

Helical-scan video tape cassette system using 12.65 mm (0.5 in) magnetic tape on type VHS —

Part 1: VHS and compact VHS video cassette system

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UDC 621.397.454

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This British Standard, having been prepared under the direction of the Electronic Equipment Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 July 1994

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First published February 1984
Second edition July 1994

The following BSI references relate to the work on this standard:
Committee reference EEL 22
Draft for comment 92 22010 DC

ISBN 0 580 23388 X

Amendments issued since publication

Amd. No.	Date	Comments

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National foreword

This Part of BS EN 60774 has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 60774-1:1994 *Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type VHS — Part 1: VHS and compact VHS video cassette system*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 774-1:1994 published by the International Electrotechnical Commission (IEC). For ease of publication, some of the figures also include the French text. This standard supersedes BS 6482:1984, which is withdrawn.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 44, 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: Electroacoustics, electroacoustic equipment, video recording, magnetic recording, video tape recorders, magnetic tapes, cassettes for magnetic tapes, recording characteristics, mechanical properties, electrical properties, dimensions, interchangeability

English version

Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type VHS Part 1: VHS and compact VHS video cassette system

(IEC 774-1:1994)

Système de magnétoscope à cassette à
balayage hélicoïdal utilisant la bande
magnétique de 12,65 mm (0,5 in) de format
VHS
Partie 1: Système de cassette vidéo VHS et
VHS compacte
(CEI 774-1:1994)

Video-Bandkassettensystem mit
Schrägschraufzeichnung auf Magnetband
12,65 mm (0,5 in) VHS-Format
Teil 1: VHS- und kompaktes VHS
Video-Kassettensystem
(IEC 774-1:1994)

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CENELEC

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

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Foreword

The text of document 60B(CO)150, as prepared by Sub-Committee 60B: Video recording, of IEC Technical Committee 60: Recording, was submitted to the IEC-CENELEC parallel vote in April 1993.

The reference document was approved by CENELEC as EN 60774-1 on 8 December 1993.

This European Standard replaces HD 463 S1:1987.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-01-01
- latest date of withdrawal of conflicting national standards (dow) 1995-01-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this standard, Annex A, Annex B, Annex C and Annex ZA are normative and Annex D and Annex E are informative.

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Section 1. General

1.1 Scope

This part of IEC 774 is applicable to the basic VHS and compact VHS video cassette system. Compact VHS video cassette is used just like the normal VHS video cassette with the aid of a cassette adaptor (see Annex D for an example of a compact video cassette adaptor) for recording and/or reproducing video and audio signals in accordance with the system defined in this standard. This standard defines the electrical and mechanical parameters and the necessary characteristics of the VHS and the compact VHS video cassette system. The requirements relate to the 525 line-60 field and 625 line-50 field TV systems. Equipment manufactured according to this standard and tapes recorded following this standard, provide the necessary interchangeability of recorded video cassettes.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 774. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 774 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 94-1:1981, *Magnetic tape sound recording and reproducing systems — Part 1: General conditions and requirements*.

IEC 756:1991, *Non-broadcast video tape recorders — Time base stability*.

IEC 1041-1:1990, *Non-broadcast video tape recorders — Methods of measurement — Part 1: General video (NTSC/PAL) and audio (longitudinal) characteristics*.

IEC 1041-3:199x, *Non-broadcast video tape recorders — Methods of measurement — Part 3: Audio characteristics for FM recording* (in preparation).

IEC 1054:1991, *Helical-scan video tape cassette system using 12,65 mm (0,5 in) magnetic tape on type VHS-FM audio recording*.

IEC 1105:1991, *Reference tapes for video tape recorder systems*.

1.3 Environment

Tests and measurements made on the system to check the requirements of this standard shall be carried out under the following conditions:

Temperature: $20\text{ °C} \pm 1\text{ °C}$

Relative humidity: $(50 \pm 2)\%$

Barometric pressure: 86 kPa to 106 kPa.

