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Electrical relays - Part 22: Electrical disturbance tests for measuring relays and protection equipment - 1 MHz burst disturbance tests

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## Essais d'influence électrique concernant les relais de mesure et dispositifs de protection

Première partie: Essais à l'onde oscillatoire amortie à 1 MHz

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## Electrical disturbance tests for measuring relays and protection equipment

Part 1: 1 MHz burst disturbance tests

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL DISTURBANCE TESTS FOR MEASURING RELAYS  
AND PROTECTION EQUIPMENT

Part 1: 1 MHz burst disturbance tests

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 the Sub-Committee 41B: Measuring relays and protection equipment.

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

Six Months' Rule	Report on Voting	Two Months' Procedure	Report on Voting
41B(C0)30	41B(C0)31	41B(C0)33	41B(C0)34

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

*The following IEC publications are quoted in this standard:*

- Publication Nos. 50(446) (1983): International Electrotechnical Vocabulary (IEV), Chapter 446: Electrical relays.
- 255-5 (1977): Electrical relays, Part 5: Insulation tests for electrical relays.
- 255-6 (1978): Electrical relays, Part 6: Measuring relays with more than one input energizing quantity.

ELECTRICAL DISTURBANCE TESTS FOR MEASURING  
RELAYS AND PROTECTION EQUIPMENT

Part 1: 1 MHz burst disturbance tests

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### 1. Scope and object

The purpose of this standard is to specify general requirements for electrical disturbance tests of static measuring relays and protection equipment.

The tests may also, where appropriate, be applied to electro-mechanical relays, for example, high speed or high sensitivity electro-mechanical relays.

The requirements are applicable only to relays or equipment in new condition.

The tests specified in this standard are type tests.

Insulation tests including impulse withstand tests are specified in IEC Publication 255-5.

The object of this standard is to state:

- 1) definitions of terms used;
- 2) standard test severity classes;
- 3) test conditions;
- 4) test procedure;
- 5) criteria for acceptance.

### 2. Definitions

For definitions of general terms not defined in this standard, reference should be made to Chapter 446 of the International Electro-technical Vocabulary (IEV) [IEC Publication 50(446)].

For the purpose of this standard, the following definitions shall apply:

#### 2.1 *Common mode voltage*

The voltage common to conductors as measured between those conductors at a given location and an arbitrary reference (usually earth).

#### 2.2 *Differential mode voltage*

The voltage at a given location as measured between two conductors of the same circuit.

### 2.3 Disturbance voltage

Unwanted voltage that may cause change in performance, component destruction or flashover.

## 3. 1 MHz burst disturbance test

### 3.1 Standard test severity classes

To cover different field conditions, this standard includes different severity classes. The test voltage is the amplitude of the first peak of the open circuit voltage of the test generator. General guidance for the selection of the test severity class is given under Sub-clause 3.1.2 below.

#### 3.1.1 Test severity classes

Depending on the test severity class, the test voltage shall be chosen from the following:

	Class I (no test)	Class II	Class III
Common mode	0 V	1 kV	2.5 kV
Differential:	0 V	0.5 kV	1 kV

In special circumstances, the same value for both common and differential modes may be specified.

#### 3.1.2 Recommendation for choice of test severity class

The test severity class should be chosen such that the expected level of disturbance voltage does not exceed the test voltage of the class chosen.

A relay or protection equipment may have different test severity classes for its input energizing circuits, auxiliary energizing circuits and output circuits.

The following examples give guidance for the selection of the test severity class (see also Appendix A).

##### Class I (no test)

Relays and protection equipment in this class are used in an environment without disturbance voltages.

##### Class II

Relays and protection equipment in this class may be used where:

- a) the auxiliary energizing circuits (power supply circuits) of the relay or protection equipment are connected to a voltage supply used exclusively for the power supply of static equipment. The leads are short, and there is no switching on other circuits connected to the supply;
- b) the input energizing circuits are not connected directly to C.T.s and/or V.T.s or where good screening and earthing is employed on the connecting leads;
- c) the output circuits are connected to a load by short leads;
- d) normally no disturbance test is required; but a higher degree of security is wanted.

### Class III

Relays and protection equipment in this class may be used where:

- a) the auxiliary energizing circuits (power supply circuits) are connected to station batteries, etc., which are not used exclusively for the power supply of static equipment;

Due to long leads, common and differential mode disturbance voltages of relatively high value may appear on the supply leads, arising from switching in other circuits connected to the same battery or supply source.

- b) the input energizing circuits are connected directly to C.T.s and/or V.T.s, where long leads are involved and no effective screening and earthing is employed;
- c) the output circuits are connected to their loads by long leads in such a way that common and differential mode voltages of relatively high value appear at the output terminals, caused for example by the electromagnetic field and/or the unbalance of the insulation with respect to earth;
- d) normally, a lower test voltage of Class II above is sufficient, but an higher degree of security is required.

## 3.2 Test conditions

### 3.2.1 Test voltage parameters

The test voltage parameters for an open circuit generator condition at the generator terminals shall be:

- Waveform:

a damped oscillatory wave, with the envelope decaying to 50% of peak value between the third and sixth periods.



- Frequency: 1 MHz - tolerance  $\pm 10\%$ .
- Repetition rate:

the test wave shall be applied to the relay under test at a repetition rate of 6-10 bursts per period of power system frequency and shall be non-synchronous with this frequency.

- Rise time of first peak:  
75 ns  $\pm 20\%$ , as measured between 10% and 90% of the peak value.
- Test voltage value:  
according to test voltage class (see Sub-clause 3.1) - tolerance:  $-10\%$ .

The accuracy of the above parameters shall be maintained for the full duration of the tests.

### 3.2.2 Test generator

The test generator connected as shown in Figure 1 shall have the following characteristics:

- Source impedance: 200  $\Omega$  resistive at 1 MHz - tolerance  $\pm 20\%$ .
- Common side of the generator to be solidly earthed.

### 3.2.3 Test circuits

- With frequency generator and coupling network: the recommended standard test circuits are shown in Figures 2, 3, 4a and 4b.
- Test leads: the test leads shall be not longer than 2 m.

## 3.3 Test procedure

3.3.1 The tests shall be carried out with the relay under reference conditions stated in the applicable standard (i.e. IEC Publication 255-6).

3.3.2 The tests shall be carried out with the following values of energizing quantities (auxiliary and input) and with loading applied to the appropriate circuits:

- auxiliary energizing quantity(ies): rated value(s);
- input energizing quantity(ies): value(s) equal to the operating value(s) adjusted both above and below by an amount equal to the claimed variation due to the disturbance voltage (see Sub-clause 3.3.6 and Sub-clause 3.4) or rated value(s) where appropriate (e.g. frequency relays);