INTERNATIONAL STANDARD

ISO 7637-3

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Road vehicles — Electrical disturbance by conduction and coupling —

Part 3:
Vehicles with nominal 12 V or 24 V supply voltage — Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines

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ISO 7637-3:1995
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Véhicules routiers — Perturbations électriques par conduction et par couplage —

Partie 3: Véhicules à tension nominale de 12 V ou 24 V — Transmission des perturbations électriques par couplage capacitif ou inductif le long des lignes autres que les lignes d'alimentation

Reference number
ISO 7637-3:1995(E)

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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.

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.

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

ISO 7637-3:1995
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ISO 7637 consists of the following parts, under the general title *Road vehicles — Electrical disturbance by conduction and coupling*:

— *Part 0: Definitions and general*

— *Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage — Electrical transient conduction along supply lines only*

— *Part 2: Commercial vehicles with nominal 24 V supply voltage — Electrical transient conduction along supply lines only*

— *Part 3: Vehicles with nominal 12 V or 24 V supply voltage — Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines*

Annex A forms an integral part of this part of ISO 7637.

Introduction

Experience collected over a long period of immunity testing of instruments, devices and equipment shows that a test simulating fast transient coupling phenomena is needed for a sufficient coverage of the wide range of electric and electromagnetic interferences. The knowledge of these facts is common among electromagnetic compatibility (EMC) experts, and many companies have developed such coupling tests.

The fast transient test uses bursts composed of a number of fast transients, which are coupled into lines of electronic equipment. The short rise time, the repetition rate and the low energy of the transients are significant for the test.

During the system development, typically the production wiring harness is not available and the vehicle electrical noises are not known. Conclusions based on theoretical and practical examinations of the impact of capacitive and inductive coupling upon test procedures for vehicle electrical systems with respect to coupling via lines other than the supply lines show that the test should be performed with the worst case situation which is represented by the capacitive coupling described in this part of ISO 7637.

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1 Scope

This part of ISO 7637 establishes a common basis for the evaluation of the EMC of electronic instruments, devices and equipment in vehicles against transient transmission by coupling via lines other than the supply lines. The test intention is the demonstration of the immunity of the instrument, device or equipment when subjected to coupled fast transient disturbances, such as those caused by switching (switching of inductive loads, relay contact bounce, etc.).

In addition, severity levels are established, and the bench test procedures are described.

This part of ISO 7637 applies to all types of road vehicles fitted with a 12 V or 24 V electrical system, regardless of the propulsion system (e.g. spark-ignition or diesel engine, electric motor).

Failure mode severity classifications for immunity to transients are given in annex A.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7637. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7637 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6722-3:1993, *Road vehicles — Unscreened low-tension cables — Part 3: Conductor sizes and dimensions for thick-wall insulated cables.*

ISO 7637-1:1990, *Road vehicles — Electrical disturbance by conduction and coupling — Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage — Electrical transient conduction along supply lines only.*

ISO 7637-2:1990, *Road vehicles — Electrical disturbance by conduction and coupling — Part 2: Commercial vehicles with nominal 24 V supply voltage — Electrical transient conduction along supply lines only.*

3 Test procedures

3.1 General

This part of ISO 7637 describes methods for testing the immunity of instruments, devices and equipment against coupled transients. These tests are to be performed in the laboratory.

The bench test method uses the coupling clamp as shown in figure 1 and gives reproducible and therefore comparable results.

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The coupling circuit consists of a coupling clamp through which all lines of the device under test that are to be influenced simultaneously as agreed between the vehicle manufacturer and the supplier, excluding or including the supply lines, are installed. The coupling length is 1 m.

To comply with the compatibility requirements, it is important that certain limits, for instance voltage (amplitude), duration, source impedance and transient rise time, are not exceeded.

The test pulse severity levels should be mutually agreed upon between manufacturers and suppliers prior to the test.

The test pulses defined are typical pulses, which represent the characteristics of most of the actual transients which may occur in the vehicle.

