
**Agricultural engineering — Electrical
and electronic equipment — Testing
resistance to environmental conditions**

*Génie agricole — Matériel électrique et électronique — Essais de
résistance aux conditions environnementales*

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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 15003 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

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Agricultural engineering — Electrical and electronic equipment — Testing resistance to environmental conditions

1 Scope

This International Standard provides design requirements and guidance for the manufacturers of electrical and electronic equipment for use in all kinds of mobile (including hand-held) agricultural machinery, forestry machinery, landscaping and gardening machinery [referred to hereafter as machine(s)]. It gives tests for specific environmental conditions and defines severity levels for tests which relate to the environmental extremes that can be experienced in practical operation of the equipment.

The standard is intended to be used in determining the suitability of the equipment of these machines, for use in a specified range of environmental conditions.

NOTE The severity levels given are general guidelines and not guaranteed worst-case exposure levels.

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.

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*

IEC 60068-2-5:1975, *Basic environmental testing procedures — Part 2: Tests — Test Sa: Simulated solar radiation at ground level*

IEC 60068-2-6:1995, *Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal)*

IEC 60068-2-9: 1975, *Basic environmental testing procedures — Part 2: Tests — Guidance for solar radiation testing*

IEC 60068-2-11:1981, *Basic environmental testing procedures — Part 2: Tests — Test Ka. Salt mist*

IEC 60068-2-13:1983, *Basic environmental testing procedures — Part 2: Tests — Test M: Low air pressure*

IEC 60068-2-14:1984, *Basic environmental testing procedures — Part 2: Tests — Test N: Change of temperature*

IEC 60068-2-27:1987, *Basic environmental testing procedures — Part 2: Tests — Test Ea and guidance: Shock*

IEC 60068-2-30:1980, *Basic environmental testing procedures — Part 2: Tests — Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60068-2-47:2005, *Environmental testing — Part 2: Tests — Mounting of specimens to vibration, impact and similar dynamic tests*

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IEC 60068-2-64:1993, *Environmental testing — Part 2: Test methods — Test Fh: Vibration, broad-band random (digital control) and guidance*

IEC 60068-2-78:2001, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

IEC 60512-1:2001, *Connectors for electronic equipment — Tests and measurements — Part 1: General*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

ISO 14982:1998, *Agricultural and forestry machinery — Electromagnetic compatibility — Test methods and acceptance criteria*

ISO 16750:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 display device
device displaying alpha-numeric characters or graphical symbols designed to be read by operative or service personnel

3.2 equipment
self-contained electronic system containing electric, electronic and mechanical components which is electrically connected to other machinery (including power sources) by means of connectors

3.3 impaired function
state in which one or more of the functions of the equipment as stated by the manufacturer are not operative or do not conform to the manufacturer's specification

3.4 location
position within machines where the equipment will normally be operating

3.5 normal mounting configuration
orientation of the equipment when in normal use

3.6 severity level
severity of the conditions under which an environmental test is undertaken, selected according to the intended location and application of the equipment

3.7 portable equipment
equipment that can be battery operated and that a person can carry

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4 General

4.1 General conditions for testing

Except where otherwise specified for a particular test, testing shall be carried out under standard reference conditions as specified in IEC 60068-1:1998, section 5. The severity levels used shall be recorded in the test report. Tests shall be conducted in accordance with IEC 60512-1.

It is desirable to use the same sample of equipment in all tests unless specified otherwise for a particular test.

It is recommended that a functionality check be done before and after each test and that functionality be monitored during a test when practical.

Combined testing is advisable in cases where equipment is subjected in use to extremes of two or more different environmental factors simultaneously (e.g. temperature and vibration) and recorded as such on the test report.

NOTE Combined testing can be used as a means of reducing overall test time.

4.2 Test sequence

The electromagnetic compatibility tests shall be carried out last, since electromagnetic emissions and susceptibility can be affected by prior exposure to other tests. The test sequence shall be recorded in the test report.

The tests should be carried out in progressively increasing order of severity.

4.3 Test report

The test report shall, as a minimum, include the following information:

- description of the equipment;
- model number or other identification;
- manufacturer's name and address;
- test lab's name and address;
- test date(s);
- tests to be conducted;
- test equipment used/calibration status and test set up information;
- the order in which the tests were conducted;
- duration of each individual test conducted;
- severity level used for testing;
- test results;
- any additional details regarding the test.

An example test report is given in Annex A.

4.4 ISO 16750 compliance

Electrical and electronic equipment in accordance with ISO 16750 that corresponds to the requirements of this International Standard is in compliance with this International Standard.

