

STN	Elektrická bezpečnosť v nízkonapäťových rozvodných sieťach so striedavým napätím do 1 000 V a s jednosmerným napätím do 1 500 V Zariadenia na skúšanie, meranie alebo sledovanie činnosti prostriedkov ochrany Časť 12: Zariadenia na meranie a sledovanie spôsobilosti (PMD)	STN EN IEC 61557-12
		35 6230

Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC - Equipment for testing, measuring or monitoring of protective measures - Part 12: Power metering and monitoring devices (PMD)

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 03/22

Obsahuje: EN IEC 61557-12:2022, IEC 61557-12:2018

Oznámením tejto normy sa od 10.11.2026 ruší
STN EN 61557-12 (35 6230) z marca 2009

EUROPEAN STANDARD

EN IEC 61557-12

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2022

ICS 17.220.20; 29.080.01; 29.240.01

Supersedes EN 61557-12:2008 and all of its amendments and corrigenda (if any)

English Version

**Electrical safety in low voltage distribution systems up to 1 000 V
AC and 1 500 V DC - Equipment for testing, measuring or
monitoring of protective measures - Part 12: Power metering and
monitoring devices (PMD)
(IEC 61557-12:2018)**

Sécurité électrique dans les réseaux de distribution basse tension jusqu'à 1 000 V c.a. et 1 500 V c.c. - Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection - Partie 12: Dispositifs de comptage et de surveillance du réseau électrique (PMD)
(IEC 61557-12:2018)

Elektrische Sicherheit in Niederspannungsnetzen bis AC 1 000 V und DC 1 500 V - Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen - Teil 12: Geräte zur Energiemessung und -überwachung (PMD)
(IEC 61557-12:2018)

This European Standard was approved by CENELEC on 2021-11-10. 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, Turkey 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

EN IEC 61557-12:2022 (E)

European foreword

The text of document 85/644/FDIS, future edition 2 of IEC 61557-12, prepared by IEC/TC 85 "Measuring equipment for electrical and electromagnetic quantities" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61557-12:2022.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-08-10
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-11-10

This document supersedes EN 61557-12:2008 and all of its amendments and corrigenda (if any).

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 Standardization Request given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For the relationship with EU Directive(s) / Regulation(s), 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.

Endorsement notice

The text of the International Standard IEC 61557-12:2018 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60044-7:1999	NOTE	Harmonized as EN 60044-7:2000 (not modified)
IEC 60044-8:2002	NOTE	Harmonized as EN 60044-8:2002 (not modified)
IEC 60051 (series)	NOTE	Harmonized as EN IEC 60051 (series)
IEC 60071-1:2006	NOTE	Harmonized as EN 60071-1:2006 (not modified)
IEC 60359:2001	NOTE	Harmonized as EN 60359:2002 (not modified)
IEC 60364-6	NOTE	Harmonized as HD 60364-6
IEC 60364-8-1	NOTE	Harmonized as HD 60364-8-1
IEC 61000-4-5	NOTE	Harmonized as EN 61000-4-5
IEC 61000-4-7:2002	NOTE	Harmonized as EN 61000-4-7:2002 (not modified)

EN IEC 61557-12:2022 (E)

IEC 61000-4-15	NOTE	Harmonized as EN 61000-4-15
IEC 61010-2-030	NOTE	Harmonized as EN IEC 61010-2-030
IEC 61010-2-031	NOTE	Harmonized as EN 61010-2-031
IEC 61010-2-032	NOTE	Harmonized as EN IEC 61010-2-032
IEC 61140:2001	NOTE	Harmonized as EN 61140:2002 (not modified)
IEC 61557-2:2007	NOTE	Harmonized as EN 61557-2:2007 (not modified)
IEC 61557-3:2007	NOTE	Harmonized as EN 61557-3:2007 (not modified)
IEC 61557-4:2007	NOTE	Harmonized as EN 61557-4:2007 (not modified)
IEC 61557-5:2007	NOTE	Harmonized as EN 61557-5:2007 (not modified)
IEC 61557-7:2007	NOTE	Harmonized as EN 61557-7:2007 (not modified)
IEC 61557-8:2014	NOTE	Harmonized as EN 61557-8:2015 (not modified)
IEC 61557-9:2014	NOTE	Harmonized as EN 61557-9:2015 (not modified)
IEC 61557-13:2011	NOTE	Harmonized as EN 61557-13:2011 (not modified)
IEC 61869-2:2012	NOTE	Harmonized as EN 61869-2:2012 (not modified)
IEC 61869-3:2011	NOTE	Harmonized as EN 61869-3:2011 (not modified)
IEC 62020	NOTE	Harmonized as EN 62020
IEC 62052-11:2003	NOTE	Harmonized as EN 62052-11:2003 (not modified)
IEC 62053 (series)	NOTE	Harmonized as EN 62053 (series)
IEC 62053-21:2003	NOTE	Harmonized as EN 62053-21:2003 (not modified)
IEC 62053-22:2003	NOTE	Harmonized as EN 62053-22:2003 (not modified)
IEC 62053-23:2003	NOTE	Harmonized as EN 62053-23:2003 (not modified)
IEC 62053-24:2014	NOTE	Harmonized as EN 62053-24:2015 (not modified)
IEC 62586 (series)	NOTE	Harmonized as EN 62586-2:2017/A1 (series)
IEC 62586-1	NOTE	Harmonized as EN 62586-1
ISO 50001	NOTE	Harmonized as EN ISO 50001

