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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Direct acting indicating analogue electrical measuring instruments and their accessories – Part 1: Definitions and general requirements common to all parts

Appareils de mesure électriques indicateurs analogiques à action directe et leurs accessoires – 0c2c5c9fb79f/icc-60051-1-2016 Partie 1: Définitions et exigences générales communes à toutes les parties





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IEC Central Office	Tel.: +41 22 919 02 11
3, rue de Varembé	Fax: +41 22 919 03 00
CH-1211 Geneva 20	info@iec.ch
Switzerland	www.iec.ch

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Edition 6.0 2016-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Direct acting indicating analogue electrical measuring instruments and their accessories – (standards.iteh.ai) Part 1: Definitions and general requirements common to all parts

 IEC 60051-1:2016

 Appareils de meşure électriques indicateurs analogiques à action directe et leurs accessoires –
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 Partie 1: Définitions et exigences générales communes à toutes les parties

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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CONTENTS

FC	FOREWORD5				
IN	INTRODUCTION				
1	Scop	e	8		
2	Norm	ative references	8		
3	Terms and definitions				
	3.1	General terms	9		
	3.2	Description of instruments according to their method of operation	13		
	3.3	Constructional features of instruments	14		
	3.4	Characteristic features of instruments			
	3.5	Characteristic values	17		
	3.6	Influence guantity, reference conditions, nominal range of use and			
		preconditioning	17		
	3.7	Uncertainty and variations	19		
	3.8	Accuracy, accuracy class and class index	21		
	3.9	Test	21		
4	Desc	ription, classification and compliance	22		
	4.1	Description	22		
	4.1.1	Description according to methods of operation or nature	22		
	4.1.2	Description according to environmental conditions	22		
	4.1.3	Description according to mechanical conditions	22		
	4.1.4	Description according to degrees of protection	22		
	4.2	Classification/chardede teb of outparts and whether the first and the fi	22		
	4.3	Compliance with the requirements of this standard	23		
5	4.3 Requ	Compliance with the requirements of this standard	23 23		
5	4.3 Requ 5.1	Compliance with the requirements of this standard.	23 23 23		
5	4.3 Requ 5.1 5.2	Compliance with the requirements of this standard.	23 23 23 23		
5	4.3 Requ 5.1 5.2 5.2.1	Compliance with the requirements of this standard. Reference conditions. Limits of intrinsic uncertainty, fiducial value	23 23 23 23 23 23		
5	4.3 Requ 5.1 5.2 5.2.1 5.2.2	Compliance with the requirements of this standard irements	23 23 23 23 23 23		
5	4.3 Requ 5.1 5.2 5.2.1 5.2.2 5.2.3	Compliance with the requirements of this standard. Reference conditions. Limits of intrinsic uncertainty, fiducial value Correspondence between intrinsic uncertainty and accuracy class Fiducial value.	23 23 23 23 23 23 23 23		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3	Compliance with the requirements of this standard irements	23 23 23 23 23 23 23 25		
5	4.3 Requ 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3.1	Compliance with the requirements of this standard. irements	23 23 23 23 23 23 23 25 25		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3.1 5.3.2	Compliance with the requirements of this standard. irements	23 23 23 23 23 23 23 25 25		
5	4.3 Requ 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3.1 5.3.2 5.3.3	Compliance with the requirements of this standard. irements	23 23 23 23 23 23 23 25 25		
5	4.3 Requised 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4	Compliance with the requirements of this standard. irements	23 23 23 23 23 23 23 25 25		
5	4.3 Requ 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4 5.5	Compliance with the requirements of this standard. irements Reference conditions Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations Nominal range of use Limits of variations Conditions for the determination of variations Operating uncertainty, overall system uncertainty and variations Electrical requirements.	23 23 23 23 23 23 23 23		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4 5.5 5.5.1	Compliance with the requirements of this standard irements Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations Nominal range of use Limits of variations Conditions for the determination of variations Operating uncertainty, overall system uncertainty and variations Electrical requirements Electrical safety requirements	23 23 23 23 23 23 23 23		
5	4.3 Requisited for the second state of the sec	Compliance with the requirements of this standard. Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations. Nominal range of use Limits of variations Conditions for the determination of variations Operating uncertainty, overall system uncertainty and variations Electrical safety requirements Self-heating	23 23 23 23 23 23 23 25 25		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4 5.5 5.5.1 5.5.2 5.5.3	Compliance with the requirements of this standard. Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations. Nominal range of use and variations Conditions for the determination of variations Operating uncertainty, overall system uncertainty and variations. Electrical safety requirements Self-heating Permissible overloads	23 23 23 23 23 23 23 25 25		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4 5.5 5.5.1 5.5.2 5.5.3 5.5.4	Compliance with the requirements of this standard	23 23 23 23 23 23 23 23		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3 5.3 5.3 5.4 5.5 5.5.1 5.5.2 5.5.3 5.5.4 5.5.3	Compliance with the requirements of this standard. irements Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations Nominal range of use Limits of variations Conditions for the determination of variations Operating uncertainty, overall system uncertainty and variations. Electrical requirements Self-heating Permissible overloads Limiting range of temperature. Deviation from zero	23 23 23 23 23 23 23 25 25		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4 5.5 5.5.1 5.5.2 5.5.3 5.5.4 5.5.5 5.5.4 5.5.5	Compliance with the requirements of this standard. irements Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations Nominal range of use and variations Conditions for the determination of variations Conditions for the determination of variations Deprating uncertainty, overall system uncertainty and variations Electrical requirements Self-heating Permissible overloads Limiting range of temperature Deviation from zero Electromagnetic compatibility (EMC)	23 23 23 23 23 23 23 23		
5	4.3 Requisits 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3.1 5.3.2 5.3.3 5.4 5.5 5.5.1 5.5.2 5.5.3 5.5.4 5.5.5 5.5.4 5.5.5 5.5.6	Compliance with the requirements of this standard	23 23 23 23 23 23 25 25		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3 5.3 5.3 5.4 5.5.2 5.5.3 5.5.1 5.5.2 5.5.3 5.5.4 5.5.5 5.5.6 5.6 5.6	Compliance with the requirements of this standard. irements. Reference conditions. Limits of intrinsic uncertainty, fiducial value . Limits of intrinsic uncertainty . Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations. Nominal range of use and variations. Nominal range of use . Limits of variations. Conditions for the determination of variations . Operating uncertainty, overall system uncertainty and variations. Electrical requirements. Electrical safety requirements Self-heating. Permissible overloads Limiting range of temperature. Deviation from zero. Electromagnetic compatibility (EMC) Constructional requirements.	23 23 23 23 23 23 23 23		
5	4.3 Requisited for the second state of the sec	Compliance with the requirements of this standard. irements. Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations. Nominal range of use and variations. Nominal range of use Limits of variations. Conditions for the determination of variations. Operating uncertainty, overall system uncertainty and variations. Electrical requirements. Electrical safety requirements Self-heating Permissible overloads Limiting range of temperature. Deviation from zero. Electromagnetic compatibility (EMC). Constructional requirements. General constructional requirements Damping	23 23 23 23 23 23 23 25 25		
5	4.3 Requi 5.1 5.2 5.2.1 5.2.2 5.2.3 5.3 5.3 5.3 5.3 5.3 5.3 5.4 5.5 5.5.1 5.5.2 5.5.3 5.5.4 5.5.5 5.5.4 5.5.5 5.5.6 5.6.1 5.6.2 5.6.3	Compliance with the requirements of this standard. irements Reference conditions. Limits of intrinsic uncertainty, fiducial value Limits of intrinsic uncertainty Correspondence between intrinsic uncertainty and accuracy class Fiducial value. Nominal range of use and variations. Nominal range of use and variations. Nominal range of use Limits of variations Conditions for the determination of variations Operating uncertainty, overall system uncertainty and variations Electrical safety requirements Self-heating Permissible overloads Limiting range of temperature Deviation from zero Electromagnetic compatibility (EMC) Constructional requirements General constructional requirements Damping Sealing to prevent access	23 23 23 23 23 23 25 25		

