MINISTRY OF AVIATION - D.L.R.D./S.R.D.E.

VALVE ELECTRONIC **CV6099**

SPECIFICATION M.O.A./CV 6099
Issue 2A, dated 16th November, 1966
Also subject to the relevant provisions of the latest issue of the associated J.S. Specification K1001.

SECURITY	
Specification	Valve
Unclassified	Unclassified

Type of Valve - Image Converter Tube, Near Infra-Red Sensitive.

Cathode - Caesium silver oxide. S1

Screen - Aluminium backed, GG5(P20).

Type of Focus - Self Focussing, Electro-Static

Envelope - Glass with metal ring connectors.

Prototype - VX 8515 (6929)

MARKING
See K1001/4
Additional Marking:-
Serial No. on the outside of the tube.

Conversion Coefficient
(See Note I)

Ratings, Characteristics and Typical Operation
(Not for Inspection purposes)
All limiting values are absolute

			NOTE
Ratings			
Max. Peak Instantaneous Fluorescent Screen Voltage	(kV)	13.0	B
Max. Continous Fluorescent Screen Voltage	(kV)	12.5	B
Min. Fluorescent Screen Voltage	(kV)	8.0	B
Max. Photocathode Current (Continuous)	(μA)	0.1	
Max. Photocathode Illumination (Continuous)	(lux)	10 i.r.f.	C
Max. Storage Temperature	(°C)	68	D
Characteristics (At Ambient Temp. of 20°C and a Fluorescent Screen Voltage of 12 kV where applicable)			
Peak Spectral Response (Angstroms)		8000 ± 1000	
Min. Conversion Coefficient (CC)	(cd/lm)	0.55	E
Magnification at Centre (nom.)		0.74	
Min. Resolution at Centre of Photocathode		50 line pairs/mm	F
Min. Resolution off axis of Photocathode		12 line pairs/mm	G
Max. Background Equivalent Illumination (Eo)	(lux)	0.025 i.r.f.	H
Max. Dark Current	(μA)	0.02	
Typical Operation			
Fluorescent Screen Voltage	(kv)	12	B

DIMENSIONS

See drawing on page 15

MOUNTING POSITION

Any. See Note A

WEIGHT

42½ gms. approx

A. This tube should be handled by the metal ring connectors in order to avoid producing a conducting surface on the glass.

Avoid exposure to direct sunlight.

Connections to the tube should not be soldered to the metal ring connectors.

Equipment designers are advised that magnetic shielding may be required to minimise the defocussing effects of extraneous fields.

B. Referred to cathode.

C. This value is the maximum illumination which may be allowed to fall on the infra-red filter which must be interposed between the light source and the photocathode.

D. This is the maximum temperature which the tube may encounter at any time. To prevent deterioration it must not be stored at a temperature of 50°C or above for longer than 500 hours. To prevent long term deterioration the tube should be kept in cold storage.

E. This is defined and measured as specified in test t.

F. This applies within a circle of 3.8 mm. diameter, concentric with the photocathode.

G. This applies within a circle of 9.5 mm. diameter, concentric with the photocathode.

H. This is defined as the equivalent input illumination in lux i.r.f. to give an increase in fluorescent screen brightness equal to that of the background brightness. It is measured as specifiedin test v.

I. The value of conversion coefficient at delivery as measured in test t is recorded to two places of decimals and this is to be marked on the tube omitting the decimal point. Thus for values not exceeding 0.99, the marking will consist of two digits and for values of 1.00 or over it will consist of three digits".

J. N.A.T.O. Stock Number 5960-99-037-2574.

TESTS

To be performed in addition to those applicable in K1001. Tests shall be performed in the specified order unless otherwise agreed with the Inspecting Authority. Tests a, b, c and s shall not be performed more than once. Where sampling tests are called for, a lot shall be taken as one calendar month's production.

Test Conditions - Unless otherwise stated.

(i) An operating voltage of 12.0 kV D.C. negative with respect to the fluorescent screen shall be applied to the cathode.

(ii) There shall be no radiation incident upon the photocathode.

(iii) The level of illumination in the vicinity of the test area shall not exceed 1 lux.

(iv) (a) All flux levels are to be measured in terms of the luminous flux obtained from a tungsten light source operating at the colour temperature given in the following table:-

Colour Temperature	Tests
2870 ± 20°K	t,v
2000 - 3000°K	e,f,g,h,j,k,l,m,s

(b) The standard infra-red filter (see Fig. 1) shall be interposed between the light source and the image tube photocathode, sufficiently close to the latter, so that only direct radiation through the filter shall reach the photocathode. Suitable baffles to ensure this shall, if necessary, be provided.

(c) For those tests where the level of radiation incident upon the photocathode is not specified but is left to the discretion of the observer, this shall never exceed 70 lux, i.r.f.

(v) The observer shall be suitably dark adapted before commencing the test.

(vi) All tests shall be carried out in an ambient temperature of 20°C ± 5°C.

