

VALVE ELECTRONICADMIRALTY SURFACE WEAPONS ESTABLISHMENT

Specification AD/CV6182 Issue 1 dated 20th November, 1968 To be read in conjunction with K1001, K1005 K1006, MIL-E-IE and MIL-T-5422E. Paragraph numbers in reference column refer to MIL-E-IE unless otherwise stated.	<u>SECURITY</u>	
	<u>Specification</u>	<u>Valve</u>
	Unclassified	Unclassified

PROTOTYPE:	M5318									
DESCRIPTION:	Travelling-wave signal amplifier for operation from 12.0 to 18.0 GHz.									
CATHODE:	Indirectly heated									
ENVELOPE:	Packaged in a periodic permanent magnet focusing system									
CONNECTIONS AND DIMENSIONS:	See Drawing Page 10									
WEIGHT:	6.0 lb max.									
MOUNTING POSITION:	Any									
COOLING:	Free Convection									
NATO STOCK NO:	5960-99-037-4624									
Parameter:	Ef	If	Ec1	Ic1	Ec2	Ic2	Ec3	Ic3	Ec4	Ic4
Unit:	V	A	Vd.c.	μ Ad.c.	Vd.c.	μ Ad.c.	Vd.c.	μ Ad.c.	Vd.c.	μ Ad.c.
<u>ABSOLUTE MAXIMUM RATINGS (Note 1)</u>										
Maximum:	6.6	-	0	50	500	50	600	50	800	50
Minimum:	6.0	-	-250	-	-	-	-	-	-	-
<u>TEST CONDITION:</u>										
(1)	0	0	0	0	0	0	0	0	0	0
(2)	6.3	-	Note 2,3	-	Note 2,3	-	Note 2,3	-	Note 2,3	-
Parameter:	Ew	Iw	Eb	Ib	Ik	Pi(r.f.)	Amb.Temp.	tk	If	
Unit:	Vd.c.	mAd.c.	Vd.c.	mA d.c.	mAd.c.	dBm	Deg.C	sec	(surge)	
<u>ABSOLUTE MAXIMUM RATINGS (Note 1)</u>										
Maximum:	1400	1.0	Ew+250	1.7	1.7	20	100	-	1.5	
Minimum:	1000	-	Ew	-	-	-	-65	120	-	
<u>TEST CONDITION:</u>										
(1)	0	0	0	0	0	as reqd.	-	0	0	
(2)	Note 2,3 4,5	-	Note 2,3,4	-	Note 33	as reqd.	-	Note 33	-	

Requirements or tests:

GENERAL

Marking - Note 2, 9, K1001, Section 4

Dimensions - Per Outline Drawing

Preparation for Delivery - Note 31

Test	Method or Para.	Requirement or Test	Conditions	Symbol	Limits		Units
					Min.	Max.	
1.		<u>Qualification Inspection</u> (Qualification Approval)					
-		Humidity - Temperature	Test Condition (1) Note 11	-	-	-	-
2.	-	Container Drop	Notes 6,16	-	-	-	-
3.	-	Shock	Test Condition (2) Notes 16,17	-	-	-	-
		<u>Quality Conformance Inspection</u> , Part 1 (100%)	After 48 hours Holding Period				
4.	E-50.2	Post Holding Period Tests					
4.1	-	Grid Current	Test Condition (2)	I _{o1} I _{o2} I _{o3} I _{o4}	-10 -10 -10 -10	+20 +20 +20 +20	μ Ad.c. μ Ad.c. μ Ad.c. μ d.c.
4.2	-	Helix Current	Test Condition (2)	I _w	-10	+200	μ Ad.c.
4.3	E-1301	Heater Current	Test Condition (1) E _f = 6.3	I _f	0.19	0.26	A
4.4	-	Cathode Current	Test Condition (2)	I _k	0.4	1.5	mA
4.5	-	Collector Current	Test Condition (2)	I _b	0.3	1.5	mA
4.6	-	Noise Figure	Test Condition (2) Notes 10,18, 20 12.0-13.5 GHz 13.5-17.0 GHz 17.0-18.0 GHz	N _F		15.5 15.0 15.5	dB dB dB

