

Railway Group Standard

GL/RT1212

Issue One

Date September 2015

DC Conductor Rail Energy Subsystem and Interfaces to Rolling Stock Subsystem

Synopsis

This document defines the requirements for the DC conductor rail energy subsystem and the interfaces to rolling stock operating over the DC electrified railway.

This document contains one or more pages which contain colour.

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Issue record

Issue	Date	Comments
One	September 2015	Original document. Replaces GE/RT8025 issue one and GM/RT1041 issue one.

Superseded documents

The following Railway Group Standards are superseded, either in whole or in part as indicated:

Superseded documents	Sections superseded	Date when sections are superseded
GE/RT8025 issue one Electrical Protective Provisions for Electrified Lines	Part of B 5.5	05 December 2015
GM/RT1041 issue one Warning Signs and Notices for Electrified Lines	All	05 December 2015

GE/RT8025 issue one Electrical Protective Provisions for Electrified Lines, ceases to be in force and is withdrawn as of 03 June 2017.

GM/RT1041 issue one Warning Signs and Notices for Electrified Lines, ceases to be in force and is withdrawn as of 05 December 2015.

Supply

The authoritative version of this document is available at www.rgsonline.co.uk. Enquiries on this document can be forwarded to enquirydesk@rssb.co.uk.

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Part 1 Purpose and Introduction

1.1 Purpose

- 1.1.1 This document mandates requirements for the 750 V DC conductor rail energy subsystem, using top contact ground level contact line (conductor rail), in order to manage interfaces with rolling stock. This document also mandates requirements for the safety of the 750 V DC conductor rail energy subsystem where this aligns with the Energy (ENE) TSI. This document does not cover requirements for 1500 V DC or 750 V DC overhead contact line systems.
- 1.1.2 This document does not contain any 'open points', that is to say, requirements that have not yet been specified, but which are within the scope of the document.

1.2 Introduction

1.2.1 Background

- 1.2.1.1 This document consolidates existing practice for 750 V DC electrification, and mandates requirements in line with a migration towards a uniform system for the Great Britain (GB) mainline 750 V DC electrified railway, while continuing to give compatibility with existing rolling stock.
- 1.2.1.2 The requirements set out in this document are relevant to new, renewed and upgrades of the energy subsystem for 750 V DC electrification in accordance with the Railway (Interoperability) Regulations and will form the basis of the National Technical Rule (NTR) when notified by the Member State.
- 1.2.1.3 When planning energy subsystem asset replacement (for example, power supply enhancement, conductor rail renewal etc) the extent to which this document is to be applied is normally determined by the project entity (where applicable in conjunction with the Competent Authority).
- 1.2.1.4 It is envisaged that, as subsystem assets are changed over time, conformity with the requirements in this document will be achieved progressively. This will facilitate EC verification and authorisation of discrete parts of the GB mainline 750 V DC electrified railway in accordance with the Railway (Interoperability) Regulations and any provisions set out in the Member State's implementation strategy.

1.2.2 Supporting documents

- 1.2.2.1 The following Rail Industry Guidance Note supports this Railway Group Standard:

GL/GN1612 Guidance on DC Conductor Rail Energy Subsystem and Interfaces to Rolling Stock Subsystem

1.3 Approval and authorisation of this document

- 1.3.1 The content of this document was approved by a Multifunctional Standards Committee on 02 July 2015.
- 1.3.2 This document was authorised by RSSB on 05 August 2015.