Section 2. VHS video tape cassette

2.1 Mechanical parameters

2.1.1 Cassette dimensions

The dimensions of the cassette shall be in accordance with Figure 1 to Figure 4.

2.1.2 Reel dimensions

The dimensions of reels shall be in accordance with Figure 5.

2.1.3 Tape winding and tape path

The tape winding and the tape path shall be in accordance with Figure 6. The E value of the tape pack shall be greater than 1,5 mm. See note 4 of Figure 4, for E value.

2.1.4 Unlocking of front cover

The unlocking of the front cover shall be accomplished when a force no greater than 0,15 N is applied to the cover unlocking pin, as shown in note 8 of Figure 1.

2.1.5 Opening of front cover

The force necessary to open the front cover as shown in note 3 of Figure 3, shall be less than 1 N.

2.1.6 Releasing of reel brake

The reel brake shall be released by the reel brake unlocking pin as shown in note 4 of Figure 3, with a force less than 0,7 N.

2.1.7 Reel spring

The reels in the cassette shall be pushed down by the reel spring with a force of $1,6^{+0,4}_{-0,2}$ N, with the reels in the position indicated in Figure 4.

Section 3. Compact VHS video cassette

3.1 Mechanical parameters

3.1.1 Cassette dimensions

The dimensions of the compact VHS video cassette shall be in accordance with Figure 7 to Figure 12. The cassette dimensions are given for two types of front covers, with and without a front cover locking structure.

3.1.2 Front cover

3.1.2.1 Front cover with a locking structure

The front cover with a locking structure is shown in Figure 13. With this type of cassette, a permanent spring force is used to keep the front cover shut. The forces F_1 and F_2 necessary to open the front cover with the lock released, as defined in note 1 of Figure 13, shall be as follows:

$$0,1 \text{ N} \leq F_1 \leq 0,25 \text{ N}$$

$$0,05 \text{ N} \leq F_2 \leq 0,2 \text{ N}$$

Even when the front cover is locked, it shall be forcibly released with a force F_3 of less than 0,8 N applied to the unlocking position, as indicated in note 3 of Figure 13. The unlocking pin shall be pushed to the unlocking position indicated in note 4 of Figure 13 with a force F_4 less than 0,8 N. The unlocking pin shall be pushed to the surface of the cassette side wall with a force F_5 less than 3 N (see note 6 of Figure 13).

3.1.2.2 Front cover without a locking structure

The front cover without a locking structure is shown in Figure 14. The front cover has two stable positions, completely closed and completely open. The front cover shall open or close by itself when it is within an angle of 20° of its completely open or completely closed position as indicated in note 1 of Figure 14. The forces F_1 and F_2 necessary to open and close the front cover as shown in Figure 14 shall be as follows:

$$0,05 \text{ N} \leq F_1 \leq 0,2 \text{ N}$$

$$0,05 \text{ N} \leq F_2 \leq 0,2 \text{ N}$$

3.1.3 Reel dimensions and brake force

The dimensions of the reel shall be in accordance with Figure 15 and Figure 16. The tape shall be pulled out with the following force as shown in note 3 of Figure 15, and note 2 of Figure 16, with the brake engaged:

Supply reel: $0,4 \text{ N} \leq F \leq 1,5 \text{ N}$

Take-up reel: $0,05 \text{ N} \leq F \leq 3 \text{ N}$

3.1.4 Tape winding and tape path

The tape winding and tape path shall be in accordance with Figure 17.

3.1.5 E value

The E values l_1 and l_2 are shown in note 1 and note 2 of Figure 17 and shall each be greater than 0,7 mm.

NOTE E value is the radial clearance between the outer edge of the wound tape and the edge of the reel flange.

3.1.6 Guide rollers

Guide rollers shall be provided as shown in Figure 17. The inclination of all rollers shall be within 0,1 mm.

3.1.7 Reel spring force

The reels in the cassette, as shown in note 4 of Figure 18, shall be pushed down by a reel spring with the following forces:

Supply reel:	$1,6 \text{ N} \pm 0,4 \text{ N}$
Take-up reel:	$0,7 \begin{smallmatrix} +0,3 \\ -0,2 \end{smallmatrix} \text{ N}$

3.1.8 Positioning screw of take-up reel

The deviation of the centre of the positioning screw head shall be less than 0,05 mm from the take-up reel axis (see Figure 18).

