

Nederlandse norm

NEN-EN 50463-2

(en)

Railway applications - Energy measurement on board trains - Part 2: Energy measuring

Spoorwegen en soortgelijk geleid vervoer -
Energienmeting aan boord van railvoertuigen -
Deel 2: Energiemeting

Vervangt NEN-EN 50463-2:2013;
NEN-EN 50463-2:2015 Ontw.

ICS 45.060.10
oktober 2017

Als Nederlandse norm is aanvaard:
 - EN 50463-2:2017, IDT

Koninklijk Nederlands Elektrotechnisch Comité
 Normcommissie 364009 'NEC (N) Elektrisch materieel, systemen en elektronische toepassingen voor
 spoorwegen en soortgelijk geleid vervoer'



THIS PUBLICATION IS COPYRIGHT PROTECTED

DEZE PUBLICATIE IS AUTEURSRECHTELIJK BESCHERMD

Apart from exceptions provided by the law, nothing from this publication may be duplicated and/or published by means of photocopy, microfilm, storage in computer files or otherwise, which also applies to full or partial processing, without the written consent of the Royal Netherlands Standardization Institute.

The Royal Netherlands Standardization Institute shall, with the exclusion of any other beneficiary, collect payments owed by third parties for duplication and/or act in and out of law, where this authority is not transferred or falls by right to the Reproduction Rights Foundation.

Auteursrecht voorbehouden. Behoudens uitzondering door de wet gesteld mag zonder schriftelijke toestemming van het Koninklijk Nederlands Normalisatie-instituut niets uit deze uitgave worden verveelvoudigd en/of openbaar gemaakt door middel van fotokopie, microfilm, opslag in computerbestanden of anderszins, hetgeen ook van toepassing is op gehele of gedeeltelijke bewerking.

Het Koninklijk Nederlands Normalisatie-instituut is met uitsluiting van ieder ander gerechtigd de door derden verschuldigde vergoedingen voor verveelvoudiging te innen en/of daartoe in en buiten rechte op te treden, voor zover deze bevoegdheid niet is overgedragen c.q. rechtens toekomt aan de Stichting Reprorecht.

Although the utmost care has been taken with this publication, errors and omissions cannot be entirely excluded. The Royal Netherlands Standardization Institute and/or the members of the committees therefore accept no liability, not even for direct or indirect damage, occurring due to or in relation with the application of publications issued by the Royal Netherlands Standardization Institute.

Hoewel bij deze uitgave de uiterste zorg is nagestreefd, kunnen fouten en onvolledigheden niet geheel worden uitgesloten. Het Koninklijk Nederlands Normalisatie-instituut en/of de leden van de commissies aanvaarden derhalve geen enkele aansprakelijkheid, ook niet voor directe of indirecte schade, ontstaan door of verband houdend met toepassing van door het Koninklijk Nederlands Normalisatie-instituut gepubliceerde uitgaven.

EUROPEAN STANDARD

EN 50463-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2017

ICS 45.060.10

Supersedes EN 50463-2:2012

English Version

Railway applications - Energy measurement on board trains - Part 2: Energy measuring

Applications ferroviaires - Mesure d'énergie à bord des
trains - Partie 2 : Mesure d'énergie

Bahnwendungen - Energiemessung auf Bahnfahrzeugen
- Teil 2: Energiemessung

This European Standard was approved by CENELEC on 2017-05-08. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword.....	7
Introduction.....	8
1 Scope.....	11
2 Normative references.....	12
3 Terms, definitions, abbreviations and symbols.....	13
3.1 Terms and definitions	13
3.2 Abbreviations	16
3.3 Symbols.....	17
4 Requirements	17
4.1 General.....	17
4.2 Energy Measurement Function (EMF)	18
4.2.1 General	18
4.2.2 Electrical requirements.....	18
4.2.3 Accuracy requirements.....	19
4.2.4 Traction system change	21
4.2.5 Re-verification.....	21
4.3 Sensors.....	21
4.3.1 General.....	21
4.3.2 General requirements	22
4.3.3 Voltage sensors.....	23
4.3.4 Current sensors.....	28
4.4 Energy Calculation Function (ECF)	34
4.4.1 General	34
4.4.2 General requirements	34
4.4.3 Electrical requirements.....	36
4.4.4 Accuracy requirements.....	37
4.4.5 Effect of temperature on error limits	38
4.4.6 Limits of additional error due to influence quantities.....	41
4.4.7 Electromagnetic compatibility	43
4.4.8 Data transfer from ECF to DHS	44
5 Conformity assessment.....	45
5.1 General.....	45
5.1.1 Introduction.....	45
5.1.2 Applicability	45
5.1.3 Methodology	45
5.2 Testing framework.....	46
5.2.1 General	46

