INCH-POUND

MIL-PRF-1/1037E
11 March 1998
SUPERSEDING
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PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, NEGATIVE GRID (MICROWAVE)
TYPE 6897

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 the latest issue of MIL-PRF-1.

DESCRIPTION: Triode, planar, ceramic and metal.

See figure 1.

Mounting position: Any.

Weight: 2 ounces nominal.

ABSOLUTE RATINGS:

Parameter: Unit:	F1 GHz	Ef V 1/	Eb V dc	eb v	Ebb V dc	Ec V dc	Ik mA dc	Ib mA dc	Ic mA dc	Pp W 3/
Maximum:										
CW osc or amp	2.5	6.3 ± 5%	1,000	----	----	-150	125	----	50	100
Anode mod CW osc or amp	2.5	6.3 ± 5%	----	1,200 2/	----	-150	100	----	50	100 4/
Test condition:	----	6.3	----	----	600	Adj	----	75	----	----

Parameter: Unit:	Pg W 5/	tk sec (min)	TE °C 6/	T (anode shank) °C (see note e of figure 1)	Cooling ----	Barometric pressure, reduced mmHg
Maximum:						
CW osc or amp	2	60	200	200	----	30
Anode mod CW osc or amp	2	60	200	200	----	30
Test condition: 4/	----	300	----	----	7/	----

1/ The transit-time heating effect of the cathode shall be compensated for 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/ 1,200 volts is at the crest of the audio wave.

3/ Up to 100 watts dissipation is allowable with forced-air cooling of the anode.

4/ For 100 percent modulation including dissipation resulting from power supplied by the modulator.

5/ The maximum instantaneous peak grid voltage for CW ratings shall be within the range of +30 to -400 volts.

6/ Maximum envelope temperature shall be limited to the specified maximum of 200°C under all operating conditions. Where emphasis is placed on long life and reliability, lower tube envelope temperatures shall be used.

7/ Sufficient conduction or convection cooling shall be provided for all seals to limit temperatures in accordance with footnote 6/. For anode cooling, an airflow of 12.5 cfm minimum shall be supplied at sea level, and with airflow at 25°C maximum directed with a cowl as shown on Drawing 157-JAN. Where long life and consistent performance are factors, cooling in excess of minimum requirements is normally beneficial. Unless otherwise specified, conduction cooling or an airflow of up to 12.5 cfm may be supplied for anode cooling in all electrical tests involving application of heater voltage.

GENERAL:

Qualification - Required.

TABLE I. Testing and inspection.

Inspection	Method	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 1 8/								
Insulation of electrodes	1211	Eb = Ek = 0 Ec = -500 V dc	0.65	II	R	50	----	Meg
Power oscillation 6/ 9/	1236	F = 2.5 GHz (min); Ebb = 1,000 V dc; Ib = 90 mA dc; Ef = 5.0 V	0.65	II	Po	15	----	W
Electrode voltage (1) (grid)	1261		0.65	II	Ec	-1.3	-3.5	V dc
Total grid current	1266		0.65	II	Ic	----	-3	μA dc

Pulse emission (1)	2212	Eb = 145 V dc;
		Ec = -10 to -150 V dc;
		egk/ik = 750 ma; Ef = 5.5 V;
		prr = 11 ± 1 pps;
		tp = 4,500 μs (min);
		tr = tf = 25 μs;
		slope = 0.5 percent;
		ripple = 0.1 percent
			0.65	II	Δik	----	120	ma

