INCH-POUND

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11 March 1998
SUPERSEDING
MIL-E-1/1735(NAVY)
30 May 1973

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, THYRATRON

TYPE 8951

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, hydrogen charging.
See figure 1 and 17/
Mounting position: Any.
Weight: 8 ounces nominal.

ABSOLUTE RATINGS:

Parameter:	Ef	epy	epx	Ebb	egy	egx	Ecc	ib	lb
Unit:	V ac	kv	kv	V dc	v	v	V dc	a	Adc
Maximum:	6.8	25	25 1/	---	1,500 2/	400	---	1,000 15/	2.5
Minimum:	5.8	---	5 % epy	1,500	450	---	-200	---	---
Test conditions: 8/	6.3	25	---	---	450	---	---	---	---

ABSOLUTE RATINGS:

Parameter:	lp	tj	prr	dik/dt	Pb	tk	TA	Cooling	Eres
Unit:	Aac	μs	pps	$\frac{a}{\mu s}$	---	sec	°C	---	V ac
Maximum:	47.5	0.005	4,000	5,000	25×10^9 7/	---	85	--- 7/	6.8
Minimum:	---	---	---	---	---	300	-55	---	5.8
Test conditions: 8/	---	---	---	---	---	300	Ambient	---	6.3

ABSOLUTE RATINGS: Charging triode circuit (see figure 4).

Parameter:	ib	Rate of change of cathode voltage
Unit:	a	kv/μs
Maximum:	65 15/	-10 16/
Minimum:	---	---
Test conditions: 8/	---	---

See footnotes at end of table I.

GENERAL:

Qualification: Required.

TABLE I. Testing and inspection.

Inspection	Method	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 1								
Emission	3251	ik = 1,500 a; tp = 5 μs ±10%; prr = 60 ±10%; tr = 0.5 μs (max) 14/	0.65	II	egk	---	250	v
Heater current (cathode)	3241		0.65	II	If	---	18	Aac
Heater current (reservoir)	3241		0.65	II	Ires	---	8	Aac

Operation (1)	3246	Ef = Eres = 5.8 V ac;
		epy = 24 kv;
		Ib = 2.2 Adc;
		tk = 300 sec (max);
		t = 1 hour 3/ 4/ 5/
			0.65	II	egy	---	450	v

Operation (1A)	3246	Operation (1); except Ef = Eres = 6.3 V ac; t = 5 hours 10/	0.65	II	egy	---	450	v
Instantaneous starting	3267	epy = 18 kv (min); Ef = Eres = 6.8 V ac 3/ 6/	0.65	II	---	---	---	---
DC anode voltage for conduction	3247	Ef = Eres = 5.8 V ac; tk = 300 sec (max); egy = 450 v (max) 3/	0.65	II	Ebb	---	1,000	V dc
Conformance inspection, part 2								
Anode delay time	3256	Operation (1) except t = 120 seconds	---	---	tad	---	0.5	μs
Anode delay time drift	3256	Anode delay time 9/	---	---	Δtad	---	0.15	μs
Time jitter	3261	Operation (1A); tk = 300 sec 12/	---	---	tj	---	0.005	μs

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method	Conditions	Acceptance level	Inspection level or code	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 3								
Life test	---	Group C: t = 500 hours 3/ 11/	---	---	---	---	---	---
Life test end points:	---							
Operation (1) and (1A), except 5/	3246		---	---	Ebb tj egy	--- --- ---	1,250 0.005 450	V dc μs v
Periodic-check tests								
Sweep-frequency vibration	1031	No voltage applied	---	---	---	---	---	---
Shock	1041	250 G; no voltage applied	---	---	---	---	---	---
Shock and sweep-frequency vibration end point:								
DC anode voltage for conduction	---		---	---	Ebb	---	1,250	V dc

1/ In pulsed operation, the peak inverse voltage exclusive of a spike of 0.05 μs maximum duration, shall not exceed 5 kv during the first 25 μs following the anode pulse.

2/ The driver pulse, measured at the tube socket with the thyratron grid disconnected: tr = 0.35 μs maximum; grid pulse duration = 2 μs minimum. The impedance of the drive circuit shall be 50 to 200 Ω.

