INTERNATIONAL STANDARD

ISO 16750-2

Third edition
2010-03-15

Road vehicles — Environmental conditions and testing for electrical and electronic equipment —

Part 2: Electrical loads

Véhicules routiers — Spécifications d'environnement et essais de l'équipement électrique et électronique —

Partie 2: Contraintes électriques

Reference number
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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 16750-2 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 16750-2:2006), which has been technically revised.

ISO 16750 consists of the following parts, under the general title *Road vehicles — Environmental conditions and testing for electrical and electronic equipment*:

— *Part 1: General*

— *Part 2: Electrical loads*

— *Part 3: Mechanical loads*

— *Part 4: Climatic loads*

— *Part 5: Chemical loads*

Road vehicles — Environmental conditions and testing for electrical and electronic equipment —

Part 2: **Electrical loads**

1 Scope

This part of ISO 16750 applies to electric and electronic systems/components for road vehicles. This part of ISO 16750 describes the potential environmental stresses and specifies tests and requirements recommended for the specific mounting location on/in the road vehicle.

This part of ISO 16750 describes the electrical loads. Electromagnetic compatibility (EMC) is not covered by this part of ISO 16750. Electrical loads are independent from the mounting location, but can vary due to the electrical resistance in the vehicle wiring harness and connection system.

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 8820 (all parts), *Road vehicles — Fuse-links*

ISO 16750-1, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750-4, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16750-1 apply.

4 Tests and requirements

4.1 General

If not otherwise specified, the following tolerances shall apply:

— frequency and time: ±5 %;

— voltages: ±0,2 V;

— resistance: ±10 %.

If not otherwise specified, measure all voltages at the relevant terminals of the device under test (DUT).

4.2 Direct current supply voltage

4.2.1 Purpose

The purpose of this test is to verify equipment functionality at minimum and maximum supply voltage.

4.2.2 Test method

Set the supply voltage as specified in Table 1 or Table 2 to all relevant inputs of the DUT. Operating modes are specified in ISO 16750-1.

The voltages listed in Table 1 or Table 2 are relevant within the operating temperature range as specified in ISO 16750-4, without time limits.

Table 1 — Supply voltage for system devices with 12 V nominal voltage

Code	Minimum supply voltage U_{Smin} V	Maximum supply voltage U_{Smax} V
A	6	16
B	8	16
C	9	16
D	10,5	16

Table 2 — Supply voltage for system devices with 24 V nominal voltage

Code	Minimum supply voltage U_{Smin} V	Maximum supply voltage U_{Smax} V
E	10	32
F	16	32
G	22	32
H	18	32

4.2.3 Requirement

All DUT functions shall remain class A as defined in ISO 16750-1 when tested in the supply voltage ranges given in Table 1 or Table 2 respectively.

4.3 Overvoltage

4.3.1 Systems with 12 V nominal voltage

4.3.1.1 Test at a temperature of T_{max} – 20 °C

4.3.1.1.1 Purpose

This test simulates the condition where the generator regulator fails, so that the output voltage of the generator rises above normal values.

4.3.1.1.2 Test method

Heat the DUT in a hot air oven to a temperature that is 20 °C below the maximum operating temperature, T_{max}. Apply a voltage of 18 V for 60 min to all relevant inputs of the DUT.

4.3.1.1.3 Requirement

The functional status for the DUT shall be minimum class C as defined in ISO 16750-1. Functional status shall be class A where more stringent requirements are necessary.

4.3.1.2 Test at room temperature

4.3.1.2.1 Purpose

This test simulates a jump start.

4.3.1.2.2 Test method

Ensure that the DUT has stabilized at room temperature. Apply a voltage of 24 V for (60 ± 6) s to all relevant inputs of the DUT.

4.3.1.2.3 Requirement

The functional status shall be minimum class D as defined in ISO 16750-1. Functional status shall be class C where more stringent requirements are necessary.