Current division (long pulse)	1372	Pulse emission (1), except egk/ib = 400 ma; Ef = 6.3 V	0.65	II	egk ic	11 210	19 325	v ma
Heater current	1301		0.65	II	If	0.95	1.10	A
Conformance inspection, part 2								
Power gain 6/ 12/	----	F = 1.85 GHz ± 5 MHz; Ebb = 600 V dc; Ec/Ib = 100 mA dc; Pd = 2.5 W; Ef = 5.8 V	----	----	Po	16	----	W
Direct-interelectrode capacitance 6/ 13/	1331	No voltages	----	----	Cin Cgp Cout	6.0 1.89 0.018	7.0 2.13 0.029	pF pF pF
Resonance 6/ 14/	----	No voltages	----	----	----	----	----	----
Grid distortion 6/ 15/	----		----	----	ΔF	+0.5	-3.0	MHz
Electrode voltage (2) (grid)	1261	Ec/Ib = 1.0 mA dc	----	----	Ec	-7	-15	V dc
Grid arc	----	See figure 2	----	----	----	----	----	----
Pulse emission (2)	2212	Pulse emission (1), except Ef = 6.3 V	----	----	Δik	----	60	mA
Transconductance	1306		----	----	Sm	22,000	27,500	μmhos
Amplification factor	1316		----	----	Mu	75	115	----
Low-frequency vibration	1031	Ec/Ib = 10 mA dc; Rp = 10,000 ohms; Ebb = 300 V dc	----	----	Ep	----	100	mV ac

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 3								
Life test (1) 3/	----	Group C; F = 500 MHz (min); Ebb = 800 V dc; Ib = 80 mA dc; initial Po = 27 W (min); Ef = 6.0 V; t = 500 hours	----	----	----	----	----	----
Life-test (1) end point:								
Life test (1)	----		----	----	ΔPo t	----	-25	%
Life test (2) 4/	----	Group D; Ef = 5.0 V; F = 2.0 GHz (min); Ebb = 900 V dc;Ib = 80 mA dc; Ec/Max Po; t = 200 hours	----	----	----	----	----	---
Life-test (2) end point:								
Power oscillation	1236		----	----	ΔPo t	----	-25	%
Periodic-check tests								
Barometric pressure, reduced 16/	1002	Pressure = 30 mmHg (max); voltage = 1,000 V ac; TA = 30° ± 10°C	----	----	----	----	----	----
Variable frequency vibration 6/ 11/ 17/	1031	F = 55 to 500 Hz; 10 G peak (min); Ec/Ib = 10 mA dc; Rp = 10,000 ohms; Ebb = 300 V dc	----	----	Ep	----	250	mV ac
Vibration-fatigue 2/ 6/	1031	Eb = Ec = 0; Ef = 6.0 V	----	----	t	96	----	hrs
Vibration-fatigue test end point:								
Total grid current 7/	1266		----	----	Ic	----	-5.0	μA dc
Torque 1/ 10/	----	No voltages	----	----	----	----	----	----
Torque-test end point:								
Total grid current	1266		----	----	Ic	----	-5.0	μA dc
Shock 5/ 6/ 11/	1041	400 G peak (min); duration = 0.5 ms (min); no voltages; X, Z+, and Z- axes	----	----	----	----	----	----
Shock-test end point:								
Total grid current 7/	1266		----	----	Ic	----	-5.0	μA dc

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

1/ Torque test shall be performed as follows:

(a) 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 0.109 inch (2.77 mm) ± 0.016 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 on the cathode connection.

(b) A torque of 15 inch-pounds shall be applied between anode and cathode without shock.

(c) A torque of 40 inch-pounds shall be applied between anode and grid without shock.

2/ Test four tubes selected at random from the first production lot of each year. If more than one tube fails to pass the specified end points, the failed test shall become a part of conformance inspection, part 2, with acceptance level of 6.5, inspection level S3, on all lots in process. After three consecutive submissions, the test shall revert to a 4-tube annual test.

3/ Life test shall be run in cavity in accordance with Drawing 160-JAN (coupling: probe feedback and probe output) as a self-excited oscillator.

4/ Life test shall be run in a self-excited oscillator cavity.

5/ Test in jig in accordance with Drawing 159-JAN.

6/ 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 jig, socket, or cavity may be at the option of the manufacturer.

7/ The following does not apply: Tubes which show permanent or tap shorts or open circuits following the applicable test.

8/ All tests listed under conformance inspection, part 1, are to be performed at the conclusion of the holding period.

9/ Test to be made in cavity in accordance with Drawing 160-JAN. The cavity shall be connected to a standard load with a VSWR less than 1.5. The output coupling from the oscillator and grid or cathode resistor, or both, may be adjusted for maximum power output.

