

Helical-scan digital video cassette recording system using 12,65 mm (0,5 in) magnetic tape — Format HD-D5 —

Part 1: VTR specifications

The European Standard EN 62330-1:2004 has the status of a British Standard

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National foreword

This British Standard is the official English language version of EN 62330-1:2004. It is identical with IEC 62330-1:2003.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio, video and multimedia systems, which has the responsibility to:

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**Helical-scan digital video cassette recording system
using 12,65 mm (0,5 in) magnetic tape -
Format HD-D5
Part 1: VTR specifications
(IEC 62330-1:2003)**

Système de magnétoscope numérique
à cassette à balayage hélicoïdal
sur bande magnétique
de 12,65 mm (0,5 in) -
Format HD-D5
Partie 1: Spécifications du magnétoscope
(CEI 62330-1:2003)

Videokassettensystem
mit Schrägspuraufzeichnung
auf Magnetband 12,65 mm (0,5 in) -
HD-D5-Format
Teil 1: VTR-Festlegungen
(IEC 62330-1:2003)

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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

The text of the International Standard IEC 62330-1:2003, prepared by Technical Area 6: Higher data rate storage media and equipment, of IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the formal vote and was approved by CENELEC as EN 62330-1 on 2004-03-01 without any modification.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-03-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62330-1:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60735	NOTE	Harmonized as EN 60735:1991 (not modified).
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HELICAL-SCAN DIGITAL VIDEO CASSETTE RECORDING SYSTEM USING 12,65 mm (0,5 in) MAGNETIC TAPE – FORMAT HD-D5 –

Part 1: VTR specifications

1 Scope

This part of IEC 62330 specifies the content, format, and recording method of the data blocks containing HD compressed video data defined in part 2, audio, and associated data which form the helical records on 12,65 mm (0,5 in) tape in cassettes as specified in IEC 61835.

In addition, this standard specifies the content, format, and recording method of the longitudinal record containing tracking information for the scanning head associated with the helical records, and also the longitudinal cue audio, and time and control code.

One video channel of HD compressed video data and four independent audio channels are recorded in the digital format. Each of these channels is designed to be capable of independent editing.

The HD compressed video data are derived from the following HD video signal:

- 1080 line / 59,94 Hz field frequency interlace system
- 720 line / 59,94 Hz frame frequency progressive system

Figure 1 and Figure 2 show block diagrams of the processes involved in the recorder.

