GENERAL POST OFFICE, E-IN-C (S2)

VALVE ELECTRONIC **CV 6189**

SPECIFICATION: CV 6189 DATED: NOVEMBER 1966 ISSUE 1 TO BE READ IN CONJUNCTION WITH K 1006	SECURITY	
	Specification	Valve
	Unclassified	Unclassified

TYPE OF VALVE: Long Life wideband amplifier pentode. Note F.

CATHODE: Indirectly heated.

ENVELOPE: Glass PINS Gold Plated.

PROTOTYPE: VX 8538 (E 180F)

MARKING

See K1001/4

BASE

B.S. 448/B9A/1.1

RATINGS (All limiting values are absolute)			NOTES
Heater Voltage	(V)	6.3	D
Heater Current	(A)	0.3	
Max. Anode Voltage (Ia=0)	(V)	400	
Max. Operating Anode Voltage	(V)	210	
Max. Anode Dissipation	(W)	3	
Max. Screen Voltage (Ig2=0)	(V)	400	
Max. Operating Screen Voltage	(V)	175	
Max. Screen Dissipation	(W)	0.9	
Max. Control Grid Negative Voltage	(V)	50	
Max. Cathode Current	(mA)	25	
Max. Grid-cathode Resistor	(kΩ)	100	
Max. Cathode-heater Voltage	(V)	60	
Max. Cathode-heater Resistor	(kΩ)	20	A
Max. Bulb Temperature	(°C)	155	D
Mutual Conductance	(mA/V)	16.5	B E

CAPACITANCES (pF)		
ca g1 (max)	0.03	C
c in (nom)	7.9	C
c out (nom)	2.9	C

CONNECTIONS

Pin	Electrode	
1	Cathode	k
2	Grid 1	g1
3	Cathode	k
4	Heater	h
5	Heater	h
6	Internally Connected	ic
7	Anode	a
8	Grid 3 + shield	g3+s
9	Grid 2	g2

DIMENSIONS

See B.S. 448/B9A/2.1
Size Ref. No: 1

Dimensions (mm)	Min	Max
A. Seated Height	-	38
C. Diameter	19	22.2
D. Overall Length	-	45

MOUNTING POSITION

NOTES

A. In the interest of stable operation it is advisable to restrict Rk_h to values of under 20 kΩ

B. With Va = 180 V, Vg2 = 150 V, Ia = 13 mA.

C. Measured with external shield.

D. Caution to Electronic Equipment Design Engineers: The life expectancy may be reduced if conditions other than these specified for life tests are imposed on the valve, and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardised if heater voltage ratings are exceeded: life and reliability performance are directly related to the degree that regulation of the heater voltage is maintained at its centre-rated value.

E. End of life values for equipment design are gm 11.0mA/V minimum, -Ig1 1.0μA maximum.

F. This type has been designed to give long life performance in respect to electrical characteristics. The mechanical performance though superior to the prototype, will not give a long life when subjected to vibration or shock for prolonged periods.

CV 6189

MILITARY SPECIFICATION SHEET

ELECTRON TUBE, RECEIVING, PENTODE, MINIATURE

DESCRIPTION: RF, sharp cutoff, high transconductance, reliable

RATING:

Parameter:	Ef	Eb	Ec1	Ec2	Ec3	Ehk	ec1	Rk	Rg1	Ik	Pp	Pg2	T (envelope)	Alt
Units:	v	Vdc	Vdc	Vdc	Vdc	v	v	ohms	Meg	mAdc	W	W	°C	ft
Absolute-maximum:	6.6	210	0	175	0	60	---	---	0.1	25	---	---	+155	60,000
Design-maximum:	---	---	---	---	---	---	---	---	---	---	2.7	0.6	---	---
Absolute-minimum:	6.0	---	50	---	---	---	100	---	---	---	---	---	---	---
TEST CONDITIONS:	6.3	190	+9	160	0	0	---	630	---	---	---	---	---	---

BASE: Miniature button, 9-pin DIAMETER: 7/8 in. max.

PIN NUMBER:	1	2	3	4	5	6	7	8	9
ELEMENT:	k	g1	k	h	h	nc	p	g3	g2

HEIGHT: 1-3/4 in. max.

