

SERVICES VALVE TEST LABORATORY

CV 5018

Specification AD/CV.5018 incorporating MIL-E-1/800B Issue No. 2 dated 4.8.61. To be read in conjunction with K.1006.	<u>SECURITY</u>	
	<u>SPECN.</u> Unclassified	<u>VALVE</u> Unclassified

<u>TYPE OF VALVE</u> Magnetron, pulsed, fixed frequency and integral magnet.  <u>CATHODE</u> Indirectly heated  <u>ENVELOPE</u> Metal-glass  <u>PROTOTYPE</u> 4J52A	<u>MARKING</u>	
	See K.1001/4 Additional marking 4J52A	
<u>RATINGS</u>	NOTE	<u>CONNECTIONS</u>
Heater voltage nominal      (V)      12.6	A	See drawing on page 5.
Heater current nominal      (A)      2.2		
Operating frequency nominal      (Mc/s)      9345 to 9405		
Max. pulse voltage      (kV)      16	B	<u>DIMENSIONS</u>
Max. pulse current      (A)      15		See drawing on page 5.
Max. mean input power      (W)      240		
Max. pulse length      ( $\mu$ S)      5.0		
Max. frequency pulling      (Mc/s)      13		
		<u>MOUNTING POSITION</u>
		Any
<u>NOTES</u>		
A. For warm-up time and heater voltage on standby and during operation see Note 4 on page 3.		
B. Sufficient cooling air (e.g. 15 cu. ft./min. at N.T.P.) shall be directed at the cooling fins to prevent the anode temperature exceeding 100°C.		

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23 August 1955  
SUPERSEDED  
MIL-E-1/800A  
5 April 1955

## INDIVIDUAL MILITARY SPECIFICATION SHEET

### ELECTRON TUBE, MAGNETRON, PULSE

JAN-4J52A

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

Description: Magnetron, Pulse, 9375Mc Nominal Fixed Frequency, 70kw Nominal Peak Power Output, Permanent Magnet, Air Cooled

Ratings:	(Note 1)			Anode			Cathode
Parameter	Ef (Note 4)	if	tk	T	VSWR	Altitude	Bushing T
Units	V	a	sec	°C		mm Hg	°C
Absolute Maximum:	14	10 (surge)	---	150	1.5:1	---	175
Minimum:	---	---	90	-55 Note 5	---	500	-55 Note 5

Design Ratings:	(Note 2)			Storage
Parameter	Ef	ib	Pi	Ambient
Units	Note 4	a	Watts	°C
Maximum:	Note 4	15	240	485
Minimum:	Note 4	12	---	-55

tp	rrv (Note 3)	
us	kv/us	
Min.	Min.	Max.
0.4	120	180
1.0	100	150
4.5	70	100

The following tests shall be performed.

For the purposes of inspection, use applicable paragraphs of MIL-E-1 and Inspection Instructions for Electron Tubes.

For miscellaneous requirements, see Paragraph 3.3, Inspection Instructions for Electron Tubes.

Ref.	Test	Conditions	AQL(%)	Insp. Level or Code	Sym.	LIMITS						Units
						Min.	LAL	Bogie	UAL	Max.	ALD	
<u>Qualification Approval Tests</u>												
3.1	Qualification Approval:	Required for JAN Marking	---	---	---	---	---	---	---	---	---	---
---	Vibration:	Osc. (1); G=10; F=50 to 500; varied over complete range in not less than 5 minutes at uniform rate, Note 18	---	---	ΔF:	---	---	---	---	±0.5	---	Mc
---	Shock:	No voltages; 50G; 4ms duration, Note 6	---	---	---	---	---	---	---	---	---	---
---	Input Capacitance:	Measured between cathode terminal and mounting plate	---	---	Cin:	10.0	---	---	---	14.0	---	uuf
---	Phase of Sink:	Osc(1); Note 12	---	---	Dist:	0.26	---	---	---	0.40	---	λg
4.9.14	Temperature Coefficient:	Osc(1); Anode Temp=70° to 100°C at reference point	---	---	ΔF/Δ°C:	---	---	---	---	0.25	---	Mc/°C
4.9.15	Low Temperature Operation:	Osc(1); tk=90(max) Stability, Note 11 Stability, Note 19	---	---	M. P.:	---	---	---	---	1	---	%
					M. P.:	---	---	---	---	5	---	%
4.16.1	Air Cooling:	Osc(1); Note 13	---	---	Δ T:	---	---	---	---	50	---	°C
4.9.12	Low Pressure Operation:	Osc. (2); Pressure 500mm Hg Absolute; Note 16	---	---	---	---	---	---	---	---	---	---
<u>Measurements Acceptance Tests Part 1 (Note 21)</u> (Generally considered as Production Tests)												
4.5	Holding Period:	t=168 hours	---	---	---	---	---	---	---	---	---	---
4.9.2	Dimensions:	Per Outline	---	---	---	---	---	---	---	---	---	---
4.9.13	Pressurizing:	40-45 p. s. i. absolute; input and output assemblies	.65	II	---	---	---	---	---	---	---	---
4.10.8	Heater Current:	Ef=12.6V; tk=180 (min.)	.65	II	H:	2.0	---	---	---	2.4	---	A

