



SLOVENSKI STANDARD
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Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment - Section 1: Vibration tests (sinusoidal)

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Relais électriques - Vingt et unième partie: Essais de vibrations, de chocs, de secousses et de tenue aux séismes applicables aux relais de mesure et aux dispositifs de protection - Section un: Essais de vibrations (sinusoïdales)

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Section un – Essais de vibrations (sinusoïdales)

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Electrical relays

Part 21:

Vibration, shock, bump and seismic test on measuring relays and protection equipment

Section One – Vibration tests (sinusoidal)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL RELAYSPart 21: Vibration, shock, bump and seismic tests on
measuring relays and protection equipmentSection One: Vibration tests (sinusoidal)

FOREWORD

- 1) 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.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

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PREFACE

This standard has been prepared by Sub-Committee 41B: Measuring Relays and Protection Equipment, of IEC Technical Committee No. 41: Electrical relays.

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

Six Months' Rule	Report on Voting
41B(C0)35	41B(C0)37

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

The following IEC publications are quoted in this standard:

Publications Nos. 50: International Electrotechnical Vocabulary (IEV).

68-2-6 (1982): Basic environmental testing procedures, Part 2: Tests. Test Fc and guidance: Vibration (sinusoidal).

255: Electrical relays.

255-7 (1978): Part 7: Test and measurement procedures for electromechanical all-or-nothing relays.

Other publication quoted:

ISO 2041-1975: Vibration and shock - Vocabulary.

ELECTRICAL RELAYSPart 21: Vibration, shock, bump and seismic tests on
measuring relays and protection equipmentSection One: Vibration tests (sinusoidal)

1. Scope

This standard is part of a series specifying the vibration, shock, bump and seismic requirements applicable to measuring relays and protection equipment (with or without contacts).

This standard includes two types of vibration tests: the vibration response test and the vibration endurance test, and is generally based upon IEC 68-2-6.

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.

2. Object

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The object of this standard is to state:

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

3. Definitions

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

- International Electrotechnical Vocabulary (IEV) [IEC 50];
- IEC 68-2-6;
- relay standards published in the IEC 255 series;
- ISO 2041.

For the purpose of this standard the following definitions shall apply.

Note. - Definitions marked with (*) are derived from IEC 68-2-6.

3.1 *Vibration test (sinusoidal)*

A test during which a specimen is submitted to sweeps of sinusoidal vibration in the three different 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 or protection equipment under test.

3.2 *Vibration response test*

A vibration test carried out on a measuring relay or protection equipment, energized under specified conditions, to determine its response to normal service conditions.

3.3 *Vibration endurance test*

A vibration test carried out on a non-energized measuring relay or protection equipment, with higher vibration levels than in normal service conditions, as an accelerated life test to simulate long-term vibration. This test also simulates some transportation conditions.

3.4 *Fixing point (*)*

Part of the specimen in contact with the fixture or vibration table at a point where the specimen is normally fastened in service.

If a part of the real mounting structure is used as the fixture, the fixing points shall be taken as those of the mounting structure and not of the specimen.

3.5 *Measuring points (*)*

The specific points at which data are obtained during the tests. They are of two main types: check point and reference point.

3.6 *Check point (*)*

A measuring point located on the fixture, on the vibration table or on the specimen as close as possible and rigidly connected to one of its fixing points.

3.7 *Reference point (*)*

A measuring point chosen from the check points whose signal is used to control the test so that the requirements of this standard are satisfied.

3.8 *Sweep-cycle (*)*

A traverse of the specified frequency range once in each direction, for example 10 Hz to 150 Hz and 150 Hz to 10 Hz.

3.9 Distortion (*)

$$\text{Distortion } d = \frac{\sqrt{a_{\text{tot}}^2 - a_1^2}}{a_1} \times 100 \text{ (percentage)}$$

where:

a_1 = r.m.s. value of the acceleration at the driving frequency

a_{tot} = total r.m.s. value of the applied acceleration
(including the value of a_1)

3.10 Cross-over frequency

That frequency at which the characteristic of a vibration changes from a constant displacement value versus frequency to a constant acceleration value versus frequency.

3.11 Standard acceleration of gravity

The standard acceleration of gravity g_n , where "n" indicates normal, having the value of 9.81 m/s². In practice this value may be rounded to 10 m/s².

4. Requirements for vibration tests (sinusoidal)

The main parameters of the vibration tests are the following:

- frequency range; [SIST IEC 60255-21-1:1995](https://standards.iteh.ai/catalog/standards/sist/86cf831b-dcdf-4b96-a3c1-ef20b8c1f01b/sist-iec-60255-21-1-1995)
- acceleration; <https://standards.iteh.ai/catalog/standards/sist/86cf831b-dcdf-4b96-a3c1-ef20b8c1f01b/sist-iec-60255-21-1-1995>
- displacement amplitude below the cross-over frequency, if any,
- sweep rate and number of sweep cycles.

4.1 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.

4.1.1 Basic motion

The basic motion shall be a sinusoidal function of time and such that the fixing points of the specimen move substantially in phase and in straight parallel lines along a specified axis, subjected to the limitations of Sub-clauses 4.1.2 and 4.1.3.

4.1.2 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 for basis motion.

4.1.3 *Distortion*

The acceleration distortion measurement shall be carried out at the reference point, which shall be declared by the manufacturer, and shall cover the frequencies up to 5 000 Hz.

The distortion as defined in Sub-clause 3.9 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.

4.1.4 *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 $\pm 15\%$.

4.1.5 *Frequency range tolerances*

The frequency range shall be equal to the specified values (Sub-clauses 4.2.1 and 4.2.2) within the following tolerances:

- ± 1 Hz for the lower frequency 10 Hz;
- ± 3 Hz for the upper frequency 150 Hz.

4.1.6 *Sweep*

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

The sweep rate shall be 1 octave per minute $\pm 10\%$.

Note.- in particular cases a lower sweep rate can be chosen, e.g. for relays and protection equipment having an operating time greater than 8 min.

4.1.7 *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.

During the vibration response test, cable connections to the specimen shall be so arranged that they impose no more restraint or mass than they would when the specimen is installed in its operating position.

Note.- Care should be taken to ensure that the specimen under test is not significantly affected by any magnetic field generated by the vibration system.

4.2 *Test severity classes*

The vibration response test and the vibration endurance test include three different severity classes (0, 1, 2), the main parameters of which are referred to in Sub-clauses 4.2.1 and 4.2.2 below.