# IEC 60730-2-9

Edition 4.1 2018-01
CONSOLIDATED VERSION

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

## Automatic electrical controls –
## Part 2-9: Particular requirements for temperature sensing controls



## Commandes électriques automatiques –
## Partie 2-9: Exigences particulières pour les commandes de détection de température



IEC 60730-2-9:2015-05+AMD1:2018-01 CSV(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

**About the IEC**
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

**About IEC publications**
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

**IEC publications search - webstore.iec.ch/advsearchform**
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

**IEC Just Published - webstore.iec.ch/justpublished**
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

**IEC Customer Service Centre - webstore.iec.ch/csc**
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

**Electropedia - www.electropedia.org**
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

**IEC Glossary - std.iec.ch/glossary**
67 000 electrotechnical terminology entries in English and French extracted from the Terms and definitions clause of IEC publications issued between 2002 and 2015. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.



---

**A propos de l'IEC**
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

**A propos des publications IEC**
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

**Recherche de publications IEC - webstore.iec.ch/advsearchform**
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

**IEC Just Published - webstore.iec.ch/justpublished**
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

**Service Clients - webstore.iec.ch/csc**
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

**Electropedia - www.electropedia.org**
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

**Glossaire IEC - std.iec.ch/glossary**
67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et définitions des publications IEC parues entre 2002 et 2015. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

# IEC 60730-2-9

Edition 4.1 2018-01
CONSOLIDATED VERSION

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

colour inside

## Automatic electrical controls –
## Part 2-9: Particular requirements for temperature sensing controls

## Commandes électriques automatiques –
## Partie 2-9: Exigences particulières pour les commandes de détection de température



INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 97.120

ISBN 978-2-8322-8584-8

# IEC 60730-2-9

Edition 4.1 2018-01

# REDLINE VERSION

# VERSION REDLINE

colour inside

## Automatic electrical controls –
## Part 2-9: Particular requirements for temperature sensing controls



## Commandes électriques automatiques –
## Partie 2-9: Exigences particulières pour les commandes de détection de température



IEC 60730-2-9:2015-05+AMD1:2018-01 CSV(en-fr)

# CONTENTS

FOREWORD ..... 4
1 Scope and normative references ..... 7
2 Terms and definitions ..... 8
3 General requirements ..... 10
4 General notes on tests ..... 10
5 Rating ..... 11
6 Classification ..... 11
7 Information ..... 12
8 Protection against electric shock ..... 14
9 Provision for protective earthing ..... 14
10 Terminals and terminations ..... 14
11 Constructional requirements ..... 14
12 Moisture and dust resistance ..... 17
13 Electric strength and insulation resistance ..... 18
14 Heating ..... 18
15 Manufacturing deviation and drift ..... 19
16 Environmental stress ..... 20
17 Endurance ..... 20
18 Mechanical strength ..... 26
19 Threaded parts and connections ..... 28
20 Creepage distances, clearances and distances through solid insulation ..... 28
21 Resistance to heat, fire and tracking ..... 28
22 Resistance to corrosion ..... 28
23 Electromagnetic compatibility (EMC) requirements – Emission ..... 28
24 Components ..... 29
25 Normal operation ..... 29
26 Electromagnetic compatibility (EMC) requirements – Immunity ..... 29
27 Abnormal operation ..... 29
28 Guidance on the use of electronic disconnection ..... 29
Annexes ..... 30
Annex G (normative) Heat and fire resistance tests ..... 30
Annex H (normative) Requirements for electronic controls ..... 31
Annex J (normative) Requirements for thermistor elements and controls using thermistors ..... 38
Annex AA (informative) Maximum manufacturing deviation and drift [a, b] ..... 39
Annex BB (informative) Time factor ..... 40
Annex CC (informative) Number of cycles ..... 43
Annex DD (normative) Controls for use in agricultural confinement buildings ..... 44
Annex EE (informative) Guide to the application of temperature sensing controls within the scope of IEC 60730-2-9 ..... 47
Bibliography ..... 73

Figure 101 – Impact tool ..... 16
Figure 102 – Aluminium cylinder for temperature change method ..... 26
Figure BB.1 – Determination of time factor in the case of a sudden temperature change ..... 41
Figure BB.2 – Determination of time factor in the case of a linear rise of test-bath temperature ..... 42
Figure EE.1 – Thermostat ..... 58
Figure EE.2 – Self-resetting temperature limiter ..... 59
Figure EE.3 – Non-self-resetting temperature limiter ..... 59
Figure EE.4 – Self-resetting thermal cut-out ..... 61
Figure EE.5 – Manual reset thermal cut-out ..... 61
Figure EE.6 – Single operation device ..... 63
Figure EE.7 – Three-stage control system ..... 64
Figure EE.8 – Schematic diagram showing usage of various controls approved to IEC 60730-2-9 ..... 68

Table 1 – Required information and methods of providing information ..... 13
Table H.101 – Compliance criteria ..... 33
Table BB.1 – Method to determine and verify time factor values (see 11.101) ..... 42
Table EE.1 – Typical examples of the classification of temperature sensing controls in accordance with IEC 60730-2-9 ..... 65
Table EE.2 – Examples of controls expected to operate during Clauses 11 and 19 of IEC 60335 (all parts) ..... 69
Table EE.3 – Guidance on the common usage of types of control ..... 70

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

# AUTOMATIC ELECTRICAL CONTROLS –

# Part 2-9: Particular requirements for temperature sensing controls

## FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 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 IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.



