BS EN 62058-21:2010

BSI Standards Publication

Electricity metering equipment (a.c.) — Acceptance inspection

Part 21: Particular requirements for electromechanical meters for active energy (classes 0,5, 1 and 2 and class indexes A and B)

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National foreword

This British Standard is the UK implementation of EN 62058-21:2010. It was derived by CENELEC from IEC 62058-21:2008. Together with BS EN 62058-11:2010, it supersedes BS EN 60514:1995 which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by tags (e.g. ⟦C⟩ ⟨C⟧).

The UK participation in its preparation was entrusted to Technical Committee PEL/13, Electricity Meters.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Amendments/corrigenda issued since publication

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62058-21

June 2010

ICS 17.220; 91.140.50

Supersedes EN 60514:1995 (partially)

English version

Electricity metering equipment (a.c.) - Acceptance inspection - Part 21: Particular requirements for electromechanical meters for active energy (classes 0,5, 1 and 2 and class indexes A and B)

(IEC 62058-21:2008, modified)

Equipement de comptage de l'électricité (a.c.) - Contrôle de réception - Partie 21: Exigences particulières pour compteurs électromécaniques d'énergie active (classes 0,5, 1 et 2 et indices de classe A et B) (CEI 62058-21:2008, modifiée)

Wechselstrom-Elektrizitätszähler - Annahmeprüfung - Teil 21: Besondere Anforderungen an elektromechanische Zähler für Wirkenergie (Klassen 0,5, 1 und 2 und Klassenzeichen A und B) (IEC 62058-21:2008, modifiziert)

This European Standard was approved by CENELEC on 2010-06-01. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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CENELEC

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

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Foreword

The text of document 13/1431/FDIS, future edition 1 of IEC 62058-21, prepared by IEC TC 13, Electrical energy measurement, tariff- and load control, was submitted to the IEC-CENELEC parallel vote.

A draft amendment, prepared by the Technical Committee CENELEC TC 13, Equipment for electrical energy measurement and load control, was submitted to the formal vote.

The combined texts were approved by CENELEC as EN 62058-21 on 2010-06-01.

EN 62058-21:2010, together with EN 62058-11:2010, supersedes EN 60514:1995.

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

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2011-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-06-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 2004/22/EC. See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62058-11:2008 was approved by CENELEC as a European Standard with agreed common modifications.

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 62058-11	2008	Electricity metering equipment (AC) - Acceptance inspection - Part 11: General acceptance inspection methods	EN 62058-11	2010
ISO/IEC Guide 98	1995	Guide to the expression of uncertainty in measurement (GUM)	-	-

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Annex ZZ
(informative)

Coverage of Essential Requirements of the EC Directives

This European Standard has been prepared under the mandate M/374 given to CENELEC by the European Commission and within its scope, the standard covers methods for statistical verification of conformity with the metrological requirements in connection the Modules F, D and H1.

EN 62058-11 specifies sampling plans, schemes and systems for lot-by-lot inspection by attributes or variables. In addition, a test procedure for 100 % inspection is specified, that can be used if the lot size is too small for sampling inspection or when sampling inspection has to be discontinued.

Considering the Part 11, EN 62058-21 specifies particular requirements for electromechanical electricity meters, including the tests to be performed, the sampling plans applicable and the performance criteria.

Table ZZ.1 provides the relationship between the Essential requirements of the MID and the stipulations of the EN 62058 series.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directives concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

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Table ZZ.1 – Relationship between the Essential requirements of the MID and the stipulations of the relevant standards