	Test	Test Conditions	AQL	Insp. Level	Symbol	Limits Min	Limits Max	Units
	During all electrical testing of the image tube with the exception of the shock test there shall be no flickering or any other indication of malfunctioning.							
	Group A							
a	High and low temperature and temperature shock tests	Test conditions (i) to (vi) are not applicable Note 1.		100%				
b	Vibration	Test conditions (i) to (vi) are not applicable Note 2.		100%				
c	Shock test	Test condition (vi) is not applicable Note 3.		100%				
d	Dark current	Note 4		100%		-	0.02	µA
e	Uniformity of image screen brightness	Note 5		100%				
f	Voltage stability	Note 6		100%				
g	Resolution (1) Centre	Note 7		100%		50	-	line -pairs /mm
	(2) Off axis			100%		12	-	line -pairs /mm
h	Spots, Streaks and Blemishes	Note 8		100%				
	Groups B and C	Omitted						
	Group D	Note 9						
j	Alignment of mechanical and optical axes.	Note 10	6.5	S2				
k	Centre magnification	Note 11	6.5	S2	M1	0.715	0.765	
l	Distortion	Note 12	6.5	S2	D	5.5	10	%

	Test	Test Conditions	AQL	Insp. Level	Symbol	Limits Min	Limits Max	Units
	Group E							
m	Irradiation Surge	Note 13		Q.A.				
n	Resistance to external pressure	Test Conditions (i) to (vi) are not applicable Note 14.		Q.A.				
p	Damp heat (long term)	DEF 5011 Class H6 Note 15		Q.A.				
	Group F							
q	Shelf Life	t = 18 months. The tube shall be stored in darkness with no voltage applied	Note 16	Note 17				
	Life Test end point							
	Conversion Coefficient	As in test t Note 18			C.C	0.37	-	cd/lm
r	Operational Life	I_a = 0.02μA Test Conditions (iv) (a) and (iv) (c) are not applicable t = 1000 hours continuous Note 19		Note 20				
	End Point Test 500 hours							
	Conversion Coefficient	As in test t Note 20	-		C.C	0.44	-	cd/lm
	End Point Test 1000 hours							
	Conversion Coefficient	As in test t Note 20	-		C.C	0.37	-	cd/lm

	Test	Test Conditions	AQL	Insp. Level	Symbol	Limits Min	Limits Max	Units
	Group G 100% Retest							
s	Accelerated ageing	Note 21		100%				
t	Conversion Coefficient (1)	Note 22		100%	C.C	0.55	-	cd/lm
u	Conversion Coefficient (2)	Predicted at t = 18 months Note 23		100%	C.C	0.37	-	cd/lm
v	Background Equivalent Illumination	Note 24		100%	Eo	-	0.025	Lux i.r.f.

NOTES

1. The image tube shall be placed in the test chamber and the internal temperature of the chamber raised gradually, in not less than 30 minutes, to 68°C. After at least 1 hour at this temperature, the temperature of the chamber shall be lowered gradually, in not less than 15 minutes, to 52°C and held there for a further 1 hour. The image tube shall then be removed from the chamber and immediately placed at room temperature for at least 1 hour. Upon completion of this test, the image tube shall be visually examined. There shall be no deformation, cracking or fracture of any part.

   Image tubes which have successfully passed this test shall be replaced in the test chamber and the temperature lowered gradually, in not less than 30 minutes, from room temperature to -54°C. The chamber shall remain at this temperature for at least 1 hour and thereafter shall be raised gradually, in not less than 15 minutes, to -32°C where it shall be held for at least 1 hour. The image tube shall then be immediately removed to room temperature and after not less than a further 1 hour the image tube shall be examined again. There shall be no deformation, cracking or fracture of any part.

2. The image tube shall be rigidly mounted with its photocathode downwards in a jig of an approved design and the complete assembly shall be vibrated along the longitudinal axis of the tube with an acceleration of not less than 6g. The vibration shall be sinusoidal, having a harmonic distortion content not exceeding 5%, at any single nominal frequency between 25 and 30 c/s and be applied for a period of not less than $2\frac{1}{2}$ minutes duration. The image tube shall then be removed from its holder and visually examined. There shall be no loose elements or particles.

3. The image tube shall be rigidly mounted in a holder of an approved design and subjected to shock impacts of peak value 75g. The waveform of the impact shock shall be substantially rectangular and the time duration for which the peak shock value is maintained shall be at least 5 milliseconds. The duration of the impact excluding any overshoot which may occur shall be 8 $\pm$ 3 milliseconds. Any overshoot which occurs during the decay period of the shock shall be damped and shall not exceed 25% of the peak value. This test shall be performed six times with the

shock impact applied along the longitudinal axis of the image tube and six times perpendicular to this same axis. During these tests, the observer shall view the image tube with the unaided eye. There shall be no signs of instability or flashing on more than two of the impacts during each series of six shocks. There shall be no signs of instability or flashing after coming to rest after each impact.

