Rectifier *Type A 207*

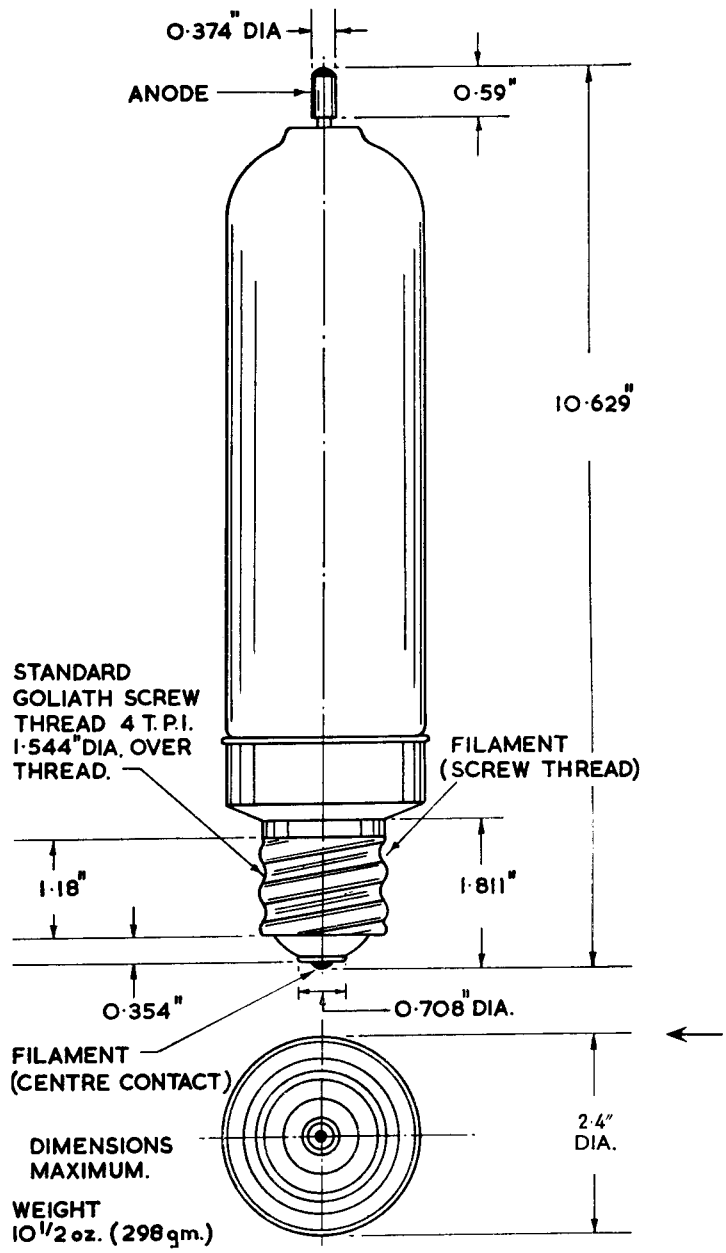
General. The A 207 is a high vacuum half-wave rectifier with a thoriated tungsten filament.

Cooling. The valve must have adequate ventilation. With an anode dissipation of 130 watts the anode will run at red heat.

Mounting. The holder of the valve must be sprung to prevent the transmission of sharp knocks to the valve. This is on account of the intrinsic brittleness of carbonised thoriated tungsten filaments. The valve is mounted on a Goliath Edison Screw base.

APPROXIMATE DATA

V_f	4	V
I_f	12	A
PIV (max)	40	kV
$I_{a\ (pk)\ (max)}$	1·1	A
$p_{a\ (max)}$	130	W
r_a	600	Ω



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*



PRINTED IN ENGLAND

Rectifier *Type A 209*

General. An oil-insulated rectifier designed for use in X-ray apparatus.

Ratings:

Continuous Duty:

$I_{dc\ (max)}$	100 mA
PIV $_{(max)}$	140 kV

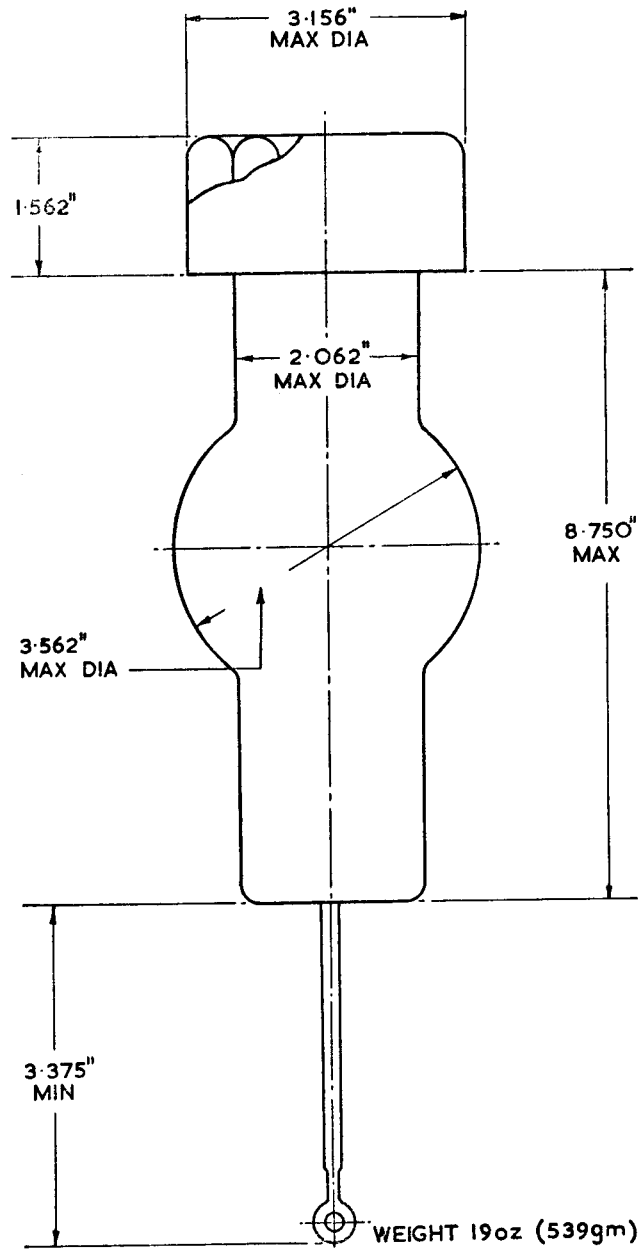
Intermittent Duty:

(applicable to usual radiographic exposure times)

$I_{dc\ (max)}$	500 mA
PIV $_{(max)}$	125 kV

These ratings apply to a full-wave bridge circuit without condenser and the stated values refer to the current as read on a DC average milliammeter in series with the load.

For half-wave circuits the current values should be halved.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Inverse Voltage Ratings. It is important that the inverse voltage of the circuit does not exceed the published maximum rating of the rectifier. Voltages in excess of the published maximum may cause instability, flash-over or puncture. To ensure dependable stable operation at rated voltage, each valve is carefully seasoned and tested at voltages in excess of rating.

Load Current Ratings. The load rating values for the curve shown are based on a full-wave circuit output without condenser. The use of any other circuit requires a correction of the current rating so that the peak values of current produced will not exceed the peak values obtained from the published full-wave rating.

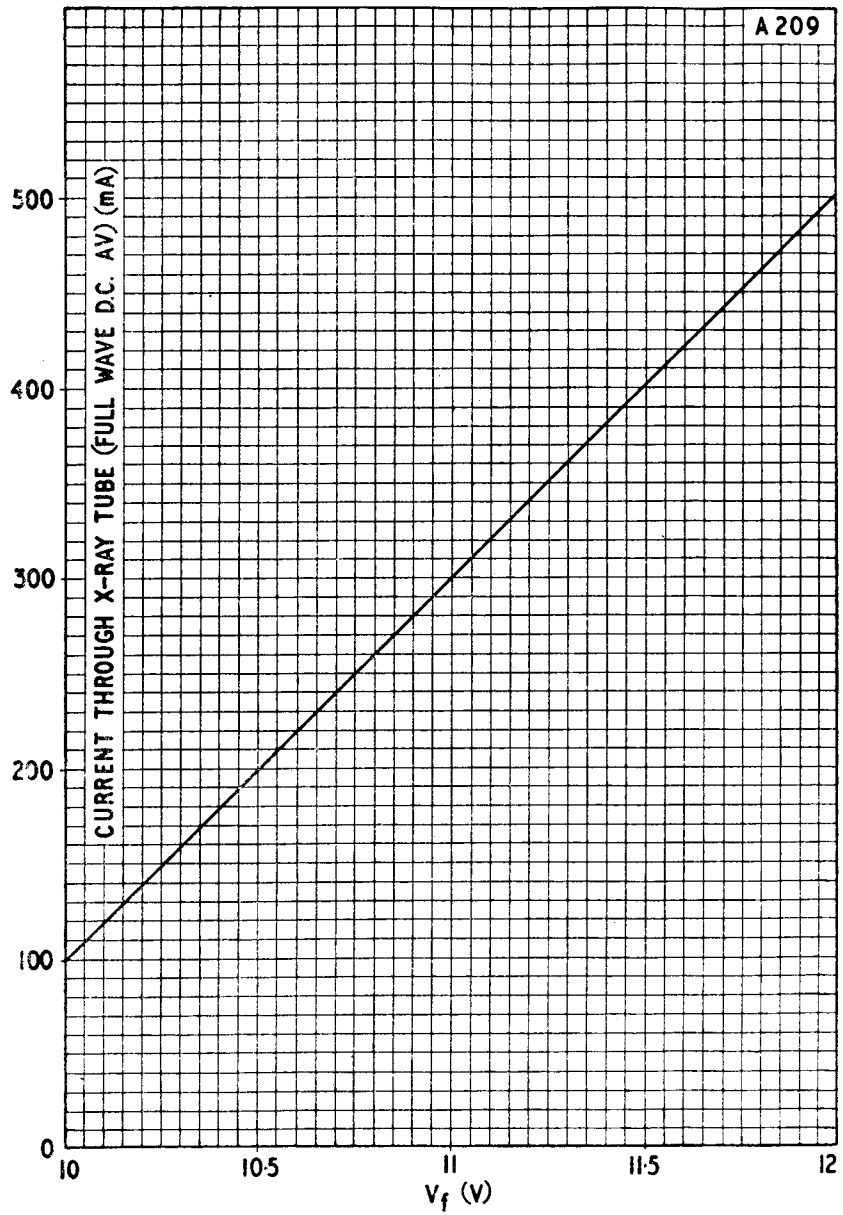
Filament Adjustments. The life of a rectifier is governed to a great extent by the operating temperature of the filament. In order to obtain long life, the practice of energizing the filaments just before the radiographic exposure, and turning them off immediately thereafter, should be followed.

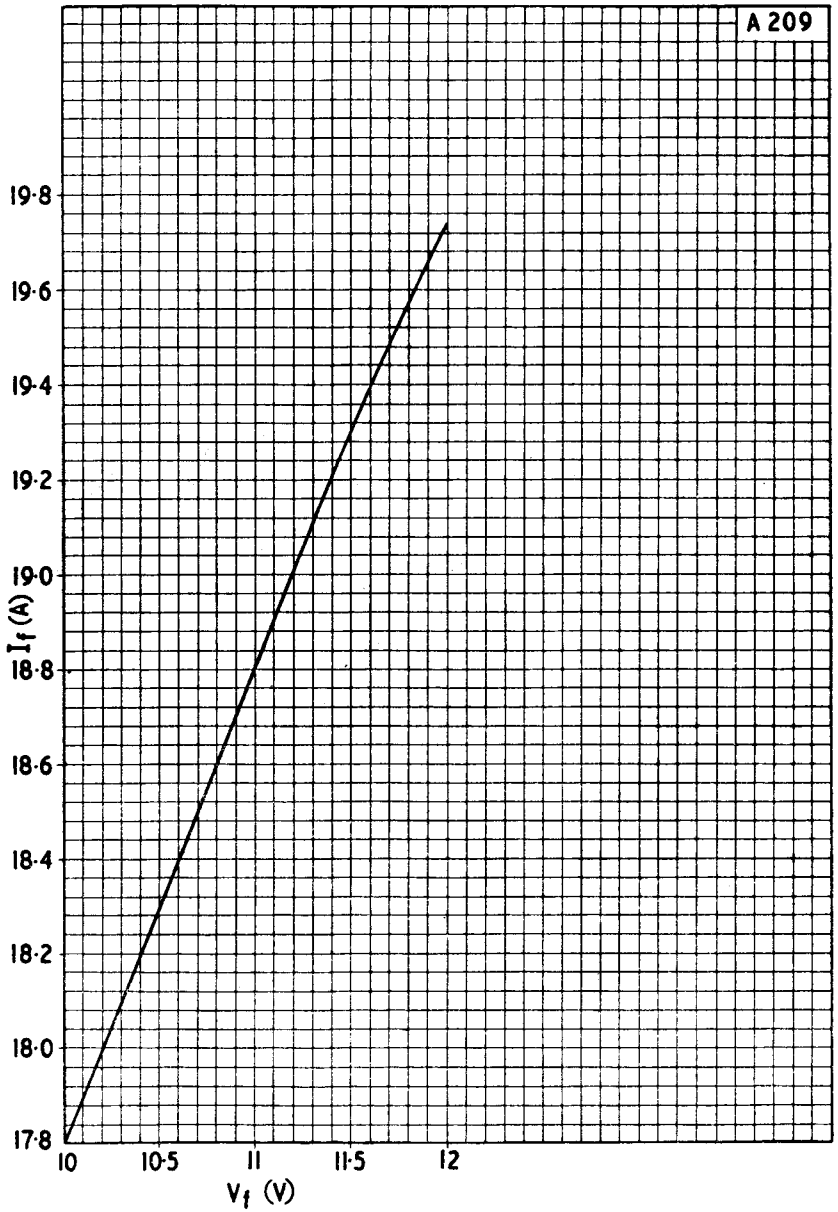
The importance of setting the filament voltage in accordance with the Filament Voltage Adjustment Chart cannot be over-estimated. Low filament voltage will result in low emission from the filament and a high forward voltage drop which may be deleterious to the operation of the valve. On the other hand, an excessive filament voltage will result in short filament life.

The Filament Voltage Adjustment Chart is based on the use of full-wave circuits without condensers. For other circuits, the filament voltage must be adjusted so that the peak values of current produced will correspond exactly with the peak values of current calculated from this chart.

Fluctuations in supply line voltage should be checked and the filament voltage set at a value high enough to avoid the possibility of the filament voltage dropping below the value indicated on the Filament Voltage Adjustment Chart.

Installation. The A 209 rectifier may be operated in any position. Adequate clearance must be maintained around the valve when it is installed in order to prevent sparking to other objects. The insulating oil should have a dielectric strength of at least 25,000 V per 0·1 in. and must be free from dirt and moisture.


A 209
CURRENT THROUGH X-RAY TUBE (FULL WAVE D.C. AV) (mA)
500
400
300
200
100
0
10
10·5
11
11·5
12
V_f (V)


A 209
19·8
19·6
19·4
19·2
19·0
18·8
18·6
18·4
18·2
18·0
17·8
I_f (A)
10
10·5
11
11·5
12
V_f (V)



PRINTED IN ENGLAND

Rectifier *Type A 214*

General. The A 214 is an oil-insulated rectifier designed for use in X-ray apparatus.

Rating

PIV (max)	125 kV
I_{dc} (max)	
(a) Continuous duty	50 mA
(b) Intermittent duty	
i Manual filament switching	300 mA
ii Automatic filament boost	500 mA

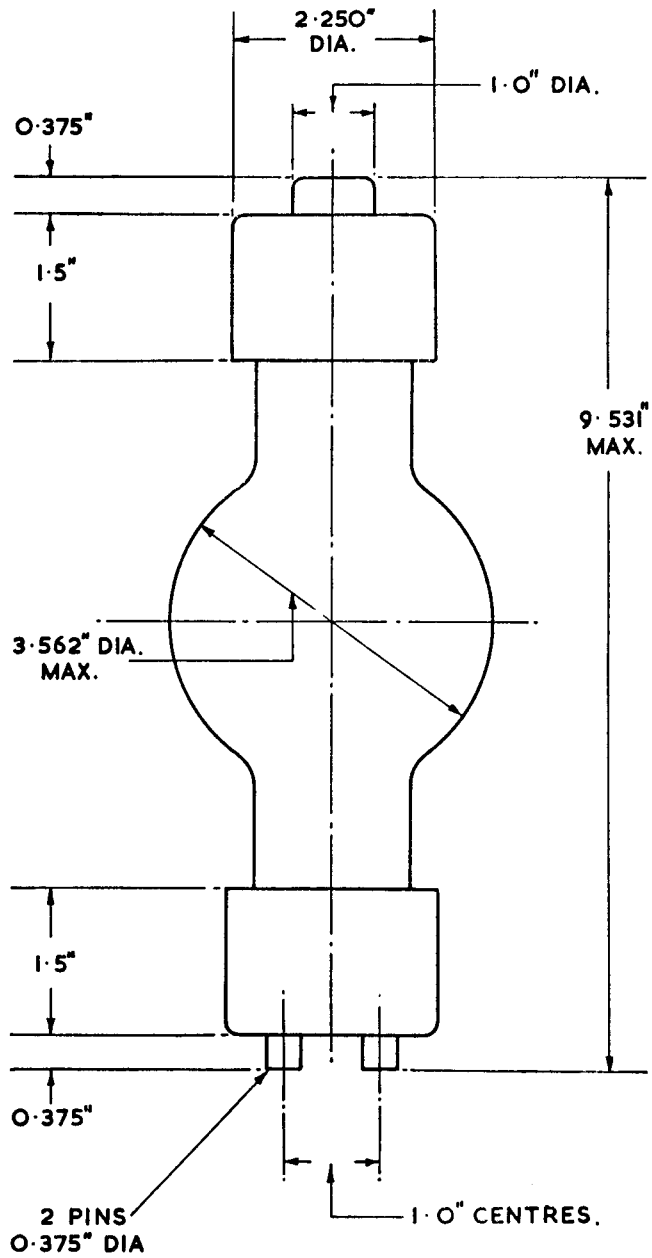
NOTE 1 These ratings apply to a full wave bridge circuit without condenser and refer to the current as read on a DC average milliammeter in series with the load.

For half wave circuits the current values have to be halved.

NOTE 2 Intermittent ratings apply to usual radiographic exposure times.

Inverse Voltage Ratings. It is important that the inverse voltage of the circuit does not exceed the published maximum rating of the rectifier. Voltages in excess of the published maximum may cause instability, flashover or puncture. To ensure dependable stable operation at rated voltage, each valve is carefully seasoned and tested at voltages in excess of the rating.

Load Current Ratings. The load rating values for the curve shown are based on a full-wave circuit output without condenser. The use of any other circuit requires a correction of the current rating so that the peak values of current produced will not exceed the peak values obtained from the published full-wave ratings.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

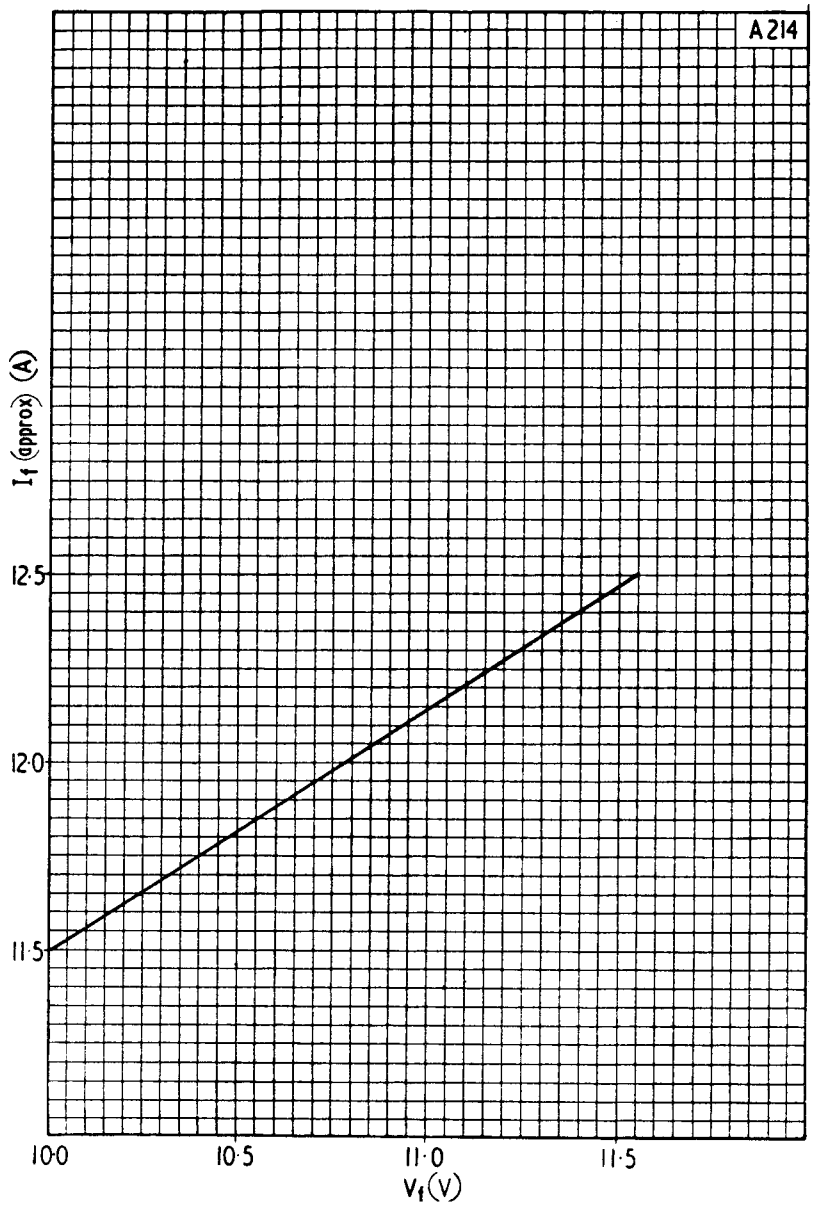
Filament Adjustments. The life of the rectifier is governed to a great extent by the operating temperature of the filament. In order to obtain long life, the practice of energizing the filaments just before the radiographic exposure, and turning them off immediately thereafter, should be followed.

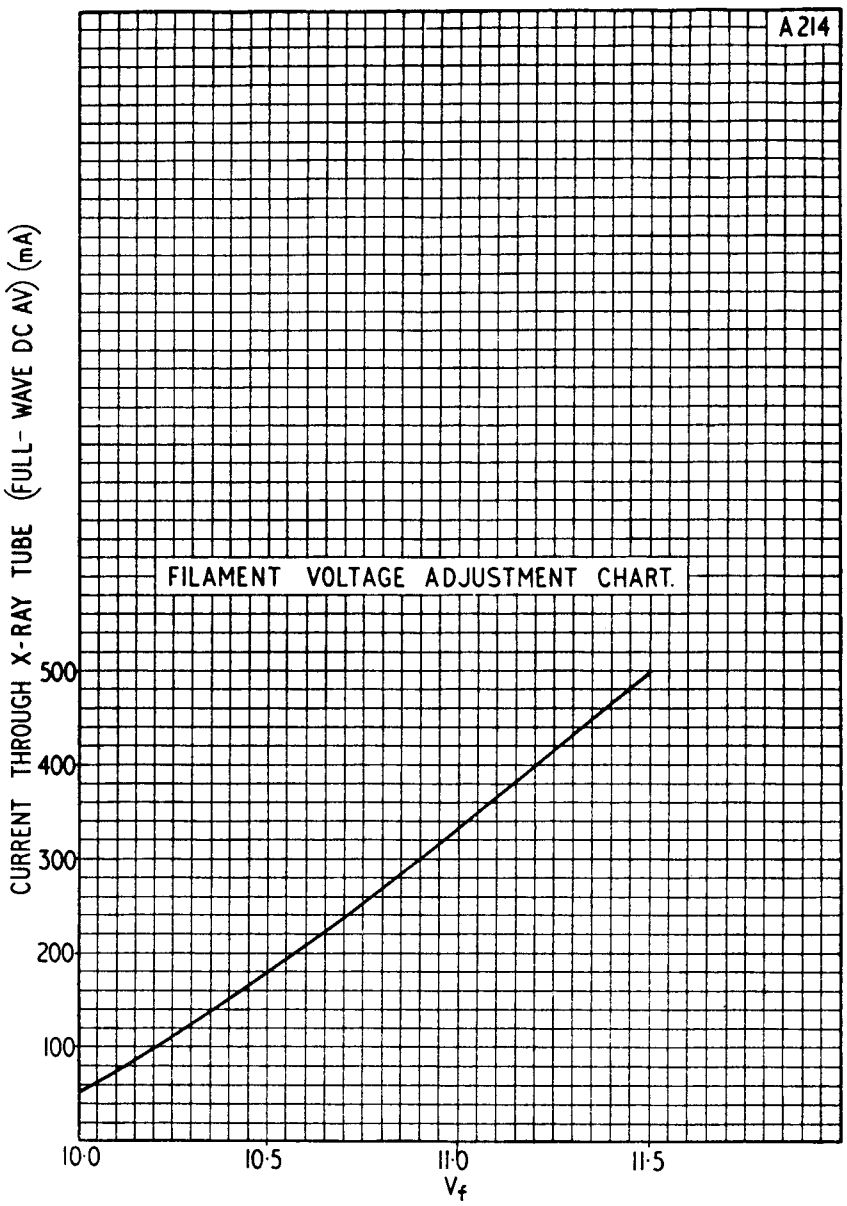
The importance of setting the filament voltage in accordance with the Filament Voltage Adjustment Chart cannot be over-estimated. Low filament voltage will result in low emission from the filament and a high forward voltage drop which may be deleterious to the operation of the valve. On the other hand, an excessive filament voltage will result in short filament life.

