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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Low-voltage switchgear and controlgear – Part 4-3: Contactors and motor-starters – AC semiconductor controllers and contactors for non-motor loads

Appareillage à basse tension – Partie 4-3: Contacteurs et démarreurs de moteurs – Gradateurs et contacteurs à semiconducteurs pour charges, autres que des moteurs, à courant alternatif

IEC 60947-4-3:2014-05(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 4-3: Contactors and motor-starters – AC semiconductor controllers and contactors for non-motor loads

FOREWORD

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International Standard IEC 60947-4-3 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This second edition cancels and replaces the first edition published in 1999, Amendment 1:2006 and Amendment 2:2011. This edition constitutes a technical revision.

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

a) Update of the marking requirements (6.1);
b) Update of the EMC requirements (8.3.2); and
c) Update of the tests requirements (9.3.1, 9.4, 9.4.1.1, 9.4.1.2, 9.4.2.1, 9.4.2.2, 9.4.2.3, 9.4.2.4, 9.4.2.6).

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

FDIS	Report on voting
121A/2/FDIS	121A/14/RVD

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

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

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

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

The provisions of the general rules (IEC 60947-1) are applicable to this standard, where specifically called for. Clauses and subclauses thus applicable, as well as tables, figures, and annexes, are identified by reference to IEC 60947-1, for example 1.2.3 of IEC 60947-1:2007, Amendment 1 (2010), Table 4 of IEC 60947-1:2007, Amendment 1 (2010) or Annex A of IEC 60947-1:2007.

The committee has decided that the contents of this publication 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

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

INTRODUCTION

This part of IEC 60947 covers low-voltage a.c. semiconductor controllers and contactors (solid-state contactors) intended for the use with non-motor loads. As controllers, they have many capabilities beyond the simple switching on and off of non-motor loads. As contactors, they perform the same functions as mechanical contactors, but utilize one or more semiconductor switching devices in their main poles.

The devices may be single-pole or multi-pole (see 2.3.1 of IEC 60947-1:2007,). This standard refers to complete devices rated as a unit incorporating all necessary heat-sinking material and terminals. It includes devices with all necessary terminals, which are supplied with or without heat-sink in knocked-down form for combination by the users, when the manufacturer gives with the device detailed information about choosing the heat-sink and mounting the device on the heat-sink.

The generic term, "controller", is used in this standard wherever the unique features of the power semiconductor switching elements are the most significant points of interest. The generic term "contactor" is used in this standard wherever the feature of simple switching on and off is the most significant point of interest. Specific designations (for example, form 4, form HxB, etc.) are used wherever the unique features of various configurations comprise significant points of interest.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 4-3: Contactors and motor-starters – AC semiconductor controllers and contactors for non-motor loads

1 Scope

This part of IEC 60947 applies to a.c. semiconductor non-motor load controllers and contactors intended for performing electrical operations by changing the state of a.c. electric circuits between the ON-state and the OFF-state. Typical applications are classified by utilization categories given in Table 2.

As controllers, they may be used to reduce the amplitude of the r.m.s. a.c. voltage on the load terminals from that of the applied voltage – either continuously or for a specified period of time. The half-wave period of the a.c. wave form remains unchanged from that of the applied voltage.

They may include a series mechanical switching device and are intended to be connected to circuits, the rated voltage of which does not exceed 1 000 V a.c.

This standard characterizes controllers and contactors for use with or without bypass switching devices.

The semiconductor controllers and contactors dealt with in this standard are not normally intended to interrupt short-circuit currents. Therefore, suitable short-circuit protection (see 8.2.5) should form part of the installation but not necessarily of the controller itself.

In this context, this standard gives requirements for semiconductor controllers and contactors associated with separate short-circuit protective devices.

This standard does not apply to:

– operation of a.c. and d.c. motors;
– low-voltage a.c. semiconductor motor controllers and starters covered by IEC 60947-4-2;
– electronic a.c. power controllers covered by the IEC 60146 series;
– all-or-nothing solid-state relays.

Contactors and control-circuit devices used in semiconductor controllers and contactors should comply with the requirements of their relevant product standard. Where mechanical switching devices are used, they should meet the requirements of their own IEC product standard and the additional requirements of this standard.

The object of this standard is to state

a) the characteristics of semiconductor controllers and contactors and associated equipment;
b) the conditions with which semiconductor controllers and contactors should comply with reference to:
   – their operation and behaviour;
   – their dielectric properties;
   – the degrees of protection provided by their enclosures, where applicable;

– their construction;

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, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60269-1:2006, *Low-voltage fuses – Part 1: General requirements*

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

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

IEC 61000-4 (all parts), *Electromagnetic compatibility (EMC) – Part 4:Testing and measurement techniques*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement* Amendment 1:2010

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms and definitions given in Clause 2 of IEC 60947-1:2007, Amendment 1 (2010), as well as the following additional terms and definitions apply:

3.1 Terms and definitions concerning a.c. semiconductor (non-motor-load) control devices

3.1.1 AC semiconductor controllers and contactors (solid-state contactors) (see Figure 1)

3.1.1.1
a.c. semiconductor controller
semiconductor switching device that provides a switching function for an a.c. electrical load (non-motor load) and an OFF-state

Note 1 to entry: Because dangerous levels of leakage currents (see 3.1.13) can exist in a semiconductor controller in the OFF-state, the load terminals should be considered to be live at all times.

Note 2 to entry: In a circuit where the current passes through zero (alternately or otherwise), the effect of "not making" the current following such a zero value is equivalent to breaking the current.

