MINISTRY OF AVIATION R.R.E. VALVE ELECTRONIC **CV 2373**

Specification MOA/CV 2373 Issue 2 dated 16th March, 1962. To be read in conjunction with K1001 excluding 5.2, 5.3, 5.8	SECURITY Specification: Unclassified Valve: Unclassified

→ denotes a change

TYPE OF VALVE:- Package Magnetron

CATHODE:- Indirectly-heated

PROTOTYPE:- CV 2229

MARKING

See K1001/4

RATING

			Note
Heater Voltage	(V)	12.6	
Heater Current	(A)	2.25	
Max. Peak Anode Current	(A)	25	A,B
Max. Peak Input Power	(kW)	500	
Max. Anode Input Power	(W)	250	
Max. Duty Cycle		0.0005	A.
Max. Pulse Duration	(usecs)	2.25	
→ Max. Rate of Rise of Pulse Voltage	(kV/usecs)	150	F
Max. Anode Temperature	(°C)	140	
Max. Cathode Terminal Temperature	(°C)	200	
Min. Cathode Heating-time	(secs)	180	C.
Nominal Operating Frequency	(Mc/s)	9375	

CONNECTIONS AND DIMENSIONS

See Drawing and Drawing and Gauge Notes on Pages 6 - 10

JOINT SERVICE CATALOGUE NUMBER

5960-99-000-2373

NOTES

A. During operation when the duty cycle = .0004 and the input power is 160 ± 30 watts, the heater voltage should be reduced to 8.0 volts.

B. Max. peak input power shall not exceed 400 kW with tp = 2.0 usecs.

C. The following switching cycle is recommended :-

Full heater voltage shall be applied for 2 minutes then HT applied to give half input power for 1 minute after which the heater voltage should be reduced to the operating level and full power applied simultaneously.

D. The valve shall not be operated for maximum peak input power at a pressure less than 600 mm Hg.

E. The heater current surge when switching on shall be limited to 3 times the normal operating current. Precautions shall be taken against pulse voltages being generated across the heater terminals.

F. This is dv/dt measured at the onset of RF oscillations.

→

TESTS

To be performed in addition to those applicable in K1001.

Test Conditions - unless otherwise specified, note 16.

Vh (V)	Ia (mean) (mA)	PRF (pps)	tp (usec)	
8.0	9.0	400	1.0	Notes 1, 2, 3.

Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits		Units
					Min.	Max.	
A. Heater Current	Vh = 12.6 V		100%	Ih	2.0	2.5	A
B. Peak Anode Voltage	Notes 2 and 3		100%	Va	18	23	kV
C. Frequency	Notes 2 and 3		100%	f	9325	9425	Mc/s
D. Efficiency	Ia = 9.0 mA Notes 2 and 3		100%	η	35	-	%
E. Frequency Pulling	Ia = 9.0 mA Notes 2 and 4		100%	-	-	15	Mc/s
F. Bandwidth	Notes 3, 5 and 10		100%	BW	-	3	Mc/s
G. Stability	Notes 6, 10 and 13		100%	-	-	0.5	%
H. Mode change	tp = ½ usec. PRF = 800 Vh = 8V Notes 9, 10 and 11		100%	-	-	0.5	%
J. Spectrum	Notes 3, 10, 11 & 12		100%	-	-	6	Mc/s
K. Thermal Factor	Max. RRV = 150 kV/us		T.A.	-	-	-0.25	Mc/°S
M. Low Temperature Operation	Max. RRV = 150 kV/us Note 7		T.A.	-	-	-	-
N. Pressurising	No voltages Note 8		T.A.	-	-	-	-
O. Life Test See K1006 4.11.3 Group D Life test end point 250 hrs. Efficiency				η	25	-	%
P. Shelf Life	Note 15						

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NOTES

1. The valve shall be operated with the heater voltage applied for 3 minutes (max.) before the applications of full H.T. The heater shall be reduced to 8 volts immediately following the application of full power.

2. The instantaneous rate of rise of pulse voltage, dv/dt measured at the onset of RF oscillations, shall exceed 150 kV/μsec.

3. The valve shall be coupled by means of a Waveguide Coupling (I-S Cat. No. Z.830033) into a No. WG15 waveguide line terminated in a resistive load giving a VSWR better than 1.1 to 1.