4.3.2 Systems with 24 V nominal voltage

4.3.2.1 Purpose

This test simulates the condition where the generator regulator fails, so that the output voltage of the generator rises above normal values.

4.3.2.2 Test at a temperature of T_{max} – 20 °C

Heat the DUT in a hot air oven to a temperature that is 20 °C below the maximum operating temperature, T_{max}. Apply a voltage of 36 V for 60 min to all relevant inputs of the DUT.

4.3.2.3 Requirement

The functional status shall be minimum class C as defined in ISO 16750-1. Functional status shall be class A where more stringent requirements are necessary.

4.4 Superimposed alternating voltage

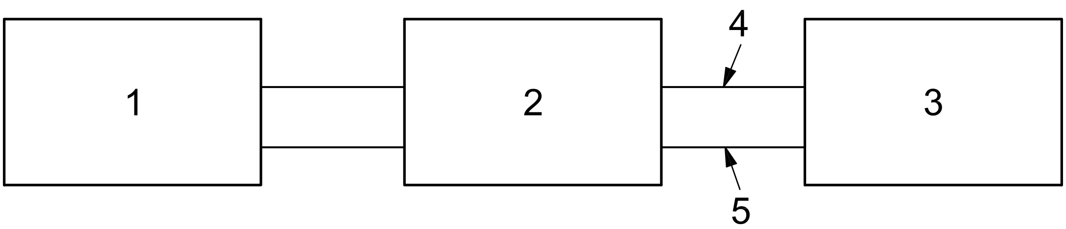
4.4.1 Purpose

This test simulates a residual alternating current on the direct current supply.

4.4.2 Test method

Connect the DUT as shown in Figure 1. Apply the following test simultaneously to all applicable inputs (connections) of the DUT; the severity level (1, 2, 3 or 4) shall be chosen in accordance with the application:

- maximum supply voltage, U_{Smax} (see Figure 2):
  - 16 V for systems with nominal voltage, U_N, of 12 V;
  - 32 V for systems with nominal voltage, U_N, of 24 V;
- a.c. voltage (sinusoidal):
  - severity 1: peak to peak voltage, U_{PP}, of 1 V, for U_N = 12 V and U_N = 24 V;
  - severity 2: peak to peak voltage, U_{PP}, of 4 V, for U_N = 12 V and U_N = 24 V;
  - severity 3: peak to peak voltage, U_{PP}, of 10 V, for U_N = 24 V only;
  - severity 4: peak to peak voltage, U_{PP}, of 2 V, for U_N = 12 V;
- internal resistance of the power supply: 50 mΩ to 100 mΩ;
- frequency range (see Figure 3): 50 Hz to 25 kHz;
- type of frequency sweep (see Figure 3): triangular, logarithmic;
- sweep duration (see Figure 3): 120 s;
- number of sweeps: 5 (continuously).



