

SLOVENSKI STANDARD oSIST prEN IEC 62590-2-1:2024

01-april-2024

Železniške naprave - Elektronski elektroenergetski pretvornik za fiksne postroje - 2-1. del: Enosmerni sistemi vleke - Diodni usmerniki

Railway applications - Electronic power converters for fixed installations - Part 2-1: DC traction applications - Diode rectifiers

iTeh Standards

Applications ferroviaires - Convertisseurs électroniques de puissance pour installations fixes - Partie 2-1: Applications de traction en courant continu - Redresseurs à diodes

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napajanje

45.040 Materiali in deli za železniško Materials and components

tehniko for railway engineering

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9/3044/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

CLOSING DATE FOR VOTING:

	2024-02-23		2024-05-	17
	SUPERSEDES DOCUMENT	S:		
	9/2863/CD, 9/2888	A/CC		
IEC TC 9: ELECTRICAL EQUIPMENT AND SYS	TEMS FOR RAII WAYS			
SECRETARIAT:	TEWS FOR RAILWAYS	SECRETARY:		
		SECRETARY:		
France		Mr Denis MIGLIANICO		
OF INTEREST TO THE FOLLOWING COMMITTEES:		PROPOSED HORIZONTAL STANDARD:		
	Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.			
FUNCTIONS CONCERNED:				
☐ EMC ☐ ENVIR	RONMENT	QUALITY ASSURA	NCE	☐ SAFETY
☐ SUBMITTED FOR CENELEC PARALLEL VOT	ING	☐ NOT SUBMITTED F	or CENELE	C PARALLEL VOTING
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The CENELEC members are invited to vot online voting system.	nt Previ			
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TITLE:				
Railway applications – Electronic power converters for fixed installations – Part 2-1: DC Traction applications – Diode rectifiers				
PROPOSED STABILITY DATE: 2027				
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

RAILWAY APPLICATIONS –ELECTRONIC POWER CONVERTERS FOR FIXED INSTALLATIONS – PART 2-1: DC TRACTION APPLICATIONS – UNCONTROLLED RECTIFIERS

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International Standard IEC 62590 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard is based on IEC 62590 Ed.2, IEC 62589 and IEC 62695.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/xxxx/FDIS	9/xxxx/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
- · replaced by a revised edition, or
- · amended.

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INTROPUSTION

1	INTRODUCTION		

- 2 Electronic power converters for traction power supply differ from other converters for industrial
- 3 use due to special electrical service conditions and due to the large range of load variation and
- 4 the peculiar characteristics of the load.
- 5 For these reasons IEC 60146-1-1 does not fully cover the requirements of railway applications
- 6 and the decision was taken to have a specific standard for this use.
- 7 Uncontrolled rectifiers consist of a rectifier diode assembly and a transformer. Both fulfil
- 8 common requirements. The transformer determines the voltage versus current characteristic.
- 9 Converter transformers for fixed installations of railway applications are covered by IEC 62695.
- 10 The series of IEC 62590 consists of the following parts:
- 11 IEC 62590-1 Railway applications Electronic Power Converters for fixed installations Part 1:
- 12 General requirements
- 13 IEC 62590-2-1 Railway applications Electronic Power Converters for fixed installations –
- 14 Part 2-1: DC traction applications Uncontrolled rectifiers
- 15 IEC 62590-2-2 Railway applications Electronic Power Converters for fixed installations -
- 16 Part 2-2: DC traction applications Controlled converters
- 17 IEC 62590-3-1 Railway applications Electronic Power Converters for fixed installations -
- 18 Part 3-1: AC traction applications Electronic power compensators
- 19 IEC 62590-3-2 Railway applications Electronic Power Converters for fixed installations -
- 20 Part 3-2: AC traction applications Static frequency converters

21

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RAILWAY APPLICATIONS – ELECTRONIC POWER CONVERTERS FOR FIXED INSTALLATIONS – PART 2-1: DC TRACTION APPLICATIONS – UNCONTROLLED RECTIFIERS

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1 Scope

- 28 This document describes functions and working principles, specifies requirements, interfaces
- 29 and test methods of uncontrolled rectifiers for DC electric traction systems. Uncontrolled
- 30 rectifiers connect a 3AC power network with a DC electric traction system with an unidirectional
- 31 power flow using diode assemblies.
- 32 The coordination between the transformer and the rectifier diode assembly is included.
- 33 This document applies to fixed installations of following electric traction systems:
- Railway networks
- metropolitan transport networks including metros, tramways, trolleybuses and fully automated transport systems, magnetic levitated transport systems, electric road systems.

