

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

Specification AD/CV2520 incorporating MIL-E-1/115E. Issue 3A Dated 21.3.62. To be read in conjunction with K1006.	<u>SECURITY</u>	
	<u>Specification</u> Unclassified	<u>Valve</u> Unclassified

—————> Indicates change.

<u>TYPE OF VALVE:</u> Hydrogen Thyatron Modulator <u>CATHODE:</u> Indirectly Heated <u>ENVELOPE:</u> Glass <u>PROTOTYPE:</u> 5C22	<u>MARKING</u> K1001/4 Add 5C22 Serial No																																											
	<u>BASE</u> B4D (Super Jumbo 4-Pin with bayonet).																																											
<table border="0" style="width: 100%;"> <thead> <tr> <th colspan="2" style="text-align: center;"><u>RATINGS</u></th> <th style="text-align: center;">Note</th> </tr> </thead> <tbody> <tr> <td>Heater Voltage (V)</td> <td>6.3</td> <td></td> </tr> <tr> <td>Heater Current (A)</td> <td>10.6</td> <td></td> </tr> <tr> <td>Max. Peak Anode Voltage (kV)</td> <td>16.0</td> <td>B</td> </tr> <tr> <td>Min. D.C. Anode Supply Voltage (kV)</td> <td>4.5</td> <td></td> </tr> <tr> <td>Max. Peak Inverse Voltage (kV)</td> <td>16.0</td> <td>C</td> </tr> <tr> <td>Max. Peak Anode Current (A)</td> <td>325</td> <td></td> </tr> <tr> <td>Min. Trigger Voltage (V)</td> <td>200</td> <td>D</td> </tr> <tr> <td>Max. Negative Grid Voltage (V)</td> <td>200</td> <td></td> </tr> <tr> <td>Max. Mean Anode Current (A)</td> <td>0.2</td> <td></td> </tr> <tr> <td>Max. Rate of rise of Anode Current (A/μS)</td> <td>1500</td> <td></td> </tr> <tr> <td>Max. value of product of peak Anode Voltage, Peak Anode Current and Pulse Repetition rate (VxIxpps)</td> <td>3.2x10⁹</td> <td></td> </tr> <tr> <td>Min. Cathode Heating Time (Mins.)</td> <td>5</td> <td></td> </tr> <tr> <td>Ambient Temperature Range (°C)</td> <td>-50 to +90</td> <td></td> </tr> </tbody> </table>	<u>RATINGS</u>		Note	Heater Voltage (V)	6.3		Heater Current (A)	10.6		Max. Peak Anode Voltage (kV)	16.0	B	Min. D.C. Anode Supply Voltage (kV)	4.5		Max. Peak Inverse Voltage (kV)	16.0	C	Max. Peak Anode Current (A)	325		Min. Trigger Voltage (V)	200	D	Max. Negative Grid Voltage (V)	200		Max. Mean Anode Current (A)	0.2		Max. Rate of rise of Anode Current (A/μS)	1500		Max. value of product of peak Anode Voltage, Peak Anode Current and Pulse Repetition rate (VxIxpps)	3.2x10 ⁹		Min. Cathode Heating Time (Mins.)	5		Ambient Temperature Range (°C)	-50 to +90		<u>CONNECTIONS</u>	
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	<u>Pin</u>	<u>Electrode</u>																																										
	1	g																																										
	2	h,k																																										
	3	h																																										
	4	k																																										
	T.C.	a																																										
	<u>TOP CAP</u> See Drawing on Page 6																																											
	<u>DIMENSIONS (INCHES)</u>																																											
	<u>Dimension</u>	<u>Min.</u> <u>Max.</u>																																										
	Length (Overall)	8.25 8.75																																										
	Diameter	2.313 2.563																																										
	Seated Height	7.531 8.031																																										
	<u>MOUNTING POSITION</u> Any See Note F																																											
<u>NOTES</u>																																												
A. All limiting values are absolute.																																												
B. See Note 1 on Sheet 2 of the attached Specification MIL-E-1/115E.																																												
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D. See Note 3 on Sheet 3 of the attached Specification MIL-E-1/115E.																																												
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F. For clamping directions see Note 5 on Sheet 2 of attached Specification MIL-E-1/115E.																																												

MILITARY SPECIFICATION SHEET
 ELECTRON TUBE, THYRATRON, HYDROGEN
 JAN-5C22^{1/}

This specification sheet forms a part of the latest issue of Military Specification MIL-E-1.