EN IEC 61557-12:2022 (E)**Annex ZA**
(normative)**Normative references to international publications
with their corresponding European publications**

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-1	-	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	-
IEC 60068-2-2	-	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	-
IEC 60068-2-30	-	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)	EN 60068-2-30	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 61000-4-30	2015	Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods	EN 61000-4-30	2015
IEC 61010-1	2010	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements	EN 61010-1	2010
+ A1 (mod)	2016		+ A1	2019
IEC 61010-2-030	2017	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits	EN IEC 61010-2-030	2021
-	-		+ A11	2021
IEC 61326-1	2012	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements	EN 61326-1	2013
IEC 62053-31	1998	Electricity metering equipment (a.c.) - Particular requirements - Part 31: Pulse output devices for electromechanical and electronic meters (two wires only)	EN 62053-31	1998

Annex ZZ (informative)

Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered

This European Standard has been prepared under a Commission's standardization request relating to harmonized standards in the field of the Low Voltage Directive, M/511, to provide one voluntary means of conforming to safety objectives of Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits [2014 OJ L96].

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZZ.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding safety objectives of that Directive, and associated EFTA regulations.

Table ZZ.1 — Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]

Safety objectives of Directive 2014/35/EU (Annex I)	Clause(s) / subclause(s) of this EN	Remarks / Notes
1. General conditions		
1 (a) the essential characteristics, the recognition and observance of which will ensure that electrical equipment will be used safely and in applications for which it was made, shall be marked on the electrical equipment, or, if this is not possible, on an accompanying document	1; 2; 3; 4; 5; 6	
1 (b) the electrical equipment, together with its component parts, shall be made in such a way as to ensure that it can be safely and properly assembled and connected	1; 2; 3; 4; 5; 6	
1 (c) the electrical equipment shall be so designed and manufactured as to ensure that protection against the hazards set out in points 2 and 3 is assured, providing that the equipment is used in applications for which it was made and is adequately maintained	Same as those covering safety objectives 2 a) to 2 d) and 3 a) to 3 c) in addition to the clauses 1; 3; 4	
2. Protection against hazards arising from the electrical equipment		
Measures of a technical nature shall be laid down in accordance with point 1, in order to ensure that:		
2 (a) persons and domestic animals are adequately protected against the danger of physical injury or other harm which might be caused by direct or indirect contact	4.9; 4.10; 6.1; 6.2; 6.3	

EN IEC 61557-12:2022 (E)

2 (b) temperatures, arcs or radiation which would cause a danger, are not produced	4.9; 4.10; 6.1; 6.2; 6.3	
2 (c) persons, domestic animals and property are adequately protected against non-electrical dangers caused by the electrical equipment which are revealed by experience	4.9; 4.10; 6.1; 6.2; 6.3	
2 (d) the insulation is suitable for foreseeable conditions	4.9; 4.10; 6.1; 6.2; 6.3	
3. Protection against hazards which may be caused by external influences on the electrical equipment Technical measures shall be laid down in accordance with point 1, in order to ensure that the electrical equipment:		
3 (a) meets the expected mechanical requirements in such a way that persons, domestic animals and property are not endangered	4.9; 4.10; 6.1; 6.2; 6.3	
3 (b) is resistant to non-mechanical influences in expected environmental conditions, in such a way that persons, domestic animals and property are not endangered	4.9; 4.10; 6.1; 6.2; 6.3	
3 (c) does not endanger persons, domestic animals and property in foreseeable conditions of overload	4.10; 5.2; 5.3; 6.1; 6.2; 6.3	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.



