

# Get Compliant!

IEC 61010-1 Safety Changes that can Impact Your Business.

## **IEC 61010-1 : 2010**

SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT FOR  
MEASUREMENT, CONTROL, AND LABORATORY USE –

### **Part 1: General requirements**

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# IEC 61010-1 Topics

2nd edition : 2001 → 3rd edition : 2010 (cancels and replaces 2nd ed.)

- First look at the 3d edition: some minor corrections, but also some more significant changes
- Significance for the manufacturer
- Changes in the scope of the standard
- Things not covered in Part 1 anymore
- List of changes Clause by Clause
- Discussion of risk assessment

# IEC 61010-1 Introduction

## Introduction

This standard is very popular, commonly used for test, measurement and control equipment and components within them: power supply, circuit board, motor drive etc..

IEC 61010-1 is a very versatile standard also because it is well **harmonized internationally**. National standard developed based on the IEC version include national deviations (differences), which, when compiled with, prove full compliance for the given country.

IEC 61010 standard has a long list of Part 2 standards for all kinds of related products: heating, centrifuges, sterilizers, washers, X-ray systems, etc.

# IEC 61010-1 Summary of changes

## The more significant changes:

- The **scope** of the standard has been **expanded** to include all locations where these products may be used, so that both professional and non-professional versions of these products are within the scope now (Foreword).
- The requirements for testing and measuring circuits (in various subclauses and the entirety of Clause 16) have been removed and moved to IEC 61010-2-030 (Foreword).
- Insulation requirements (6.7) have been completely rewritten.
  - Specific requirements have been added for **solid insulation** and **thin-film insulation**.
  - Subclause 6.7 now contains only the insulation requirements for MAINS CIRCUITS of OVERVOLTAGE CATEGORY II up to 300 V, and for secondary circuits.
- The insulation requirements for all other circuits have been moved to a new Annex K.

# IEC 61010-1 Summary of changes

## The more significant changes:

- Additional requirements for protection against **mechanical HAZARDS** (Clause 7) have been included.
- **Surface temperature limits** (Clause 10) have been modified (now conform to the limits of EN 563 - Safety of machinery – temperatures of touchable surfaces ergonomics data to establish temperature limit values for hot surfaces).
- Radiation requirements (Clause 12) have been modified, and take into account a distinction between **intended emission and unintended emission**.

# IEC 61010-1 Summary of changes

## The more significant changes:

- Requirements for **reasonably foreseeable misuse and ergonomic aspects** have been added (Clause 16).
- A new clause (Clause 17) has been added to deal with **HAZARDS and environments not covered by the standard**, along with a new informative annex (Annex J) dealing with **RISK assessment**.
- A new informative annex (Annex E) addresses methods of **reducing the POLLUTION DEGREE of a micro-environment**.
- Requirements for the qualification of **coatings for protection against POLLUTION** have been added (Annex H).
- A new informative annex (Annex I) has been added to further explain how to determine the **WORKING VOLTAGE** of a MAINS CIRCUIT.

# IEC 61010-1 for the manufacturer

## Why it is important for the manufacturer:

- Your product tested or certified to 2d edition of the standard **may not be in compliance any more.** (DOW September 30, 2013 – different for EN, UL etc.)
- You need to understand the changes to reflect or possible design, component changes
- Re-evaluation for compliance with the 3d edition may be negligible to a major effort depending on your design.
- Fortunately now this 3d edition seems to be harmonized for most countries so proving compliance may help worldwide.



# IEC 61010-1 what is not covered

IEC 61010-1 does not include requirements anymore to test and measurements circuits.

All related clauses have been removed from this part 1 of the standards and now are covered in IEC 61010-2-030

# IEC 61010-1

## 1. Scope

### 1.1 Scope:

#### 1.1.1 Included:

a) – power supplies -> ... for laboratory use

a) – *Added*: “This standard also applies to test equipment integrated into manufacturing processes and intended for testing manufactured devices..”

a) – *Added*: note 2: “Manufacturing test equipment is likely to be installed adjacent to and interconnected with industrial machinery in this application”

b) Electrical control equipment -> **Electrical industrial process-control equipment**

#### 1.1.2 (exclusions):

~~f) (IEC 60521 AC watt-hour meters)~~

i) Added IEC 61010-031 (hand held probe assemblies)

j) Added IEC 61243-3 (live working – Voltage detectors – Part 3: two-pole low-voltage type)

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## 1. Scope

### 1.2 Object

#### 1.2.1 Included in scope

*Changed* : design and methods of construction used provide adequate protection for the OPERATOR and the surrounding area -> **HAZARDS to the OPERATOR**

and the surrounding area are reduced to a tolerable level (see also added **Annex J – (informative) Risk assessment!**

Requirements for protection against **HAZARDS arising from REASONABLY FORESEEABLE MISUSE** and ergonomic factors are specified in Clause 16.