4. Measured using a VSWR of not less than 1.5 to 1 varied through all phases.

5. With an input pulse width of one microsecond the RF bandwidth shall be measured between one-quarter power points of the spectrum by means of a spectrum analyser.

6. The test shall be performed using Modulator Type 2, after a holding period of not less than 168 hours. The valve shall be started from cold with the switching cycle as detailed in Note 1. The valve shall be operated into a waveguide line giving a V.S.W.R. of not less than 1.5 to 1 adjusted in phase for minimum coupling. The valve shall be considered stable when it shows less than 0.5% of arcs during any five minute interval within 15 minutes of switching on the H.T. The percentage of arcs is defined as the number of arcs in the five minute interval divided by the total number of magnetron pulses during that interval. Arcs shall be recorded by an electronic counter which is adjusted to respond to 10% above the operating peak current.

7. The valve shall operate satisfactorily with not more than 240 seconds between the application of Vh and Va. The valve shall be at -55°C initially.

8. The valve shall be tested for leakage with the air pressure in the input and output waveguide assemblies maintained at 40-45 lbs/sq.in. absolute.

9. The valve shall be operated into a waveguide line giving a VSWR of not less than 1.5 to 1 adjusted in phase for maximum coupling. The valve shall be considered satisfactory when it shows less than the specified number of missing pulses during any five-minute interval of a test period of 15 minutes. The percentage of missing pulses if defined as the number of pulses of RF energy less than 70% of normal in the five-minute interval divided by the total number of modulator pulses in that interval.

10. "The valve shall be tested using a Modulator Type 2 which includes a 0.0025 μF ± 10% capacitor connected between the trigatron output and the earth return of the delay line.

The Modulator shall be used in conjunction with a Pulse Transformer A.M.Reference No. 10K/20384, (permissible alternative 10K/17797), which shall be normally mounted with approximately $\frac{1}{8}$" spacing from Reference Plane 1 of the valve, connections to cathode and heater terminals being made with a Cap Assembly 10AD/813. Connection between the pulse transformer and modulator shall be made with Cable Assembly (High Voltage Pulse) A.M. Reference No. 10HB/3384; permissible alternatives are Connectors Special 10HA/17345, and 10HA/12778.

The trigatron choke shall be adjusted so that the average rate of rise of voltage between the 20% and the 85% levels exceed 110 kV/μsec. (This obsolescent definition is used in order that the current pulse shape normally experienced with this modulator is retained). The choke inductance shall not exceed 14μH.

The voltage monitoring lead shall not remain connected to the valve during the tests G, H and J".

NOTES (Cont'd

11. The Modulator Type 2 shall be adjusted to deliver 500 kW ± 5% peak power at 0.5 microseconds, 800 pps to the valve under test.