10/ 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 conformance inspection, part 2, with acceptance level 6.5, inspection level S3, on all lots in process. After three consecutive successful submissions, the test shall revert to a 10-tube quarterly test. This is a nondestructive test except in case of failure.

11/ Perform test on 10 tubes selected at random from the first production lot each calendar year. If more than one tube fails, the test shall become a part of conformance inspection, part 2, with acceptance level 6.5, inspection level S3. After three consecutive successful submissions, the test shall revert to an annual 10-tube test.

12/ Test to be conducted in power amplifier cavity. Driving power is defined as the net power delivered to the amplifier cavity input terminals and the reflected power is to be subtracted from the incident power to obtain the net driving power. The output tuning and load coupling are to be adjusted for maximum power output.

13/ Measured in socket in accordance with Drawing 158-JAN.

14/ Grid - anode resonance: Test in cavity in accordance with Drawing 278-JAN. Cavity shall resonate at 1.354 GHz ± 2.0 MHz with tuning slug in accordance with Drawing 277-JAN at TA = 25° ± 5°C.

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

Points	Capacitance (pF)	Frequency (GHz)
	Cgp	Fgp
1	1.89	1.92
2	1.89	1.95
3	2.13	1.87
4	2.13	1.90

TABLE I. Testing and inspection - Continued.

15/ Test shall be made in cavity in accordance with Drawing 281-JAN. Calibrate the circuit by adjusting the cavity until the frequency of resonance is 2.0 GHz ± 5 MHz at room temperature, with a tube which meets the resonance test requirements. In the grid-distortion test, the frequency shall first be measured with Ef = 6.3 volts, then the grid dissipation increased to 2 watts with Eb = -150 V dc. The change in frequency shall be not greater than the limit specified herein. Cooling air at room temperature may be used.

16/ Voltage shall be 60 Hz ac applied between anode and grid. No other voltages shall be applied. There shall be no evidence of failure as indicated by an arc-over. Perform test on 10 tubes selected from the first production lot of each year. If more than one tube fails, the test shall become a part of conformance inspection, part 2, with acceptance level 6.5, inspection level S3. After three consecutive successful submissions the test shall revert to a 10-tube annual test. This is not a destructive test.

17/ The tube shall be mounted in socket in accordance with Drawing 276-Jan and vibrated with simple harmonic motion. The peak acceleration over the frequency range shall be within ± 20 percent of the 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 through one complete sweep cycle in each position X and Z, except that if the cumulative result 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 reading. 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, 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.

