

MIL-E-1/1590A  
 17 November 1967  
SUPERSEDING  
 MIL-E-1/1590 (NAVY)  
 12 July 1965

## MILITARY SPECIFICATION SHEET

## ELECTRON TUBE, GAS

## TYPE 8613

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: Ceramic-metal hydrogen thyratron with internal reservoir.

See figure 1

Mounting position: Any

Weight: 1 pound 2 ounces nominal

ABSOLUTE RATINGS:

Parameter:	Ef	epy	epx	Ebb	egy	egx	Ecc	$\frac{dik}{dt}$	ib
Unit:	Vac	kv	kv	kVdc	v	v	Vdc	a/ $\mu$ s	a
Maximum:	6.8	16.0	16.0	---	600	200	200	2,000	500
	(see note 6)	(see note 1)	(see note 2)		(see note 3)				
Minimum:	5.8	2.0	5% epy	1.0	175	---	---	---	---
<u>TEST CONDITIONS:</u>	6.3	---	---	---	175	---	0	---	---

ABSOLUTE RATINGS:

Parameter:	Ip	Ib	tk	prp	Pb	tj	TA	Cooling
Unit:	Aac	Adc	sec	pps	---	$\mu$ s	$^{\circ}$ C	---
Maximum:	8.0	0.5	---	---	$10.0 \times 10^9$	0.005	125	(see note 5)
	(see note 4)							
(A) Minimum:	---	---	180	---	---	(see note 7)	---	---
<u>TEST CONDITIONS:</u>	---	---	180	2,000	---	---	Ambient	---

REQUIREMENT OR TEST:GENERAL

3.2	Qualification - Required	E-50.3	Preheating
E-50.2	Holding period (t = 96 hours minimum)	5.	Preparation for delivery

(A) For changes, see pages 1, 2, 3, 4, and 6.

METHOD OR PARAGRAPH	REQUIREMENT OR TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS		UNIT
						MIN	MAX	
	<u>Quality conformance inspection, part 1</u>							
Appendix D, 20(a), 30	Visual and mechanical inspection criteria		---	---	---	---	---	---
3267	Instantaneous starting	epy = 16.0 kv (min); Ef = 6.8 Vac (see notes 9 and 10)	0.65	II	---	---	---	---
----	Operation (1)	epy = 18.0 kv; Ef = 5.8 Vac (see notes 6, 9, 11 and 18)	0.65	II	egy	---	175	v
3256	Anode delay time	Operation (1); t = 120	0.65	II	tad	---	0.50	$\mu$ s
3256	Anode delay time drift	Anode delay time (see note 12)	0.65	II	$\Delta$ tad	---	0.10	$\mu$ s
3241	Heater current	Ef = 6.3 Vac	0.65	II	If	6.0	11.5	Aac
----	DC anode voltage	Ef = 5.8 Vac (see note 9)	0.65	II	Ebb	---	1,000	Vdc
Ⓐ 3251	Emission	ik = 500 a; tp = 5.0 $\mu$ s $\pm$ 10%; tr = 0.5 $\mu$ s(max); prf = 60 pps $\pm$ 10%; time interval = 2.5 $\mu$ s	0.65	II	egk	---	175	v
	<u>Quality conformance inspection, part 2</u>							
Ⓐ Appendix D, 20(b)	Dimensions	See figure 1	6.5	L6	---	---	---	---
Ⓐ 1031	Sweep-frequency vibration	10 to 2,000 Hz (see note 8)	6.5	L6	---	---	---	---
----	Post-sweep-frequency vibration end points	Operation (1)	6.5	L6	egy	---	175	v
		DC anode voltage	6.5	L6	Ebb	---	1,000	Vdc
		Time jitter	6.5	L6	tj	---	0.005	$\mu$ s
----	Operation (1A)	Operation (1); Ef = 6.8 Vac; tk = 180 sec (see note 11)	6.5	L6	egy	---	175	v
Ⓐ ----	Operation (2)	epy = 14.0 kv; prf = 2,500 pps, Ef = 5.8 Vac; t = 300 sec (see note 14)	6.5	L6	egy	---	175	v
3261	Time jitter	Operation (1), except epy = 8 kv (see note 13)	6.5	L6	tj	---	0.005	$\mu$ s
	<u>Quality conformance inspection, part 3</u>							
Ⓐ 4.7	Life-test (1) provisions	Group C; operation (1); t = 1,000 hours (see notes 9, 16, and 17)	---	---	---	---	---	---