**RISK assessment for HAZARDS or environments not fully covered above is specified in Clause 17.**

#### 1.2.2 Excluded from scope

Removed from list (now part of the standard) :

~~e) Servicing (repair)~~

~~f) Protection of servicing (repair) personnel~~



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## 1. Scope

### 1.4 Environmental conditions

#### 1.4.1 Normal environmental conditions

*Modified: f) TRANSIENT OVERVOLTAGES up to the levels of OVERVOLTAGE CATEGORY II*

*Added: g) TEMPORARY OVERVOLTAGES occurring on the MAINS supply.*

NOTE 2 Manufacturers may specify more restricted environmental conditions for operation; nevertheless the equipment must be safe within these normal environmental conditions

#### 1.4.2 Extended environmental conditions

*Added : f) WET LOCATION;*

*Added : g) TRANSIENT OVERVOLTAGES up to the levels of OVERVOLTAGE CATEGORY III or IV (see Annex K).*

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## 2. Normative references

### 2 Normative references

Some updates applied to reflect on standard changes.

Removed standards withdrawn or otherwise not anymore referenced.

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## 4. Tests

### 4.3.2.5 Mains supply

~~e) Unless the equipment is specified for use only on a non-earthed MAINS supply, one pole of the reference test supply shall be at or near earth potential.~~

### 4.3.2.11 Duty cycle – *periods now defined as RATED*

***Short-term or intermittent operation that develops significant heat during startup, shall be operated shortest period with shortest recovery.***

### ~~4.3.2.13 Heating equipment~~

### 4.4.2.2 Protective Impedance – *modified (no high integrity components def):*

c) If a PROTECTIVE IMPEDANCE is formed with a single component that meets the requirements of 6.5.4, it need not be short-circuited or disconnected.

### 4.4.2.5 Motors – *Added:*

**One supply phase of any multi-phase motor shall be interrupted while the motor is operating at its intended full load.**

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## 4. Tests

4.4.2.10 Cooling – *moved from 4.4.2.11 (heating devices):*

d) loss of cooling liquid shall be simulated.

4.4.2.12 Interlocks:

~~HIGH INTEGRITY components of interlock systems (see 14.6 and 15.3) need not be short circuited or open-circuited.~~

*Added:* 4.4.2.14 Voltage selectors

**Voltage selectors** which an OPERATOR can set for different RATED supply voltages shall be **set for each possible setting** with the equipment connected to each of its RATED supply circuits.

4.4.4.2 Temperature (*fault conditions*)

(see Clause 10 for test and limits).

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## 5. Marking

### 5 Marking

*Standard references are updated*

5.1.3 Mains supply

c) *added*: The marked value shall not be less than 90 % of the maximum value.

~~The measured value shall not exceed the marked value by more than 10 %.~~

#### Table 1 – Symbols

~~8 Equipotentiality~~

*Added* : 17  - **ISO 361 – Ionizing radiation**

5.1.5 Terminals, connections and operating devices 5.1.5.1 General – *Added*:

Push-buttons and actuators of **emergency stop devices**, and indicators used only to indicate a warning of danger or the need for urgent action, shall be **coloured red** and coded as specified in IEC 60073. ....

NOTE 3 National authorities may require that equipment used in certain environments meet the man-machine interface requirements pertinent to that environment.



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## 5. Marking


### 5.1.5.1 Terminals

~~e) ACCESSIBLE FUNCTIONAL EARTH TERMINALS connected to ACCESSIBLE conductive parts, with an indication that this is the case, unless it is self-evident. Symbol 8 of table 1 is acceptable for this marking.~~

~~5.1.5.2 Measuring circuit terminals— all section removed as now it is covered by IEC 61010-2-030~~

5.1.6 Switches and circuit breakers – ***on-position marking is only a recommendation, off must be marked***

Symbols 9 and 10 shall not be used for switches other than the power supply switch.

5.1.7 Equipment protected by DOUBLE INSULATION or REINFORCED INSULATION – not fully protected, cannot be marked with Symbol 11. Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION may be marked with Symbol 11 or Table 1 (*not anymore shall be marked*) 

5.1.8 Field wiring terminal – *Warning marking is not for the minimum cable temperature rating, but to consult the installation instructions*



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## 5. Marking

### 5.4 Documentation

5.4.1 *Clearing types of manuals: safety manuals for OPERATOR or the RESPONSIBLE BODY shall accompany the equipment, for service personnel authorized by the manufacturer – shall be available.*

~~e) Instructions for use (in 5.4.4)~~

~~f), g) Measurement category (now in IEC 61010-2-030)~~

*Added:*

e) **information about how to mitigate RISKS remaining after a RISK assessment has been performed (see Clause 17);**

f) for equipment which for safety reasons requires **specific accessories** (for example probe assemblies) with specific characteristics, the documentation shall indicate that **only accessories which meet the manufacturer's specifications shall be used;**

g) if a HAZARD could be caused by an incorrect reading when measuring, indicating or detecting harmful or corrosive substances, or HAZARDOUS LIVE electrical quantities, the instructions shall provide guidance on how to determine that the equipment is functioning correctly;

h) instructions for **lifting and carrying** (see 7.5).

