UL 60730-2-15

STANDARD FOR SAFETY

Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls

UL Standard for Safety for Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls, UL 60730-2-15

Third Edition, Dated November 6, 2019

Summary of Topics

This new edition of ANSI/UL 60730-2-15 is an adoption of the third edition of IEC 60730-2-15. This new edition dated November 6, 2019, was issued to reflect the latest approval date as an American National Standard that was proposed June 28, 2019.

The requirements are substantially in accordance with Proposal(s) on this subject dated June 28, 2019.

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Standard for Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls

Prior to the second edition of UL 60730-2-15, the requirements for the products covered by this Standard were included in UL 60730-2-16A and in UL 60730-2-18.

Second Edition – July, 2014

Third Edition

November 6, 2019

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

The most recent designation of ANSI/UL 60730-2-15 as an American National Standard (ANSI) occurred on November 6, 2019. 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 60730-2-15: third edition Automatic electrical controls – Part 2-15: Particular requirements for automatic electrical air flow, water flow and water level sensing controls. IEC publication 60730-2-15 is copyrighted by the IEC.

This UL Standard 60730-2-15 Standard for Safety for Automatic Electrical Controls – Part 2-15: Particular requirements for automatic electrical air flow, water flow and water level sensing controls, is to be used in conjunction with the fifth edition of UL 60730-1. The requirements for automatic electrical air flow, water flow and water level sensing controls are contained in this Part 2 Standard and UL 60730-1.

Where a particular subclause of UL 60730-1 is not mentioned in UL 60730-2-15, the UL 60730-1 subclause applies.

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 60730-2-15, Automatic Electrical Controls – Part 2-15: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls, copyright 2017, 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.

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.

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

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

AUTOMATIC ELECTRICAL CONTROLS – Part 2-15: Particular requirements for automatic electrical air flow, water flow and water level sensing controls

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.

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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.

International Standard IEC 60730-2-15 has been prepared by IEC technical committee 72: Automatic electrical controls.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) changes to align with the fifth edition of 60730-1, including the revised title.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
72/1080/FDIS	72/1101/RVD

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

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

This Part 2-15 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the 5th edition of that standard (2013). Consideration may be given to future editions of, or amendments to, IEC 60730-1.

This part 2-15 supplements or modifies the corresponding clauses in IEC 60730-1, so as to convert that publication into the IEC standard: Particular requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls.

Where this document 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 document indicates that the relevant clause or subclause of Part 1 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:

• 10.1.4,

• 12.1.101.

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 in the IEC 60730 series, published under the general title *Automatic electrical controls*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore. iec. ch" in the data related to the specific document. At this date, the document will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

101DV DE *Modification of the 7th paragraph after item (9) by replacing it with the following paragraph:*

This Part 2-15 is intended to be used in conjunction with UL 60730-1, edition 5.

102DV DE *Modification of Item (1) of the paragraph starting with, "In this publication"*

– words in SMALL ROMAN CAPITALS in the text are defined in clause 2.

103DV 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.

No Text on This Page

AUTOMATIC ELECTRICAL CONTROLS – Part 2-15: Particular requirements for automatic electrical air flow, water flow and water level 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 air flow, water flow and water level sensing controls for use in, or in association with, boilers with a maximum pressure rating of 2 000 kPA (20 bar) and equipment for general household and similar use including controls for heating, air-conditioning and similar applications.

NOTE Examples are water flow and water level sensing controls of the float or electrode-sensor type used in boiler applications and air flow, water flow and water level sensing controls for swimming pool pumps, water tank pumps, cooling towers, dishwashers, washing machines, air conditioning chillers and ventilation applications.

This document also applies to automatic electrical air flow, water flow and water level 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.

1.1.1
Replacement:

This document applies to the inherent safety, to the operating values, operating sequences where such are associated with equipment protection, and to the testing of automatic electrical air flow, water flow and water level sensing controls used in, or in association with, equipment.

This document is also applicable to controls for appliances within the scope of IEC 60335-1.

Automatic electrical air flow, water flow and water level sensing controls for equipment not intended for normal household use, but which nevertheless may be used by the public, such as equipment intended to be used by laymen in shops, in light industry and on farms, are within the scope of this document.

This document is also applicable to individual controls utilized as part of a control system or controls which are mechanically integral with multifunctional controls having non-electrical outputs.

This document is not applicable to pressure sensing controls, requirements for which are contained in IEC 60730-2-61.[1].

[1] IEC 60730-2-6, *Automatic electrical controls – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*.

This document does not apply to air flow, water flow and water level sensing controls designed exclusively for industrial applications unless explicitly mentioned in the relevant equipment standard.

NOTE Throughout this document, the word "equipment" means "appliance and equipment".

