

INCH-POUND

MIL-PRF-1/1726B
w/AMENDMENT 2
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SUPERSEDING
MIL-PRF-1/1726B
AMENDMENT 1
4 February 2003

PERFORMANCE SPECIFICATION SHEET
ELECTRON TUBE, MICROWAVE (NEGATIVE GRID)
TYPE 8533W

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and MIL-PRF-1.

DESCRIPTION: Triode, planar ceramic-metal.
See figure 1.
Mounting position: Any.
Weight: 2.5 ounces (71 grams) nominal.

ABSOLUTE RATINGS:

Parameter:	F	E _f	E _b	ep _y	E _c	I _b	I _b	I _c	t _p
Unit:	GHz	V <u>1/</u>	kV dc	kv	V dc	mA dc	a <u>2/</u>	a	μs
Maximum:									
Anode pulsed osc or amp:	3.0	6.3±5%	---	10.0	-150	---	5.0	2.5	3.5
Grid pulsed osc or amp:	3.0	6.3±5%	8.0	---	-150	---	5.0	2.5	---
Test conditions:	---	6.3	1.0	---	Adj	100	---	---	---

ABSOLUTE RATINGS:

Parameter:	D _u	P _p	P _q	t _k	TE	T (anode shank)	Cooling	Barometric pressure, reduced
Unit:	---	W	W <u>3/</u>	sec	°C <u>4/</u>	°C <u>4/</u>	---	mmHg <u>19/</u>
							<u>4/ 5/</u>	
Maximum:								
Anode pulsed osc or amp:	0.0025	100	1.5	60	250	250	---	35
Grid pulsed osc or amp:	---	100	1.5	60	250	250	---	35
Test conditions:	---	---	---	300	---	---	<u>6/</u>	---

See footnotes at end of table I.

GENERAL: Qualification: Required.

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TABLE I. Testing and inspection.

Inspection	MIL-STD-1311 method	Conditions	Acceptance level <u>21/</u>	Symbol	Limits		Unit
					Min	Max	
<u>Conformance inspection, part 1</u>							
Heater current	1301		0.65	If	1.2	1.4	A
Electrode voltage (1) (grid)	1261	<u>9/</u>	0.65	Ec	-2.0	-7.0	V dc
Insulation of electrodes	1211	Eb = Ek = 0; Ec = -500 V dc	0.65	R	50	---	MegΩ
Total grid current	1266	<u>7/ 9/</u>	0.65	Ic	---	-8.0	μA dc
Pulsing emission	1231	eb = ec = etd/is = 10.0 a; tp = 3 μs (max); prf = 600 (max)	0.65	etd	---	200	v
High-voltage hold off	---	Eb = 10.0 kV dc; <u>8/</u> Ec = -150 V dc	0.65	Ib	---	1.0	mA dc
<u>Conformance inspection, part 2</u>							
Electrode voltage (2) (grid)	1261	Ec/Ib = 1.0 mA dc	---	Eco	---	-30.0	V dc
Power gain	---	F = 1,100 ±50 MHz; Ebb = 3.0 kV dc (min); Ecc = -40 V dc; tp = 3 μs (min); Du = 0.002 (min); pd = 400 w <u>10/ 11/</u>	---	G	7.0	---	dB
Direct-interelectrode capacitance	1331	No voltages applied; use fixture in accordance with Drawing 158-JAN <u>10/ 20/</u>	---	{ Cin Cgp Cout	{ 7.0 1.5 ---	{ 9.0 1.8 0.05	{ pF pF pF
Resonance	---	No voltages applied <u>10/ 12/</u>	---	---	---	---	---

See footnotes at end of table.

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TABLE I. Testing and inspection - Continued.

Inspection	MIL-STD-1311 method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 3</u>						
Life test	---	Group C; filament standby; t = 500 hours <u>18/</u>	---	---	---	---
Life-test end point	---	<u>18/</u>	Δib	---	25	%
Variable-frequency vibration	---	F = 55 to 500 Hz; acceleration = 10 G (peak); Ebb = 400 V dc; Rp = 10,000 ohms; Ec/Ib = 10 mA dc <u>10/ 13/ 14/</u>	Ep	---	250	mV ac
Torque	---	No voltages applied <u>10/ 13/ 15/</u>	---	---	---	---
Shock	1042	Condition A; no voltages applied <u>13/ 16/</u>	---	---	---	---
Torque and shock-test end point:	---					
Total grid current	1266		Ic	---	-10	μA dc
Barometric pressure, reduced	1002	Pressure = 35 mmHg (max); voltage = 1,800 V ac; TA = +30°C \pm 10°C <u>13/ 17/</u>	---	---	---	---

