

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



AMENDMENT 2  
AMENDEMENT 2

Automatic electrical controls –  
Part 1: General requirements

Dispositifs de commande électrique automatiques –  
Partie 1: Exigences générales

STANDARD PREVIEW  
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## FOREWORD

This amendment has been prepared by IEC technical committee 72: Automatic electrical controls.

The text of this amendment is based on the following documents:

FDIS	Report on voting
72/1226/FDIS	72/1237/RVD

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

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

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## 1 Scope and normative references

### 1.2 Normative references

Replace reference IEC 60664-3:2003 with the following:

IEC 60664-3:2016, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

Add the following references:

IEC 61051-1, *Varistors for use in electronic equipment – Part 1: Generic specification*

IEC 61051-2, *Varistors for use in electronic equipment – Part 2: Sectional specification for surge suppression varistors*

IEC 61051-2-2, *Varistors for use in electronic equipment – Part 2: Blank detail specification for zinc oxide surge suppression varistors. Assessment level E*

## 2 Terms and definitions

### 2.1 Definitions relating to ratings, voltages, currents, frequencies, and wattages

Replace Definitions 2.1.4 and 2.1.5 with the following:

#### 2.1.4

##### extra-low voltage

##### ELV

voltage not exceeding the maximum values of 50 V AC (RMS), 70,7 V AC (peak) or 120 V DC (ripple-free) between conductors and between conductors and earth which is permitted to be maintained indefinitely under normal and single-fault conditions

Note 1 to entry: Ripple-free is conventionally defined as an RMS ripple voltage of not more than 10 % of the DC component.

Note 2 to entry: The use of **ELV** other than in **SELV system** or **PELV system** is not a protective measure against electric shock, this is in line with IEC 61140:2001.

#### 2.1.5

##### safety extra-low voltage

##### SELV

voltage for use in **SELV system** or **PELV system** between simultaneously **accessible part(s)** and between any **accessible part** and earth, not exceeding the limits of 30 V AC (RMS), 42,4 V AC (peak) or 60 V DC (ripple free) under normal and single-fault condition, which is provided by an independent source (such as safety isolating transformers, motor generators, and batteries) or when obtained from higher voltage is obtained by a **safety isolating transformer** or a converter with separate windings providing equivalent insulation

Note 1 to entry: The voltage limits are based on the assumption that the **safety isolating transformer** is supplied at its rated voltage. For the purpose of the output test in 24.1.1, the secondary output voltage limit shall be increased as specified in 17.2.2.

Note 2 to entry: Transformers used in converters that have separate windings and provide equivalent insulation are covered under IEC 61558-2-6 and IEC 61558-2-16.

Note 3 to entry: **SELV** limits are defined regardless of any special condition which may occur in installation. Different requirements may be specified in the relevant electrical installation standards (e.g. IEC 60364 (all parts)) or in the applicable local regulations.

Note 4 to entry: Ripple-free is conventionally defined as an RMS ripple voltage of not more than 10 % of the DC component.

Note 5 to entry: **SELV** limits may be different in other product or system standards. In case a control is declared exclusively for use in applications governed by a different standard, the limits set by the application standard apply (e.g. controls to be used exclusively in household appliances according IEC 60335 set of standards or connected to HBES/BACS systems according to IEC 63044-3 accept different **SELV** voltage limits).

Add the following new definition:

#### 2.3.33

##### mounting surface temperature

##### $T_s \text{ max}$

declared maximum temperature to which the mounting surface of the control is intended to be exposed including any likely overshoot once a control has operated

## 2.13 Miscellaneous definitions

### 2.13.4 normal use

Add the following Note 3:

Note 3 to entry: **Normal use** may include standby mode, and one or more operating modes.

Add the following new definition:

#### 2.13.12 intentionally weak trace

printed circuit board trace intended to rupture under conditions of abnormal operation to prevent the occurrence of a condition which could impair compliance with this document

Note 1 to entry: See 11.1.4.

