

Specification for

Analogue audio disk records and reproducing equipment —

(Implementation of
CENELEC HD 337 S3)

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Committees responsible for this British Standard

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- British Broadcasting Corporation
- British Kinematograph, Sound and Television Society
- Council for Educational Technology for the United Kingdom
- Electronic Engineering Association
- Independent Television Association
- Sound and Communication Industries' Federation

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

- Association of Professional Recording Studios
- Audio Engineering Society
- British Tape Industry Association
- Royal Photographic Society
- Training and Educational Systems Testing Bureau

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National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Committee and is identical with IEC 98:1987 “*Analogue audio disk records and reproducing equipment*”, published by the International Electrotechnical Commission (IEC).

This British Standard is also in agreement with Harmonization Document HD 337 S3, published by the European committee for Electrotechnical Standardization (CENELEC).

This standard supersedes BS 1928:1965 and BS 4852-1:1972 which are both withdrawn.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

For the purposes of this standard, the references made in Appendix C to BS 1928, which is superseded by this standard, for catalogue numbers TCS 101, TCS 104 and TCS 105 should be read as referring to this British Standard, BS 7063.

Cross-references

International Standard	Corresponding British Standard
IEC 50 (806):1975	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 3:Group 10:1979 <i>Recording and reproduction of sound and video terminology</i> (Technically equivalent)
IEC 263:1982	BS 6397:1983 <i>Specification for scales and sizes for plotting frequency characteristics and polar diagrams</i> (Identical)
IEC 268-3:1988	BS 6840 <i>Sound system equipment</i> Part 3:1989 <i>Methods for specifying and measuring the characteristics of sound system amplifiers</i> (Identical)
IEC 268-5:1989	Part 5:1990 <i>Methods for specifying and measuring the characteristics of loudspeakers</i> (Identical)
IEC 386:1972	BS 4847:1989 <i>Method of measurement of speed fluctuations in sound recording and reproducing equipment</i> (Identical)
IEC 417:1973	BS 6217:1981 <i>Guide to graphical symbols for use on electrical equipment</i> (Identical)
IEC 581-3:1978	BS 5942 <i>High fidelity audio equipment and systems: minimum performance requirements</i> Part 3:1980 <i>Specification for record playing equipment and cartridges</i> (Identical)
IEC 651:1979	BS 5969:1981 <i>Specification for sound level meters</i> (Identical)

International Standard	Corresponding British Standard
ISO 406:1982	BS 308 <i>Engineering drawing practice</i> Part 2:1985 <i>Recommendations for dimensioning and tolerancing of size</i> (Technically equivalent)

The Technical Committee has reviewed the provisions of IEC 27, IEC 38, IEC 268-3 and ISO 1101, to which references are made in the text and has decided that they are acceptable for use in conjunction with this standard. IEC 65:1985, to which reference is made in the text, has been harmonized by CENELEC under HD 195 and is implemented by BS 415:1990 which is a related British Standard.

The following related British Standards also exist:

IEC 27	BS 5775 <i>Specification for quantities, units and symbols. Parts are identical with the ISO 31 series of Parts</i>
IEC 38:1983	BS 77:1958 <i>Specification. Voltages for a.c. transmission and distribution systems</i>
ISO 1101:1983	BS 308 <i>Engineering drawing practice</i> Part 3:1972 <i>Geometrical tolerancing</i>

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 to iv, pages 1 to 26, 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 Scope

This standard applies to analogue audio disk records and the corresponding professional and domestic reproducing equipment. It excludes amplifiers and loudspeakers, methods of measurement for which can be found in IEC Publications 268-3 and 268-5 respectively. It also excludes all aspects of quality grading, which can be found in IEC Publication 581-3.

2 Object

This standard consists of three sections, the objects of which are as follows:

Section 1 lists all general information necessary to ensure correct interpretation of subsequent sections of this standard.

Section 2 specifies the parameters which are necessary to ensure compatibility between analogue audio disk records and the corresponding reproducing equipment.

Section 3 lists and defines the most important parameters affecting the performance of reproducing equipment, and establishes agreed methods of measurement for these parameters.

Section 1. General

3 Definitions

The following definitions shall apply for the purposes of this standard. In cases where the definition appears in the International Electrotechnical Vocabulary (IEV) [IEC Publication 50], the appropriate reference is stated in brackets after the heading for the definition.

