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Road vehicles — Electrical disturbances from conduction and coupling —

Part 2:
Electrical transient conduction along supply lines only

Véhicules routiers — Perturbations électriques par conduction et par couplage —

Partie 2: Perturbations électriques transitoires par conduction uniquement le long des lignes d'alimentation

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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 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7637-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This third edition cancels and replaces the second edition (ISO 7637-2:2004), which has been technically revised. It also incorporates the Amendment ISO 7637-2:2004/Amd.1:2008. It does not specify test pulses 4, 5a, and 5b, which are now specified in ISO 16750-2 and ISO 21848.

ISO 7637 consists of the following parts, under the general title *Road vehicles — Electrical disturbances from conduction and coupling*:

— *Part 1: Definitions and general considerations*

— *Part 2: Electrical transient conduction along supply lines only*

— *Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines*

Road vehicles — Electrical disturbances from conduction and coupling —

Part 2:
Electrical transient conduction along supply lines only

1 Scope

This part of ISO 7637 specifies test methods and procedures to ensure the compatibility to conducted electrical transients of equipment installed on passenger cars and commercial vehicles fitted with 12 V or 24 V electrical systems. It describes bench tests for both the injection and measurement of transients. It is applicable to all types of road vehicles independent of the propulsion system (e.g. spark ignition or diesel engine, electric motor).

Function performance status classification for immunity to transients is given in Annex A.

2 Normative references

The following referenced documents are indispensable for the application 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 7637-1, *Road vehicles — Electrical disturbances from conduction and coupling — Part 1: Definitions and general considerations*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7637-1 apply.

4 Test procedure

4.1 General

Methods for measuring the transient emission on supply lines and test methods for the immunity of devices against such transients are given. These tests, called “bench tests”, are performed in the laboratory.

The bench test methods, some of which require the use of the artificial network, will provide comparable results between laboratories.

A bench test method for the evaluation of the immunity of a device against supply line transients may be performed by means of a test pulse generator. This may not cover all types of transients which can occur in a vehicle; therefore, the test pulses described in 5.6 are characteristic of typical pulses.

In special cases, it may be necessary to apply additional test pulses. However, some test pulses may be omitted if a device, depending on its function or its connection, is not influenced by comparable transients in the vehicle. It is part of the vehicle manufacturer's responsibility to define the test pulses required for a specific device.

4.2 Test temperature and supply voltages

The ambient temperature during the test shall be (23 ± 5) °C.

The supply voltages shall be as shown in Table 1 unless other values are agreed upon by the users of this part of ISO 7637, in which case such values shall be documented in the test reports.

U_A is the supply voltage defined in Table 1, which shall be measured at the output of the pulse generator.

Table 1 — Supply voltages

Supply voltage	Nominal 12 V system V	Nominal 24 V system V
U_A	13,5 ± 0,5	27 ± 1

4.3 Voltage transient emissions test

4.3.1 General

This clause defines a test procedure to evaluate automotive electrical and electronic components for conducted emissions of transients along battery fed or switched supply lines of a device under test (DUT). A DUT which is considered a potential source of conducted disturbances should be tested according to the procedure described in this clause.

Care shall be taken to ensure that the surrounding electromagnetic environment does not interfere with the measurement set-up.

The test method applies to DUT with or without internal mechanical or electronic switch driving inductive loads.

Voltage transients from the disturbance source, the DUT, are measured using the artificial network to standardize the impedance loading on the DUT (see 5.1).

All wiring connections between the artificial network, switch, and the DUT shall be spaced (50 ± 5) mm above the metal ground plane.

The cable sizes shall be chosen in accordance with the real situation in the vehicle, i.e. the wiring shall be capable of handling the operating current of the DUT, and as agreed between vehicle manufacturer and supplier.

Grounding of the DUT case to the ground plane shall reflect the vehicle installation and shall be defined in a test plan.

If no requirements are specified in the test plan, then the DUT shall be placed on a non-conductive material (50 ± 5) mm above the ground plane.