***May use electronic media*** - if might not be available, printed media needed.

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## 5. Marking

### 5.4.2 Equipment ratings

b) *Added* : ... as required by 6.6.1 a);

c) *Added* : ... as required by 6.6.1 b);

*Added: f) for equipment with an impact RATING less than 5 J*, the information specified in 8.1 d). (with IK code or symbol 14, rated energy level stated)

### 5.4.3 Equipment installation

~~g) the maximum sound power level produced ...~~

~~i) for voltage and current measuring circuit TERMINALS ...~~ (now in IEC 61010-2-030)

### 5.4.4 Equipment operation

*Added: j) details of methods of reducing the RISKS of burns from surfaces permitted to exceed the temperature limits of 10.1.*

*Added: If equipment conforming to IEC 60950 is used with equipment conforming to this standard, and if there is a HAZARD due to moisture or liquids, the instructions for use shall specify any additional precautions necessary.*

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## 5. Marking

### 5.4.5 Equipment maintenance (*Added:*) **and service**

***Added:*** If applicable, manufacturer's documentation shall **instruct against replacing detachable MAINS supply cords by inadequately RATED cords.**

***Added:*** If equipment conforming to IEC 60950 is used with equipment conforming to this standard, and if there is a HAZARD due to moisture or liquids, the instructions for use shall specify any additional precautions necessary.

***Added:*** 5.4.6 Integration into systems or effects resulting from special conditions aspects resulting from **integration into systems** or effects resulting from **special ambient or application conditions** shall be described in the documentation.

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## 6. Protection against electric shock

### **Added section: 6.4.4 Impedance**

**An impedance used as a primary means of protection shall meet all the following requirements:**

- a) it shall limit the current or voltage to not more than the applicable level of 6.3.2;**
- b) it shall be RATED for the maximum WORKING VOLTAGE and for the amount of power that it will dissipate;**
- c) CLEARANCE and CREEPAGE DISTANCE between terminations of the impedance shall meet the applicable requirements of 6.7 for BASIC INSULATION.**

Conformity is checked by inspection, by measuring the voltage or current to confirm that they do not exceed the levels of 6.3.2, and by measuring CLEARANCE and CREEPAGE DISTANCE as specified in 6.7.

### **6.5 Additional means of protection in case of SINGLE FAULT CONDITIONS**

*6.5.1 reversed, added reference to Annex D, editorial changes through 6.5*

*Added : Figure 4 – Acceptable arrangement of protective means against electric shock*

#### **6.5.2.1 Protective bonding**

~~NOTE ACCESSIBLE conductive parts need not be bonded to the PROTECTIVE CONDUCTOR TERMINAL if they are separated from all HAZARDOUS LIVE parts by DOUBLE INSULATION or REINFORCED INSULATION.~~

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## 6. Protection against electric shock

### 6.5.2.3 PROTECTIVE CONDUCTOR TERMINAL

~~h.2. Devices used for indirect bonding in test and measurement equipment (see 6.5.1.5) are permitted to be part of the PROTECTIVE BONDING (in IEC 61010-2-030)~~

j) **Added:** Figure 5 – Examples of binding screw assemblies

k) **Added:** The contact pressure required for a bonding connection shall not be capable of being reduced by deformation of materials forming part of the connection.

### 6.5.2.4 Impedance of PROTECTIVE BONDING of plug-connected equipment

**Mains cord impedance requirement not excluded, detachable cord impedance shall not exceed 0,2  $\Omega$ .**

### Added: 6.5.2.6 Transformer PROTECTIVE BONDING screen

... that is separated only by BASIC INSULATION from a winding that is connected to a HAZARDOUS LIVE circuit, the screen shall satisfy the requirements of 6.5.2.2 a) and b), and be of low impedance.

Conformity is checked by inspection and by one of the following tests:

- a) a test current of twice the value of the overcurrent protection means of the winding for 1 min between the screen and the PROTECTIVE CONDUCTOR TERMINAL. ...
- b) the test of 6.5.2.4 using test current twice the value of the overcurrent protection means of the winding. The impedance shall not exceed 0,1  $\Omega$ .

**NOTE :** If test a) or b) is carried out, a specially prepared sample transformer having an extra lead-out wire from the free end of the screen is used to ensure that the current during the test passes through the screen.