37 2 Normative references

- 38 The following documents are referred to in the text in such a way that some or all of their content
- 39 constitutes requirements of this document. For dated references, only the edition cited applies. For
- 40 undated references, the latest edition of the referenced document (including any amendments) applies."
- 41 IEC/TR 60146-1-2:2019, Semiconductor converters General requirements and line
- 42 commutated converters Part 1-2: Application guide
- 43 IEC 62695:2014, Railway applications Fixed installations Traction transformers
- 44 IEC 61000-2-12:2003, Electromagnetic compatibility (EMC) Part 2-12: Environment;
- 45 Compatibility levels for low-frequency conducted disturbances and signalling in public medium-
- 46 voltage power supply systems; Basic EMC Publication
- 47 IEC 62590-1 as soon as published Railway applications Electronic Power
- 48 Converters for fixed installations Part 1: General
- 49 IEC 60076-1:2011, Power transformers Part 1: General

50 3 Terms, definitions, symbols and abbreviated terms

- 51 For the purposes of this document, the following terms and definitions apply.
- 52 ISO and IEC maintain terminological databases for use in standardization at the following
- 53 addresses:
- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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ideal crest no-load voltage

93 94

95

96

 U_{iM}

56 3.1 Terms and definitions 57 58 semiconductor device 59 device whose essential characteristics are due to the flow of charge carriers within a 60 semiconductor 61 62 Note 1 to entry: The definition includes devices whose essential characteristics are only in part due to the flow of charge carriers in a semiconductor but that are considered as semiconductor devices for the purpose of specification. 63 [SOURCE: IEC 60050-521:2002, 521-04-01] 64 electronic power converter 65 operative unit for electronic power conversion, comprising one or more electronic valve devices, 66 transformers and filters if necessary and auxiliaries if any 67 Note 1 to entry: In English, the two spellings "convertor" and "converter" are in use, and both are correct. In this 68 69 document, the spelling "converter" is used in order to avoid duplications. 70 [SOURCE: IEC 60050-551:1998 551-12-01, modified - figure not used, and parentheses 71 removed] 72 3.1.3 73 rectifier 74 AC/DC converter for rectification 75 [SOURCE: IEC 60050-551:1998 551-12-07, modified – figure not used] 76 3.1.4 rectifier diode assembly valve device assembly for rectification standards.itch.ai) 77 78 79 Note 1 to entry: Often the term rectifier is used instead of rectifier diode assembly. 80 ideal no-load direct voltage <u>oSIST prEN IEC 62590-2-1:2024</u> 81 **U**_{dirds.iteh.ai/catalog/standards/sist/3826eadf-0b5a-425a-ba60-dfefb8e008b5/osist-pren-iec-62590-2-1-2024} 82 theoretical no-load direct voltage of an AC/DC converter assuming no reduction by phase 83 84 control, no threshold voltages of electronic valve devices, and no voltage rise at small loads 85 [SOURCE: IEC 60050-551:1998, 551-17-15] 86 87 88 real no-load direct voltage 89 U_{d00} 90 actual mean direct voltage at zero direct current [SOURCE: IEC 60050-551:1998, 551-17-29, modified - "the" removed] 91 92 3.1.7

crest value of the voltage, appearing between the end terminals of an arm neglecting internal