5.6.	5	Stopper	32	
5.6.	6	Preferred values	32	
5.6.	7	Adjusters, mechanical and/or electrical	32	
5.6.	8	Effects of vibration and shock	33	
5.6.9	9	Degrees of protection provided by enclosure	33	
5.6.	10	Terminals	34	
6 Info	rmatio	on, markings and symbols	34	
6.1	Info	rmation	34	
6.2	Mar	kings, symbols and their locations	35	
6.3	Mar influ	kings relating to the reference values and nominal ranges of use of ence quantities	36	
6.4	The	symbols for marking instruments and accessories	36	
6.5	Mar	kings and symbols for terminals	45	
6.5.	1	Requirements for markings	45	
6.5.2	2	Earthing (grounding) terminals	45	
6.5.3	3	Measuring circuit terminals	45	
6.5.4	4	Special markings for terminals	45	
6.6	Inst	uctions for use	45	
7 Pac	kage .		46	
8 Test	t rules		46	
8.1	Тур	e of test Teh STANDARD PREVIEW	46	
8.2	Тур	e tests	46	
8.3	Rou	tine tests	46	
8.4	Rec	urrent tests	46	
8.5	Non	conformity.classificationtalog/standards/sist/ca65420d-7ea1-432e-8a12	47	
8.6	Jud	gement of test resultse2e5e9fb79f/iec-60051-1-2016	47	
Annex A	(norn	native) Limits of intrinsic uncertainty and variations	48	
Annex B humidity.	(infor	mative) Relationship between ambient temperature and relative	51	
Annex C	(infor	mative) Estimation of uncertainties	52	
C.1	Unc	ertainties in this standard	52	
C.2	Ope	rating uncertainty	52	
C.2.	1	General	52	
C.2.	2	Estimating absolute operating uncertainty according to type test results	52	
C.2.	3	Estimating absolute operating uncertainty according to limit of intrinsic uncertainty and limit of variations due to every influence specified by		
		this standard	53	
C.3	Ove	rall system uncertainty	54	
C.4	Fidu	cial operating uncertainty	54	
Annex D	(norn	native) Routine Tests	55	
Bibliogra	phy		56	
Figure 1	– Me	asuring range 10 A to 50 A	31	
Figure 2	– Me	asuring range 80 V to 110 V	32	
Figure 3	– Me	asuring ranges 0,06 M Ω to 0,4 M Ω and 0,1 M Ω to 2 M Ω	32	
Figure A.1 – Effect of temperature				
Figure A.2 – Effect of temperature.				
	·	eletionship between embient temperature and relative humidity	4 3 E1	
Figure B. I – Relationship between ambient temperature and relative numidity				

