SLOVENSKI STANDARD
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Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section 3: Seismic tests

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Relais électriques - Partie 21: Essais de vibrations, de chocs, de secousses et de tenue aux séismes applicables aux relais de mesure et aux dispositifs de protection - Section 3: Essais de tenue aux séismes

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Electrical relays –

Part 21:
Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 3: Seismic tests

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL RELAYS –

Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 3: Seismic tests

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 cooperation 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, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

3) They have the form of recommendations for international use 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.

International Standard IEC 255-21-3 has been prepared by IEC technical committee 95: Measuring relays and protection equipment.

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

DIS	Report on Voting	Amendment to DIS	Report on Voting
41B(CO)54*	41B(CO)57	41B(CO)58	41B(CO)69

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

Annex A is for information only.

* Subcommittee 41B has been changed into new technical committee 95.

ELECTRICAL RELAYS –

Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 3: Seismic tests

1 Scope and object

This International standard is one of a series of parts specifying the vibration, shock, bump and seismic requirements applicable to electromechanical and static measuring relays and protection equipment, with or without output contacts.

This standard includes two alternative types of seismic tests (see annex A):

- the single axis sine sweep seismic test (method A); and
- the biaxial multi-frequency random seismic test (method B).

During preparation of this standard, it was determined that the number of countries in which the first test method was preferred was about equal to the number of countries in which the second method was preferred. For this reason both methods have been retained, and neither have been identified as reference (or "referee") method.

The requirements of this standard are applicable only to measuring relays and protection equipment in a new condition.

The tests specified in this standard are type tests.

The object of this standard is to state:

- definitions of terms used;
- test conditions;
- standard test severity classes;
- test procedures;
- criteria for acceptance.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard 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 50: *International Electrotechnical Vocabulary (IEV)*

IEC 68-2-6: 1982, *Environmental testing – Part 2: Tests – Test Fc and guidance: Vibration (sinusoidal)*

IEC 68-2-57: 1989, *Environmental testing – Part 2: Tests – Test Ff: Vibration – Time-history method*

IEC 68-3-3: 1991, *Environmental testing – Part 3: Guidance – Seismic test methods for equipments*

IEC 255-21-1: 1988, *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 1: Vibration tests (sinusoidal)*

IEC 255-21-2: 1988: *Electrical relays – Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment – Section 2: Shock and bump tests*

ISO 2041: 1990, *Vibration and shock – Vocabulary*

3 Definitions

For definitions of general terms not defined in this standard, reference should be made to:

- IEC International Electrotechnical Vocabulary (IEV) (IEC 50)
- IEC 68-2-6, IEC 68-2-57, and IEC 68-3-3;
- IEC relay standards published in the IEC 255 series and in particular IEC 255-21-1 and IEC 255-21-2;
- ISO 2041.

3.1 *Single axis sine sweep seismic test*

A test during which a specimen is submitted to sweeps of sinusoidal vibration in the three orthogonal axes of the specimen in turn, in terms of constant displacement and/or constant acceleration, within a standard frequency range.

NOTE – The term specimen includes any auxiliary part which is an integral functional feature of the measuring relay protection equipment under test.

3.2 *Biaxial test*

A test during which a specimen is submitted to stresses in the horizontal and vertical axes simultaneously.

3.3 *Biaxial multi-frequency random seismic test*

A test during which a specimen is submitted to a random sequence of stresses with a test response spectrum which reproduces the standard response spectrum by a biaxial multi-frequency input motion.

3.4 *Standard response spectrum*

A response spectrum whose shape shall be according to figure 1, and whose main parameters are the damping and the zero period acceleration defined below.

3.5 *Damping*

A generic term ascribed to the numerous energy dissipation mechanisms in a system.

In practice, damping depends on many parameters such as construction, mode of vibration, strain, applied forces, velocity, materials, joint slippage, etc.

3.6 *Zero period acceleration*

High frequency asymptotic value of acceleration of the response spectrum (see figure 1).

NOTE – The zero period acceleration is of practical significance as it represents the largest peak value of acceleration in a time-history. This is not to be confused with the peak value of acceleration in the response spectrum.

3.7 *Random motion sample*

Sample of random motion record modified in frequency range and amplitude so as to produce the required or the standard response spectrum.

3.8 *Time-history*

Recording, as a function of time, of acceleration or displacement or velocity, resulting from a given event (see figure 2).

3.9 *Strong part of the time-history*

The strong part of the time-history is the part of the time-history from the time when the plot first reaches 25 % of the maximum value to the time when it reaches for the last time the 25 % level(see figure 2).

4 Requirements for single axis sine sweep seismic test (method A)

4.1 *Main parameters*

The main parameters of the single axis sine sweep seismic test are the following:

- frequency range;
- acceleration;
- displacement amplitude below the cross-over frequency;
- sweep rate and number of sweep cycles.

4.2 *Test apparatus and mounting*

The required characteristics of the vibration generator and fixture, together with the mounting requirements, shall be as follows. The characteristics apply when the specimen is mounted on the generator.

4.2.1 *Basic motion*

The basic motion shall be a sinusoidal function of time, and such that the fixing point of the specimen moves substantially in phase and in straight parallel lines along a specified axis, subject to the requirements of 4.2.2 and 4.2.3.

4.2.2 *Transverse motion*

The maximum vibration amplitude at the check points in any axis perpendicular to the specified axis shall not exceed 50 % of the specified amplitude.

4.2.3 *Distortion*

The acceleration distortion measurement shall be carried out at the reference point, which shall be declared by the manufacturer.

The distortion, as defined in 3.9 of IEC 255-21-1, shall not exceed 25 %. In cases where a distortion value greater than 25 % is obtained, the distortion shall be noted, and agreed between manufacturer and user.

4.2.4 *Vibration amplitude tolerances*

The actual vibration displacement and acceleration amplitude along the required axis of the reference point shall be equal to the specified value, within a tolerance of ±15 %.

4.2.5 *Frequency range tolerances*

The frequency range shall be equal to the specified values (see 4.3 and 5.2.4) within the following tolerances:

±0,2 Hz, for the lower frequency 1 Hz;

±1 Hz, for the upper frequency 35 Hz.

4.2.6 *Sweep*

The sweeping shall be continuous and the frequency shall change exponentially with time.

The sweep rate shall be 1 octave per min ± 10 %.

4.2.7 *Mounting*

The specimen shall be fastened to the vibration generator or fixture by its normal means of attachment in service so that the gravitational force acts on it in the same relative direction as it would in normal use.

The test fixture shall be rigid structure to minimize amplification and spurious motion within the frequency range of the test.