

PERFORMANCE SPECIFICATION SHEET  
 ELECTRON TUBE, NEGATIVE GRID (MICROWAVE)  
 TYPE 8964 1/

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: 2.5 ounces (71 grams) nominal.

**ABSOLUTE RATINGS:**

Parameter: Unit:	F MHz	Ef <u>2/</u> V	Eb V dc	epy kV	Ec V dc	ec v	Ib mA dc	Ib a	Ic a	tp μs
Maximum: Anode pulsed freq multiplier:	3000	6.0 ± 5%	----	3.5	----	-150	----	3.0	1.5	6.0
Test conditions:	----	6.0	1,000	----	Adj	----	100	----	----	----

**ABSOLUTE RATINGS:**

Parameter: Unit:	Du ----	Pp W	Pg <u>3/</u> W	tk sec (min)	TE °C <u>4/</u>	T (Anode shank) °C <u>4/</u>	Cooling <u>4/ 5/</u>
Maximum: Anode pulsed freq multiplier:	0.0033	100	1.5	60	250	250	----
Test conditions:	----	----	----	300	----	----	<u>6/</u>

- 1/ Replaces EIMAC type number Y-561.
- 2/ The transit-time heating effect of the cathode may have to be compensated for by a reduction in the heater voltage after dynamic operation of the tube has started. This 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 any particular set of operating conditions. A maximum variation of ±5 percent from optimum is permitted. No reduction in heater voltage is required to 500 MHz.
- 3/ The maximum instantaneous peak grid voltage for pulse service shall be within the range of +250 to -750 volts.
- 4/ Sufficient conduction, convection, or forced-air cooling shall be provided for the anode shank and all seals to limit the maximum temperature to the specified value under all operating conditions. Where emphasis is placed on long and reliable life, lower temperatures should be maintained.
- 5/ With an anode dissipation of 100 watts and with an incoming air temperature of 25°C maximum at seal level a minimum airflow of 12.5 cfm shall be directed across the anode cooler, using the cowl.
- 6/ In all electrical tests involving application of heater voltage, conduction, convection, and/or forced-air cooling may be used to assure operation within the maximum rated temperature limits.

GENERAL:

Qualification - Required.

Compatibility testing - Required

(In addition to the requirements specified herein, compatibility testing shall be required in the AN/URN-3 and AN/GRN-9 equipments. A sample of 20 tubes shall be supplied to Naval Air Test Center (NESTED), Patuxent River, Maryland 20670 on a noninterference basis, to be tested for freedom from oscillation, adequate gain and tuning capability, and good tracking, in both low and high band heads. Also, of the 20 tubes supplied, a sample of four tubes shall be selected for life testing. Each tube shall achieve a minimum of 500 hours operation. In the event of no failures the sample shall be considered as acceptable when a total of 1,600 hours has been accumulated.

TABLE I. Testing and Inspection.

Inspection	Method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 1 1/</u>						
Heater current	1301		If	0.90	1.05	A
Electrode voltage (1) (grid)	1261		Ec	-0.5	-5.5	V dc
Total grid current	1266		Ic	----	-8.0	$\mu$ A dc
Insulation of electrodes	1211	Eb = Ek = 0; Ec = -500 V dc	Rgk	50	----	Meg
Pulsing emission	1231	eb = ec = etd/is = 6.0 a; tp = 3 $\mu$ s (max); pr = 600 (max)	etd	----	200	V
Amplification factor	1316	Eb = 500 V dc; Ib = 50 mA dc	Mu	150	180	----
<u>Conformance inspection, part 2</u>						
Electrode voltage (2) (grid) 2/	1261	Ec/Ib = 1.0 mA dc	Eco	----	-25.0	V dc
Direct-interelectrode capacitance (grounded cathode connection)	1331	Fixture.	Cin Cgp Cout	6.30 1.85 ----	7.50 2.15 0.035	pF pF pF
Resonance 3/	----	No voltages	----	----	----	----
<u>Conformance inspection, part 3</u>						
Life test 4/	----	Group C; Ef = 6.0 V; filament standby; t = 500 hours	----	----	----	----
Life-test end point 4/	----		$\Delta$ ib	----	25	%
Variable-frequency vibration 5/ 6/	1031	F = 55 to 500 to 55 Hz; Accel = 10 G peak (min); Ebb = 400 V dc; Rp = 10,000 ohms; Ec/Ib = 10 mA dc	Ep	----	250	mV ac
Barometric pressure, reduced 5/ 8/	1002	Pressure = 35 mmHg (max); voltage = 1,800 V ac; TA = 30°C $\pm$ 10°C	----	----	----	----

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Conditions	Symbol	Limits		Unit
				Min	Max	
<u>Conformance inspection, part 3</u>						
Torque <u>5/ 7/</u>	----	No voltages	----	----	----	----
Shock, specified pulse <u>5/</u>	1042	Condition A; no voltages; fixture.	----	----	----	----
Torque and shock test end point:	----					
Total grid current	1266		Ic	----	-10	µA dc

1/ All test listed under conformance inspection, part 1, shall be performed at the conclusion of the holding period.

