

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Direct acting indicating analogue electrical measuring instruments and their accessories –

Part 5: Special requirements for phase meters, power factor meters and synchrosopes

[IEC 60051-5:2017](#)

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Appareils mesureurs électriques indicateurs analogiques à action directe et leurs accessoires –

Partie 5: Exigences particulières pour les phasemètres, les appareils de mesure de facteur de puissance et les synchronoscopes



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**Direct acting indicating analogue electrical measuring instruments and their accessories –
Part 5: Special requirements for phase meters, power factor meters and synchrosopes**

IEC 60051-5:2017

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Appareils mesureurs électriques indicateurs analogiques à action directe et leurs accessoires –

Partie 5: Exigences particulières pour les phasemètres, les appareils de mesure de facteur de puissance et les synchronoscopes

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Description, classification and compliance.....	7
4.1 Description	7
4.2 Classification	7
4.3 Compliance with the requirements of this standard	7
5 Requirements	8
5.1 Reference conditions	8
5.2 Limits of intrinsic uncertainty, fiducial value	8
5.2.1 Limits of intrinsic uncertainty	8
5.2.2 Correspondence between intrinsic uncertainty and accuracy class	8
5.2.3 Fiducial value	8
5.3 Nominal range of use and variations	8
5.3.1 Nominal range of use.....	8
5.3.2 Limits of variations.....	9
5.3.3 Conditions for the determination of variations	10
5.4 Operating uncertainty, overall system uncertainty and variations	10
5.5 Electrical requirements	10
5.5.1 Electrical safety requirements.....	10
5.5.2 Self-heating.....	10
5.5.3 Permissible overloads.....	10
5.5.4 Limiting range of temperature	11
5.5.5 Deviation from zero	11
5.5.6 Electromagnetic compatibility (EMC)	11
5.5.7 Special requirements for synchroscopes.....	12
5.6 Constructional requirements	12
5.6.1 General constructional requirements	12
5.6.2 Damping.....	12
5.6.3 Sealing to prevent access.....	12
5.6.4 Scales	12
5.6.5 Stopper.....	12
5.6.6 Preferred values	12
5.6.7 Adjusters, mechanical and/or electrical.....	13
5.6.8 Effects of vibration and shock	13
5.6.9 Degrees of protection provided by enclosure	13
5.6.10 Terminals	13
6 Information, markings and symbols.....	13
6.1 Information	13
6.2 Markings, symbols and their locations.....	13
6.3 Markings relating to the reference values and nominal ranges of use of influence quantities.....	13
6.4 The symbols for marking instruments and accessories.....	13
6.5 Markings and symbols for terminals	13

6.5.1	Requirements for markings	13
6.5.2	Earthing (grounding) terminals.....	13
6.5.3	Measuring circuit terminals	14
6.5.4	Special markings for terminals.....	14
6.6	Instructions for use	14
7	Package	14
8	Test rules	14
Annex A (normative) Nonconformity classification of tests		15
Bibliography.....		16

Table 1 – Reference conditions and tolerances, additional to those given in Table 2 of IEC 60051-1:2016, for testing purposes relating to the influence quantities.....	8
Table 2 – Limits of the nominal range of use and permissible variations in addition to those given in Table 3 of IEC 60051-1:2016.....	9
Table 3 – Overloads of short duration	11
Table A.1 – Nonconformity classification of tests	15

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIRECT ACTING INDICATING ANALOGUE ELECTRICAL
MEASURING INSTRUMENTS AND THEIR ACCESSORIES –****Part 5: Special requirements for phase meters,
power factor meters and synchrosopes**

FOREWORD

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International Standard IEC 60051-5 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This fifth edition cancels and replaces the fourth edition published in 1985. This edition constitutes a technical revision.

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

- a) updating of content in line with new editions of IEC 60051-1 and IEC 60051-9;
- b) addition of Annex A to specify the nonconformity classification of test items.

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

CDV	Report on voting
85/581/CDV	85/581A/RVC

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 International Standard is to be used in conjunction with IEC 60051-1:2016.

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

A list of all parts in the IEC 60051 series, published under the general title *Direct acting indicating analogue electrical measuring instruments and their accessories*, 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
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INTRODUCTION

IEC 60051 is published in separate parts according to the following structure and under the general title: *Direct acting indicating analogue electrical measuring instruments and their accessories*.