4. Dark current is defined as that electrical current which flows within the image tube and across the external surfaces of the image tube with no radiation incident on the photocathode.

5. A diffused and filtered illumination level of 0.35 lux shall be incident on the photocathode. The whole of the image screen shall be viewed through a nominal 10 power magnifier for evidence of non-uniform screen brightness. There shall be no line of demarcation if any variation of brightness exists, nor shall there be a mottled or water mark appearance.

6. A voltage of 13.0 kV shall be applied to the image tube for a period of not less than 1 minute. The rate of rise of voltage is defined by an RC combination with time constant 0.1 sec. e.g. R = 100 M. ohms, C = 1000 pF, nominal. During this test the image screen shall be observed through a nominal 10 power magnifier. There shall be no arcing, flashing, flickering or any other indication of malfunctioning.

7. This test shall be performed using a X10 or higher power magnifier.

The test chart shown in Figure 2 of this specification shall be projected on to the photocathode using an optical system such as shall not detract from the resolution capability of the image tube or of the observer. The optical system shall comprise a light source, condenser lens assembly with the test chart in close proximity to it, a high quality projection lens and the standard infra-red filter. The test chart shall be placed so that the outer circle A is concentric with the tube axis.

Using a convenient level of filtered radiation the longitudinal position of the image tube shall be adjusted to present the best simultaneous resolution of the four test patterns in the centre of the test chart, although it is not necessary to view all four patterns at the same time. Without further adjustments to the input optical system and the tube, the resolution of the image tube shall be such that all the patterns on the test chart are resolved.

8. (a) The image tube screen shall be examined with a 2.5 power magnifier. There shall be no bright spots, streaks or other configuration of greater intensity than the background brightness of the image screen.

(b) With a convenient level of filtered radiation incident upon the image tube photocathode, the image screen shall be viewed through a 2.5 power magnifier. There shall be no ion spots.

(c) The image tube, without the operating voltage applied to it shall be held vertically with its photocathode downwards and it shall be tapped in such a way as to cause any loose particles which may be present inside the tube to fall towards the photocathode.

With the operating voltage restored to the image tube the useful image screen shall then be examined with a 10 power magnifier. The photocathode shall be illuminated through a lens at an aperture of f/2.8 to give a nominal 70 lux filtered on the cathode. The screen shall be examined for spots. The aperture of the lens shall then be reduced to f/11 and the number of grey and dark spots shall be assessed. Differentiation between cathode and screen spots shall be made and the number of cathode spots of size not less than 0.05 mm shall not exceed 10 and none shall exceed 0.15 mm. No spots present shall exceed 0.30 mm and otherwise shall not exceed the size and quantities in all three categories shown below. Spot size is defined as the maximum dimension.

Spot size (mm)	Number of spots within 10.16 mm diameter circle*	Number of spots within area bounded by two circles* of diameter 10.16 mm and 19.05 mm
0.23 to 0.30	0	2
0.15 to 0.30	0	12
0.05 to 0.30	10 minus the total number of photocathode spots as defined above.	32

*Circles on planar space image at the photocathode concentric with the tube axis.

9. The tests in this group may be performed after the Group G tests if desired.

10. A perspex disc with two lines perpendicular to one another engraved across its diameter shall be located accurately inside the photocathode bearing surface and against the photocathode window (see dimensional outline drawing page 15). A similar disc but having a circle of 1.14 mm radius engraved upon it concentric with the centre of the disc shall be accurately located against the image tube screen. With a convenient level of filtered radiation incident upon the photocathode, the image screen shall be observed using a 10 power magnifier.

The projection of the point of intersection of the photocathode crosswires on the screen shall be within the prescribed circle at the screen.

11. A metal disc, having an accurately bored aperture of diameter one sixth of the photocathode useful diameter (i.e.3.20±0.05mm) at its centre shall be located inside the photocathode bearing surface and against the photocathode window.

Using a convenient level of filtered radiation, the diameter of the image produced on the phosphor screen shall be determined using a X10 travelling microscope with crosswires in the optical system.

The centre magnification, M_1, of the image tube is defined as the ratio of the diameter of the image produced on the phosphor screen to the diameter of the aperture at the photocathode.

12. The outer magnification M_2, of the image tube, is to be measured by the method described in Note 11 for centre magnification M_1, except that the diameter of the aperture shall be 80% of the photocathode useful diameter (i.e. 15.20 ± 0.05 mm).

The percentage distortion of the image tube shall be determined from the following formula:-

$$D = \frac{(M_2 - M_1)}{M_1} \times 100$$

where D = percentage distortion

M_1 = centre magnification (obtained in test k)

M_2 = outer magnification

13. This is a conditioning test only. The whole of the cathode area shall be subjected, for a period of 1 ± 0.5 sec., to the sudden application of radiation produced by an illumination of 7000 lux i.r.f. in the cathode plane. The total source impedance of the power supply shall be 2 kM. ohms ± 10%.