12. The spectrum shall be examined at ½ microsecond pulse width.

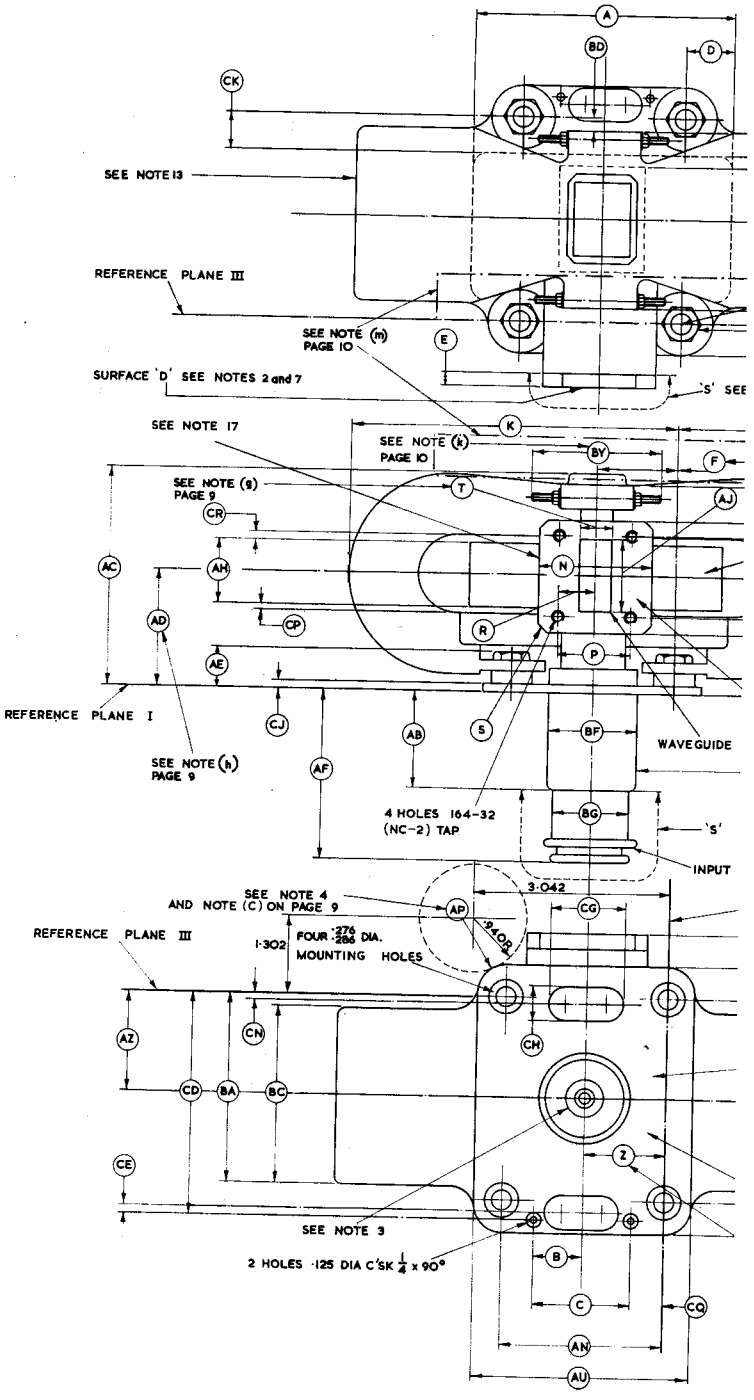
13. The modulator Type 2 shall be set up as in Note 11, then switched to 2 microseconds pulse width without any alteration of the HT control.

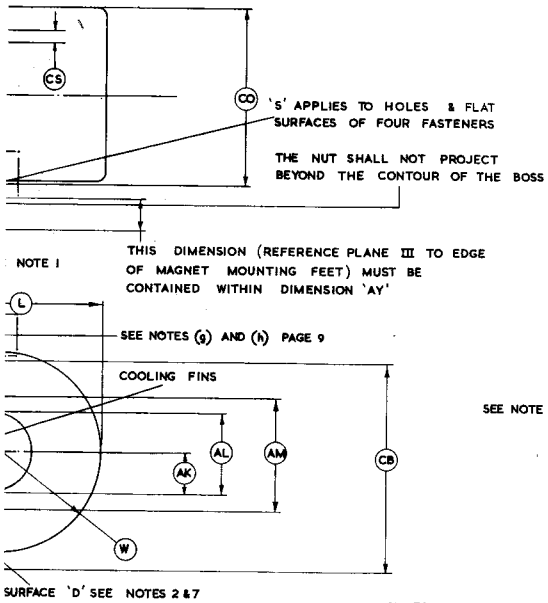
14. The Modulator Type 2, A.M. Ref. No. 10D/18638, as specified in M.O.S./R.R.E. specification RRE 30572, copies of which may be obtained on application to :-

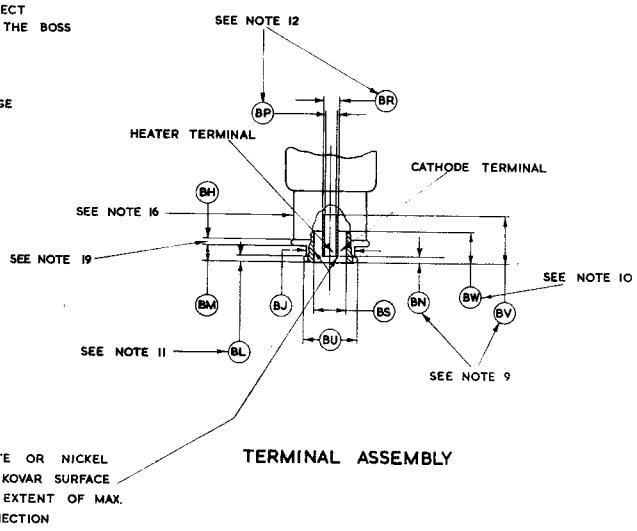
The Secretary, The Ministry of Aviation, Castlewood House, 77-91, New Oxford Street, London,W.C.1.

