

Acceptance code for gears —

Part 1: Determination of airborne sound power levels emitted by gear units

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- British Gear Association
- British Horological Federation
- British Railways Board
- Engineering Equipment and Materials Users' Association
- Federation of British Engineers' Tool Manufacturers
- Federation of Manufacturers of Construction Equipment and Cranes
- Gauge and Tool Makers' Association
- Institution of Mechanical Engineers
- Lloyd's Register of Shipping
- London Underground Ltd.
- Ministry of Defence
- Power Generation Contractors' Association (BEAMA Ltd.)

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Advanced Manufacturing Technology Research Institute
- Agricultural Engineers' Association
- Association of Building Engineers
- Association of Consulting Engineers
- British Broadcasting Corporation
- British Cement Association
- British Compressed Air Society
- British Industrial Truck Association
- British Occupational Hygiene Society
- British Steel plc
- British Telecommunications plc
- Construction Industry Research and Information Association
- Department of Health
- Department of the Environment (Building Research Establishment)
- Department of Trade and Industry (National Engineering Laboratory)
- Department of Trade and Industry (National Physical Laboratory)
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Engineering Industries Association
- Fan Manufacturers' Association
- Federation of Associations of Specialists and Sub-contractors
- Federation of Manufacturers of Construction Equipment and Cranes
- Federation of Piling Specialists
- Health and Safety Executive
- Hevac Association
- Institute of Acoustics
- Institute of Occupational Hygienists
- Institute of Physics
- Institute of Sound and Vibration Research
- Institution of Electrical Engineers
- Institution of Mechanical Engineers
- Rotating Electrical Machines Association (BEAMA Ltd.)
- Royal Institute of British Architects
- Society of Environmental Engineers
- University of Liverpool
- University of Manchester

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National foreword

This Part of BS 7676 has been prepared under the direction of the Machinery and Components Standards Policy Committee. It is identical with ISO 8579-1:1993 *Acceptance code for gears — Part 1: Determination of airborne sound power levels emitted by gear units*, which was prepared jointly by Technical Committee ISO/TC 60, Gear, and ISO/TC 43, Acoustics, of the International Organization for Standardization (ISO), in which the United Kingdom played an active part.

BS 7676 comprises the following Parts:

- *Part 1: Determination of airborne sound power levels emitted by gear units;*
- *Part 2: Determination of mechanical vibrations of gear units during acceptance testing.*

Cross-references

International Standard	Corresponding British Standard
ISO 3744:1981	BS 4196 <i>Sound power levels of noise sources</i> Part 4:1981 <i>Engineering methods for determination of sound power levels for sources in free-field conditions over a reflecting plane</i> (Identical)
IEC 225:1966	BS 2475:1964 <i>Specification for octave and one-third octave band-pass filters</i> (Technically equivalent)
IEC 651:1979	BS 5969:1981 <i>Specification for sound level meters</i> (Identical)

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, 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.

Introduction

The gear unit is only part of the total acoustic system which includes, in addition to the gear unit, the prime mover, driven equipment, gear unit mounting, foundation and acoustic environment. Each of these might affect the measured level of sound emitted from the gear unit. Therefore, unless otherwise agreed, the gear manufacturer is to ensure that the level of noise emitted from a gear unit under the test conditions in his factory is within contractually specified or negotiated limits.

The measurement method specified in this part of ISO 8579 determines the A-weighted sound power level of sound radiated over a reflective surface (for example, in an anechoic room with a reflective floor). Correction values are provided so that the procedure can be applied, within specified limits, in factory test areas, commonly used by a manufacturer.

In some instances it may be necessary to determine sound power levels in octave or one-third-octave bands; procedures are included for that purpose. However, the use of those procedures is to be agreed between the manufacturer and purchaser.

1 Scope

This part of ISO 8579 specifies the conditions under which sound emitted from gear units is determined in order to establish a common procedure for comparison.

It is applicable to all power transmission gearing other than gears for fine mechanisms.

The methods in this part of ISO 8579 are based on ISO 3744 and ISO 3746.

NOTE 1 This part of ISO 8579 does not include a method using substitution of a reference sound source in a reverberation room for determining sound power level. To make use of this method, see ISO 3743.

If it is necessary to determine sound power levels in octave or one-third-octave bands, the procedures of this part of ISO 8579 should be agreed upon between manufacturer and purchaser.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8579. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8579 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3744:1981, *Acoustics — Determination of sound power levels of noise sources — Engineering methods for free-field conditions over a reflecting plane.*

IEC 225:1966, *Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations.*

IEC 651:1979, *Sound level meters.*

3 Definitions

For the purposes of this part of ISO 8579, the following definitions apply.

3.1

background noise

any sound at the points of measurement which does not originate from or is not directly emitted by the gear unit

3.2

band pressure level

the effective sound pressure level corresponding to the sound energy contained within the band

3.3

measurement surface

an imaginary surface enveloping the gear unit, on which the measurement points lie (See 5.4.1.)

3.4

measurement-surface area, S

the area, expressed in square metres, of the measurement surface

3.5

measurement-surface quantity, L_S

the sound pressure level which relates different measurement-surface areas:

$$L_S = 10 \log_{10} \left(\frac{S}{S_0} \right) \text{ dB}$$

where

$$S_0 = 1 \text{ m}^2$$

3.6

nearfield

zone, the limit of which is defined by the distance r_n from the geometric centre of the sound source beyond which the sound pressure decreases in proportion to $1/r$

beyond this zone, if the distance is doubled, the reduction of the sound pressure level should be 6 dB with a permissible deviation of 1 dB. The nearfield limit depends upon the frequencies of interest

3.7

frequency spectrum of the noise

spectrum showing the sound pressure level distribution throughout the frequency range. The appearance of the spectrum depends on the bandwidth characteristics of the analyser used

3.8

sound pressure level, L_p

level defined by

$$L_p = 20 \log_{10} \left(\frac{p}{p_o} \right) \text{ dB}$$

where

- p is the measured root-mean-square sound pressure;
- p_o is the reference sound pressure, expressed in the same units as p [for air $p_o = 20 \mu\text{Pa}^a$].

^a $1 \mu\text{Pa} = 10^{-6} \text{ N/m}^2$

3.9

A-weighted sound pressure level, L_{pA}

sound pressure level reading given by a sound level meter complying with IEC 651, with frequency weighting A

NOTE 2 This is often abbreviated to “weighted sound level” or “sound level” in English-speaking countries.

3.10

sound power level, L_W

level defined by

$$L_W = 10 \log_{10} \left(\frac{P}{P_o} \right) \text{ dB}$$

where

- P is the measured sound power;
- P_o is the reference sound power, expressed in the same units as P [= 1 pW^a].

^a $1 \text{ pW} = 10^{-12} \text{ W}$

NOTE 3 L_{WA} is an A-weighted sound power level, determined in such a manner that the acoustic power level in each of the bands is obtained with frequency weighting A.

4 Instrumentation

4.1 Sound level meter

The sound level meter shall comply with the requirements of IEC 651 for a type 1 instrument.

The instructions on the use of the equipment shall be followed to ensure that the intended degree of precision is met.

Any filter used for noise analyses shall comply with IEC 225. Narrow-band or Fourier Transform equipment may also be used.

NOTE 4 Octave or one-third-octave band levels determined by recombining narrow-band or discrete-frequency levels may not be accurate.

4.2 Calibration of measuring equipment

The overall acoustical performance of the measuring equipment shall be checked and any specified adjustments made immediately before and rechecked immediately after each series of machine noise measurements.

More detailed calibrations of all the measuring equipment shall be carried out at least once every two years (see ISO 3744:1981, 5.5).

4.3 Location of instruments and observer

Any measuring amplifiers, filters, or observers shall be positioned to minimize errors due to reflections.

5 Test conditions

5.1 Objectives of the test

In principle, only that noise emitted from the gear unit should be measured. However, equipment that is integral with and near and essential to the function of the gear unit in service (for example pumps, fans, etc.) shall be included. The type of additional equipment used and the condition under which it was operated shall be exactly stated in the test report.

If a gear unit is mounted in a set of machinery in such a way that the individual level of noise emitted by the gear unit cannot be measured, and if the level of noise emitted from the set is not of interest, measurement in accordance with other agreed procedures should be used (such as acoustic intensity, cross-correlation, or structural vibration measurements).

5.2 Test conditions of the gear unit

For the purposes of this part of ISO 8579, the conditions given in 5.2.1 to 5.2.5 shall apply, unless otherwise agreed between the gear manufacturer and the purchaser.

5.2.1 The unit shall be tested at its intended operating speed or, if intended for variable speed service, at the arithmetic mean of its speed range.

5.2.2 The gear unit shall be tested in its intended direction of rotation or, if reversible, in both directions.

5.2.3 The gear unit may be operated with or without load, at the gear manufacturer's discretion.

5.2.4 The test measurements shall be conducted using the operating lubricating system and the lubricant viscosity equivalent to the operating viscosity.

5.2.5 Noise measurement shall be conducted when the machinery is operating within its design temperature range.