

INCH-POUND

MIL-PRF-1/1702C  
2 May 2003  
SUPERSEDING  
MIL-PRF-1/1702B  
17 April 1998

PERFORMANCE SPECIFICATION SHEET  
ELECTRON TUBE, NEGATIVE GRID (MICROWAVE)  
TYPE 8745

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:** UHF triode: conduction, convection, and forced-air cooled, ceramic and metal.

See figure 1.

Mounting position: Any.

**ABSOLUTE RATINGS:**

Parameter:	F1	Ef	Eb	epy	Ec	Ib	ib	ic	tp	Du
Unit:	MHz	V <u>1/</u>	V dc	kv	V dc	mA dc	a <u>2/</u>	a	μs	---
Maximum:										
Anode pulsed Osc. or Amp.	3,000	6.0 ±5 percent	---	4.5	-150	---	1.5	0.7	250	0.005
Grid pulsed Osc. or Amp.	3,000	6.0 ±5 percent	3,500	---	-150	---	1.5	0.7	250	0.005
Test conditions:	---	6.0	1,000	---	Adj.	100	---	---	---	---

**ABSOLUTE RATINGS:**

Parameter:	Pp	Pg	tk	TE	T Anode shank	Cooling
Unit:	W	W <u>3/</u>	s (min)	°C <u>4/</u>	°C <u>4/</u>	<u>4/ 5/</u>
Maximum:						
Anode pulsed Osc. or Amp.	100	2.0	60	250	250	---
Grid pulsed Osc. or Amp.	100	2.0	60	250	250	---
Test conditions:	---	----	300	---	---	<u>6/</u>

**GENERAL:**

Qualification: Required.

MIL-PRF-1/1702C

TABLE I. Testing and inspection.

Method	Requirement or test	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
	<u>Conformance inspection, part 1</u>	<u>7/</u>					
1301	Heater current			If	0.90	1.05	A
1261	Electrode voltage (1) (grid)			Ec	-2.5	-7.5	V dc
1211	Insulation of electrodes		Eb = Ek = 0; Ec = -500 V dc	Rgk	50	---	MegΩ
1266	Total grid current			Ic	---	-8.0	μA dc
1231	Pulsing emission		Ef = 5.7 V; eb = ec = etd/is = 5.0 a; tp = 3 μs (max); pr = 600 (max)	etd	---	150	v
---	Video pulse operation	<u>8/</u>	Ebb = 4,000 V dc; Ec = -150 V dc; egk/ik = 1.0 a (min); tp = 250 μs ±10 percent; pr = 20 ±10 percent; t = 60 seconds	---	---	---	---
---	High-voltage hold-off	<u>9/</u>	Eb = 5,000 V dc; Ec = -150 V dc; t = 30 seconds	Ib	---	1.0	mA dc
	<u>Conformance inspection, part 2</u>	<u>10/</u>					
1261	Electrode voltage (2) (grid)		Ec/Ib = 1.0 mA dc	Eco	---	-25.0	V dc
1236	Power oscillation (pulse)	<u>11/</u>	F = 3,000 MHz (min); epy = 3.5 kv; Ec = -1.5 V dc (min); Rg/Ib = 7.5 mA dc Ic = 4.5 mA dc (max); Ef = 5.8 V	Po	4.0	---	W (useful)
1331	Direct-interelectrode capacitance		Use fixture in accordance with Drawing 158-JAN ( <u>21/</u> ); ground cathode connection	Cin Cgp Cout	5.60 1.85 ---	7.00 2.10 0.035	pF pF pF
---	Resonance test	<u>12/ 13/</u>	No voltages applied	---	---	---	---

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Method	Requirement or test	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
	<u>Conformance inspection, part 3</u>	<u>14/ 15/</u>					
1031	Variable-frequency vibration	<u>10/ 16/</u>	F = 55 Hz to 500 Hz; Acceleration = 10 G (peak); Ebb = 300 V dc; Rp = 10,000 ohms; Ec/lb = 10 mA dc	Ep	---	250	mV ac
---	Torque	<u>10/ 17/</u>	No voltages	---	---	---	---
---	Torque-test end point						
1266	Total grid current			lc	---	-10	μA dc
1042	Shock, specified pulse		Condition A; use fixture in accordance with Drawing 280-JAN (21/); no voltages	---	---	---	---
---	Shock, specified pulse-test end point						
1266	Total grid current			lc	---	-10	μA dc
1002	Barometric pressure, reduced	<u>18/</u>	Pressure = 35 mmHg (max); Voltage = 1,800 V ac, 60 Hz; TA = 30°C ±10°C	---	---	---	---
---	Life	<u>19/</u>	Group S, monthly; Ef = 5.7 V; Filament standby	---	---	---	---
---	Life-test end point (1,000 hours)	<u>19/</u>		Δlb	---	25	%

- 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-cathode voltage shall be within the range of +250 to -750 volts.
- 4/ Sufficient conduction, convection, and forced-air cooling shall be provided to limit the envelope and anode shank temperature to the specified value under all operating conditions. Reliability will be seriously impaired if this maximum is exceeded. Where emphasis is placed on long and reliable life, lower temperatures should be used.
- 5/ At an anode dissipation of 100 watts and with an incoming air temperature of 25°C maximum at sea level, a minimum air flow of 12.5 cfm must be directed across the anode cooler, using the cowl as shown on Drawing 157-JAN (21/), or equivalent.
- 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.

TABLE I. Testing and inspection - Continued.

- 7/ All tests listed under conformance inspection, part 1, shall be performed at the conclusion of the holding period. The acceptance level for each test shall be 0.65 (see MIL-PRF-1, table III).
- 8/ Test in circuit on figure 2 or equivalent. There shall be no indication of any arc during the 60 second test period.
- 9/ There shall be no indication of any arc during a test period of 60 seconds.
- 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/ The applied voltage pulse shape shall be measured with a noninductive resistor of 1,150 ohms  $\pm 2$  percent inserted in place of the tube. The pulse shape shall be:  $t_p = 0.4 \mu s$  maximum, and  $t_f = 0.7 \mu s$  maximum. The pulse repetition rate (prf) shall be adjusted so that  $D_u = 0.0025 \pm 5$  percent with the above measured pulse length. Test in cavity in accordance with Drawing 279-JAN (21). The cavity shall be connected to a load with a VSWR of less than 1.5:1. The oscillator output coupling and the grid or cathode resistor may be adjusted for maximum power output.
- 12/ Grid-anode resonance: Test in cavity in accordance with Drawing 278-JAN (21). Cavity shall resonate at  $1354 \pm 2.0$  MHz with tuning slug in accordance with Drawing 277-JAN (21) at  $T_A = 25^\circ C \pm 5^\circ C$ .

Grid-cathode resonance: Test in cavity in accordance with Drawing 283-JAN (21). Cavity shall resonate at  $1719 \pm 2.0$  MHz with tuning slug in accordance with Drawing 277-JAN (21) at  $T_A = 25^\circ C \pm 5^\circ C$ .

When plotted on graphs of resonant frequency versus grid-anode capacitance and resonant frequency versus grid-cathode capacitance, the tube under test (TUT) shall be represented by a point within the 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	5.6	1980	1790
2	1.85	5.6	2010	1820
3	2.10	7.0	1910	1740
4	2.10	7.0	1940	1770

- 13/ The acceptance level shall be 6.5 (see MIL-PRF-1, table III).
- 14/ When tube type 8745 is physically identical to tube type 7815 (except for the installation of the transverse anode cooler assembly), and has been made in the same production period as tubes which are being or have been tested to the applicable tube specification sheet (TSS) for tube type 7815, then the one sample may represent both types insofar as the listed tests are identical.
- 15/ These tests shall be performed during the initial production and once each succeeding 12-calendar month period in which there is production. A zero defect sampling plan shall be used, with sample of three tubes having an acceptance number of zero. In the event of failure, the test shall be made as part of conformance inspection, part 2, with an acceptance level of 6.5 (see MIL-PRF-1, table III). The regular "12 calendar month" zero defect sampling plan shall be reinstated after three consecutive samples have been accepted.

TABLE I. Testing and inspection - Continued.

- 16/ The TUT shall be mounted in a socket in accordance with Drawing 276-JAN (21/) 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 Hz 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 direction X and Z except that if the cumulative results of test 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 value of the alternating voltages  $E_p$ , 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 the cycling vibration.
- 17/ The 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  $7/64$ -inch ( $2.76 \text{ mm}$ )  $\pm$   $1/64$ -inch ( $0.41 \text{ mm}$ ) 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. This part of the test shall not be required if the space between the heater cup and the cathode sleeve is completely filled with insulating material.
  - 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.
- 18/ Voltage shall be applied between the anode and grid. No other voltages shall be applied.
- 19/ At zero hours, establish the drive conditions necessary to obtain 2.0 amperes peak anode current with an anode voltage of 1,000 V dc and a bias voltage of -40 V dc and  $E_f = 6.0 \text{ V}$ . The pulse width of the modulator shall be  $2 \mu\text{s}$  (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 ( $\Delta I_b$ ) is as specified.
- 20/ Revision letters are not used to denote changes due to the extensiveness of the changes.
- 21/ Contact preparing activity if help is needed locating JAN drawings.

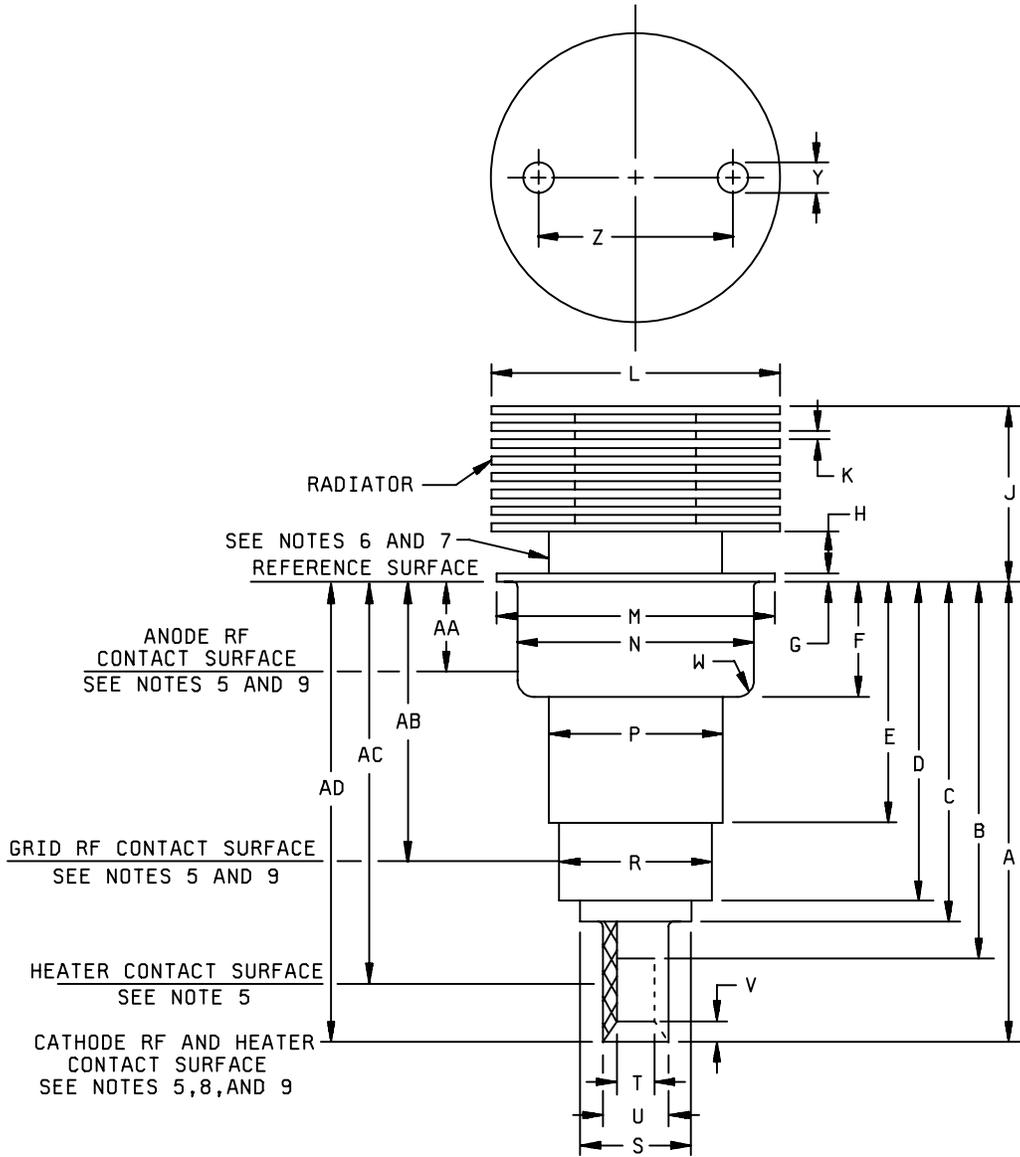


FIGURE 1. Outline drawing for electron tube type 8745.

MIL-PRF-1/1702C

Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
Conformance inspection, part 2					
A	1.815	1.875	46.10	47.62	
B	---	1.534	---	38.96	
C	---	1.475	---	37.46	
D	1.289	1.329	32.74	33.76	
E	0.970	1.010	24.64	25.65	
F	0.462	0.477	11.73	12.12	
J	0.766	0.826	19.46	20.98	
N	1.025	1.035	26.04	26.29	2, 10
R	0.655	0.665	16.64	16.89	2, 10
T	0.213	0.223	5.41	5.66	3, 10
U	0.315	0.325	8.00	8.26	2, 3, 10
Conformance inspection, part 3					4
G	---	0.040	---	1.02	
H	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	0.752	0.792	19.10	20.12	
S	---	0.545	---	13.84	
V	---	0.086	---	2.18	
W	---	0.100	---	2.54	
Y	0.105	0.145	2.67	3.68	
Z	0.650	0.850	16.51	21.59	
Electrode contact areas					1, 11
AA	0.035	0.361	0.89	9.17	2
AB	1.185	1.265	30.10	32.13	2
AC	1.534	1.728	38.96	43.89	3
AD	1.475	1.815	37.46	46.10	2, 3

FIGURE 1. Outline drawing for electron tube type 8745 - Continued.

MIL-PRF-1/1702C

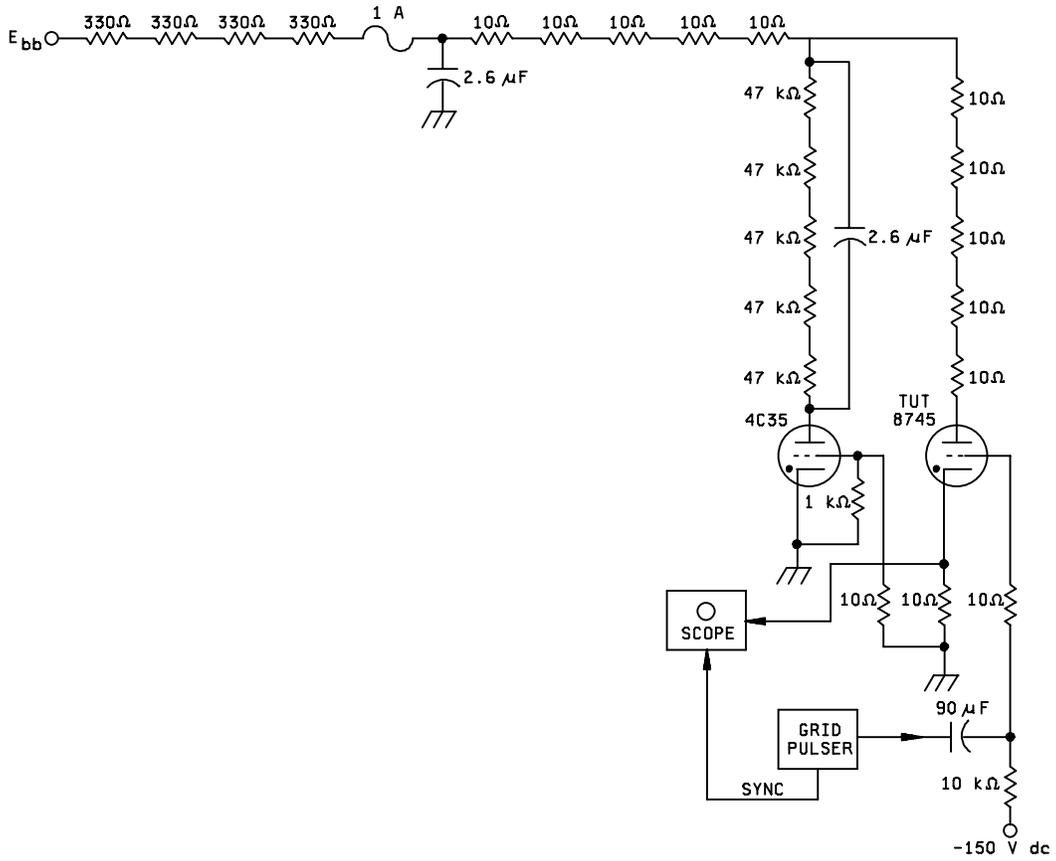
NOTES:

1. Electrode contact surfaces and reference dimensions for eccentricity measurements.
2. The total indicated runout of the anode and grid contact surface with respect to the cathode contact surface shall not exceed 0.020 inch (0.51 mm).
3. The total indicated runout of the cathode contact surface with respect to the heater contact surface shall not exceed 0.012 inch (0.30 mm).
4. All 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 conformance inspection, part 2.
5. Silver plated 30 MSI minimum. Note 4 shall apply.
6. Plating not required over radiator of copper, aluminum, or approved equivalent.
7. This surface shall be used for measurement of anode shank temperature.
8. Inner edge of heater and outer edge of cathode rf connection shall be free from burrs and sharp edges.
9. Total indicated runout (TIR) of contact surfaces shall be gauged from centerline of reference and shall be as follows. Grid rf contact surface and reference dimension for eccentricity measurements.

Contact surface	TIR, maximum	Reference
Anode	0.020	Cathode
Grid	0.020	Cathode
Heater	0.012	Cathode

10. Diameters N, R, T, and U shall apply throughout entire contact areas as defined by dimensions AA, AB, AC, and AD respectively.
11. Dimensions in electrode contact areas table are for socket design purposes and are not intended for inspection purposes.

FIGURE 1. Outline drawing for electron tube type 8745 - Continued.



NOTE: All resistance in ohms, 2W.

FIGURE 2. Video pulse operation test circuit.

MIL-PRF-1/1702C

Custodians:

Navy - EC  
Air Force - 11  
DLA - CC

Preparing activity:

DLA - CC

(Project 5960-3666)

Review activities:

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