



UL 60730-2-14

STANDARD FOR SAFETY

Automatic Electrical Controls – Part 2-14: Particular Requirements for Electric Actuators

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UL Standard for Safety for Automatic Electrical Controls – Part 2-14: Particular Requirements for Electric Actuators, UL 60730-2-14

Third Edition, Dated August 7, 2018

Summary of Topics

This revision of ANSI/UL 60730-2-14 dated November 30, 2021 adopts the first amendment of IEC 60730-2-14 issued March 2019.

Please note that the national difference document incorporates all of the U.S. national differences for UL 60730-2-14. This standard is an adoption of IEC 60730-2-14, Edition 2 including amendment 1, published by the IEC, March 2019.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated August 27, 2021.

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ANSI/UL 60730-2-14-2021

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UL 60730-2-14

Automatic Electrical Controls – Part 2-14: Particular Requirements for Electric Actuators

Prior to the first edition of UL 60730-2-14, the requirements for the products covered by this Standard were included in UL 8730-2-14.

First Edition – February, 2002
Second Edition – February, 2013

Third Edition

August 7, 2018

This ANSI/UL Standard for Safety consists of the Third Edition including revisions through November 30, 2021.

The most recent designation of ANSI/UL 60730-2-14 as an American National Standard (ANSI) occurred on November 30, 2021. 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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Bibliography

Preface (UL)

This UL Standard is based on IEC Publication IEC 60730-2-14: second edition including Amendment 1, Standard for Automatic Electrical Controls – Part 2-14: Particular Requirements for Electric Actuators, is to be used in conjunction with UL 60730-1. IEC publication 60730-2-14 is copyrighted by the IEC.

This UL Standard 60730-2-14, Standard for Automatic Electrical Controls – Part 2-14: Particular Requirements for Electric Actuators, is to be used in conjunction with the fifth edition of UL 60730-1. The requirements for electric actuators are contained in this Part 2 Standard and UL 60730-1.

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

Where a particular subclause of UL 60730-1 is not mentioned in UL 60730-2-14, the UL 60730-1 subclause applies.

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

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NATIONAL DIFFERENCES

GENERAL

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60730-2-14, Automatic Electrical Controls – Part 2-14: Particular Requirements for Electric Actuators, copyright 2019, 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 2-14: Particular requirements for electric actuators

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.

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6) All users should ensure that they have the latest edition of this publication.

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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.

This Consolidated version of IEC 60730-2-14 bears the edition number 2.1. It consists of the second edition (2017-08) [documents 72/1079/FDIS and 72/1100/RVD] and its amendment 1 (2019-03) [documents 72/1168/FDIS and 72/1175/RVD]. The technical content is identical to the base edition and its amendment.

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

This second edition constitutes a technical revision. This edition includes the following significant technical changes with respect to the previous edition:

- adapting it to the 5th 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 fifth edition of that standard (2013) including its amendment 1 (2015). 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.

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

The committee has decided that the contents of the base publication and its amendment 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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

101DV DE *Modification of the 6th paragraph after item (9) by replacing it with the following paragraph:*

This Part 2-14 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.

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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.

This part 2-14 applies to ELECTRIC ACTUATORS powered by primary or secondary batteries, requirements for which are contained within the standard, including Annex V.

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.

1.1.1DV.2 DC Replacement of third and fourth paragraphs of [1.1.1](#) with the following:

This part 2 does not apply to electric actuators which are mechanically integrated with valves. See UL 60730-2-8, Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Electrically Operated Valves, Including Mechanical Requirements or the Standard for Electrically Operated Valves, UL 429.

This part 2 does not apply to electric motors, requirements for which are contained in UL 1004 series of standards.

1.1.1DV.4 DR Modification of [1.1.1](#) by adding the following paragraph:

Electric actuators intended for plenum use are covered under the scope of this standard.

1.1.2 Requirements for manual switches not integral with an ELECTRIC ACTUATOR are contained in IEC 61058-1.

1.1.2DV.1 DC Replacement of [1.1.2](#) with the following:

Requirements for manual switches not integral with an electric actuator are contained in UL 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.

1.1.3DV.1 D2 Modification of [1.1.3](#) by adding the following text:

The maximum current is unlimited.

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.

1.1.5 Void.

1.1.6 Void.

1.1.7 Replacement:

This part 2-14 applies also to ELECTRIC ACTUATORS incorporating ELECTRONIC DEVICES, requirements for which are contained in Annex [H](#).

1.1.8 *Replacement:*

This part 2-14 applies also to ELECTRIC ACTUATORS using NTC or PTC THERMISTORS, requirements for which are contained in Annex J.