15. 5% of the production shall be stored for one year. The valves shall pass all the tests. Records shall be sent to the Specification Authority who may require some of these valves to be life tested. At his discretion the remainder may be shipped.

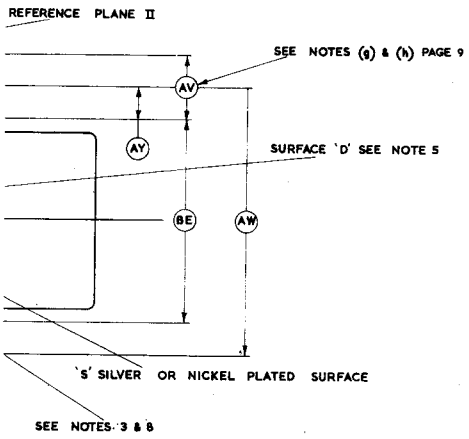
16. At the discretion of the manufacturer, Modulator Type 2 as set up in note 10, but otherwise meeting these conditions, may be used for tests B,C,D,E,K,M.

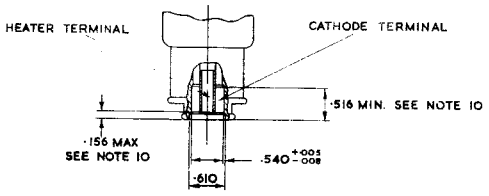

A
BD
D
CK
SEE NOTE 13
REFERENCE PLANE III
SEE NOTE (m) PAGE 10
E
SURFACE 'D' SEE NOTES 2 and 7
'S' SEE
SEE NOTE 17
K
SEE NOTE (k) PAGE 10
BY
F
SEE NOTE (g) PAGE 9
T
CR
AJ
AC
AH
N
AD
CP
R
P
AE
REFERENCE PLANE I
CJ
AB
S
BF
WAVEGUIDE
SEE NOTE (h) PAGE 9
AF
4 HOLES 164-32 (NC-2) TAP
BG
'S'
INPUT
3·042
SEE NOTE 4 AND NOTE (C) ON PAGE 9
AP
CG
REFERENCE PLANE III
1·302
FOUR ·276 ·266 DIA. MOUNTING HOLES
9·409
AZ
CN
CH
CD
BA
BC
CE
Z
SEE NOTE 3
2 HOLES ·125 DIA C'SK 1/4 x 90°
B
C
CQ
AN
AU



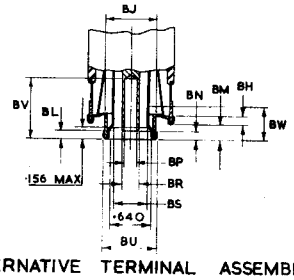


TERMINAL ASSEMBLY





ALTERNATIVE TERMINAL ASSEMBLY I (NOTE 20)



ALTERNATIVE TERMINAL ASSEMBLY II (NOTE 20)

Outline Drawing Dimensions and Notes

All dimensions are in inches.
Tolerances unless otherwise stated: Decimal dimensions ± .005"
: Fractional dimensions ± 1/64"

