BS EN IEC 60730-2-9:2019+A1:2019



BSI Standards Publication

Automatic electrical controls

Part 2-9: Particular requirements for temperature sensing controls

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National foreword

This British Standard is the UK implementation of EN IEC 60730-2-9:2019+A1:2019. It is identical to IEC 60730-2-9:2015, incorporating amendment 1:2018. It supersedes BS EN 60730-2-9:2010, which will be withdrawn on 22 February 2022.

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 A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee CPL/72, Electrical control devices for household equipment and appliances.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Amendments/corrigenda issued since publication

Date	Text affected

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60730-2-9:2019/A1

February 2019

ICS 97.120

English Version

Automatic electrical controls - Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2015)

Dispositifs de commande électrique automatiques - Partie 2-9: Règles particulières pour les dispositifs de commande thermosensibles
(IEC 60730-2-9:2015)

Automatische elektrische Regel- und Steuergeräte - Teil 2-9: Besondere Anforderungen an temperaturabhängige Regel- und Steuergeräte
(IEC 60730-2-9:2015)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 72/990/FDIS, future edition 4 of IEC 60730-2-9, prepared by IEC/TC 72 "Automatic electrical controls" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60730-2-9:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-08-22
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-02-22

This document supersedes EN 60730-2-9:2010.

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Endorsement notice

The text of the International Standard IEC 60730-2-9:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated :

IEC 60079	NOTE	Harmonized in EN 60079 series.

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Foreword to amendment A1

The text of document 72/1112/FDIS, future IEC 60730-2-9:2015/A1, prepared by IEC/TC 72 "Automatic electrical controls" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60730-2-9:2019/A1:2019.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2019-08-22
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-02-22

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

IEC 60335-2-2	NOTE	Harmonized as EN 60335-2-2.
IEC 60335-2-3	NOTE	Harmonized as EN 60335-2-3.
IEC 60335-2-4	NOTE	Harmonized as EN 60335-2-4.
IEC 60335-2-5	NOTE	Harmonized as EN 60335-2-5.
IEC 60335-2-6	NOTE	Harmonized as EN 60335-2-6.
IEC 60335-2-7	NOTE	Harmonized as EN 60335-2-7.
IEC 60335-2-8	NOTE	Harmonized as EN 60335-2-8.
IEC 60335-2-9	NOTE	Harmonized as EN 60335-2-9.
IEC 60335-2-11	NOTE	Harmonized as EN 60335-2-11.
IEC 60335-2-13	NOTE	Harmonized as EN 60335-2-13.
IEC 60335-2-14	NOTE	Harmonized as EN 60335-2-14.
IEC 60335-2-15	NOTE	Harmonized as EN 60335-2-15.

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IEC 60335-2-16	NOTE	Harmonized as EN 60335-2-16.
IEC 60335-2-17	NOTE	Harmonized as EN 60335-2-17.
IEC 60335-2-21	NOTE	Harmonized as EN 60335-2-21.
IEC 60335-2-23	NOTE	Harmonized as EN 60335-2-23.
IEC 60335-2-24	NOTE	Harmonized as EN 60335-2-24.
IEC 60335-2-25	NOTE	Harmonized as EN 60335-2-25.
IEC 60335-2-29	NOTE	Harmonized as EN 60335-2-29.
IEC 60335-2-30	NOTE	Harmonized as EN 60335-2-30.
IEC 60335-2-34	NOTE	Harmonized as EN 60335-2-34.
IEC 60335-2-35	NOTE	Harmonized as EN 60335-2-35.
IEC 60335-2-41	NOTE	Harmonized as EN 60335-2-41.
IEC 60335-2-61	NOTE	Harmonized as EN 60335-2-61.
IEC 60335-2-73	NOTE	Harmonized as EN 60335-2-73.
IEC 60335-2-75	NOTE	Harmonized as EN 60335-2-75.
IEC 60335-2-80	NOTE	Harmonized as EN 60335-2-80.
IEC 60335-2-89	NOTE	Harmonized as EN 60335-2-89.
IEC 60730-2-22	NOTE	Harmonized as EN 60730-2-22.