The supply voltage U_A and the disturbance voltage shall be measured (see 4.3.2 and 4.3.3 for measurement guidance) using a voltage probe (see 5.5) and an oscilloscope or waveform acquisition equipment.

For values, see Annex B.

DUT operating conditions of particular interest in the measurements are the switch-off and the exercising of the various operating modes of the DUT. Exact operating conditions of the DUT shall be specified in the test plan.

NOTE Measurements at turn-on can be of interest in some instances.

The sampling rate and trigger level shall be selected to capture a waveform displaying the complete duration of the transient, and with sufficient resolution to display the highest positive and negative portions of the transient.

Utilising the proper sampling rate and trigger level, the voltage amplitude shall be recorded by actuating the DUT according to the test plan. Other transient parameters, such as rise time, fall time, transient duration, etc. may also be recorded. Unless otherwise specified, ten waveform acquisitions are necessary. It is necessary to report only the waveforms with the highest positive and negative amplitude (with their associated parameters).

The measured transient shall be evaluated in accordance with Annex B. All pertinent information and test results shall be reported. If required per test plan, include transient evaluation results with respect to the performance objective as specified in the test plan.

The test applies to an inductive load (such as power window, power seat, relay, electric mirror, etc.) with a large inductance or a high load current, which connects to the vehicle power supply, or a DUT which switches such an inductive load.

If an inductive load has a small inductance or a low load current and is driven by an internal regulated voltage (e.g. 5 V), which is isolated from the vehicle power supply, the test is not applicable unless specified in a test plan.

4.3.2 Test set-up for slow pulses

The test set-up is described in Figure 1 a).

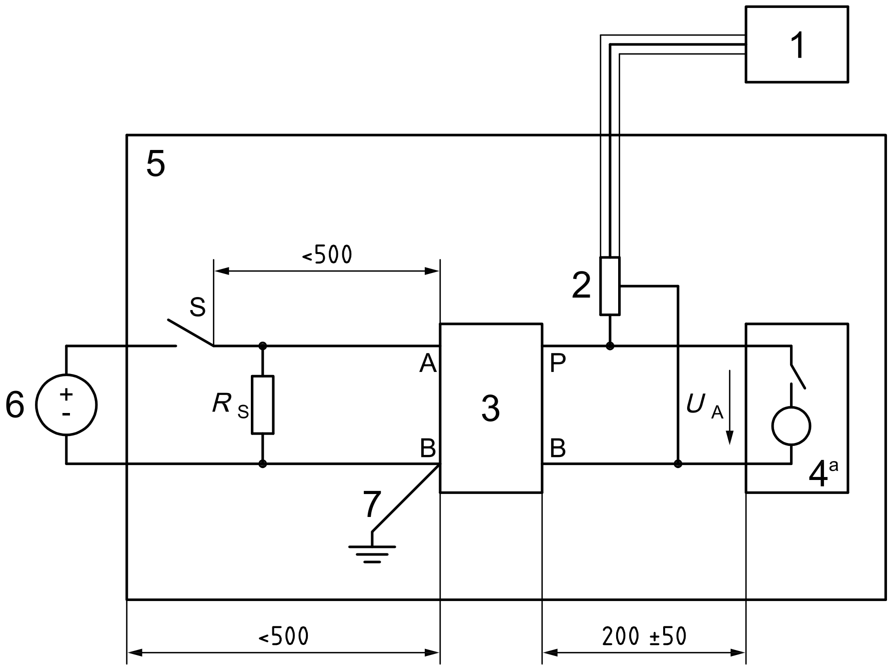
The disturbance source is connected via the artificial network to the shunt resistor R_s (see 5.2), the switch S (see 5.3) and the power supply (see 5.4).

The switch S represents the main switch (e.g. ignition switch, relay, etc.) which supplies the DUT and could be located at several metres from the DUT.

In the case of a DUT having an internal mechanic and/or electronic switch driving inductive load, the test set-up described in Figure 1 a) is applicable with the DUT internal switch closed (DUT inductive loads powered when opening switch S).

Depending on the DUT internal switch type (relay, electronic switches, IGBT, etc.) it may not be possible to ensure a controlled closure of the internal switch. The detail state of the internal switch(es) shall be recorded in the test report.