The Filament Voltage Adjustment Chart is based on the use of full-wave circuits without condenser. For other circuits, the filament voltage must be adjusted so that the peak values of current produced will correspond exactly with the peak values of current calculated from this chart.

Fluctuations in supply line voltage should be checked and the filament voltage set at a value high enough to avoid the possibility of the filament voltage dropping below the value indicated on the Filament Voltage Adjustment Chart.

Installation. The A 214 rectifier may be operated in any position. Adequate clearance must be maintained around the valve when it is installed in order to prevent sparking to other objects. The insulating oil should have a dielectric strength of at least 25,000 volts per 0·1 inch and must be free from dirt and moisture.


A214
I_f (approx) (A)
12·5
12·0
11·5
10·0
10·5
11·0
11·5
V_f (V)


A214
FILAMENT VOLTAGE ADJUSTMENT CHART.
CURRENT THROUGH X-RAY TUBE (FULL-WAVE DC AV) (mA)
500
400
300
200
100
10·0
10·5
11·0
11·5
V_f



PRINTED IN ENGLAND

MINIATURE
PLANAR TRIODE
6·3V INDIRECTLY HEATED

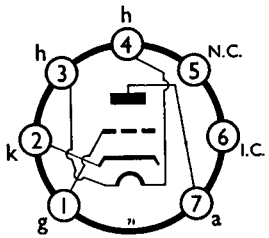
A1714

APRIL, 1954

A low noise triode with planar electrodes for use as an R.F. oscillator or amplifier at frequencies up to 1000 Mc/s.

A1714 is the commercial equivalent of CV408.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G

Overall length :	54	max.	mm.
Seated length :	47·5	max.	mm.
Diameter :	19	max.	mm.

HEATER

V_h	6·3	V
I_h	0·49 approx.	A

MAXIMUM RATINGS (design centre)

V_a	250	V
I_g	15	mA
p_a	2·5	W

CHARACTERISTICS

V_a	150	V
I_a	10	mA
μ	42·5	—
r_a	5	kΩ
g_m	8·5	mA/V
r_{in}*	20	kΩ
c_{in}*	5	pF
Noise factor*	2	db
$r_{eq\ noise\ ref\ g1}$	500	Ω

*Taken at 45 Mc/s.

CAPACITANCES (of unscreened valve)

		Cold	*Hot* (I_a = 10 mA)	
$c_{g\text{-}k}$	(heater earthed)	2·2	3·6	pF
$c_{g\text{-}all}$	(less anode)	2·25	4·0	pF
$c_{a\text{-}g}$		0·95	—	pF
$c_{a\text{-}all}$	(less g)	0·7	—	pF
$c_{a\text{-}k}$	(heater earthed)	0·065	—	pF

TYPICAL OPERATION

Neutralised R.F. amplifier (circuit : Fig. 1).

V_a	150		V
V_g	−2·2	approx.	V
I_a	10	approx.	mA
R_k	220		Ω

The circuit of fig. 1 will give good signal-to-noise ratio at frequencies of the order of 45 Mc/s. Inductances L1, L2 and L3 are wound on formers with variable dust-iron cores, L2 being the neutralising coil. The coils should be tuned to the centre of the pass band, the band-width being of the order of 10-15 Mc/s.

R.F. oscillator using lumped circuit (Fig. 2).

V_a	100		V
I_a	30		mA
I_g	14	max.	mA
P_{out}	1		W
η	33		%
f	500		Mc/s.

The circuit layout is important. " E " is an earthed copper plate placed vertically across the valve holder and soldered to tags 1 and 5 and to the centre spigot. The capacitors " C " are of the feed-through type. For a frequency of 500 Mc/s the inductance " L" is a coil $\frac{1}{2}$ in. diameter wound with approximately two turns of 16 or 18 s.w.g. copper wire. The R.F. choke is made from 20 s.w.g. enamelled wire, $\frac{1}{8}\lambda$ long, (where λ is the wavelength in use), close wound on a $\frac{1}{4}$ in. diameter former. R_k should be adjusted for optimum conditions.

Used with suitably designed distributed circuits, the A1714 will give appreciable outputs at frequencies up to 1,000 Mc/s.

MOUNTING

Any position.

SCREENING

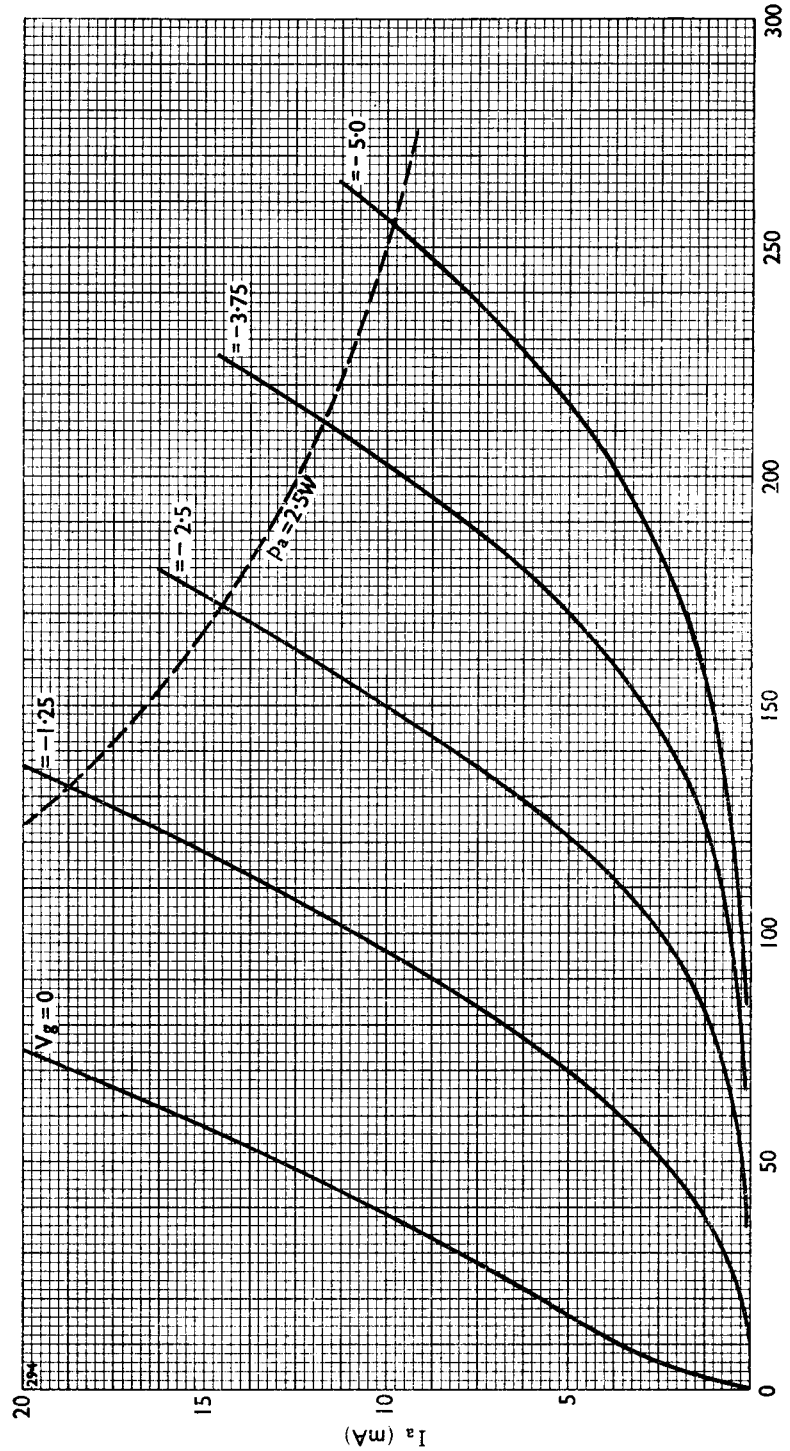
A separate screening canister should be used when application demands.

RETAINING

In equipments subject to vibration or shock, the use of a retaining device is recommended.

MICROPHONY

The valve is free from microphony in normal receiver applications.


I_a (mA)
V_a
$V_g = 0$
$= -1{\cdot}25$
$= -2{\cdot}5$
$= -3{\cdot}75$
$= -5{\cdot}0$
$p_a = 2{\cdot}5W$
0
50
100
150
200
250
300
5
10
15
20
294

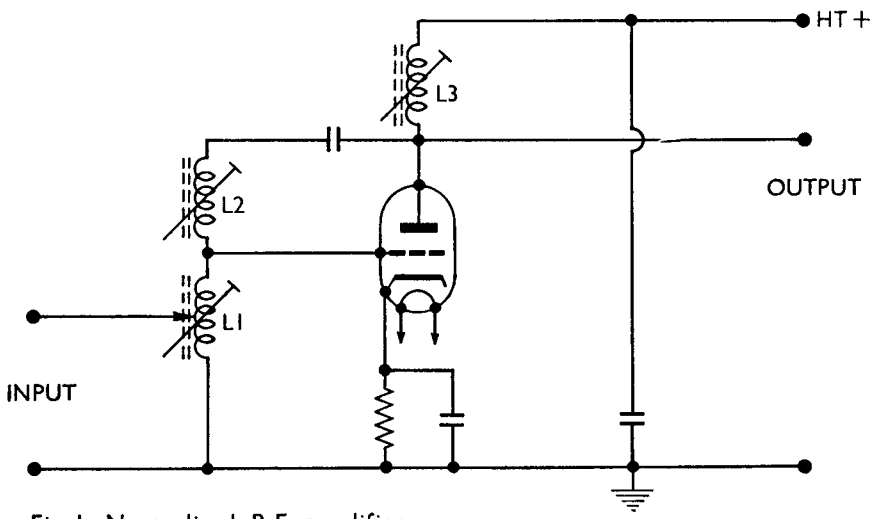


Fig. 1. Neutralised R.F. amplifier.

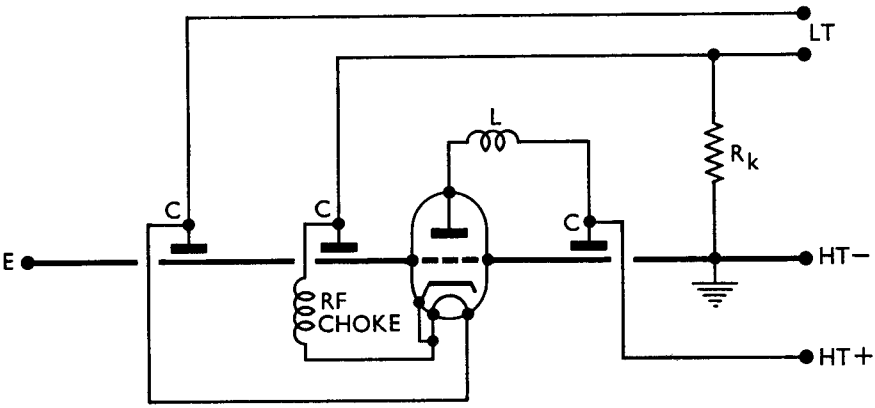


Fig. 2. R.F. oscillator using lumped circuit.

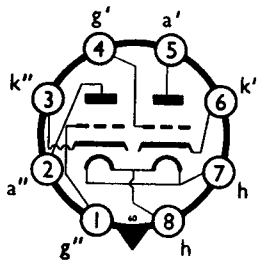
DOUBLE TRIODE

6·3V INDIRECTLY HEATED

A1834

APRIL, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base

Base : International octal
Bulb : Dome top pear

Overall length : 140 max. mm.
Seated length : 107 max. mm.
Diameter : 50 max. mm.

RATINGS

V_h		6·3	V
I_h		2·5	A
v_{h-k} (pk)		300 max.	V
		Per system	
V_a		250 max.	V
p_a		13 max.	W
μ	at V_a (b) = 135 I_a = 125 mA	2·1	
r_a		280	Ω
g_m		7·5	mA/V

TYPICAL OPERATION

D.C. Amplifier (values per system)

	Max. rating	Typical operation	
V_a(b)	250	135	V
I_a	125	125	mA
p_a	13		W
R_k		250	Ω
$R_{g\,k}$		1	MΩ

Scanning Booster (Max. ratings per system)

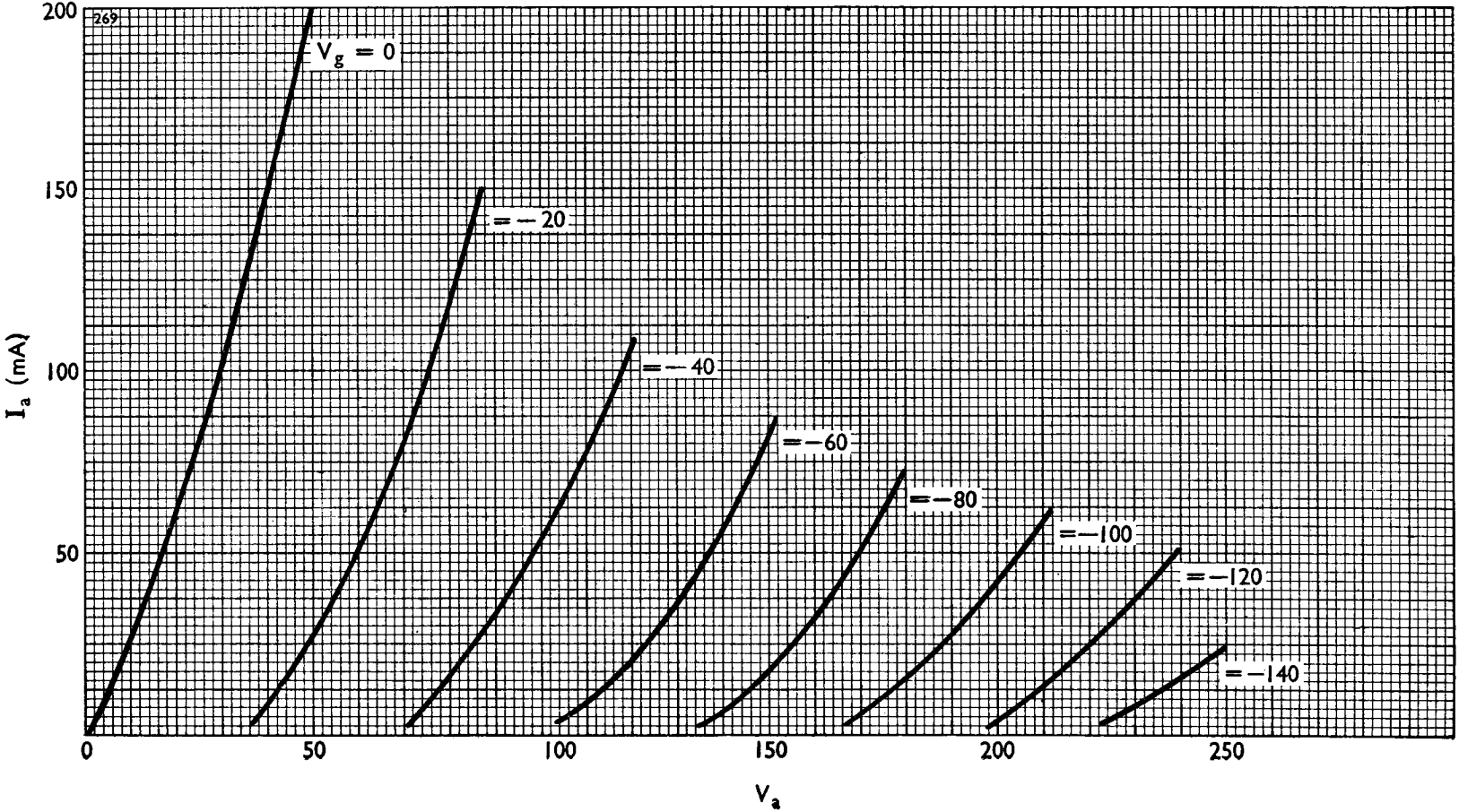
PIV*	1·7	kV
v_{h-k} (pk)	300	V
I_a	125	mA
p_a	13	W

* Duration of PIV limited to 10 μS and should not exceed 15% of scanning cycle.

The maximum permissible D.C. resistance between grid and cathode is limited to 1 MΩ with auto-bias. Fixed bias operation is not recommended.

MOUNTING

Any position.

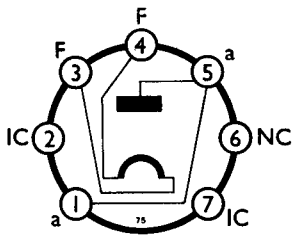

269
200
150
100
50
I_a (mA)
$V_g = 0$
$= -20$
$= -40$
$= -60$
$= -80$
$= -100$
$= -120$
$= -140$
0
50
100
150
200
250
V_a

VHF NOISE GENERATOR DIODE
TUNGSTEN FILAMENT

A2087
ISSUE 2
AUGUST, 1959

The A2087 is a commercial equivalent of the CV2171.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Max. overall length :	55 mm.
Max. seated length :	49 mm.
Max. diameter :	19 mm.

FILAMENT

*V_f (range)	0—4·3	V
I_f (at V_f=4·3V)	0·6 (approx)	A

*The saturated anode current is regulated by variation of the filament voltage. With a 6·3V filament supply, a variable series resistor of 10Ω max. will be suitable for most purposes.

MAXIMUM RATINGS

V_a	200	V
I_a	20	mA
p_a	2	W
V_f	4·8	V

CHARACTERISTICS

V_a	40	V
$I_{a(sat)}$	7 (approx)	mA
V_f	3·7 (approx)	V

CAPACITANCES (measured on a cold valve fitted with external shield)

$c_{a\text{-}f}$: 1·35pF (approx) *$c_{a\text{-}all}$: 2·7pF (approx)

*Includes capacitance to filament, pins 2 & 7 and external shield.

TYPICAL OPERATION

Noise Diode for use up to 220Mc/s

V_a	100	100	100	V
$I_{a(sat)}$ (range)	0—20	0—20	0—20	mA
V_f (range) (approx)	0—4·3	0—4·3	0—4·3	V
*R_s	50	70	300	Ω
*Noise factor measurement (range) (approx)	0—13	0—14·5	0—20·8	dB

*When measuring receiver noise factor, using with the diode a source resistance R_s (to match the receiver input) and the technique of setting the value of $I_{a(sat)}$ to double the noise output power to the receiver detector, the range of noise factor that can be measured with a given value of R_s is as shown.

Then, noise factor = $10 \log_{10} (20.I_a.R_s)$ dB,
where I_a is the diode saturated anode current in amperes and R_s is the source resistance in ohms.

INSTALLATION

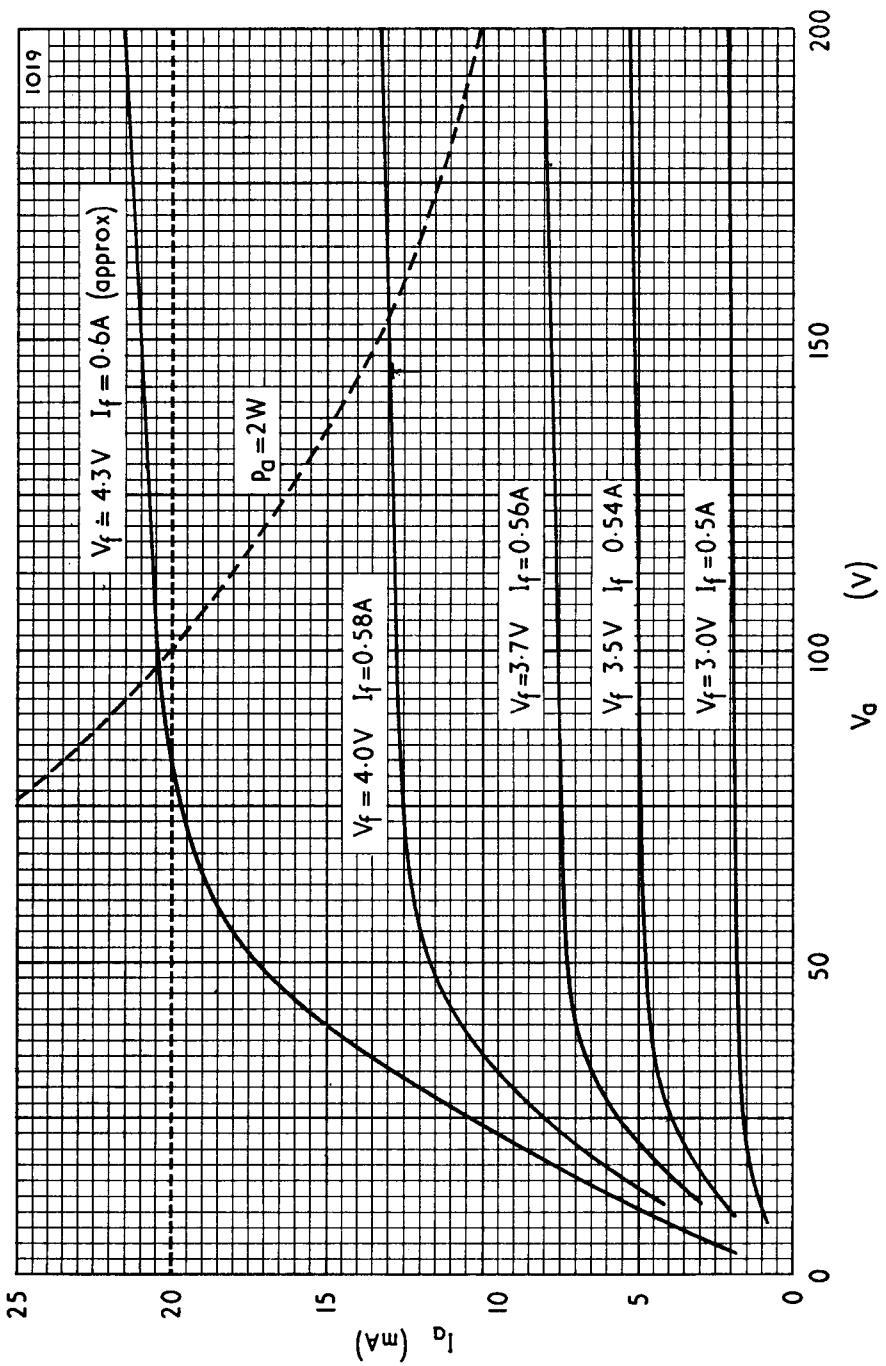
The valve can be mounted in any position.

A screening canister, which also serves as a retainer, is necessary.

Free air circulation around the canister is preferable. The temperature of the hottest part of the bulb must not exceed 200°C.

This valve has been designed to give a life of 1000—2000 hours operating at a saturated current of 5mA. With a saturated current of 20mA the life is approximately 100 hours.

No correction of the noise factor for electron transit time when measured as above is necessary for use up to 220Mc/s.


