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Road vehicles — Test methods for electrical disturbances from electrostatic discharge

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

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Foreword

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

This third edition cancels and replaces the second edition (ISO 10605:2008~~) + cor 1:2010 + amd 1:2014~~), which has been technically revised. It also incorporates the Amendment ISO 10605:2008:/Amd.1 2014 and the Technical Corrigendum ISO 10605:2008/Cor 1:2010.

The main changes are as follows:

— introduction of alternative test set-up with field coupling plane for direct and indirect discharges on component (powered-up test);

— minimum number of discharges changed from 50 to 10 for indirect discharge on component (powered-up test);

— interval between successive single discharges changed from 50 ms to 1 s for indirect discharge on component (powered-up test);

— addition of a ground connection for discharges on DUT pins for Component packaging and handling test method (unpowered test);

— optional test set-up and procedure for electronic modules (powered-up test) moved from Annex to main body;

— addition of new Annex G.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The electrostatic discharge, due to former charge build-ups generated, for example, when moving about inside a vehicle or getting out of it, has assumed greater significance with the increase of vehicle electronic modules. Tests simulating the electrostatic discharge of humans, in common use by various industries, were examined and it was determined that they were not fully applicable to the automotive environment. As a consequence, tests tailored to the automotive environment were developed.

Tests that simulate an electrostatic discharge (ESD) into a vehicle electrical system are based on the human ESD model. Sensitive electrical devices can be adversely affected by energy either coupled or radiated from electrostatic discharges.

This document describes ESD tests that are applicable to both automotive electronic modules and vehicles.

Road vehicles — Test methods for electrical disturbances from electrostatic discharge

1 Scope

This document specifies the electrostatic discharge (ESD) test methods necessary to evaluate electronic modules intended for vehicle use. It applies to discharges in the following cases:

— ESD in assembly;

— ESD caused by service staff;

— ESD caused by occupants.

This document describes test procedures for evaluating both electronic modules on the bench and complete vehicles. This document applies to all types of road vehicles regardless of the propulsion system (e.g. spark-ignition engine, diesel engine, electric motor).

The test for electronic modules on the bench described in this ~~standard~~document applies to any DUT (powered by an unshielded power system, DUT powered by a shielded power system, self-powered DUT, etc.).

This document does not apply to pyrotechnic modules.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11452-1, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11452-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
air discharge
test method characterized by bringing the test generator discharge tip close to the *device under test (DUT)* (3.3); the discharge is by arcing on the DUT

3.2
contact discharge
test method characterized by contact of the test generator discharge tip with the ~~DUT,~~*device under test (DUT)* (3.3), where discharge is initiated by the generator discharge switch

3.3
DUT
device under test
~~**DUT**~~
single component or combination of components as defined to be tested

3.4
direct discharge
discharge directly on the ~~DUT~~*device under test (DUT)* (3.3)

3.5
ESD
electrostatic discharge
~~**ESD**~~
transfer of electrostatic charge between bodies at different potentials occurring prior to contact or induced by an electrostatic field

3.6
ESD generator
instrument that simulates the *human ESD model* (3.9)

3.7
GP
ground plane
~~**GP**~~
flat conductive *surface* (3.11) whose potential is used as a common reference

Note 1 to entry: The test voltage should also be referenced to the ground plane.

3.8
holding time
interval of time within which the decrease of the test voltage due to leakage, prior to the discharge, is 10 %

3.9
human ESD model
network of passive elements and voltage that characterizes a charged person as a source of an *electrostatic discharge* (3.5) for automotive conditions

3.10
indirect discharge
discharge to a coupling plane near the *device under test (DUT)* (3.3)

~~NOTE~~ Note 1 to entry: Discharge current produces a transient field that might affect the DUT. Indirect discharge simulates discharge by a human being on items near the DUT.

3.11
surface
uninterrupted housing area, gap or opening

EXAMPLE Switches, tip switches, points of contact, air vents, speaker openings.

4 Test conditions

The user shall specify the test severity level(s) for the component and vehicle tests. Suggested test levels are included in Annex C.

Standard test conditions shall be as follows:

— ambient temperature: (25 ±± 10) °C;

— relative humidity between 20 % and 60 % %.

If other values are agreed to by the users, these values shall be documented in the test report.

5 Test location

Shielded enclosures or even absorber-lined shielded enclosures are allowed but not required.

NOTE ESD testing creates transient fields, which can interfere with sensitive electronic devices or receivers, even at a distance of a few meters. It is advisable that this be considered when choosing a test location.

6 Test apparatus and instrumentation

6.1 ESD generator

The ESD generator characteristics shall be as specified in Table 1.

Table 1 — General ESD generator parameters

Parameter	Characteristic
Output voltage range contact discharge mode	2 kV to 15 kV, or as required in the test plan [a]
Output voltage range air discharge mode	2 kV to 25 kV, or as required in the test plan [a]
Output voltage accuracy	≤ 5 %
Output polarity	Positive and negative
Rise time of short circuit current in contact discharge mode (10 % to 90 %)	0,7 ns to 1,0 ns
Holding time	≥ 5 s
Storage capacitances[b]	150 pF, 330 pF
Discharge resistances[b]	330 Ω,Ω, 2 000 ΩΩ

[a] See examples in Annex C.

[b] Storage capacitance and discharge resistance are nominal values, ESD generator shall meet discharge current specifications in 6.3.

NOTE ~~1~~ When an ESD generator is supplied from an external supply source, AC or DC, or controlled by a separate unit and this (these) cable(s) is (are) not combined (bundled) with the ESD generator discharge return cable, unintended current can flow through this (these) cable(s).

The ESD generator should be able to generate a repetition rate of at least 20 discharges per second down to manual control without any degradation of the discharge current waveform.

