
Oprema za merjenje električne energije (a.c.) - 3. del: Posebne zahteve - Statični števcji za delovno energijo (razredni indeksi A, B in C)

Electricity metering equipment (a.c.) -- Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

Wechselstrom-Elektrizitätszähler -- Teil 3: Besondere Anforderungen - Elektronische Wirkverbrauchszähler der Genauigkeitsklassen A, B und C

Equipement de comptage d'électricité (c.a.) -- Partie 3: Prescriptions particulières - Compteurs statiques d'énergie active (classes de précision A, B et C)

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**Electricity metering equipment (a.c.)
Part 3: Particular requirements -
Static meters for active energy
(class indexes A, B and C)**

Equipement de comptage
d'électricité (c.a.)
Partie 3: Prescriptions particulières -
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der Genauigkeitsklassen A, B und C

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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

This European Standard was prepared by the Technical Committee CENELEC TC 13, Equipment for electrical energy measurement and load control.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50470-3 on 2006-05-01.

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) 2007-05-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2009-05-01

This EN 50470-3 is related to:

- EN 62053-21:2003, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2)* and
- EN 62053-22:2003, *Electricity metering equipment (a.c.) – Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)*.

The structure of the standards is similar, modifications in this European Standard are provided in the perspective of compliance with the Essential Requirements of the Directive 2004/22/EC on Measuring Instruments (MID).
<https://standards.iteh.ai/catalog/standards/sist/4ec7a3ba-3a23-4087-bd29-02d0f6d67d32/sist-en-50470-3-2007>

This standard is to be used with 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)*.

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.

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1 Scope

This European Standard applies to newly manufactured static watt-hour meters intended for residential, commercial and light industrial use, of class indexes A, B and C, for the measurement of alternating current electrical active energy in 50 Hz networks. It specifies particular requirements and type test methods.

It applies to static watt-hour meters for indoor and outdoor application, consisting of a measuring element and register(s) enclosed together in a meter case. It also applies to operation indicator(s) and test output(s).

If the meter has (a) measuring element(s) for more than one type of energy (multi-energy meters), or when other functional elements, like maximum demand indicators, electronic tariff registers, time switches, ripple control receivers, data communication interfaces etc. are enclosed in the meter case (multi-function meters) then this standard applies only for the active energy metering part.

This standard distinguishes between:

- meters of class indexes A, B and C;
- direct connected and transformer operated meters;
- meters for use in networks equipped with or without earth fault neutralizers.

It does not apply to:

- watt-hour meters where the voltage across the connection terminals exceeds 600 V (line-to-line voltage for meters for polyphase systems);
- portable meters;
- reference meters.

Methods for acceptance testing are covered by the IEC 62058 series of standards ¹⁾.

The dependability aspect is covered by the documents of the IEC 62059 series.

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.

Publication	Year	Title
EN 50470-1	2006	<i>Electricity metering equipment (a.c.) – Part 1: General requirements, tests and test conditions – Metering equipment (class indexes A, B and C)</i>
EN 62059-41	2006	<i>Electricity metering equipment – Dependability – Part 41: Reliability prediction (IEC 62059-41:2006)</i>

3 Terms, definitions and abbreviations

For the purposes of this document, the terms and definitions given in EN 50470-1 apply.

¹⁾ At draft stage.

4 Standard electrical values

The values given in EN 50470-1 apply.

5 Mechanical requirements

The requirements given in EN 50470-1 apply.

6 Climatic conditions

The conditions given in EN 50470-1 apply.

7 Electrical requirements

In addition to the electrical requirements in EN 50470-1, meters shall fulfil the following requirements.

7.1 Power consumption

7.1.1 Measurement method

The power consumption in the voltage and current circuits shall be determined at reference conditions given in 8.7.1 by any suitable method. The overall maximum error of the measurement of the power consumption shall not exceed 5 %.

7.1.2 Voltage circuits

The active and apparent power loss in each voltage circuit of a meter at reference voltage, reference temperature and reference frequency shall not exceed the values shown in Table 1.

Table 1 – Power consumption in voltage circuits

Meters (single- and polyphase)	Power supply connected to the voltage circuits	Power supply not connected to the voltage circuits
Power consumption in voltage circuit	2 W and 10 VA	0,5 VA
Power consumption of auxiliary power supply	--	10 VA
NOTE 1 In order to match voltage transformers to meters, the meter manufacturer should state the power factor of the burden (for transformer operated meters only). NOTE 2 The above figures are mean values. Switching power supplies with peak power values in excess of these specified values are permitted, but it should be ensured that the rating of associated voltage transformers is adequate. NOTE 3 For multifunctional meters see EN 62053-61.		

7.1.3 Current circuits

The apparent power taken by each current circuit of a meter at reference current, reference frequency and reference temperature shall not exceed the values shown in Table 2.

Table 2 – Power consumption in current circuits

Meters, (single- and polyphase)	Test current	Class index		
		A	B	C
Direct connected	$I_{ref} = 10 I_{tr}$	2,5 VA	4,0 VA	4,0 VA
Transformer operated	I_n	1,0 VA	1,0 VA	1,0 VA
NOTE In order to match current transformers to meters, the meter manufacturer should state the power factor of the burden (for transformer operated meters only).				