This test, when required, is to be performed after test c in Group A, and the tube must subsequently satisfy the tests d to h in Group A, and tests s, t, v in Group G.

14. The image tube shall be subjected to the application of an external pressure of 2 kg per square cm above atmospheric pressure for not less than 1 minute. There shall be no deformation, cracking or fracture of any part.

15. Devices used for this test may be either dummy image tubes or selected from those which have failed any electrical test. Upon completion of this test, surface moisture shall be removed by shaking and the image tube shall be visually examined. There shall be no signs of deterioration in the varnish.

16. For Qualification Approval purposes, the manufacturer shall provide sufficient evidence to show, to the satisfaction of the Q/A Authority, that the requirements of this shelf life can be met, and that it can also be used to predict, with a high degree of confidence, the shelf life trend for at least 18 months, of individual tubes off future production. The method of prediction shall be approved by the Q/A Authority.

This test shall also be performed on every lot for record purposes, to maintain a check on the required standard of shelf life performance. All relevant records of these tests shall be available for the information of the Approving and Inspection Authorities, when required. Any significant changes in results which might affect the predictions made in test u must be brought to the attention of the Inspection Authority.

17. Unless otherwise agreed with the Approving and Inspection Authorities, a random sample shall be drawn from each lot in accordance with the following table:-

Lot Size	Sample Size
3 to 15	3
16 to 25	4
26 to 40	5
41 to 65	7
66 to 110	10
111 to 180	15
181 to 300	20
301 to 500	25
501 to 800	30
801 to 1300	35

Unless otherwise called for in the contract with the manufacturer the sample tubes for this test shall have satisfied all other tests except test r (Operational Amdt 1 Life), and test u (Conversion Coefficient (23)).

18. Unless otherwise agreed with the Approving and Inspection Authorities, the end point test shall be performed on every tube in the sample every four months from the month in which the lot was released, for at least 20 months from release.

19. The life test sample shall consist of not less than seven tubes per month and shall be selected randomly from tubes which have satisfied the requirements of the Group A tests.

Each tube shall be provided with its own lamp. The current through the tube shall be checked daily and the lamp voltage adjusted as necessary to give the specified current.

20. This life test shall be conducted for 1000 hours and acceptance shall be on the basis of the 500 hour and 1000 hour requirements. Failures due to mechanical defects of the envelope shall not be considered in the calculation of the average life expectancy.

The life test shall be assessed at each end point test time by calculating the average life expectancy of the sample by the methods described below. This is a destructive test.

(a) If a tube satisfied the end point test requirements up to and including the time of the end point test which is being considered, it shall be credited with a life equal to the duration of the test to that end point test time.

(b) If the time of failure to satisfy the end point test requirements is known exactly, it shall be credited with a life equal to the number of hours on life completed before failure.

(c) If the time of failure to satisfy the end point test requirement is not known exactly, the tube shall be credited with a life computed as follows:-

Estimate the time at which the conversion coefficient was equal to the end point test limit by linear interpolation on a conversion coefficient/time diagram between the conversion coefficient at the last successful reading and the conversion coefficient at the first unsuccessful reading.

The average life of the sample shall be the average of the hours credited to the individual tubes in the sample. The total number of tubes placed on life test from the lot shall be considered the life test sample, but at the discretion of the Inspection Authority, any tube whose failure is due to test equipment failure or operator error, shall not be considered in the calculation of the average. The average life expectancy of the sample shall not be less than 80% of the time to the end point test.

In the event that a life test sample fails, a lot may be re-assessed by drawing a further random sample of not less than seven tubes from the lot, repeating the life test and then calculating the average life on the combined sample. The lot shall be rejected if the average life expectancy is less than 80%.

21. The image tube shall be conditioned by subjecting the whole of the photocathode area to an illumination of 70 lux i.r.f. for 5 hours or by operating the tube at a current of 0.1 μA for 5 hours. During this period an operating voltage of 12kV shall be applied to the image tube. The image tube shall then be stored, in the dark, and without further processing, for at least 4 weeks, after which period the measurement of conversion coefficient shall be made in the manner described in Note 22.

22. The conversion coefficient is defined as the ratio of the luminous intensity of the fluorescent screen in a direction normal to the screen with the infra-red filter in place to the luminous flux incident on the photocathode in the absence of the infra-red filter.

i.e. $CC = \frac{I}{F}$ candelas per lumen

where I = luminous intensity of the phosphor screen in candelas

and F = luminous flux incident on the photocathode in the absence of the infra-red filter, in lumens.

