



UL 60730-2-9

STANDARD FOR SAFETY

Standard for Automatic Electrical Controls – Part
2-9: Particular Requirements for Temperature
Sensing Controls

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UL Standard for Safety for Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9

Fourth Edition, Dated February 14, 2017

Summary of Topics

This new edition of ANSI/UL 60730-2-9 adopts the fourth edition of IEC 60730-2-9 with national differences.

The new requirements are substantially in accordance with Proposal(s) on this subject dated December 2, 2016.

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February 14, 2017

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ANSI/UL 60730-2-9-2017

UL 60730-2-9

**Standard for Automatic Electrical Controls – Part 2-9: Particular
Requirements for Temperature Sensing Controls**

Prior to the first edition of UL 60730-2-9, the requirements for the products covered by this Standard were included in UL 8730-2-9.

First Edition – January, 2003

Third Edition – October, 2010

Fourth Edition

February 14, 2017

This ANSI/UL Standard for Safety consists of the Fourth Edition.

The most recent designation of ANSI/UL 60730-2-9 as an American National Standard (ANSI) occurred on February 14, 2017. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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Preface (UL)

This UL Standard is based on IEC Publication IEC 60730-2-9: Fourth edition Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls. IEC publication 60730-2-9 is copyrighted by the IEC.

This UL Standard 60730-2-9, Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, is to be used in conjunction with the fifth edition of UL 60730-1. The requirements for temperature sensing controls are contained in this Part 2 Standard and UL 60730-1.

Requirements of this Part 2 Standard, where stated, amend the requirements of UL 60730-1.

Where a particular subclause of UL 60730-1 is not mentioned in UL 60730-2-9, the UL 60730-1 subclause applies.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication IEC 60730-2-9 are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are national differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

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 nongovernmental 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:

- 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;*

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- 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 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.

101DV DE *Modification of Item (1) of the part 2:*

- Words in SMALL ROMAN CAPITALS in the text are defined in Clause 2.

102DV DE *Addition to the part 2:*

The numbering system in the Standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

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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 nonelectrical 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.

1.1.101DV D2 Modify text of 1.1.101 with the following:

This standard applies to single operation devices, thermostats for drip-type coffee makers, self-heating thermal protectors (SHTP) for recessed lighting fixtures, and Fan/Heat sequencers as defined in this standard.

1.2 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

2.2.107ADV D2 Add the following definitions to Clause 2.2:**2.2.107ADV.1**

THERMOSTATS FOR DRIP-TYPE COFFEE MAKERS — an automatic thermostat (operating control with type 2 action) intended for use in household Drip-Type Coffee Makers.

2.2.107ADV.2

SET-POINT TEMPERATURE RATING (T_{s-p}) FOR THERMOSTATS FOR USE IN DRIP-TYPE COFFEE MAKERS — The temperature at which the thermostat's electrical load switching contacts change state upon temperature rise. For adjustable thermostats the Set-Point Temperature Rating (T_{s-p}) is the temperature at which the thermostat's electrical load switching contacts change state, upon temperature rise, with the thermostat adjusted to the maximum temperature setting. This rated value is a nominal figure of a temperature range. The range is defined by the allowable tolerances specified in Table 7.2

2.2.107ADV.3

OPERATING TEMPERATURE INITIAL (T_{OP-INT}) FOR THERMOSTATS FOR USE IN DRIP-TYPE COFFEE MAKERS – A temperature, measured during the deviation test, at which the thermostat's electrical load switching contacts change state upon temperature rise. If multiple trials of the deviation test are conducted, this value is the arithmetic average of up to three trials.

2.2.107ADV.4

OPERATING TEMPERATURE FINAL (T_{OP-FIN}) FOR THERMOSTATS FOR USE IN DRIP-TYPE COFFEE MAKERS – A temperature, measured during the drift test conducted after the endurance test sequence, at which the thermostat's electrical load switching contacts change state upon temperature rise. If multiple trials of the final drift test are conducted, this value is the arithmetic average of up to three trials.

