INCH-POUND

MIL-PRF-1/1634E
16 December 2002
SUPERSEDING
MIL-PRF-1/1634D
7 October 1996

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, POWER
TYPES 8321, 8321A, AND 8322

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: Tetrode, ceramic-metal (see figure 1).
Mounting position: Any.
Weight: 4 ounces (113.4 grams) nominal.

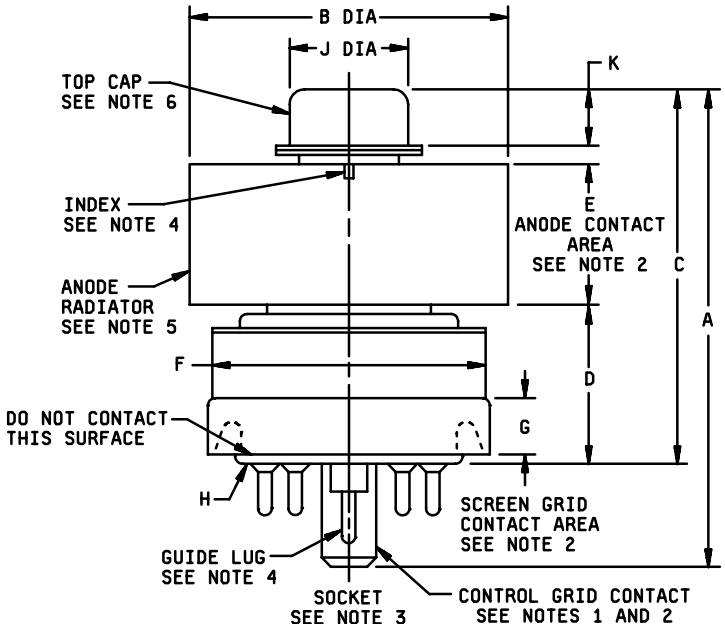
ABSOLUTE-MAXIMUM RATINGS:

Parameter	Ef	F1	tk	Eb	Ec1	Ec2	Ehk	Ib
	V ac Note 1	Mhz	sec (min)	V dc	V dc	V dc	V dc	mA dc
Class AB1:								
8321, 8321A	6.0 ±10%	110	30	2500	----	400	±150	275
8322	26.5 ±10%	110	60	2500	----	400	±150	275
Class A:								
8321, 8321A	6.0 ±10%	110	30	2500	----	400	±150	400
8322	26.5 ±10%	110	60	2500	----	400	±150	400
Test Condition:								
8321, 8321A	6.0	----	120	1000	Adj	300	0	150
8322	26.5	----	240	1000	Adj	300	0	150

Parameter	Ic1	Pg2	Pp	T (anode core and seals)	Cooling	Altitude
	mA dc	W	W	°C	Note 2	Ft
Class AB1:						
8321, 8321A	2.0	8.0	350	250	----	10,000
8322	2.0	8.0	350	250	----	10,000
Class A:						
8321, 8321A	----	8.0	350	250	----	10,000
8322	----	8.0	350	250	----	10,000
Test Condition:						
8321, 8321A	----	----	----	----	Note 3	----
8322	----	----	----	----	Note 3	----

GENERAL: Qualification: Required.
Special requirement: See note 18.
Performance requirements: Unless otherwise specified, all tubes listed on this TSS shall utilize the same test conditions and requirements.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.