Section 4. Tape characteristics of VHS and compact VHS cassette

4.1 Dimensions of the video tape

4.1.1 Magnetic tape thickness

The maximum thickness of the magnetic tape, including the coating, shall be 20,0 μm . See Annex A for alternative thicknesses of VHS cassette and Annex B for compact VHS cassette respectively.

4.1.2 Magnetic tape width

The width of the magnetic tape shall be $12,65 \text{ mm} \pm 0,01 \text{ mm}$.

4.1.3 Magnetic tape length

For the length of the magnetic tape of VHS cassette, see Annex A, and Annex B for compact VHS cassette.

4.2 Magnetic tape properties

4.2.1 Type of magnetic tape

The type of magnetic tape to be used shall be high-resolution magnetic tape (for example cobalt iron oxide tape).

4.2.2 Magnetic orientation

The magnetic coating shall be longitudinally oriented.

4.2.3 Coercivity

The coercivity shall be approximately $50 \times 10^3 \text{ A/m}$.

4.3 Reference tape

The reference tape numbered VRT-2 is applicable. Details are described later in Annex C.

4.4 Leader tape and trailer tape

4.4.1 Automatic stop

The light transmittance of the leader and trailer tape shall be at least 50 % for VHS cassette and more than 70 % for compact VHS cassette respectively in order to ensure that the automatic stopping device of the machine functions properly at both ends of the magnetic tape.

4.4.2 Dimensions of the leader and trailer tape (VHS cassette)

Leader and trailer tape length shall lie between 130 mm and 190 mm. As for exact length, which is dependent on hub size used, see Annex A.

Leader and trailer tape thickness shall be $40 \begin{smallmatrix} +5 \\ -25 \end{smallmatrix} \mu\text{m}$ and the width shall be $12,65 \text{ mm} \pm 0,03 \text{ mm}$.

4.4.3 Dimensions of the leader and trailer tape (compact VHS cassette)

The leader and trailer tape length shall be $80 \text{ mm} \pm 5 \text{ mm}$ and $110 \text{ mm} \pm 5 \text{ mm}$ respectively.

The leader and trailer tape thickness shall be $20 \begin{smallmatrix} +2 \\ -6 \end{smallmatrix} \mu\text{m}$ and the width shall be $12,65 \text{ mm} \pm 0,03 \text{ mm}$.

4.4.4 Splicing

The splice and the attachment of the leader and trailer tape to the hub shall be capable of resisting a force of 30 N. The splicing gap shall be less than 0,07 mm.

4.5 Amount of tape remaining

The window and the upper flange of the supply reel shall be transparent to indicate the amount of tape remaining.

Section 5. Video cassette recorders

5.1 Tape speed

TV system	Standard speed mm/s	Tolerances %
525 line-60 field	33,35	$\pm 0,5$
625 line-50 field	23,39	$\pm 0,5$

5.2 Drum diameter

The drum diameter shall be 62,00 mm $\pm$ 0,01 mm.

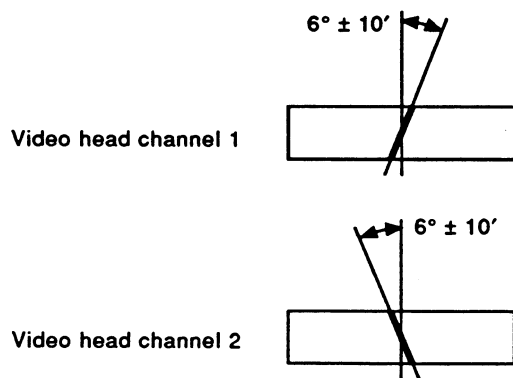
NOTE Different dimensions of drum diameter are also possible as far as the track configuration and dimensions are in accordance with Figure 19 and Table 2.

