INTERNATIONAL STANDARD

ISO 10605

First edition
2001-12-15

Road vehicles — Test methods for electrical disturbances from electrostatic discharge

Véhicules routiers — Méthodes d'essai des perturbations électriques provenant de décharges électrostatiques

Reference number
ISO 10605:2001(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10605 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This first edition of ISO 10605 cancels and replaces ISO/TR 10605:1994, which has been technically revised.

Annexes A and B form a normative part of this International Standard.

Introduction

The familiar static charge generated and discharged when moving about inside a vehicle or getting out of it has assumed greater significance with the increase in the number of vehicle electronic modules. Tests in common use by various industries simulating the electrostatic discharge of humans were examined and determined to be inapplicable to an automotive environment. Consequently, tests tailored to this environment have been developed.

Tests that simulate an electrostatic discharge (ESD) into a vehicle electrical system are based on the human ESD model, which consists essentially of a capacitor formed by a person to his or her surroundings and discharged through a path that includes the person's resistance. Sensitive electrical devices can be adversely affected by energy either coupled or radiated from electrostatic discharges.

This International Standard describes ESD tests applicable to both automotive electronic modules and vehicles.

Road vehicles — Test methods for electrical disturbances from electrostatic discharge

1 Scope

This International Standard specifies electrostatic discharge (ESD) test methods for evaluating electronic modules intended for use in road vehicles, including procedures for evaluating electronic modules both on the bench and in completed vehicles. Additionally, it specifies a test procedure for classifying the ESD sensitivity of modules for packaging and handling, and a procedure for calibrating the simulator used to generate the electrostatic discharges, as well as functional status classifications for immunity to ESD.

This International Standard is applicable to all types of road vehicles, regardless of the vehicle propulsion system (e.g. spark-ignition engine, diesel engine, electric motor).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, 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. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7637-1:—[1], *Road vehicles — Electrical disturbances from conduction and coupling — Part 1: Definitions and general considerations*

ISO 7637-2:—[2], *Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only*

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 2: Electrostatic discharge immunity test*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
electrostatic discharge
ESD
transfer of electrostatic charge between bodies at different potentials occurring prior to contact or induced by an electrostatic field

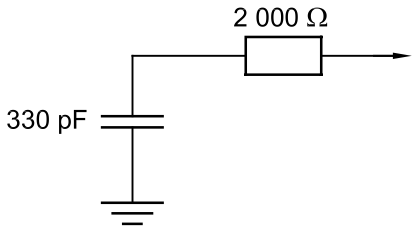
1) To be published. (Revision of ISO 7637-0:1990)

2) To be published. (Revision of ISO 7637-1:1990 and ISO 7637-2:1990)

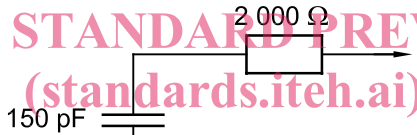
3.2
human ESD model
capacity, voltage and resistance that characterize a person as a source of an electrostatic charge for automotive conditions

See Figure 1.

NOTE Figure 1 defines the capacitance/resistance parameters for an occupant inside and a person outside a vehicle. Figure 1 a) is also applicable for module tests, while Figure 1 b) is also applicable for sensitivity classification.



a) Occupants inside passenger compartment



b) Persons reaching into passenger compartment from outside

Figure 1 — Human ESD model

3.3
ground plane
metal sheet or plate used as a common reference for the device under test, ESD simulator and auxiliary equipment

3.4
ESD simulator
instrument that simulates the human ESD model

4 Test equipment

4.1 General

Test equipment used to verify the requirements of the device under test shall not be sensitive to ESD.

The following test equipment is applicable to all test procedures specified in this International Standard, including those of annex A.

4.2 ESD simulator

The ESD simulator shall have the following characteristics.

a) Voltage range: variable from – 25 kV to + 25 kV.

b) Capacitance: 330 pF ± 10 %, 150 pF ± 10 % (two probes).

c) Resistance: 2 000 Ω ± 10 %.

d) Risetime:

   1) direct contact, 0,7 ns to 1 ns (at a 2 Ω load);

   2) air discharge, ⩽ 5 ns (at a 2 Ω load);

   3) tip shapes (see Figure 2), in accordance with IEC 61000-4-2.

The simulator shall be designed so that the discharge capacitance is fully charged to the desired voltage before the energy is switched to the device under test.

The construction of the ESD simulator shall be such that the high-voltage ground and the chassis ground are electrically isolated from one another.

Simulator equipment used shall be of a type that is commercially available.

4.3 Ground plane

A ground plane is a metallic sheet (copper, brass, etc.[3]) that shall have a minimum thickness of 1 mm and an area of at least 1 m^2, ensuring that it projects beyond the device under test by at least 100 mm on all sides. The ground plane shall be connected to the facility ground by a ground strap less than 2 m long and at least 50 mm wide.

4.4 Insulation blocks

Insulation blocks, if used, shall be constructed of clean, non-hygroscopic material. The blocks shall be (25 ± 2,5) mm in height and project beyond the device under test by at least 20 mm on all sides.