1019
V_f ≐ 4·3V I_f = 0·6A (approx)
P_a = 2W
V_f = 4·0V I_f = 0·58A
V_f = 3·7V I_f = 0·56A
V_f 3·5V I_f 0·54A
V_f = 3·0V I_f = 0·5A
I_a (mA)
25
20
15
10
5
0
0
50
100
150
200
V_a (V)

A2087

OV.4794

Printed in England. C.

MINIATURE OUTPUT PENTODE 6·3V INDIRECTLY HEATED

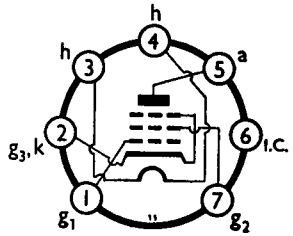
A2134

MARCH, 1955

The A2134 is the commercial equivalent of CV2179.

It is particularly suitable for use as the series valve in voltage stabilising equipment.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	64—70	mm.
Seated length :	58—64	mm.
Max. diameter :	19	mm.

HEATER

V_h	6·3	V
I_h	0·635	A

MAXIMUM RATINGS (design centre)

Pentode connection			Triode connection		
V_a	300	V	$V_{a,\ g2}$	300	V
V_{g2}	300	V	$p_{a,\ g2}$	12	W
$V_{h\text{-}k}$ (pk)	150	V			
p_a	9	W			
p_{g2}	3	W			

CHARACTERISTICS

Pentode connection			Triode connection		
V_a	165	V	$V_{a,\ g2}$	165	V
V_{g2}	165	V	V_{g1}	−9	V
V_{g1}	−9	V	μ	10	
μ	220		r_a	835	Ω
r_a	23·2	kΩ	g_m	12	mA/V
g_m	9·5	mA/V			

CAPACITANCES (of unscreened valve) :

$c_{a\text{-all}}$ 10 pF $c_{g1\text{-all}}$ 10 pF $c_{a\text{-}g1}$ 0·3 pF

TYPICAL OPERATION

Pentode Connection

Single Valve. Class A

% full input	45	100	100	75	50	%
V_a	100	150	165	165	165	V
V_{g2}	100	150	165	165	165	V
V_{g1} (o)	−4·6	−7·8	−9·3	−10	−11·4	V
I_a (o)	39	56	53	40	29	mA
I_{g2} (o)	6·5	9·5	9	7·2	5·4	mA
R_k	100	120	150	220	330	Ω
v_{in} (pk)	5	7	8·5	6·7	4·7	V
R_L	2·5	3	3	4	6	kΩ
P_{out}	1·45	3·5	4·1	2·84	2·3	W
D	8·6	11	10	10	10	%

The conditions given in the last two columns are those obtained when the valve is over-biased. They are useful when H.T. power is limited and reduced power output can be tolerated.

Two Valves. Push-pull, Class AB_1

Data per pair unless otherwise stated.

V_a	100	165	200	250	V
V_{g2}	100	165	165	165	V
V_{g1} (o)	−5	−11·9	−10	−11·2	V
I_a (o)	70	107	87	66	mA
I_a (max. sig.)	73	110	100	80	mA
I_{g2} (o)	12	18	14	10	mA
I_{g2} (max. sig.)	15	36	25	24	mA
R_k (per valve)	120	150	200	300	Ω
v_{in} (pk) (g_1-g_1)	11	20	25	30	V
R_L (a−a)	3	3	4·5	7·5	kΩ
P_{out}	2·25	9	11·5	13·3	W
D	3·3	4·6	4	4·5	%

Triode Connection

Two Valves. Push-pull, Class AB_1,

Data per pair unless otherwise stated.

$V_{a,g2}$	165	V
V_{g1} (o)	−10·5	V
$I_{a,g2}$ (o)	65	mA
$I_{a,g2}$ (max. sig.)	74	mA
R_k (per valve)	330	Ω
v_{in} (pk) (g_1-g_1)	24	V
R_L (a−a)	3	kΩ
P_{out}	2·6	W
D	1·4	%

GRID RESISTOR

The maximum permissible D.C. resistance from control grid to cathode is limited to 0·27 MΩ ±20% for auto-bias and 0·1 MΩ for fixed bias applications.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

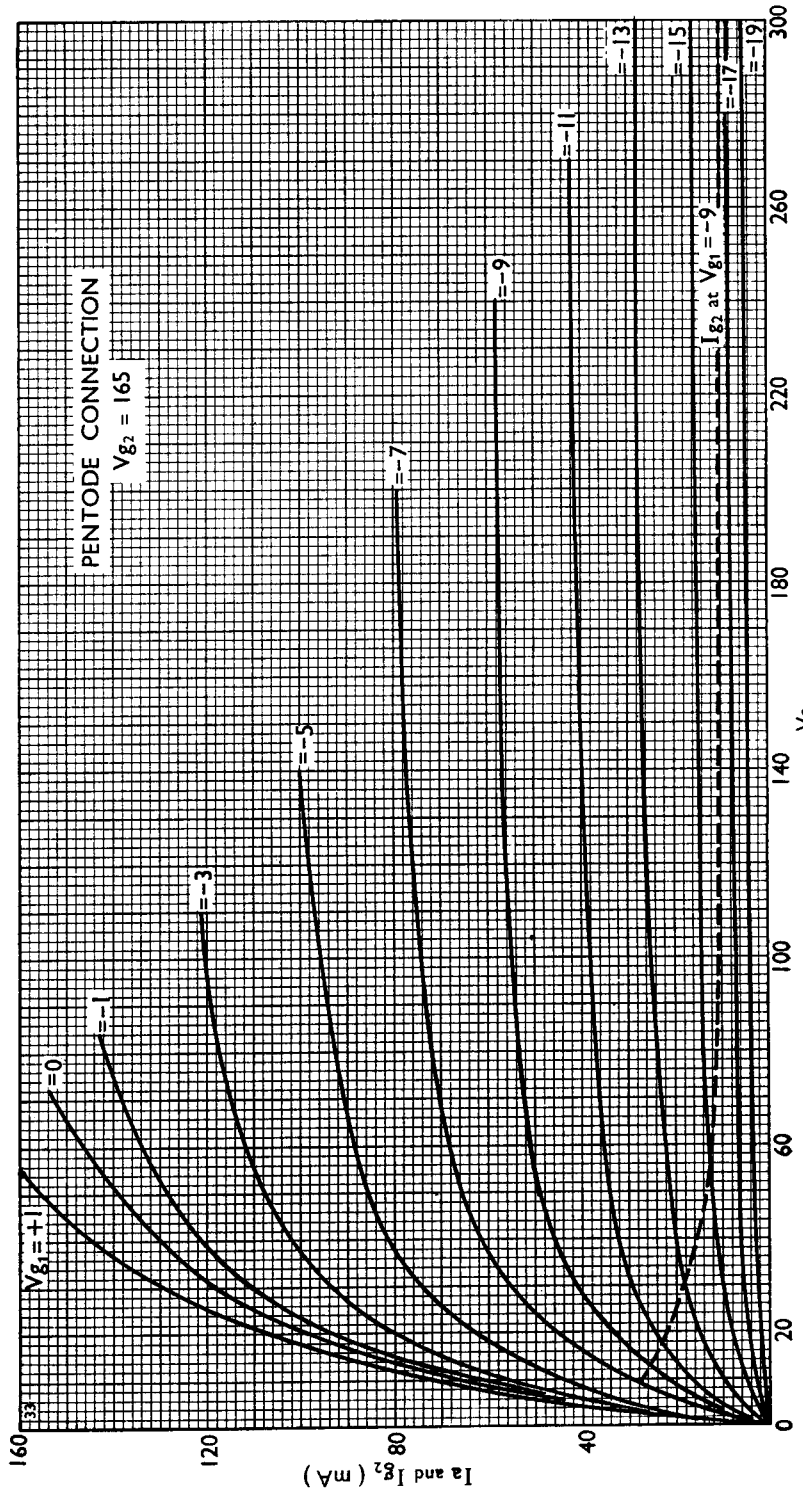
The use of a retaining device is recommended.

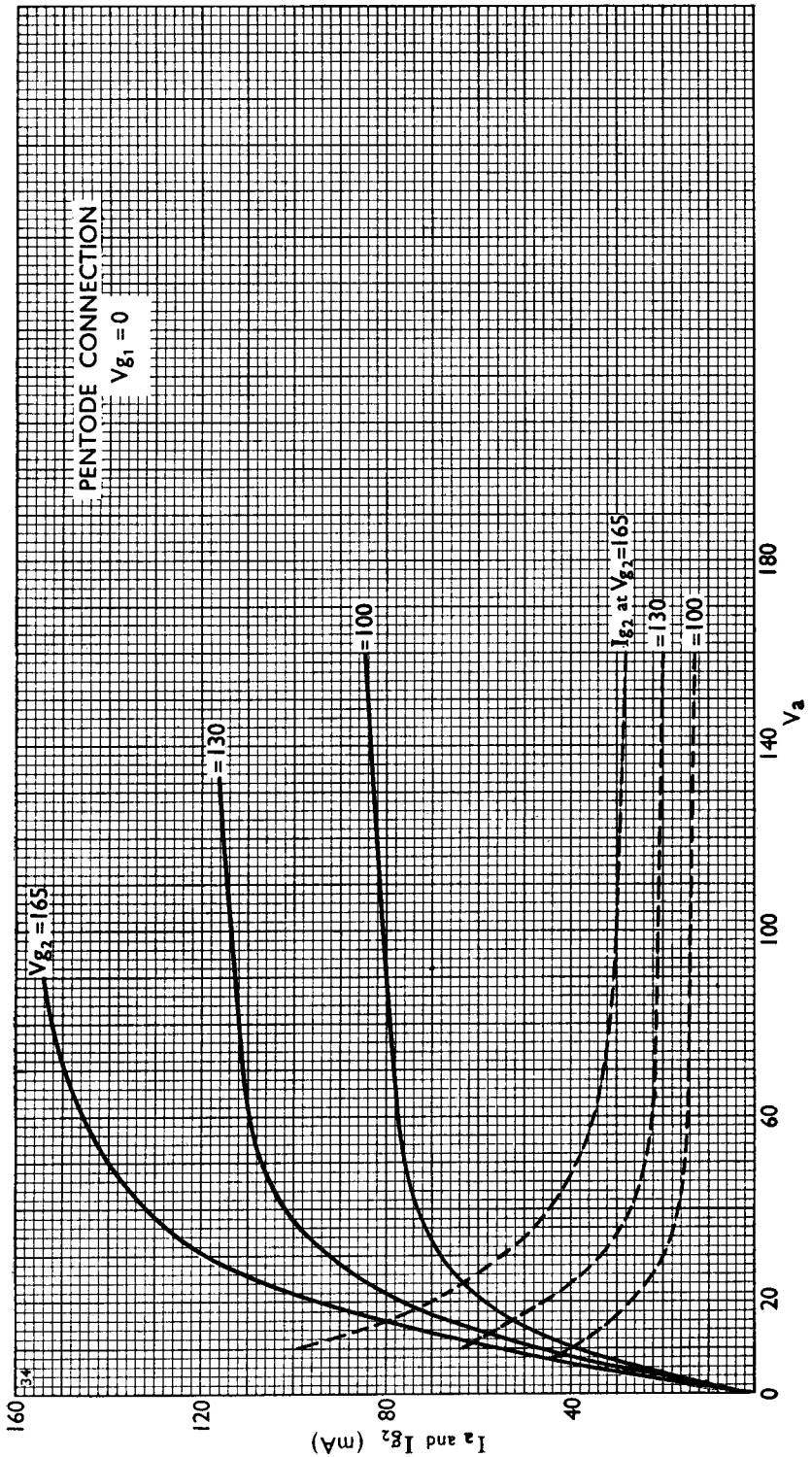
VENTILATION

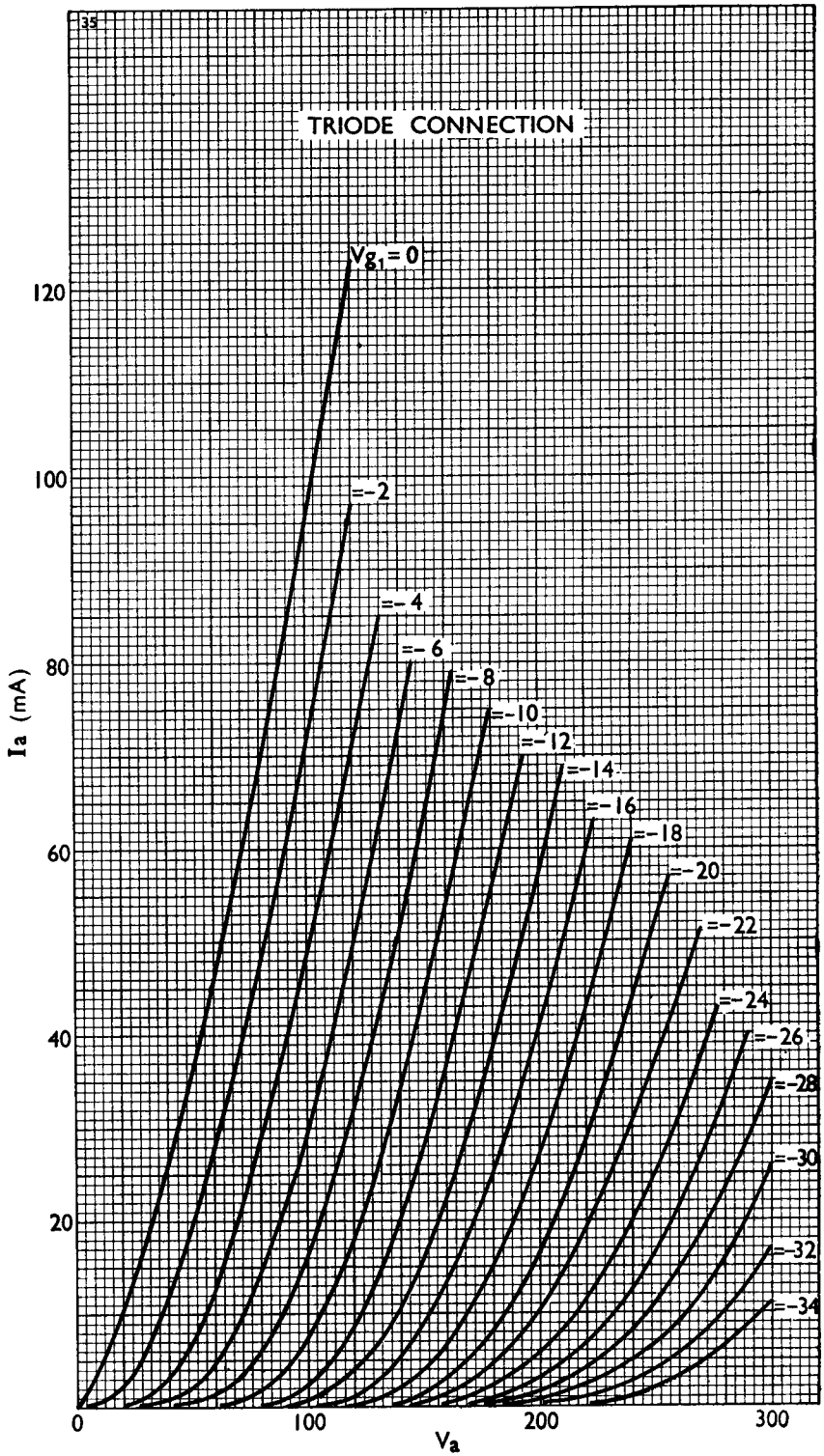
Free air circulation around the bulb is preferable. If a retaining device in the form of a canister is employed, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

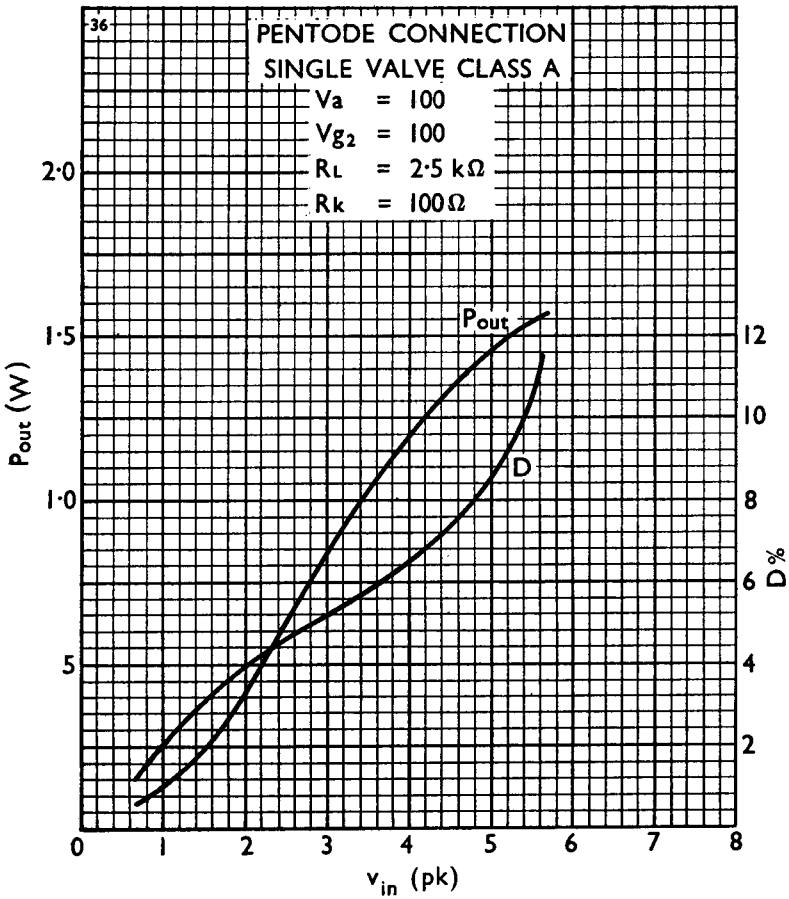
MICROPHONY

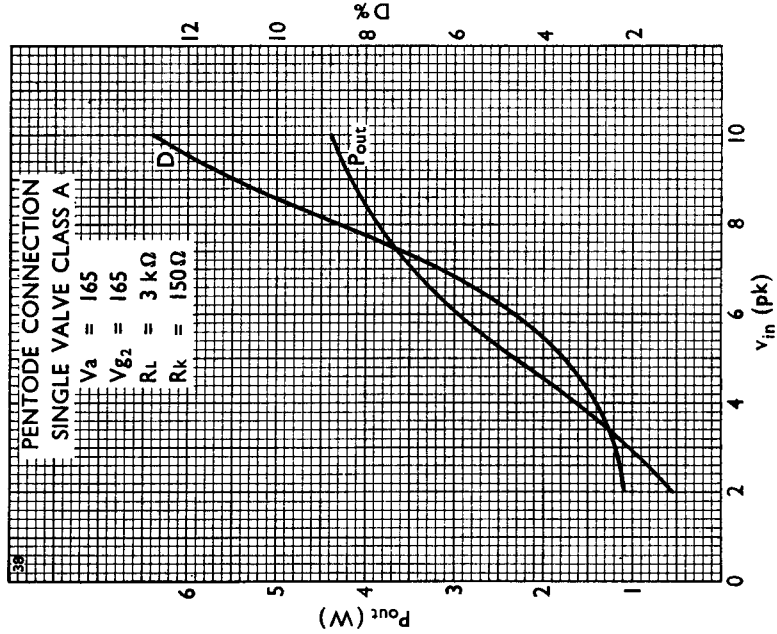
Free from microphony in all normal receiver applications.

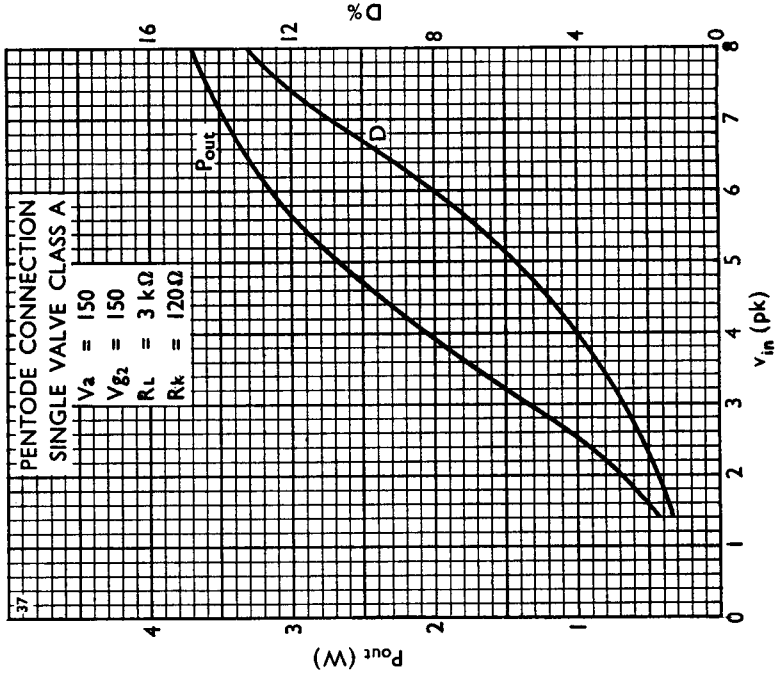

PENTODE CONNECTION
V_{g_2} = 165
V_{g_1} = +1
=0
=-1
=-3
=-5
=-7
=-9
=-11
=-13
=-15
=-17
=-19
I_{g_2} at V_{g_1} = -9
133
160
120
80
40
0
20
60
100
140
180
220
260
300
V_a
I_a and I_{g_2} (mA)

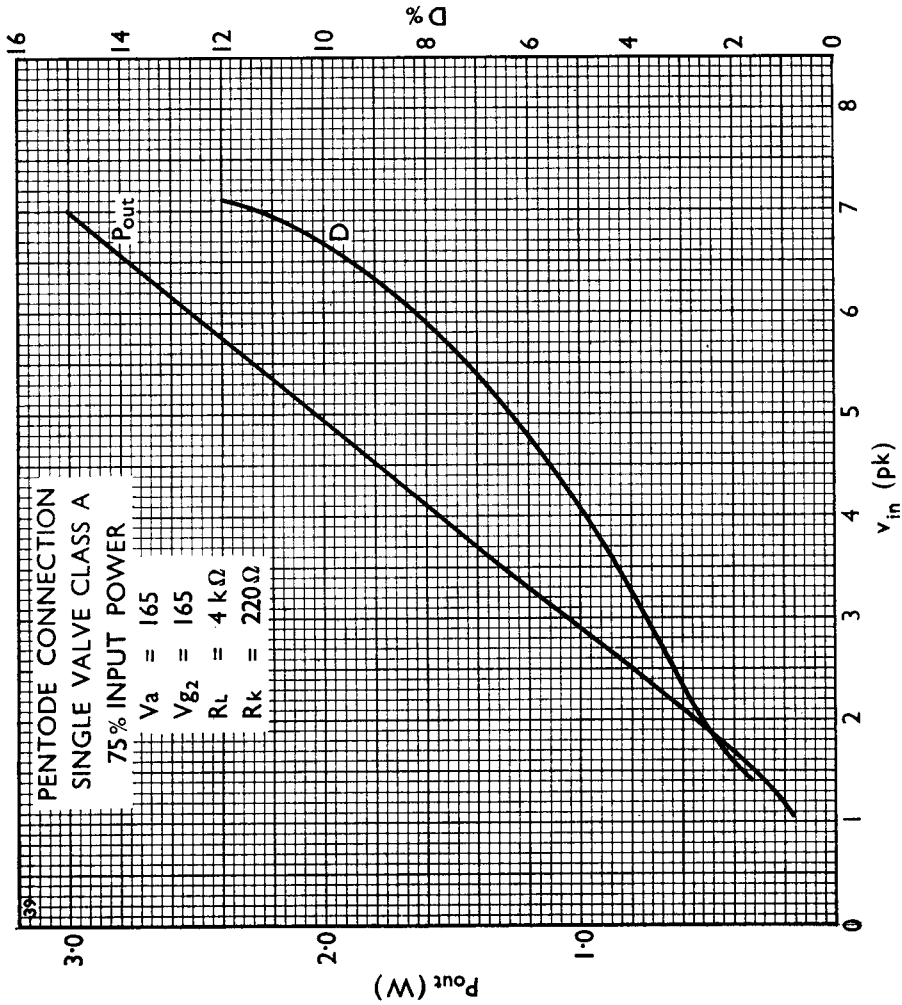

PENTODE CONNECTION
$V_{g_1} = 0$
V_{g_2}=165
=130
=100
I_{g_2} at V_{g_2}=165
=130
=100
I_a and I_{g_2} (mA)
V_a
160
120
80
40
0
20
60
100
140
180
34

