



NSAI
Standards

Irish Standard
I.S. EN 50388:2012

Railway Applications - Power supply
and rolling stock - Technical criteria for
the coordination between power supply
(substation) and rolling stock to
achieve interoperability

I.S. EN 50388:2012

Incorporating amendments/corrigenda issued since publication:

EN 50388:2012/AC:2012
EN 50388:2012/AC:2013

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.

<i>This document replaces:</i> EN 50388:2005/AC:2010	<i>This document is based on:</i> EN 50388:2012 EN 50388:2005/AC:2010	<i>Published:</i> 30 March, 2012 25 August, 2010
This document was published under the authority of the NSAI and comes into effect on: 18 April, 2012		ICS number: 29.280 45.060.01
NSAI 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	Sales: T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		



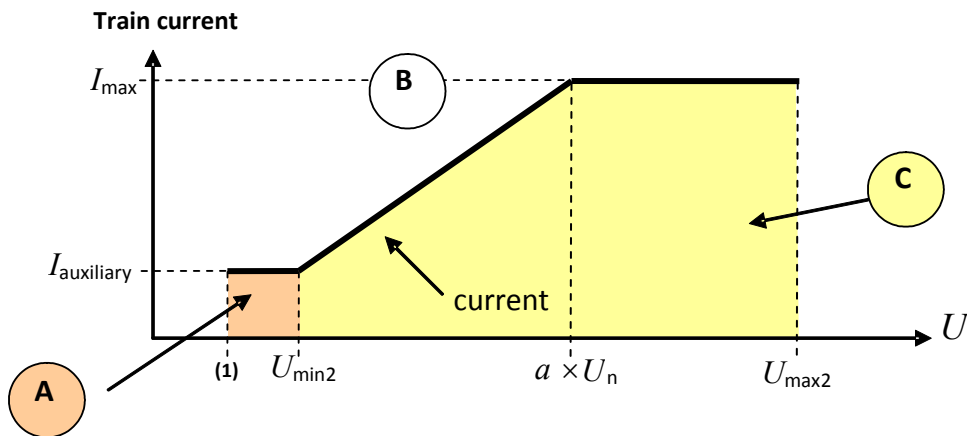
Corrigendum to EN 50388:2012

English version

Corrigendum to EN 50388:2012 published 2012-08-24

1 Modification to Figure 1

Replace Figure 1 by the following new figure:



- A** No traction
- B** Current level exceeded
- C** Allowable current levels

Corrigendum to EN 50388:2012 published 2013-04-26

2 Modification to 12.1.1

In the first bullet, **delete** "in the conditions described in 11.4".

Corrigendum to EN 50388:2012 published 2013-08-30

3 Modification to Table F.1

In Table F.1, Column: SK and Row: d.c. 3000 V, **replace** "1000 for single track line" by "1400 for single track line".

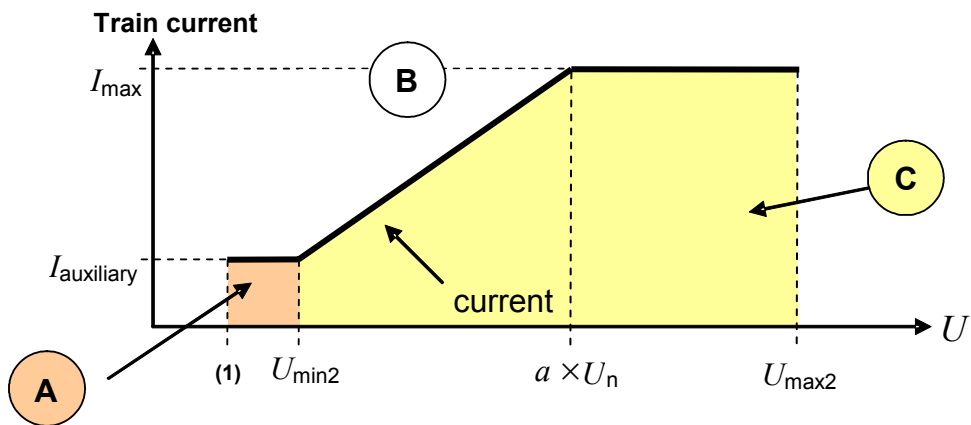
This page is intentionally left BLANK.



