

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

The European Standard EN 50327:2003, with the incorporation of amendment A1:2005, has the status of a British Standard

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National foreword

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**Railway applications –
Fixed installations –
Harmonisation of the rated values for converter groups
and tests on converter groups**
(includes amendment A1:2005)

Applications ferroviaires –
Installations fixes –
Harmonisation des valeurs assignées et
des essais sur les groupes convertisseurs
(inclut l'amendement A1:2005)

Bahnanwendungen –
Ortsfeste Anlagen –
Harmonisierung der Bemessungswerte
von Stromrichtergruppen und Prüfungen
von Stromrichtergruppen
(enthält Änderung A1:2005)

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CENELEC

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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.

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

Foreword to amendment A1

This amendment to the European Standard EN 50327:2003 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.

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Introduction

Converters, traction transformers and switchgear are ordered in most cases as individual items and are tested in manufacturer's premises as such.

It is evident that tuning is necessary to choose compatible ratings and that certain performances cannot be verified (through additional or investigation type tests) unless at least the traction transformer and the converter are coupled together.

That is the reason for this document.

1 Scope

This European Standard provides requirements for some type tests which are significant only when made on the entire group.

It provides also a basic relationship between compatible ratings of traction transformer and converter(s), in order to provide minimum requirements for the choice of their ratings.

Moreover it gives the minimum values to be considered in order to choose switching devices with characteristics suitable for the converter group(s) involved.

Annexes provide useful information as a guide for the group designer.

Table 1 indicates the components of a converter group and the relevant applicable standards.

Table 1 - Components of a converter group

Component	Standard
Converter	EN 50328
Traction transformer	EN 50329
Interbridge reactor	EN 60289 and informative annex D
Reactors	EN 60289
Transducers	EN 50123-7-1 EN 50123-7-2
Instrument transformers (as applicable)	EN 50152-3-2 / EN 50152-3-3 EN 60044 series
Control devices	as applicable
Busbars and connections	as applicable

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 hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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 50123-7-2	2003	Railway applications – Fixed installations – D.C. switchgear Part 7-2: Measurement, control and protection devices for specific use in d.c. traction systems - Isolating current transducers and other current measuring devices
EN 50125-2	2002	Railway applications – Environmental conditions for equipment – Part 2: Fixed electrical installations

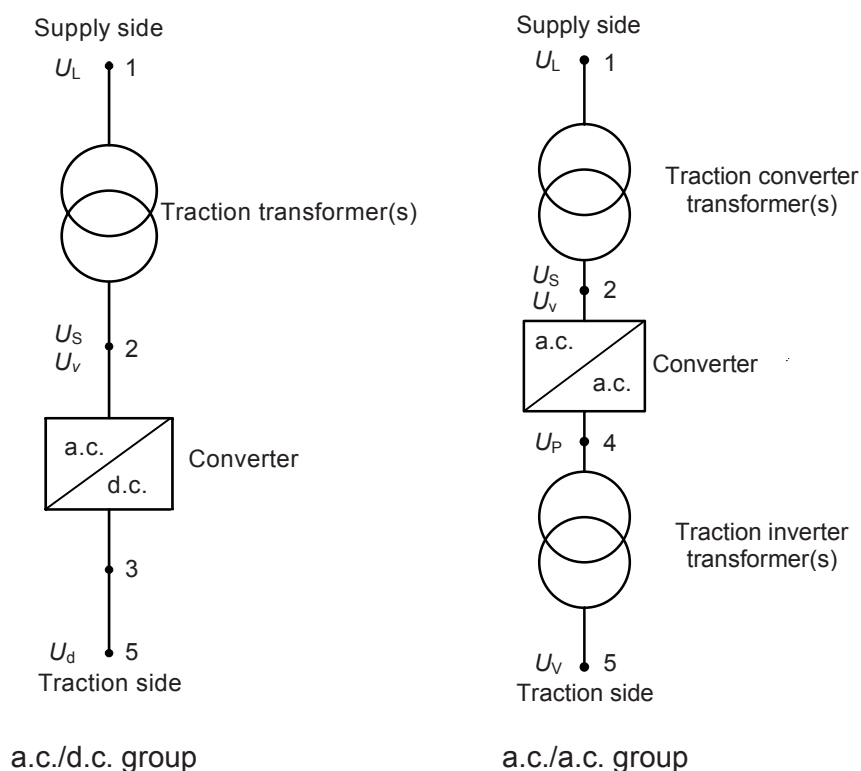
EN 50152-3-2	2001	Railway applications – Fixed installations - Particular requirements for a.c. switchgear – Part 3-2: Measurement, control and protection devices for specific use in a.c. traction systems - Single-phase current transformers
EN 50152-3-3	2001	Railway applications – Fixed installations - Particular requirements for a.c. switchgear – Part 3-3: Measurement, control and protection devices for specific use in a.c. traction systems - Single-phase inductive voltage transformers
EN 50163	1995	Railway applications – Supply voltages of traction systems
EN 50328	2003	Railway applications – Fixed installations – Electronic power converters for substations
EN 50329	2003	Railway applications – Fixed installations – Traction transformers
EN 60044	Series	Instrument transformers (IEC 60044 series, mod.)
EN 60076	Series	Power transformers (IEC 60076 series, mod.)
EN 60289	1994	Reactors (IEC 60289:1988, mod.)
EN 61000-2-12	- ¹⁾	Electromagnetic compatibility (EMC) Part 2-12: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems
IEC 60050-811	1991	International Electrotechnical Vocabulary (IEV) Chapter 811: Electric traction
IEC/TR 60146-1-2	1991	Semiconductor convertors – General requirements and line commutated convertors Part 1-2: Application guide