Transients generated by the supply disconnection of the DUT are measured at the moment of opening the switch S (the switch S is operated in order to generate transient disturbance).



a) Transient emission test set-up to measure slow pulses (ms-range or slower)

Figure 1 — Transient emission test set-up to measure pulses (*continued*)

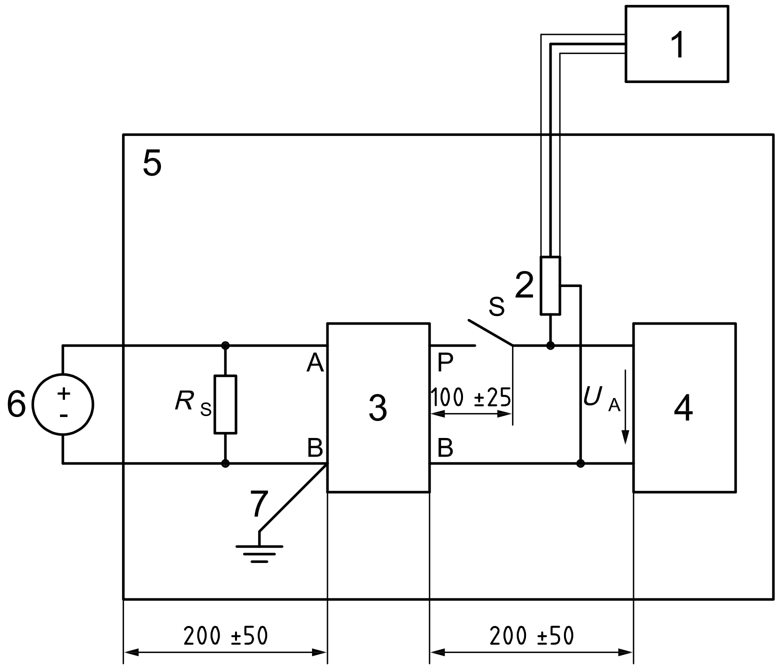
4.3.3 Test set-up for fast pulses

The test set-up is described in Figure 1 b) for DUT without internal switch.

The disturbance source is connected via the artificial network to the shunt resistor R_s (see 5.2), the switch S (see 5.3) and the power supply (see 5.4).

Transients generated by the supply disconnection of the DUT are measured at the moment of opening the switch S (the switch S is operated in order to generate transient disturbance).

Dimensions in millimetres
Drawing not to scale



b) Transient emission test set-up to measure fast pulses (ns to µs range) for DUT without internal switch

Figure 1 — Transient emission test set-up to measure pulses (*continued*)

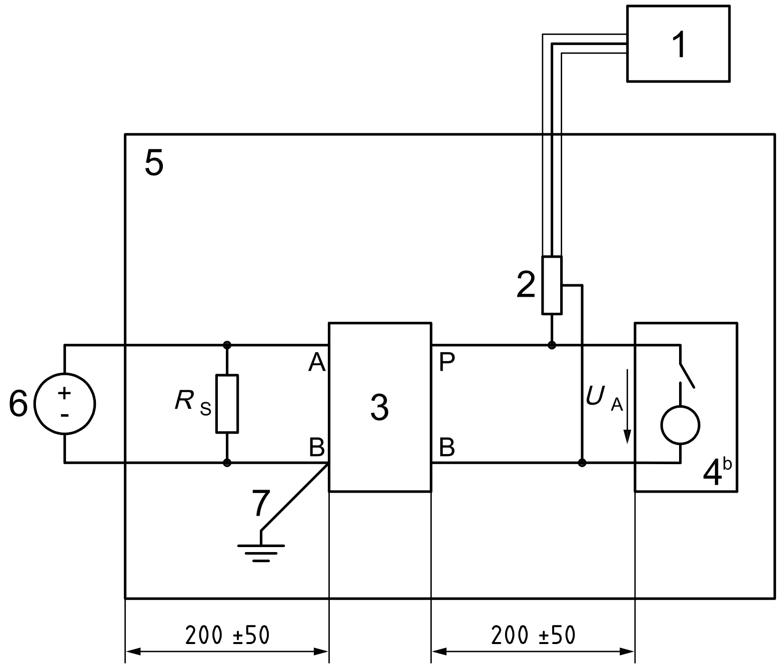
The test set-up is described in Figure 1 c) for DUT with internal switch.