ABSOLUTE-MAXIMUM RATINGS:

Parameter:	Ef	epy	epx	Ebb	Ecc	egx	egy	ib	tk	dik/dt	Ib	Pb	TA	Cooling	pr	Alt
Unit:	V	kv	kv	Vdc	Vdc	v	v	a	sec	a/us	mAdc	---	^o C	---	---	ft
Maximum:	6.3/7.5%	16.0	16.0	---	---	200	---	325	---	1,500	200	3.2x10 ⁹	f90	(See note 4)	---	10,000
Minimum:	---	---	5% epy	4,500	---	---	(See note 3)	---	300	---	---	---	-50	---	---	---
TEST CONDITIONS:	---	16.0	---	---	0	---	150	---	---	---	---	---	---	---	1,000	---

PIN NUMBER: 1 2 3 4 Cap BASE: A4-18 MOUNTING POSITION: Any

ELEMENT: g h h k p CAP: See figure 1 OUTLINE: See figure 1
 k (see note 6)

CLAMPING: See note 5

DIMENSIONS: See figure 1

ENVELOPE: See figure 1

PAR. NO.	TEST	CONDITIONS	AQL (percent defective)	INSPECTION LEVEL	SYMBOL	LIMITS		UNIT
						Min	Max	
	<u>General</u>							
3.1	Qualification	Required for JAN marking	---	---	---	---	---	---
3.6	Performance		---	---	---	---	---	---
4.5	Holding period	t = 96 hours	---	---	---	---	---	---
---	Cathode	Coated unipotential	---	---	---	---	---	---
	<u>Qualification inspection (see note 7)</u>							
4.9.20.3	Variable frequency vibration	No voltages applied (see notes 8 and 9)	---	---	---	---	---	---
4.9.20.5	Shock test	Angle = 13 ^o (see notes 10 and 11)	---	---	---	---	---	---
---	Post shock test end points	Operation (1) Dc anode voltage Time jitter	---	---	egy Ebb tj	---	150 2,500 0.005	v Vdc us
---	Operation (2)	TA = 90 ^o C; t = 5.0 hours; Ef = 6.3/ 0.50 Vac (see notes 12, 13, and 14)	---	---	egy	---	150	v

^{1/} Formerly designated as 5C22/HT-415.

PAR. NO.	TEST	CONDITIONS	AQL (percent defective)	INSPECTION LEVEL	SYMBOL	LIMITS		UNIT
						Min	Max	
	<u>Acceptance inspection, part 1 (production) (see note 15)</u>							
4.9.1	Mechanical-production tests	Envelope	---	---	---	---	---	---
4.10.8	Heater current	Ef = 6.3 Vac	0.65	II	If	9.6	11.6	Aac
---	† Instantaneous starting	Ef = 6.8 Vac; epy = 13.5 kv min; tk = 300 (see notes 12 and 16)	0.65	II	---	---	---	---
---	† Operation (1)	Ef = 5.8 Vac; epy = 18.0 kv min; prr = 800; t = 300 (see notes 12, 13, and 14)	0.65	II	egy	---	150	v
4.10.17.2	Critical anode voltage for conduction	(See notes 12 and 17)	0.65	II	Ebb	---	2,500	Vdc
---	Emission	Ef = 6.30 Vac; ik = 325 a min; prr = 60%±10%; tp = 5 us ±10%; tr = 0.5 us max (see note 18)	0.65	II	egk	---	175	v
	<u>Acceptance inspection, part 2 (design)</u>							
4.9.19.2	High-frequency vibration	No voltages applied (see note 9)	6.5	L6	---	---	---	---
4.9.19.3	Bump	Angle = 20° (see note 9)	6.5	L6	---	---	---	---
---	Operation (1A)	Operation (1); Ef = 6.80 Vac	6.5	L6	egy	---	150	v
---	Anode delay time	Operation (1); t = 120; egy = 150 v (see note 19)	6.5	L6	tad	---	0.65	us
---	Anode delay time drift	Anode delay time (see note 20)	6.5	L6	Δ tad	---	0.10	us
---	Time jitter	Ef = 6.30 Vac; epy = 5.0 kv max (see notes 12 and 21)	6.5	L6	tj	---	0.005	us
	<u>Acceptance inspection, part 3 (life)</u>							
4.11	Life tests	Group C; Ef = 6.30 Vac (see notes 12, 14, and 22)	---	---	t	500	---	hr
4.11.4	Life-test end point	Operation (1) and operation (1A) (see note 23)	---	---	egy	---	160	v
		Dc anode voltage; egy = 160 v	---	---	Ebb	---	4,000	Vdc
		Time jitter; egy = 160 v	---	---	tj	---	0.010	us
		Anode delay time; egy = 160v	---	---	tad	---	0.70	us
		Anode delay time drift; egy = 160v	---	---	Δ tad	---	0.10	us
4.9.18 and 4.9.18.1.6.2	Container drop	Required (see note 24)						
5.	Preparation for delivery	(See note 25)						

