

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Safety requirements for electrical equipment for measurement, control, and laboratory use –  
Part 2-030: Particular requirements for testing and measuring circuits**

**Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire –  
Partie 2-030: Exigences particulières pour les circuits de test et de mesure**



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Partie 2-030: Exigences particulières pour les circuits de test et de mesure**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX



ICS 19.080; 71.040.10

ISBN 978-2-88910-988-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 2-030: Particular requirements for testing and measuring circuits**

FOREWORD

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International Standard IEC 61010-2-030 has been prepared by IEC technical committee 66: Safety of measuring, control and laboratory equipment.

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

FDIS	Report on voting
66/417/FDIS	66/427/RVD

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

This Part 2-030 is to be used in conjunction with the latest edition of IEC 61010-1. It was established on the basis of the third edition (2010) of IEC 61010-1. Consideration may be given to future editions of, or amendments to, IEC 61010-1.

This Part 2-030 supplements or modifies the corresponding clauses in IEC 61010-1 so as to convert that publication into the IEC standard: *Particular requirements for testing and measuring circuits*.

Where a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. Where this part states “addition”, “modification”, “replacement”, or “deletion” the relevant requirement, test specification or note in Part 1 should be adapted accordingly.

In the second edition of IEC 61010-1, the requirements for testing and measuring circuits were included in Part 1 itself. In the third edition of IEC 61010-1, these requirements have been removed from Part 1 and have become the basis for the requirements in this Part 2.

In addition to the requirements removed from Part 1, the following major requirements have been added to this standard. Numerous other changes have also been made.

- The terminology for MEASUREMENT CATEGORY I has changed. In this Part 2, it is termed “not rated for measurements within MEASUREMENT CATEGORIES II, III, or IV”.
- CLEARANCES and CREEPAGE DISTANCES have been added for unmated measuring circuit TERMINALS.
- Requirements have been added for specialized measuring circuit TERMINALS.
- Requirements for TRANSIENT OVERVOLTAGE limiting devices have been revised.
- Requirements have been revised and added pertaining to REASONABLY FORESEEABLE MISUSE of measuring circuits, including disconnection of the protective earth and usage of the equipment in a manner that might cause arc flash.
- Insulation requirements for measuring circuits have been primarily located in Annex K.
- Annex AA has been added to describe the characteristics of MEASUREMENT CATEGORIES.
- Annex BB has been added to describe hazards that may be encountered when using measuring circuits.

In this standard:

- a) the following print types are used:
  - requirements: in roman type;
  - NOTES: in small roman type;
  - *conformity and test: in italic type;*
  - terms used throughout this standard which have been defined in Clause 3: SMALL ROMAN CAPITALS;
- b) subclauses, figures, tables and notes which are additional to those in Part 1 are numbered starting from 101. Additional Annexes are numbered AA and BB.

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

A list of all parts of the IEC 61010 series, under the general title *Safety requirements for electrical equipment for measurement, control, and laboratory use*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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The contents of the corrigendum of May 2011 have been included in this copy.



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

## Part 2-030: Particular requirements for testing and measuring circuits

### 1 Scope and object

This clause of Part 1 is applicable except as follows:

#### 1.1.1 Equipment included in scope

*Replace the text with the following:*

This part of IEC 61010 specifies safety requirements for testing and measuring circuits which are connected for test or measurement purposes to devices or circuits outside the measurement equipment itself.

These include measurement circuits which are part of electrical test and measurement equipment, laboratory equipment, or process control equipment. The existence of these circuits in equipment requires additional protective means between the circuit and an OPERATOR.

NOTE 1 These testing and measuring circuits may, for example:

- measure voltages in circuits of other equipment,
- measure temperature of a separate device via a thermocouple,
- measure force on a separate device via a strain gauge,
- inject a voltage onto a circuit to analyze a new design.

NOTE 2 Testing and measuring circuits that are not within the scope of this Part 2 are considered to be covered by the requirements of Part 1.

NOTE 3 Equipment containing these testing and measuring circuits may be intended for performing tests and measurements on hazardous conductors, including MAINS conductors and telecommunication network conductors. See Annex BB for considerations of HAZARDS involved in various tests and measurements.

### 2 Normative references

This clause of Part 1 is applicable.

### 3 Terms and definitions

This clause of Part 1 is applicable except as follows:

#### 3.5 Safety terms

*Add a new definition:*

##### 3.5.101

##### MEASUREMENT CATEGORY

classification of testing and measuring circuits according to the type of MAINS CIRCUITS to which they are intended to be connected

NOTE MEASUREMENT CATEGORIES take into account OVERVOLTAGE CATEGORIES, short-circuit current levels, the location in the building installation at which the test or measurement is to be made, and some forms of energy limitation or transient protection included in the building installation. See Annex AA for more information.

