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Interested committees:

Title: Draft BS IEC 62590-1 Railway applications - Fixed installations - Electronic Power Converters. Part 1: General requirements.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



9/2813/CD

COMMITTEE DRAFT (CD)

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IEC TC 9 : ELECTRICAL EQUIPMENT AND SYSTEMS FOR RAILWAYS

SECRETARIAT:

France

SECRETARY:

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 CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

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Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Railway applications – Fixed installations – Electronic Power Converters – Part 1: General requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**RAILWAY APPLICATIONS –
FIXED INSTALLATIONS –
ELECTRONIC POWER CONVERTERS
Part 1: GENERAL REQUIREMENTS****FOREWORD**

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

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.

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

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

This document in conjunction with the other parts of IEC 62590 will replace the IEC 62589 and the former IEC 62590.

- a) Split into common requirements and special requirements for different converters
- b) Interface Model for the different Systems connected
- c) Split into circuits with their requirements like insulation coordination
- d) Energy efficiency addressed
- e) More to be added

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 IEC 60146 series does not fully cover the requirements of railway applications and the decision was taken to have a specific standard for this use.

Converter transformers for fixed installations of railway applications are covered by IEC 62695.

This standard defines common vocabulary and requirements. Other parts will cover different applications.

IEC 62590-1 Railway applications – Fixed installations – Electronic Power Converters – Part 1: General requirements

IEC 62590-2-1 Railway applications – Fixed installations – Electronic Power Converters – Part 2-1: DC applications - Uncontrolled rectifiers

IEC 62590-2-2 Railway applications – Fixed installations – Electronic Power Converters – Part 2-2: DC applications – Controlled converters

IEC 62590-3-1 Railway applications – Fixed installations – Electronic power converters– Part 3-1: AC traction applications – Electronic power compensators

IEC 62590-3-2 Railway applications – Fixed installations – Electronic power converters – Part 3-2: AC traction applications – Static frequency converters

RAILWAY APPLICATIONS – FIXED INSTALLATIONS – ELECTRONIC POWER CONVERTERS Part 1: GENERAL REQUIREMENTS

1 Scope

This document specifies the common requirements and definitions for all power converter applications in fixed installations for power supply of railway systems.

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 trucks.

This document applies to AC/DC converters, DC converters and AC converters. Converters for improvement of power quality and for energy saving are included.

Converters connected to electric traction system feeding 3AC, 1AC or DC system for auxiliary purpose are not scope of this document but some aspects may be used.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60076-11, Power transformers - Part 11: Dry-type transformers

IEC 60076-14, Power transformers - Part 14: Liquid-immersed power transformers using high-temperature insulation materials

IEC 60071-1, Insulation co-ordination - Part 1: Definitions, principles and rules

IEC 60146 (all parts), Semiconductor converters

IEC 60529, Degrees of protection provided by enclosures (IP code)

IEC 60664-1, Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests

IEC 60721 series, Classification of environmental conditions

IEC 60850, Railway applications - Supply voltages of traction systems

IEC 60364-1, Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions

IEC 61000-2 series, Electromagnetic compatibility (EMC), Environment

- 56 61000-3 series, Electromagnetic compatibility (EMC, Limits
- 57 IEC 61992-7-1: 2006, Railway applications - Fixed installations - DC switchgear - Part 7-1:
58 Measurement, control and protection devices for specific use in d.c. traction systems -
59 Application guide
- 60 IEC 62236-2, Railway applications - Electromagnetic compatibility - Part 2: Emission of the
61 whole railway system to the outside world / Applies in conjunction with IEC 62236-1 (2018-02)
- 62 IEC 62236-5, Railway applications - Electromagnetic compatibility - Part 5: Emission and
63 immunity of fixed power supply installations and apparatus / Applies in conjunction with IEC
64 62236-1 (2008-12)
- 65 IEC 62497-1, Railway applications - Insulation coordination - Part 1: Basic requirements -
66 Clearances and creepage distances for all electrical and electronic equipment
- 67 IEC 62498-2, Railway applications - Environmental conditions for equipment - Part 2: Fixed
68 electrical installations
- 69 IEC 62313, Railway applications - Power supply and rolling stock - Technical criteria for the
70 coordination between power supply (substation) and rolling stock
- 71 IEC 62695, Railway applications - Fixed installations - Traction transformers
- 72 IEC 62924, Railway applications – Fixed installations – Stationary energy storage system for
73 DC traction systems.

