MINISTRY OF AVIATION D.L.R.D./R.A.E.

CV3988

SPECIFICATION M.O.A./CV3988 incorporating Specification MIL-E-1/1055A	SECURITY	
	SPECIFICATION	VALVE
Issue No. 1 Dated 13.9.61	Unclassified	Unclassified
To be read in conjunction with K1006		

TYPE OF VALVE:- Microwave Coaxial Triode

CATHODE:- Indirectly Heated

ENVELOPE:- Ceramic and Metal

PROTOTYPE:- 6442

MARKING

See K1001/4

CONNECTIONS

See Fig. 1 (Page 6)

DIMENSIONS

See Fig. 1 (Page 6)

RATINGS

(All limiting values are absolute)

Heater Voltage	(V)	6.3
Heater Current	(A)	0.9
Max Heater Cathode Voltage	(V)	±90
Max Seal Temperature	(°C)	175

Note A

Parameter	Symbol	Class A	Oscillator or Amplifier	
		R.F. Amp	Anode Modulated	Anode Pulsed
Max. Anode Voltage	(V)	350	275	3000
Max. Neg. Grid Voltage	(V)	25	50	100
Max. Peak Anode Current	(A)	-	-	2.5
Max. Anode Current	(mA)	35	35	2.5
Max. Grid Current	(mA)	-	15	1.25
Max. Peak Cathode Current	(A)	-	-	3.75
Max. Peak Grid Current	(A)	-	-	1.25
Max. Anode Dissipation	(W)	8.0	6.0	7.5
Max. Input Power	(W)	12.0	9.5	7.5
Max. Pulse Duration	(μSec)	-	-	2.0
Max. Duty Cycle	-	-	-	0.001
Min. Cathode Heating Time	(Sec)	-	30	60

NOTES

A. Sufficient conduction and convection cooling must be provided to limit the envelope temperature to 175°C under all operating conditions.

B. The Joint Services Catalogue Number is 5960-99-037-3988

MIL-E-1/1055A
8 April 1960
SUPERSEDING
MIL-E-1/1055
18 June 1957

CV3988

MILITARY SPECIFICATION SHEET

ELECTRON TUBE, PLANAR TRIODE

JAN-6442

This specification sheet forms a part of the latest issue of Military Specification MIL-E-1.

DESCRIPTION: Microwave coaxial triode, double ended, ceramic and metal construction

F1 = 3,500 Mc, pulsed

ABSOLUTE RATINGS:

Parameter: / Unit:	Ef V	eb v	Eb Vdc	Ec Vdc	Ehk Vdc	ib a	Ib mAdc	Ic mAdc	ik a	ic a	Pp W	Pi W	tp us	Du ---	tk sec	T (seal) °C (see note 1)	Alt ← ft (see note 2)
Osc or amp (see note 3)																	
Maximum:	6.3±5% (see note 4)	---	350	-50	±90	---	35	15	---	---	8.0	12	---	---	---	175	80,000
Minimum:	6.3-10%	---	---	---	---	---	---	---	---	---	---	---	---	---	30	---	---
Plate modulated Osc or amp (see note 5)																	
Maximum:	6.3±5% (see note 4)	---	275	-50	±90	---	35	15	---	---	6.0	9.5	---	---	---	175	80,000
Minimum:	6.3-10%	---	---	---	---	---	---	---	---	---	---	---	---	---	30	---	---
Plate pulsed Osc or amp (see note 6)																	
Maximum:	6.3±5% (see note 4)	3,000	---	-100	±90	2.5 (see note 7)	2.5	1.25	3.75	1.25	7.5	7.5	2.0	0.001 (see note 8)	---	175	25,000
Minimum:	6.3-10%	---	---	---	---	---	---	---	---	---	---	---	---	---	60	---	---
Class A RF amp																	
Maximum:	6.3±5%	---	350	-25	±90	---	35	---	---	---	8.0	12	---	---	---	175	80,000
Minimum:	6.3-10%	---	---	---	---	---	---	---	---	---	---	---	---	---	0	---	---
TEST CONDITIONS:	6.3 (see note 9)	---	350	Adj	---	---	35	---	---	---	---	---	---	---	120 min	(See note 10)	--- ←

