

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Low-voltage switchgear and controlgear –  
Part 4-1: Contactors and motor-starters – Electromechanical contactors and  
motor-starters**

**Appareillage à basse tension –  
Partie 4-1: Contacteurs et démarreurs de moteurs – Contacteurs et démarreurs  
électromécaniques**



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Electromechanical contactors and motor-starters**

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International Standard IEC 60947-4-1 has been prepared by subcommittee 121A: Low-voltage switchgear and controlgear, of IEC technical committee 121: Switchgear and controlgear and their assemblies for low voltage.

This fourth edition cancels and replaces the third edition published in 2009 and its Amendment 1:2012. This edition constitutes a technical revision.

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

- Scope structure and exclusions
- Editorial correction of notes and hanging paragraphs
- Reference to IEC 62683-1
- Motor protective switching device (MPSD) with its requirements

- Safety aspects related to:
  - General aspects;
  - Limited energy circuits;
  - Electronic circuits;
  - Assessment procedure for electromechanical overload protection used in safety - applications (new Annex L)
- Introduction of provisions covering the impact of higher locked rotor current to achieve high efficiency class
- Mention of dedicated wiring accessories
- Pickup power measurement
- Alignment to IEC 60947-1:2007, IEC 60947-1:2007/AMD1:2010, and IEC 60947-1:2007/AMD2:2014
- Direct current requirements for covering photovoltaic application (new Annex M)
- Load monitoring indicators (new Annex O)
- Short-circuit breaking tests of MPSD (new Annex P)
- Co-ordination under short-circuit conditions between a MPSD and another short-circuit protective device associated in the same circuit (new Annex Q)

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

FDIS	Report on voting
121A/224/FDIS	121A/233/RVD

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.

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

This document shall be read in conjunction with IEC 60947-1:2007, IEC 60947-1:2007/AMD1:2010, IEC 60947-1:2007/AMD2:2014, *Low voltage switchgear and controlgear – Part 1: General rules*. The provisions of the general rules are applicable to this document, where specifically called for.

The provisions of the general rules dealt with IEC 60947-1 are applicable to this part of IEC 60947 series where specifically called for. Clauses and subclauses, tables, figures and annexes of the general rules thus applicable are identified by reference to IEC 60947-1:2007, IEC 60947-1:2007/AMD1:2010, and IEC 60947-1:2007/AMD2:2014. For example, 4.3.4.1 of IEC 60947-1:2007, Table 4 of IEC 60947-1:2007, or Annex A of IEC 60947-1:2007.

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.

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## INTRODUCTION

This document introduces the requirements for motor protection switching devices (MPSD).

MPSDs have been available on the market for many years. They are introduced in this document for covering the minimum safety and performance requirements of a manual motor starter with integral electromechanical or electronic short-circuit protection. This device fulfils all requirements of a starter and specific requirements of a circuit-breaker according to IEC 60947-2, mainly  $I_{cu}$  and  $I_{cs}$ , for protecting the motor and its circuit with control devices e.g. a contactor. An MPSD is not intended to support neutral pole, DC ratings, rated uninterrupted current  $I_u$ , backup protection, short-circuit tripping time-delay, selectivity category, withdrawable capability, RCD, recloser, EMC requirements of IEC 60947-2, etc.

Circuit-breakers according to Annex O of IEC 60947-2:2016 with motor overload protection characteristic according to this document but without starter ratings e.g. AC-3 are also available on the market. These devices are not covered by this document.

## LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters

#### 1 Scope

This part of IEC 60947 is applicable to the following equipment:

- electromechanical contactors and starters including motor protective switching device (MPSD);
- actuators of contactor relays;
- contacts dedicated exclusively to the coil circuit of this contactor or this contactor relay;
- dedicated accessories (e.g. dedicated wiring, dedicated latch accessory);

intended to be connected to distribution circuits, motors circuits and other load circuits, the rated voltage of which does not exceed 1 000 V AC or 1 500 V DC.

This document covers also the assessment procedure for electromechanical overload protection used in safety applications such as protecting a motor located in explosive atmosphere from the outside atmosphere: See Annex L.

This document does not apply to:

- starters for DC motors<sup>1</sup>;  
NOTE 1 The requirements for DC motor starters are under consideration for the next maintenance cycle.
- auxiliary contacts of contactors and contacts of contactor relays. These are covered by IEC 60947-5-1;
- starter used downstream to frequency drive<sup>1</sup>;  
NOTE 2 Additional requirements for starter used downstream to frequency drive are under consideration for the next maintenance cycle.
- short-circuit protective device integrated within starters other than MPSDs. This is covered by IEC 60947-2 and IEC 60947-3;
- the use of the product with additional measure within explosive atmospheres. These are given in IEC 60079 series;
- embedded software design rules<sup>1</sup>;
- cyber security aspects. These are covered by IEC 62443 series.

The objective of this document is to state:

- a) the characteristics of the equipment;
- b) the conditions applicable to the equipment with reference to:
  - 1) its operation and behaviour,
  - 2) its dielectric properties,
  - 3) its degree of protection,

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<sup>1</sup> For this subject the manufacturer is responsible for taking additional safety measures.

- 4) its construction including safety measures against electric shock, fire hazard and mechanical hazard;
- c) the tests intended for confirming that these conditions have been met, and the methods to be adopted for these tests;
- d) the information to be given with the equipment or in the manufacturer's literature.

## 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 60034-1:2017, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-12:2016, *Rotating electrical machines – Part 12: Starting performance of single-speed three-phase cage induction motors*

IEC 60034-30-1, *Rotating electrical machines – Part 30-1: Efficiency classes of line operated AC motors (IE code)*

IEC 60038, *IEC standard voltages*

IEC 60068-2-14:2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60085:2007, *Electrical insulation – Thermal evaluation and designation*

IEC 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-7-712, *Low voltage electrical installations – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems*

IEC 60715:2017, *Dimensions of low-voltage switchgear and controlgear – Standardized mounting on rails for mechanical support of switchgear, controlgear and accessories*

IEC 60730-1, *Automatic electrical controls – Part 1: General requirements*

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

IEC 60947-1:2007/AMD1:2010

IEC 60947-1:2007/AMD2:2014

IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-5-1:2016, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

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

IEC 61051-2, *Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 61810-1, *Electromechanical elementary relays – Part 1: General and safety requirements*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 11:2015/AMD1:2016

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

ISO 3864-2, *Graphical symbols – Safety colours and safety signs – Part 2: Design principles for product safety labels*

### 3 Terms, definitions, symbols and abbreviated terms

#### 3.1 General

For the purposes of this document, the terms and definitions of Clause 2 of IEC 60947-1:2007/AMD1:2010/AMD2:2014, as well as the following terms, definitions, symbol and abbreviations 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>

#### 3.2 Alphabetical index of terms

	Reference
A	
abnormal operating condition .....	3.6.1
accessible part.....	3.6.2
auto-transformer starter .....	3.4.4.2
auto-transformer .....	3.4.4.3
C	
closed transition (with an auto-transformer starter or star-delta starter) .....	3.4.22
combination starter .....	3.4.7
combination switching device.....	3.4.26
CO operation .....	3.5.2
contactor (mechanical).....	3.3.1
D	
dedicated wiring accessory .....	3.4.32
direct-on-line starter.....	3.4.2