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VEEREM. ELEKTERVEOSÜSTEEMIDE JA VEEREMI  
VAHELISE KOOSTALITUSVÕIME SAAVUTAMISE  
KOOSKÕLASTATUD TEHNILISED TINGIMUSED. OSA 2:  
STABIILSUS JA HARMOONIKUD

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

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>See Eesti standard EVS-EN 50388-2:2025 sisaldab Euroopa standardi EN 50388-2:2025 ingliskeelset teksti.</p> <p>Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 07.03.2025.</p> <p>Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.</p>	<p>This Estonian standard EVS-EN 50388-2:2025 consists of the English text of the European standard EN 50388-2:2025.</p> <p>This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.</p> <p>Date of Availability of the European standard is 07.03.2025.</p> <p>The standard is available from the Estonian Centre for Standardisation and Accreditation.</p>
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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  
Koordination zwischen elektrischen  
Bahnenergieversorgungssystemen und Fahrzeugen zum  
Erreichen der Interoperabilität - Teil 2: Stabilität und  
Oberschwingungen

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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.

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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

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- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2028-03-31

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
- 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 documentation	
	Clause	Main requirements	Clause	Most important elements
<b>Electrical resonance stability</b>	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.	5.1	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		
<b>Low-frequency stability</b>	4.2	Demonstration of stable operation for predefined operation scenarios of electric traction power supply system and one or several identical traction units at one location.	5.2	Verification either by — time domain simulation (or 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.		
<b>Overvoltages caused by harmonics</b>	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. 4.3.3 Defines applicability	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 reduce risk of overvoltages check of

Topic	Requirements		Tests and documentation	
	Clause	Main requirements	Clause	Most important elements
		and the overvoltage limits for static converter stations. 4.3.4 Infrastructure related topics.		correct transition between pulsing and blocking of line converter. 5.3.2 Demonstration of compliance for static converters by: <ul style="list-style-type: none"> <li>— Assessing the overvoltage by combining the converter with a line of variable length.</li> <li>— defining the assessment method in time domain.</li> <li>— plausibility check of the simulation model by measurement.</li> </ul> 5.3.3 Demonstration of compliance for infrastructure.
	A.3	Technical background relating to overvoltages caused by harmonics including example calculations for rolling stock		
	B.3	Examples of real overvoltage experiences caused by harmonics		
<b>Topics related to all phenomena</b>	A.4	Depot cases		
	Annex C	Data related to the compatibility study of harmonics and dynamic effects		
	Annex D	Examples experienced in DC systems		

## 1 Scope

This document establishes the acceptance criteria according to EN 50388-1:2022, 10.2 for compatibility between traction units and power supply for known phenomena and known technologies. That is in relation to:

- co-ordination between controlled elements and also between these elements and resonances in the electrical infrastructure in order to achieve network system stability;
- co-ordination of harmonic behaviour with respect to excitation of electrical resonances.

The following electric traction systems are within the scope:

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

Public three-phase networks are out of the scope, but networks which are dedicated to railways are included.

This document is applied in accordance with the requirements in EN 50388-1:2022, Clause 10. It does not apply retrospectively to rolling stock or railway power supply elements already in service.

It is the aim of this Part 2 to support acceptance of new elements (rolling stock or infrastructure) by specifying precise requirements and methods for demonstration of compliance. This document acts as “code of practice” quoted in EN 50388-1:2022, 10.2. However, it is still admissible to use the process as defined in EN 50388-1:2022, 10.3 instead.

This version of the standard only applies to AC systems. Later versions might include similar effects in DC networks in addition, see Annex D.

The main phenomena identified and treated in this document are:

- electrical resonance stability;
- low frequency stability;
- overvoltages caused by harmonics.

The interaction with signalling (including track circuits) is not dealt with in this document.

## 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.

EN 50388-1:2022, *Railway Applications - Fixed installations and rolling stock - Technical criteria for the coordination between electric traction power supply systems and rolling stock to achieve interoperability - Part 1: General*

EN 50163:2004,<sup>1</sup> *Railway applications - Supply voltages of traction systems*

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<sup>1</sup> As impacted by EN 50163:2004/A1:2007, EN 50163:2004/Corrigendum May 2010, EN 50163:2004/AC:2013, EN 50163:2004/A2:2020, EN 50163/A3:2022.