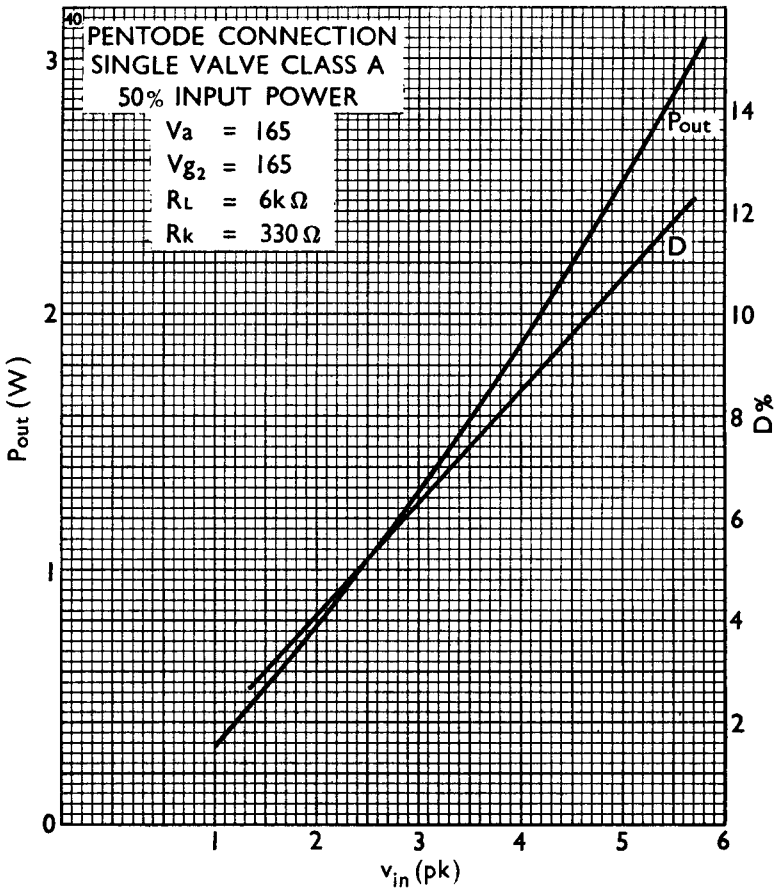

35
TRIODE CONNECTION
$V_{g_1} = 0$
=-2
=-4
=-6
=-8
=-10
=-12
=-14
=-16
=-18
=-20
=-22
=-24
=-26
=-28
=-30
=-32
=-34
120
100
80
60
40
20
0
100
200
300
Ia (mA)
Va

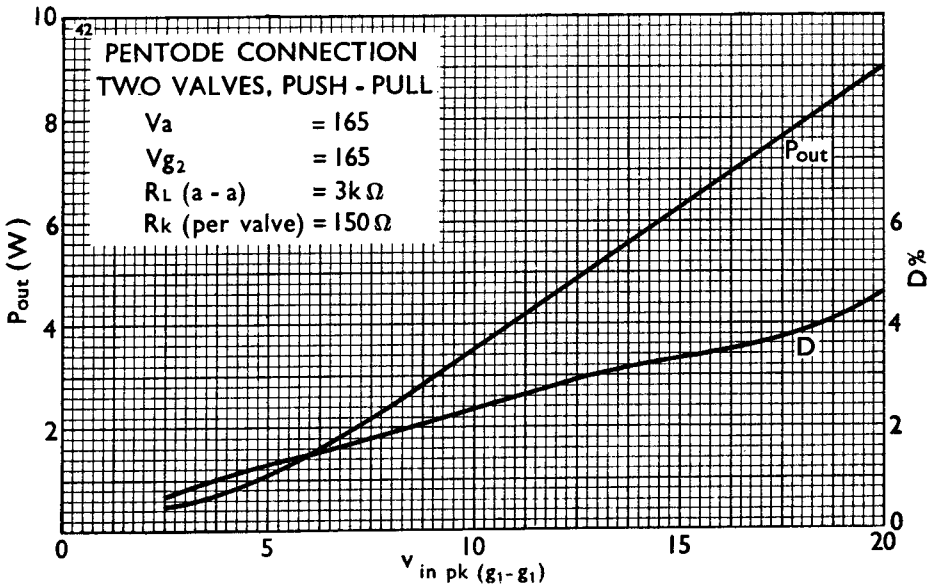

36
PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 100
Vg2 = 100
RL = 2·5 kΩ
Rk = 100Ω
Pout
D
Pout (W)
D%
vin (pk)
2·0
1·5
1·0
5
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8

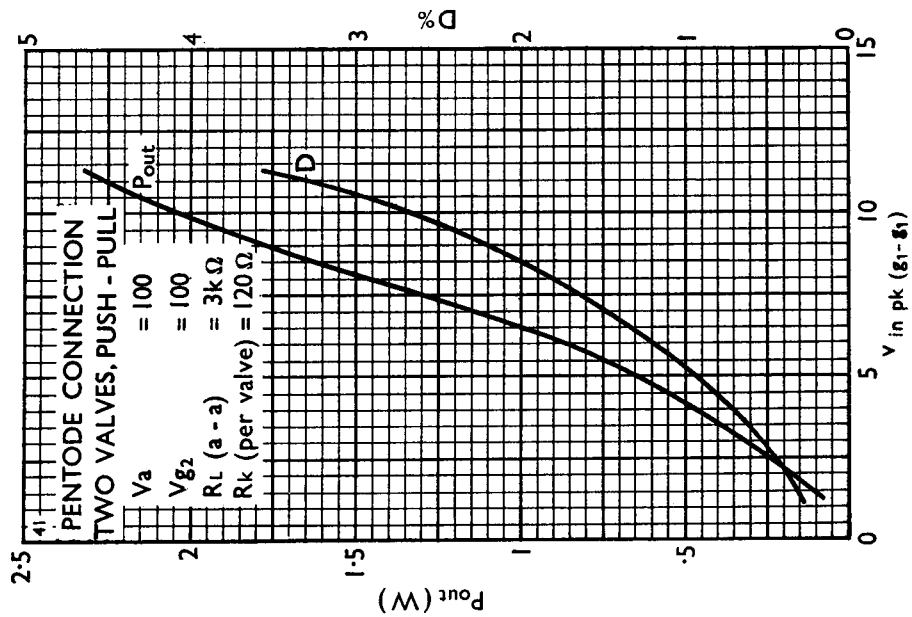

PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 165
Vg2 = 165
RL = 3 kΩ
Rk = 150Ω
D
Pout
38
Pout (W)
Vin (pk)
D%

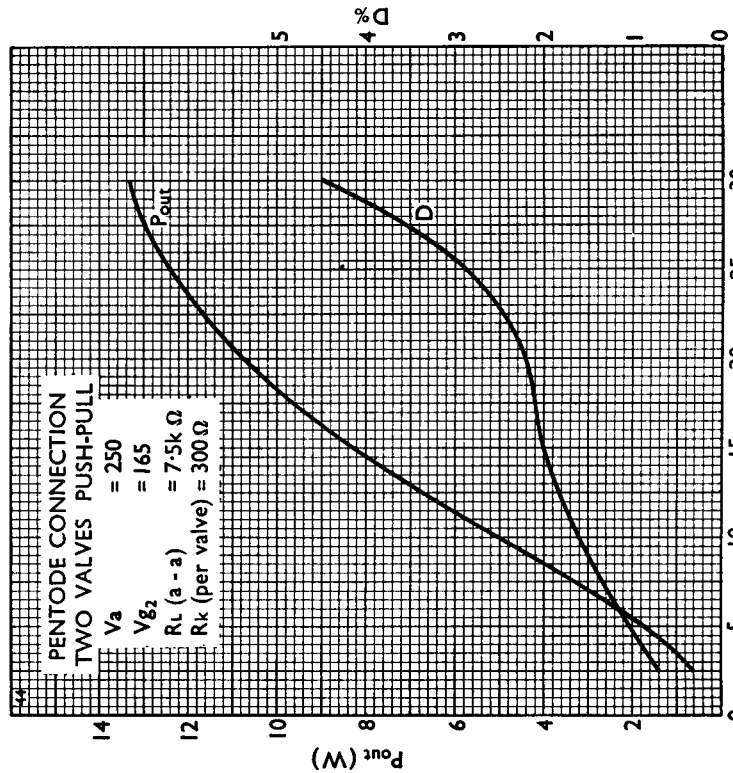

PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 150
Vg2 = 150
RL = 3 kΩ
Rk = 120Ω
Pout
D
37
Pout (W)
Vin (pk)
D%

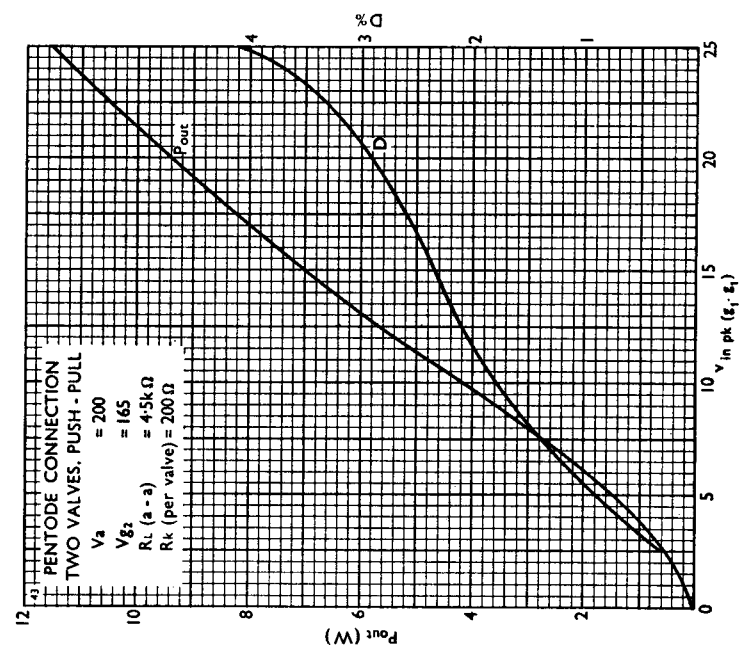

PENTODE CONNECTION
SINGLE VALVE CLASS A
75% INPUT POWER
Va = 165
Vg2 = 165
RL = 4 kΩ
Rk = 220Ω
Pout
D
Pout (W)
D %
vin (pk)
3·0
2·0
1·0
0
2
4
6
8
10
12
14
16
1
3
5
7
39


PENTODE CONNECTION
SINGLE VALVE CLASS A
50% INPUT POWER
Va = 165
Vg2 = 165
RL = 6kΩ
Rk = 330Ω
Pout
D
Pout (W)
D%
vin (pk)
0
1
2
3
2
4
6
8
10
12
14
1
2
3
4
5
6

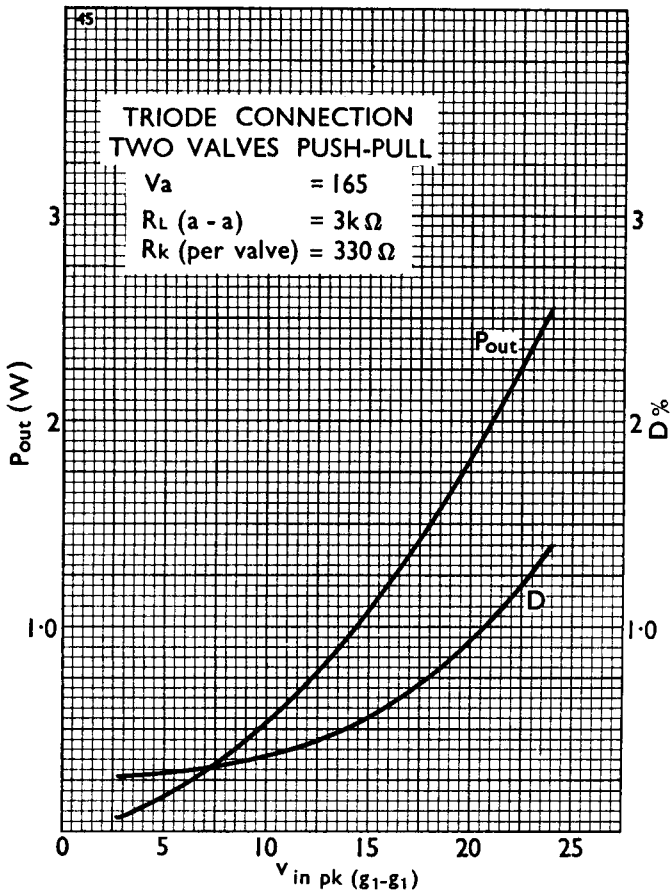

42
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 165
Vg2 = 165
RL (a - a) = 3kΩ
Rk (per valve) = 150Ω
Pout
D
Pout (W)
D%
V in pk (g1-g1)
0
2
4
6
8
10
5
15
20


41
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 100
Vg2 = 100
RL (a - a) = 3kΩ
Rk (per valve) = 120Ω
Pout
D
D%
Pout (W)
V in pk (g1-g1)
0
1
2
3
4
5
·5
1·5
2·5
10
15


PENTODE CONNECTION
TWO VALVES PUSH-PULL
Va = 250
Vg2 = 165
RL (a - a) = 7·5k Ω
Rk (per valve) = 300 Ω
Pout
D
Pout (W)
D%
V in pk (g1-g1)


PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 200
Vg2 = 165
RL (a - a) = 4·5k Ω
Rk (per valve) = 200 Ω
Pout
D
Pout (W)
D%
V in pk (g1-g1)

A2134



Printed in England. C.

HIGH VOLTAGE DIODE

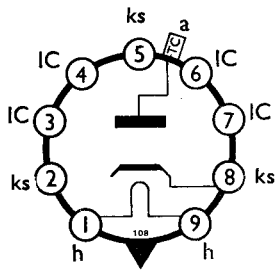
A2272

NOVEMBER, 1955

A high voltage vacuum diode with an indirectly heated cathode suitable for use as a rectifier or an inverse diode at high ambient temperatures.

A2272 is the commercial equivalent of CV2318.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base: B9G
Top cap: CT2
Bulb: Tubular

Overall length: 115 max. mm.
Seated length: 100 max. mm.
Diameter: 45 max. mm.

HEATER

V_h	6·3	V
I_h	1·6 (approx.)	A

RATINGS

As Rectifier

$V_{in\ (rms)}$	5·5 max.	kV
PIV	16 max.	kV
$V_{h\text{-}k}$	250 max.	V
I_{out}	100 max.	mA
$I_{k\ (pk)}$	600 max.	mA
$I_{a\ (surge)}$	2 max.	A
R_s	4000 max.	Ω
t_{hk}	60 min.	s
T_{amb}	90 max.	°C

As Inverse Diode

PIV	16 max.	kV
*$I_{a\ (pulse)}$	7·5 max.	A
†$I_{a\ (puise)\ fault\ conditions}$	14 max.	A
p_a	10 max.	W
t_{hk}	60 min.	s
T_{amb}	90 max.	°C

* $t_p = 1\ \mu$ Sec., PRF 1000 pps.

† Max. duration of fault = 2 secs.
Max. frequency of fault = 1 per 5 minutes.

CAPACITANCE

$C_{a\text{-}all}$	6·0	pF

SWITCHING

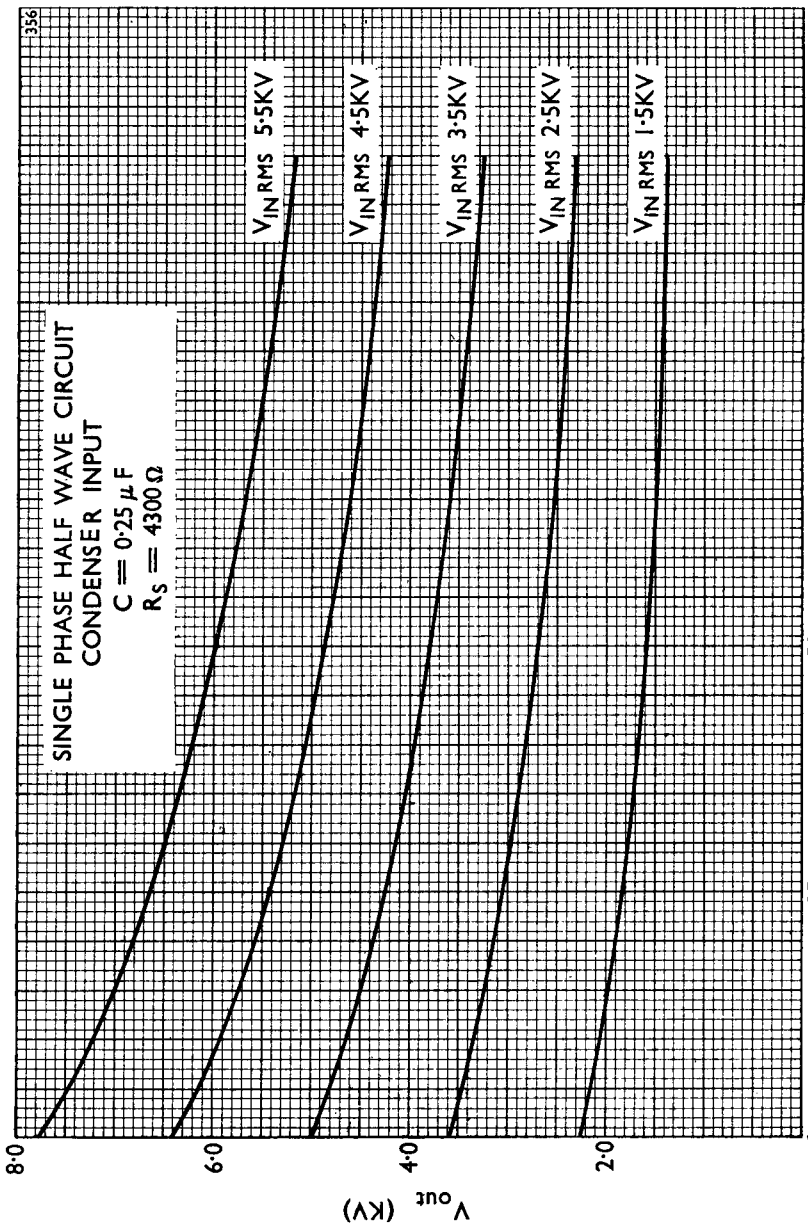
Direct.

MOUNTING

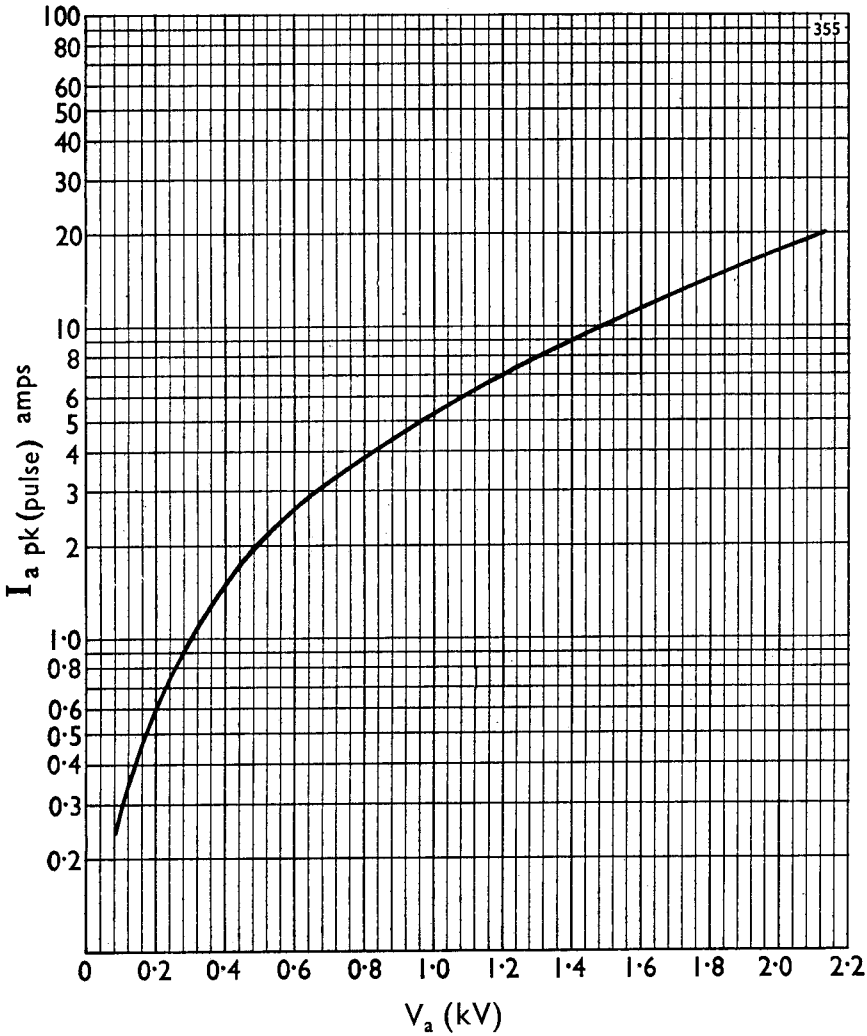
Any position.

OPERATIONAL NOTE

Pins marked IC should be connected externally to ks


356
SINGLE PHASE HALF WAVE CIRCUIT
CONDENSER INPUT
C = 0·25 μF
R_S = 4300 Ω
V_{IN} RMS 5·5KV
V_{IN} RMS 4·5KV
V_{IN} RMS 3·5KV
V_{IN} RMS 2·5KV
V_{IN} RMS 1·5KV
8·0
6·0
4·0
2·0
V_{out} (KV)
0
25
50
75
100
I_{out} (mA)

A2272



Printed in England. C.

Triode *Type ACM 3*

VIDEO FREQUENCY MODULATOR AND CATHODE FOLLOWER

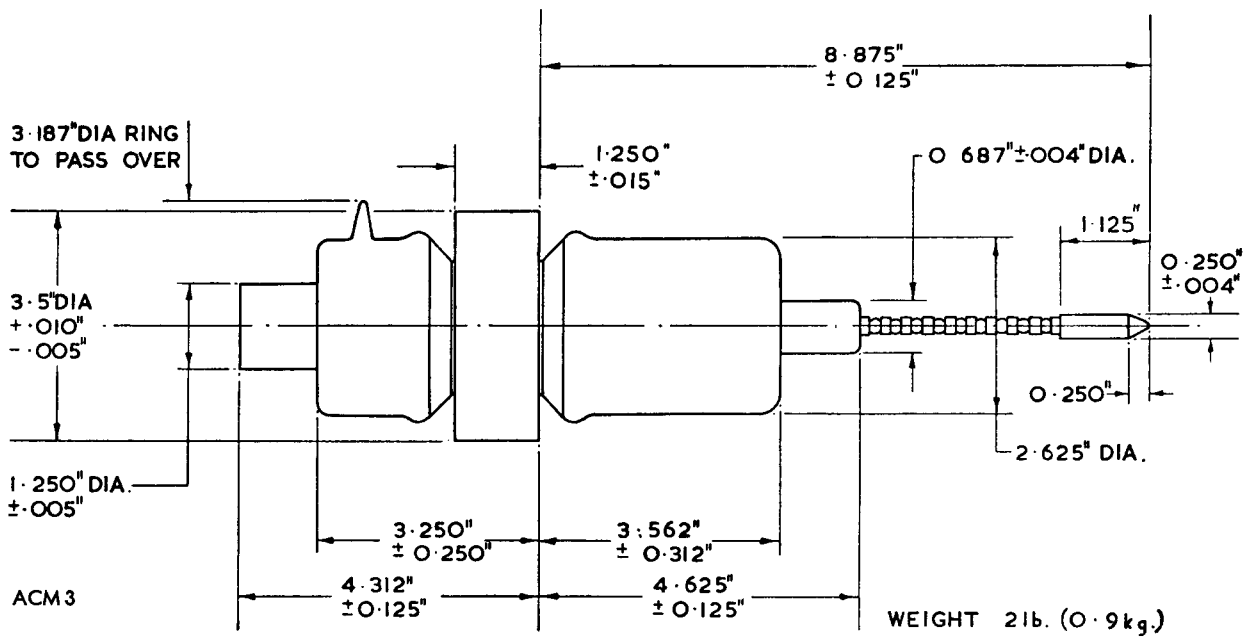
General. A forced-air-cooled triode fitted with an indirectly heated oxide coated cathode, designed for use as a video frequency modulator and cathode follower. The ACM 3 is not suitable for positive grid drive.