Envelope: T-6-1/2 (6-6)

PAR. No.	TEST (SEE NOTE 1)	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS (SEE NOTE 3)						UNIT
						Min	LAL	Bogey	UAL	Max	ALD	
	General											
3.1	Qualification	Required	---	---	---	---	---	---	---	---	---	---
3.6	Performance	(See Note 2)										
	Qualification inspection (see notes 4, 11 & 23)											
---	Cathode	Coated unipotential	---	---	---	---	---	---	---	---	---	---
3.4.3	Base connections		---	---	---	---	---	---	---	---	---	---
---	Sweep frequency vibration (1)	Ef = 6.3 Vdc; Eb = 180 Vdc; Ec2 = 150 Vdc; Rp = 2,000 ohms; RL/lb = 13 mAdc (see note 5)	---	S-2	Ep	---	---	---	---	500	---	mVac
4.10.3.4	Noise and microphonics (for reliable receiving tubes)	Ef = 6.3; Ehk = 0; Ebb = Ecc2 = 200Vdc Ec1 = 0; Eca1 = 600 mVac; Rk = 1,000; Rp = 0.1 Meg; Rg2 = 0.5 Meg; Ck = 1,000 uf; Cg2 = 2 uf (see note 8)	2.5	I	---	---	---	---	---	---	---	---
4.9.20.5	Shock test	Hammer angle = 30° Ehk = +100 Vdc (see note 12)	---	---	---	---	---	---	---	---	---	---
4.9.20.6	Fatigue test	G = 2.5; F = 25 min, 60 max; fixed frequency Note 22.	6.5	---	---	---	---	---	---	---	---	---
	Post shock and fatigue test end points	Low-frequency vibration	---	---	Ep	---	---	---	---	400	---	mVac
		Heater-cathode Leakage										
		Ehk = +100 Vdc	---	---	Ihk	---	---	---	---	20	---	µAdc
		Ehk = -100 Vdc	---	---	Ihk	---	---	---	---	20	---	µAdc
		Transconductance(1)	---	---	Sm	12500	---	---	---	---	---	umhos
		Total grid current	---	---	Ic1	0	---	---	---	02	---	µAdc
4.11.7	Heater-cycling	Ef = 7.5 V; Ehk = 60 Vdc; Eb = Ec1 = Ec2 = 0 (See note 13)	1.0	---	---	---	---	---	---	---	---	---
4.11.4	Life-test end points	Heater-cathode Leakage										
		Ehk = +100 Vdc	---	---	Ihk	---	---	---	---	20	---	µAdc
		Ehk = -100 Vdc	---	---	Ihk	---	---	---	---	20	---	µAdc

