

MINISTRY OF SUPPLY - R.R.E.

VALVE ELECTRONIC

CV2281

Specification MDS/CV2281 Issue 4, Dated 10, 6, 58 To be read in conjunction with K1001 excluding 5.2, 5.3, and 5.8.	SECURITY <u>Specification</u> <u>Valve</u> Restricted Unclassified
---	--

TYPE OF VALVE - Package magnetron CATHODE - Indirectly heated PROTOTYPE - V19041	MARKING See K1001/4																																																															
<table border="1"> <thead> <tr> <th rowspan="2"></th> <th rowspan="2">RATING</th> <th colspan="3">MAX. MIN. Note</th> </tr> <tr> <th>Max.</th> <th>Min.</th> <th>Note</th> </tr> </thead> <tbody> <tr> <td>Heater Voltage</td> <td>V</td> <td>7.0</td> <td>5.7</td> <td>A</td> </tr> <tr> <td>Cathode heating time</td> <td>sec</td> <td>-</td> <td>120</td> <td>A</td> </tr> <tr> <td>Peak Anode Current</td> <td>A</td> <td>5.5</td> <td>3.5</td> <td>-</td> </tr> <tr> <td>Mean Anode power</td> <td>W</td> <td>82.5</td> <td>-</td> <td>B</td> </tr> <tr> <td>Duty cycle</td> <td></td> <td>.0025</td> <td>-</td> <td>C</td> </tr> <tr> <td>Pulse length</td> <td>usec.</td> <td>2.5</td> <td>-</td> <td>C</td> </tr> <tr> <td>Anode temperature</td> <td>°C</td> <td>140</td> <td>-</td> <td>B</td> </tr> <tr> <td>Rate of Rise of voltage</td> <td>KV/usec.</td> <td>75 at 4.5A</td> <td>-</td> <td>B</td> </tr> <tr> <td>Altitude</td> <td>ft.</td> <td>10,000</td> <td>-</td> <td>-</td> </tr> <tr> <td>Frequency</td> <td>M/s</td> <td>8830</td> <td>8770</td> <td>-</td> </tr> <tr> <td>V.S.W.R.</td> <td></td> <td>1.5:1</td> <td>-</td> <td>-</td> </tr> </tbody> </table>		RATING	MAX. MIN. Note			Max.	Min.	Note	Heater Voltage	V	7.0	5.7	A	Cathode heating time	sec	-	120	A	Peak Anode Current	A	5.5	3.5	-	Mean Anode power	W	82.5	-	B	Duty cycle		.0025	-	C	Pulse length	usec.	2.5	-	C	Anode temperature	°C	140	-	B	Rate of Rise of voltage	KV/usec.	75 at 4.5A	-	B	Altitude	ft.	10,000	-	-	Frequency	M/s	8830	8770	-	V.S.W.R.		1.5:1	-	-	DIMENSIONS AND CONNECTIONS See Page MOUNTING POSITION Any SUPPORT Face Plate WEIGHT 5lbs, approx.
			RATING	MAX. MIN. Note																																																												
	Max.	Min.		Note																																																												
Heater Voltage	V	7.0	5.7	A																																																												
Cathode heating time	sec	-	120	A																																																												
Peak Anode Current	A	5.5	3.5	-																																																												
Mean Anode power	W	82.5	-	B																																																												
Duty cycle		.0025	-	C																																																												
Pulse length	usec.	2.5	-	C																																																												
Anode temperature	°C	140	-	B																																																												
Rate of Rise of voltage	KV/usec.	75 at 4.5A	-	B																																																												
Altitude	ft.	10,000	-	-																																																												
Frequency	M/s	8830	8770	-																																																												
V.S.W.R.		1.5:1	-	-																																																												

NOTES

- A. The Cathode heating time shall be a minimum of 120 seconds at an ambient temperature of greater than 0°C, and a minimum of 180 seconds at temperatures between 0°C and -55°C.

For mean power inputs in excess of 25 watts, the heater voltage shall be reduced within 3 seconds after applying high voltage according to the following schedule

$$E_f = 6.3 \left(1 - \frac{P_i}{180} \right) \pm .6 \text{ volts, where :-}$$

P_i = Average pulse power input in watts.

