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

**Part 1:
General**

iTeh STANDARD PREVIEW

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

Partie 1: Généralités

ISO 16750-1:2003

<https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8e6c-81d832bb31c3/iso-16750-1-2003>



PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 16750-1:2003](https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8e6c-81d832bb31c3/iso-16750-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8e6c-81d832bb31c3/iso-16750-1-2003>

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

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.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Classification by mounting location	2
5 Operating modes	4
6 Functional status classification	4
7 Tests and requirements	5
8 Designation	6
Annex A (informative) Example test sequence plan	8
Annex B (informative) Example life test/statement of reliability	9

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 16750-1:2003](https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8e6c-81d832bb31c3/iso-16750-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8e6c-81d832bb31c3/iso-16750-1-2003>

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 16750-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

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*

[ISO 16750-1:2003](https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8c6c-81d832bb31c3/iso-16750-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8c6c-81d832bb31c3/iso-16750-1-2003>

Introduction

The objective of ISO 16750 as a whole is to assist the user in systematically defining and/or applying a set of internationally accepted environmental conditions, tests and operating requirements, based on the anticipated actual environment in which the equipment will be operated and to which it will be exposed during its life cycle.

The following environmental factors have been considered in the development of ISO 16750.

— World geography and climate

Road vehicles are owned and operated in nearly all land regions of the earth. Significant variation in environmental conditions owing to climatic environment, including diurnal and seasonal cycles, can therefore be expected. Consideration has been given to worldwide ranges in temperature, humidity, precipitation and atmospheric conditions, including dust, pollution and altitude.

— Type of vehicle

Environmental conditions in and on road vehicles can depend on vehicle design attributes such as engine type, engine size, suspension characteristics, vehicle mass, vehicle size, electrical supply voltage and so on. Consideration has been given to typical types of vehicles, including commercial vehicles (heavy trucks), passenger cars and trucks, and diesel and gasoline engines.

— Vehicle use conditions and operating modes

Environmental conditions in and on the vehicle vary significantly with road quality, type of road surface, road topography, vehicle use (commuting, towing, cargo transport, etc.) and driving habit. Operating modes such as storage, starting, driving, stopping and so on have been considered.

— Equipment life cycle

Electrical and electronic equipment must also be resistant to environmental conditions experienced during manufacture, shipping, handling, storage, vehicle assembly and vehicle maintenance and repair. Such conditions and test (e.g. handling drop test) are within the scope of ISO 16750.

— Vehicle supply voltage

Supply voltage varies with vehicle use, operating mode, electrical distribution system design and even climatic conditions. Faults within the vehicle electrical system, such as alternator overvoltage and intermittences in connection systems, may occur. Such conditions are within the scope of ISO 16750.

— Mounting location in the vehicle

In current or future car concepts, systems/components are mounted in almost any location of the car. The environmental requirements for each specific application greatly depend on its mounting location. Each location in a car has its own distinct set of environmental loads. As an example, the range of temperatures in the engine compartment differs a lot from the range in the passenger compartment. This is also true for the vibration loads. But in this case, not only the vibration levels are different, the type of vibration load also varies. Body mount components are typically exposed to random vibrations, whereas, for engine mount systems/components, the additional sine vibration from the engine has to be considered. Additionally, devices installed in doors are exposed to a high number of mechanical shocks from door slamming.

It is desirable for the car manufacturer to group the different environmental load types and levels in a reasonable number of standard requirement sets. This strategy makes it possible to carry systems/components from one car project to another. Furthermore, the exact requirement levels are often unknown when designing a component for a future car concept. The expected environmental loads are usually compiled from other car concepts with similar conditions. The grouping is normally done by mounting location. But it is difficult to define the correct number of different mounting locations and respective load profiles owing to a conflict of aims between having only a few requirement classes and tailoring to the requirement levels for each application. The reason is that environmental loads are not only dependent on mounting location. Other major factors affect the stress levels for systems/components. For example, body styles, drive train concepts or package densities can create absolutely different requirement levels for devices that are installed in different cars at almost the same location.