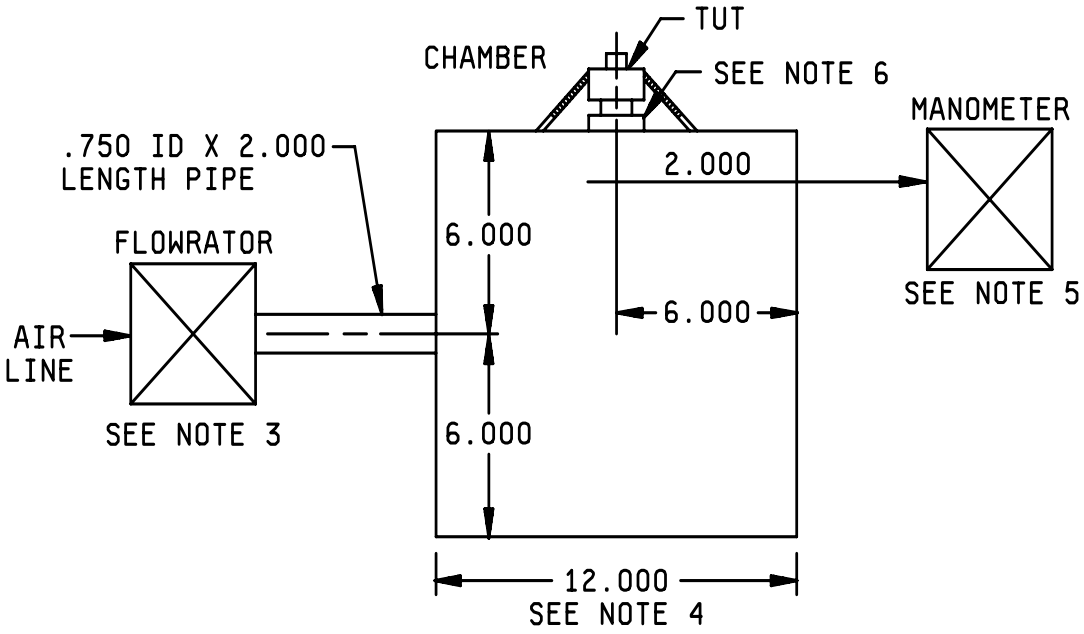
PIN CONNECTIONS	
PIN NO.	ELEMENT
1	g2
2	k
3	h
4	k
5	INT CON
6	k
7	h
8	k
CENTER POST	g1
RADIATOR & CAP	a
BASE RING	g2

Subject	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
Conformance inspection, part 2					
A	2.324	2.464	59.03	62.59	
C	1.810	1.910	45.97	48.51	
Conformance inspection, part 3					
B	1.610	1.640	40.89	41.66	
D	0.750	0.810	19.05	20.57	

Subject	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
E	0.710	0.790	18.03	20.07	
F	----	1.406	----	35.71	
G	0.187	----	4.75	----	
H	Base: B8-236				1
J	0.559	0.573	14.20	14.55	
K	0.240	----	6.10	----	

NOTES:
1. Pin alignment shall be checked by means of gauge GB8-3. Dimensions of control-grid contact shall be inspected by means of gauges specified on drawing 246-JAN (see note 19) and shall be conformance inspection, part 2.
2. Alignment of anode, screen-grid, and control-grid contact surfaces shall be determined by means of gauges specified on drawing 168-JAN (see note 19). Conformance inspection, part 2, shall apply.
3. Air-system socket shall be as specified on drawing 246-JAN (see note 19), EIMAC SK-600, or equal.
4. Location of guide lug of control-grid contact shall be referenced by a notch or arrow on the anode radiator in position shown.
5. Anode clamping shall be confined to anode radiator.
6. Top cap outline optional provided it meets requirements of dimensions J and K.

FIGURE 1. Outline drawing of electron tube type 8321, 8321A, and 8322.



Inches	Millimeter
.750	(19.05)
2.000	(50.80)
6.000	(152.40)
12.000	(304.80)

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Fisher Porter flowrator model B4-27-10/77, or equivalent.
4. Twelve inch (304.80 mm) cube inside dimensions, compound sealed.
5. F. W. Dwyer manometer, 0 to 1 inch (25.40 mm) of water (Fisher Scientific Community 11-295-5 draft gauge), or equivalent.
6. Socket specified on drawing 246-JAN (see note 19).

FIGURE 2. Baffle system.

