

Live working — Voltage detectors —

Part 2: Resistive type to be used for voltages of 1 kV to 36 kV a.c.

The European Standard EN 61243-2:1997, with the incorporation of amendments A1:2000 and A2:2002 has the status of a British Standard

ICS 13.260

National foreword

This British Standard is the English language version of EN 61243-2:1997 including amendment A1:2000 and A2:2002. It was derived by CENELEC from IEC 61243-2:1995 including corrigenda June 1996, July 1999, March 2002, amendment 1:1999 and amendment 2:2002.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by tags **C** **C**.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

IEC corrigendum June 1996 was incorporated within BS EN 61243-2 on publication. IEC corrigendum July 1999 replaces the previously used cleaning fluids in **6.6.3** with isopropanol, and added a note about employer responsibility. IEC corrigendum March 2000 replaces reference to IEC 410:1973 in Clause **2** and **C.1** with ISO 2859-1:1999. The reference to IEC 61318:1994 in **C.2** was also added.

The UK participation in its preparation was entrusted to Technical Committee PEL/78, Tools for live working, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

This is one of a family of standards being developed by this technical committee. For the latest information please read the BSI Catalogue at “<http://www.bsi.global.com>”.

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

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 43, and a back cover.

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Amendments issued since publication

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Live working — Voltage detectors — Part 2: Resistive type to be used for voltages of 1 kV to 36 kV a.c

(includes amendments A1:2000 + A2:2002)
(IEC 61243-2:1995 + A1:1999 + A2:2002, modified)

Travaux sous tension
DéTECTEURS de tension —
Partie 2: Type résistif pour usage
sur des tensions alternatives
de 1 kV à 36 kV
(inclut les amendements A1:2000 et A2:2002)
(CEI 61243-2:1995 + A1:1999 + A2:2002,
modifiée)

Arbeiten unter Spannung
Spannungsprüfer —
Teil 2: Resistive (ohmsche)
Ausführungen für Wechselspannungen
von 1 kV bis 36 kV
(enthält Änderungen A1:2000 und A2:2002)
(IEC 61243-2:1995 + A1:1999 + A2:2002,
modifiziert)

This European Standard was approved by CENELEC on 1997-03-11. Amendment A1 was approved by CENELEC on 1999-12-01. Amendment A2 was approved by CENELEC on 2002-07-01. 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 the International Standard IEC 61243-2:1995 and its corrigendum June 1996, prepared by IEC TC 78, Tools for live working, together with the common modifications prepared by the Technical Committee CENELEC TC 78, was submitted to the CENELEC Unique Acceptance Procedure and was approved by CENELEC as EN 61243-2 on 1997-03-11.

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) 1998-03-01
- latest date by which national standards conflicting with the EN have to be withdrawn (dow) 1998-03-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information.

In this standard, Annex A, Annex B, Annex C, Annex D, Annex E and Annex ZA are normative, Annex F and Annex G are informative.

Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of document 72/288/FDIS, future amendment 1 to IEC 61243-2, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61243-2:1997 on 1999-12-01.

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- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-09-01
- latest date by which national standards conflicting with the amendment have to be withdrawn (dow) 2002-12-01

Endorsement notice

The text of amendment 1:1999 to the International Standard IEC 61243-2:1995 was approved by CENELEC as an amendment to the European Standard without any modification.

Foreword to amendment A2

The text of document 78/431/FDIS, future amendment 2 to IEC 61243-2:1995, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 61243-2:1997 on 2002-07-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2003-04-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2005-07-01

Annexes designated “normative” are part of the body of this standard. In this standard Annex ZA is normative. Annex ZA has been added by CENELEC.

Endorsement notice

The text of amendment 2:2002 to the International Standard IEC 61243-2:1995 was approved by CENELEC as an amendment to the European Standard without any modification.