Corrigendum to EN 50388:2012

English version

Replace Figure 1 by the following new figure:



- A** No traction
- B** Current level exceeded
- C** Allowable current levels

This page is intentionally left BLANK.

EUROPEAN STANDARD

EN 50388

NORME EUROPÉENNE

March 2012

EUROPÄISCHE NORM

ICS 29.280; 45.060.01

Supersedes EN 50388:2005 + corr. May.2010

English version

**Railway Applications -
Power supply and rolling stock -
Technical criteria for the coordination between power supply (substation)
and rolling stock to achieve interoperability**

Applications ferroviaires -
Alimentation électrique
et matériel roulant -
Critères techniques pour la coordination
entre le système d'alimentation (sous-
station) et le matériel roulant pour réaliser
l'interopérabilité

Bahnanwendungen -
Bahnenergieversorgung und Fahrzeuge -
Technische Kriterien für die Koordination
zwischen Anlagen der
Bahnenergieversorgung und Fahrzeugen
zum Erreichen der Interoperabilität

This European Standard was approved by CENELEC on 2012-02-13. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, 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.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Contents

Foreword	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Periods over which parameters can be averaged or integrated	8
5 Separation sections	9
5.1 Phase separation sections	9
5.2 System separation sections.....	9
6 Power factor of a train	10
6.1 General	10
6.2 Inductive power factor.....	10
6.3 Capacitive power factor	11
6.4 Acceptance criteria	11
7 Train current limitation	12
7.1 Maximum train current	12
7.2 Automatic regulation	12
7.3 Power or current limitation device	13
7.4 Acceptance criteria	13
8 Requirements for performance of power supply	13
8.1 General	13
8.2 Description.....	13
8.3 Values for $U_{\text{mean useful}}$ at the pantograph.....	14
8.4 Relation between $U_{\text{mean useful}}$ and U_{min1}	14
8.5 Acceptance criteria	14
9 Type of line and electrification system	15
10 Harmonics and dynamic effects	15
10.1 General	15
10.2 Acceptance procedure for new elements	17
10.3 Compatibility study.....	17
10.4 Methodology and acceptance criteria.....	20
11 Coordination of protection	21
11.1 General	21
11.2 Protection against short-circuits	21
11.3 Auto-reclosing of one or more substation circuit breakers and effect of loss of line voltage and re-energisation on the traction unit	22
11.4 D.C. electrification systems, transient current during closure	23
11.5 Acceptance criteria	23
12 Regenerative braking	23
12.1 General conditions on the use of regenerative braking.....	23
12.2 Use of regenerative braking.....	24
12.3 Acceptance criteria	24
13 Effects of d.c. operation on a.c. systems	24
14 Tests	25
15 Test methodology	25
15.1 Separation sections	25
15.2 Power factor.....	25
15.3 Train current limitation	26
15.4 Quality index of the power supply.....	26
15.5 Harmonics and dynamic effects	27
15.6 Coordination of protection.....	28
15.7 Regenerative braking.....	28
Annex A (informative) Integration periods over which parameters can be averaged	30

