VALVE ELECTRONIC

ADMIRALTY SURFACE WEAPONS ESTABLISHMENT

Specification AD/CV 5315 Issue 1 Dated 2nd April, 1962. To be read in conjunction with K1001	SECURITY Specification: Unclassified Valve: Unclassified

TYPE OF VALVE: Microwave gas switch (Plug-in pulsed attenuator)

ENVELOPE: Metal and Glass

PROTOTYPE: E2815

This is a pulsed attenuator for use in combination with other plug-in valves. Since it contains a primed electrode it also provides a measure of passive protection.

MARKING

See K1001/4

DIMENSIONS

See drawing on page 6

MOUNTING POSITION

Any

PACKAGING

See K1005

RATING *

(All limiting values are absolute)

			Note
Minimum Negative d.c. Primer Supply.	(V)	950	A.B.
Max. Steady Primer Current	(μA)	25	B.
Min. Primer Current.	(μA)	15	B.
Max. Pulse Primer Current	(μA)	1000	C.D.
Peak Power Rating	(W)	3	E.
Operating Frequency Range		S-Band	F.

NOTES

A. The primer supply voltage should have less than 1% peak-to-peak ripple voltage and be negative with respect to the body of the valve. The regulation of the supply should be negligible for the load current required.

B. The primer current shall be limited by series resistors of which at least 0.5 M ohms must be adjacent to the primer terminal.

C. Pulses should be initiated at least 20 μsecs in advance of the transmitter pulse to ensure full attenuation. Pulses up to 50 μsecs duration may be applied. Minimum recovery time will be achieved if the primer pulse terminates during the transmitter pulse.

D. A suitable modulator circuit is shown on page 8.

E. At a duty cycle of 0.002.

(Notes continued on page 2)

F. OPERATING FREQUENCY RANGE

The valve is designed to operate in No. 10 or No. 11 waveguide and the operating frequency depends on the mounting. It is most suitable for the low frequency end of S-band, up to 3300 Mc/s. (For higher frequencies the CV5210 should be used). Chokes are provided on the valve and r.f. contact with the mount is not important.

A typical mount for No. 11 waveguide (Mount A) is shown on page 9 and for No. 10 waveguide (Mount B) on page 10. Higher Q values can be obtained using double irises and lower values by using a small ridge in the waveguide.

Typical performance

The valve is intended to be used as the back gap in a combination band-pass filter, the front elements being a Pre-T.R. (e.g. type CV2423, CV6060 or CV2430) followed by an unprimed gap (e.g. type CV5398 or CV2378).

		MOUNT A.	MOUNT B.	NOTES
Centre frequency	(Mc/s)	3283	2983	(i)
Loaded Q Value		6.7	5.2	(i) (ii)
Insertion loss	(dB)	0.25	0.26	(i)
Primer voltage - primer current 20 μA	(V)	250	250	
Primer voltage - primer current 700 μA	(V)	500	500	
Spike leakage - primer current 20 μA	(e/p)	0.60		(iii)
Spike leakage - primer pulsed	(e/p)	0.06		(iii) (iv)
Recovery time to 6dB - primer pulsed	(μsecs)	30		(iii) (iv) (v)

NOTES

(i) CV5315 element only with the primer operating at 20 μA.

(ii) Q value. This is the Q of the cell in its mount when loaded by a matched guide in both directions. To calculate Q, the v.s.w.r. of the mount terminated in a matched load is plotted as a function of frequency. The Q is then deduced from the formula

$$Q_L = \frac{1-r}{2\sqrt{r}} \cdot \frac{fo}{f_2 - f_1}$$

Where r = v.s.w.r. (<1) within the range 0.5 to 0.6 at which f_1 and f_2 are quoted.

(iii) Operating behind a CV5398 in a combination mounting.

(iv) The primer current is pulsed to 700 μA, the current pulse being initiated at least 20 μsec. before the transmitter fires. A suitable modulator circuit is shown on page 8.

(v) Recovery time is dependent on incident power and frequency. The figures quoted are for operation in combination with a CV5398.

G. The Joint Services Catalogue No. is:- 5960-99-037-2273

TESTS

CV5315

To be performed in addition to those applicable in K1001

All tests are to be carried out 7 days after completion of manufacture. at least.