IEC 61557-12

Edition 2.0 2018-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC. – Equipment for testing, measuring or monitoring of protective measures –

Part 12: Power metering and monitoring devices (PMD)

Sécurité électrique dans les réseaux de distribution basse tension jusqu'à 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection –

Partie 12: Dispositifs de comptage et de surveillance du réseau électrique (PMD)



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
 3, rue de Varembe
 CH-1211 Geneva 20
 Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.



IEC 61557-12

Edition 2.0 2018-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC. – Equipment for testing, measuring or monitoring of protective measures –

Part 12: Power metering and monitoring devices (PMD)

Sécurité électrique dans les réseaux de distribution basse tension jusqu'à 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection –

Partie 12: Dispositifs de comptage et de surveillance du réseau électrique (PMD)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.220.20; 29.080.01; 29.240.01

ISBN 978-2-8322-6077-7

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references.....	11
3 Terms, definitions and notations.....	11
3.1 General definitions	11
3.2 Definitions related to uncertainty and performance.....	13
3.3 Definitions related to electric phenomena	17
3.4 Definitions related to measurement techniques	20
3.5 Notations	21
3.5.1 Functions.....	21
3.5.2 Symbols and abbreviations.....	21
3.5.3 Indices.....	22
4 Requirements	22
4.1 General requirements.....	22
4.2 PMD general architecture	22
4.3 Classification of PMD	23
4.4 Structure of PMD.....	24
4.4.1 Structure of PMD related to sensors	24
4.4.2 Requirements for self-powered PMD	24
4.5 List of applicable performance classes.....	25
4.6 Operating and reference conditions for PMD.....	25
4.6.1 Reference conditions	25
4.6.2 Rated operating conditions.....	26
4.7 Start-up conditions	28
4.8 Requirements for PMD functions	28
4.8.1 General requirements.....	28
4.8.2 Active power (P) and active energy (E_a) measurements	29
4.8.3 Reactive power (Q_A , Q_V) and reactive energy (E_{rA} , E_{rV}) measurements.....	35
4.8.4 Apparent power (S_A , S_V) and apparent energy (E_{apA} , E_{apV}) measurements	38
4.8.5 Frequency (f) measurements.....	40
4.8.6 RMS phase current (I) and neutral current (I_N , I_{Nc}) measurements	41
4.8.7 RMS voltage (U) measurements	45
4.8.8 Power factor (PF_A , PF_V) measurements	47
4.8.9 Short term flicker (P_{st}) and long term flicker (P_{lt}) measurements	47
4.8.10 Voltage dip (U_{dip}) and voltage swell (U_{swl}) measurements	48
4.8.11 Voltage interruption (U_{int}) measurements	53
4.8.12 Transient overvoltage (U_{tr}) measurements	54
4.8.13 Voltage unbalance (U_{nb} , U_{nba}) measurements	54
4.8.14 Voltage harmonics (U_h) and voltage THD (THD_U and $THD-R_U$) measurements	55
4.8.15 Current unbalance (I_{nb} , I_{nba}) measurements	56
4.8.16 Current harmonics (I_h) and current THD (THD_i and $THD-R_i$) measurements	57

4.8.17	Minimum, maximum, peak, three-phases average and demand measurements	58
4.9	General mechanical requirements.....	58
4.9.1	Vibration requirements	58
4.9.2	IP requirements	58
4.10	Safety requirements	59
4.10.1	Protection against electrical hazards	59
4.10.2	Protection against mechanical hazards	60
4.10.3	Protection against other hazards	60
4.11	EMC requirements	60
4.11.1	Immunity	60
4.11.2	Emission.....	60
4.12	Inputs and/or outputs	60
4.12.1	General	60
4.12.2	Analog outputs.....	60
4.12.3	Pulse outputs.....	61
4.12.4	Control outputs	61
4.12.5	Analog inputs.....	61
4.12.6	Pulse and control inputs	61
5	Marking and operating instructions.....	61
5.1	General.....	61
5.2	Marking.....	61
5.3	Operating, installation and maintenance instructions.....	62
5.3.1	General	62
5.3.2	General characteristics	62
5.3.3	Essential characteristics.....	62
6	Tests.....	64
6.1	General.....	64
6.2	Type tests of PMD.....	65
6.2.1	General	65
6.2.2	Tests of intrinsic uncertainty.....	65
6.2.3	Tests of variation of uncertainty with influence quantities	65
6.2.4	Test of temperature influence	65
6.2.5	Active power	66
6.2.6	Apparent power.....	68
6.2.7	Power factor	69
6.2.8	Common mode voltage rejection test.....	69
6.2.9	Frequency.....	69
6.2.10	Measurement of voltage harmonics and THD_U	70
6.2.11	Measurement of current harmonics and THD_I	70
6.2.12	Dips and swells.....	71
6.2.13	Voltage interruptions	71
6.2.14	Outputs tests	71
6.2.15	Climatic tests	72
6.2.16	EMC tests	73
6.2.17	Start-up tests	73
6.2.18	Gapless measurement test.....	73
6.2.19	Safety tests.....	73
6.3	Routine tests.....	73