1.1.1DV D2 *Modification of the sixth paragraph of 1.1.1 by adding the following text:*

This document also applies to air flow, water flow and water level sensing controls used in commercial and industrial applications where no other standard currently covers the product.

1.1.2 *Addition:*

This document applies to automatic electrical controls, mechanically or electrically operated, responsive to or controlling air flow, water flow and water level.

1.1.3 Not applicable.

NOTE Requirements for manual switches not forming part of an automatic control are contained in IEC 60669 and IEC 61058-1.

1.1.5 *Replacement:*

This document applies to a. c. or d. c. automatic electrical air flow, water flow and water level sensing controls with a rated voltage not exceeding 690 V a.c. or 600 V d.c.

1.1.6 *Replacement:*

This document takes into account the response value of an automatic action of a control where such a response value is dependent upon the method of mounting the control. Where a response value is of significant purpose for the protection of the user, or surroundings, the value defined in the appropriate household equipment standard or as determined by the manufacturer shall apply.

1.1.7 *Replacement:*

This document applies also to controls incorporating electronic devices, requirements for which are contained in Annex H.

This document applies also to controls using NTC and PTC thermistors, requirements for which are contained in Annex J.

2 Terms and definitions

This clause of Part 1 is applicable except as follows:

2.2 Definitions of types of control according to purpose

Additional definitions:

2.2.101
BOILER WATER LEVEL CUT-OUT
water level SENSING CONTROL of the float or electrode-sensor type for boiler applications intended to respond to a low water level during abnormal operating conditions and which has no provision for SETTING BY THE USER

Note 1 to entry: A water level cut-out may be of the automatic or of the manual reset type. A boiler water level cutout is a type of WATER LEVEL PROTECTIVE CONTROL (see 2.2.105).

2.2.102
BOILER WATER LEVEL LIMITER
water level SENSING CONTROL of the float or electrode-sensor type for boiler applications which is intended to keep a water level below or above one particular value during normal operating conditions and which may have provision for SETTING BY THE USER

Note 1 to entry: A BOILER WATER LEVEL LIMITER is normally of the automatic reset type.

2.2.103
BOILER WATER FEED CONTROL
water level SENSING CONTROL of the float or electrode-sensor type for boiler applications which is intended to keep the water level in a boiler above one particular value during normal operating conditions and which may have provision for SETTING BY THE USER

Note 1 to entry: A BOILER WATER FEED CONTROL is of the automatic reset type. A BOILER WATER FEED CONTROL is used on a boiler to cycle a feeder pump or feeder water valve. For the purposes of this document, a type 2 BOILER WATER FEED CONTROL is considered to be a BOILER WATER LEVEL LIMITER.

2.2.104
WATER LEVEL OPERATING CONTRO
control which is intended to keep the water level below or above one particular value during normal operating conditions and which may have provision for SETTING BY THE USER

Note 1 to entry: A WATER LEVEL OPERATING CONTROL is of the automatic reset type.

2.2.105
WATER LEVEL PROTECTIVE CONTROL
control which is intended to prevent a hazardous situation during abnormal OPERATION of the equipment either by

a) keeping the water level below or above one or more particular values, or by

b) energizing or de-energizing the associated equipment at one or more particular values of water level.

2.2.106
WATER FLOW OPERATING CONTROL
flow SENSING CONTROL intended to sense or maintain the water flow between two particular values during normal operating conditions and which may have provision for SETTING BY THE USER.

Note 1 to entry: A WATER FLOW OPERATING CONTROL is of the automatic reset type.

2.2.107
AIR FLOW OPERATING CONTROL
flow SENSING CONTROl intended to sense or maintain the air flow between two particular values during normal operating conditions and which may have provision for setting by the user

Note 1 to entry: An AIR FLOW OPERATING CONTROL is of the automatic reset type.

2.2.108
WATER FLOW CUT-OUT
flow SENSING CONTROL intended to respond to a lack of water flow during abnormal operating conditions and which has no provision for SETTING BY THE USER

Note 1 to entry: A WATER FLOW CUT-OUT is of the automatic or manual reset type.

2.2.109
AIR FLOW CUT-OUT
flow SENSING CONTROL intended to respond to a lack of air flow during abnormal operating conditions and which has no provision for SETTING BY THE USER

Note 1 to entry: An AIR FLOW CUT-OUT is of the automatic or manual reset type.

2.3 Definitions relating to the function of controls

Additional definition:

2.3.101
RESPONSE DELAY
delay provided to increase the response value of a WATER LEVEL OPERATING CONTROL for the purpose of preventing unnecessary cycling of the equipment due to fluctuating liquid level.

Note 1 to entry: This is usually expressed in units of time.

3 General requirements

This clause of Part 1 is applicable.