MID Annex I		Subject	EN 62058-11	EN 62058-21	EN 62058-31
		NOTE The text in this column is for orientation. For the full text see the MID.			
1		Allowable Errors			
	1.1	Under rated operating conditions and in the absence of disturbance	–	5.6 Accuracy tests, Table Z2 5.7 Verification of the register	5.6 Accuracy tests, Table Z2 5.7 Verification of the register
	1.2	Under rated operating conditions and in the presence of disturbance	–	–	–
	1.3	Climatic, mechanical and EM environment and other influence quantities to be specified by the manufacturer	–	–	–
	1.3.1	Climatic environments, upper and lower temperature limit	–	–	–
	1.3.2	Mechanical environments, vibration and shock	–	–	–
	1.3.3	Electromagnetic environments, unless otherwise laid down in the appropriate instrument-specific annexes.	–	–	–
	1.3.4	Other influence quantities	–	–	–
	1.4	Carrying out the tests	–	–	–
	1.4.1	Basic rules for testing and determination of errors	–	5.6, Accuracy test	5.6, Accuracy test
	1.4.2	Ambient humidity	–	–	–
2		Reproducibility	–	–	–
3		Repeatability	–	4.3	4.3
4		Discrimination and Sensitivity	–	–	–
5		Durability	–	–	–
6		Reliability	–	–	–
7		Suitability		5.3 AC voltage test	5.3 AC voltage test
	7.1	No feature likely to facilitate fraudulent use, possibilities for unintentional misuse minimal	–	–	–
	7.2	Suitable for intended use under practical working conditions, no unreasonable demand of the user	–	–	–

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MID Annex I		Subject	EN 62058-11	EN 62058-21	EN 62058-31
	7.3	Errors of a utility measuring instrument at flows or currents outside the controlled range not unduly biased.	–	–	–
	7.4	When the measurand is constant over time, the measuring instrument shall be insensitive to small fluctuations of the value of the measurand, or shall take appropriate action.	N.A.	N.A.	N.A.
	7.5	Robust and materials of construction suitable for the intended use conditions.	–	–	–
	7.6	Designed so as to allow the control of the measuring tasks after the instrument has been placed on the market and put into use. Software that is critical for the metrological characteristics identifiable. Metrological characteristics not inadmissibly influenced by the associated software.	–	–	–
8		Protection against corruption	–	–	–
	8.1	Metrological characteristics not influenced in any inadmissible way by the connection to it of another device, by any feature of the connected device itself or by any remote device that communicates with the measuring instrument.	–	–	–
	8.2	Hardware component critical for metrological characteristics designed so that it can be secured. Security measures to provide evidence of an intervention.	–	–	–
	8.3	Software that is critical for metrological characteristics shall be identified as such and shall be secured. Software identification. Evidence of an intervention available for a reasonable period of time.	–	–	–
	8.4	Measurement data, critical software and metrologically important parameters stored or transmitted adequately protected against accidental or intentional corruption.	–	–	–
	8.5	For utility measuring instruments the display of the total quantity supplied or the displays from which the total quantity supplied can be derived, whole or partial reference to which is the basis for payment, shall not be able to be reset during use.	–	–	–

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MID Annex I		Subject	EN 62058-11	EN 62058-21	EN 62058-31
9		Information to be borne by and to accompany the instrument	–	–	–
	9.1	Shall bear the following inscriptions: - manufacturers mark or name; - information in respect of accuracy. When applicable: - information in respect of the conditions of use; - measuring capacity; - measuring range; - identity marking; - number of the EC-type examination certificate or the EC design examination certificate; - information whether or not additional devices providing metrological results comply with the provisions of this Directive on legal metrological control.	–	5.2	5.2
	9.2	For too small instruments, marking on packaging and in any accompanying documents	N.A.	N.A.	N.A.
	9.3	Accompanying information on - operation and where relevant - rated operating conditions; - mechanical and electromagnetic environment classes; - the upper and lower temperature limit, whether condensation is possible or not, open or closed location; - instructions for installation, maintenance, repairs, permissible adjustments; - instructions for correct operation and any special conditions of use; - conditions for compatibility with interfaces, sub-assemblies or measuring instruments.	–	–	–
	9.4	Utility meters do not require individual instruction manuals.	–	–	–
	9.5	Decimal scale interval	–	–	–
	9.6	Material measure	N.A.	N.A.	N.A.
	9.7	Units of measurement and symbols in accordance with Community legislation	–	–	–
	9.8	Marks and inscriptions clear, non-erasable, unambiguous and non-transferable.	–	–	–