The concept of ISO 16750 is to define requirement classes for separate load types. The Standard distinguishes between electrical, mechanical, thermal, climatic and chemical loads. For each load type, several requirement classes are defined. Every requirement class is determined by a specific code letter. The complete environmental requirement set is created by defining the code letter combination. The code letters are defined in the relevant parts of ISO 16750. A Table in Annex A of relevant parts of ISO 16750 gives the usual mounting locations together with examples of their respective code letters. For normal applications, these are the code letters to be used. If an application is very specific and because of this the given code letter combinations cannot be used, it is possible to create new code letter combinations to serve this purpose. In order that none of the given code letters is reused, new requirement levels can be created by using the code letter "Z". In this case, the specific requirements need to be defined separately but it is desirable not to change the test methods.

The user of ISO 16750 would be well advised to consider at least the following mounting locations for a device under test (DUT) with respect to thermal, mechanical, climatic and chemical load.

a) Responsibility of manufacturer

Due to technological limitations or variations in vehicle design, the vehicle manufacturer could be required to place a component in a location where it cannot withstand the environmental conditions specified in ISO 16750. Under these circumstances, it is the responsibility of the vehicle manufacturer to provide the necessary environmental protection.

b) Applicability to wiring harnesses, cables and electrical connectors

Although some environmental conditions and tests in ISO 16750 could be relevant to vehicle wiring harnesses, cables and connectors, its scope is not sufficient to be used as a complete standard. Therefore, ISO 16750 is not designed to be directly applied to such devices and equipment. Other, applicable standards have to be taken into account.

c) Applicability to parts or assemblies in or on equipment

ISO 16750 specifies environmental conditions of, and tests for, electrical and electronic equipment directly mounted in or on the vehicle. On the one hand, it is not intended for direct application to parts or assemblies that are part of the equipment. For example, ISO 16750 is not to be directly applied to integrated circuits (ICs) or discrete components, electrical connectors, printed circuit boards (PCBs), gauges, displays, controls, etc. that are attached in or on the equipment. Electrical, mechanical, climatic and chemical loads for such parts and assemblies can be quite different to those it describes. On the other hand, it is desirable to use ISO 16750 to help derive environmental conditions and test requirements for parts and assemblies that are intended for use in road vehicle equipment. For example, a temperature range of $-40\text{ }^{\circ}\text{C}$ to $+90\text{ }^{\circ}\text{C}$ could be specified for an assembly contained inside a piece of equipment having a temperature range of $-40\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$ and a temperature rise of $20\text{ }^{\circ}\text{C}$.

d) Applicability relative to system integration and validation

The user of ISO 16750 is cautioned to understand that its scope is limited to conditions and testing at the equipment level and therefore does not represent all conditions and testing necessary for complete verification and validation of the vehicle system. Environmental and reliability testing at equipment part and vehicle system levels could be required. For example, ISO 16750 does not necessarily ensure that environmental and reliability requirements for solder joints, solderless connections, integrated circuits, and so on are met. Such items must be assured at the part, material or assembly level. Likewise, vehicle and system level testing is required to validate the equipment in the vehicle application.

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

Part 1: General

1 Scope

This part of ISO 16750 gives definitions and general specifications for the potential environmental stresses, that can affect electric and electronic systems and components in respect of their mounting location directly on or in road vehicles and specifies the corresponding tests and requirements. It does not cover electromagnetic compatibility (EMC).

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 16750-1:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750-2:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads*

ISO 16750-3:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads*

ISO 16750-4:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads*

ISO 16750-5:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 5: Chemical loads*

3 Terms and definitions

For the purposes of this document and the other parts of ISO 16750, the following terms and definitions apply.

3.1

nominal voltage

U_N

voltage value used to describe the electrical system of a vehicle

3.2

supply voltage

voltage of the electrical system of a vehicle that varies with the system load and the operating condition of the alternator/generator

3.3

test voltage

voltage or voltages applied to the device under test (DUT) during a test

3.4

minimum operating temperature

T_{min}

minimum value of the ambient temperature at which the systems/components can be operated

3.5

maximum operating temperature

T_{max}

maximum value of the ambient temperature at which the systems/components can be operated continuously

3.6

hot-soak temperature

$T_{max,HS}$

maximum value of the ambient temperature which can temporarily occur in the engine compartment after the vehicle has stopped and the engine is turned off

3.7

paint repair temperature

$T_{max,PR}$

maximum temperature which can occur during vehicle paint repair

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 16750-1:2003](https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8c6c-81d832bb31c3/iso-16750-1-2003)

<https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8c6c-81d832bb31c3/iso-16750-1-2003>

4 Classification by mounting location

4.1 Engine compartment

Device under test (DUT) mounted

- to the body,
- to the frame,
- on the flexible plenum chamber, not rigidly attached,
- in the flexible plenum chamber, not rigidly attached,
- on the engine,
- in the engine,
- on the transmission/retarder, or
- in the transmission/retarder.

