

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Low-voltage switchgear and controlgear –  
Part 5-2: Control circuit devices and switching elements – Proximity switches**

**Appareillage à basse tension –  
Partie 5-2: Appareils et éléments de commutation pour circuits de commande –  
DéTECTEURS DE PROXIMITÉ**

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**Appareillage à basse tension –  
Partie 5-2: Appareils et éléments de commutation pour circuits de commande –  
DéTECTEURS de proximité**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 29.120.40; 29.130.20

ISBN 978-2-8322-0408-5

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## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 5-2: Control circuit devices and switching elements –  
Proximity switches**

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**This consolidated version of IEC 60947-5-2 consists of the third edition (2007) [documents 17B/1570/FDIS and 17B/1576/RVD] and its amendment 1 (2012) [documents 17B/1733/CDV and 17B/1774/RVC]. It bears the edition number 3.1.**

**The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience. A vertical line in the margin shows where the base publication has been modified by amendment 1. Additions and deletions are displayed in red, with deletions being struck through.**



International Standard IEC 60947-5-2 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

The document 17B/1570/FDIS, circulated to the National Committees as Amendment 3, led to the publication of the new edition.

The main changes with respect to the previous edition are as follows:

- modification of Table 3;
- modifications of voltage dips and voltage interruptions immunity tests, in Table 8;
- modification of status of Annex A, now informative.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 60947 series, under the general title *Low-voltage switchgear and controlgear*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability 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

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## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 5-2: Control circuit devices and switching elements – Proximity switches

#### 1 General

The provisions of the general rules in IEC 60947-1 are applicable to this standard, where specifically called for. General rules clauses and subclauses thus applicable, as well as tables, figures and annexes, are identified by references to IEC 60947-1, e.g. subclause 7.1.9.3 of IEC 60947-1 or Annex C of IEC 60947-1.

Clauses 1 to 8 contain the general requirements. Specific requirements for the various types of proximity switches are given in Annex A.

#### 1.1 Scope and object

This part of IEC 60947 applies to inductive and capacitive proximity switches that sense the presence of metallic and/or non-metallic objects, ultrasonic proximity switches that sense the presence of sound reflecting objects, photoelectric proximity switches that sense the presence of objects and non-mechanical magnetic proximity switches that sense the presence of objects with a magnetic field.

These proximity switches are self-contained, have semiconductor switching element(s) and are intended to be connected to circuits, the rated voltage of which does not exceed 250 V 50 Hz/60 Hz a.c. or 300 V d.c. This Standard is not intended to cover proximity switches with analogue outputs.

The object of this standard is to state for proximity switches:

- definitions;
- classification;
- characteristics;
- product information;
- normal service, mounting and transport conditions;
- constructional and performance requirements;
- tests to verify rated characteristics.

#### 1.2 Normative references

The following referenced documents are indispensable for the application 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 60050(441):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear and fuses*  
Amendment 1 (2000)

IEC 60068-2-6:1995 2007, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14:1984 2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*  
Amendment 1 (1986)

IEC 60068-2-27:~~1987~~ 2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60445:2010, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors*

~~IEC 60446:2007, Basic and safety principles for man-machine interface, marking and identification – Identification of conductors by colours or numerals~~

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*  
Amendment 1:2010

IEC 61000-3-2:2005, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)*  
Amendment 1:2008  
Amendment 2:2009

~~IEC 61000-3-3:1994, Electromagnetic compatibility (EMC) – Part 3-3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current  $\leq 16$  A~~  
~~Amendment 1 (2001)~~  
~~Amendment 2 (2005)~~

IEC 61000-3-3:2008, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations (and flicker in public low-voltage supply systems, for equipment with rated current  $\leq 16$  A per phase and not subject to conditional connection*

IEC 61000-4-2:~~1995~~ 2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*  
Amendment 1 (1998)  
Amendment 2 (2000)

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*  
Amendment 1:2007  
Amendment 2:2010

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-6:~~2003~~ 2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*  
Amendment 1 (2004)  
Amendment 2 (2006)

IEC 61000-4-8:~~1993~~ 2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*  
Amendment 1 (2000)

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-13:2002, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low-frequency immunity tests*  
Amendment 1:2009

IEC 61076-2 (all parts), *Connectors for electronic equipment – Product requirements – Part 2: Circular connectors*

IEC 61140:2001, *Protection against electric shock – Common aspects for installation and equipment*  
Amendment 1 (2004)

CISPR 11:~~2003~~ 2009, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic Radio-frequency disturbance characteristics – Limits and methods of measurement*

~~Amendment 1 (2004)~~

~~Amendment 2 (2006)~~

Amendment 1:2010

~~ISO 630:1995, Structural steels – Plates, wide flats, bars, sections and profiles~~

~~Amendment 1 (2003)~~

ISO 630 (all parts), *Structural steels*

## 2 Definitions

Clause 2 of IEC 60947-1 applies with the following additions:

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## 2.1 Basic definitions

### 2.1.1

#### **proximity switch**

a position switch which is operated without mechanical contact with the moving part

[IEV 441-14-51] <sup>1</sup>

#### 2.1.1.1

##### **inductive proximity switch**

a proximity switch producing an electromagnetic field within a sensing zone and having a semiconductor switching element

#### 2.1.1.2

##### **capacitive proximity switch**

a proximity switch producing an electric field within a sensing zone and having a semiconductor switching element

#### 2.1.1.3

##### **ultrasonic proximity switch** (see Figure 2)

a proximity switch transmitting and receiving ultrasound waves within a sensing zone and having a semiconductor switching element

#### 2.1.1.4

##### **photoelectric proximity switch** (see Figure 1)

a proximity switch which senses objects that either reflect or interrupt visible or invisible light and having a semiconductor switching element

##### 2.1.1.4.1

###### **type D**

diffuse reflective photoelectric proximity switch which is directly operated through lateral or axial approach to its reference axis by a defined object

##### 2.1.1.4.2

###### **type R**

retroreflective photoelectric proximity switch which is indirectly operated through lateral approach to its reference axis between emitter-receiver and reflector by a defined object

##### 2.1.1.4.3

###### **type T**

through beam photoelectric proximity switch which is indirectly operated through lateral approach of its reference axis between emitter and receiver by a defined object

#### 2.1.1.5

##### **non-mechanical magnetic proximity switch**

proximity switch which senses the presence of a magnetic field and has a semiconductor switching element and no moving parts in the sensing element

#### 2.1.1.6

##### **direct operated proximity switch**

proximity switch which detects its target without the use of an external means, e.g. a reflector

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<sup>1</sup> See IEC 60050(441).