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Level 2

Limits and Test Method of Induced Voltages on Telecommunications Cables due to Electrification Systems

Endorsement and Authorisation

Endorsed by:

Richard Feasby, Working Group Chair

Authorised by:

Steve Hailes, Steering Group Chair

Accepted for issue by:

Mick McManus, National Standards Manager

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Issue Record

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1	June 2006	First issue
2	March 2010	Updated to reflect Engineering reorganisation

Reference documentation

NR/GN/TEL/31106, *Overview of electromagnetic coupling between traction systems and telecommunications cables*

NR/SP/TEL/50016, *Methodology for the demonstration of compatibility with telecommunications systems*

NR/L2/TEL/31001, *Telecommunications maintenance testing & failure investigation*

NR/L2/TEL/30003, *Immunity Test Requirements For Lineside Communications Systems*

NR/L2/TEL/30070, *Maintenance of Telecommunications Copper Cables*

NR/PS/TEL/00015, *Unit twin copper telecommunications cable*

BS EN 50122-1, *Railway applications – Fixed installations.*

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 6 March 2010.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 4 to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 4 was reached and not to comply with requirements contained herein, unless the designated Standard Owner has stipulated otherwise in the accompanying Briefing Note.

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1 Purpose

This standard defines the test limits and test methods for induced voltages on copper telecommunications cables due to AC electrification systems in normal and credible failure modes.

This standard is intended to address the following risks that induced voltages on lineside copper may cause:

- hazardous accessible and touch voltages
- damage to systems connected to copper telecommunications cables
- interference to systems connected to copper telecommunications cables

2 Scope

GE/RT8016 clause **5** requires the production of an interactions plan to verify the effect of electrification systems on other systems, including the risks to personnel and lineside telecommunications systems.

This standard applies to lineside telecommunications cables in areas of AC electrification only. DC electrification systems do not induce significant voltages on lineside copper cables so no verification activity is necessary in this respect.

This standard defines acceptable limits for the voltage on lineside copper telecommunications cables and verification activities required to satisfy Network Rail's responsibilities for safety and EMC under ROGS, which shall be implemented when substantial changes are made to:

- the electrification system
- the screening of copper telecommunications cables
- the length or layout of copper telecommunications circuits
- increase the traffic density of electric vehicles

Verification of the compatibility of new or modified AC electric rolling stock with lineside telecommunications systems is covered in NR/SP/TEL/50016.

Verification of the compatibility of new telecommunications systems for connection to lineside copper cables is covered in NR/L2/TEL/30003.

For maintenance tests in AC electrified areas, see NR/L2/TEL/30070.

3 Roles and responsibilities

3.1 Designated Project Engineer (DPE)

Prior to implementing the changes, the Designated Project Engineer responsible for introducing the change shall:

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1. carry out a risk assessment to determine the level of modelling and validation required to demonstrate compliance with this standard;
2. produce a test plan to address the risks listed in the scope ;
3. prepare a migration plan (if required) to address the risks listed in the scope during implementation of the change;
4. present the test plan and any migration plan to the Professional Head (S&T), or his nominated representative, for approval;
5. issue a Telecommunications Commissioning Certificate using the form in Appendix A, after successful completion of the verification activities, and prior to transferring the system to Maintenance

4 Definitions

4.1 Abbreviations

AC

Alternating Current

BT

Booster Transformer

DC

Direct Current

E&P

Electrification and Plant

EMC

Electromagnetic Compatibility

FFT

Fast Fourier Transform

FSD

Full Scale Deflection

FTE

Fast Transient Earth

OHLE

Overhead Line Equipment

RC

Return Conductor

ROGS

Railways and Other Guided Transport Systems (Safety) Regulations 2006

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RR

Rail Return (AC Traction Electrification System)

S&T

Signalling and Telecommunications

V_L

Longitudinal Voltage

V_T

Transverse Voltage

4.2 Definitions

Accessible voltage

The voltage between two accessible conductors under operating conditions which can be bridged by persons, the conductive path being conventionally from hand to both feet through the body or from hand to hand (horizontal distance of 1 m to a touchable part)

Booster transformer

A transformer installed in the OHLE to suppress noise induced into S&T cables by encouraging return traction current to flow in the return conductor

Hot wire working

Operational conditions (including use of insulated gloves) which apply when maintaining lineside telecommunications cables where the longitudinal voltage may exceed the permitted voltage for continuous conditions.

Load bank

A diesel train containing a resistive load bank which draws a steady current from the contact wire, typically in the range 100-200 A.

Return bond

A conductor that electrically bonds the return conductor to the return rail (red bond)

Return conductor

An OHLE conductor to complete the traction electrification circuit but installed up near the traction conductor, distant from the S&T route to encourage suppression of induced noise at its source by diverting traction return current away from the return rail

Return rail

A running rail that is used to complete the traction electrification circuit. In a "Return Rail" system, it is the only current return path except the earth.