Inspection	Notes	Method	Conditions	Symbol	Limits		Unit
					Min	Max	
Conformance inspection, part 1	17						
Electrode current (screen)		1256		Ic2	-7.0	+3.0	mA dc
Electrode voltage (grid)		1261		Ec1	-11.5	-18.0	V dc
Total grid current	4	1266	Eb = 2,500 V dc; Ib = 140 mA dc	Ic1		-25.0	µA dc
Primary grid emission (control)		1266	Pg1 = 0.5 W; t = 15; anode and screen grid floating	Isg1		-25.0	µA dc
Primary grid emission		1266	Ec1 = 0; t = 15; Pg2 = 8.0 W; anode floating	Isg2		-250.0	µA dc
Heater current		1301	8321 8321A 8322	If	2.2 2.0 0.50	3.6 3.4 0.81	A ac A ac A ac
Pulsing emission (1)	5,6	1231	etd = eb = ec2 = ec1 = 400 V; 8321: Ef = 5.4 V ac 8322: Ef = 23.8 V ac etd = eb = ec2 = ec1 = 400 V; 8321A: Ef = 5.7 V ac	Is	30.0 20.0		a a
Pulsing emission (2)	5,6	1231	eb = ec2 = ec1 = etd/is = 30 a for 8321 and 8322; For 8321A, eb = ec2 = ec1 = etd/is = 20 a	etd		400	v
Current division (long pulse)		1372	Eb = 500 V dc; Ec2 = 400 V dc; Ec1 = -100 V dc; prr = 11 ±1 pps; tp = 4,500 µs (min); egk/ib = 850 mA	egk ic2		0.0 150	v mA
Interelement leakage resistance, cold		1366	Ef = 0 (30 minutes, minimum); Rs = 2.5 Meg; E = 100 V dc; g1 neg E = 500 V dc; g1 neg E = 500 V dc; g2 neg	Rg1k Rg1g2 Rg2p	50 50 50		Meg Meg Meg

See footnotes at end of table.

Inspection	Notes	Method	Conditions	Symbol	Limits		Unit
					Min	Max	
Conformance inspection, part 2							
Direct-interelectrode capacitance		1331		Cgp		0.05	pF
				Cin	21.0	26.2	pF
				Cout	5.0	6.0	pF
Heater-cathode leakage	7	1336	Ehk = +150 V dc	Ihk		500	µA dc
			Ehk = -150 V dc	Ihk		500	µA dc
Conformance inspection, part 3							
Life test (1)	8,10		Group C; linear amplifier power output and distortion (1-tone modulation)	t	500		hours
Life test (1) end points:							
Linear amplifier power output and distortion (procedure 2.1)		2204	Eb = 2,200 V dc; Ec2 = 400 V dc; Ec1/Ibo = 70 mA dc; Eg1/Ib = 225 mA dc (1-tone); Rl = 5,000 ±100 Ω; Rg = 1,000 Ω maximum; anode tank Q = 10 to 15 t = 180 (max); f = 2 to 10 MHz	Po	240		W(useful)
				3rd IM	-21		dB
				5th IM	-29		dB
				Ic1		100	µA dc
Primary grid emission (control)		1266	Pg1 = 0.5 W; t = 15; anode and screen grid floating	Isg1		-25.0	µA dc
Primary grid emission		1266	Ec1 = 0; t = 15; Pg2 = 8.0 W; anode floating	Isg2		-250.0	µA dc
Heater-cathode leakage	7	1336	Ehk = +150 V dc	Ihk		500	µA dc
			Ehk = -150 V dc	Ihk		500	µA dc
Interelement leakage resistance, cold		1366	Ef = 0 (30 minutes, minimum); Rs = 2.5 Meg;				
			E = 100 V dc; g1 neg	Rg1k	20		Meg
			E = 500 V dc; g1 neg	Rg1g2	20		Meg
			E = 500 V dc; g2 neg	Rg2p	20		Meg
Life test (2)			Group C; heater standby; no voltages, except as follows:	t	500		hours
			8321, 8321A: Ef = 6.4 V ac				
			8322: Ef = 28.0 V ac				

See footnotes at end of table.

