

Letter of instruction

Information for users

The following document:

NR/L1/ELP/27000 Issue 1

has had changes made to it, most recently, with effect from **18 April 2013**.

Instructions for use

It is essential that you first read and understand each letter of instruction pertaining to the standard before proceeding to use the standard. You must then apply the requirements of each letter to the standard.

NR/BS/LI/269	Issue 2	18 April 2013	Proceed to letter ►
NR/L1/ELP/27000	Issue 1	04 June 2011	Proceed to standard ►

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Level 1

Asset Management Policy for Electrical Power assets

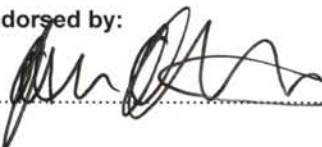
Endorsement and Authorisation

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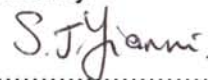
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Issue record

Issue	Date	Comments
1	4 June 2011	First issue

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 4 June 2011.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 3 (Option Selection) to continue to comply with the issue of any relevant Network Rail standards current when GRIP Stage 3 was completed and not to comply with requirements contained herein, unless stipulated otherwise in the scope of this standard.

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1 Purpose

This asset management policy for electrical power assets has been written to demonstrate how these assets will be managed to meet the requirements of Network Rail's corporate objectives and the Network Rail asset management policy.

The defined outputs for electrical power assets are:

- to achieve 28% improvement in performance by the end of control period 4 compared to 2006/07, as measured by the number of incidents caused by failures of overhead lines or conductor rails that result in train performance delays in excess of 500 minutes;
- that signalling power supply failures that result in train performance delays are managed to support the achievement of our train reliability targets;
- to improve the remaining life of electrification distribution assets;
- to maintain the 2001/02 asset condition profiles for fixed plant assets.

2 Scope

This Network Rail standard specifies the asset management policy for electrical power assets.

3 Overview of asset portfolio

3.1 Electrification types

Approximately 40% of the rail network is electrified and 60% of all rail traffic is electric powered. Three distinct electrification types are employed:

- 25 kV ac overhead electrification (64%);
- 660/750 V dc conductor rail electrification (36%); and
- 1500 V dc overhead electrification (<1%).

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3.2 Main electric power assets

The main electric power assets are:

- a) Overhead Line Equipment (OLE);
- b) High Voltage (HV) switchgear;
- c) grid supply points;
- d) cables;
- e) transformers (power and booster);
- f) dc Low Voltage (LV) switchgear;
- g) transformer rectifiers;
- h) conductor rail;
- i) supervisory control and data acquisition (SCADA) systems;
- j) rail heating power supplies;
- k) signalling power supplies;
- l) non-traction High Voltage distribution systems;
- m) portfolio of small plant installations;

3.3 Overhead line equipment

Overhead line equipment (OLE) can be described as the arrangement of wires suspended over the railway line for supplying electricity to electric trains. Its main purpose is to enable safe and reliable transfer of electric current to a roof mounted pantograph, which makes sliding contact with the contact wire.

3.4 High Voltage switchgear

The supply of electrical traction power to dc electrification systems is derived from the utility supply systems at typically 33 kV 3-phase ac. HV switchgear is used to control incoming and outgoing connections to each substation and the local transformer rectifier.

25 kV overhead line electrification uses single and dual phase HV switchgear to section the OLE.

3.5 Grid supply points

The supply of electrical traction power to the electrification systems is derived from a Distribution Network Operator or the National Grid.

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3.6 Cables

High voltage cables are used as the transmission medium for power between supply points and loads. Different cable types are used dependent upon the application.

Low voltage cables are used for dc electrification and for earthing and bonding.

3.7 Transformers (power and booster)

Power transformers are used to change the distribution voltages within the network to levels appropriate for the supply of electric traction or auxiliary loads.

Booster transformers are used to improve the effectiveness of the traction return current path.

Autotransformers are used to balance phases in autotransformer schemes.

3.8 dc Low Voltage switchgear

dc LV switchgear is used on dc electrified lines to distribute power to the conductor rail. dc LV switchgear is also used at locations between substations known as Track Paralleling Huts to parallel supplies from adjacent substations which then provide increased voltage to trains and improved fault protection. This switchgear typically operates at 750V dc.

3.9 Transformer rectifiers

The supply of electrical traction power to third rail dc systems is derived from the utility supply systems at typically 33 kV 3-phase ac. This supply must be transformed to a lower voltage using a transformer and rectified to dc using a multi-phase rectifier. Since these two components work together and are often built as one module, they are conventionally treated as a set. Typically these transform from 33 kV ac to 750V 12 pulse dc.

3.10 Conductor rail

The main purpose of the dc conductor rail is to enable safe and efficient transfer of electric current to a train mounted collector shoe which makes sliding contact with the top surface of the conductor rail.