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MID Annex I		Subject	EN 62058-11	EN 62058-21	EN 62058-31
10		Indication of result	–	–	–
	10.1	Display or hard copy	N.A.	N.A.	N.A.
	10.2	Indication of result clear and unambiguous. Easy reading.	N.A.	N.A.	N.A.
	10.3	Hard copy easily legible and not erasable	N.A.	N.A.	N.A.
	10.4	Direct sales trading transactions	N.A.	N.A.	N.A.
	10.5	Fitted with a metrologically controlled display accessible without tools to the consumer. The reading of this display is the measurement result that serves as the basis for the price to pay.	5.7 Verification of the register	5.7 Verification of the register	5.7 Verification of the register
11		Further processing of data to conclude the trading transaction	N.A.	N.A.	N.A.
	11.1	Durable record of the measurement result (other than utility meter)	N.A.	N.A.	N.A.
	11.2	Durable proof of the measurement result	N.A.	N.A.	N.A.
12		Conformity evaluation Designed so as to allow ready evaluation of its conformity with the appropriate requirements of this Directive.	–	–	–
Annex MI-003		ACTIVE ELECTRICAL ENERGY METERS			
1		Accuracy	–	–	–
2		Rated operating conditions	–	–	–
3		MPEs		5.6 Accuracy tests, Table Z2 5.7 Verification of the register	5.6 Accuracy tests, Table Z2 5.7 Verification of the register
4		Permissible effect of disturbances	–	–	–
	4.1	General – Special EM environment	–	–	–
	4.2	Effect of disturbances of long duration	–	–	–
		Reversed phase sequence	–	–	–
		Voltage unbalance (only applicable to polyphase meters)	–	–	–
		Harmonic contents in the current circuits	–	–	–
		DC and harmonics in the current circuit	–	–	–
		Fast transient bursts	–	–	–

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MID Annex I		Subject	EN 62058-11	EN 62058-21	EN 62058-31
		Magnetic fields	–	–	–
		HF (radiated RF) electromagnetic field;	–	–	–
		Conducted disturbances introduced by radio-frequency fields	–	–	–
		Oscillatory waves immunity	–	–	–
	4.3	Permissible effect of transient electromagnetic phenomena	–	–	–
	4.3.1	Behavior during and immediately after a disturbance Recovery Critical change value	–	–	–
	4.3.2	Critical change value for overcurrent	–	–	–
5		Suitability			
	5.1	Measurement error below the rated operating voltage	–	–	–
	5.2	Display of total energy - sufficient number of digits - not resettable during use	–	–	–
	5.3	Retain energy register reading for 4 months	–	–	–
	5.4	Running with no load	–	5.4 Test of no-load condition	5.4 Test of no-load condition
	5.5	Starting	–	5.5 Starting, Table Z1	5.5 Starting, Table Z1
6		Units	–	–	–
7		Putting into use	–	–	–
		CONFORMITY ASSESSMENT B + F or B + D or H1.	Specifies 100% testing and sampling inspection methods to support modules F, D and H1	–	–

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INTRODUCTION

This standard together with IEC 62058-11 cancels and replaces IEC 60514, *Acceptance inspection of class 2 alternating-current watt-hour meters,* which was a Technical Report.

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ELECTRICITY METERING EQUIPMENT (a.c.) – ACCEPTANCE INSPECTION –

Part 21: Particular requirements for electromechanical meters for active energy (classes 0,5, 1 and 2 〉C〈 and class indexes A and B 〉C〈)

1 Scope

This part of IEC 62058 specifies particular requirements for acceptance inspection of newly manufactured direct connected or transformer operated electromechanical meters for active energy (classes 0,5, 1 and 2) delivered in lots in quantities above 50. The method of acceptance of smaller lots should be agreed upon by the manufacturer and the customer.

The process described herein is primarily intended for acceptance inspection between the manufacturer and the purchaser.

〉C〈 This European standard applies to meters of accuracy classes 0,5, 1 and 2, as well as to meters of class indexes A and B. 〉C〈

NOTE It can also be used for other purposes, for example to support initial verification.