- Part 1: Definitions and general requirements common to all parts
- Part 2: Special requirements for ammeters and voltmeters
- Part 3: Special requirements for wattmeters and varmeters
- Part 4: Special requirements for frequency meters
- Part 5: Special requirements for phase meters, power factor meters and synchrosopes
- Part 6: Special requirements for ohmmeters (impedance meters) and conductance meters
- Part 7: Special requirements for multi-function instruments
- Part 8: Special requirements for accessories
- Part 9: Recommended test methods

IEC 60051-5 is not complete in itself and is read in conjunction with IEC 60051-1.

All of these parts are arranged in the same format and a standard relationship between subject and clause number is maintained throughout these parts. This arrangement will assist the reader of IEC 60051 to distinguish information relating to the different types of instruments.

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DIRECT ACTING INDICATING ANALOGUE ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES –

Part 5: Special requirements for phase meters, power factor meters and synchrosopes

1 Scope

This part of IEC 60051 applies to direct acting indicating phase meters, power factor meters and synchrosopes having an analogue display.

This document also applies to non-interchangeable accessories (as defined in 3.1.23 of IEC 60051-1:2016) used with phase meters, power factor meters and synchrosopes.

This document also applies to a phase meter or power factor meter whose scale marks do not correspond directly to its electrical input quantity, provided that the relationship between them is known.

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 60051-5:2017](https://standards.iteh.ai/catalog/standards/sist/b0f4498c-9c1f-4148-9254-35e196910a75/iec-60051-5-2017)

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IEC 60051-1:2016, *Direct acting indicating analogue electrical measuring instruments and their accessories – Part 1: Definitions and general requirements common to all parts*

3 Terms and definitions

See IEC 60051-1:2016.

4 Description, classification and compliance

4.1 Description

See IEC 60051-1:2016.

4.2 Classification

Phase meters, power factor meters and synchrosopes shall be classified in one of the accuracy classes denoted by the following class indices:

0,1, 0,2, 0,3, 0,5, 1, 1,5, 2, 2,5, 3, 5

4.3 Compliance with the requirements of this standard

See IEC 60051-1:2016.

5 Requirements

5.1 Reference conditions

See IEC 60051-1:2016. The reference value of the influence quantities should be as given in Table 2 of IEC 60051-1:2016 and Table 1.

Table 1 – Reference conditions and tolerances, additional to those given in Table 2 of IEC 60051-1:2016, for testing purposes relating to the influence quantities

Influence quantity	Reference conditions unless otherwise marked		Tolerance permitted for testing purposes, applicable for a single reference value ^a
Voltage component of the measured quantity	Rated voltage or any voltage within the reference range		±2 % of the rated value
Current component of the measured quantity	40 % ... 100 % of rated current		–
Frequency of voltage and current components of the measured quantity	Instruments using phase shifting devices	Reference frequency	±0,1 % of the reference frequency
	Other instruments	45 Hz to 65 Hz	±2 % of the reference frequency
Phase balance (for polyphase instruments)	Symmetrical voltages and currents		^b
^a This tolerance applies when a single reference value is specified in this table or is marked by the manufacturer. For a reference range, no tolerance is allowed.			
^b Each of the voltages (between any two lines or between line and neutral) should not differ by more than 1 % from the average of the voltages (line-to-line or line-to-neutral) of the system.			
Each of the currents in the phases should not differ by more than 1 % from the average of the currents.			
The angles between each of the currents and the corresponding phase-to-neutral voltages should not differ by more than 2° from the average of the angles.			

5.2 Limits of intrinsic uncertainty, fiducial value

5.2.1 Limits of intrinsic uncertainty

See IEC 60051-1:2016.

For a synchroscope, the accuracy requirements apply only at the synchronizing mark.

5.2.2 Correspondence between intrinsic uncertainty and accuracy class

See IEC 60051-1:2016.

5.2.3 Fiducial value

The fiducial value corresponds to a phase angle of 90°.

The class index is marked using symbol E-1 given in Table 6 of IEC 60051-1:2016 (see Clause 6 of IEC 60051-1:2016).

