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Railway Application - Fixed Installations - Protection from Corrosion: measures to be taken on direct current catenaries to reduce the risk of corrosion of adjacent piping and cable systems

2nd edition, reviewed in 2022 (1st edition published in 2016).

This document has been reviewed under the Systematic Review process by the experts of the Energy Management Sector.



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This IRS is the updated version of the UIC Leaflet 605 - 2nd Edition - issued on the 01/01/1981.

This IRS replaces the UIC Leaflet 605.

2nd edition, April 2023

2nd edition, reviewed in 2022.

The experts of the energy management sector have made a check of the normative references and updated them.

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Foreword

An International Railway Solution (IRS) is a document drawn up by consensus and applied on a voluntary basis which aims to facilitate and harmonise railway operation.

IRSs are gradually replacing UIC leaflets.

Members of the International Union of Railways (UIC) participate in the creation of IRSs, of which they benefit in full. Furthermore, marketing to railway stakeholders contributes to the sharing and harmonisation of good practices, in accordance with UIC's primary goal.

While IRSs do not have the force of law, they are created and published in a professional manner and with technical approval on the basis of UIC procedures, and have full technical legitimacy in the railway sector.

The "General application" section constitutes the heart of the IRS and contains the working group's expertise applicable in the broadest manner. The addition of a "Specific application" aims to cover factors specific to a region, a type of service, etc.

Some provisions shall be implemented in all cases to ensure correct application and maintain the system's cohesiveness. Certain operational circumstances require that specific provisions be systematically applied by all users of the document.

For the purposes of understanding, the user acknowledges that the expression of:

- obligation indicates requirements to be respected in order to comply with the expertise expressed in the document (usually "shall"),
- recommendation indicates options that are favourable but not essential (usually "should"),
- permission indicates options that are recognised but without consequence (usually "may"),
- capacity indicates possibilities from a technical standpoint and not permissions or probabilities (usually "can").

Obligation, recommendation and capacity can be expressed in the negative to indicate prohibiting, non-recommendation, and incapacity.

If applicable, notably for the purposes of compliance with a UIC approval, passages that are recommended or mandatory for the cohesiveness of the system will be accompanied by the letters "R" and "MCS" respectively.

This IRS reflects the following UIC working group expertise:

UIC Rail System Forum - Energy Management Sector - "Energy and Electric Traction"
Working Group cooperation with experts nominated by IEC in a common project about life cycle of OCL systems.

It integrates in full or in part the following UIC leaflets:

- none

It complements the following standards:

- none

The following IRSs constitute a complementary series:

- none

Executive summary

The first part of this IRS aims to define the measures to be taken on DC electrified railways to reduce the risk of corrosion of metallic fixed installations which are part of the traction system, as well as of any other metallic element located in any position in the earth, which may carry vagabond currents resulting from the operation of the railway system.

The second part of this IRS gives some hints on AC corrosion effect based on the latest studies.

It is stressed that in-depth studies are still necessary to assess this matter.

It integrates in full or in part the following UIC leaflets:

- none

It complements the following standards:

- none

Field of application

This IRS can be applied to all systems operated at the following voltages according to *EN 50163:2004* [4].

- 1.5 kV and 3 kV DC,
- 15 kV AC,
- 25 kV AC and 2 x 25 kV AC.

Reference documents

The following documents are cited in this IRS or strongly support its requirements and recommendations:

1. European Standards

European Committee for Electrotechnical Standardization (CENELEC)

- [1] *EN 50122-1:2022: Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock*
- [2] *EN 50122-2:2022: Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 2: Provisions against the effects of stray currents caused by DC traction systems*
- [3] *EN 50162:2004: Protection against corrosion by stray current from direct current systems*
- [4] *EN 50163:2004/A2:2020: Railway Applications - Supply voltages of traction systems*
- [5] *EN 50443:2011: Effects of electromagnetic interference on pipelines caused by high voltage a.c. electric traction systems and/or high voltage a.c. power supply systems*

European Committee for Normalization (CEN)

- [6] *EN 15280:2013: Evaluation of a.c. corrosion likelihood of buried pipelines applicable to cathodically protected pipelines, withdrawn in September 2017*

2. International Standards

International Electrotechnical Commission (IEC)

- [7] *IEC 60050-811:2017: International Electrotechnical vocabulary (IEV) - Part 811: Electric traction*

International Standardization Organization (ISO)

- [8] *ISO 21857:2021: Petroleum, petrochemical and natural gas industries - Prevention of corrosion on pipeline systems influenced by stray currents (ISO 21857:2021)*

Abbreviations and Symbols

AC	Alternating Current
DC	Direct Current
G'_{RE}	Conductivity to earth S/km
HS	High Speed
VLD	Voltage-Limiting Device

Concepts, terms and definitions

The subject of the glossary below is: vocabulary to describe IRSs

1. Ballasted track

Rails mounted on wooden or concrete sleepers.

2. Concrete slab track

Modern form of track construction which has been used successfully throughout the world for HS lines, light rail, and tram systems.

3. Contact line

Conductor system for supplying traction units with electrical energy via current-collection equipment.

4. Electric traction power supply system

Railway electrical distribution network used to provide energy for rolling stock.

The system may comprise (*EN 50122-1*):

- contact line systems,
- extended return circuit,
- running rails of non-electric tracks, which are in the vicinity of, and conductively connected to the running rails of an electric traction system,
- electrical installations, which are supplied by contact lines either directly or via a transformer,
- electrical installations in power plants and substations, which are utilized solely for distribution of power directly to the contact line,
- electrical installations of switching stations.

5. Fault

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

6. Item

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