The disturbance source is connected via the artificial network to the shunt resistor R_S (see 5.2) and the power supply (see 5.4).

In this case the internal switch shall be operated in order to generate transient disturbance (there is no need for the switch S).

Transients generated by the supply disconnection of the DUT are measured at the moment of opening the internal switch (the switch is operated in order to generate transient disturbance), with the probe connected as close to the DUT terminals as possible.

Dimensions in millimetres
Drawing not to scale



c) Transient emission test set-up to measure fast pulses (ns to µs range) for DUT with internal switch

Key

1 oscilloscope or equivalent
2 voltage probe
3 artificial network
4 DUT (source of transient)
5 ground plane
6 power supply
7 ground connection; length <100 mm
R_S shunt resistance, as specified in 5.2
S switch, as specified in 5.3
U_A supply voltage

NOTE For A, B, and P, see Figure 3.

[a] Optionally with internal switch driving inductive load.
[b] With internal load and switch.

Figure 1 — Transient emission test set-up to measure pulses

4.4 Transient immunity test

4.4.1 Location of the DUT

The DUT shall be placed on a non-conductive low relative permittivity ($\varepsilon_r \leqslant 1{,}4$) support with a thickness of (50 ± 5) mm.

Grounding of the DUT case to the ground plane shall reflect the vehicle installation and shall be defined in a test plan.

4.4.2 Location of the power supply lines

For test pulses 3a and 3b, the leads between the terminals of the test pulse generator and the DUT shall be laid out in a straight parallel line on a low relative permittivity ($\varepsilon_r \leqslant 1{,}4$) support with a thickness of (50 ± 5) mm and shall have a length of (500 ± 100) mm.

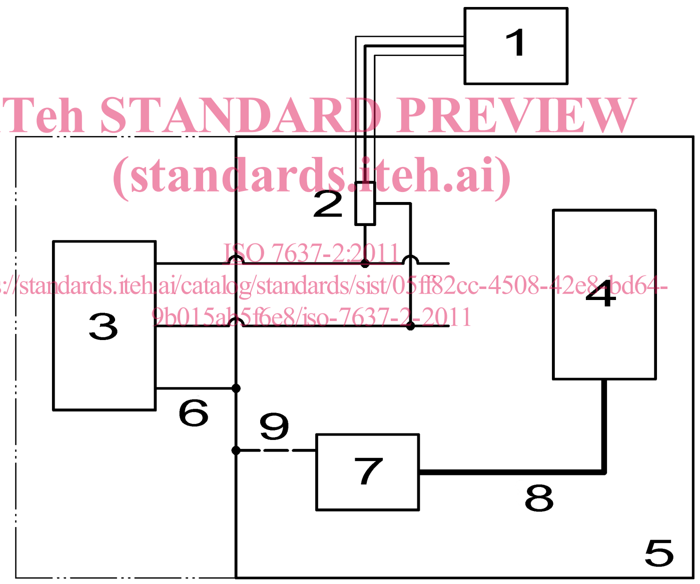
4.4.3 Location of the load simulator

Preferably, the load simulator shall be placed directly on the ground plane. If the load simulator has a metallic case, this case shall be bonded to the ground plane.

Alternatively, the load simulator may be located adjacent to the ground plane (with the case of the load simulator bonded to the ground plane).

