

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Automatic electrical controls –  
Part 2-14: Particular requirements for electric actuators

Dispositifs de commande électrique automatiques –  
Partie 2-14: Exigences particulières pour les actionneurs électriques

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IEC 60730-2-14:2017  
https://standards.iteh.ai/catalog/standards/sist/c691251-0c8c-493e-b2c0-4bc5b10b1606/iec-60730-2-14-2017





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INTERNATIONALE

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ICS 29.120.01; 97.120

ISBN 978-2-8322-4695-5

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Access standards and specifications through solid insulation

4bc5b10b1606/iec-60730-2-14-2017

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International Standard IEC 60730-2-14 has been prepared by IEC technical committee 72: Automatic electrical controls.

This second edition cancels and replaces the first edition, published in 1995, its Amendment 1 (2001) and its Amendment 2 (2007). This edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

- adapting it to the 5<sup>th</sup> Ed of IEC 60730-1,
- addition of checking electric actuators with action 1.AB or 2AB, and
- modification of tests under abnormal condition.

This Part 2-14 is intended to be used in conjunction with IEC 60730-1. It was established on the basis of the 5<sup>th</sup> edition of that standard (2013). Consideration may be given to future editions of, or amendments to, IEC 60730-1.

This part 2-14 supplements or modifies the corresponding clauses in IEC 60730-1, so as to convert that publication into the IEC standard: Particular requirements for electric actuators.

Where this part 2-14 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 part 2-14 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:

- Table 1,
- 27.2.3.1.

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.
  - Defined terms: **bold type**.
- 2) 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 text of this International Standard is based on the following documents:

FDIS	Report on voting
72/1079/FDIS	72/1100/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.

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.

## AUTOMATIC ELECTRICAL CONTROLS –

### Part 2-14: Particular requirements for electric actuators

#### 1 Scope and normative references

This clause of Part 1 is applicable except as follows:

##### 1.1 Replacement:

This part 2-14 applies to **electric actuators** for use in, on, or in association with equipment for household and similar use. The equipment may use electricity, gas, oil, solid fuel, solar thermal energy, etc., or a combination thereof.

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

EXAMPLE 1 **Electric actuators** for appliances within the scope of IEC 60335.

This International Standard is applicable to **controls** for building automation within the scope of ISO 16484.

This part 2-14 also applies to automatic **electrical 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.

EXAMPLE 2 **Controls** for commercial catering, heating and air-conditioning equipment.

This part 2-14 is also applicable to individual **electric actuators** utilized as part of a **control system** or **controls**, which are mechanically integral with **multifunctional controls** having non-electrical outputs.

EXAMPLE 3 Independently mounted water valves, **controls** in smart grid **systems** and **controls** for building automation systems within the scope of ISO 16484-2.

This part 2-14 does not apply to automatic **electric actuators** intended exclusively for industrial process applications unless explicitly mentioned in the relevant part 2 or the equipment standard.

1.1.1 This part 2-14 applies to the inherent safety, to the **operating values**, **operating times** and **operating sequences** where such are associated with equipment safety and to the testing of **electric actuators** used in or in association with equipment.

NOTE Requirements for specific **operating values**, **operating times** and **operating sequences** may be given in the standards for appliances and equipment.

This standard is also applicable to the **functional safety** of **low complexity safety related systems** and **controls**.

This part 2-14 does not apply to **electric actuators** which are mechanically integrated with valves covered by a separate part 2, e.g. IEC 60730-2-8.

This part 2-14 does not apply to electric motors, requirements for which are contained in IEC 60034.

1.1.2 Requirements for manual switches not integral with an **electric actuator** are contained in IEC 61058-1.

### 1.1.3 Replacement

This part 2-14 applies to a.c. or d.c. powered **electric actuators** with a rated voltage not exceeding 690 V a.c. or 600 V d.c.

### 1.1.4 Replacement

This part 2-14 does not take into account the **response value** of an **automatic action** of an **electric actuator**, if such a **response value** is dependent upon the method of mounting the **electric actuator** 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 household equipment or as determined by the manufacturer shall apply.