Ref.	Dimension Min.	Dimension Max.	Insp. Level	Remarks. See drawing notes 6 and 18 (Notes marked (a) etc. are in the "Overall Acceptance Gauges Requirements.)
A	3.95	4.10	100%	Plan dimension of fin packet
B	0.740	0.760	100%	Centre line of both blowing slots
C	1.495	1.505	100%	Hole centres
D	0.7	0.8	100%	Plan view of fin packet to reference plane II
E	0.1875	-	T.A.	Thickness of waveguide flange
F	1.230	1.270	S	See notes (g), (h)
K	-	5.1	S	Magnet from reference plane II
L	-	2.6	S	Magnet from reference plane II
N	1.815	1.845	T.A.	Overall flange dimensions
P	1.470	1.478	100%	Flange hole centres aperture.
R	0.732	0.742	100%	Flange hole centres with reference to centre line of/
S	1.141	1.172	T.A.	Radius
T	0.495	0.499	T.A.	Waveguide aperture. See notes (g), (h)
W	1.4	1.7	T.A.	Magnet radius. See also note (m)
Z	1.250	1.250	-	Basic dimension defines axis Q, see notes 3 and 8
AB	1.5	-	T.A.	Glass length
AC	-	3.6	T.A.	Height of seal off cover. See also note (m)
AD	1.772	1.812	S	See notes (g), (h)
AE	0.594	0.656	100%	Overall height of plate/magnet fixing including screws
AF	2.486	2.611	100%	Height of terminal assembly above reference plane I
AH	0.9	1.1	100%	Fin packet thickness
AJ	1.120	1.124	T.A.	Waveguide aperture. Notes (g), (h)
AK	0.671	0.681	100%	Hole centres to centre line of waveguide aperture
AL	1.348	1.356	100%	Hole centres on flange
AM	1.820	1.840	T.A.	Flange size
AN	2.490	2.510	100%	Magnet-plate fixing centres
AP	0.495	-	100%	Plate radius. See notes 4, (c)
AU	-	3.505	100%	Plate width.
AV	0.882	0.932	100%	See notes (g), (h)
AW		4.130	100%	Plate width
AY		0.452	100%	Edge of plate to reference plane III
AZ	1.500	1.500	-	Basic dimension, defines axis Q, see note 3 and 8
BA	2.875	3.000	100%	Edge magnet from reference plane III
BC	~~2.739~~	2.860	100%	Magnet thickness
BD	0.114	-	100%	Magnet clamp to plate hole centres
BE	2.990	3.010	100%	Plate hole centres
BF	-	1.375	T.A.	Glass diameter
BG	-	1.375	T.A.	Cathode stalk
BH	-	0.150	T.A.	See note 19
BJ	-	0.775	T.A.	Outside of cathode terminal
BL	0.115	0.135	T.A.	Flange
BM	0.2	0.3	T.A.	
BN	0.125	0.187	100%	See note 9
BP	0.164	0.174	S	
BR	0.245	0.255	100%	
BS	0.532	0.545	100%	

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Ref.	Dimension		Insp. Level	Remarks. See drawing notes 6 and 18
	Min.	Max.		
BU	0.825	0.838	S	
BV	0.75	-	S	See note 9
BW	0.516	-	100%	See note 10
BY	-	2.125	100%	Length over screw fixing magnets together, see note (k)
CB	-	3.313	100%	Height of magnet lugs above reference plane I
CD	3.365	3.385	100%	Small hole centres from reference plane III
CE	0.120	0.130	S	Centre line of blowing slot.
CG	1.115	1.135	S	Length slot. Refers to both slots
CH	0.490	0.510	S	Width slot. Refers to both slots
CJ	0.110	0.140	T.A.	Plate thickness
CN	0.048	0.150	S	Centre line of blowing slot
CK	0.365	-	100%	Plan view of fin packet to centre line of fixing holes
CO	-	2.8	S	Width across magnet lugs
CP	0.100	-	100%	Separation of magnet and adjacent fin
CQ	0.48	0.52	S	Hole centre to reference plane II
CR	0.100	-	100%	Separation of magnet and adjacent fin
CS	0.370	-	100%	From edge of fin packet to end of anode block at position above and below fin packet.

Outline Drawing Notes

1. All metal surfaces shall be covered with a black finish except those marked "S" and "D". Surfaces marked "S" shall be Silver or Nickel plated.

2. Hermetic connections can be made to surface "D".

3. Z and AZ are basic dimensions which define an axis Q which is perpendicular to reference plane I.

   The axis of the cathode terminal shall be within a radius of .046 plus any tolerance on BS, of the axis Q. See note (e), page 9.

4. This dimension applies to the corner indicated only.

5. All points on the mounting surface shall be within 0.005 of reference plane I.

6. Dimensions marked T.A. shall be inspected at Type Approval only, and need not otherwise be checked.

7. With the flange on a surface flat to 0.0005 parallel tol., a 0.005 gauge $\frac{1}{8}$" wide shall not enter. This test at Inspection Level S in note 18.

8. Any portion of the assembly extending below reference plane I shall be within a cylinder of diameter $1\frac{1}{2}$" maximum, the axis of which coincides with the axis Q defined in 3 above.

9. These dimensions define the ends of the cylindrical section given by the BP dimension, andthe BR dimension. See also note (n)

10. These dimensions define the ends 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 0.010. See note (p)

13. Warning:- Maintain minimum clearance 2" between this magnet and magnetic materials, (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 $\frac{1}{8}$ wide, 1.312 ± 0.015 diameter with centre located 9/32 from the bottom edge of the flange may be used as an alternative design.

17. Temperature rise test point. This point is on the anode block in front of cooling fins.

18. Dimensions marked S shall be sample inspected at Inspection Level I, given in table IIIA of K1001/AX1. The lot shall mean the batch awaiting release. The lot shall be accepted in respect of these dimensions if no rejects are found.

