

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Live working – Voltage detectors –
Part 1: Capacitive type to be used for voltages exceeding 1 kV AC**

**Travaux sous tension – Détecteurs de tension –
Partie 1: Type capacitif pour usage sur des tensions alternatives de plus de 1 kV**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIVE WORKING – VOLTAGE DETECTORS –

Part 1: Capacitive type to be used for voltages
exceeding 1 kV AC

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61243-1 has been prepared by IEC technical committee 78: Live working.

This third edition cancels and replaces the second edition published in 2003 and Amendment 1:2009. This edition constitutes a technical revision.

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

- a) The scope is more precise, stating that only bare contact to the part to be tested is reliable for these contact *voltage detectors*. The rationale is that tests on painted or coated conductors have led to wrong indications, as this non-conductive paint or coat acts as a capacitor with different capacity according to the thickness. This capacity has an effect on the *threshold voltage*.
- b) A *contact probe* is introduced as a new type of non-conductive *contact electrode*.
- c) A new type "*exclusively outdoor type*" has been defined and implemented into the requirements and test procedure.

- d) A *selector* for voltage and frequency is allowed if foreseeable misuse is excluded.
- e) The marking for *voltage detectors* with low *interference voltage* has been made more precise.
- f) The indication groups have been made more precise and requirements and tests for the "*ready to operate state*" and "*stand-by state*" added.
- g) Requirements and tests for electromagnetic compatibility have been implemented.
- h) An example for good electrical connection for the tests is introduced.
- i) A new test set-up with one bar has been added for *voltage detectors* of category L for overhead line configuration.
- j) A dielectric test for tubes and rods has been implemented for those not covered by IEC 60855-1 or IEC 61235.
- k) Old Annex E (mechanical shock test – pendulum method) has been deleted (see IEC 60068-2-75 pendulum method) and replaced by an information and a guideline on the use of the *limit mark* and the *contact electrode extension*.
- l) Annex E and Annex F have swapped places to make it easier for the reader to combine the classification of defects (Annex D) and the rationale for this classification (new Annex E).
- m) A new informative Annex H has been created to give information for further developments of *voltage detectors* due to field experiences.
- n) Editorial changes have been made to harmonize with other new published standards.

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

CDV	Report on voting
78/1253/CDV	78/1294/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

Terms defined in Clause 3 are given in *italic* print throughout this document.

A list of all parts in the IEC 61243 series, published under the general title *Live working – Voltage detectors*, 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,
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INTRODUCTION

This document has been prepared according to the requirements of IEC 61477, where applicable.

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[IEC 61243-1:2021](https://standards.iteh.ai/catalog/standards/sist/9690b10d-d9a6-4b76-aab1-1ac657b1c439/iec-61243-1-2021)

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LIVE WORKING – VOLTAGE DETECTORS –

Part 1: Capacitive type to be used for voltages exceeding 1 kV AC

1 Scope

This part of IEC 61243 is applicable to portable *voltage detectors*, with or without built-in power sources, to be used on electrical systems for voltages of 1 kV to 800 kV AC, and frequencies of 50 Hz and/or 60 Hz.

This document applies only to *voltage detectors* of capacitive type used in contact with the bare part to be tested, as a complete device including its *insulating element* or as a separate device, adaptable to an *insulating stick* which, as a separate tool, is not covered by this document (see 4.4.2.1 for general design).

Other types of *voltage detectors* are not covered by this document.

NOTE Self ranging *voltage detectors* (formally "multi range *voltage detectors*") are not covered by this document.

Some restrictions or formal interdictions on their use are applicable in case of switchgear of IEC 62271 series design, due to insulation coordination, on overhead line systems of electrified railways (see Annex B) and systems without neutral reference. For systems without neutral reference, the insulating level is adapted to the maximum possible voltage to the earth (ground).

Products designed and manufactured according to this document contribute to the safety of users provided they are used by persons trained for the work, in accordance with the hot stick working method and the instructions for use.

Except where otherwise specified, all the voltages defined in this document refer to values of phase-to-phase voltages of three-phase systems. In other systems, the applicable phase-to-phase or phase-to-earth (ground) voltages are used to determine the *operating voltage*.

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 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60417, *Graphical symbols for use on equipment* (Available from: <http://www.graphical-symbols.info/equipment>)

IEC 60942, *Electroacoustics – Sound calibrators*

IEC 61000-6-2:2016 *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61260 (all parts), *Electroacoustics – Octave-band and fractional-octave-band filters*

IEC 61318, *Live working – Conformity assessment applicable to tools, devices and equipment*

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

IEC 61477, *Live working – Minimum requirements for the utilization of tools, devices and equipment*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 62271 (all parts), *High-voltage switchgear and controlgear*

ISO 286-1, *Geometrical product specifications (GPS) – ISO code system for tolerances on linear sizes – Part 1: Basis of tolerances, deviations and fits*

ISO 286-2, *Geometrical product specifications (GPS) – ISO code system for tolerances on linear sizes – Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

ISO 3744:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering method for an essentially free field over a reflecting plane*

CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CIE 015.2, *Colorimetry*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61318 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

accessory

item used to lengthen the handle or the *contact electrode* or *contact probe*, to improve the efficiency of the *contact electrode* or *contact probe* or to enable the *contact electrode* or *contact probe* to reach the part to be tested

3.2

active signal

audible or visual phenomenon whose presence, absence or variation is considered as representing information on the condition "voltage present" or "voltage not present"

Note 1 to entry: A signal indicating that the *voltage detector* is ready to operate is not considered as an *active signal*.

