

Specification for

**Pre-recorded capacitance
grooveless videodisc system
50 Hz/625 lines — PAL, on
Type VHD**

Committees responsible for this British Standard

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- Association of Professional Recording Services Ltd.
- Audio Engineering Society
- British Broadcasting Corporation
- British Kinematograph, Sound and Television Society
- British Tape Industry Association
- Electronic Components Industry Federation
- Independent Television Association
- National Council for Educational Technology (NCET)
- Royal Photographic Society
- Royal Television Society

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National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee. It is identical with IEC 844 : 1988 *Pre-recorded capacitance grooveless videodisc system 50 Hz/625 lines — PAL, on Type VHD*, published by the International Electrotechnical Commission (IEC). For ease of production, some of the figures also include the French text.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

PRE-RECORDED CAPACITANCE GROOVELESS VIDEODISC SYSTEM

50 Hz/625 lines — PAL, on Type VHD

INTRODUCTION

The disc in this videodisc system is constituted of multiple pit rows in spiral form on the flat surface. Each track has information pits recorded with both video and audio signals, and tracking pits recorded between the information tracks, which guide the capacitance pick-up tracking precisely in the information track.

The disc is mainly made of electro-conductive plastic material. The disc is 260 mm in diameter, has a maximum playing time of 60 min/side, 120 min/both sides, and is normally inserted in a specific disc case and, when in play-back, it can reproduce video information along with two channels of audio or stereo sound.

SECTION ONE — GENERAL

1. Scope

This standard applies to pre-recorded capacitance grooveless videodiscs for the 50 Hz/625 lines — PAL compatible system and gives dimensional and other characteristics necessary to ensure interchangeability of the videodisc.

2. Object

To serve as a reference for manufacturers intending to make discs or players compatible with the system described herein.

3. Standard atmospheric conditions for testing

Measurements and mechanical checks are to be carried out at any combination of temperature, humidity and air pressure within the following limits, unless otherwise specified:

Ambient temperature:	15 °C to 35 °C
Relative humidity:	45% to 75%
Air pressure:	86 kPa to 106 kPa

Samples shall be conditioned in the testing environment for 24 h before testing.

SECTION TWO — DISC PARAMETERS

Characteristics to be specified	Requirements	Method and/or conditions of measurement
4. Mechanical parameters (see Figure 1)		All mechanical items From Sub-clauses 4.1 to 4.4, parameters shall be measured at $20 \pm 1^\circ\text{C}$ and $(50 \pm 2)\%$ relative humidity after 24 h conditioning
4.1 Thickness of the disc		
4.1.1 Thickness of outer track guard (<i>A</i>)	$3.0 \pm 0.2 \text{ mm}$	
4.1.2 Thickness of outermost recorded area (<i>B</i>)	$1.2 \pm 0.2 \text{ mm}$	
4.1.3 Thickness of centre track guard area (<i>C</i>)	$3.0 \pm 0.2 \text{ mm}$	
4.1.4 Thickness of innermost recorded area (<i>D</i>)	$1.3 \pm 0.2 \text{ mm}$	
4.1.5 Thickness of clamping area (<i>E</i>)	$1.2 \pm 0.2 \text{ mm}$	
4.1.6 Height of outermost recorded area (<i>F</i>)	$2.1 \pm 0.2 \text{ mm}$	
4.1.7 Height of innermost recorded area (<i>G</i>)	$2.15 \pm 0.2 \text{ mm}$	
4.1.8 Gradient of recorded area (<i>H-I</i>)	$0.05 \pm 0.025 \text{ mm}, H > I$	
4.1.9 Width of outer cutting edge (<i>J</i>)	$1.0^{+0.4}_{-0.7} \text{ mm}$	
4.2 Diameter of the disc		
4.2.1 Outer diameter of disc (<i>K</i>)	$260.0^{+0.5}_{-1.0} \text{ mm}$	
4.2.2 Diameter of outer track guard (<i>L</i>)	$257.0^{+0}_{-1} \text{ mm}$	
4.2.3 Diameter of centre track guard area (<i>M</i>)	73^{+1}_{-0} mm	
4.2.4 Width of centre track guard area (<i>N</i>)	More than 3 mm	
4.2.5 Diameter of centre hole (<i>O</i>)	$38.2 \pm 0.05 \text{ mm}$	
4.2.6 Starting diameter of lead-in area (<i>P</i>)	$250.0^{+1}_{-0} \text{ mm}$	
4.2.7 Starting diameter of program area (<i>R</i>)	244^{+0}_{-1} mm	
4.2.8 End diameter of program area (<i>S</i>)	More than 122.5 mm	
4.2.9 End diameter of program-end signal area (<i>T</i>)	Less than 92.2 mm	
4.2.10 Outer diameter of centre track guard (<i>U</i>)	Less than 80 mm	