Tests are to be performed in the specified order unless otherwise agreed with the Inspecting Authority.

Test conditions - unless otherwise stated:-

Primer Voltage (V)	Primer Series Resistance (MΩ)	Test Frequency (Mc/s)
1000 ± 3%	40.3 ± 5%	2983

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
a	Primer Operating Voltage	The primer current shall be 20 ± 2 μA. Note 1		100%		200	320	V
b	Centre Frequency. This frequency shall be determined as the mean of frequencies at which the v.s.w.r.'s are the same and in the range 0.75 ± 0.05	The line shall be energised with 20 ± 10 mW r.f. power and terminated in an impedance matched better than 0.98 v.s.w.r. Notes 1, 2		100%		2965	3000	Mc/s
c	V.S.W.R. Determined as if the line were terminated in a perfectly matched load.	As test "b" above Notes 1, 2		100%		0.87	-	
d	Total Insertion Loss	The line shall be energised with 20 ± 10 mW r.f. power and the valve mounted between impedances matched better than 0.91 v.s.w.r. Notes 1, 2		100%		-	0.35	dB
e	Attenuation. The increase in attenuation is measured when the primer current is increased from 20 μA to 700 μA.	As test "d" except that primer current = 725 ± 25 μA Notes 1, 2		100%		16	-	dB
f	Noise. Increase in noise power when the primer current is switched on.	The valve under test shall be mounted in a noise factor measuring equipment. The increase in noise power when switching on the primer shall be measured. Local oscillator frequency = 2955 Mc/s. Notes 1, 2 and 3		100%		-	0.80	dB

TESTS (Contd.)

	Test	Test Conditions	AQL %	Insp. Level	Symbol	Limits Min.	Limits Max.	Units
g	Passive Leakage Power							
	(i) Spike leakage energy	The valve under test shall be mounted behind a CV5398 such that 5 ±1kW peak r.f. power is incident on the CV5398 through an attenuator having a loss of at least 10dB. Pulse length- (i) 0.1 μsec. min. (ii) 0.9 ± 0.1 μsecs. Notes 1, 4, 5, 6 & 7		T.A.		-	0.75	e/p
	(ii) Total leakage energy					-	0.80	e/p
h	Pulsed Leakage Power	As test "g" except that primer current = 725 ±25 μA Alternatively the current may be pulsed, in which case the current pulse shall be initiated at least 20 μsecs in advance of the transmitter pulse. Notes 1, 4, 5, 7, 8 and 9		T.A.				
	(i) Spike leakage energy					-	0.10	e/p
j	Life							
	End points - (i) Centre Frequency	The valve under test shall be mounted behind a CV5398 such that 5 ± 1kW peak r.f. power is incident on the CV5398 or in a single mount with 2.5 ± 0.5W peak incident on the valve under test. Duty cycle = 0.002 max. Primer current as in test "h" Notes 1, 9, 10, 11 and 12		T.A.		1000 2960	- 3005	Hours Mc/s
	(ii) v.s.w.r.						0.84	
	(iii) Total Insertion Loss						0.4	dB
	(iv) Passive leakage power							
	(a) Spike leakage						0.8	e/p
	(b) Total leakage						0.85	e/p
	(v) Pulsed leakage power							
	(a) Spike leakage						0.15	e/p

NOTES

1. The primer supply voltage shall have a peak-to-peak ripple voltage not exceeding 1% and shall be negative with respect to the body of the valve. The current to the primer shall be limited by series resistors of which at least 0.5MΩ shall be adjacent to the primer terminal.
2. The valve shall be tested in the mount shown on page 10.
3. A block diagram of the suggested noise factor measuring equipment is shown on page 7. The overall noise factor of the equipment shall be within the range 7-9dB, with no current flowing in the primer circuit of the valve under test. The gas discharge noise source type CV1881 shall be used.
4. The valve shall be tested in the combination mount C.401070.
5. Duty cycle not to exceed 0.001.
6. If the measured mean leakage powers are p1 and p2 respectively then:-

   Spike leakage energy = $10^{\frac{p1}{p.r.f.}}$ ergs/pulse

   Total leakage energy = $10^{\frac{p2}{p.r.f.}}$ ergs/pulse

NOTES (Contd.)