NOTE: The relationship between conversion coefficient and conversion index is

$$CI = C.C \times \frac{\pi}{T} = CC \times 27.1$$

where CI = Conversion Index $\left(\frac{lm}{lm\ IRF}\right)$

CC = Conversion Coefficient $\left(\frac{cd}{lm}\right)$

T = Integrated transmission coefficient for infra-red filter (as shown in Fig. 1) = 0.116

The measurements shall be made under the following conditions:-

(i) The colour temperature of the source shall be $2870 \pm 20^{\circ}K$

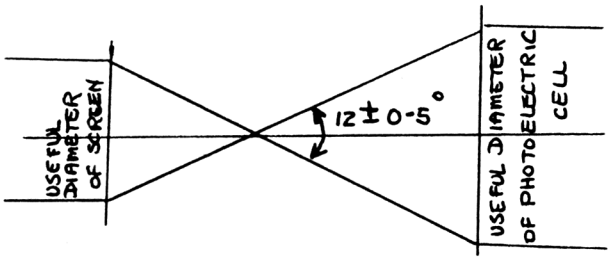
(ii) The infra-red filter shall have a spectral response as shown in Fig. 1.

(iii) The illumination on the photocathode shall be even over an area bounded by a circle of 12.7 mm. diameter centred on the photocathode and shall have a value of 0.01 to 0.02 lumen.

(iv) The luminous intensity of the phosphor screen shall be measured in terms of candelas.

(v) In making the aforesaid measurements, the response of the measuring device shall have a spectral response approximating to the C.I.E. average photopic eye.

(vi) When using a photoelectric cell for determination of luminous intensity its position relative to the phosphor screen shall be as shown below:-



23. The method of prediction, which has been approved by the Q/A Authority, shall be defined in the contract with the manufacturer, and shall involve the use of the results on previously manufactured similar tubes as tested in test q.

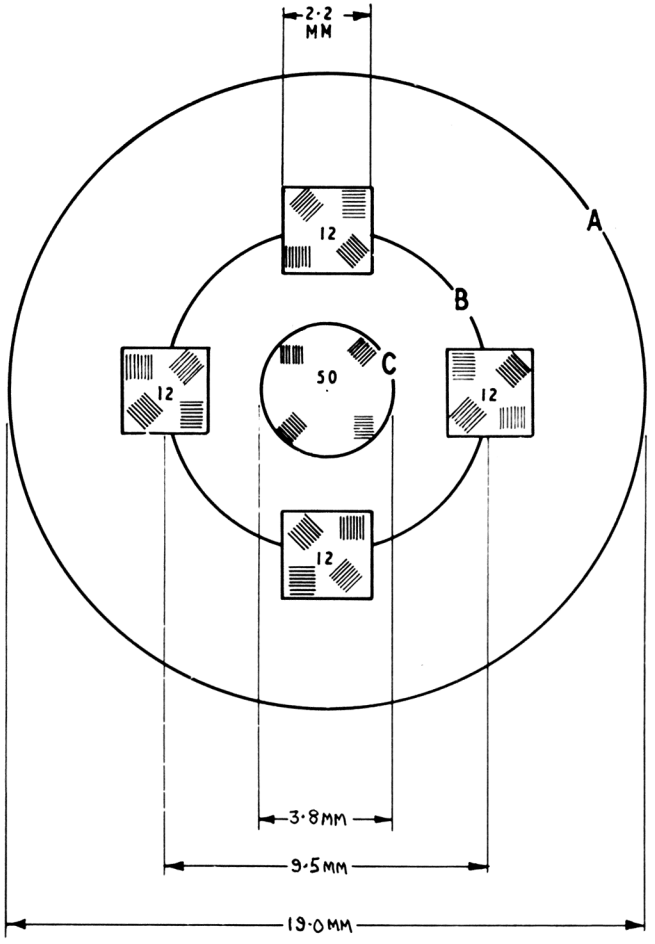
24. This test shall be performed at an ambient temperature of 20 ± 1°C in a darkened enclosure from which all extraneous sources of illumination have been removed. The manufacturer may, at his discretion, perform the test at a higher ambient temperature (up to a maximum of 25°C) but the specified limit shall apply whether or not this concession is used.

A filtered illumination level, Ei, having an accurately known value of the order of 1 lux, shall be incident upon a circular area of 12.7 mm diameter centred on the photocathode. By means of a diaphragm in close proximity to the image tube screen, the emitted radiation from the phosphor over a circular area of 6 mm diameter around the centre of the screen, shall be received by the cathode of a photomultiplier tube.

The photomultiplier tube shall be of the end window type, and shall have an S11 spectral response. The cathode of the photomultipler tube shall be at a fixed distance (of the order of 30 mm) from the tube screen. The sensitivity of the photomultiplier tube shall be adjusted by varying the H.T. voltage to its dynode resistance network until a convenient value of photomultipler tube anode current (Ia) is obtained. This value shall be chosen well within the linear portion of the photomultipler characteristic. The radiation incident upon the image tube photocathode shall then be excluded and the remaining multipler anode current (I_B) measured.

The background equivalent illumination (Eo) is then $\frac{I_B}{Ia} \times Ei$

where I_B and Ia are in microamperes and Eo and Ei are in lux i.r.f. For negligible error (less than 10%) in determining the degree of background equivalent illumination, the photomultiplier dark current should be less than one thirtieth of I_B.



