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INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Live working – Voltage detectors – Part 1: Capacitive type to be used for voltages exceeding 1 kV a.c.

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

IEC 61243-1:2003/A1:2009

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FOREWORD

This amendment has been prepared by IEC technical committee 78: Live working.

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

CDV	Report on voting
78/751/CDV	78/794/RVC

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

2 Normative references

Replace the existing reference to IEC 60071-1:1993 by the following:

IEC 60071-1:2006, *Insulation co-ordination – Part 1: Definitions, principles and rules*

Replace the existing reference to IEC 61318:2003 by the following:

IEC 61318:2007, *Live working – Conformity assessment applicable to tools, devices and equipment*

3 Terms and definitions

Replace the first sentence by the following:

For the purposes of this document, the terms and definitions given in IEC 61318:2007 and the following apply.

3.1
voltage detector

Replace the existing definition and note by the following:

device used to provide clear evidence of the presence or the absence of the operating voltage

NOTE For example, voltage detectors can be described as capacitive type or resistive type.

[Definition 11.2.5 of IEC 60743, modified, and IEV 651-10-04, modified]

3.4
family of voltage detectors

Replace the existing definition by the following:

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

3.10
insulating stick

Replace the existing definition by the following:

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

[Definition 2.5.1 of IEC 60743 and IEV 651-02-01]

NOTE For voltage detection, an insulating stick is intended to be attached to a voltage detector as a separate device in order to provide the length to reach the installation to be tested and adequate safety distance and insulation to the user.

3.29
type test

Delete the definition.

3.30
routine test

Delete the definition.

3.31
sampling test

Delete the definition.

3.32
acceptance test

Delete the definition.

4.2 Functional requirements

4.2.1 Clear indication

Replace the existing text by the following:

The voltage detector shall give an unambiguous indication of the presence and/or the absence of the system operating voltage as a function of the nominal voltage or nominal voltage range of the voltage detector, and its nominal frequency or nominal frequencies.

Indication may not be reliable in the vicinity of large conductive parts that create equipotential zones.

When the voltage detector is used in accordance with instructions for use, the presence of an adjacent live or earthed part shall not affect its indication.

When used in accordance with instructions for use, the voltage detector shall not indicate "voltage present" for usual values of interference voltages.

4.2.1.1 Continuous indication

The voltage detector shall give continuous indication when in direct contact with a live part.

4.2.1.2 Threshold voltage

4.2.1.2.1 General

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

The indication “voltage present” shall appear if the voltage to earth on the part to be tested is greater than 45 % of the nominal voltage.

NOTE 1 45 % of the nominal voltage corresponds to $0{,}78\,U_n/\sqrt{3}$.

The indication "voltage present" shall not appear if the voltage to earth on the part to be tested is equal to or less than 10 % of the nominal voltage.

NOTE 2 10 % of the nominal voltage corresponds to $0{,}17\,U_n/\sqrt{3}$ and is the maximum phase to earth induced voltage normally encountered in the field.

To fulfil the above requirements, the threshold voltage U_t shall satisfy the following relationship:

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

For voltage detectors with only one nominal voltage, U_n max. equals U_n min.

NOTE 3 There is a theoretical limit of 4,5 to the ratio between U_n max. and U_n min. to achieve clear indication of the voltage detector. This value corresponds to the division of 0,45 by 0,1.

NOTE 4 It may happen that the induced voltage level on a specific network is higher than 10 % of the nominal voltage or of the maximum nominal voltage of the range.

It may also happen that the variations of the nominal voltage network are such that the 0,45 U_n or 0,45 U_n max. is not the lowest possible value.

Moreover, when is it expected that the voltage detector will be used in the vicinity of large conductive parts that create equipotential zones (see 4.2.1), the customer may specify a low value of the threshold voltage.

In all these cases, manufacturer and customer should reach an agreement to set the appropriate value for the threshold voltage, while keeping it within the range specified above. The setting of the threshold voltage is further limited by the requirements for clear indication which shorten the range of possible values, and the relevant tests (clear indication) have to be passed.

4.2.1.2.2 Particular case of voltage detectors to be used on networks with low values of interference voltage

In some cases, the customer may wish to take advantage of a network with low values of interference voltage by reducing the lower limit of the threshold voltage below 0,10 U_n max.