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## 6. Protection against electric shock

### 6.5.3 ~~DOUBLE INSULATION~~ SUPPLEMENTARY INSULATION and REINFORCED INSULATION

*Simplified, refers to 6.7 only. Conformity check to 6.7 only.*

### 6.5.4 PROTECTIVE IMPEDANCE

*Clearer description: ... limit the current or voltage to the levels of 6.3.1 in NORMAL CONDITION and 6.3.2 in SINGLE FAULT CONDITION.*

*HIGH-INTEGRITY, replaced compliance requirement:*

a) an **appropriate single component** which shall be constructed, selected and tested so that safety and reliability for protection against electric shock is assured. In particular, the component shall be:

**1) RATED for twice the maximum WORKING VOLTAGE;**

**2) if a resistor, RATED for twice the power dissipation for the maximum WORKING VOLTAGE.**

~~c) a combination of BASIC INSULATION and a current- or voltage-limiting device.~~

**Added:** A PROTECTIVE IMPEDANCE shall not be a single electronic device that employs electron conduction in a vacuum, gas or semiconductor

**Modified:** Conformity is checked by inspection, by measuring the current or voltage to confirm that they do not exceed the applicable levels of 6.3 and by measuring CLEARANCES and CREEPAGE DISTANCES as specified in 6.7. Conformity of a single component is checked by inspection of its RATINGS.



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## 6. Protection against electric shock

### 6.5.5 Automatic disconnection of the supply

Simplified, function of device not explained as protection in single fault condition

~~a) It shall be supplied with the equipment or the installation instruction shall specify the device to be fitted as part of the installation.~~

**Added:**

### 6.5.6 Current- or voltage-limiting device

**A current- or voltage-limiting device shall meet all the following requirements:**

- a) it shall be **RATED** to limit the current or voltage to the levels not exceeding the values of 6.3.2;
- b) it shall be **RATED** for the maximum **WORKING VOLTAGE** and, if applicable, for the maximum operational current;
- c) **CLEARANCE** and **CREEPAGE DISTANCE** between the terminations of the current or voltage limiting device shall meet the applicable requirements of 6.7 for **SUPPLEMENTARY INSULATION**.

Conformity is checked by inspection, by **measuring the voltage or current** to confirm that they do not exceed the levels of 6.3.2, and by **measuring CLEARANCES and CREEPAGE DISTANCES** as specified in 6.7. (supplementary insulation)



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## 6. Protection against electric shock

*Added: 6.7.1.4 Solid insulation – definition, explanation*

*Added: 6.7.1.5 Requirements for insulation according to type of circuit – types as referred to in 6.7.2, 6.7.3, Annex K K.1, K.2, K.3*

**6.7.2 MAINS CIRCUITS** → *Insulation for MAINS CIRCUITS of OVERVOLTAGE CATEGORY II with a nominal supply voltage up to 300 V*

*Table 4 replaced, simplified, reorganized; CR/CL increased for  $50V < U < 100V$  same as  $100V < U < 150V$*

*Voltages over 300V now covered in Annex K*

**Added:**

**6.7.2.2 Solid insulation**

**6.7.2.2.1 General**

**Solid insulation of MAINS CIRCUITS shall withstand the electric and mechanical stresses that may occur in NORMAL USE, in all RATED environmental conditions (see 1.4), during the intended life of the equipment.**

*Conformity: AC test (6.8.3.1) 1 min., and DC test for DC supply only (6.8.3.2)*

*Table 5 for test voltages <300V and Overvoltage Category II*

*Additional requirements for a) used as ENCLOSURE or PROTECTIVE BARRIER (Clause 8), b) moulded or potted parts (6.7.2.2.2), c) inner layers of printed wiring boards (6.7.2.2.3), d) thin-film insulation (6.7.2.2.4).*

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## 6. Protection against electric shock

**Added:** 6.7.2.2.2 Moulded and potted parts

*...same two layers moulded together shall be separated by at least 0,4 mm ...*

*Conformity is checked by inspection and either by measurement of the separation or by inspection of the manufacturer's specifications.*

**Added:** Figure 6 – Distance between conductors on an interface between two layers

**Added:** 6.7.2.2.3 Inner insulating layers of printed wiring boards

*...conductors located between the same two layers shall be separated by at least 0,4 mm...*

*... REINFORCED INSULATION of inner insulating layers ... must either comply:*

- a) the thickness of the insulation is at least 0,4 mm; or*
- b) the insulation is assembled from at least two separate layers .. Each rated for test voltage of Table 5 for BASIC INSULATION; or*
- c) the insulation is assembled from at least two separate layers .. Combination of layers rated for test voltage of Table 5 for REINFORCED INSULATION.*

**Added:** Figure 7 – Distance between adjacent conductors along an interface of two inner layers

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## 6. Protection against electric shock

**Added:** 6.7.2.2.4 Thin-film insulation

**Conductors located between the same two layers (see Figure 8, item L).shall be separated by the applicable CLEARANCE and CREEPAGE DISTANCE of 6.7.2.1.**

