

Low-voltage switchgear and controlgear —

Part 8: Control units for built-in thermal protection (PTC) for rotating electrical machines

ICS 29.130.20

National foreword

This British Standard is the UK implementation of EN 60947-8:2003+A2:2012. It is identical to IEC 60947-8:2003, incorporating amendments 1:2006 and 2:2011. It supersedes BS EN 60947-8:2003, which will be withdrawn on 22 June 2014.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated in the text by A1 A1.

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

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Low-voltage switchgear and controlgear
Part 8: Control units for built-in thermal protection (PTC)
for rotating electrical machines
(IEC 60947-8:2003)

Appareillage à basse tension
Partie 8: Unités de commande pour la
protection thermique incorporée (CTP)
aux machines électriques tournantes
(CEI 60947-8:2003)

Niederspannungsschaltgeräte
Teil 8: Auslösegeräte für den eingebauten
thermischen Schutz (PTC) von
rotierenden elektrischen Maschinen
(IEC 60947-8:2003)

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CENELEC

European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 17B/1276/FDIS, future edition 1 of IEC 60947-8, 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 60947-8 on 2003-07-01.

This Part 8 shall be used in conjunction with EN 60947-1. The provisions of the general rules dealt with in EN 60947-1 are applicable to this standard, where specifically called for. Clauses and subclauses, tables, figures and annexes thus applicable are identified by reference to "IEC 60947-1", e.g. 1.2.3 of IEC 60947-1, Table 4 of IEC 60947-1 or Annex A of IEC 60947-1.

The following dates were fixed:

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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-07-01

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 and ZA are normative and annex C is informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60947-8:2003 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A1

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Endorsement notice

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Foreword to amendment A2

The text of document 17B/1732/FDIS, future edition 1 of IEC 60947-8:2003/A2, 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 approved by CENELEC as EN 60947-8:2003/A2:2012.

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Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC)

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 60947-8:2003/A2:2011 was approved by CENELEC as a European Standard without any modification.

CONTENTS

INTRODUCTION.....	5
1 Scope	6
2 Normative references	6
3 Terms, definitions, symbols and abbreviations.....	8
3.1 Terms and definitions	8
3.2 Symbols and abbreviations	12
4 Classification.....	12
5 Characteristics	12
5.1 General.....	12
5.2 Type of equipment.....	12
5.3 Rated electrical values of protection systems	14
5.4 Rated electrical values of characteristic variation thermal detectors	15
5.5 Rated voltage of the detector circuit of the control unit	15
6 Product information	16
6.1 Nature of information	16
6.2 Marking.....	16
6.3 Instructions for installation, operation and maintenance.....	16
7 Normal service, mounting and transport conditions.....	17
8 Constructional and performance requirements.....	17
8.1 Constructional requirements	17
8.2 Performance requirements.....	18
8.3 Electromagnetic compatibility (EMC).....	20
8.3.1 General	20
8.3.2 Immunity.....	20
8.3.3 Emission.....	21
9 Tests.....	21
9.1 Kinds of tests	21
9.2 Compliance with constructional requirements	22
9.3 Compliance with performance requirements	22
9.4 EMC tests	27
9.5 Routine and sampling tests.....	29
Annex A (normative) Thermal detectors used in thermal protection systems.....	31
Annex B (normative) Special tests.....	33
Annex ZA (normative) Normative references to international publications with their corresponding European publications	35
Annex ZZ (informative) Coverage of Essential Requirements of EU Directives.....	37
Figure A.1 – Characteristic curve of a typical Mark A detector.....	32
Table 1 – Tests for EMC – Immunity.....	28
Table 2 – Vibration test parameters.....	19

INTRODUCTION

Thermal protection systems which are based on the principle of monitoring the temperature of the protected parts constitute a simple and effective means of protecting rotating electrical machines against excessive temperature rises, including those caused by faults in the cooling system, or excessively high ambient temperature, whereas systems of protection based only on monitoring the current absorbed may not ensure this type of protection.

