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Specification for Tyne & Wear Metro (Sunderland Extension) - OLE Maintenance (formerly RT/E/S/27223)

This temporary front sheet facilitates change to the new Network Rail Standards referencing nomenclature.

The Ref above will be formally allocated to this standard when it is next changed in the meantime the contents, date and issue number of this Network Rail Standard are **UNCHANGED and with immediate effect it should be referred to as “(new ref) formerly (old ref)”.**

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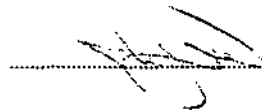
Ref	RT/E/S/27223
Issue	E1
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Business Process Document

Specification for Tyne and Wear Metro (Sunderland Extension) - OLE maintenance

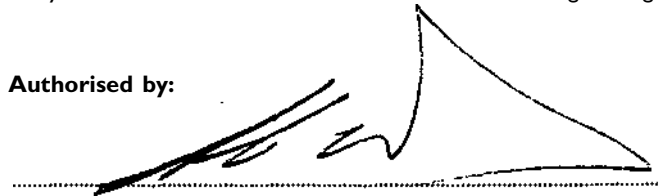
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Issue record

Issue	Date	Comments
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Implementation

The requirements of this document are mandatory and shall be implemented from the date of issue recorded in the Issue Record.

Compliance

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Contents

1	Purpose	5
2	Scope	5
3	Reference documentation	6
4	Definitions	6
5	Maintenance instruction	10
5.1	Inspections	10
5.1.1	Routine status checks (RSC1 to RSC3)	10
5.1.2	Complete inspections (CI 1 and CI 2)	15
5.1.3	Special inspections (SI 1 and SI 2)	15
5.1.4	Performance tests (PT1 to PT4)	16
5.1.5	Corrective maintenance (CM1 to CM2)	16
5.1.6	Full overhauls and renewals (FOR1 and FOR2)	17
5.1.7	Overview of maintenance schedules	18
5.2	Maintenance procedures of OLE	19
5.2.1	Insulators	19
5.2.2	Section insulators (SI's)	19
5.2.3	Contact wire repair	19
5.2.4	Catenary wire repair	20
5.2.5	Voltage limiting devices	20
5.3	Maintenance vehicles and equipment	20
5.4	Maintenance records	20
6	Technical data on contact and catenary position	21
6.1	Tolerances for maintenance	21
6.1.1	Contact wire	21
6.1.2	Catenary wire	22
6.1.3	Track tolerance	23
6.2	Alignment	23
6.2.1	Contact wire	23
6.2.2	Catenary wire	25
6.2.3	Crossovers	26
6.3	Electrical clearances	27
6.3.1	Live equipment to earth	27
6.3.2	Pantograph to in-span structures and other obstructions	27

6.4	Mechanical clearances	28
6.4.1	Minimum clearance between pantograph and steady arm	28
6.4.2	Mechanical clearances to steady arms	28
6.5	Catenary clearances – auto tensioned equipment	28
6.5.1	Setting of overlaps	28
6.5.2	Balance weight setting	29
6.5.3	Setting of tension springs	29
7	Safety precaution guidelines	29
7.1	Safety precautions against the danger of electrical shock	29
7.2	Safety precautions against the danger due to working at elevated heights	30
7.3	Safety precautions against the danger due to running trains or track vehicles	30
8	Technical information and tables	30
8.1	Maximum permissible deviation	30
8.1.1	Blow-off table	31
8.1.2	Stagger effect table	33
8.2	Calculation of mid-span offset	35
8.3	Sweep	35
8.3.1	Tangent track and curved track with staggers on opposite sides	35
8.3.2	Curved track with staggers on the same side	35
8.4	Radial loads	36
8.5	Minimum unrestricted movement of balance weights	37
8.5.1	Contact wire	37
8.5.2	Catenary wire	38
8.6	Fall Due to ice loading at mid-span	39
Appendix A - Sign convention		40
Appendix B – Maintenance and testing of voltage limiting devices type CLS		41
Appendix B – Maintenance and testing of voltage limiting devices type CLS		41
Appendix C – EO2 sheet		42

Ref:	RT/E/S/27223
Issue:	I
Date:	June 2005

I Purpose

This specification states the minimum requirements in order to ensure the safety and reliability of the Tyne and Wear Metro (Sunderland Extension) Overhead Line Electrification (OLE) energised at 1500V d.c..