Test	Method or Para.	Requirement or Test	Conditions	Symbol	Limits		Units
					Min.	Max.	
4.7	-	Gain	Test Condition (2) Notes 10,18,21 F = F1,F2,F3,F4,F5	Gss	24	35	dB
4.8	-	Frequency Gain Variation	Test Condition (2) Notes 19,21	ΔG_{ss}	-	8.5	dB
4.9	-	Saturation Power Output	Test Condition (2) Notes 10,18,22 F = F1,F2,F3,F4,F5	Po	3	16	dBm
4.10	-	Power Gain	Test Condition (2) Notes 10,18,23 F = F1,F2,F3,F4,F5	Gp	Note 24	-	-
4.11	-	Input Match	Test Condition (2) Note 26	VSWR	-	2.5	Ratio
4.12	-	Output Match	Test Condition (2) Note 26	VSWR	-	2.5	Ratio
4.13	-	Stability	Test Condition (2) No r.f. input Note 32	Po	No Osc.		
<u>Quality Conformance Inspection, Part 3</u>							
5.	-	Magnetic Shielding	Test Condition (2) Notes 7,8	-	-	-	-
6.	-	Temperature	Test Condition (2) Notes 10,12,13,29 F = F1,F2,F3,F4,F5	-	-	-	-
7.	-	Vibration	Test Condition (2) Notes 7,14,15,16	-	-	-	-
8.	-	Insertion Loss	Test Condition (1) Notes 7,25	L	55	-	dB

Test	Method or Para.	Requirement or Test	Conditions	Symbol	Limits		Units
					Min.	Max.	
9.	-	Life Test	Test Condition (2) Notes 10,27,28, 29 F = F1,F2,F3, F4,F5	t	1000	-	hours
10.	-	Life Test End Points	Test Condition (2) Note 10 F = F1,F2,F3, F4,F5	-	Note 30		-

NOTES

1. The absolute maximum ratings define the upper limits of electrical inputs which may be applied to the tube without danger of permanent damage. (MIL-E-1, Para. 6.5). The electrical input ratings necessary to provide the required tube performance are specified elsewhere.
2. The tube operating voltages and currents shall be listed on a label affixed to the tube. The voltages shall fall within the following limits:-

<u>Element</u>	<u>Minimum Voltage</u>	<u>Maximum Voltage</u>
Heater	6.24	6.36
Grid 1	-50	5
Grid 2	5	150
Grid 3	5	300
Grid 4	75	500
Helix	1100	1300
Collector	Ew+5	Ew+210

All voltages are measured with respect to cathode.

3. In order to maintain the specified performance over the specified temperature range, the following power supply requirements must be met:-

<u>Element</u>	<u>Installation Accuracy</u> (+%)	<u>Stability (+%)</u> (Long term variation)	<u>Ripple</u> (Volts p-p short term variation)
Heater	1.0	1.0	
Grid 1	0.15	1.0	0.020
Grid 2	-	1.0	0.020
Grid 3	0.15	1.0	0.020
Grid 4	0.15	1.0	0.050
Grid 5	0.15	1.0	0.050
Helix	0.15	0.1	0.050
Collector	0.15	5.0	10.0

- (a) Installation accuracy is set on accuracy at 20°C.
 - (b) Stability includes power supply variations from all causes including temperature.
4. Tube may be operated with any one of the following elements at capsule potential:-

Cathode
Helix
Collector

5. The symbols and abbreviations used are defined in MIL-E-1E, except as follows:-

Iw Helix Current
Ew Helix Voltage
GHz 10^9 Hz
Gss Small Signal Gain
Gp Power Gain
L Insertion Loss
dBm dB relative to 1 milliwatt

NOTES CONT'D

6. The tube shall be packed in its regular shipping container and the packaged tube subjected to the drop tests specified in K1005. There shall be no mechanical damage following the drop tests.
7. These tests shall be performed on one tube every 6 months when the tube is in continuous production or one tube per 100 tubes, whichever comes sooner. In the event of a failure, corrective action shall be taken by the manufacturer and the Approval Authority informed.
8. The tube under test shall be mounted parallel with, and at a distance not greater than 3" between centres from another CV6182 on a steel plate which is 18" square by $\frac{1}{2}$ " thick. The tube under test shall operate within the limits specified for each test listed under Quality Conformance Inspection Part 1. (Tests 4.1 through 4.13)
9. A label shall be fixed to the body of each tube. The label shall be indelibly marked "Magnetised Materials".
10. The test frequencies F_n are defined as follows:-

<u>Designation</u>	<u>Frequency (GHz)</u>
F1	12.0
F2	13.5
F3	15.0
F4	16.5
F5	18.0

11. Follow procedure of MIL-T-5422E.
12. The results of all performance measurements shall be recorded. These measurements shall be of the Grid and Helix Currents, Gain, Saturation Power Output and Noise Figure as specified in Quality Conformance Part 1. The temperature test shall be performed as follows:-

<u>Step</u>	<u>Condition</u>	<u>Time at Indicated Capsule Temperature Prior to measurements</u>	<u>Measurements</u>
1	Room ambient temp. Normal test rig outside chamber.	-	Required Record ambient temp.
2	Room temp. as in Step 1 but with tube in chamber.	-	Required
3	Adjust chamber to -10°C	40 minutes	Required
4	Adjust chamber to -62°C	1 hour	Not required
5	Adjust chamber to 45°C	2 hours 10 minutes	Required
6	Adjust chamber to 70°C	30 minutes	Required
7	Adjust chamber to 90°C	25 minutes	Required
8	Room ambient temp. Normal test rig outside chamber.	1 hour 25 minutes	Required Record ambient temp.