NOTE 1 This particular case could help to deal with the use of the voltage detector in the vicinity of large conductive parts. In spite of this change of the threshold voltage for a lower value, the theoretical limit of 4,5 for the ratio between U_n max. and U_n min. still remains valid, and the relevant tests (clear indication) have to be passed.

In such case, the voltage detector shall have a special marking and a warning shall be included in the instructions for use to inform the users of the modification brought to the threshold voltage.

NOTE 2 The special marking should be the result of an agreement between the manufacturer and the client.

4.2.3 Temperature and humidity dependence of the indication

Replace the existing fourth paragraph by the following:

In these cases, the threshold voltage shall satisfy 4.2.1.2.

4.4.2 Dimensions, construction

Replace the existing Table 2 and the notes by the following:

Table 2 – Minimum length of the insulating element (L_i) of a voltage detector as a complete device

U_r kV	L_i mm
$1 < U_r \leq 7{,}2$	320
$7{,}2 < U_r \leq 12$	360
$12 < U_r \leq 17{,}5$	370
$17{,}5 < U_r \leq 24$	470
$24 < U_r \leq 36$	520
$36 < U_r \leq 72{,}5$	830
$72{,}5 < U_r \leq 123$	1 300
$123 < U_r \leq 170$	1 700
$170 < U_r \leq 245$	2 300
$245 < U_r \leq 420$	3 600
$420 < U_r \leq 525$	4 300
$525 < U_r \leq 765$	6 600

NOTE 1 The nominal voltage U_n is used when the parameters to be specified are related to the installation dimensioning or to the functional performance of the voltage detector, while the rated voltage U_r is used when insulation performance of the voltage detector is concerned.

NOTE 2 The L_i values of Table 2 correspond to the minimum distance in air (obtained from Tables 1 and 2 of IEC 61936-1) plus an additional safety distance.

NOTE 3 The L_i values of Table 2 can be used as a guidance to determine the length of the insulating stick used with a voltage detector as a separate device. However, the length of the insulating stick for live working can be shortened for voltage detectors as a separate device taking into account the minimum approach distances or in accordance with national or regional regulations.

Replace the second paragraph by the following:

For L_i equal to or greater than 520 mm, conductive parts not exceeding 200 mm (in total), measured from the limit mark towards the handle, are allowed within the minimum length of the insulating element if they are completely externally insulated.

4.5 Markings

In the list of items of marking, add the following item after the second existing item:

– special marking for low interference voltage, when relevant;

Replace the last item of the existing list of markings by the following:

– number of the relevant IEC standard immediately adjacent to the symbol, (IEC 61243-1).

Add the following new paragraphs at the end of the existing subclause:

To be marked with the number of this IEC standard, the product shall satisfy all the requirements specified herein.

With every voltage detector or with every batch of voltage detectors to be delivered, the manufacturer shall provide information related to the number of the IEC standard with the year of publication.

6.1 General

Add the following new paragraph at the beginning of the existing subclause:

This standard provides testing provisions to demonstrate compliance of the product to the requirements of Clauses 4 and 5. These testing provisions are primarily intended to be used as type tests for validation of the design input. Where relevant, alternative means (calculation, examination, tests, etc.) are specified within the test subclauses for the purpose of voltage detectors having completed the production phase.

6.1.2 Type test

Replace the first item of the existing list by the following:

– The type tests shall be performed at the lowest and at the highest nominal voltages delimiting the family of voltage detectors. Within the limits of the family, bridging tests (6.3.1 and 6.3.2) shall be performed for each distance d_1 of Table 8 under the highest voltage of each voltage range. Mechanical tests shall be done only once covering the worst conditions.

6.1.3 Routine test

Delete the subclause.

6.1.4 Sampling test

Delete the subclause.

6.1.5 Test methods

Renumber this subclause as 6.1.3.

6.2.1.2 Measurement of threshold voltage

Replace the existing text of the subclause by the following:

6.2.1.2.1 Type test

The test set-up used for the measurement of the threshold voltage is of the ball and ring type, as shown in Figure 2.

The electrode arrangement is selected according to the category of the voltage detectors. Figure 2a gives the arrangement for voltage detectors of category S and Figure 2b for voltage detectors of category L.