Figure C.1 – Different kinds of uncertainty	52
Table 1 – Minimum IP requirements	22
Table 2 – Reference conditions and tolerances for testing purposes relating to the influence quantities	24
Table 3 – Limits of the nominal range of use and permissible variations	26
Table 4 – The diameters of conductive screw and the diameters or the area of contact surface	34
Table 5 – Units, quantities and SI prefixes	37
Table 6 – Symbols for marking instruments and accessories	38

- 4 -

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<u>IEC 60051-1:2016</u> https://standards.iteh.ai/catalog/standards/sist/ca65420d-7ea1-432e-8a12-0e2e5e9fb79f/iec-60051-1-2016

INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIRECT ACTING INDICATING ANALOGUE ELECTRICAL MEASURING INSTRUMENTS AND THEIR ACCESSORIES –

Part 1: Definitions and general requirements common to all parts

FOREWORD

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International Standard IEC 60051-1 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This sixth edition cancels and replaces the fifth edition published in 1997. This edition constitutes a technical revision.

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

- adding the EMC requirements;
- updating the safety symbols and requirements according to new IEC 61010 series;
- replacing the concept of "error" to the concept of "uncertainty";
- adding service environment classification and classification by method of operation, mechanical condition and the degrees of protection;

- adding the requirements for transport and storage of instruments and accessories according to IEC 60359;
- updating the Annexes to provide more information.

The text of this standard is based on the following documents:

FDIS	Report on voting
85/521/FDIS	85/536/RVD

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

This publication 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 publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, standards.iteh.ai)
- amended.

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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 Synchroscopes.
- 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.

Parts 2 to 9 are not complete in themselves and shall be read in conjunction with this Part 1.

All of these parts are arranged in the same format and a standard relationship between subject and clause number is maintained throughout. This re-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 1: Definitions and general requirements common to all parts

1 Scope

This part of IEC 60051 specifies definitions and general requirements for direct acting indicating analogue electrical measuring instruments and their accessories.

This part applies to direct acting indicating analogue electrical measuring instruments, such as:

- ammeters and voltmeters;
- wattmeters and varmeters;
- frequency meters of pointer and vibrating-reed types;
- phasemeters, power-factor meters and synchroscopes;
- ohmmeters(impedance meters) and conductance meters;
- multi-function instruments of the above types D PREVIEW

It also applies to:

(standards.iteh.ai)

- certain accessories used with these instruments, such as:
 - shunts; https://standards.iteh.ai/catalog/standards/sist/ca65420d-7ea1-432e-8a12-
 - series resistors and impedance⁵elements;
- combination of the instruments and the accessories provided that the adjustments have been made for the combination;
- direct acting indicating electrical measuring instrument whose scale marks do not correspond directly to its electrical input quantity, provided that the relationship between them is known;
- instruments and accessories having electronic devices in their measuring and/or auxiliary circuits.