[SOURCE: IEC 60050-101:1998, 101-12-02, modified – The term "signal" has been replaced by "*active signal*". In the definition, "physical" has been replaced by "audible or visual" and "on the condition "voltage present" or "voltage not present"" has been added.]

3.3

adaptor

part of a *voltage detector* as a separate device which permits attachment of an *insulating stick*

3.4

clear indication

unambiguous detection and indication of the voltage state at the *contact electrode* or *contact probe*

3.5

clear perceptibility

case where the indication is unmistakably discernible by the user under specific environmental conditions when the *voltage detector* is in its operating position

3.6

contact electrode

bare conductive part of the conductive element which establishes the physical electric connection to the component to be tested

Note 1 to entry: The task of the *contact electrode* is to give the user the feedback that he or she is in touch with the part to be tested.

3.7

contact electrode extension

externally insulated conductive element between the *indicator* and the *contact electrode*, intended to achieve the correct position of the *indicator* relative to the installation being tested

3.8

contact probe

part which establishes the physical contact with the bare part to be tested

Note 1 to entry: The contact of the *contact probe* with the part to be tested is conductive, all the other part of the *contact probe* is non-conductive.

Note 2 to entry: The *contact probe* with non-conductive part establishes the mechanical positioning of the detector in order to guarantee the contact between the component to be tested and the *contact electrode*.

3.9

design

different constructions of *voltage detectors*, either as a complete device with or without *contact electrode extension*, or as a separate device intended to be equipped with an *insulating stick*, with or without *contact electrode extension*

3.10

exclusively outdoor type

<*voltage detector*> designed for outdoor use exclusively in wet and dry conditions

Note 1 to entry: It is a special type of *voltage detector* designed for outdoor installations when large *contact electrodes* are required.

3.11

family of voltage detectors

for testing purposes, a group of *voltage detectors*, delimited by a minimum and a maximum *rated voltage*, that are identical in design (including dimensions) and only differ by their *nominal voltages* or *nominal voltage ranges*

3.12

hand guard

distinctive physical guard separating the handle from the *insulating element*

Note 1 to entry: Its purpose is to prevent the hands from slipping and passing into contact with the *insulating element*.

3.13

indicator

part of the *voltage detector* which indicates the presence or absence of the *operating voltage* at the *contact electrode* or *contact probe*

3.14

indoor type

<*voltage detector*> designed for use in dry conditions, normally indoors

3.15

insulating element

part of a *voltage detector* as a complete device that provides adequate safety distance and insulation to the user

3.16

insulating stick

insulating tool essentially made of an insulating tube and/or rod with end fittings

[SOURCE: IEC 60050-651:2014, 651-22-01]

3.17

interference field

superposed electric field which may affect the indication

Note 1 to entry: It may result from the part to be tested or other adjacent parts and may have any phase relationship.

Note 2 to entry: The extreme cases for the tests areas follows.

- An in-phase *interference field* exists when a small change of potential in the direction of the *voltage detector* axis results in an incorrect indication. This occurs as a result of the dimensions and/or configuration of the part of the installation to be tested (or of adjacent parts of the installation having voltages in the same phase).
- An *interference field* in phase opposition exists when a strong change of potential in the direction of the *voltage detector* axis results in an incorrect indication. This occurs as a result of the adjacent parts of the installation having voltages in phase opposition.

3.18

interference voltage

voltage picked up inductively or capacitively by the part to be tested

3.19

limit mark

distinctive location or mark to indicate to the user the physical limit to which the *voltage detector* may be inserted between live parts or may touch them

3.20

maintenance test

test carried out periodically on a *voltage detector* or parts of it to ascertain and ensure that its performance remains within specified limits, after having made certain adjustments, if necessary

[SOURCE: IEC 60050-151:2001, 151-16-25, modified – In the definition, "an item" is replaced by "a *voltage detector* or parts of it", "to verify" is replaced by "to ascertain and ensure".]

3.21

nominal voltage

U_n

suitable approximate value of voltage used to designate or identify a system or device

Note 1 to entry: The *nominal voltage* of the *voltage detector* is the parameter associated with its *clear indication*.

[SOURCE: IEC 60050-601:1985, 601-01-21, modified – "or device" has been added at the end of the definition.]

3.22

operating voltage

<in a system> value of the voltage under normal conditions, at a given instant and a given point of the system

Note 1 to entry: This value is measured (normally), estimated or expected.

[SOURCE: IEC 60050-601:1985, 601-01-22, modified – The domain <in a system> has been added.]

3.23

outdoor type

<*voltage detector*> designed for use in wet conditions, either indoors or outdoors

3.24

protection against bridging

protection against flashover or breakdown, when the insulation between the parts of installation to be tested, at different potentials, is reduced by the presence of the *voltage detector*

3.25

rated voltage

U_r

value of voltage generally agreed upon by manufacturer and customer, to which certain operating specifications are referred

Note 1 to entry: The *rated voltage* of the *voltage detector* is the voltage selected from IEC 60071-1:2019, Tables 2 and 3, column 1, which should either be equal to the *nominal voltage* (or the highest *nominal voltage* of its *nominal voltage range*), or the next higher voltage selected from those tables.

3.26

ready to operate state

state at which the *voltage detector* has been switched on and tested on the live part or external tester, or tested with built-in self-test and gives the ready to operate indication

3.27

response time

time delay between sudden change of the voltage state on the *contact electrode* or *contact probe* and the associated *clear indication*