4 General notes on tests

This clause of Part 1 is applicable except as follows:

4.1 Conditions of test

4.1.7 *Addition:*

The rates of change of level or flow declared in Table 1 and used in Clause 17 (i.e. α1, β1, α2, β2) shall have test tolerances as declared by the manufacturer.

4.3 Instructions for test

Additional subclause:

4.3.1.101 The values in Table AA.1 apply for the testing of independently mounted water level sensing controls used in boiler applications in 17 unless a higher number is declared. The values in Table CC.1 apply for the testing of independently mounted air and water flow SENSING CONTROLS in 17 unless otherwise declared. Values for integrated and incorporated CONTROLS are specified in the appropriate equipment standard.

4.3.5.1 *Modification:*

The second sentence is not applicable to combinations of boiler water level SENSING CONTROLS using a common sensing mechanism.

5 Rating

This clause of Part 1 is applicable.

6 Classification

This clause of Part 1 is applicable except as follows:

6.3 According to their purpose

6.3.9
Additional subclauses:

6.3.9.101 – BOILER WATER LEVEL CUT-OUT;

6.3.9.102 – BOILER WATER LEVEL LIMITER;

6.3.9.103 – BOILER WATER FEED CONTROL;

6.3.9.104 – WATER LEVEL OPERATING CONTROL;

6.3.9.105 – WATER LEVEL PROTECTIVE CONTROL;

6.3.9.106 – AIR FLOW OPERATING CONTROL;

6.3.9.107 – WATER FLOW OPERATING CONTROL;

6.3.9.108 – AIR FLOW CUT-OUT;

6.3.9.109 – WATER FLOW CUT-OUT.

6.4 According to features of automatic action

6.4.1
Additional subclause:

6.4.1.101 – BOILER WATER FEED CONTROLS within the scope of this standard document are classified as having TYPE 1 ACTION.

For the purpose of this document, a TYPE 2 BOILER WATER FEED CONTROL is considered to be a BOILER WATER LEVEL LIMITER.

6.4.2
Additional subclause:

6.4.2.101 – BOILER WATER LEVEL CUT-OUTS and BOILER WATER LEVEL LIMITERS within the scope of this document are classified as having TYPE 2 ACTION.

6.4.3
Additional subclause:

6.4.3.101 – manual reset boiler water level SENSING CONTROLS within the scope of this document shall have a trip-free mechanism classified as type 2.D, 2.H or 2.J action;

6.4.3.102 – an action incorporating RESPONSE DELAY (type 1.AJ or 2.AJ).

6.5 According to the degree of protection and control pollution degree

6.5.2 *Addition:*

Controls declared in Table 1, requirement 107, to be wholly or partially submerged in water during usage shall have enclosures classified as IPX8 which provide protection against continuous immersion in water as specified in IEC 60529.

7 Information

This clause of Part 1 is applicable except as follows:

Table 1
(7.2 of edition 3) – Required information and methods of providing information

Information	Clause or subclause	Method
Modifications:		
23 Temperature limits of mounting surfaces (T_s)	6.12.2, 14.1, 17.3	D
27 Number of automatic cycles (A) for each automatic action [101)]	6.11, 17.8, 17.9	X
34 Not applicable		
44 Not applicable		
Additional requirements:		
101 Maximum fluid temperature (T_L) in °C	14.5.1	D
102 Response time, if applicable, for boiler water level SENSING CONTROLS	15	C
103 Maximum working pressure, if applicable	2.3.29, 18.102	C/D[(104)]
104 Method of determining response time for boiler water level SENSING CONTROLS	15.6.101	X
105 Test method for 18.101.2 for boiler water level SENSING CONTROLS	18.101.2	X
106 Any special environmental conditions in which the control is intended to be used (other than declared in Table Table 1, requirement 15)[102)]	12.1.101	D
107 Cord-connected float control which may be wholly or partially submerged in water or any other special environmental conditions declared in requirement 106	6.5.2, 11.7.1.1, 11.7.1.2.1, 11.7.1.2.2, 12.1.1.101	D
108 RESPONSE DELAY	2.3.101, 6.4.3.102, 11.4.101, H.11.12.8, Table BB.1	D
109 Unique or common type reference of special mounting means, if any[103)]	11.6.3.1	C
110 Leveling indication for mounting, if any	11.11.101	C

Additional notes:

[101)] The minimum number of automatic cycles is 6 000 for water level SENSING CONTROLS of the float type.

[102)] This information may be taken from the appropriate IEC equipment standard or may be as declared by the manufacturer.

[103)] The unique or common type reference(s) shall be marked on both the mounting means and the control.

[104)] Method C is required for air flow, water flow and boiler water level SENSING CONTROLS.

Modification in Note i of the table:

Replace "Air flow" with "Air flow or water flow".

Addition to Note i:

For water level CONTROLS, limits of activating quantity are specified either in the applicable household appliance standard, by the appliance manufacturer or as declared by the water level control manufacturer (see 17.7 and 17.8).

