SLOVENSKI PREDSTANDARD

oSIST prEN 61557-8:2005

november 2005

Električna varnost v nizkonapetostnih razdelilnih sistemih izmenične napetosti do 1 kV in enosmerne napetosti do 1,5 kV – Oprema za preskušanje, merjenje ali nadzorovanje zaščitnih ukrepov – 8. del: Naprave za nadzor izolacije v sistemih informacijske tehnologije

Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems

ICS 17.220.20

Referenčna številka
oSIST prEN 61557-8:2005(en)

85/275/CDV

COMMITTEE DRAFT FOR VOTE (CDV)
PROJET DE COMITÉ POUR VOTE (CDV)

Project number Numéro de projet	IEC 61557-8 Ed. 2.0	
IEC/TC or SC: **TC 85** CEI/CE ou SC:	Date of circulation Date de diffusion **2005-07-29**	Closing date for voting (Voting mandatory for P-members) Date de clôture du vote (Vote obligatoire pour les membres (P)) **2006-01-06**
Titre du CE/SC: Equipement de mesure des grandeurs électriques et électromagnétiques	TC/SC Title: Measuring equipment for electrical and electromagnetic quantities	
Secretary: Mr. Bo CHEN Secrétaire:		
Also of interest to the following committees Intéresse également les comités suivants	Supersedes document Remplace le document 85/257/CD and 85/260/CC	
Functions concerned Fonctions concernées ☐ Safety / Sécurité ☐ EMC / CEM ☐ Environment / Environnement ☐ Quality assurance / Assurance qualité		

CE DOCUMENT EST TOUJOURS À L'ÉTUDE ET SUSCEPTIBLE DE MODIFICATION. IL NE PEUT SERVIR DE RÉFÉRENCE.

LES RÉCIPIENDAIRES DU PRÉSENT DOCUMENT SONT INVITÉS À PRÉSENTER, AVEC LEURS OBSERVATIONS, LA NOTIFICATION DES DROITS DE PROPRIÉTÉ DONT ILS AURAIENT ÉVENTUELLEMENT CONNAISSANCE ET À FOURNIR UNE DOCUMENTATION EXPLICATIVE.

THIS DOCUMENT IS STILL UNDER STUDY AND SUBJECT TO CHANGE. IT SHOULD NOT be USED FOR REFERENCE PURPOSES.

RECIPIENTS OF THIS DOCUMENT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

Titre :

Title : IEC 61557-8 Ed. 2.0: Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 8: Insulation monitoring devices for IT systems

Note d'introduction

Introductory note

ATTENTION	ATTENTION
CDV soumis en parallèle au vote (CEI) et à l'enquête (CENELEC)	**Parallel IEC CDV/CENELEC Enquiry**

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1000 V a.c. AND 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures –

Part 8: Insulation monitoring devices for IT systems

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61557-8 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

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

FDIS	Report on voting
85/xx/FDIS	85/xxx/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 of IEC 61557 shall be used in conjunction with part 1.

The committee has decided that the contents of this publication will remain unchanged until **2010.** At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

ELECTRICAL SAFETY IN LOW-VOLTAGE DISTRIBUTION SYSTEMS UP TO 1000 V a.c. AND 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures –

Part 8: Insulation monitoring devices for IT systems

1 Scope

This part of IEC 61557 specifies the requirements for insulation monitoring devices which permanently monitor the insulation resistance to earth of unearthed IT a.c. systems, for IT a.c. systems with galvanically connected d.c. circuits having nominal voltages up to 1000 V a.c., as well as of unearthed IT d.c. systems with voltages up to 1500 V d.c. independent from the method of measuring.

NOTE 1 IT systems are described in IEC 60364-4-41 amongst other literature. Additional data for a selection of devices in other standards is to be noted.

NOTE 2 Various standards specify the use of insulation monitoring devices ~~on~~ in IT systems. In such cases, the objective of the equipment is to signal a drop in insulation resistance below a minimum limit.