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Part 2 Electrical Requirements

2.1 System voltage

- 2.1.1 The system voltage shall comply with the requirements set out in BS EN 50163:2004+A1:2007 clause 4.1 applicable to 750 V DC systems, excluding the special national condition for the United Kingdom referred to in clause 4.1 and set out in Annex B of BS EN 50163:2004+A1:2007.
- 2.1.2 The energy subsystem shall be configured so that the contact line is at a positive potential with respect to the traction return rail.
- 2.1.3 It is permissible that, where rolling stock is operated which is incapable of withstanding the maximum non-permanent voltage set out in 2.1.1, the upper non-permanent voltage limit $U_{\max 2}$ shall be reduced so that the voltage at the DC current collector shall not exceed 850 V when a train is present.
- 2.1.4 The minimum value of $U_{\text{mean useful}}$ at the DC current collector shall be 675 V. This shall be calculated using the method set out in BS EN 50388:2012, clauses 8.2, 8.3 and 8.4, where the phrase 'at the pantograph' shall be interpreted as meaning 'at the DC current collector'.

2.2 Short circuit fault levels

- 2.2.1 The maximum prospective sustained short circuit fault level at the track shall not exceed 200 kA. The short circuit fault level when broken at 20 ms shall not exceed 64 kA.

2.3 Electrical protection coordination

- 2.3.1 The substation and track paralleling hut protection systems shall meet the requirements set out in BS EN 50388:2012 Table 7.
- 2.3.2 The disconnection time for the energy subsystem equipment under short circuit fault conditions at the contact line shall be within the range 10 ms to 200 ms with the electrical protection system operating normally. An additional 500 ms time delay is permissible on infrequent occasions under conditions where back-up protection operates.

2.4 Loss of line voltage and reclosure sequence

- 2.4.1 When the power supply to the contact line is switched off (for example, by a protection system) and is to be restored, the reclosure shall not be attempted until at least 15 seconds has elapsed.
- 2.4.2 If the track feeder circuit breaker trips on closure, there shall be a delay period of at least 15 seconds before reclosure of the track feeder circuit breakers.
- 2.4.3 If the track feeder circuit breaker trips on closure a second time, there shall be a delay period of at least one minute before the subsequent reclosure of the track feeder circuit breakers.

2.5 Train current

- 2.5.1 The energy subsystem shall be designed to operate with a maximum allowable train current for each train of not less than 6.8 kA.
- 2.5.2 Where it is designated that the route is to be designed to a lower value of maximum allowable train current for each train, this shall be published in the Register of Infrastructure.

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2.6 Running rail and across track cable current

- 2.6.1 The maximum total DC traction current flowing in the running rails beneath a train shall not exceed 9 kA.
- 2.6.2 The maximum DC traction load current flowing in an across track cable, or cables grouped together at a single location, over which any train may pass, shall not exceed 10 kA.

2.7 Regeneration capability

- 2.7.1 The DC conductor rail energy subsystem shall be designed to permit the use of regenerative braking.

2.8 Electrical insulation coordination

- 2.8.1 Insulation which separates 750 V live parts from earth or the return circuit shall have the minimum dielectric withstand rating values as set out in BS EN 50124-1:2001.

2.9 Safety requirements

2.9.1 Protective provisions, direct contact – exposed live parts in stations

- 2.9.1.1 Protective provisions against direct contact with live parts of the energy subsystem shall be provided by safety clearances or, where the safety clearances are not achievable, by obstacles.
- 2.9.1.2 The live conductor rail shall not be located adjacent to station platforms, except where it is not reasonably practicable. In this case, protective guard boarding shall be provided throughout the length of conductor rail adjacent to the platform.

2.9.2 Protective provisions – touch voltages

- 2.9.2.1 Protection against electric shock shall be provided by compliance with the touch voltage requirements set out in BS EN 50122-1:2011, clauses 6.1, 6.2.2, 9.1 and 9.3.

2.10 Electrical clearances

2.10.1 Clearance for live parts of conductor rail equipment to structures, and conductor rail equipment to vehicles

- 2.10.1.1 With the exception of insulated guard boarding, the minimum static electrical clearance shall be 75 mm and the minimum passing electrical clearance shall be 25 mm.

2.11 Safety warning signs

2.11.1 Warning to crews on trains of a traction system changeover

- 2.11.1.1 On the approach to an electrical changeover to 750 V DC, signs AJ04 and AJ06 and, where necessary, AJ03, shall be provided. Signs shall be placed at the trackside and readable for a minimum of two seconds at the highest permissible (including enhanced permissible) speed approaching the location concerned.