The Tyne and Wear Metro Rail Infrastructure is an electrified network using an overhead line catenary system energised at 1500V d.c.. This light rail system is designed for speeds of up to 80km/h. Current collection is by means of two pantographs at 28.4m apart. The design of the catenary is based on a double insulation concept. The cantilevers and their components are made of aluminium, with mast fixtures of steel or aluminium.

The Sunderland Extension has been in use since 2002.

2 Scope

In order to ensure trouble-free operation, regular preventive maintenance must be performed. The nominated maintainer of the line is responsible for assigning this work as appropriate.

This specification shall give guidance on the following topics:

- Maintenance
- Inspections
- Performance Tests
- Corrective Maintenance
- Full Overhauls and Renewals and time schedules for all these procedures
- Repair and Maintenance Procedures
- Height and Stagger Analysis
- Technical Data on Contact and Catenary position (including settings, requirements and tolerances)
- Maintenance of OLE

For specific design information about the OLE system please refer to the 'System Description' of the Tyne and Wear Metro.

For works, such as reinstallation or repair, please refer to the 'Installation Manual' of the Tyne and Wear Metro.

For High voltage and Low voltage distribution equipment, please refer to the 'System Description' of the Tyne and Wear Metro.

NOTE: Before work of any nature is undertaken on or about the catenary system the proposed work shall be subject to risk assessment in relation to dangers from live parts of the catenary system, live pantographs and other roof mounted electrical equipment, as well as trains running on nearby tracks.

3 Reference documentation

RT/E/C27039 (formerly ECP 34) BS EN 50149	Wind loading on overhead line equipment and structures
DIN 48201 EN 50119	Railway applications. Fixed installations. Electric traction. Copper and copper alloy grooved contact wires Leitungseile; Seile aus Kupfer (Copper stranded conductors) Railway applications. Fixed installations. Electric traction overhead contact lines

4 Definitions

Ancillary wires	Those conductors other than the contact or catenary wires used within the OLE system (e.g. cross span wires, mid point anchor tie wires, return conductors, earthed conductors).
Blow-off	Blow-off is the maximum displacement through which the contact wire is blown off across track at mid-span under full wind conditions with no mast deflection.
Contact wire gradient	In the event of a change in the contact wire height, the contact wire is graded up or down. For the Tyne and Wear Metro, the gradient may not exceed 1:200, or 1:400 in the case of alternating gradient (in accordance with EN 50119).
Contact wire sag	The amount by which the contact wire of AT equipment is lower (and higher) at mid-span than at the adjacent registration locations. Radial ice on a stranded catenary wire will increase its self-weight and therefore increase the sag of the contact wire.

Ref:	RT/E/S/27223
Issue:	I
Date:	June 2005

Design wind speed	For OLE, a design wind speed has been assigned by the designer. This takes into account base wind speed, topographical details, ground surface roughness and embankment height. If further assessments become necessary, they shall be made in accordance with the Code of Practice for Wind Loading on Overhead Line Equipment and Structures – ECP 34. For the Tyne and Wear Metro, the main design wind speed for open line sections taken from ECP 34 as 27.8m/s. For embankment sections additional factors as described in ECP 34 have to be taken into account for the catenary system design.
Electrical clearance – passing	Passing clearance is the minimum distance required between live parts of the OLE and any earthed material or rail vehicle, or between pantograph and any earthed material, under any permissible conditions of operation and maintenance of vehicles, track and overhead equipment.
Electrical clearance – static	Static clearance is the minimum distance required between the live parts of the OLE (under any permissible conditions of maintenance and when not subjected to uplift from a pantograph) and structure or earthed parts of the overhead equipment.
Encumbrance, system height or system depth	This is the vertical distance between the nominal contact wire level and centre-line of the catenary at any location. It is normally quoted at registration locations.

Ref:	RT/E/S/27223
Issue:	I
Date:	June 2005

Fixed termination (FT) and automatically tensioned (AT) equipment

The Overhead Line System is divided up into sections with FT or AT equipment. The distance between the AT equipment or FT at each end is described as the tension length. AT equipment, such as tensioning wheels, maintain the tension and height of the contact wire and catenary wire relatively constant despite changes in temperature. FT equipment, where the equipment is anchored directly onto the mast, the sag of the contact wire varies considerably with changes in temperature (which directly effects it's tension).

