



BSI Standards Publication

Live working - Voltage detectors

Part 6: Guidelines on non-contact voltage detectors (NCVD)
for use at nominal voltages above 1 kV AC

National foreword

This Published Document is the UK implementation of IEC TR 61243-6:2017.

The UK participation in its preparation was entrusted to Technical Committee PEL/78, Tools for live working.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2017
Published by BSI Standards Limited 2017

ISBN 978 0 580 89676 7

ICS 13.260; 29.260.99; 29.240.20; 29.240.99

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 October 2017.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------



IEC TR 61243-6

Edition 1.0 2017-03

TECHNICAL REPORT



**Live working – Voltage detectors –
Part 6: Guidelines on non-contact voltage detectors (NCVD) for use at nominal
voltages above 1 kV AC**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 13.260; 29.240.20; 29.260.99

ISBN 978-2-8322-3903-2

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 The principles of an NCVD	11
4.1 NCVD designed to work at a distance without any contact	11
4.2 NCVD designed to work with reference points.....	13
4.2.1 General	13
4.2.2 NCVD designed to work with one reference point	14
4.2.3 NCVD designed to work with two reference points	15
5 Different designs of non-contact voltage detectors.....	17
6 Limitations and recommendations of use for each type of NCVD	19
6.1 Principal limitations.....	19
6.2 Recommendations for the selection, calibration and use of NCVD	19
6.2.1 Selection of the appropriate type of NCVD.....	19
6.2.2 Calibration of the selected device	20
6.2.3 Use of the selected device.....	20
7 Recommended requirements	21
7.1 General.....	21
7.2 Recommended general requirements	21
7.2.1 Safety.....	21
7.2.2 Indication.....	21
7.2.3 Electromagnetic compatibility (EMC)	21
7.3 Recommended functional requirements	22
7.3.1 Clear indication.....	22
7.3.2 Clear perceptibility.....	25
7.3.3 Temperature and humidity dependence of the indication.....	26
7.3.4 Frequency dependence	26
7.3.5 Response time.....	26
7.3.6 Power source dependability	26
7.3.7 Testing element.....	26
7.3.8 Non response to DC voltage (static electric field).....	27
7.3.9 Immunity to electrostatic discharges	27
7.3.10 Time rating	27
7.4 Electrical requirements	27
7.4.1 Insulating material	27
7.4.2 Protection against bridging for Type 3 only	27
7.4.3 Resistance against sparking	28
7.4.4 Resistive (impedance) element of Type 5 only	28
7.5 Recommendations for mechanical performance	28
7.5.1 General	28
7.5.2 Design	28
7.5.3 Dimensions and construction	28

7.5.4	Degree of protection provided by enclosure	30
7.5.5	Grip force and deflection.....	30
7.5.6	Vibration drop and shock resistance	31
7.6	Markings	31
7.7	Instructions for use	31
Annex A (informative)	General considerations about voltage detection	32
A.1	General.....	32
A.2	Principles of functioning of voltage detectors	32
A.2.1	Basic analysis.....	32
A.2.2	Voltage detection with two contact electrodes (bi-polar detectors)	32
A.2.3	Voltage detection with one contact electrode	33
A.2.4	Voltage detection without contact electrode	34
Annex B (informative)	Instructions for use.....	36
Annex C (informative)	In-service care	37
C.1	General.....	37
C.2	Maintenance	37
Annex D (informative)	Suitable for live working; double triangle	38
Bibliography.....		39
Figure 1	– NCVD working at a distance without any contact	12
Figure 2	– Effect of the relative position of the non-contact voltage detector	13
Figure 3	– NCVD working at a distance with one reference point	14
Figure 4	– Non-contact voltage detector with a reference point making contact with the cable insulation covering an insulated conductor	15
Figure 5	– Non-contact voltage detector working with two reference points making contact with the cap and pin of an insulator	16
Figure 6	– Non-contact voltage detector working with two reference points on an underground cable	16
Figure 7	– Directional properties of NCVD working at distance.....	25
Figure 8	– Examples of designs of NCVDs	29
Figure A.1	– Bi-polar voltage detection principle	33
Figure A.2	– Capacitive multipolar voltage detection principle.....	34
Table 1	– Types of non-contact voltage detector	18
Table 2	– Limitations for use	19
Table 3	– Specific recommendations for use	20
Table 4	– Examples of values of the radius of the cone of detection as a function of the directional properties angle	24
Table 5	– Climatic categories	26
Table 6	– Minimum length of the insulating element or of the insulating stick (L_i)	30
Table C.1	– Recommended checking points for in-service care	37

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LIVE WORKING – VOLTAGE DETECTORS –**Part 6: Guidelines on non-contact voltage detectors (NCVD)
for use at nominal voltages above 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, accept IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 61243-6, which is a Technical Report, has been prepared by IEC technical committee 78: Live working.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
78/1143/DTR	78/1162A/RVDTR

Full information on the voting for the approval of this Technical Report 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 standard.

A list of all parts of 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,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

With the aim of ensuring the safety of the users the purpose of a *voltage detector* is to give a *clear indication* of the presence or absence of the operating voltage, without any need for interpretation or analytical evaluation by the user.

IEC 61243-1, IEC 61243-2 and IEC 61243-3 apply to portable voltage detectors designed to work correctly when they are in direct contact with the bare part of the installation to be tested.

At HV and UHV, large distances between the user and the bare parts to be tested make the handling of a very long *insulating element* or *insulating stick* an ergonomic and safety concern. In such situations, it may become convenient to avoid any contact with the bare part to be tested and to perform voltage detection at a distance.

This document provides considerations and performance guidelines for portable “non-contact” *voltage detectors* and it can be used as a reference for the development of national, industry or manufacturer's standard(s) or for the selection of a product by users.

This document has been prepared taking into consideration the provisions given in IEC 61477.

LIVE WORKING – VOLTAGE DETECTORS –

Part 6: Guidelines on non-contact voltage detectors (NCVD) for use at nominal voltages above 1 kV AC

1 Scope

This part of IEC 61243, which is a Technical Report, is applicable to portable *non-contact voltage detectors* (NCVD) with built-in power source, to be used to indicate the presence or the absence of the *operating voltage* on electrical systems for *nominal voltages* above 1 kV AC and frequencies of 16 2/3 Hz, 50 Hz and/or 60 Hz.

NOTE 16,7 Hz is often referenced.

This document applies only to devices that are not designed to be used in contact with the bare part of the installation on which the presence or the absence of the *operating voltage* has to be tested.

This document describes only devices, and their behaviour, using electric field and voltage gradient detection principles even if other principles could be used. It provides performance guidelines, recommendations for use and recommended minimum criteria for selection.

Devices like personal safety distance *voltage detectors*, distance *voltage detectors* for emergency responders or machine operators are not covered by this document.

Except when otherwise specified, all the voltages defined in this document refer to 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 61318, *Live working – Conformity assessment applicable to tools, devices and equipment*

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:

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

3.1 adaptor

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