3/ The circuit used for this test is shown on figure 3. The anode circuit constants shall be chosen for a resonant charging condition of 4,000 pps minimum. At epy = 24 kv and ib = 580a minimum, the rate of rise of the current pulse (dik/dt) shall be 5,000 a/μs minimum. The pulse width (tp) shall be 2.4 μs ± 10 percent. The grid pulse measurements at the tube socket with the thyratron grid disconnected shall be as follows: tr = 0.35 μs minimum, tp = 2.0 μs maximum, Zg = 200 Ω minimum, Ecc = -70 V minimum.

4/ The anode temperature and grid seal temperature shall not exceed 350°C at any time during this test.

5/ Anode voltage shall be applied as specified in 6/. Full anode voltage (epy = 24 kv) shall be reached within 5 seconds after starting. The tube shall operate at the specified anode voltage for a total of 6 hours which may include two interruptions during the initial 30 minutes and one interruption during the last 5 1/2 hours.

6/ This test shall be the first test performed after the holding period. The tube shall operate satisfactorily on push button starting within two attempts when the anode voltage (epy) is applied to the tube under test in such a manner as to rise from 0 to 18 kv minimum within 0.03 second. The filter in the rectifier shall be designed so that epy reaches at least 9 kv within 0.015 second. The interval between successive attempts to instantaneously start the tube shall be not less than 10 seconds nor more than 30 seconds.

7/ There shall be no artificial anode or envelope cooling directed onto the tube. Blowers or anode radiators shall not be used.

TABLE I. Testing and inspection - Continued.

8/ The heat dissipator, Hughes Aircraft Company, Part Number 529033 (grid radiator), or equivalent shall be used during all tests of this specification.

9/ This test shall be performed simultaneously with operation (1) test. Anode delay time measurement shall be made at the end of 2, 4, and 30 minutes of the operation (1) tests. The anode delay time drift (Δtad) measurement is the numerical difference between 2 minutes and 4 minutes, or 2 minutes and 30 minutes anode delay time readings, whichever is greater.

10/ Operation (1A) shall be a continuation of operation (1) with the specified change in operating conditions made after 1 hour.

11/ Where production is less than 50 tubes per month, life-test sample size shall be 1 tube per month.

12/ The tube shall be tested by applying a peak forward anode voltage, as specified in the test conditions for the time jitter test immediately after the tk. The tj shall be not greater than the amount specified after 120 seconds of operation.

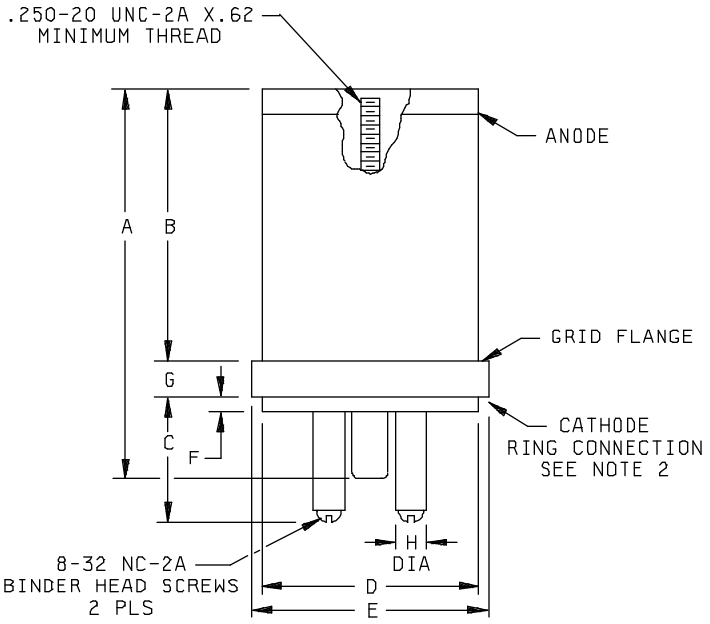
13/ The tube shall operate at the specified anode voltage for a total of 6 hours which may include three interruptions during the initial 30 minutes and three interruptions during the last 5 1/2 hours.

