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MINISTRY OF SUPPLY (R.R.E.)

VALVE ELECTRONIC **CV2424-27**

Specification MOS/CV2424, 2425, 2426, 2427. Issue No. 2. dated 15. 1. 59. To be read in conjunction with K1006 and with MIL-E-1/9790 dated 18th June, 1957.	Security Specification: Restricted Valve: Unclassified
Type of Valves: Pulse Magnetron, Fixed Frequency Prototype: 4J50A. with different frequency range, and additional rugged features. (VX9170, VX2519).	MARKING See K1001/4 Additional Markings:- Serial No. .....
RATING RATING as on Page 1 of MIL-E-1/9790 with additions as in notes AA-CC.	Connections and Dimensions As MIL-E-1/9790 plus dimensioned collar (Note GG).
TESTS TESTS as on Pages 2, 3 of MIL-E-1/9790 with additions as in notes AA, DD-GG.	

NOTES

A.A. Amend frequency as in following table:

Valve	Nominal fixed frequency Page 1 Phase of Sink Page 2	Osc.(1) Frequency page 2 Life test end point Page 3.	Note 5 Page 3	Units
CV2424	8580	8500 - 8665	8475 - 9020	Mc/s
CV2425	8750	8665 - 8830	" "	"
CV2426	8910	8830 - 8995	" "	"
CV2427 (Restricted use only)	8960	8925 - 8995	" "	"

B.B. The duty cycle of .001 may be exceeded provided that Pi does not exceed 635 watts and that ib lies between the stated MAX limits and the MIN limits as under:-

CV2424, 25, 26 MIN limit 15 Amps
CV2427 MIN limit 12 Amps (Restricted use only.)

C.C. Output Coupling Add:- Magnetron couples to choke flange Z830033. Details of this and related items are given in RCL351, 352, which may be obtained from Radio Components Standardisation Committee, 77-91 New Oxford Street, London WC1.

D.D. Copies of "Inspection Instructions for Electron Tubes" can be obtained from the Secretary TVC/TL5(B), The Ministry of Supply, Castlewood House, 77-91 New Oxford Street, London W.C.1.

E.E. Page 2. Qualification:- Required for CV Markings.

F.F. Page 2. Holding Period:- Add (a) ^{M}t = 24 hrs, Ef = 7.0 Vac, for test tk = 60, Ef = 13.75 Vac. Valve must repass all 100% tests.
Add (b) ^{M}t = 1200 hrs no voltages, valve must repass all 100% tests. Shipments will be discontinued if a failure occurs. Shipment can be resumed if no rejects in next five tested, and if no more than one in the next fifteen tested.

C.G. Page 2. Dimensions:- As drawing on Page 4. In addition the diameter of the undimensioned collar shall not exceed 1.375 inches. (See central projection and two left hand side scrap views).

H.H. Page 2. Container Drop:- Add to meet the requirements of K1005.

J.J. Page 2. Insert after Container Drop:- ***Impulse Acceleration no voltages, acceleration = 25g. MIN for 40 milliseconds. Valve must repass all 100% tests.

K.K. 4.9.19.2. ***Vibration:- Add 50c/s at 10g (MIN) for one minute (MIN). Valve must repass all 100% tests.

L.L. Page 2. Insert below 4.9.19.2: ***Vibration with pulse voltages. Conditions:- As for Osc(1) test, limits as for Osc(1) tests, microphony ΔF = 1.0mc/s total excursion. The vibration to be applied shall be those illustrated in Fig 2(c) of RAE Technical Memo. Des 1. Issue 1, July 1952, as modified by the transmission curves of Fig 3 (Loc.cit). The vibration shall be applied along the axis of the cathode stem and in two other mutually perpendicular directions at right angles to this

M.M. Page 2. Insert between 4.10.8 and 4.16.3:- ***Additional Type Approval Test. For this the following test shall be carried out as the third test after the specified holding period of 168 hrs (MIN). The stability shall be measured as in Note 5, and recorded. The spectrum width, expressed as a multiple of $\frac{1}{tp}$, and the minor lobe height shall also be measured, Notes 3 and 4 also apply.