- 1/ The transit-time heating effect of the cathode may require compensation by a reduction in heater voltage after dynamic operation of the tube has started. The back heating is a function of frequency, grid current, grid bias, anode current, duty cycle, and circuit design and adjustment. There is an optimum heater voltage which will maintain the cathode at the correct operating temperature for a particular set of operating conditions. A maximum variation of ± 5 percent from optimum is permitted. No reduction in heater voltage is required up to and including 500 MHz.
- 2/ The regulation or series-anode-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.
- 3/ The maximum instantaneous peak grid voltage CW ratings shall be within the range of +30 to -400 volts. The maximum instantaneous peak grid voltage for grid-pulse conditions shall be within the range +250 to -750 volts.
- 4/ Sufficient conduction, convection, and forced-air cooling shall be provided to limit the envelope and anode shank temperatures to the specified value under all operating conditions. Reliability will be seriously impaired if the maximum is exceeded. Where emphasis is placed on long and reliable life, lower temperatures should be used.
- 5/ Unless otherwise specified, at an anode dissipation of 100 watts and with an incoming air temperature of 25°C maximum at sea level, a minimum airflow of 12.5 cfm shall be directed across the anode cooler, using the cowl as shown on Drawing 157-JAN (see 20/).
- 6/ Sufficient conduction, convection, and forced-air cooling may be used in all electrical tests involving application of heater voltage to maintain the anode shank and seal temperatures within the specified maximum value.
- 7/ This test is to be the first test performed at the conclusion of the holding period.
- 8/ After heater warm-up, the anode voltage shall be raised slowly to 10 kV dc. Intermittent arcing may occur as the anode voltage is increased, but more than 5 arcs shall be cause for rejection. The voltage shall be held at the 10 kV dc level for 60 seconds; if any arcs occur during this time, or Ib exceeds the specified limit of 1.0 mA dc, the tube shall be rejected.
- 9/ Airflow through the anode radiator shall be between 3.5 and 4.0 cfm with the cowl as shown on Drawing 157-JAN (see 20/). The grid current shall be measured not less than 5 minutes after the anode dissipation has been set at 100 watts.

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TABLE I. Testing and inspection - Continued.

- 10/ Other tube contact configurations may be used provided the tube contact area remains unchanged and the socket, jig, or cavity gives equal performance. Mounting of the socket, jig, or cavity may be at the option of the manufacturer.
- 11/ Test to be conducted in power amplifier cavity as shown on Fidelitone Microwave, Inc., Drawing JVM D9819, or equivalent. Driving power is defined as the new power delivered to the amplifier cavity input terminals and the reflected power shall be subtracted from the incident power to obtain the net driving power. The output tuning shall be adjusted for maximum power output.
- 12/ Grid-anode resonance: Test in cavity in accordance with Drawing 278-JAN. Cavity shall resonant at $1,354 \pm 2.0$ MHz with tuning slug in accordance with Drawing 277-JAN at TA = $+25 \pm 5^\circ\text{C}$. (see 20/).
- Grid-cathode resonance: Test in cavity in accordance with Drawing 283-JAN. Cavity shall resonant at $1,719 \pm 2.0$ MHz with tuning slug in accordance with Drawing 277-JAN at TA = $+25 \pm 5^\circ\text{C}$. (see 20/).

When plotted on graphs of resonant frequency versus grid-anode capacitance and resonant frequency versus grid-cathode capacitance, the tube under test shall be represented by a point within the parallelogram whose four corners are located by the following points:

Points	Capacitance (pF)		Frequency (MHz)	
	Cgp	Cgk	Fgp	Fgk
1	1.5	7.0	2,115	1,765
2	1.5	7.0	2,145	1,795
3	1.8	9.0	2,040	1,725
4	1.8	9.0	2,070	1,755

