

INTERNATIONAL STANDARD

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**Automatic electrical controls -
Part 2-6: Particular requirements for automatic electrical pressure sensing
controls including mechanical requirements**

**Dispositifs de commande électriques automatiques -
Partie 2-6: Exigences particulières pour les dispositifs de commande électriques
automatiques sensibles à la pression, y compris les exigences mécaniques**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Automatic electrical controls -
Part 2-6: Particular requirements for automatic electrical pressure
sensing controls including mechanical requirements**

FOREWORD

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IEC 60730-2-6 has been prepared by IEC technical committee 72: Automatic electrical controls. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2015 and its Amendment 1:2019. This edition constitutes a technical revision.

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

Adoption of IEC 60730-1:2022 with all of its significant changes to IEC 60730-1:2013, IEC 60730-1:2013/AMD 1:2015 and IEC 60730-1:2013/AMD2:2020.

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

Draft	Report on voting
72/1486/FDIS	72/1504/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

This part 2-6 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the sixth edition of that standard (2022). Consideration may be given to future editions of, or amendments to, IEC 60730-1.

This part 2-6 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 pressure sensing controls including mechanical requirements.

Where this part 2-6 states "addition", "modification" or "replacement", the relevant requirement, test specification or explanatory matter in part 1 should be adapted accordingly.

When a particular subclause of Part 1 is not mentioned in this Part 2, that 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 reader's attention is drawn to the fact that Annex Q, Annex R, Annex S and Annex T list all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

In this publication:

The following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type*;
- explanatory matter: in smaller roman type;
- defined terms: **bold type**.

Subclauses, notes or items which are additional to those in Part 1 are numbered starting from 101, additional annexes are lettered AA, BB, etc.

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

- reconfirmed,
- withdrawn, or
- revised.

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1 Scope

This clause of Part 1 is replaced by the following:

This document applies to **automatic electrical pressure sensing controls**

- for use in, on, or in association with equipment for household appliance and similar use;

NOTE 1 Throughout this document, the word "equipment" means "appliance and equipment" and "controls" means "pressure **sensing controls**".

- for building automation within the scope of ISO 16484 series and IEC 63044 series (HBES/BACS);

EXAMPLE 1 Independently mounted **automatic electrical pressure sensing controls**, controls in smart grid systems and controls for building automation systems within the scope of ISO 16484-2.

- for equipment that is used by the public, such as equipment intended to be used in shops, offices, hospitals, farms and commercial and industrial applications;

EXAMPLE 2 **Automatic electrical pressure sensing controls** for commercial catering, heating and air-conditioning equipment.

- that are **smart enabled automatic electrical pressure sensing controls**;

EXAMPLE 3 Smart grid **automatic electrical pressure sensing controls**, remote interfaces/control of energy-consuming equipment including computer or smart phone.

- that are AC or DC powered controls with a rated voltage not exceeding 690 V AC or 600 V DC;
- used in, on, or in association with equipment that use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof;
- utilized as part of a control system or controls which are mechanically integral with multifunctional controls having non-electrical outputs;
- using NTC or **PTC thermistors** and to discrete **thermistors**, requirements for which are contained in Annex J;
- that are mechanically or electrically operated, responsive to or controlling a pressure or vacuum;
- as well as manual controls when such are electrically and/or mechanically integral with automatic controls.

NOTE 2 Requirements for manually actuated mechanical switches not forming part of an automatic control are contained in IEC 61058-1-1.

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

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

This document applies to

- the inherent safety of pressure **sensing controls**, and
- functional safety of pressure **sensing controls** and safety related systems,
- pressure **sensing controls** where the performance (for example the effect of EMC phenomena) of the product can impair the overall safety and performance of the controlled system,
- the operating values, operating times, and operating sequences where such are associated with equipment safety.

This document specifies the requirements for construction, operation and testing of automatic electrical controls used in, on, or in association with an equipment.

This document does not

- apply to pressure **sensing controls** intended exclusively for industrial process applications unless explicitly mentioned in the relevant part 2 or the equipment standard. However, this document can be applied to evaluate automatic electrical controls intended specifically for industrial applications in cases where no relevant safety standard exists;
- take into account the response value of an automatic action of a pressure **sensing control**, if such a response value is dependent upon the method of mounting the control 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 will apply;
- address the integrity of the output signal to the network devices, such as interoperability with other devices unless it has been evaluated as part of the control system.

This document contains requirements for electrical features of pressure **sensing controls** and requirements for mechanical features that affect their intended **operation**.

NOTE Subclause 20.101, as it pertains to gas and/or oil controls, is under consideration pending review or revision of ISO 22967, ISO 22968 and ISO 23550, if applicable.

In general, these pressure **sensing controls** are integrated or incorporated with the equipment or are intended to be integrated in, or on the equipment. This document also covers these controls when they are independently mounted. **In-line cord controls** are not covered by this document.

2 Normative references

This clause of Part 1 is applicable.