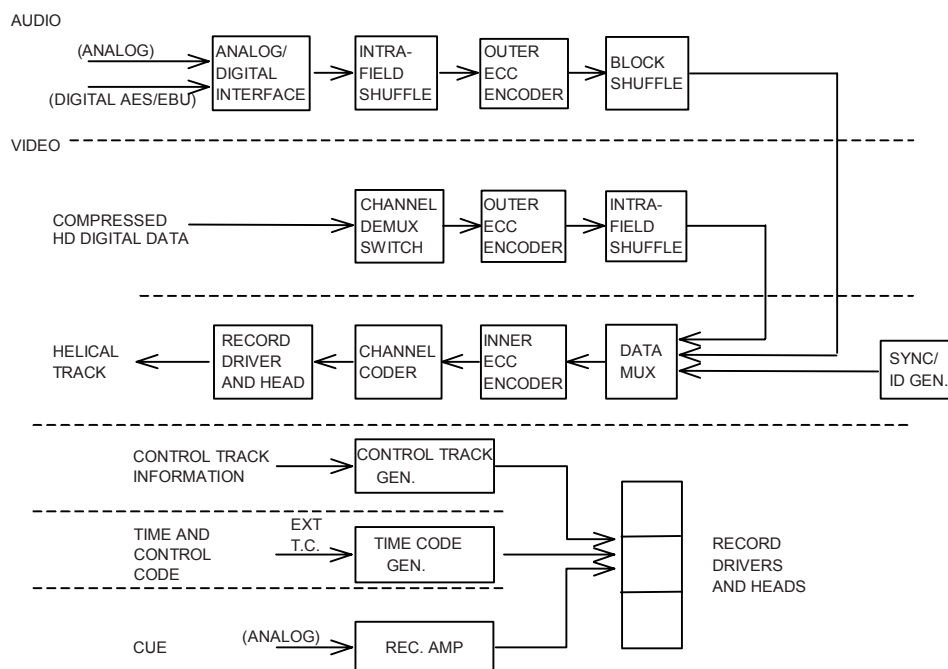


Figure 1 – Record block diagram

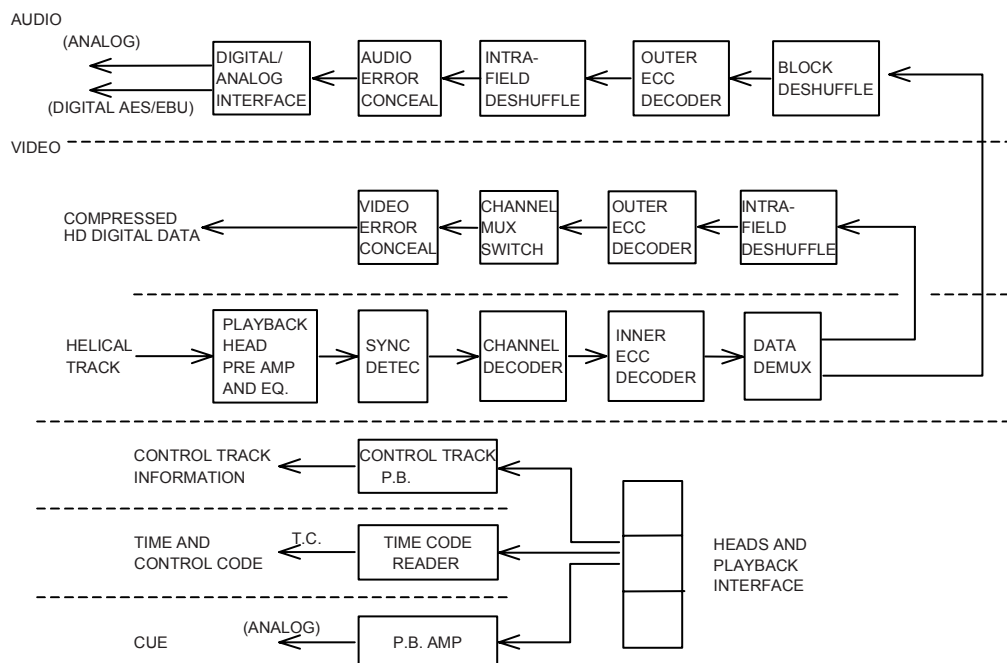


Figure 2 – Playback block diagram

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60461:2001, *Time and control code for video tape recorders*

IEC 60958, *Digital audio interface*

IEC 61835, *Helical-scan digital component video cassette recording system using 12,65 mm (0,5 in) magnet tape – Format D-5*

ITU-R BS. 647 *A digital audio interface for broadcasting studios*

SMPTE RP 155:1995, *Audio levels and Indicators for Digital Audio Records on Digital Television Tape Recorders*

3 Environment and test conditions

3.1 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 °C $\pm$ 1 °C
Relative humidity	(50 $\pm$ 2) %
Barometric pressure	from 86 kPa to 106 kPa
Tape conditioning	not less than 24 h
Centre tape tension	0,31 N $\pm$ 0,05 N (see Annex A)

3.2 Reference tape

Blank tape for reference recordings should be available from any source meeting the tape characteristics as portrayed by this standard.

3.3 Calibration tape

The calibration tapes meeting the requirements of 3.3.1 and Clause 4 should be available from manufacturers who produce DTTRs and players in accordance with this standard.

3.3.1 Record locations and dimensions

Tolerances shown in Table 1 will be reduced by 50 %.

3.3.2 Calibration signals

Two sets of signals should be recorded on the calibration tape:

- a) Video: 100 % colour bars
- Audio: 1 kHz tone at 20 dB below full scale on each of audio channels
- Cue: 1 kHz tone at reference level; 10 kHz tone at reference level

- b) A signal of constant recorded frequency (i.e. one-half the Nyquist frequency) shall be recorded only on tracks of field 0, segment 0 for the purpose of mechanical alignment. Recording level should conform to 6.6.3.

4 Video tape

4.1 Base

The base material shall be polyester or equivalent.

4.2 Width

The tape width shall be 12,650 mm $\pm$ 0,008 mm.

The tape, covered with glass, is measured without tension at a minimum of five different positions along the tape using a calibrated comparator having an accuracy of 0,001 mm (1 μ m). The tape width is defined as the average of the five readings.

4.3 Width fluctuation

Tape width fluctuation shall not exceed 5 μ m peak to peak. Measurement of tape width fluctuation shall be taken over a tape length of 900 mm. The value of tape width fluctuation shall be evaluated by measuring the tape width at 10 points, each separated by a distance of 100 mm.

4.4 Tape thickness

Two types of tape thickness shall be permitted by this standard. The first tape thickness shall be 10,2 μ m to 11,0 μ m (referred to as 11 μ m); the second tape thickness shall be 13,0 μ m to 14,0 μ m (referred to as 14 μ m).

4.5 Transmissivity

Transmissivity shall be less than 5 %, measured over the range of wavelengths 800 nm to 900 nm.

4.6 Offset yield strength

The offset yield strength shall be greater than 9 N for 11 μ m tape and 10 N for 14 μ m tape. The force required to produce 0,2 % elongation of a 1 000 mm test sample with a pull rate of a 10 mm per minute shall be used to confirm the offset yield strength. The line beginning at 0,2 % elongation parallel to the initial tangential slope is drawn and then read at the point of intersection of the line and the stress-strain curve.

4.7 Magnetic coating

The magnetic layer of the tape shall consist of a coating of metal particles or equivalent.

4.8 Coating coercivity

The coating coercivity shall be a class 1 800 (144 000 A/m) with an applied field of 400 000 A/m (5 000 Oe) as measured by a 50 Hz or 60 Hz B-H meter or vibrating sample magnetometer (VSM).

4.9 Particle orientation

The metal particles shall be longitudinally oriented.