NOTE 3 Insulation monitoring devices according to this part of IEC 61557 may also be used for de-energized electrical systems.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61557. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 61557 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60255-23:1994, *Electrical relays – Part 23: Contact performance*

IEC 60364-4-41: 2001, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock*

IEC 60664-1: 2002, *Insulation co-ordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-3: 2003, *Insulation coordination for equipment within low voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution.*

IEC 60721-3-1: 1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2: 1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60721-3-3: 1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations*

IEC 60947-5-1:2003, Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices

IEC 60947-5-4:2002, Low-voltage switchgear and controlgear - Part 5-4: Control circuit devices and switching elements - Method of assessing the performance of low-energy contacts - Special tests

IEC 61010-1: 2001, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61140: 2001, *Protection against electric shock – Common aspects for installation and equipment*

Draft of IEC 61326-2 Ed.1 [IEC 65A/405/CD], Electrical equipment for measurement, control and laboratory use - EMC requirements

IEC 61557-1: 1997, *Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements*

3 Definitions

For the purposes of this part of IEC 61557, the definitions given in IEC 61557-1 and the following definitions apply.

3.1 **extraneous d.c. voltage (U_{fg}):** A d.c. voltage occurring in a.c. systems between the a.c. conductors and earth (derived from d.c. parts)

3.2 **insulation resistance (R_F):** Resistance in the system being monitored, including the resistance of all the connected appliances to earth

3.3 **specified response value (R_{an}):** Value of the insulation resistance, permanently set or adjustable, on the device and monitored if the insulation resistance falls below this limit

3.4 **response value (R_a):** Value of the insulation resistance at which the device responds under specified conditions

3.5 **relative (percentage) ~~error~~uncertainty** (A[%]): Response value minus the specified response value, divided by the specified response value, multiplied by 100 and stated as a percentage

$$A[\%] = \frac{R_a - R_{an}}{R_{an}} \times 100\ \%$$

3.6 **system leakage capacitance (C_e):** Maximum permissible value of the total capacitance to earth of the system to be monitored, including any connected appliances, up to which value the insulation monitoring device can work as specified

3.7 **rated contact voltage:** Voltage for which a relay contact is rated to open and close under specified conditions

3.8 **response time (t_{an}):** Time required by an insulation monitoring device to respond under the conditions specified in 6.1.2

3.9 **measuring voltage (U_m):** Voltage present at the measuring terminals during the measurement.

~~NOTE 1 In a fault-free and de-energized system, this represents the voltage present between the terminals of the system to be monitored and the terminals of the protective conductor.~~

NOTE ~~2~~ Additionally to the definition in IEC 61557-1, the measuring voltage (U_m) is the voltage present in a fault-free and de-energized system between the terminals of the system to be monitored and the terminals of the protective conductor.

3.10 **measuring current (I_m):** Maximum current that can flow between the system and earth, limited by the internal resistance R_i from the measuring voltage source of the insulation monitoring device

3.11 **internal impedance (Z_i):** Total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at the nominal frequency

3.12 **internal d.c. resistance (R_i):** Resistance of the insulation monitoring device between the terminals to the system being monitored and earth

3.13 **functional earthing (FE):** Earthing a point or points in a system or in an installation or in equipment for purposes other than electrical safety

NOTE For insulation monitoring devices this is the measuring connection to earth

4 Requirements

The following requirements as well as those given in IEC 61557-1 shall apply.

4.1 Insulation monitoring devices shall be capable of monitoring the insulation resistance of IT systems including symmetrical and asymmetrical components and to give a warning, if the insulation resistance between the system and earth falls below a predetermined level.

NOTE 1 A symmetrical insulation deterioration occurs when the insulation resistance of all conductors in the system to be monitored decreases (approximately) similarly. An asymmetrical insulation deterioration occurs when the insulation resistance of, for example, one conductor decreases substantially more than that of the other conductor(s).

NOTE 2 So-called earth fault relays using a voltage asymmetry (voltage shift) in the presence of an earth fault as the only measurement criterion, are not insulation monitoring devices in the interpretation of this part of IEC 61557.

NOTE 3 A combination of several measurement methods, including asymmetry monitoring, may become necessary for fulfilling the task of monitoring under special conditions on the system.

4.2 Insulation monitoring devices shall comprise a test device, or be provided with means for the connection of a test facility, for detecting whether the insulation monitoring device is capable of fulfilling its functions. The system to be monitored shall not be directly earthed and the devices shall not suffer damage. This test is not intended for checking the response value.

4.3 Contrary to IEC 61557-1 the PE connection of ~~i~~Insulation monitoring devices is a measuring connection and may be treated as functional earth connection (FE). If the IMD additionally has parts, which are grounded for protection purposes, this connection shall be treated as protective connection (PE).

4.4 When the specified response value R_{an} of the insulation monitoring device is adjustable, unintentional changes of the setting shall be prevented by suitable means.

NOTE Standards for the installation of electrical systems state the lowest value that is permissible as a setting on insulation monitoring devices with variable response values.