## 7 Information

### 7.2 Methods of providing information

**Table 1 (7.2 of edition 3) – Required information and methods of providing information (1 of 4)**

Replace line 23, Line 43, line 76, line 86 and line 87 with the following:

	Information	Clause or subclause	Method
23	Maximum temperature of mounting surface ( $T_{s\max}$ ) if it differs by more than 20 K from $T_{\max}$	6.12.2, 14.1, 17.3	C
43	Reset characteristics for cut-out action <sup>1</sup>	6.4, 11.4.11, 11.4.12	D or E
76	Type of printed circuit board protection	Annex P or Annex Q	X
86	For <b>SELV</b> or <b>PELV</b> circuits, the <b>ELV</b> limits realized	2.1.5, 8.1.1, T.3.2	X
87	Value of accessible voltage of <b>SELV/PELV</b> circuit, if different from 8.1.1, and the product standard(s) referred to for the application of the <b>control</b> , in which the accessible <b>SELV/PELV</b> level(s) is (are) given	2.1.4, 6.8.4.1, 6.8.4.2, 8.1.1.1	X

## 8 Protection against electric shock

### 8.1 General requirements

#### 8.1.1

Replace the second and third paragraphs with the following:

Unless otherwise specified, **accessible parts** connected to **SELV systems** or **PELV systems** where the voltage does not exceed the **SELV** limits of 2.1.5 are not considered to be **hazardous live parts**.

For **accessible parts** connected to a **SELV system** or a **PELV system** where the voltage exceeds the **SELV** limits of 2.1.5 or the voltage limits declared in item 87 of Table 1, the current measured between the simultaneously **accessible parts** and between **accessible parts** and earth shall not exceed the limits in H.8.1.10.1 under fault-free (normal) and single-fault conditions.

### 8.1.1.1

Replace the second dashed text and the Note with the following:

- if the manufacturer declares the application, product standard governing the application and level of voltage for accessible **SELV**/PELV circuits considered to be non-hazardous by the application standard (Table 1, requirement 87).

## 11 Constructional requirements

### 11.1 Materials

Add the following new subclause:

#### 11.1.4 Intentionally weak traces

**Intentionally weak traces** shall be used only to protect against hazards caused by failure of components included in Table H.24. See H.27.1.1.8.

### 11.4 Actions

#### 11.4.11 Type 1.H or 2.H action

Add the following *NOTE* after the compliance criteria:

*NOTE* The test is given in the relevant part 2.

#### 11.4.12 Type 1.J or 2.J action

Add in the last sentence before “–35 °C” the text “0 °C or”, so that it reads “0 °C or –35 °C”.

Add the following *NOTE* after the compliance criteria:

*NOTE* The test is given in the relevant part 2.

### 13.2 Electric strength

**Table 12 (13.2 of edition 3) – Insulation or disconnection test voltages <sup>a</sup> (1 of 2)**

Replace in the row for *Electronic disconnection* in the most right column “–” with “ $2 \times U$ ” as follows:

Insulation or disconnection to be tested <sup>c, d</sup>	Test voltage for working voltage ( $U$ ) <sup>b, q</sup>		
	SELV <sup>e</sup>	Working voltage $\leq 50 \text{ V}$ <sup>f</sup>	Working voltage <sup>f</sup> $50 \text{ V} < U \leq 690 \text{ V}$
<b>Electronic disconnection</b> <sup>m, n</sup>	100	100	$2 \times U$

## 14 Heating

Replace in 14.5.1 the text “different from  $T_{\max}$ ” with “higher than  $T_{\max}$  by more than 20 K as follows:

**14.5.1** The temperature of the **switch head** is maintained between  $T_{\max}$  and either  $(T_{\max} + 5) \text{ °C}$  or 1,05 times  $T_{\max}$ , whichever is greater. The temperature of any mounting surface

is maintained between  $T_{s \max}$  and either  $(T_{s \max} + 5)$  °C or 1,05 times  $T_{s \max}$  whichever is the greater if  $T_{s \max}$  is higher than  $T_{\max}$  by more than 20 K.

## 17 Endurance

### 17.2 Electrical conditions for the tests

**Table 15 – (17.2.2 of edition 3) – Electrical conditions for the overload tests of 17.7 and 17.10**

Add the following two “Type of circuits” into the table, after the row “Declared motor load”, as shown below.

**Table 15 (17.2.2 of edition 3) – Electrical conditions for the overload tests of 17.7 and 17.10**

(this table applies in Canada, USA, and all countries which use an overload test)

Type of circuit	Operation	AC circuit			DC circuit	
		V	A	Power factor	V	A
Declared specific load (classified 6.2.3)	Making and breaking	$V_R$	$1,5 I_x$	0,75 – 0,8	$V_R$	$1,5 I_R$
20 mA load (classified 6.2.4)	Making and breaking	$V_R$	$1,5 I_x$	0,95	$V_R$	20 mA Non-inductive

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In the line for “Pilot duty load”:

[IEC 60730-1:2013/AMD2:2020](https://standards.iteh.ai/catalog/standards/sist/e289402f-531d-43c8-b0c7-857f555ffc14/iec-60730-1-2013-amd2-2020)

- Replace 11 with 10 in the 4<sup>th</sup> column,
- Remove 1,1 in front of  $V_A/V_T$  in the 4th column.