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Ref.	Test	Conditions	AQL(%)	Insp. Level or Code	Sym.	LIMITS						Units
						Min.	LAL	Bogie	UAL	Max.	ALD	
4.16.3	<u>Oscillation (1):</u>	Notes 4, 7 and 8										
4.16.3.2	Heater:	Ef=12.6V for tk=90 (max.);Ef=9.1V for test	---	---	---	---	---	---	---	---	---	
4.16.3.3	Pulse Characteristics:	tp=0.4±0.05; Du=0.00065;rrv=170±15 kv/us; Note 3	---	---	---	---	---	---	---	---	---	
4.16.3.4	Average Anode Current:	Ib=9.8mAdc	---	---	---	---	---	---	---	---	---	
4.16.3.7	Spectrum Measurements:	Measurements shall be made at 11a and 15a; Notes 9 and 10	.65	II	---	---	---	---	---	---	---	
	Minor Lobes:		.65	II	Ratio:	8.0	---	---	---	---	---	db
	R. F. Bandwidth:		.65	II	ΔF:	---	---	---	---	$\frac{2.0}{tp}$	---	Mc
---	Stability:	Note 11	.65	II	M. P.:	---	---	---	---	0.25	---	%
4.16.5	Pulling Factor:		.65	II	ΔF:	---	---	---	---	13.0	---	Mc
4.16.3	<u>Oscillation (2):</u>											
4.16.3.2	Heater:	Ef=12.6V for tk=90 (max.);Ef=7.9V for test	---	---	---	---	---	---	---	---	---	
4.16.3.3	Pulse Characteristics:	tp=5.0±0.5us;Du=0.001; rrv=110±10 kv/us; Note 3	---	---	---	---	---	---	---	---	---	
4.16.3.4	Average Anode Current:	Ib=15mAdc	---	---	---	---	---	---	---	---	---	
4.10.7.3	Frequency:	Anode Temp. at reference point = 100±10°C	.65	II	F:	9350	---	---	---	9400	---	Mc
4.16.3.5	Pulse Voltage:		.65	II	epy:	14	---	---	---	16	---	kv
4.16.3.6.1	Power Output:	within t=100	.65	II	Po:	70	---	---	---	---	---	W
4.16.3.7	Spectrum Measurements:	Measurements shall be made at 12a & 15a; Notes 9 and 10	.65	II	---	---	---	---	---	---	---	
	Minor Lobes:		.65	II	Ratio:	6.0	---	---	---	---	---	db
	R. F. Bandwidth:		.65	II	ΔF:	---	---	---	---	$\frac{2.5}{tp}$	---	Mc
4.16.6	Pushing Factor:	ib=12a to 15a	.65	II	ΔF:	---	---	---	---	0.5	---	Mc/amp
---	†Stability (1):	Notes 11 and 14	.65	II	M. P.:	---	---	---	---	0.25	---	%
<u>Measurements Acceptance Tests Part 2</u>			<u>(Generally considered as Design Tests)</u>									
---	Vibration:	Heater voltage only; G=15;F=60;duration 15 minutes;No heater-cathode or cathode-anode shorts during test; Note 18	6.5	IA	---	---	---	---	---	---	---	
	†Sheif Life:	t=90 days;Osc(2);Note 20	---	---	---	---	---	---	---	---	---	
	Stability: Note 11		6.5	IA	M. P.:	---	---	---	---	0.5	---	%
	Stability: Note 19		6.5	IA	M. P.:	---	---	---	---	10	---	%
---	Stability (2):	Osc(2);rrv=60±10kv/us; Note 11	6.5	IA	M. P.:	---	---	---	---	0.25	---	%