2 Normative references

The following referenced documents are indispensable for the application 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 62058-11:2008, *Electricity metering equipment (a.c.) – Acceptance inspection – Part 11: General acceptance inspection methods*

ISO/IEC GUIDE 98: 1995, *Guide to the Expression of Uncertainty in Measurement*

〉C〈 EN 50470-1:2006, *Electricity metering equipment (a.c.) - Part 1: General requirements, tests and test conditions - Metering equipment (class indexes A, B and C)*

EN 50470-2:2006, *Electricity metering equipment (a.c.) - Part 2: Particular requirements - Electromechanical meters for active energy (class indexes A and B)* 〉C〈

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms, definitions, symbols and abbreviations of IEC 62058-11 apply.

4 Test conditions

4.1 Place of inspection

Subclause 5.15 of IEC 62058-11 applies.

4.2 Reference conditions

The tests shall be carried out under the following conditions:

Table 1 – Voltage and current unbalance for polyphase meters

Condition	Class of meter		
	0,5	1	2
Each of the voltages between phase and neutral and between any two phases shall not differ from the average corresponding voltage by more than	± 0,5 %	± 1 %	± 1 %

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Condition	Class of meter		
	0,5	1	2
Each of the currents in the conductors shall not differ from the average current by more than	± 1 %	± 2 %	± 2 %
The phase displacements of each of these currents from the corresponding phase-to-neutral voltage, irrespective of the phase angle, shall not differ from each other by more than	2°		

Table 2 – Reference conditions

Influence quantity	Reference value	Permissible tolerances for meters of class		
		0,5	1	2
Ambient temperature	Reference temperature or, in its absence, 23 °C [a]	± 1 °C	± 2 °C	± 2 °C
Voltage	Reference voltage	± 0,5 %	± 1,0 %	± 1,0 %
Frequency	Reference frequency	± 0,2 %	± 0,3 %	± 0,5 %
Phase sequence	L1 – L2 – L3	-		
Voltage unbalance	All phases connected	-		
Wave-form	Sinusoidal voltages and currents	Distortion factor less than		
		2 %	2 %	3 %
Continuous magnetic induction of external origin	Equal to zero	-		
Magnetic induction of external origin at the reference frequency	Magnetic induction equal to zero	Induction value which causes a variation of error not greater than [b]		
		± 0,1 %	± 0,2 %	± 0,3 %
		but should in any case be smaller than 0,05 mT [b]		
Operation of accessories	No operation of accessories	-		
Working position	Vertical working position [c]	± 0,5 °		
Conducted disturbances, induced by radio frequency fields, 150 kHz to 80 MHz	Equal to zero	< 1 V		

[a] If the tests are made at a temperature other than the reference temperature, including permissible tolerances, the results shall be corrected by applying the appropriate temperature coefficient of the meter.

[b] The test consists of

1) for a single-phase meter, determining the errors first with the meter normally connected to the mains and then after inverting the connections to the current circuits as well as to the voltage circuits. Half of the difference between the two errors is the value of the variation of error. Because of the unknown phase of the external field, the test should be made at 0,1 I_b resp. 0,05 I_n at unity power factor and 0,2 I_b resp. 0,1 I_n at 0,5 power factor;

2) for a three-phase meter, making three measurements at 0,1 I_b resp. 0,05 I_n at unity power factor, after each of which the connection to the current circuits and to the voltage circuits are changed over 120° while the phase sequence is not altered. The greatest difference between each of the errors so determined and their average value is the value of the variation of error.

[c] Determination of the vertical working position (see IEC 62053-11, 5.1).

The construction and assembly of the meter should be such that the correct vertical position is ensured (in both the front-to-back and left-to-right vertical planes) when

– the base of the meter is supported against a vertical wall, and

– a reference edge (such as the lower edge of the terminal block) or a reference line marked on the meter case is horizontal.

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For meters of class index A and B, the values in Table 1 and Table 2, specified for meters of class 2 and class 1 apply respectively.

4.3 Uncertainty of measurement of percentage error

The measuring process shall be such that the uncertainty of the measurement of the percentage error should not exceed 1/5th of the limit of percentage error for the given test point at reference conditions.

For determining the uncertainty of measurement, see ISO/IEC GUIDE 98.