## 4 Tests

This clause of Part 1 is applicable.

## 5 Marking and documentation

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

### 5.1.5 TERMINALS, connections and operating devices

*Add a new subclause:*

#### 5.1.5.101 Measuring circuit TERMINALS

##### 5.1.5.101.1 General

Except as permitted in 5.1.5.101.4:

- a) the RATED voltage to earth of measuring circuit TERMINALS shall be marked, and
- b) the RATED voltage or the RATED current, as applicable, of each pair or set of measuring circuit TERMINALS that are intended to be used together shall be marked, and
- c) the pertinent MEASUREMENT CATEGORY for each pair or set of measuring circuit TERMINALS or symbol 14 of Table 1 of Part 1 shall be marked as specified in 5.1.5.101.2 and 5.1.5.101.3, if applicable.

NOTE 1 Measuring circuit TERMINALS are usually supplied in pairs or sets. Each pair or set of TERMINALS may have a RATED voltage or a RATED current, or both, within that set, and each individual TERMINAL may have a RATED voltage to earth. Some instruments may have a measurement RATED voltage (between TERMINALS) different from the RATED voltage to earth. Markings should be clear to avoid misunderstanding.

Symbol 14 of Table 1 shall be marked if current measuring TERMINALS are not intended for connection to current transformers without internal protection (see 101.2).

Markings shall be placed adjacent to the TERMINALS. However, if there is insufficient space (as in multi-input equipment), the marking may be on the RATING plate or scale plate, or the TERMINAL may be marked with symbol 14 of Table 1.

NOTE 2 For any set of measuring circuit TERMINALS, symbol 14 of Table 1 does not need to be marked more than once, if it is close to the TERMINALS.

*Conformity is checked by inspection and, if applicable, as specified in 5.1.5.101.2 and 5.1.5.101.3, taking into account the exceptions in 5.1.5.101.4.*

##### 5.1.5.101.2 Measuring circuit TERMINALS RATED for MEASUREMENT CATEGORIES II, III or IV

The relevant MEASUREMENT CATEGORY shall be marked for measuring circuit TERMINALS RATED for measurements within MEASUREMENT CATEGORIES II, III or IV. The MEASUREMENT CATEGORY markings shall be “CAT II”, “CAT III” or “CAT IV” as applicable.

NOTE Marking more than one type of MEASUREMENT CATEGORY and its RATED voltage to earth is permissible (see also 5.1.5.101.1, Note 1).

*Conformity is checked by inspection.*

### 5.1.5.101.3 Measuring circuit TERMINALS RATED for connection to voltages above the level of 6.3.1

Symbol 14 of Table 1 shall be marked for measuring circuit TERMINALS RATED for connection to voltages above the levels of 6.3.1, but that are not RATED for measurements within MEASUREMENT CATEGORIES II, III or IV (see also 5.4.1 bb)).

*Conformity is checked by inspection.*

### 5.1.5.101.4 Low voltage, permanently connected, or dedicated measuring circuit TERMINALS

Measuring circuit TERMINALS do not need to be marked if

- a) they are intended to be permanently connected and not ACCESSIBLE (see 5.4.3 aa) and bb)), or
- b) they are dedicated only for connection to specific TERMINALS of other equipment, or;
- c) it is obvious from other indications that the RATED voltage is below the levels of 6.3.1.

NOTE Examples of acceptable indications that the inputs are intended to be less than the levels of 6.3.1 include:

- the full scale deflection marking of a single-range indicating voltmeter or ammeter or maximum marking of a multi-range multimeter;
- the maximum range marking of a voltage selector switch;
- a marked voltage or power rating expressed in dB, mW or W, where the equivalent value, as explained in the documentation, is below 33 V a.c.

### 5.4.1 General

*Add new items to the list:*

- aa) information about each relevant MEASUREMENT CATEGORY if the measuring circuit has a RATING for MEASUREMENT CATEGORY II, III or IV (see 5.1.5.101.2);
- bb) for measuring circuits that do not have a RATING for MEASUREMENT CATEGORY II, III or IV, but could be misused by connection to such circuits, a warning not to use the equipment for measurements on MAINS CIRCUITS, and a detailed RATING including TRANSIENT OVERVOLTAGES (see AA.2.4 for more information).

NOTE Some equipment may have multiple MEASUREMENT CATEGORY RATINGS for the same measuring circuit. For such equipment, the documentation needs to clearly identify the MEASUREMENT CATEGORIES where the equipment is intended to be used and where it must not be used.