4.5 Insulation monitoring devices shall comprise a visual warning device or be provided with the facility for connecting such a device which indicates its operation. This device shall not be provided with means for being switched off. Built-in or externally connectable audible signalling devices may be fitted with a resetting facility. Sending of an audible signal in the case of a newly occurring fault, following a fault that has been cleared and after the devices may have been reset, shall be ensured.

NOTE An indication of the value of the insulation resistance by means of a measuring facility is, in itself, not sufficient as a facility for visual signalling.

4.6 The maximum operating ~~error~~uncertainty of insulation monitoring devices is expressed by relative (percentage) ~~error~~uncertainty. The ~~error~~uncertainty and its limits are listed in table 1.

4.7 When insulation monitoring devices include facilities for indicating the insulation resistance, the ~~error~~uncertainty of these facilities under nominal operating conditions ~~should~~ shall be stated by the manufacturer.

4.8 Insulation monitoring devices shall have minimum clearances and creepage distances in accordance with IEC 60664-1 and IEC 60664-3.

Clearances and creepage distances shall be selected in accordance with

- overvoltage category III

- pollution degree 3 for all external connections and user accessible parts

- pollution degree 2 for printed circuit boards inside the IMD

- pollution degree 1 for printed circuits inside the IMD which are coated according to IEC 60664-3

4.9 Where different voltages are used by an insulation monitoring device (e.g. U_v, U_n), clearances and creepages shall be designed for the highest voltage.

4.10 A division into circuits with different nominal insulation voltages is permissible in device combinations (e.g. for IT systems with nominal voltages higher than 1000 V a.c. and 1500 V d.c.) when the electrical connection is made via resistive, capacitive or inductive voltage dividers and if, in the case of a fault, the occurrence of inadmissibly high touch voltages or inadmissibly high currents to earth are prevented by circuit design features. Such circuit design features (see IEC 61140) can be, for example, additionally provided in the form of reliable voltage dividers or a duplication of the resistors (safety impedance) in the voltage divider.

4.11 Insulation monitoring devices shall comply with the requirements for electromagnetic compatibility (EMC) in accordance with the draft of IEC 61326-2 [IEC 65A/405/CD], Annex G.

4.12 Additional requirements for insulation monitoring devices are listed in table 1.

5 Marking and operating instructions

5.1 *Marking*

In addition to the marking in accordance with IEC 61557-1, the following information shall be provided on the insulation monitoring device.

5.1.1 Type of device as well as mark of origin or name of the manufacturer.

5.1.2 IT system to be monitored (if the IMD is designed for a specific type of IT system).

5.1.3 Wiring diagram or number of the wiring diagram or number of the operating instructions.

5.1.4 Nominal system voltage U_n or range of the nominal voltage.

5.1.5 Nominal value of the supply voltage ~~U_v~~ U_s or working range of supply voltage.

5.1.6 Nominal frequency of the supply voltage U_v or working range of frequencies for the supply voltage~~–~~.

5.1.7 Specified response value R_{an} or minimum and maximum response value R_{an} and, if applicable, the range of specified response values where the relative (percentage) ~~error~~uncertainty is higher than that listed in table 1.

5.1.8 Mandatory on the outside and, if necessary, inside the device: serial number, year of manufacture or type designation.

The data given in 5.1.1 shall be indelibly marked on the insulation monitoring device in such a manner that they remain legible after installation of the device.

5.2 *Operating instructions*

The operating instructions shall state the following in addition to the statements given in IEC 61557-1.

5.2.1 Internal impedance Z_i of the measuring circuit as a function of the nominal frequency.

5.2.2 Peak value of the measuring voltage U_m in accordance with table 1 when fed with the nominal value of the supply voltage ~~U_v~~U_s.

5.2.3 Maximum value of the measuring current I_m in accordance with table 1 when the terminals are short-circuited.

5.2.4 Technical data of the interface for the connection of an external warning device including rated voltage and current, rated insulation voltage and explanation of the interface function. For contact circuits, data shall reference to IEC 60255-23 or IEC 60947-5-1 and IEC 60947-5-4.

5.2.5 Information that insulation monitoring devices shall not be connected in parallel (e.g. when systems are coupled).

5.2.6 Wiring diagram when this is not marked on the devices in accordance with subsection 5.1.3.

5.2.7 Information relating to the effect of the system leakage capacitances C_e, and their permissible maximum value.

5.2.8 Extraneous d.c. voltage (U_{fg}) of any polarity that can be applied continuously to the insulation monitoring device without damaging it.