At no time shall the heater current be allowed to reach a surge value of 3 amperes.

When operated under the conditions specified in Note C, the heater voltage shall be reduced to $4.5V \pm 10\%$.

Z.17353.R

CV2281/4/1

- B. The anode shall be cooled to the temperature specified by a suitable flow of air over the anode body, and guide attachment brackets which serve as cooling fins.

The preferred direction of air blast is indicated on outline drawing.

- C. These ratings apply only for operation with equally spaced pulses.

The valve may also be operated in "bursts" of pulses under the following conditions:-

Pulse length	0.45 usec.
P.R.F.	50Kc/s for bursts of 40 usec. duration
Frequency of bursts:	2 e/s.
Peak anode current	4.0 to 5.5A
Rate of rise of voltage	80 KV/usec. abs. max.

The peak current may exceed this value to a max of 8 amps. peak during not more than the first 10% of the burst, but the missing pulse ratio for these pulses may exceed the figure given in the test specification.

- D. The rate of rise of voltage is defined as the slope of the steepest tangent above 80% amplitude.
- E. The CV2281 is used in ARI 5851 and ARI 5885. The mounting position of the magnetron relative to the hole in the bulkhead screen is shown on drawing on page 9 .

To be performed in addition to those applicable in K1001

Test Conditions, P or Q unless otherwise specified								
V _n	I _a (Mean)	Pulse width	Duty	rrv				
(V)	(mA)	(μ s)	Cycle	KV/ μ sec.	Note 1			
P 4.5	9	1.0 \pm 0.1	.002	75 min.				
Q 6.3	4.5	2.0 \pm 0.2	.001	75 min.				
Test	Test condition	Notes	AQL %	Insp. Level	Symbol	Limits		Units
						Min.	Max.	
a Heater Current	V _h = 6.3V	"	-	100%	I _h	.43	.60	A
b Peak Anode Voltage	P	1, 2, 3.	-	"	V _a	5.3	5.7	KV
c Power Output	P	"	-	"	-	14	-	W
d Frequency	P	1, 2, 3, 4	-	"	f	8770	8830	Mc/s
e Frequency Pulling	P	1, 2, 3, 5	-	"	-	-	15	Mc/s
f Bandwidth	P, I _a = 7.5mA	1, 2, 3, 6	-	"	BW	-	2.5	Mc/s
g Bandwidth	P	"	-	"	"	-	"	"
h Missing Pulses	P	1, 2, 3, 7	-	"	-	-	0.25	%
j Bandwidth	Q, I _a = 3.5 mA	1, 2, 3, 6	-	"	BW	-	1.25	Mc/s
k Bandwidth	Q	"	-	"	"	-	"	"
l Missing Pulses	Q	1, 2, 3, 7	-	"	-	-	0.25	%
m Cold impedance, V.S.W.R.	No voltages	9	-	"	VSWR	8	-	-
n Cold impedance, Position of min.	No voltages	9	-	"	-	Record	-	mm.
o Life Test	Q	1, 2, 3, 16.	-	8	-	250	-	hrs
	End Points	-	-	-	-	-	-	-
	Test (e)	-	-	-	-	11	-	W
	Test (d)	-	-	-	f	8770	8830	Mc/s
	Test (f)	-	-	-	BW	-	3.0	Mc/s
	Test (j)	-	-	-	-	-	1	%
p Vibration	No voltages	8, 10, 17	6.5	I	-	-	-	-
q Pressurizing	No voltages	11	-	100%	-	45	-	lbs/sq. in. Abs.
r Drop	No voltages	12, 17	6.5	I	-	-	-	-
s Burst Operation	Operating voltage	1, 2, 13	-	100%	V _a	5.3	5.7	KV.
	Peak Operating Current	"	-	"	I _a peak	4.75	5.5	A.
t Burst Operation Made change	Current Range	1, 13, 14	-	"	"	4.0	5.5	A.
u Low temperature Operation.	See note 15.	15.	-	T.A.	-	-	-	-