NOTES CONT'D

13. Where measured, the performance at the operating temperatures shall be compared with the performance at Step 2 (Note 12) and the differences shall not exceed the following limits:-

<u>Performance</u>	<u>Limits</u>
Gain	± 4 dB
Saturation Power Output	± 2.5 dB
Noise Figure	± 3 dB

The grid and helix currents shall not exceed the following limits:-

Grid Currents	As specified in Test 4.1
Max. Helix Current	250 μ Ad.c. for Steps 3 and 5 in Note 12
	350 μ A d.c. for Steps 6 and 7 in Note 12

There shall be no change greater than Measurement Error (Note 34) in performance between Steps 1 and 8 (Note 12).

In the event of failure the Approval Authority shall be informed immediately.

14. Measure gain using a swept frequency technique. Gain variation due to resonances during the test shall be less than 0.5 dB at any frequency between 12.0 and 18.0 GHz.
15. The tube shall be vibrated in three mutually perpendicular directions successively one of which shall be the major axis.
- (a) Resonance search: 5 to 55 Hz at ± 0.010 " amplitude, 1 Hz steps, 15 secs each. Record resonant frequencies.
- (b) 5 to 15 Hz at ± 0.030 " amplitude, 1 Hz steps, 2 minutes/step.
16 to 25 Hz at ± 0.020 " amplitude, 1 Hz steps, 2 minutes/step.
26 to 55 Hz at ± 0.010 " amplitude, 1 Hz steps, 2 minutes/step.
Record resonant frequencies.
- (c) Two hours at resonances.
16. Before and after this test, perform Quality Conformance Inspection Tests 4.6, 4.7 and 4.9. There shall be no change greater than the limits of Measurement Error (Note 34).
17. Following the procedure of MIL-T-5422E subject the operating tube, with no r.f. input and at the prevailing room temperature, to 18 impact shocks of 30g and a time duration of 11 ± 1 ms. Three impact shocks shall be applied in each direction to the tube in each of three mutually perpendicular axes.
18. At the discretion of the manufacturer, a swept frequency signal source may be employed and the performance recorded continuously over the frequency band.

NOTES CONT'D

19. Frequency Gain Variation shall be measured using a swept frequency source over the operating band.
20. Noise mounts of A.I.L. manufacture having Part No. 07091 shall be assumed to have a relative excess noise temperature of 15.3 dB.
21. Gain tests shall be performed with input power adjusted to give an output power level of 1 milliwatt.
22. The Saturation Power Output test shall be performed as follows:-

