

Magnetic tape sound recording and reproducing systems —

Part 5: Specification for electrical magnetic tape properties

**BS EN
60094-5:1994**

*Implementing
Amendment No. 1, not
published separately*

**BS 6288-5:
1989**

*Incorporating
Amendments Nos. 1
and 2*

IEC 94-5:1988

*Incorporating
Amendment 1:1996*

The European Standard EN 60094-5:1993 with the incorporation of amendment A1:1996 has the status of a British Standard

ICS 33.160.30

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW



Document Sharing Hub

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Equipment Standards Policy Committee (EEL/-) to Technical Committee EEL/22, upon which the following bodies were represented:

- 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

This British Standard, having been prepared under the direction of the Electronic Equipment Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 July 1989

© BSI 12-1998

The following BSI references relate to the work on this standard:
Committee reference EEL/22
Draft for comment 79/33117 DC

ISBN 0 580 17238 4

Amendments issued since publication

Amd. No.	Date of issue	Comments
6407	September 1991	
8126	March 1994	
9292	February 1997	Indicated by a sideline in the margin

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
Text of EN 60094-5	5
List of references	Inside back cover

National foreword

This British Standard has been prepared by Subcommittee EPL/100/2 (formerly EEL/22) and is the English language version of EN 60094-5:1993 *Magnetic tape sound recording and reproducing systems. Part 5 Electrical magnetic tape properties* including amendment A1:1996, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 94-5:1988 including Amendment 1:1996, published by the International Electrotechnical Commission (IEC). Agreement has been given to retain the cross-reference of this standard as Part 5 of the BS 6288 series for ease of reference in relation to other Parts of the series.

Reference to page numbers in the text relate to the IEC page numbers given in brackets at the bottom of each page.

BS 6288 consists currently of the following Parts:

- *Part 1 (BS EN 60094-1): Specification for general conditions and requirements;*
- *Part 2 (BS EN 60094-2): Calibration tapes;*
- *Part 3 (BS EN 60094-3): Methods of measuring the characteristics of recording equipment for sound on magnetic tape;*
- *Part 4 (BS EN 60094-4): Mechanical magnetic tape properties;*
- *Part 5 (BS EN 60094-5): Electrical magnetic tape properties;*
- *Part 6: Specification for reel-to-reel systems;*
- *Part 7 (BS EN 60094-7): Specification for cassettes for commercial tape records and domestic use;*
- *Part 8: Specification for eight track magnetic tape cartridge for commercial tape records and domestic use;*
- *Part 9: Specification for magnetic tape cartridge for professional use;*
- *Part 10: Specification for time and address codes;*
- *Part 11: Guide to and address code for compact cassettes.*

Cross-references

Publication referred to	Corresponding British Standard
EN 60094	BS EN 60094 <i>Magnetic tape sound recording and reproducing systems</i>
EN 60094-1:1993 (IEC 94-1:1981)	BS EN 60094-1:1994 (BS 6288-1:1994) <i>Specification for general conditions and requirements</i>
EN 60094-2:1995 ^a (IEC 94-2:1994)	BS EN 60094-2 (BS 6288-2:1995) <i>Calibration tapes</i>
EN 60094-7:1993 (IEC 94-7:1986)	BS EN 60094-7:1994 (BS 6288-7:1994) <i>Specification for cassettes for commercial tape records and domestic use</i>
EN 60651:1994 (IEC 651:1979)	BS EN 60651:1994 <i>Specification for sound level meters</i>
HD 311.6 S1:1986 (IEC 94-6:1985)	BS 6288 <i>Magnetic tape sound recording and reproducing systems</i> Part 6:1987 <i>Specification for reel-to-reel systems</i>
IEC 50 (806):1975	BS 4727 <i>Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms</i> Part 3 <i>Terms particular to telecommunications and electronics</i> Group 10:1979 <i>Recording and reproduction of sound and video terminology</i>

IEC 386:1972 BS 4847:1989 *Method of measurement of speed
fluctuations in sound recording and reproducing
equipment*

^a EN 60094-2:1993 has been superseded by EN 60094-2:1995.

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, the EN title page, pages 2 to 30, 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.