If the uncertainty exceeds this limit, then inspection by variables cannot be used. Only inspection by attributes will be possible, and the limits of percentage error shall be corrected using the following formula:

$$e_{corr}(I, \cos\varphi) = 6/5 \bullet e(I, \cos\varphi) - U$$

where:

- $e(I, \cos\varphi)$ is the limit of percentage error for the given test point at reference conditions;
- U is the measurement uncertainty.

EXAMPLE If, for a given test point, the limit of percentage error at reference conditions is

$e(I, \cos\varphi) = \pm 2\,\%$; and

U = 0,5 %; then

$e_{corr}(I, \cos\varphi) = \pm(6/5 \bullet 2{,}0 - 0{,}5) = \pm 1{,}9\%$.

Instead of the original limit, this corrected limit applies.

Table 3 gives percentage error limits corrected with uncertainty of measurement, using the formula above.

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Table 3 – Percentage error limits corrected with uncertainty

Percentage error limit %	Uncertainty of measurement of percentage error, %									
	0,6	**0,5**	**0,45**	**0,4**	**0,35**	**0,3**	**0,25**	**0,2**	**0,15**	**0,1**
± 3,0	± 3,0	± 3,0	± 3,0	± 3,0	± 3,0	± 3,0	± 3,0	± 3,0	± 3,0	± 3,0
± 2,5	± 2,4	± 2,5	± 2,5	± 2,5	± 2,5	± 2,5	± 2,5	± 2,5	± 2,5	± 2,5
± 2,0	± 1,8	± 1,9	± 1,95	± 2,0	± 2,0	± 2,0	± 2,0	± 2,0	± 2,0	± 2,0
± 1,5	± 1,2	± 1,3	± 1,35	± 1,4	± 1,45	± 1,5	± 1,5	± 1,5	± 1,5	± 1,5
± 1,0	± 0,6	± 0,7	± 0,75	± 0,8	± 0,85	± 0,9	± 0,95	± 1,0	± 1,0	± 1,0
± 0,6	± 0,12	± 0,22	± 0,27	± 0,32	± 0,37	± 0,42	± 0,47	± 0,52	± 0,57	± 0,6
± 0,5	0	± 0,1	± 0,15	± 0,2	± 0,25	± 0,3	± 0,35	± 0,4	± 0,45	± 0,5
± 0,4	0	0	± 0,03	± 0,08	± 0,13	± 0,18	± 0,23	± 0,28	± 0,33	± 0,38
± 0,3	0	0	0	0	± 0,01	± 0,06	± 0,11	± 0,16	± 0,21	± 0,26
± 0,2	0	0	0	0	0	0	0	± 0,04	± 0,09	± 0,14
NOTE In any case, the uncertainty should not exceed half of the percentage error limit.										

4.4 Cover and seal

The meters shall be inspected and tested with their covers on and manufacturer's seal unbroken.

NOTE If testing of mechanical aspects is required, the conditions should be agreed between the manufacturers and the purchaser.

5 Inspection procedure

5.1 Tests to be performed and inspection methods

Table 4 specifies the characteristics to be inspected, the classification of nonconformities, and the inspection method(s) that can be applied, with reference to the sampling plans given in IEC 62058-11.

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Table 4 – Acceptance tests and inspection methods

Test No.	Test	Classification of nonconformities	Inspection methods available [a]	IEC 62058-11 sampling plan
1	AC voltage test	Critical	Lot-by-lot inspection by attributes, single sampling, Ac = 0 or	Table 6
			Isolated lot inspection by attributes, procedure A, Ac = 0	Table 18
2	No-load	Non-critical	Lot-by-lot inspection by attributes, single sampling, AQL = 1,0 or	Table 2
			Lot-by-lot inspection by attributes, double sampling, AQL = 1,0 or	Table 7
			Isolated lot inspection by attributes, single or double sampling, Procedure A, LQ = 5,0 or	Table 17
			Isolated lot inspection by attributes, single or double sampling, Procedure B, LQ = 5,0	Table 20
3	Starting	Non-critical	As for test No.2	
4...9	Accuracy	Non-critical	As for test No. 2, in addition	
			Lot-by-lot inspection by variables, "s" method, AQL = 1,0 or	Table 24
			Lot-by-lot inspection by variables, "σ" method, AQL = 1,0	Table 26
10	Meter constant	Critical	As for test No. 1	
-	Other tests	See 5.8		-

[a] 100 % inspection can always be used, see Clause 6 of IEC 62058-11.