## 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 definition:*

#### 2.2.101

##### **electric actuator**

device in which a **prime mover** is mechanically linked to a valve, damper or similar device and which responds to **initiation** from a **control** or switch

Note 1 to entry: The **electric actuator** moves the valve, damper or similar device to defined positions and may also incorporate other functions, such as electric interlock switches and/or feedback.

### 2.3 Definitions relating to the function of controls

*Additional definitions:*

#### 2.3.101

##### **multi-position action**

action denoting that the **electric actuator** operates in such a manner that only two or more defined positions can be reached

#### 2.3.102

##### **modulating action**

action denoting that the **electric actuator** operates in such a manner that every position between two defined limits can be reached

#### 2.3.103

##### **travel time**

time taken by an **electric actuator** to move from one defined position to another

#### 2.3.104

##### **stroke**

distance travelled by a linear actuator

#### 2.3.105

##### **angular rotation**

operating movement of a rotary actuator given in radians or degrees



### 3 General requirements

This clause of Part 1 is applicable.

### 4 General notes on tests

This clause of Part 1 is applicable.

### 5 Rating

This clause of Part 1 is applicable.

### 6 Classification

This clause of Part 1 is applicable, except as follows:

#### 6.1 According to nature of supply

##### 6.1.1 Control for a.c. only

*Replacement:*

**Electric actuators** which are designed for a.c. supply only shall not be used on d.c. supply.

#### 6.3 According to their purpose

*Additional subclauses:*

##### 6.3.101 – electric actuator;

##### 6.3.102 – electric actuator as a component of a multi-purpose control or **system**.

NOTE See also H.6.18 according to classes of **control** functions.

#### 6.4 According to features of automatic action

*Additional subclauses:*

##### 6.4.101 Type of action

###### 6.4.101.1 Multi-position action

###### 6.4.101.2 Modulating action

##### 6.4.102 Type of movement

###### 6.4.102.1 Rotary movement

###### 6.4.102.2 Linear movement

*6.4.3 Additional subclauses:*

**6.4.3.101** –an action in which the **electric actuator** assumes a predefined position upon loss of the electrical supply and/or upon loss of the **control** signal (type 1.AA or type 2.AA);

**6.4.3.102** – an action in which the **electric actuator** operates normally between 1,1  $V_R$  and 0,85  $V_R$  inclusive and in which it either operates normally or assumes a predefined position between 0,85  $V_R$  and a declared lower percentage of rated voltage (type 1.AB or type 2.AB).

**6.11 According to number of automatic cycles (A) of each automatic action**

*Modification:*

*Subclauses 6.11.8 to 6.11.12 inclusive are not applicable.*

**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
<i>Modifications:</i>		
7 The type of load controlled by each external circuit	6.2, 14	D
22 Temperature limits of the actuator, if $T_{min}$ lower than 0 °C or $T_{max}$ other than 60 °C	6.7, 14,5, 14.7, 17.3	D
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 <sup>102</sup>	6.11	X
28 Not applicable		
34 Detail of any limitation of <b>operating time</b> <sup>101, 103</sup>	14, 17	C
37 Not applicable		
38 Not applicable		
43 Not applicable		
44 Not applicable		
47 Not applicable		
<i>Additional requirements:</i>		
101 Impedance protected motor	14.4.101	D
102 Thermally protected motor	14.4.102	D
103 Type of movement	2.3.104, 2.3.105, 6.4.102	D
104 Type of action	2.3.101, 2.3.102, 6.4.101	D
105 Maximum rated mechanical load	14.4, 15.5.102	D
106 <b>Travel time</b>	2.3.103, 15.5.101, 15.5.102	D
107 <b>Stroke</b>	2.3.104	D
108 <b>Angular rotation</b>	2.3.105	D
109 Response time and method of measurement (for types 1.AA or 2.AA)	6.4.3.101 15.5.102	D
110 Lower percentage of rated voltage (for types 1.AB or 2.AB)	6.4.3.102	D
<i>Additional notes:</i>		
<sup>101</sup> This may be given as a maximum percentage of ON time of the power supply to avoid over-heating of the windings in a declared period of time.		
<sup>102</sup> <b>Electric actuators</b> are subjected to a minimum of 6 000 cycles.		
<sup>103</sup> For integrated and incorporated <b>electric actuators</b> , the method is D.		

