

BRITISH STANDARDS INSTITUTION
2, PARK STREET, LONDON W1A 2BS

BS CECC 11 001-012



Specification available from:- AS SHOWN IN PD 9002,
CECC 00 200, AND

RANK ELECTRONIC TUBES LIMITED,
SIDCUP BY-PASS,
SIDCUP, KENT. DA14 6LZ.

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ELECTRONIC COMPONENTS OF ASSESSED QUALITY : DETAIL
SPECIFICATION IN ACCORDANCE WITH CECC 11 000 : 1980

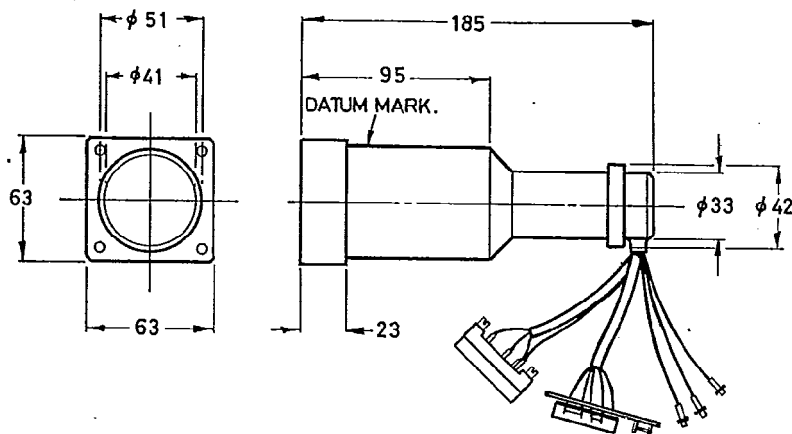
MANUFACTURER'S TYPE NUMBER
G 0541-S3

NATO Stock No.
5960-99-967-0650

Outline and dimensions Third angle projection
dimensions in mm.

SEE PD 9002 and CECC 00 200

For ordering information
see Clause 4.



For detail dimensions and base connections see
Appendix B

Marking information see Clause 3.

DISPLAY MONITOR CATHODE RAY
TUBE ASSEMBLY

DEFLECTION : MAGNETIC

FOCUS : ELECTROSTATIC

GUN : PENTODE

SCREEN : 41 mm dia. min.

PHOSPHOR : S3 (JEDEC P43)

COLOUR : GREEN $x=0.333$
 $y=0.556$

PERSISTENCE: MEDIUM

TUBE, COILS AND SHIELD
POTTED ON TO MOUNTING COLLAR

FULL ASSESSMENT
(ADDITIONAL)

1. DATA (not for inspection purposes)

Mechanical

Mounting position : Unrestricted

Mass (weight)

0.9 kg max.

Environmental

Temperature

Operating

Min.

Max.

-40 °C

+80 °C

Storage

-40 °C

+85 °C

Shock

Peak acceleration

1960 m/s²

Time duration

3 ms

In both directions of three axes

Vibration

Random

20 to 500 Hz
500 to 2000 Hz

0.10 g²/Hz
0.10 g²/Hz falling to
0.01 g²/Hz at 2 kHz

Mould Growth

Non operational

to IEC 68 Test J Severity 28 days

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

Bump

Non operational

Peak acceleration 245 m/s²

Pulse duration 6ms

In both directions of 3 axes. Total 4000 bumps

Damp Heat

Non operational

40 °C at R.H. 93%, 4 days

Electrical - Limiting values (absolute maximum rating system - IEC 134)

	<u>Min.</u>	<u>Max.</u>	<u>Units</u>
Heater voltage	5.7	6.9	V
Second grid voltage	200	600	V
Third grid voltage	700	1900	V
Fourth grid voltage	4.5	8.5	kV
Modulator voltage (positive)	Must never become positive		
Modulator voltage (negative)	0.5	200	V
Heater to cathode voltage (heater positive)	-	200	V
Heater to cathode voltage (heater negative)	-	200	V
Cathode mean current	-	150	μA
Intensity modulator electrode cathode circuit resistance	-	1.5	MΩ

2. OPERATING CONDITIONS AND TYPICAL CHARACTERISTICS

When the tube is operated under the conditions given below, the characteristic values which follow them are attainable:

V_h = 6.3 Vdc; V_{g2} = 300 V; V_{g4} = 8 kV;

Deflection coil integral with tube assembly.

