or approach anything attached to, or near to, the live OLE.

You must not try to resecure a wagon sheet if you think it may come within 1 metre of live parts of the OLE.

If you see anything attached to or near to the live OLE that should not be there, you must immediately report it to the ECO.

You must treat anything attached to or near to the OLE as live and dangerous to life.

Part A 3 section

3.5 Return conductors

Return conductors carried on insulators are live unless they have been earthed and an Overhead Line Permit has been issued.

all
concerned

You must treat return conductors as live and dangerous to life.

The isolation and earthing of adjacent OLE does **not** necessarily make the return conductors safe.

You may only treat the return conductors as safe when the ECO has given an assurance that Part B section 1.2 of this module has been carried out.

At certain locations where anyone may normally work or stand, the return conductors have a protective insulating covering. At these locations you may treat them as not being dangerous.

3.6 Precautions that must be taken when working on traction units or other vehicles

a) Traction units

Except as shown below, you must never climb above the floor level of the driving cab on a traction unit.

all
concerned

You may only do this:

- on a line where there is no OLE above or adjacent to the traction unit
- if the OLE has been isolated and earthed and an Overhead Line Permit has been issued.

b) Other vehicles

all
concerned

Except as shown below, you must never climb on the roofs or open upper decks of vehicles, or on the steps giving access to the roof of any vehicle.

You may only do this:

- on a line where there is no OLE above or adjacent to the vehicle
- if the OLE has been isolated and earthed and an Overhead Line Permit has been issued
- if the specific conditions in local instructions have been met (as shown in section 3.8 of this module)
- if local isolation is allowed and you have received an assurance that this has been done.

c) Cant rail line

If the cant rail is indicated on the side of a vehicle, you must never go above or allow anything to be carried above that level unless an alternative safe system of work has been approved as shown in Part A section 3.2 of this module.

3.7 Using long items

all
concerned

You must take extreme care when using or carrying long items. You must make sure they do not come within 2.75 metres of the OLE.

You must carry long items horizontally and, if necessary, get other people to help you.

If you are using a brake stick or shunting pole, you must make sure you do not raise it near to the OLE.

Part A 3

section

3.8 Exterior carriage cleaning and loading or unloading rail vehicles

You must only carry out the following activities at locations authorised by the REPE and for which local instructions have been issued:

all
concerned

- Cleaning the outside of carriages by hand.
- Cleaning vehicle ends, traction cab windows and destination indicators.
- Loading or unloading open rail wagons by hand.
- Loading or unloading single-deck carflat vehicles.

3.9 Making sure the OLE is safe

If you have any doubts as to whether the OLE or any part of the OLE is live, you must treat it as being live.

all
concerned

If necessary, you can get further advice from the REPE or other competent authority appointed in writing by the REPE.

4 Communicating with the ECO

*The people responsible: **all concerned***

4.1 General

**all
concerned**

You may contact the ECO directly by radio or by telephone.

4.2 Formal message numbering system

**all
concerned**

The ECO uses a unique numbering system to handle formal messages. You must use this message identification each time you speak with the ECO.

The ECO will give a unique four-digit number each time it sends a message based on the time, using the 24-hour clock.

For example, if the ECO gave you a message at 1815 hours the message would be identified to you as:

1815

4.3 Identifying the location from where you are speaking

If you see an unusual occurrence or incident involving the OLE, you must immediately report it. When reporting it, you must check you are speaking to the correct person. You must then state:

all
concerned

- your name, job title and employer
- the line or lines concerned
- the location (for example, the nearest bridge, station, signal or other structure)
- the number on the nearest OLE structure or identifying plate (this will tell the ECO exactly where you are)
- the telephone number or radio call number (whichever you are using) so that the ECO can contact you if necessary.

All messages about an Overhead Line Permit, the position of local earths, or other related matters **must** state:

- the number or numbers on the OLE structures, and
- the name of the line or lines affected to which the message relates.

1 Part B Emergency procedures

Switching off the electricity in an emergency

The people responsible: all concerned, train crew, signaller, signal box supervisor, person in charge of the emergency isolation, nominated person

This is an emergency procedure. You must read this section together with other appropriate sections of this module.

1.1 Immediate actions

a) Types of incident

all concerned

You must **immediately** contact the ECO (or arrange for this to be done) if you become aware of:

- a derailment
- a lineside fire
- a fire on a vehicle or train
- a person in contact with, or in danger of coming in contact with, the OLE
- damage to the OLE
- an incident or other emergency requiring, or likely to require, the electricity supply to be switched off.