and external voltage surge and voltage drops in valves, at no load

- 8 -

97 3.1.8

- 98 transition current
- 99 mean direct current of a converter connection when the direct current(s) of the commutation
- 100 group(s) become(s) intermittent when decreasing the current
- 101 [SOURCE: IEC 60050-551:1998, 551-17-20, modified "the" removed]
- 102 **3.1.9**
- 103 leakage reactance of the primary winding <of a three-winding transformer>
- 104 **X**_n
- difference between the mean of the short circuit reactance values measured between the
- 106 primary winding and each secondary winding and one half of the short circuit reactance
- 107 measured between the two secondary windings
- 108 **3.1.10**
- 109 leakage reactance of each of the secondary windings <of a three-winding transformer>
- 110 X_{S1}, X_{S2}
- 111 sum of the half difference of the short circuit reactance values measured between the primary
- 112 winding and each secondary winding and one half of the short circuit reactance measured
- 113 between the two secondary windings
- 114 **3.1.11**
- 115 reactance ratio <of a three-winding transformer>
- 116 coupling factor < of a three-winding transformer>
- 117 *F*
- 118 ratio between the leakage reactance of the primary winding and the sum of the leakage
- 119 reactances of the primary and secondary winding
- 120 Note 1 to entry: In case of a traction transformer with two secondary windings, used for a twelve-pulse reaction
- 121 converter, the reactance ratio is designed to have the same no-load secondary voltages and the same impedance
- between the primary and each secondary winding, in order to obtain an even sharing of the current on both bridges
- 123 in case the DC outputs are paralleled. Then $X_{S1} = X_{S2} = X_{S}$ and
- 124 $K = X_p / (X_S + X_p)$
 - <u>05181 pren 1EC 62590-2-1:2024</u>
- http25/sta 3.1.12 iteh.ai/catalog/standards/sist/3826eadf-0b5a-425a-ba60-dfefb8e008b5/osist-pren-iec-62590-2-1-2024 interphase transformer
 - 127 electromagnetic device enabling the operation in parallel of two or more phase displaced
 - 128 commutating groups through inductive coupling between the windings placed on the same core
 - 129 [SOURCE: IEC 60050-551:1998, 551-14-16, modified "an" removed]
 - 130 **3.1.13**
 - 131 rated 3AC voltage
 - 132 rated voltage of the rectifier on the 3AC power network side
 - 133 **3.1.14**
 - 134 rated 3AC voltage of a rectifier diode assembly
 - 135 highest value of the transformer traction side no load voltage that a rectifier diode assembly is
 - 136 designed for
 - 137 **3.1.15**
 - 138 rated load <of a rectifier>
 - 139 rated current <of a rectifier>
 - 140 I_{Nd}
 - value of a DC current a rectifier is designed for.

142	Note 1 to	entry: All rated values of the components are derived from this value
143	Note 2 to	entry: A rectifier can have a rated continuous load and rated loads in conjunction with a duty class.
144	3.1.16	
145 146	•	ower <of a="" rectifier=""> rect current multiplied with DC voltage at rated current</of>
140	rated di	rect current multiplied with DO voltage at rated current
147	3.1.17	
148 149		nort circuit current <of a="" assembly="" diode="" rectifier=""> cuit withstand current of a rectifier diode assembly for every 3AC connection</of>
	011011 011	can windland carrent of a recamer aloae assembly for every extension
150 151	Note 1 to circuit cur	entry: A 12-pulse parallel connection should have 2 times the rated short circuit current as a total short rent.
152	Note 2 to	entry: It is an initial short circuit current according to IEC 60909.
153		
154	3.2 Sy	
155		resistive direct voltage drop of the rectifier related to $U_{ m di}$ at rated current
156	XI V	inductive direct voltage drop of the rectifier related to U_{di} at rated current
157	I _{dlinmax}	maximum current value of the range of linear voltage drop
158	I _{Nd}	rated DC current on the traction side of the rectifier
159	I_{\vee}	transformer phase current on the valve side
160	K	coupling factor ITeh Standards
161 162	400	real no-load direct voltage, theoretically resulting from peak value of a symmetrical sinusoidal 3AC voltage $U_{ m v0}$
163	U _{di} i	ideal no-load direct voltage
164	U _{iM} i	deal crest no-load voltage
165	u _{kt} i	impedance voltage of the transformer EC 62590-2-1:2024
htt 166 sta	u_{kt1}, u_{kt}	impedance voltage of a three-winding transformer with one secondary winding
167		shorted for winding 1 respective winding 2
168	U_{Nd}	DC voltage at rated DC current in V
169	U_{v0}	no-load phase to phase voltage of the transformer valve side
170	X_{p}	leakage reactance of the primary winding (for three winding transformer)
171	X_{S}	mean value of the leakage reactance of each of the secondary windings (for three
172		winding transformer)
173 174	$X_{S1} X_{S2}$	leakage reactance of each of the secondary windings (for transformer with two secondary windings)
175	X _{scP/S1}	short circuit reactance between the primary winding and secondary winding 1
176	^scP/S1	(for transformer with two secondary windings)
177	X _{scP/S2}	short circuit reactance between the primary winding and secondary winding 2
178	551 752	(for transformer with two secondary windings)
179	$X_{\text{scS1/S2}}$	
180		(for transformer with two secondary windings)
181	Xoonicas	short circuit reactance between the primary winding and both secondary windings
182	30F/313	(for transformer with two secondary windings)