3 Definitions, symbols and abbreviations

3.1 Basic connections of converter groups

For the purpose of this standard it is given a schematic overview of the various types of converter groups as far as the main components are concerned. The various types of converter groups are schemed in Figure 1 and Figure 2.

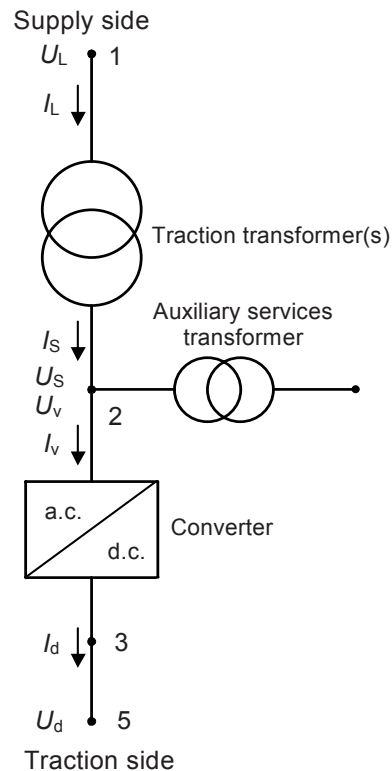
¹⁾ To be pulished.



Point	Rated voltage(s)	Rated current	Basic current	Rated service current	Basic service current
1: Supply-side	U_{NL}	I_{NL}	I_{BL}	I_{NGL}	I_{BGL}
2: Transformer output	U_{NS}	I_{NS}	I_{BS}	I_{NGS}	I_{BGS}
2: Converter input	U_{Nv}	I_{Nv}	I_{Bv}	I_{NGv}	I_{BGv}
3: a.c./d.c. converter output	$U_{Nd} (U_{di} U_{di\alpha})$	I_{Nd}	I_{Bd}	n.a.	n.a.
4: a.c./a.c. or d.c./a.c. converter output	U_{NP}	I_{NP}	I_{BP}	n.a.	n.a.
5: a.c. traction-side	U_{NV}	I_{NV}	I_{BV}	n.a.	n.a.
5: d.c. traction-side	$U_{Nd} (U_{di} U_{di\alpha})$	I_{Nd}	I_{Bd}	n.a.	n.a.

NOTE 1 "input" - "output" are referred to the normal flow of the current.
n.a. = not applicable (not significant).

Figure 1 - Diagrams of converter groups and related quantities



NOTE Connection point 2 is separately indicated as transformer output and as converter input. In effect, it is possible that a connection is present for auxiliary supplies or that other circuit components are interposed.

Figure 2 - Typical arrangement of an a.c./d.c. group with auxiliary services transformer

3.2 Symbols

$\boxed{A_1}$ d_{rB}	resistive direct voltage drop of the converter group in percent of U_{di}
d_{xB}	inductive direct voltage drop of the converter group in percent of U_{di}
e_{rB}	resistive component of the relative short-circuit voltage of the converter transformer
e_{xB}	inductive component of the relative short-circuit voltage of the converter transformer
e_{xL}	inductive component of the relative impedance of the feeding grid
f_N	rated frequency $\boxed{A_1}$
I_{Bd}	basic d.c. current on the output or intermediate side of a converter group
I_{BGL}	basic service current on the supply-side of the converter group
I_{BGS}	basic service current on the converter side of a traction converter transformer
I_{BGv}	basic service current on the supply side of a traction converter
I_{BL}	basic current on the supply-side of a converter group
I_{BP}	basic current on the inverter-side of a traction inverter transformer
I_{BS}	basic current on the converter side of a traction converter transformer
I_{BV}	basic current on the transformer side of a traction converter
I_{Bv}	basic a.c. current on the traction side of a traction converter group
$\boxed{A_1}$ $I_{dlinmax}$	maximum current value of the range of linear voltage drop $\boxed{A_1}$
I_{Nd}	rated d.c. current on the traction side of a converter group