74 **3 Terms and definitions**

75 For the purposes of this document, the following terms and definitions apply.

76 ISO and IEC maintain terminological databases for use in standardization at the following
77 addresses:

- 78 • IEC Electropedia: available at <http://www.electropedia.org/>
- 79 • ISO Online browsing platform: available at <http://www.iso.org/obp>

80 **3.1 Electrical Circuits**

81 **3.1.1**

82 **electric traction system**

83 railway electric distribution network used to provide energy for rolling stock

84 Note 1 to entry: The system includes

- 85 • contact line systems,
- 86 • return circuit of electric traction systems,
- 87 • running rails of non-electric traction systems, which are in the vicinity of, and conductively connected to the
88 running rails of an electric traction system,
- 89 • electric installations, which are supplied from contact lines either directly or via a transformer,
- 90 • electric installations in power plants and substations, which are utilized solely for generation and distribution of
91 power directly to the contact line,
- 92 • electric installations of switching stations.

93 [SOURCE: IEC 60050-811:2017 811-36-21]

94 **3.1.2**

95 **DC traction system**

96 electric traction system operating with DC

97 **3.1.3**

98 **single-phase traction system**

99 **1AC traction system**

100 electric traction system operating with single phase AC

101 Note 1 to entry: Autotransformer systems are having a phase-shift of 180 electrical degrees between their poles.
102 Therefore, they are included in 1AC traction systems from the electrical point of view.

103 **3.1.4**

104 **three phase traction system**

105 **3AC traction system**

106 Electric traction system operation with three phase AC

107 **3.1.5**

108 **electric power network**

109 particular installations, substations, lines or cables for the transmission and distribution of
110 electricity

111 Note 1 to entry: The boundaries of the different parts of this network are defined by appropriate criteria, such as
112 geographical situation, ownership, voltage, etc.

113 Note 2 to entry: In this document, this term is used to indicate a power supply network from which an electric traction
114 system receives electric power.

115 Note 3 to entry: A lot of synonyms are used indicating special properties like distribution network, transmission
116 network, national grid, upstream network, or others. The term electric power network is chosen because it is the most
117 general.

118 [SOURCE: IEC 60050-601:1985 601-01-02, modified – The notes 2 and 3 to entry have been
119 added]

120 **3.1.6**

121 **three-phase power network**

122 **3AC power network**

123 electric power network operated with three phases AC

124 **3.1.7**

125 **(electronic) (power) converter**

126 operative unit for electronic power conversion, comprising one or more electronic valve devices,
127 transformers and filters if necessary and auxiliaries if any

128 Note 1 to entry: In English, the two spellings "convertor" and "converter" are in use, and both are correct. In this
129 document, the spelling "converter" is used in order to avoid duplications.

130 [SOURCE: IEC 60050-551:1998 551-12-01, modified – figure not used and parentheses
131 removed]

132 **3.1.8**

133 **AC/DC converter**

134 electronic converter for rectification or inversion or both

135 [SOURCE: IEC 60050-551:1998 551-12-02]

3.1.9**rectifier**

AC/DC converter for rectification

Note 1 to entry: rectification names the conversion from AC to DC and inversion the conversion from DC to AC.

Note 2 to entry: For purpose of this standard the rectifier includes the transformer. In common language only the valve device assembly is called a rectifier.

[SOURCE: IEC 60050-551:1998: 551-12-07, modified - Note 1 and 2 to entry added]

3.1.10**inverter**

AC/DC converter for inversion

Note 1 to entry: – In English, the two spellings “invertor” and “inverter” are in use, and both are correct. In this document the spelling “inverter” is used in order to avoid duplications.

Note 2 to entry: rectification names the conversion from AC to DC and inversion the conversion from DC to AC.

[SOURCE: IEC 60050-551:1998 551-12-10, modified- Note 2 to entry added]

3.1.11**reversible converter**

Converter in which the direction of the power flow is reversible

[SOURCE: IEC 60050-551:1998 551-12-37]

3.1.12**AC converter**

converter for AC conversion

[SOURCE: IEC 60050-551:1998 551-12-17]

3.1.13**DC converter**

converter for DC conversion

[SOURCE: IEC 60050-551:1998 551-12-27]

3.2 Semiconductor devices and combinations**3.2.1****control equipment**

entirety of devices and programs and, in a broader sense, all instructions and programs used for the task of controlling

Note 1 to entry: Control equipment also comprises the process control station and instructions include operating manuals.