NOTES

1 EACH TEST PATTERN SHALL CONSIST OF 8 BLACK LINES WITH A LINE TO SPACE RATIO OF 1:1 THE BLACK LINES SHALL BE ON A BACKGROUND WITH CONTRAST AS HIGH AS POSSIBLE.

2 THE LENGTH TO BREADTH RATIO OF EACH LINE SHALL BE 15:1

3 THE ORIENTATION OF EACH PATTERN SHALL BE DISPLACED FROM THE ORIENTATION OF AN ADJACENT PATTERN BY 45°

4 THE DIMENSIONS SHOWN ON THIS DRAWING SHALL BE THOSE OF THE PLANAR SPACE IMAGE AT THE PHOTO-CATHODE

5 IN CIRCLE B THE OVERALL SIZE OF EACH PATTERN SHALL BE SUCH AS TO SUBTEND 12 LINE PAIRS/MM AT THE PHOTO-CATHODE (ONE LINE PAIR IS EQUAL TO THE COMBINED WIDTH OF ONE BLACK LINE AND ONE SPACE) EACH BOX SHALL CONTAIN FOUR PATTERNS AND THE FOUR BOXES SHALL BE EQUALLY SPACED ON THE CIRCUMFERENCE OF THE CIRCLE

6 IN CIRCLE C THE OVERALL SIZE OF EACH PATTERN SHALL BE SUCH AS TO SUBTEND 50 LINE PAIRS/MM AT THE PHOTO CATHODE THE FOUR TEST PATTERNS SHALL BE EQUALLY SPACED NEAR THE CIRCUMFERENCE OF THE CIRCLE

FIG. 2 RESOLUTION CHART (NOT TO SCALE)

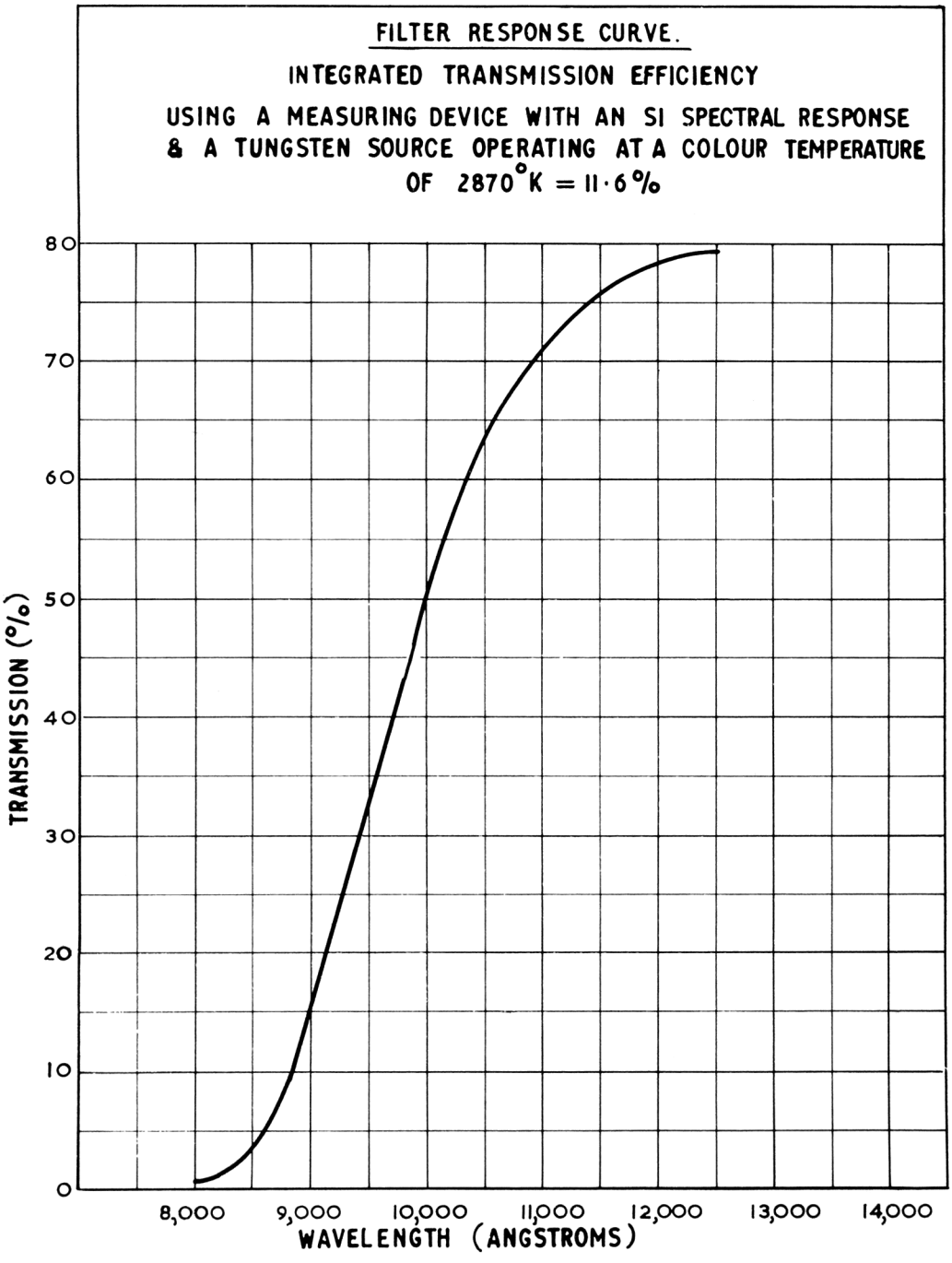
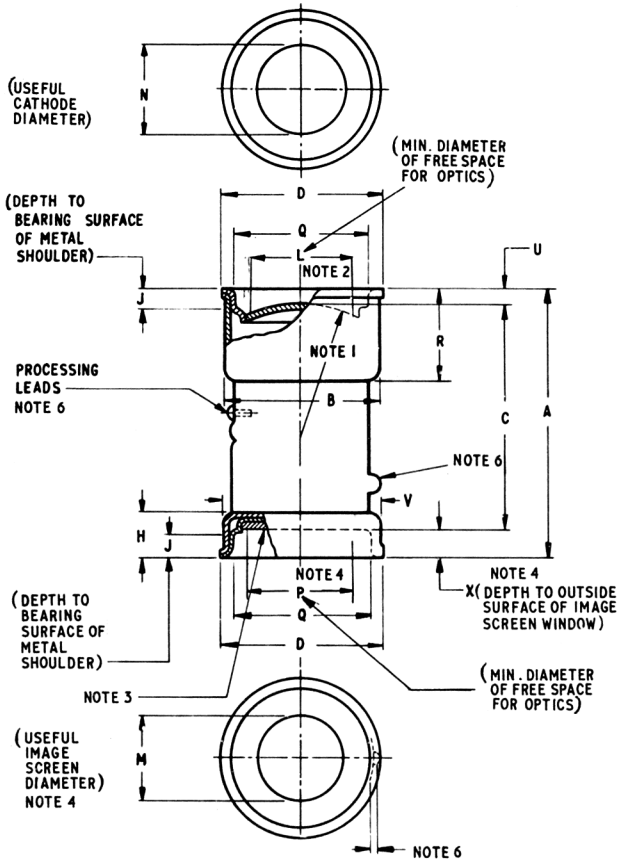