These series standards do not apply to:

- special purpose instruments which are covered by their own IEC standards;
- special purpose devices which are covered by their own IEC standards when they are used as accessories.

This standard does not specify requirements concerning dimensions of instruments or accessories (for the former, see IEC 60473).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60051-1:2016 © IEC 2016

IEC 60051-9, Direct acting indicating analogue electrical measuring instruments and their accessories – Part 9: Recommended Test Methods¹

IEC 60359:2001, *Electrical and electronic measurement equipment – Expression of performance*

IEC 60529:2013, Degrees of protection provided by enclosures (IP Code)

IEC 60721-3-3:1994, Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations IEC 60721-3-3/AMD1:1995 IEC 60721-3-3/AMD2:1996

IEC 60721-3-7:1995, Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 7: Portable and non-stationary use IEC 60721-3-7/AMD1:1996

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

IEC 61010-2-030:2010, 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 60051-1:2016

IEC 61326-2-1:2012 Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-1: Particular requirements Test configurations, operational conditions and performance criteria for sensitive test and measurement equipment for EMC unprotected applications

ISO 780:1997, Packaging – Pictorial marking for handling of goods

3 Terms and definitions

For the purpose of this standard, the terms and definitions given in IEC 60359 as well as the following, apply.

3.1 General terms

3.1.1

electrical measuring instrument

measuring instrument intended to measure an electrical or non-electrical quantity using electrical or electronic means

[SOURCE: IEC 60359:2001, 3.2.4]

3.1.2

analogue display instrument

measuring instrument intended to present or display the output information as a continuous function of the measured quantity

¹ To be published.

Note 1 to entry: An instrument in which a change of the indication occurs by small discrete steps, but which does not have a digital display, is considered to be an analogue display instrument.

- 10 -

3.1.3

indicating instrument

measuring instrument which displays at any time the value of the measured quantity without recording it

Note 1 to entry: The indicated value may be different from the value of the quantity measured by the instrument and may be in units of a different quantity.

3.1.4

direct acting indicating instrument

instrument in which the indicating device is mechanically connected to and actuated by the moving element

3.1.5

multi-function instrument

instrument having a single means of indication intended for the measurement of more than one kind of quantity (e.g. an instrument measuring current, voltage and resistance)

3.1.6

fixed instrument

measuring instrument designed to be permanently mounted and which is intended to be connected by means of permanently installed conductors

ISOURCE: IEC 60050-300:2001, 312-02-17]

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3.1.7

portable instrument

<u>IEC 60051-1:2016</u>

instrument specifically designed to be carried by hand a65420d-7ea1-432e-8a12-

0e2e5e9fb79f/iec-60051-1-2016

Note 1 to entry: The instrument is intended to be connected and disconnected by the user.

3.1.8

hand-held instrument

instrument intended to be held by one hand during normal use

3.1.9

panel mounted instrument

fixed installed instrument intended to be mounted in a cut out of a panel or a chassis

[SOURCE: IEC 62586-1:2013, 3.1.6]

3.1.10

polyphase instrument

instrument for measurement in a polyphase system and arranged for connection to more than one phase of the system

3.1.11

astatic instrument

measuring instrument in which the measuring element is, by design, unaffected by uniform magnetic fields of external origin

[SOURCE: IEC 60050-300:2001, 312-02-05]

IEC 60051-1:2016 © IEC 2016 - 11 -

[SOURCE: IEC 60050-300:2001, 313-01-01]

3.1.13 voltmeter instrument intended to measure the value of a voltage

[SOURCE: IEC 60050-300:2001, 313-01-03]

3.1.14 ohmmeter resistance meter instrument intended to measure electrical resistance

[SOURCE: IEC 60050-300:2001, 313-01-09]

3.1.15

wattmeter instrument intended to measure active power

[SOURCE: IEC 60050-300:2001, 313-01-06]

3.1.16

varmeter instrument intended to measure reactive powerRD PREVIEW

[SOURCE: IEC 60050-300:2001, 313-0107]rds.iteh.ai)

3.1.17

IEC 60051-1:2016

phase meter https://standards.iteh.ai/catalog/standards/sist/ca65420d-7ea1-432e-8a12instrument which indicates the phase angle between two electrical input quantities of the same frequency and of similar waveform

Note 1 to entry: Such an instrument measures:

- the phase angle between a voltage and another voltage or between a current and another current,

or

- the phase angle between a voltage and a current.