Parameter	Symbol	Units	Value
Initial anode temperature	-	°C	-50°C MAX.
Heater warm up time	tk	secs	180 MAX.
Initial heater voltage	Ef	volts	13.0 MAX.
Heater supply frequency	F	cps	1000 ± 10%
Pulse current	ib	Amps	15 MAX for CV2424,5,6 12 MAX. for CV2427
Duty Cycle	Du	-	.002 MIN.
Heater run voltage	Ef	volts	13.3 - .0125 Pi for Pi < 595 watts, 23.3 - .0293 Pi for Pi > 595 watts.
V.S.W.R. of load	-	ratio	1.5 MIN.
Phase of V.S.W.R.	-	-	All
Pulse width	tp	uS	1 ± .01
dv/dt at onset of R.F.	r.r.v.	kv/uS	60 MAX.

N.N. Transfer Note 7 from Stability on Page 3 to Stability on page 2.

O.O. Delete Note 9.

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P.P. Page 2. Oscillation (1) and Oscillation (2):- Add the following:- A modulator will be accepted as having a suitable Rate of Rise of Voltage if it is demonstrated to the satisfaction of the Inspecting Authority that the maximum rate of rise of voltage measured lies within the specified limits. During the measurement of rate of rise the modulator will be adjusted so that it would give the specified operating conditions if any otherwise acceptable magnetron were fitted. For the test the modulator shall be terminated by a capacitor of value equal to the nominal input capacitance of the magnetron. The measurement shall be made over the interval between the point where the voltage first equals 80% and the point where it first equals 100% of the pulse voltage of the magnetron. The value shall not fall after its maximum in this interval to less than 95% of the maximum value.

Q.Q. For Type Approval the manufacturer shall make four valves available, and shall carry out all the tests (except life) on these valves. In addition at least one valve shall have been life tested. The manufacturer shall send to the approving authority detailed results of these tests. The approving authority shall be enabled to repeat any of these tests, using the same valves. The valves delivered shall be similar to the Type Approval samples.

MIL-E-1/979C
18 June 1957
SUPERSEDING
MIL-E-1/979B
26 December 1956

INDIVIDUAL MILITARY SPECIFICATION SHEET

ELECTRON TUBE, MAGNETRON, PULSE

JAN-4J50A

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

Description: Magnetron, Pulse, 9375 Mc Nominal Fixed Frequency, 225kw Nominal Peak Power Output, Permanent Magnet, Air Cooled

Absolute Ratings: (Note A)

Parameter:	Ef	If	tk	VSWR	rrv	Alt.	Anode T	Cathode T	Du
Units:	V	A	sec.		kv/us	mm of Hg	°C	°C	—
Maximum:	15	15	—	1.5	160	—	150	165	.001
Minimum:	—	—	180	—	60	600	—	—	—
Notes:	D	(Surge)	—	—	—	—	E	E	—

Design Ratings: (Notes B & C)

Parameter:	Ef	ib	Pi	tp	rrv @ tp= 0.5 us	rrv @ tp= 1.75 us	rrv @ tp= 5.0 us	Pressurization Input	Pressurization Output
Units:	Vac	a	W	us	kv/us	kv/us	kv/us	PSIA	PSIA
Maximum:	Note D	27.5	750	6.0	160	140	110	45	45
Minimum:	Note D	—	—	—	120	95	70	—	—
Notes:	—	F	—	—	C	C	C	—	G

Output Coupling: Magnetron couples to a UG-52A/U choke flange.

Note A: These ratings can not be used simultaneously and no individual rating should be exceeded. The requirements of MIL-E-1, paragraph 6.5 apply.

Note B: To relate the various parameters employ the following formula:

$$Pi = ib \times Du \times 21.5kv$$

Note C: The rate of rise of voltage (rrv) shall be expressed in kilovolts per microsecond 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 uufd.

Note D: Prior to the application of high voltage, the cathode shall be heated to the required initial operating temperature. This may be done by applying 13.75 volts for three minutes. On standby, the heater voltage shall not exceed 13.75 volts. On the application of anode power, the heater voltage should be lowered to the voltage specified, and for various power inputs, up to 595 watts, it should be adjusted approximately (within 5 percent) according to the following formula:

$$Ef = 14 - 0.0125\ Pi$$

For inputs above 595 watts, the following formula shall be used:

$$Ef = 24 - 0.0293\ Pi$$

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

Note E: To be measured at the point specified on the Outline Drawing.

Note F: For pulse widths above 1.2 us, the maximum design pulse current shall be reduced in accordance with the following formula:

$$ib = 29.6 - 1.934\ tp$$

Note G: To prevent waveguide breakdown, pressurization is required.