*... REINFORCED INSULATION though the layers ... must either comply:*

- a) the thickness through the insulation is at least 0,4 mm; or*
- b) the insulation consists of at least two separate layers .. Each rated for test voltage of Table 5 for BASIC INSULATION; or*
- c) the insulation consists of at least three separate layers .. Any of which have been tested to exhibit adequate electric strength. (Compliance tested by AC or DC dielectric test voltages from Table 5 reinforced insulation)*

**Added:** Figure 8 – Distance between adjacent conductors located between the same two layers

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## 6. Protection against electric shock

### ~~6.7.4 Measuring circuits (in IEC 61010-2-030)~~

#### *Added new sections:*

#### **6.7.3.4 Solid insulation** – *(similar to 6.7.2.1 for mains circuits), conformity is testing :*

- a) *per table 6, 5 s only with Reinforced insulation value 1.6 times of basic or supplementary insulation, and*
- b) *Working voltage > 300V test per 6.8.3.1 for 1 min with voltages 1.5 times the working voltage for basic or supplementary insulation and 2 times the working voltage for reinforced insulation.*

*Additional requirements for when used as ENCLOSURE or PROTECTIVE BARRIER (per Clause 8), as moulded and potted parts (per 6.7.3.4.2), as inner insulating layers of printed wiring boards (per 6.7.3.4.3), as thin-film insulation (per 6.7.3.4.4)*

#### **6.7.3.4.2 Moulded and potted parts** – *(Similar to 6.7.2.2.2 for mains circuits) thickness is from Table 8 - Minimum values for distance or thickness (see 6.7.3.4.2 to 6.7.3.4.4) (based on peak a.c. or d.c. working peak or recurring peak voltages).*

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## 6. Protection against electric shock

### *Added new sections:*

#### **6.7.3.4.3 Inner insulating layers of printed wiring boards –** *(Similar to 6.7.2.2.3 for mains circuits)*

*Minimum distance and thickness of insulation are from Table 8*

*Insulation electric strength tested by Table 6*

*For multi layer, test per table 6 with a multiplier of 1.6*

#### **6.7.3.4.4 Thin-film insulation –** *(Similar to 6.7.2.2.4 for mains circuits)*

*Conductors shall be separated by at least the applicable CLEARANCE and CREEPAGE DISTANCE of 6.7.3.2 and 6.7.3.3*

Conformity is checked by measurement or by inspection of the part or the manufacturer's Specifications

*One of the methods must be used:*

- a) Thickness per Table 8*
- b) For at least 2 separate layers rated per Table 6 for basic insulation*
- c) For at least 3 separate layers any 2 must be of adequate electric strength.*

*Conformity is checked by the a.c. test of 6.8.3.1 with a duration of at least 1 min, or, for circuits stressed only by d.c., the 1 min d.c. test of 6.8.3.2, using the applicable test voltage from Table 6 multiplied by 1,6, applied to two of the three layers.*

**NOTE** *For the purposes of this test a special sample may be assembled with only two layers of the material.*

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## 6. Protection against electric shock

### 6.9 Constructional requirements for protection against electric shock

Some restructuring

#### 6.9.1 General

**Added** : d) CLEARANCES and CREEPAGE DISTANCES between the ENCLOSURE and HAZARDOUS LIVE parts shall not be reduced below the values for BASIC INSULATION by loosening of parts or wires.

#### 6.9.3 Color coding

Clarifying the use of green-yellow insulation: a) protective earth, b) protective bounding, c) potential equalization for safety, d) functional earth

### 6.10.2 Fitting of non-detachable MAINS supply cords

#### 6.10.2.2 Cord anchorage

**5) After test cord shall pass the a.c. voltage test of 6.8.3.1 (without humidity preconditioning) with a duration of at least 1 min:**

- i) with PE between PE and L-N, voltage per Table 5 or Table K.8 for line to neutral voltage,**
- ii) without PE L to N voltage per Table 5 or Table K.8 for reinforced insulation.**

#### ~~6.11.2.3 HAZARDS arising from function~~

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## 7. Protection against mechanical hazards

### 7 Protection against mechanical HAZARDS - *fully rewritten, applies risk assessment*

#### 7.1 General

... or cause a HAZARD in a SINGLE-FAULT CONDITION that might not be easily noticed.

...

- a) **sharp edges** which could cause cuts (see 7.2);
- b) **moving parts** that could crush body parts or penetrate the skin (see 7.3);
- c) **unstable equipment that could fall** on a person while in use or while being moved (see 7.4 **Stability**);
- d) **falling equipment**, resulting from breakage of the carrying device (see 7.5 **Lifting devices and supporting parts**), **wall mounting** bracket (see 7.6) or other support part (see 7.5); and
- e) **expelled parts** from the equipment (see 7.7).