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

3.2 Definitions of types of control according to purpose

Additional definitions:

3.2.101

pressure limiter

pressure **sensing control** which is intended to keep a pressure below or above a predetermined value during normal operating conditions and which can have provision for setting by the user

Note 1 to entry: A **pressure limiter** may be of the automatic or of the manual reset type. It does not make the reverse operation during the normal duty cycle of the equipment.

3.2.102

pressure operating control

pressure **sensing control** set at a high or low pressure, or both, between which limits the equipment is normally intended to operate

3.2.103**pressure cut-out**

pressure **sensing control** intended to keep a pressure below or above one particular value during abnormal operating conditions of the equipment and which has no provisions for **setting by the user**

Note 1 to entry: A **pressure cut-out** may be of the automatic or of the manual reset type.

Note 2 to entry: A **pressure cut-out** will provide a Type 2 action.

Note 3 to entry: A **pressure cut-out** may have an adjustable stop intended to be set by the **control manufacturer**, the **equipment manufacturer** or the **installer**.

3.3 Definitions relating to the function of controls

Additional definitions:

3.3.101**pressure medium**

medium used to transmit the pressure to the pressure **sensing element**

Note 1 to entry: **Pressure medium** as used in this document refers to either gases or liquids.

3.3.102**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**.

3.3.103**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**.

3.8 Definitions relating to component parts of controls

Additional definition:

3.8.101**vent**

that opening from the atmospheric side of a diaphragm to the atmosphere through which air is discharged or drawn in when the control is functioning

4 General

This clause of Part 1 is applicable except as follows:

4.3 General notes on tests**4.3.2 Conditions of test****4.3.2.7 Replacement:**

The rates of pressure change declared in Table 1 requirement 31, and used in Clause 19 (i.e. $\alpha_1, \beta_1, \alpha_2, \beta_2$) shall have test tolerances as declared by the manufacturer.

4.3.4 Instructions for test

4.3.4.1 According to submission

Additional subclause:

4.3.4.1.101 The values in Annex AA apply for the testing of independently mounted pressure **sensing controls** in Clause 19. Values for integrated and **incorporated controls** are specified in the appropriate equipment standard.

5 Required technical information

5.2 Methods of providing technical information

This clause of Part 1 is applicable except as follows:

Table 1 – Required technical information and methods of providing these information

	Information	Clause or subclause	Method
<i>Replacement:</i>			
19	Number of cycles of actuation (M) for each manual action Preferred values are: 100 000 cycles; 30 000 cycles; 10 000 cycles; 6 000 cycles; 3 000 cycles ⁱ ; 300 cycles ^j ; 30 cycles ^j NOTE For controls with more than one manual action, a different value can be declared for each. If a control has more than one intended "OFF" position, then a cycle of actuation is regarded as a movement from one "OFF" position to the next "OFF" position.	Annex AA, 19.10, 19.11	X
20	Number of automatic cycles (A) for each automatic action. Preferred values are: 300 000 cycles; 200 000 cycles; 100 000 cycles; 30 000 cycles; 20 000 cycles; 10 000 cycles; 6 000 cycles; 3 000 cycles ^a ; 1 000 cycles ^a ; 300 cycles ^b ; 30 cycles ^{bd} ; 1 cycle ^c . 1) Not applicable to thermostats or to other fast cycling actions. 2) Applicable only to manual reset. 3) Applicable only to actions which require the replacement of a part after each operation. 4) Can only be reset during manufacturer servicing. NOTE For controls having more than one automatic action, a different value can be declared for each.	Annex AA, 13.1.3.3, Table 14, 19.7.6, 19.8.4	X
29	Not applicable		
38	Not applicable		
42	Operating pressure (or pressures)	3.3.11, 17, H.17.4	
52	Not applicable		
<i>Additional items:</i>			
101	Pressure medium	3.3.101, 9.3.101, 20.101	X
102	Operating differential	3.3.25, H.17.4, H.17.6	D
103	Maximum working pressure	3.3.28, 9, 19, 20	D
<i>Addition to Footnote h:</i> For pressure sensing controls , limits of activating quantity are specified either in the applicable appliance standard, by the appliance manufacturer or as declared by the pressure sensing control manufacturer (see 19.7 and 19.8).			

6 Protection against electric shock

This clause of Part 1 is applicable.

7 Provision for protective earthing

This clause of Part 1 is applicable.

8 Terminals and terminations

This clause of Part 1 is applicable.

9 Constructional requirements

This clause of Part 1 is applicable except as follows:

9.4 Actions

Additional subclause:

9.4.101 Type 2.N action (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)

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 pressure and **drift** is exceeded.

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Compliance is checked by the following test:

The operating pressure of a Type 2.N control shall be measured under the conditions of Clause 17. If the control has means for setting, it shall be set to the highest value.

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

No positive drift is allowed beyond the declared value.

*A separate shroud or sleeve may be employed for protection of the **sensing element** to achieve conformance with Clause 20.*

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

9.11 Requirements during mounting, use, maintenance and servicing

Additional subclauses:

9.11.101 Parts in contact with a diaphragm shall have no sharp burrs, projections or the like which chafe or abrade the diaphragm.