3.1

monophonic record (IEV 806-03-67)

a record which carries one channel of information in the form of lateral displacements of a spiral groove

3.2

stereophonic record (IEV 806-03-68)

a record which carries two channels of information in the form of displacements of a single spiral groove in two mutually perpendicular directions

3.3

rated value

exact theoretical or target value of a given parameter

3.4

nominal value

approximate or abbreviated value of a given parameter

3.5

recorded velocity (v) (modified IEV 806-04-56)

the alternating velocity imparted to a stylus tip of negligible dimensions fitted to a pickup head of negligible mechanical impedance when tracing the groove of a record rotating at rated angular velocity

3.6

reference recorded velocity (v_0)

a recorded velocity of specified magnitude at a specified frequency

3.7

recorded level (modified IEV 806-02-09)

relationship between any recorded velocity (v) and a reference recorded velocity (v_0) expressed on a logarithmic scale as follows:

$$\text{Recorded level} = 20 \lg \left(\frac{v}{v_0} \right) \text{ dB}$$

3.8 Recording and reproducing chains

3.8.1

recording chain (IEV 806-01-05)

a chain for transmission of signals from the input of the system to and including the recording medium

3.8.2

reproducing chain (IEV 806-01-09)

a chain for transmission of the signals from the recording medium to the output of the system

3.9 Recording and reproducing characteristics

For ideal reproduction, the recording characteristic is the mirror image of the reproducing characteristic, so that constant level signals at various frequencies applied to the input of the recording chain shall result in constant level signals at the output of the reproducing chain.

For practical reproduction, in order to minimize the effects of mechanical imperfections in the reproducing chain, the rated reproducing characteristic is not the mirror image of the rated recording characteristic at low frequencies.

3.9.1

recording characteristic (modified IEV 806-02-11)

the recorded levels obtained, as a function of frequency, when constant level signals at various frequencies are applied to the input of a recording chain

3.9.2

reproducing characteristic (modified IEV 806-02-14)

the reproduced (output) levels obtained, as a function of frequency, when constant recorded levels at various frequencies are applied to the input of a reproducing chain

3.10

plain groove (IEV 806-03-14)

any length of groove which carries no recording

3.11

lead-in groove (modified IEV 806-03-16)

the length of plain groove that starts near the periphery of the record and the pitch of which is greater than the normal recording pitch

3.12

received surface (modified IEV 806-03-26)

the portion of the surface of a record on which the groove spacing is at normal recording pitch except on marker spaces, if any

3.13

marker space (IEV 806-03-29)

a portion of the recorded surface where the groove pitch has been increased to mark the separation of two successive bands of recording

3.14

lead-out groove (modified IEV 806-03-17)

the length of plain groove which succeeds the recorded surface, and the pitch of which is greater than the normal recording pitch

3.15

finishing groove (modified IEV 806-03-18)

the plain circular groove which succeeds the lead-out groove

3.16

tracking force

the static force between stationary record and reproducing stylus when in the playing position

4 Units and symbols

Unless otherwise stated, the letter symbols for quantities and units are in accordance with IEC Publication 27.

5 Drawings

Unless otherwise stated, the drawings are given in accordance with IEC and ISO standards. Amongst the most important of these are ISO Standards 406 and 1101.

6 Scales for graphical presentation of data

6.1 General

Linear or logarithmic scales are recommended for graphical presentation. Linear decibel scales are equivalent to logarithmic scales. Other kinds of scale, such as double logarithmic, should be avoided. When using decibel scales, the zero reference should, if possible, be the rated value. In those cases, where each of the scales refers directly to physical units, it is recommended to avoid a combination of linear and logarithmic scales.

Where quantities represented by abscissae and ordinates are of the same kind, it is recommended that the same unit length be used for both.

Linear scales with remote zero point should be avoided as far as possible.

For further information see IEC Publication 263.

6.2 Scales for frequency characteristics

Graphs should be drawn with frequency in hertz as abscissae on a logarithmic scale, and the level expressed in decibels as ordinates on a linear scale.

The scale ratio should be such that the length representing one decade of frequency is the same as the length representing 25 dB or 50 dB difference in level. The preferred length per decade is 50 mm.

If the size of the graph is changed, the scale ratio should be left unaltered.

Section 2. Compatibility between analogue audio disk records and reproducing equipment

7 The disk

7.1 Types of disk record

The following types of disk record shall be standard:

Type designation	Nominal diameter (cm)	Nominal speed (rev/min)
3033	30	33
2533	25	33
1733	17	33
3045	30	45
1745	17	45

7.2 Dimensions of disk

The dimensions for types 3033, 2533 and 3045 are shown in Figure 4, page 20.

The dimensions for types 1733 and 1745 are shown in Figure 5, page 21.

7.3 Unbalance of disk

The centre of gravity of disks having a small centre hole shall lie within an 8 mm diameter circle concentric with the centre of the centre hole.

7.4 Direction of rotation

The direction of rotation of the disk shall be clockwise when viewed from the side being reproduced.

7.5 Direction of recording

The direction of recording shall be such that, on reproduction, the pickup shall travel as closely as possible along a straight line towards the centre of the disk.

7.6 Speed of rotation

The speed of rotation during recording shall be within $\pm 0.5\%$ of the rated recording speed, the rated recording speed being such as to give the intended musical pitch at one of the following rated reproducing speeds:

33 $\frac{1}{3}$ rev/min: for disk record types 3033, 2533 and 1733,

45 rev/min: for disk record types 3045 and 1745.