### 5.4.3 Equipment installation

*Add new items to the list:*

- aa) for permanently connected measuring circuit TERMINALS RATED for MEASUREMENT CATEGORIES II, III or IV, information regarding the MEASUREMENT CATEGORY, RATED maximum WORKING VOLTAGE, and RATED maximum current, as applicable (see 5.1.5.101);
- bb) for permanently connected measuring circuit TERMINALS that are not RATED for MEASUREMENT CATEGORIES II, III or IV, information regarding the RATED maximum WORKING VOLTAGE, RATED maximum current, and RATED maximum TRANSIENT OVERVOLTAGES as applicable (see 5.1.5.101).

## 6 Protection against electric shock

This clause of Part 1 is applicable except as follows:

### 6.1.2 Exceptions

*Add a new item to the list:*

- aa) locking or screw-held type measuring TERMINALS, including TERMINALS which do not require the use of a TOOL.

### 6.5.2.1 General

*Replace the conformity statement with the following:*

*Conformity is checked as specified in 6.5.2.2 to 6.5.2.6 and 6.5.2.101.*

### 6.5.2.3 PROTECTIVE CONDUCTOR TERMINAL

*Replace h) 2) with the following h) 2):*

- h) 2) the PROTECTIVE BONDING shall not be interrupted by any switching or interrupting device. Devices used for indirect bonding in test and measurement circuits (see 6.5.2.101) are permitted to be part of the PROTECTIVE BONDING.

*Add a new subclause:*

### 6.5.2.101 Indirect bonding for testing and measuring circuits

Indirect bonding establishes a connection between the PROTECTIVE CONDUCTOR TERMINAL and ACCESSIBLE conductive parts if these become HAZARDOUS LIVE as a result of a fault. Devices to establish indirect bonding are:

- a) voltage limiting devices which become conductive when the voltage across them exceeds the relevant levels of 6.3.2 a), with overcurrent protection to prevent breakdown of the device;

*Conformity is checked by connecting the ACCESSIBLE conductive parts to the MAINS supply TERMINALS while the equipment is connected to the MAINS supply as in NORMAL USE. The voltage between the ACCESSIBLE conductive parts and the PROTECTIVE CONDUCTOR TERMINAL shall not exceed the relevant levels of 6.3.2 a) for more than 0,2 s.*

- b) voltage-sensitive tripping devices which interrupt all poles of the MAINS supply, and connect the ACCESSIBLE conductive parts to the PROTECTIVE CONDUCTOR TERMINAL whenever the voltage across them reaches the relevant levels of 6.3.2 a).

*Conformity is checked by applying the relevant voltage level of 6.3.2 a) between the ACCESSIBLE conductive parts and the PROTECTIVE CONDUCTOR TERMINAL. The tripping action shall take place within 0,2 s.*

## 6.6 Connections to external circuits

*Add new subclauses:*

### 6.6.101 Measuring circuit TERMINALS

Conductive parts of each unmated measuring circuit TERMINAL which could become HAZARDOUS LIVE when the maximum RATED voltage is applied to other measuring circuit TERMINALS on the equipment shall be separated by at least the CLEARANCE and CREEPAGE DISTANCE of Table 101 from the closest approach of the test finger touching the external parts of the TERMINAL in the least favourable position. See Figure 1 of Part 1.

**Table 101 – CLEARANCES and CREEPAGE DISTANCES for measuring circuit TERMINALS with HAZARDOUS LIVE conductive parts**

Voltage on conductive parts of TERMINAL		CLEARANCE and CREEPAGE DISTANCE
V a.c. r.m.s.	V d.c.	mm
$\geq 33 \leq 300$	$\geq 70 \leq 414$	0,8
$> 300 \leq 600$	$> 414 \leq 848$	1,0
$> 600 \leq 1\ 000$	$> 848 \leq 1\ 414$	2,6

NOTE Values are determined by calculation for REINFORCED INSULATION. Transients are not taken into account.

*Conformity is checked by inspection and measurement.*

### 6.6.102 Specialized measuring circuit TERMINALS

Components, sensors, and devices intended to be connected to specialized measuring circuit TERMINALS shall not be both ACCESSIBLE and HAZARDOUS LIVE, in either NORMAL CONDITION or SINGLE-FAULT CONDITION, even when the maximum RATED voltage is applied to any other measuring circuit TERMINAL.

NOTE These specialized TERMINALS include, but are not limited to, TERMINALS for semiconductor measuring functions, capacitance measurements, and thermocouple sockets.