For voltage detectors with a nominal voltage range, the test set-up shall be selected according to the highest nominal voltage.

The ball and ring electrodes shall be connected as shown in Figure 4a.

The voltage detector shall be installed in such a manner that its contact electrode touches the ball electrode and the indicator is approximately concentrically located in relation to the ring electrode (in the horizontal axis).

The threshold voltage shall be measured by increasing the test voltage until the status of the signal changes according to its type of indication.

The test shall be considered as passed if the measured threshold voltage is within the limits specified in 4.2.1.2.

6.2.1.2.2 Alternative test for voltage detectors having completed the production phase

The alternative test consists of checking that the threshold voltage of a manufactured voltage detector is within ± 5 % of the threshold voltage of a voltage detector that has successfully passed the type tests according to 6.2.1.2.1. This test can be performed by means of an alternative high voltage test set up.

6.2.1.3 Influence of in-phase interference field

Replace the second sentence of the penultimate paragraph by the following:

For voltage detectors with a nominal voltage range, the tests shall be performed for the lower nominal voltage.

6.2.1.5 Influence of interference voltage

Add the following new sentence at the end of the penultimate existing paragraph:

For low interference voltage detectors the test voltage shall be 95 % of the threshold voltage specified in the agreement between the manufacturer and the customer.

6.2.2 Clear perceptibility of visual indication

Replace the existing text of the subclause by the following:

6.2.2.1 Type test

The test set-up is given in Figure 5.

The intensity of the light striking an unpolished grey screen with a reflectivity index of 18 % and the signal source of the indicator shall be:

– 50 000 lux ± 10 % for outdoor type voltage detector with standard light D_{55} according to CIE 15.2 corresponding to colour temperature of 5 500°K ± 10 %;
– 1 000 lux ± 10 % for indoor type voltage detector with standard light A according to CIE 15.2 corresponding to colour temperature of 3 200°K ± 10 %.

The voltage detector is positioned in the direction of axis A – B, and its signal source part is centered on the axis A – B in normal use, according to Figure 5a.

The visual perceptibility test shall be performed by energizing the voltage detector by any relevant means corresponding to the application of the threshold voltage plus 10 %.

By switching the voltage "on" and "off", the voltage detector is set to respond in such a manner that the indications "voltage present" and "voltage not present" alternate several times in conditions unknown to the observer.

Three observers with average sight look towards the voltage detector, through the 5 mm holes in the front plate (see Figure 5b).

The test shall be considered as passed if the indication is seen by the three observers through each hole.

6.2.2.2 Alternative test for voltage detectors having completed the production phase

The alternative test consists in comparing the perceptibility of the visual indication of a manufactured voltage detector to the one of a voltage detector which has passed successfully the type test according to 6.2.2.1 (reference voltage detector). The test shall be considered as passed if both perceptibilities are almost identical.

6.2.3 Clear perceptibility of audible indication

Replace the existing text of the subclause by the following:

6.2.3.1 Type test

The test shall be carried out in free-field over reflecting plane conditions, in an environment following the requirements of Annex A of ISO 3744:1994.

NOTE 1 Such test conditions can be encountered in semi-anechoic rooms.

Averaged over the microphone positions, the level of the background noise shall be at least 6 dB(A) but preferably more than 15 dB(A) below the sound pressure level to be measured. If the difference between the sound pressure levels of the background noise and the source noise is between 6 dB(A) and 15 dB(A), a correction shall be applied as described in 8.3 of ISO 3744:1994.

The instrumentation system, including the microphone and cable, shall meet the requirements for a class 1 instrument specified in IEC 61672-1. The filters used shall meet the requirements for a class 1 instrument specified in IEC 61260.

During each series of measurements, a sound calibrator with an accuracy of class 1 specified in IEC 60942 shall be applied to the microphone to verify the calibration of the entire instrument system.

The audible perceptibility test shall be performed by energizing the voltage detector by any relevant means corresponding to the application of the threshold voltage plus 10 %.

The voltage detector shall be arranged as shown in Figure 6a, in such a manner that the sound axis of the voltage detector is parallel to the ground and at least 1,5 m away from any sound-reflecting surfaces.