Characteristics to be specified	Requirements	Method and/or conditions of measurement
4.3 <i>Maximum radial deviation (ΔW) between centre of centre hole and outer edge of disc (W) (see Figure 1)</i>	0.5 mm p-p*	Measured at 1 rotation / 2 TV frames
4.4 <i>Maximum radial deviation (ΔV) between centre of centre hole and recorded track (V) (see Figure 1)</i>	0.2 mm p-p	
4.5 <i>Rotation speed</i>	1 rotation / 2 TV frames	
4.6 <i>Maximum unbalance force</i>	0.42 N	
4.7 <i>Lead-in area</i>	The space between starting diameter of lead-in area and starting diameter of program area shall be filled with lead-in tracks	
4.8 <i>Minimum area of program-end signal tracks</i>	The space between end diameter of program-end signal area and end diameter of program area shall be filled with program-end signal tracks	To be measured on the standard turntable
4.9 <i>Track form</i>	Spiral	
4.10 <i>Height of program area during rotation at playback speed</i>	2.1 ± 0.2 mm	
4.10.1 <i>Maximum vertical deflection or acceleration at playback speed within the area of program material</i>	$f \leq 30$ Hz 200 μ m p-p $30 \text{ Hz} < f \leq 250$ Hz 0.35 g $250 \text{ Hz} < f$ 0.14 g	
4.11 <i>Maximum radial deflection or acceleration at playback speed</i>	$f \leq 12.5$ Hz 200 μ m p-p $12.5 \text{ Hz} < f < 600$ Hz 0.07 g $600 \text{ Hz} \leq f$ 0.1 μ m p-p Just one frequency can exceed 0.2 g at $50 \text{ Hz} \leq f$ (see Figure 6b, dotted line)	
4.12 <i>Tangential deviation at nominal velocity</i>		Curves are shown in Appendix B
4.12.1 <i>Time base error</i>	0.5% p-p at 50 Hz roll off with 12 dB/oct	
4.12.2 <i>Shift between two adjacent tracks</i>	Less than 200 ns	
4.13 <i>Pit information and tracking signal pit dimensions</i>		
4.13.1 <i>Pitch of information track</i>	$1.35 \mu\text{m} \pm 10\%$	

*Peak-to-peak (p-p).

Characteristics to be specified	Requirements	Method and/or conditions of measurement
4.13.2 Pit width of information track	(Pitch of information track) × (0.6 ± 0.1)	Parameters to be measured at 20 ± 1 °C and 48% to 52% relative humidity, no less than 24 h following exposure to specified environment
4.13.3 Pit depth of information signal	0.3 ± 0.08 μm	
4.13.4 Pitch of tracking signal	Symmetrical with respect to information tracks (see Clause 9)	
4.13.5 Pit width of tracking signal	(Pitch of information track) × (0.37 ± 0.03)	
4.13.6 Pit depth of tracking signal	0.12 ± 0.035 μm	
5. Disc material	Electro-conductive material	
5.1 Resistivity	Less than 125 Ω	
6. Other mechanical parameters		
6.1 Direction of rotation	Clockwise, as seen from stylus	
6.2 Direction of disc tracking	From outside to inside	
6.3 Disc case	Description of the disc case is given in Appendix C	
6.4 Temperature and humidity requirements	Shall satisfy all requirements following exposure to a temperature and relative humidity within the range of the frame described below:	
Relative humidity (%) Temperature (°C)		

SECTION THREE — RECORDING PARAMETERS

7. Audio parameters**7.1 Channel applications**

The disc shall contain two separate audio channels.

This offers the following possibilities:

- a) stereophonic sound;
- b) monophonic sound — two independent audio programs;
- c) monophonic sound — one audio program on both channels;
- d) future use of one or both channels for cueing.

7.2 Subcarrier frequencies

Channel 1 (left channel in stereo)

$$f = 217.75 \times f_H = 3.402 \text{ MHz (nominal)}$$

Channel 2 (right channel in stereo)

$$f = 237.25 \times f_H = 3.707 \text{ MHz (nominal)}$$

7.3 Type of modulation

The audio signal shall be frequency modulated on the subcarriers with a maximum deviation of ± 75 kHz for 100% modulation.