**NOTE** If the equipment consists of two or more units, the value of the mass refers to the mass of each individual unit. However, if one or more units are intended to be attached to or supported by another unit, these units are treated as a single unit.

#### 7.2 Sharp edges

*Parts to be smooth, rounded no injury during normal use. Suggested testing not defined, referencing UL 1439 as acceptable procedure.*



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## 7. Protection against mechanical hazards

### 7.3 Moving parts

#### 7.3.1 General

***HAZARDS from moving parts shall not exceed a tolerable level except as specified in 7.3.2.***

*The conditions specified in 7.3.4 and 7.3.5 are considered to represent a tolerable level. If these conditions are not met, a RISK assessment shall be carried out according to 7.3.3 or Clause 17.*

#### 7.3.2 Exceptions

- a) Equipment with **easily-touched moving parts which are obviously intended to operate on parts or materials external to the equipment**  
...
- b) If, during routine **maintenance outside NORMAL USE**, it is unavoidable  
..., *access is permitted if all met:*
  - 1. must use a tool to access**
  - 2. Instructions require training**
  - 3. Warning markings added on the covers providing access**



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## 7. Protection against mechanical hazards

### 7.3.3 RISK assessment for mechanical HAZARDS to body parts

**RISKS shall be reduced to a tolerable level** by at least the applicable minimum protective measure of Table 12, taking into account the Severity, probability of exposure and possibility of avoiding the HAZARD.

*(Sic. similar to ISO 12100 simplified and ISO 13849-1 referenced risk assessment method, previously in EN 1050)*

Mechanical HAZARD conditions			Minimum protective measures <sup>d</sup>
Severity <sup>a</sup>	Probability of exposure <sup>b</sup>	Possibility of avoiding the HAZARD <sup>c</sup>	
S	E <sub>2</sub>	P <sub>2</sub>	C
S	E <sub>2</sub>	P <sub>1</sub>	C
S	E <sub>1</sub>	P <sub>2</sub>	C
S	E <sub>1</sub>	P <sub>1</sub>	B
M	E <sub>2</sub>	P <sub>2</sub>	B
M	E <sub>2</sub>	P <sub>1</sub>	A
M	E <sub>1</sub>	P <sub>2</sub>	A
M	E <sub>1</sub>	P <sub>1</sub>	No action

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## 7. Protection against mechanical hazards

### a Severity:

M = Moderate HAZARDS, sufficient to bruise or scratch a body part.

S = Serious HAZARDS, sufficient to break bones or dismember a body part.

### b Probability of exposure:

E1 = Exposure is not intended during NORMAL USE

E2 = Exposure is intended during NORMAL USE

### c Possibility of avoiding the HAZARD:

P1 = Possibility of avoidance:

– The motion is visible and velocity is low enough for body parts to be removed without being trapped,

or

– an audible or visible alarm is activated before body parts can be trapped.

P2 = No possibility of avoidance:

Conditions other than P1.

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## 7. Protection against mechanical hazards

### d Minimum protective measures:

A = Low level measures; warning markings, audible or visual signals or instructions for use.

B = Moderate measures; emergency switches, PROTECTIVE BARRIERS or covers removable only with a TOOL, distances (see ISO 13852 or EN 294), or separations (see ISO 13854 or EN 349).

C = Stringent measures; interlocks, PROTECTIVE BARRIERS or covers removable only with a TOOL and with instructions to disconnect from the power source.

### 7.3.4 Limitation of force and pressure

The physical levels specified below are not considered to be hazardous. They are based on a **combination of contact force, duration and contact area**. The levels below shall be met in NORMAL CONDITION and SINGLE-FAULT CONDITION.

The maximum tolerable **continuous contact pressure** is 50 N/cm<sup>2</sup>, with a maximum force of 150 N.

The maximum tolerable **temporary force** for body contact areas of at least 3 cm<sup>2</sup> is 250 N for a maximum duration of 0,75 s. The measurement of this force is made with a force gauge which has a spring ratio of at least 25 N/mm.

# IEC 61010-1

## 7. Protection against mechanical hazards

### 7.4 Stability

*Revised: Requirement added for **castors** – support at least 4 times it's normal load, or tested per d) and e) (added new requirements).*

*d) Castor loaded with 4 times the load of the greatest load on any castor*

*e) Greatest load supporting castor removed and equipment placed on a flat surface.*

*Notes added to perform these test safely.*

### 7.5 Provisions for lifting and carrying

**Added:** 7.5.3 Lifting devices and supporting parts

Parts of lifting devices and parts that support heavy loads shall be RATED for the maximum load or shall be tested to withstand four times the maximum static load.

Conformity checked by rating verification or test:

4 x maximum load placed at the least favorable position, there shall be no breakage or deformation that could cause a hazard.

### 7.6 Wall mounting

**Added:** ... If more than one fastener is specified for mounting a bracket, then **one fastener is removed and the test is repeated** with a weight equal to two times the weight of the equipment.