If, for the different tests, the sampling plans give different sample sizes, then the number of samples shall be equal to the largest sample size. The smaller sample shall be chosen from the larger sample randomly.

〖C〗 See also EN 62058-11, 5.5. 〈C〗

5.2 Preliminary tests and pre-conditioning

The meters selected for inspection shall be visually examined in order to verify that they belong to the same type, that their specified markings are correct and that none of them shows signs of damage. The meters shall be in conformity with the type approval and they shall have the same voltage and current charactesristics.

Before the tests, the meters shall be energized at reference voltage and loaded with the current specified below, at unity power factor, to reach thermal stability.

The value of the current shall be 0,1 I_b for direct connected meters or 0,1 I_n for transformer operated meters respectively.

The tests shall be performed in the order below.

〖C〗 For meters of class indexes A and B, the value of the current shall be I_{tr}. 〈C〗

5.3 Test No. 1: AC voltage test

The a.c. voltage test shall be carried out in accordance with Table 5.

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The test voltage shall be substantially sinusoidal, having a frequency between 45 Hz and 65 Hz, and applied for 2 s. The power source shall be capable of supplying at least 500 VA. The rise time and the fall time of the test voltage shall be ≤ 2 s. The auxiliary circuits with reference voltage equal to or below 40 V shall be connected to earth.

During this test, no flashover, disruptive discharge or puncture shall occur.

Table 5 – AC voltage test

Test voltage r.m.s for meters of insulation class		Points of application of the test voltage
I	II	
1,6 kV	3,2 kV	Between on the one hand, all the current and voltage circuits as well as the auxiliary circuits whose reference voltage is over 40 V, connected together, and, on the other hand, earth.

If the manufacturer provides evidence that the test has been already performed on each item before acceptance inspection, then this test does not have to be performed.

5.4 Test No. 2: Test of no-load condition

When the meter is energized at reference voltage, at unity power factor and with the test current applied, and connected as shown in the diagram of connections, the rotor shall not make a complete revolution.

For drum-type registers, these conditions shall apply with only one drum moving.

The value of the test current shall be 0,001 I_b, in case of direct connected meters or 0,001 I_n in case of transformer operated meters.

NOTE Unlike during type testing, the test is done with a small current, because the test conditions are different.

〈C〉 The value of the test current for meters of class indexes A and B shall be 0,01 I_{tr}. 〈C〉

5.5 Test No. 3: Starting

When the meter is energized at reference voltage, (and in case of polyphase meters, with balanced load) and connected as shown in the diagram of connections, the rotor shall start and make more than one revolution at the current given in Table 6.

For meters with drum-type registers, the test shall be made with not more than two drums moving.

Table 6 – Value of current for starting test

Meters for	Class of meter			Power factor
	0,5	1	2	
Direct connection	--	0,004 I_b	0,005 I_b	1
Connection through current transformers	0,002 I_n	0,002 I_n	0,003 I_n	1

〈C〉 For meters of class index A and B, instead of the values of Table 6, the values of Table Z1 apply:

Table Z1 – Value of current for starting test for meters of class index A and B

Meters for	Meters of class index		Power factor
	A	B	
Direct connection	0,05 I_{tr}	0,04 I_{tr}	1
Connection through current transformers	0,06 I_{tr}	0,04 I_{tr}	1

〈C〉

5.6 Tests No. 4 to 9: Accuracy tests

The accuracy tests for single phase or polyphase meters shall be carried out at the test points specified in Table 7, in the order shown in the table, without waiting for thermal equilibrium to be attained between the measurements.