If you receive a message from another person about an emergency, you must pass on all this information to the ECO.

Part B **1** section

b) Reporting the emergency

When you contact the ECO, you must first say, '**This is an emergency call**'.

all
concerned

You must then state:

- where you are speaking from
- your name, job title and employer
- the line or lines concerned
- the location (for example, the nearest bridge, station, signal or other structure)
- the number on the nearest OLE structure or identifying plate (this will tell the ECO exactly where you are)
- the telephone number or radio call number (whichever you are using) so that the ECO can contact you if necessary.

You must also tell the ECO the reason why you have asked for the electricity to be switched off and **whether any person is in danger from live OLE**. You must say whether the emergency services are waiting to give assistance.

c) Instructions for train crew

If you see an obstruction on a line other than that which your train is standing, you must immediately make sure the other line is protected by carrying out the instructions in module M1 *Train stopped by train accident, fire or accidental division*.

train crew

You must do this before asking for the electricity to be switched off.

d) Instructions for signallers

signaller

If you become aware of an emergency, you must carry out the appropriate train signalling regulations.

You must do this before asking for the electricity to be switched off.

1.2 Further actions

a) Staying in contact with the ECO

all concerned

You must stay in contact with the ECO, or if you have reported the incident through another person, stay in contact with that person until you have been assured that:

- the electricity has been switched off and the OLE has been made safe to be approached but **not** touched, or
- for rescue purposes, Part B section 2.1 of this module has been carried out, the electricity supply has been switched off and the OLE has been made safe to be approached and touched but only if hands are covered with a material which will not conduct electricity, or
- other arrangements have been made including who will be treated as the person in charge of the emergency isolation.

The ECO will only give you an assurance that one of these has been carried out when the isolation has been made between neutral sections or between a neutral section and the terminal end.

If you are a person passing on this information on behalf of someone else, you must stay in contact with the ECO until an assurance has been given that these arrangements have been put in place.

Part B 1 section

b) What the ECO will do

On receiving your message, the ECO will decide whether to carry out an emergency isolation or take other actions.

all
concerned

If the ECO decides to carry out an emergency isolation, this may be done without first arranging a blockage to electric trains.

The ECO will decide whether you will be treated as the person in charge of the emergency isolation.

The ECO may appoint another person to be in charge of the emergency isolation, in which case you will be told this has happened.

The ECO will appoint the most appropriate person to be in charge of the emergency isolation.

The ECO will tell the following about the extent of the emergency isolation:

- Operations Control
- the signal box supervisor or signaller.

You must complete the forms shown in section 6 of module AC2.

signaller or
signal box
supervisor

1.3 Managing an emergency isolation

a) Shortening the emergency isolation

person in
charge of the
emergency
isolation

Where remotely controlled earthing switches are provided to allow an emergency isolation to be shortened, without affecting the assurances given in Part B section 1.2 a) of this module, the ECO will carry out shortening.

Under these circumstances the electrical sections that are to stay isolated and earthed will be blocked to electric trains before electricity is restored to the other sections.

b) If the power is to be restored to unaffected areas

The ECO will tell you and all concerned if the power is to be restored to unaffected areas. This will only be done when all the following have been carried out:

- The emergency isolation has been put into effect.
- All immediate actions to deal with the circumstances on the site of the emergency have been put into effect.
- The ECO has arranged for the nominated person and other suitable personnel to attend (but only if the emergency is going to last a long time) so that the OLE in the affected area can be isolated and earthed and an Overhead Line Permit issued.

c) If passengers are to be detrained

If passengers are to be detrained, you must make sure that all passengers are kept clear of the OLE. You must not approach the OLE until you have received an assurance from the ECO. Refer to Part B section 1.2 a) of this module.

Part B 1 section

d) Handing over responsibilities to another person (not the nominated person)

If you hand over the responsibility of the emergency isolation to someone else, you must tell the ECO immediately. You must give the name, job title and employer of the person taking over from you.

person in charge of the emergency isolation

If you take over the responsibility of the emergency isolation, you must immediately confirm the arrangements with the ECO.

1.4 Duties of the nominated person

a) Taking over responsibilities

If you are in charge of the emergency isolation, the nominated person will contact you when arriving on site. You and the nominated person must both contact the ECO to transfer the responsibility of the emergency from you to the nominated person.

person in charge of the emergency isolation

b) What the nominated person will do

The nominated person will:

- establish the Overhead Line Permit working limits to allow the emergency to be dealt with
- arrange, through the ECO, for the signaller to provide signal protection
- issue Overhead Line Permits to the appropriate COSS.