FILTER RESPONSE CURVE.
INTEGRATED TRANSMISSION EFFICIENCY
USING A MEASURING DEVICE WITH AN SI SPECTRAL RESPONSE
& A TUNGSTEN SOURCE OPERATING AT A COLOUR TEMPERATURE
OF 2870°K = 11·6%
TRANSMISSION (%)
0
10
20
30
40
50
60
70
80
8,000
9,000
10,000
11,000
12,000
13,000
14,000
WAVELENGTH (ANGSTROMS)

FIG. 1

DESIGN DATA

FOR INSPECTION REQUIREMENTS ON DIMENSIONS SEE TABLE ON PAGE 16



INFRARED IMAGE CONVERTER TUBE

REF.		A	B	C	D	H	J	L	M	N	P	Q	R	U	V	X
mms.	MAX.	59.30	33.40	51.68	34.92	10.41	5.08	–	–	–	–	30.861	19.58	3.17	33.40	5.08
	MIN.	56.77	32.90	49.92	33.66	9.15	3.56	20.3	16.0	19.05	19.05	30.607	18.06	1.66	32.90	3.56
INCHES.	MAX.	2.335	1.315	2.035	1.375	0.410	0.200	–	–	–	–	1.215	0.771	0.125	1.315	0.200
	MIN.	2.235	1.295	1.965	1.325	0.360	0.140	0.80	0.630	0.750	0.750	1.205	0.711	0.065	1.295	0.140

NOTES:-

1. **FACEPLATE DIMENSIONS.**
   RADIUS OF CURVATURE 31.24 ± 0·50 mm (1·230 ± ·02 inch) INTERNAL AND EXTERNAL.
   CENTRE FACEPLATE THICKNESS 1·52 ± 0·10 mm (·060 ± ·004 inch)
   MAX. VARIATION IN EDGE THICKNESS 0·10 mm (·004 inch)

2. THE EXTERNAL RADIUS OF CURVATURE OF THE PHOTOCATHODE FACEPLATE SHALL BE MAINTAINED OVER A DIAMETER DEFINED BY DIMENSION L. OUTSIDE THIS AREA THERE SHALL BE NO PROTUBERANCE OF GLASS ABOVE THE PLANE OF THE PROJECTED AREA DEFINED BY DIMENSION L.