Since the operating temperature and response times of thermal protection systems are fixed in advance, they may not be adjusted in relation to the conditions of use of the machine and they may not be completely effective for all fault conditions or improper use of the machine.

A thermal protection system in accordance with this standard may consist of a characteristic change thermal detector which has an associated control unit to convert a point on the characteristic of the detector to a switching function. A very large number of thermal protection systems are in use and, in all cases, the machine manufacturer will fit the detectors in the machine. The machine manufacturer will either supply the control unit with the machine or specify particulars of the control unit to be used.

It is also customary for the control units to be considered as part of the control system and not necessarily supplied with the machine. For this reason it is considered necessary to have an interchangeable system, where the characteristics of association between the detector and the control unit are specified. This particular system is not considered superior in any way to other systems complying with the requirements of this standard, but in some fields the practice is likely to be that this interchangeable system will be used, as indicated by the designation "Mark A".

LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 8: Control units for built-in thermal protection (PTC) for rotating electrical machines

1 Scope

This part of IEC 60947 specifies rules for control units, which perform the switching functions in response to the thermal detectors incorporated in rotating electrical machines according to IEC 60034-11, and the industrial application.

It specifies rules for that type of system comprising a positive temperature coefficient (PTC) thermistor detector having particular characteristics, and its associated control unit.

The PT100 detectors are covered by IEC 60751, where the resistor values are given according to the temperatures of the detector.

The present rules lay down the characteristics of association of this particular positive temperature coefficient thermistor detector and its associated control unit (designated “Mark A detector” and “Mark A control unit”), when they are used in thermal protection systems.

NOTE It is not possible to specify all the requirements for the operating characteristics of a control unit, as they are dependent on some aspects of the thermal detectors. Some aspects of the requirements of the thermal protector system can only be specified when account is taken of the characteristics of the rotating machine to be protected and the method of installation of the detector within the machine.

For these reasons, for each characteristic it is necessary to specify who is responsible for stating the required values and who is responsible for compliance with the requirement and for carrying out any confirmatory test.

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.

☐^{A1} IEC 60034-11:2004, *Rotating electrical machines – Part 11: Thermal protection*

☐^{A2} IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold* ☐^{A2}

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

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock* ☐^{A1}

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

☐^{A1} IEC 60417:2002, *Graphical symbols for use on equipment* ☐^{A1}

IEC 60738-1:1998, *Thermistors – Directly heated positive step-function temperature coefficient – Part 1: Generic specification*

IEC 60751:1983, *Industrial platinum resistance thermometer sensors*

Amendment 1 (1986)

Amendment 2 (1995)

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

IEC 60947-5-1:2003, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

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

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*

Amendment 1 (2010)

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

Corrigendum 1 (2009)

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

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

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)

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

Amendment 1 (2010)

CISPR 22:2008, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, relevant definitions of IEC 60947-1, together with the following definitions, apply.

3.1 Terms and definitions

	Reference
A	
Abrupt characteristic change thermal detector	3.1.14
B	
Built-in thermal protection	3.1.1
C	
Category of thermal protection	3.1.12
Characteristic variation thermal detector	3.1.13
Control circuit	3.1.16
Control system	3.1.5
Control unit	3.1.15
Control unit with dynamic wire break detection	3.1.25
Control unit with short-circuit detection within the thermal detector circuit	3.1.24
D	
Detector operating temperature (TNF)	3.1.17
E	
Electrically separated contact elements	3.1.20
M	
Mark A control unit	3.1.23
Mark A detector	3.1.22
Maximum temperature after tripping	3.1.11
P	
Protected part	3.1.6
PTC thermistor detector	3.1.21
R	
Reset temperature	3.1.19
S	
Switching type thermal detector	3.1.4
System operating temperature (TFS)	3.1.18
T	
Thermal detector	3.1.3
Thermal overload with rapid variation	3.1.8
Thermal overload with slow variation	3.1.7
Thermal protection system	3.1.2
Thermal protection with detector	3.1.10
Thermally critical part of a machine	3.1.9