S&T route

Signalling and Telecoms route.

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Touch voltage

Voltage under fault conditions between parts when touched simultaneously

5 Introduction

AC electric traction systems generate a voltage along the length of lineside conductors (longitudinal voltage, V_L).

This document defines limits for the induced voltages on lineside telecommunications cables and the test methods to be applied to verify that the following risks have been adequately addressed:

- *hazardous touch and accessible voltages*
- *damage to lineside telecommunications systems*
- *interference to lineside telecommunications systems*

The effects of electric traction on trackside conductors are discussed in greater detail in NR/GN/TEL/31106.

6 Requirements for Commissioning Electrification and Telecommunications Cabling Systems in Electrified Areas

6.1 Process

The process for demonstrating compliance with this standard is shown in Figure 1. The steps in the process are detailed in the following sections.

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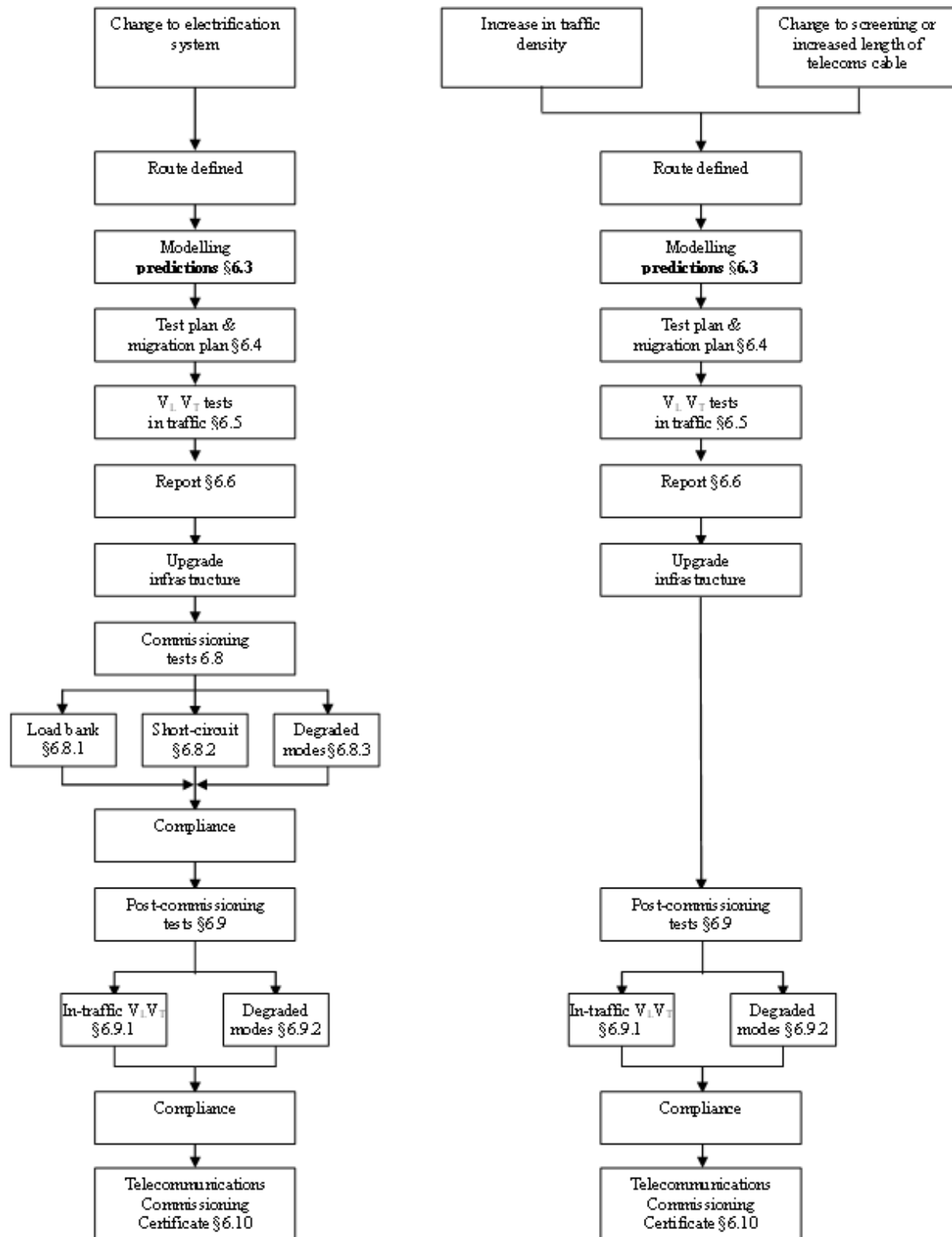


Figure 1 - Verifying Compliance of Telecoms Cables to V_L and V_T Limits