2/ The electrode voltage (2) grid test may be performed alternately in the following manner:

Eb = 600 V dc; Ec/Ib = 1.0 mA dc; and the limit for Eco shall be -15.0 V dc (max).

3/ Grid-anode resonance. Test in cavity. Cavity shall resonate at 1,354 ±2.0 MHz with tuning slug at TA = 25°C ±5°C.

Grid-cathode resonance. Test in cavity. Cavity shall resonate at 1,719 ±2.0 MHz with tuning slug at TA = 25°C ±5°C.

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 a parallelogram whose four corners are located by the following points:

Points	Capacitance (pF)		Frequency (MHz)	
	C-gp	C-gk	F-gp	F-gk
1	1.85	6.30	1,965	1,730
2	1.85	6.30	2,015	1,780
3	2.15	7.50	1,850	1,690
4	2.15	7.50	1,900	1,740

4/ At zero hours, establish the drive conditions necessary to obtain  $i_b = 2.0$  a (peak anode current) with Eb = 2,000 V dc and a bias voltage Ec = -40 V dc. the pulse width (tp) of the modulator shall be 2 µs minimum and the duty (Du) shall be 0.0025 maximum. With the drive level determined at zero hours, check the anode current at end of life. The maximum allowable drop in anode current (ΔIb) shall be 25 percent.

5/ This test will be performed quarterly, with 8 samples. Acceptance shall be based upon accept on zero failures. All tests shall be considered as nondestructive except in case of failure, and separate samples may be used for each test at the option of the manufacturer. In case of failure, the failing test shall become a conformance inspection, part 2, acceptance on zero failures, for three consecutive successful submissions, at which time the testing may revert to the conformance inspection, part 3 basis.

TABLE I. Testing and inspection - Continued.

- 6/ The tube shall be mounted in a socket and vibrated with simple harmonic motion. The peak acceleration over the frequency range shall be within  $\pm 20$  percent of the reference acceleration at 100 Hz. The frequency shall vary from 55 to 500 Hz and return to 55 Hz with approximate 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 of orientation 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 axis, subsequent measurements need be taken only in the axis giving the higher reading. The voltages specified herein shall be applied to the tube during vibration. The value of the alternating voltage,  $E_p$ , produced across the resistor,  $R_p$ , 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,  $E_p$ , shall not exceed the limit specified herein at any point in the sweep-frequency range during the last complete cycle of vibration.
- 7/ The torque test procedure shall be as follows:
- (a) A torque of 15 inch-pounds shall be applied between the anode contact surface and the cathode without perceptible shock.
  - (b) A torque of 40 inch-pounds shall be applied between the anode contact surface and the grid without perceptible shock.
- 8/ The applied voltage shall be 60 Hz, between the anode and grid. No other voltages shall be applied. There shall be no evidence of failures as indicated by arc-over.

