

Methods for

Basic environmental testing procedures —

Part 2.1: Tests —
Test Fdc — Random vibration —
wide band reproducibility low

(This part should be read in conjunction with Part 1.1: General and it is recommended that reference be made to Part 2.1Fd)

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Foreword

The basic requirements for the random vibration test, wide band, are given in BS 2011-2.1, *Test Fd — Electrotechnical Commission*.

The basic requirements for the random vibration test, wide band, are given in BS 2011, Part 2 *Tests, Test Fd — Random vibration: wide band*, general requirements. In addition, three possible degrees of reproducibility have been specified called High, Medium and Low and designated Test Fda, Fdb and Fdc respectively. Each of these forms a separate test method complete with its recommended confirmation procedures:—

BS 2011-2.1, *Test Fda — Random vibration: wide band, reproducibility high*.

BS 2011-2.1, *Test Fdb — Random vibration: wide band, reproducibility medium*.

BS 2011-2.1, *Test Fdc — Random vibration: wide band, reproducibility low*.

All the information required by the relevant specification writer is, therefore, contained in Test Fd, General requirements, whilst that needed by the test engineer is contained in Tests Fda, Fdb or Fdc, whichever is specified.

Whilst the relevant specification writer need only read Test Fd General requirements, and the test engineer the specified test Fda, Fdb or Fdc, it is strongly recommended that all users read BS 2011-2.1Fd and that part of BS 2011, Test Fd, containing the reproducibility required.

It should be noted that two terms of particular importance to the subject of random vibration testing are referred to frequently throughout the text of this publication. They are defined here to ensure that the text is made as clear as possible to the reader.

Acceleration spectral density (hereinafter abbreviated to A.S.D.) is the spectral density of an acceleration variable and is given in units of acceleration squared per unit frequency.

A.S.D. spectrum defines the way the A.S.D. varies within the frequency range.

This British Standard, incorporating Amendment No. 1 published in 1977 and Amendment No. 2 published in 1984, is technically equivalent to IEC Publication 68-2-37:1973 “*Basic environmental testing procedures, Part 2: Tests — Test Fdc: Random vibration wide band — Reproducibility Low*”, published by the International Electrotechnical Commission (IEC).

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 8 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 Object

The object of this test method is to determine the ability of components and equipments to withstand specified severities of random vibration.

This random vibration test is applicable to components and equipments which may in service be subjected to conditions involving vibration of a stochastic nature. The purpose of the test is to determine mechanical weakness and/or degradation in specified performance and to use this information in conjunction with the relevant specification to decide whether a specimen complies with the requirements of that specification.

During the application of the environmental stress (conditioning) specified by this test, the specimen is subjected to random vibration of a given level within a wide frequency band. Due to complex mechanical reactions from the specimen and its fixture, this test requires particular care in the preparation and performance, and in the confirmation of the specified requirements.

2 Mounting and control

2.1 Mounting. The specimen shall be mounted on the test apparatus in accordance with BS 2011-4.1.

2.2 Test deleted

2.3 Test deleted

2.4 Reference and control points. The test requirements are confirmed by measurements made at the reference point and in certain cases at control points, all related to fixing points of the specimen. Measurements at the control points are only necessary when a fictitious reference point is specified.

In the case of a large number of small specimens mounted on one fixture, the reference and/or the control points may be related to the fixture rather than to the specimens when the lowest resonance mode of the loaded fixture is above the upper test frequency limit f_2 .

2.4.1 Fixing point. A fixing point is defined as a part of the specimen in contact with the fixture or vibration table at a point where the specimen is normally fastened in service. If a part of the real mounting structure is used as the fixture, the fixing points shall be taken as those of the mounting structure and not of the specimen.

2.4.2 Control point. A control point is normally a fixing point. It shall be as close as possible to the fixing point and in any case shall be rigidly connected to the fixing point.

If a fictitious reference point is specified, and four or less fixing points exist, each shall be used as a control point. If more than four fixing points exist, four representative ones shall be defined in the relevant specification, these to be used as control points.

NOTE For large and/or complex specimens it is important that the control points are defined in the relevant specification.

2.4.3 Reference point. The reference point is the single point from which the reference signal is obtained to confirm the test requirements and is taken to represent the motion of the specimen. It may be a control point or a fictitious point created by manual or automatic processing of the signals from the control points.

If a fictitious point is used, the spectrum of the reference signal is defined as the arithmetic mean at each frequency of the A.S.D. values of the signals from all control points. In this case the total r.m.s. value of the reference signal is equivalent to the root mean square of the r.m.s. value of the signals from the control points.

The relevant specification shall state the point to be used or how it should be chosen. It is recommended that for large and/or complex specimens a fictitious point be used.

3 Resonance searches

If the relevant specification calls for resonance searches, the tolerances given in the sinusoidal vibration test in BS 2011-2, Test F Vibration, shall apply during the following sinusoidal test phase.

3.1 Sinusoidal amplitude. Unless otherwise stated in the relevant specification, the sinusoidal amplitude to be used for resonance searches is determined by the specified A.S.D. level. (See Table 1.) This amplitude shall be applied at the reference point. Where a fictitious reference point is to be used during the random vibration conditioning this sinusoidal amplitude shall be applied at a control point.

Table 1 — A.S.D. and related sinusoidal amplitude

Specified A.S.D. level		Sinusoidal amplitude (peak values)	
(m/s ²) ² /Hz	Equivalent g ² /Hz	m/s ²	Equivalent g
< 4.8	< 0.05	9.8	1.0
4.8–19.2	0.05–0.2	14.7	1.5
> 19.2	> 0.2	19.6	2.0

3.2 Resonance search procedure. A complete sinusoidal sweep (up and down) of the frequency range shall be carried out for both the initial and final resonance searches.