**This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.**

**IEC 60730-2-9 edition 4.1 contains the fourth edition (2015-05) [documents 72/990/FDIS and 72/998/RVD] and its amendment 1 (2018-01) [documents 72/1112A/FDIS and 72/1118/RVD].**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**

International Standard IEC 60730-2-9 has been prepared by technical committee TC 72: Automatic electrical controls.

This fourth edition constitutes a technical revision.

This edition includes alignment with the text of 60730-1 fifth edition and the following significant technical changes with respect to the previous edition:

a) modification of heating-freezing tests in Clause 12;
b) alignment of the EMC requirements in H.26 to those in other part 2 standards;
c) addition of requirements in Clause H.27 to cover class B and C control functions of temperature sensing controls;

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

This Part 2-9 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the fifth edition (2013) of that publication. Consideration may be given to future editions of, or amendments to, IEC 60730-1.

This Part 2-9 supplements or modifies the corresponding clauses in IEC 60730-1 so as to convert that publication into the IEC standard: Particular requirements for temperature sensing controls.



Where this Part 2-9 states "addition", "modification", or "replacement", the relevant requirement, test specification or explanatory matter in part 1 should be adapted accordingly.

Where no change is necessary, this part 2 indicates that the relevant clause or subclause applies.

In the development of a fully international standard, it has been necessary to take into consideration the differing requirements resulting from practical experience in various parts of the world and to recognize the variation in national electrical systems and wiring rules.



The “in some countries” notes regarding differing national practices are contained in the following subclauses:

| | | |
|---|---|---|
| 4.1.101 | 17.8.4.101 | Annex AA |
| 7.2, Table 1 | 17.16.101 | Clause CC.2 |
| 11.4.101 | 17.16.102 | DD.9.2 |
| 11.101 | 17.16.105 | EE.3.6 |
| 12.101.3 | 18.102.3 | |
| 13.2 | 23.101 | |

In this publication:

1) The following print types are used:
   – Requirements proper: in roman type;
   – *Test specifications: in italic type;*
   – Notes; in small roman type;
   – Words defined in Clause 2: **bold**.
2) Subclauses, notes, tables and figures which are additional to those in part 1 are numbered starting from 101, additional annexes are lettered AA, BB, etc.

A list of all parts of the IEC 60730 series, published under the title *Automatic electrical controls* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment 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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

# AUTOMATIC ELECTRICAL CONTROLS –

# Part 2-9: Particular requirements for temperature sensing controls

## 1 Scope and normative references

This clause of Part 1 is applicable except as follows:

### 1.1 Scope

*Replacement:*

This part of IEC 60730 applies to automatic electrical temperature **sensing controls** for use in, on or in association with equipment, including **electrical controls** for heating, air-conditioning and similar applications. The equipment may use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof.

NOTE Throughout this standard, the word "equipment" includes "appliance" and "control system".

This standard is applicable to automatic electrical temperature **sensing controls** forming part of a building automation **control system** within the scope of ISO 16484.

This standard also applies to automatic electrical temperature **sensing controls** for equipment that may be used by the public, such as equipment intended to be used in shops, offices, hospitals, farms and commercial and industrial applications.

This standard does not apply to automatic electrical temperature **sensing controls** intended exclusively for industrial process applications, unless explicitly mentioned in the relevant equipment standard.



#### 1.1.1

*Replacement:*

This standard applies to the inherent safety, to the **operating values**, **operating times**, and **operating sequences** where such are associated with equipment safety, and to the testing of automatic electrical temperature **sensing control** devices used in, or in association with, equipment.

NOTE Examples of such **controls** include **boiler thermostats**, **fan controls**, **temperature limiters** and **thermal cut-outs**.

This standard is also applicable to the functional safety of low complexity safety-related temperature **sensing controls** and **systems**.

#### 1.1.2

*Addition:*

This standard also applies to the electrical safety of temperature sensing controls with non-electrical outputs such as refrigerant flow and gas **controls**.

**1.1.3** Not applicable.

**1.1.4**

*Replacement:*

This standard applies to **manual controls** when such are electrically and/or mechanically integral with automatic temperature **sensing controls**.