7.4 Polarity of modulation

Both audio subcarrier frequencies shall have the same polarity of modulation, which may be positive or negative.

7.5 Pre-emphasis

Prior to modulation, the audio signal shall have a pre-emphasis of +6 dB/oct, with a time constant $t = 50 \pm 1.5 \mu\text{s}$.

7.6 Noise reduction system

A noise reduction system shall be employed, which is described in Appendix A.

8. Video parameters**8.1 Video signal****8.1.1 Video signal standards**

The video signal shall be a PAL compatible television signal.

Chrominance sub-carrier frequency: $162.5 f_H (= 2.539 \text{ MHz})$.

The chrominance burst signal shall be recorded in both black and white and colour. (See block diagram in Figure 3.)

8.1.2 Address signals

In the video signal, lines 14, 15, 17, 327, 328 and 330 are reserved for the address and data signals; the lines that are not specified have a video content set at the blanking level and are reserved for future applications.

8.1.3 Maximum video level

The maximum luminance level of the video signal shall not exceed 77% of peak white level (black level = 30%), and the maximum chrominance saturation shall not exceed 100%.

8.2 *Video signal modulation*

8.2.1 *Type of modulation*

The video signal shall be frequency modulated on to the main carrier.

8.2.2 *Blanking level frequency*

The main carrier frequency corresponding to the blanking level (30%) shall be $6.6 \text{ MHz} \pm 50 \text{ kHz}$.

8.2.3 *Main carrier deviation*

The tip of sync (0%) to white level (100%) carrier deviation shall be $1.8 \text{ MHz} \pm 35 \text{ kHz}$.

White level corresponds to the highest frequency.

8.2.4 *Video pre-emphasis*

Prior to modulation, the video signal shall have a pre-emphasis with time constants of t_1 and t_2 .

$$t_1 = 800 \pm 20 \text{ ns}$$

$$t_2 = 200 \pm 20 \text{ ns}$$

The pre-emphasis curve is shown in Figure 4.

8.2.5 *Chrominance signal level compensation*

The chrominance signal, after separation from the composite signal, shall have its level with respect to the colour burst adjusted by an A.C.C. circuit having the characteristics as given in Figure 5.

The amplitude of this compensated chrominance signal is increased by 3.5 dB prior to recombination with the luminance signal to obtain correct pre-emphasis. (See block diagram in Figure 3.)

An example of the RF spectrum is shown in Appendix D.

8.3 *Audio subcarrier modulation of main carrier*

8.3.1 *Type of modulation*

The audio subcarrier shall be frequency modulated on to the main carrier.

8.3.2 *Amplitude of audio subcarrier*

The level of each audio subcarrier shall be $(62 \pm 3.5)\%$ with respect to the video signal after the video pre-emphasis.

9. **Tracking system and signal format**

The tracking signal is recorded on to both sides of the information track in the form of short rows of pits. The tracking signal is a tone burst with a repetition rate of horizontal sync.

The tracking signal is recorded between two information tracks symmetrical to the axis of the information track.

In order to maintain the two different frequencies of the control signal, f_{p1} and f_{p2} , on each side of the information track, the frequency of the tone burst shall be changed alternately between f_{p1} and f_{p2} by the index signal f_{p3} in each revolution during recording.

The index signal f_{p3} is a sine-wave tone burst which is recorded with the information signal. The signal, when played back, serves on the player as a command signal to switch the polarity of radial servo-system (see Figure 2).

9.1 Tracking signal frequency

$$f_{p1} = 32.5 f_H (= 508 \text{ kHz})$$

$$f_{p2} = 45.5 f_H (= 711 \text{ kHz})$$

9.1.1 Timing of tracking signal

The tracking signal shall start at the leading edge of the horizontal blanking signal. (See Figure 7.)

9.2 Index signal frequency

$$f_{p3} = 17.5 f_H (= 273 \text{ kHz})$$

9.2.1 Timing of index signal

The index signal in the program area shall be recorded once every two frames in the vertical blanking period as shown in Figure 8. The index signal in the lead-in and the program-end area shall be recorded in the same manner as the index signal in the program area, except that the tail of the index signals is extended. The total length of the index signal shall be 2.50 ms $\pm$ 10% in the lead-in area and 14.2 ms $\pm$ 10% in the program-end area.