Note 2 to entry: This entry was numbered 351-32-32 in IEC 60050-351:2006.

[SOURCE: IEC 60050-351:2013 351-56-24]

3.2.2**valve device assembly**

electrically and mechanically combined assembly of electronic valve devices or stacks, complete with all its connections and auxiliaries in its own mechanical structure.

177 [SOURCE: IEC 60050-551:1998 551-14-13, modified – note omitted and adaption to current
178 ISO directive]

179 3.2.3

180 **commutation**

181 in an electronic power converter, the transfer of current from one conducting arm to the next to
182 conduct in sequence, without interruption of the current, both arms conducting simultaneously
183 during a finite time interval

184 [SOURCE: IEC 60050-551:1998 551-16-01]

185 3.2.4

186 **line-commutation**

187 an external commutation where the commutating voltage is supplied by the line

188 Note 1 to entry: The term line refers to the line to line voltage of the feeding 3AC power network.

189 [SOURCE: IEC 60050-551:1998 551-16-12, modified – note 1 to entry added]

190 3.2.5

191 **self-commutation**

192 a commutation where the commutating voltage is supplied by components within the converter
193 or the electronic switch

194 [Source: IEC 60050-551: 1998 551-16-15]

195 3.3 Rated values

196 3.3.1

197 **nominal voltage <for converter>**

198 voltage by which a converter is designated

199 Note 1 to entry: Standardized values are given in IEC 60850

200 3.3.2

201 **rated continuous current**

202 I_r

203 mean value of current which a converter is capable of carrying continuously without damage,
204 for specified service conditions

205 Note 1 to entry: The rated continuous current does not include overloads. If a specified overload is needed a derating
206 is necessary and a duty class is applied.

207 3.3.3

208 **duty class**

209 tabled representation of current capability and test values for standard design converters in
210 terms of current values and duration selected to represent a characteristic group of practical
211 applications

212 Note 1 to entry: The current values are expressed in per unit of the rated current I_N .

213 3.3.4

214 **rated current**

215 I_N

216 current value a piece of equipment is designed for in conjunction with a duty class

217 Note 1 to entry: One piece of equipment can have several pairs of rated current and duty class.

3.3.5**load cycle**

conventional representation of the current demand to a converter

Note 1 to entry: The current values are expressed in A or in per unit of the rated current.

Note 2 to entry: The load cycle shows the repetitive variation of the loads with time and, hence, the overloads and underloads the converter is expected to carry, as well as, for the transformers, the duration and intervals assumed.

[SOURCE: IEC 60050-811:2017, 811-28-38, modified, Note 1 to entry is modified]

3.3.6**efficiency**

ratio of output power to input power of a device

Note 1 to entry: If the output power and/or input power is electric, active power is meant.

[SOURCE: IEC 60050-151:2001 151-15-25]

3.3.7**user <of converters>**

entity which procures, installs and/or operate equipment, and agrees with the manufacturer about the equipment characteristic

Note 1 to entry: A typical user of converters is a railway infrastructure manager. Also, an entity which performs system integration is regarded as a user as well.

Note 2 to entry: The system integrator needs all relevant data in order to define components fitting to the system. Without system integration, the basic function is not guaranteed, and energy efficient operation is not possible.

Note 3 to entry: A user, for example, defines applicable standards/regulations for harmonics as they are specific for every supply system 3AC as well as traction.”

3.3.8**manufacturer <of converters>**

entity which produces and/or distributes equipment, and agrees with the user about the quality characteristics

3.4 Electromagnetic compatibility and harmonic distortion**3.4.1****power factor**

under periodic conditions, ratio of the absolute value of the active power P to the apparent power S :

$$\lambda = \frac{|P|}{S}$$

[SOURCE: IEC 60050-131:2002 131-11-46, modified, Note deleted]

3.4.2**substation voltage drop**

change of voltage at the substation terminals due to the interaction of the load and the substation impedance.

Note 1 to entry: Tolerances of nominal voltages are given in IEC 60850. Generally, tolerance for the rest part of the electric traction system is chosen wider than that of at the substation.