- 13/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. An accept on zero defect sampling plan shall be used with a sample of three tubes. In the event of failure, the test will be made as part of conformance inspection, part 2, with accept on zero defect sampling (see 21/). The regular 12-calendar month sampling plan shall be reinstated after three consecutive samples have been accepted. None of the testing shall be considered as destructive, except in case of failure.
- 14/ The tube shall be mounted in a socket in accordance with Drawing 276-JAN (see 20/) and vibrated with simple harmonic motion. The peak acceleration over the frequency range shall be within ± 20 percent of reference acceleration at 100 Hz. The frequency shall vary from 55 to 500 Hz and return to 55 Hz with approximately logarithmic progression and shall require 4 minutes minimum, 6 minutes maximum to traverse the range. Each tube shall be vibrated for 30 minutes in each axis X and Z, except that if the cumulative results of tests 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 voltages specified herein shall be applied to the tube during vibration. 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, and 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 20,000 Hz. The value of the vibrational output, Ep, shall not exceed the limit specified herein at any point in the sweep-frequency range during the last complete cycle of the cycling vibration.
- 15/ The torque test shall be performed as follows:
- The tube shall be held securely at the cathode connection. A force of 5 pounds shall be applied to the heater cup without perceptible shock. This test may be made by applying the force at right angles to the inside of the cup at a point .109 inch (2.77 mm) \pm .016 inch (0.41 mm) from the cathode end of the tube. An approved equivalent method may be used. The heater cup shall not loosen or short circuit to the cathode connection.
 - A torque of 15-inch pounds shall be applied between anode and cathode without shock.
 - A torque of 40-inch pounds shall be applied between anode and grid without shock.
 - A torque of 30-inch pounds shall be applied, both clockwise and counter-clockwise, between the anode cooler and the anode contact surface, with no resulting loosening of the cooler or damage to the tube.
- 16/ Test in jig made in accordance with Drawing 280-JAN (see 20/).
- 17/ Voltage to be 60 Hz ac applied between the anode and grid. No other voltages shall be applied. There shall be no evidence of failure as indicated by arc-over.

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TABLE I. Testing and inspection - Continued.

- 18/ At zero hours, establish the drive conditions necessary to obtain 3.0 amperes peak anode current with an anode voltage of 2,000 V dc and a bias voltage of -40 V dc. The pulse width of the modulator shall be 2 μ s minimum and the duty cycle shall be 0.0025 maximum. With the drive level determined at zero hours, check the anode current at the end of life. The maximum allowable drop in anode current (Δ ib) is as specified.
- 19/ Operation at this altitude is possible in a suitably designed circuit.
- 20/ Contact preparing activity if help is needed locating JAN drawings.
- 21/ This specification sheet uses an accept on zero defect sampling plan in accordance with MIL-PRF-1, table III.