COOLING: See note 1

CATHODE: Coated, unipotential

DIMENSIONS AND CONTACTS: See figure 1

FSC 5960

PAR. NO.	TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL	SYMBOL	LIMITS						UNIT
						Min	LAL	Bogie	UAL	Max	ALD	
	General											
3.1	Qualification	Required for JAN marking	---	---	---	---	---	---	---	---	---	---
3.6	Performance		---	---	---	---	---	---	---	---	---	---
4.5	Holding period	t = 72 hr	---	---	---	---	---	---	---	---	---	---
4.9.2	Dimensions	(See fig. 1) (see note 11)	---	---	---	---	---	---	---	---	---	---
	Acceptance inspection, part 1 (production) (see notes 12 and 13)											
---	Pulsed oscillation (1)	F = 3,450 Mc min; epy = 3,000 v; Rg/Ib = 2.5 mAdc; tpv = 1.0 us ±10% trv = 0.1 us max; tfv = 0.2 us max; prr/Du = 0.001 ±5%; Ef = 6.0 V (see notes 14 and 15)	0.65	II	Po	1.75	---	---	---	---	---	W
---	Pulsed oscillation (2)	Pulsed oscillation (1) cond	(See note 16)	(See note 16)	Po	---	2.0	2.2	---	---	---	W
4.8	Insulation of electrodes	Ef = 6.3 V (see note 17)	0.65	II	Rgp Rgk	250 25	--- ---	--- ---	--- ---	--- ---	--- ---	Meg Meg
4.10.1.1	Emission	Eb = Ec/Is = 40 mAdc	0.65	II	Eb = Ec	---	---	---	---	4.0	---	Vdc
4.10.1.5	Pulsing emission	Prr = 500 pps max tp = 1 to 3 usec; Du = 0.0005 min; eb = ec/is = 8a (see note 18)	0.65	II	eb = ec	---	---	---	---	175	---	v
4.10.5.2	Grid voltage (1)		0.65	II	-Ec	2.5	---	---	---	5.75	---	Vdc
4.10.5.2	Grid voltage (2)		(See note 16)	(See note 16)	-Ec	---	3.35	4.13	4.90	---	1.5	Vdc
4.10.6.1	Total grid current		0.65	II	-Ic	---	---	---	---	0.5	---	uAdc
	Acceptance inspection, part 2 (design)											
4.10.5.2	Grid voltage (3)	Ec/Ib = 2 mAdc	6.5	L6	-Ec	5.0	---	---	---	11.5	---	Vdc
4.10.8	Heater current		6.5	L6	If	840	---	---	---	960	---	mA
4.10.9	Transconductance (1)		6.5	L6	Sm	13,500	---	---	---	19,000	---	umhos