METHOD OR PARAGRAPH	REQUIREMENT OR TEST	CONDITIONS	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL OR CODE	SYMBOL	LIMITS		UNIT
						MIN	MAX	
	<u>Quality conformance inspection, part 3</u> -Continued							
4.7.3	Life-test (1) end points	Operation (1) and (1A) Anode delay time DC anode voltage; egy = 200 V Time jitter; egy = 200 V	---	---	egy tad Ebb	---	200 0.6 1,250	v $\mu$ s Vdc
(A)	<u>Periodic-check tests</u> (see 4.1.1.2)							
Appendix D, 20(b)	Dimensions	See figure 1	---	---	---	---	---	---
1041	Shock	100 G	---	---	---	---	---	---
----	Post-shock end points	Operation (1) DC anode voltage Time jitter	---	---	egy Ebb tj	---	175 1,000 0.005	v Vdc $\mu$ s
----	Operation (3)	TA = 125° C; t = 5 hours (see notes 9 and 15)	---	---	egy	---	175	v

## NOTES:

- Instantaneous starting is permissible. The maximum permissible instantaneously applied epy is 16.0 kv and shall not be attained in less than 0.04 second.
- In pulsed operation, the peak inverse voltage, exclusive of a spike of 0.05  $\mu$ s (maximum) duration, shall not exceed 5.0 kv during the first 25  $\mu$ s following the anode pulse.
- The driver pulse, measured at tube socket with thyatron grid disconnected, shall have the following characteristics: amplitude per ratings; tr = 0.35  $\mu$ s (maximum); tp = 2.0  $\mu$ s (minimum); Zg = 250 to 500 ohms. At -55° C, 200 V (minimum) shall be required.
- For hydrogen thyatron applications, Ip shall be computed as the square root of the product of Ib x ib.
- A cooling airblast of 10 cubic feet per minute (cfm) may be directed into the anode cup when operating at maximum anode dissipation.
- The optimum reservoir voltage for operation in accordance with operation (1) conditions shall be 6.3 Vac and shall be held to within  $\pm 7\frac{1}{2}$  percent.
- Appreciably less jitter than 0.005  $\mu$ s can be realized if the anode voltage is 8.0 kv or more, the grid-drive amplitude is near the maximum and the grid-drive impedance is near minimum.
- There shall be no pronounced resonance in the range from 10 to 2,000 Hz.
- The tube shall be tested in the test circuit shown on figure 2. Tests performed at repetition rates less than the resonant rate shall be made with a hold-off diode in the charging circuit. The circuit constants shall be chosen under resonant charging conditions so that: epy = 18.0 kv; ib = 180 a (minimum);  $\frac{dik}{dk} = 1,500$  a/ $\mu$ s (minimum); tp = 1.0  $\pm$  10 percent  $\mu$ s; prr = 1,000 pps (minimum).

NOTES: -Continued

9. - Continued

WARNING: These conditions are specified only for the purpose of determining circuit constants. The actual operating voltage and repetition rates for each test are specified in the conventional manner under the particular conditions or under general test conditions, as the case may be.

Grid pulse, as measured at tube socket with thyatron grid disconnected, shall have the following characteristics:  $t_r = 0.35 \mu s$  (minimum);  $t_p = 2.0 \mu s$  (maximum). The internal impedance of driver shall be 500 ohms (minimum).

10. The tube shall operate satisfactorily on push-button starting within three attempts when the anode voltage ( $e_{py}$ ) is applied to the tube under test in such a manner as to rise from 0 to 16.0 kv (minimum) within 0.03 second. (The filter in the rectifier shall be designed so that the  $e_{py}$  reaches at least 7.0 kv within 0.015 second).
11. The tube shall operate continuously for 10 minutes.
12. This test shall be performed simultaneously with the operation (1) test. An anode delay time measurement shall be made at the end of 2 and 10 minutes of the operation (1) test. The change in anode delay time (with respect to the 2-minute reading) shall not exceed the value specified herein at any time during this test.
13. The tube shall be tested by applying a peak forward anode voltage not to exceed that specified in the test conditions for the time jitter test immediately after the cathode warmup period ( $t_k$ ). The variation in firing time ( $t_j$ ), shall be not greater than the amount specified herein after 60 seconds of operation.
14. The circuit constants shall be so chosen that the  $e_{py} = 14.0$  kv;  $i_b = 130$  a (minimum);  $\frac{d i_k}{d t} = 1,250$  a/ $\mu s$  (minimum);  $t_p = 0.4 \mu s \pm 10$  percent;  $prr = 2,500$  pps (minimum). Grid pulse shall be the same as note 9.
15. This test shall be conducted for a total of 5 consecutive hours with no more than three kickouts and with no evidence of detrimental anode heating. The tube shall be started with  $E_f = 107 - 1/2$  percent Vac and operate at this value for 4 hours. At the start of the fifth hour and while the tube is still operating, the filament voltage shall be lowered to  $E_f = 92 - 1/2$  percent Vac and remain there for the final hour of operation.
16. Where production is less than 50-tubes per month, 1 tube shall be tested. During every  $100 \pm 24$ -hour life-test period, the life test shall be shut off for 60 minutes (minimum) and then checked for life-test end points.
17. In cases where the month's production to be sampled is less than 250 units, the following alternate sampling procedure may be used:

$$\begin{array}{ll} N1 = 2 & C1 = 0 \\ N2 = 2 & C2 = 1; \end{array}$$

except that  $C1 = 1$  if the first samples from the preceding lot contained no defectives.

Where:

- N1 is size of first sample.
- N2 is size of second sample.
- C1 is allowable failures in first sample.
- C2 is total allowable failures for first and second samples.

18. There shall be no evidence of arcbreak or detrimental anode heating during this test.

Custodians:

Army - EL  
Navy - EC  
Air Force - 11

Preparing activity:

Navy - EC  
(Project 5960-2286-2)

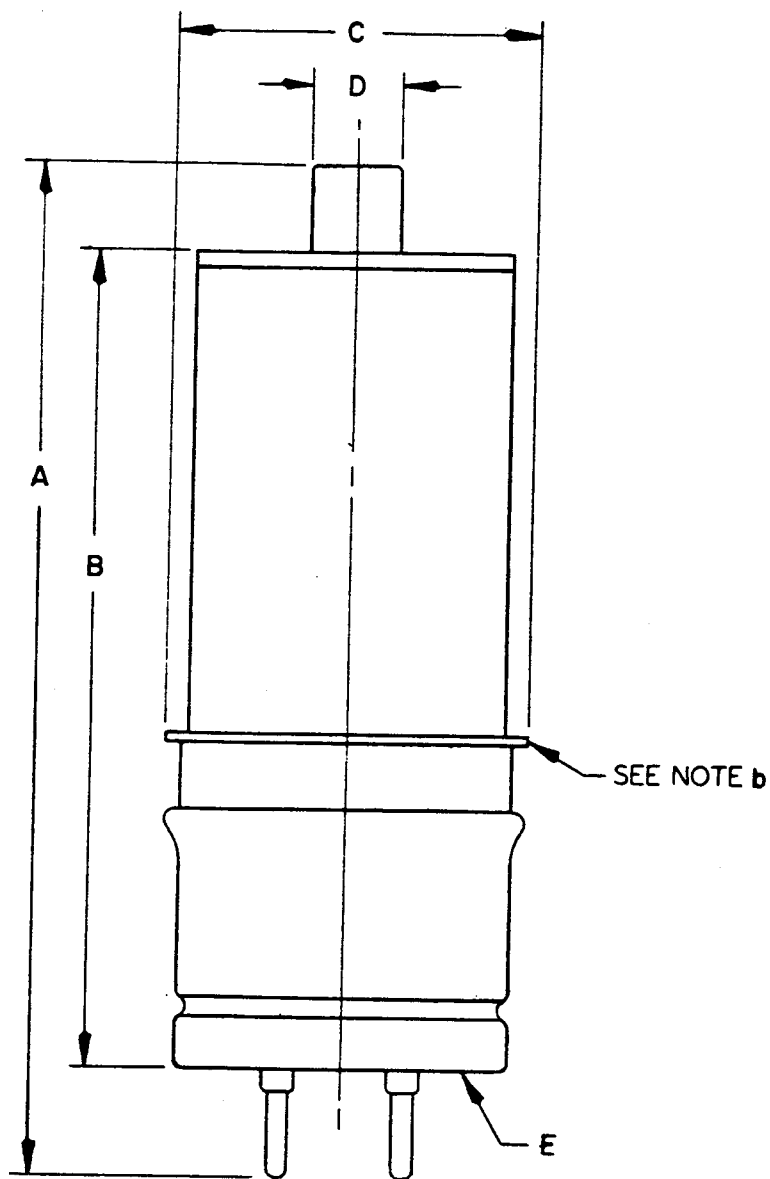
Review activities:

Army - EL  
Navy - EC, SH  
Air Force - 11, 17, 85

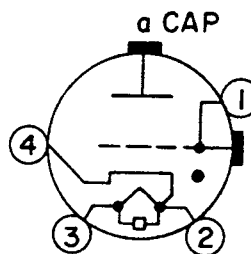
Code "C"