Key

1 sweep generator

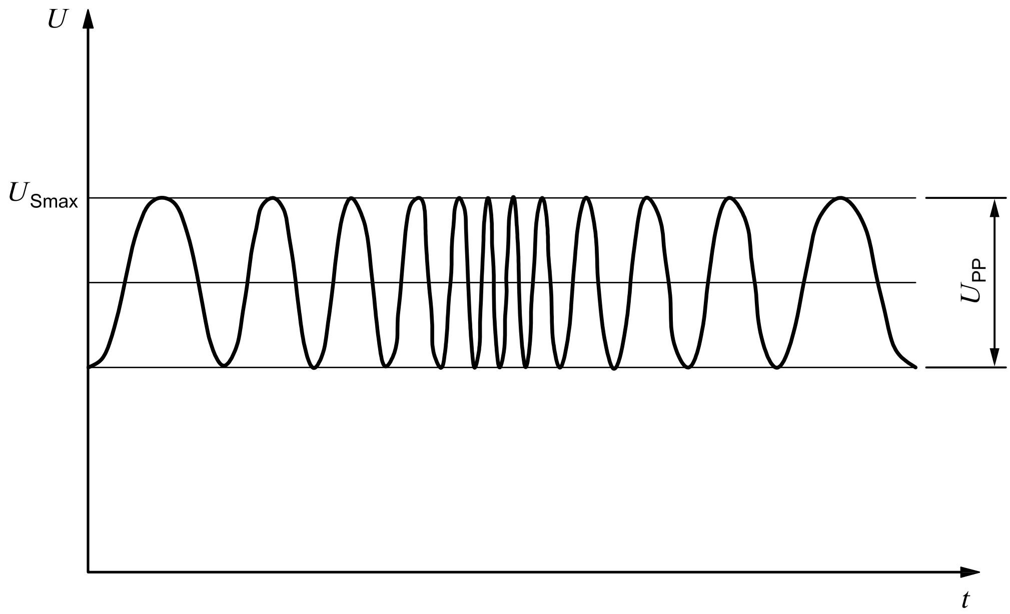
2 power supply unit capable of being modulated

3 DUT

4 positive

5 ground or return

Figure 1 — Test set-up to superimpose a.c. voltage on component power supply lines



Key

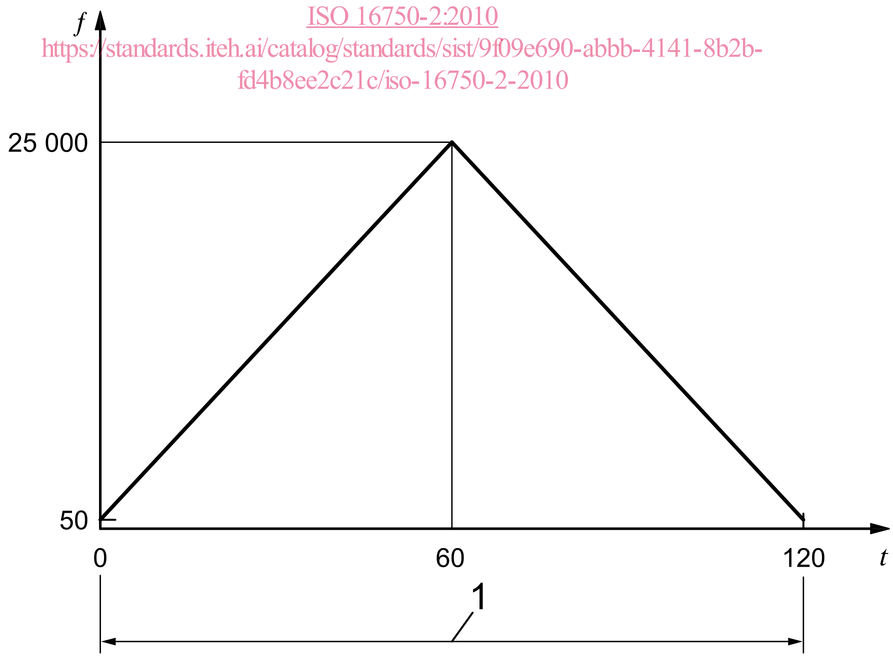
t time

U test voltage

U_{PP} peak to peak voltage

U_{Smax} maximum supply voltage

Figure 2 — Test voltage with superimposed sinusoidal a.c. voltage



Key

t time, in seconds

f frequency, logarithmic scale, in hertz

1 one cycle

Figure 3 — Frequency sweep

4.4.3 Requirement

The functional status shall be class A as defined in ISO 16750-1.

4.5 Slow decrease and increase of supply voltage

4.5.1 Purpose

This test simulates a gradual discharge and recharge of the battery.

4.5.2 Test method

Apply the following test simultaneously to all applicable inputs (connections) of the DUT.