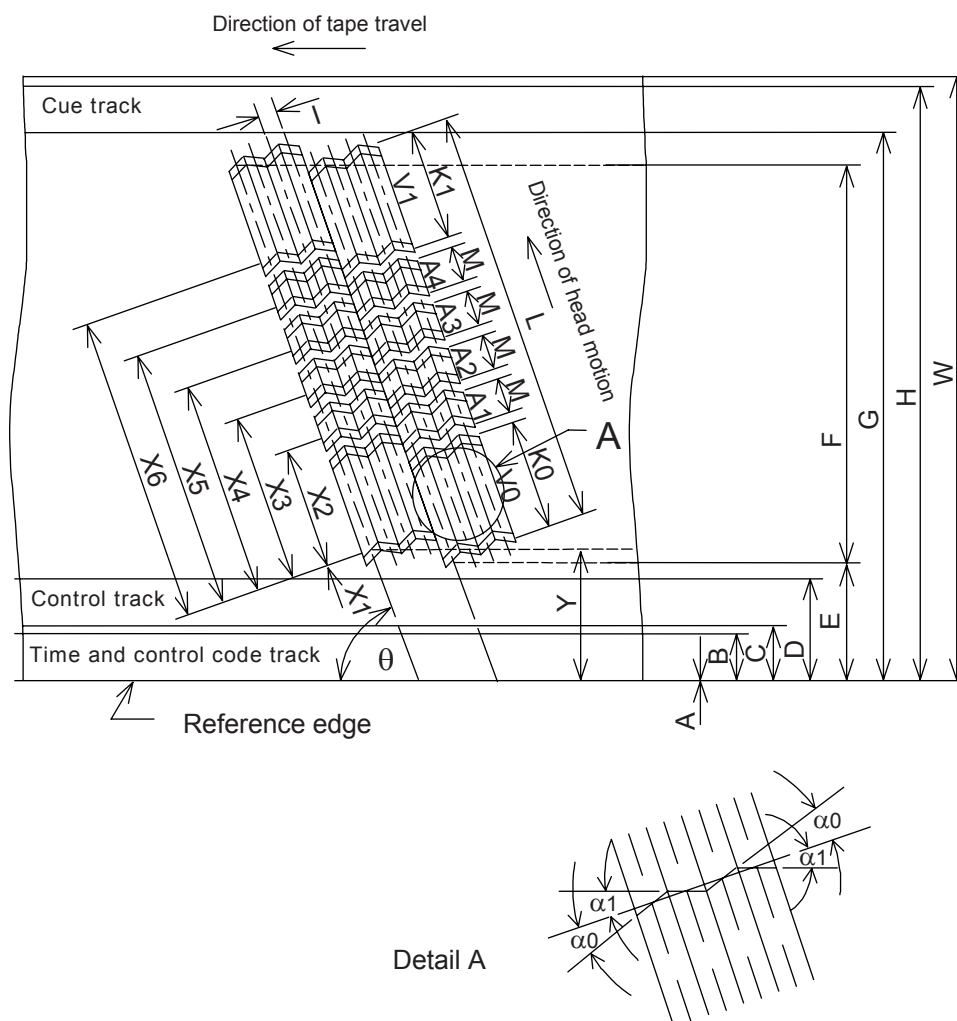
5 Helical recordings

5.1 Tape speed

The tape speed shall be 167,228 mm/s. The tolerance shall be $\pm 0,2\%$.

5.2 Record location and dimensions

- 5.2.1** The format requires full-width erasure for continuous recording and flying erasure for insert editing.
- 5.2.2** Record location and dimensions for continuous recording shall be as specified in Figure 3, Figure 4 and Table 1. In recording, sector locations on each helical track shall be contained within the tolerance specified in Figure 3 and Table 1.
- 5.2.3** The reference edge of the tape for record location dimensions specified in this standard shall be the lower edge as shown in Figure 3. The magnetic coating, with the direction of tape travel as shown in Figure 3, is on the side facing the observer (measuring techniques are shown in Annex B).
- 5.2.4** As indicated in Figure 3, this standard anticipates a zero guard band between recorded tracks, and the record head width should be equivalent to the track pitch of 20 μm . The scanner head configuration should be chosen so that the recorded track widths are contained within the limits of 18 μm to 22 μm .
- 5.2.5** In insert editing, this standard provides a guard band of 2 μm (nominal) between the previously recorded track and the inserted track at editing points only. A typical track pattern for insert editing is shown in Figure C.1.



NOTE 1 A1, A2, A3, and A4 are audio sectors.

NOTE 2 V0 and V1 are video sectors.

NOTE 3 Tape viewed from magnetic coating side.

NOTE 4 Dimensions X1 to X6 are determined by the programme reference point as defined in Figure 4.