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Table 7 – Accuracy test points and limits of percentage error

Test No.	Value of current for		Power factor	Applicable for meter type	Load (in case of polyphase meters)	Limits of percentage error for meters of class		
	Direct connected meters	Trans-former operated meters				0,5 S	1	2
4	0,05 I_b	0,02 I_n	1	Single- and polyphase	Balanced	± 1,0	± 1,5	± 2,5
5	I_b	I_n	1	Single- and polyphase	Balanced	± 0,5	± 1,0	± 2,0
6	I_b	I_n	0,5	Single- and polyphase	Balanced	± 0,8	± 1,0	± 2,0
7	I_b	I_n	1	Polyphase	Single phase [a]	± 1,5	± 2,0	± 3,0
8	I_b	I_n	1	Polyphase	Single phase [b]	± 1,5	± 2,0	± 3,0
9	I_{max}	I_{max}	1	Single- and polyphase	Balanced	± 0,5	± 1,0	± 2,0

[a] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to any of the phases.

[b] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to a phase different from the phase in test 7.

〈C〉 For meters of class index A and B, instead of the values of the values of Table 7, the values of Table Z2 apply:

Table Z2 – Accuracy test points and limits of errors for meters of class index A and B

Test No.	Value of current for direct connected and transformer operated meters	Power factor	Applicable for meter type	Load (in case of polyphase meters)	Percentage error limits for for meters of class index	
					A	B
4	I_{min}	1	Single- and polyphase	Balanced	± 2,5	± 1,5
5	10 I_{tr}	1	Single- and polyphase	Balanced	± 2,0	± 1,0
6	10 I_{tr}	0,5	Single- and polyphase	Balanced	± 2,0	± 1,0
7	10 I_{tr}	1	Polyphase	Single phase [a]	± 3,0	± 2,0
8	10 I_{tr}	1	Polyphase	Single phase [b]	± 3,0	± 2,0
9	I_{max}	1	Single- and polyphase	Balanced	± 2,0	± 1,0

[a] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to any of the phases.

[b] The meter shall be supplied with three phase symmetrical voltage. The current shall be applied to a phase different from the phase in test 7.

〈C〉

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〈C〉 The values of Table Z2 are taken from EN 50470-2, Table 4 and Table 5, Percentage error limits at reference conditions.

To ensure that the requirements of EN 50470-2, Table 8, Maximum Permissible Error (MPE), are also met, and with this the essential requirements of the MID are met, the actual percentage error limits to be used during conformity assessment shall be established using the method described below.

For each test point, the values of variation of percentage error due to temperature, voltage and frequency variation, established during type testing, shall be subtracted from the MPE using the formula:

$$e_{\text{calc}}(I,\cos\varphi) = \sqrt{MPE^2 - \delta^2_{\text{Type}}(T,I,\cos\varphi) - \delta^2_{\text{Type}}(U,I,\cos\varphi) - \delta^2_{\text{Type}}(f,I,\cos\varphi)}$$

where:

$e_{\text{calc}}(I,\cos\varphi)$ is the value of calculated limit of percentage error under reference conditions;

MPE is the value of maximum permissible error taken from EN 50470-2, Table 8, for the given test point;

$\delta_{\text{Type}}(T,I,\cos\varphi)$ is the value of the variation of percentage error due to variation of temperature, established during type testing;

$\delta_{\text{Type}}(U,I,\cos\varphi)$ is the value of the variation of percentage error due to variation of voltage, established during type testing;

$\delta_{\text{Type}}(f,I,\cos\varphi)$ is the value of the variation of percentage error due to variation of frequency, established during type testing.

The actual limit of percentage error to be applied for each test point shall be the lesser of the value shown in Table Z1, and the value $e_{\text{calc}}(I,\cos\varphi)$ calculated as described above.

An eventual correction of the percentage error limits, due to uncertainty of the measurement of percentage error as described in 4.3, also applies.

During manufacturing, the values of the variation of percentage error due to temperature, voltage and frequency variation shall be established in adequate intervals to ensure that they are essentially same as established during type testing.

EXAMPLE:

A meter of class index A, manufactured for the temperature range of 5 °C to 30 °C is tested.