5.2.9 Test voltage according to 4.9 and conformity to the relevant EMC standards.

5.2.10 Electrical data for the contact circuits according to 5.2.4.

6 Tests

The following tests in addition to those required according to IEC 61557-1 shall be executed.

6.1 *Type tests*

Type tests shall be executed in accordance with 6.1.1 to 6.1.7.

6.1.1 *Response values*

Response values shall be tested at the lowest and at the highest value of the specified nominal voltage U_n and of the supply voltage U_v.
For this test insulation resistance shall be simulated as follows:

- single pole (from one phase of U_n)
- symmetrically (same resistor from all phases of U_n)

The measuring devices for the tests shall be able to accommodate slow, continuous or fine step changes in the simulated insulation resistance as well as an additional parallel connection of leakage capacitances. Capacitors with an insulation resistance of at least one hundred times the specified response value and a tolerance limit of 10% maximum shall be used for simulating system leakage capacitances. During testing, the test resistance shall be reduced slowly, starting from high values, while observing the operation of the insulation monitoring device. The insulation resistances and intrinsic leakage capacitances presented by the test circuit shall be taken into account when determining the response value.

When the insulation monitoring device is provided with a continuously variable specified response value, or digital setting without mechanical switches, the compliance with the conditions listed in table 1 shall be checked at a minimum of five points of the setting range. This check shall be executed at the end points as well as at approximately evenly distributed points in the setting range. This also applies to setting facilities without a switch.

If the specified response value can be set by means of a mechanical switch, each step shall be tested. The initial test shall be executed without any system leakage capacitances in circuit whilst the test resistance is reduced so slowly that the steady-state response value can be found.

Detailed statements shall be provided by the manufacturer. If the measuring method is affected by the magnitude of the system leakage capacitance C_e, a check shall be carried out by means of an insertion of capacitors, in steps, to determine whether the limits listed in table 1 are met over the range of capacitance stated by the manufacturer. The relative percentage ~~error~~uncertainty shall be determined.

6.1.2 *Response time*

With a leakage capacitance C_e of 1 μF and at the nominal system voltage, the insulation resistance shall be suddenly reduced from nearly infinity to 50 % of the minimum response value R_{an}, and the delay to the operation of the output circuit shall be measured.

6.1.3 *Peak value of the measuring voltage U_m*

A peak voltage measurement shall be used to check whether the requirements given in table 1 are met and whether the statement under 5.2.2 is applicable. The internal resistance of the voltage measuring instrument shall be at least 20 times the internal d.c. resistance R_i of the measuring circuit.

6.1.4 *Internal resistance and impedance*

The following tests shall be used to check whether the requirements given in table 1 are met. These tests shall be executed with or without supply voltage U_v and an appropriate measuring voltage shall be applied between the interconnected system terminals and the earth terminal. The ~~error~~uncertainty limit of the measuring devices shall not exceed 5% under reference conditions.

6.1.4.1 *Internal impedance Z_i*

For determining the internal impedance Z_i in accordance with table 1, the voltage source shall be identical to the nominal system voltage U_n, the frequency shall be identical to the nominal system frequency, the distortion factor shall be below 5% the internal resistance shall be below 10 Ω. The internal impedance is calculated from the peak-to-peak value I_{pp} of the resulting current by using the following equation:

$$Z_i = \frac{2 \times \sqrt{2} \times U_n}{I_{pp}}$$

6.1.4.2 *Internal d.c. resistance R_i*

For determining the internal d.c. resistance R_i in accordance with table 1, the d.c. voltage shall have a magnitude in the order of the nominal system voltage U_n, but not exceed the permissible maximum extraneous d.c. voltage U_{fg}. The internal d.c. resistance R_i is calculated from the resulting current I by using the following equation:

$$R_i = \frac{U_n}{I} \quad (U_n \leq U_{fg})$$

6.1.5 *Facilities for indicating the insulation resistance*

When insulation monitoring devices are fitted with facilities for indicating the insulation resistance, a test shall be carried out to check whether the ~~error~~uncertainty limits stated by the manufacturer in accordance with 4.7 are met.

6.1.6 *Dielectric strength tests*

Insulation monitoring devices shall be tested in accordance with IEC 61010-1.

6.1.7 *Electromagnetic compatibility (EMC)*

The electromagnetic compatibility test shall be executed in accordance with 4.11.

6.2 *Routine tests*

Routine tests shall be executed on each insulation monitoring device.