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Ref.	Test	Conditions	ACL(%)	Insp. Level or Code	Allowable Defectives per Characteristic		Sym	Limits		Units																				
					1st Sample	Combined Samples		Min.	Max.																					
4.11	<u>Acceptance Life Tests</u>		---	---	---	---	Cy:	833	---	Cycles																				
	Cycling Life Test:	Group D; VSWR=1.5 min. with phase varying thru a minimum of 1/2 $\lambda$ approx every 15 min.; Note 15																												
		<table border="1"> <thead> <tr> <th>Cond.</th> <th>Ib</th> <th>Ef</th> <th>Duration</th> </tr> </thead> <tbody> <tr> <td>Standby</td> <td>---</td> <td>12.6V</td> <td>3 min.</td> </tr> <tr> <td>Osc(1)</td> <td>9.8mA</td> <td>9.1V</td> <td>3 min.</td> </tr> <tr> <td>Osc(2)</td> <td>15.0mA</td> <td>7.9V</td> <td>15 min.</td> </tr> <tr> <td>Off</td> <td>---</td> <td>0</td> <td>9 min.</td> </tr> </tbody> </table>	Cond.	Ib	Ef	Duration	Standby	---	12.6V	3 min.	Osc(1)	9.8mA	9.1V	3 min.	Osc(2)	15.0mA	7.9V	15 min.	Off	---	0	9 min.								
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4.11.4	Cycling Life Test																													
	Enc Point:																													
	Power Output:	Oscillation (2)	---	---	---	---	Po:	56	---	W																				
	Frequency:	Oscillation (2)	---	---	---	---	F:	9345	9405	Mc																				
	Minor Lobes:	Oscillation (2) Notes 9, 10 and 17	---	---	---	---	Ratio:	6	---	db																				
	R. F. Bandwidth:	Oscillation (2) Notes 9, 10 and 17	---	---	---	---	$\Delta F$ :	---	$\frac{2.5}{tp}$																					
	Stability:	Oscillation (1) & (2) Notes 11 & 17	---	---	---	---	M. P.:	---	2	%																				
<u>Packaging Information</u>																														
4.9.18.1.8	Carton Drop:	(i) Package Group 9; Carton Size D																												

Note 1: These ratings shall not be used simultaneously and no individual rating shall be exceeded.

Note 2: To relate the various parameters, the following formula shall be employed:

$$P_i = I_b \times D_u \times 15000$$

Note 3: The rate of rise of voltage (rrv) shall be expressed in kilovolts per micro-second defined by the steepest tangent to the leading edge of the voltage pulse above 80 percent amplitude. Any capacitance used in viewing system shall not exceed 6.0 uuf.

Note 4: Prior to the application of high voltage, the cathode shall be heated to the required initial operating temperature. This shall be done by applying 12.6 volts for 3 minutes. On standby, the heater voltage shall not exceed 12.6 volts. On the application of anode power, the heater voltage shall be lowered to the voltage specified, and for various power inputs, it shall be adjusted approximately (within 5 percent) according to the following formula:

$$E_f = 11.6 \text{ minus } 0.017 P_i$$

The tube heater shall be protected against arcing by the use of a connector that places a minimum capacitance of 4000 uuf across the heater directly at the input terminals.

Note 5: Temperature shall be measured at the point shown on outline Draw<sup>t</sup>

Note 6: (a) This test shall be performed on the Naval Research Laboratory's Standard Shock Machine for Electronic Devices. A resilient cushion (see note 6 (b)) shall be interposed between hammer and anvil of table and a suitable hammer angle selected to produce a shock of the specified magnitude and duration (see note 6 (c)). The mounting plate of the tube shall be bolted with brass bolts to either the table or the standard angle bracket, depending upon the direction of the desired shock, using a 1-9/16-inch thick brass spacer between the tube mounting plate and the table or angle bracket. The shock shall be measured on the brass spacer. The tube shall be given one shock in each of the following directions:

- (1) Parallel to cathode, with cathode terminals pointing away from the hammer.
- (2) Perpendicular to cathode axis and output waveguide axis.
- (3) Perpendicular to cathode axis and parallel to the output waveguide axis.