NOTES:

1. For instantaneous starting applications where plate voltage is applied instantaneously, the maximum permissible epy is 13.5 kv and shall not be attained in less than 0.04 second.
2. In pulsed operation, the peak inverse voltage, exclusive of a spike of 0.05 us maximum duration, shall not exceed 5.0 kv during the first 25 us after the pulse.
3. Driver pulse measured at tube socket with thyatron grid disconnected shall be epy = 200 v minimum; time of rise = 0.5 us maximum; grid pulse duration = 2 us minimum; impedance of driver circuit = 500 ohms maximum.
4. Cooling of the anode lead is permissible, but there shall be no air blast directly on the bulb.
5. Clamping is permissible by the base, by the bulb, or both, in the area up to 4-1/4 inches above the top of the base only.
6. Where equipment is designed to withstand shock and vibration, it is recommended that the anode connector be of the spring clip type (National Company type 12, or equivalent).
7. All tests listed hereon shall be performed during qualification inspection; however, these four tests are normally performed during qualification inspection only.
8. There shall be no pronounced resonance in the specified range.
9. There shall be no evidence of shorts of any kind resulting from this test.
10. Use clamp as specified on Drawing 243-JAN.
11. Tubes subjected to the destructive test specified in 4.9.20.5 are not to be delivered on the contract or order.
12. The circuit used for this test is shown on figure 2. The anode circuit constants shall be chosen so that at epy = 16.0 kv under resonant charging conditions: $dik/dt = 1,500$ a/us minimum; $ib = 175$ a; $tp = 1.0$ us ± 10 percent; $pr = 1,000$.
 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 the general conditions, as the case may be. Tests performed at repetition rates less than the resonant repetition rate shall be made with a holdoff diode in the charging circuit.
 The grid pulse characteristic shall be $tp = 2.0$ us maximum; $tr = 0.5$ us minimum. Internal impedance of driver = 500 ohms minimum.
13. The tube shall operate continuously without evidence of arc-back.
14. There shall be no evidence of anode heating during the test.
15. The AQL for the combined defectives for attributes in acceptance inspection, part 1 (production), excluding inoperatives and mechanical, shall be 1 percent.
16. This shall be the first test after the holding period. No voltages are to be applied prior to the start of this test. The test procedure is as follows: Filament voltage is applied 300 seconds (tk) in advance of the application of anode voltage. The grid-drive voltage is applied less than 10 seconds previous to applications of anode voltage. Pushbutton starting shall be attempted up to three times, with intervals of from 10 to 30 seconds between successive attempts. Any tube failing to operate satisfactorily when the anode voltage (epy) applied rises from 0 to 13.5 kv within 0.03 second (the filter in the rectifier shall be designed so that the epy reaches at least 7 kv within 0.015 second) will be considered a failure.
17. This test shall be conducted within 60 seconds after the operation (1) test.
18. The positive pulse shall be applied to the grid of the tube. Measure the voltage between grid and cathode 2.5 us maximum after the beginning of the current pulse. The average voltage shall not rise during the last 4 us. Plate floating.

NOTES:

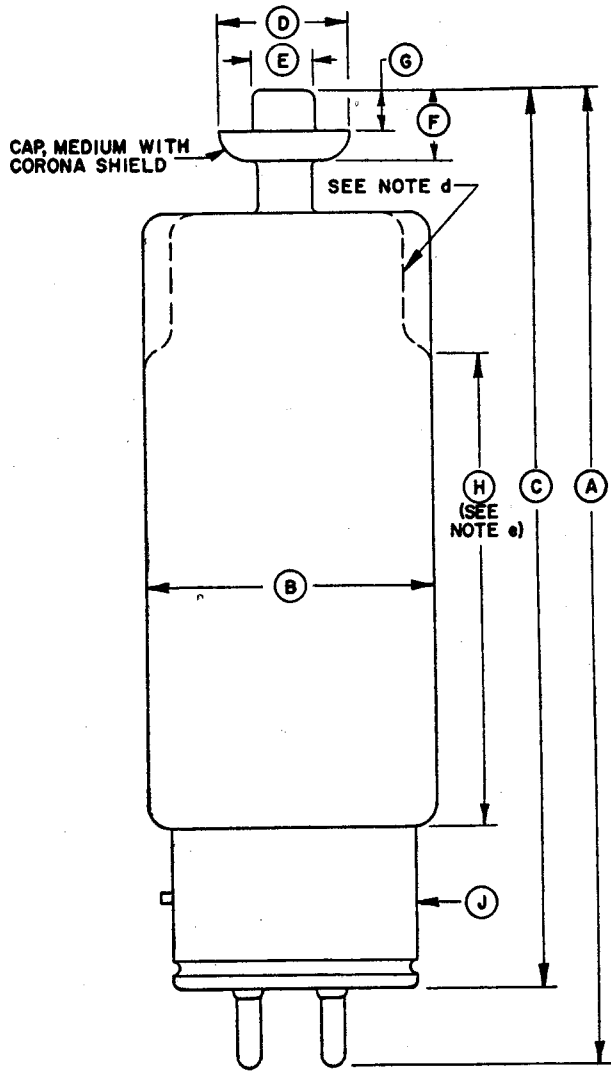
19. The anode delay time (tad) is a time interval between the point on the rising portion of the grid pulse which is 26 percent of the maximum unloaded pulse amplitude and the point where anode conduction takes place.
20. During the interval between 2 minutes and 7 minutes of the anode delay time test, the change in anode delay time (Δ tad) relative to the tad value observed on the anode delay time test shall not exceed the specified value.
21. The variation in firing time (tj) shall be measured at 50 percent of pulse amplitude and shall be not greater than the amount specified.
22. Life test shall be run with the tube in a horizontal position and shall be shut down every 96 hours for a 60-minute interval.
23. Anode heating shall not be cause for rejection on operation (1) and operation (1A) performed during periodic life-test end-point test.
24. Not required for qualification inspection.
25. Tubes shall be prepared for domestic or overseas shipment, as specified in the contract or order, in accordance with Specification MIL-E-75 and appendix thereto. When specified in the contract or order, rough handling (container drop) test (i) shall be performed on the individual container utilized.
26. Referenced documents shall be of the issue in effect on the date of invitation for bids.

Preparing activity:

Navy - Bureau of Ships
(Project 5960-0376)

Custodians:

Army - Signal Corps
Navy - Bureau of Ships
Air Force



DIM.	AQL (PERCENT DEFECTIVE)	INSPECTION LEVEL	LIMITS	
			Min	Max
QUALIFICATION INSPECTION				
D	---	---	0.994 dia	1.170 dia
E	---	---	0.559 dia	0.573 dia
F	---	---	0.609	0.641
G	---	---	0.375	---
H	---	---	4.250	---
J	Base: A4-18 (see note c)			
ACCEPTANCE INSPECTION, PART 1 (PRODUCTION)				
A	(See	I	8.250	8.750
B	note		2.313 dia	2.563 dia
C	b)		7.531	8.031

- NOTES:
- a. All dimensions in inches.
 - b. The AQL for the combined mechanical defectives in acceptance inspection, part 1 (production), shall be 1 percent.
 - c. Refers to Specification MIL-E-1.
 - d. Alternate seal configuration.
 - e. Clamping shall be confined to the base and the area designated by dimension H.

Figure 1. Outline drawing.

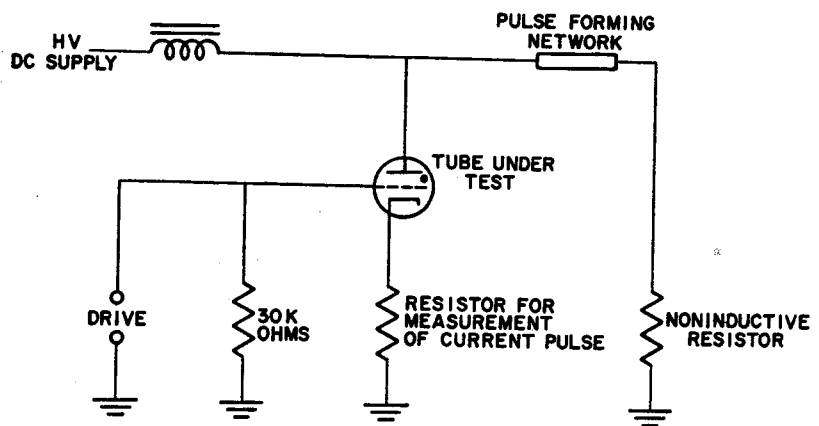


Figure 2. Test circuit.