Table 1DV D2 *Modification of Table 1 with the following two national differences:*

DV.1 Insert row 2A, with the first column being "2A", the second column being "Date code of manufacturing for INDEPENDENTLY MOUNTED CONTROLS[105A]", the third column being "blank" and the fourth column being "C".

DV.2 Add: "Note 105A – The date code shall be the date or other dating period of manufacture not exceeding any three consecutive months. The date of manufacture is able to be abbreviated, in a nationally accepted conventional code, or in a code affirmed by the manufacturer. When a manufacturer's code is used, the code:

a) Must not repeat in less than 20 years, and;

b) Must 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 except as follows:

10.1 Terminals and terminations for external copper conductors

10.1.4 *Additional note:*

NOTE 101 In Canada and the USA, controls for operation above 50 V shall be provided with suitable wiring terminals or leads for the connection of fixed wiring conductors having an ampere rating of no less than:

• 1,25 times the ampere rating of a fixed electric space-heating equipment load;

• 1,25 times the full-load motor current rating of a single motor;

• 1,25 times the combination load of a full-load motor current and 1,25 times a fixed electric space-heating equipment load;

• 1,25 times the full load current of the largest motor plus the full load amperes of the other loads;

• 1,0 times all other loads.

Compliance is checked by inspection

10.1.4DV D2 ***Delete the above note to 10.1.4.***

11 Constructional requirements

This clause of Part 1 is applicable except as follows:

11.4 Actions

11.4.11 Type 1.H or 2.H action

Modification:

Delete the last sentence of the first paragraph.

11.4.12 Type 1.J or 2.J action

Modification:

Delete the last sentence of the first paragraph.

Additional subclause:

11.4.101 Type 1.AJ or 2.AJ action

A type 1.AJ or 2.AJ action shall be designed such that a RESPONSE DELAY, as declared, is provided.

For type 2.AJ action, RESPONSE DELAY is checked by the test of 15.5.

11.7 Attachment of cords

11.7.1 Flexing

11.7.1.1 *Addition:*

For controls declared in Table 1, requirement 107 the appropriate test of 11.7.1.2.1 shall be conducted.

Additional subclause:

11.7.1.2.1.101
CONTROLS declared in Table 1, requirement 107, are subjected to the following test only.

Three samples of controls declared in Table 1, requirement 107, shall be subjected to a flexing test while mounted in the flexing apparatus shown in Figure 9. The cord, without any additional weight, shall be subjected to a minimum backward and forward movement through an angle of 90°. The cord shall be conducting the maximum rated current at maximum rated voltage. The number of flexings (that is one movement through 90°) shall be 30 000 at a rate of 60 flexings per minute.

Immediately following the flexing test, the control shall be subjected to the following immersion test:

The CONTROLS, including their cords, shall be immersed and maintained in water or other special environmental condition as declared in Table 1, requirements 106 and 107 at T_L for seven days such that the water, or other environmental condition, is at least 1 m above the highest point of the float CONTROL.

11.7.1.2.2 *Addition:*

For controls tested in accordance with 11.7.1.2.1.101, the following evaluation criteria are used: After the test, the control shall comply with the requirements of Clause 8, 12.3 and Clause 13 for basic insulation, and there shall be no evidence of ingress of the test medium, compliance for which is checked by inspection.

11.11 Requirements during mounting, maintenance and servicing

Additional subclause:

11.11.101 If the operation of a type 2 water level CONTROL of the float type is affected by its being placed out of level, the CONTROL shall be provided with a leveling indicator (e.g. a bubble, pendulum, horizontal or vertical line).

Compliance is checked by inspection and the test of 15.5.

Additional subclauses:

11.101 Construction requirements relating to operating mechanism

11.101.1 Screws and nuts which attach parts to movable members shall be swaged or otherwise locked.

NOTE For example, this would apply to the float hinge pivot of a water level SENSING CONTROL.

11.101.2 Operating parts shall be separated by barriers or by their physical location from conductors to be connected to the CONTROL to avoid interference with the movement of such parts by the conductors.

Compliance with 11.101.1 and 11.101.2 is checked by inspection.

11.101.3DV D2 *Addition of 11.101.3DV.1 and 11.101.3DV.2 to the part 2:*

11.101.3DV.1 The operating mechanism of a manually operated switch shall not subject parts to damage.

11.101.3DV.2 Compliance with 11.101.3DV.1 is checked by inspection.

12 Moisture and dust resistance

This clause of Part 1 is applicable except as follows.

12.1 Protection against ingress of water and dust

12.1.1 *Addition:*

For controls declared in Table 1, requirement 107, and having enclosures classified as IPX8, the requirements of 12.1.2 to 12.1.6, are not applicable.

