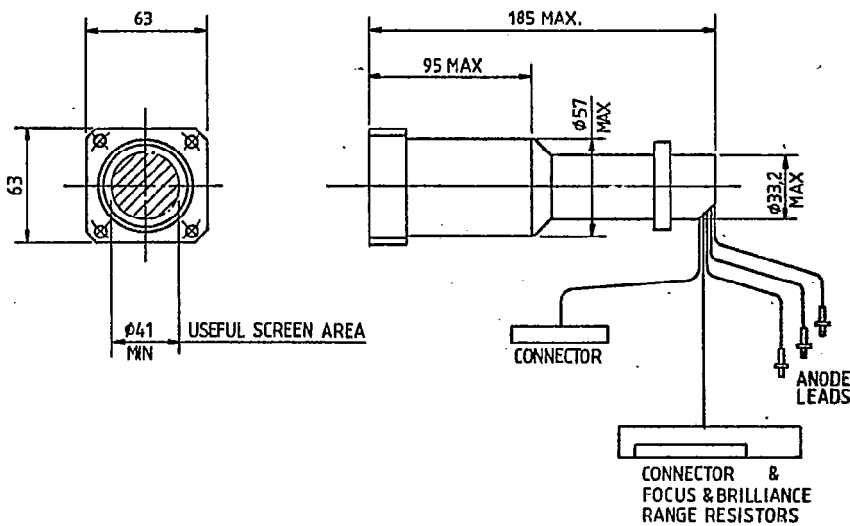


BRITISH STANDARDS INSTITUTION 2, PARK STREET, LONDON, W1A 2BS	BS CECC 11001-011 ISSUE 2 APRIL 1985.
Specification available from:- AS SHOWN IN PD 9002, CECC 00 200 AND THORN EMI Brimar Limited GREENSIDE WAY MIDDLETON, MANCHESTER M24 1SN Tel: 061-681 7072 Telex: 665326	 Page 1 of 47 pages
ELECTRONIC COMPONENTS OF ASSESSED QUALITY DETAIL SPECIFICATION IN ACCORDANCE WITH BS CECC 11000 : 1980	MANUFACTURER'S TYPE NUMBER 05E/50427V3 SEE PD 9002 AND CECC 00 200
Outline and dimensions Third angle projection  All dimensions in millimeters For detail dimensions see Appendix B Marking information see Clause 5	For ordering information see Clause 6 MINIATURE HIGH RESOLUTION CATHODE RAY TUBE Deflection: Magnetic Focus: Electrostatic Useful screen: 41 mm dia Phosphor: V3 (Jedec P43) Persistence: Medium short Colour: Yellowish-green Faceplate: Optically polished optical quality glass Tube and deflection coil encapsulated in a magnetic shield FULL ASSESSMENT + ADDITIONAL ASSESSMENT

Data (not for inspection purposes)

- | | |
|--|--|
| <p>1. <u>Mechanical</u>
Mounting position
Mass</p> | <p>Unrestricted
0.9 kg (Nom)</p> |
| <p>2. <u>Environmental</u>
Operational temperature range
Shock</p> | <p>-40°C to + 80°C
Peak acceleration 200 g, half sine
wave, duration 3 ms, in both
directions of 3 axes.</p> |

DATA CONTINUED ON NEXT PAGE

Refer to Qualified Products List PD 9002 and/or CECC 00 200 for details of manufacturers approved to this specification.

Data (not for inspection purposes) (continued)

2. Environmental (continued)

Bump	Peak acceleration 25 g in both directions of 3 axes. Total number of bumps 4000.
Vibration	Wide band random motion 20 to 500 Hz at 0.1 g ² /Hz falling to 0.01 g ² /Hz at 2000 Hz in three axes at +30 °C, +80 °C and -30 °C for a total of 18 hours.
Mould growth	IEC 68-2-10 test J. Severity 28 days.