Add a new paragraph after the 2<sup>nd</sup> dashed item with the following text:

For Canada, pilot duty, the AC circuit voltage value is  $1,2 V_T$  for making and breaking operation.

**Table 16 – (17.2.3 of edition 3) – Electrical conditions for the overload tests of 17.8, 17.9, 17.11, 17.12 and 17.13**

Replace in the title of the table “overload” with “endurance”.

Add the following two “Type of circuits”, after the row “Declared motor load”, as shown below.

**Table 16 (17.2.3 of edition 3) – Electrical conditions for the endurance tests of 17.8, 17.9, 17.11, 17.12 and 17.13**

(this table applies in Canada, USA, and all countries which use an overload test)

Type of circuit	Operation	AC circuit			DC circuit	
		V	A	Power factor	V	A
Declared specific load (classified 6.2.3)	Making and breaking	$V_R$	As determined by load <sup>a</sup>		$V_R$	As determined by load <sup>a</sup>
20 mA load (classified 6.2.4)	Making and breaking	$V_R$	20 mA	0,95	$V_R$	20 mA Non-inductive



In the line for “Pilot duty load”, remove 1,1 in front of  $V_T$  in the 3<sup>rd</sup> column for Making and Breaking.

Add the following new footnote to the end of the table:

<sup>a</sup> A control may be operated faster than 1 cycle per minute if synthetic loads are used or if a sufficient number of banks of lamps controlled by a commutator are employed so that each bank will cool for at least 59 seconds between successive applications.”

## 20 Creepage distances, clearances and distances through solid insulation

Replace in the first line of the 2<sup>nd</sup> paragraph “coating” with “protection”.

Replace in the second paragraph “IEC 60664-3:2003” with “IEC 60664-3:2016”.

## 24 Components

### 24.1

Add the following text after the third paragraph:

If varistors are used as surge protective devices, they shall be selected to withstand the impulses corresponding to the installation class for which is intended to be used. Additionally, if they are connected to the supply mains, they shall comply with IEC 61051-1, IEC 61051-2 or IEC 61051-2-2.

### 24.5

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Add the following text at the end of the second dashed item: 2020

“, or protected against the risk of electric shock through double or reinforced insulation, or by means of **protective impedance**;

Add the following text at the end of the third dashed item:

“, or the **control** or final equipment complies with Clause H.27.1.1.5 when the **thermistor** is open or short circuited”;

## Annex H – Requirements for electronic controls

### H.7 Information

Replace item 60 with the following:

Information	Clause or subclause	Method
60 Installation class (surge immunity) and operating modes	24.1, H.26.8.2, H.26.8.3, Annex R	X

## H.11 Constructional requirements

### H.11.2.5

Replace the second paragraph and the NOTE with the following paragraph:

The use of only one Y1 capacitor is permitted where the capacitor complies with IEC 60384-14 appropriate to the **working voltage** of application where it is used.

Additionally, add the following compliance criteria text after the text “Capacitors shall comply with IEC 60384-14, class Y”.

Compliance is checked by

- a) open-circuiting each impedance component in turn;
- b) short-circuiting of those impedance components which are likely to fail by a short circuit (according to Clause H.27);
- c) applying a fault condition according to Clause H.27 to any part of the circuit which might influence the maximum leakage current with the protective impedance intact.

Operation of a protective device or loss of one pole of the supply shall also be considered as faults.

#### H.11.12.4.1.3.2 Access to data exchange

Remove the first paragraph and remove in the last line of the second paragraph the text “of which”.