PAR. NO.	TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL	SYMBOL	LIMITS						UNIT
						Min	LAL	Bogie	UAL	Max	ALD	
	Acceptance inspection, part 2 (design) - Contd											
4.10.9	Transconductance (2)		(See note 16)	(See note 16)	Sm	---	15,200	16,500	17,800	---	2,200	umhos
4.10.11.1	Amplification factor (1)		6.5	L6	Mu	35	---	---	---	65	---	---
4.10.11.1	Amplification factor (2)		(See note 16)	(See note 16)	Mu	---	43	50	57	---	12	---
4.10.14	Direct interelectrode capacitance (1)	No voltages (see note 19)	6.5	L6	Cgp Cgk Cpk	2.10 4.60 ---	--- --- ---	--- --- ---	--- --- ---	2.45 5.45 0.045	--- --- ---	uuf uuf uuf
4.10.14	Direct interelectrode capacitance (2)	No voltages (see note 19)	(See note 16)	(See note 16)	Cgp Cgk	--- ---	2.21 4.85	2.28 5.03	2.34 5.20	--- ---	0.18 0.45	uuf uuf
4.10.15	Heater-cathode leakage	Ehk = +100 Vdc Ehk = -100 Vdc Eb = Ec = 0	6.5	L6	Ihk Ihk	--- ---	--- ---	--- ---	--- ---	100 100	--- ---	uAdc uAdc
	Acceptance inspection, part 3 (periodic and life)											
4.9.12.1	Low-pressure voltage breakdown (1)	Pressure = 250 mmHg max; Voltage = 3,000 Vac; TA = 30° ±10° C (see note 20)	---	---	---	---	---	---	---	---	---	---
4.9.12.1	Low-pressure voltage breakdown (2)	Pressure = 20 mmHg max; Voltage = 500 Vac; TA = 30° ±10° C (see note 20)	---	---	---	---	---	---	---	---	---	---
4.9.19.2	High-frequency vibration	Ebb = 300 Vdc; Ec/Ib = 10 mAdc; Rp = 10,000 ohms (see notes 21 and 22)	---	---	Ep	---	---	---	---	100	---	mVac
---	Shock	No voltages; 400 G peak min 1.0 ms duration min (see note 22 and 23)	---	---	---	---	---	---	---	---	---	---
---	Shock test end point	Total grid current	---	---	-Ic	---	---	---	---	0.6	---	uAdc
---	Torque	No voltages (see notes 22 and 24)	---	---	---	---	---	---	---	---	---	---
---	Torque test end point	Total grid current	---	---	-Ic	---	---	---	---	0.6	---	uAdc

PAR. NO.	TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL	SYMBOL	LIMITS						UNIT
						Min	LAL	Bogie	UAL	Max	ALD	
	Acceptance inspection, part 3 (periodic and life) - Contd											
4.11 and 4.11.3.2	Life test	Group C; t = 500 hr; pulsed oscillation (1) cond	---	---	---	---	---	---	---	---	---	---
4.11.4	Life test end point	Pulsed oscillation (1)	---	---	ΔP_{o_t}	---	---	---	---	25	---	%
4.9.18. and 4.9.18.1.7	Container drop	Required										
5.	Preparation for delivery	(See note 25)										

NOTES:

1. Sufficient conduction and convection cooling must be provided to limit the envelope temperature to the specified maximum of 175° C under all operating conditions. Reliability will be seriously impaired if this maximum is exceeded.
2. Operation at this altitude is possible in a suitably designed circuit.
3. Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 percent of the carrier conditions.
4. This tube operates at frequencies where transit-time effects of the electron current must be considered. The principal effects influencing the tube operation are the decrease in power output and operating efficiency with increase in frequency, and the bombardment and heating of the cathode by electrons from the region of the grid, which can be sufficiently severe to result in short tube life and erratic operation. Operating frequency, circuit design and adjustment, grid bias, grid current, average power input and the operating voltage contribute to some degree to the magnitude of the resulting cathode bombardment. There is a heater voltage which will maintain the cathode at the correct operating temperature for a set of operating conditions. If the conditions of operation result in appreciable cathode back-heating, it may be necessary to initiate dynamic operation of the tube at normal heater voltage, followed by a reduction of heater voltage to the proper value. A maximum variation of ±5 percent in heater voltage is recommended where consistent operation and extended tube life is a factor. For application above 500 megacycles, recommendations regarding the proper heater voltage for a specific set of operating conditions should be obtained from the tube manufacturers through the service laboratory.
5. Carrier conditions for use with a maximum modulation factor of 1.0.
6. Tube shall not be operated for more than 5 microseconds in any 5,000-microsecond interval. Tube shall not be grid-pulsed beyond the CW ratings.
7. The regulation or series-plate-supply impedance, or both, shall limit the instantaneous peak current, with the tube considered as a short circuit, to a maximum of 10 times the specified maximum current rating.
8. For applications above a duty factor of 0.001, recommendations are to be obtained from the tube manufacturers through the service laboratory.
9. All preheating of tubes prior to test will be at 6.3 volts, ±5 percent.
10. During any test the maximum temperature of any part of the envelope must be limited to 175° C maximum by conduction and/or forced convection cooling.
11. The tests called for on figure 1 shall be considered separately from the rest of the specification.
12. All tests listed under acceptance inspection, part 1 (production), are to be performed at the conclusion of the holding period.
13. The AQL for the combined defectives for attributes in acceptance inspection, part 1 (production), excluding inoperatives and mechanical, shall be 1 percent.
14. Test in cavity in accordance with Drawing 253-JAN. Measure useful power output with the coupling and tuning adjusted for maximum power output. The tube shall operate under the given conditions and after the required circuit adjustments for a minimum of 10 seconds without arcing or instability, as evidenced by pronounced variations in the average plate current meter or the power output meter. If temporary arcing does occur during the 10-second period, the tube must subsequently