A1 3.1.1 A1**built-in thermal protection**

protection of certain parts (called protected parts) of a rotating electrical machine against excessive temperatures resulting from certain conditions of thermal overload, achieved by means of a thermal protection system, the whole or part of which is a thermally sensitive device incorporated within the machine

A1 3.1.2 A1**thermal protection system**

system intended to ensure the thermal protection of a rotating electrical machine by means of a built-in thermal detector together with a control unit

A1 3.1.3 A1**thermal detector**

electrical insulated device (component), sensitive to temperature only, which will initiate a switching function in the control system when its temperature reaches a predetermined level

A1 3.1.4 A1**switching type thermal detector**

thermal detector which causes a direct operation of a switching element

NOTE The combination of the thermal detector and the switching element is rated as a unit and mounted in the rotating electrical machine.

A1 3.1.5 A1**control system**

system to translate a particular point on the characteristic of a thermal detector to a switching function on the supply to the rotating electrical machine

NOTE The system is capable of being reset (either manually or automatically) when the temperature falls to the reset value.

A1 3.1.6 A1**protected part**

part of a rotating electrical machine, the temperature of which is limited to a predetermined value by the action of the thermal protection system

A1 3.1.7 A1**thermal overload with slow variation**

slow temperature rise above the normal operating temperature

NOTE 1 The variation of the temperature of the protected part is sufficiently slow for the temperature of the thermal detector to follow without appreciable delay.

NOTE 2 A thermal overload with slow variation may be caused, for instance, by:

- defects in ventilation or in the ventilation system, for example partial blocking of the ventilation ducts, excessive dust, dirt on the windings or on the cooling ribs of the frame;
- an excessive rise in the ambient temperature or in the temperature of the cooling medium;
- gradually increasing mechanical overload;
- prolonged voltage drop or over-voltage in the machine supply;
- excessive duty in a machine.

A1 3.1.8 A1

thermal overload with rapid variation

rapid rise of temperature above the normal operating temperature

NOTE 1 The variation of the temperature of the protected part may be too rapid for the temperature of the thermal detector to follow without delay. This may result in a significant temperature difference between the thermal detector and the protected part.

NOTE 2 A thermal overload with rapid variation may be caused, for instance, by stalling the machine or in certain circumstances, by phase failure or by starting under abnormal conditions (inertia too high, voltage too low, load torque abnormally high).

A1 3.1.9 A1

thermally critical part of a machine

part of a machine in which the temperature most rapidly reaches its dangerous value

NOTE A part of a machine which is thermally critical in the case of thermal overload with slow variation may not be so for a thermal overload with rapid variation.

A1 3.1.10 A1

thermal protection with detector

form of protection where the part of the machine in which the thermal detector(s) is (are) incorporated is the thermally critical part

A1 3.1.11 A1

maximum temperature after tripping

maximum value of the temperature which is reached by the protected part of the machine during the period which follows tripping by the thermal protection system, for thermal overload with rapid variation

A1 3.1.12 A1

category of thermal protection

indication of the permissible temperature levels on the windings of a machine when subjected to the thermal overload

A1 3.1.13 A1

characteristic variation thermal detector

thermal detector which has a characteristic the variation of which, related to the temperature, is able to initiate a switching function in the control system for one temperature fixed in advance during manufacture or by initial adjustment of the control unit

NOTE For example, a resistor detector, thermocouple detector, negative temperature coefficient thermistor detector, positive temperature coefficient thermistor detector.

A1 3.1.14 A1

abrupt characteristic change thermal detector

thermal detector which has a characteristic, the abrupt change of which for one temperature fixed in advance during manufacture is able to initiate a switching operation in the control system

A1 3.1.15 A1

control unit

device which converts into a switching function the variation of the characteristic of a thermal detector

A1 NOTE The control unit may be part of other devices or systems. **A1**

A1 3.1.16 A1

control circuit

circuit controlling the switching device which makes and breaks the power supply