Compliance is checked by inspection before and after the tests of Clause 19.

9.11.102 An operating spring shall be retained and arranged to prevent abrasion, binding, buckling or interference with its free movement.

Compliance is checked by inspection before and after the tests of Clause 19.

9.11.103 If failure of any part of the control would allow unsafe leakage of a hazardous fluid, that part shall be made of a material having a melting point (solidus temperature) of not less than 510 °C and a tensile strength of not less than 68 MPa at 204 °C.

Such parts shall not sag, distort, melt, oxidize or show leakage of fluid during any of the tests specified herein.

Compliance is checked by inspection before and after the tests of Clause 19.

9.11.104 A part including a sheath, capillary tube, bellows or diaphragm shall be resistant to atmospheric corrosion and attack by the fluid it can normally contact in service, if failure of the part will permit external fluid leakage of a combustible fluid or cause the control to malfunction.

NOTE Brass alloys containing less than 81 % copper and more than 9 % zinc are not considered resistant to the corrosive effects of fuel oils.

9.11.105 A control in which a flexible diaphragm, bellows or similar construction constitutes the only flammable gas or fluid seal shall have the atmospheric side of the diaphragm or bellows enclosed in a casing designed to limit external fluid leakage in the event of a diaphragm or bellows rupture or shall have provisions for connection of a **vent** pipe or tubing intended to be routed to the outdoors or other safe location.

9.11.106 A control designed to supervise the pressure of fuel oil of 1,00 mm²/s to 600 mm²/s viscosity is not required to conform to 20.101 and 20.102, provided three samples of the control, when subjected to a 100 000 cycle endurance test, show no evidence of leakage during the test and when subjected to a hydrostatic test of four times the maximum working pressure, following the endurance test, and the control conforms to one of the following:

- a) the bellows, Bourdon tube, diaphragm or similar element is made of stainless steel or material of equivalent resistance to corrosion designated material class A, if leakage from a ruptured element will be into the control enclosure, in which case such leakage is to be released to the exterior of the control before entering any opening provided for conduit connection, or
- b) the bellows, Bourdon tube, diaphragm or similar element is made of stainless steel or material of equivalent resistance to corrosion designated material class B, if leakage from a ruptured element will be to the exterior of the control enclosure only.

NOTE 1 Suitable class A and B materials are shown in Annex BB.

NOTE 2 1 mm²/s = 1 centistoke.

Additional subclauses:

9.101 Construction requirements relating to operating mechanism

9.101.1 If screws and nuts serve to attach operating parts to movable members, they shall be swaged or otherwise locked.

9.101.2 The operating mechanism of a manually operated switch shall not subject parts to damage.

9.101.3 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 9.101.1 to 9.101.3 inclusive is checked by inspection.

9.102 A **pressure cut-out** shall not reset or be resettable manually or otherwise at a value above the maximum or below the minimum operating pressure, whichever is declared.

9.103 A **pressure cut-out** with a manually operated reset device shall be trip-free.

Compliance with 9.102 and 9.103 is checked by inspection.

10 Threaded parts and connections

This clause of Part 1 is applicable.

11 Creepage distances, clearances and distances through solid insulation

This clause of Part 1 is applicable.

12 Components

This clause of Part 1 is applicable.

13 Fault assessment on electronic circuits

This clause of Part 1 is applicable except as follows:

13.1 Fault assessment for inherent safety

13.1.3 Component fault assessment

13.1.3.8 Compliance criteria

Item c) is not applicable.

14 Moisture and dust resistance

This clause of Part 1 is applicable except as follows:

14.1 Protection against ingress of water and dust

14.1.1 Addition:

The tests in this subclause are not intended to determine the suitability of the seal between the control and the equipment.

15 Electric strength and insulation resistance

This clause of Part 1 is applicable.

16 Heating

This clause of Part 1 is applicable.

17 Manufacturing deviation and drift

This clause of Part 1 is applicable.

18 Environmental stress

This clause of Part 1 is applicable.

19 Endurance

This clause of Part 1 is applicable except as follows:

19.1 General requirements

19.1.5 Compliance criteria

Replacement:

Compliance with 19.1.2 and 19.1.3 is checked by the tests of 19.15.

19.1.6 Test sequence and conditions

19.1.6.2 Addition:

The tests of Clause 19 shall be conducted at the declared maximum working pressure and **operating differential** as declared in Table 1, requirement 102 and 103.

19.15 Test for particular purpose controls

Additional subclauses:

19.15.101 Pressure operating controls

Subclauses 19.1 to 19.5 inclusive are applicable.

Subclause 19.6 is not applicable.

Subclauses 19.7 and 19.8 are applicable.

Subclause 19.9 is applicable, but only to slow-make, slow-break automatic actions.

Subclauses 19.10 to 19.13 inclusive are applicable but only to those **pressure operating controls** which have a manual action (including an actuating means providing setting by the user).

Subclause 19.14 is applicable.

19.15.102 Pressure limiter

Subclauses 19.1 to 19.5 inclusive are applicable.

Subclause 19.6 is not applicable.