Figure 3 – Location and dimensions of recorded tracks

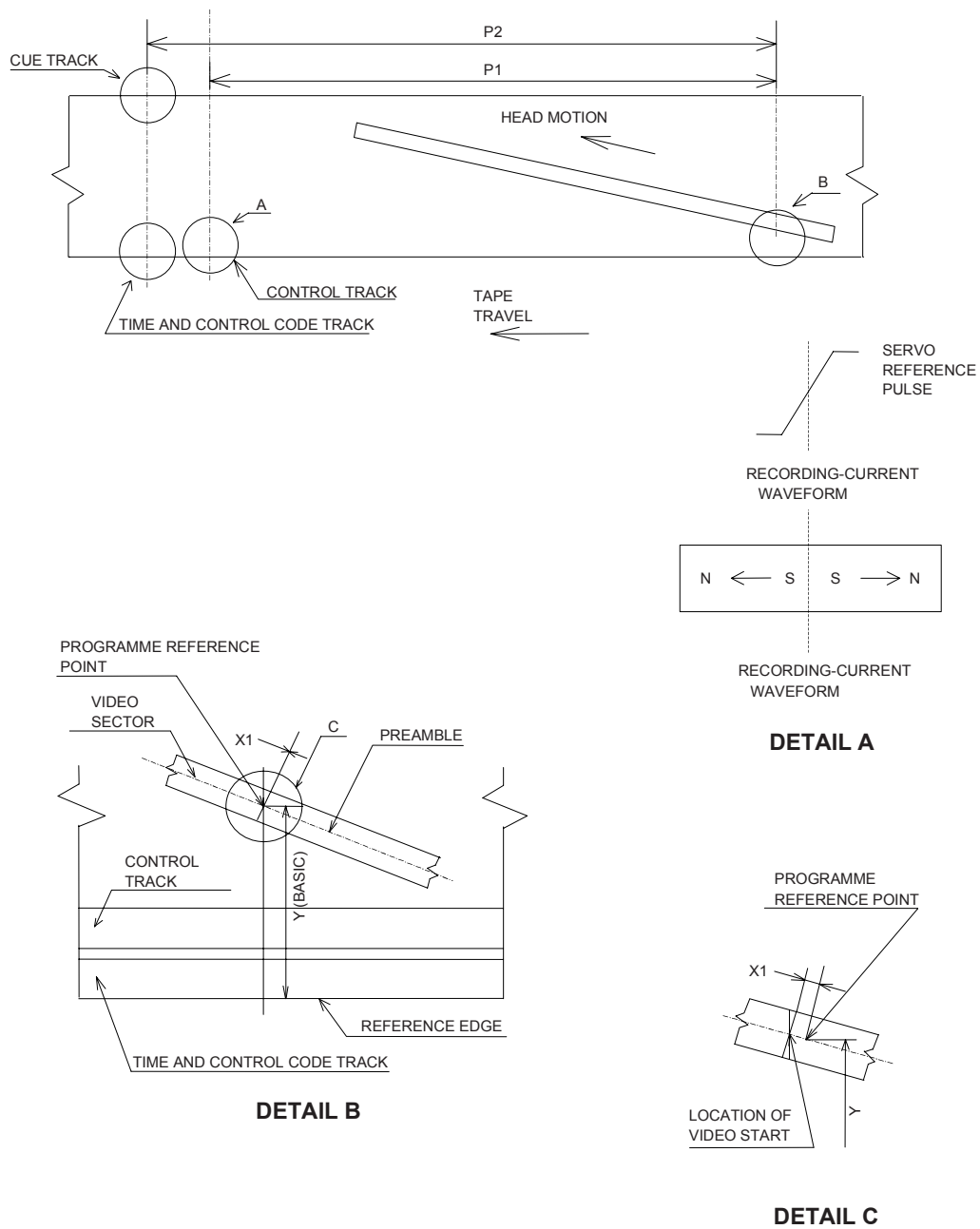


Figure 4 – Location of cue and time and control code track record

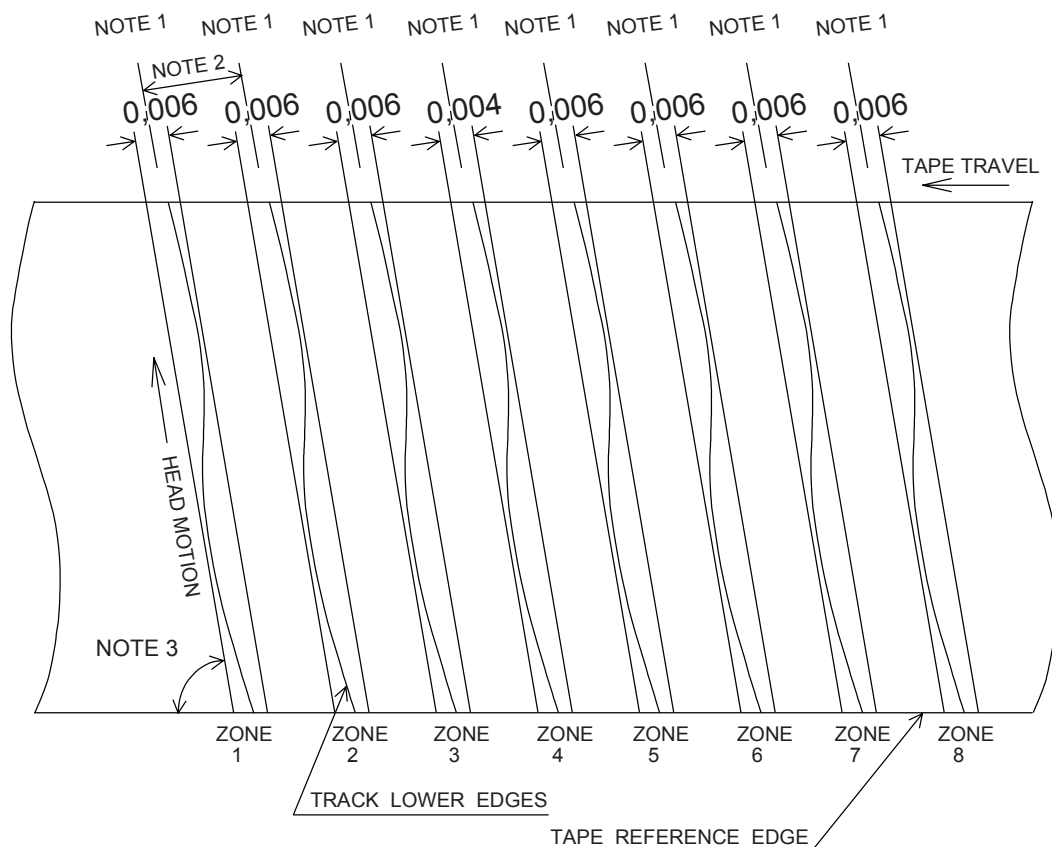
Table 1 – Record location and dimensions
Dimensions in millimetres

