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

Part 3: Mechanical loads

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

Partie 3: Contraintes mécaniques

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

This third edition cancels and replaces the second edition (ISO 16750-3:2007), 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 3: Mechanical loads

1 Scope

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

This part of ISO 16750 describes mechanical loads.

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

IEC 60068-2, 6, *Environmental testing — Part 2-6: Testing, Test Fc: Vibration (Sinusoidal)*

IEC 60068-2, 14, *Basic environmental testing procedures — Part 2-14: Tests — Test Nb: Change of temperature*

IEC 60068-2, 64, *Environmental testing — Part 2-64: Test methods — Test Fh — Vibration, broad-band random (digital control) and guidance*

IEC 60068-2, 80, *Environmental testing — Part 2-80: Tests — Test Fi: Vibration — Mixed mode testing*

IEC 60068-2-31, *Environmental testing procedures — Part 2: Tests; Test Ec: Free fall, Clause 5.2*

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 Vibration

4.1.1 General

The vibration test methods specified consider various levels of vibration severities applicable to on-board electrical and electronic equipment. It is recommended that the vehicle manufacturer and supplier choose the test method, the environmental temperature and vibration parameters depending on the specific mounting location.

Following the expressions in MIL-STD please notice:

When applied properly, the environmental management and engineering processes described in this part of ISO 16750 can be of enormous value in generating confidence in the environmental worthiness and overall durability. However, it is important to recognize that there are limitations inherent in laboratory testing that make it imperative to use proper caution and engineering judgement when extrapolating these laboratory results to results that may be obtained under actual service conditions. In many cases, real-world environmental stresses (singularly or in combination) cannot be duplicated practically or reliably in test laboratories. Therefore, users of this part of ISO 16750 should not assume that a system or component that passes laboratory tests of this part of ISO 16750 would also pass field/fleet verification trials.

— "The specified values are the best estimation one can get up to the moment when results from measurements in the car are received – but they do not replace a car measurement!"

The specified values apply to direct mounting in defined mounting locations. Using a bracket for mounting can result in higher or lower loads. If the device under test (DUT) is used in the vehicle with a bracket then all vibration and mechanical shock test shall be done with this bracket.

Carry out the vibration with the DUT suitably mounted on a vibration table. The mounting method(s) used shall be noted in the test report. Carry out the frequency variation by logarithmic sweeping of 0,5 octave/minute for sinusoidal tests and the sinusoidal part of sine on random tests. The scope of the recommended vibration tests is to avoid malfunctions and breakage mainly due to fatigue in the field. Testing for wear has special requirements and is not covered in this part of ISO 16750.

Loads outside of the designated test frequency ranges are to be considered separately.

NOTE Deviations from the load on the DUT can result, should vibration testing be carried out according to this part of ISO 16750 on a heavy and bulky DUT, as mounting rigidity and dynamic reaction on the vibrator table excitation are different compared to the situation in the vehicle. This deviation can be minimized by applying the average control method (see Annex A).

Application of the weighted average control method according to IEC 60068-2, 64 is to be agreed upon.

Subject the DUT during the vibration test to the temperature cycle according to IEC 60068-2, 14, with electric operation according to diagram 1. Alternatively, a test at constant temperature may be agreed on.

Operate the DUT electrically as indicated in Figure 1 at T_{min} (short functional test after the DUT completely reached T_{min}). This functional test shall be as short as possible — only long enough to check the proper performance of the DUT. This minimizes self-heating of the DUT. Additional electrical operation of the DUT between 210 min and 410 min of the cycle (see Figure 1).

Additional drying of test chamber air is not permitted.

In the vehicle, vibration stress can occur together with extremely low or high temperatures; for this reason, this interaction between mechanical and temperature stress is simulated in the test, too. A failure mechanism is, for example, a plastic part of a system/component, which mellows due to the high temperature and cannot withstand the acceleration under this condition.