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BSI Standards Publication

Railway Application — Fixed Installations — Specification for reversible d.c. substations

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Applications ferroviaires - Installations fixes - Spécification pour sous-stations réversibles à courant continu

Bahnanwendungen - Ortsfeste Anlagen - Spezifikation rückspeisefähiger Unterwerke für Gleichstrombahnen

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Contents

Page

European foreword

This document (CLC/TR 50646:2015) has been prepared by CLC/SC 9XC “Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)”.

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

Introduction

This document originates from the Technical Specification issued by UIC/UNIFE on the same topic, and was offered as a CENELEC Technical Report. The purpose of this Technical Report is to provide recommendations for reversible DC substations.

Reversible substations are capable of feeding the train regenerative braking energy (up to 100 %) back to the AC high voltage distribution network, while maintaining the capability of exchanging energy between trains on the DC line. A substantial amount of energy can be saved for DC systems which operate electric trains fitted with regenerative braking, on commuter services or operating on steep gradient lines. The system receptivity can be improved by feeding the excess regenerative braking energy to the upstream AC network (e.g. AC railway network or national grid) at a higher voltage level.

This document provides recommendations if DC Reversible Traction Substations are installed to improve line receptivity of DC power supply networks. This document is suitable for newly manufactured traction substations as well as for upgrading and renewal of existing lines. This technical recommendation aims at improving the energy efficiency of the DC transport system, reducing energy consumption, and contributing to a greener environment.

1 Scope

This Technical Report provides recommendations for DC reversible substations. These recommendations apply to systems and components that facilitate the flow of energy to and from the upstream AC grid including their related interfaces.

These recommendations provide the necessary functions for the recovery of braking energy. It is intended to be used in fixed electrical installations with nominal voltage not exceeding 3 000 V DC which supply electrical power to vehicles used in public guided transport systems, i.e. railway vehicles, tramway vehicles, underground vehicles and trolley-buses

It is intended to provide an overview of state-of-the-art applications, define the minimum recommendations that are presently available, and provide functional recommendations to be applied to these substations.

This document focuses mainly on the substation converters and the traction transformers. Other devices such as switchgear - if they are the same as in classic substations - are not addressed here. Moreover this specification addresses performance, constraints, validation and acceptance criteria for the implementation of reversible substations.

This document provides the minimum recommendations to be fulfilled. However, due to the different possible solutions and different types of existing technologies, this document does not provide technical specifications of the basic components that facilitate the functionalities described.

2 Normative references

The following standards, in whole or in part, are normatively referenced in this document and are essential for its application. For dated references, only the cited edition applies. For undated references the latest edition of the referenced document (including any amendment) applies.

EN 50160, *Voltage characteristics of electricity supplied by public electricity networks*

EN 50163, *Railway applications — Supply voltages of traction systems*

EN 50327, *Railway applications — Fixed installations — Harmonisation of the rated values for converter groups and tests on converter groups*

EN 50328:2003, *Railway applications — Fixed installations — Electronic power converters for substations*

EN 50329, *Railway applications — Fixed installations — Traction transformers*

EN 50388, *Railway Applications — Power supply and rolling stock — Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability*

IEC 60050, *Electropedia: The World's Online Electrotechnical Vocabulary ("IEV Online")*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 60050 and the following apply.

3.1.1
contact line
conductor system for supplying electric energy to vehicles through current-collecting equipment

[SOURCE: IEC 60050-811-33-01:1991]