CV2281/4/3

1. Full heater voltage to be applied for 2 minutes for ambient temperatures above 0°C before application of H.T. Heater Voltage to be reduced as required within 3 seconds of application of H.T.
2. The Rate of Rise of Voltage of the test modulator shall be determined by the method given below.
The value obtained for the Rate of Rise of Voltage must not be less than the value specified. A modulator will be accepted as having suitable characteristics in respect of Rate of Voltage if the instantaneous value of the rate of rise of voltage measured with the modulator adjusted to give the specified operating conditions with the magnetron under test and with the magnetron then replaced by a capacitor of value equal to the nominal input capacitance of the magnetron where specified and otherwise equal to the average value for the type of magnetron submitted, the measurement being made over the interval between the point where the voltage first equals 80% and the point where the voltage first equals 105% of the Pulse Voltage of the magnetron under test, measured under the conditions obtaining during the test, does not fall after the maximum in this interval to less than 95% of its maximum value nor has a value less than 90% of its maximum at any point in the interval.
Measurement of Rate of Rise of Voltage. The Rate of Rise of Voltage is defined as the maximum instantaneous value of rate of rise of voltage measured across the magnetron under test after the voltage first exceeds 80% of the Pulse Voltage of the magnetron under test measured under the conditions specified for the test. Any capacitance used in the viewing system shall not exceed 6.0µF. See Radiation Laboratory Report No. 523 which may be obtained from the Technical Information Library, First Avenue House, High Holborn, London, W.C.1. quoting reference C.R.B.44/3332.
3. Refers to operation in approved modulator. Load V.S.W.R. must not exceed 1.05.
4. Anode block temperature $40^{\circ}\text{C} \pm 10.0^{\circ}\text{C}$, measured at point indicated on outline drawing.
5. V.S.W.R. greater than 1.5 in all positions of the mismatch. Frequency pulling is the maximum variation in frequency as the mismatch is varied through all phases.
6. Bandwidth to be $\frac{2.5}{\text{tp}}$ Mc/s maximum as measured on a spectrum on a spectrum analyser at \pm power points. The side lobes must be at least 6db down.
7. Pulses are defined as missing if their energy is less than 70% of normal level in range 8770 to 8830 Mc/s. The number of missing pulses shall not exceed the number specified, expressed as a percentage, during any consecutive 5-minute interval of a 15-minute test period.

8. Ten valves per week minimum, initially until an evidence of satisfactory quality, the inspector will apply the provisions of para. 17 below.
9. First standing wave minimum located on waveguide side of Reference Plane A, and measurement taken between these points. When this number is subtracted from $\lambda/2$ the remainder, (Length of point A to minimum towards tube), should fall in specified limit.
10. Each valve shall be mounted rigidly on a platform and vibrated with simple harmonic motion of $0.040'' \pm 0.025''$ amplitude, at 25 ± 2.0 cps at right angles to direction of Cathode support for 60 secs. Tube must re-pass tests a-1.
11. Leakage to be less than .005 lbs./wt./hour. (This is equivalent to a drop in pressure of $\frac{1}{25}$ p.s.i. per min. for a container of capacity N litres pressurised to 45 lbs/sq.ins abs.).
12. Initially 10 valves min. per month shall be packed in approved packing and dropped four times. Once on the top and bottom and once on each of two adjacent sides, from a height of 3 feet onto a rigid horizontal surface. Valves must re-pass all above tests a-1. On evidence of satisfactory quality the provisions of para. 17 below will apply.
13. Refers to operation in an approved modulator. 25% of valves must run for 12 hours and then re-pass tests a-1. If no failures the remainder may be run for 1 hour only. If any failures all valves must be run for 12 hours.

The modulator shall have the following characteristics:

Pulse length	0.4 usec. Min.
Duty Cycle	.0016 min.
Pulse repetition rate	50 Kc/s $\pm 5\%$
Duration of Burst	40 ms. $\pm 5\%$
Rate of rise of voltage	80 KV/ per usec. min.