Note 3 to entry: See 2.2.3 of IEC 60947-1:2007 for the definition of semiconductor switching device.

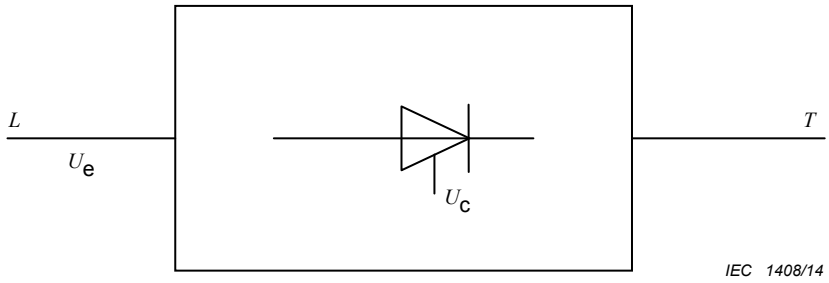
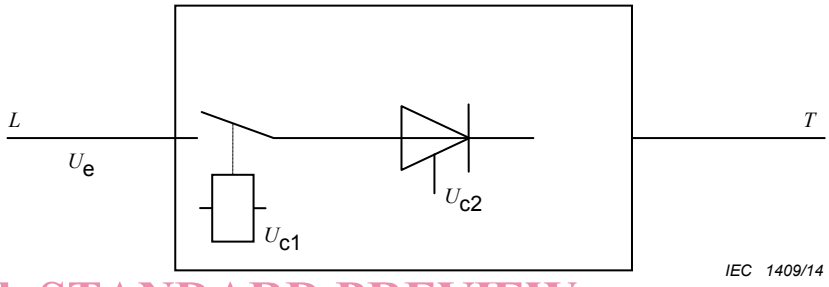
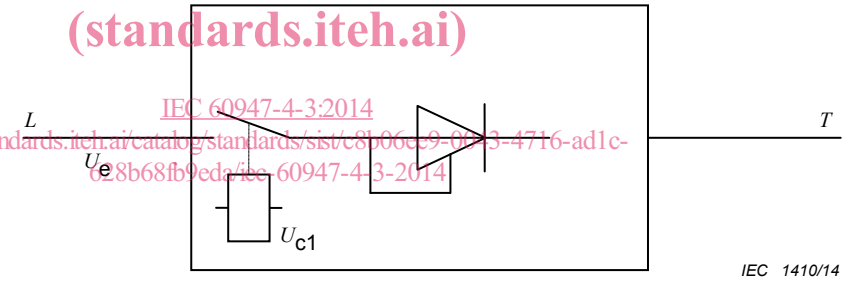
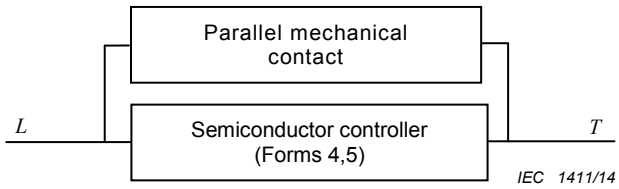
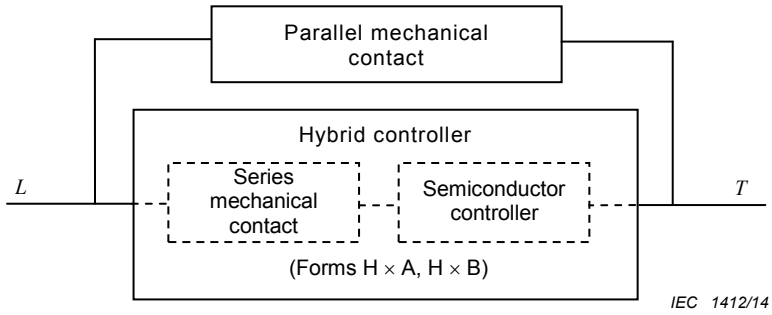
3.1.1.1.1
semiconductor controller (form 4)
a.c. semiconductor controller in which the switching function may comprise any method specified by the manufacturer. It provides control functions which may include any combination of ramp-up, load control or ramp-down. A full-on state may also be provided

3.1.1.1.2
Vacant

3.1.1.1.3
semiconductor direct-on-line controller (form 5)
semiconductor DOL controller (form 5)
special form of a.c. semiconductor controller in which the switching function is limited to the full-voltage, unramped method only and where the additional control function is limited to providing FULL-ON (also known as a semiconductor contactor or solid-state contactor)

Note 1 to entry: It is a device (see 2.2.13 of IEC 60947-1:2007) which performs the function of a contactor by utilizing a semiconductor switching device (see 2.2.3 of IEC 60947-1:2007). It has only one position of rest (OFF-state or Open state in the case of an H*x*B hybrid controller) and is operated by the application of a control signal. It is capable of carrying load currents as well as changing the state of the said load (electrical circuit) between the FULL-ON and the OFF-states (Open) under normal circuit conditions including operating overload conditions.

3.1.1.2
Vacant

Device	
Controller (all forms)	
Hybrid controller H*x*A [a] where *x* = 4 or 5	
Hybrid controller H*x*B [b] where *x* = 4 or 5	
Bypassed controller	
Bypassed hybrid controller [c]	

[a] Two separate controls for the controller and the series mechanical switching device respectively.
[b] One control only for the series mechanical switching device.
[c] For other configurations, tests can be suitably adapted by agreement between the user and the manufacturer.

Figure 1 – Graphical possibilities of controllers