In the case of AT equipment, the tension length is provided with a mid-point anchor located roughly half-way between the two ends of the tension length. The distance between mid-point anchor and termination equipment is described as a half tension length. Instead of a mid-point anchor, a mid-point termination also be provided which is known as a half tension length.

The transition section between two adjacent tension lengths is known as an overlap.

Minimum stagger

The minimum stagger is a value which is specified to obtain minimum clearances between the moving pantograph of the train and the contact wire registration arm bracket.

Nominal contact wire level

Nominal contact wire level is the level at a registration location of a line between the underside of the contact wire at the first dropper on each side of the location. This is usually different from the actual contact wire level on account of either steady arm weight or radial load.

Overhead Line Equipment (OLE)

The arrangement of wires, suspended over the railway line, for supplying electricity to electric trains, together with the associated fittings, insulators and other attachments by means of which the wires are suspended or registered in position, plus the feeders, switches and jumpers etc.

Permissible deviation

Permissible deviation is the maximum allowable displacement, which the contact wire may be from the centre-line of the static pantograph at any point in the span, under full wind conditions with no mast deflection.

Permissible mid-span offset (PMSO)

Permissible mid-span offset is the maximum allowable displacement, which the contact wire may be from the centre-line of the static pantograph under still air conditions at mid-span.

Radial loads

Radial loads are the horizontal forces, resulting from the contact and catenary wires, acting on the OLE registration equipment. The stagger of contact wire, due to the requirement for sweep and registration on curved track, creates these forces. Generally, the radial load is opposite to the direction of stagger.

For the Tyne and Wear Metro, the maximum radial load value is 2.5kN.

Stagger effect

Due to stagger, the maximum contact wire deviation may not occur at mid-span. Stagger effect is the displacement that should be added to the value of “blow-off” measured at mid-span, to determine the maximum distance through which the contact wire is blown-off across track in span under full wind conditions.

Sweep

Sweep is the lateral movement of the contact wire across the pantograph in the course of its travel between any two successive registration points and is the total of such movement, either from one side to the other, or from one side towards the centre and back towards the same side to attain even wear on the pantograph carbon collector strips.

Temperature range

The ambient temperature range specified for open track is –12 °C to +35 °C. In tunnel sections, an ambient temperature of +5 °C to +20 °C is assumed.

ESI

Electricity Supply Industry

SCADA

Supervisory control and data acquisition.

ST

Signalling and telecommunications

Ref:	RT/E/S/27223
Issue:	I
Date:	June 2005

5 Maintenance instruction

Generally speaking, maintenance is understood as the whole of all procedures, which are periodically necessary to ensure that a given system operates at optimum performance at all times. This includes preventive maintenance, such as lubricating moving parts in order to prevent or minimise wear and tear, or corrective maintenance, i.e. the replacement of parts based on a predetermined time schedule.

Due to their design and materials employed, none of the movable parts (e.g. mast insulators and tension wheels) used in the catenary system for the Tyne and Wear Metro need to be periodically greased or oiled.

At areas where environmental pollution take place (extreme air humidity combined with aggressive dust, vapour or gas), all insulators need however to be cleaned periodically to maintain their full insulation capacity.

It is not possible to state from the beginning the frequency of this work. It will be done as part or the whole of a detailed Corrective Maintenance (CM2) in dependence of the results of the Routine Status Check (RSC I). The maintenance periodicities shall be determined by an approved Network Rail risk assessment. Where this is not yet possible then default to those as listed.

All OLE maintenance work shall be undertaken using competent personnel.

5.1 Inspections

Inspections of the OLE equipment shall be undertaken in order to identify any defect and/or apparent condition which will affect safety and/or operability.

5.1.1 Routine status checks (RSC I to RSC3)

Status checks are performed at regular intervals in order to determine the current status of all components of the catenary system and therefore to be in a position to evaluate their residual life and to decide if the scheduled maintenance programme can be continued or whether there is need for additional, corrective work.

5.1.1.1 Routine status check RSC I

This check is due every 13 weeks, and includes catenaries, supports and tensioning devices. The inspection can be made mainly on foot, with the aid of binoculars, without the need to de-energise the catenary and suspend normal train operations.