3. Limiting values (absolute maximum rating system IEC 134)

	Min.	Max.	Units
Heater voltage (Vh)	5.7	6.9	V
Heater to cathode, positive voltage	-	200	V
negative voltage	-	200	V
Intensity modulator electrode cathode circuit resistance		1.5	MΩ
Intensity modulator electrode negative voltage (Vg1)	1	200	V
Intensity modulator electrode positive voltage (Vg1)	modulator must never become positive w.r.t. cathode		
First anode voltage (Vg2)	200	600	V
Second (focus) anode voltage (Vg3)	700	1900	V
Third (final) anode voltage (Vg4)	4.5	8.5	kV
Average cathode current over 100 ms	-	150	μA

4. Operating conditions and typical characteristics (not for inspection purposes)

When the tube is operated under the conditions given below, the characteristic values which follow them are attainable.
Vh = 6.3 V ± 2 %; Vg2 = 300 V; Vg4 = 8 kV; Cathode and collar at earth.

	Min.	Max.	Units
Heater current (Ih)	270	330	mA
Intensity modulator cut-off voltage (Vg1)	-30	-65	V
Focus anode voltage (Vg3)	1320	1545	V
First anode current (Ig2). (May increase to ± 18 μA with ageing)	-	±10	μA
Useful screen dimension	41 dia		mm

5. Marking The following shall be clearly and durably marked on the tube and primary pack

1. Manufacturer's type number
2. Manufacturer's code
3. Date code
4. BS CECC 11001-011
5. Manufacturer's serial number
6. NATO stock number if applicable

Special marking relating to hazards. Each tube and package shall contain a warning of hazards in respect of handling, implosion and X-rays.

6. Ordering information

Orders for these cathode ray tubes shall contain the following minimum information:

1. Quantity
2. Manufacturer's type number
3. BS-CECC 11001-011 and where applicable the NATO Stock Number

Any special requirements and packaging instructions shall be included in the order.

7. Related documents

BS 6001	Sampling procedures and tables for inspection by attributes.
BS 9000	General requirements for a system for electronic components of assessed quality.
BS-CECC 11000	Cathode ray tubes: generic specification
CECC 00 200	Qualified products list
IEC 68	Basic environmental testing procedure
IEC 100	Methods for the measurement of direct interelectrode capacitance of electronic tubes and valves
IEC 134	Rating systems for electronic tubes and valves and analogous semiconductor devices
PD 9002	BS 9000 component selection guide.

8. Structural similarity

Not applicable.

9. X-radiation

All high voltage devices operating at voltages above 5 kV produce progressively more dangerous X-rays as the voltage is increased. The device envelope usually provides only limited protection and further shielding may be required.

10. Additional information

1. The precautions taken in manufacture reduce the possibility of spontaneous implosion to a minimum, but any additional stress due to mishandling considerably increases the risk of implosion; such implosion may occur immediately or be delayed.
2. The tube should be operated at it's minimum useful brightness in order to prevent damage to the screen material. There is a possibility of a rapid burn on the screen if the spot is allowed to remain stationary.
3. The tube should be shielded from magnetic fields which can be detrimental to its performance.

TEST CONDITIONS AND INSPECTION REQUIREMENTSGROUP A - Lot by Lot

General test conditions (unless stated otherwise for particular tests)

Heater voltage (Vh) = 6.3 V.

First anode voltage (Vg2) = 300 V.

Final anode voltage (Vg4) = 8 kV.

Intensity modulator electrode negative voltage (Vg1) = adjusted as required.

Focus anode voltage (Vg3) = adjusted as required.

Collar at earth potential.

Raster details: CCIR 625 line raster with 2:1 interlace at 25 Hz frame rate and flyback blanking. Active lines 575. Or 312 line raster non-interlaced with 50 Hz field rate and flyback blanking. Active lines 287. Raster size 32.8 mm x 24.6 mm. Writing speed 0.63 mm/μs.

Pulse conditions: Rise and fall times within 10 % of pulse duration. Droop within 10 % of pulse amplitude.

Pre-heating: Apply Vh only for 2 minutes.

All electrode voltages are with respect to cathode unless otherwise stated.

Astigmatism correction is not applied.

Samples submitted to tests which are marked (D) shall not be accepted for release under BSE 9000 (see 2.6.5 of BSE 9000 part 1).