7. Measured with a thermistor head having a working match better than 0.65 v.s.w.r. over the band 2500 Mc/s to 4100 Mc/s.

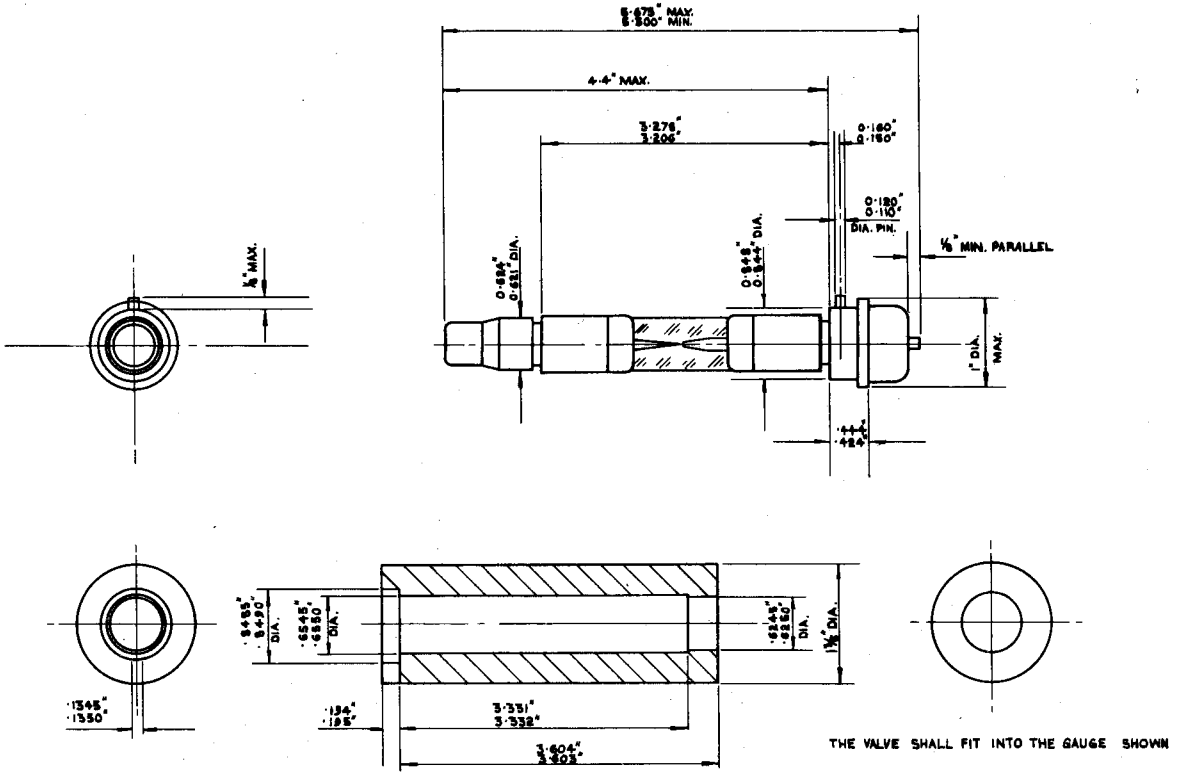
8. Spike leakage energy calculated as in Note 6.