NOTES:

14. Contd operate for 60 seconds without arcing. The test may be discontinued at the end of the 10-second period if the power output has not completely stabilized but is rising. If the power output is falling, the test will be continued until a stable reading is obtained. For qualification purposes, a stabilized reading must be obtained. All readings shall be "nonsquegging" power.

15. The pulse characteristics are defined as follows:

    (a) epy is the smooth peak voltage excluding spike (see fig. 44 of MIL-E-1).

    (b) The interval of trv and tfv is between 20 and 85 percent of the smooth peak value of the voltage pulse.

    (c) The definition of tp is applicable to tpv.

    (d) The parameters tpv, tfv, and trv may be measured with the tube replaced by a 1,000-ohm noninductive resistor.

    The load VSWR shall be 1.5 maximum.

16. Variable sampling in 4.1.1.7 and Appendix C, shall use a sample size of 15 tubes and three subgroups of five tubes each. ←

17. The insulation between the grid and the cathode shall be measured with a voltage of 100 Vdc. The other insulation test shall be made in accordance with 4.8.

18. There shall be no evidence of arcing during this test.

19. Direct interelectrode capacitance shall be measured in shielded socket in accordance with Drawing 260-JAN.

20. Voltage shall be applied between plate and grid. No other voltages shall be applied. There shall be no evidence of failure as indicated by visual arc-over. Perform test on 10 tubes selected at random from the first production lot of each year. If more than one tube fails, the test shall become a part of acceptance inspection, part 2 (design), with AQL 6.5 percent, inspection level L6. After three consecutive successful submissions, the test shall revert to an annual 10-tube test. This is not a destructive test. ←

21. Test in socket in accordance with Drawing 261-JAN.

22. Test 10 tubes selected at random from the first production lot of each calendar year and approximately every 90 days during the year. If more than one tube fails to pass the specified end points, the failed test shall become a part of acceptance inspection, part 2 (design), with AQL 6.5 percent, inspection level L6, on all lots in process. ←

23. Test in socket in accordance with Drawing 261-JAN. Each tube shall be subjected to a total of 20 shocks; that is five shocks in each position, X1, X2, Y1, and Y2 in any sequence. This is a destructive test. ←

24. A torque of 15 inch-pounds shall be applied between the anode and heater terminal No. 1 without perceptible shock. This is not a destructive test.

25. The tubes shall be inclosed in a moisture-vaporproof barrier and prepared for domestic or overseas shipment as specified in the contract or order in accordance with Specification MIL-E-75 and appendix thereto. When specified in contract or order, rough handling (container drop) test (i) shall be performed on the individual container utilized.

