SLOVENSKI STANDARD

SIST EN 60947-4-2:2000

prva izdaja
junij 2000

Nizkonapetostne stikalne in krmilne naprave – 4-2. del: Kontaktorji in motorski zaganjalniki – Polprevodniški krmilniki in zaganjalniki motorjev na izmenični tok

Low-voltage switchgear and controlgear - Part 4-2: Contactors and motor-starters - AC semiconductor motor controllers and starters

ICS 29.130.20

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Partly supersedes HD 419.2 S1:1987
Supersedes EN 60947-4-2:1996 and its amendments

English version

Low-voltage switchgear and controlgear
Part 4-2: Contactors and motor-starters
AC semiconductor motor controllers and starters
(IEC 60947-4-2:1999)

Appareillage à basse tension
Partie 4-2: Contacteurs et démarreurs de moteurs - Gradateurs et démarreurs à semiconducteurs de moteurs à courant alternatif
(CEI 60947-4-2:1999)

Niederspannungsschaltgeräte
Teil 4-2: Schütze und Motorstarter
Halbleiter-Motor-Steuergeräte und -Starter für Wechselspannung
(IEC 60947-4-2:1999)

This European Standard was approved by CENELEC on 1999-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

The text of document 17B/998/FDIS, future edition 2 of IEC 60947-4-2, prepared by SC 17B, Low-voltage switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60947-4-2 on 1999-10-01.

This European Standard, together with EN 60947-4-3:2000, supersedes HD 419.2 S1:1987. This European Standard supersedes EN 60947-4-2:1996, with its corrigendum June 1997 and its amendments A1:1997 and A2:1998.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-12-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annexes A, B, C, D and ZA are normative and annexes E, F, G and H are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60947-4-2:1999 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60146	NOTE: Harmonized in the EN 60146 series.
IEC 60269-2	NOTE: Harmonized as EN 60269-2:1995 (not modified).
IEC 60269-2-1	NOTE: Harmonized as HD 630.2.1 S4:2000 (modified).
CISPR 22	NOTE: Harmonized as EN 55022:1998 (modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60034-1 (mod)	1996	Rotating electrical machines Part 1: Rating and performance	EN 60034-1	1998
IEC 60050-161	1990	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-
IEC 60269-1	1998	Low-voltage fuses Part 1: General requirements	EN 60269-1	1998
IEC 60410	1973	Sampling plans and procedures for inspection by attributes	-	-
IEC 60439-1 + corr. December	1992 1993	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies	EN 60439-1	1994
IEC 60664 (mod)	series	Insulation coordination for equipment within low-voltage systems	HD 625	series
IEC 60947-1 (mod)	1999	Low-voltage switchgear and controlgear Part 1: General rules	EN 60947-1	1999
IEC/TR3 61000-2-1	1990	Electromagnetic compatibility (EMC) Part 2: Environment Section 1: Description of the environment Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems	-	-
IEC 61000-3-2	1995	Part 3-2: Limits - Limits for harmonic current emissions (equipment input current up to and including 16A per phase)	EN 61000-3-2 + corr. July	1995 1997
IEC 61000-4-2	1995	Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	1995

Publication	Year	Title	EN/HD	Year
IEC 61000-4-3 (mod)	1995	Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3	1996
IEC 61000-4-4	1995	Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	1995
IEC 61000-4-5	1995	Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	1995
IEC 61000-4-6	1996	Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	1996
IEC 61000-4-11	1994	Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	1994
CISPR 11 (mod)	1997	Industrial, scientific and medical (ISM) radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55011	1998
CISPR 14-1	1993	Electromagnetic compatibility Requirements for household appliances, electric tools and similar apparatus Part 1: Emission - Product family standard	EN 55014-1	1993
CISPR 14-2	1997	Part 2: Immunity - Product family standard	EN 55014-2 + corr. December	1997 1997

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Partie 4-2: Contacteurs et démarreurs de moteurs – Gradateurs et démarreurs à semiconducteurs de moteurs à courant alternatif

Low-voltage switchgear and controlgear –

Part 4-2: Contactors and motor-starters – AC semiconductor motor controllers and starters

International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site http://www.iec.ch

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FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60947-4-2 has been prepared by subcommittee 17B: Low-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This second edition of IEC 60947-4-2 cancels and replaces the first edition published in 1995, amendment 1 (1997) and amendment 2 (1998). It constitutes a technical revision.