9. A suitable modulator circuit is shown on page 8.

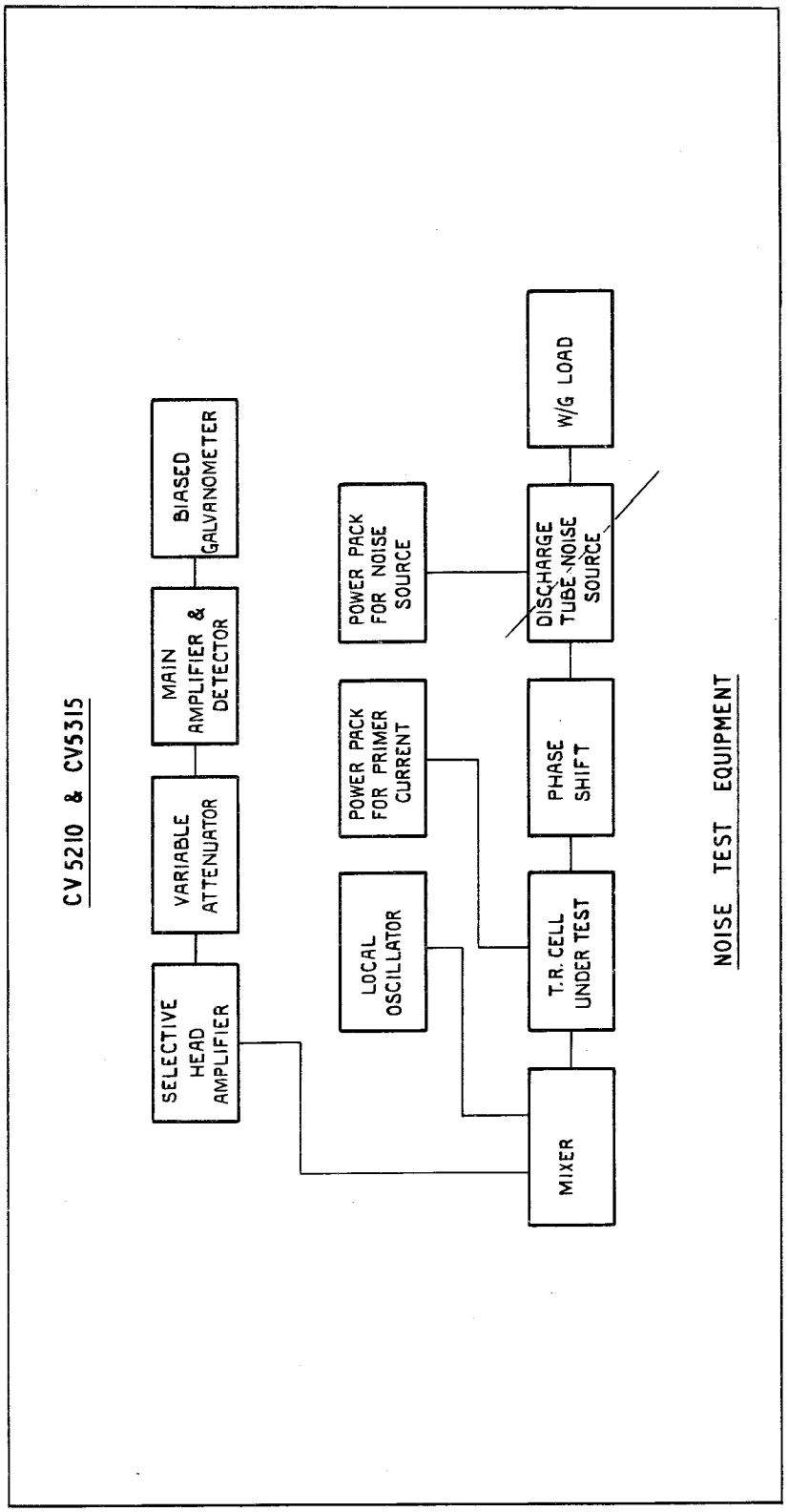
10. The valve shall be tested in the combination mount C.401070 or single mount shown on page 10.