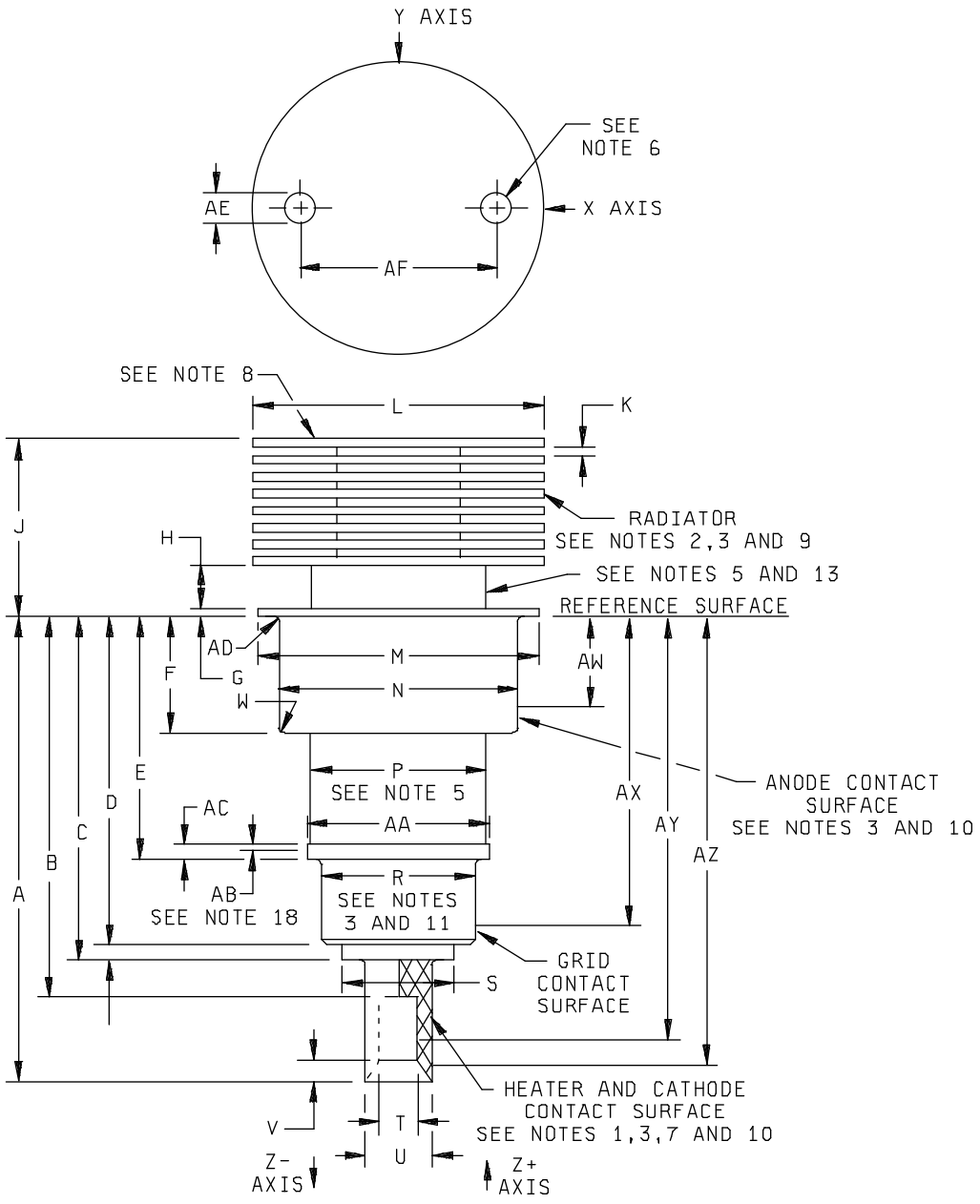


FIGURE 1. Outline drawing of electron tube type 6897.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 2				
A	1.815	1.875	46.10	47.63
B	----	1.534	---	38.96
C	----	1.365	---	34.67
D	1.289	1.329	32.74	33.76
F	0.948	0.972	24.08	24.69
G	0.462	0.477	11.73	12.12
J	0.766	0.826	19.46	20.98
N	1.025	1.035	26.04	26.96
R	0.655	0.665	16.64	16.90
T	0.213	0.223	5.41	5.66
U	0.315	0.325	8.00	8.26
AA	0.776	0.792	19.71	20.12
AB	0.040	----	1.02	----
Conformance inspection, part 3 (periodic check) (see note 2)				
H	----	0.040	---	1.02
I	0.125	0.185	3.18	4.70
K	0.025	0.046	0.64	1.17
L	1.234	1.264	31.34	32.11
M	1.180	1.195	29.97	30.35
P	----	0.765	---	19.43
S	----	0.545	---	13.84
V	----	0.086	---	2.18
W	----	0.100	---	2.54
AC	0.069	0.085	1.75	2.16
AD	---	0.035	---	0.89
AE	0.105	0.145	2.67	3.68
AF	0.650	0.850	16.51	21.59
Electrode contact areas (see note 12)				
AW	0.035	0.361	0.89	9.17
AX	1.040	1.240	26.42	31.50
AY	1.534	1.728	38.96	43.89
AZ	1.475	1.815	37.47	46.10

FIGURE 1. Outline drawing of electron tube type 6897 - Continued.