A measuring plane shall be established, perpendicular to the sound axis according to Figure 6a. The distance of 400 mm can be increased by 200 mm if this will enable higher sound intensities to be measured.

The measurements shall be carried out for the indications "voltage present" and "voltage not present", at each of the twelve microphone positions of Figure 6b. The sound pressure level shall be measured in each octave band of the frequency range 1 000 Hz to 4 000 Hz, with the A-weighting network.

The period of observation shall be at least 10 s for a continuous signal. For an intermittent signal, the integration time for the measurement shall be shorter than the signal duration.

The test shall be considered as passed, if for each microphone position, the sound pressure level, within at least one octave band of the frequency range of interest, is greater than

– 80 dB(A), (ref.: 20 µPa) for a voltage detector with continuous sound signal;
– 77 dB(A), (ref.: 20 µPa) for a voltage detector with intermittent sound signal.

When there is an additional visual indication these values may be reduced by 10 dB(A).

NOTE 2 Other higher values may be agreed between manufacturer and customer for specific usage in very noisy areas.

6.2.3.2 Alternative test for voltage detectors having completed the production phase

The alternative test consists in comparing the perceptibility of the audible indication of a manufactured voltage detector to the one of a voltage detector which has passed successfully the type test according to 6.2.3.1 (reference voltage detector). The test shall be considered as passed if both perceptibilities are almost identical.

6.2.4 Frequency dependence

Replace the existing text of the subclause by the following:

6.2.4.1 Type test

The test shall be carried out using the test set-up and the test procedure of 6.2.1.2.1

For a voltage detector with one nominal frequency, the test shall be performed at 97 % and 103 % of the nominal frequency.

For a voltage detector with more than one nominal frequency, the test shall be performed at 97 % and 103 % of each nominal frequency.

The test shall be considered as passed if the threshold voltage is within the limits specified in 4.2.1.2.

6.2.4.2 Alternative means for voltage detectors having completed the production phase

The manufacturer shall prove that he has followed the same documented assembly procedure as per the type tested device. The manufacturer shall document components that affect the frequency performance.

6.2.5 Response time

Replace the existing text of the subclause by the following:

6.2.5.1 Type test

The test voltage applied shall be the threshold voltage plus 10 %.

NOTE For practical reasons, other equivalent means for energizing the voltage detector are allowed.

The test voltage shall be applied ON, then OFF and ON twenty times. The duration of the ON and OFF periods shall be adjusted to 1 s long.

The test shall be considered as passed if each visual or audible signal is seen or heard as a rhythmical indication having a minimum frequency of 0,5 Hz. The first signal(s) shall appear during the first cycle.

6.2.5.2 Alternative means for voltage detectors having completed the production phase

The manufacturer shall prove that he has followed the same documented assembly procedure as per the type tested device. The manufacturer shall document components that affect the response time.

6.2.8 Non-response to d.c. voltage

Replace the existing text of the subclause by the following:

6.2.8.1 Type test

For a voltage detector with a nominal voltage range, the test voltage shall be selected according to the higher nominal voltage. The test voltage shall be $U_n\sqrt{2}/\sqrt{3}$.

The voltage detector shall be placed with the contact electrode on a d.c. voltage source, in accordance with IEC 60060-1. The test shall be repeated with the polarity reversed.

The test shall be considered as passed if there is no continuous signal longer than 1 s.

NOTE For practical reasons, other equivalent means for energizing the voltage detector are allowed.

6.2.8.2 Alternative means for voltage detectors having completed the production phase

The manufacturer shall prove that he has followed the same documented assembly procedure as per the type tested device. The manufacturer shall document components that affect the non-response to d.c. voltage.

6.2.9 Time rating

Replace the existing text of the subclause by the following:

6.2.9.1 Type test

The voltage detector shall be placed with the contact electrode on an a.c. voltage source, and the test voltage applied for 5 min.

The test voltage shall be 1,2 U_n for a voltage detector having a nominal voltage lower than or equal to 123 kV.

The test voltage shall be $1{,}2\,U_n/\sqrt{3}$ but shall be greater than 148 kV (≈1,2 times 123 kV) for a voltage detector having a nominal voltage higher than 123 kV.

The test shall be considered as passed if the status of the signal corresponding to "voltage present" is uninterrupted for all the test period.