

SLOVENSKI STANDARD SIST EN 50388-2:2025

01-maj-2025

Fiksni postroji in vozna sredstva za železniške naprave - Tehnični kriteriji za uskladitev med napajalnimi viri in voznimi sredstvi za doseganje interoperabilnosti - 2. del: Stabilnost in harmoniki

Fixed installations and rolling stock for railway applications - Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Part 2: Stability and harmonics

Bahnanwendungen - Ortsfeste Anlagen und Bahnfahrzeuge - Technische Kriterien für die Koordination zwischen Anlagen der Bahnenergieversorgung und Fahrzeugen zum Erreichen der Interoperabilität - Teil 2: Stabilität und Oberschwingungen

Installations Fixes et Matériel Roulant pour les Applications ferroviaires - Critères techniques pour la coordination entre les installations fixes de traction électrique et le matériel roulant pour réaliser l'interopérabilité

Ta slovenski standard je istoveten z: EN 50388-2:2025

ICS:

29.280 Električna vlečna oprema Electric traction equipment 45.060.01 Železniška vozila na splošno Railway rolling stock in

general

SIST EN 50388-2:2025 en

iTeh Standards (https://standards.iteh.ai) Document Preview

<u>SIST EN 50388-2:2025</u>

https://standards.iteh.ai/catalog/standards/sist/3270365h-78c1-4fcc-hfd6-0h56ac8d22d1/sist-en-50388-2-2025

EUROPEAN STANDARD NORME EUROPÉENNE EUROPÄISCHE NORM

EN 50388-2

March 2025

ICS 45.060.01; 29.280

English Version

Fixed installations and rolling stock for railway applications Technical criteria for the coordination between electric traction
power supply systems and rolling stock to achieve
interoperability - Part 2: Stability and harmonics

Installations Fixes et Matériel Roulant pour les Applications ferroviaires - Critères techniques pour la coordination entre les installations fixes de traction électrique et le matériel roulant pour réaliser l'interopérabilité - Partie 2 : Stabilité et harmoniques

Ortsfeste Anlagen und Bahnfahrzeuge für Bahnanwendungen - Technische Kriterien für die Koordinierung zwischen elektrischen Bahnenergieversorgungssystemen und Fahrzeugen zum Erreichen der Interoperabilität - Teil 2: Stabilität und Oberschwingungen

This European Standard was approved by CENELEC on 2025-02-03. 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