5.2.2	Reporting.....	46
5.3	Design review.....	47
5.3.1	General	47
5.3.2	Device design review	47
5.3.3	EMF design review	48
5.4	Type testing.....	48
5.4.1	General	48
5.4.2	Common type testing.....	48
5.4.3	Sensor type test.....	52
5.4.4	ECF type test.....	59
5.5	Routine test	70
5.5.1	General	70
5.5.2	Visual Inspection	70
5.5.3	Insulation test	70
5.5.4	Accuracy tests	71
Annex A	(normative) Test with magnetic induction of external origin	73
A.1	General.....	73
A.2	Test method 1.....	73
A.3	Test method 2.....	73
Annex B	(normative) EMF Configurations	75
B.1	Background.....	75
B.2	General.....	75
B.3	EMF with several CMF's in parallel.....	75
B.4	EMF with several VMF's connected to one ECF.....	76
B.5	EMF with several pairs of VMF and CMF.....	76
B.6	Several EMF's in parallel.....	77
B.7	One VMF or CMF connected to several ECFs.....	77
B.8	EMF without VMF	78
Annex C	(informative) Expressing EMF accuracy	79
C.1	Summary.....	79
C.2	Error limits or uncertainty.....	79
C.3	Presentation of error limits.....	79
C.4	Uncertainty calculations	80
C.4.1	AC active power.....	80
C.4.2	Primary values	81
C.4.3	Uncertainty in the measurement of active power (Watts).....	81
C.4.4	Relative uncertainty	82
C.4.5	Uncertainty in the measurement of reactive power (var)	83
C.4.6	Relative uncertainty	84
Annex D	(informative) Recommendations for re-verification and defining of its regime.....	85
D.1	Re-verification.....	85
D.1.1	Introduction and background.....	85

D.1.2 Approaches to re-verification.....	85
D.2 Recommendations for defining the re-verification regime	86
D.2.1 General approach	86
D.2.2 Testing regime	87
Annex E (informative) Durability test	88
E.1 General.....	88
E.2 Initial measurements	88
E.3 Conditioning.....	88
E.4 Intermediate measurements	89
E.5 Final temperature ramp.....	90
E.6 Final measurements and acceptance criteria	90
E.7 Information to be given in the test report	90
Annex ZZ (informative) Relationship between this European Standard and the Essential Requirements of Directive 2008/57/EC.....	92
Bibliography.....	93
Figures	
Figure 1 — EMS functional structure and dataflow diagram	10
Figure 2 — EMF functional block diagram.....	11
Figure 3 — Example of energy index value	14
Figure 4 — Example of maximum percentage error for a VMF of class 0,5 R and a VMF of class 1,0 R with input signal in the range $U_{min1} \leq U \leq U_{max2}$	26
Figure 5 — Example of maximum percentage error for a CMF class 1,0 R AC with input signals in the range $10 \% I_n \leq I \leq 120 \% I_n$, $5 \% I_n \leq I < 10 \% I_n$ and $1 \% I_n \leq I < 5 \% I_n$	32
Figure 6 — Primary current and voltage ranges	38
Figure 7 — Example of maximum percentage error for an ECF of class 0,5 R and an ECF of class 1,0 R with input signals in Area 1 and Area 2.....	40
Figure 8 — Test point matrix for ECF accuracy tests (type test).....	61
Figure 9 — Test point matrix for tests of ambient temperature variation and influence quantities.....	62
Figure 10 — Test circuit diagram for determining the influence on accuracy of odd harmonics or sub-harmonics in the current circuit	65
Figure 11 — Phase-fired waveform (shown for 50 Hz)	65
Figure 12 — Analysis of harmonic content of phase-fired waveform (shown for 50 Hz)	66
Figure 13 — Burst fire waveform (shown for 50 Hz).....	66
Figure 14 — Analysis of harmonics (shown for 50 Hz)	67
Figure 15 — Test point matrix for ECF Accuracy Tests (type test).....	72