6.3.1	Protective bonding test.....	73
6.3.2	Dielectric strength test	74
6.3.3	Uncertainty test.....	74
Annex A (informative) Metering, measuring and monitoring applications.....		75
A.1	Applications on demand side and supply side	75
A.2	Link between applications, devices and standards	75
Annex B (informative) Definitions of electrical parameters.....		77
B.1	General.....	77
B.2	Definitions in the presence of a neutral	77
B.3	Power measurement in three-phase three-wire systems using the two-wattmeter method	81
B.3.1	General	81
B.3.2	Total active power.....	82
B.3.3	Total vector reactive power using quadrature phase shift definition	82
B.3.4	Total vector reactive power using Budeanu's definition	83
B.4	Additional relationships in case of sinusoidal voltage	83
Annex C (informative) Convention about the sign of the power factor		84
C.1	General.....	84
C.2	Convention for power factor (consumer perspective)	84
C.3	Convention for power factor (producer reference frame).....	85
Annex D (normative) Definitions of minimum, maximum, peak and demand values		87
D.1	Demand quantities	87
D.1.1	General	87
D.1.2	Power demand.....	87
D.1.3	Current demand	87
D.1.4	Thermal current demand (or bi-metal current demand)	87
D.1.5	Specified intervals for demand calculation	87
D.2	Peak demand quantities	88
D.3	Three-phase average quantities	88
D.4	Maximum and minimum quantities	88
Annex E (informative) Intrinsic uncertainty and operating uncertainty		89
E.1	General.....	89
E.2	Operating uncertainty calculation.....	89
Annex F (informative) Recommended sensor classes for the different kinds of PMD.....		91
F.1	General considerations.....	91
F.2	Specific case of an active power and energy measurement, achieved by a PMD associated with an external current sensor or/and a voltage sensor	91
F.3	List of functions affected by uncertainty of external sensors	91
Annex G (informative) Notion of measurement uncertainty		93
G.1	General considerations.....	93
G.2	Computing the expanded uncertainty	93
G.2.1	General	93
G.2.2	Estimated standard deviation	93
G.2.3	Expanded uncertainty.....	94
G.3	Determining the measurement uncertainty	95
G.3.1	Systematic error.....	95
G.3.2	Measurement uncertainty	95
G.4	Using the measurement uncertainty as a pass/fail criterion	96

G.4.1	Intrinsic uncertainty tests	96
G.4.2	Tests with influence quantities.....	96
G.4.3	Overall pass/fail criterion.....	96
Bibliography	98
Figure 1	– PMD generic measurement chain	23
Figure 2	– Description of different types of PMD	24
Figure 3	– Relationship between ambient air temperature and relative humidity	28
Figure 4	– Waveform for odd harmonics influence test on active power measurement	66
Figure 5	– Spectral content for odd harmonics influence test on active power measurement.....	67
Figure 6	– Waveform for sub-harmonics influence test on active power measurement	68
Figure 7	– Spectral content for sub-harmonics influence test on active power measurement.....	68
Figure 8	– Common mode voltage influence testing	69
Figure 9	– Waveform for harmonics influence test on frequency measurement	70
Figure A.1	– Simplified overview of measurement applications on supply side and demand side.....	75
Figure B.1	– Arithmetic and vector apparent powers in sinusoidal situation	81
Figure B.2	– Three-phase circuit without neutral.....	82
Figure C.1	– Formatting of power factor with a consumer perspective	84
Figure C.2	– Convention for power factor with a producer perspective.....	85
Figure D.1	– Thermal current demand	87
Figure D.2	– Fixed block interval	88
Figure D.3	– Sliding block interval	88
Figure E.1	– Different kinds of uncertainties	89
Figure E.2	– Flowchart for the determination of the operating uncertainty.....	90
Figure G.1	– Illustration of the notion of measurement uncertainty	95
Figure G.2	– Overview of the uncertainty test procedure.....	97
Table 1	– Functional classification of PMD with minimal required functions	23
Table 2	– Structure of PMD.....	24
Table 3	– List of applicable performance classes.....	25
Table 4	– Reference conditions for testing.....	26
Table 5	– Rated operating temperatures for portable equipment	26
Table 6	– Rated operating temperatures for fixed installed equipment.....	27
Table 7	– Humidity and altitude operating conditions	27
Table 8	– Intrinsic uncertainty table for active power and active energy measurement	30
Table 9	– Influence quantities for active power and active energy measurement (1 of 3).....	31
Table 10	– Minimum test period	34
Table 11	– Starting current for active power and active energy measurement.....	35
Table 12	– Intrinsic uncertainty table for reactive power and reactive energy measurement.....	35
Table 13	– Influence quantities for reactive power and reactive energy measurement.....	36
Table 14	– Minimum test period	37