Inspection	Notes	Method	Conditions	Symbol	Limits		Unit
					Min	Max	
Conformance inspection, part 3 - Continued							
Life test (2)							
end points:							
Linear amplifier power output and distortion (procedure 2.1)		2204	Eb = 2,200 V dc; Ec2 = 400 V dc; Ec1/Ibo = 70 mA dc; Eg1/Ib = 225 mA dc (1-tone); Rl = 5,000 ± 100Ω; Rg = 1,000 Ω maximum; anode tank Q = 10 to 15 t = 180 (max); f = 2 to 10 MHz	Po Ic1	240	100	W(useful) µA dc
Interelement leakage resistance, cold		1366	Ef = 0 (30 minutes, minimum); Rs = 2.5 Meg; E = 100 V dc; g1 neg E = 500 V dc; g1 neg E = 500 V dc; g2 neg	Rg1k Rg1g2 Rg2p	20 20 20		Meg Meg Meg
Humidity	8,11,16	1011	Ic1 = -30 µA dc (max) under post-test conditions				
Vibration, mechanical	12	1032	Ebb = 2,000 V dc; Ec1/Ib = 100 mA dc; Rp = 4,900 Ω; G = 10 (peak); F = 28 to 750 to 28 Hz	Ep		30	V ac
Shock, specification pulse	13	1042	Eb = 2,000 V dc; Ec1 = -100 V dc; test condition A; except 90 G				
Vibration, mechanical and shock end points:							
Electrode voltage (grid)		1261		Ec1	-11.5	-18.0	V dc
Total grid current		1266	Eb = 2,500 V dc; Ib = 140 mA dc;	Ic1		-30.0	µA dc
Forced cooling	8,11 14	1143	Eb = 2,000 V dc; Ec1/Ib = 175 mA dc; Ic1 = -35 µA dc (max) under post-test conditions	T (anode core)		250	°C

See footnotes at end of table.

Inspection	Notes	Method	Conditions	Symbol	Limits		Unit
					Min	Max	
Conformance inspection, part 3 - Continued							
Coolant-pressure drop versus coolant flow (forced air)	8,15	1155	Eb = 2,000 V dc; Ec1/Ib = 175 mA dc			1.3	In.$H_2$0
Linear amplifier power output and distortion (procedure 2.1)	8,9,16	2204	Eb = 2,200 V dc; Ec2 = 400 V dc; Ec1/Ibo = 70 mA dc; Eg1/Ib = 225 mA dc (1-tone); Rl = 5,000 ± 100 Ω; Rg = 1,000 Ω maximum; anode tank Q = 10 to 15 t = 180 (max); f = 2 to 10 MHz	Po 3rd IM 5th IM Ic1	250 -22 -30	 50	W(useful) dB dB µA dc

NOTES:

1. Maximum tube life may be obtained by adjusting the heater voltage (Ef) in accordance with the application. The heater voltage (nominal and derated) shall be maintained within ±5 percent when consistent operation.

2. At an anode dissipation of 350 watts and an incoming air temperature of 50°C maximum, a minimum airflow of 7.8 cubic feet per minute (cfm) at sea level shall pass through the tube's anode cooler. At this flow rate of 7.8 cfm, the static pressure drop across the tube and socket shown on drawing 246-JAN (see note 19) is approximately 1.2 inches of water. The pressure drop varies with the amount of escaping air and the shape and construction of the air director. Air cooling of the tube shall be increased with increased incoming air temperature or with increased altitude, or a combination of both. In all cases of operation, a socket which provides forced-air cooling of the base shall be used and maximum seal temperature ratings must not be exceeded. The airflow shall be applied before or simultaneously with electrode voltages, and may be removed simultaneously with them.

3. In all electrical tests involving heater voltage, the socket shown on drawing 246-JAN (see note 19) shall be used. Forced-air cooling is permitted at the rate of 8.0 cfm maximum for the base and anode, unless otherwise specified in the specific test conditions. A separate source may be used for the base and anode provided neither exceeds 8.0 cfm. Air under standard conditions of temperature and pressure shall be used, or appropriate corrections applied.

4. This test shall be the first test performed at the conclusion of the holding period.

5. The voltages applied to the plate and grids shall not exceed 450 volts. The applied voltage shall have a maximum pulse repetition rate (prr) such that the duty cycle (Du) shall not exceed 0.0002 (0.02 percent) based on the pulse length measured at 50 percent amplitude. The pulse duration (tp) shall not be less than 3 µs at 5 percent of the maximum value, and shall not exceed 2 µs at 50 percent amplitude.

6. Method 1231: Pulsing emission (1) or pulsing emission (2) may be performed alternately. However, only one of these tests shall be performed.

7. Measurements shall be taken during an interval of three minutes immediately following the required warmup period.

8. The test sample may be composed of tube type 8321, 8321A, or 8322, or a combination thereof to satisfy the specified requirements for both tube types.

9. Prior to conducting this test, the TUT shall be operated in a static condition (Eb = 2200 V dc; Ec2 = 400 V dc; Ec1/Ibo = 70 mA dc) for three minutes (minimum) to demonstrate that the Ibo value remains constant (i.e., Ibo = 70 ±5 mA dc). The TUT shall be considered to fail this test if it exhibits instability after five minutes of testing. If there is a failure, reprocessing and retesting for stability shall be the only condition permitted for continuing this test.

