

Specification for

General requirements for equipment for use in aircraft —

Part 2: All equipment —

Section 3: Environmental conditions —

Subsection 3.14: Acoustic vibration

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Foreword

This British Standard is part of a composite standard in the Aerospace Series of British Standards specifying general requirements for equipment in aircraft. An introduction to the complete British Standard is given in British Standard 3G. 100-0 Introduction.

This subsection of British Standard 3G. 100 gives details of an acoustic noise test for aircraft equipments and components. It includes appendices to provide a guide to assist in the selection of suitable chambers and noise sources. The tests described are designed to cater for severe noise environments in aircraft and rocket vehicles, e.g. from jet engine exhaust, boundary layer turbulence, etc.

Although, in general, other noise sources are negligible when compared to the above examples, the user should be aware that in some instances they may be significant, e.g. shock cell noise, gunfire etc. Furthermore, the principals of test could, where appropriate, be used to cover other acoustic environments.

The test is complementary to and does not replace the vibration test described in British Standard 3G. 100-2.3.1, Vibration. In this respect, it should be noted that vibration isolators do not necessarily isolate equipment from acoustically induced vibration.

This standard makes reference to the following British Standards:

BS 3G. 100, *General requirements for equipment in aircraft.*

BS 3G. 100-0, *Introduction.*

BS 3G. 100-2.3.0, *Standard test requirements.*

BS 661, *Glossary of acoustical terms.*

BS 2475, *Octave and one third octave band pass filters.*

BS 3593, *Preferred frequencies for acoustical measurements.*

BS 4197, *A precision sound level meter.*

Information concerning metric (SI) units is given in BS 350, Conversion factors and tables; BS 3763, The International System of units (SI), and PD 5686, The use of SI units.

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 Scope

This British Standard specifies details of tests to determine the ability of aircraft equipment and components to withstand four grades of acoustic environment.

This standard should also be read in conjunction with British Standard 3G. 100-0.

2 Definitions

For the purposes of this standard the definitions of BS 661 shall apply.

3 Conditions for testing

3.1 Standard test requirements. For the purposes of this test the appropriate requirements stated in British Standard 3G. 100-2.3.0 shall apply.

3.2 Mounting

3.2.1 The equipment under test, i.e. specimen, shall be mounted in a suitable chamber (as described in **3.3.1.1**) in such a manner that all appropriate external surfaces are exposed to the acoustic field. The principal surfaces of the specimen shall not be parallel to any surface of the test chamber.

3.2.2 Specimens should be suspended in the test chamber on an elastic suspension. The resonance frequency of the suspension system and specimen combined shall be less than 25 Hz, unless otherwise stated. Care must be exercised to ensure that no spurious acoustic or vibratory inputs are introduced.

Where the specimen is provided with specific means of mounting, the suspension system should be attached to the specimen in such a way that it does not interfere with the free movement of parts of the specimen which may move independently.

3.2.3 If cables, pipes etc., are required to be connected to the equipment during the test as prescribed in the relevant equipment specification, these should be arranged so as to add similar restraints and mass as in the normal installation.

3.3 Testing system

3.3.1 Required characteristics

3.3.1.1 Test chamber. The test chamber should be of such shape and construction as to produce as closely as possible a diffuse sound field. Appendix B and Appendix C give guidance concerning the choice and sizes of suitable chambers.

In general, a reverberant chamber is to be preferred. An irregular pentagonal chamber as illustrated in Figure 2 is recommended. The source opening should be small in relation to the total wall area.

Where possible the chamber should be of such a size that the volume occupied by the specimen does not exceed 10 % of the chamber volume.

As far as possible the specimen should be mounted centrally in the chamber. It should be noted that near to the source opening a direct sound field may exist.

In order that a measure of standardization of the test can be achieved, it is recommended that the chamber should be chosen from one of the three preferred sizes given in Table 2.

3.3.1.2 Noise source. The acoustic energy supplied to the test chamber should be of a random nature approximating to a normal distribution, with amplitudes up to a peak value not less than three times the root mean square (r.m.s.) value.

3.3.1.3 Measuring system. The measuring and indicating instruments used with the microphones and the microphones themselves shall be capable of handling random noise as defined in **3.3.1.2**. The measuring system shall give the r.m.s. value of the sound pressure when measuring a random noise.

3.3.1.4 Microphones. The microphones used shall be calibrated for random incidence.

3.3.1.5 Spectrum measurements. The sound pressure level (SPL) shall be measured in octave bands with centre frequencies and band-widths in accordance with the requirements of BS 3593.

3.3.2 Tolerances

3.3.2.1 Acoustic measuring system. The accuracy of the measuring system should correspond to the precision grade for sound level meters, given in BS 4197, and for octave band filters, given in BS 2475. The indications obtained in this manner may be compared directly with the levels (and tolerances) in Figure 1 without further allowance for instrumentation errors.

3.3.2.2 Tolerances on sound pressure level and spectrum. The spectrum of the sound field shall be initially adjusted with the specimen and its suspension removed from the chamber.

The overall sound pressure level, determined from Table 1, shall be produced in the chamber, conforming with the octave band spectra given in Figure 1. Measuring equipment capable of resolution better than one octave may be used but the appropriate reductions should be made to the octave band sound pressure levels in Figure 1 to give the required overall sound pressure level.

Measurements shall be made by using one microphone (or more if desired) placed in the area to be occupied by the test specimen.