26. Referenced documents shall be of the issue in effect on the date of invitation for bids.

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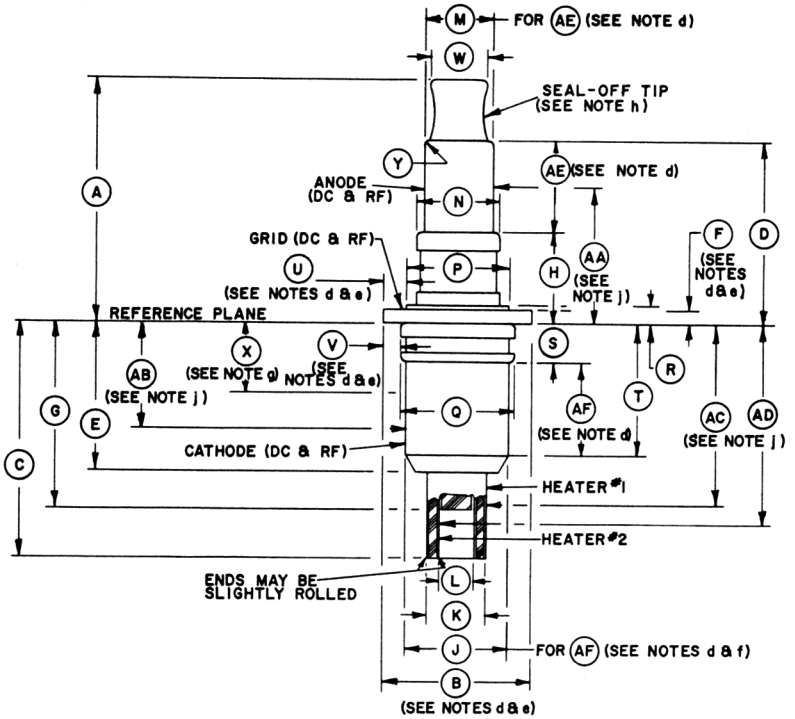

DIM	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL	LIMITS Min	LIMITS Max
ACCEPTANCE INSPECTION, PART 2 (DESIGN)				
A			---	1.328
B			0.810 dia	0.818 dia
C			1.219	1.281
D			0.953	0.984
E			0.750	0.813
F	6.5	L6	0.070	0.078
G			---	1.016
H			---	0.515
J			0.539 dia	0.549 dia
K			0.318 dia	0.328 dia
L			0.180 dia	0.190 dia
M			0.365 dia	0.371 dia
ACCEPTANCE INSPECTION, PART 3 (PERIODIC)				
N			---	0.453 dia
P			0.560 dia	0.570 dia
Q			---	0.609 dia
R	(SEE	(SEE	0.077	0.097
S	NOTE	NOTE	---	0.266
T	c)	c)	0.719	---
W			---	0.313
X			---	0.375
NOMINAL DIMENSIONS (SEE NOTE b)				
U	0.094			
V	0.094			
Y	0.016 R			
AA	0.750			
AB	0.547			
AC	1.000			
AD	1.109			
AE	0.438			
AF	0.453			

NOTES:
a. All dimensions in inches.
b. Dimensions without tolerances are for information and are not required for inspection purposes.
c. These dimensions shall be tested on 10 tubes per month when in continuous production. Failure of more than one tube to meet tolerances for any dimension shall cause that dimension to become, for all lots in process, part of acceptance inspection, part 2 (design).
d. Contact surface shall be confined to this area.
e. Only these surfaces shall be used for tube stops or clamping.
f. Maximum diameter shall not be increased by solder.
g. Tube marking shall be confined to this area.
h. Exhaust tubulation must not be subjected to any mechanical stress.
j. Eccentricity shall be gaged at points designated and shall be as follows (note c shall apply):

Contact	Eccentricity	Reference
Anode	0.010 max	Grid contact
Cathode	0.010 max	Grid contact
Anode-cathode	0.020 TIR	Grid contact
Heater No. 1	0.015 max	Grid contact
Heater No. 2	0.015 max	Grid contact
Heater No. 1 and 2	0.030 TIR	Grid contact

Figure 1. Outline drawing.

* U.S. GOVERNMENT PRINTING OFFICE : 1960 O—550647