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

Ref.	Test	Conditions		Min.	Max.	
3.1	Qualification	Required for JAN Marking				
4.5	Holding Period:	t= 168 hours				
4.9.2	Dimensions:	Per Outline Drawing				
4.9.8	Salt Spray Corrosion:	Omit				
4.9.18	Container Drop:	(i) Package Group 9; Container Size D				
4.9.19.1	*Vibration:	No Voltages				
4.9.19.2	**Vibration:	No Voltages				
———	**Phase of Sink:	F=9375Mc, Note 8	Dist:	.25	.40 λg	
4.9.13	Pressurizing:	40 to 45 psia; input and output assemblies				
4.10.8	Heater Current:	Ef= 13.75 Vac; tk= 180 (Min.)	If:	3.0	3.5	A
4.16.3	Oscillation (1):	Notes 1, 2, and D				
4.16.3.2	Heater:	Ef=13.75 Vac for tk=180 (Max.); Ef=6.6 Vac for test				
4.16.3.3	Pulse Characteristics:	tp=0.5$\pm$ 0.05 us; Du=0.001; rrv=160 kv/us (min.)				
4.16.3.4	Average Anode Current:	Ib=27.5 mAdc				
4.16.3.5	Pulse Voltage:		epy:	20.0	23.0	kv
4.16.3.6	Power Output:		Po:	225	—	W
4.10.7.3	Frequency:	Temp. of anode block approx. 100°C	F:	9345	9405	Mc
4.16.5	Pulling Factor:		Δ F:	———	15	Mc
4.16.3.7	Spectrum Measurements:	Notes 3, 4, and D Ib= 18, 23 and 27.5 mAdc				
	Minor Lobes		Ratio:	6	—	db
	R. F. Bandwidth		Δ F:	—	2.5/tp	Mc
———	Stability:	Notes 3 and 5	M.P.:	—	1.0	%
4.9.14	**Temperature Coefficient:	Anode temp = 70°C to 100°C at reference point	ΔF/ΔT:	—	0.25	Mc/°C
4.16.1	**Air Cooling:	Note 6	Δ T:	—	50	°C
4.9.1[illegible]	**Low Pressure Operation:	Pressure=600 mm Hg absolute (max.)				
4.16.3	Oscillation (2):	Notes 1, 2, and D				
4.16.3.2	Heater:	Ef=13.75 Vac for tk=180 (Max); Ef=9.2 Vac for test				

Ref.	Test	Conditions	Min.	Max.
4.16.3.3	Pulse characteristics:	tp=5.5 ≠ 0.5 us; Du= .001; rrv= 110 kv/us(min.)		
4.16.3.4	Average Anode Current:	Ib= 18 mAdc		
4.16.3.6.1	*Power Output:		Po: 140	— W
4.16.3.7	*R. F. Bandwidth:		Δ F: —	1.0 Mc
———	≠Stability:	Notes 3, 5 and 7	M.P.: —	1.0 %
4.9.15	**Low Temperature Operation:	tk= 180 (max.)		
4.11	Life Test:	Oscillation (1); Group D; VSWR = 1.5:1 (min.) cycled through λ g in 30 minutes max.	Life: 682 —	Cycles

One cycle shall consist of the following:

Condition	Ib	Ef	Duration
Standby	0	13.75 Vac	3 minutes
Osc. (1)	27.5 mAdc	6.6 Vac	22 minutes
Off	0	0	5 minutes minimum

4.11.4	Life Test End Points:	Oscillation (1)		
		Power Output	Po: 170 —	W
		Frequency	F: 9345 9405	Mc
		R. F. Bandwidth	Δ F: — 3.0/tp	Mc
		Stability	M.P.: — 2.0	%
		Side Lobes	Ratio: 6.0 —	db

Note 1: The Modulator shall be such that the energy per pulse delivered to the tube, if arcing occurs, can not greatly exceed the normal energy per pulse.

Note 2: 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.

Note 3: 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 4: A suitable spectrum is considered one in which the major lobe has a shape such that its slope does not change sign more than once for power levels greater than the specified db below its peak.