    If any valve is rejected, the whole batch will be inspected for the dimensions found faulty, and reject valves may not be shipped.

19. The feature defined by this dimension must not exceed 1.375" in diameter, to be checked at sample level S.

    At the discretion of the manufacturer, this feature may be suppressed.

20. Dimensions BN BV BR BP apply to all Terminal Assemblies.

Overall Acceptance Gauges Requirements

At Type Approval, the manufacturer shall submit to the Specification Authority full drawings of acceptance gauges, which shall conform to the general principles set out under. The Specification Authority shall have the right to copy from and extract essential features for incorporation in drawings of gauges to be part of the next issue of this specification.

General principles of acceptance gauging:-

(a) The four mounting holes to be used to give datum for reference plane II and reference plane III, the locating pins to be $0.266"^{+0.001}_{-0}$

(b) Reference plane I shall be taken from the base plate of the jig which shall be a smooth surface and flat to 0.002" parallel tolerance.

(c) AP shall be gauged using zone tolerances from a radius. This radius shall be $0.940^{+0.001}_{-0}$ and shall have its centre $1.302^{+0}_{-0.001}$ from reference plane III, and $3.042^{+0}_{-0.001}$ from reference plane II.

(d) A hole at $1.500^{+0}_{-0.001}$ diameter, centrally disposed between the four locating pins to accept the cathode stalk.

(e) The cathode terminal is defined as the inside surface having the diameter BS = $0.540^{+0.005}_{-0.008}$ over the length $0.516^{+0.001}_{-0}$ corresponding to BW minus the $0.156^{+0}_{-0.001}$ dimension shown in the alternative terminal assys. The inside diameters over the $0.156^{+0}_{-0.001}$ dimension shall not be gauged.

(f) The cathode terminal as defined in (e) shall be gauged for concentricity with the 1.500 hole in (d) above with a plug concentric with the 1.500 hole of diameter $0.440^{+0.001}_{-0}$

(g) The waveguide aperture to a depth of 1/16, holes and flange dimensions should satisfy gauges similar to V21065, V21067. In addition the waveguide aperture to a depth of 0·410 shall accept a rectangular plug gauge of dimensions $0.495^{+0}_{-0.0002}$ by $1.120^{+0}_{-0.0002}$

(h) The waveguide aperture shall accept to a depth of 0·400 a rectangular positioning plug, $1.080^{+0.001}_{-0}$ by $0.455^{+0.001}_{-0}$ which is parallel to reference plane I and centrally disposed about the datum pins in (a) above, and centrally disposed about a height of 1.792" above reference plane I.

(j) The gauges shall also define the fin packet for position and dimensions as in the outline drawing.

Gauges Requirements Cont'd.

(k) The magnet clampings defined by dimension BY shall not interfere with cylinders of diameter $0.390\ ^{+0.001}_{-0}$ concentric with the locating pins in (a) extending to $3.6''\ ^{+0.032}_{-0}$ above the base plate of the jig in (b).

(l) In general gauges shall define all other relative dimensions as in the outline drawing.

(m) No parts of the magnetron shall touch the sides of a solid defined by:-

(a) Two planes $3.494\ ^{+0}_{-0.001}$ and 4.25 ± 0.015 from Reference Plane I. on magnets side of ref. Plane I

(b) Two planes $3.73\ ^{+0.001}_{-0}$ and $1.23\ ^{+0.001}_{-0}$ from Reference Plane II. i.e. symetrically disposed w.r.t. magnetron.

(c) Reference Plane III and one plane $0.836\ ^{+0.001}_{-0}$ from Reference Plane III. and on seal off cover side.

(n) The heater terminal is defined as the outside diameter BR = 0.250 ± 0.005 over the dimension BV minus BN. The heater terminal shall be gauged with go and no go gauges with $0.245\ ^{+0}_{-0.0005}$ and $0.255\ ^{+0.0005}_{-0}$ internal bores mainted for a length of $0.75\ ^{+0.001}_{-0}$ from the cathode datum.

The dimension BN shall be separately gauged.

(p) The concentricity tolerance of heater and cathode shall be interpreted and gauged in the following way. A hard metal sphere of diameter $0.1285\ ^{+0}_{-0.0005}$ shall freely circulate in the interspace between the cathode and heater terminals.