1.1.9 *Replacement:*

This part 2-14 applies to the electrical and FUNCTIONAL SAFETY of ELECTRIC ACTUATORS capable of receiving and responding to communications signals, including signals for power billing rate and demand response.

The signals may be transmitted to or received from external units being part of the ELECTRIC ACTUATOR (wired), or to and from external units, which are not part of the ELECTRIC ACTUATOR (wireless) under test.

1.1.10 *Replacement:*

This part 2-14 does not 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.

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

2.3.106

MAXIMUM RATED MECHANICAL LOAD

maximum mechanical resistance to the active movement of an actuator under normal operating conditions

Note 1 to entry: See also [6.4.102.1](#) and [6.4.102.2](#).

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 subclause:

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

NOTE MAXIMUM RATED MECHANICAL LOAD for rotary movement actuators can be declared in terms of rated torque (for the complete ANGULAR ROTATION) or, alternatively, in terms of maximum torque, running torque and percentage of the angular rotation in which the maximum torque occurs. The value of the percentage of the angular rotation in which the maximum torque occurs is independent from any specific position within the travel of the actuator; maximum torque can be reached at any position within the actuator travel (e.g. at start position, at end position, at each end, in the middle, etc.).

6.4.102.2 LINEAR MOVEMENT

NOTE MAXIMUM RATED MECHANICAL LOAD for linear movement actuators can be declared in terms of rated force (for the complete STROKE) or, alternatively, in terms of maximum force, running force and percentage of the stroke in which the maximum force occurs. The value of the percentage of the stroke in which the maximum force occurs is independent from any specific position within the travel of the actuator; maximum force can be reached at any position within the actuator travel (e.g. at start position, at end position, at each end, in the middle, etc.).

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 $0\text{ }^{\circ}\text{C}$ or T_{max} other than $60\text{ }^{\circ}\text{C}$	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 ^{bb}	6.11	X
28	Not applicable		

Table 1 Continued on Next Page

Table 1 Continued

Information		Clause or subclause	Method
34	Detail of any limitation of OPERATING TIME ^{aa}	14, 17	C ^{cc}
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 ^{dd}	2.3.106, 6.4.102.1, 6.4.102.2, 14.4, 15.5.102, 17.4.101	D
106	TRAVEL TIME	2.3.103, 15.5.101, 15.5.102	D
107	STROKE	2.3.104	D
108	ANGULAR ROTATION	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 footnotes:</i>			
^{aa} 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.			
^{bb} ELECTRIC ACTUATORS are subjected to a minimum of 6 000 cycles.			
^{cc} For integrated and incorporated ELECTRIC ACTUATORS, the method is D.			
^{dd} For test purposes, representative physical load may be defined by agreement between the manufacturer and testing authority (e.g. dedicated test device).			

Table 1DV D2 Modification of [Table 1](#) (7.2 of edition 3) by adding item 111 and note 105):

111	Date code for INDEPENDENTLY MOUNTED CONTROLS ¹⁰⁵⁾	7.2.1, 7.2.1	C
¹⁰⁵⁾	The date code shall be the date or other dating period of manufacture not exceeding any three consecutive months. The date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer, provided that the code:		
	a) Does not repeat in less than 20 years, and b) Does not require reference to the product records of the manufacturer to determine when the product was manufactured.		

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:

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.

11.13.101DV D2 Addition of 11.13.101DV.1:

11.13.101DV.1 If an electronic circuit is relied upon to either reduce the power consumption to the motor or removing power to the load of an actuator under normal or abnormal operation of the product, that electronic circuit/component is considered to be providing a protective function. Such electronic components/circuits shall comply with the relevant requirements for protective controls unless it can be shown through a fault assessment and tests of clause [27](#) that failure or malfunction of the protective circuit/component will not lead to a hazardous condition.

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".

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:

17.2.3.1DV D2 Modification of 17.2.3.1 by adding the following:

208 V for controls rated at any voltage between 200 to 208 volts

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.

Additional subclause:

17.4.101 The ELECTRIC ACTUATOR shall be loaded with the MAXIMUM RATED MECHANICAL LOAD (item 105 of [Table 1](#)).

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} .

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.

21.101DV DR Addition of 21.101DV.1:

21.101DV.1 Electric actuators employing polymeric parts that are intended to be installed in air handling spaces or in other environmental air space (plenums) shall be investigated for the application and their fire-resistance and low-smoke-producing characteristics in accordance with the Standard for Fire test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, UL 2043.

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 except as follows:

25.2 Not 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:

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](#).

