

# Description and measurement of environmental noise —

## Part 3: Guide to application to noise limits

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Environment and Pollution Standards Policy Committee (EPC/-) to Technical Committee EPC/1, upon which the following bodies were represented:

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 British Broadcasting Corporation  
 British Occupational Hygiene Society  
 British Telecommunications plc  
 Department of Health  
 Department of the Environment (Building Research Establishment)  
 Department of Trade and Industry (Air Division)  
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 Institute of Sound and Vibration Research  
 Institution of Civil Engineers  
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 Society of Environmental Engineers  
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The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

Association of Consulting Scientists  
 Association of Metropolitan Authorities  
 Association of Noise Consultants  
 British Cement Association  
 British Coal Corporation  
 British Forging Industry Association  
 British Gas plc  
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 Engineering Industries Association  
 Federation of Civil Engineering Contractors  
 Institution of Environmental Health Officers  
 London Regional Transport  
 Ministry of Defence  
 Petroleum Industry Association  
 Royal Automobile Club  
 University of Salford

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# National foreword

This Part of BS 7445 has been prepared under the direction of the Environment and Pollution Standards Policy Committee and is identical with ISO 1996-3:1987, “Acoustics — Description and measurement of environmental noise — Part 3: Application to noise limits”, published by the International Organization for Standardization (ISO). ISO 1996-3 was prepared by Subcommittee 1, Noise, of ISO Technical Committee 43, Acoustics, with the active participation and approval of the UK.

BS 7445 at present comprises the following Parts which have been published.

- *Part 1: Guide to quantities and procedures;*
- *Part 2: Guide to the acquisition of data pertinent to land use;*
- *Part 3: Guide to application to noise limits.*

## Cross-references

International standard	Corresponding British Standard
	BS 7445 Description and measurement of environmental noise
ISO 1996-1:1982	Part 1:1991 Guide to quantities and procedures (Identical)
ISO 1996-2:1987	Part 2:1991 Guide to the acquisition of data pertinent to land use (Identical)
	BS 4196 Sound power levels of noise sources
ISO 3744:1981	Part 4:1981 Engineering methods for determination of sound power levels for sources in free-field conditions over a reflecting plane (Identical)
ISO 3746:1979	Part 6:1981 Survey method for determination of sound power levels of noise sources (Identical)
ISO 3891:1978	BS 5727:1979 Method for describing aircraft noise heard on the ground (Identical)
IEC 651:1979 <sup>a</sup>	BS 5969:1981 Specification for sound level meters (Identical)
IEC 804:1985 <sup>a</sup>	BS 6698:1986 Specification for integrating-averaging sound level meters (Identical)

<sup>a</sup> International Electrotechnical Commission.

ISO 1999 is referred to in clause 0 for information only and does not affect the use of this standard.

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## Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, 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.

## 0 Introduction

0.1 ISO 1996 comprises the following three parts:

- *Part 1: Basic quantities and procedures;*
- *Part 2: Acquisition of data pertinent to land use;*
- *Part 3: Application to noise limits.*

0.2 This part of ISO 1996 lays down guidelines for the ways in which noise limits should be specified and describes procedures to be used for checking compliance with such limits. It is assumed that noise limits are established by local authorities according to these guidelines and are embodied in noise limit regulations to which reference is made.

For certain types of sources of noise, more detailed procedures may be used, for example those specified in ISO 3891 for aircraft noise. ISO 3891 is consistent with the requirements of ISO 1996.

This part of ISO 1996 does not specify noise limits.

Reference should be made to ISO 1999 for situations where noise may cause hearing impairment.

## 1 Scope and field of application

This part of ISO 1996 lays down guidelines for the specification of noise limits and describes methods for the acquisition of data that enable specific noise situations to be checked for compliance with specified noise limits.

## 2 References

ISO 1996-1, *Acoustics — Description and measurement of environmental noise — Part 1: Basic quantities and procedures.*

ISO 1996-2, *Acoustics — Description and measurement of environmental noise — Part 2: Acquisition of data pertinent to land use.*

IEC Publication 651, *Sound level meters.*

IEC Publication 804, *Integrating-averaging sound level meters.*

## 3 Definitions

For the purposes of this part of ISO 1996, the definitions given in ISO 1996-1 apply.

## 4 Specification of noise limit requirements

### 4.1 General

Noise limits are specified in terms of equivalent continuous A-weighted sound pressure levels or rating levels during time intervals and at locations appropriate to specific noise sources and conditions.

Noise limits may be set by national or local authorities on the basis of general considerations of compatibility with human activities and land use, taking into account the results of survey measurements, if available. Such limits may depend on many factors such as the time of day, the activities to be protected, the type of noise source, and climatic, social and economic factors.

Noise limit regulations have to comprise a number of basic elements which, in combination, define uniquely the circumstances under which compliance with the regulations can be verified. These elements are as follows:

- a) noise descriptor;
- b) relevant time intervals;
- c) the sources and their conditions of operation, where appropriate;
- d) locations where the noise limits have to be verified;
- e) meteorological conditions, where appropriate,;
- f) criteria for assessment of compliance with the limits.

These elements are described in more detail in 4.2.

NOTE For control and enforcement purposes, it may be appropriate to specify limits for emission by individual sources or group(s) of sources.

## 4.2 Specification of noise limits

### 4.2.1 Noise descriptors

The preferred noise descriptor for the specification of noise limits is the equivalent continuous A-weighted sound pressure level or rating level during given reference time interval(s). If noise limits are specified in terms of rating levels, the procedures to be used for determining the levels shall be specified. Limits that apply to noise events may be specified in terms of sound exposure level.

If additional limits are specified in terms of other descriptors, the procedures for determining such values shall be specified.