7.2 AC voltage test

The a.c. voltage test shall be carried out in accordance with Table 3.

The test voltage shall be substantially sinusoidal, having a frequency between 45 Hz and 65 Hz, and applied for 1 min. The power source shall be capable of supplying at least 500 VA.

For the tests relative to earth, the auxiliary circuits with reference voltage equal to or below 40 V shall be connected to earth.

All tests shall be carried out with the case closed and the cover and terminal cover(s) in place.

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

iTeh STANDARD PREVIEW Table 3 – AC voltage tests (standards.iteh.ai)

Test	Applicable to	Test voltage r.m.s.	Points of application of the test voltage
A	Protective class I meters	2 kV	a) 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.
		2 kV	b) Between circuits not intended to be connected together in service.
B	Protective class II meters	4 kV	a) 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.
		2 kV	b) Between circuits not intended to be connected together in service.

8 Accuracy requirements and tests

8.1 Limits of percentage error due to variation of the load

When the meter is under reference conditions given in 8.7.1, and the current and the power factor are varied, the percentage errors shall not exceed the limits specified for the relevant class indexes in Table 4 and Table 5.

If the meter is designed for the measurement of energy in both directions, the values in Table 4 and Table 5 shall apply for each direction.

**Table 4 – Percentage error limits at reference conditions
(single-phase meters and polyphase meters with balanced loads)**

Value of current for direct connected or transformer operated meters	Power factor	Percentage error limits for meters of class index		
		A	B	C
$I_{\min} \leq I < I_{tr}$	1	± 2,5	± 1,5	± 1,0
$I_{tr} \leq I \leq I_{\max}$	0,5 ind...1...cap 0,8	± 2,0	± 1,0	± 0,5

NOTE For the relationships I_{\min} / I_{tr} and I_{\max} / I_{tr} see EN 50470-1, Table 3.

**Table 5 – Percentage error limits at reference conditions
(polyphase meters carrying a single-phase load,
but with balanced polyphase voltages applied to voltage circuits)**

Value of current for direct connected or transformer operated meters	Power factor	Percentage error limits for meters of class index		
		A	B	C
$I_{tr} \leq I \leq I_{\max}$	0,5 ind...1	± 3,0	± 2,0	± 1,0

NOTE For the relationship I_{\max} / I_{tr} see EN 50470-1, Table 3.

The difference between the percentage error when the meter is carrying a single-phase load and a balanced polyphase load at I_{ref} and unity power factor shall not exceed 2,5 %, 1,5 % and 1 % for class indexes A, B and C respectively.

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8.2 Repeatability

The application of the same measurand under the same conditions of measurement shall result in the close agreement of successive measurements. The repeatability at any test point given in Table 13 shall be better than $1/10^{\text{th}}$ of the limit of percentage error at reference conditions. The manufacturer shall state the necessary number of pulses.

8.3 Limits of additional percentage error due to influence quantities

When the current and the power factor are held constant at a point within their respective specified measuring ranges, and any single influence quantity is taken from its reference value and varied within its specified operating range, with the meter otherwise operated at reference conditions as specified in 8.7.1, the additional percentage error shall not exceed the limits specified for the relevant class indexes given in Table 6 and Table 7.

Concerning additional percentage error due to temperature variation, the requirements for each sub-range within the full temperature range specified by the manufacturer apply.

NOTE For example, if the manufacturer specifies that the meter is intended for the temperature range -10 °C to +40 °C, then the requirements for the sub-ranges 5 °C to 30 °C, -10 °C to 5 °C and 30 °C to 40 °C apply.

**Table 6 – Limits of additional percentage error due to influence quantities
(single-phase meters and polyphase meters with balanced loads)**

Influence quantity	Value of current for direct connected or transformer operated meters	Power factor	Limits of additional percentage error for meters of class index		
			A	B	C
Temperature variation					
5 °C to 30 °C	$I_{\min} \leq I \leq I_{\max}$	1	± 1,8	± 0,9	± 0,5
	$I_{tr} \leq I \leq I_{\max}$	0,5 ind, 0,8 cap	± 2,7	± 1,3	± 0,9
-10 °C to 5 °C 30 °C to 40 °C	$I_{\min} \leq I \leq I_{\max}$	1	± 3,3	± 1,6	± 1,0
	$I_{tr} \leq I \leq I_{\max}$	0,5 ind, 0,8 cap	± 4,9	± 2,3	± 1,6
-25 °C to -10 °C 40 °C to 55 °C	$I_{\min} \leq I \leq I_{\max}$	1	± 4,8	± 2,4	± 1,4
	$I_{tr} \leq I \leq I_{\max}$	0,5 ind, 0,8 cap	± 7,2	± 3,4	± 2,4
-40 °C to -25 °C 55 °C to 70 °C	$I_{\min} \leq I \leq I_{\max}$	1	± 6,3	± 3,1	± 1,9
	$I_{tr} \leq I \leq I_{\max}$	0,5 ind, 0,8 cap	± 9,4	± 4,4	± 3,1
Voltage variation ± 10 %	$I_{\min} \leq I \leq I_{\max}$	1	± 1,0	± 0,7	± 0,2
	$I_{tr} \leq I \leq I_{\max}$	0,5 ind, 0,8 cap	± 1,5	± 1,0	± 0,4
Frequency variation ± 2 %	$I_{\min} \leq I \leq I_{\max}$	1	± 0,8	± 0,5	± 0,2
	$I_{tr} \leq I \leq I_{\max}$	0,5 ind, 0,8 cap	± 1,0	± 0,7	± 0,2
NOTE For the relationships I_{\min} / I_{tr} and I_{\max} / I_{tr} see EN 50470-1, Table 3.					