CV 6189

PAR. No.	TEST (SEE NOTE 1)	CONDITIONS	AQL (PERCENT DEFECTIVE	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS (SEE NOTE 3)						UNIT
						Min	LAL	Bogey	UAL	Max	ALD	
	Acceptance inspection, part 1 (production) (See note 6)											
4.10.8	Heater current		0.65	II	If	285	---	---	---	315	---	mA
4.10.15	Heater-cathode leakage	Ehk = +100 Vdc Ehk = -100 Vdc	0.65	II	Ihk Ihk	--- ---	--- ---	--- ---	--- ---	10 10	--- ---	µAdc µAdc
4.10.6.1	Total grid current		0.65	II	Ic1	0	---	---	---	0·1	---	µAdc
4.10.4.1	Plate current (1)	Ebb = 180 Vdc; Ecc1 = 0 Vdc; Ecc2 = 150 Vdc; Ecc3 = 0 Vdc; Rk = 78 ohms	---	---	Ib	---	11·0	13·0	15·0	---	5·0	mAdc
4.10.4.1	Plate current (1)		0.65	II	Ib	8·0	---	---	---	18·0	---	mAdc
4.10.4.1	Plate current (2)	Ec1 = -6·0 Vdc; Ebb = 180 Vdc; Ecc2 = 150 Vdc; Ecc3 = 0 Vdc;	0.65	II	Ib	---	---	---	---	100	---	µAdc
4.10.4.3	Screen-grid current		---	---	Ic2	---	3·1	3·3	3·5	---	0·4	mAdc
4.10.4.3	Screen-grid current		0.65	II	Ic2	2·9	---	---	---	3·7	---	mAdc
4.10.9	Transconductance (1)		---	---	Sm	---	15·0	16·5	18·0	---	2·5	mA/V
4.10.9	Transconductance (1)		0.65	II	Sm	14·2	---	---	---	18·8	---	mA/V
4.9.1	Mechanical-production tests	Outline 6-6	---	---	---	---	---	---	---	---	---	---
	Acceptance inspection, part 2 (design)											
4.8	Insulation of electrodes	g1 - all p - all	2.5	S3	(R (R	100 100	--- ---	--- ---	--- ---	--- ---	--- ---	Meg Meg
4.10.9	Transconductance (2)	Ef = 5·7 V	2.5	I	Δ Sm Ef	---	---	---	---	7	---	%
4.10.6.2	Grid emission	Ef = 7·5 V; Ec1 = -6·0 Vdc; Rk = 0 (See note 7)	2.5	I	Ic1	0	---	---	---	0·5	---	µAdc
4.10.4	Direct interelectrode capacitance	Shield No.315 (See note 9) Shield No.315 (See note 9) Shield No.315 (See note 9)	6.5	Code E	Cglp Cin Cout	--- 6·7 2·5	--- --- ---	--- --- ---	--- --- ---	0·03 ~~8·7~~ 8·5 3·5	--- --- ---	µµf µµf µµf
4.9.12.1	Low-pressure voltage breakdown	Pressure = 55·5 mm Hg; voltage = 500Vac	6.5	(See note 10)	---	---	---	---	---	---	---	---
4.9.19.1	Low-frequency vibration	Rp = 2,000 ohms	6.5	Code H	Ep	---	---	---	---	300	---	mVac
	Acceptance inspection, part 3 (degradation rate) (See note 10)											
4.9.6.1	Miniature-tube base strain		---	---	---	---	---	---	---	---	---	---
4.9.6.3	Glass strain (for receiving tubes)		6.5	I	---	---	---	---	---	---	---	---
	Acceptance inspection, part 3 (life) (See note 11)											
4.11.3.1 (a) 1-½ hrs.	Stability life test	Eb = 200 Vdc; Ec1 = +9 Vdc; Ec2 = 170 Vdc; Ec3 = 0; Rk=680 Ohms Rg1 = 0·5 Meg; TA = room Vh-k = 70V DC (see note 14)		---	---	---	---	---	---	---	----	---
4.11.4	Life-test end point (stability)	Change in transconductance (1) of individual tubes.	1.0	Code H	Δ Sm t	---	---	---	---	10	---	%
4.11.3.1 (b) 100 hrs	Survival-rate life test	Stability life test conditions, or equivalent (see notes 15 and 16)		---	---	---	---	---	---	---	---	---
4.11.4	Life-test end points (100 hours)	-Ig1 Transconductance(1) Ihk	0.65 1.0 0.65	II --- ---	--- Δ Sm t ---	--- --- ---	--- --- ---	--- --- ---	--- --- ---	0·5 15 10·0	--- --- ---	µAdc % µAdc