5.3 Nominal range of use and variations

5.3.1 Nominal range of use

See IEC 60051-1:2016. The limits of the nominal range of use for influence quantities shall be as given in Table 3 of IEC 60051-1:2016 and Table 2.

Table 2 – Limits of the nominal range of use and permissible variations in addition to those given in Table 3 of IEC 60051-1:2016

Influence quantity		Limits of the nominal range of use unless otherwise marked	Permissible variation expressed		
Distortion of voltage and/or current components of the measured quantity	Distortion factor	5 %	100 %		
	Peak factor ^a	1 to 3 ^b	Under consideration		
Frequency of voltage and current components of the measured quantity	Instruments using phase shifting devices	Reference frequency ± 1 % or lower limit of reference range -1 % and upper limit of reference range +1 %	100 %		
	Other instruments	Reference frequency ± 10 % or lower limit of reference range -10 % and upper limit of reference range +10 %			
Voltage components of the measured quantity		Reference voltage ± 15 % or lower limit of reference range -15 % and upper limit of reference range +15 %	100 %		
Current components of the measured quantity		20 %...120 % of rated current	100 %		
Phase balance (for polyphase instruments)		Disconnection of one current component of the measured quantity	200 %		
Magnetic field of external origin		0,4 kA/m		Class indices 0,3 and smaller	Class indices 0,5 and greater
			Electro-dynamic instruments if not static and/or not having a magnetic screen	3 % of the fiducial values ^c	6 % of the fiducial values ^c
			Ferro-dynamic instruments if not static and/or not having a magnetic screen	1,5 % of the fiducial values ^c	3 % of the fiducial values ^c
			All other instruments	0,75 % of the fiducial values ^c	1,5 % of the fiducial values ^c
^a For instruments having electronic devices in their measuring circuits.					
^b The permissible variation due to a peak factor of other than $\sqrt{2}$ (corresponding to a sine wave) is included in the permissible variation due to distortion of the measured quantity. For instruments having a peak factor capability greater than 3, the manufacturer shall state: <ol style="list-style-type: none"> 1) The peak factor producing a variation of 100 % of the class index. 2) The upper and lower limits of the frequency response (bandwidth) to 0,707 times the indication at the reference frequency. 3) The effective maximum rate of change of internal instrument AC amplifier response (slew rate), expressed in volts per second, using appropriate SI prefixes. 					
^c Not as a percentage of the class index.					

5.3.2 Limits of variations

See IEC 60051-1:2016 and Table 2.

5.3.3 Conditions for the determination of variations

See IEC 60051-1:2016.

5.4 Operating uncertainty, overall system uncertainty and variations

See IEC 60051-1:2016.

5.5 Electrical requirements

5.5.1 Electrical safety requirements

See IEC 60051-1:2016.

5.5.2 Self-heating

See IEC 60051-1:2016.

However, the requirements of IEC 60051-1:2016 do not apply to synchrosopes.

5.5.3 Permissible overloads

5.5.3.1 Continuous overload

For the recommended test, see IEC 60051-9.

All phase meters and power factor meters, together with their non-interchangeable accessory(ies), if any, except for instruments fitted with a non-locking switch, shall be subjected to a continuous overload of 120 % of the rated value for all current circuits simultaneously for a period of 2 h.

After having cooled to the reference temperature, the instrument, together with its non-interchangeable accessory(ies), if any, shall comply with its accuracy requirements but without repeating the overload.

The continuous overload test shall be carried out under reference conditions except for current.

The requirements for continuous overload do not apply to synchrosopes.

5.5.3.2 Overloads of short duration

5.5.3.2.1 For the recommended test, see IEC 60051-9.

All phase meters, power factor meters and synchrosopes, together with their non-interchangeable accessory(ies), if any, shall be subjected to overloads of short duration.

However, these requirements do not apply to instruments whose scale marks do not correspond directly to their electrical input quantities (but not excluding instruments intended to be used with (an) instrument transformer(s)).

5.5.3.2.2 The values of current and voltage for the overloads of short duration shall be the product of the relevant factor given in Table 3 and the rated value of voltage or the upper limit of the nominal range of use for current unless other values are stated by the manufacturer.

The overloads shall be applied separately to each input circuit.