Table 15 – Starting current for reactive energy measurement.....	38
Table 16 – Intrinsic uncertainty table for apparent power and apparent energy measurement.....	38
Table 17 – Influence quantities for apparent power and apparent energy measurement.....	39
Table 18 – Intrinsic uncertainty table for frequency measurement	40
Table 19 – Influence quantities for frequency measurement.....	41
Table 20 – Rated range of operation for phase current measurement.....	41
Table 21 – Rated range of operation for neutral current (calculated or measured)	42
Table 22 – Intrinsic uncertainty table for phase current	42
Table 23 – Intrinsic uncertainty table for neutral current measurement	42
Table 24 – Intrinsic uncertainty table for neutral current calculation	43
Table 25 – Influence quantities for phase current and neutral current measurement	44
Table 26 – Rated range of operation for RMS voltage measurement	45
Table 27 – Intrinsic uncertainty table for RMS voltage measurement.....	45
Table 28 – Influence quantities for RMS voltage measurement	46
Table 29 – Intrinsic uncertainty table for power factor measurement	47
Table 30 – Intrinsic uncertainty table for flicker measurement	48
Table 31 – Rated range of operation for voltage dips and swells measurement	50
Table 32 – Intrinsic uncertainty table for voltage dips and swells measurement	51
Table 33 – Influence quantities for dips and swells measurement.....	52
Table 34 – Intrinsic uncertainty table for voltage interruption measurement.....	54
Table 35 – Intrinsic uncertainty table for transient overvoltage measurement	54
Table 36 – Intrinsic uncertainty table for voltage unbalance measurement.....	55
Table 37 – Rated range of operation for voltage harmonics measurement.....	55
Table 38 – Intrinsic uncertainty table for voltage harmonics measurement.....	55
Table 39 – Intrinsic uncertainty table for voltage THD_U or $THD-R_U$ measurement.....	56
Table 40 – Intrinsic uncertainty table for current unbalance measurement.....	56
Table 41 – Rated range of operation for current harmonics measurement	57
Table 42 – Intrinsic uncertainty table for current harmonics measurement.....	57
Table 43 – Intrinsic uncertainty table for current THD_i and $THD-R_i$ measurement.....	57
Table 44 – Minimum IP requirements for PMD	58
Table 45 – PMD specification form	63
Table 46 – Characteristics specification template	64
Table A.1 – Main measurement applications.....	76
Table B.1 – Definition of symbols	77
Table B.2 – Calculation definitions for electrical parameters	78
Table C.1 – Conventions for the sign of Power factor with a Consumer perspective.....	85
Table C.2 – Conventions for the sign of power factor with a producer perspective	86
Table F.1 – PMD SD associated with current sensor or PMD DS associated with voltage sensor or PMD SS associated with voltage and current sensors.....	91
Table F.2 – List of functions affected by uncertainty of external sensors	92
Table G.1 – Correction factor $C(N)$ for sample size N	94

INTERNATIONAL ELECTROTECHNICAL COMMISSION**ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION
SYSTEMS UP TO 1 000 V AC AND 1 500 V DC. –
EQUIPMENT FOR TESTING, MEASURING OR
MONITORING OF PROTECTIVE MEASURES –****Part 12: Power metering and monitoring devices (PMD)****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61557-12 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) PMD-A has been withdrawn due the fact these devices are now mainly covered by the IEC 62586 series of standards.
- b) Three categories of PMD have been created with a list of minimum required functions for each category.