3. **IMAGE SCREEN DIMENSIONS.**
   THICKNESS 1·90 TO 2·15 mm (·075 TO ·085 inch) AT CENTRE.
   MAX. VARIATION IN EDGE THICKNESS 0·127 mm (·005 inch)

4. WITHIN THE AREA DEFINED BY DIMENSION M, THE DEVIATION FROM FLATNESS OF THE EXTERNAL SURFACE OF THE IMAGE SCREEN SHALL NOT EXCEED 0·051 mm (0·002 inch) FROM PEAK TO VALLEY. OUTSIDE THIS AREA, BUT WITHIN THE AREA DEFINED BY DIMENSION P, THE DEVIATION FROM FLATNESS SHALL NOT EXCEED 0·100 mm (0·004 inch) FROM PEAK TO VALLEY.
   DIMENSION X APPLIES OVER DIMENSION P ONLY.
   WITHIN THE ANNULAR AREA OF THE IMAGE SCREEN WINDOW, OUTSIDE THAT DEFINED BY DIMENSION P, THERE SHALL BE NO PROTUBERANCE OF THE GLASS ABOVE THE PLANE OF THE AREA DEFINED BY DIMENSION P.

5. INDEX OF REFRACTION FOR FACEPLATE AND IMAGE SCREEN GLASS SHALL BE 1·49 ± ·04

6. NO PART OF THAT PORTION OF THE TUBE BETWEEN THE METAL CONTACT RINGS SHALL PROTRUDE BEYOND THE OVERALL DIAMETER (DIMENSION 'D') OF THE INDIVIDUAL TUBE.

7. TUBE AXIS IS ESTABLISHED BY THE CENTRELINE OF THE 'Q' DIMENSIONS AT END OF TUBE.

8. THE PHOTOCATHODE SHALL BE OF CAESIUM SILVER OXIDE.

9. THE IMAGE SCREEN SHALL BE ALUMINIUM BACKED WITH A GG5 (P20) RESPONSE

10. ALL EXPOSED METAL SHALL BE NICKEL PLATED. OR AN ALTERNATIVE FINISH USED

11. ALL METAL PROCESSING TERMINALS PROTRUDING THROUGH THE GLASS ENVELOPE SHALL BE CUT OFF AND GROUND FLUSH WITH THE GLASS BEAD. THE METAL PROCESSING TERMINALS SHALL BE COATED WITH GLYPTOL OR EQUIVALENT.
    THE RETURN LEAD USED FOR PROCESSING IS DIAMETRICALLY OPPOSITE EXHAUST TUBING.

12. 2 COATS OF AN APPROVED NON-HYGROSCOPIC, TRANSPARENT, VARNISH SHALL BE APPLIED TO THE EXPOSED GLASS SURFACES OF THE TUBE WITH THE EXCEPTION OF THE PHOTOCATHODE AND IMAGE SCREEN FACEPLATES. (THE STERLING VARNISH COMPANY'S V130/1 MEETS THESE REQUIREMENTS AND IS APPROVED FOR USE ON THIS TUBE.)

Amdt 2

CV6099

INSPECTION REQUIREMENTS ON DIMENSIONS

Ref.	Description	AQL	Insp. Level
A	Overall length	2.5	I
B	Diameter of cylindrical part of cathode end-piece	2.5	I
C	Length between external surface of photocathode and image screen	2.5	I
D	Overall diameter of end-piece	2.5	I
Q	Internal diameter of end-piece	2.5	I
U	Depth of photocathode below end of cathode end-piece	2.5	I
V	Diameter of cylindrical part of anode end-piece	2.5	I
X	Depth of image screen below end of anode end-piece	2.5	I
H	Overall length of anode end-piece	-	Q.A.
J	Depth of anode or cathode bearing surface from metal shoulder	-	Q.A.
L	Minimum diameter over which external radius of curvature of cathode shall be maintained	-	Q.A.
M	Useful image screen diameter	-	Q.A.
N	Useful cathode diameter	-	Q.A.
P	Diameter of flat portion of image screen	-	Q.A.
R	Overall length of cathode end-piece	-	Q.A.
	Faceplate dimensions	-	Q.A.
	Image screen dimensions	-	Q.A.
	Index of refraction of faceplate and image screen	-	Q.A.

ELECTRONIC VALVE SPECIFICATIONS

SPECIFICATION MOA/CV6099, ISSUE 2A, DATED 16TH NOVEMBER, 1966.

AMENDMENT NO. 1.

Page 10 Note 17. After "test r(Operational Life)", add

", and test u(Conversion Coefficient(2))."

March, 1967. TVC for SRDE.

(445707)

ELECTRONIC VALVE SPECIFICATIONS
SPECIFICATION CV6099
ISSUE NO. 2A DATED 16th NOVEMBER, 1966
AMENDMENT NO. 2

Page 15, Note 10, add:

"or an approved alternative finish used."

December, 1968 Ministry of Technology/SRDE

31/3/69