1 Scope	C	ontent	S	Page		
2 Normative references 6 3 Terms, definitions, abbreviations and symbols .7 3.1 Terms and definitions .7 3.2 Abbreviations and symbols .10 4 Requirements .10 4.1 Electrical resonance stability .10 4.2 Low-frequency stability .13 4.2.1 Introduction .13 4.2.2 General requirements .13 4.2.3 Rolling stock .15 4.2.4 Static converters .15 4.2.5 Infrastructure .16 4.3.1 General .16 4.3.2 Rolling stock .16 4.3.3 Static converters .20 4.3.4 Infrastructure .21 4.4 Specific issues arising during lifetime of new element .21 5 Tests and documentation .22 5.1 Electrical resonance stability .22 5.1.1 Rolling stock .22 5.2.2	Eu	ropean f	oreword	3		
2 Normative references 6 3 Terms, definitions, abbreviations and symbols	Int	roductio	n	4		
2 Normative references 6 3 Terms, definitions, abbreviations and symbols	1	Scope		6		
3.1 Terms and definitions, abbreviations and symbols 7 3.1 Terms and definitions 7 3.2 Abbreviations and symbols 10 4 Requirements 10 4.1 Electrical resonance stability 10 4.2 Low-frequency stability 13 4.2.1 Introduction 13 4.2.2 General requirements 13 4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3.1 General 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 16 4.3.3 Static converters 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2.2 Low-frequency stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2.1 Rolling stock 22 5.3.1 Rolling stock 22 5.3.1 Rolling stock 22 5.3.1 Rolling stock 28 5.2.2 Static converters 29 5.3.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 29 5.3.3 Infrastructure 29 5.3.3 Norevoltages caused by harmonics 29 5.3.2 Static converters 29 5.3.3 Infrastructure 29 5.3.3 Infrastructure 29 5.3.3 Norevoltages caused by harmonics 29 5.3.3 Static converters 30 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 4 4 4 4 4 4 4 4	2	-				
3.1 Terms and definitions 3.2 Abbreviations and symbols 10						
3.2 Abbreviations and symbols	3		•			
4 Requirements 10 4.1 Electrical resonance stability 10 4.2 Low-frequency stability 13 4.2.1 Introduction 13 4.2.2 General requirements 13 4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 28 5.2.2 Static converters 29 5.3.1 Rolling stock 28 5.2.2 Static converters 29 5.3.3 Infrastructure 29 5.3.3 Overvoltages caused by harmonics 29		-				
4.1 Electrical resonance stability 10 4.2 Low-frequency stability 13 4.2.1 Introduction 13 4.2.2 General requirements 15 4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 22 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30	_		•			
4.2 Low-frequency stability 13 4.2.1 Introduction 13 4.2.2 General requirements 15 4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.3.5 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 22 5.2.3 Infrastructure 29 5.3.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 29 5.3.3 Infrastructure 30 <t< th=""><td>4</td><td>•</td><td></td><td></td></t<>	4	•				
4.2.1 Introduction 13 4.2.2 General requirements 13 4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex B (informative) Technical background 3			·			
4.2.2 General requirements 13 4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33			·			
4.2.3 Rolling stock 15 4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples fro						
4.2.4 Static converters 15 4.2.5 Infrastructure 16 4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.2 Static converters 30 5.3.3 Infrastructure 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30			•			
4.2.5 Infrastructure 16 4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.2.3 Infrastructure 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Data related to the compatibility study of harmonics and dynamic e						
4.3 Overvoltages caused by harmonics 16 4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.2.3 Infrastructure 29 5.3.1 Rolling stock 29 5.3.2 Static converters 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Examples experienced in DC systems 58 Annex ZZ (informative						
4.3.1 General 16 4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Data related to the compatibility study of harmonics and dynamic effects 46 Annex ZZ (informative) <td></td> <td>_</td> <td></td> <td></td>		_				
4.3.2 Rolling stock 16 4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Data related to the compatibility study of harmonics and dynamic effects 46 Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered 60		_	· · · · · · · · · · · · · · · · · · ·			
4.3.3 Static converters 20 4.3.4 Infrastructure 21 4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.2.3 Infrastructure 29 5.3.1 Rolling stock 29 5.3.2 Static converters 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Examples experienced in DC systems 58 Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covere		_				
4.3.4 Infrastructure		_				
4.4 Specific issues arising during lifetime of new element 21 5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.2.3 Infrastructure 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Data related to the compatibility study of harmonics and dynamic effects 46 Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered 60			Static converters	20		
5 Tests and documentation 22 5.1 Electrical resonance stability 22 5.1.1 Rolling stock 22 5.1.2 Infrastructure 26 5.2 Low-frequency stability 28 5.2.1 Rolling stock 28 5.2.2 Static converters 29 5.2.3 Infrastructure 29 5.3 Overvoltages caused by harmonics 29 5.3.1 Rolling stock 29 5.3.2 Static converters 30 5.3.3 Infrastructure 31 Annex A (informative) Technical background 33 Annex B (informative) Examples from experienced phenomena (measurements) 42 Annex C (informative) Data related to the compatibility study of harmonics and dynamic effects 46 Annex Z (informative) Examples experienced in DC systems 58 Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered 60		_				
5.1 Electrical resonance stability	5					
5.1.1Rolling stock225.1.2Infrastructure265.2Low-frequency stability285.2.1Rolling stock285.2.2Static converters295.2.3Infrastructure295.3Overvoltages caused by harmonics295.3.1Rolling stock295.3.2Static converters305.3.3Infrastructure31Annex A (informative)Technical background33Annex B (informative)Examples from experienced phenomena (measurements)42Annex C (informative)Data related to the compatibility study of harmonics and dynamic effects46Annex D (informative)Examples experienced in DC systems58Annex ZZ (informative)Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered60	J					
5.1.2 Infrastructure		-				
5.2 Low-frequency stability		_				
5.2.1 Rolling stock		-				
5.2.2 Static converters						
5.2.3 Infrastructure						
5.3 Overvoltages caused by harmonics						
5.3.1 Rolling stock						
5.3.2 Static converters						
5.3.3 Infrastructure						
Annex A (informative) Technical background						
Annex B (informative) Examples from experienced phenomena (measurements)	Δn					
Annex C (informative) Data related to the compatibility study of harmonics and dynamic effects46 Annex D (informative) Examples experienced in DC systems		•	,			
Annex D (informative) Examples experienced in DC systems		•				
Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered60		-				
		nex ZZ	(informative) Relationship between this European Standard and the Es	sential		
	Rik	•	` '			

European foreword

This document (EN 50388-2:2025) has been prepared by CLC/SC 9XC, "Electric supply and earthing systems for public transport equipment and auxiliary apparatus (Fixed installations)", of CLC/TC 9X, "Electrical and electronic applications for railways".