# IEC 61010-1

## 8 Resistance to mechanical stresses

Conformity: inspection and all the tests:

- 1) Static test of 8.2.1
- 2) Impact test of 8.2.2 (for other than hand held) – or test per IEC 62262
- 3) 8.3.1 and 8.3.2 (for other than fixed or  $m > 100\text{kg}$ )

Verification - Added:

- i) there have been no leaks of corrosive or harmful substances
- iv) the insulation of internal wiring remains undamaged;

### 8.2.2 ~~Dynamic test~~ -> Impact test

***NOTE** A support is considered to be sufficiently rigid if its displacement is less than or equal to 0,1 mm ....*

**Can test empty enclosures,**

New enclosure may be used instead of damaged (if otherwise passes).

Fixed equipment : **each test 1 point, but no limit to test points !!!**

**All sides can be tested** (90 degree rotation, side or top, horizontal (pendulum) or vertical (dropped ball) surface test)

Energy level applicable defines X height for test (**Table 15 added**).

### 8.3 Drop test

*Simplified, removed sections for corner drop and face drop.*

# IEC 61010-1

## 9 Protection against the spread of fire

### 9.6 Overcurrent protection

***Added:* A minimum of BASIC INSULATION is required between MAINS connected parts of opposite polarity on the supply side of the overcurrent protection device.**

# IEC 61010-1

## 10 Equipment temperature limits and resistance to heat

### 10 Equipment temperature limits and resistance to heat

#### 10.1 Surface temperature limits for protection against burns

**Modified: Easily touched surfaces** of equipment RATED for a maximum ambient temperature above 40 ° C are permitted to exceed the values of **Table 19** in NORMAL CONDITION, and to exceed 105 ° C in SINGLE FAULT CONDITION, by not more than the amount by which the maximum RATED temperature exceeds 40 ° C.

**Table 19** – (Surface temperature limits in NORMAL CONDITION) replaces Table 15 of 2d ed., adding more materials and some changes in limits.

# IEC 61010-1

## 11 Protection against HAZARDS from fluids

### 11 Protection against HAZARDS from fluids

#### 11.3 Spillage

**Extended:** ... result of the contact of potentially aggressive substances such as corrosive, toxic or flammable liquids) with parts of the equipment.

If in NORMAL USE potentially aggressive substances (such as corrosive, toxic or flammable liquids) are likely to be spilled on parts of the equipment, the **wetted material should be analyzed** to determine compatibility with the aggressive substance

#### 11.7.2 Leakage and rupture at high pressure

**Change:** Conformity check by hydraulic testing only **if a HAZARD could arise.**

*Test: Figure 9 of 2d ed. Replaced by:*

The test pressure is the maximum pressure multiplied by **a factor of 1,5 for testing against leakage and by factor 2,0 for testing against burst.**

*Removed the requirement to de-activate overpressure safety device limiting the maximum working pressure for the test.*

*Clarified exception and test requirement for fluid-containing parts of refrigeration systems (IEC 60335-2-24 or IEC 60335-2-89)*



## 12 Protection against radiation, including laser sources, and against sonic and ultrasonic pressure

### 12.3 Ultraviolet (UV) radiation

*Replaced note – only descriptive*

**Conformity:** checked by inspection and by **evaluation of the RISK assessment**  
**Documentation**

### 12.5.2 Ultrasonic pressure

**Added:** for intended emission equipment which can cause a hazard – manufacturer shall measure the maximum ultrasonic pressure level which the equipment can produce.

*Measured at the operator's normal position. If exceeds the limit of 100dB, marking and documentation requirements.*

*Conformity is checked by measurements!*

# 14 Components and subassemblies

## 14 Components and subassemblies

### 14.1 General

**Added: a) ... NOTE 1** For example if components meet the safety requirements of IEC 60950-1 but are **RATED** for a less severe environment than the applicable environment of 1.4, they also need to meet relevant additional requirements of his standard.

*Some restructuring, correction in Table 15 replacing Table 10 of 2d ed.*

### ~~14.6 HIGH INTEGRITY components~~

### 14.7 Printed wiring boards

*Flammability classification of V-1 does not apply to printed wiring boards which contain only limited-energy circuits meeting the requirements of 9.4.*

# 15 Protection by interlocks

## 15 Protection by interlocks

### 15.2 Prevention of reactivating

**Replaced:** interlock reactivation by hand -> Until the action which caused the interlock to operate has been reversed or cancelled, an interlock for the protection of an OPERATOR shall prevent the HAZARD being re-established by reactivating without the use of a TOOL.