Dimensions		Nominal	Tolerance
A	Time and control code track lower edge	0	Basic
B	Time and control code track upper edge	0,450	±0,050
C	Control track lower edge	0,900	±0,050
D	Control track upper edge	1,300	±0,050
E	Programme area lower edge	1,629	Derived
F	Programme area width	10,020	Derived
G	Cue audio track lower edge	11,950	±0,050
H	Cue audio track upper edge	12,550	±0,050
I	Helical track pitch	0,0200	Ref
K0	Video sector 0 length	55,458	Derived
K1	Video sector 1 length	55,391	Derived
L	Helical track total length	116,397	Derived
M	Audio sector length	0,936	Derived
P1	Control track reference pulse to programme reference point (see Figure 4)	180,549	±0,050
P2	Cue/time and control code signal, start of code word, to programme reference point (see Figure 4)	183,400	±0,100
X1	Location of start of video sector V0	0	±0,050
X2	Location of start of audio sector A1 ¹⁾	55,752	±0,050
X3	Location of start of audio sector A2 ¹⁾	57,049	±0,050
X4	Location of start of audio sector A3 ¹⁾	58,345	±0,050
X5	Location of start of audio sector A4 ¹⁾	59,642	±0,050
X6	Location of start of video sector V1	60,938	±0,050
Y	Programme reference point	1,640	Basic
θ	Track angle	4,938 4 °	Basic
α0	Azimuth angle (track 0)	- 20,038 °	± 0,150 °
α1	Azimuth angle (track 1)	19,962 °	± 0,150 °
NOTE Measurements shall be made under the conditions specified in 3.1. The measurements shall be corrected to account for actual tape speed (see Figures B.1 and B.2). 1) Audio channel numbers vary.			

5.3 Helical track record tolerance zones

The lower edges of any eight consecutive tracks starting at the first track in each video frame shall be contained within the pattern of the eight tolerance zones established in Figure 5. Each zone is defined by two parallel lines which are inclined with respect to the tape reference edge at an angle of 4,938 4° basic.

The centre lines of all zones shall be spaced apart 0,020 0 mm basic. The width of zones 1 to 3 and 5 to 8 shall be 0,006 mm basic. The width of zone 4 shall be 0,004 mm basic. These zones are established to contain track angle errors, track straightness errors, and vertical head offset tolerance (measuring technique is shown in Annex B).



- NOTE 1 Tolerance zone centrelines.
 NOTE 2 0,020 0
 NOTE 3 4,938 4°
 NOTE 4 All dimensions in millimetres.

Figure 5 – Location and dimensions of tolerance zones of helical track record

5.4 Relative positions of recorded information

5.4.1 Relative positions of longitudinal tracks

Audio, video, control track, time and control code, and cue track with information intended to be time coincident shall be positioned as shown in Figure 3 and Figure 4.

5.4.2 Programme area reference point

The programme area reference point is determined by the intersection of a line parallel to the reference edge of the tape at a distance Y from the reference edge and the centre line of the first track in each video field (segment 0, track 0). (See Figure 3 and Figure 4.)

The end of the preamble and start of the video sector are located at the programme area reference point, and the tolerance is dimension X1. The locations are shown in Figure 3 and Figure 4; dimensions X1 and Y are in Table 1. The relationship between sectors and contents of each sector is specified in Clause 6.

5.5 Gap azimuth

5.5.1 Cue track, control track, time code track

The azimuth angle of the cue, control track, and time and control code head gaps used to produce longitudinal track records shall be perpendicular to the track record.

5.5.2 Helical track

The azimuth of the head gaps used for the helical track shall be inclined at angles α_0 and α_1 as specified in Table 1, with respect to a line perpendicular to the helical track. The azimuth of the first track of every field (segment 0, track 0) shall be oriented in the counterclockwise direction with respect to a line perpendicular to the helical track direction when viewed from the side of tape containing the magnetic record.