3.1.18

power factor meter

instrument intended to measure the ratio of the active to the apparent power in an electrical circuit

[SOURCE: IEC 60050-300:2001, 313-01-14]

3.1.19

synchroscope

instrument intended to indicate that two alternating voltages or polyphase voltage systems have the same frequency and are in phase

[SOURCE: IEC 60050-300:2001, 313-01-22]

3.1.20

accessory

element, group of elements or device associated with the measuring circuit of a measuring instrument in order to confer specified characteristics to the measuring instrument

3.1.21

interchangeable accessory

accessory having its own properties and accuracy, these being independent of those of the instrument with which it may be associated

Note 1 to entry: An accessory is considered to be interchangeable when its rated characteristics are known and marked and are sufficient to enable its errors and variations to be determined without using the associated instrument. A shunt whose adjustment takes into account an instrument current which is not negligible and which is known, is considered to be interchangeable.

3.1.22

accessory of limited interchangeability

accessory having its own properties and accuracy, which can only be associated with measuring instruments for which certain characteristics are within specified limits

3.1.23

non-interchangeable accessory

accessory adjusted to take into account the electrical characteristics of a specific measuring instrument

3.1.24

shunt

resistor connected in parallel with a measuring circuit of a measuring instrument

Note 1 to entry: A shunt is generally intended to provide a voltage proportional to a current to be measured.

3.1.25

series resistor (impedance) (standards.iteh.ai)

resistor (impedance) connected in series with a measuring circuit of a measuring instrument

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Note 1 to entry: A series resistor (impedance) is generally intended to extend the voltage measuring range of an https://standards.iteh.ai/catalog/standards/sist/ca65420d-7ea1-432e-8a12-0e2e5e9fb79f/iec-60051-1-2016

3.1.26

instrument lead

lead comprising one or more conductors, specially designed for interconnecting measuring instruments to external circuits or to accessories

3.1.27

calibrated instrument lead

instrument lead whose resistance has a specified value

Note 1 to entry: A calibrated instrument lead is considered as being an interchangeable accessory of a measuring instrument.

3.1.28

distortion factor (total harmonic distortion factor) (of a quantity)

ratio of the r.m.s. value of the harmonic content to the r.m.s. value of the non-sinusoidal quantity

3.1.29

ripple content of a quantity

ratio of the r.m.s. value of the fluctuating component to the value of the d.c. component

3.1.30

peak factor

ratio of the peak value to the r.m.s. value of a periodic quantity

3.2 Description of instruments according to their method of operation

3.2.1

permanent-magnet moving-coil instrument

instrument which operates by the interaction of the magnetic field due to a current in a movable coil with the field of a fixed permanent magnet

Note 1 to entry: The instrument can have more than one coil, measuring the sum or ratio of the currents in them.

3.2.2

moving-magnet instrument

instrument which operates by the interaction of the field of a movable permanent magnet with the magnetic field due to a current in a fixed coil

Note 1 to entry: The instrument can have more than one coil.

3.2.3

moving-iron instrument

instrument which operates by the attraction between a movable piece of soft magnetic material and the field due to a current in a fixed coil or by the repulsion (and attraction) between one (or more) fixed piece(s) of soft magnetic material and a movable piece of soft magnetic material, both (all) magnetized by a current in a fixed coil

3.2.4

polarized moving-iron instrument

instrument comprising a movable piece of soft magnetic material polarized by a fixed permanent magnet and magnetically excited by a current in a fixed coil (standards.iteh.ai)

3.2.5

electrodynamic instrument

IEC 60051-1:2016 instrument which operates by the interaction of the magnetic field due to a current in a movable coil with the magnetic field due to a current in one or more fixed coils

3.2.6

ferrodynamic instrument (iron-cored electrodynamic instrument)

electrodynamic instrument in which the electrodynamic effect is modified by the presence of soft magnetic material in the magnetic circuit

3.2.7

induction instrument

instrument which operates by the interaction of the magnetic field(s) of (a) fixed a.c. electromagnet(s) with the magnetic field(s) due to currents which they induce in (a) movable conductive element(s)

3.2.8

thermal instrument (electrothermal instrument)

instrument which operates by the heating effect(s) of (a) current(s) on it(s) conductor(s)

3.2.8.1

bimetallic instrument

thermal instrument in which the deformation of a bimetallic element (the materials having different rates of expansion due to a change in temperature), heated directly or indirectly by a current, produces the indication

3.2.8.2

thermocouple instrument

thermal instrument making use of the e.m.f. of one or more thermocouples heated by the current to be measured

Note 1 to entry: The e.m.f. is often measured using a permanent-magnet moving-coil instrument.