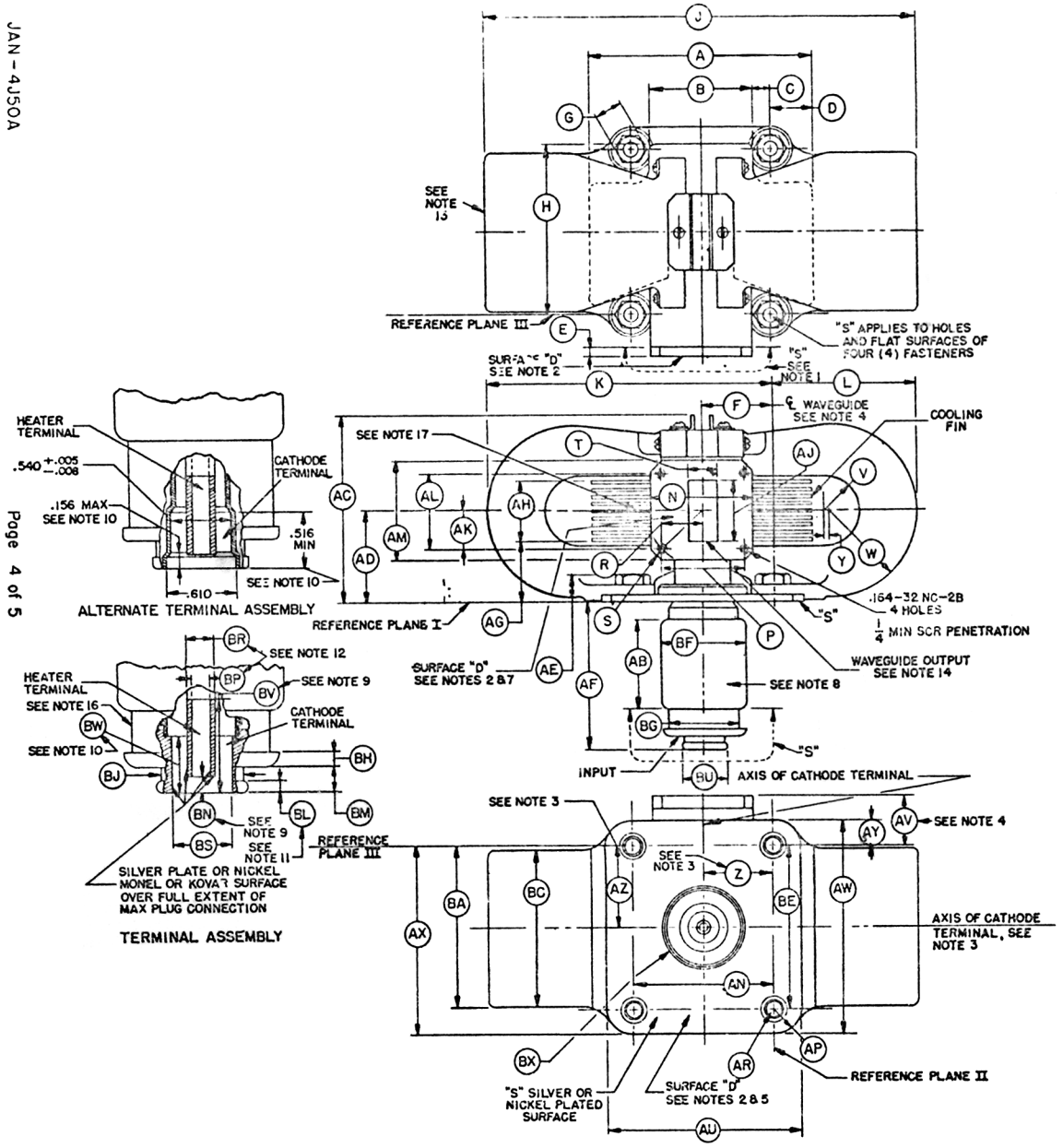
Note 5: Stability shall be measured in terms of the average number of output pulses missing, expressed as a per cent of the number of input pulses applied during the period of observation. The missing pulses (M.P.), due to any causes, are considered to be "missing" if the RF energy is less than 70 percent of the normal energy level in the frequency range of 9330 to 9425Mc. The VSWR of Note 3 shall be adjusted to that phase producing maximum instability and the missing pulses counted during any consecutive five minute interval of a ten minute test period.

Note 6: An air flow of 80 cfm at approximately 760 mm of mercury will be directed on the cooling fins from an orifice of 4-1/4 by 1-1/4 inches. The temperature rise shall be measured at that point on the anode block specified on the outline drawing.

Note 7: This test shall be the first one performed after the specified holding period.

Note 8: 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 9: Referenced specification shall be of the issue in effect on the date of invitation for bids.