Cooling. The anode requires cooling by air blast. The volume of air necessary is about 60 cu. ft. per minute at a pressure equal to a 1-in. head of water. The grid seal also requires to be cooled by air and the volume of air necessary is about 6 cu. ft. per minute at a pressure equal to a 1-in. head of water. All cooling supplies must be in operation before the application of any supply voltages, and must continue until all voltages have been removed.

Mounting. The valve must be mounted vertically with the cathode end uppermost. Rigid connections must be made to the anode only.

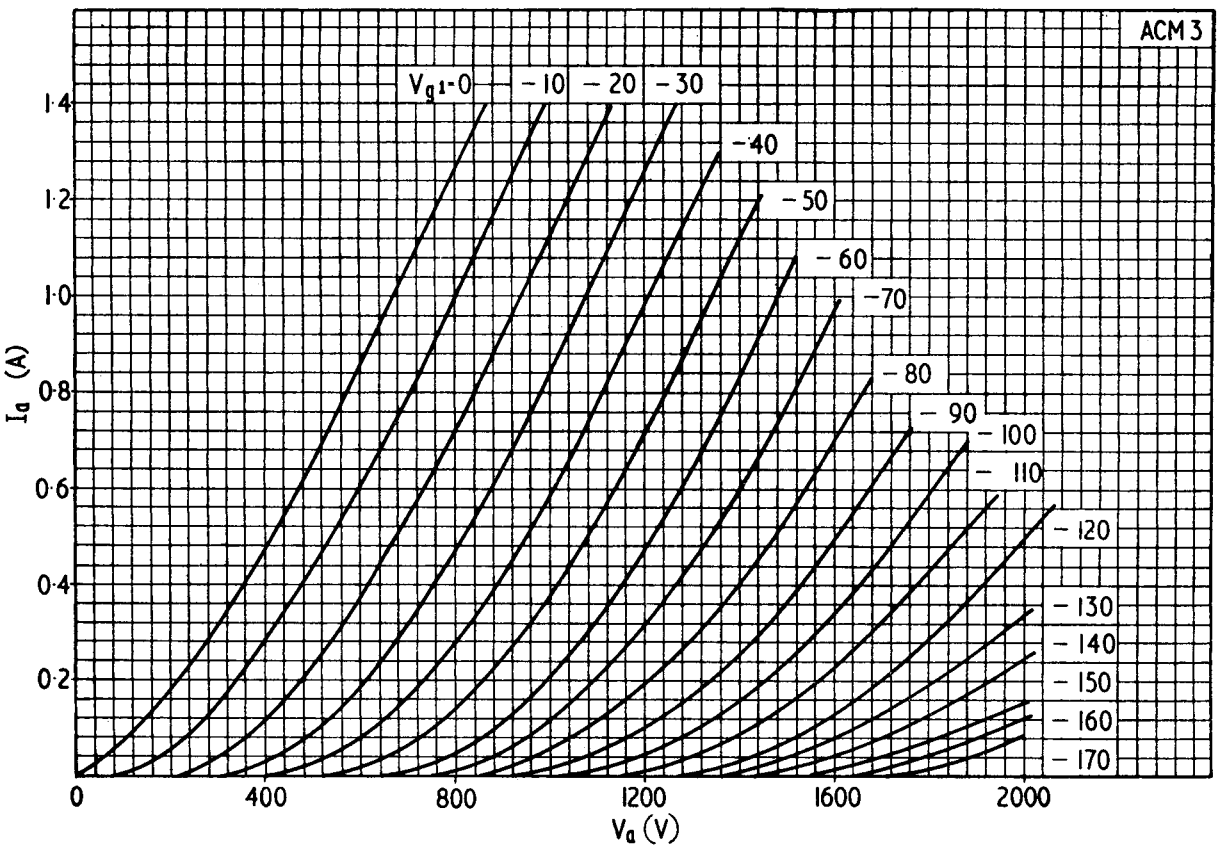
APPROXIMATE DATA

V_f	6	V
I_f	17	A
$V_{a\ (max)}$	2	kV
$p_{a\ (max)}$	2	kW
$I_{k\ (pk)\ (max)}$	2	A
μ	14	
g_m (taken at $\frac{1}{2}$ $I_{k\ (pk)}$)	27	mA/V
$c_{a\text{-}g_1}$	15	pF
$c_{a\text{-}k}$	5	pF
$c_{g_1\text{-}k}$	20	pF



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford



PRINTED IN ENGLAND

Pentode *Type ACPT8*

HF POWER AMPLIFIER AND OSCILLATOR

General. A transmitting pentode fitted with a thoriated tungsten filament and a copper anode which is cooled by means of a radiator.

The valve is designed to give a large output at high frequencies, having a permissible anode dissipation of 750 W and giving useful output down to 9 metres. With forced air cooling the anode dissipation may be increased to 1·1 kW. At this rating the volume of air required is 10 cu. ft. per minute at a pressure equal to 3-in. head of water.

In view of the low suppressor volts required for anode current cut-off, this valve is very suitable for suppressor modulation.

The screen and control grids are aligned, giving high overall efficiency.

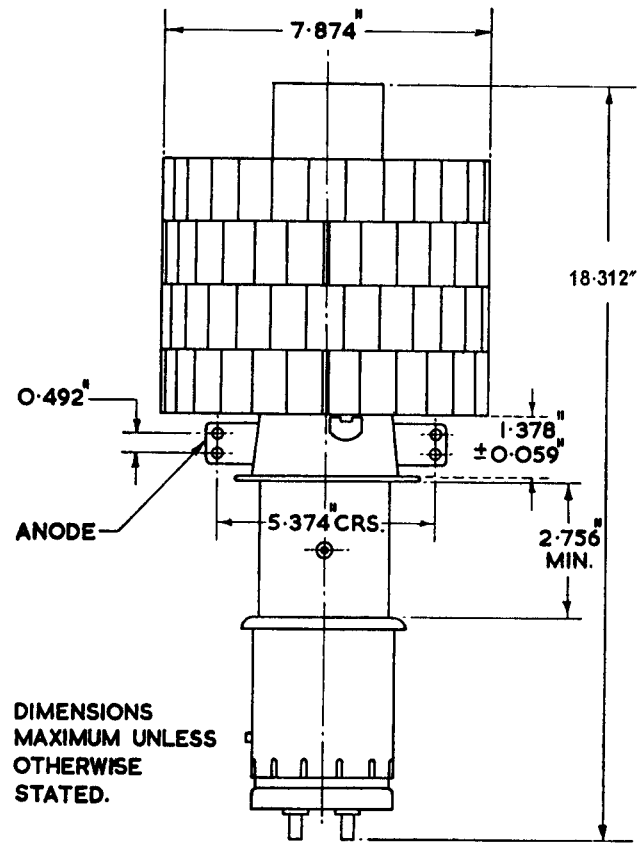
The figures quoted for maximum permissible ratings are only applicable for use at wavelengths down to 15 metres. At shorter wavelengths the maximum permissible anode voltage and input must be reduced to the following percentage of the quoted figures:

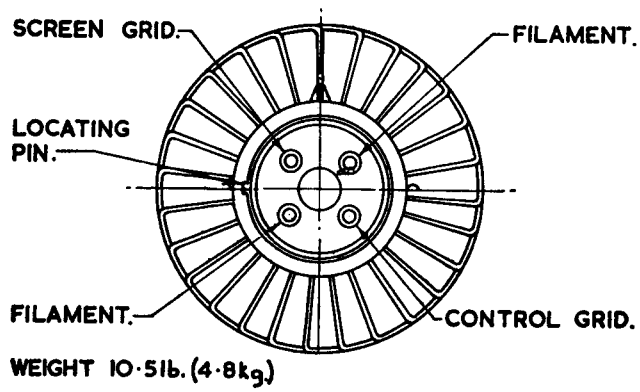
For operation down to 13 metres	85%
For operation down to 11·5 metres	70%
For operation down to 10·5 metres	60%
For operation down to 9·5 metres	50%

APPROXIMATE DATA

V_f	11	V
I_f	16	A
g_m* (taken at Va 4,500, V_{g2} 800, p_a 750 W)	6·5	mA/V
g_m* (taken at $\frac{1}{2}$ $I_{e\ pk}$)	10	mA/V
$I^*_{e\ (pk)}$	4·25	A
$c_{a\text{-}gl}$	0·1	pF
c_{in}	65	pF
c_{out}	26	pF

* No attempt must be made to measure these figures statically.





WEIGHT 10·5 lb. (4·8 kg)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

(1) HF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

Maximum permissible ratings

V_a	4,500	V	
I_a	600	mA	
P_{in}	V_{g3} +80 V	2·5	kW
	V_{g3} 0 V	2·2	kW
I_{g1}	100	mA	
V_{g2}	800	V	
p_{g2}	100	W	
p_a	750	W	

Typical Operation

V_a	4,500	4,500	3,500	2,500	V
I_a	550	475	380	330	mA
V_{g2}	800	500	500	500	V
I_{g2}	120	180	160	160	mA
p_{g2}	96	90	80	80	W
V_{g3}	+80	0	0	0	V
V_{g1}	−250	−200	−200	−200	V
I_{g1}	60	90	80	80	mA
$R_{g1\text{-}k}$	4,000	2,200	2,500	2,500	Ω
$v_{g1\ (pk)}$	400	400	350	350	V
P_{dr} (b)	40	50	40	40	W
Z_a	3,600	4,000	4,000	3,200	Ω
p_a	700	650	380	275	W
P_{out}	1,800	1,500	950	550	W

(2) HF POWER AMPLIFIER CLASS C

(Grid modulated, one valve, carrier conditions, permissible modulation 100%*)*

Maximum permissible ratings

V_a	4,500	V
I_a	300	mA
P_{in}	1·15	kW
I_{g1}	100	mA
V_{g2}	800	V
p_{g2}	100	W
p_a	750	W

Typical Operation

V_a	4,500	3,500	V
I_a	225	210	mA
V_{g2}	800	800	V
I_{g2}	20	20	mA
p_{g2}	16	16	W
V_{g3}	0	0	V
V_{g1}	−160	−155	V
I_{g1}	5	5	mA
$v_{g1\ (pk)}$	185	170	V
P_{dr} (b) (c)	10	10	W
$v_{pk\ (mod)}$ (d)	80	80	V
P_{mod} (d)	2·5	2·5	W
$Z_{a\ (mod)}$	2,500	2,500	Ω
Z_a	4,500	4,000	Ω
p_a	650	500	W
P_{out}	350	240	W

(3) HF POWER AMPLIFIER CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%*)*

Maximum permissible ratings

V_a	3,500	V
I_a	350	mA
P_{in}	1·2	kW
I_{g1}	100	mA
V_{g2}	800	V
p_{g2}	100	W
p_a	500	W

Typical Operation

V_a	3,500	2,500	V
I_a	300	265	mA
V_{g2}	500	500	V
R_{g2}	30,000	20,000	Ω
I_{g2}	90	95	mA
p_{g2}	45	47·5	W
V_{g3}	0	0	V
V_{g1}	−100	−90	V
I_{g1} (b)	48	45	mA
$v_{g1\ (pk)}$	190	190	V
P_{dr} (b)	14	14	W
P_{mod} (d)	680	400	W
$Z_{a\ (mod)}$	9,000	8,000	Ω
Z_a	5,500	4,500	Ω
p_a	350	190	W
P_{out}	700	450	W

(4) HF POWER AMPLIFIER

(Suppressor modulated, one valve, carrier conditions, permissible modulation 100%)

Maximum permissible ratings

V_a	4,500	V
I_a	250	mA
P_{in}	1·12	kW
I_{g1}	100	mA
V_{g2}	800	V
p_{g2}	100	W
p_a	750	W

Typical Operation

V_a	4,500	4,500	V
I_a	200	200	mA
V_{g2}	500	(a)	V
I_{g2}	180	120	mA
p_{g2}	90	90	W
V_{g3}	−160	−135	V
V_{g1}	−120	−120	V
I_{g1} (b)	95	45	mA
$v_{g1\ (pk)}$	250	230	V
P_{dr} (b)	30	15	W
$v_{pk\ (mod)}$ (d)	160	135	V
P_{mod} (d)	Negligible	Negligible	
Z_a	5,500	5,500	Ω
p_a	600	580	W
P_{out}	300	320	W

(5) HF POWER AMPLIFIER CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%)

Maximum permissible ratings

V_a	4,500	V
I_a	300	mA
P_{in}	1·1	kW
V_{g2}	800	V
p_{g2}	100	W
p_a	750	W

Typical Operation

V_a	4,500	3,500	V
I_a	240	240	mA
V_{g2}	800	800	V
I_{g2}	20	20	mA
p_{g2}	16	16	W
V_{g3}	0	0	V
V_{g1}	−85	−85	V
I_{g1} (b)	1	1·5	mA
$v_{g1\ (pk)}$	85	85	V
P_{dr} (b) (c)	5	6	W
Z_a	4,750	4,000	Ω
p_a	740	580	W
P_{out}	340	250	W

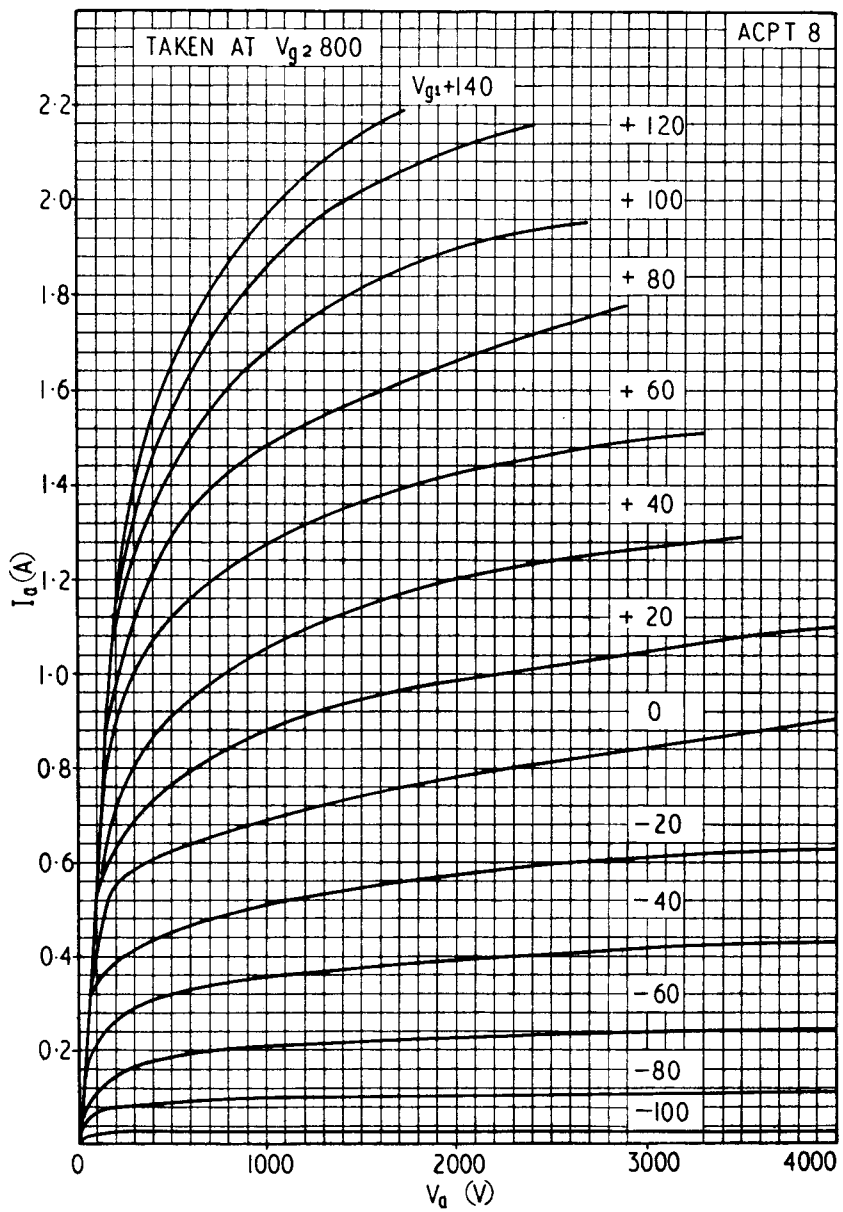
NOTES

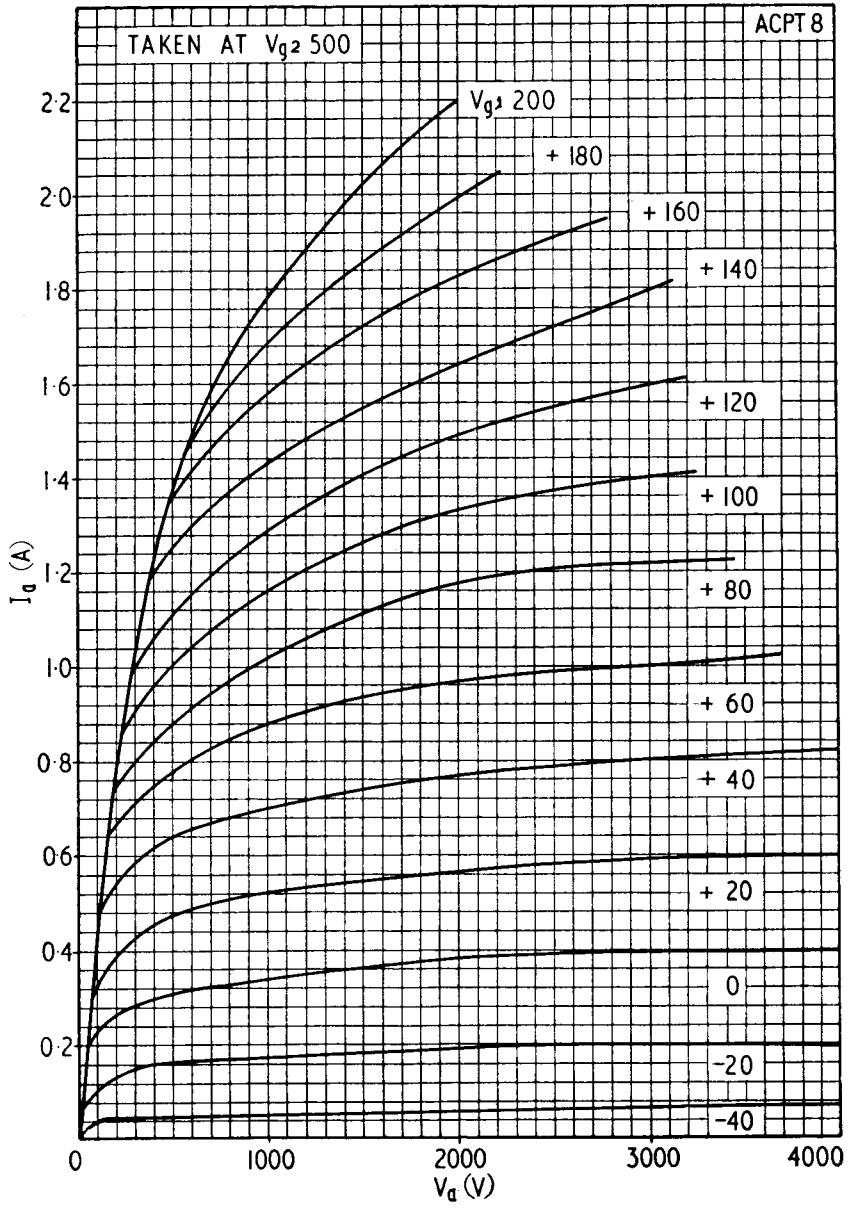
(a) Screen voltage obtained by means of a dropping resistance of 30,000 Ω from anode HT supply.

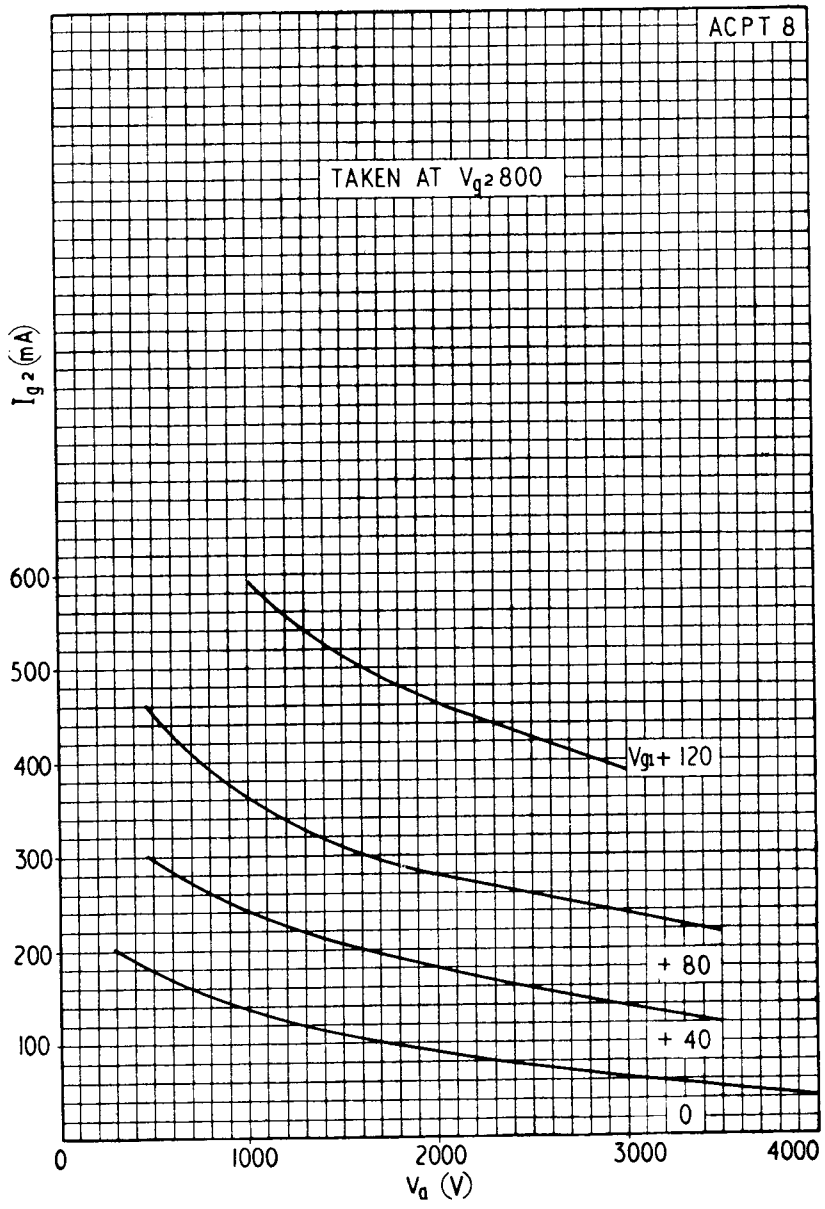
(b) Subject to wide variation. The figures are approximate only.

