This is a free page sample. Access the full version online.

NSAI Standards

Irish Standard Recommendation
S.R. CLC/TR 50646:2015

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

© CENELEC 2015 No copying without NSAI permission except as permitted by copyright law.

This is a free page sample. Access the full version online.

S.R. CLC/TR 50646:2015

Incorporating amendments/corrigenda/National Annexes issued since publication:

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard — national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on:	*Published:*
CLC/TR 50646:2015	2015-12-11

This document was published under the authority of the NSAI and comes into effect on:	ICS number:
2015-12-29	NOTE: If blank see CEN/CENELEC cover page

NSAI	T +353 1 807 3800	Sales:
1 Swift Square,	F +353 1 807 3838	T +353 1 857 6730
Northwood, Santry	E standards@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.ie	W standards.ie

Údarás um Chaighdeáin Náisiúnta na hÉireann

This is a free page sample. Access the full version online.

National Foreword

S.R. CLC/TR 50646:2015 is the adopted Irish version of the European Document CLC/TR 50646:2015, Railway Application - Fixed Installations - Specification for reversible d.c. substations

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This is a free page sample. Access the full version online.

This page is intentionally left blank

This is a free page sample. Access the full version online.

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CLC/TR 50646

December 2015

ICS 29.280

English Version

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

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

Bahnanwendungen - Ortsfeste Anlagen - Spezifikation rückspeisefähiger Unterwerke für Gleichstrombahnen

This Technical Report was approved by CENELEC on 2015-10-26.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2015 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. CLC/TR 50646:2015 E

This is a free page sample. Access the full version online.

Contents

Page

European foreword 4

Introduction 5

1 Scope 6

2 Normative references 6

3 Terms, definitions and abbreviations 6
3.1 Terms and definitions 6
3.2 Abbreviations 7

4 General 8
4.1 Application of reversible substation 8
4.2 Energy efficiency analysis 8
4.3 System architecture 8
4.4 Braking safety 10

5 Standard performances 10
5.1 General recommendations 10
5.2 Performance of the system 10
5.2.1 Power rating 10
5.2.2 Energy efficiency 10
5.2.3 Harmonics and reactive power compensation 10
5.2.4 Additional recommendations 11
5.2.5 Safety 11
5.2.6 Availability 11

6 Constraints 11
6.1 Climatic environment 11
6.2 Electromagnetic compatibility 11
6.3 Harmonic content 11
6.4 Interfaces with operational environment 11
6.4.1 General 11
6.4.2 Installation 11
6.4.3 Power supply and distribution 12
6.4.4 Monitoring 12
6.4.5 Rolling stock 12
6.4.6 Operation 12

7 Functional aspects 12
7.1 General 12
7.2 Energy regeneration 13
7.3 Power quality 13
7.3.1 General 13
7.3.2 Substation voltage and load balancing 14
7.3.3 Harmonic compensation 14
7.3.4 Reactive power optimization 14
7.4 Protection functions 14
7.5 Automatic converter configuration 15
7.6 Substation control and monitoring 15
7.7 Centralized control function 16

8 System simulation and equipment sizing 16
8.1 General 16
8.2 Energy consumption computation 17

This is a free page sample. Access the full version online.

8.3 Rating of equipment 17

9 Further standardization needs 18

Bibliography 20

This is a free page sample. Access the full version online.

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)”.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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

This is a free page sample. Access the full version online.

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.

This is a free page sample. Access the full version online.

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]

SAI GLOBAL

This is a free preview. Purchase the entire publication at the link below:

Product Page

Looking for additional Standards? Visit Intertek Inform Infostore

Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation