

Svenska Elektriska Kommissionen, SEK

Fastställt	Utgåva	Sida	Ingår i
2003-08-26	1	1 (1+53)	SEK Område 9

© Copyright SEK. Reproduction in any form without permission is prohibited.

Järnvägsanläggningar – Fasta installationer – Statiska omriktare för ställverk

Railway applications –

Fixed installations –

Electronic power converters for substations

Som svensk standard gäller europastandarden EN 50328:2003. Den svenska standarden innehåller den officiella engelska språkversionen av EN 50328:2003.

Nationellt förord

SS-EN 50328 ersätter tidigare utgiven svensk standard SS-EN 60146-1-1, utgåva 1, 1993, vilken för de typer av strömriktare som omfattas av SS-EN 50328, ej gäller fr o m 2005-09-01.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

Svenska Elektriska Kommissionen, SEK, svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK
Box 1284
164 29 Kista
Tel 08-444 14 00
www.sekom.se

EUROPEAN STANDARD

EN 50328

NORME EUROPÉENNE

EUROPÄISCHE NORM

March 2003

ICS 29.200; 29.280

Partly supersedes EN 60146-1-1:1993

English version

**Railway applications -
Fixed installations -
Electronic power converters for substations**

Applications ferroviaires -
Installations fixes -
Convertisseurs électroniques
de puissance pour sous-stations

Bahnanwendungen -
Ortsfeste Anlagen -
Leistungselektronische Stromrichter
für Unterwerke

This European Standard was approved by CENELEC on 2002-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This European Standard was prepared by SC 9XC, Electric supply and earthing systems for public transport equipment and ancillary apparatus (fixed installations) of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50328 on 2002-09-01.

This European Standard supersedes EN 60146-1-1:1993 for the specific products concerning railway applications as mentioned in the scope of this standard.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2003-09-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2005-09-01

Annexes designated "informative" are given for information only.
In this standard, Annexes A, B and C are informative.

Contents

Introduction	5
1 General.....	6
1.1 Scope.....	6
1.2 Normative references.....	6
1.3 Classification of traction supply power converters and valve	7
1.4 List of principal letter symbols	8
1.5 Definitions	9
2 Service conditions.....	20
2.1 Code of identification of cooling method.....	20
2.2 Environmental conditions	21
2.3 Electrical service conditions	23
3 Converter equipment and assemblies	25
3.1 Electrical connections.....	25
3.2 Calculation factors.....	26
3.3 Losses and efficiency.....	27
3.4 Power factor.....	27
3.5 Direct voltage harmonic content.....	28
3.6 Electromagnetic compatibility (EMC).....	28
3.7 Rated values for converters	28
3.8 Mechanical characteristics	31
3.9 Marking	32
4 Tests.....	33
4.1 General	33
4.2 Test specifications.....	34
Annex A (informative) Information required	40
A.1 General	40
A.2 Diode rectifiers	40
A.3 Controlled converters and inverters.....	41
A.4 Frequency converters (direct and d.c. link converters)	43
Annex B (informative) Determination of the current capability through calculation of the virtual junction temperature.....	45
B.1 General	45
B.2 Approximation of the shape of power pulses applied to the semiconductor device	45
B.3 The superposition method for calculation of temperature.....	46
B.4 Calculation of virtual junction temperature for continuous load.....	46
Annex C (informative) Index of definitions	50
Bibliography	53

Figure 1 - Illustration of angles	13
Figure 2 - Voltage drop.....	17
Figure 3 - A.C. voltage waveform	24
Figure B.1 - Approximation of the shape of power pulses	46
Figure B.2 - Calculation of the virtual junction temperature for continuous load	47
Figure B.3 - Calculation of the virtual junction temperature for cyclic load	48
Table 1 - Immunity levels	19
Table 2 - Letter symbols for cooling mediums and heat transfer agents.....	20
Table 3 - Letter symbols for methods of circulation	20
Table 4 - Connections and calculation factors for line commutated converters	26
Table 5 - Standardized duty classes.....	30
Table 6 - Semiconductor device failure conditions.....	31
Table 7 - Summary of tests	34
Table 8 - Insulation levels for a.c./d.c. converters.....	36
Table B.1 - Examples for typical applications	49

Introduction

Semiconductor converters for traction power supply differ from other converters for industrial use due to special electrical service conditions and due to the large range of load variation and the peculiar characteristics of the load.

For these reasons EN 60146-1-1 does not fully cover the requirements of railway applications and the decision was taken to have a specific European standard for this use.

Converter transformers for fixed installations of railway applications are covered by EN 50329.

Harmonization of the rated values and tests of the whole converter group are covered by EN 50327.

1 General

1.1 Scope

This European Standard specifies the requirements for the performance of all fixed installations electronic power converters, using controllable and/or non-controllable electronic valves, intended for traction power supply.

The devices can be controlled by means of current, voltage or light. Non-bistable devices are assumed to be operated in the switched mode.

This European Standard applies to fixed installations of following electric traction systems:

- railways,
- guided mass transport systems such as: tramways, light rail systems, elevated and underground railways, mountain railways, trolleybusses.

This European Standard does not apply to

- cranes, transportable platforms and similar transportation equipment on rails,
- suspended cable cars,
- funicular railways.

This European Standard applies to diode rectifiers, controlled rectifiers, inverters and frequency converters.

The equipment covered in this European Standard is the converter itself.

1.2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed below. For dated references, subsequent amendments or revisions of any of these publications apply to this European Standard only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 50121 Series	2000	Railway applications - Electromagnetic compatibility
EN 50123-7-1	2003	Railway applications - Fixed installations - D.C. switchgear Part 7-1: Measurement, control and protection devices for specific use in d.c. traction systems - Application guide
EN 50124-1	2001	Railway applications - Insulation coordination Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment
EN 50163	1995	Railway applications - Supply voltages of traction systems
EN 50327	2003	Railway applications - Fixed installations - Harmonisation of the rated values for converter groups and tests on converter groups
EN 50329	2003	Railway applications - Fixed installations - Traction transformers
EN 60529	1991	Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)
EN 60721	Series	Classification of environmental conditions (IEC 60721 series)