A.1	General	30
A.2	Reference time period over which values can be averaged or integrated	30
Annex B	(informative) Selection criteria determining the voltage at the pantograph	31
Annex C	(informative) Investigation of harmonic characteristics and related overvoltages	33
C.1	General	33
C.2	Overvoltages caused by system instability	33
C.3	Overvoltages caused by harmonics	34
C.4	Examples	34
Annex D	(informative) Data related to the compatibility study of harmonics and dynamic effects	37
D.1	Characterisation of the traction power supply fixed installations	37
D.2	Characterisation of the trains	40
Annex E	(informative) Total inductive and capacitive power factor	43
Annex F	(informative) Maximum allowable train current	46
Annex G	(normative) Special national conditions	48
Annex ZZ	(informative) Coverage of Essential Requirements of EU Directives	49
Bibliography	50
Figures		
Figure 1	— Maximum train current against voltage	12
Figure 2	— Procedure for compatibility study of harmonics and dynamic effects	18
Figure E.1	— Allowed power factor versus drawn active and reactive power (P and Q) by the train	44
Tables		
Table 1	— Total inductive power factor λ of a train	11
Table 2	— Value of factor a	13
Table 3	— Minimum $U_{\text{mean useful}}$ at pantograph	14
Table 4	— Electrification systems as a function of the type of line	15
Table 5	— Description of steps (1 of 2)	19
Table 6	— Maximum contact line-rail short-circuit level	21
Table 7	— Action on circuit breakers at an internal fault within a traction unit	22
Table 8	— Use of regenerative braking	24
Table 9	— Tests	25
Table 10	— $U_{\text{mean useful}}$ (zone)	26
Table 11	— $U_{\text{mean useful}}$ (train)	27
Table 12	— Relationship between $U_{\text{mean useful}}$ and U_{min1}	27
Table A.1	— Integration periods	30
Table D.1	— Characterisation of a.c. electrified lines	38
Table D.2	— Characterisation of d.c. electrified lines	39
Table D.3	— Characterisation of one a.c. train with respect to impedances, harmonics and stability (1 of 2)	40
Table D.4	— Characterisation of one d.c. train with respect to impedances, harmonics and stability	42
Table F.1	— Maximum allowable train current	46

Foreword

This document (EN 50388:2012) has been prepared by CLC/SC 9XC, "Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)", of Technical Committee CLC/TC 9X, "Electrical and electronic applications for railways". It also concerns the expertise of CLC/SC 9XB, "Electromechanical material on board of rolling stock".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-02-13
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-02-13

This document supersedes EN 50388:2005 + corrigendum May 2010.

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, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive 2008/57/EC, see informative Annex ZZ, which is an integral part of this document.

For TSI lines, modification and amendments shall be made within a procedure which is related to the legal status of the HS and CR TSIs.

1 Scope

This European Standard establishes requirements for the compatibility of rolling stock with infrastructure particularly in relation to:

- co-ordination of protection principles between power supply and traction units, especially fault discrimination for short-circuits;
- co-ordination of installed power on the line and the power demand of trains;
- co-ordination of traction unit regenerative braking and power supply receptivity;
- co-ordination of harmonic behaviour.

This European Standard deals with the definition and quality requirements of the power supply at the interface between traction units and fixed installations.

This European Standard specifies the interface between rolling stock and electrical fixed installations for traction, in respect of the power supply system. The interaction between pantograph and overhead contact line is dealt with in EN 50367. The interaction with the “control-command” subsystem (especially signalling) is not dealt with in this standard.

Requirements are given for TSI lines (both high speed and conventional) and classical lines.

For classical lines, values, where given, are for the existing European networks. Furthermore the maximum values that are specified are applicable to the foreseen developments of the infrastructure of the Trans European rail networks.

The following electric traction systems are within scope:

- railways;
- guided mass transport systems that are integrated with railways;
- material transport systems that are integrated with railways.

This European Standard does not apply retrospectively to rolling stock already in service.

Information is given on electrification parameters such as to enable train operating companies to confirm, after consultation with the rolling stock manufacturers, that there will be no consequential disturbance on the electrification system.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50122-2:2010, *Railway applications — Fixed installations — Electrical safety, earthing and the return circuit — Part 2: Provisions against the effects of stray currents caused by d.c. traction systems*

EN 50122-3:2010, *Railway applications — Fixed installations — Electrical safety, earthing and the return circuit — Part 3: Mutual Interaction of a.c. and d.c. traction systems*

EN 50123-1:2003, *Railway applications — Fixed installations — D.C. switchgear — Part 1: General*

EN 50163:2004 + A1:2007, *Railway applications — Supply voltages of traction systems*

EN 50367, *Railway applications — Current collection systems — Technical criteria for the interaction between pantograph and overhead line (to achieve free access)*

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](#)
-