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2.11.2 Short circuiting bar, and hook switch operating tools

2.11.2.1 The specification for the following equipment appropriate for each route shall be provided:

- a) Short circuiting bars.
- b) Hook switch operating tools.

2.11.3 Use of short circuiting bar

2.11.3.1 In areas where the use of a short circuiting bar is prohibited, guard boarding shall be provided or an insulating shroud shall be fitted to the underside of the conductor rail.

2.11.4 Tunnel emergency circuits

2.11.4.1 On lines where emergency tunnel pinch wires are provided, the use of the pinch wires shall remove power from the conductor rail(s) on all affected lines and prevent inadvertent re-energisation.

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3.1.3 Conductor rail ramp geometry for third rail system

- 3.1.3.1 The static and dynamic lateral position of conductor rail ramps (excluding side entry ramps) relative to the gauge face of the running rails shall comply with the position limits set out in Table 1.
- 3.1.3.2 The conductor rail ramps shall be compatible with current collector shoes hanging at the minimum dynamic height of 34.5 mm above running rail permitted by the vehicle lower sector gauge for all dynamic conditions of the track and conductor rail.
- 3.1.3.3 The maximum gradient of conductor rail ramps shall comply with the limits set out in Table 2. The local ramp gradient, relative to the general running rail gradient, shall be determined over measurement lengths of 150 mm +/- 5 mm.

Line speed	Facing	Trailing
Up to 20 mph and side entry ramps	1:12	1:12
Up to 45 mph (72 km/h)	1:24 1:30 (at installation)	1:24
Above 45 mph (72 km/h) and up to 100 mph (160 km/h)	1:30 1:48 (at installation)	1:24
Note 1: For bi-directional lines, the facing value should be used for both values.		