The tip voltage should be checked continuously by the generator internal tip voltage supervision.

For contact discharge a grounded discharge resistor with ~~1MΩ~~1 MΩ ±20 % resistance from tip to ground is recommended and prevents pre-pulse-voltage occurrence which can lead to non-reproducible test results; proper fixing of resistor shall not change the current shape.

In cases where a 2 m length of the discharge return cable is insufficient (e.g. for tall DUTs), a length not exceeding 3 m may be used and compliance with the waveform specifications shall be guaranteed (e.g. by the manufacturer or from calibration).

The ESD generator protective earth terminal shall be terminated to the facility protective earth.

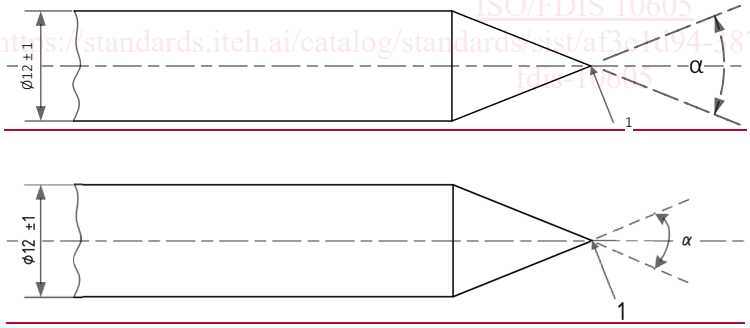
Guidance on automatic operated ESD testing can be ~~founded~~found in Annex G.

6.2 Discharge tips

6.2.1 Contact discharge tip

The discharge tip for contact mode ESD is shown in Figure 1. The tip is typically made of stainless steel. For contact discharge to pins the discharge tip shape can be varied. The diameter of the tip shall be 12~~+~~ ± 1 mm. Springs for safe contact and a bending of not more than 90° are possible. The current shape with modified tip shall comply with the given specification. The angle "alpha" shall be between 25° and 40°.

Dimensions in millimetres



Key

~~1 sharp point~~

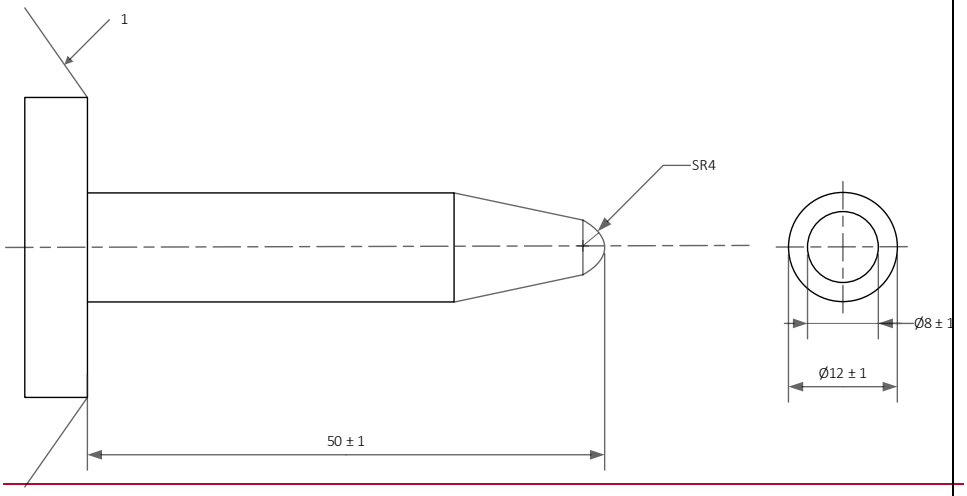
1 sharp point

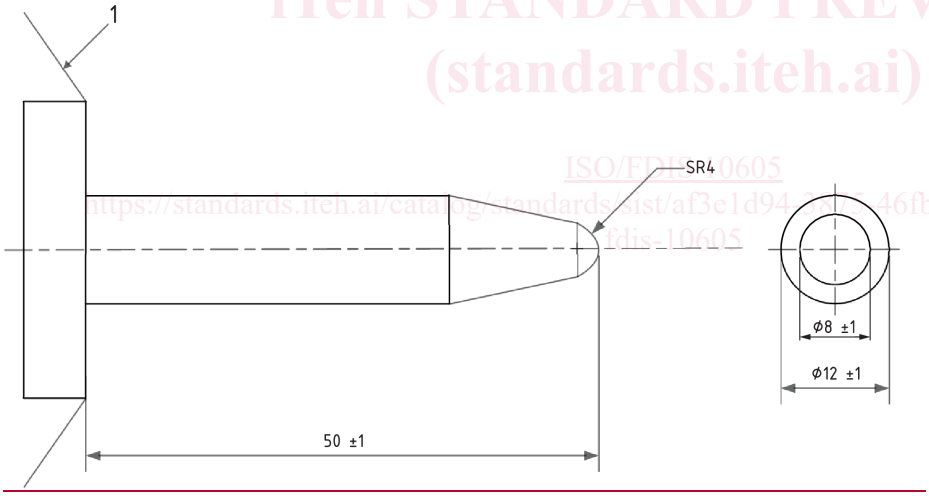
Figure ~~—~~1 — Contact discharge tip of the ESD generator

6.2.2 Air discharge tip

The discharge tip for air discharge mode ESD is shown in Figure 2.

Dimensions in millimetres





Key

~~1 body of simulator~~

1 body of simulator

NOTE For air discharge at test voltages higher than 15 kV, a larger tip (e.g. 20 mm to 30 mm diameter) can be used to avoid pre-discharge.

Figure 2 — Air discharge tip of the ESD generator