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1 Scope

This part of IEC 61243 is applicable to portable voltage detectors with or without a built-in power source to be used on electrical systems for voltages of 1 kV to 36 kV a.c., and frequencies from 15 Hz to 60 Hz.

This part applies only to resistive voltage detectors used in contact with the part to be tested, as a single unit or as a separate device completed by an adaptable insulating pole covered in IEC 60855 or IEC 61235. Other types of voltage detectors are not covered by this part of standard. Capacitive voltage detectors are covered in IEC 61243-1.

The upper voltage limit is in accordance with the tests described in this part of IEC 61243.

Some restrictions on their use are applicable in the case of factory-assembled switchgear and on overhead systems of electrified railways (see Annex B).

NOTE 1 Except when otherwise specified, all the voltages defined in this standard refer to phase-to-phase voltages of three-phase systems. Resistive detectors may be used in other than three-phase systems, but the applicable phase-to-phase or phase-to-earth (ground) voltage shall be used to determine the operating voltage.

NOTE 2 Although this standard does not cover d.c. voltage detectors, some detectors may respond to d.c. voltage.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61243. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61243 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(151):1978, *International Electrotechnical Vocabulary (IEV) — Chapter 151: Electrical and magnetic devices*.

IEC 60050(601):1985, *International Electrotechnical Vocabulary (IEV) — Chapter 601: Generation, transmission and distribution of electricity — General*.

IEC 60060-1:1989, *High-voltage test techniques — Part 1: General definitions and test requirements*.

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*. Amendment 1 (1992).

IEC 60068-2-6:1982, *Environmental testing — Part 2: Tests — Test Fc and guidance: Vibration (sinusoidal)*.

IEC 60068-2-14:1984, *Environmental testing — Part 2: Tests — Test N: Change of temperature*.

IEC 60068-2-32:1975, *Environmental testing — Part 2: Tests — Test Ed: Free fall*. Amendment 2 (1990).

IEC 60071-1:1993, *Insulation co-ordination — Part 1: Definitions, principles and rules*.

IEC 61318:1994, *Live working — Guidelines for quality assurance plans*.

IEC 60417 (all parts), *Graphical symbols for use on equipment*. ^(A2)

IEC 60651:1979, *Sound level meters* Amendment 1 (1993).

IEC 60855:1985, *Insulating foam-filled tubes and solid rods for live working*.

IEC 61235:1993, *Live working — Insulating hollow tubes for electrical purposes*.

ISO 2859-1:1999, *Sampling procedure for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*.

ISO 3745:1977, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms*.

ISO 8402:1986, *Quality — Vocabulary*.

ISO 9000:1987, *Quality management and quality assurance standards — Guidelines for selection and use*.

ISO 9002:1987, *Quality systems — Model for quality assurance in production and installation*.

ISO 9004:1987, *Quality management and quality system elements — Guidelines*.

ICI 15.2:1986, *Colorimetry*.

3 Definitions

For the purposes of this part of IEC 61243, the following definitions apply.

3.1

adaptor

part allowing the assembly of the detector

3.2

accessories

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

3.3

contact electrode

conductive part which makes the electrical connection to the part to be tested

3.4

contact electrode extension

externally insulated conductive section between the resistive element and the contact electrode, intended to achieve the correct position of the indicator relative to the part to be tested

3.5

voltage detector

a portable device used to detect the presence or the absence of the operating voltage of part to be tested

3.6

capacitive detector

device whose operation is based on the current passing through the stray capacitance to earth (ground)

3.7

resistive detector (detector)

device whose operation is based on the current passing through a resistor located in the resistive element, and a galvanic connection to earth (ground). Resistive detectors are of two types:

- a single unit including or not an insulating element, with or without contact electrode extension; and
- a separate unit completed with an adaptable insulating pole, with or without contact electrode extension.