For example, modulators as in Note E may be used. Adjust mains input to 115 volts, if peak current is outside limits and KV within limits, and the valve is oscillating in the right mode, the modulator must be adjusted. The adjustment may be done by varying the input voltage to the E.H.T. supply for the final valve.

14. The current shall be varied over the range prescribed.

Two alternative methods of test are acceptable:-

- (a) There shall be no missing pulses as viewed on a spectrum analyser nor any double current or voltage pulses.
- (b) The number of missing pulses (as defined in Note 7) shall not exceed 1%, ignoring up to the first 10% of the burst.

15. Low Temperature Operation (Type Approval Test).

The valve shall operate satisfactorily at -55°C with not more than 180 seconds between the application of V_h and V_a . The valve to be at -55°C initially.

16. The magnetron is classed under Group D (MIL-E-1C Specification) for the purpose of life testing. The definitions of average life and other relevant factors are given in the document, "Inspection Instruction for Electron Tubes" Oct. '55, published by: Armed Services Electron Standards Agency, Fort Monmouth, New Jersey, and obtainable from the Secretary, M.O.S., Castlewood House, New Oxford Street, London, W.C.1. Further information is given in the K1006 (II) Specification, para 4.11.3.2.

The relevant information is given below:-

The number of tubes to be life tested shall not be less than one per month. At the option of the manufacturer additional tubes in any quantity considered necessary to represent more accurate statistical sampling of the lot may initially or subsequently be subjected to life test. Such tubes shall be subjected to all tests required and failure data shall be based on the total number of tubes placed on test. Tubes used for the life test shall be manufactured in addition to the quantity called for in the order, and shall be manufactured and tested at the expense of the contractor. The tubes shall be taken at random by the Government inspector throughout the production.

In calculating the average life of a life test group of tubes the life of each tube shall be determined by adding to the hours at the last life-test-and-point passing test either 10% of the hours specified as the minimum life, or one-half of the hours between the last life-test-and-point passing test and the life-test-and-point failure test, whichever value is smaller. At the conclusion of the time specified for life test, the average life of the life test group of tubes placed on test shall be not less than 80% of the number of hours specified. If this percentage is not attained, all tubes represented by the sample shall be rejected subject to negotiation.