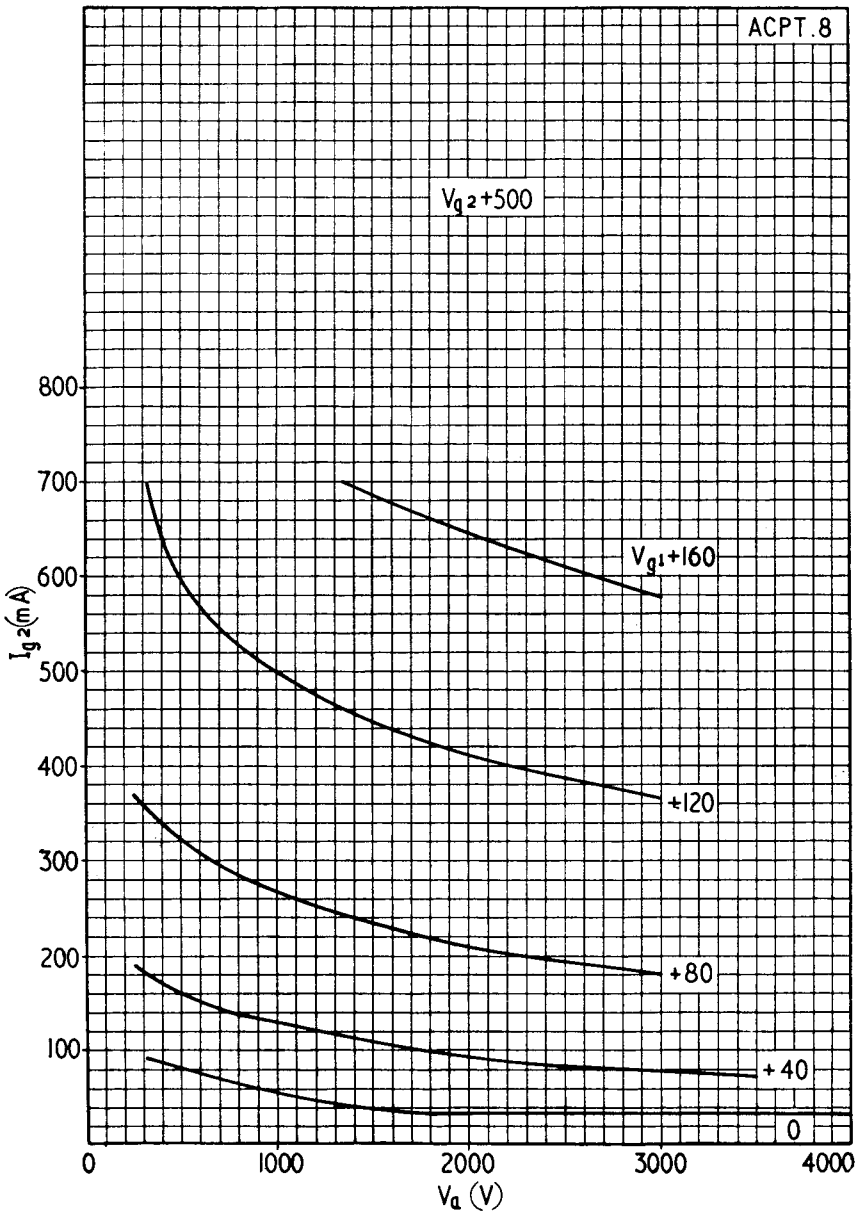
(c) At crest of audio cycle with 100% modulation.

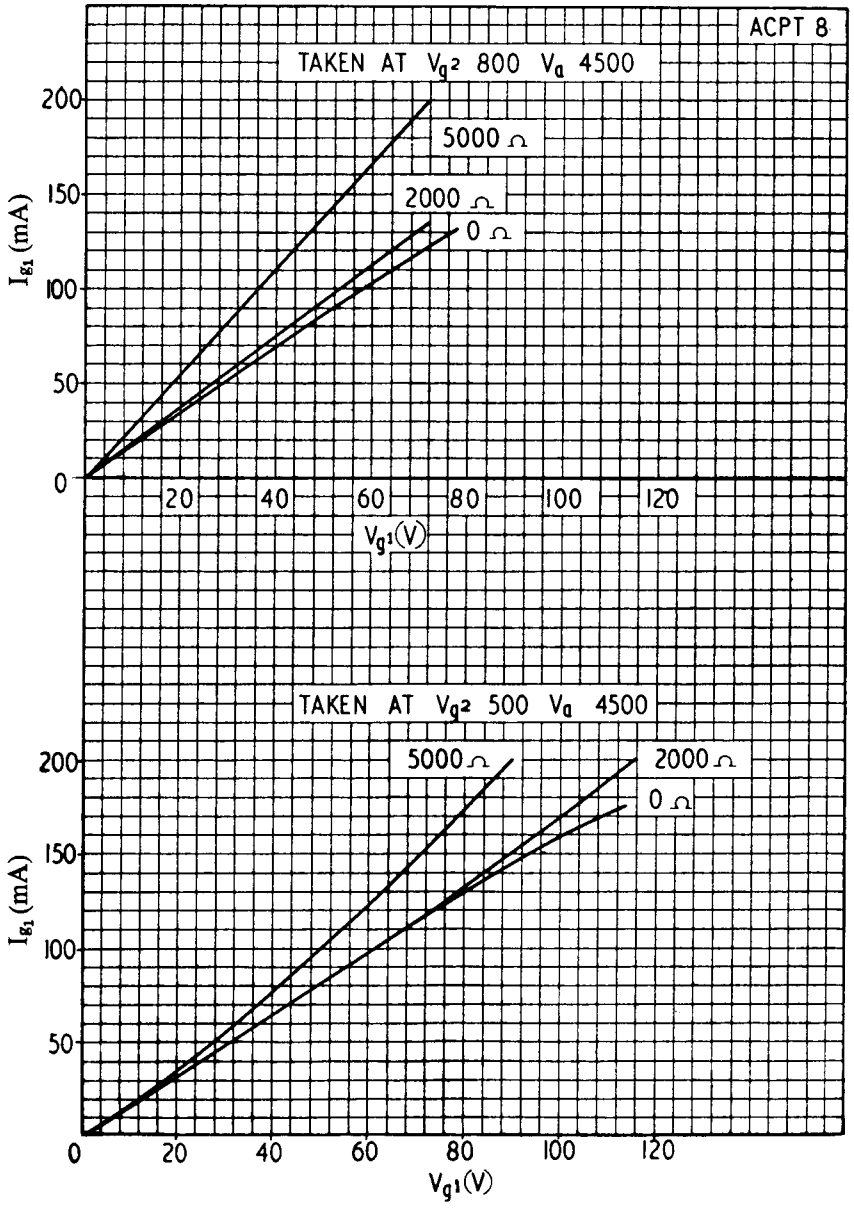
(d) 100% modulation.

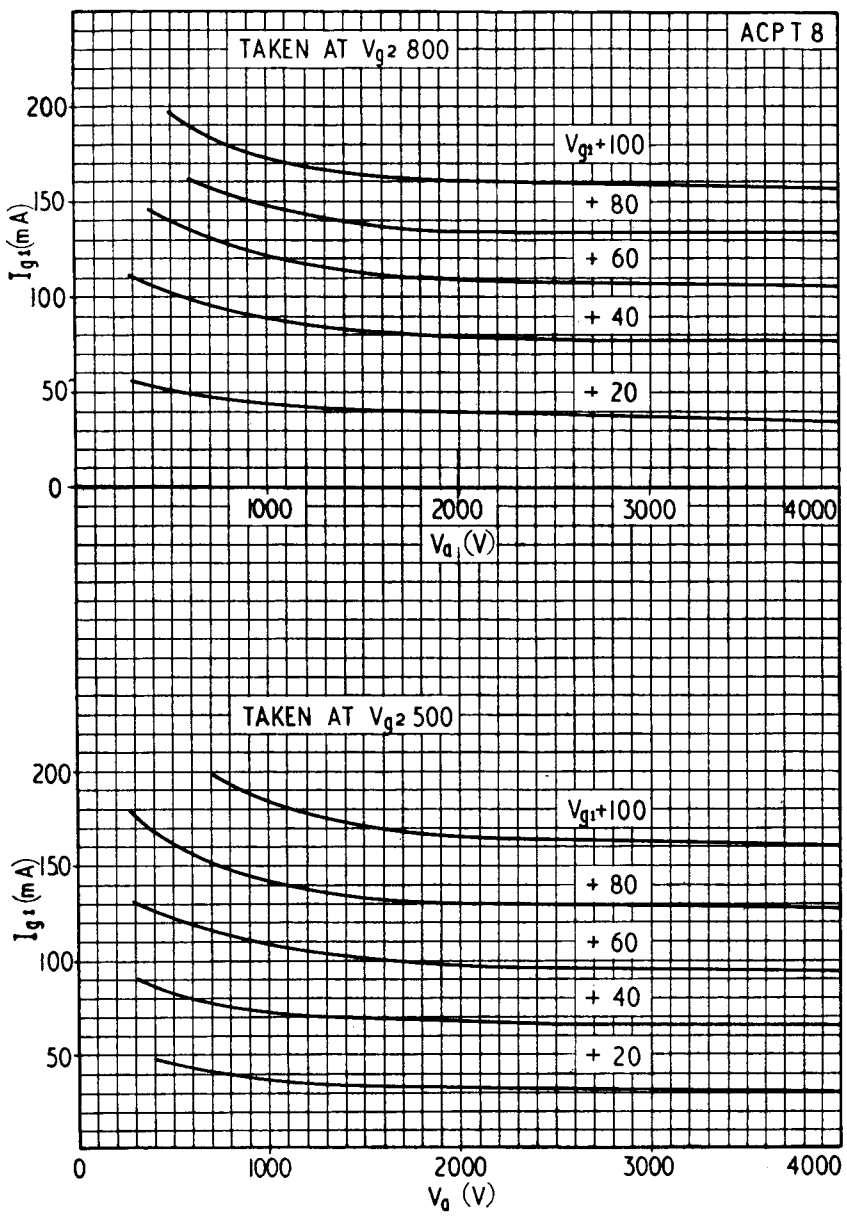

TAKEN AT V_{g2} 800
ACPT 8
V_{g1} +140
+ 120
+ 100
+ 80
+ 60
+ 40
+ 20
0
-20
-40
-60
-80
-100
2·2
2·0
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
I_a (A)
0
1000
2000
3000
4000
V_a (V)

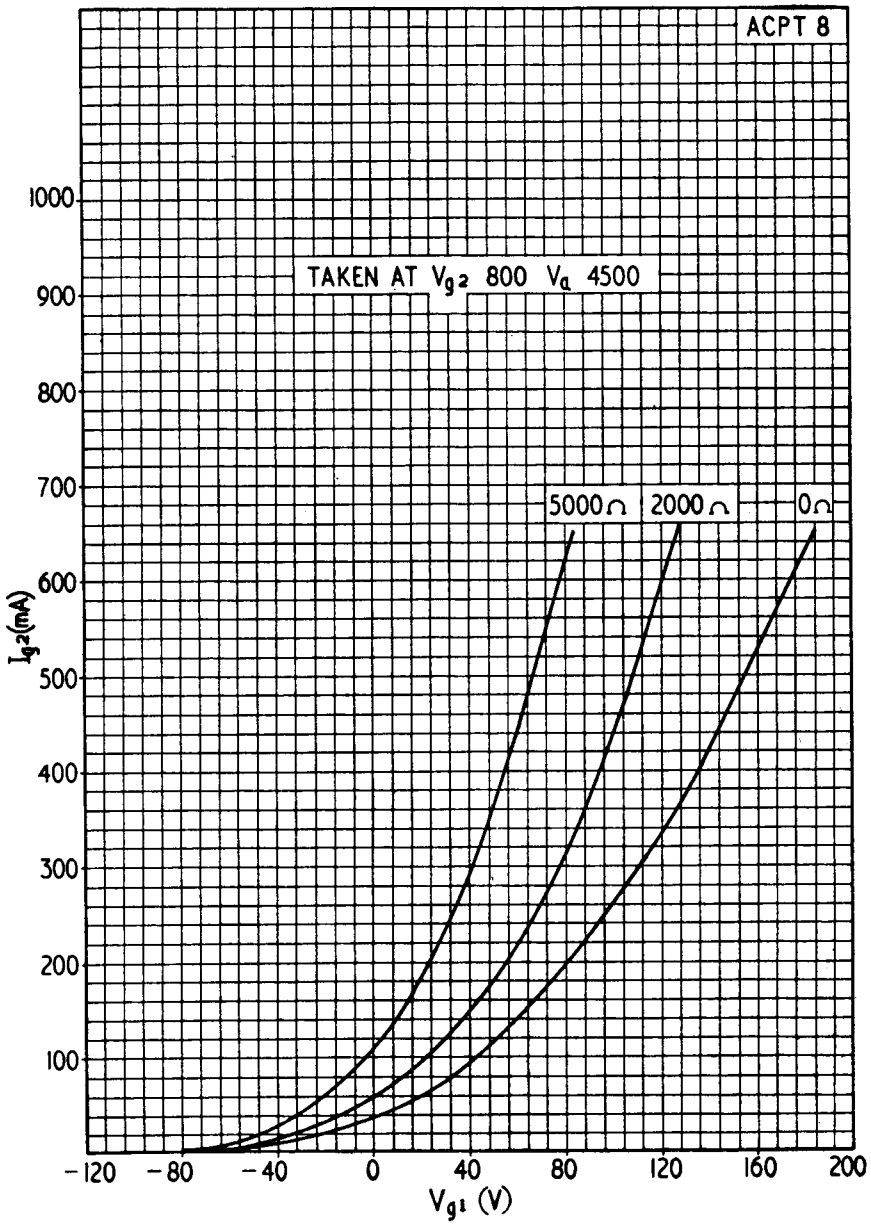

TAKEN AT V_{g2} 500
ACPT 8
V_{g1} 200
+ 180
+ 160
+ 140
+ 120
+ 100
+ 80
+ 60
+ 40
+ 20
0
-20
-40
2·2
2·0
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
I_a (A)
0
1000
2000
3000
4000
V_a (V)

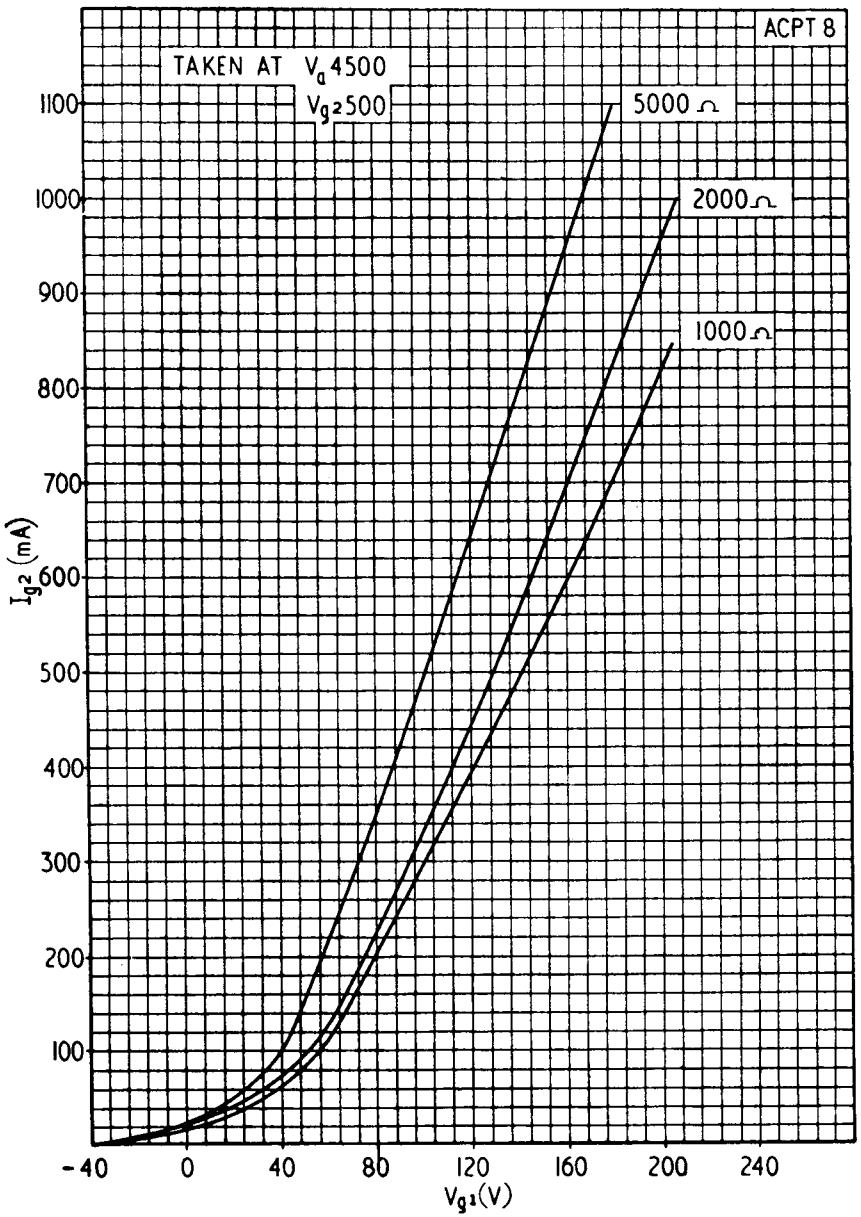

ACPT 8
TAKEN AT V_{g2} 800
I_{g2} (mA)
600
500
400
300
200
100
0
1000
2000
3000
4000
V_a (V)
V_{g1} + 120
+ 80
+ 40
0

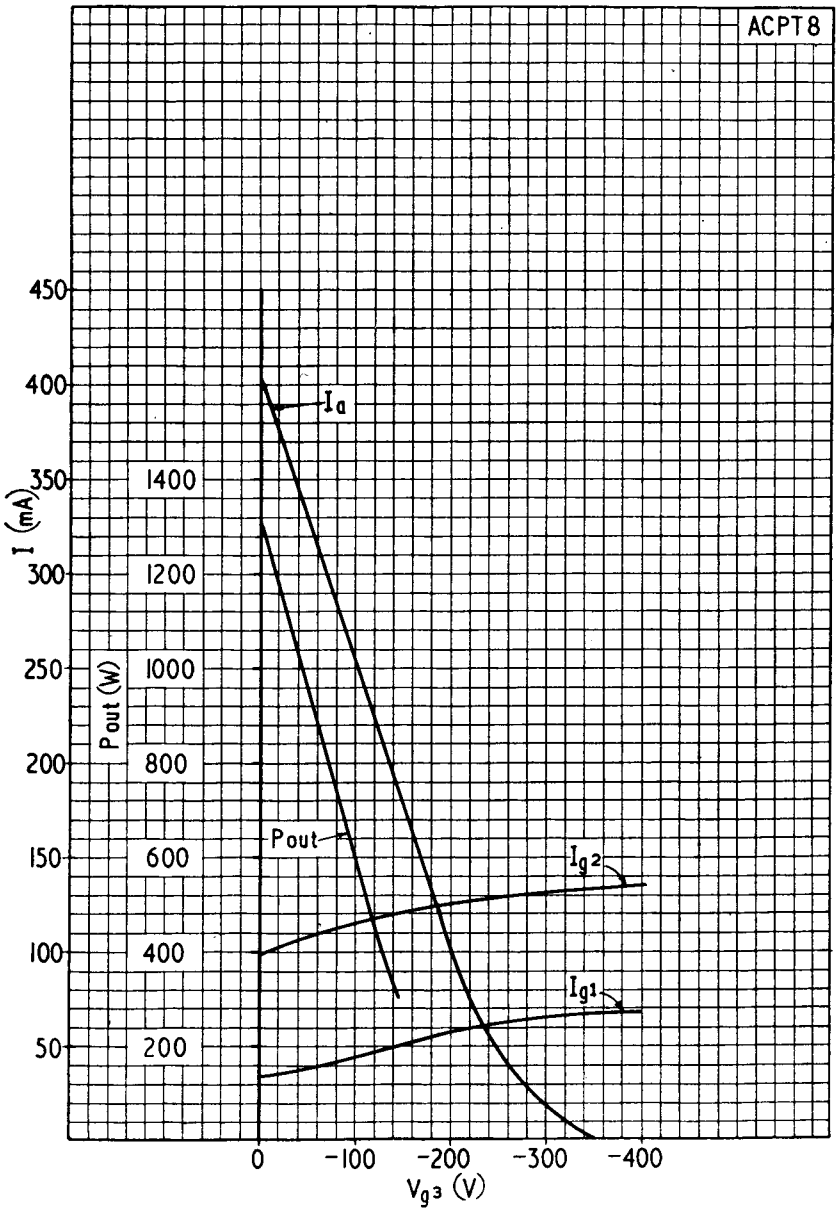

ACPT.8
V_{g2} +500
I_{g2} (mA)
800
700
600
500
400
300
200
100
0
1000
2000
3000
4000
V_a (V)
V_{g1} +160
+120
+80
+40
0


ACPT 8
TAKEN AT V_{g2} 800 V_a 4500
5000 Ω
2000 Ω
0 Ω
I_{g1} (mA)
200
150
100
50
0
20
40
60
80
100
120
V_{g1}(V)
TAKEN AT V_{g2} 500 V_a 4500
5000 Ω
2000 Ω
0 Ω
I_{g1} (mA)
200
150
100
50
0
20
40
60
80
100
120
V_{g1}(V)

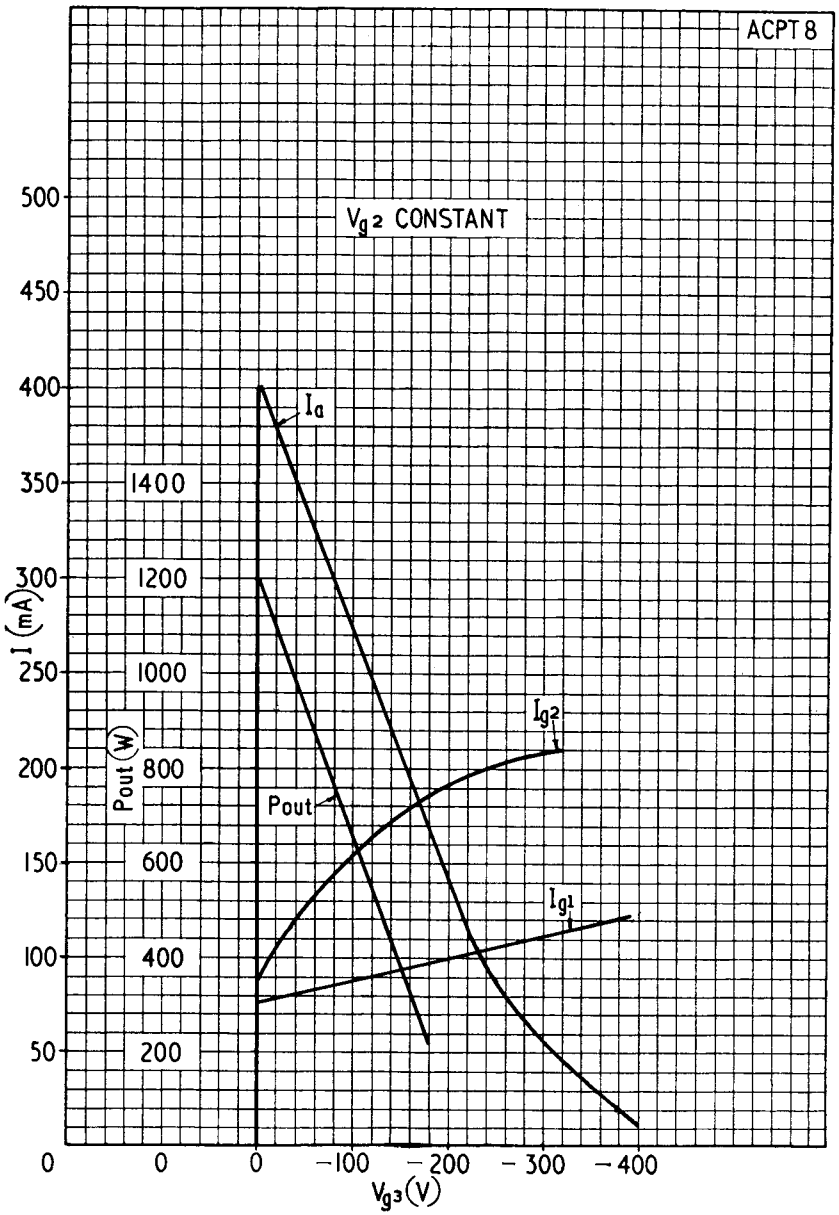

ACPT 8
TAKEN AT V_{g2} 800
V_{g1}+100
+ 80
+ 60
+ 40
+ 20
I_{g1}(mA)
200
150
100
50
0
1000
2000
3000
4000
V_a (V)
TAKEN AT V_{g2} 500
V_{g1}+100
+ 80
+ 60
+ 40
+ 20
I_{g1} (mA)
200
150
100
50
0
1000
2000
3000
4000
V_a (V)


ACPT 8
TAKEN AT V_{g2} 800 V_a 4500
5000 Ω
2000 Ω
0 Ω
I_{g2}(mA)
1000
900
800
700
600
500
400
300
200
100
-120
-80
-40
0
40
80
120
160
200
V_{g1} (V)