NOTES:

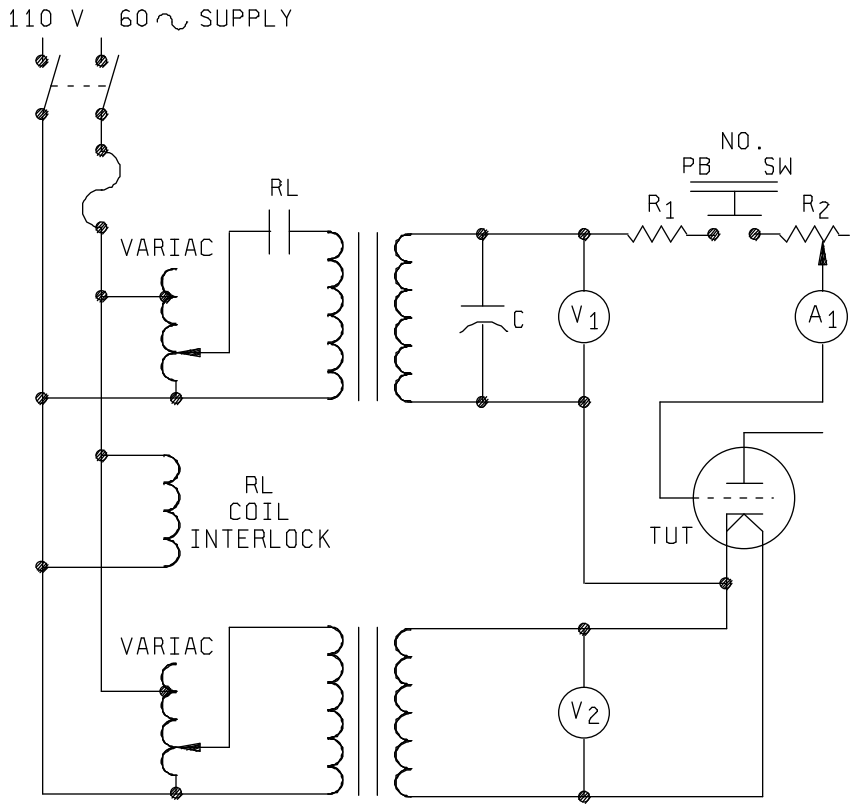
1. Insulation material is required between heater and heater-cathode, and it shall be securely affixed.
2. These dimensions shall be tested on 10 tubes per month when in continuous production. Failure of more than one tube to meet tolerances for any dimensions shall cause that dimension to become, for all lots in process, part of conformance inspection, part 2.
3. Silver plated 30 MSI minimum. Note 2 shall apply.
4. Plating not required over radiator and radiator support of copper, aluminum, or approved equivalent.
5. This surface shall be used for measurement of anode shank temperature.
6. Holes for tube extractor through top fin only.
7. Inner edge of heater and outer edge of cathode RF connection shall be free from burrs and sharp edges.
8. 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.
9. 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

10. Diameters N, R, T and U shall apply throughout entire contact areas as defined by dimensions AW, AX, AY, and AZ, respectively.
11. Dimensions in electrode contact areas table are for socket design purposes and are not intended for inspection purposes.
12. This surface shall not be used for clamping or locating.
13. Minimum flat dimension.

FIGURE 1. Outline drawing of electron tube type 6897 - Continued.



C - 1 μF, 1,000 V dc
R1 - 500 Ω, 10 W
R2 - 1,000 Ω, 50 W, variable
V1 - 0 to 400 V ac
V2 - 0 to 10 V ac
A1 - 0 to 150 mA dc

Test procedure:

1. Remove tube from preheat rack and place in test socket.
2. Check heater voltage at V2 (6.0 V ac) and grid voltage at V1 (285 V ac).
3. Press pushbutton switch, applying voltage between grid and cathode. Pushbutton switch is normally open.
4. Adjust R2 to 100 mA dc on A1 if necessary.
5. Hold pushbutton switch closed for at least 10 seconds. Tube shall be rejected if current drops to zero or fluctuates and continuous arcing occurs.

FIGURE 2. Grid arc test set wiring diagram.

Custodians:
Army - CR
Navy - EC
Air Force - 80

Review activities:
Army - AR, CR4
Navy - AS, CG, MC, OS, SH
Air Force - 19, 99

Preparing activity:
DLA - CC

(Project 5960-3466-36)