Compliance is checked by the tests 12.1.101.

Additional subclauses:

12.1.101 Prior to subjecting three samples of the cord-connected float control to the following immersion test, the CONTROL shall be subjected to the impact resistance test in 18.2.

The CONTROLS are to be immersed and maintained in the test medium or other special environmental condition as declared in Table 1, requirements 106 and 107, at T_L for seven days such that the test medium, or other environmental condition, is at least 1 m above the highest point of the float CONTROL.

After the test, the CONTROL shall comply with the requirements of Clauses 8 and 13 and 12.3 for basic insulation, and there shall be no evidence of ingress of the test medium when compliance is checked by inspection.

12.1.102 Air flow, water flow and WATER LEVEL OPERATING CONTROLS which are declared in Table 1, requirement 106, for use in a special environmental condition shall be evaluated further for use in this environment.

Compliance is checked by the appropriate tests for the declared environment described in the relevant IEC standard or by a test method agreed between manufacturer and testing authority.

After the test, the control is deemed to comply if:

– there is no evidence of ingress of the test medium;

– all actions function automatically and manually in the intended and declared manner, and

– the requirements of 17.5 are still met.

13 Electric strength and insulation resistance

This clause of Part 1 is applicable except as follows:

Additional subclause:

13.101 Electric strength of probes

Probes of electrode-sensor type boiler water level sensing controls shall be subjected to the following tests:

NOTE The purpose of this test is to evaluate degradation of probe insulating material as a result of exposure to conditions in the boiler.

Three samples of the probe shall be conditioned for 10 days in a test boiler operating at the manufacturer's declared maximum working pressure and water temperature. The samples are then removed from the test boiler and any surface contamination is removed.

The conditioned samples and three unconditioned samples are then immediately subjected to an increasing voltage until dielectric breakdown occurs.

The average breakdown voltage of the conditioned samples shall be not less than 50 % of the breakdown voltage of the unconditioned samples and, furthermore, shall be not less than the appropriate value in Table 12.

14 Heating

This clause of Part 1 is applicable except as follows:

14.4.3.1 Not applicable.

14.5.1 *Replacement:*

For water flow and water level sensing controls, the control is mounted in the declared manner with the water maintained at T_L (Table 1, requirement 101) and, if applicable, at maximum working pressure. The test is conducted with the switch head in an ambient temperature maintained between T_{max} and either (T_{max} + 5) °C or 1,05 times T_{max}, whichever is greater. For water flow sensing controls, the test is conducted with and without water flowing.

15 Manufacturing deviation and drift

This clause of Part 1 is applicable except as follows:

15.6
Additional subclause:

15.6.101 If a response time has been declared, the response time of the sample shall be initially measured at T_{max} and T_{min} and, if an absolute value is declared, shall be within the manufacturer's declared time. If a range is declared, the initial measured response time shall be within the declared range.

The measured values for each sample shall be recorded as a reference value, so that the repeat tests after the environmental tests of Clause 16 and the endurance tests of Clause 17 will enable the drift to be determined. The values measured during the repeat test shall be within ±5 % of the initial measured value and, if a range is declared, shall be within the declared range.

15.6.101DV D2 *Add the following text to 15.6.101:*

See Annex BB.

16 Environmental stress

This clause of Part 1 is applicable.

17 Endurance

This clause of Part 1 is applicable except as follows:

17.1.1 *Addition:*

Air and water flow SENSING CONTROLS shall operate as intended. When subjecting the controls to the requirements of Clause 17, the flow SENSING CONTROLS shall be actuated and cycled by means simulating the actual applications. The simulated mechanical cycling means shall be agreed to between the manufacturer and the test authority. The specified fluid and/or specific flow rate are not required.

17.1.2.1 *Replacement:*

Compliance with 17.1.1 and 17.1.2 is checked by the tests of 17.16.

17.16 Test for particular purpose controls

Additional subclauses:

17.16.101 Boiler water level cut-out

• 17.1 to 17.5 inclusive are applicable.

• 17.6 is applicable to actions classified as type 2.M, the value of "X" being as small as practicable.

• 17.7 and 17.8 are applicable except that, where necessary, the reset operation is obtained by actuation. This actuation shall be as specified in 17.4 for accelerated speed, as soon as permitted by the mechanism, or as declared by the manufacturer in Table 1.

• 17.9, 17.11 and 17.12 are not applicable.

• 17.10 and 17.13 do not apply to the normal reset manual action which is tested during the automatic test of 17.7 and 17.8. If the water level cut-out has other manual actions which are not tested during the automatic tests, then these subclauses are applicable.

• 17.14 is applicable.

17.16.102 Boiler water level limiter

• 17.1 to 17.5 inclusive are applicable.

• 17.6 is applicable to actions classified as type 2.M, the value of "X" being as small as practicable.