9.2.2 Recording format of index signal

The index signal is superimposed on to the frequency modulated video and audio signals.

9.2.3 Level of index signal

The level of the index signal is – 16 dB with respect to the main carrier.

10. Address signals

The code signals on the video disc provide special information, which can be utilized by the player to control special functions and provide picture, frame or time information.

10.1 Disc code formats

The VHD disc has the following types of code:

- a) Lead-in.
- b) Program-end signal.
- c) Program time code and picture numbers.
- d) Chapter numbers.
- e) Chapter local address numbers.
- f) Audio mode and auto still.
- g) Track numbers.

10.1.1 29 bit bi-phase space coded signal

This signal is inserted in selected video lines during the vertical interval. It is subdivided into seven groups of 4 bits plus 1 bit for parity check, and each group can be any hexadecimal word (see Figures 9a and 9b). The first group of 4 bits is the key, and starts at a logic one level. Each bit cell is $12/455 \times f_H$ in length, with the digital level between 30% and 82% (see Figure 10).

10.1.2 Lead-in

The lead-in code indicates where the program area starts. The 29-bit bi-phase space lead-in code with a hexadecimal value of “C C F F Y₁ Y₂ Y₃” is inserted into lines 14 and 327, “C₈ F $\alpha_2 \beta_1 \beta_2 \gamma$ ” is inserted into lines 15 and 328, and “C₄ F T₂ T₃ T₄ T₅” is inserted into lines 17 and 330 during full tracks prior to the active program start.

Y₁, Y₂, and Y₃ indicate the seconds with a 12-bit binary word and decrease to 0 at the program start. α_2 , β_1 , and β_2 indicate respectively the minutes, seconds ($\times 10$), seconds ($\times 1$) in BCD. γ indicates the picture numbers coded in hexadecimal. α_2 , β_1 , β_2 and γ also decrease to 0 at the program start.

T₂ ... T₅ indicate respectively the $\times 1000$, $\times 100$, $\times 10$, $\times 1$ of the track number in BCD.

The track number is decreased continuously to 0 at the program start.

10.1.3 Program-end signal

The program-end signal code follows immediately after the end of the active program. The 29-bit bi-phase space program-end signal code with a hexadecimal value of “C C E E Y₁ Y₂ Y₃” is inserted in lines 14 and 237, “C₈ E $\alpha_2 \beta_1 \beta_2 \gamma$ ” is inserted in lines 15 and 328, and “C₄ E T₂ T₃ T₄ T₅” is inserted in lines 17 and 330.

Y₁, Y₂ and Y₃ indicate the seconds with a 12-bit binary word which shall be incremented. α_2 , β_1 and β_2 indicate respectively the minutes, seconds ($\times 10$), seconds ($\times 1$) in BCD. γ indicates the picture numbers coded in hexadecimal. α_2 , β_1 , β_2 and γ shall also be incremented.

T₂ ... T₅ indicate respectively the $\times 1000$, $\times 100$, $\times 10$, $\times 1$ of the track number in BCD. The track number is increased continuously from 0 in the program-end area. If the program-end area is longer than 9999 tracks, the increment of the track number should be stopped at number 9999, and this number is then retained to be recorded.

10.2 Audio mode code

The audio mode code is always present during the active program. The 29-bit bi-phase space audio mode code with a hexadecimal value of “C Z₁ X₁ X₂ Y₁ Y₂ Y₃” is inserted in lines 14 and 327, “C Z₂ $\alpha_1 \alpha_2 \beta_1 \beta_2 \gamma$ ” is inserted in lines 15 and 328, and “C V₁ T₁ T₂ T₃ T₄ T₅” is inserted in lines 17 and 330. V₁ and T₁ are in BCD. (See Figures 9a and 9b.)

The last two bits in V₁ are mode bits designating audio mode and auto still mode.

Lines 14 and 327		Lines 15 and 328		Lines 17 and 330			
Z ₁		Z ₂		V ₁		T ₁	
C	1100	8	1000	4	0100	0-5 (0***) ↑ Mode flag	Monophonic Stereo Dual Still
D	1101	9	1001	5	0101		
E	1110	A	1010	6	0110		
F	1111	B	1011	7	0111		

10.3 Auto still code

The auto still code enables the playback equipment to switch automatically to the still mode from twice the normal (quick motion) speed or slow motion. The 29-bit bi-phase space auto