REF	DIMENSIONS	
	MIN	MAX
*A	4.000	
*B	1-7/8	
*C	5/16	
*D	3/4	
*E	1/4 (FLANGE)	
F	1.250	
*G	1/2	
*H		3-1/8
*J		7-11/16
*K		5-3/32
*L		2-19/32
*N	1.830	
P	1.470	1.478
R	.732	.742
*S	1-5/32 R	
*T	.497	
*V	5/8 R	
*W	1-9/16 R	
*Y	3/64	
Z	1.250	
*AB	1½ (MIN. GLASS LENGTH)	
*AC		3-13/32
AD	1.633	1.673
*AE	19/32	21/32
AF	2-5/8	2-3/4
*AG	1-3/32	1-3/16
*AH	61/64	1-3/64
*AJ	1.122	
AK	.671	.681
AL	1.348	1.356
*AM	1.820	1.840
AN	2.490	2.510
*AP	13/32 R	
*AR	.276 DIA	.286 DIA
*AU		3-15/32
AV	.882	.932
*AW		2-7/8
*AX		3-27/64
*AY		27/64
AZ	1.500	
*BA		3.000
*BC		2-7/8
BE	2.990	3.010
*BF		1-1/2
*BG	1-1/4 DIA	
*BH	.125	
*BJ	.750 DIA	
BL	.115	.135
BM	.250	
BN	.125	.137
BP	.164	.174
BR	15/64	17/64
BS	.532	.545
BU	.825	.830
BV	3/4	
BW	.516	
*BX		1-1/2 DIA

NOTES:

** 1. ALL METAL SURFACES COVERED BY BLACK FINISH EXCEPT THOSE MARKED "S" & "D". ("S" SHALL BE SILVER OR NICKEL PLATED SURFACES)

2. HERMETIC CONNECTIONS CAN BE MADE TO SURFACE "D".

3. THE AXIS OF THE CATHODE TERMINAL SHALL BE WITHIN A RADIUS OF 3/64 OF THE SPECIFIED LOCATION. (NOTE 4 APPLIES)

4. THE LIMITS INCLUDE ANGULAR AS WELL AS LATERAL DEVIATIONS.

* 5. ALL POINTS ON THE MOUNTING SURFACE SHALL BE WITHIN .005 OF REFERENCE PLANE I.

** 6. DIMENSIONS WITHOUT LIMITS ARE FOR EQUIPMENT DESIGN AND QUALIFICATION APPROVAL ONLY AND NEED NOT BE CHECKED.

* 7. WITH THE FLANGE ON A PLANE SURFACE, A .005 THICKNESS GAUGE 1/8 WIDE SHALL NOT ENTER.

8. ANY PORTION OF THE ASSEMBLY EXTENDING BELOW REFERENCE PLANE I SHALL BE WITHIN A 3/4 RADIUS OF THE SPECIFIED AXIS OF THE INPUT.

9. THESE DIMENSIONS DEFINE THE EXTREMITIES OF THE CYLINDRICAL SECTION GIVEN BY THE "BP" DIMENSION.

10. THESE DIMENSIONS DEFINE THE EXTREMITIES OF THE CYLINDRICAL SECTION GIVEN BY THE "BS" DIMENSION.

**11. NO CLAMPING MEANS TO BEAR BEYOND THIS DIMENSION.

12. THE HEATER TERMINAL SHALL BE CONCENTRIC WITH THE CATHODE TERMINAL WITHIN .010.

13. WARNING - MAINTAIN MINIMUM CLEARANCE 2 INCHES BETWEEN THIS MAGNET AND MAGNETIC MATERIAL (MAGNETS, STEEL TOOLS, PLATES, ETC).

**14. THE OPENING IN THE WAVEGUIDE SHALL BE ENCLOSED BY A DUST COVER WHEN TUBE IS NOT IN USE.

15. MEANS OTHER THAN SOFT SOLDER SHALL BE USED FOR MECHANICAL STRENGTH.

16. THE INCLUSION OF A CYLINDRICAL RIB 1/8 WIDE, 1.312±.015 DIAMETER WITH CENTER LOCATED 9/32 FROM THE BOTTOM EDGE OF THE FLANGE MAY BE USED AS AN ALTERNATE DESIGN.

17. TEMPERATURE RISE TEST POINT. THIS POINT IS ON THE ANODE BLOCK IN FRONT OF COOLING FINS.