5 Tests

5.1 General

5.1.1 Monitoring for impaired function

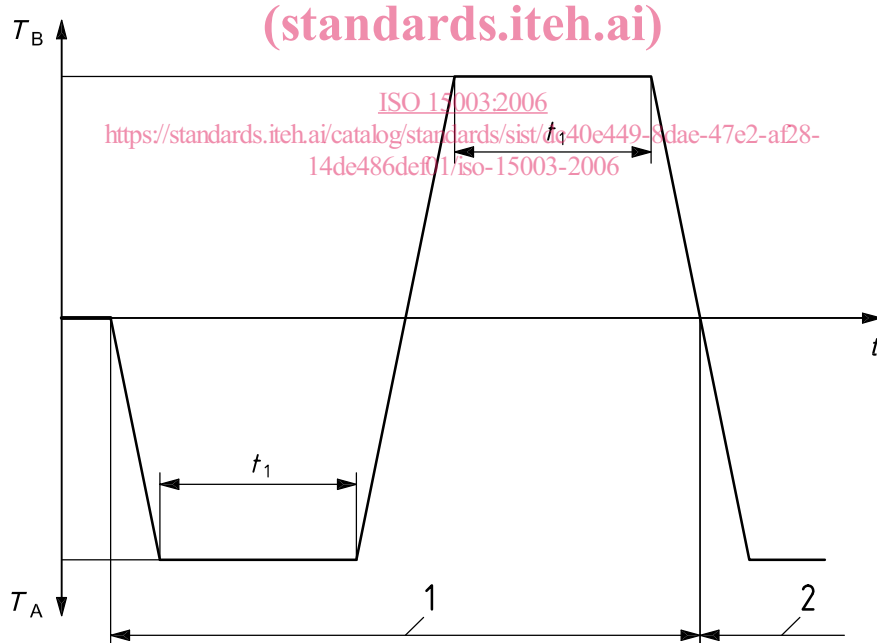
Where equipment is to be monitored for impaired function during or after a test, the equipment shall be connected to power and signal input and output lines in accordance with the manufacturer's instructions.

5.2 Cold and dry heat

5.2.1 Changes of temperature with specified rate of change

5.2.1.1 Test method

A cold and dry heat test shall be conducted in accordance with IEC 60068-2-14:1984, Test Nb, with the exception that testing can be done using one test chamber. The temperature cycle is shown in Figure 1. The steady state time shall be 3 h; the transition times shall be adjusted to yield three cycles in 24 h.



Key

- T_A minimum temperature
- T_B maximum temperature
- t time
- t_1 steady state time = 3 h
- 1 first cycle
- 2 second cycle

Figure 1 — Temperature cycle for cold and dry heat test

5.2.1.2 Test limits

See Table 1.

Table 1 — Test levels for temperatures

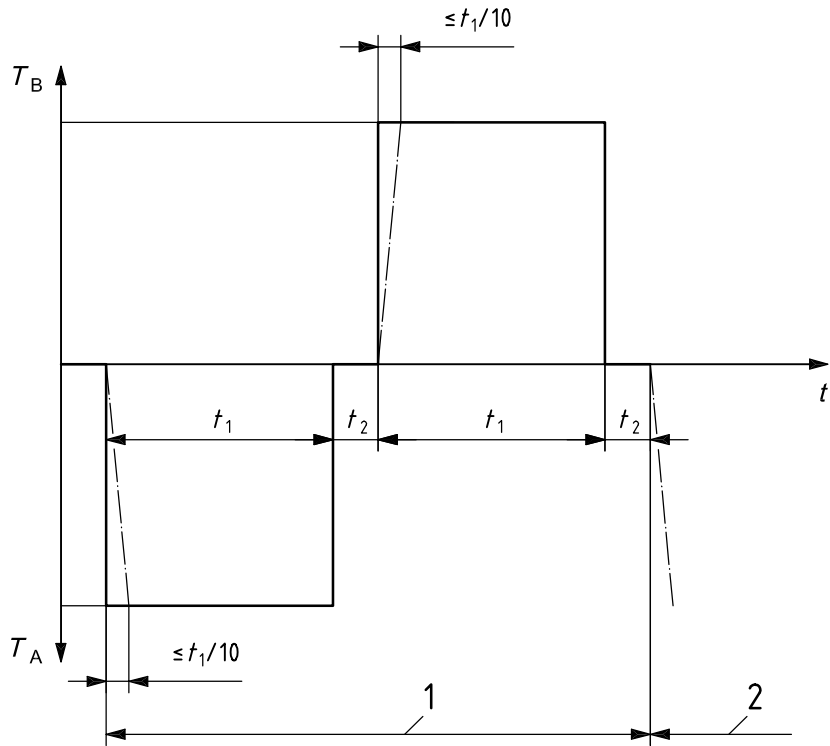
Level	T_A °C	T_B °C
1	0	70
2	-20	70
3	-40	85
4	-40	105
5	-40	125
Refer to B.2 for examples of severity levels.		

5.2.2 Temperature shock

5.2.2.1 Test method

The temperature shock test shall be conducted in accordance with IEC 60068-2-14:1984, Test Na, with the cycle shown in Figure 2. The steady state time t_1 shall be 0,5 h, and the transition time $t_2 \leq 1$ min; the number of cycles shall be 10.