3.8

insulating element

section of insulating material which provides adequate distance and insulation to the user

3.9

resistive element

element which contains the current-limiting resistor and conductive parts

3.10

testing element

built-in or external device, by means of which the functioning of the detector can be checked by the user



3.11

earth lead

lead that connects the detector to earth (ground). It includes an earth clip or clamp or other devices which connect permanently or not the lead to the detector and to the earth system (other devices equivalent to clip and clamp are permissible)

3.12

indicator

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

3.13

clear indication

unambiguous detection and indication of the voltage state at the contact electrode

3.14**insulating pole**

pole made of insulating material

3.15**interference field**

electric field which may affect the indication. It may result from the part to be tested or other adjacent components and may have any phase relationship

The extreme cases for the tests are:

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

3.16**interference voltage**

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

**3.17****hand guard**

distinctive physical guard separating the handle from the insulating element 

NOTE Its purpose is to prevent the hand from slipping and passing into contact with the resistive or the insulating element.

3.18**limit mark**

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

3.19**clear perceptibility**

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

3.20**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 detector

3.21**stand-by state**

state at which the detector is ready to work at the threshold voltage without manual switching “ON”

3.22**response time**

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

3.23**indoor type**

detector designed for use in dry conditions, normally indoors

3.24**outdoor type**

detector designed for use in wet conditions either indoors or outdoors

3.25

rated voltage (U_r)

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

The rated voltage of the detector is the voltage selected from IEC 60071-1, Table 2, 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

threshold voltage (U_t)

minimum voltage between the live part and earth (ground) required to give a clear indication corresponding to specific conditions as defined in the corresponding test

NOTE Threshold voltage, as defined in this standard is related to specific conditions of test. Users should be aware that their requirements for threshold voltage for field operation need to be related to the test conditions in the standard.

IEV definitions

3.27

nominal voltage (U_n)

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

[IEV 601-01-21, modified]

Nominal voltage of the detector is the parameter associated with its clear indication. A detector may have more than one nominal voltage, or a nominal voltage range. Limit values of the nominal voltage range are named U_n min. and U_n max.

3.28

acceptance test

contractual test to prove to the customer that the device meets certain conditions of its specification

[IEV 151-04-20]

3.29

maintenance test

test carried out periodically on a device or equipment to ascertain and, if necessary, make certain adjustments to ensure that its performance remains within specified limits

[IEV 151-04-22]

3.30

routine test

test to which each individual device is subjected during or after manufacture to ascertain whether it complies with certain criteria

[IEV 151-04-16]

3.31

sampling test

test on a number of devices taken at random from a batch

[IEV 151-04-17]

3.32

type test

test on one or more devices of a certain design to show that the design meets established specification

[IEV 151-04-15]



3.33

active signal

active signal is the combination of visual and audible indication functioning simultaneously

4 Requirements

4.1 General

4.1.1 Safety

The detector shall be designed and manufactured to be safe for the user, provided it is used in accordance with safe working methods and the instructions for use.

4.1.2 Indication

The detector shall give a clear indication of the state “voltage present” and/or “voltage not present”, by means of the change of the status of the signal. The indication shall be visual and/or audible.

4.2 Functional requirements

4.2.1 Clear indication

4.2.1.1 The detector shall clearly indicate the presence or the absence of the system operating voltages as a function of its nominal voltage or nominal range, and its nominal frequency or nominal frequency range.

Manufacturer and customer shall agree on one of the four following classes.

— Class A: Detector with a single nominal voltage or several switchable nominal voltages.

The threshold voltage U_t shall satisfy the following relationship for each nominal voltage:

$$0,15 U_n \leq U_t \leq 0,40 U_n$$

— Class B: Detector with a narrow range of nominal voltage, e.g.:

$$U_n \text{ max.} = 2 U_n \text{ min.}$$

The threshold voltage U_t shall satisfy the relationship:

$$0,15 U_n \text{ max.} \leq U_t \leq 0,40 U_n \text{ min.}$$

— Class C: Detector with a wide range of nominal voltage, e.g.:

$$U_n \text{ max.} = 3 U_n \text{ min.}$$

The threshold voltage U_t shall satisfy the relationship:

$$0,10 U_n \text{ max.} \leq U_t \leq 0,45 U_n \text{ min.}$$

— Class D: If it is not possible to use any of the above-mentioned classes, because of the layout of electrical installations combined with the presence of interference fields, the manufacturer and customer shall reach an agreement to set the appropriate value of U_t .