	<u>Min.</u>	<u>Max.</u>	<u>Unit</u>
Heater current	0.27	0.33	A
Voltage required on the modulator electrode for spot cut-off	30	65	-V
Focus electrode voltage	1.320	1.545	kV
Useful screen diameter	41	-	mm
Resolution M.T.F. 350c/raster width	30	-	%

3. MARKING

Each tube and package shall bear the following markings:

- Manufacturer's type number.
- NATO Stock Number if applicable.
- Special marking relating to hazards. Each tube and/or package contains a warning of hazards with respect to handling, implosion and Xrays.
- Factory Identification Code.
- Date Code.
- To BS CECC 11 001-012
- Manufacturer's serial number.

Orders for components to this specification shall include the following minimum information:

- (1) Quantity
- (2) Manufacturer's type number.
- (3) NATO Stock Number if applicable.
- (4) Specification BS CECC 11 001-012 Issue 2
- (5) Any special requirements and packaging instructions shall be included in the order.

BS 6001	Sampling procedures and tables for inspection by attributes.
BS 9000	General requirements for a system for electronic components of assessed quality.
CECC 00 200	CECC Qualified Products List.
BS CECC 11 000	Generic specifications : Cathode ray tubes.
BS CECC 40 101	Resistors.
DEF.STAN 61.12(pt 18)	Equipment wires, Low Toxicity.
IEC 68	Basic environmental testing procedures.
IEC 100	Methods for the measurement of direct interelectrode capacitances 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.

None applicable.

This tube when operated within its rated conditions will not emit X-rays above the recommended permissible level of 0.5 mR/h discernible at 50 mm distance from any part of its external surface. Under fault conditions (above 10 kV on fourth grid) it may emit X-rays above the recommended permissible level.

- 8.1 The assembly comprises a high resolution, rugged, cathode ray tube with the associated high precision deflection coils potted on to the tube, which in turn is potted into a mounting collar. A mu-metal shield is fitted over the tube, and the tube electrodes are supplied through flying leads potted into the assembly. All leads are terminated with connectors. The front mounting collar and the rear mounting ring are rigidly attached to the mu-metal shield.
- 8.2 The tube faceplate is made of non-solarising glass which will not discolour appreciably with time under normal operating conditions.
- 8.3 The screen material will be damaged if the spot remains stationary, particularly under d.c conditions.
- 8.4 The potting compound used to secure the tube must not be exposed for long periods to atmospheres or liquids containing petroleum extracts including glycol.
- 8.5 Warm-up time : E.H.T may be applied in less than 60 s after applying heater voltage, provided that the modulator voltage is negative with respect to cathode. The modulator must be negative to cathode when the first anode voltage is applied.

8.6 Standby Mode of Operation

The tube will be run in a stand-by mode of operation to allow immediate display of the raster when the system is powered up to the fully operational condition. The heater will be at 6.3 V. To prevent poisoning of the cathode under these conditions, a voltage of +15 V will be applied to the second grid and the modulator will be biased by a 1M ohm resistor connecting it to the cathode.

8.7 Brilliance control resistors, and Focus range resistors.

Connector assembly PL6 includes a mounting plate with four select on test resistors. The mounting plate is described in Appendix B/3. Selection of resistors is described in Appendices K/1, K/2 and L.

8.8 External Finish

External finishes are corrosion resistant; shield is matt black epoxy paint and mounting surfaces are treated with Alocrom.