1.5 Restoring power to the unaffected area

all concerned

The ECO will carry out any switching needed to restore the electricity supply to the unaffected area and will give details of the amended isolation details as appropriate to:

- Operations Control
- signal box supervisor
- signaller.

signaller or signal box supervisor or operations controller

You must amend the forms shown in section 6 of module AC2.

1.6 When all personnel are clear of the affected section or sections

all concerned

When all personnel are clear, including emergency service personnel, the nominated person will cancel the Overhead Line Permit and then (whichever is appropriate):

- issue permits to other railway personnel, or
- arrange for the sections to be made live.

The nominated person will ask the ECO to arrange for the signaller to be told.

Part B 1 section

1.7 When the emergency isolation is no longer required and the affected section can be re-energised

As soon as the emergency is over and the affected section can be re-energised, you must:

- immediately tell the ECO that the emergency is over (or arrange for this to be done)
- wait for further instructions.

person in charge of the emergency isolation

When the ECO receives this information and, provided the affected section has not been isolated and earthed in order to issue an Overhead Line Permit as shown in section 7 of module AC2, the ECO will ask you to confirm that all personnel and materials are clear of the OLE. If you can do this, the ECO will:

- return the system to normal and tell all personnel concerned
- confirm with you that you are no longer required to be in charge of the emergency isolation.

2 Rescuing a person from the OLE

The people responsible: all concerned

2.1 When the person is not completely below or is within 1 metre of the live OLE

all concerned

You must make sure the electricity is switched off before you approach a person who:

- **is not completely** below the live OLE, or
- **is within** 1 metre of the live OLE.

You must make sure an emergency isolation has been taken as shown in Part B section 1 of this module.

If you become involved in rescuing a person **after** an emergency isolation has been taken, you may have to come into contact with the:

- OLE, or
- person touching the live OLE.

In either case, you must make sure your hands are covered with something dry which will not conduct electricity. This is because a residual voltage may be present even though the electricity has been **switched off**.

Part B2 section

2.2 When the person is completely below and no part of the body is nearer than 1 metre to the live OLE

Whenever possible, you must make sure an emergency isolation has been taken to rescue someone in danger from live OLE.

all
concerned

However, if you become involved in rescuing a person, it is not essential for the electricity to be switched off if you are sure that no part of your body or clothing or anything you are holding will come within 1 metre of the live OLE or anything in contact with it and the person you are rescuing is:

- **completely** below the live OLE, and
- not nearer than 1 metre to it.

It is safe for you to touch the person as the body will contain no harmful electric charge.

If you doubt that you or the person you are rescuing is within 1 metre of the live OLE, you must make sure an emergency isolation has been taken.

You must make sure that the casualty does not come within 1 metre of the live OLE or anything in contact with it.

3 Removing an object from the OLE

The people responsible: all concerned

3.1 Telling the ECO

all concerned

You must tell the ECO **immediately** if you see or are made aware of an object:

- hanging from the OLE, or
- in contact with the OLE, or
- close to the OLE.

The ECO will make arrangements to remove the object.

3.2 Removing an object from the OLE

all concerned

You must not try to remove or approach an object hanging from, in contact with or close to the OLE unless you have been specially trained and authorised to do so.

If the electricity is to be switched off, the ECO will agree with the Operations Control, the signal box supervisor or signaller (whichever is appropriate) that the electricity may be switched off from the complete sections without blocking them.

3.3 When the object has been removed

all concerned

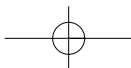
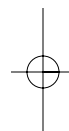
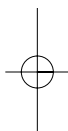
As soon as the object has been removed and it is safe to do so, the ECO will:

- immediately re-energise the section or sections concerned
- tell Operations Control, the signal box supervisor or signaller (whichever is appropriate) that this has been done.

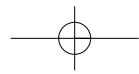
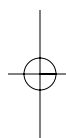
Glossary of terms and abbreviations

The term	Includes or means:
Operations Control	The general term used for Network Rail Operations Control offices.
Protection	Ways of making sure that a line is protected. This includes keeping signals at danger, placing detonators on the line, using a track circuit operating clip and showing a hand danger signal.
Traction unit	Locomotive, multiple unit, self-propelled rail vehicle or road-rail vehicle operating in rail mode.
Train	Light locomotive, self-propelled rail vehicle or road-rail vehicle in rail mode.
Traincrew	Driver and guard.
Train signalling regulations	Instructions for use by the signaller that give details of the rules, regulations and instructions relating to each different kind of signalling system.
Your employer	The company, or subsidiary of a larger organisation for whom you work.

Notes



Notes





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