4.2.1.2 The user shall not have access to the threshold voltage setting.

Ⓒ

4.2.1.3 The detector shall give permanent indication when in direct contact with a live part. Ⓒ

4.2.1.4 The presence of an adjacent live or earthed part shall not affect the indication when used in accordance with the instructions for use.

The detector shall not indicate usual values of interference voltages as “voltage present”. The presence of an interference field shall not affect the indication when used in accordance with instructions for use.

4.2.2 Clear perceptibility

The detector shall give a clear indication under normal light and noise conditions.

The types of indications of detector are divided into four groups:

— group I: Indication with at least two distinct active signals, which give an indication of the condition “voltage present” and “voltage not present”. The “stand-by” state is not necessary;

— group II: Indication with one active signal, which gives an indication of the condition “voltage not present” when activated by manually switching “on” and is suppressed when the contact electrode is put into contact with a live component;

Ⓒ

— group III: Indication with one active signal which gives an indication of the condition voltage present and shall have a stand-by state. Ⓒ

4.2.2.1 Visual indication

The indication shall be clearly visible to the user in the operating position and under normal light conditions.

When two signals are used, the indication shall not rely solely on light of different colours for perceptibility. Additional characteristics, such as physical separation of the light sources, distinctive form of the light signals or flashing light shall be used.

4.2.2.2 Audible indication

The indication shall be clearly audible to the user when in the operating position and under normal noise conditions.

4.2.3 Temperature and humidity dependence of the indication

In this standard, there are three categories of detectors according to climatic conditions of operation: cold (C), normal (N) and warm (W).

The detector shall operate correctly in the temperature range of its climatic category, according to Table 1.

The threshold voltage shall not vary by more than $\pm 10\%$, with respect to the threshold voltage measured at the standard atmospheric conditions.

Table 1 — Climatic categories

Climatic categories	Climatic conditions ranges (operation and storage)	
	Temperature °C	Humidity %
Cold (C)	−40 to +55	20 to 96
Normal (N)	−25 to +55	20 to 96
Warm (W)	−5 to +70	12 to 96

4.2.4 Frequency dependence

The detector shall operate correctly between 97 % of the lower frequency and 103 % of the higher frequency of the frequency range.

A detector with more than one nominal frequency shall operate for each frequency between 97 % and 103 % of the nominal frequency.

4.2.5 Response time

The response time shall be less than 1 s.

4.2.6 Power source dependability

A detector with a built-in power source shall give clear indication until the source is exhausted, unless its usage is limited by an indication of non-readiness or automatic shut-off as mentioned in the instructions for use.

4.2.7 Testing element

The testing element, whether built-in or a separate item, shall be capable of testing all the electrical circuits, including the resistive element, the energy source and the functioning of the indication. When all circuits cannot be tested, any limitation shall be clearly stated in the instructions for use, and these circuits shall be constructed with high reliability. When there is a built-in testing element, the detector shall give an indication of “ready” or “not ready”.

4.2.8 Time rating

The detector shall be able to perform without failure when subjected to the rated voltage for 5 min.

4.3 Electrical requirements

4.3.1 Insulating material

The insulating material shall be adequately rated for the nominal voltage.

4.3.2 Protection against bridging

Protection shall be such that the detector cannot cause flashover or breakdown between live parts of an installation or between a live part of an installation and earth.

4.3.3 Resistance against sparking

The detector shall be constructed so that the indicator cannot be damaged or shut off as a result of spark discharge.