NOTE Requirements for manual switches not forming part of an **automatic control** are contained in IEC 61058-1.

**1.1.5**

*Replacement:*

This standard applies to a.c. or d.c. powered temperature **sensing controls** with a rated voltage not exceeding 690 V a.c. or 600 V d.c.

**1.1.6**

*Replacement:*

This standard does not take into account the **response value** of an **automatic action** of a temperature **sensing control**, if such a **response value** is dependent upon the method of mounting it in the equipment. Where a **response value** is of significant purpose for the protection of the **user**, or surroundings, the value defined in the appropriate equipment standard or as determined by the manufacturer shall apply.



**1.1.7**

*Replacement:*

This standard applies also to temperature **sensing controls** incorporating **electronic devices**, requirements for which are contained in Annex H and to temperature **sensing controls** using **NTC thermistors** or **PTC thermistors**, requirements for which are contained in Annex J.

*Additional subclause:*

**1.1.101** This standard applies to **single operation devices** as defined in this standard.

### 1.1 Normative references

*Addition:*

IEC 60216-1:2013, *Electrical insulating materials – Thermal endurance properties – Part 1: Ageing procedures and evaluation of test results*

IEC 60691, *Thermal links – Requirements and application guide*

IEC 60730-2-4, *Automatic electrical controls for household and similar use – Part 2-4: Particular requirements for thermal motor protectors for motor-compressors of hermetic and semi-hermetic type*

## 2 Terms and definitions

This clause of Part 1 is applicable except as follows:

## 2.2 Definitions of types of control according to purpose

**2.2.19**
**operating control**

*Add, to the definition, the following note:*

Note 1 to entry: In general, a **thermostat** is an **operating control**.

**2.2.20**
**protective control**

*Add, to the definition, the following note:*

Note 1 to entry: In general, a **thermal cut-out** is a **protective control**.

*Additional definitions:*

**2.2.101**
**single-operation device**
**SOD**
**control** having a temperature **sensing element** which is intended to operate only once and then requires complete replacement

**2.2.101.1**
**bimetallic single-operation device**
**single operation device** (**SOD**) having a bimetallic temperature **sensing element**

Note 1 to entry: A **bimetallic single operation device** (**SOD**) does not reset above a declared temperature (see 11.4.103).

Note 2 to entry: Requirements for thermal links (which are not allowed to reset) are contained in IEC 60691.

**2.2.101.2**
**non-bimetallic single-operation device**
**single operation device** (**SOD**) having a temperature **sensing element** which is part of a combination action **control**, the **operation** of which cannot be separated from other functions of the **control** and having a non-bimetallic thermal element that operates only once and then requires complete or partial replacement

Note 1 to entry: When such parts can be tested separately, they are considered to be thermal links within the scope of IEC 60691.

Note 2 to entry: The ageing period and thermal response of the device is dependent on the intended use of the device. As a result, the nature of the testing applicable to the device is representative of the application conditions for which the **protective control** is intended (see 7.2).

Note 3 to entry: **Non-bimetallic SODs** provide the equivalent of **micro-disconnection**.

**2.2.101.2.1**
**rated functioning temperature**
***$T_f$***
temperature of the **sensing element** of a **non-bimetallic SOD** which causes it to change the state of conductivity of the **control** when measured under specified conditions as declared by the manufacturer

**2.2.102**
**room thermostat**
independently mounted or incorporated **thermostat** intended to control the temperature of habitable space

**2.2.103**
**fan control**
automatic temperature **sensing control** intended to control the **operation** of a fan or blower

**2.2.104**
**boiler thermostat**
**thermostat** intended to control boiler/liquid temperature

**2.2.105**
**modulating thermostat**
**thermostat** which controls the temperature between two limits by continuously controlling the input to the load

**2.2.106**
**voltage maintained thermal cut-out**
**thermal cut-out** which is maintained in its operated condition by the voltage which appears across it in that condition

**2.2.107**
**agricultural thermostat**
**thermostat** intended for use in agricultural confinement buildings

### 2.3 Definitions relating to the function of controls

**2.3.14** *Additional definition:*



**2.3.14.101**
**time factor**
transient response of temperature **sensing controls** by defined change of the **activating quantity**

### 2.5 Definitions of types of control according to construction



*Additional definitions:*

**2.5.101**
**push-and-turn actuation**
**two-step actuation** accomplished by first pushing, then rotating the **actuating member** of the control

**2.5.102**
**pull-and-turn actuation**
**two-step actuation** accomplished by first pulling, then rotating the **actuating member** of the control

## 3 General requirements

This clause of Part 1 is applicable.

## 4 General notes on tests

### 4.1 Conditions of test

This clause of Part 1 is applicable except as follows:

### 4.1 Conditions of test