10. The following measurements shall be made prior to conducting life test (1): Method 1366: Interelement leakage resistance with 50 Meg (minimum) for each of the required measurements. Method 2204: Linear power output and distortion with limits and conditions as specified under conformance inspection, part 2.

11. At the conclusion of this test, the TUT shall satisfy the requirements of the total grid current test (method 1266) specified herein under conformance inspection, part 1.

12. The TUT shall be mounted in a resonance free jig and vibrated with sinusoidal excitation in each of the three mutually perpendicular lanes: (The X-axis shall be defined as normal to a plane drawn through base pins numbered 3 and 7.)

    Survey test: The TUT shall be vibrated for 60 seconds at the frequency which produces maximum vibration output noise voltage in each of the three positions. If at the end of 60 seconds, the vibration noise output is increasing, the vibration shall continue until there is no further increase. There shall be no indication of shorts during this test and the TUT output noise voltage shall not exceed the limit specified herein.

    Cycling test: The frequency shall vary from 28 to 750 to 28 Hz with approximately logarithmic progression, and shall require 6 to 12 minutes to transverse the range, which shall constitute one cycle. The TUT shall be vibrated for one such cycle in each of the three planes.

13. The TUT shall be subjected to six shocks of the specified peak amplitude and duration in each of the three mutually perpendicular directions. Following the impact test, the TUT shall be rejected if it exhibits permanent shorts, or more than one temporary short during the test.

14. The forced cooling test shall be conducted as follows: The base and anode of the TUT shall be cooled by applying an airflow of 7.8 cfm (maximum) from a single source using the infinite baffle system shown on figure 2, or equivalent. Air under standard conditions of temperature and pressure shall be used, or appropriate corrections applied. The anode core temperature shall not exceed the specified limits at the specified test conditions. Temperature shall be measured by means of a thermocouple embedded in the top of the core, adjacent to the cooler. This shall be done by drilling a small hole, shallow enough to prevent loss of TUT vacuum, placing the welded thermocouple junction therein, and then peening the edges of the hole to hold the thermocouple firmly in place. In all cases, good electrical continuity between the thermocouple and the metal area in close proximity shall be demonstrated prior to performing the cooling test.

15. This test shall be performed with the TUT operating under the conditions specified for the forced cooling test (see note 14), using the infinite baffle system shown on figure 2, or equivalent. The static pressure drop shall be measured across the TUT and sockets.

16. This test shall be performed during the initial production and once each succeeding three-calendar months in which there is production. A sampling plan shall be used, with a sample of four tubes with an acceptance number of zero defects. In the event of failure, this test will be made as a part of conformance inspection, part 2, with an acceptance level of 6.5 (see note 17). The regular "three-month" sampling plan shall be reinstated after three consecutive samples have been accepted.

17. The acceptance level for each test listed under conformance inspection, part 1, shall be 0.65. This specification sheet uses an accept on zero defect sampling plan in accordance with MIL-PRF-1, table III.

18. Reclaimed materials shall be utilized to the maximum extent possible as cited in MIL-STD-961 and MIL-STD-962 within the quality limits required by this document and to fulfill compliance with the Resource and Recovery Act of 1976 (Public Law 94-580 dated 21 October 1976).

19. Direct questions on the availability of “JAN” drawings to the preparing activity: DSCC-VAT, Defense Supply Center Columbus, P.O. Box 3990, Columbus, OH 43216-5000.

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

Review activities:
Army - AV, CE, CR4, MI, SM
Navy - AS, CG, MC, OS
Air Force - 99

Preparing activity:
DLA - CC

(Project 5960-3620)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-1/1634E	**2. DOCUMENT DATE (YYMMDD)** 021120

3. DOCUMENT TITLE
ELECTRON TUBE, POWER TYPES 8321, 8321A, AND 8322

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME P.O. Box 3990	b. TELEPHONE (Include Area Code) (1) Commercial (614)692-0506 (2) AUTOVON 850-0506
c. ADDRESS (Include Zip Code) Defense Supply Center Columbus Attn: DSCC-VAT Columbus, Ohio 43216-5000	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340

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