4.3.4 Resistive element

The resistive element of the detector shall be adequately rated with respect to voltage and power.

4.3.5 Leakage current

The detector shall be so rated that the leakage current shall not exceed 0,5 mA.

4.3.6 Circuit current

The maximum circuit current through the detector when the rated voltage is applied to the contact electrode shall be as low as possible and never exceed 3,5 mA.

4.3.7 Indicator casing

If an indicator casing is subject to dielectric stress, it shall maintain its dielectric strength for which it is designed either in dry or wet conditions.

4.4 Mechanical requirements

4.4.1 Design

[C]

The user shall be provided with adequate distance by combination of a resistive element and an insulating element. The resistive element provides the distance and the insulating element provides the insulation. [C]

4.4.1.1 Detector as a complete unit

[C]

- a) The detector as a single unit shall include at least the following elements: earth lead, handle, hand guard, resistive element, insulating element, indicator, contact electrode and limit mark (see Figure 1b). [C]
- b) The detector as a separate unit shall include at least: earth lead, resistive element, indicator, contact electrode, limit mark, adaptor and insulating pole (see Figure 1c).

4.4.2 Dimensions, construction

[C]

The minimum length of insulation between the hand guard and the limit mark shall be 525 mm and be achieved by the provision of a resistive element with an insulating element. [C]

The limit mark shall be about 20 mm wide, permanent and clearly recognizable by the user.

When provided, the handle shall be at least 115 mm in length.

When provided, the hand guard shall be permanently fixed and have a minimum height h_{HG} of 20 mm.

In order to adapt the detector to different uses, the contact electrode may readily be interchangeable with other types of contact electrodes depending on the type of installation and instructions for use.

The maximum length of the bare portion of contact electrode is given in Table 2.

Table 2 — Maximum length of bare portion of contact electrode

U_n or U_n min (range) kV	Maximum length mm
$1 < U_n \leq 3,6$	25
$3,6 < U_n \leq 12$	40
$12 < U_n \leq 24$	60
$24 < U_n \leq 36$	80

NOTE For certain applications, other values may be agreed between manufacturer and customer.

The earth lead shall be made of high-voltage flexible, multistrand cable. The insulation of the lead and the connection of the earth lead to the indicator shall withstand a voltage of $1,2 U_r$.

The earth lead shall be so constructed so as not to disconnect inadvertently. The earth lead shall be provided with a securing device when attached to an earth point.

The earth lead shall resist to a pull force of 200 N.



The resistance against buckling and ageing for the earth lead shall be proved.

4.4.3 Grip force and deflection

The detector shall be designed to facilitate reliable operation with reasonable physical effort by the user.

The grip force shall not exceed 200 N.

The detector shall be designed to allow a safe approach towards the installation to be tested. The deflection under its own weight shall be as low as possible, and shall not exceed 10 % for the total length of the complete unit, measured in horizontal position.

The weight of the indicator shall be minimal and compatible with the performance requirements.

4.4.4 Vibration resistance

The indicator, the resistive element and the contact electrode extension shall be vibration resistant.

4.4.5 Drop resistance

The detectors shall be drop resistant.

4.4.6 Shock resistance

The indicator, the resistive element and the contact electrode extension shall withstand mechanical shocks according to Annex D.

4.5 Markings

4.5.1 Markings on the detector

Each detector shall have at least the following markings:

- nominal voltage and/or range of nominal voltages;
- indication group;
- nominal frequency and/or range of nominal frequencies;
- name or trademark of the manufacturer;
- model reference, serial number;
- indication of type “indoor” or “outdoor”;
- climatic category (C, N or W);
- year of production;
- symbol IEC 60417-5216 — Suitable for live working; double triangle;
- number of the relevant IEC standard immediately adjacent to the symbol;
- date of verification of operation and dielectric properties (in-service care);
- warning notice “earth lead must be connected to earth before use”;
- response to d.c. voltage.