(b) A resilient cushion consisting of 9/32-inch thick rubber sheet of thirty Shore Durometer hardness, covering the entire anvil of the table, has been found to produce the specified shock duration under the given conditions of table load and shock magnitude.

(c) Because of the varying resilience of the tube on its mounting plate with different shock directions and the high ratio of tube to table weight, the hammer angle will vary with the tube orientation to produce the required magnitude of shock.

(d) Criteria for passing shock test: After the shock test, the tube shall show no mechanical failure and shall meet all electrical requirements of the tube specification sheet with the exception of life tests.

Note 7: The modulator shall be such that the energy per pulse delivered to the tube, if arcing occurs, shall not greatly exceed the normal energy per pulse.

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- Note 8: The load termination of the magnetron during this test shall be a waveguide line with a VSWR of less than 1.05:1, except where specifically noted, herein.
- Note 9: The tube shall be operated into a transmission line with a VSWR of 1.5:1 adjusted in phase to produce maximum spectrum degradation.
- Note 10: A suitable spectrum shall be considered one in which the major lobe has a shape such that its slope does not change sign more than one for power levels greater than the specified db below its peak.
- Note 11: Stability shall be measured in terms of the average number of output pulses missing, expressed as a percent of the number of input pulses applied during the period of observation. The missing pulses (M.P.), due to any causes, are considered to be "missing" if the r. f. energy is less than 70 percent of the normal energy level in the frequency range of 9330 to 9425 megacycles. The VSWR of Note 9 shall be adjusted to that phase producing maximum instability and the missing pulses counted during any consecutive 5-minute interval of a 10-minute test period.
- Note 12: Using a standard cold test technique, the phase of sink as measured from the output flange to the first minimum, toward the load, shall be within the limits specified herein.
- Note 13: An air flow of 15 c. f. m. at approximately 760 mm Hg shall be directed on the cooling fins from an orifice of 2-1/2 by 1-3/16 inches. The temperature rise shall be measured at that point on the anode block as shown on outline drawing.
- Note 14: This test shall be the first one performed after the specified holding period.
- Note 15: Air cooling shall be adjusted so that the anode block runs at 150°C or at the maximum temperature it will reach in the absence of cooling, whichever is lower. This shall be adjusted during the Oscillation (2) portion of the cycle.
- Note 16: The tube shall be operated in a transmission line with a load VSWR of 1.5:1 and variable phase. At specified pressure, there shall be no evidence of breakdown at either the input or output assemblies.
- Note 17: If during life test the tube does not meet the specified limits, it shall be recycled for an additional five cycles. At such time, the tests shall be repeated. Should the tube fail the second test, it shall be considered unsatisfactory.
- Note 18: Direction of vibration shall be in a plane perpendicular to the axis of the cathode.
- Note 19: Stability shall be measured in terms of the average number of output pulses missing, expressed as a percent of the number of input pulses applied during the period of observation. The missing pulses (M.P.), due to any causes, are considered to be "missing" if the r. f. energy is less than 70 percent of the normal energy level in the frequency range of 9330 to 9425 megacycles. The VSWR of note 9 shall be adjusted to that phase producing maximum instability and the missing pulses counted during the first minute of operation.
- Note 20: This test shall be performed on four tubes per month when tube is in continuous production, but shipments of that month's production shall not be held pending completion of the test. So long as three of the four tubes for each of the first three months of a production run pass the test and 75 percent of the cumulative quantity of tubes tested pass the test, tubes shall be considered to conform to this specification. If either of the conditions are not met, shipments shall be halted until three of four tubes of current production conform to test.
- Note 21: The AQL for the combined defectives for attributes in Measurements Acceptance Tests, Part 1, excluding Inoperatives and Mechanical shall be one (1) percent. A tube having one or more defects shall be counted as one (1) defective. MIL-STD-105, Inspection Level II shall apply.
- Note 22: Reference specification shall be of the issue in effect on the date of invitation for bid.