5.3 Tape tension

The tape tension during recording and reproducing shall be between 0,30 N and 0,45 N, measured at the entrance of the drum.

5.4 Inclined azimuth angle

The gap line of video heads shall be slanted in accordance with the figure below.



5.5 Track configuration and dimensions

5.5.1 Record locations

The track configuration and dimensions shall be in accordance with Figure 19 and Table 2.

5.5.2 Switching position and video signal overlap

The switching position between the two video heads shall lie between five and eight horizontal scanning lines ahead of the front edge of the vertical synchronizing pulse. The minimum overlap of the two video heads shall be three horizontal lines.

5.5.3 Relations of video track and video signal field

The track used for the first field of the recorded video signal is not specified. However, recorders which can distinguish between fields shall record the first field on the channel 1 track.

Section 6. Recording characteristics

6.1 FM recording of luminance component

6.1.1 Low-pass filter

The luminance component of the composite video signal shall be separated by a low-pass filter, the attenuation of which is greater than 40 dB at the chrominance sub-carrier frequency.

6.1.2 Pre-emphasis and clipping

The luminance signal shall be pre-emphasized and clipped prior to frequency modulation. The characteristics of the pre-emphasis network measured without the low-pass filter are shown in Figure 23, and clipping levels are shown below. The level from sync tip to peak white is 100 %.

White clipping level: (160^{+10}_{-5}) % measured from sync tip.

Dark clipping level: (40 ± 10) % measured from sync tip.

6.1.3 Modulation characteristics

FM carrier frequencies corresponding to reference video levels shall be as shown in the following Table 1.

Table 1 — FM carrier frequency

	525 line-60 field	625 line-50 field
Reference white level	4,4 MHz $\pm$ 0,1 MHz	4,8 MHz $\pm$ 0,1 MHz
Reference sync level	3,4 MHz $\pm$ 0,1 MHz	3,8 MHz $\pm$ 0,1 MHz
Frequency deviation, white to sync	1,0 MHz $\pm$ 0,1 MHz	1,0 MHz $\pm$ 0,1 MHz

6.1.4 FM high-pass filter

The amplitude frequency response of the FM high-pass filter shall be in accordance with Figure 22.

6.1.5 Recording level

The recording current shall have the optimum value at all frequencies within the entire FM carrier range, as defined in Table 1.

NOTE Optimum record current is the recording current value which is necessary to obtain the maximum output signal level during playback.

6.2 NTSC chrominance signal recording

6.2.1 Recording method

The chrominance signal is separated from the NTSC colour video signal through a band-pass filter with a centre frequency of 3,58 MHz and -3 dB points at ± 500 kHz.

The separated chrominance component shall be then down-converted so that its new carrier frequency equals 40 times the horizontal scanning rate. This recording process is illustrated in Figure 20 and explained in 6.2.2.

6.2.2 Phase rotation of the chrominance signal

The chrominance signal of channel 1 track shall be phase advanced by 90° at every horizontal sync interval. The chrominance signal of channel 2 track shall be phase retarded by 90° at every horizontal sync interval. Phase shift should be completed prior to the colour burst. Channel 1 and channel 2 are specified in clause 5.4.

6.2.3 Recording level

The chrominance signal is recorded with the FM signal acting as bias. Its record level should be adjusted so that the playback level is 7 dB to 10 dB below the level corresponding to the saturation record level of this chrominance signal with the optimum FM bias current.

NOTE The saturation record level of the unmodulated chrominance carrier is reached when the play-back level no longer increases with increase in record current.

6.2.4 Colour burst amplitude doubler

The amplitude of the colour burst shall be increased by $(6 \pm 0,5)$ dB prior to recording.

6.3 PAL chrominance signal recording

6.3.1 Recording method

The chrominance signal is separated from the PAL colour video signal through a band-pass filter with a centre frequency of 4,43 MHz and -3 dB points at ± 500 kHz.

The separated chrominance component shall be then down-converted so that its new carrier frequency equals 40 times the horizontal scanning rate plus 1,953 kHz (626,953 kHz).