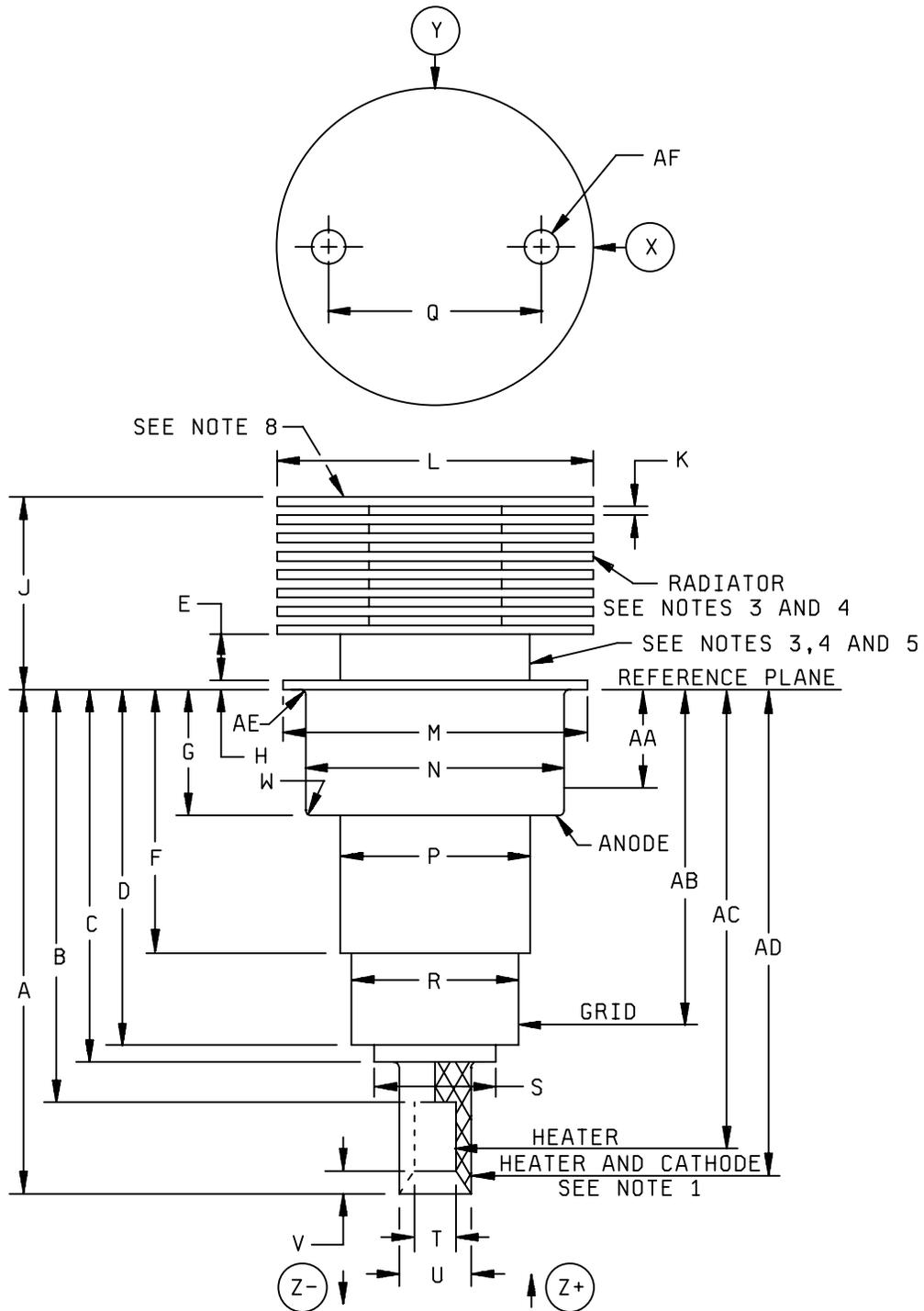


FIGURE 1. Outline drawing of electron tube type 8964.

MIL-PRF-1/1756B

LTR	Dimensions				Notes
	Millimeters		Inches		
Conformance inspection, part 2					
	Min	Max	Min	Max	
A	44.96	46.48	1.770	1.830	
B	----	37.47	----	1.475	
C	----	35.69	----	1.405	
D	30.91	31.93	1.217	1.257	
F	22.66	23.67	0.892	0.932	
G	11.73	12.12	0.462	0.477	
J	19.46	20.98	0.766	0.826	
N	26.04	26.29	1.025	1.035	3, 10, 11
R	16.64	16.89	0.655	0.665	3, 10, 11
T	5.41	5.66	0.213	0.223	3, 7, 10, 11
U	8.00	8.26	0.315	0.325	3, 7, 10, 11
Conformance inspection, part 3 5/					
E	3.18	4.70	0.125	0.185	
H	----	1.02	----	0.040	
K	0.64	1.17	0.025	0.046	9
L	31.34	32.11	1.234	1.264	
M	29.97	30.35	1.180	1.195	
P	19.10	20.12	0.752	0.792	12
Q	16.51	21.59	0.650	0.850	
S	----	13.84	----	0.545	
V	----	2.18	----	0.086	
W	----	2.54 RAD	----	0.100 RAD	
Electrode contact areas					2
AA	0.89	9.17	0.035	0.361	
AB	28.27	30.30	1.113	1.193	
AC	33.30	38.23	1.311	1.505	
AD	32.31	40.94	1.272	1.612	
AE	----	0.89 RAD	----	0.035 RAD	
AF	2.67	3.68	0.105	0.145	6

FIGURE 1. Outline drawing of electron tube type 8964 - Continued.

NOTES:

1. Insulation material between heater and heater-cathode shall be securely affixed.
2. Dimensions in electrode contact area table are for socket design purposes and are not intended for inspection purposes.
3. Silver plated 30 MSI minimum.
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 (152.40 mm) drop test without loosening and without distortion as judged by ability to maintain dimension K.
9. Distortion of fins permissible provided distance between adjacent fins at any point on circumference meets tolerances for dimension K.
10. Eccentricity of contact surfaces shall be gaged from center line of reference shall be as follows:

<u>Contact surface</u>	<u>TIR maximum</u>	<u>Reference</u>
Anode	0.020	Cathode
Grid	0.020	Cathode
Heater	0.012	Cathode

11. Diameters N, R, T, and U shall apply throughout entire contact areas as defined by dimensions AA, AB, AC, and AD respectively.
12. This surface shall not be used for clamping or locating.

FIGURE 1. Outline drawing of electron tube type 8964 - Continued.

Custodians:  
Navy - EC

Review Activities:  
Navy - AS, CG, OS, SH

Preparing activity:  
DLA - CC

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