Figure A.1 — Test configuration for test method 173

Figure A.2 — Test configuration for test method 274

Figure B.1 — EMF with several CMF's in parallel75

Figure B.2 — EMF with several VMF's connected to one ECF76

Figure B.3 — EMF with several pairs of VMF and CMF77

Figure B.4 — EMF with several ECF's77

Figure B.5 — One VMF connected to two ECF's78

Figure B.6 — EMF without VMF78

Tables

Table 1 — Nominal traction system voltages19

Table 2 — Reference conditions20

Table 3 — EMF percentage error limits21

Table 4 — Percentage error limits - VMF25

Table 5 — Maximum percentage error for a VMF including ambient temperature variation26

Table 6 — Temperature coefficient for VMF27

Table 7 — Influence quantities for voltage sensors28

Table 8 — Percentage error limits — AC CMF30

Table 9 — Percentage error limits – DC CMF30

Table 10 — Maximum percentage error for a CMF including ambient temperature variation31

Table 11 — Temperature coefficient for CMF32

Table 12 — Percentage error limits with harmonics — AC current sensor33

Table 13 — Influence quantities for current sensors33

Table 14 — Variations due to short-time overcurrents37

Table 15 — Variations due to self-heating37

Table 16 — ECF percentage error limits for active energy38

Table 17 — Maximum percentage error for an ECF including ambient temperature variation39

Table 18 — Temperature coefficient for the ECF40

Table 19 — Influence quantities for the ECF42

Table 20 — Test current for harmonics.....54

Table ZZ.1 — Correspondence between this European Standard, the TSI “Locomotives and Passenger Rolling Stock” (REGULATION (EU) No 1302/2014 of 18 November 2014) and Directive 2008/57/EC amended by Directive 2011/18/EU.....92

Voorbereid
Preview

European foreword

This document (EN 50463-2:2017) has been prepared by CLC/TC 9X “Electrical and electronic applications for railways”.

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) 2018-04-06
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2020-10-06

This document supersedes EN 50463-2:2012.

EN 50463-2:2017 includes the following significant technical changes with respect to EN 50463-2:2012:

- updated requirements for events, quality codes, flags and logs (Clause 4);
- updated for consistency between Table 16 and Figure 6 regarding “Area 2” (Clause 4).

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.

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(s) see informative Annex ZZ, which is an integral part of this document.

This document is Part 2 of the EN 50463 series which consists of the following parts, under the common title *Railway applications — Energy measurement on board trains*:

- *Part 1: General*;
- *Part 2: Energy measuring*;
- *Part 3: Data handling*;
- *Part 4: Communication*;
- *Part 5: Conformity assessment*.

This series of European Standards follows the functional guidelines description in EN ISO/IEC 17000:2004, Annex A “Principles of conformity assessment”, tailored to the Energy Measurement System (EMS).

The requirements for Energy Measurement Systems in the relevant Technical Specifications for Interoperability are supported by this series of European Standards.

EN 50463-2:2017 (E)**Introduction**

The Energy Measurement System provides measurement and data suitable for billing and may also be used for energy management, e.g. energy saving.

This series of European Standards uses the functional approach to describe the Energy Measurement System and on-ground Data Collecting System. These functions are implemented in one or more physical devices. The user of this series of standards is free to choose the physical implementation arrangements.

a) Structure and main contents of the EN 50463 series:

This series of European Standards is divided into five parts. The titles and brief descriptions of each part are given below:

1) EN 50463-1 — General:

The scope of EN 50463-1 is the Energy Measurement System (EMS).

EN 50463-1 provides system level requirements for the complete EMS and common requirements for all devices implementing one or more functions of the EMS.