PAR. No.	TEST	CONDITIONS	SAMPLE SIZE	ALLOWABLE DEFECTIVES PER CHARACTERISTIC	SYMBOL	LIMITS Min	LIMITS Max	UNIT
4.11.3	Intermittent life-test operation	Stability life test conditions; TA = room (see note 19)	20					
4.11.4	Life-test end points (intermittent) 500 hours.	(See note 17) Inoperatives (see note 18)		1	---	---	---	---
		Total grid current		1	Ic1	---	-0·5	UAdc
		Heater current		1	If	285	315	mA
		Transconductance (1) (individuals)		1	Sm	12·5	-	mA/V
		Change of Average Transconductance (1)		---	Δ Av. Sm	---	7	%
		Transconductance (2)		1	Sm	---	10	%
					Δ Ef			
		Heater-cathode leakage						
		Ehk = +100 Vdc		1	Ihk	---	10	µAdc
		Ehk = -100 Vdc		1	Ihk	---	10	µAdc
		Insulation of electrodes						
		g1 - all		1	R	50	---	Meg
		p - all		1	R	50	---	Meg
		Total Defectives (see note 21)						
4.11.4	Life-test end points (intermittent) 1000 hours.	(See note 18) Inoperatives	20	1	---	---	---	---
		Total grid current		1	Ic1	---	0·5	µAdc
		Heater current		1	If	285	315	mA
		Transconductance (1) (Individuals)		1	Sm	12·0	---	mA/V
		Change of Average Transconductance (1) (See note 20)		---	Δ Av. Sm	---	10	%
		Transconductance (2)		1	Sm	---	10	%
					Ef			
		Heater-cathode leakage						
		Ehk = +100 Vdc		1	Ihk	---	10	µAdc
		Ehk = -100 Vdc		1	Ihk	---	10	µAdc
		Insulation of electrodes						
		g1 - all		1	R	30	---	Meg
		p - all		1	R	30	---	Meg
		Total Defectives (See note 21)						
4.11.4	Life-test end points (intermittent) 2000 hours.	(See note 18) Inoperatives	20	1	---	---	---	---
		Total grid current		1	Ic1	---	1·0	µAdc
		Transconductance (1) (Individuals)		1	Sm	12·0	---	mA/V
		Average transconductance (1) (See note 20)			Av. Sm	---	---	mA/V
		Heater-cathode leakage						
		Ehk = +100 Vdc		1	Ihk	---	10	µAdc
		Ehk = -100 Vdc		1	Ihk	---	10	µAdc
		Insulation of electrodes						
		g1 - all		1	R	30	---	Meg
		p - all		1	R	30	---	Meg
		Total Defectives (See note 21)						
4.11.4	Life-test end points (intermittent) 3000 hours.	(See note 18) Inoperatives	20	1	---	---	---	---
		Total grid current		1	Ic1	---	1·0	µAdc
		Transconductance (1) (Individuals)		1	Sm	12·0	---	mA/V
		Average transconductance (1) (See note 20)			Av. Sm	---	---	mA/V
		Heater-cathode leakage						
		Ehk = +100 Vdc		1	Ihk	---	10	µAdc
		Ehk = -100 Vdc		1	Ihk	---	10	µAdc
		Insulation of electrodes						
		g1 - all		1	R	30	---	Meg
		p - all		1	R	30	---	Meg
		Total Defectives (See note 21)						

CV 6189

NOTES

1. The sequence of tests listed hereon is the suggested order in which the tests should be conducted.

2. In addition to the paragraphs specified hereon, the following tests and requirements listed in 3.6 shall apply: 3.3, 3.3.1, 3.4.1, 3.4.2, 3.4.3, 3.7, 3.7.7, 3.8, 4.1, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.9.1, 4.9.2, 4.9.4, 4.9.20.1.

3. Variable sampling. See 4.1.1.7.

4. All tests listed hereon shall be performed during qualification inspection; however, these seven tests are normally performed during qualification inspection only, and on the 1st batch of new production run.

5. Sweep frequency vibration. The tubes shall be fastened rigidly to the vibration platform and vibrated with simple harmonic motion over a frequency range of 50 to 500 cps at an acceleration value of 2.5 G. The acceleration over the frequency range shall be within ± 20 per cent of the reference acceleration at 100 cps. The frequency shall increase from 50 to 500 cps with approximate logarithmic progression and shall require 4 minutes minimum, 5 minutes maximum, to traverse the range. Each tube shall be vibrated in positions X1 and X2, except that if the cumulative result of test on 50 or more tubes of a construction show that more than 75 percent of the tubes have higher output voltages in one position, subsequent measurements need to be taken only in the position giving the higher readings. The tubes shall be tested with the specified voltages applied thereto during vibration. The value of Ebb shall be the same as the value of Eb under the test conditions and shall be applied to the tube through the specified resistor, Rp. The value of the alternating voltage, Ep, produced across the resistor Rp, as a result of vibration, shall be measured with a suitable device. This device shall have an appropriate voltage range; shall have the ability to measure, with an error of less than 10 percent, the rms value of a sine wave of voltage at all frequencies from 20 to 5,000 cps; and shall have dynamic response characteristics equivalent to or faster than a VU meter (as described in Publication ASA Standard No. C16.5-1954). The value of Ep shall not exceed the limit specified at any point in the frequency range, nor shall this test result in open circuits, permanent shorts, or tap shorts as specified in 4.7.1, 4.7.1, 4.7.2, and 4.7.3.

6. The AQL for the combined defectives for attributes in acceptance inspection, part 1 (production), excluding inoperatives and mechanical, shall be 1 percent.