4.5 Coaxial target

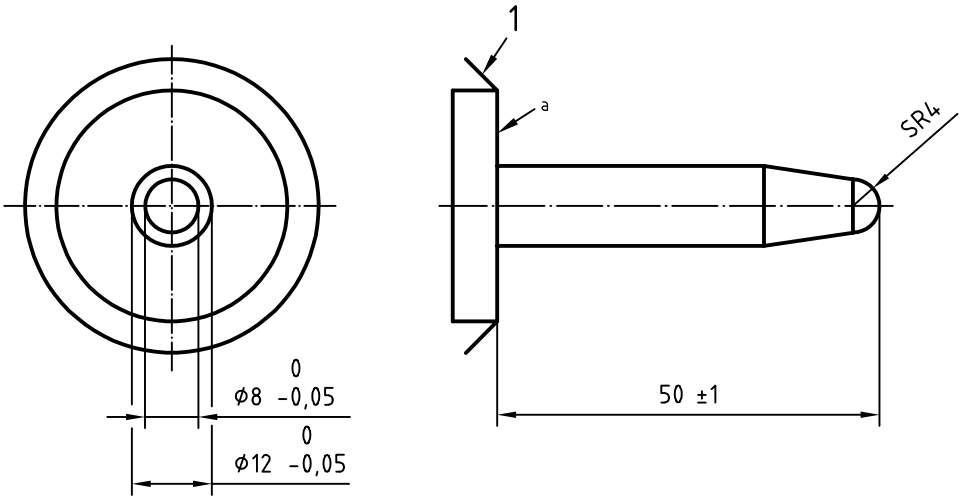
A coaxial target as specified in IEC 61000-4-2:1995 shall be used during the ESD simulator verification given in annex A.

4.6 Wideband attenuator

If needed, a 50 Ω, 20 dB wideband attenuator is to be attached to the output of the coaxial target during the ESD simulator verification given in annex A.

3) If aluminium is used, care shall be taken that oxidizing does not prevent a good ground connection.

Dimension in millimetres



a) Air discharges

b) Direct contact discharges

Key

1 ESD simulator
2 Sharp point

[a] The discharge switch (e.g. vacuum relay) shall be mounted as close as possible to the tip of the discharge electrode.

Figure 2 — ESD simulator discharge tip probes

4.7 Analog or digital measurement device

An analog measurement device with a minimum effective single-shot bandwidth of 1 GHz, or a digital measurement device with a minimum sampling rate of four Giga-samples per second and a single shot bandwidth of at least 1 GHz, each with a 50 Ω input impedance, is needed to certify the risetime of the ESD simulator. The use of a Faraday shield to separate the target from the measurement device is highly recommended.

4.8 Electrometer

An electrometer with a minimum input resistance of 100 GΩ shall be used to verify the ESD simulator charging voltage.

4.9 Static dissipative material

Use static dissipative material to bleed-off the charge (see 7.2.2.1). Ensure that it projects beyond the device under test. The surface resistivity of this material shall be between $10^7\ \Omega$ per square and $10^9\ \Omega$ per square[4)]. The static dissipative material shall be placed on, and connected to, a ground plane if required by the manufacturer.

5 Test procedure for electronic modules (powered-up test)

5.1 General

Prior to performing the test, generate a test plan that includes interface test points, electronic module mode of operation and any special instructions and changes from the standard test.

Before applying any discharges to the device under test, verify that the ESD simulator discharge verification procedure of annex A has been performed within the time period established by the laboratory or the customer.

For the test of electronic modules, use the 330 pF capacitor probe [Figure 1 a)].

5.2 Test

5.2.1 General

Maintain the ambient temperature during the test at (23 ± 5) °C and the relative humidity between 30 % and 60 % (20 °C and 30 % relative humidity is preferred), or using other values agreed to by the user, in which case such values shall be documented in the test report.

Set up the test in accordance with Figure 3.

Connect the ESD simulator high-voltage ground directly to the ground plane by a grounding strap as in 4.3 and Figure 3.

Place the device under test on the ground plane (see Figure 3). Place the chassis-mounted electronic modules directly on, and connect them to, the ground plane. Test electronic modules isolated from ground in normal installation with an insulator between the electronic module and the ground plane using insulation blocks (4.4). Connect all voltage supply pins to an appropriate power source. Provide inputs for all other pins as necessary to put the device under test into a simulated mode of operation.

Ensure that the device under test is at least in a powered, idling mode.

Test each exposed shaft, button, switch or surface of the device under test accessible to an occupant inside the vehicle, at each of the voltage levels defined in annex B or as specified in the test plan, in accordance with 5.2.2 and 5.2.3.

Subject each discharge point to a minimum of three positive polarity and three negative polarity discharges at each voltage level, with a minimum time duration between discharges of 5 s.

At each voltage level, all discharge points of a device may be tested first at a single polarity and then with the opposite polarity.

During and after each series of three discharges, verify that the device under test meets all applicable performance requirements.

---

4) The measurement is to be made on a square piece of material that can be any dimension [m^2, mm^2, $(0,5\ m)^2$]. Surface resistivity is defined as follows: for an electric current flowing across a surface, the ratio of d.c. voltage drop per unit length to the surface current per width. In effect, the surface resistivity is the resistance between two opposite sides of a square and is independent of the size of the square or its dimensional units. Surface resistivity is expressed in ohms per square.[1]