• 17.7 and 17.8 are applicable except that, where necessary, the reset operation is obtained by actuation. This actuation shall be as specified in 17.4 for accelerated speed, as soon as permitted by the mechanism, or as declared by the manufacturer in Table 1.

• 17.9 to 17.13 inclusive are not applicable.

• 17.14 is applicable.

17.16.103 Boiler water feed controls

• 17.1 to 17.5 inclusive are applicable.

• 17.6 is applicable to actions classified as type 2.M, the value of "X" being as small as practicable.

• 17.7 and 17.8 are applicable except that, where necessary, the reset operation is obtained by actuation. This actuation shall be as specified in 17.4 for accelerated speed, as soon as permitted by the mechanism, or as declared by the manufacturer in Table 1.

• 17.9 is applicable.

• 17.10 to 17.13 are not applicable.

• 17.14 is applicable.

17.16.104 Water level operating controls

• 17.1 to 17.5 inclusive are applicable.

• 17.6 is not applicable.

• 17.7 and 17.8 are applicable.

• 17.9 to 17.13 are not applicable.

• 17.14 is applicable.

17.16.105 Water level protective controls

• 17.1 to 17.5 inclusive are applicable.

• 17.6 is not applicable.

• 17.7 and 17.8 are applicable.

• 17.9 to 17.13 are not applicable.

• 17.14 is applicable.

17.16.106 Air and water flow sensing controls

• 17.1 to 17.5 inclusive are applicable.

• 17.6 is not applicable.

• 17.7 and 17.8 are applicable except that, where necessary, the reset operation is obtained by actuation. This actuation shall be as specified in 17.4 for accelerated speed, as permitted by the mechanism, or as declared by the manufacturer in Table 1.

• 17.9 to 17.14 inclusive are applicable.

18 Mechanical strength

This clause of Part 1 is applicable except as follows:

Additional subclauses:

18.101 Those parts of a boiler water level SENSING CONTROL which are exposed to boiler pressure shall be capable of withstanding for 1 min without bursting, a hydraulic pressure equal to 400 % of the maximum working pressure declared in Table 1, requirement 103.

The float assembly of a float-operated boiler water level sensing control shall withstand 200 % of the maximum working pressure declared in Table 1, requirement 103, when tested as declared in Table 1, requirement 105.

Compliance is checked by the tests of this subclause.

18.101.1 Except for electrode-sensor type boiler water level SENSING CONTROLS, one sample is subjected to the test.

For electrode-sensor type boiler water level SENSING CONTROLS, one sample subjected to the test of 13.101 shall be used. In addition, a second previously untested sample of the electrode-sensor type is used after being conditioned for 30 days in an oven maintained at a temperature between 102 % and 105 % of the declared maximum water temperature (Table 1, requirement 101).

The boiler water level SENSING CONTROL is to be fitted to a tank filled with water and connected to a hydraulic pump. The pressure is to be raised gradually to 400 % of the declared maximum working pressure and held for 1 min.

Leakage at a gasket or fitting is permitted provided the leakage does not occur below 200 % of the declared maximum working pressure.

18.101.2 The float assembly of a float-operated boiler water level SENSING CONTROL shall withstand 200 % of the declared maximum working pressure when tested as declared in Table 1, requirement 105.

18.102 A flow SENSING CONTROL employing a Bourdon tube, a flexible metal bellows, a diaphragm or the like rated 2 000 kPa or more which is not contained within an enclosure shall withstand for 1 min without bursting a hydraulic pressure equal to four times the maximum working pressure of the CONTROL.

The CONTROL under test is to be filled with water to exclude air and is connected to a hydraulic pump. The pressure is to be raised gradually to the required test pressure.

Leakage at a gasket or fitting during this test is permitted provided the leakage does not occur below 50 % of the required test pressure and the test can be continued to four times maximum working pressure.

18.103 A flow SENSING CONTROL employing a Bourdon tube, a flexible metal bellows, a diaphragm or the like that is contained within an enclosure shall comply with 18.102 or shall:

• withstand for 1 min without visible leakage a hydraulic pressure of two times the maximum working pressure, and

• withstand for 1 min a hydraulic pressure equal to four times the maximum working pressure, or if this pressure cannot be reached without damage to the equipment, at least three times the maximum working pressure. Also it shall be demonstrated that the enclosure can either relieve pressure equal to four times the maximum working pressure without rupturing in a manner likely to endanger persons or surroundings, or that it can withstand the test pressure.

The test is conducted as in 18.102.

18.104 A flow cut-out shall be capable of withstanding for 1 min, without bursting, a hydraulic pressure equal to four times the maximum working pressure.

The CONTROL under test is to be filled with water to exclude air and connected to a hydraulic pump. The pressure is to be raised gradually to the required test pressure.