All tests are non-destructive

AQL given in %

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
SUB-GROUP A1						100%	
- Visual inspection	4.3	As 4.3 plus connector terminations	See 4.3				
- Non operating endurance	4.9.1	Duration = 24 h min.					
- Dimensions		Check with Profile Gauge. See Appendix Q. Measure dimensions BL, BS and lead lengths PL6, PL7, PL8, PL9, PL10. See Appendix B.			As Inspection Drawing Appendix B		

SUB-GROUP A1 CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Gas content coefficient	4.6.1	Vg2 = 200 V. Vg3 = -40 V. Adjust Vg1 for Ik = 400 μ A Measure Ig3 Calculate $\frac{Ig3}{Ik}$		0.2	nA/ μ A		
- Intensity modulator electrode cut-off voltage.	4.6.2	Visual extinction of spot.	-30	-65	V (record value)		
- Cathode emission	4.6.3	Minimum cathode factor K = 2. Overscanned raster. Vg4 = 4 kV Vg3 = As measured in Optimum Focus test.	Calculated Ik min = $K(\text{cut-off voltage})^{3/2}$				
- Quality of fluorescent screen and faceplate	4.6.10	Defocused overscanned raster. Adjust Vg1 for convenient screen luminance. Useful screen area. Non-uniformity of brightness. Visual inspection.	As blemish specification Appendix A 41 dia.		mm		
- Flashover	4.6.7 Method A	Screen horizontal and uppermost. Vg4 = 10 kV Vg3 = 700 V Vg2 = 600 V Raster over useful screen area. Adjust Vg1 to -150 V. Tap tube neck for 15 s.	Performance requirements as in 4.6.7 Method A.				
- Stray emission	4.6.6	Screen horizontal and uppermost. Vg4 = 10 kV Vg3 = 700 V Vg2 = 600 V Vg1 = -150 V Switch off deflection coil current.	Performance requirements as in 4.6.6				

SUB-GROUP A1 CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Microphony		Adjust Vmod for just visible focused raster over useful screen area. Tap tube neck for 10 s at 4 taps per second. Use hammer similar to design shown in 4.6.6.					
- Mechanical spot displacement	4.6.5. Method B	The undeflected spot to be within a 2.0 x 2.0 mm square aligned with the X & Y axes and centred on the geometric centre of the front collar. Note: The geometric centre is the point of intersection of the 'X' and 'Y' axes. (See Inspection drawing Appendix B).	-	2.0 x 2.0 square	mm		
- Orientation of X-axis trace to collar face Z.		As Appendix C. Calculate alignment error angle ϕ .	-	± 1	degree		
- Optimum focus		See Appendix P. Measure optimum focus voltage (Vg3).	1320	1545	V		
- Resolution (Modulation Transfer Function method) and Luminance Characteristics		See Appendix E. Display raster. Measure luminance over 10 mm dia., area min. Average cathode current at 223 cd/m ² . Vg1 drive (V223) at 223 cd/m ² .		50 23	μ A V		
		<u>Horizontal MTF</u> At 250 cycles/raster width: Screen centre - position E. Screen positions A, C, G, J.	55 50		% %		
		At 350 cycles/raster width: Screen positions A, C, E, G, J.	30		%		
		<u>Vertical Modulation Ratio</u> Screen positions A, C, E, G, J.	30		%		

SUB-GROUP A1 CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Orthogonality		As Appendix D. Angle between axes.	89.25	90.75	degrees		
- Coil sensitivity		Measure d.c. current required to deflect a focused spot from centre in each direction for distance stated below. Direction of deflection facing tube face: Connector PL6 Pin 1 + ve deflects left. Pin 16 + ve deflects down. Pin 14 + ve deflects left.					
X-axis		20 mm deflection to left. 20 mm deflection to right.	450 450	550 550	mA mA		
Y-axis		15 mm deflection upwards. 15 mm deflection down- wards.		180 180	mA mA		
X-shift coil		3 mm deflection.		66	mA		
- Deflection current symmetry		Calculate deflection current symmetry, in per- centage, from the differ- ence between the currents measured and recorded for Coil Sensitivity tests above. Calculate for both axes. X-axis symmetry. Y-axis symmetry.		1.5 1.5	% %		
- Magnetic shield to front collar continuity		Measure resistance between magnetic shield and tube front collar.		0.2	Ω		
- Focus control padding resistors inspection.		See Appendix M.					

