

Methods for

Testing resistance to environmental conditions of electronic equipment used in agriculture and horticulture

Committees responsible for this British Standard

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- Agricultural Engineers' Association
- Forestry Commission
- Health and Safety Executive
- Milk Marketing Board
- Ministry of Agriculture, Fisheries and Food
- National Farmers' Union
- Silsoe College, Cranfield Institute of Technology
- Silsoe Research Institute

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Foreword

This British Standard has been prepared under the direction of the Agricultural Machinery and Implements Standards Policy Committee.

The use of electronic equipment to monitor and control agricultural equipment is growing rapidly. Such equipment is essential for optimizing machine operation and minimizing use of labour time, fuel and raw materials such as chemical spray and fertilizers. Without the sophistication of electronic monitoring and control, British agricultural equipment is likely to suffer further from import penetration. With it, the export potential of British equipment is greatly enhanced. The recent establishment of a British Standard (BS 7436-1:1991) for data communication on mobile agricultural equipment will contribute significantly towards that goal. To exploit potential applications, consideration has also been given to the environment in which the electronic equipment is to perform. The agricultural environment is particularly hostile and can involve extreme climatic conditions, shock and vibration, dust, slurries and fluids, some of which are highly corrosive. The electronic equipment needs to withstand these conditions and operate reliably over a predictable life. It has been stated that the environmental specification for agricultural electronics can be more demanding than for military electronics.

This standard is based on a draft prepared by Silsoe Research Institute under contract for BSI. Material has been drawn from a wide range of environmental standards published, inter alia, by BSI, the International Organization for Standardization (ISO), the Deutsches Institut für Normung e.V. (DIN), the Society of Automotive Engineers (SAE) and the American Society of Agricultural Engineers (ASAE), together with documents from commercial companies and published papers.

Attention is also drawn to tests given in BS 2011-1.1:1989, BS 5772-1:1985, BS EN 61010-1:1993 and PD 6521:1988, which may be appropriate for this type of equipment. Not all tests are applicable to given equipment in a given location. BS 2011-2.1 gives guidance on test equipment.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard gives methods for testing resistance of on-farm electronic equipment to environmental conditions (climatic, mechanical, dynamic and electric) to which the equipment may be subjected. It gives tests for specific environmental conditions and defines severity levels for tests which relate to the environmental extremes that may be experienced in practical operation of the equipment.

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

The tests are applicable to mobile and stationary equipment in both protected and exposed on-farm locations.

The standard is intended to determine the suitability of on-farm equipment for use in a specified range of environmental conditions.

2 References

2.1 Normative references

This British Standard incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this British Standard only when incorporated in it by updating or revision.

2.2 Informative references

This British Standard refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this British Standard the definitions given in BS 2011-1.1:1989 apply, together with the following.

3.1

display device

device displaying alpha-numeric characters 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 is not operative or does not conform to the manufacturer's specification

3.4

location

position within an agricultural enterprise where the equipment will normally be operating

3.5

normal mounting configuration

orientation of the equipment when in service

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

livestock building

building used to house large farm animals (e.g. cattle) or poultry

3.8

horticultural building

building in which crops are grown

NOTE This includes greenhouses and mushroom houses.

3.9

produce store

building in which agricultural or horticultural produce is stored for short or long periods

NOTE This includes grain stores, vegetable stores and fruit stores.

3.10

portable equipment

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

4 General

4.1 Safety of test apparatus

Electronic measuring apparatus used in carrying out tests shall conform to BS EN 61010-1:1993.

4.2 General conditions for tests

Except where otherwise specified for a particular test, testing shall be carried out under standard reference conditions as specified in section 5 of BS 2011-1.1:1989. The severity levels used shall be recorded on the test report. Tests shall be conducted in accordance with BS 5772-1:1985.

The same sample of equipment shall be used in all tests unless specified otherwise for a particular test.

NOTE Consideration should be given to the environment and conditions in which the equipment is expected to operate. Where appropriate, combined tests should be carried out (e.g. temperature and vibration) and recorded as such on the test report.

Combined testing is advisable in cases where equipment is subjected in use to extremes of two or more different environmental factors simultaneously.

4.3 Test sequence

The temperature tests shall be carried out first. The electromagnetic compatibility tests shall be carried out last, since electromagnetic emissions and susceptibility can be affected by prior exposure to other tests.

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

The test sequence shall be recorded on the test report.

4.4 Test report

The test report shall give the following information:

- description of the equipment;
- model number or other identification;
- manufacturer's name and address;
- date of submission of the equipment to the conditioning process and the conditions used (see 4.5);
- the order in which the tests were conducted (see 4.3);
- severity level used for testing;
- test results;
- any additional details regarding the test.

NOTE An example of a test report layout is given in Annex A.

4.5 Conditioning

Equipment to be subjected to testing shall first be conditioned according to a climatic sequence as described in BS 2011-1.1:1989. The sequence shall consist of the following categories:

- dry heat;
- damp heat, cyclic (test D) (see clause 5);
- cold;
- damp heat, cyclic (test D) (see clause 5).

The sequence used shall be recorded on the test report in the form of three groups of digits corresponding to the minimum cold test temperature, the maximum dry heat temperature and the number of days exposure to damp heat.

Example

55/100/56 represents – 55 °C, 100 °C and 56 days.

4.6 Location of equipment

The location of the equipment within an agricultural enterprise shall be classified using a two-letter code as follows:

- LA: stationary, protected from weather;
- LB: stationary, protected from weather, in a livestock building;
- LC: stationary, protected from weather, in horticultural buildings and produce stores;
- LD: stationary, unprotected from weather;
- LE: mobile, protected from weather (e.g. in a tractor cab);
- LF: mobile, unprotected from weather;
- LG: mobile, in an engine compartment;
- LH: portable.

5 Designation of environmental tests

The families of tests given in this British Standard shall be designated by the following code letters (selected from BS 2011-1.1:1989 and PD 6521:1988).

- A cold
- B dry heat
- C damp heat (steady state)
- D damp heat (cyclic)
- E impact
- F vibration
- G operational mechanical shock^a
- K corrosive atmosphere
- L dust
- M air pressure
- N change of temperature
- P explosive atmospheres^b
- R liquids^a
 - R_a water spray
 - R_b urea nitrogen
 - R_c liquid lime
 - R_d NPK fertilizer (7½ % N, 7½ % P, 7½ % K compound fertilizer)
 - R_e ammonium hydroxide
 - R_g diesel fuel
 - R_h petrol fuel
 - R_j hydraulic oil