User activities:

Army - ME  
Navy - AS, OS, MC, CG  
Air Force - 19



(A)



PIN CONNECTIONS	
Pin No.	Element
1	g
2	h, k
3	h
4	h, k
cap	a

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses (see note d)	
	Minimum	Maximum
Quality conformance inspection, part 2		
A	6.125 (155.58)	6.625 (168.28)
B	4.750 (120.65)	5.150 (130.81)
C	2.000 (50.80)	2.375 (60.33)
D	.559 (14.20)	.573 (14.55)
Quality conformance inspection, part 3 (periodic check)		
E	Base: A4-18	

(A)

NOTES:

- a. Do not use metal clamp on ceramic envelope.
- b. This flange is mechanically and electrically connected to the grid.
- c. Recommended anode connector - lightweight spring-clip type (National Co. type 12, or equivalent).
- d. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 1. Outline drawing of electron tube type 8613.

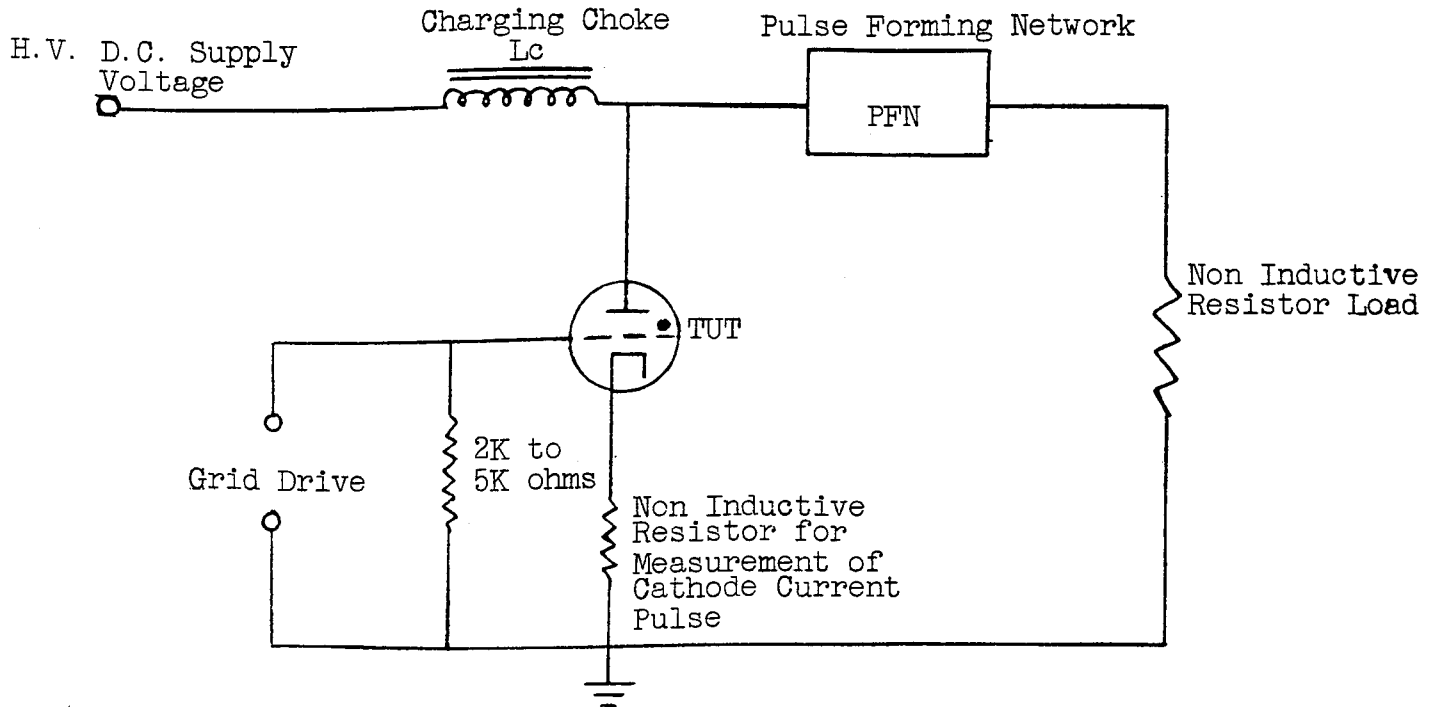


Figure 2 - Test circuit.

(A) For changes, see pages 1, 2, 3, 4, and 6.