Decrease the supply voltage from the minimum supply voltage, U_{Smin}, to 0 V, then increase it from 0 V to U_{Smin}, applying a change rate of (0,5 ± 0,1) V/min linear, or in equal steps of not more than 25 mV.

4.5.3 Requirement

The functional status inside the supply voltage range (see Table 1 or Table 2) shall be as specified in 4.2.3. Outside that range, it shall be minimum class D as defined in ISO 16750-1. The functional status of class C may be specified where more stringent requirements are necessary.

4.6 Discontinuities in supply voltage

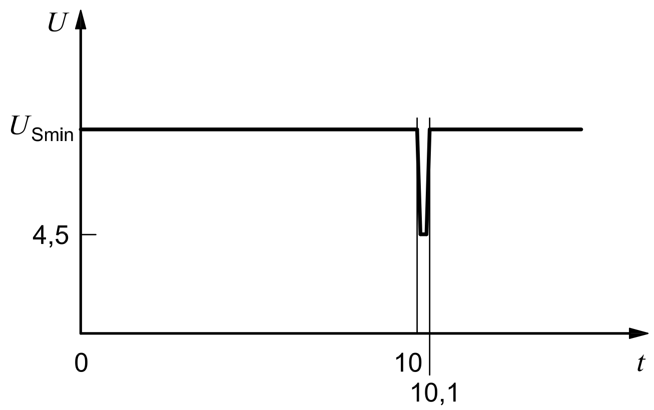
4.6.1 Momentary drop in supply voltage

4.6.1.1 Purpose

This test simulates the effect when a conventional fuse element melts in another circuit.

4.6.1.2 Test method

Apply the test pulse (see Figures 4 and 5) simultaneously to all relevant inputs (connections) of the DUT. The rise time and fall time shall be not more than 10 ms.



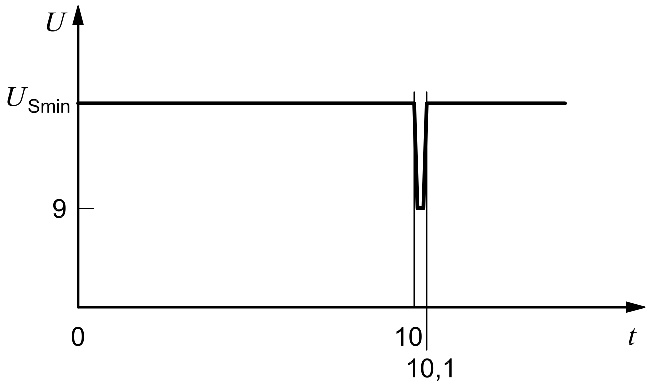
Key

t time, in seconds

U test voltage, in volts

U_{Smin} minimum supply voltage

Figure 4 — Short voltage drop for systems with 12 V nominal voltage



Key

t time, in seconds

U test voltage, in volts

U_{Smin} minimum supply voltage

Figure 5 — Short voltage drop for systems with 24 V nominal voltage

4.6.1.3 Requirement

The functional status shall be minimum class B as defined in ISO 16750-1. Reset is permitted upon agreement.

4.6.2 Reset behaviour at voltage drop

4.6.2.1 Purpose

This test verifies the reset behaviour of the DUT at different voltage drops. This test is applicable to equipment with reset function, e.g. equipment containing microcontroller(s).

4.6.2.2 Test

Apply the test pulse simultaneously in Figure 6 to all relevant inputs (connections) and check the reset behaviour of the DUT.

Decrease the supply voltage by 5 % from the minimum supply voltage, U_{Smin}, to 0,95U_{Smin}. Hold this voltage for 5 s. Raise the voltage to U_{Smin}. Hold U_{Smin} for at least 10 s and perform a functional test. Then decrease the voltage to 0,9U_{Smin}. Continue with steps of 5 % of U_{Smin}, as shown in Figure 6, until the lower value has reached 0 V. Then raise the voltage to U_{Smin} again.