In special cases it may be necessary to apply additional test pulses. It is part of the vehicle manufacturer's responsibility to define the test pulses needed for certain instruments, devices and equipment.

3.2 Test set-up

The device under test should be connected to the original operating devices (loads, sensors, signal sources, etc.) using a test harness or the production wiring harness, as agreed upon between the suppliers and the vehicle manufacturer.

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3.2.1 Test equipment

The following auxiliary equipment is used in the test set-up (see figure 1):

— ground plane;

— coupling clamp;

— test pulse generator.

If the actual original operating devices are not available, they may be simulated.

3.2.2 Ground plane

The ground plane shall be a metallic sheet (for example, copper, brass or galvanized steel) with a minimum thickness of 1 mm. The minimum size of the ground plane shall be 2 m × 1 m; however, the final size depends on the dimensions of the device under test. The ground plane shall be connected to the facility earth ground.

3.2.3 Test configuration

The device under test shall be placed on a ground plane and shall be separated from it by an insulating support having a thickness of 0,05 m to 0,1 m, unless the device under test casing is connected with the chassis and has its own ground connection. The device under test shall be placed on the same side of the coupling clamp as the pulse generator.

The device under test shall be arranged and connected according to its requirements. To minimize extraneous capacitive coupling to the device under test, it is recommended that the minimum distance between the device under test and all other conductive structures, such as the walls of a shielded room (with the exception of the ground plane underneath the device under test and the coupling clamp) should be more than 0,5 m.

The device under test shall be connected to the grounding system according to the manufacturer's installation specification; no additional ground connections are allowed.

Where use of a test harness is specified, the power supply lines routed outside the coupling clamp shall have a length of about 1 m. The distance between the device under test and the coupling clamp, and between the peripheral device and the coupling clamp shall be (400 ± 50) mm. The portions of the lines being tested, which are outside the coupling clamp shall be placed at a distance of (100 ± 20) mm above the ground plane, and at 90° ± 15° to the longitudinal coupling clamp axis.

This test set-up is shown in figure 1. The hinged lid shall be placed as flat as possible to ensure mechanical contact with the test harness.