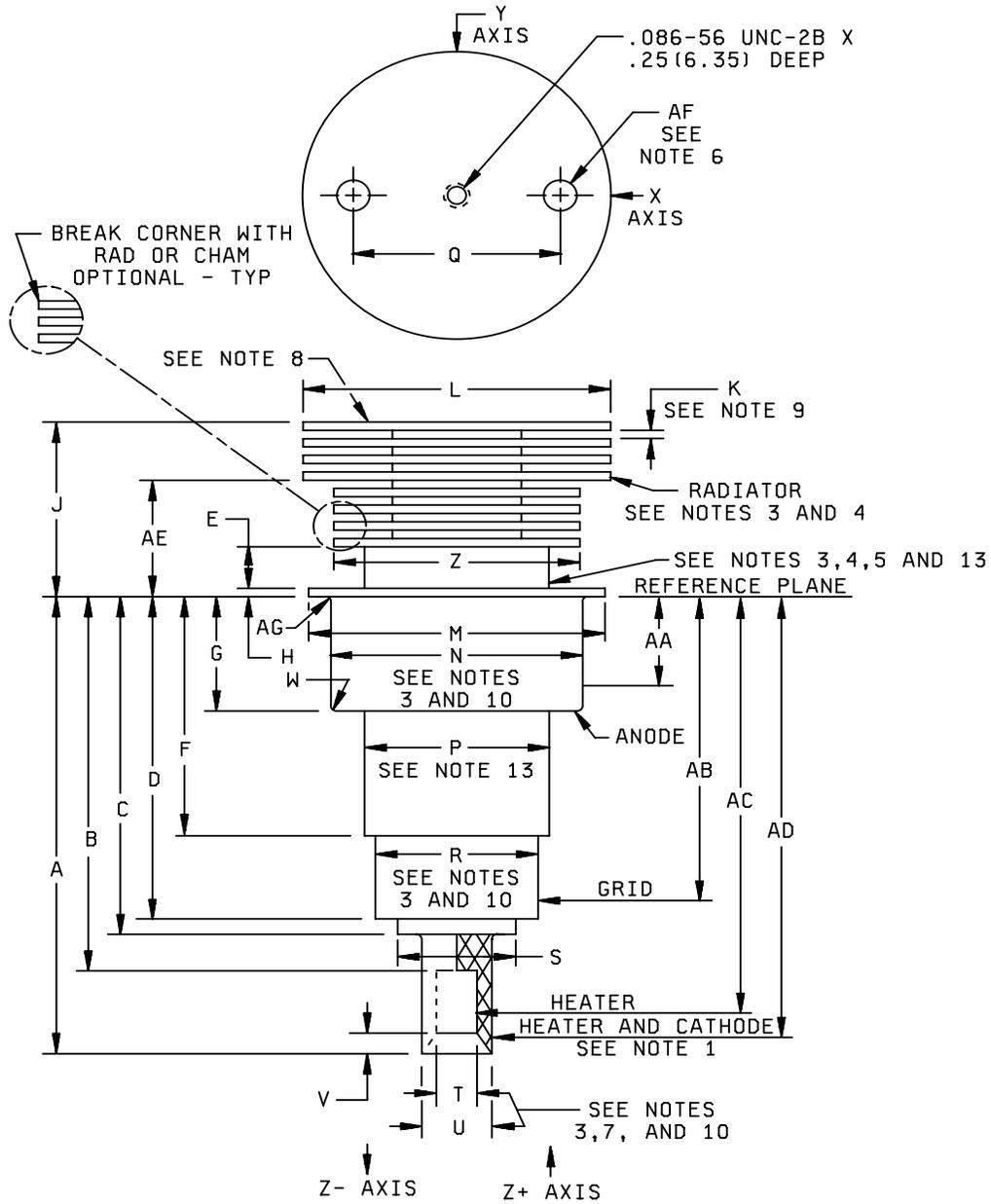


FIGURE 1. Outline drawing of electron tube type 8533W.

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LTR	Dimensions			
	Inches		Millimeters	
Conformance inspection, part 2				
	Min	Max	Min	Max
A	1.815	1.875	46.10	47.63
B	---	1.534	---	38.96
C	---	1.475	---	37.47
D	1.289	1.329	32.74	33.76
F	.970	1.010	24.64	25.65
G	.462	.477	11.73	12.12
J	.766	.826	19.46	20.98
N	1.025	1.035	26.04	26.29
R	.655	.665	16.64	16.89
T	.213	.223	5.41	5.66
U	.315	.325	8.00	8.26
Z	1.120	1.130	28.45	28.70
Conformance inspection, part 3 (see note 2)				
E	.125	.185	3.18	4.70
H	---	.040	---	1.02
K	.025	.046	0.64	1.17
L	1.234	1.264	31.34	32.11
M	1.180	1.195	29.97	30.35
P	.772	.792	19.61	20.12
Q	.650	.850	16.51	21.59
S	---	.545	---	13.84
V	---	.086	---	2.18
W	---	.100 RAD	---	2.54 RAD
AE	.420	---	10.67	---
AF	.105	.145	2.67	3.68
AG	---	.035 RAD	---	0.89 RAD
Electrode contact areas - see note 12)				
AA	.035	.361	0.89	9.17
AB	1.185	1.265	30.10	32.13
AC	1.534	1.728	38.96	43.89
AD	1.475	1.815	37.47	46.10

NOTES:

- Insulation material is required between heater and heater-cathode and shall be securely affixed.
 - Dimensions shall be checked during the initial production and once each succeeding 12-calendar months in which there is production. An accept on zero defect sampling plan shall be used with a sample of three tubes. In the event of failure, the test shall be made as a part of conformance inspection, part 2, with accept on zero defect sampling (see 21/). The regular 12-calendar month sampling plan shall be reinstated after three consecutive samples have been accepted.
 - Silver plated 30 MSI minimum.
 - Plating not required over radiator and radiator support of copper, aluminum, or approved equivalent.
 - This surface shall be used for measurement of anode shank temperature.
 - Holes for tube extractor through top fin only.
 - Inner edge of heater and outer edge of cathode rf connection shall be free from burrs and sharp edges.
 - This fin shall withstand a 6-inch drop test without loosening and without distortion as judged by ability to maintain dimension K. Note 2 shall apply.
 - Distortion of fins permissible provided distance between adjacent fins at any point on circumference meets tolerances for dimension K.
 - Eccentricity of contact surfaces shall be gauged from center line of reference and shall be as follows. Note 2 shall apply.
- | Contact surface | TIR maximum | Reference |
|-----------------|-------------|-----------|
| Anode | .020 | Cathode |
| Grid | .020 | Cathode |
| Heater | .012 | Cathode |
- Diameters N, R, T, and U shall apply throughout entire contact areas as defined by dimensions

AA, AB, AC, and AD, respectively.

- Dimensions in electrode contact areas table are for socket design purposes and are not intended for inspection purposes.
- This surface shall not be used for clamping or locating.

FIGURE 1. Outline drawing of electron tube type 8533W - Continued.

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Referenced documents. In addition to MIL-PRF-1, this specification sheet references the following documents: MIL-STD-1311, 158-JAN, 157-JAN, 278-JAN, 277-JAN, 283-JAN, 276-JAN, 280-JAN, and JVM D9819.

Amendment notations. The margins of this specification sheet are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

Custodians:

Army - CR
Navy - EC
Air Force - 11
DLA - CC

Preparing activity:

DLA - CC
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Review activities:

Navy - AS, CG, MC, OS
Air Force - 99

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