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Key

- T_A minimum temperature
- T_B maximum temperature
- t time
- t_1 steady state time = 0,5 h
- t_2 transition time ≤ 1 min
- 1 first cycle
- 2 second cycle

Figure 2 — Cycle for temperature shock test

5.2.2.2 Test limits

See Table 2.

Table 2 — Test levels for temperatures

Level	T_A °C	T_B °C
1	0	70
2	-20	70
3	-40	85
4	-40	105
5	-40	125

Refer to B.2 for examples of severity levels.

5.3 Damp heat, steady state

5.3.1 Test method

The steady state damp heat test shall be conducted in accordance with IEC 60068-2-78.

5.3.2 Test limits

Expose the equipment under test to 93 ± 2 % relative humidity at 40 ± 2 °C for the lengths of time (durations) according to Table 3.

Table 3 — Test levels for durations

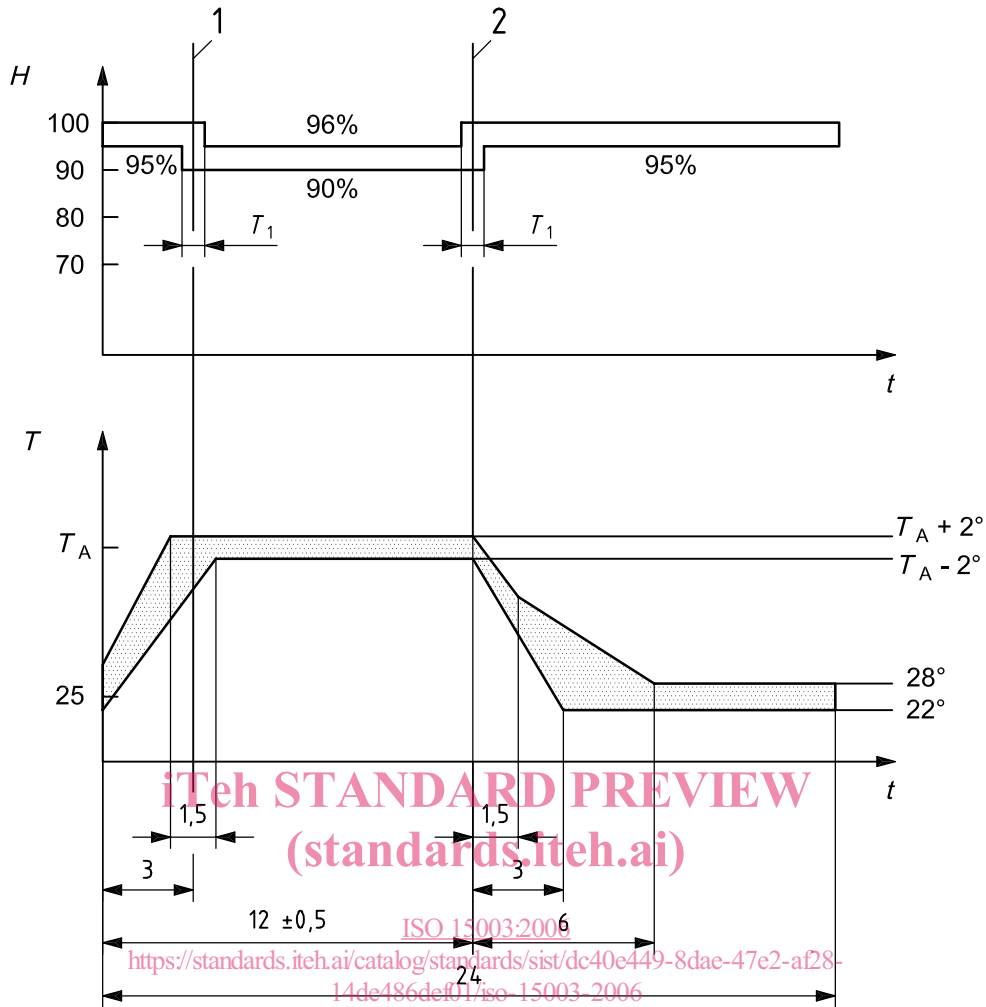
Level	Duration days
1	4
2	10
3	21
Refer to B.3 for examples of severity levels.	

5.4 Damp heat, cyclic

5.4.1 Test method

The cyclic damp heat test shall be conducted in accordance with IEC 60068-2-30 and Figure 3.

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- Key**
- T temperature, °C
 - T_A minimum temperature
 - t time
 - H humidity, %
 - 1 end of temperature rise
 - 2 start of temperature fall

Figure 3 — Damp heat test cycle

5.4.2 Test limits

See Table 4.

Table 4 — Test levels for number of cycles

Level	Number of cycles	T_A °C
1	2	40
2	2	55
3	6	55

Refer to B.4 for examples of severity levels.