TEST CONDITIONS AND INSPECTION REQUIREMENTS

GROUP A - Lot by Lot

GENERAL TEST CONDITIONS. (unless stated otherwise for a particular test)

Vh 6.3 V $\pm$ 0.1 V Vg2 300 V $\pm$ 1 % Vg4 8 kV $\pm$ 2 %. All other electrode voltages as required.

Deflection coil: The alignment of the deflection coil is set for optimum display and potted on to the tube to maintain this position.

Raster details: 625 line TV standard, interlaced at a field repetition frequency of 50 Hz. Horizontal and vertical dimensions of the display to be beyond the edge of the phosphor screen, (overscanned).
With Line and Field blanking of 12 μ s and 1.6 ms respectively applied to tube.

Pre-heating: Apply Vh only for 2 mins max.

All potentials are with respect to the cathode unless otherwise stated.

Photometer Photodetector response sensitivity, shall be that of the C.I.E Standard observer.
Aperture 10 mm dia.

All tests are non destructive AQL: given in %

INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN. MAX.	UNITS	IL AQL
Subgroup A1					
-Visual					
Pre non-operating endurance	4.3		See 4.3		100 %
-Intensity modulator electrode cut-off voltage	4.6.2	Focused spot	30 65 (record)	-V	
-Cathode emission	4.6.3	Min. cathode factor K = 2.5 Modulator voltage equal to half the value in 4.6.2. Defocused raster	* Ik = $\frac{K(\text{cut-off voltage})^{3/2}}{\sqrt{128}}$		
-Non-operating endurance (holding period)	4.9.1	No voltages. Duration 24 hr. min.			

* To be calculated



GROUP A (continued)

INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN.	MAX.	UNITS IL AQL
Subgroup A1 (cont'd)					100 %
Post non-operating endurance tests					
-Gas content coefficient (Ig3/Ig2)	4.6.1	Vg2 = 300 V Vg3 + g4 = -40 V. Ik = 200 A. Measure Ig3, calculate Ig3/Ig2	-	0.2	nA/μA
-Intensity modulator electrode cut-off	4.6.2	Focused spot	30 (record value)	65	-V
-Cathode emission	4.6.3	Min. cathode factor K = 2.5. Modulator voltage equal to half the value in 4.6.2. Defocused raster.			
-Quality of fluorescent screen and faceplate	4.6.10	Adjust modulator electrode for convenient screen luminance			Ik to be within 15 % of the value recorded in 4.6.3 pre non-operating endurance test
-Useful screen area		w.r.t geometric centre of collar	41 dia	-	mm
-Mechanical spot displacement, each axis	4.6.5 Method B	No deflection fields. Measured with respect to geometric centre of the reference collar. See Appendix M.	-	1.0	mm
-Deflection sensitivity and symmetry		Test method as Appendix E. Connect d.c. only to coil under test. (Other two coils to be open-circuit)			
X axis		Deflect focused spot ±20 mm from centre Symmetry of deflection - see Appendix E.	±450	±550 ±1.5	mA %
Y axis		Deflect focused spot ±15 mm from centre	-	±175	mA
X shift		Deflect focused spot ±3 mm from centre	-	±66	mA
-Rotation reference		Test method as Appendix F. Angle between X scan and collar top edge		1	degree
-Luminance characteristics	4.6.4 (Proc.1)	Raster 32.8 x 24.6 mm. Luminance 223 cd/m ² . Writing speed 0.63 mm/μs. Measurements to be made at centre of raster. Modulator voltage from cut-off (drive)		22	V
		Cathode current	-	75	μA

GROUP A (continued)

INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN.	MAX.	UNITS IL AQL
Subgroup A1 (cont'd)					100 %
-Resolution (Modulation transfer function)		Test method as in Appendix C Raster size 32.8 x 24.6 mm 1. Horizontal MTF Measurement Line modulation at 350 cycles Line modulation at 250 cycles centre corners 2. Vertical MTF Measurement Vertical modulation Adjust focus voltage for the best overall resolution. Test method as Appendix H Display vertical and horizontal diametral traces. Measure deviation from right angle. Luminance 20 cd/m ² . Tap with forked hammer for 5 secs. Vg2 = 600 V Vg3 = 1.9 kV Vg4 = 10 kV Vg1 set to cut-off. Plane of screen horizontal and uppermost. Period of observation 60 s. Tap with specified hammer for 5 sec. Vg2 = 600 V Vg3 = 1.9 kV Vg4 = 10 kV Vg1 set to cut-off. Plane of screen vertical. Period of observation 60 s. Tap with specified hammer for 5 sec.	30 55 50	- - -	% % %
-Focus			50	-	%
-Orthogonality			1.32	1.545	kV
-Microphony				0.75	degree
-Stray emission	4.6.6			None visible	
-Flashover	4.6.7 Method A			See 4.6.6	
-Detail dimensions	4.4	Inspection drawing		See 4.6.7	
-Deflection Polarity		Deflection down Deflection left Shift left		As inspection drawing (Group A) (Appendix B) Pos.volt. on PL6 Pin 16,neg. volt. on PL6 Pin 17. Pos.volt. on PL6 Pin 1, neg. volt. PL6 Pin 5. Pos.volt. on PL6 Pin 14,neg. volt. PL6 Pin 13.	

GROUP A (continued)

INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN. MAX.	UNITS	IL AQL
Subgroup A1 (cont'd)					
-Conductance		Collar to mu-metal shield, No voltages	5	Siemens	100 %
-Select on test resistors R1 and R2 : R3 and R4		Raster 32.8 x 24.6 Procedure as described in Appendices K & L.			
Subgroup A2					II 1.5
-Deflection coils		Frequency 50 kHz Method of test, see Appendix J.	-38	dB	
-Intercoupling		Measure at 500 V. Between X and Y coils.	10	MΩ	
-Insulation		Both coils and core	10	MΩ	
-Deflection Linearity	4.6.22 Method A	X deflection ±5 mm and ±15 mm Y deflection ±5 mm and ±15 mm	-	%	
Subgroup A3					S4 6.5
-Mass					
-Heater current	4.6.8		0.9	Kg	
-Heater to cathode leakage	4.6.9	V _{h-k} (Heater positive) = 200 V V _{k-h} (Heater negative) = 200 V	0.33	A	
-Intensity modulator electrode total negative current	4.6.12 Method A	Adjust V _{g1} for cut-off V _{g3} = 1.9 kV	-	μA	
-Electrode leakage current	4.6.11	V _{g2} = 600 V V _{g3} = 1.9 kV V _{g4} = 10 kV	-	μA	
Second grid Third grid Fourth grid			2	μA	
-Deflection coils:			2	μA	
Inductance:		Measure at 1 kHz. shield at earth potential. No voltages on tube electrodes	450	μH	
X coil			2.7	mH	
Y coil			860	μH	
X shift coil			1.5	ohm	
Resistance:		D.C	15.0	ohm	
X coil		D.C	20.4	ohm	
Y coil		D.C	8.0	ohm	
X shift coil					

GROUP B Lot by lot					
General test conditions - as for Group A. Only tests marked (D) are destructive					
INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN. MAX.	UNITS	IL AQL
-Dimensions	4.4	See 4.4	See inspection drawing (Group B) (Appendix B)	S4	4.0