**Table H.11 – Examples of defences against unauthorised access and transmission failure modes**

To cover	Threats	Defences							
		Sequence number <sup>b</sup>	Time stamp <sup>c</sup>	Time out <sup>d</sup>	Feed-back message <sup>e</sup>	Sourced destination identifier <sup>f</sup>	Identification procedure	Safety code <sup>g</sup>	Cyrtographic techniques
Transmission failure modes <sup>h</sup>	Repetition of a message	x	x						
	Deletion of message	x							
	Insertion of message	x			x	x	x		
	Re-sequence of data in message	x	x						
	Corrupted, deleted or inserted data in message							x <sup>a</sup>	x
	Delay in sending / receiving the message		x	x					
Unauthorized access	Masquerade <sup>i</sup>				x		x		x

Examples of defences against unauthorized access can also be found in the applications covered by EN 50159:2011.

a	See Table H.1, items 6.1 and 6.2.
b	Additional data field containing a number that changes in a predefined way from message to message.
c	Information concerning time of transmission attached to a message by the sender.
d	Delay between two messages exceeding a predefined allowed maximum time. NOTE 1 If this is the case, an error can be assumed.
e	Response from a receiver to a sender, via a return channel.
f	Identifier which is assigned to each entity. NOTE 2 This identifier can be a name, number or arbitrary bit pattern. This identifier will be used for the safety-related communication. Usually the identifier is added to the user data.
g	Redundant data included in a safety-related message to permit data corruptions to be detected by the safety-related transmission function.
h	These failure modes are of random and systematic nature.
i	Masquerade: Making an inauthentic message look like an authentic message by an unauthorized user.

#### H.11.12.4.3.6 Consideration for the evaluation of reset functions on the final application

Add the following note as NOTE 1 and renumber the existing note to NOTE 2:

NOTE 1 Remote reset requirements are dictated by the end product requirements (example – the boiler standard).

#### H.11.12.4.4.1

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Add in the first paragraph after “Software updates” the following text “for Class B and Class C software”.

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#### H.26 Electromagnetic compatibility (EMC) requirements – Immunity

Add in the 1<sup>st</sup> paragraph of H.26.1 after “normal use” the text “(see NOTE 3 of 2.13.4)”.

#### H.26.8.3 Test procedure

Replace the second paragraph with the following and remove the third paragraph:

If the system has more than one relevant operating mode, the impulses can be distributed over the relevant operating modes provided that, for each operating mode, a minimum of one impulse of each polarity (+, -) and each phase angle described in IEC 61000-4-5, shall be applied.

#### H.26.9 Electrical fast transient/burst immunity test

##### H.26.9.2 Test levels

Add in the paragraph for “operating conditions” after “as in the relevant part 2”, “or, in the absence of a part 2, the relevant operating modes”.

##### H.27.1.1.2

Replace in d) “an electrical” with “a power” and add an item f) with the following text:

f) The power supply to the **control** shall have the capability of supplying a short-circuit current of at least 500 A.

*Add the following new subclauses:*

**H.27.1.1.7** If the test is terminated by the functioning of a component other than an overcurrent protective device, the following criteria shall be met, in addition to H.27.1.1.3:

- a) To ensure consistency and repeatability, the test is to be repeated on two additional samples resulting in the same component terminating the test.
- b) To ensure that the disconnection is reliable, an electric strength potential corresponding to functional insulation, as specified in Table 12, shall be applied across the “functioned” component. Each sample shall comply with the criteria of 13.2. Parallel paths that could compromise the electric strength test results shall be disconnected.

To ensure reproducibility of the test results, the following information shall be recorded: specify the component by the type, ratings and other relevant technical information.

**H.27.1.1.8** If the test is terminated by the functioning of an **intentionally weak trace**, an analysis shall be conducted on the open trace and the control shall comply with the criteria of items a), c), and d) of H.27.1.1.3. The analysis of the open trace shall consist of at least the following:

- a) Upon functioning, an electric strength potential based on the value for functional insulation per table 12 shall be applied across the two ends of the opened trace.
- b) To ensure consistency and repeatability, the test is to be repeated on two additional samples with complying results.

To ensure reproducibility of the test results, the following information shall be recorded:

- specify the dimensions of the weak trace (width, length, thickness, shape),
- material of PCB,
- other relevant technical information.

An example of material is FR4, CEM1, CEM 3, type and thickness of conformal coating, etc.

## **Annex J – Requirements for thermistor elements and controls using thermistors**

### **J.4.3.5.4.1**

*Add to the end of the 1<sup>st</sup> sentence the following new text:*

“provided that it complies with the applicable declaration (e.g. number of cycles) of the control.”

## **Annex Q – Printed circuit board protection performance test**

### **Q.1**

*Replace the existing text with the following:*

Printed circuit boards conforming with all the requirements for type 1 protection as specified in IEC 60664-3:2016 shall comply with the minimum **creepage distance** requirements of Clause 20 of this document, **pollution degree 1**.

NOTE Type 1 protection improves the microenvironment of the parts under the protection (IEC 60664-3, 2016).