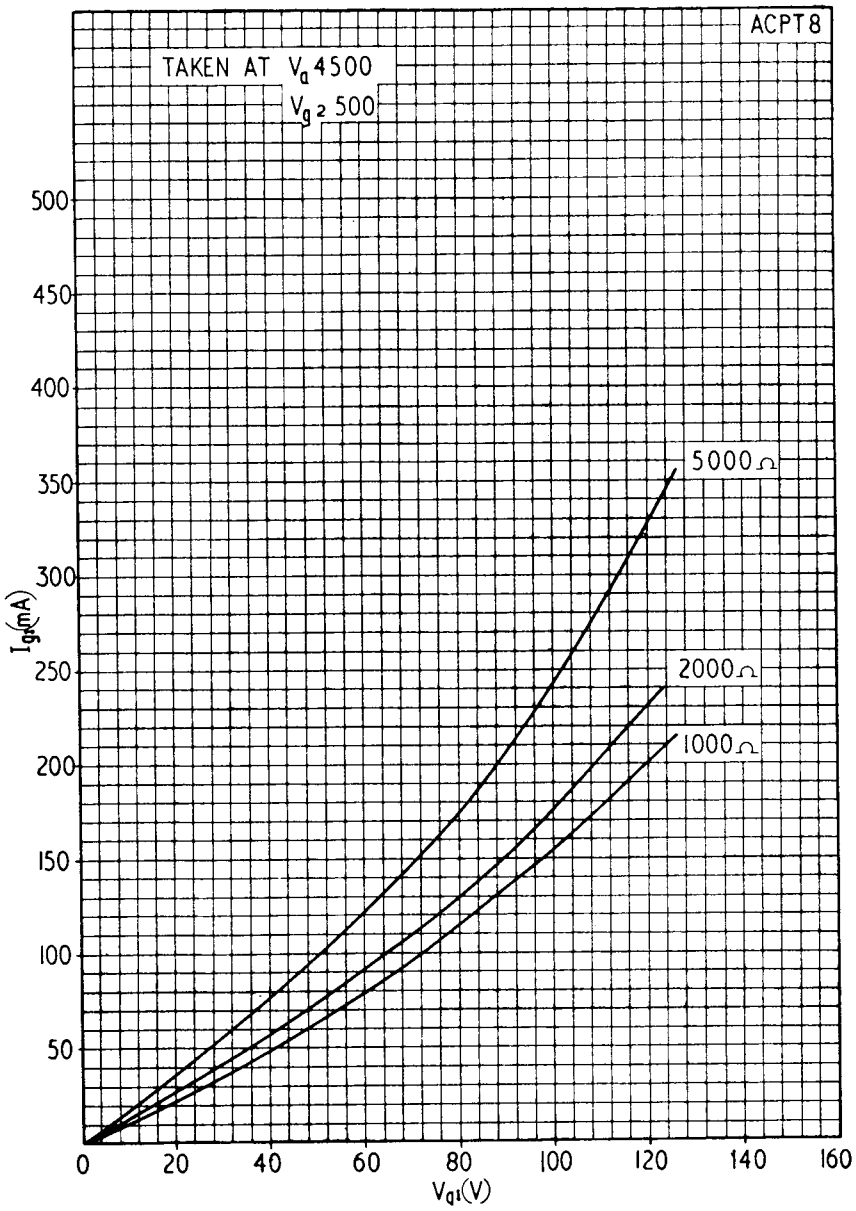

ACPT 8
TAKEN AT V_a 4500
V_{g2} 500
5000 Ω
2000 Ω
1000 Ω
I_{g2} (mA)
1100
1000
900
800
700
600
500
400
300
200
100
-40
0
40
80
120
160
200
240
V_{g1}(V)

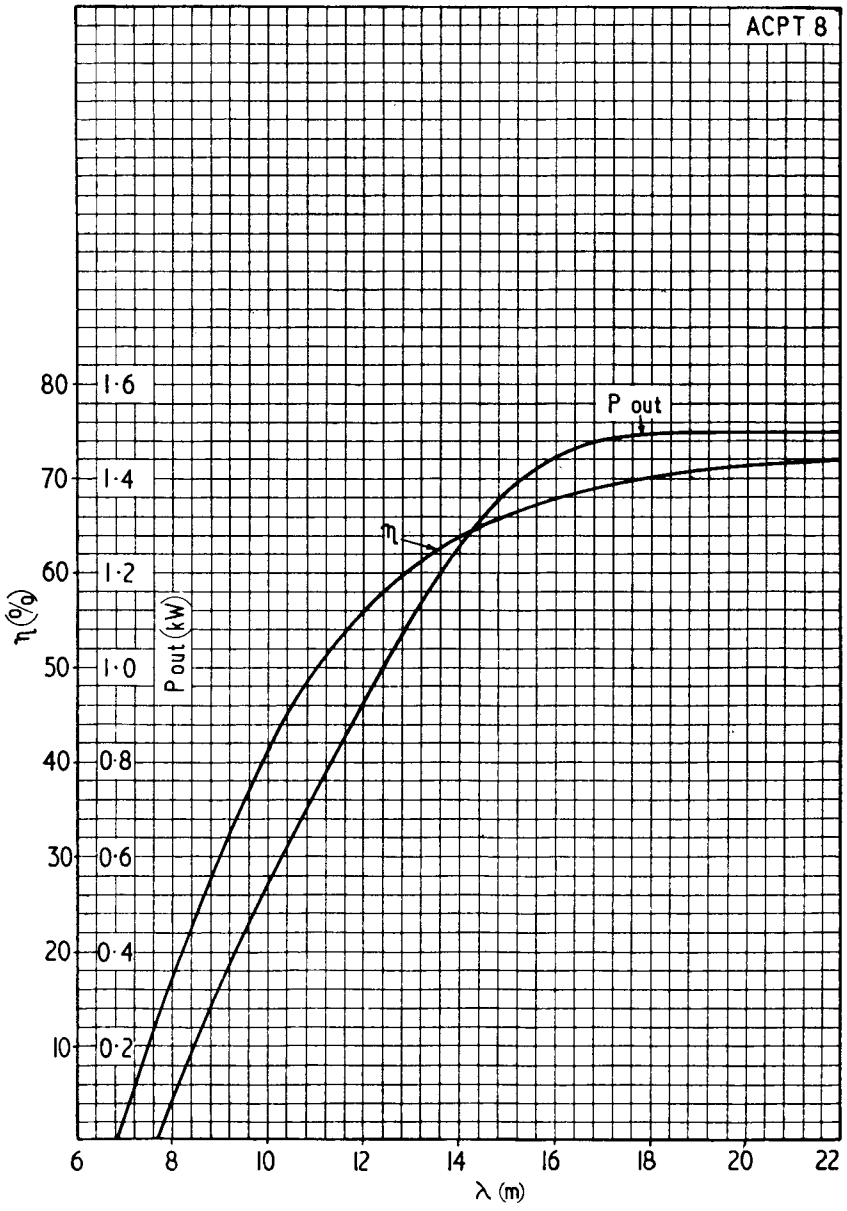


Taken at V_a 4,500, V_{g_1} −120, $v_{g_{1(pk)}}$ 230, V_{g_2} via 30k Ω resistor.



Taken at V_a 4,500, V_{g_1} −120, $v_{g_{1(pk)}}$ 250, V_{g_2} constant.


ACPT 8
TAKEN AT V_a 4500
V_{g2} 500
5000Ω
2000Ω
1000Ω
I_{g1}(mA)
500
450
400
350
300
250
200
150
100
50
0
20
40
60
80
100
120
140
160
V_{g1}(V)


ACPT 8
P out
η
η(%)
P out (kW)
80
70
60
50
40
30
20
10
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
6
8
10
12
14
16
18
20
22
λ (m)



PRINTED IN ENGLAND

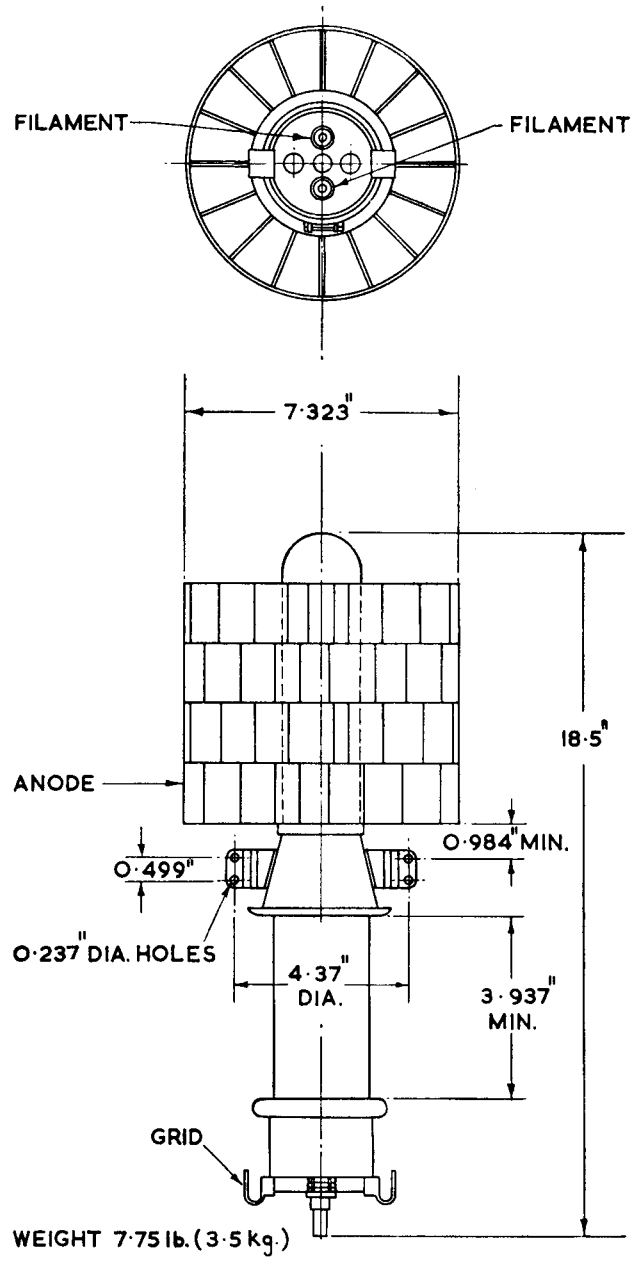
Triode *Type ACT 9*

HF POWER AMPLIFIER AND OSCILLATOR

General. An air-cooled transmitting triode fitted with a tungsten filament, suitable for use at frequencies up to 80 Mc/s. The figures quoted for maximum permissible ratings apply to operation at frequencies up to 15 Mc/s. On higher frequencies the anode voltage must be reduced, and a curve is given showing the maximum permissible anode voltage against frequency. As the efficiency falls with frequency the input must be reduced in order to avoid exceeding the permissible anode dissipation.

Cooling. For an anode dissipation up to 800 W (maximum), convection cooling is adequate provided there is at least 12 in. free clearance all around the valve and the air circulation is unrestricted. If forced air cooling is employed the anode dissipation may be increased to 1,100 W (maximum). The volume of air required is 10 cu. ft. per minute equal to a 3-in. head of water. The temperature on the outer surface of the radiator must not exceed 150°C. All cooling supplies must be started before the application of any supply voltages.

Mounting. The valve must be mounted vertically with the anode uppermost.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

V_f		16	V*
I_f		22	A
$V_{a\ (max)}$		10	kV
$p_{a\ (max)}$	Convection cooling		800 W
$p_{a\ (max)}$	Forced air cooling		1,100 W
$p_{g1\ (max)}$		40	W
$I_{g1\ (rf)\ max}$		14	A
μ	taken at V_a 5 kV, p_a 1 kW	40	
r_a		13,000	Ω
g_m		3·1	mA/V
$c_{a\text{-}g1}$		15·9	pF
$c_{a\text{-}k}$		1·6	pF
$c_{g1\text{-}k}$		23·2	pF

* Each valve is marked with the filament voltage to give 2 A emission at 90% saturation.

(1) HF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

Maximum permissible ratings

V_a	10,000	V	
I_a	400	mA	
P_{in}	3·25	kW	3·9 kW (a)
I_{g1dc}	100	mA	
p_a	800	W	1,100 W (a)

Typical Operation

V_a	10,000	10,000	7,500	5,000	V
I_a	380	320	360	360	mA
V_{g1}	−500	−500	−500	−480	V
I_{g1} (c)	50	40	45	50	mA
$R_{g1\text{-}k}$	10,000	12,500	11,000	9,600	Ω
$v_{g1\ (pk)}$	1,000	925	1,000	1,000	V
P_{dr} (c)	60	50	60	65	W
Z_a	12,000	15,000	10,000	6,400	Ω
p_a	1,000(a)	760	700	550	W
P_{out}	2·8	2·44	2·0	1·25	kW

(2) HF POWER AMPLIFIER CLASS C

(Grid-modulated, one valve, carrier conditions, permissible modulation 100%)

Maximum permissible ratings

V_a	10,000	V	
I_a	230	mA	
P_{in}	1·3	kW	1·75 kW(a)
I_{g1}	100	mA	
P_a	800	W	1,100 W(a)

Typical Operation

V_a	10,000	7,500	10,000	7,500	V
I_a	170	225	125	165	mA
V_{g1}	−430	−385	−330	−320	V
I_{g1} (c)	3·0	4·0	2·5	3·0	mA
$v_{g1\ (pk)}$	560	600	420	480	V
P_{dr} (c) (d)	25	35	12	20	W
$v_{(pk)\ mod}$ (e)	240	265	180	200	V
P_{mod} (e)	5·0	6·0	3·0	4·0	W
$Z_{a\ (mod)}$	5,800	6,000	5,500	5,000	Ω
Z_a	15,000	7,500	19,000	11,000	Ω
p_a	1,050(a)	1,090(a)	770	790	W
P_{out}	650	600	480	450	W

(3) HF POWER AMPLIFIER CLASS C

(Anode-modulated, one valve, carrier conditions, permissible modulation 100%)

Maximum permissible ratings

V_a	8,000	V
I_a	250	mA
P_{in}	2	kW
I_{g1}	100	mA
p_a	530	W

Typical Operation			
V_a	8,000	5,000	V
I_a	225	225	mA
V_{g1}(b)	–450	–320	V
I_{g1} (c)	25	30	mA
$v_{g1\ (pk)}$	800	680	V
P_{dr} (c)	26	26	W
P_{mod} (e)	900	565	W
$Z_{a(mod)}$	35,000	22,000	Ω
Z_a	18,000	10,000	Ω
p_a	400	300	W
P_{out}	1,400	825	W

(4) HF POWER AMPLIFIER CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%)

Maximum permissible ratings

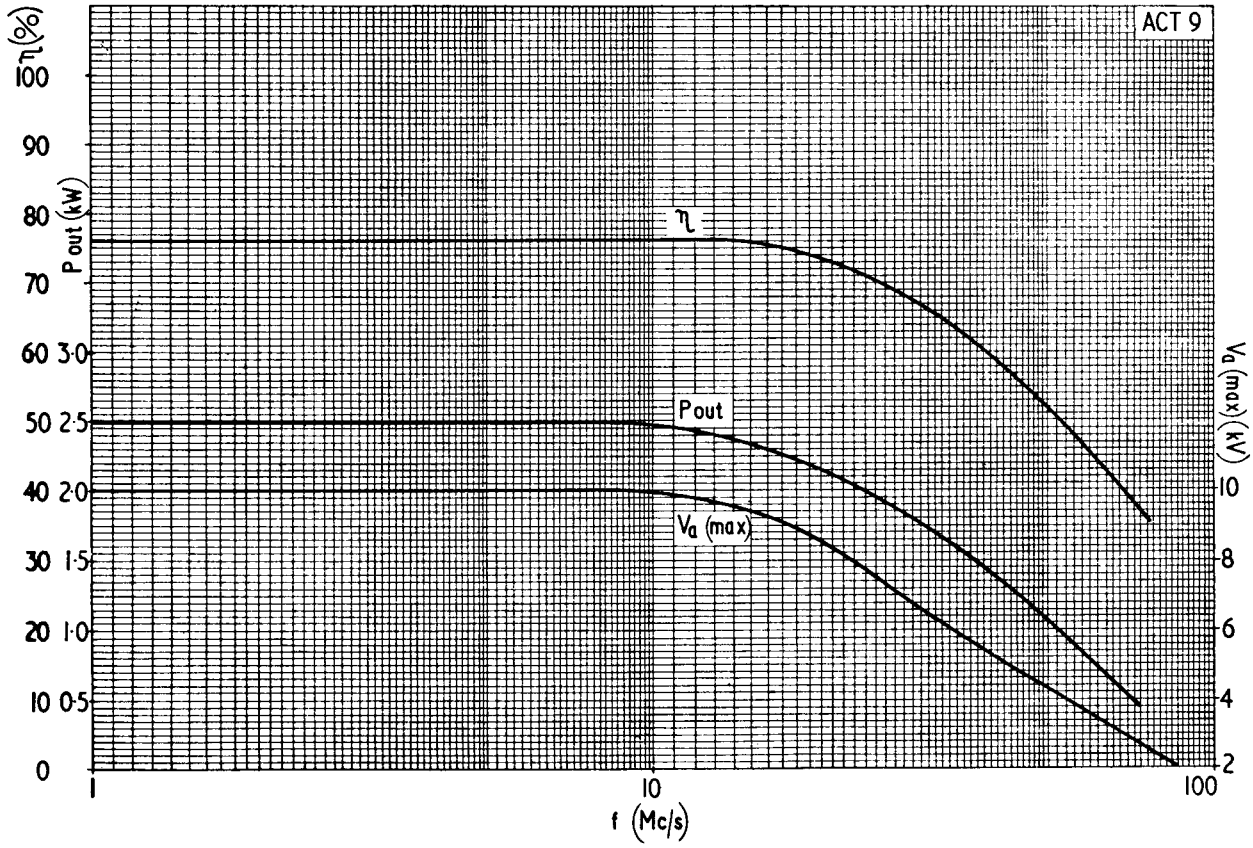
V_a	10,000	V		
I_a	250	mA		
P_{in}	1·22	kW	1·65	kW(a)
I_{g1}	100	mA		
p_a	800	W	1,100	W(a)

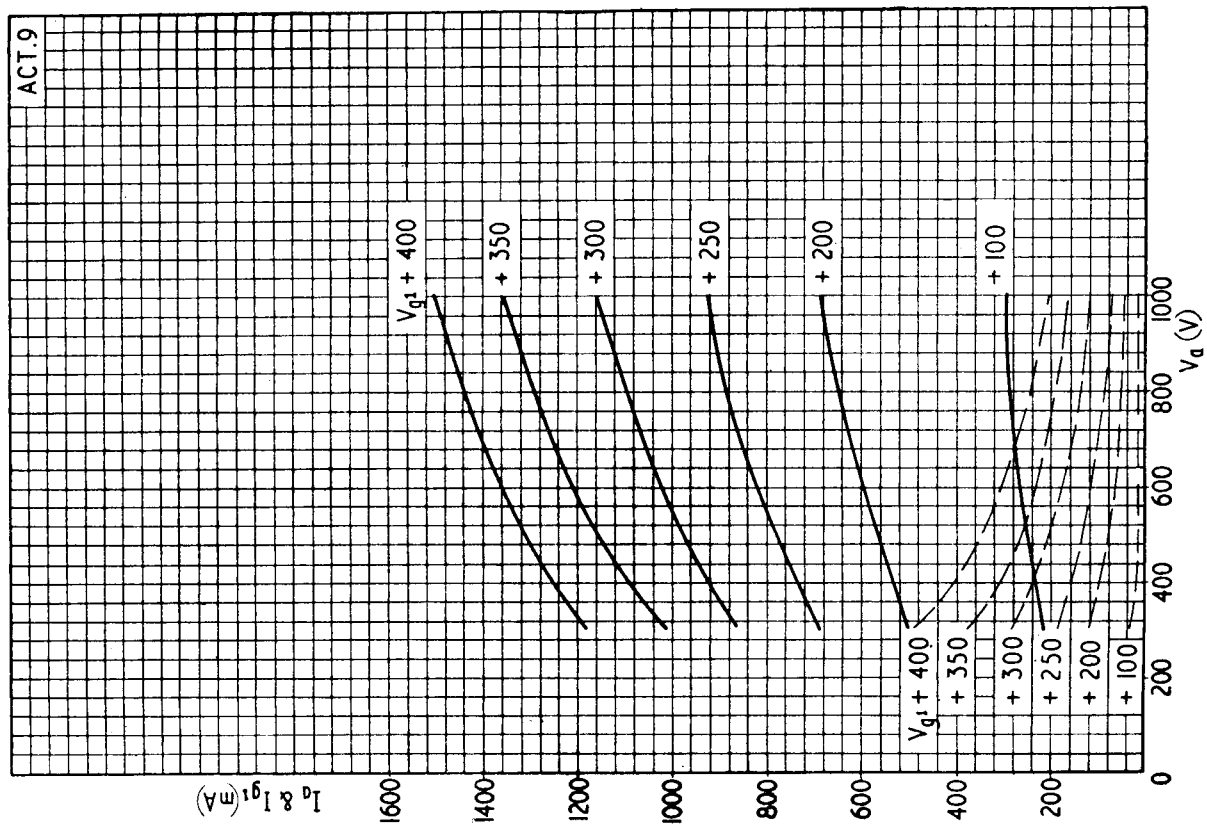
Typical Operation

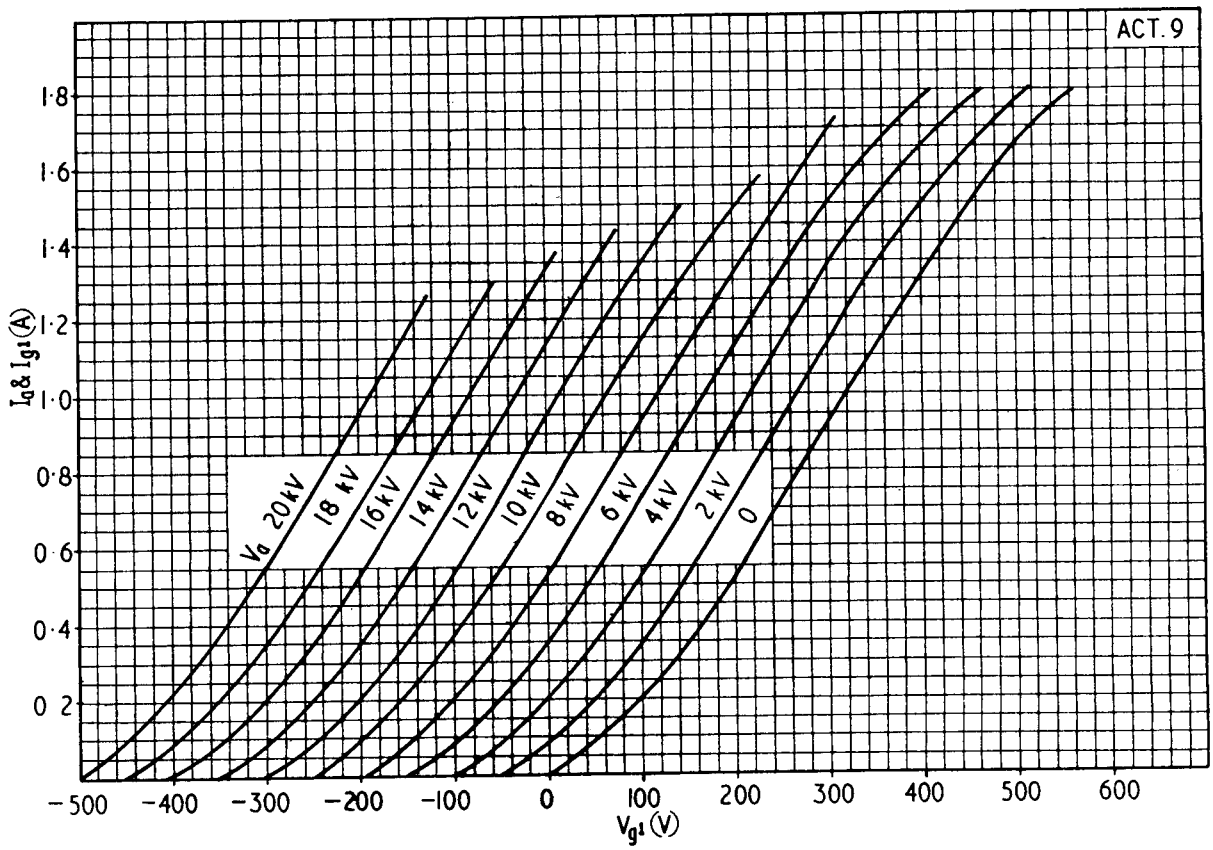
V_a	10,000	7,500	10,000	7,500	5,000	V
I_a	160	200	120	150	200	mA
V_{g1}	–175	–100	–175	–100	–60	V
I_{g1} (c)	2·0	3·0	1·5	2·5	5·0	mA
$v_{g1(pk)}$	235	220	200	185	220	V
P_{dr}(c)(d)	15	15	10	12	20	W
Z_a	17,000	10,000	24,000	13,000	6,700	Ω
p_a	1,070(a)	1,020(a)	790	765	700	W
P_{out}	530	480	410	360	300	W