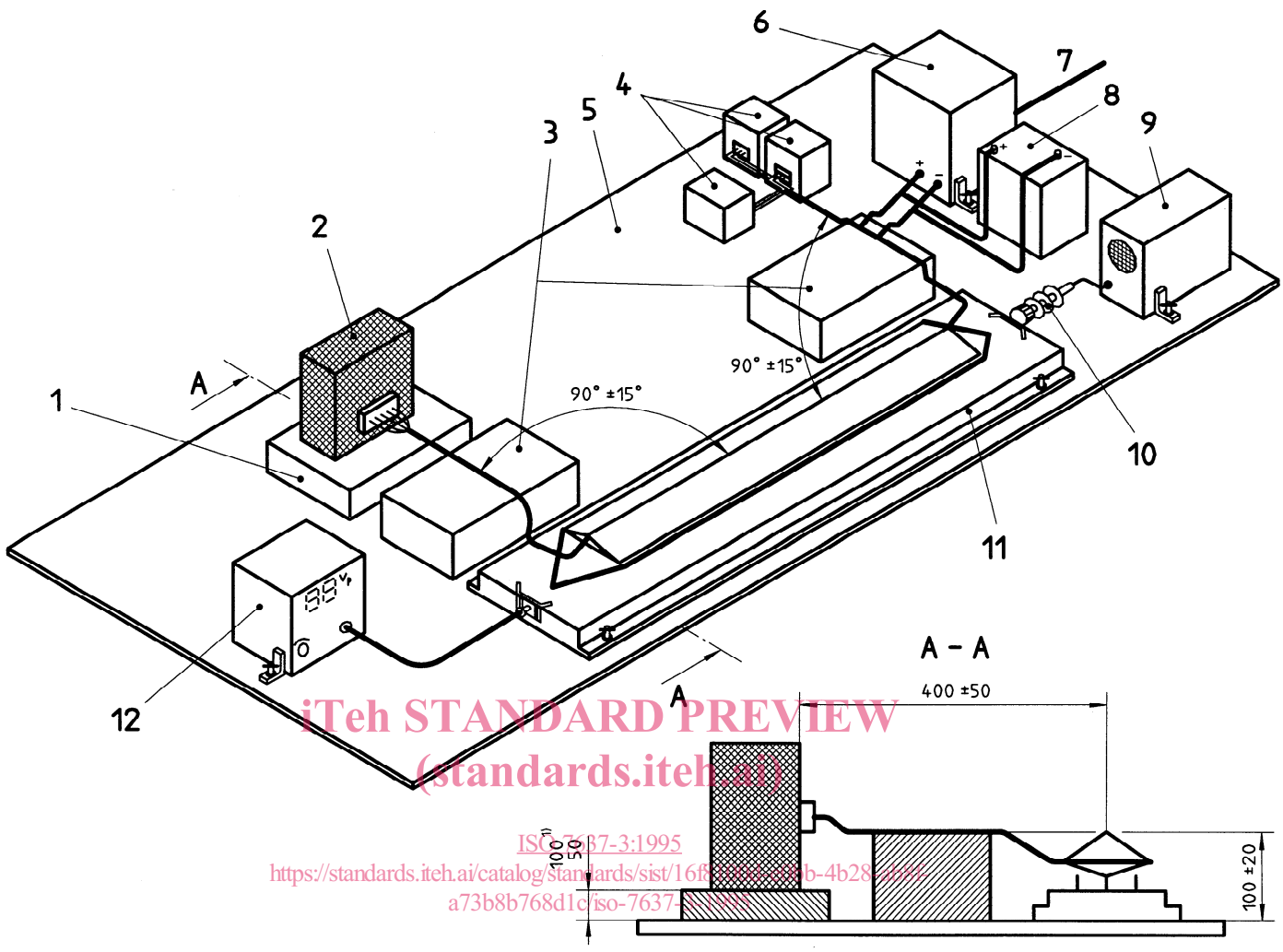
It is recommended that the length of the harness be limited to 2 m in order to improve the reliability of the results. Where a production harness with a length exceeding 2 m is used, the wire length should not be coiled; the wire harness arrangement shall be specified in the test report. The maximum distance of 0,45 m between the device under test and the coupling clamp shall be maintained.

To get reproducible test results, the test set-up shall be mechanically fixed.

3.2.4 Ground connection of loads, sensors, etc.

Where appropriate, all individual units are connected to the ground plane as closely as possible.

Dimensions in millimetres



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1) The selected dimension shall be specified in the test plan and documented in the test report.

Key

1 Insulating support if device under test is not to be connected to ground in the vehicle
2 Device under test
3 Insulating supports for the test harness
4 Peripheral items (such as sensors, load, accessories) mounted as in the vehicle
5 Ground plane
6 Power supply 12 V or 24 V
7 a.c. power supply
8 Battery
9 Oscilloscope
10 50 Ω attenuator
11 Coupling clamp
12 Test pulse generator

Figure 1 — Test set-up with coupling clamp

3.2.5 Test temperature

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

3.3 Application of test voltage

The test pulse generator shall be connected to the coupling clamp terminated in a 50 Ω resistor.

The test pulse generator shall be calibrated prior to performance of the test. The pulse amplitude is calibrated with a 50 Ω oscilloscope connected to the coupling clamp via a 50 Ω attenuator and 50 Ω cable (see figure 2). No lines are permitted to route through the coupling clamp during calibration.

The voltage measurement is made by a 50 Ω oscilloscope connected to a 50 Ω attenuator by a 50 Ω coaxial cable. The attenuator is used instead of the coupling clamp termination resistor.

The tests shall be performed according to the test plan, which shall specify

a) test pulse type;

b) test voltage level;

c) test pulse duration;

d) operating conditions of the device under test;

e) use of a test harness or a production wiring harness.