2) EN 50463-2 — Energy measuring:

The scope of EN 50463-2 is the Energy Measurement Function (EMF).

The EMF provides measurement of the consumed and regenerated active energy of a traction unit. If the traction unit is designed for use on AC traction systems, the EMF also provides measurement of reactive energy. The EMF provides the measured quantities via an interface to the Data Handling System.

The EMF consists of the three functions: Voltage Measurement Function, Current Measurement Function and Energy Calculation Function. For each of these functions, accuracy classes are specified and associated reference conditions are defined. This part also defines all specific requirements for all functions of the EMF.

The Voltage Measurement Function measures the voltage of the Contact Line system and the Current Measurement Function measures the current taken from and returned to the Contact Line system. These functions provide signal inputs to the Energy Calculation Function.

The Energy Calculation Function inputs the signals from the Current and Voltage Measurement Functions and calculates a set of values representing the consumed and regenerated energies. These values are transferred to the Data Handling System and are used in the creation of Compiled Energy Billing Data (CEBD).

The standard has been developed taking into account that in some applications, the EMF may be subjected to legal metrological control. All relevant metrological aspects are covered in this part of EN 50463.

EN 50463-2 also defines the conformity assessment of the EMF.

3) EN 50463-3 — Data handling:

The scope of EN 50463-3 is the Data Handling System (DHS) and the associated requirements of Data Collecting System (DCS).

The on board DHS receives, produces and stores data, ready for transmission to any authorized receiver of data on board or on ground. The main goal of the DHS is to produce Compiled Energy Billing Data and transfer it on an interoperable basis to an on-ground Data Collecting System (DCS). The DHS can support other functionality on board or on-ground with data, as long as this does not conflict with the main goal.

The DCS on-ground receives Compiled Energy Billing Data and transfer it to settlement system.

EN 50463-3 also defines the conformity assessment of the DHS and for the transfer of CEBD to an on-ground Data Collecting System (DCS).

4) EN 50463-4 — Communication:

The scope of EN 50463-4 is the communication services.

This part of EN 50463 gives requirements and guidance regarding the data communication between the functions implemented within EMS as well as between such functions and other on board units where data are exchanged using a communications protocol stack over a dedicated physical interface or a shared network.

It includes the reference to the on board to ground communication service and covers the requirements necessary to support data transfer between DHS and DCS including the transfer of CEBD on an interoperable basis.

EN 50463-4 also defines the conformity assessment of the communications services.

5) EN 50463-5 — Conformity assessment:

The scope of EN 50463-5 is the conformity assessment procedures for the EMS.

EN 50463-5 also covers re-verification procedures and conformity assessment in the event of the replacement of a device of the EMS.

b) EMS functional structure and dataflow:

Figure 1 illustrates the functional structure of the EMS, the main sub-functions and the structure of the dataflow and is informative only. Only the main interfaces required by this standard are displayed by arrows.

Since the communication function is distributed throughout the EMS, it has been widely omitted for clarity, except for the train to ground communication. Not all interfaces are shown.