27.101 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;*
- 180 °C, for class 155 (F) winding insulation;*
- 200 °C, for class 180 (H) winding insulation;*
- 220 °C, for class 200 (N) winding insulation;*
- 240 °C, for class 220 (R) winding insulation;*
- 270 °C, for class 250 winding insulation.*

NOTE If the load cannot be increased in appropriate steps, the motor and the protective electronics, if applicable, can be removed from the appliance and tested separately.

27.102.3.1 During the test, the MAXIMUM TEMPERATURE recorded on insulating parts shall not exceed 1,5 times the relevant values specified in Clause [14](#).

27.102.4 For electrical actuators which are used in a continuous OPERATION for longer than 24 h without interruption the load is again increased and the test is repeated until the protective device operates or the motor stalls.

27.102.5 For electrical actuators which are used in OPERATION mode which will not exceed 24 h without interruption, the test is repeated after the winding temperature has reached environmental temperature conditions. The test will be performed with an increased load so that the current through the motor windings is raised by 10 % increments. The electrical actuator is operated again until steady conditions are established, the supply voltage being maintained at its original value. This procedure will be repeated until the protective device operates or the motor stalls.

28 Guidance on the use of electronic disconnection

This clause of Part 1 is applicable.

FIGURES

The figures of Part 1 are applicable.

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Annexes

The annexes of Part 1 are applicable, except as follows:

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Annex H (normative)

Requirements for electronic controls

This annex of Part 1 is applicable except as follows:

H.11 Constructional requirements

H.11.12 Controls using software

H.11.12.2.6 *Addition:*

The values declared in [Table 1](#), requirement 71, may be given in the applicable equipment standard.

Additional subclause:

H.11.12.2.6.101

The CONTROL response(s) declared in [Table 1](#), requirement 72, may be given in the applicable equipment standard.

H.26 Electromagnetic compatibility (EMC) requirements – Immunity

H.26.1 *Addition:*

If an ELECTRIC ACTUATOR is a component of a multi-purpose control or SYSTEM and provides a PROTECTIVE CONTROL function, then the ELECTRIC ACTUATOR shall be treated as a PROTECTIVE CONTROL throughout Clause [H.26](#).

H.26.1DV D2 *Replacement:*

If an electric actuator is a component of a multi-purpose control or system and provides a protective control function or employs protective circuitry as described in clause [11.13.101DV](#), then the electric actuator shall be treated as a protective control throughout Clause [H.26](#).

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

H.26.5.1.2 Test procedure for voltage dips and interruptions

Addition:

Each test is performed three times.

Additional subclause:

H.26.5.1.101 Compliance

After the test according to [H.26.5.1.2](#) of all the voltage dips and the voltage interruption of more than one cycle of the supply wave form, the ELECTRIC ACTUATOR shall provide normal OPERATION.

During the test according to [H.26.5.1.2](#) of an interruption of one cycle and of an interruption of one half-cycle of the supply wave form, the CONTROL shall continue to operate after restoration of the supply voltage from the position the ELECTRIC ACTUATOR was in right before the interruption.

H.26.5.2.2 Test procedure

Addition:

The test shall be performed in the fully open, fully closed, and if possible, in a partly open position.

Additional subclause:

H.26.5.2.101 Compliance

After the test according to [H.26.5.2.2](#) of voltage test level 0 % V_R , the electric actuator shall provide normal operation.

During the tests according to [H.26.5.2.2](#) of voltage test level 40 % V_R , the control shall continue to operate after restoration of the supply voltage from the position the electric actuator was in immediately before the interruption.

H.26.6 Not applicable.

H.26.8 Surge immunity test

H.26.8.3 Test procedure

Addition:

The five pulses in each polarity shall be distributed in the following operating modes:

- 1 pulse in the closed position;
- 3 pulses during energized movement in the most surge sensitive position;
- 1 pulse in the open position.

Additional subclause:

H.26.8.101 Compliance

The ELECTRIC ACTUATOR shall tolerate the surge immunity test on the mains supply and signal lines, so that, when tested in accordance with [H.26.8.3](#),

a) for the value of test level 2: it shall continue to function in accordance with the requirements of this standard. No influence to the actual position of the ELECTRIC ACTUATOR is recognized;

b) for the value of test level 3: for a protective ELECTRIC ACTUATOR used as a component of a protective multi-purpose control or SYSTEM, it shall either perform as in a) or it may stop operating and shall indicate that it has done so to the protective multi-purpose control or SYSTEM.

NOTE The acceptability of the indication to the protective multi-purpose control or SYSTEM is dependent on the application.

c) if declared according to [Table 1](#), requirement 90 after the tests,