INTERNATIONAL STANDARD

ISO 7637-1

Second edition
2002-03-15

Road vehicles — Electrical disturbances from conduction and coupling —

Part 1: Definitions and general considerations

Véhicules routiers — Perturbations électriques par conduction et par couplage —

Partie 1: Définitions et généralités

Reference number
ISO 7637-1:2002(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

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 part of ISO 7637 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7637-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition of ISO 7637-1 cancels and replaces ISO 7637-0:1990, which has been technically revised. The first editions of ISO 7637-1 and ISO 7637-2 (both published in 1990) have been combined to form the second edition of ISO 7637-2.

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

Introduction

Electrical and radio-frequency disturbances occur during normal operation of many items of motor vehicle equipment. They are generated over a wide frequency range, and can be distributed to on-board electronic devices and systems by conduction, coupling or radiation.

In recent years, an increasing number of electronic devices for controlling, monitoring and displaying a variety of functions have been introduced into vehicle designs. It is necessary to consider the electrical and electromagnetic environment in which these devices operate and, in particular, the disturbances generated in the vehicle electrical system itself. Such disturbances can cause degradation (temporary malfunction or even permanent damage) of the electronic equipment. Moreover, “worst-case” situations are usually those resulting from disturbances generated inside the vehicle by, for example, ignition systems, generator and alternator systems, electric motors and actuators.

While narrowband signals generated on or outside the vehicle (by broadcasting and radio transmitters) can also affect the performance of electronic devices, and recognizing that protection from such potential disturbances has to be considered as part of total system certification, these matters are nevertheless outside the scope of ISO 7637 and are not covered by it.

See ISO 11451 [1] and ISO 11452 [2] for immunity to radiated disturbances for vehicles and for components, respectively, ISO 10605 [3] for immunity to electrostatic discharge (ESD).

Road vehicles — Electrical disturbances from conduction and coupling —

Part 1: Definitions and general considerations

1 Scope

This part of ISO 7637 defines the basic terms relating to electrical disturbances from conduction and coupling used in its other parts, and gives general information on the whole of ISO 7637 and common to all parts.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 7637. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 7637 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.

IEC 60050-151, *International Electrotechnical Vocabulary — Part 151: Electrical and magnetic devices*

IEC 60050-161, *International Electrotechnical Vocabulary — Chapter 161: Electromagnetic compatibility*

3 Terms and definitions

For the purposes of this part of ISO 7637, the terms and definitions given in IEC 60050-151 and the following apply.

3.1
electromagnetic compatibility
EMC
ability of equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbance to anything in that environment

[IEC 60050-161]

3.2
electromagnetic disturbance
any electromagnetic phenomenon which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter

NOTE An electromagnetic disturbance may be an electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

[IEC 60050-161]

3.3
electromagnetic interference
EMI
degradation of the performance of equipment, transmission channel or system caused by an electromagnetic disturbance

NOTE The English words “interference” and “disturbance” are often used indiscriminately.

[IEC 60050-161]

3.4
degradation (of performance)
undesired departure in the operational performance of any device, equipment or system from its intended performance

NOTE The term “degradation” can apply to temporary or permanent failure.

[IEC 60050-161]

3.5
immunity (to a disturbance)
ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[IEC 60050-161]

3.6
(electromagnetic) susceptibility
inability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

NOTE Susceptibility is a lack of immunity.

[IEC 60050-161]

3.7
(electromagnetic) radiation
(1) phenomenon by which energy in the form of electromagnetic waves emanates from a source into space

(2) energy transferred through space in the form of electromagnetic waves

NOTE By extension, the term “electromagnetic radiation” sometimes also covers induction phenomena.

[IEC 60050-161]

3.8
shielded enclosure
screened room
mesh or sheet metallic housing designed expressly for the purpose of separating electromagnetically the internal and the external environment

[IEC 60050-161]

3.9
ground (reference) plane
flat conductive surface whose potential is used as a common reference

[IEC 60050-161]

3.10
artificial network
AN
network inserted in the supply leads of an apparatus to be tested that provides, in a given frequency range, a specified load impedance for the measurement of disturbance voltages and isolates the apparatus from the power supply in that frequency range

3.11
transient
phenomenon or quantity which varies between two consecutive steady states during a time interval which is short compared to the time scale of interest

NOTE "Transient" is a general term and can be used to describe a single pulse or a burst (a complex series of transient voltage variations).