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Annex ZA of EN 60730-1:2016 applies, except as follows:

Publication	Year	Title	EN/HD	Year
Addition:				
IEC 60216-1	2013	Electrical insulating materials - Thermal endurance properties - Part 1: Ageing procedures and evaluation of test results	EN 60216-1	2013
IEC 60691	-	Thermal-links - Requirements and application guide	EN 60691	-
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	EN 60730-2-4	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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

FDIS	Report on voting
72/990/FDIS	72/998/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 fourth edition cancels and replaces the third edition published in 2008, and its Amendment 1:2011. This 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:

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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.

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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.

A bilingual version of this publication may be issued at a later date.

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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**.

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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:

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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

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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:

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4.1 Conditions of test

Additional subclauses:

4.1.101 For the purposes of the tests of this standard and unless otherwise indicated, ambient temperature excursions beyond T_{max} during abnormal **operation** as a precursor to the **operation** of a manual reset **thermal cut-out** or a **bimetallic SOD** are ignored.

NOTE In Canada and the USA, the preceding applies only to **bimetallic SODs**.

4.1.102 For manual reset **thermal cut-outs** and **bimetallic SODs** which have an **operating value** above T_{max}, the temperature at the **sensing element** is raised, as necessary, to achieve any cycling required during the tests.

4.2 amples required

4.2.1 *Addition:*

Six samples of **bimetallic SODs** are used for the test of Clause 15 and a further six for the test of Clause 17.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows:

6.4 According to features of automatic action

6.4.3 *Additional subclauses:*

6.4.3.101 – for sensing actions, no increase in the **operating value** as a result of any leakage from the **sensing element**, or from parts connecting the **sensing element** to the **switch head** (type 2.N);

6.4.3.102 – an action which operates after a declared thermal cycling test as specified in 17.101 (type 2.P);

NOTE In general, **thermal cut-outs** for specific applications, such as pressurized water heating systems, may be classified as having Type 2.P action.

6.4.3.103 – an action which is initiated only after a **push-and-turn actuation** or **pull-and-turn actuation** and in which only rotation is required to return the **actuating member** to the **OFF position** or rest position (type 1.X or 2.X);

6.4.3.104 – an action which is initiated only after a **push-and-turn actuation** or **pull-and-turn actuation** (type 1.Z or 2.Z);

6.4.3.105 – an action which cannot be reset under electrically loaded conditions (type 1.AK or 2.AK);

6.4.3.106 – an action which operates after declared agricultural environmental exposures (type 1.AM or 2.AM).

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6.7 According to ambient temperature limits of the switch head

Additional subclauses:

6.7.101 **Controls** for use in or on cooking appliances.

6.7.102 **Controls** for use in or on ovens of the self-cleaning type.

6.7.103 **Controls** for use in or on food-handling appliances.

6.7.104 The **non-bimetallic SODs** are limited for use in appliances for heating or employing liquids or steam. It is not suitable for instantaneous water heaters and storage water heaters.

6.8.3 *Modification:*

Replace the first paragraph by:

For an **in-line cord control**, a free standing control, an **independently mounted control** or a **control** integrated or incorporated in an assembly utilizing a non-electrical energy source:

6.15 According to construction

Additional subclause:

6.15.101 – **controls** having parts containing liquid metal.

7 Information

This clause of Part 1 is applicable except as follows:

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7.2 Methods of providing information

Table 1 – Required information and methods of providing information

Addition:

	Information	Clause or subclause	Method
101	Maximum **sensing element** temperature (other than relevant to requirement 105) [101]	6.7 6.15 14.101	X
102	**Time factor** with or without sheath	2.3.14.101 11.101 BB.1.2	X
103	**SOD** reset temperature (either –35 °C or 0 °C)	2.2.101 11.4.103 17.15.2.3	X
104	Number of cycles for **bimetallic SOD** with 0 °C reset	17.15.1.3.1	X
105	Maximum **sensing element** temperature for the test of 17.16.107 (T_e)	6.7.102 17.16.107	D
106	**Controls** having parts containing liquid metal [102]	6.15.101 11.1.101 18.102	D
107	Tensile yield strength	11.1.101	X
108	Minimum current for the purpose of the test of 23.101 [103]	23.101	D
109	$T_{max.1}$ is the maximum ambient temperature in which the **control** may remain continuously in the operated condition so that Table 13 temperatures are not exceeded [105]	14.4.3.1	D
110	Time period t_1 is the maximum time during which the ambient temperature can be higher than $T_{max.1}$ after the **control** has operated [105]	14.4.3.1	D
111	Temperature limit above which automatic reset of a manual reset thermal cut-out or a **voltage maintained thermal cut-out** shall not occur (not higher than –20 °C)	2.2.106 11.4.106 17.16.104.1 17.16.108	X
112	For type 2.P **controls**, the method of test	17.101	X
113	The click rate *N* or switching **operations** per minute for the purposes of testing to CISPR 14-1	23	X
114	**Rated functioning temperature** (T_f)	2.2.101.2.1 17.15.2	C
115	Ageing temperature for **non-bimetallic SOD** [106]	17.15.2.2 17.15.2.3	D
116	Rate of rise of temperature for testing **non-bimetallic SOD** [107]	17.15.2.2 17.15.2.3	D
117	**Agricultural thermostat**	2.2.107 6.4.3.106 11.4.107 11.6.3.101 Annex DD	D

