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Railway Application - Fixed Installations

Guidelines on OCL earthing systems for safety in tunnels

International Railway Solution to be classified in volumes of UIC

VII – Fixed Installations

Application:

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All members of the International Union of Railway

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The International Railway Solution

The International Railway Solution (IRS) are structured in a General Part and in some eventual Application Parts.

The General Part is valid worldwide, while the Application Parts are valid for a specific railway application, based on a geographical or on a service implementation.

The eventual Application Parts may thus be added according to the current needs of the Railway Community.

Structure of the International Railway Solution:

IRS 70018 Railway Application - Fixed Installations - Guidelines on OCL earthing systems for safety in tunnels

General part

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Foreword

This IRS is prepared by UIC Energy and Electrical Traction Experts Group of the Rail System Forum to provide all the Railways with guidelines to better manage the safety in railway tunnels by appropriate OCL emergency earthing systems.

This document describes the systems, technologies, equipments and operations to perform disconnecting, securing against re-connection, verifying the dead status of OCL, carrying out the earthing sequence as well as the procedures to adopt for ascertaining the emergency earthing and the conditions to authorize rescue/emergency services to access tunnels.

In order to be applicable in Europe this document has been drafted in accordance with TSI "safety in railway tunnels". Even if the document is conform to the European Regulation, the content of this IRS is valid, applicable and approved at worldwide level. This document is applicable to high speed and conventional rail however not to light/urban rail

Summary

This IRS was drawn up to provide all railways with standard guidelines to better manage safety in railway tunnels through appropriate OCL emergency earthing systems

This IRS is linked with other IRS prepared by the same UIC experts group and published by UIC on maintenance guidelines, diagnosis aspects, workers' safety and incidents evaluation in the railway energy systems, as:

- IRS 70014 "Maintenance guidelines for overhead contact lines", that defines the main parameters to be checked and observed and the maintenance activities to be carried out in order to ensure the expected OCL performance;
- IRS 70015 "Diagnosis of the OCL conditions" that gives information on the diagnostic systems in order to characterize the behaviour of the OCL in static or dynamic conditions;
- IRS 70016 "Safety measures to be adopted when working on or nearby overhead contact lines" that provides guidelines for improving the safety of the personnel working on or in the vicinity of OCLs;
- IRS 70017 "Evaluation of incidents on the railway energy systems" that provide guidelines for the evaluation of energy system incidents based on uniform criteria and common objectives.

The IRS 70018 can be applied to energy systems operating at the following voltages:

- 1.5 kV and 3 kV dc;
- 15 kV – 16 2/3 Hz;
- 25 kV – 50 Hz.

Normative references

- [1] EC - TSI - "Technical Specifications for Interoperability relating to Safety in railway tunnel of the trans-European rail system" Ed. 2014
- [2] EC - TSI - "Technical Specifications for Interoperability relating to the 'energy' sub-system of the trans-European rail system" Ed. 2014
- [3] IEC - 60050-191 "International Electrotechnical Vocabulary. Chapter 191: Dependability and quality of service" Ed. 1990-12
- [4] IEC - 60050-466 "International Electrotechnical Vocabulary. Chapter 466: Overhead lines" Ed. 1990-10
- [5] IEC 60050-811 "International Electrotechnical Vocabulary. Chapter 811: Electric traction" Ed. 1991-10
- [6] CENELEC - European Standard EN 50119 "Railway applications: Fixed installations – Electric traction overhead contact lines" Ed. 2011
- [7] CENELEC - European Standard EN 50122-1 "Railway applications: Fixed installations – Protective provisions relating to electrical safety and earthing" Ed. 2011
- [8] CENELEC - European Standard EN 50110-1 "Railway applications: Fixed installations – Operation of electrical installations" Ed. 2004-11
- [9] UIC - Leaflet 704 R "Railway Transport Systems - Electromagnetic Compatibility" 1st edition of 1.7.96
- [10] UIC - Leaflet 791 R "Quality assurance of the overhead line equipment" 2nd edition of 1.1.90
- [11] UIC - Report IF – 7/96 Report on "Maintenance of high-speed lines" April 1996
- [12] UIC - Leaflet 791-1 R "Maintenance guidelines for overhead contact lines" Ed. 2006
- [13] UIC - IRS 70015 "Diagnosis of the OCL conditions" Ed. 2016
- [14] UIC - IRS 70016 "Safety measures to be adopted when working on or nearby overhead contact lines" Ed. 2016
- [15] EN 50267-2-1 "Common test methods for cables under fire conditions. Test on gases evolved during combustion of materials from cables - Part 2-1: Procedures - Determination of amount of halogen acid gas" Ed. 1999
- [16] EN 50267-2-2 "Common test methods for cables under fire conditions. Test on gases evolved during combustion of materials from cables - Part 2-1: Procedures - Determination of degree of acidity of gases for materials of measuring pH and conductivity" Ed. 1999

[17] EN 50268-2 – “Common test methods for cables under fire conditions.
Measurement of smoke density of cables burning under defined conditions. Procedure”
Ed. 2000

Terms and definitions

The definitions required in this IRS are all those referring to OCL as reported in Chapter 4 of [1] and in the following list, which refer to energy system and general aspects concerned.