3.11 SCADA

The supervisory control and data acquisition (SCADA) system remotely controls electrical distribution equipment within substations and other locations from an electrical control room.

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3.12 Electric Rail heating

Electric heating of switches and crossings, and conductor rail is provided to achieve their correct operation during the winter months.

3.13 Signalling power supplies

High integrity power supplies are provided for signal control centres and trackside signalling equipment.

3.14 Non-traction High Voltage distribution systems

High Voltage (greater than 1000V ac) distribution systems form part of the power distribution to major installations such as stations and depots, connecting the local utility supply to Network Rail electrical loads.

3.15 Portfolio of small plant installations

A portfolio of small plant installations such as lighting and tunnel ventilation is also provided to support operations.

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4 Policy statements

The policy statements are given as Tables 2 to 20.

Revised policy statements are highlighted using a light yellow background as such.

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New policy statements are highlighted using a light green background as such.

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Guidance associated with any policy statement is highlighted using a grey background.

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Assets shall be operated and, where necessary, replaced, according to the principle of lowest whole life costs (WLC). WLC shall include capital costs, maintenance costs, Schedule 4 costs, Schedule 8 costs, energy costs, disposal costs and any costs of affecting adjacent sites. Replacement of an existing asset may be brought forward if the net present value of bringing the replacement forward is less than the WLC of the existing asset during the period up to the originally planned replacement.

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Number	Policy Statement										
E&P-0	<p>Electrical Power Network Management</p> <p>Every electrical network shall have</p> <ul style="list-style-type: none"> • diagram(s) of the electrical network showing the interconnections between the various plant items including the switchgear and their location(s) • documented fault levels at all relevant points • justification for protective device configurations • description of methods of isolation • an assessment of the rise of earth potential at all relevant locations • a register, which includes details such as manufacturer and type, serial number and year of manufacture, date of installation, voltage and current rating, short-circuit rating and type of operating mechanism, earth mat resistance & soil resistivity at all relevant locations • details of operational limitations due, for example, to the possibility of overstressing • a maintenance record for each transformer and item of switchgear • record of routine & fault operations for circuit-breakers • schedule of the details of any modifications carried out. • details of key standards (including version) used to design the network. 										
E&P-0a	<p>Electrical Power policy shall be based upon the following key external standards.</p> <table> <tr> <td>BS EN 50122 – 1</td><td>Railway applications - Fixed installations - Part 1: Protective provisions relating to electrical safety and earthing</td></tr> <tr> <td>BS EN 50119</td><td>Railway applications – Fixed installations - Electric traction overhead contact lines</td></tr> <tr> <td>BS EN 50163</td><td>Railway applications - Supply voltages of traction systems</td></tr> <tr> <td>BS EN 50388</td><td>Railway applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability</td></tr> <tr> <td>BS 7671</td><td>Requirements for Electrical Installations</td></tr> </table>	BS EN 50122 – 1	Railway applications - Fixed installations - Part 1: Protective provisions relating to electrical safety and earthing	BS EN 50119	Railway applications – Fixed installations - Electric traction overhead contact lines	BS EN 50163	Railway applications - Supply voltages of traction systems	BS EN 50388	Railway applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability	BS 7671	Requirements for Electrical Installations
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BS EN 50388	Railway applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability										
BS 7671	Requirements for Electrical Installations										

Table 1a) – General

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Number	Policy Statement
E&P-1	Assets shall be subject to appropriate inspection and maintenance regimes designed to provide the required level of service outputs at minimum whole life cost or within affordability constraints.
E&P-2	Within affordability constraints, assets shall be replaced with the least whole life cost solution that will meet the output requirements for the relevant route.
Guidance [E&P – 2]	<p>Six levels of interventions are possible</p> <ul style="list-style-type: none"> • Proactive inspection and maintenance • Reactive repair • Refurbishment to reinstate original condition • Refurbishment to extend asset life to the required period. • Replacement of existing assets (total asset or integral sub-component, for example circuit breaker truck within switchboard) • Renewal / modification of electrical systems to optimise network for industry requirements <p>Optimisation of the network (to increase capacity, rationalise equipment, or improve system efficiency) should always be considered, and wherever possible system renewal should be the first option for consideration in order to</p> <ul style="list-style-type: none"> • avoid inefficient piecemeal renewal of assets • reduce associated risk and cost associated with degraded mode operation • develop a modern system architecture at the lowest cost.
E&P-2a	Energy losses shall be included in any whole life cost assessment process as part of option selection. UK Government predicted energy prices shall be used
Guidance [E&P – 2a]	<p>The UK government energy price predictions are published by HM Treasury's and Department of Energy & Climate Change in the document "Valuation of energy use and greenhouse gas emissions for appraisal and evaluation" - January 2010.</p> <p>(see supporting document folder)</p>
E&P-2b	For all main assets, condition shall be periodically assessed using data collated via the routine maintenance regime and other methods.
E&P-2c	For all main assets, asset performance shall be periodically assessed using incident/investigation reports collated via the routine maintenance regime.