5.6 Transport and scanner

The effective drum diameter, tape tension, helix angle, and tape speed taken together determine the track angle. Different methods of design and/or variations in drum diameter and tape tension can produce equivalent recordings for interchange purposes.

One possible configuration of the transport uses a scanner with an effective diameter of 76,000 mm. Scanner rotation is in the same direction as tape motion during normal playback mode. Data is recorded by two groups of four heads mounted 180° apart. Figure 6 shows one possible mechanical configuration of the scanner, and Table 2 shows the corresponding mechanical parameters. Figure 7 shows the relationship between the longitudinal heads and the scanner. Other mechanical configurations are allowable provided the same footprint of recorded information is produced on tape.

Erase heads are described in 5.2.1 and Figure 6.

Table 2 – Parameters for a possible scanner design

Parameters		
Scanner rotation speed (rps)		90/1,001
Number of tracks per rotation		8
Drum diameter (mm)		76,000
Centre span tension (N)		0,31
Helix angle (degrees)		4,9000
Effective wrap angle (degrees)		176,9
Scanner circumferential speed (m/s)		21,5
H1,H3 over wrap head entrance (degrees)		14,1
H1,H3 over wrap head exit (degrees)		6
Angular relationship (degrees)	H1 – H4:	13,570
	H2 – H4:	9,047
	H3 – H4:	4,523
	H5 – H8:	13,570
	H6 – H8:	9,047
	H7 – H8:	4,523
	H4 – H8:	180,000
Vertical displacement (mm)	H1 – H4:	0,054
	H2 – H4:	0,036
	H3 – H4:	0,018
	H5 – H8:	0,054
	H6 – H8:	0,036
	H7 – H8:	0,018
Maximum tip projection (μm)		42,0
Record head track width (μm)		20