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Additional footnotes:

101 This declaration applies only to temperature **sensing controls** containing liquid metal. For temperature **sensing controls** used in or on self-cleaning ovens, this declaration is the temperature for the cooking **operation**.

102 A1 In China, the use of liquid metal in or on cooking or food handling equipment is not allowed.

In Canada parts of controls containing mercury is not allowed. A1

103 When no minimum is declared, the test value is 15 mA.

105 Consideration should be given to the provision of information by the **equipment manufacturer** relating to the minimum time that the appliance has to be disconnected from the supply to allow a **voltage maintained thermal cut-out** to reset.

106 Determined by the **control manufacturer** based on the opening temperature of the **thermal-cut-out**.

107 Determined by the **control manufacturer** referring to the actual maximum rate of rise probable in the projected end-use equipment.

8 Protection against electric shock

This clause of Part 1 is applicable.

9 Provision for protective earthing

This clause of Part 1 is applicable.

10 Terminals and terminations

This clause of Part 1 is applicable.

11 Constructional requirements

This clause of Part 1 is applicable except as follows:

11.1 Materials

Additional subclauses:

11.1.101 Parts containing liquid metal

For **controls** declared under Table 1, requirement 106, parts that contain mercury (Hg), and parts of any **control** that contain sodium (Na), potassium (K), or both, shall be constructed of metal that has a tensile yield strength at least four times the circumferential (hoop) or other stress on the parts at a temperature 1,2 times the **maximum temperature** of the **sensing element** (T_e).

Compliance is checked by inspection of the manufacturer's declaration and by the test of 18.102.

11.1.102 Material for non-bimetallic SODs

Insulating material used in **non-bimetallic SODs** as defined in this standard shall comply with the requirements of IEC 60216-1:2013 and be suitable for the application.

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11.3 Actuation and operation

11.3.9 Pull-cord actuated control

Addition:

NOTE 101 Note 2 is not applicable to **controls** classified as type 1.X or 2.X or type 1.Z or 2.Z.

11.4 Actions

11.4.3 Type 2 action

Additional subclauses:

11.4.3.101 Capacitors shall not be connected across the contacts of a **thermal cut-out**.

11.4.3.102 Constructions requiring a soldering **operation** to reset **thermal cut-outs** are not permitted.

11.4.13 Type 1.K or 2.K action

Additional subclauses:

11.4.13.101 A type 2.K action shall be so designed that in the event of a break in the **sensing element**, or in any other part between the **sensing element** and the **switch head**, the declared disconnection or interruption is provided before the sum of the declared **operating value** and **drift** is exceeded.

*Compliance is checked by breaking the **sensing element**. The breaking may be achieved by partly pre-cutting or filing through.*

*The temperature **sensing control** is heated to within 10 K of the operating temperature and the temperature then increased at a rate not to exceed 1 K/min. The contacts shall open before the sum of the declared **operating value** plus **drift** is exceeded.*

11.4.13.102 Type 2.K action may also be achieved by compliance with a), b) or c).

a) Two **sensing elements** operating independently from each other and actuating one switch head.

b) Bimetallic **sensing elements** with

   1) exposed elements attached with at least double spot welding of the bimetal at both of its ends, or

   2) elements so located or installed in a **control** of such construction that the bimetal is not likely to be physically damaged during installation and use.