GROUP C - PERIODIC					
General test conditions - as for Group A, Raster size 32.8 x 24.6 mm. Only tests marked (D) are destructive					
INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN. MAX.	UNITS	IL AQL
Subgroup C1		Periodicity up to three months. Sample size 8, one reject permitted			
-Capacitances	2.2 IEC 100	No voltages. Inclusive of leads and connector. Modulator to all Cathode to all	- -	25 25 pF pF	
Subgroup C2		Not applicable			
Subgroup C3		Inspection level and Sample Size see 4.9.2 of BS CECC 11 000			
-Operating Endurance (D)	4.9.2	Focused raster as in 4.6.4 Duration 1000 h. min. Measure at conclusion of 1000 h. approx.			
-Intensity modulator electrode cut-off voltage	4.6.2	As in Subgroup A1 Change in cut-off voltage	-	5 V	
-Cathode emission	4.6.3	As in subgroup A1 Minimum cathode factor K = 1.8	*Ik = $K(\text{cut-off voltage})^{3/2} / 128$		
-Luminance characteristics	4.6.4 (Proc.1)	As in subgroup A1 Change in luminance	-	50 %	

GROUP D - Qualification approval only					
General test conditions - as for Group A Raster size 32.8 x 24.6 mm.					
Only tests marked (D) are destructive					
INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN.	MAX.	UNITS IL AQL
-Vibration (D)		The sample size and acceptance criterion shall be as in 3.4			
-Random (Cyclic operational/non-operational)	IEC 68	Test Fc Raster, 223 cd/m ² Tube mounted in accordance with Appendix D Test levels 20 to 500 Hz : 0.1 g ² /Hz 500 to 2000 Hz : 0.1 g ² /Hz falling to 0.01 g ² /Hz at 2 kHz See Appendix D2 for programme of temperatures, tube operation periods, and vibration periods. One cycle at 3 temperatures, +30 °C, +80 °C and -30 °C, on each of 3 mutually perpendicular axes.			There shall be no visible breakup of the raster during the operating periods.
-Post Vibration tests	4.3		See 4.3		
-Visual	4.6.3	As in subgroup A1. K = 2.5 min. Change in value from initial value	-	15	%
-Cathode emission	4.6.1	As in subgroup A1	-	0.2	nA/μA
-Gas content coefficient	4.6.2	As in subgroup A1. Change in value	-	7	%
-Intensity modulator electrode cut-off voltage	4.6.6	As in subgroup A1	See 4.6.6		
-Stray emission	4.6.7 Method A	As in subgroup A1	See 4.6.7		
-Flashover	4.6.5	As in subgroup A1	-	1.0	mm
-Mechanical spot displacement, each axis	4.6.10	Adjust modulator electrode voltage for convenient screen luminance	As blemish specification (Appendix A)		
-Quality of fluorescent screen and faceplate			41 dia.	-	mm
and					
-Useful screen area					

GROUP D (continued)

INSPECTION OR TEST	REFERENCE BS CECC 11 000	CONDITIONS OF TEST	INSPECTION REQUIREMENTS		
			MIN. MAX.	UNITS	IL AQL
-Post vibration tests (cont'd) -Resolution (m.t.f) and -Focus characteristics		As in subgroup A1. 350 cycles/raster width	30	%	
-Shock Non operational	IEC 68	As in subgroup A1 Test Ea. Tube mounted in accordance with Appendix D1. Severity: Wave shape: half sine. Peak acceleration 1962 m/s^2 . Pulse duration 3 ms. Three successive shocks in each direction of three mutually perpendicular axes one axis being the tube neck axis. (18 shocks total)	1.32	1.545 kV	
-Post shock tests As required for post vibration test	IEC 68	Test J Duration 28 days	Scale 1		
-Mould growth Non operational	4.3 IEC 68	Magnification x 50			
-Post mould growth test -Visual inspection		Test Eb. Tube mounted in accordance with Appendix D1. Severity: Peak acceleration 245 m/s^2 . Pulse duration 6 ms, 666 bumps in each axis and reverse (4000 bumps total)			
-Bump Non operational					
-Post bump test As required for post vibration test.					
-Dry heat	IEC 68	Test Bb. Raster 223 cd/m^2			
-Operational		T = +80 °C. Duration at temperature, 2 h.			
-Non operational		T = +85 °C. Duration at temperature, 2 h.			
-Post Dry Heat tests As required for post vibration tests			There shall be no visible breakup of the raster during operation.		