4 Test instruments description and specifications

4.1 Power supply and measurements instrumentation

The power supply (buffered battery) and the oscilloscope (preferably of the storage type) shall be as specified in ISO 7637-1 and ISO 7637-2. Cables shall be in accordance with ISO 6722-3.

4.2 Coupling clamp

The clamp provides the means of coupling the test pulses into the circuit under test without any galvanic connection to the device under test, except via the earth plane, wiring harness and/or auxiliary equipment.

The clamp coupling efficiency depends on the diameter and the material of the cables.

The coupling clamp, as shown in figure 3, may be made for example of brass, copper or galvanized steel.

Both ends of the coupling clamp shall be equipped with a 50 Ω coaxial connector.

The recommended configuration of the coupling clamp is shown in figure 1.

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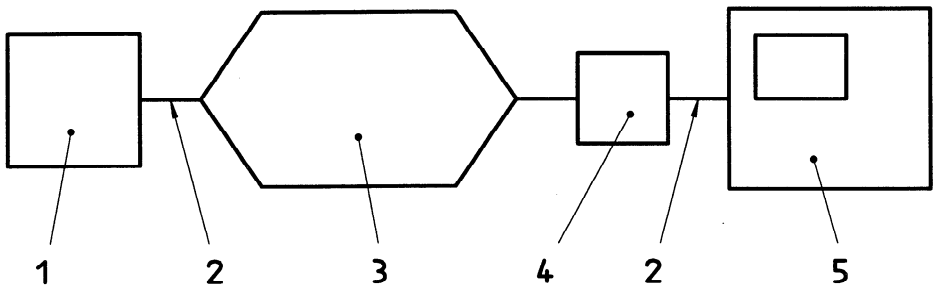
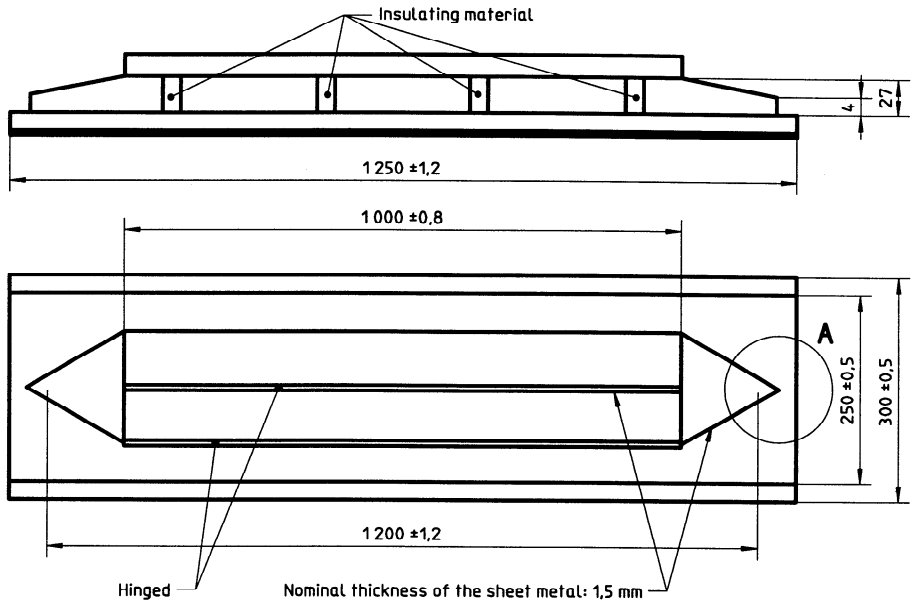