Availability

The ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided.

Cross-passage

Short tunnel to connect two or more parallel tunnels, to provide a connection, used for rescue, maintenance and installations, sometimes also for aerodynamic reasons.

Contact line

Conductor system to supply electrical energy to vehicles through current collection equipment.

Consecutive tunnels [1]

If two or more tunnels following each other fulfil the following conditions, they are defined as one tunnel and the appropriate specifications have to be fulfilled. The conditions are:

- separation between tunnels in open air is longer than the maximum length of the train intended to be operated on the line plus 100 meter;
- the open air area and track situation around the separation between tunnels allow passengers to move away from the train along a safe space. The safe space shall contain all passengers of the maximum capacity of the train intended to be operated on the line.

Energy system

All the electrical installations needed to supply an electric traction network including substations, contact lines, return circuit and pantographs, as set out in the Technical Specifications for Interoperability.

Electric traction systems

Electric lines equipped to transmit electric power from substations to trains.

Electro dispatching (ELD)

A central site equipped for remote command and control of electric traction installations from where shift operators control the energized state of installations and authorise their switching off at the request of the OCL personnel.

Electrical Substation (ESS)

Installation, the main function of which is to supply a contact line system, at which the voltage of a primary supply system, and in certain cases the frequency, is converted to the voltage and frequency of the contact line.

Earthing

Measure to connect the overhead line or conductor rail directly to the earth to avoid inadmissible high contact voltage during works at electrified lines.

Emergency Communication

- (1) Communication between RU staff and IM in the case of emergency;
- (2) Railway independent communication system for rescue services and state authorities.

Emergency plan

Strategy devised under the direction of the Infrastructure Manager, in co-operation, where appropriate, with Railway Undertakings, Rescue services and relevant authorities for each tunnel. The plan shall be consistent with the self-rescue, evacuation and rescue facilities provided.

Failure

The termination of the ability of an item to perform a required function. After failure, the item has a fault. "Failure" is an event, as distinguished from "fault" which is a state.

Fault

The state of an item characterised by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external energy supply.

IM

Infrastructure Manager.

Item

Any part, component, device, sub-system, functional unit, equipment or system (consisting of hardware, software or both) that can be considered individually.

Incident

Any unexpected or unwanted event.

Inspections

Activities intended to monitor the state of the overhead line and to evaluate the extent of maintenance work required, such as foot inspections, test car runs, observation of pantograph reaction etc.. The inspections are usually undertaken with the overhead line switched on.

Maintenance

Combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function.

Maintenance plan

Regulation for maintenance including inspection, repair and reconstruction with relevant specifications.

Maintenance interventions

Combination of all technical actions (excluding administrative and supervision actions) intended to retain an item in, or restore it to, a state in which it can perform a required function.

Overhead line

Electric line consisting of conductors supported above ground by means of insulators and appropriate supports.

Overhead Contact Line (OCL)

Contact line placed above the upper limit of the vehicle gauge and supplying vehicles with electrical energy through pantographs.

Preventive maintenance

Maintenance activities carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning of an item.

Renewals

Interventions planned to improve the performance of operating installations through large-scale works, such as renewal of components, adjustments of particular functional aspects and/or improvements of operating characteristics.

RU

Railway Undertaking

Rescue area

Area for rescue services to install different equipment (e.g. triage, on scene commando, pumping station, etc.). It is also possible to evacuate people from this place.

Rescue services

Includes fire brigades, medical organisations (e.g. red cross, etc), technical organisations (e.g. THW in Germany), special army units or police units (e.g. genie corps, SAR).

Safe area

A safe area is a place inside or outside a tunnel where all of the following criteria apply:

- conditions are survivable
- access for people is possible aided and unaided
- people may accomplish self-rescue if the opportunity is available, or may wait to be rescued by the rescue services using procedures detailed in the emergency plan
- communication shall be possible, either by mobile phone or by fixed connection to the control centre of the IM.

Scheduled maintenance (hard time maintenance)

Preventive maintenance carried out in accordance with an established time schedule.

Timetable for maintenance

Suspension of traffic on the tracks for maintenance.

Technical room

Room with technical equipment for railway applications (e.g. signalling, energy supply, traction control, etc.).

Abbreviations and Symbols

The main abbreviations used in this IRS are the following :

Abbrev.	Description	Symbol		
		General	State / Type	
CCD	Continuity Control Device		-	-
CD	Current Device		-	-
CRRS	Coordinator of Railway Rescue Services		-	-
CRS	Coordinator of Rescue Services		-	-
ED	Earthing Device		 close	 Open
EDC	Earthing Device Cabinet		-	-
EDCC	Earthing Devices Control Centre		-	-
ELD	Electro Dispatcher	-	-	-
EP	Emergency Plan	-	-	-
ESS	Electrical Substation	-	-	-
F	Feeder	- - - -	- - - - Live	- - - - Dead
IC	Infrastructure Coordinator		-	-
IM	Infrastructure Manager		-	-
MEI	Mechanical and/or Electrical Interlock		-	-
OC	Operating Cabinet		-	-
OCL	Overhead Contact Line		- - - - Live	- - - - Dead
REDC	Remote Earthing Device Cabinet		-	-