3.12
peak amplitude
highest absolute value of the amplitude of a transient

3.13
pulse
comparatively smooth transient with defined shape and time characteristics

3.13.1
pulse duration
time from the instant the absolute value of the pulse rises above 10 % of the absolute value of the peak amplitude to the instant it falls below 10 % of this

3.13.2
pulse rise time
time taken for the absolute value of the pulse to increase from 10 % to 90 % of the absolute value of the peak amplitude

3.13.3
pulse fall time
time taken for the absolute value of the pulse to decrease from 90 % to 10 % of the absolute value of the peak amplitude

3.14
burst
transient comprised of a complex series of transient voltage variations

NOTE For bursts, in addition to the parameters given in the definitions of 3.13, those of 3.14.1 to 3.14.4 are also relevant. For an illustration of a burst transient waveform, see ISO 7637-2.

3.14.1
burst duration
time during which a complex series of transient voltage variations occurs during a single burst

3.14.2
time between bursts
time between the end of one burst and the start of the next one

3.14.3
burst cycle time
time between the start of the first pulse of two consecutive bursts

3.14.4
pulse repetition time
time between the start of two repetitive pulses within the burst

3.15
failure mode severity classification
system of classification describing the performance objectives of a function when a device is subjected to the test conditions

3.15.1
functional status classification
operational status of a function during and after exposure of a device to an electromagnetic environment

3.15.2
test pulse
⟨test method⟩ representative pulse applied to the device under test

NOTE See the respective parts of ISO 7637 for the applicable test pulse.

3.15.3
test pulse severity
specification of severity level of essential test pulse parameters

3.16
coupling
interaction between circuits, transferring energy from one circuit to another

3.16.1
coupling network
electrical circuit for the purpose of transferring energy from one circuit to another

3.16.2
de-coupling network
electrical circuit for the purpose of reducing or eliminating disturbances coupled from one circuit to another

3.16.3
coupling clamp
device of defined dimensions and electromagnetic characteristics designed for common-mode coupling of the disturbance transient to the circuit under test without any galvanic connection to it

4 General aim and practical use of ISO 7637

ISO 7637 is concerned with the problem of electrical transient disturbances in road vehicles and also in trailers. It deals with the emission of transients, transient transmission via electrical wiring and the potential susceptibility of electronic components to electrical transients.

The test methods and procedures, and test instrumentation and limits, given in the various parts of ISO 7637 are intended to facilitate component specification for electrical disturbance by conduction and coupling. A basis is thus provided for mutual agreement between vehicle manufacturers and component suppliers, intended to assist rather than restrict.

Immunity measurements of complete vehicles are generally able to be carried out only by the vehicle manufacturer, owing to, for example, the desire to preserve the secrecy of prototypes or a large number of different vehicle models. Therefore, for research, development, and quality control, a laboratory measuring method is used by the vehicle manufacturer and equipment suppliers to test electronic components.

These tests, specified in the different parts of ISO 7637, are called “bench tests”. The bench-test methods, some of which require the use of an artificial network, will provide comparable results between laboratories. They also give a basis for the development of devices and systems and may be used during the production phase.

Protection from potential disturbances has to be considered as a part of total vehicle validation. It is important to know the correlation between laboratory tests and vehicle.

A bench test method for the evaluation of the immunity of a device against supply or data-line transients may be performed by means of a test pulse generator; this may not cover all types of transients that can occur in a vehicle. Therefore, the test pulses described in the different parts of ISO 7637 are characteristic of typical pulses.

Certain devices are particularly susceptible to some characteristics of electrical disturbances, such as pulse repetition rate, pulse width and time relation to other signals. A standard test, therefore, cannot apply in all cases and it is necessary for the designer of potentially susceptible equipment to anticipate the appropriate test conditions through an in-depth knowledge of the design and function of the particular equipment.

A device shall be subjected only to those tests in the relevant part of ISO 7637 which apply to that device. Only the tests necessary to replicate the use and mounting location of the device under test need be included in the test plan. This will help ensure a technically and economically optimized design for potentially susceptible components and systems.