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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Withdrawn

Automatic electrical controls for household and similar use – Part 2-15: Particular requirements for automatic electrical air flow, water flow and water level sensing controls

Dispositifs de commande électrique automatiques à usage domestique et analogue – Partie 2-15: Exigences particulières pour les dispositifs de commande électrique automatiques détecteurs de débit d'air, de débit d'eau et de niveau d'eau

IEC 60730-2-15:2008

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AUTOMATIC ELECTRICAL CONTROLS FOR HOUSEHOLD AND SIMILAR USE –

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

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FOREWORD

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

This second edition cancels and replaces the first edition published in 1994 and its Amendment 1 (1997), the first edition of IEC 60730-2-16 published in 1995 and its Amendments 1 (1997) and 2 (2001) and the first edition of IEC 60730-2-18 published in 1997. This second edition constitutes a technical revision.

This second edition is a consolidation of three standards IEC 60725-2-15, IEC 60730-2-16 and IEC 60730-2-18. The title and scope were revised to reflect the additional topics covered by the standard.

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

FDIS	Report on voting
72/757A/FDIS	72/761/RVD

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

This publication 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 third edition of that standard (1999) and its Amendments 1 (2003) and 2 (2007). 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 Part 2-15 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 2-15 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 practice are contained in the following subclauses:

- 10.1.4
- 12.1.1.101

In this publication:

1) The following print types are used:

– Requirements proper: in roman type.

– *Test specifications: in italic type.*

– Explanatory matter: in smaller roman type.

2) Subclauses or figures which are additional to those in Part 1 are numbered starting from 101.

A list of all parts of the IEC 60730 series, under the general title: *Automatic electrical controls for household and similar use*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

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AUTOMATIC ELECTRICAL CONTROLS FOR HOUSEHOLD AND SIMILAR USE –

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

Withdrawn

1 Scope and normative references

This clause of Part 1 is replaced as follows:

1.1 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.

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.

1.1.1 This standard 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, household and similar equipment.

This standard is also applicable to controls for appliances within the scope of IEC 60335-1 and IEC 60364-7-702.

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 standard.

This standard 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 standard is not applicable to pressure-operated air flow, water flow and water level sensing controls, requirements for which are contained in IEC 60730-2-6[1)].

This standard does not apply to air flow, water flow and water level sensing controls designed exclusively for industrial applications.

Throughout this standard, the word "equipment" means "appliance and equipment".

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

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1) IEC 60730-2-6, *Automatic electrical controls for household and similar use – Part 2-6: Particular requirements for automatic electrical pressure sensing controls including mechanical requirements*

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1.1.3 This standard contains requirements for electrical features of air flow, water flow and water level sensing controls and requirements for mechanical features that may affect their intended operation and electrical safety.

1.1.4 This standard applies to manual controls when such are electrically and/or mechanically integral with air flow, water flow and water level sensing controls.

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

1.1.5 In general, these air flow, water flow and water level sensing controls are integrated or incorporated with the equipment or are intended to be integrated or incorporated in or on the equipment. This standard also covers controls when they are independently mounted or of in-line cord construction.

1.2 This standard applies to controls with a rated voltage not exceeding 690 V and a rated current not exceeding 63 A.

1.3 This standard 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.

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

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

1.5 Normative references

This subclause of Part 1 is applicable except as follows:

Addition:

IEC 60364-7-702, *Electrical installation of buildings – Part 7: Requirements for special installations or locations – Section 702: Swimming pools and other basins*

IEC 60669 (all parts), *Switches for household and similar fixed-electrical installations*

2 Definitions

This clause of Part 1 is applicable except as follows:

2.2 Definitions of types of control according to purpose

2.2.19

Addition:

See 2.2.103, 2.2.104, 2.2.106 and 2.2.107.

2.2.20

Addition:

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See 2.2.101, 2.2.105, 2.2.108 and 2.2.109.

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

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

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

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 standard, a Type 2 boiler water feed control is considered to be a boiler water level limiter.

2.2.104
water level operating control
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

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

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

An air flow operating control is of the automatic reset type.

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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

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

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

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 shall have tolerances agreed between the manufacturer and test house.

Additional subclause:

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

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4.3 Instructions for test

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 are classified as having Type 1 action.

For the purpose of this standard, a Type 2 boiler water feed control is considered to be a boiler water level limiter.

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6.4.2

Additional subclause:

6.4.2.101 Boiler water level cut-outs and boiler water level limiters within the scope of this standard are classified as having Type 2 action.

6.4.3

Additional subclauses:

6.4.3.101 – manual reset boiler water level sensing controls within the scope of this standard 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 Item 107 of Table 7.2 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 7.2

Modification:

	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 items:			
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 7.2 Item 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 Item 106	6.5.2, 11.7.1.1, 11.7.1.2.1, 11.7.1.2.2, 12.1.1.101	D

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108	Response delay	2.3.101, 6.4.3.102, 11.4.101, H.11.12.8, Annex BB	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.

Modify the table in Note 4:

Change "Air flow" to "Air flow or water flow".

Add, to Note 4, the following text:

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).

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 *Addition:*

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.

11 Constructional requirements

This clause of Part 1 is applicable except as follows:

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11.4 Actions

11.4.11 *Modification:*

Delete the last sentence of the first paragraph.

11.4.12 *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 Subclause 15.5.

11.7 Attachment of cords

11.7.1 Flexing

11.7.1.1 *Addition:*

For controls declared in Item 107 of Table 7.2, the appropriate test of 11.7.1.2.1 shall be conducted.

11.7.1.2.1 *Modification:*

This clause of Part 1 is applicable except for controls declared in Item 107 of Table 7.2. Controls so declared are subjected to the following test only, and not that of Part 1.

Three samples of controls declared in Item 107 of Table 7.2 shall be subjected to a flexing test while mounted in the flexing apparatus shown in Figure 9. The cord 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.

For this test, the cord is not loaded with additional weight.

Additional subclause:

11.7.1.2.1.101 *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 Items 106 and 107 of Table 7.2, 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 Subclause 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, Subclause 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

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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.

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.

12 Moisture and dust resistance

This clause of Part 1 is applicable except as follows.

12.1 Protection against ingress of water and dust

Additional subclauses:

12.1.1.101 For controls declared in Item 107 of Table 7.2, and having enclosures classified as IPX8, the requirements of 12.1.2 to 12.1.6, inclusive, do not apply. These controls shall withstand the following test:

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.

In the USA, the impact resistance test shall be conducted as described in Subclause D.2.11.2.

The controls are to be immersed and maintained in the test medium or other special environmental condition as declared in Items 106 and 107 of Table 7.2, 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 Subclause 12.3 for basic insulation, and there shall be no evidence of ingress of the test medium when compliance is checked by inspection.

12.1.101 Air flow, water flow and water level operating controls which are declared in Item 106 of Table 7.2 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:

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– *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:

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 13.2.

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 7.2, Item 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:

15.2 to **15.4** *Replacement:*

For evaluating the deviation and drift of the air flow, water flow or water level at which a Type 2 control operates, a method of test is agreed between manufacturer and testing authority.

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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.

16 Environmental stress

This clause of Part 1 is applicable.

17 Endurance

This clause of Part 1 is applicable except as follows:

17.1 General requirements

Additional subclause:

17.1.1.101 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 *Modification:*

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 7.2.

– 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.

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– 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 7.2.

– 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 7.2.

– 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 7.2.

– 17.9 to 17.14 inclusive are applicable.

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