*Conformity is checked by inspection and measurement. Components, sensors, and devices intended to be connected to specialized measuring circuit TERMINALS are connected. The measurements of 6.3 are made to establish that the levels of 6.3.1 and 6.3.2 are not exceeded when each of the following voltages is applied to each other measuring circuit TERMINAL, if applicable:*

- maximum RATED a.c. voltage at any RATED MAINS frequency;*
- maximum RATED d.c. voltage;*
- maximum RATED a.c. voltage at the maximum RATED measurement frequency.*

## 6.9 Constructional requirements for protection against electric shock

*Add a new subclause:*

### 6.9.101 Over-range indication

If a HAZARD could arise from an OPERATOR'S reliance on the value (for example, voltage) displayed by the equipment, the display shall give an unambiguous indication whenever the value is above the maximum positive value or below the minimum negative value of the range to which the equipment is set.

NOTE Examples of ambiguous indications include the following, unless there is a separate unambiguous indication of an over-range value:

- analogue meters with stops at the exact ends of the range;
- digital meters which show a low value when the true value is above the range maximum (for example 1 001,5 V displayed as 001,5 V);
- chart recorders which print a trace at the edge of the chart, thus indicating a value at the range maximum when the true value is higher.

*Conformity is checked by inspection and by provoking an over-range value.*

## 7 Protection against mechanical HAZARDS

This clause of Part 1 is applicable.

## 8 Resistance to mechanical stresses

This clause of Part 1 is applicable.

## 9 Protection against the spread of fire

This clause of Part 1 is applicable.

## 10 Equipment temperature limits and resistance to heat

This clause of Part 1 is applicable.

## 11 Protection against HAZARDS from fluids

This clause of Part 1 is applicable.

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

This clause of Part 1 is applicable.

## 13 Protection against liberated gases and substances, explosion and implosion

This clause of Part 1 is applicable.

## 14 Components and subassemblies

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

*Add a new subclause:*

### 14.101 Circuits or components used as TRANSIENT OVERVOLTAGE limiting devices in measuring circuits used to measure MAINS

If control of TRANSIENT OVERVOLTAGE is employed in a measuring circuit used to measure MAINS, any overvoltage limiting component or circuit shall have adequate strength to limit likely TRANSIENT OVERVOLTAGES.

*Conformity is checked by applying 5 positive and 5 negative impulses with the applicable impulse withstand voltage of Table 102, spaced up to 1 min apart, from a hybrid impulse generator (see IEC 61180-1). The generator shall produce an open-circuit voltage waveform of 1,2/50  $\mu$ s, a short-circuit current waveform of 8/20  $\mu$ s, with an output impedance (peak open-circuit voltage divided by peak short-circuit current) of 2  $\Omega$  for MEASUREMENT CATEGORIES III and IV or 12  $\Omega$  for MEASUREMENT CATEGORIES II. Resistance may be added in series if needed to raise the impedance. The test impulse is applied while*

*the circuit is working under conditions of NORMAL USE, in combination with the MAINS. The voltage is the maximum RATED line-to-neutral voltage of the MAINS being measured.*

*The test voltage is applied between each pair of TERMINALS used to measure MAINS where voltage-limiting devices are present.*

*No HAZARD shall arise in the event that the component ruptures or overheats during the test. If a rupture occurs, no part of the component shall bridge safety-relevant insulation. If the component overheats, it shall not heat other materials to their self-ignition points. Tripping the circuit breaker of the MAINS installation is an indication of failure.*

**Table 102 – Impulse withstand voltages**

Nominal a.c. or d.c. line-to-neutral voltage of MAINS being measured  V	Impulse withstand voltage  V		
	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III	MEASUREMENT CATEGORY IV
≤50	500	800	1 500
>50 ≤ 100	800	1 500	2 500
>100 ≤ 150	1 500	2 500	4 000
>150 ≤ 300	2 500	4 000	6 000
>300 ≤ 600	4 000	6 000	8 000
>600 ≤ 1 000	6 000	8 000	12 000

## 15 Protection by interlocks

This clause of Part 1 is applicable.

## 16 HAZARDS resulting from application

This clause of Part 1 is applicable.

## 17 Risk assessment

This clause of Part 1 is applicable.

*Add a new clause:*

## 101 Measuring circuits

### 101.1 General

The equipment shall provide protection against HAZARDS resulting from NORMAL USE and REASONABLY FORESEEABLE MISUSE of measuring circuits, as specified below.

- a) If a HAZARD could result, a current measuring circuit shall not interrupt the circuit being measured during range changing, or during the use of current transformers without internal protection (see 101.2).