Descriptors: Sound recording, magnetic tape, electrical property

English version

Magnetic tape sound recording and reproducing systems Part 5: Electrical magnetic tape properties

(includes amendment A1:1996)
(IEC 94-5:1988 + A1:1996)

Systèmes d'enregistrement et de lecture du son
sur bandes magnétiques
Cinquième partie: Propriétés électriques des
bandes magnétiques
(inclut l'amendement A1:1996)
(CEI 94-5:1988 + A1:1996)

Systeme für Tonaufzeichnung und -wiedergabe
auf Magnetband
Teil 5: Elektrische Eigenschaften von
Magnetbändern (enthält Änderung A1:1996)
(IEC 94-5:1988 + A1:1996)

This European Standard was approved by CENELEC on 1993-09-22; amendment A1 was approved by CENELEC on 1996-03-05. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

As a consequence of the IEC-CENELEC Agreement, HD 311.5 S1:1989 (IEC 94-5:1988) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The text of the International Standard was approved by CENELEC as EN 60094-5 on 22 September 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-10-01
- latest date of withdrawal of conflicting national standards (dow) —

Annexes designated “normative” are part of the body of the standard. In this standard, Annex ZA is normative.

Foreword to amendment A1

The text of document 60A/178/FDIS, future amendment 1 to IEC 94-5:1988, prepared by SC 60A (transformed into SC 100B, Recording, of IEC TC 100, Audio, video and multimedia systems and equipment), was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 60094-5:1993 on 1996-03-05.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-12-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1996-12-01

Contents

	Page
Foreword	2
Section 1. General	
1.1 Scope	5
1.2 Object	5
Section 2. Technical requirements and information concerning testing conditions	
2.1 Standard atmospheric conditions	5
2.2 Mechanical characteristics of tape transports	5
2.3 Electrical characteristics of test equipment	6
2.4 Calibration tape	7
2.5 Reference tape	7
2.6 Bias	8
2.6.1 Reference bias	9
2.6.2 Conventional test bias	9
Section 3. Parameters to be measured	
3.1 Bias ratio	11
3.2 Maximum output level	11
3.3 Relative tape sensitivity	14
3.4 Reference level to bias noise ratio	14
3.5 Signal to bias noise ratio	15
3.6 Reference level to d.c. noise ratio	15
3.7 Reference level to print ratio	16
3.8 Erasing attenuation	17
3.9 Uniformity variations	18
3.10 Drop-out annoyance	18
Section 4. Information to be supplied by the magnetic tape manufacturer	
4.1 Recommended form for published data	21
Appendix A Equipment noise correction	25
Appendix B Measuring means	26
Appendix C Intermodulation distortion measuring equipment	28
Annex ZA (normative) Other international publications quoted in this standard with the references of the relevant European publications	29
Figure 1 — Output signal spectrum	12
Figure 2 — Input signal spectrum	12
Figure 3 — Output signal spectrum	13
Figure 4 — Characteristics of high-pass filter for d.c. noise measurement	16
Figure 5 — Circuit for d.c. noise measurement	16
Figure 6	19
Figure A1 — Subtracting noise powers	25

	Page
Table I — Rated tape speeds	5
Table II — Type of head	6
Table III — IEC primary reference tapes	8
Table IV — Table of maximum output levels specified for domestic IEC primary reference tapes	10
Table V	21
Table VI — Recommended parameters to be quoted in published data for professional tapes 6.30 mm wide	22
Table VII — Recommended parameters to be quoted in published data for domestic tape and unrecorded tape used for commercial tape records (6.30 mm wide)	23
Table VIII — Recommended parameters to be quoted in published data for domestic tape and unrecorded tape used for commercial tape records (3.81 mm wide)	24

Section 1. General

1.1 Scope

This standard applies to non-perforated magnetic tape used for professional and domestic analogue sound recording and reproduction.

1.2 Object

The object of this standard is to list and define the characteristics, methods of measurement and equipment necessary to determine the electrical properties of magnetic tapes. It will also enable users of magnetic tapes to compare the technical product data of different manufacturers, produced in accordance with this standard.