This recording process is illustrated in Figure 20, and explained in 6.3.2.

6.3.2 Phase rotation of the chrominance signal

The chrominance signal of channel 2 track only shall be phase-retarded by 90° at every horizontal sync interval. The channel 1 track remains at 0° . Phase shift should be completed prior to the colour burst. Channel 1 and channel 2 are specified in clause 5.4.

6.3.3 Recording level

The chrominance signal is recorded with the FM signal acting as bias. Its record level should be adjusted so that the playback level is 7 dB to 10 dB below the level corresponding to the saturation record level of this chrominance signal with the optimum FM bias current.

NOTE The saturation record level of the unmodulated chrominance carrier is reached when the play-back level no longer increases with increase in record current.

6.4 SECAM chrominance signal recording

6.4.1 Recording method

The chrominance signal is separated from the SECAM colour video signal through a band-pass filter with a centre frequency of 4,32 MHz and -3 dB points at ± 800 kHz.

The separated chrominance component shall be counted down so that the frequency of the recorded chrominance signal becomes a quarter of the input chrominance frequency. This recording process is illustrated in Annex E, Figure E1. An alternative method of SECAM chrominance signal recording is illustrated in Figure E2.

6.4.2 Recording level

The chrominance signal is recorded with the FM signal acting as bias. Its record level should be adjusted so that the play-back level is 7 dB to 10 dB below the level corresponding to the saturation record level of this chrominance signal with the optimum FM bias current.

NOTE The saturation record level of the unmodulated chrominance carrier is reached when the play-back level no longer increases with increase in record current.

6.5 Audio signal recording

6.5.1 Recording level

The recorded reference audio level shall be 100 nWb/m.

6.5.2 De-emphasis characteristics

The recording and reproducing characteristics of the audio signal, as defined in section 3 of IEC 94-1 shall make use of the following time constants.

$$t_1: \quad 120 \mu\text{s}$$

$$t_2: \quad 3\,180 \mu\text{s}$$

6.6 Control signal recording

6.6.1 Recording signal

A positive going edge of the recorded control pulse signal shall be coincident with the start of channel 1 track scanning as shown in Figure 24. Channel 1 and channel 2 video tracks are specified in clause 5.4.

6.6.2 Polarity

The control head pole tip nearest to the video drum assembly shall be north polarized when the control signal pulse is positive.

6.6.3 Recording current wave-form

The rise time shall be less than 200 μ s.

Table 2 — Track configuration (see Figure 19)

Dimensions in millimetres

		525 line-60 field	625 line-50 field
<i>A</i>	Tape width	$12,65 \pm 0,01$	$12,65 \pm 0,01$
<i>B</i>	Total video width	10,60	10,60
<i>W</i>	Effective video width (180°)	10,07	10,07
<i>L</i>	Videotrack centre from reference edge of the tape	6,2	6,2
<i>P</i>	Video track pitch	0,058	0,049
<i>T</i>	Video track width	0,058	0,049
<i>C</i>	Control track width	$0,75 \pm 0,1$	$0,75 \pm 0,1$
<i>R</i>	Audio track width (monophonic)	$1,0 \pm 0,1$	$1,0 \pm 0,1$
<i>D</i>	Audio track (channel 2) width (stereophonic-right)	$0,35 \pm 0,05$	$0,35 \pm 0,05$
<i>E</i>	Audio track (channel 1) width (stereophonic-left)	$0,35 \pm 0,05$	$0,35 \pm 0,05$
<i>F</i>	Audio track reference line	$11,65 \pm 0,05$	$11,65 \pm 0,05$
<i>h</i>	Audio to audio track guard band width	$0,3 \pm 0,05$	$0,3 \pm 0,05$
θ	Video track angle	5°58'09,9"	5°57'50,3"
θ_0	Video track angle (tape stationary)	5°56'07,4"	5°56'07,4"
<i>X</i>	Position of audio and control head	79,244	79,244
NOTE Where tolerances are not given, the quoted values are nominal.			