It is also relevant to the scope and 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 (dop) 2026-03-31 implemented at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards (dow) 2028-03-31 conflicting with this document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

EN 50388 "Railway applications – Fixed installations and rolling stock - Technical criteria for the coordination between traction power supply and rolling stock to achieve interoperability" consists of the following parts:

- Part 1: General (https://standards.iteh.ai)
- Part 2: Stability and harmonics

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZZ, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Introduction

This document is linked to EN 50388-1:2022, which describes the general technical criteria for the coordination between power supply and rolling stock to achieve interoperability.

To improve readability, this document is structured as shown in Table 1, which only shows references to the most important clauses and subclauses.

Table 1 — Structure of this document

Topic	Requirements		Tests and	Tests and documentation	
	Clause	Main requirements	Clause	Most important elements	
Electrical resonance stability	4.1	Definition of a limit frequency f_L — Lowest electric traction power supply system resonance frequency is > f_L . — All controlled elements are passive for all frequencies > f_L . Requirements for filter capacitors.		For controlled elements, in most cases measurement of frequency response of input admittance is required. 5.1.1.2 Defines in which cases input admittance has to be measured and how it has to be measured. 5.1.1.3 Defines the combined test. 5.1.1.4 Defines in which cases simulation is sufficient and specifies the requirements for the simulator. 5.1.1.5 Defines in which cases declaration of conformity is sufficient. 5.1.2 Defines the methods to be used to assess the lowest resonant frequency of the power supply.	
	A.1	Technical background about electrical resonance stability			
	B.1	Examples of real electrical resonance instability experiences			
Low- frequency stability	4.2 h.ai/catalc	Demonstration of stable operation for predefined operation scenarios of electric traction power supply system and one or several identical traction units at one location.	5.2025 1-4fcc-bf	Verification either by — time domain simulation (or 88-2-2 measurements); or — any other validated method.	
	A.2	Technical background about low-frequency stability A.2.1 Background and experiences. A.2.2 Acceptance criteria and verification.			
	B.2	Examples of experienced low frequency power oscillations.			
Overvoltages caused by harmonics	4.3	4.3.2 Rolling stock Defines the limit of the overvoltage and specifies the calculation method by using line current spectrum, bandpass filtering, summation methods and standardized power supply impedances. 4.3.2.3 Overvoltage detection. Suggests methods of overvoltage detection.	5.3	5.3.1 Demonstration of compliance for rolling stock by: — Calculation of line current spectrum including plausibility check by measurement. — Calculation of harmonic voltage assessment using the method given in 4.3. — Check of interlacing between units. — Check of overvoltage protection. — If diode rectification is used to	

Topic	Requirements		Tests and documentation		
	Clause	Main requirements	Clause	Most important elements	
		and the overvoltage limits for static converter stations.		correct transition between pulsing and blocking of line converter.	
		4.3.4 Infrastructure related topics.		5.3.2 Demonstration of compliance for static converters by:	
				 Assessing the overvoltage by combining the converter with a line of variable length. 	
				 defining the assessment method in time domain. 	
				 plausibility check of the simulation model by measurement. 	
				5.3.3 Demonstration of compliance for infrastructure.	
	A.3	Technical background relating example calculations for rolling		Itages caused by harmonics including	
	B.3	Examples of real overvoltage experiences caused by harmonics			
Topics related to all phenomena	A.4	Depot cases			
	Annex C	Data related to the compatibility study of harmonics and dynamic effects			
	Annex D	Examples experienced in DC systems			

(https://standards.iteh.ai) Document Preview

SIST EN 50388-2:2024

https://standards.iteh.ai/catalog/standards/sist/3270365h-78c1-4fcc-hfd6-0h56ac8d22d1/sist-en-50388-2-202