19 Threaded parts and connections

This clause of Part 1 is applicable.

19.101DV D2 *Addition of 19.101DV.1 to the part 2:*

19.101DV.1 10-day moist ammonia air stress cracking test

19.101DV.1.1 After being subjected to the conditions in 19.101DV.1.2 – 19.101DV.1.4, a brass part containing more than 15 percent zinc shall show no evidence of cracking when examined using 25X magnification.

19.101DV.1.2 Each test sample is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Such stresses are to be applied to the sample prior to and maintained during the test. Samples with threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened to the torque specified in Table 19.101DV.1. Teflon tape or pipe compound are not to be used on the threads.

Table 19.101DV.1
Torque requirements for threaded connections

Nominal thread size, mm (inches)		Torque N·m (pound-inches)	
25.4	(1)	135.6	(1200)
31.8	(1-1/4)	163.8	(1450)
38.1	(1-1/2)	175.1	(1550)
50.8	(2)	186.4	(1650)
63.5	(2-1/2)	197.7	(1750)
76.2	(3)	203.4	(1800)

19.101DV.1.3 Three representative products are to be degreased and then continuously exposed in a set position for ten days to a moist ammonia-air mixture maintained in a glass chamber approximately 305 by 305 by 305 mm (12 by 12 by 12 inch) having a glass cover.

19.101DV.1.4 Approximately 600 ml (21 ounces) of aqueous ammonia having a specific gravity of 0.94 is to be maintained at the bottom of the glass chamber below the representative products. The representative products are to be positioned 38.1 mm (1-1/2 inch) above the aqueous ammonia solution and supported by an inert tray. The moist ammonia-air mixture in the chamber is to be maintained at atmospheric pressure and at a temperature of 34 ±2°C (93.2 ±3.6°F).

20 Creepage distances, clearances and distances through solid insulation

This clause of Part 1 is applicable.

21 Resistance to heat, fire and tracking

This clause of Part 1 is applicable.

22 Resistance to corrosion

This clause of Part 1 is applicable.

23 Electromagnetic compatibility (EMC) requirements – Emission

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Normal operation

This clause of Part 1 is applicable.

26 Electromagnetic compatibility (EMC) requirements – Immunity

This clause of Part 1 is applicable. See also Annex H.

27 Abnormal operation

This clause of Part 1 is applicable except as follows:

Addition:

For air flow and water flow SENSING CONTROLS, 27.2 and 27.3 are not applicable

See also Annex H.

27DV D2 *Modification of 27 of the Part 2:*

Delete statement that 27.2 and 27.3 are not applicable.

28 Guidance on the use of electronic disconnection

This clause of Part 1 is applicable.

Figures

The figures of Part 1 are applicable.

Annexes

The annexes of Part 1 are applicable except as follows:

Annex H
(normative)

Requirements for electronic controls

This annex of part 1 is applicable except as follows:

H.2 Terms and definitions

H.2.23 Definitions relating to functional safety

Additional definitions:

H.2.23.101
PERMANENT OPERATION
continuous monitoring of the protective function during the operation of the appliance or system for longer than 24 h

Note 1 to entry: 24 h is considered the typical time interval between a first and a second fault.

H.2.23.102
NON-PERMANENT OPERATION
continuous monitoring of the protective function during the operation of the appliance or system for less than 24 h

Note 1 to entry: 24 h is considered the typical time interval between a first and a second fault.

H.6 Classification

H.6.18 According to classes of control functions

H.6.18.1 – Control of class A control functions

Additional note:

NOTE 101 In general, water level sensors perform Class A CONTROL function.

H.7 Information

Table 1
(7.2 of edition 3) – Required information and methods of providing information

Information	Clause or subclause	Method
58a *Addition:* See Footnote a of Table H.101		
Additional requirements:		
111 The output condition of air flow cut-outs, water flow cut-outs and boiler water level cut-outs and limiters after operation[105]	H.26.2.102 H.26.2.103 H.26.2.104 H.26.2.105 H.27.1.2 H.27.1.1.2	X
112 The control is for permanent operation or non-permanent operation.	H.2.23.101 H.2.23.102 H.27.1.2.2.2 H.27.1.2.3.2	X
113 Frequency of the DEFINED STATE test function	H.27.1.2.2.2 H.27.1.2.3.2 H.27.1.2.3.3	X
Additional note: [105)] For example, conducting or non-conducting, as applicable.		

H.11 Constructional requirements

H.11.12 Controls using software

H.11.12.2.6 *Replace the second paragraph by the following:*

NOTE The value of the declared times can be specified in the applicable equipment standard.

H.11.12.2.7

Additional note:

NOTE 101 The responses declared in Table 1, requirement 72, may be specified in the applicable appliance standard.

