

Method of test for

Estimating the risk of hearing handicap due to noise exposure

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- National Coal Board
- Oil Companies Materials Association

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Foreword

This British Standard has been prepared under the authority of the Engineering Divisional Council.

In 1971 ISO/R 1999¹⁾ was published, but since the preparation of that ISO Recommendation further work on this subject has been done, and the results of some of this work are reflected in this standard. This standard therefore differs substantially from ISO 1999 and has been submitted to the ISO Committee as a UK proposal for the revision of that standard.

Persons regularly exposed to noise can develop hearing loss of such severity that their appreciation of music, perception of everyday acoustic signals or understanding of speech may be impaired. Hearing handicap, as understood in this standard, is impairment of understanding of conversational speech in low levels of background noise, and can be inferred from the shift in hearing threshold level.

This standard is based on data which give, in statistical terms, the relation between different noise exposures and the permanent noise-induced threshold shift in people of various ages. These data apply to persons free from auditory impairment other than that due to noise (with allowance for the effects of age) and having substantially similar hearing levels in both ears.

The risk of sustaining hearing handicap is estimated in terms of the *handicap percentage*. This is the percentage of noise-exposed persons attaining or exceeding a particular average hearing threshold level at which a hearing handicap is deemed to exist. Noise exposure is quantified in terms of the noise immission. The handicap percentage is tabulated for different noise immission levels and ages.

Since this standard is based on statistical data it cannot be expected to provide an accurate assessment of hearing handicap due to noise exposure in individual persons.

Determination of a maximum tolerable noise exposure is outside the scope of this standard; it involves consideration of risk in relation to other factors. For occupational noise exposure such a limit is specified in the Department of Employment (HMSO, 1972) Code of Practice for Reducing Exposure of Employed Persons to Noise.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, 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⁾ Subsequently reissued as International Standard ISO 1999:1975.

1 Scope

This British Standard specifies a relationship between noise exposure and the expected incidence of hearing handicap. A handicap is deemed to exist when the average hearing threshold level at 1 kHz, 2 kHz and 3 kHz attains or exceeds a certain value. The measure of noise exposure is derived from the equivalent continuous A-weighted sound level during one working day (assumed to be of duration 8 h), and expressed as a *noise immission level* for a given number of years of exposure. This British Standard applies to noise which is steady, intermittent, fluctuating or impulsive in character. In the case of impulsive noise this standard is not applicable where the instantaneous sound pressure exceeds 600 Pa [150 dB relative to 20 μ Pa] at any time during the exposure. Methods for the determination of equivalent continuous sound level are given in clause 5.

NOTE The frequency combination of 1 kHz, 2 kHz and 3 kHz is in conformity with Department of Health and Social Security (1973), Occupational deafness: Report by the Industrial Injuries Advisory Council (Cmnd 5461, HMSO). Other frequency combinations such as 0.5 kHz, 1 kHz and 2 kHz have been advocated elsewhere for the same purpose without clearly demonstrable superiority. It should also be noted that the hearing level of 50 dB referred to in the DHSS report corresponds to a 20 % disablement and differs from the criterion used in this standard for the minimum hearing level at which hearing handicap is considered to begin.

2 References

The titles of the publications referred to in this standard are listed on the inside back cover.

3 Definitions

For the purposes of this British Standard the following definitions apply.

3.1

partial noise exposure index

an index determined by a sound level and its duration within a working day of 8 h (symbol E_i)

3.2

composite noise exposure index

the sum of partial noise exposure indices for all relevant sound levels over a working day of 8 h

3.3

equivalent continuous sound level

that sound level in dB(A) which, if present for 8 h per day, produces the same composite noise exposure index as the various measured sound levels over one day (symbol L_{eq})

3.4

noise immission

an index of the total energy incident on the ear over a specified period of time. Noise immission level (NIL) is the A-weighted noise immission defined as follows:

$$NIL = L_{eq} + 10 \log_{10} (T/T_0)$$

where

L_{eq} is the equivalent continuous sound level in dB(A)

T is the duration of the exposure expressed in calendar years

T_0 is one calendar year

NOTE A typical calendar year is assumed to comprise 2 000 h of actual noise exposure.

3.5

permanent impairment of hearing for conversational speech due only to the effects of noise and age

the hearing of a person is deemed to be impaired sufficiently to cause a handicap if the arithmetic average of the hearing threshold levels, of the two ears combined, at 1 kHz, 2 kHz and 3 kHz is equal to or greater than 30 dB referred to the audiometric zero of BS 2497-1, BS 2497-2 and BS 2497-3

3.6

handicap percentage

the percentage of persons in a population attaining or exceeding the 30 dB average hearing threshold level described in 3.5, where age and noise exposure are the causative factors and no pathological condition is involved. The definition assumes that the hearing levels in the two ears are substantially similar

4 Noise measurement

4.1 General. Noise measurements shall be made with the A-weighting and expressed in dB(A). The measurement locations and the length of time for which measurements are made shall be chosen so as to represent adequately the noise experienced in a typical day by the persons at risk. The method of noise measurement shall be selected from the procedures described in 4.2 and 4.3, according to the nature of the noise. The method described in 4.3.1 is always applicable but the methods described in 4.2, 4.3.2.1 and 4.3.2.2, which allow the use of simpler equipment, are appropriate in many cases.