NOTE Verification of reproducing speed by means of stationary stroboscopic bars in countries employing 50 Hz electric supplies can be made at 45.11 rev/min only (see Sub-clause 14.2.1).

8 The groove

8.1 Direction of groove modulation

The stereophonic groove shall carry two channels of information. The two channels shall be recorded in such a manner that they can be reproduced by movements of a reproducing stylus tip in two directions at 90° to each other, and at 45° to a radial line through the stylus tip and the centre of the record; these movements shall be tangential to, or lie in a plane through the stylus tip and the record centre, inclined at an angle of 20^{+5}_0 anticlockwise to the normal to the record surface through the stylus tip as viewed towards the record centre (vertical tracking angle). The resulting modulation shall be optimum for reproducing styli having a rake angle of between 0 and -5° (see Figure 1, page 17).

The monophonic groove shall carry one channel of information. It shall be recorded on both groove walls in such a manner that it can be reproduced by lateral movements of a stylus tip as described above.

8.2 Arrangement of stereophonic channels

8.2.1 Channel orientation

The right-hand channel, as viewed by the audience, shall be recorded on the outer groove wall, the left-hand channel on the inner groove wall.

8.2.2 Channel phasing

The phasing of the two recorded signals shall be suitable for reproduction on two-channel equipment so connected that movement of the reproducing stylus tip along the radial line through stylus tip and disk centre (as with a monophonic record) produces in-phase sound pressures at the left and right-hand loudspeakers.

8.2.3 Channel levels

The levels of the two recorded signals shall be suitable for reproduction on two-channel equipment, of identical channel gain, so connected that movement of the reproducing stylus along the radial line through the stylus tip and disk centre (as with a monophonic record) produces equal sound pressures at the left and right-hand loudspeakers.

8.2.4 Channel polarity

The polarity of the two recorded signals should preferably be suitable for reproduction on two-channel equipment so connected that movement of the reproducing stylus tip along the radial line through stylus tip and disk centre in a direction away from the disk centre shall produce compression in front of the left and right-hand loudspeakers similar to that produced by the live programme source.

8.3 Groove dimensions

Instantaneous top width:	0.030 mm minimum
Bottom radius:	0.008 mm maximum
Included angle:	$90 \pm 5^\circ$

8.4 Lead-in groove

The pitch of the lead-in groove shall be 1.2 ± 0.4 mm.

The minimum groove width shall be 0.050 mm.

8.5 Outer diameter of recorded surface

The recorded surface shall start with at least one turn of plain groove and have a maximum outer diameter of:

- 292.6 mm for types 3033 and 3045;
- 241.8 mm for type 2533;
- 168.3 mm for types 1733 and 1745.

8.6 Eccentricity of groove spiral

The distance of the centre of the groove spiral to the centre of the centre hole shall be not more than 0.2 mm.

8.7 Marker space

The pitch of the lead-over groove in a marker space shall be not greater than 1.6 mm.

A marker space shall not occur at a diameter of less than 127 mm.

8.8 Lead-out groove

The pitch of the lead-out groove shall be 6.4 ± 3.2 mm.

The top width of the lead-out groove shall increase to a minimum of 0.075 mm when the pitch exceeds 6.4 mm.

The lead-out groove shall have at least one turn.

8.9 Finishing groove

The diameter of the finishing groove shall be:

- 106.4 $\pm$ 0.8 mm for types 3033, 2533 and 3045;
- 97.4 $\pm$ 1.0 mm for types 1733 and 1745.

9 Label information

The label shall give at least the following information:

- a) Catalogue number.
- b) If more than one record, side number and total number of sides, for example Side 5 of 8.
- c) Programme title.
- d) Nominal speed of rotation.
- e) Type of recording.

If stereophonic, it shall be clearly marked with either the word “STEREO” or with the symbol $\odot$ as specified in IEC Publication 417 (reference 5071). Word and symbol may be used simultaneously.

If monophonic, it shall be clearly marked with either the word “MONO” or with the symbol ∇ as specified in IEC Publication 417 (reference 5070). Word and symbol may be used simultaneously.

10 Recording and reproducing characteristics

10.1 Recording characteristic

10.1.1 Statement of rated recording characteristic

The rated recording characteristic shall be a combination of the following three curves:

- one rising with increasing frequency in conformity with the admittance of a parallel combination of a capacitance and a resistance having a time constant of $t_1 = 75 \mu\text{s}$;
- one falling with decreasing frequency in conformity with the admittance of a series combination of a capacitance and a resistance having a time constant of $t_2 = 318 \mu\text{s}$;
- one rising with decreasing frequency in conformity with the impedance of a series combination of a capacitance and a resistance having a time constant of $t_3 = 3\,180 \mu\text{s}$.