SUB-GROUP A1 CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Brilliance range control resistors selection		Test conditions and procedure as detailed in Appendix L.					
		Total resistance (R100V + ROV).	80	120	kΩ		
		Record individual values of R100V and ROV.	Record				
- CRT package wiring continuity and brilliance range control check		See Appendix T. Test conditions as preceding test. Measure luminance.	6	12	cd/m ²		
SUB-GROUP A2						11	1.5
- Deflection linearity		See Appendix N. Measure horizontal deflection linearity at screen positions, E, D, F, K and M (See Fig. N).		8	%		
		Measure vertical deflection linearity at screen positions E, B, H, L and N (See Fig. N).		8	%		
Remaining applicable Sub-Group A2 tests performed 100% in Sub-Group A1.							
SUB-GROUP A3						S4	6.5
- Heater current	4.6.8	Apply V _h = 6.3 V only.	270	330	mA		
- Heater to cathode leakage	4.6.9						
(1) Heater positive w.r.t. cathode		V _h -k (heater positive) = 200 V.		40	μA		
(2) Heater negative w.r.t. cathode		V _k -h (heater negative) = 200 V.		40	μA		

SUB-GROUP A3 CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Intensity modulator electrode negative current	4.6.12 Method B	$R_{mod} = 10 \text{ M}\Omega$.		5	μA		
- Electrode leakage current	4.6.11	$V_{g4} = 10 \text{ kV}$, $V_{g3} = 700 \text{ V}$, $V_{g2} = 600 \text{ V}$, $V_{g1} = -150 \text{ V}$. Measure I_{g2} Measure I_{g3} Measure I_{g4}		± 3 ± 6 3	μA μA μA		
- Coil inductances		Measure at 1 kHz X scan coil Y scan coil X shift coil	450 2.7 1.5	550 3.3 2.0	μH mH mH		
- Coil resistances		X scan coil Y scan coil X shift coil	2.83 15.0 -	3.47 20.4 8.0	Ω Ω Ω		
- Inter-coupling of X-coil to Y-coil		Measure magnetic inter-coupling, at 40 kHz, of the X-coil on to the Y-coil in terms of decibels. $\text{dB} = 20 \log \frac{V_1}{V_2}$ where V_1 = Y-coil induced voltage and V_2 = X-coil applied voltage.		- 40	dB		
- X-coil self capacitance		See Appendix R.		50	pF		

GROUP B - Lot by Lot							
General test conditions - as for Group A							
Only tests marked (D) are destructive						AQL : given in %	
INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Dimensions, major	4.4	See inspection drawing Appendix B.				S4	4,0
			As inspection drawing, Group B dimensions				
GROUP C - PERIODIC							
General test conditions - as for Group A							
Only tests marked (D) are destructive						AQL : given in %	
INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
SUB-GROUP C1	Applicable Sub-Group C1 tests performed in Sub-Group A1 and A3						
SUB-GROUP C2	At 3 monthly intervals					1	1,5
- Resolution (Modulation trans- fer Function Method) measured at 9 screen posi- tions		See Appendix E. Conditions of test as for Resolution (MTF) in Sub-Group A1.					
		Horizontal MTF					
		At 250 cycles/raster width: Screen centre - position E.	55		%		
		Screen positions A, B, C, D, F, G, H, J.	50		%		
		At 350 cycles/raster width: Screen positions A, B, C, D, E, F, G, H, J.	30		%		
		Vertical modulation ratio					
		Screen positions A, B, C, D, E, F, G, H, J.	30		%		