- c) Added a new Annex A explaining the different applications linked to the relevant standards and devices, and another new Annex C about the power factor conventions.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
85/644/FDIS	85/649/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61557 series, published under the general title *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Energy distribution systems need to guarantee energy efficiency, availability and network performances in order to address the following challenges:

- sustainable development requirements where energy measurement, for instance, is recognised as an essential element of energy management, part of the overall drive to reduce carbon emissions and to improve the commercial efficiency of manufacturing, commercial organizations and public services;
- technological evolutions (electronic loads, electronic measuring methods, etc.);
- end-users needs (cost saving, compliance with aspects of building regulations, etc.) regarding electrical energy management as well as other energies, or fluids. Other functionalities involving several non electrical parameters are often needed in parallel;
- safety and continuity of service;
- evolution of installation standards, for instance over-current detection is now a new requirement for the neutral conductor due to harmonic content.

Monitoring electrical quantities in internal networks allows to address these challenges.

The devices on the current market have different characteristics, which need a common system of references. Therefore there is a need for this document in order to facilitate the choices of the end-users in terms of performance, safety, interpretation of the indications, etc. This document provides a basis by which such devices can be specified and described, and their performance evaluated.

In order to fulfil the requirements of the energy efficiency project, many PMD measuring electrical parameters can also collect data (water, air, gas, temperature...) coming from other sensors or meters inside building or plant areas. In order to be able to transmit all these data to a supervision software it will be relevant to equip the PMD with a communication bus. The supervision software will then manage all the collected data in order to monitor them and produce useful reports for energy usage and consumption analysis.

ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V AC AND 1 500 V DC. – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES –

Part 12: Power metering and monitoring devices (PMD)

1 Scope

This part of IEC 61557 specifies requirements for power metering and monitoring devices (PMD) that measure and monitor the electrical quantities within electrical distribution systems, and optionally other external signals. These requirements also define the performance in single- and three-phase AC or DC systems having rated voltages up to 1 000 V AC or up to 1 500 V DC.

These devices are fixed or portable. They are intended to be used indoors and/or outdoors.

Power metering and monitoring devices (PMD), as defined in this document, give additional safety information, which aids the verification of the installation and enhances the performance of the distribution systems.

The power metering and monitoring devices (PMD) for electrical parameters described in this document are used for general industrial and commercial applications.

This document does not address functional safety and cyber security aspects.

This document is not applicable for:

- electricity metering equipment that complies with IEC 62053-21, IEC 62053-22, IEC 62053-23 and IEC 62053-24. Nevertheless, uncertainties defined in this document for active and reactive energy measurement are derived from those defined in IEC 62053 (all parts);
- the measurement and monitoring of electrical parameters defined in IEC 61557-2 to IEC 61557-9 and IEC 61557-13 or in IEC 62020;
- power quality instrument (PQI) according IEC 62586 (all parts);
- devices covered by IEC 60051 (all parts) (direct acting analogue electrical measuring instrument).

NOTE 1 Generally such types of devices are used in the following applications or for the following general needs:

- energy management inside the installation, such as facilitating the implementation of documents such as ISO 50001 and IEC 60364-8-1;
- monitoring and/or measurement of electrical parameters;
- measurement and/or monitoring of the quality of energy inside commercial/industrial installations.

NOTE 2 A measuring and monitoring device of electrical parameters usually consists of several functional modules. All or some of the functional modules are combined in one device. Examples of functional modules are:

- measurement and monitoring of several electrical parameters simultaneously;
- energy measurement and/or monitoring, as well as sometimes compliance with aspects of building regulations;
- alarms functions;
- demand side quality (current and voltage harmonics, over/under voltages, voltage dips and swells, etc.).

NOTE 3 PMD are historically called power meter, power monitor, power monitor device, power energy monitoring device, power analyser, multifunction meter, measuring multifunction equipment, energy meters.

NOTE 4 Metering, measuring and monitoring applications are explained in Annex A.

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.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2: Tests – Tests B: Dry heat*

IEC 60068-2-30, *Environmental testing – Part 2-30 – Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-4-30:2015, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods*

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61010-1:2010/AMD1:2016

IEC 61010-2-030:2017, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits*

IEC 61326-1:2012, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 62053-31:1998, *Electricity metering equipment (a.c.) – Particular requirements – Part 31: Pulse output devices for electromechanical and electronic meters (two wires only)*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN