

MILITARY SPECIFICATION SHEET  
 ELECTRON TUBE, RECEIVING  
 TYPE 6948

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

The complete requirements for procuring the electron tube described herein shall consist of this document and the latest issue of Specification MIL-E-1.

DESCRIPTION: Double triode, subminiature, high Mu

Outline - - - - - 3-11 (EIA)  
 Base - - - - - E8-10  
 Envelope - - - - - T3  
 Cathode - - - - - Coated unipotential  
 Base connections:  
 Pin No. - - - 1 2 3 4 5 6 7 8  
 Element - - - 2a 2g h 2k 1k h 1g 1a

ABSOLUTE-MAXIMUM RATINGS:

Parameter:	Ef	Eb	eb	Ec	Ehk	Rk/k	t
Unit:	V	Vdc	v	Vdc	v	Ohms	sec
Maximum:	6.9	250	360	0,-55	200	---	---
Minimum:	5.5	---	---	---	---	---	---
Absolute maximum for accelerated warmup:	9.5	---	---	---	150	---	10

TEST CONDITIONS: 6.3 100 --- 0 0 1,500 ---

ABSOLUTE RATINGS:

Parameter:	Cycles	Rg/g	Ik/k	Pp/a	TE	Alt	Radiation
Unit:	---	Meg	mAdc	W	°C	ft	NVT NV
Maximum:	---	1.0	10	0.5	250	Note 1	10 <sup>16</sup> 10 <sup>12</sup>
Minimum:	---	---	---	---	---	---	---
Absolute maximum for accelerated warmup:	50	---	---	---	---	---	---

TEST CONDITIONS: --- --- --- --- --- --- ---

GENERAL:

Qualification - Required  
 Reliable tube

Method	Requirement or test	Notes	Conditions	AQL (percent defective)	Inspection level or code	Symbol	Limits		Unit
							Min	Max	
<u>Qualification inspection</u>									
---	Radiation rating	2		---	---	--	---	---	---
<u>Quality conformance inspection, part 1</u>									
1301	Heater current			0.4	II	I <sub>f</sub>	330	370	mA
1336	Heater-cathode leakage	3		0.4	II	I <sub>hk</sub>	---	15.0	μAdc
1266	Total grid current	3,4	F <sub>h</sub> = 150 Vdc; E <sub>c</sub> = -1.5 Vdc; R <sub>k</sub> = 0; R <sub>g</sub> = 1.0 Meg	0.4	II	I <sub>c</sub>	0	-0.3	μAdc
1256	Electrode current (1) (anode)	3		0.4	II	I <sub>b</sub>	0.50	1.10	mAdc
1256	Electrode current (2) (anode)	3	E <sub>c</sub> = -3.5 Vdc; R <sub>k</sub> = 0	0.4	II	I <sub>b</sub>	---	30	μAdc
1306	Transconductance (1)	3		0.4	II	S <sub>m</sub>	1,350	1,950	μmhos
1201	Short and discontinuity detection			0.4	II	---	---	---	---
<u>Quality conformance inspection, part 2</u>									
1211	Insulation of electrodes	3		2.5	I	R	500	---	Meg
1256	Electrode current (1) (anode)(difference between sections)			2.5	I	I <sub>b</sub>	---	0.2	mAdc
1306	Transconductance (2)	3	E <sub>f</sub> = 5.5 V	2.5	I	ΔS <sub>m</sub> E <sub>f</sub>	---	15	%
1266	Grid emission	3,5	E <sub>f</sub> = 7.5 V; E <sub>c</sub> = -3.5 Vdc; R <sub>g</sub> = 1.0 Meg; R <sub>k</sub> = 0	2.5	Code G	I <sub>c</sub>	0	-0.5	Adc
1246	Audio frequency noise	6,7	E <sub>ca</sub> = 45 mVdc; R <sub>g</sub> = 0.1 Meg R <sub>k</sub> = 750 ohms; R <sub>p</sub> = 0.2 Meg	2.5	I	EB	---	---	---
2201	Noise and microphonics (num)	3,8	E <sub>f</sub> = 6.3 Vac at 400 Hz; E <sub>b</sub> = E <sub>c</sub> = 0; R <sub>k</sub> /k = 5,000 ohms	2.5	I	---	---	15	mvpp
1256	Electrode current (1) (anode)(tube operation time)	3	t = 20 seconds	6.5	Code F	I <sub>b</sub>	85	115	%
1316	Amplification factor	3		6.5	Code F	M <sub>u</sub>	60	85	---
1321	AC amplification	3	E <sub>bb</sub> = 100 Vdc; E <sub>cc</sub> = 0; R <sub>k</sub> = 0; E <sub>sig</sub> = 0.2 Vac	6.5	Code F	E <sub>p</sub>	7.5	---	Vdc

Method	Requirement or test	Notes	Conditions	AQL (percent defective)	Inspection level or code	Symbol	Limits		Unit
							Min	Max	
<u>Quality conformance inspection, part 2</u> -Continued									
1331	Direct-interelectrode capacitance	3 ?	No shield No shield No shield (Triode 1) No shield (Triode 2) No shield No shield	6.5	Code F	Cgp Cin Cout Lout Cgg Cpp	0.55 1.2 0.15 0.19 --- ---	0.95 2.0 0.25 0.31 0.014 0.86	pF pF pF pF pF
1031	High-frequency vibration	3	Rp = 10,000 ohms	1.0	I	Ep	---	10	mVac
---	White noise	3,9	Peak accel = 15 G; Rp = 10,000 ohms	2.5 2.5	I I	ep Ep	---	60 10	mVPP mV
1116	Lead fatigue			2.5	Code G	---	---	---	---
1041	Shock	10	Accel = 750 G	15	S4	---	---	---	---
1031	Sweep-frequency-vibration fatigue		F = 30 to 3,000 Hz; t = 3 minutes	6.5	Note 11	---	---	---	---
---	Shock and sweep-frequency-vibration fatigue-test end points:								
1031	High-frequency vibration	3	Rp = 10,000 ohms	---	---	Ep	---	50	mVac
1336	Heater-cathode leakage	3		---	---	Ihk	---	15	$\mu$ Adc
1306	Transconductance (1), change of individual tubes	3		---	---	$\Delta$ Sm t	---	20	%
2126	Envelope strain			4.0	I	---	---	---	---
1105	Permanence of marking			---	---	---	---	---	---
Method	Requirement or test	Notes	Conditions			Symbol	Limits		Unit
<u>Quality conformance inspection, part 3</u>									
1506	Heater-cycling life (1)		Ef = 7.0 V, 1 minute on, 4 minutes off; Ehk = 140 Vac; Eb = Ec = 0			---	---	---	---
1506	Heater-cycling life (2)		Ef = 8.5 V, 10 seconds on, 4 minutes (min) off; 300 cycles; Ehk = 150 Vdc; Eb = Ec = 0			---	---	---	---
---	Heater-cycling life (1) and (2)-test end points:								
1336	Heater-cathode leakage	3				Ihk	---	15	$\mu$ Adc
1211	Insulation of electrodes	3				R	50	---	Meg
1516	Stability life		Ebb = 250 Vdc; Rk/k = 270 ohms; Ehk = 200 Vdc; Rg/g = 1.0 Meg; Rp/a = 30,000 ohms; TA = room; Rhk = 5,000 ohms			---	---	---	---

Method	Requirement or test	Notes	Conditions	Symbol	Limits		Unit
					Min	Max	
	<u>Quality conformance inspection, part 3</u> -Continued						
	Stability life-test end point:						
1306	Transconductance (1), change of individual tubes	3		$\Delta S_m$ t	---	15	\$
1501	Intermittent life	12	Ebb = 250 Vdc; Rk/k = 270 ohms; Ehk = 200 Vdc; Rg/g = 1.0 Meg; Rp/a = 30,000 ohms; Rrk = 5,000 ohms; TA = room; TE = 250°C (min); Group E	---	---	---	---
	Intermittent life-test end points: (200 hours):	13					
1266	Total grid current	3	Eh = 150 Vdc; Ec = -1.5 Vdc; Rk = 0; Rg = 1.0 Meg	Ic	0	-1.0	$\mu$ Adc
1301	Heater current	3		If	330	380	mA
1306	Transconductance (1), change of individual tubes	3		$\Delta S_m$ t	---	25	\$
1306	Transconductance (2)	3	Ef = 5.5 V	$\Delta S_m$ t	---	20	\$
1336	Heater-cathode leakage	3		Ihk	---	15	$\mu$ Adc
1211	Insulation of electrodes	3		R	200	---	Meg
1306	Transconductance (1), average change			Avg $\Delta S_m$ t	---	15	\$

NOTES:

- See "Reduced pressure (altitude) rating," and altitude, maximum peak voltage in the basic document.
- This test shall be conducted in a suitable reactor with the required intensity and dosage that is not less than 10 percent of the specified rating. Before and after irradiation, the tubes under test (TUT) shall be within the specified limits for all electrical tests listed herein under quality conformance inspection, part 1.
- Test each unit separately.
- This test shall be performed at the conclusion of the holding period.
- Prior to this test, the tubes under test (TUT) shall be preheated for 5 minutes at the conditions specified below. Test within 3 seconds after preheating. The 3-minute test shall not be permitted. Grid emission shall be the last test performed on the sample selected for the grid emission test.

Ef	Eb	Ec	Rk/k	Rg/g
V	Vdc	Vdc	ohms	Meg
7.5	250	0	1,300	1.0

- Tie 1k to 2k; 1g to 2g; and 1a to 2a.
- The rejection level shall be set at the VU meter reading obtained during calibration.
- Maximum total distortion of the filament supply voltage shall be 5 percent. The frequency response of the peak-to-peak measuring device from 20 to 5,000 Hz shall be within 0.5 dB of its response at 400 Hz. Ground leads except those for the cathode and heater lead No. 3. Measure hum voltage across specified Rk.
- The tube shall be rigidly mounted on a table vibrating so that the instantaneous values of acceleration shall constitute approximately a "white noise" spectrum which is free from discontinuities from 100 to 5,000 Hz and such that the rms value of acceleration for frequencies outside this band

## NOTES - Continued

shall constitute no more than 5 percent of the total rms acceleration. The spectrum of instantaneous acceleration shall be such that each octave of bandwidth delivers  $2.3 \pm 0.2$  G's rms acceleration. With this the case, the rms value of acceleration for any bandwidth within the spectrum is equal to:

$$\text{GRM Grms} = 2.3 \sqrt{3.32 \log_{10} (F2/F1)}$$

Where  $f_2$  and  $f_1$  are the upper and lower frequencies respectively of the band under consideration. The degree of clipping of the peak accelerations shall be such that the peak value of acceleration is at least 15 G's. Half the tubes in the sample shall be vibrated in position X, the other half in position Y. The voltage ( $e_p$ ) produced across the resistor ( $R_p$ ) as a result of vibration shall be coupled through a compensating amplifier to a low-pass filter. The compensating amplifier shall have a high-input impedance (250 Kohms or more) and shall be adjusted to compensate for any insertion losses in the filter. The combined frequency response of amplifier and filter shall be flat within  $\pm 0.5$  dB from 50 to 8,000 Hz, shall be down no more than 5 dB at 10,000 Hz and 20 Hz, and down at least 30 dB at 13,000 Hz. For reading peak-to-peak value of output voltage, the filter output shall be fed directly to the input of a Ballantine Model 305 peak-to-peak Electronic Voltmeter, or equal, while the rms value shall be measured with the Hewlett Packard Model 400 C, or equal. The impedance of the anode and screen voltage supplies shall not exceed that of a 40  $\mu$ F capacitor at 10 Hz.

10. A grid resistor of 0.1 megohm shall be added except when a thyratron-type short indicator is used.
11. This test shall be conducted on the initial lot and thereafter on a lot approximately every 12 months. When one lot has passed, the 12-month rule shall apply. In the event of lot failure, the lot shall be rejected and the succeeding lots shall be subjected to this test until a lot passes. MIL-STD-105, sample size code letter E, shall apply.
12. Envelope temperature (TE) requirements, when measured in accordance with the temperature by conduction-band measurements (method 1226), will be satisfied if a TUT having bogey Ib ( $\pm 5$  percent) under normal test conditions, is determined to operate at or above minimum specified temperature at any position in the life-test rack.
13. The allowable defectives per characteristic shall not be greater than 1 for the first sample and shall not be greater than 3 for combined samples. Total defectives shall be 2 and 5, respectively.
14. Revision letters are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

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Army - ER  
Navy - EC  
Air Force - 85

## Preparing activity:

Air Force - 85  
(Project 5960-3253)

## Review activities:

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