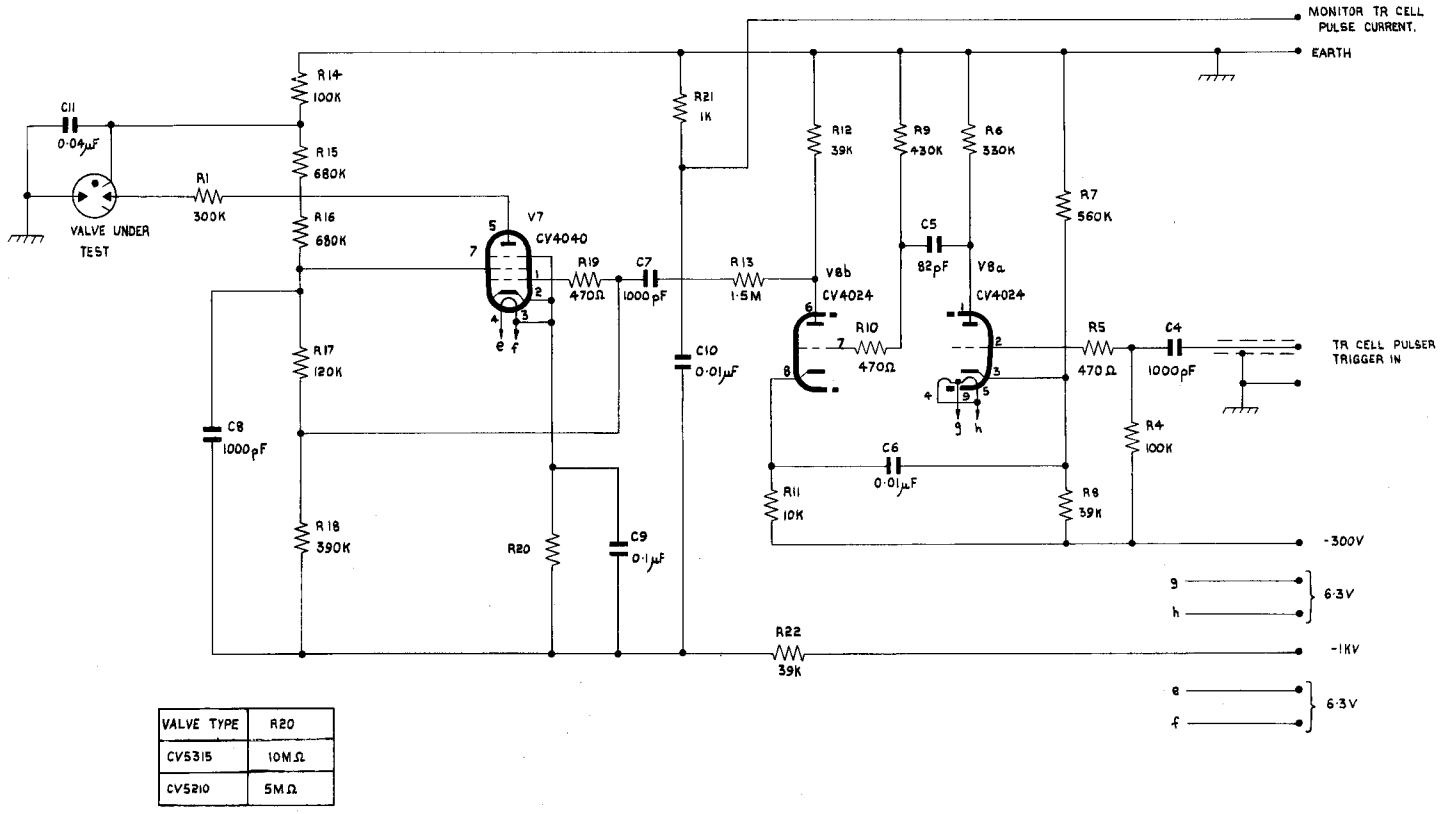
11. The end points to be tested as given in tests "b", "c", "d", "f" and "g".

12. Production life testing to be carried out under these conditions but the attenuation test "e" may be substituted for end points (iv) and (v) if the combination mount C.401070 is not available. In this case records shall be submitted to the Specification Authorities with the aim of establishing end-point test limits.