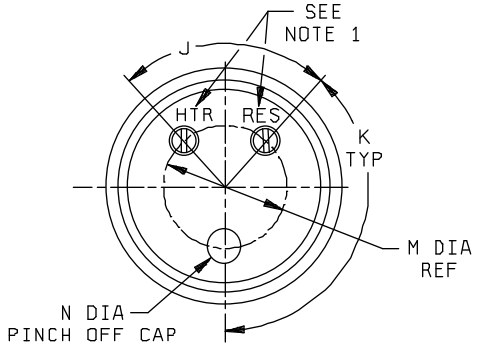
14/ The positive pulse shall be applied to the grid of the tube with the anode floating. Measure the voltage between grid and cathode not more than 2.5 μs after the beginning of the current pulse. The average voltage shall not increase from the voltage measurement point to the end of the pulse. As an alternate, the test may be conducted by connecting the grid to the anode through a 1-ohm resistance, applying the positive pulse and reading the peak voltage drop between anode and cathode (epk). The limit for this reading shall be the same as that for egk in the emission test.

15/ The absolute maximum ib is 1,000a when used in the circuit of figure 3, with a pulse width (tp) of less than 70 μs. The absolute maximum ib is 65a when used in the circuit of figure 4, with a pulse width (tp) of greater than 400 μs.

16/ When used in the circuit of figure 4, the absolute-maximum rate of change of cathode voltage at the time of switch tube trigger is -10 kv/μs.

17/ An MT-4 mounting assembly (or equivalent) shall be provided as an integral part of each tube (see figure 2 for reference only).

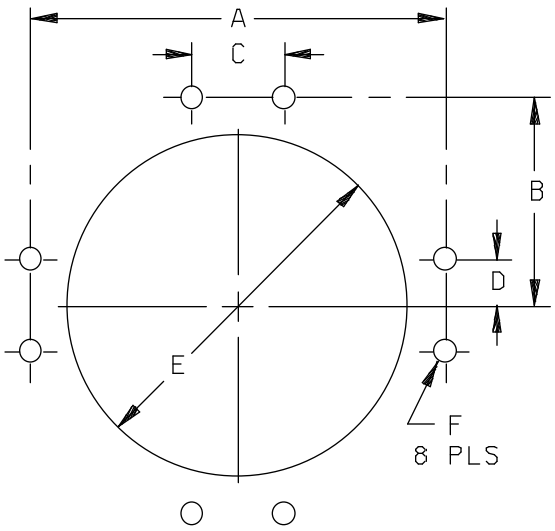




Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
Conformance inspection, part 2				
A	---	5.420	---	137.67
B	---	3.700	---	93.98
C	---	1.555	---	39.50
D	2.985	3.015	75.82	76.58
E	3.245	3.305	82.42	83.95
F	0.120	0.200	3.05	5.08
G	0.520	0.570	13.26	14.48
H	---	0.375	---	9.53
N	---	0.469	---	11.91
Reference dimensions				
J	90°		90°	
K	135°		135°	
M	---	1.500	---	38.10

NOTES:
1. Reservoir and heater terminals shall be identified and marked on tube base as specified herein.
2. Other side of reservoir and heater terminals are internally connected and are common to cathode.

FIGURE 1. Outline drawing of electron tube type 8951.



MOUNTING HOLE DIMENSIONS

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	3.846	3.876	97.69	98.45
B	1.926	1.936	48.92	49.17
C	.844	.868	21.44	22.05
D	.423	.433	10.74	11.00
E	3.170 DIA		80.52 DIA	
F	.219 DIA THRU		5.56 DIA THRU	