### 7.3.1 Addition:

NOTE Actuators of class II construction provided with a cord for connection to the **fixed wiring** which does not have a plug fitted may carry the symbol for class II construction.

## 8 Protection against electric shock

This clause of part 1 is applicable.

## 9 Provision for protective earthing

This clause of Part 1 is applicable.

## 10 Terminals and terminations

This clause of Part 1 is applicable.

## 11 Constructional requirements

This clause of Part 1 is applicable except as follows:

### 11.4 Actions

*Additional subclauses:*

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**11.4.101** A type 1.AA or 2.AA action shall operate such that for any duration of voltage interruption which is greater than the response time declared in Table 1 requirement 109, the actuator assumes the predefined position and resumes normal **operation** upon restoration of the supply.

*Compliance is checked by test.*

**11.4.102** A type 1.AB or 2.AB action shall operate normally between  $1,1 V_R$  and  $0,85 V_R$  inclusive and shall respond as declared by the manufacturer at voltages below  $0,85 V_R$  and the voltage declared in Table 1, requirement 110.

*Compliance is checked by test.*

## 12 Moisture and dust resistance

This clause of Part 1 is applicable.

## 13 Electric strength and insulation resistance

This clause of Part 1 is applicable.

## 14 Heating

This clause of Part 1 is applicable except as follows:

**14.3** Not applicable.

#### 14.4 Replacement of the first paragraph by the following:

The tests based on an action type 1.AB or 2.AB shall be checked by the lowest ( $0,85 V_R$ ) and the highest ( $1,1 V_R$ ) rated voltage as declared by the manufacturer. During this test, the temperature shall not exceed the values specified in Table 13 (14.1 of edition 3.)

The actuator shall be loaded with the maximum rated mechanical load. Each **duty cycle** shall be operated at the declared maximum **stroke** or **angular rotation**.

14.4.3.1 to 14.4.3.3 Not applicable.

14.4.4 Not applicable.

Additional subclauses:

**14.4.101** If stalling of the **electric actuator** drive shaft is part of normal **operation**, then the drive shaft of motorized actuators shall be stalled and temperatures measured after steady-state conditions are reached. The temperatures shall comply with the limits of Table 13. In addition, if any protective device provided does not cycle under stalled conditions, then the **electric actuator** is also considered to comply with the requirements of the burnout test of 27.2.

**14.4.102** If stalling of the **electric actuator** drive shaft is not part of normal **operation**, then Table 13 limits do not apply during stalling. The **electric actuator** shall comply with the requirements of the burnout test of 27.2.

14.5.1 Replacement:

Change "switch head" to "**electric actuator**"

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14.5.2 Not applicable.

14.6 Replacement:

The temperatures specified for the **electric actuator** shall be attained in approximately 1 h.

14.7 Replacement:

The temperature of the medium in which the **electric actuator** is located shall be measured as near as possible to the centre of the space occupied by the samples and at a distance of approximately 50 mm from the actuator.

## 15 Manufacturing deviation and drift

This clause of Part 1 is applicable except as follows:

15.5 Additional subclauses:

**15.5.101** The **travel time** shall be measured at  $0,85 V_R$ .

**15.5.102** The **travel time** and the response time shall be measured with the maximum rated mechanical load declared by the manufacturer and in the most unfavourable mounting position declared by the manufacturer.

15.6 Not applicable.

## 16 Environmental stress

This clause of Part 1 is applicable.

## 17 Endurance

This clause of Part 1 is applicable except as follows:

### 17.4 Manual and mechanical conditions for the tests

#### 17.4.2 Replacement:

The speed of movement of the **electric actuator** drive shaft shall be as declared by the manufacturer.

#### 17.4.4 Replacement:

The method of acceleration shall be as agreed between the manufacturer and the testing authority.

#### 17.6 Not applicable.

*Additional subclause:*

**17.8.101** The tests based on an action type 1.AB or 2.AB shall be checked with 50 % of the cycles at 0,85 of the minimum  $V_R$  at ambient temperature or  $T_{min}$ , if lower than 0 °C, and 50 % of the cycles at 1,1 of the maximum  $V_R$  at  $T_{max}$ .

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## 18 Mechanical strength

This clause of Part 1 is applicable.