The columns of Table Z3 show the following:

- column 1: the number of test, as identified in Table Z1;
- column 2: the values of the mpe, taken from EN 50470-2, Table 8;
- column 3: the values of temperature variation, established during the type test;
- column 4: the values of voltage variation, established during the type test;
- column 5: the values of frequency variation, established during the type test;
- column 6: the calculated values of percentage error limits;
- column 7: the percentage error limits taken from Table Z2. 〈C〉

〈C〉 Table Z3 – Example for determining the percentage error limits to be applied

Test No.	MPE	$\delta_{Type}(T, I, \cos\varphi)$	$\delta_{Type}(U, I, \cos\varphi)$	$\delta_{Type}(f, I, \cos\varphi)$	$e_{calc}(I, \cos\varphi)$	$e(I, \cos\varphi)$
4	± 3,5	+ 0,5	- 0,2	+ 0,1	± 3,46	± 2,5
5	± 3,5	+ 0,3	- 0,2	+ 0,1	± 3,48	± 2,0
6	± 3,5	+ 0,5	- 0,2	+ 0,1	± 3,46	± 2,0
7	± 4,0	+ 0,4	- 0,2	+ 0,1	± 3,97	± 3,0
8	± 4,0	+ 0,4	- 0,2	+ 0,1	± 3,97	± 3,0
9	± 3,5	+ 0,3	- 0,2	+ 0,1	± 3,48	± 2,0

As the values of $e(I, \cos\varphi)$, taken from Table Z2 are smaller than the values $e_{calc}(I, \cos\varphi)$ calculated from the MPE taking into account the values of variation of percentage error due to temperature, voltage and frequency variation, established during type testing, the values $e(I, \cos\varphi)$ of Table Z2 shall be used.

If the meter is intended for a wider temperature range, then the calculation has to be performed for each temperature range, and the smallest percentage error limits – out of all the calculated values $e_{calc}(I, \cos\varphi)$ and the values $e(I, \cos\varphi)$ of Table Z2 – shall be used. 〈C〉

5.7 Test No. 10: Verification of the register

This test shall be performed by measuring a sufficient amount of energy, to verify that the accuracy of incrementing the register reading is better than ±1,0 %.

The test shall be done for each meter on at least one tariff register.

5.8 Other tests

The manufacturer and the customer may agree to perform testing of any additional functionality and mechanical aspects.

The inspection methods – 100 % testing, inspection by attributes or inspection by variables – and the acceptance conditions shall be agreed by the manufacturer and the customer.

Some examples for mechanical testing are given below:

- meshing of the register;
- soldered and welded seams;
- tightness of screws;
- swarf, filings and metal dust especially in the air-gap(s) of the brake magnet(s);
- any other item which is deemed desirable.

6 Criteria for lot acceptance non-acceptance, disposal of unacceptable lots

See IEC 62058-11, 5.18 and the relevant clauses for each inspection scheme.

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7 Test record and evaluation

The test results of the sample shall be recorded and evaluated in the inspection sheet given in Table 8 below.

NOTE Tests agreed between the manufacturer and the purchaser may be added.

For larger sample sizes, several inspection sheets may be necessary. The results shall be evaluated on the last sheet. In this case, in the line “Result” write “Continued on next inspection sheet”. The cell “Lot number” can be used for numbering the inspection sheets including test results of a lot.

For double sampling plans, two sets of inspection sheets may be necessary.

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Table 8 – Inspection sheet

1st / 2 nd sample		Inspection by attributes						Inspection by attributes or variables							
Meter	Last figures of serial no.	Test number													
		1	10		2	3		4	5	6	7	8	9		
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
…															
Number of nonconformities															
Number of nonconforming meters[a]															
Acceptance number		0	0												
Rejection number		1	1												
Inspector		Measurement uncertainty													
		Percentage error limits ±													
		Sample mean $\bar{x}_i$													
Date		Standard deviation s_i													
		f_s or f_σ													
Lot number		MSSD or MPSD													
		$\hat{p}_{Ui}$													
		$\hat{p}_{Li}$													
		$\hat{p}_i$													
								$\sum_{i=1}^{n} \hat{p}_i =$			$p^* =$				
Result: Accept / Reject / 2nd sample															

[a] See IEC 62058-11, 7.4.4.1.

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NOTE Harmonized as EN 62052-11:2003 (not modified).

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NOTE Harmonized as EN 62053-11:2003 (not modified).

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