Key

1 Test pulse generator
2 50 Ω cable
3 Coupling clamp
4 50 Ω attenuator
5 Oscilloscope

Figure 2 — Set-up for calibration of test pulse amplitude

Dimensions in millimetres



a) General view

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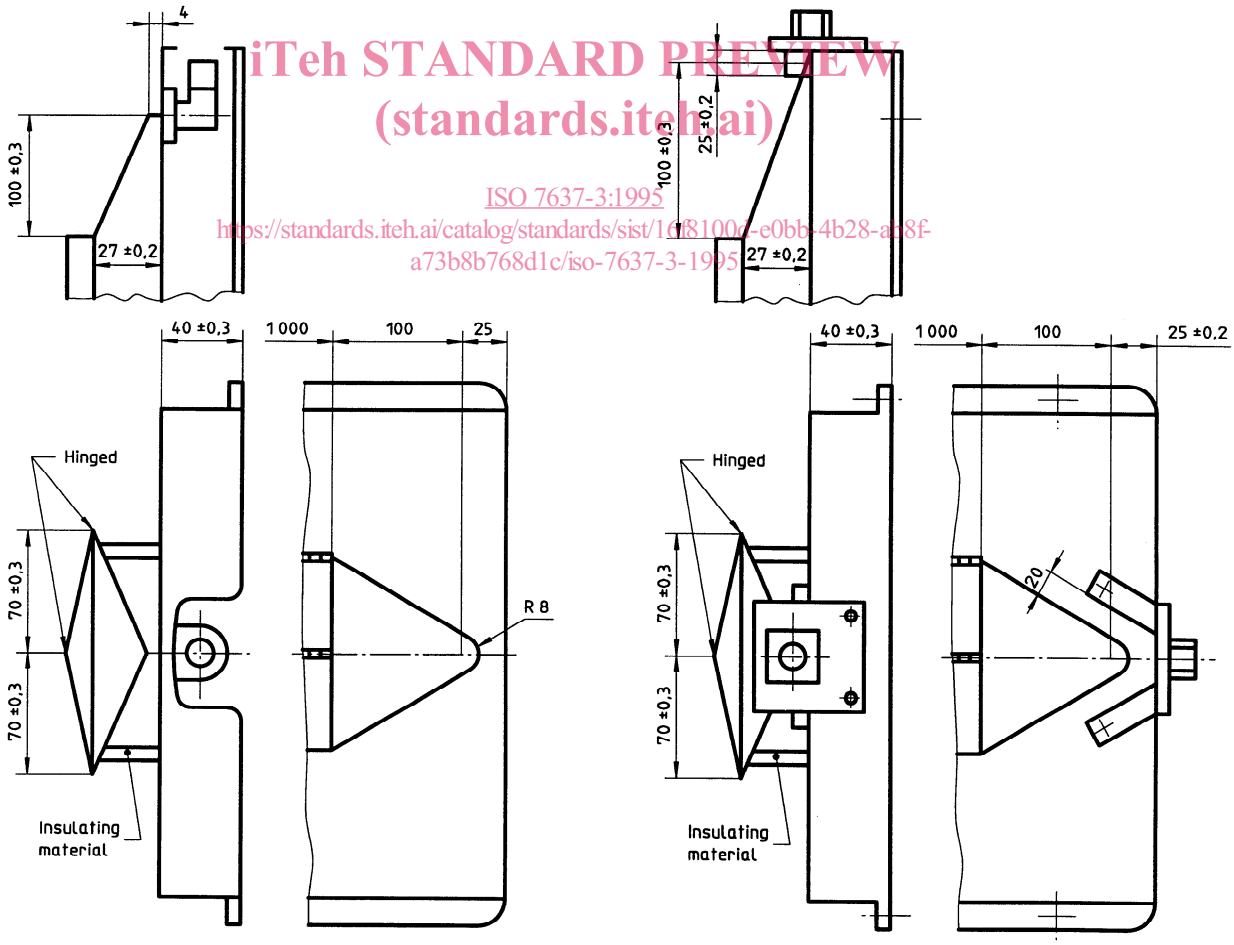

b) Alternative 1 of detail A

c) Alternative 2 of detail A

Figure 3 — Coupling clamp