## 19 Threaded parts and connections

This clause of Part 1 is applicable.

## 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.

## 27 Abnormal operation

This clause of Part 1 is applicable except as follows:

### 27.2 Burnout test

*Replacement of the first sentence by the following:*

This clause is applicable to actuators where an external mechanical blockage will not cause an internal overload of the actuator. If means (e.g. a **clutch**) is used to decouple the external blockage to the internal mechanical structure, then a blockage of the mechanical parts between the motor and the decoupling means shall be tested according 27.2.1.

#### 27.2.2 Replacement:

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*After this test, the actuator shall comply with the items a) to g) of H.27.1.1.3 .*

#### 27.2.3 Blocked mechanical output test (abnormal temperature test)

*Replacement of the first paragraph by the following:*

**Electric actuators** shall withstand the effects of blocked output without exceeding the temperatures indicated in Table 26. Temperatures are measured by the method specified in 14.7.1.

This test is not conducted on **electric actuators** which meet the requirements of 14.4.101.

##### 27.2.3.1

*Replacement of the first and second paragraph, including the NOTE, by the following:*

**Electric actuators** are tested for 24 h or until thermal equilibrium has been reached with the output blocked in the most unfavorable position at rated voltage and in a room temperature in the range of 15 °C to 30 °C, the resulting measured temperature being corrected to a 25 °C reference value.

NOTE For the test with disconnected phase on three phase actuators, see 27.101.

**27.3** Not applicable.

### 27.101 Test with disconnected phase on three phase actuators

**27.101.1** *With any one phase disconnected, the actuator is operated under normal operation and supplied at **rated voltage**. For asymmetrical motor windings, the test is to be repeated until all phases have been singly opened.*

**27.101.1.1** *The test duration shall be such that the first and second hour winding temperatures are recorded or until temperatures stabilize, whichever is longer. Temperatures are measured by the method specified in 14.7.1.*

**27.101.1.2** *The temperature of the winding shall not exceed the temperatures indicated in Table 26.*

### 27.102 Running overload

**27.102.1** *A running overload test is carried out on electrical actuators that are intended to be remotely or automatically controlled or liable to be operated continuously in unattended mode. If present, overload protective devices relying on electronic circuits to protect the motor windings are also subjected to the running overload test. This test is not applicable to integrated actuators.*

**27.102.2** *The electrical actuator is operated under normal **operation**, carrying its rated load and supplied at rated voltage until the temperature of the motor windings stabilizes. The protector or protective circuit shall not operate or open the circuit while the actuator is operating under the above conditions.*

**27.102.2.1** *For all actuators where the trip point in the sensing variable is not known or cannot be quickly determined (for example, temperature sensing, impedance protected motors, sensor-less motor protection, position sensing, etc.), the load to the actuator is increased in increments of 10 % of the rated value (torque, current, etc.) and operated until temperatures of the winding stabilize. If the protector or the protective circuit does not operate under this overload condition, the load to the actuator is again increased by 10 % of the previous load setting and the actuator is operated until temperatures of the windings stabilize. This process is continued until the protective device or protective circuit operates.*

*When the protector or protective circuit operates, the load is slowly decreased until the protector or protective circuit is not activated. The loading parameters (torque, current, etc.) shall be measured and recorded. The actuator is then run at this load until the temperature of the winding stabilizes.*

*Any mechanical protection, such as a **clutch**, shall be defeated for this test.*

**27.102.2.2** *For actuators where the trip point in the sensing variable is known or can be quickly determined (example, current sensing), the load to the actuator is gradually increased, in a controlled manner, until the protective device or protective circuit is activated. This is the trip point and the loading parameters (torque, current etc.) shall be measured and recorded. Then, the load is slowly decreased until the protector or protective circuit is not activated. The actuator is then run at this load until the temperature of the winding stabilizes.*

NOTE A brake dynamometer can be used to gradually increase the torque on the actuator shaft in a controlled manner.

**27.102.3** *During the test, the winding temperature prior to the operation of the protective device or protective circuit shall not exceed*

- 140 °C, for class 105 (A) winding insulation;
- 155 °C, for class 120 (E) winding insulation;
- 165 °C, for class 130 (B) winding insulation;