**Table 7 – Limits of additional percentage error due to influence quantities
(polyphase meters carrying a single phase load,
but with balanced polyphase voltages applied to voltage circuits)**

Influence quantity	Value of current for direct connected or transformer operated meters	Power factor	Limits of additional percentage error for meters of class index		
			A	B	C
Temperature variation					
5 °C to 30 °C	$I_{tr} \leq I \leq I_{\max}$	1	± 1,8	± 0,9	± 0,5
		0,5 ind	± 2,7	± 1,3	± 0,9
-10 °C to 5 °C 30 °C to 40 °C	$I_{tr} \leq I \leq I_{\max}$	1	± 3,3	± 1,6	± 1,0
		0,5 ind	± 4,9	± 2,3	± 1,6
-25 °C to -10 °C 40 °C to 55 °C	$I_{tr} \leq I \leq I_{\max}$	1	± 4,8	± 2,4	± 1,4
		0,5 ind	± 7,2	± 3,4	± 2,4
-40 °C to -25 °C 55 °C to 70 °C	$I_{tr} \leq I \leq I_{\max}$	1	± 6,3	± 3,1	± 1,9
		0,5 ind	± 9,4	± 4,4	± 3,1
Voltage variation ± 10 %	$I_{tr} \leq I \leq I_{\max}$	1	± 1,5	± 1,0	± 0,3
		0,5 ind	± 2,0	± 1,5	± 0,5
Frequency variation ± 2 %	$I_{tr} \leq I \leq I_{\max}$	1	± 1,0	± 0,7	± 0,3
		0,5 ind	± 1,3	± 1,0	± 0,3
NOTE For the relationship I_{\max} / I_{tr} see EN 50470-1, Table 3.					

8.4 Maximum permissible error (MPE)

In addition to the requirements of 8.1 and 8.3, the composite error of the meter shall not exceed the values given in Table 8.

When the operating range of the meter covers more than one temperature range, then the respective requirements for each temperature range apply.

The composite error at a certain load shall be calculated from the following formula:

$$e_c = \sqrt{e^2(I, \cos \varphi) + \delta^2(T, I, \cos \varphi) + \delta^2(U, I, \cos \varphi) + \delta^2(f, I, \cos \varphi)}$$

where

$e(I, \cos \varphi)$ = the intrinsic error of the meter at a certain load;

$\delta(T, I, \cos \varphi)$ = the additional percentage error due to the variation of the temperature at the same load;

$\delta(U, I, \cos \varphi)$ = the additional percentage error due to the variation of the voltage at the same load;

$\delta(f, I, \cos \varphi)$ = the additional percentage error due to the variation of the frequency at the same load.

See also 8.7.6.

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Table 8 – Maximum permissible error (MPE)

Value of current	Power factor	Operating temperature range											
		5 °C to 30 °C			-10 °C to 5 °C or 30 °C to 40 °C			-25 °C to -10 °C or 40 °C to 55 °C			-40 °C to -25 °C or 55 °C to 70 °C		
		Meter class index											
		A	B	C	A	B	C	A	B	C	A	B	C
Single-phase meter; polyphase meter with balanced loads													
$I_{\min} \leq I < I_{tr}$	1	± 3,5	± 2,0	± 1,0	± 5,0	± 2,5	± 1,3	± 7,0	± 3,5	± 1,7	± 9,0	± 4,0	± 2,0
$I_{tr} \leq I \leq I_{\max}$	0,5 ind...1... 0,8 cap	± 3,5	± 2,0	± 0,7	± 4,5	± 2,5	± 1,0	± 7,0	± 3,5	± 1,3	± 9,0	± 4,0	± 1,5
Polyphase meter carrying a single-phase load, but with balanced voltage supplied to the voltage circuits													
$I_{tr} \leq I \leq I_{\max}$	0,5 ind...1	± 4,0	± 2,5	± 1,0	± 5,0	± 3,0	± 1,3	± 7,0	± 4,0	± 1,7	± 9,0	± 4,5	± 2,0

8.5 Effect of disturbances of long duration

When the meter is otherwise operated at reference conditions, the additional percentage error due to disturbances of long duration, when applied one by one, shall not exceed the critical change values specified in Table 9.

For testing, see 8.7.7.