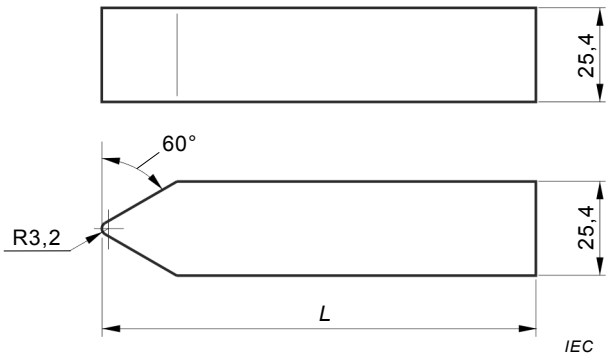
c) If the loss of the fluid fill causes the contacts of the **control** to remain closed or leakage causes upward shift beyond the declared maximum operating temperature, the bulb and capillary of a temperature **sensing control** which is actuated by a change in the pressure of a fluid confined in the bulb and capillary shall conform to the following.

   There shall be no damage to the bulb or capillary to the extent which will permit escape of any of the fill when an impact **tool**, as illustrated in Figure 101, is dropped once from a height of 0,60 m so that the tapered end of the **tool** strikes the bulb or capillary in a perpendicular position. For this test, the capillary or the bulb shall be on a concrete surface.

   If the capillary is provided with a separate shroud or sleeve, it is to be left in place during the test described above.

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Dimensions in millimetres



Material: Steel, CRS, Break all corners

L to be sized to obtain total mass of 0,454 kg

Figure 101 – Impact tool

Additional subclauses:

11.4.101 Type 2.N action

A type 2.N action shall be so designed that in the event of a leak in the **sensing element**, or in any other part between the **sensing element** and the **switch head**, the declared disconnection or interruption is provided before the sum of the declared **operating value** and **drift** is exceeded.

Compliance is checked by the following test:

*The **operating value** of a type 2.N **control** is measured under the conditions of Clause 15 of Part 1. If the **control** has means for **setting**, it is set to the highest value.*

*After this measurement, a hole is artificially produced in the **sensing element** and the measurement of the **operating value** is repeated.*

*No positive **drift** is allowed above the declared value.*

A separate shroud or sleeve may be employed for protection of the bulb and capillary to achieve conformance with Clause 18.

NOTE 1 The test can be replaced by theoretical computations of the physical mode of operation.

NOTE 2 In Canada and the USA, a type 2.N action is checked by item c) of 11.4.13.102.

11.4.102 Type 2.P action

A type 2.P action shall be so designed that it operates in its intended manner after a thermal cycling test.

Compliance is checked by the test of 17.101.

11.4.103 Bimetallic single-operation device

A **bimetallic single-operation device** shall be so designed that it does not reset above the reset value declared in Table 1, requirement 103.

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Compliance is checked by the test of 17.15.

11.4.104 Type 1.X or 2.X

A type 1.X or 2.X action shall be so designed that a turn action can only be accomplished after the completion of a push-action or a pull-action. Only rotation shall be required to return the **actuating member** of the **control** to the **OFF position** or rest position.

Compliance is checked by the tests of 18.101.

11.4.105 Type 1.Z or 2.Z

A type 1.Z or 2.Z action shall be so designed that a turn action can only be accomplished after the completion of a push-action or a pull-action.

Compliance is checked by the tests of 18.101.

11.4.106 Voltage maintained thermal cut-out

A **voltage maintained thermal cut-out** shall be so designed that it does not reset above the reset value declared in Table1, requirement 111.

11.4.107 Type 1.AM or 2.AM

A type 1.AM or 2.AM action shall be so designed that it operates in its intended manner after the declared agricultural environmental exposures.

Compliance is checked by the tests of Annex DD.

11.6 Mounting of controls

11.6.3 Mounting of independently mounted controls

Additional subclause:

11.6.3.101 For **agricultural thermostats** declared in Table 1, requirement 117, the mounting method shall be such that the integrity of the protection by the enclosure is not compromised.

Additional subclause:

11.101 Time factor

If a **time factor** is declared, this shall be checked by one of the applicable determining methods as indicated in Annex BB. The determined value shall not exceed the rated values. See Table BB.1.

NOTE In Germany, for temperature **sensing controls** intended to control boiler water or flue gas temperature in heat generating systems, the maximum values of **time factor** given in Table BB.1 shall not be exceeded.

12 Moisture and dust resistance

This clause of Part 1 is applicable except as follows:

Additional subclauses:

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