2.2.107ADV.5

MAXIMUM NORMAL USE TEMPERATURE RATING (T_{MAX}) FOR THERMOSTATS FOR USE IN DRIP-TYPE COFFEE MAKERS – The maximum temperature permitted on the thermostat's sensing surface during normal operation of the coffee maker. This temperature is equal to or greater than T_{s-p} .

2.2.107ADV.6

MAXIMUM DRY OPERATION TEMPERATURE RATING (T_{DRY}) FOR THERMOSTATS FOR USE IN DRIP-TYPE COFFEE MAKERS – The maximum temperature permitted on the thermostat's sensing surface during abnormal (dry) operation of the coffee maker. This temperature is equal to or greater than T_{max} .

2.2.107ADV.7

RESET TEMPERATURE (T_{RESET}) FOR THERMOSTATS FOR USE IN DRIP-TYPE COFFEE MAKERS – A temperature at which the thermostat's electrical load switching contacts change state upon temperature fall. This value is a performance-based value noted during the endurance test. This temperature need not be declared by the manufacturer. Deviation and Drift tolerances are not applied to T_{reset} .

2.2.107BDV D2 Add the following definition to Clause 2.2:**2.2.107BDV.1**

FAN/HEAT SEQUENCER – a combination control (operating control with type 2 action) that may be used alone or with other devices to sequentially control a fan and heater or heating elements in electric central air-heating equipment.

2.2.107CDV D2 Add the following definition to Clause 2.2:**2.2.107CDV.1**

SELF-HEATING THERMAL PROTECTORS (SHTP) – a thermal protective device consisting of a temperature sensitive switching element and a load voltage heater within a common housing.

When mounted on a non-Type IC recessed fixture, the SHTP is intended to cycle under field related abnormal heating conditions. An SHTP is a protective control as defined in this standard.

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:

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 Samples 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.

4.2.1DV D2 Modify Clause 4.2.1 by adding the following:

Additional samples of the Self-heating thermal protectors (SHTP) are required for the tests of Clauses 15, 17 and 27.

4.3.5.101DV D2 Add Clause 4.3.5.101DV.1 to the Part 2:

4.3.5.101DV.1 The values in Annex CC.2 apply for the testing of INDEPENDENTLY MOUNTED, FREE STANDING and cord-connected temperature SENSING CONTROLS in Clause 17. Unless otherwise specified in the appropriate equipment standard, the values in Annex CC.2 also apply for INTEGRATED and INCORPORATED CONTROLS.

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).

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.

6.7.103ADV D2 Add Clause 6.7.103ADV.1 to Clause 6.7.103:

6.7.103ADV.1 Thermostats for use in household drip-type coffee makers.

6.7.103BDV D2 Add Clause 6.7.103BDV.1 to Clause 6.7.103:

6.7.103BDV.1 Self-heating thermal protectors for use in recessed lighting fixtures.

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:

7.2 Methods of providing information

Addition:

Table 1 – Required information and methods of providing information

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
<i>Additional footnotes:</i> 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 In China, the use of liquid metal in or on cooking or food-handling equipment is not allowed. In Germany, CONTROLS using liquid metal are allowed only with a special marking on the control. Documentation (D) shall contain a clear warning of the actual danger that may occur. The following symbol shall be used for marking the control:  In Canada, the use of mercury is not allowed. 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.			

Table 7.2DV D2 Addition of the following to Table 7.2:

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Table 7.2DV.1

Information	Clause or subclause	Method
117ADV Date code of manufacturing for INDEPENDENTLY MOUNTED CONTROLS ^{105ADV}		C
117BDV Set-point Temperature Rating (T_{s-p})	2.2.107BDV, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117CDV Operating Temperature – Initial ($T_{op-init}$)	2.2.107ADV.3, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	–
117DDV Operating Temperature – Final (T_{op-fin})	2.2.107ADV.4, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	–
117EDV Maximum Normal Use Temperature Rating (T_{max})	2.2.107ADV.5, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117FDV Maximum Dry Operation Temperature Rating (T_{dry})	2.2.107ADV.6, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117GDV Reset Temperature (T_{reset})	2.2.107ADV.7, 15.5.6ADV, 15.5.6BDV, 17.16.102ADV.1	X
117HDV Number of Timings	2.2.107BDV, 15.5.6BDV, 15.5.6CDV, 15.5.6CDV.1.2, 17.16.102BDV.1	X
117IDV Time-to-open (“off”), sec (range) for a given ambient temperature	2.2.107BDV, 15.5.6BDV, 15.5.6CDV, 15.5.6CDV.1.2, 17.16.102BDV.1	X
117JDV Time-to-close (“on”), sec (range) for a given ambient temperature	2.2.107BDV, 15.5.6BDV, 15.5.6CDV, 15.5.6CDV.1.2, 17.16.102BDV.1	D
NOTES Additional notes ^{105A)} The date code shall be the date or other dating period of manufacture not exceeding any three consecutive months. The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code: a) Does not repeat in less than 20 years, and b) Does not require reference to the product records of the manufacturer to determine when the product was manufactured.		

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 subclause:

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.

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.

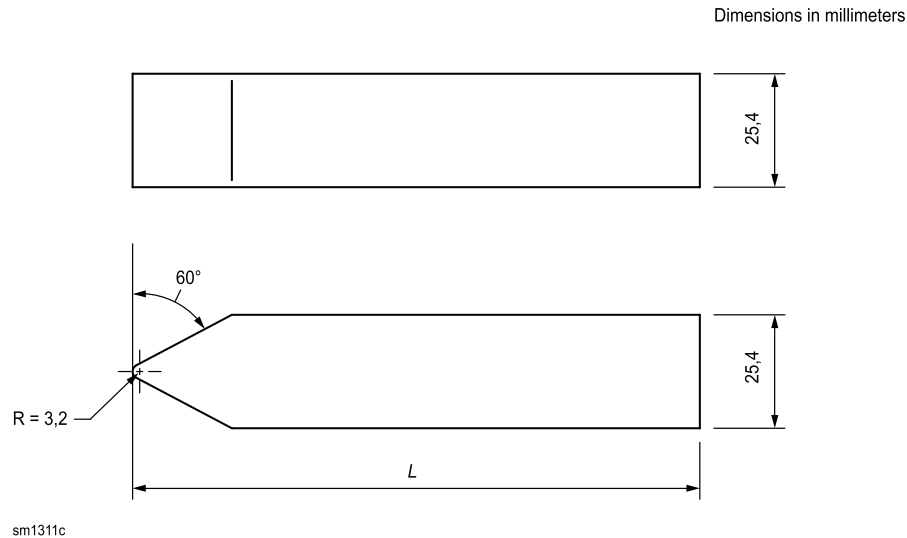
b) Bimetallic SENSING ELEMENTS with

- 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.



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.

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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.

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 Table 1, 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.

11.11.101DV D2 Addition of 11.11.101DV.1 – 11.11.101DV.3 to 11.11 to the Part 1:

11.11.101DV.1 A cut-out or limiter incorporating a transformer, relay, or the like shall be supplied by a one-side grounded system with a voltage rating not exceeding 120 volts nominal. A switch or protective device shall be connected in the ungrounded supply conductor circuit.

11.11.101DV.2 A mercury switch shall be enclosed. Wire leads shall be as short as possible and terminate at eyelets or the equivalent, or in soldered connections at terminal plates in the supporting box or shall be fastened so that no strain is placed on the mechanism.

11.11.101DV.3 An INDEPENDENTLY MOUNTED CONTROL with manual reset shall be resettable from the exterior of the enclosure.

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:

12.101 Refrigeration controls

CONTROLS which have the SWITCH HEAD and SENSING ELEMENT mounted in the evaporator of refrigeration or similar equipment, producing conditions of over temperature and of freezing and melting, shall maintain insulation integrity.

12.101.1 *Compliance is checked by the following tests.*