(sic. This interlock may be different from the original interlock – which may have any function)

# 16 HAZARDS resulting from application

## 16 ~~Test and measurement equipment~~ -> HAZARDS resulting from application

*Moved:* 16.1 Current measuring circuits and 16.2 Multifunction meters and similar equipment to IEC 61010-2-030

### 16.1 REASONABLY FORESEEABLE MISUSE

**No HAZARDS shall arise if adjustments, knobs, or other software-based or hardware-based controls are set in a way not intended, and not described in the instructions. Other possible cases of REASONABLY FORESEEABLE MISUSE that are not addressed by specific requirements in this standard shall be addressed by RISK assessment (see Clause 17).**

### 16.2 Ergonomic aspects

***Hazards from ergonomics -> risk assessment must be performed:***

a) limitation of body dimensions; b) displays and indicators; c) accessibility and conventions of controls; d) arrangements of TERMINALS

*Added note to reference standards:* EN 894-2, EN 894-3, ISO 9241, SEMI S8

# 17 RISK assessment

## 17 RISK assessment

### For HAZARDS not fully addressed in Clauses 6 to 16

- a) RISK analysis - identify HAZARDS and estimate the RISKS
- b) RISK evaluation - evaluate the estimated severity and likelihood of a RISK -> verify risk level
- c) RISK reduction - If the initial RISK level is not acceptable ; followed by a) and b) until acceptable

Any residual risks: identify them in the instructions, also required to provide adequate information on mitigation (5.4.1 e. - Documentation)

Order of measures for risk reduction in this order:

- 1) Eliminate(?) or reduce the risk
- 2) take the necessary protective measures
- 3) inform users of the residual RISKS + training + PPE

**Note:** Annex J (informative) can be used, other methods: ISO 14971, SEMI S10-1296, IEC 61508, ISO 14121-1, and ANSI B11.TR3. Other methods can also be used.

**Conformity:** evaluate RA documentation (manufacturer).



# Annexes

## Annex A - Measuring circuits for touch current

Added tolerance values to R, C values for the test circuits

## Annex D - Parts between which insulation requirements are specified

**Replaced:** T - ACCESSIBLE external TERMINAL in with

TA - ACCESSIBLE external TERMINAL (not exceeding the values of 6.3.1 in NORMAL CONDITION)

TN - TERMINAL (which may exceed the values of 6.3.1 in NORMAL CONDITION, and therefore shall not be ACCESSIBLE)

Accordingly updated Figures D.1, D.2, D.3

# Annexes

## Annex F - ROUTINE TESTS

### F.3 MAINS CIRCUITS

#### F.3.1 General

Added : Protective conductor terminal (with all accessible conductive parts)

Added : Reference to impulse tests

#### ~~F.3 Other circuits~~ → F.4 Floating circuits

Test voltage value 1.5 times maximum rated voltage to earth, but minimum 350 V a.c. r.m.s. or 500 V d.c.. If clamping device used 0.9 times device rating, but not less than maximum rated voltage to earth.

#### Test voltages in

*Added:* Table F.1 – Test voltages for ROUTINE TESTS of MAINS CIRCUITS

Nominal line-to-neutral voltage of MAINS supply	OVERVOLTAGE CATEGORY II			OVERVOLTAGE CATEGORY III			OVERVOLTAGE CATEGORY IV		
	a.c. r.m.s. or d.c.	a.c.	d.c.	1,2/50 $\mu$ s Impulse	a.c.	d.c.	1,2/50 $\mu$ s Impulse	a.c.	d.c.
V	V r.m.s.	V	V peak	V r.m.s.	V	V peak	V r.m.s.	V	V peak
$\leq 150$	840	1 200	1 200	1 400	2 000	2 000	2 200	3 100	3 100
$>150 \leq 300$	1 400	2 000	2 000	2 200	3 100	3 100	3 300	4 700	4 700
$>300 \leq 600$	2 200	3 100	3 100	3 300	4 700	4 700	4 300	6 000	6 000
$>600 \leq 1 000$	3 300	4 700	4 700	4 300	6 000	6 000	5 300	7 500	7 500

# Annexes

## Annex J - RISK assessment

### New Informative Annex

“A RISK assessment process based on ISO/IEC Guide 51 (1999) is given below. Other RISK assessment procedures are contained in ISO 14971, SEMI S10, IEC 61508, ISO 14121-1, and ANSI TR3. Other established procedures which implement similar steps can also be used.”

### J.1 RISK assessment procedure

### J.2 Achieving TOLERABLE RISK

### J.3 An application of RISK assessment procedures



# Annexes

## Annex K - Insulation requirements not covered by 6.7

### New Formative Annex

“The concept of OVERVOLTAGE CATEGORIES is elaborated in IEC 60364 and in IEC 60664-1. The descriptions below are made up of edited extracts from these two standards.”

Simplifies the testing, since this section is used only in the voltage ranges above 300 V

Represents a comprehensive set of requirements for voltages over 300 V a.c. and other than overvoltage category II, similar to that in 6.7 and 6.8 extended.