4.2 Passenger compartment

DUT mounted in a position

- without special requirements,
- exposed to direct solar radiation, or
- exposed to radiated heat (other than solar radiation).

4.3 Luggage compartment/load compartment

DUT mounted

- inside.

4.4 Mounting on the exterior/in cavities

DUT mounted

- to the body,
- to the frame,
- on the underbody/in the wheel housing
 - 1) sprung masses, or
 - 2) unsprung masses (wheel, wheel bracket, axle).
- in/on a passenger compartment door,
- to the engine compartment cover,
- to the luggage compartment lid/door,
- to the trunk lid/door,
- in cavities
 - 1) open towards exterior, or
 - 2) open towards interior,
- in special compartments (e.g. battery box).

4.5 Other mounting locations

For some locations with special environmental conditions (e.g. exhaust system), no standard specifications can be given. In these cases, the load shall be stated in the specification of the DUT.

5 Operating modes

The following operating modes apply.

a) Operating mode 1

No voltage is applied to the DUT.

- Operating mode 1.1: DUT not connected to wiring harness.
- Operating mode 1.2: DUT connected to wiring harness simulating vehicle installation.

b) Operating mode 2

The DUT is electrically operated with supply voltage U_B (battery voltage) as in a vehicle with shut-off engine and with all electrical connections made.

- Operating mode 2.1: system/component functions are not activated (e.g. sleep mode)
- Operating mode 2.2: systems/components with electric operation and control in typical operating mode.

c) Operating mode 3

The DUT is electrically operated with supply voltage U_A (engine/alternator operative) and all electrical connections made.

- Operating mode 3.1: system/component functions are not activated.
- Operating mode 3.2: systems/components with electric operation and control in typical operating mode.

ITeH STANDARD PREVIEW

(standards.iteh.ai)

ISO 16750-1:2003

<https://standards.iteh.ai/catalog/standards/sist/8a96247d-bf41-4efb-8e6c-81d832bb31c3/iso-16750-1-2003>

6 Functional status classification

6.1 General

This element describes the functional status of a DUT during and after a test.

The minimum functional status shall be given in each test. An additional test requirement may be agreed between device supplier and vehicle manufacturer.

Vehicle manufacturer and device supplier shall specify operations that are not allowed.

6.2 Class A

All functions of the device/system perform as designed during and after the test.

6.3 Class B

All functions of the device/system perform as designed during the test. However, one or more may go beyond the specified tolerance. All functions return automatically to within normal limits after the test. Memory functions shall remain Class A.

6.4 Class C

One or more functions of a device/system do not perform as designed during the test but return automatically to normal operation after the test.

6.5 Class D

One or more functions of a device/system do not perform as designed during the test and do not return to normal operation after the test until the device/system is reset by simple “operator/use” action.

6.6 Class E

One or more functions of a device/system do not perform as designed during and after the test and cannot be returned to proper operation without repairing or replacing the device/system.

7 Tests and requirements

7.1 General

The values specified in ISO 16750-2 to ISO 16750-5 cover basic requirements.

DUT with several mounting locations shall be tested to meet the most severe requirements.

7.2 General test conditions

Unless otherwise specified, all tests shall be performed at a room temperature (RT) of $+ 23\text{ °C} \pm 5\text{ °C}$ and a relative humidity of 25 % to 75 %.

ISO 16750-1:2003

The test voltages shall be in accordance with Table 1 unless other values are specified in a different part or parts of ISO 16750 or are agreed upon by the users of ISO 16750, in which case such values shall be documented in the test reports.

Table 1 — Test voltages for Operating modes 2 and 3 (see Clause 5)

Test voltage	12 V system V	24 V system V
U_A	$14 \pm 0,2$	$28 \pm 0,2$
U_B	$12 \pm 0,2$	$24 \pm 0,2$
U_A = engine/alternator operative (Operating mode 3). U_B = battery voltage (Operating mode 2).		

7.3 Test sequence

Prior to testing, a test sequence plan shall be agreed upon, stating the type, number, combination and sequence of the individual tests.

A life test is to be defined specifically for the product and to be taken into account in the test sequence plan.

See Annex A for an example.