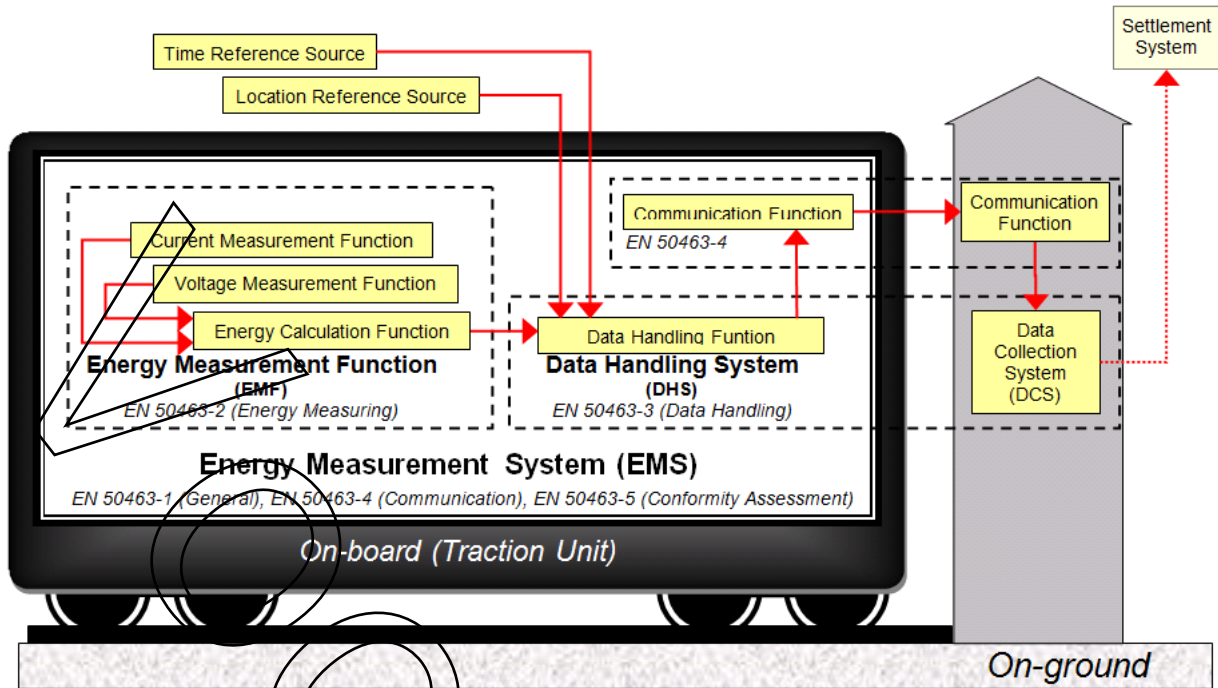


Figure 1 — EMS functional structure and dataflow diagram

Preview
 01b000010

Bestelformulier

Stuur naar:

NEN Standards Products & Services
t.a.v. afdeling Klantenservice
Antwoordnummer 10214
2600 WB Delft



NEN Standards Products & Services

Postbus 5059
2600 GB Delft

Vlinderweg 6
2623 AX Delft

T (015) 2 690 390
F (015) 2 690 271

www.nen.nl/normshop

Ja, ik bestel

__ ex. NEN-EN 50463-2:2017 en Spoorwegen en soortgelijk geleid vervoer - € 99.98
Energie meting aan boord van railvoertuigen - Deel 2: Energiemeting

Wilt u deze norm in PDF-formaat? Deze bestelt u eenvoudig via www.nen.nl/normshop

Gratis e-mailnieuwsbrieven

Wilt u op de hoogte blijven van de laatste ontwikkelingen op het gebied van normen, normalisatie en regelgeving? Neem dan een gratis abonnement op een van onze e-mailnieuwsbrieven. www.nen.nl/nieuwsbrieven

Gegevens

Bedrijf / Instelling

T.a.v. O M O V

E-mail

Klantnummer NEN

Uw ordernummer BTW nummer

Postbus / Adres

Postcode Plaats

Telefoon Fax

Factuuradres (indien dit afwijkt van bovenstaand adres)

Postbus / Adres

Postcode Plaats

Datum Handtekening

Retourneren

Fax: 015 2 690 271

E-mail: klantenservice@nen.nl

Post: NEN Standards Products & Services,

t.a.v. afdeling Klantenservice
Antwoordnummer 10214,
2600 WB Delft

(geen postzegel nodig).

Voorwaarden

- De prijzen zijn geldig tot 31 december 2018, tenzij anders aangegeven.
- Alle prijzen zijn excl. btw, verzend- en handelingskosten en onder voorbehoud bij o.m. ISO- en IEC-normen.
- Bestelt u via de normshop een pdf, dan betaalt u geen handeling en verzendkosten.
- Meer informatie: telefoon 015 2 690 391, dagelijks van 8.30 tot 17.00 uur.
- Wijzigingen en typfouten in teksten en prijsinformatie voorbehouden.
- U kunt onze algemene voorwaarden terugvinden op: www.nen.nl/leveringsvoorwaarden.