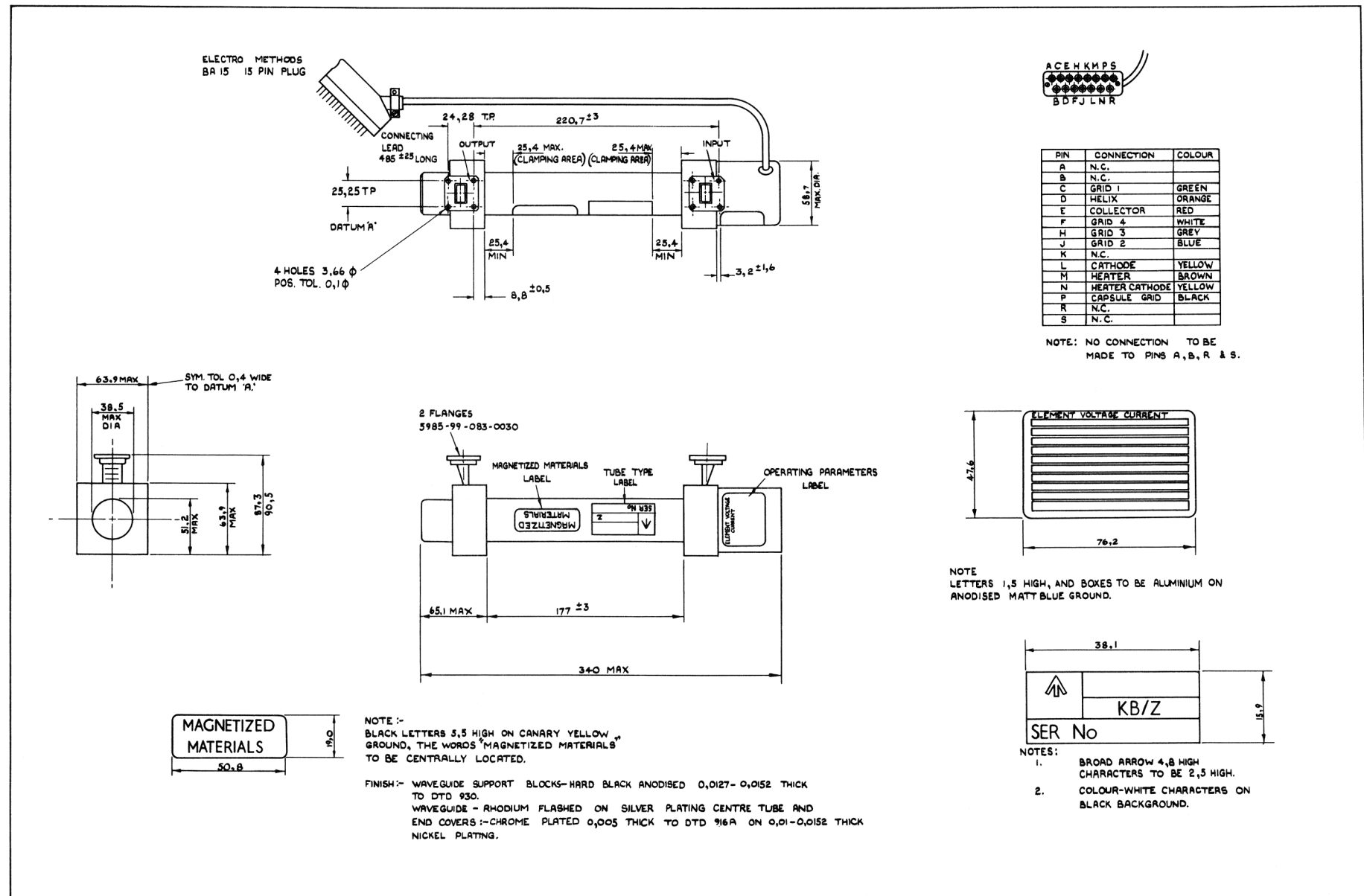
At each frequency, increase the power input until the first power output peak is reached, measure the power output at this value of power input.
23. Power Gain is defined as the gain measured with the input power adjusted to give the power output obtained using the setting procedure specified in Note 22.
24. Power Gain shall be not less than the value of Gss-9 dB.
25. The Insertion Loss shall be measured across the frequency band using a swept frequency technique.
26. The V.S.W.R. at the relevant connector shall be measured across the frequency band using a swept frequency technique, the other connector being terminated in a matched load.
27. The tube selected for this test shall have passed the acceptance tests (Quality Conformance Inspection, Part1), or have the approval of the Inspecting Officer.
28. Before the life tests and at 50, 100, 200, 500 and 1000 hours, the Electrode currents, the gain, saturated power output and noise figure shall be measured.
29. This test shall be one tube per lot where lot size shall consist of 25 tubes or 1 month's production, whichever is the greater.
30. The end of life is defined as the time at which any of the following conditions occur:-

Grid currents exceed the limits specified in Test 4.1
Helix current exceeds the limits specified in Test 4.2
Gain changes by more than 3 dB
Saturation power changes by more than 2 dB.
Noise Figure changes by more than 1 dB

In the event of failure the Approval Authority shall be informed.
31. Preservation, packaging and packing. Unless otherwise specified in the contract or order, preservation, packaging and packing shall be according to J.S. Specification K1005.

NOTES CONT'D

32. With the tube input and output separately terminated in a short, the phase of the mismatch shall be varied by 360 electrical degrees and helix voltage swept plus and minus 2 per cent from its optimum value at a 50 to 400 c/s rate. The detected tube output shall be viewed as the vertical deflection on an oscilloscope and the helix voltage as the horizontal deflection. The sensitivity of the test circuit shall be that necessary to indicate the tube noise output. The onset of oscillation is observed as a discontinuity in the oscilloscope trace.
33. Installation and alignment shall be as follows:-
- (a) Connect power supply and r.f. lines to the T.W.T.
 - (b) Apply rated heater voltage for a period of two minutes. The full rated heater voltage may be applied instantaneously.
 - (c) Set Grid 2 to zero volts and set all other elements to voltages shown on the tube label.
 - (d) Turn up the voltage on Grid 2 until the collector current reaches the value shown on the tube label. Grid 2 voltage shall then be approximately that shown on the label. Collector current shall be set to an accuracy of 1%.
 - (e) After initial installation and setting of voltages, subsequent turn-on procedure may be as follows:-
 1. Same as (b).
 2. All other voltages may then be immediately turned on to the preset values with the proviso that the helix voltage is achieved before the Grid 2 voltage.
34. Measurement Error shall be defined as:-
- Gain ± 1 dB
- Saturated Power Output ± 1 dB
- Noise ± 0.5 dB



OUTLINE DRAWING OF TUBE

DIMENSIONS IN mm

CV 6182/1/10