7. Prior to this test, tubes shall be preheated a minimum of 5 minutes at the conditions indicated below. Three-minute test is not permitted. Test at specified conditions within 3 seconds after pre-heating. Grid emission shall be the last test performed on the sample selected for the grid-emission test.

Ef	Ec1	Ec2	Eb	Rk
V	Vdc	Vdc	Vdc	ohms
7.5	+9	160	190	630

8. The rejection level shall be set at the VU meter reading obtained during calibration.

9. Pin 6 floating

10. This test shall be conducted on the initial lot and thereafter on a lot approximately every 30 days. When one lot has passed, the 30-day rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test until a lot passes. Standard MIL-STD-105, sample size code letter F, shall apply.

11. Destructive tests. Tubes subjected to the following destructive tests are not to be delivered on the contract or order.

4.9.20.5	Shock test
4.9.20.6	Fatigue test
4.11.7	Heater-cycling life-test operation
4.11.5	Intermittent life-test operation

12. A grid resistor of 0.1 megohm shall be added; however, this resistor will not be used when a thyratron-type short indicator is employed.

13. The no-load to steady state full load regulation of the heater voltage supply shall be not more than 3.0 percent. This test shall be made on a lot-by-lot basis. A failure or defect shall consist of an open heater, open cathode circuit, heater-cathode short, or heater-cathode leakage in excess of the specified heater-cycling life test end point limit.

14. Stability life test. The sampling and testing procedures for this test shall be in accordance with 20.2.5.1 of Appendix C.

15. Survival-rate life test. The sampling and testing procedure for this test shall be as specified in 20.2.5.2 to 20.2.5.2.4, inclusive, of Appendix C.

16. For survival-rate life test, the equivalent stability-life-test conditions shall be as specified in 20.2.5.2.5 of Appendix C.

17. Order of evaluation for life test defects. See 4.11.3.1.2.

18. An inoperative, as referenced in life test, is defined as a tube having one or more of the following defects: Discontinuity (see 4.7.1), permanent shorts (see 4.7.2), air leaks (see 4.7.6.).

19. This is a long life test and the frequency of switching periods may be reduced to not less than one every 24 hours. Prior to any measurements on intermittent life test all tubes shall be preheated for at least 15 minutes at life test operating conditions.

20. The average transconductance of the sample can be recorded at any number of time intervals in addition to those specified and the best straight line calculated from all points. The slope of the line shall not exceed 0.3 mA/V per 1,000 hours between 1,000 and 3,000 hours. If the sample fails to meet the above limit, life may be continued up to 4,000 hours. The same limit shall be applied. In this case the change of average transconductance between 0 and 2,000 hours shall not exceed 10%.
The slope of the best line (b) is calculated from the following formula:-

$$b = \frac{n\Sigma\frac{n}{1}\ tgm - \Sigma\frac{n}{1}\ t\Sigma\frac{n}{1}\ gm}{n\Sigma\frac{n}{1}\ t^2 - (\Sigma\frac{n}{1}\ t)^2}$$

Where n = number of points at which gm average is calculated.

t = Kilo hours at each test end point.

gm = Average transconductance mA/V recorded at time t.

21. Only one defect allowed for all faults in the 20 valve sample, but if a second defect is obtained before 3,000 hours the batch may be run on to 4,000 hours, and the lot accepted if no further defect occurs or alternatively a second additional sample of 20 valves may be run for 1,000 hours and if no defect is obtained in this second batch and no further defect occurs in the first batch up to 3,000 hours the lot may be accepted.

22. This test may at the discretion of the manufacturer be made at an alternative frequency of 170 c/s ± 5 c/s.

23. The valve shall be manufactured to an approved manufacturing specification, and such specifications lodged with the Approving Authority. To obtain approval of a Manufacturing Specification, a sample specified by the Approving Authority, shall be run on life test for 10,000 hours, the results to be submitted to that Authority. Specification Number 9H0 is an approved specification.

ELECTRONIC VALVE SPECIFICATION

DATED NOVEMBER 1966

SPECIFICATION CV 6189 ISSUE 1

AMENDMENT NO 1

PAGE 2 PARA 4.10.4

Cin Maximum Limit. Amend 8.5 to read 8.7

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