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
SUB-GROUP C3	At yearly intervals. The sample size and acceptance criterion shall be as in 3.4 and 4.9.2 of CECC 11000 as appropriate.						
- Mass				1	Kg		
- Heater modulation	4.6.31	Focused raster just visible non-synchronised with heater supply frequency of 50 Hz approx.	No intensity modulation				
- Capacitances	2.2 IEC 100	Modulator (Vg1) electrode to all. Measure before fitting connectors. Keep modulator lead separate from other leads.	-	12	pF		
		Cathode to electrode to all. Keep cathode lead separate from other leads.	-	8	pF		
- Damp heat	4.8.3	Duration 4 days.	See 4.8.3				
- Operating endurance (D)	4.9.2	Focus raster. Maintain Ik at initial value measured for luminance of 223 cd/m ² in Sub-Group A1. Duration 1000 h min.					
- Post Operating endurance tests							
Intensity modulator electrode cut-off voltage	4.6.2	As in Sub-Group A1. Measure cut-off voltage and calculate change from initial value.	-	5	V		
Luminance characteristics		Display raster and measure luminance with Vg1 drive set to value previously recorded for luminance of 223 cd/m ² in Sub-Group A1 under Luminance Characteristics.	111	-	cd/m ²		

SUB-GROUP C3 CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Post Operating endurance tests (continued)							
Cathode warm up time		As Appendix F. Measure warm up time to reach 80% of the luminance value measured and recorded in the preceding test.		30	s		
Cathode emission	4.6.3	As in Sub-Group A1 except K = 1.8.	Calculated $I_k(\text{min}) = K(\text{cut-off voltage})^{3/2}$				
Electrode leak- age current	4.6.11	Vg1 = -150 V, Vg2 = 600 V, Vg3 = 700 V, Vg4 = 10 kV. Measure Ig2 Measure Ig3 Measure Ig4		± 10 ± 15 5	µA µA µA		

GROUP D - Qualification approval only

General test conditions - as for Group A.

Only tests marked (D) are destructive

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
The sample size and acceptance criterion shall be as in 3.4 of CECC 11000							
- Cathode warm up time		See Appendix F. Raster characteristics as for Resolution and Lumin- ance in Sub-Group A1. Maximum warm-up time to reach 200 cd/m ² .	-	30	s		
- Standby mode		As Appendix H. Standby period = 24 h. Change in Vg1 drive.		1	V		

GROUP D CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Persistence		Display raster. Adjust V_{g1} for screen luminance of 223 cd/m^2 . Excitation time = 120 s ± 20 s. Ambient temperature = 20 ± 5 °C. Measure decay time to 22.3 cd/m^2 .		3	ms		
- Deflection linearity		See Appendix S. X-axis linearity. Y-axis linearity. Difference between adjacent vertical line spacings.		± 2 ± 2 8	% % %		
- Pattern distortion		See Appendix G.		2.5	%		
- Gamma		See Appendix K. Test conditions as for Resolution and Luminance in Sub-Group A1.	Record				
- Vibration (D)		IEC 68-2-36 Test Fdb. Random vibration $0.1 \text{ g}^2/\text{Hz}$, 20-500 Hz, falling to $0.01 \text{ g}^2/\text{Hz}$ at 2000 Hz. Vibrate for 6 hour test periods on each of three major axes, made up of three 2 hour periods at +30 °C, +80 °C and -30 °C. At every temperature level display a focused raster for two 45 minute periods and for one 15 minute period at completion of a test cycle. Appendix J shows test chamber temperature time period sequences relative to vibration and tube operation for one axis. Temperature transition time to be approximately 2 °C per minute, but not more than 3 °C per minute. Tube and leads to be clamped to and rigidly attached to vibration table.	Observe for raster break-down				

GROUP D CONTINUED

INSPECTION OR TEST	REFERENCE CECC 11000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS				
			MIN	MAX	UNITS	IL	AQL
- Post Vibration tests End point tests 1 thro 15 (See page 17)							
- Shock	4.8.4	Tube and leads to be clamped to and rigidly attached to shock table. One axis (Z) to be the tube neck axis. The tube neck axis to lie horizontal for the two other axes (X and Y). Peak acceleration 200 g (1960 m/s²), half sine wave, pulse duration 3 ms. 3 successive shocks in each direction of each axis, 18 shocks total.					
- Post Shock tests End point tests 1 thro 15 (See page 17)							
- Bump	4.8.5	Tube and leads to be clamped and rigidly attached to bump machine. Peak acceleration = 245 m/s² (25 g). Pulse duration = 6 ms. Number of bumps = 667 ± 10 applied in the two senses of three major axes. Total number of bumps = 4000.					
- Post Bump tests Eng point tests 1 thro 15 (See page 17)							