Table 1b) – General

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Number	Policy Statement
E&P-3	New constructions of OLE shall be subjected to a sampled initial inspection regime after 1 year in service. Where necessary, provision shall be made for primary creep adjustments and rectification of defects during the first three years of service life.
E&P-4	All OLE components shall be inspected at regular intervals according to their design and usage in accordance with NR/L2/ELP/21087
E&P-5	Deleted see policy 2b
E&P-6	Deleted see policy 2c
E&P-7	Emerging design weaknesses/defects in OLE components/designs shall be removed where business justified, by means of 'campaign changes' or route specific initiatives to improve reliability, availability, maintainability and safety and extend the life of component parts.
E&P-8	Business justified campaign changes shall be planned for delivery by the end of control period 4.
E&P-9	Major renewals of the structures, foundations, wiring, components and contact wire shall be planned on the basis of a nominal asset life of 80 to 140 years, according to equipment type, usage and condition.
E&P-9a	OLE structure repair shall: <ul style="list-style-type: none"> • be programmed to prolong the life of the structure • be undertaken only as required by condition assessment • not support fixed interval OLE structure painting. • be adapted to suit the defined OLE structure category

Table 2a) – Overhead Line Equipment (OLE)

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Guidance [E&P – 9a]	<p>For minimum whole life-cost, we have defined a “differentiated” approach to OLE structure management with the scope and frequency of intervention varying according to OLE structure type.</p> <table><tr><th rowspan="2">Structure Type</th><th colspan="3">Intervention Scope</th></tr><tr><th>Policy A</th><th>Policy B</th><th>Policy C</th></tr><tr><td>UC / BFB</td><td>–</td><td></td><td>1 or 4</td></tr><tr><td>Pole / Tubular</td><td>–</td><td>2</td><td></td></tr><tr><td>Double Channel</td><td>–</td><td></td><td>1 or 4</td></tr><tr><td>Welded Angle (Boom)</td><td>–</td><td>2</td><td></td></tr><tr><td>Welded Angle (Mast)</td><td>–</td><td>2</td><td></td></tr><tr><td>Welded Rod (Boom)</td><td>–</td><td>3</td><td></td></tr><tr><td>Welded Rod (Mast)</td><td>–</td><td>3</td><td></td></tr></table> <p><u>Frequency</u> Condition of OLE structures can be managed using the following policies:</p> <p>Policy A</p> <ul style="list-style-type: none">-New asset has only a short maintenance-free period.-Regular intervention; condition maintained and little deterioration.-Periodicity of intervention typically 5 – 10 years-This policy applied where degradation rate, asset criticality and individual asset value are highest. <p>Policy B</p> <ul style="list-style-type: none">-Periodic maintenance to remedy most of the asset degradation.-Less frequent intervention than Policy A but successive interventions are less effective over the asset life.-Periodicity of intervention typically 15 – 25 years until intervention no longer cost effective <p>Policy C</p> <ul style="list-style-type: none">-Asset degrades until condition is only just in serviceability band.-Occasional life extension works with scope limited to that needed to delay asset failure and restore serviceability-Life extension less beneficial later in asset life-Periodicity of intervention typically 30 – 50 years-Asset renewed when life extension no longer cost-effective <p>This policy applied where degradation rate, asset criticality and individual asset value are lowest.</p> <p><u>Scope</u></p> <ol style="list-style-type: none">1. Planted Universal Column / Broad Flanged Beam / Pole / Double Channel Structures<ul style="list-style-type: none">-Repair of foundation watershed cap-Re-application of waterproof seal to mast base and cap2. Fabricated Angle Section Portals<ul style="list-style-type: none">-Localised ‘patch painting’ of structural members which have been subject to corrosion-Repair of foundation watershed cap-Re-application of waterproof seal to mast base and cap3. Welded Rod Portal Structures<ul style="list-style-type: none">-Thorough preparatory treatment by hand and complete repaint-Repair of foundation watershed cap-Re-application of waterproof seal to mast base and cap4. Bolted Base UC / BFB / dc Structures<ul style="list-style-type: none">-Denso taping of projecting bolts. <p>This approach will be modelled, and if required, modified during the CP5 policy review.</p>	Structure Type	Intervention Scope			Policy A	Policy B	Policy C	UC / BFB	–		1 or 4	Pole / Tubular	–	2		Double Channel	–		1 or 4	Welded Angle (Boom)	–	2		Welded Angle (Mast)	–	2		Welded Rod (Boom)	–	3		Welded Rod (Mast)	–	3	
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Welded Rod (Boom)	–	3																																		
Welded Rod (Mast)	–	3																																		

Table 2b) – Overhead Line Equipment (OLE)