NOTE 1 For large-amplitude noise, such as the noise generated by sonic booms, mining or quarry blasts, measurements with C-weighting are used in some countries to determine the rating level.

NOTE 2 If it proves impossible to find locations where the noise from a source can be measured in isolation, limits may be specified in terms of the sound power level of the source. Methods for determining this quantity should then be specified (for example in accordance with ISO 3744 or ISO 3746).

### 4.2.2 Relevant time intervals

The reference time intervals shall be chosen to take into account typical human activities and variations in the operation of the noise source.

Noise levels from the source(s) under consideration may vary strongly at the locations selected. It may then be necessary to carry out measurements, during a number of reference time intervals, to establish a representative long-term average sound level or long-term rating level. The number of samples of the reference time interval required will depend on the range of variation.

The long-term interval shall be chosen to take into account variations in source emission and sound propagation. For situations where variations of the received sound pressure levels are mainly determined by meteorological conditions, or where emitted noise varies in a complex manner, this time interval may be from one week to one year.

#### **4.2.3 Sound sources and their operating conditions**

The source(s) to which the noise limits apply shall be specified, together with their conditions of operation.

NOTE Special noise limits may be specified for periods during which the source is known to emit unusual types or levels of noise, e.g. when the source is undergoing maintenance.

#### **4.2.4 Locations**

The locations where the noise limits have to be met shall be clearly specified. They shall be appropriate for the measurement of the noise emitted by the source(s) under consideration. The height of the microphone above the ground shall be specified (see ISO 1996-1 and ISO 1996-2).

If these locations are subsequently found to be unsuitable for measurement of the noise emitted by the source under consideration, additional positions shall be specified where such measurements can be made (check points). Noise limits at the check points shall be derived from the levels specified at the initial locations.

NOTE When specifying limits, the importance of certain transmission paths should be considered. This may be of special importance for establishing limits for indoor receiver positions (e.g. transmission through open or closed doors and windows).

#### **4.2.5 Meteorological conditions**

##### **4.2.5.1 General**

For outdoor transmission, changes in meteorological conditions may influence the received noise level if the distance between the source and the receiver is about 30 m or more. In such cases, the noise limits shall be based on an average value for either all relevant meteorological conditions or for specified meteorological conditions only.

Since, for identical patterns of noise, the long-term average level will be different for the two cases, the noise limits should be fixed accordingly.

Reference may be made to one of the two cases outlined in 4.2.5.2 and 4.2.5.3.

##### **4.2.5.2 Averaging of levels for all meteorological conditions**

In this case, the noise limits refer to noise levels averaged for all relevant meteorological conditions. The measurements shall be made at times such that the results will be representative for the range of meteorological conditions for the site under consideration. The long-term average level may be calculated from the individual results, if required after weighting each result with a factor representing the fraction of the long-term time interval during which the corresponding meteorological conditions prevailed.

NOTE 1 Under certain meteorological conditions, it may be difficult to determine the specific noise of the source under consideration if there is insufficient difference between the levels of this specific noise and the residual noise.

NOTE 2 This technique has the advantage that it takes into account both variations due to meteorological conditions and variations in the source emission.

##### **4.2.5.3 Determination of levels in specified meteorological conditions**

In this case, the noise limits refer to noise levels in specified meteorological conditions. The meteorological conditions in which measurements are to be carried out shall be specified.

NOTE 1 The conditions specified will usually be those for which the noise levels at the locations where the noise limits have to be complied with are the highest. In this case, the specified wind direction should form an angle of less than 45° with the direction from the source to these locations.

Measurements during strong temperature inversions near the ground should, however, be avoided.

NOTE 2 Care should be taken to ensure that the specified meteorological conditions cover all relevant source operating conditions.

#### **4.2.6 Criteria for assessing compliance with limits**

In order to assess compliance with a noise limit, it will, in general, be necessary to consider the average of a number of measurements and their statistical distribution. Noise limit regulations should indicate how this information should be used for assessing compliance with the limits.

## **5 Checking compliance with limits**

### **5.1 Instrumentation**

The instrumentation and its calibration shall comply with the requirements given in ISO 1996-1.

### **5.2 Location of measurement positions**

Measurements for verification of compliance with noise limits shall be carried out at the positions and at the elevations specified in the noise limit regulations.

### 5.3 Measurement time intervals and meteorological conditions

Measurements shall be made over the time intervals and in the meteorological conditions specified in the relevant noise limit regulations.

## 6 Presentation of results

The results shall be recorded in a report of the investigation of compliance with noise limits, which shall include at least the following information:

- a) the relevant section of the noise limit regulations in question;
- b) the date and time of measurements;
- c) the location of measurement positions;
- d) the instrumentation used, details of its calibration and the types of analyses carried out;
- e) meteorological conditions during the measurements (wind direction, wind speed, relative humidity, temperature, recent precipitation);
- f) operating and loading conditions of the sound source(s) under consideration;
- g) results of all acoustic measurements or calculations of the noise from the main source under consideration;
- h) noise due to other sources, if significant;
- i) any calculation methods used in evaluating the measurements;
- j) results and interpretation from an acoustical point of view;
- k) any other information required by the noise limit regulations.

## 7 Bibliography

- ISO 1999, *Acoustics — Assessment of occupational noise exposure for hearing conservation purposes.*
- ISO 3744, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for free-field conditions over a reflecting plane.*
- ISO 3746, *Acoustics — Determination of sound power levels of noise sources — Survey method.*
- ISO 3891, *Acoustics — Procedure for describing aircraft noise heard on the ground.*





## Publication(s) referred to

See national foreword.

**BS 7445-3:  
1991  
ISO 1996-3:  
1987**

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