Ref:	RT/E/S/27223
Issue:	I
Date:	June 2005

Catenaries:

- Check alignment of contact wires at crossovers in relation to ambient temperature

Reference drawing: 3 EGF 001953 Z 5153.

Criterion: at +10°C ambient temperature, the contact wire of the secondary track shall be situated just in the middle of the cross contact bridge mounted on the main track in-running contact wire.

- Check of loose, torn off or mis-aligned droppers
- Check for twisted contact wires
- Check for broken strands of catenary
- Check position of mid-point wires and anchors

Reference Drawing: 3 EGF 001626 Z 5093

Criterion: anchor ties shall always be sufficiently tight and out of reach of the pantograph

- Check condition of insulators, clamps and other catenary components

Supports:

- Check absence of interference between catenaries and cantilevers at overlaps and crossovers
- Check condition of insulators and clamps
- Check condition of all rail connections where provided

Tensioning Devices:

- Check for smooth movement of balance weights

Reference Drawing: 3 EGF 001595 Z 5093

Criterion: the value of the length 'l' shall be in accordance with the diagram on the drawing

- Check for smooth travel of cable over tensioning wheels
- Check condition of insulators and clamps

Ref:	RT/E/S/27223
Issue:	I
Date:	June 2005

5.1.1.2 Routine status check RSC2

This check is due every 12 months. It is performed from the platform of the maintenance vehicle, which is positioned under the de-energised and earthed catenary.

Position of Contact Wire:

- Check the stagger of contact wire at supports

Criterion: the stagger measured at an ambient temperature of about +10°C (when the cantilevers are perpendicular to track axis) must have the same value as written in the 'OLE Lowerings and Overhead Line Layout Plans' document.

- Check the height of the incoming and outgoing contact wires at overlaps and main line crossovers.

Reference Drawing: 3 EGF 001572 Z 5003

Criterion for crossovers: the contact wire leaving the crossover, which is no longer being used, must rise going towards the next support, yet the cross contact bridge bar must not be lifted at the same time.

- Check the contact wire height above top of rail at critical locations (e.g. lowered contact wire, level crossings) using a suitable measuring device

Criterion: the minimum contact wire height may not drop under the values as specified in section 6.2.1.1

Contact Wire condition:

- Make a close visual inspection of all contact wires over their entire length
- Measure contact wire thickness at least one point in each tension length
- Take the same measurement at all points with assumed or identified increased wear, such as overlaps, section insulators, mid-point anchors and where the contact wire has been lowered (e.g. tunnels and bridges)

Note: the ratio contact wire thickness / wear is given by the table below for 120mm² (type RiS 120) as used on the Tyne and Wear Metro; the wear shall never exceed 30% of the original cross-sectional area.

Ratio thickness/loss of cross section for a contact wire type RiS 120 (120mm ²)					
Normally permissible wear				Very exceptional wear	
Measured contact wire thickness (mm)	Loss of cross section	Measured contact wire thickness (mm)	Loss of cross section	Measured contact wire thickness (mm)	Loss of cross section
13.20	0.0%	11.60	7.9%	10.10	20.4%
13.10	0.1%	11.50	8.6%	10.00	21.4%
13.00	0.4%	11.40	9.3%	9.90	22.3%
12.90	0.7%	11.30	10.1%	9.80	23.3%
12.80	1.0%	11.20	10.9%	9.70	24.2%
12.70	1.4%	11.10	11.7%	9.60	25.2%
12.60	1.9%	11.00	12.5%	9.50	26.2%
12.50	2.3%	10.90	13.3%	9.40	27.2%
12.40	2.8%	10.80	14.2%	9.30	28.2%
12.30	3.4%	10.70	15.0%	9.20	29.2%
12.20	3.9%	10.60	15.9%		
12.10	4.5%	10.50	16.8%		
12.00	5.2%	10.40	17.7%		
11.90	5.8%	10.30	18.6%		
11.80	6.5%	10.20	19.5%		
11.70	7.2%				

Tensioning Devices:

- Check balance weight position in relation to ambient temperature

Refer to tables in Section 8.5

Electrical Clearance in air between live components of the catenary and earth:

- Check static clearance to earthed components, e.g. tunnel soffit, overbridges, platform roofs and signals.
- Check static clearance to vegetation.

Section Insulators (SI's):

- Check SI skids and track plane are parallel
- Check wear of skids and running surfaces. Change skids if showing signs of excessive burning.