I_{NGL}	rated service current on the supply-side of a converter group
I_{NGS}	rated service current on the converter side of a traction converter transformer
I_{NGv}	rated service current on the supply side of a traction converter
I_{NL}	rated current on the supply-side of a converter group
I_{NP}	rated current on the inverter-side of a traction inverter transformer
I_{NV}	rated a.c. current on the traction side of a converter group
I_{Nv}	rated current on the transformer side of a traction converter
I_{NS}	rated current on the converter side of a traction converter transformer
$\boxed{\text{A1}} I_{\text{SS}}$	sustained d.c. short-circuit current
I_{SSmax}	theoretical maximum value of the steady state d.c. short-circuit current at $L_{\text{d}} = \infty$
$\hat{I}_{\text{SS}}$	transient peak value of the d.c. short-circuit current $\boxed{\text{A1}}$
K	coupling factor
k_{dx}	conventional load ratio
$\boxed{\text{A1}} L_{\text{s}}$	inductance of the secondary windings of the converter transformer
L_{d}	inductance on the load side (i.e. traction side)
R_{d}	resistance on the load side (i.e. traction side) $\boxed{\text{A1}}$
S_{NL}	rated power of the supply side winding of a traction transformer
S_{NP}	rated power of the inverter side winding of an inverter transformer
S_{NSn}	rated power of a winding in a traction transformer
S_{NV}	rated power of the traction side winding(s) of an inverter transformer
$\boxed{\text{A1}} T_{\text{c}}$	circuit time constant of the load circuit
T_{s}	time constant of the grid on the supply side of the converter group $\boxed{\text{A1}}$
U_{di}	ideal no-load direct voltage
$U_{\text{di}\alpha}$	controlled ideal no-load direct voltage
U_{d0}	conventional no-load direct voltage
U_{d00}	real no-load direct voltage
U_{max1}	highest permanent voltage
U_{Nd}	rated direct voltage
U_{nd}	nominal voltage
U_{NL}	rated voltage on the supply-side of a converter group
U_{NP}	rated voltage on the inverter side of a traction inverter transformer
U_{NS}	rated voltage on the converter side(s) of a traction converter transformer
U_{NV}	rated a.c. voltage on the traction side(s) of an inverter transformer
U_{Nv}	rated a.c. voltage on the supply side of a converter
$\boxed{\text{A1}} V_{\text{D}}$	resistive direct voltage drop on the load side (i.e. traction side) in percent of U_{di}
V_{Dt}	total relative resistive direct voltage drop in percent of U_{di} $\boxed{\text{A1}}$
Ψ	power factor ratio

3.3 Definitions

For the purpose of this European Standard the following definitions apply:

3.3.1

converter group

the chain consisting of the traction transformer and the associated converter

3.3.2

traction transformer

transformer connected to an a.c. or d.c. contact line, directly or through a converter, used in fixed installations of railway applications

3.3.2.1

traction converter transformer

traction transformer on the supply side of a converter group and supplying contact line(s) through static converter(s)

3.3.2.2

traction inverter transformer

traction transformer on the traction (contact line) side of a converter group and supplied by a static converter(s) (inverter)

3.3.3

electronic power converter

operative unit for power conversion comprising one or more assemblies of semiconductor devices

3.3.4

rated value

numerical value for the electrical, thermal, mechanical and environmental rating assigned to the quantities which define the operation of a converter group in the conditions specified in accordance with this European Standard and on which the supplier's guarantees and tests are based

3.3.5

rated frequency (f_N)

frequency on either side of the converter group for the conversion of which the converter group is designed to operate

3.3.6

rated voltage on the supply-side of a converter group (U_{NL})

r.m.s. value of the sinusoidal no-load voltage assigned to be applied to the supply-side terminals of a converter group

3.3.7

rated voltage on the converter side(s) of a traction converter transformer (U_{Ns})

r.m.s. value of the no-load voltage at the line-to-line terminals of the converter side(s) of a traction converter transformer, at the rated voltage on the supply side of the traction transformer

3.3.8

rated a.c. voltage on the supply side of a converter (U_{Nv})

r.m.s. value of the no-load voltage between vectorially consecutive commutating phase terminals of a commutating group, at the rated voltage on the supply side of the traction converter transformer