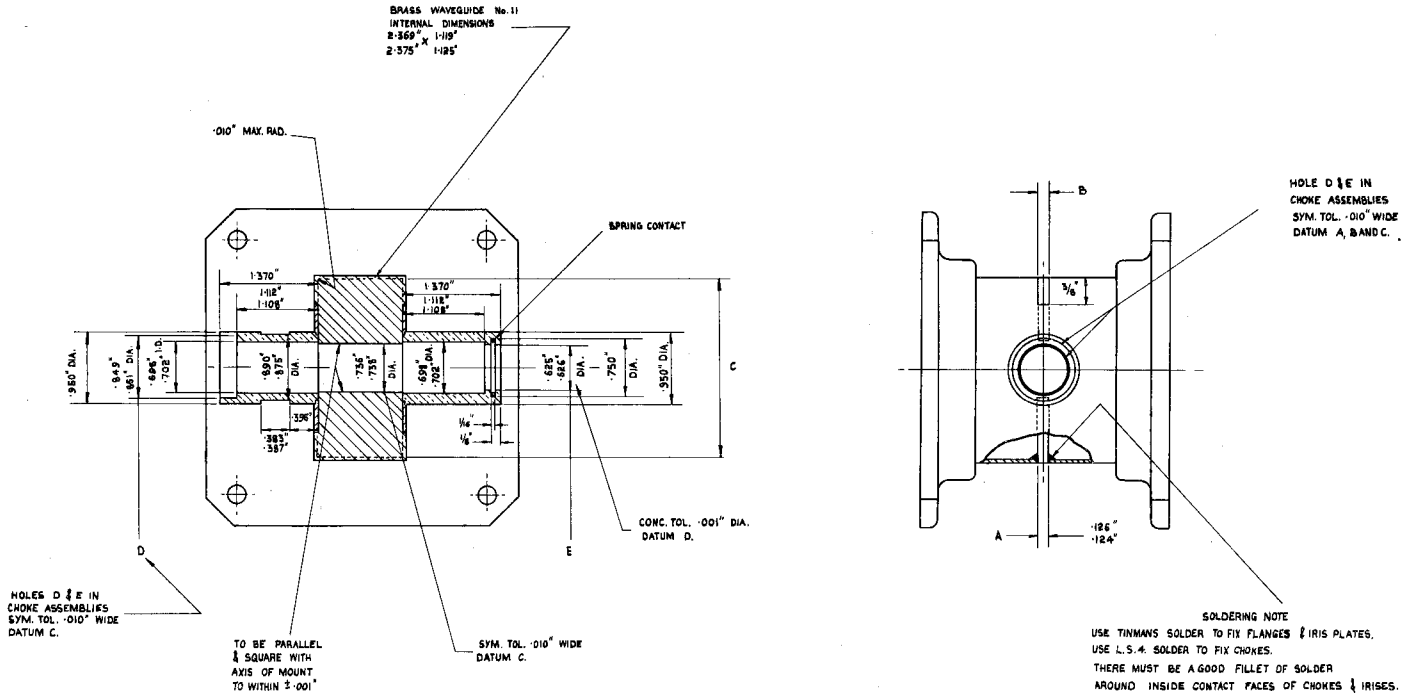
OUTLINE DRAWING


CV 5210 & CV5315
SELECTIVE HEAD AMPLIFIER
VARIABLE ATTENUATOR
MAIN AMPLIFIER & DETECTOR
BIASED GALVANOMETER
LOCAL OSCILLATOR
POWER PACK FOR PRIMER CURRENT
POWER PACK FOR NOISE SOURCE
MIXER
T.R. CELL UNDER TEST
PHASE SHIFT
DISCHARGE TUBE NOISE SOURCE
W/G LOAD
NOISE TEST EQUIPMENT