H.23 Electromagnetic compatibility (EMC) requirements – Emission

H.23.1.2 Radio frequency emission

Addition:

Integrated and incorporated automatic electronic air flow, water flow and water level SENSING CONTROLS are not subjected to the tests of this subclause, as the results of these tests are influenced by the incorporation of the electronic control into the equipment and the use of measures to CONTROL emissions used therein. They may, however, be carried out under declared conditions if so requested by the manufacturer.

H.26 Electromagnetic compatibility (EMC) requirements – Immunity

Additional note:

NOTE 101 Water level operating controls are classified as having TYPE 1 ACTION, therefore only H.26.8 is applicable.

H.26.2 *Addition:*

For air flow, water flow and boiler water level SENSING CONTROLS, after each test, one or more of the following criteria shall apply as permitted in Table H.101.

Additional subclauses:

H.26.2.101 The air flow, water flow or boiler water level SENSING CONTROL shall remain in its current condition and thereafter shall continue to operate as declared within the limits verified in Clause 15, if applicable.

H.26.2.102 The air flow, water flow or boiler water level SENSING CONTROL shall assume the condition declared in Table 1, requirement 111, and thereafter shall operate as in H.26.2.101.

H.26.2.103 The air flow, water flow or boiler water level SENSING CONTROL shall assume the condition declared in Table 1, requirement 111, such that it cannot be reset automatically or manually. The output wave form shall be sinusoidal or as declared in requirement 53 of Table 1, requirement 106 for normal operation.

H.26.2.104 The air flow, water flow or boiler water level SENSING CONTROL shall remain in the condition declared in Table 1, requirement 111. A non-self-resetting control shall be such that it can only reset manually. After the low air flow, low water flow or water level which caused cut-out to occur is no longer present, it shall operate as in H.26.2.101 or shall remain in the declared condition as in H.26.2.103.

H.26.2.105 The air flow, water flow or boiler water level SENSING CONTROL may return to its initial state and thereafter shall operate as in H.26.2.101.

If a CONTROL is in the condition declared in Table 1, requirement 111, it may reset but shall resume the declared condition again if the low air flow, low water flow or water level which caused it to operate is still present.

H.26.2.106 The outputs and functions of an air flow, water flow or boiler water level SENSING CONTROL shall be as declared in Table 1, requirements 58a or 58b.

Table H.101
Compliance criteria

Applicable Clause H.26 tests	Compliance criteria permitted					
Air flow cut-outs, WATER FLOW CUT-OUTS and BOILER WATER LEVEL CUT-OUTS and limiters	H.26.2.101	H.26.2.102	H.26.2.103	H.26.2.104	H.26.2.105	H.26.2.106[a]
H.26.4 to H.26.14 inclusive	B	B	B	A	A	X
Air flow operating, water flow operating and BOILER WATER FEED CONTROLS	H.26.2.101	H.26.2.102	H.26.2.103	H.26.2.104	H.26.2.105	H.26.2.106[a]
H.26.8, H.26.9	X				X	X
X permitted for other than air flow, water flow and BOILER WATER LEVEL CUT-OUTS. A = permitted when the disturbance is applied after operation. B = permitted when the disturbance is applied before operation.						
[a] This compliance criteria is permitted only for integrated or incorporated controls, since the acceptability of the output must be judged in the appliance.						

H.26.3 *Addition:*

The WATER LEVEL OPERATING CONTROL is energized during the tests.

For air flow and water flow SENSING CONTROLS, after the tests of H.26.4 to H.26.14 inclusive, the samples shall meet the requirements of Clause 8, 17.5 and Clause 20.

H.26.5 Voltage dips, voltage interruptions and voltage variations in the power supply network

H.26.5.2 Voltage verification test

H.26.5.2.2 Test procedure

Modification:

Replacement of the last paragraph:

The CONTROL is subjected to each of the specified voltage test cycles three times with 10 s intervals between each test cycle. For a CONTROL declared under Table 1, requirement 111, each test cycle is performed three times when the CONTROL is in the declared condition and three times when it is not. For other water level SENSING CONTROLS, the relevant operating modes are conducting and not conducting.

H.26.6 Test of influence of voltage unbalance

Addition:

For air flow and water flow SENSING CONTROLS, this subclause is not applicable.

H.26.8 Surge immunity test

H.26.8.3 Test procedure

Addition:

The relevant operating modes are conducting and not conducting.

Additional subclause:

H.26.8.3.101 For CONTROLS declared under Table 1, requirement 111, three of the tests are performed when the CONTROL is in the declared condition and two are performed when it is not.

H.26.9 Electrical fast transient/burst immunity test

H.26.9.3 Test procedure

Addition:

The relevant operating modes are conducting and not conducting.

Additional subclause:

H.26.9.3.101

For controls declared under Table 1, requirement 111, the tests are performed when the CONTROL is in the declared condition and when it is not.