Table 2 3rd rail positive conductor rail ramp gradient

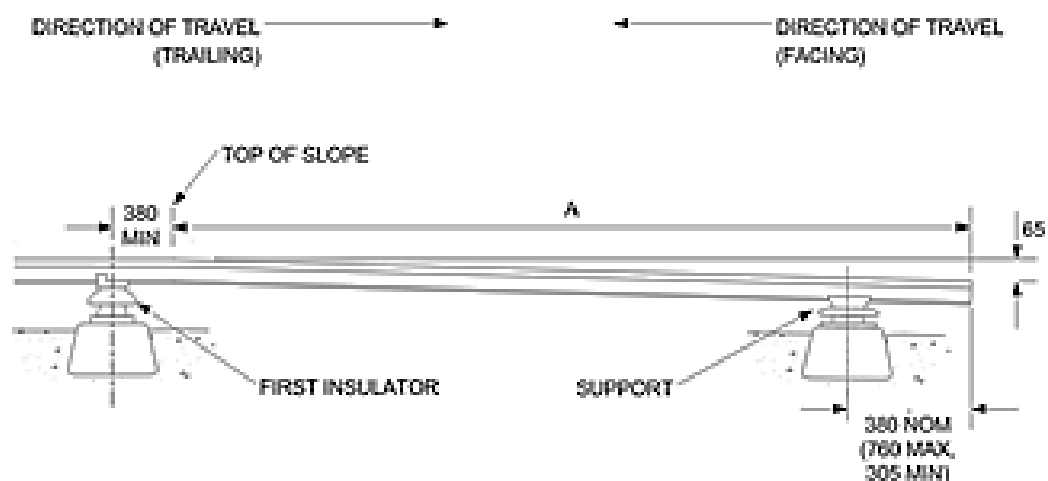


Figure 2 Typical arrangement of single-slope conductor rail ramp

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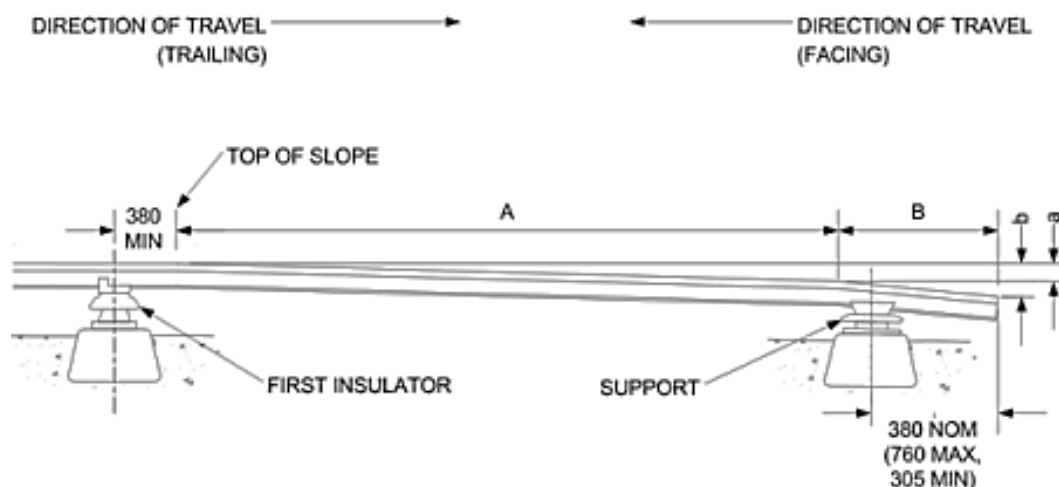


Figure 3 Typical historical arrangements of conductor rail ramp

- 3.1.3.4 The position of side entry ramps shall be as shown in Figure 4. Side entry ramps shall only be used for line speeds up to 20 mph (32 km/h) on the converging line. Side ramps shall not be fitted on routes operated by rolling stock equipped with tripcocks.

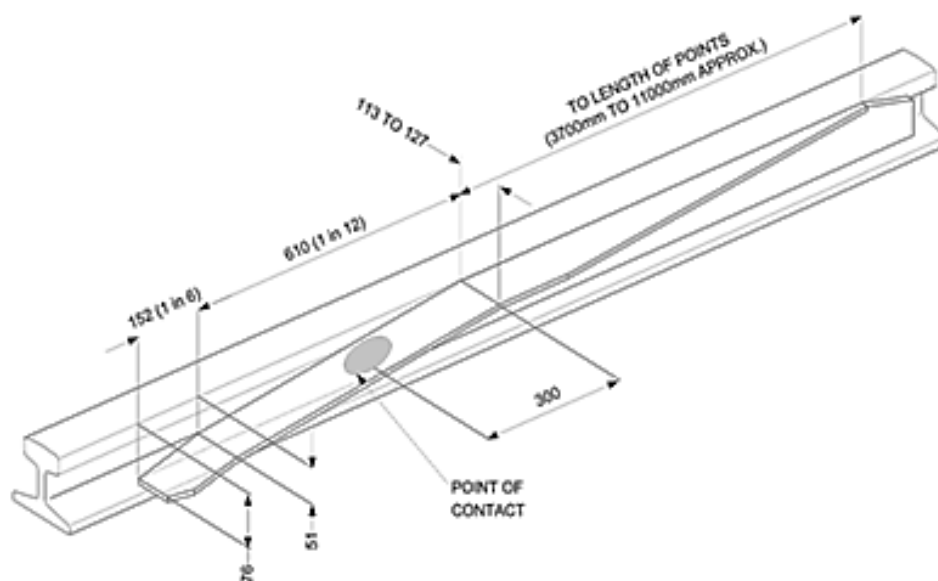


Figure 4 Arrangement of side entry ramp

3.1.4 Conductor rail joints

- 3.1.4.1 The maximum allowable step in the contact surface at any conductor rail joint, including joints at ramp ends, shall be 1 mm.