Section 2. Technical requirements and information concerning testing conditions

2.1 Standard atmospheric conditions

Ambient temperature

$$\boxed{20 \begin{smallmatrix} + 5 \\ - 5 \end{smallmatrix}} \text{ } ^\circ\text{C}$$

Relative humidity

$$\boxed{60 \pm 15} \text{ } \%$$

Where necessary the tests shall be preceded by a period of conditioning to ensure that the test specimen has reached equilibrium with the environment.

2.2 Mechanical characteristics of tape transports

a) Tape speed

The tape transports shall be capable of operating at the mandatory rated tape speed specified in Table I.

Table I — Rated tape speeds

Tape application	Speed (cm/s)
Professional 6.30 mm wide tapes	$38.1 \pm 0.2\%$
Domestic 6.30 mm wide tapes	$9.53 \pm 0.2\%$
Domestic 3.81 mm wide tapes	$4.76 \pm 0.2\%$

Other tape speeds may be required when additional optional information is given.

The tape speed fluctuations (wow and flutter) shall be not more than 0.15 % when measured in accordance with IEC Publication 386.

b) Tape widths

Tape transports shall be capable of accommodating tape widths of 6.30 mm and/or 3.81 mm with tolerances as specified in IEC Publication 94-1.

In addition tape transports may be used to accommodate the other tape widths and track allocations specified in IEC Publication 94-1 or IEC Publications 94-6 to 94-9.

c) Tape guides

Tape guides shall be such as to ensure stability of measurement without affecting the inherent characteristics of the tape.

d) Tape tensions

The tape tensions at the recording and replay heads shall be 1.0 ± 0.4 N for 6.30 mm wide tapes and 0.5 ± 0.2 N for 3.81 mm wide tapes.

It is recommended that pressure pads should not be used.

e) Heads

For details see Table II and Appendix B.

Table II — Type of head

Type of tape	Erase All tests	Record All tests		Replay All tests			Country of origin
	Track configuration	Track configuration	Gap length (μm)	Gap length (μm)	Track configuration	Relative part of IEC Publication 94	
Professional 6.30 mm wide	Full width	Full width	7 (A) 18 (B)	3 (A)	Two track two channel Nos. 1 and 2	6 Figure 8	Germany
Domestic 6.30 mm wide	Full width	Full width	7 (A)	2 (N)	Four tracks two channels Nos. 1 and 3	6 Figure 9	Germany
Domestic 3.81 mm wide	Full width	Full width	4 (A) 1.5 (B)	1 (N)	Four tracks two channels Nos. 1 and 2	7 Figure 1	Japan

A = mandatory

B = optional (for use when additional information is given at the discretion of the tape manufacturer)

N = not specified

f) Tape wrap

The total angular displacement of the tape around the head. The tape wrap shall be $6 \pm 2^\circ$ (0.105 ± 0.035 rad) around each head.

The heads shall be set or adjustments provided so that:

- i) the face of the head contacting the tape is parallel to the corresponding faces of the guides;
- ii) the head is positioned so that the tape wrap is symmetrical with respect to the gap;
- iii) the head gap alignment can be set accurately and rigidly. If the tape under test has a coating thickness greater than that of the reference tape being used, the wrap symmetry with respect to the gap shall be adjusted for maximum short wavelength response.

2.3 Electrical characteristics of test equipment

a) Reproducing characteristic

The reproducing characteristic of the test equipment used shall give a flat frequency response when reproducing the relevant calibration tape specified in IEC Publication 94-2.

b) Recording characteristic

The recording chain shall be adjusted to obtain constant current in the recording head over the specified audio-frequency range.

The third harmonic distortion of both recording and reproducing chains shall be less than 0.02 % throughout the measuring range, for signal levels which enable the maximum output level to be obtained from the tape under test.

The weighted system noise (including hum) generated by the recording and reproducing chains should be at least 12 dB below the combined value of weighted system and tape noise.

If this condition cannot be achieved a corrected noise value may be derived from the equipment noise correction curve (see Appendix A).

c) Bias and erase requirements

The signal applied to the bias and erase heads shall be equal to a frequency of 80 kHz or higher with an even harmonic distortion content of less than 0.05 %.

A higher bias frequency is necessary when optional measurements are made at duplicating tape speeds.

d) Output level meter

The meter used for all measurements shall be of the r.m.s. (square law) type specified in IEC Publication 651.