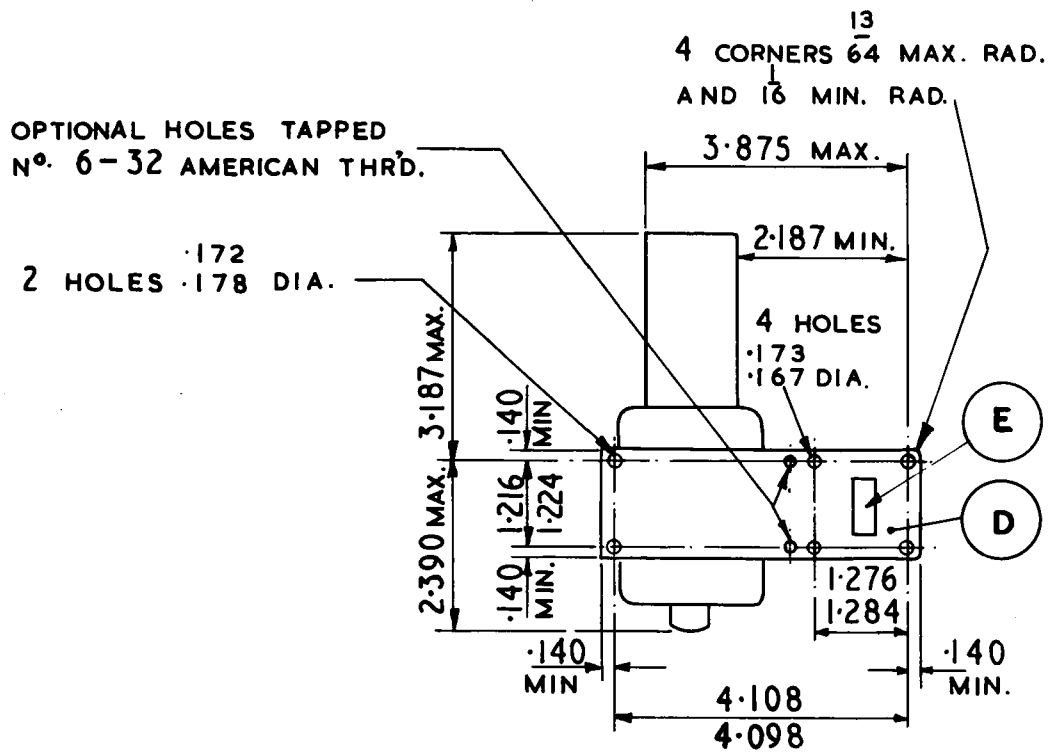
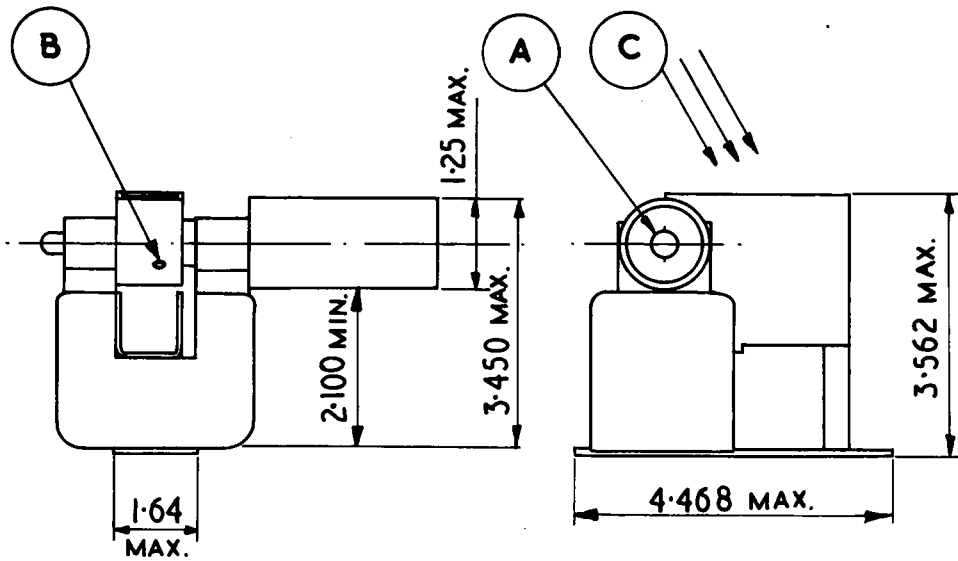
17. When in full production, Acceptance Sampling Procedures as set out in Para. 5.3.2. of Inspection Instructions for use with K1006 shall apply with the following exceptions:-

- (1) A lot shall consist of 111 valves or 1 month's production whichever is the greater (5.3.1.3. refers).
- (2) A valve having one or more defects shall count as one defective.
- (3) Reduced inspection may be allowed after 5 successive lots have been accepted (MIL-STD-105A para. 9.3.3. refers).
- (4) Normal inspection shall be used and shall be continued until reduced or tightened inspection is used. (MIL-STD-105A para. 9.2 refers).

GENERAL DRAWING NOTE

- A. 0.84 ID x 0.56 Deep (MIN) with bayonet Lamp cap type BA9s/4 (B.S.52. 1952) Centre Line through pins to be within $\pm 10^\circ$ to vertical centre line through valve.
- B. Anode temperature measured at this point.
- C. Recommended direction of air blast.
- D. Surface A: With tube resting on a flat surface, a feeler gauge .020 thick and $\frac{1}{8}$ " wide shall not enter more than $\frac{1}{8}$ " at any point. Mounting surface and interior surfaces of waveguide shall be plated or otherwise protected against oxidation in an approved manner.
- E. The position of the waveguide hole shall be such as to ensure satisfactory electrical performance when using a standard W316 coupler IEC Ref. 2830051. Details of this and related items are given in RCL 351, 352, which may be obtained from Radio Components Standardisation Committee, 77-91 New Oxford Street, London W.C. 1.

THIRD ANGLE PROJECTION



DIMENSIONS IN INCHES.