The text of this standard is based on the first edition, amendments 1 and 2 and the following documents:

FDIS	Report on voting
17B/998/FDIS	17B/1012/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A, B, C and D form an integral part of this standard.

Annexes E, F, G and H are for information only.

The committee has decided that this publication remains valid until 2000. At this date, in accordance with the committee's decision, the publication will be

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

INTRODUCTION

This standard covers low-voltage a.c. semiconductor motor controllers and starters, that have many capabilities and features beyond the simple starting and stopping of an induction motor, such as controlled starting and stopping, manoeuvering and controlled running.

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, starter, is used wherever the consequences of operating the power semiconductor switching elements, together with suitable overload protective means are the most significant points of interest. Specific designations (for example form 1, form HxB, etc.) are used wherever the unique features of various configurations comprise significant points of interest.

The provisions of IEC 60947-1, General Rules, 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 subclause 1.2.3 of IEC 60947-1, table 4 of IEC 60947-1 or annex A of IEC 60947-1.

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 4-2: Contactors and motor-starters – AC semiconductor motor controllers and starters

1 Scope and object

This standard applies to controllers and starters, which may include a series mechanical switching device, intended to be connected to circuits, the rated voltage of which does not exceed 1 000 V a.c.

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

Controllers and starters dealt with in this standard are not normally designed 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 or starter.

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

This standard does not apply to:

– continuous operation of a.c. motors at motor speeds other than the normal speed;
– semiconductor equipment, including semiconductor contactors (see 2.2.13 of IEC 60947-1) controlling non-motor loads;
– electronic a.c. power controllers covered by IEC 60146.

Contactors and control circuit devices used in controllers and starters 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 as follows:

– the characteristics of controllers and starters and associated equipment;
– the conditions with which controllers and starters shall comply with reference to:
  a) their operation and behaviour;
  b) their dielectric properties;
  c) the degrees of protection provided by their enclosures where applicable;
  d) their construction;
– the tests intended for confirming that these conditions have been met, and the methods to be adopted for these tests;
– the information to be given with the equipment, or in the manufacturer's literature.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60947. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60947 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60034-1:1996, *Rotating electrical machines – Part 1: Rating and performance* [1)]

IEC 60050(161):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60269-1:1998, *Low-voltage fuses – Part 1: General requirements*

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

IEC 60439-1:1992, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*

IEC 60664 (all parts), *Insulation coordination for equipment within low-voltage systems*

IEC 60947-1:1999, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC/TR3 61000-2-1:1990, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 1: Description of the environment – Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems*

IEC 61000-3-2:1995, *Electromagnetic compatibility (EMC) – Part 3: Limits – Section 2: Limits for harmonic current emissions (equipment input current ≤16 A per phase)* [2)]

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test – Basic EMC publication* [3)]

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio-frequency, electromagnetic field immunity test* [4)]

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1) There exists a consolidated edition 10.2 (1999) that includes IEC 60034-1 (1996), its amendment 1 (1997) and amendment 2 (1999).

2) There exists a consolidated edition 1.2 (1998) that includes IEC 61000-3-2 (1995), its amendment 1 (1997) and amendment 2 (1998).

3) There exists a consolidated edition 1.1 (1999) that includes IEC 61000-4-2 (1995) and its amendment 1 (1998).

4) There exists a consolidated edition 1.1 (1998) that includes IEC 61000-4-3 (1995) and its amendment 1 (1998).

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test – Basic EMC publication*

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11:1994, *Electromagnetic compatibility (EMC) – Part 4: Testing and measuring techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests*

CISPR 11:1997, *Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement*[5)]

CISPR 14-1:1993, *Electromagnetic compatibility – Requirements for household appliances, electrical tools and similar apparatus – Part 1: Emission – Product family standard*

CISPR 14-2:1993, *Electromagnetic compatibility – Requirements for household appliances, electrical tools and similar apparatus – Part 2: Immunity – Product family standard*

3 Definitions

For the purposes of this standard, relevant definitions of clause 2 of IEC 60947-1 and the following additional definitions apply.

3.1 Definitions concerning a.c. semiconductor motor control devices

3.1.1 AC semiconductor motor controllers and starters (see figure 1)

3.1.1.1
a.c. semiconductor motor controller
semiconductor switching device (see 2.2.3 of IEC 60947-1) that provides the starting function for an a.c. motor and an OFF-state

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

5) There exists a consolidated edition 3.1 (1999) that includes CISPR 11 (1997) and its amendment 1 (1999).