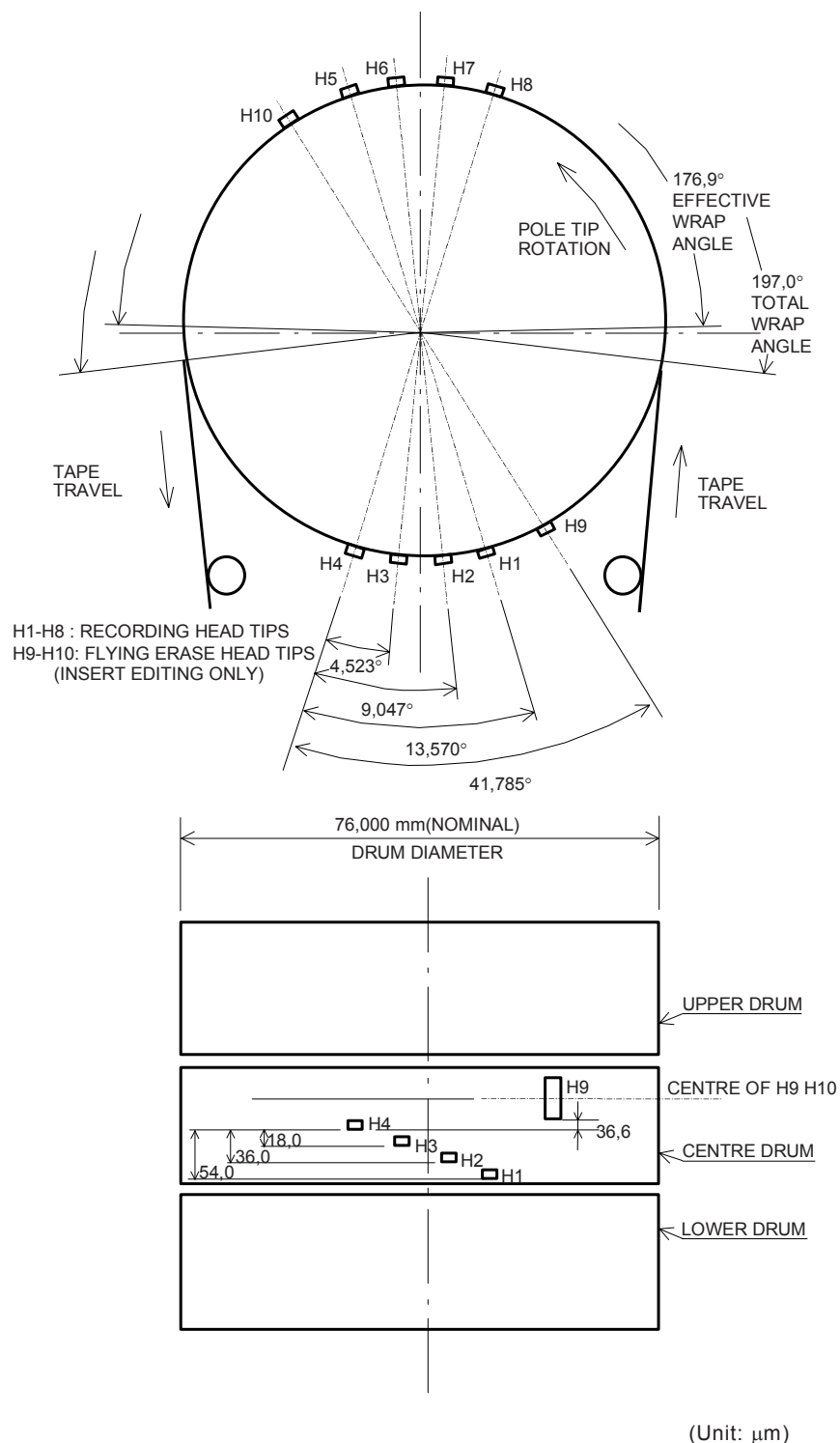


Figure 6 – A possible scanner configuration

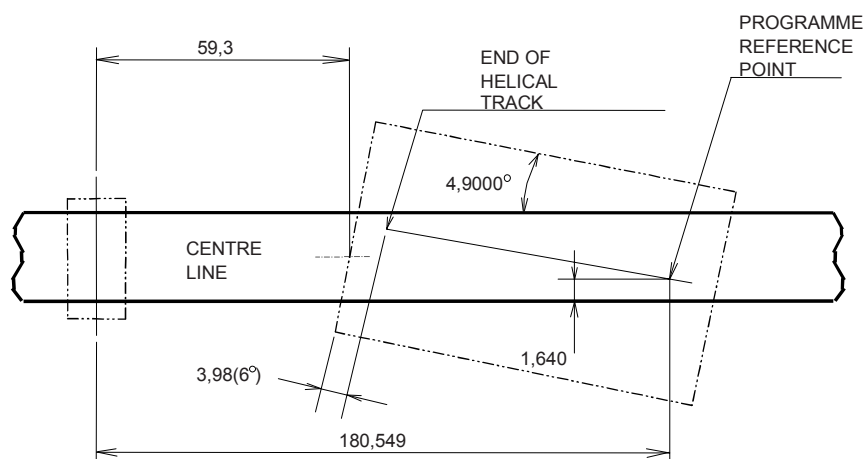
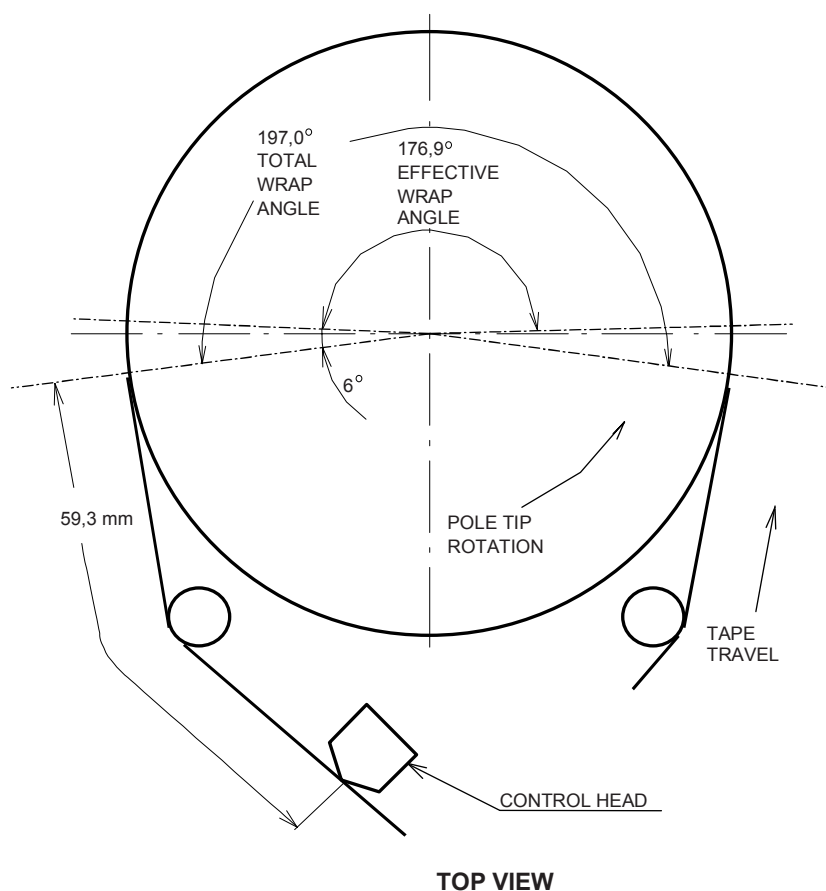