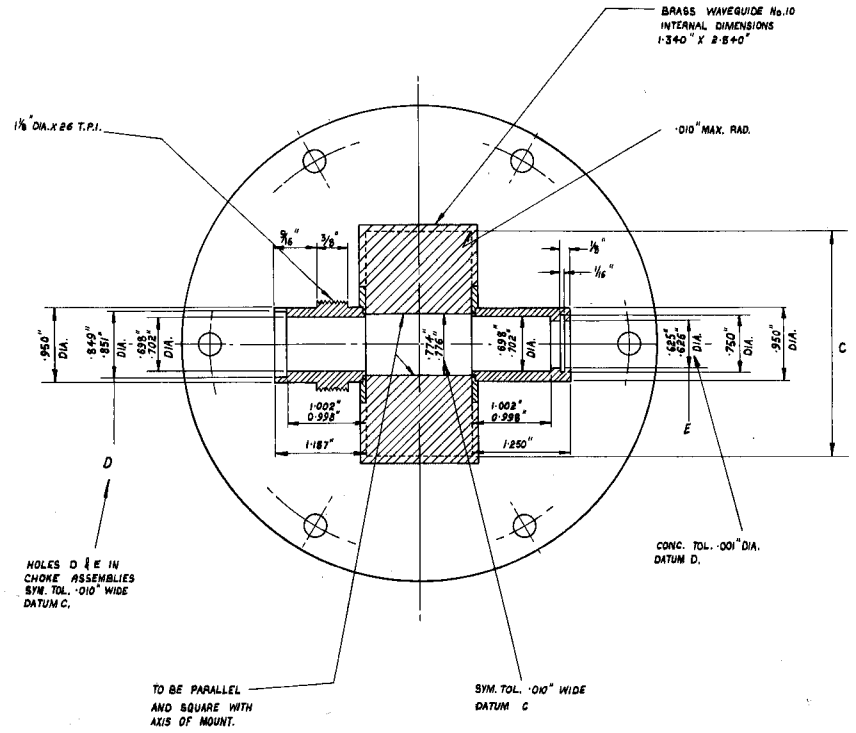


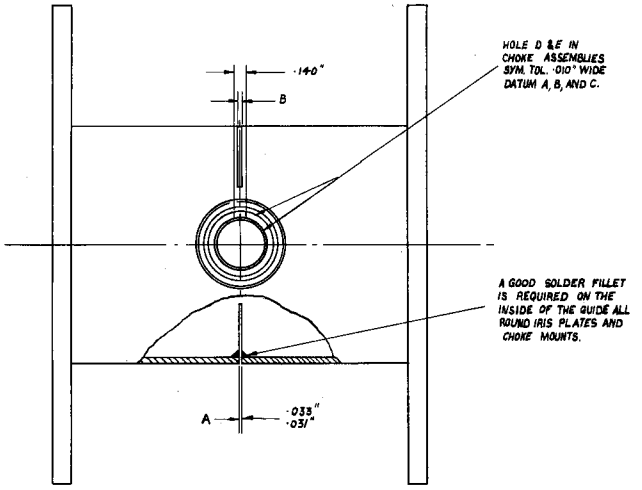
VALVE TYPE	R20
CV5315	10MΩ
CV5210	5MΩ

PRIMER PULSING CIRCUIT


BRASS WAVEGUIDE No. 11
INTERNAL DIMENSIONS
2·368" x 1·119"
2·575" x 1·125"
·010" MAX. RAD.
SPRING CONTACT
1·370"
1·112"
1·108"
1·370"
1·118"
1·108"
·960" DIA.
·949"
·951" DIA.
·698"
·702" I.D.
·890"
·875" DIA.
·735"
·755" DIA.
·691"
·702" DIA.
·625"
·626" DIA.
·750" DIA.
·950" DIA.
C
·396"
·383"
·387"
1/16"
1/8"
CONC. TOL. ·001" DIA.
DATUM D.
D
E
HOLES D & E IN
CHOKE ASSEMBLIES
SYM. TOL. ·010" WIDE
DATUM C.
TO BE PARALLEL
& SQUARE WITH
AXIS OF MOUNT
TO WITHIN ±·001"
SYM. TOL. ·010" WIDE
DATUM C.
B
3/16"
A
·126"
·124"
HOLE D & E IN
CHOKE ASSEMBLIES
SYM. TOL. ·010" WIDE
DATUM A, B AND C.
SOLDERING NOTE
USE TINMANS SOLDER TO FIX FLANGES & IRIS PLATES.
USE L.S.4. SOLDER TO FIX CHOKES.
THERE MUST BE A GOOD FILLET OF SOLDER
AROUND INSIDE CONTACT FACES OF CHOKES & IRISES.

MOUNT A


BRASS WAVEGUIDE No.10
INTERNAL DIMENSIONS
1·340" X 2·540"
1⅛" DIA. x 26 T.P.I.
·010" MAX. RAD.
9/16"
3/8"
⅛"
1/16"
·950" DIA.
·849" ·851" DIA.
·695" ·702" DIA.
·774" ·776"
·698" ·702" DIA.
·625" ·627" DIA.
·750" DIA.
·950" DIA.
C
1·002" 0·998"
1·187"
1·002" 0·998"
1·250"
D
E
HOLES D & E IN CHOKE ASSEMBLIES SYM. TOL. ·010" WIDE DATUM C.
CONC. TOL. ·001" DIA. DATUM D.
TO BE PARALLEL AND SQUARE WITH AXIS OF MOUNT.
SYM. TOL. ·010" WIDE DATUM C


·140"
B
HOLE D & E IN CHOKE ASSEMBLIES SYM. TOL. ·010" WIDE DATUM A, B, AND C.
A GOOD SOLDER FILLET IS REQUIRED ON THE INSIDE OF THE GUIDE ALL ROUND IRIS PLATES AND CHOKE MOUNTS.
A
·035" ·031"

TEST MOUNT B