4.4.4 Test set-up

Prior to test with the DUT, the test pulse generator is set up [see Figure 2 a)] to provide the specific pulse polarity, amplitude, duration and resistance without DUT (see 5.6). The peak voltage U_s shall be adjusted to be the required test level with the tolerances of +10 % and 0 %.



a) Pulse adjustment

Key

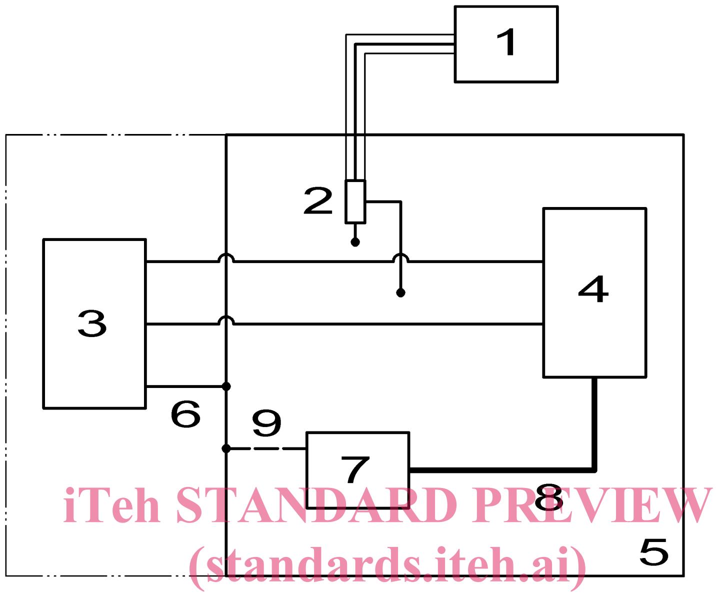
1 oscilloscope or equivalent
2 voltage probe
3 test pulse generator
4 DUT disconnected
5 ground plane
6 DC power ground connection; maximum length for test pulse 3 is 100 mm
7 load simulator (connected to ground plane if required)
8 interconnect cable routed away from DUT power leads under test to avoid coupling
9 load simulator ground (if required)

Figure 2 — Transient immunity test set-up (*continued*)

Next, the DUT is connected to the generator [see Figure 2 b)] while the oscilloscope is disconnected.

Depending on the real conditions, the function of the DUT may be evaluated during and/or after the application of the test pulses.

For correct generation of the required test pulses it may be necessary to switch the power supply on and off. The switching can be performed by the test pulse generator if the power supply is integral to it.



b) Pulse injection

Key

1 oscilloscope or equivalent

2 voltage probe disconnected

3 test pulse generator

4 DUT

5 ground plane

6 DC power ground connection; maximum length for test pulse 3 is 100 mm

7 load simulator (connected to ground plane if required)

8 interconnect cable routed away from DUT power leads under test to avoid coupling

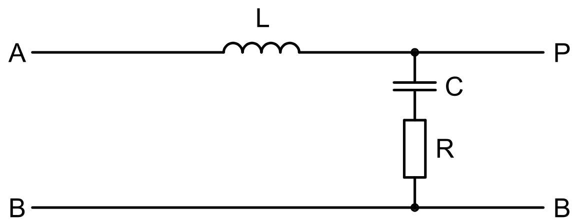
9 load simulator ground (if required)

Figure 2 — Transient immunity test set-up

5 Test instrument description and specifications

5.1 Artificial network

The artificial network is used as a reference standard in the laboratory in place of the impedance of the vehicle wiring harness in order to determine the behaviour of equipment and electrical and electronic devices. An example of a schematic diagram is given in Figure 3.



Key

A power supply terminal
B common terminal
C capacitor
L inductor
P terminal for the DUT
R resistor

Figure 3 — Example of a schematic diagram of artificial network

The artificial network shall be able to withstand a continuous load corresponding to the requirements of the DUT.

The resulting values of impedance $|Z_{PB}|$, measured between the terminals P and B while terminals A and B are short-circuited, are given in Figure 4 as a function of frequency assuming ideal electric components. In reality, the impedance of an artificial network shall not deviate more than 10 % from the curve given in Figure 4.

The main characteristics of the components are as follows:

— inductor: L = 5 µH (air-core winding);

— internal resistance between terminals P and A: <5 mΩ;

— capacitor: C = 0,1 µF for working voltages of 200 V AC and 1 500 V DC;

— resistor: R = 50 Ω.