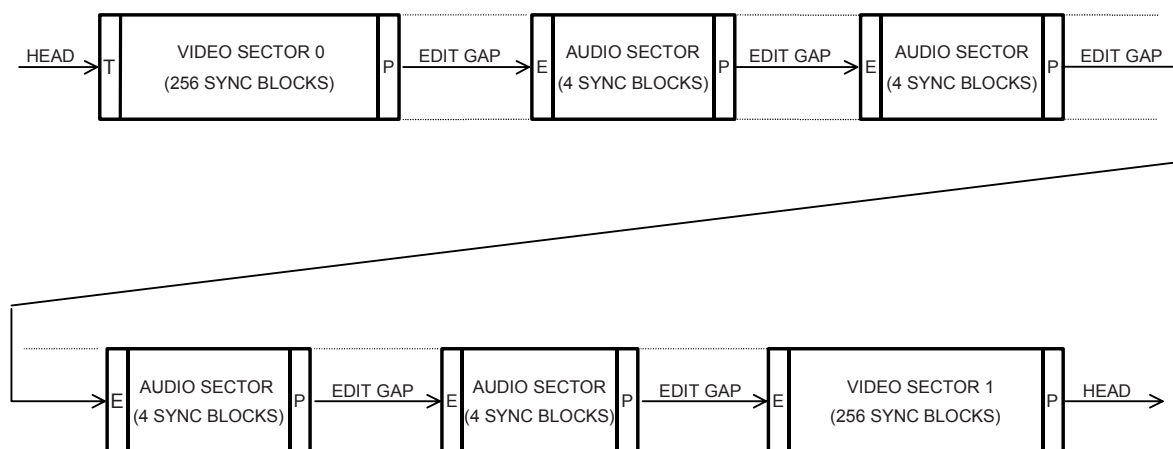
Figure 7 – A possible longitudinal head location and tape wrap

6 Programme track data

6.1 Introduction

Each HD TV field (1080/60i) or frame (720/60p) is recorded on 12 tracks.

The helical tracks contain digital data from the video channel and four audio channels. Each track contains a video sector followed by four audio sectors corresponding to four audio channels and followed by a second video sector, recorded in that order. An edit gap between sectors accommodates timing errors during editing. Figure 8 shows the arrangement of video and audio sectors on the tape.



T Track preamble (58 bytes)

E In-track preamble

P Postamble (4 bytes)

Sync block: 97 bytes

Edit gap: 162bytes nominal

Figure 8 – Sector arrangement on helical track

6.2 Labelling convention

The least significant bit is written on the left and first recorded to tape.

The lowest numbered byte is shown at the left/top and is the first encountered in the input data stream.

Byte values are expressed in hexadecimal notation unless otherwise noted. An h subscript indicates hexadecimal value.

6.3 Sector details

Each sector (audio or video) is divided into the following elements:

- preamble containing clock run-up sequence, sync pattern, identification pattern and fill pattern;

- sync blocks containing sync pattern and identification pattern, followed by a fixed length data block with error control;
- postamble containing sync pattern and identification pattern.

6.3.1 Sync block

The sync block format is common to both audio and video sectors. Each sync block contains a sync pattern (2 bytes) and an inner code block. Each inner block contains an identification pattern (2 bytes) and 85 data bytes of video, audio, or outer check bytes followed by 8 inner check bytes.

The inner code block contains the two bytes of the identification pattern together with 85 data bytes. Figure 9 shows the sync block format.

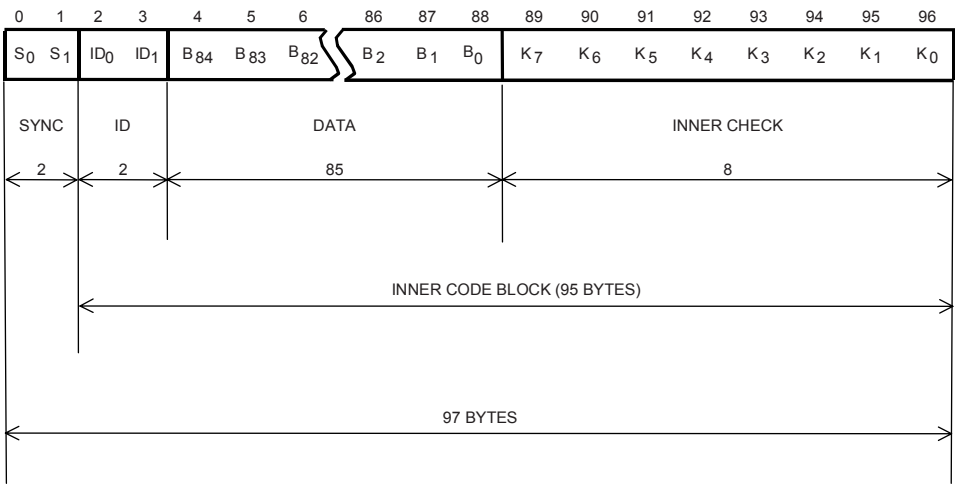


Figure 9 – Sync block format

6.3.2 Sync pattern

- a) Length: 16 bits (2 bytes).
- b) Pattern: 97F1 (in hexadecimal notation).

		LSB						MSB	
Byte 0	-	1	1	1	0	1	0	0	1
Byte 1	-	1	0	0	0	1	1	1	1

- c) Protection: none.
- d) Randomization: none.

6.3.3 Identification pattern

As illustrated in Figure 10, the first two bytes of each inner block are used for identification of sync block, television field, segment (group of helical tracks scanned simultaneously), sector (portion of a track), and helical track. Bits 1 to 6 of the second byte (byte 3 of sync block) of the identification pattern identify the track. Bit 7 of the second byte (byte 3) identifies a sector on the helical track (see Figure 11).

- a) Length: 16 bits (2 bytes).
- b) Arrangement: the sync block number (byte 2 and the bit 0 of byte 3) follows a coded sequence along the track. Figure 12 shows the sequence of the sync block numbers.

The sector ID (bits 1to7 of byte 3) identifies a particular sector.