Mounting hole dimensions

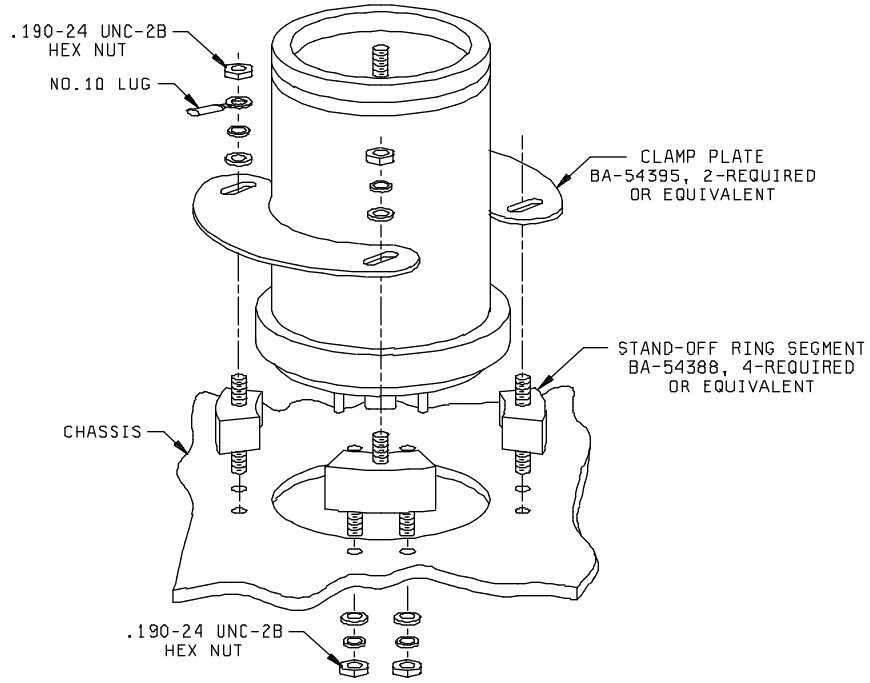


FIGURE 2. MT-4 tube mounting assembly

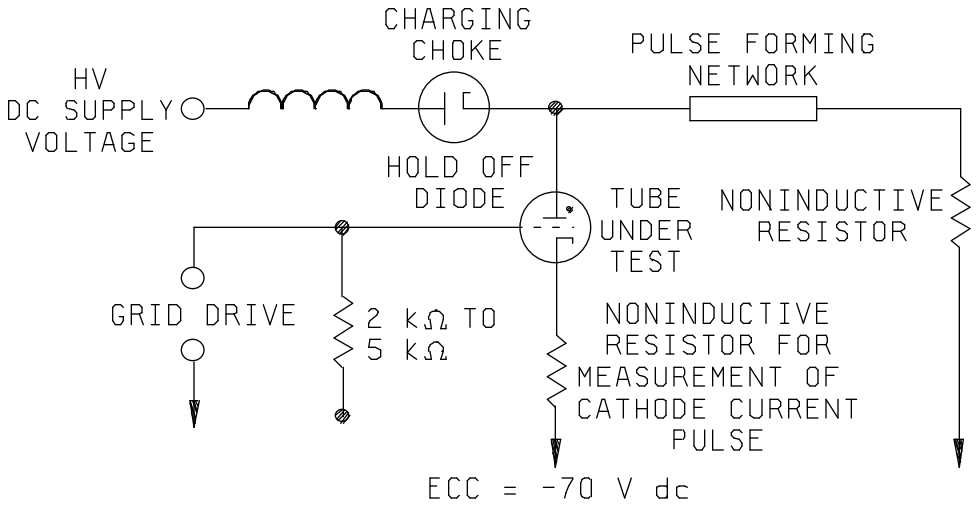


FIGURE 3. Basic soft tube modulator circuit.

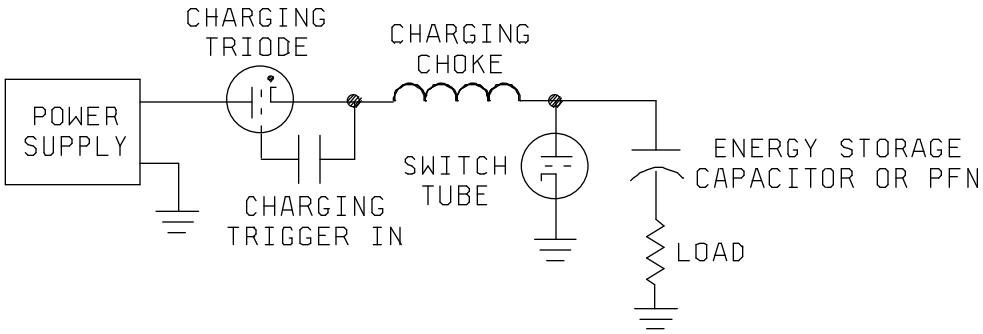


FIGURE 4. Basic charging triode current.

Custodian:
Navy - EC

User activities:
Navy - AS, CG, MC, OS, SH

Preparing activity:
DLA - CC

(Project 5960-3476-08)