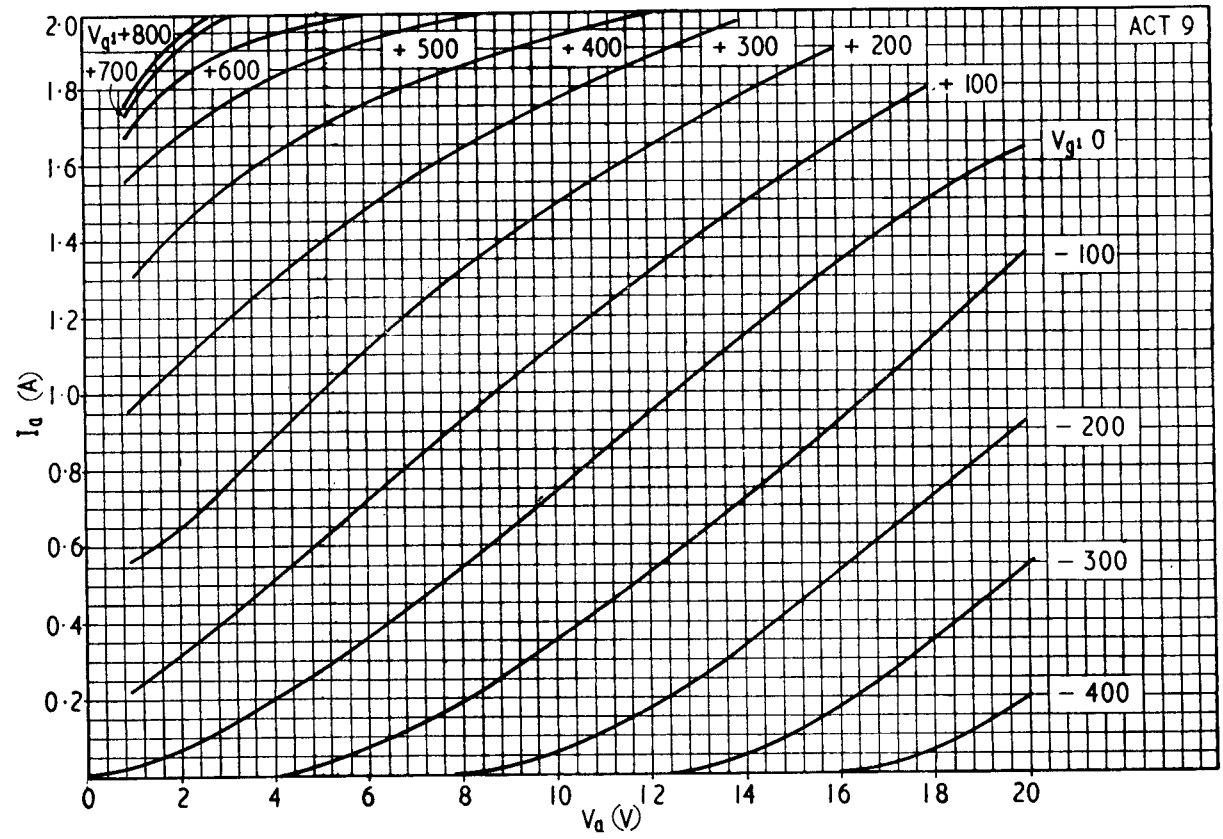
NOTES

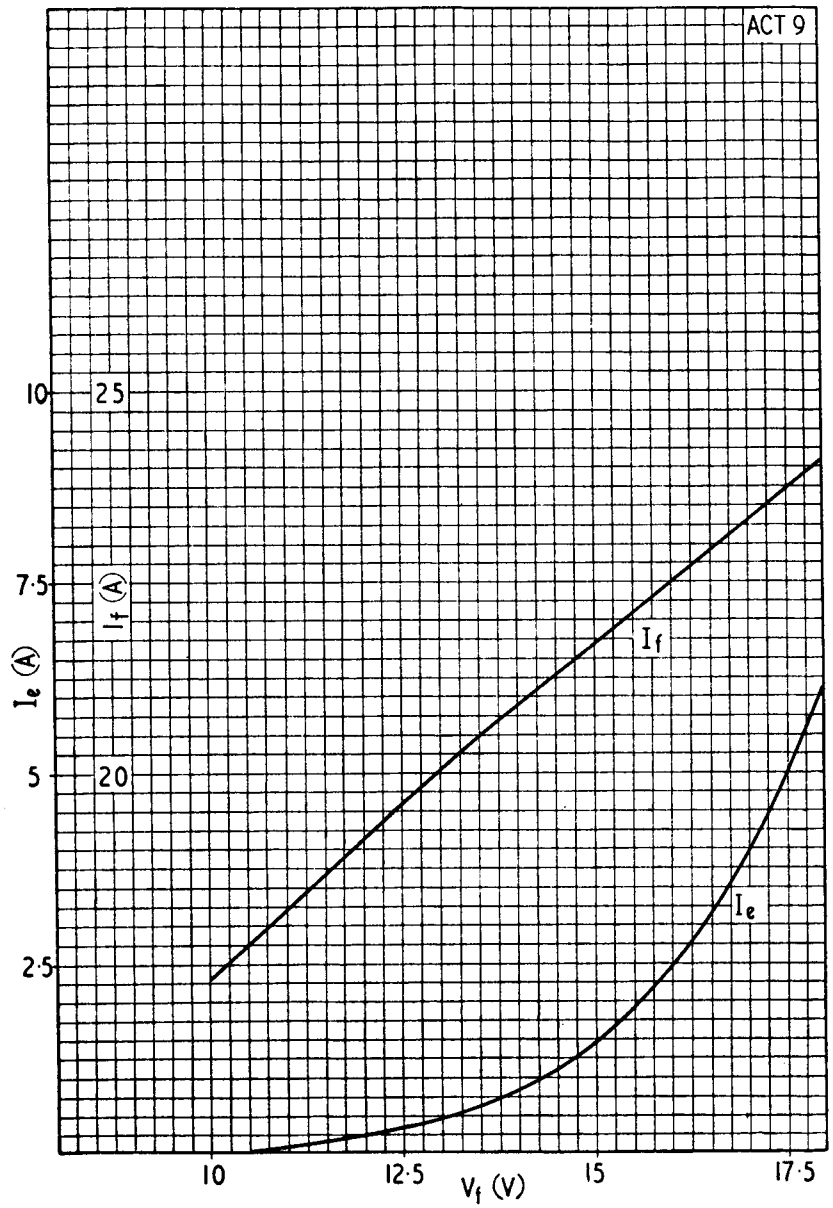
(a) With forced air cooling.
(b) Obtained by grid resistance.
(c) Subject to wide variation. The figures are approximate only.
(d) At crest of audio cycle with 100% modulation.
(e) 100% mod.

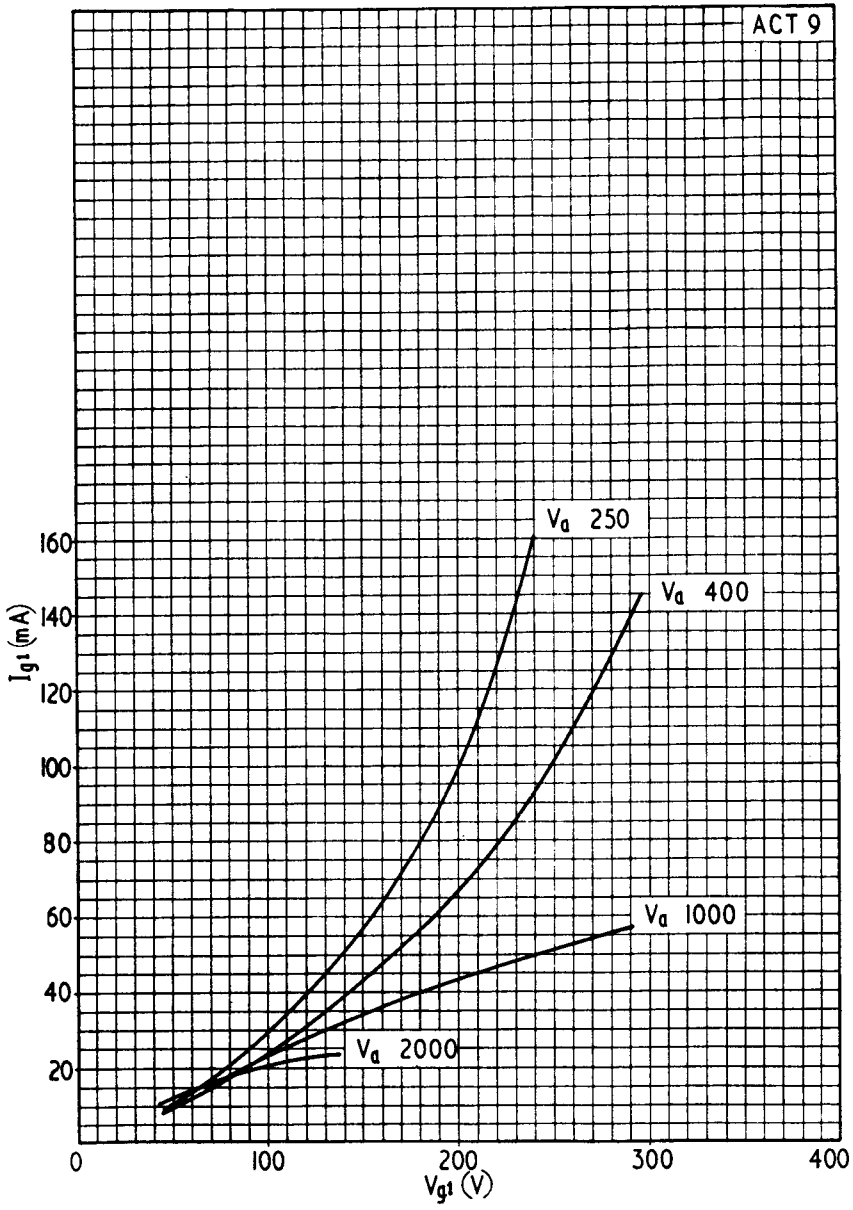

ACT 9
η(%)
100
90
80
70
60
50
40
30
20
10
0
Pout (kW)
3·0
2·5
2·0
1·5
1·0
0·5
η
Pout
Va (max)
Va (max) (kV)
10
8
6
4
2
1
10
100
f (Mc/s)


ACT.9
Vg1 + 400
+ 350
+ 300
+ 250
+ 200
+ 100
Va (V)
0
200
400
600
800
1000
Ia & Ig1 (mA)
1600
1400
1200
1000
800
600
400
200


ACT. 9
I_a & I_{g1} (A)
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0 2
V_a 20kV
18 kV
16kV
14kV
12kV
10kV
8kV
6 kV
4kV
2 kV
0
−500 −400 −300 −200 −100 0 100 200 300 400 500 600
V_{g1} (V)


ACT 9
I_a (A)
2·0
1·8
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
V_{g1}+800
+700
+600
+ 500
+ 400
+ 300
+ 200
+ 100
V_{g1} 0
− 100
− 200
− 300
− 400
0 2 4 6 8 10 12 14 16 18 20
V_a (V)


ACT 9
10
25
7·5
I_f (A)
I_e (A)
5
20
2·5
I_f
I_e
10
12·5
15
17·5
V_f (V)


ACT 9
160
140
120
100
80
60
40
20
I_{g1} (mA)
V_a 250
V_a 400
V_a 1000
V_a 2000
0
100
200
300
400
V_{g1} (V)



PRINTED IN ENGLAND

Triode *Type ACT 14*

HF AMPLIFIER AND OSCILLATOR

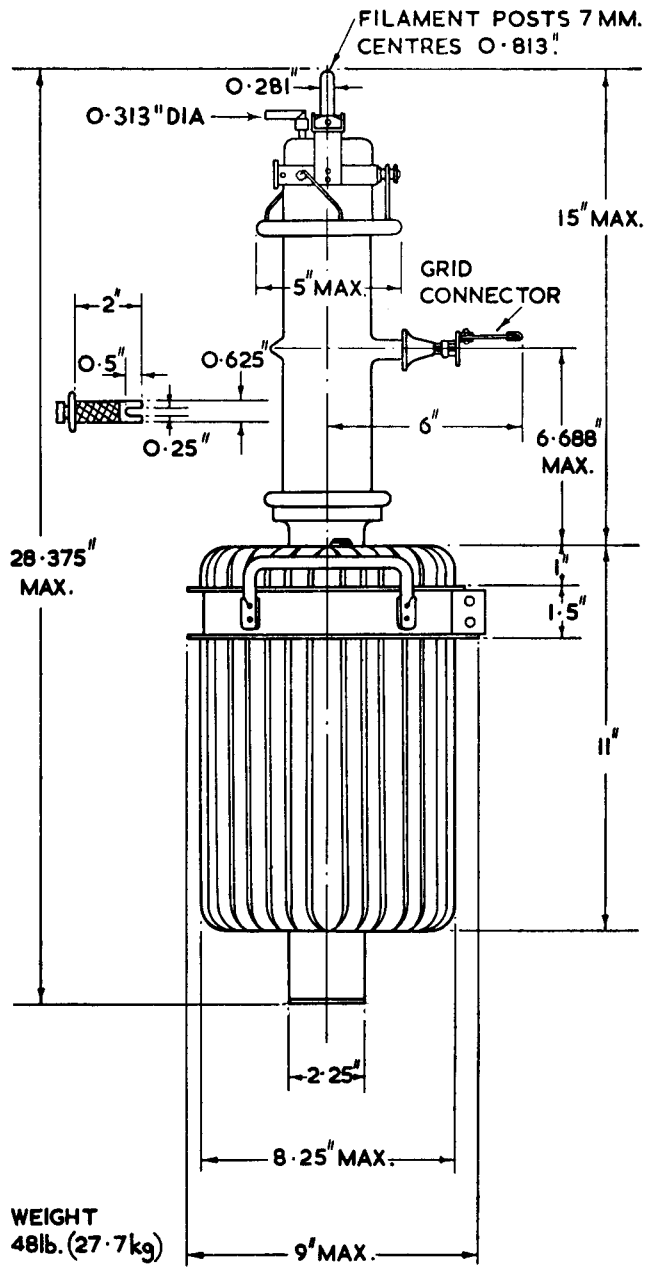
General. A forced-air cooled transmitting triode fitted with a tungsten filament.

Cooling. The anode requires cooling by air blast and the volume of air necessary is 600 cu. ft. per minute at a pressure equal to an 8-in. head of water. All cooling supplies must be started before the application of any voltage and the temperature of the air intake must not exceed 35°C (95°F).

Filament Starting. The cold resistance of the filament is approximately 0·021 Ω. The filament current must never exceed 105 A at any time during the switching-on period. If the valve is operated for periods greater than 15 minutes without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during the standby period.

Mounting. The valve must be mounted with its axis vertical and the filament seals uppermost. Rigid connections must be made to the anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

APPROXIMATE DATA

V_f		18–20	V
I_f		72	A
$V_{a(max)}$		12	kV
$p_{a(max)}$		10	kW
$p_{gl(max)}$		350	W
$I_{gl(pk)\ (RF)\ (max)}$		30	A
μ	taken at Va 10 kV	45	
r_a	taken at Va 10 kV	5,000	Ω
g_m	taken at Va 10 kV, V_{gl} 0 V	9	mA/V
$f_{(max)}$		40	Mc/s
$c_{a\text{-}gl}$		31·8	pF
$c_{a\text{-}k}$		2·2	pF
$c_{gl\text{-}k}$		24·3	pF

Each valve is marked with the filament voltage to give 10 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

V_a		12·0	10·0	8·0	kV
I_a		2·6	2·5	2·4	A
V_{gl}		−375	−460	−290	V
I_{gl}	(a)	140	130	250	mA
$v_{gl(pk)}$		1,375	1,460	1,290	V
P_{dr}	(a)	200	200	320	W
Z_a		2,300	1,860	1,630	Ω
p_a		9·7	8·3	6·2	kW
P_{out}		21·5	16·7	13·0	kW

(2) HF POWER AMPLIFIER. CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%)

V_a		10·0	7·5	kV
I_a		1·05	1·0	A
V_{gl}		−685	−575	V
I_{gl}	(a)	25	26	mA
$v_{gl(pk)}$		1,145	1,035	V
P_{dr}	(a)	40	30	W
Z_a		4,480	3,160	Ω
p_a		2·2	2·0	kW
P_{out}		8·3	5·5	kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%)

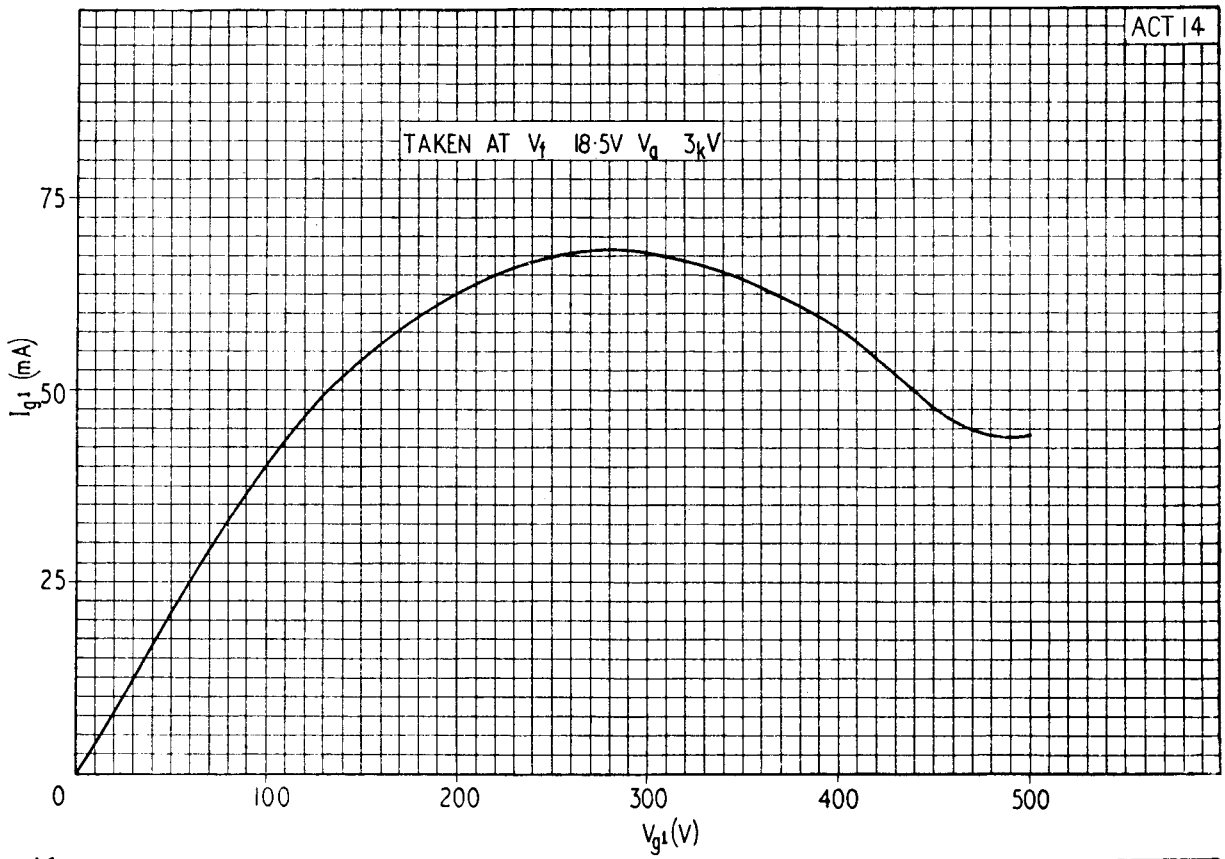
V_a		12·0	10·0	kV
I_a		1·2	1·2	A
V_{gl}		−270	−220	V
$v_{gl(pk)}$		510	490	V
P_{dr}	(a) (b)	20	20	W
Z_a		2,530	2,000	Ω
p_a		10·0	8·5	kW
P_{out}		4·4	3·5	kW

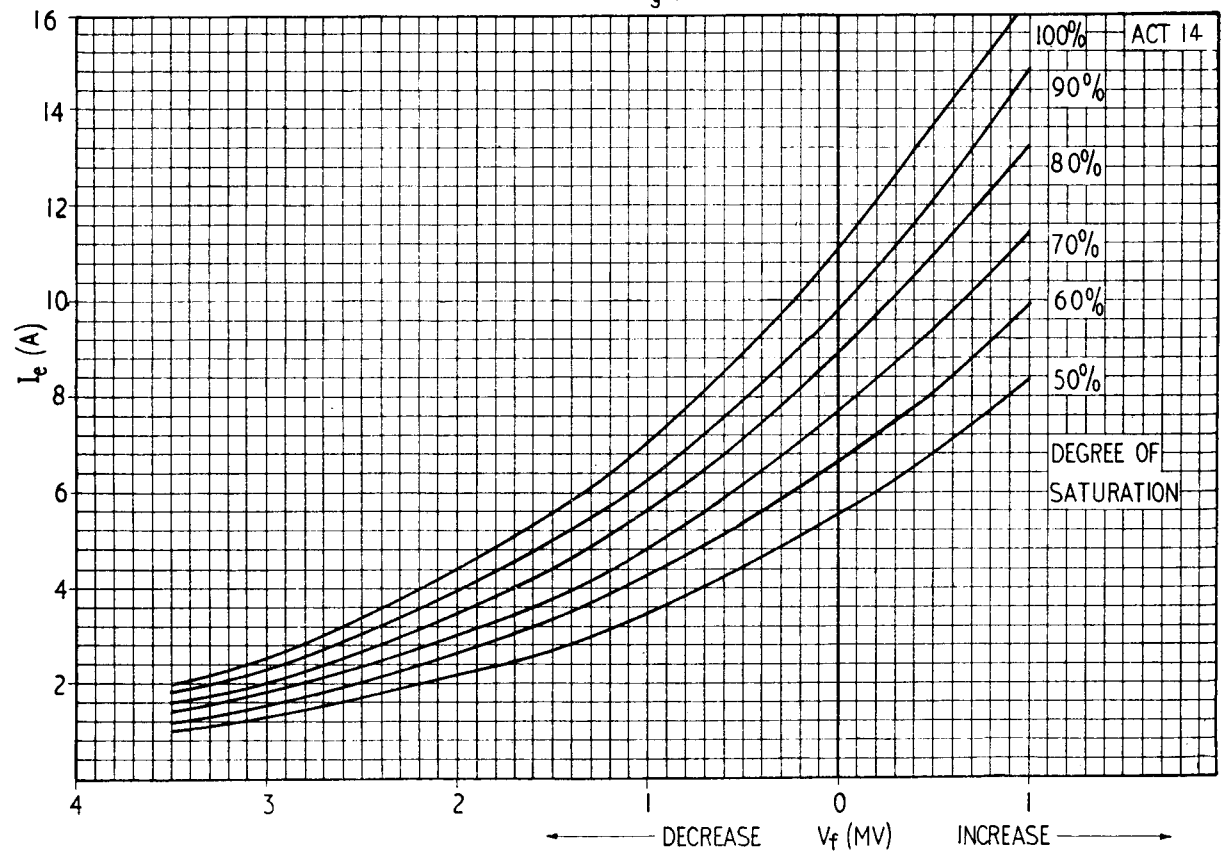
The figures quoted above are only applicable when operating at frequencies of up to 15 Mc/s. Above this the anode voltage must be reduced to the following percentages of the maximum:

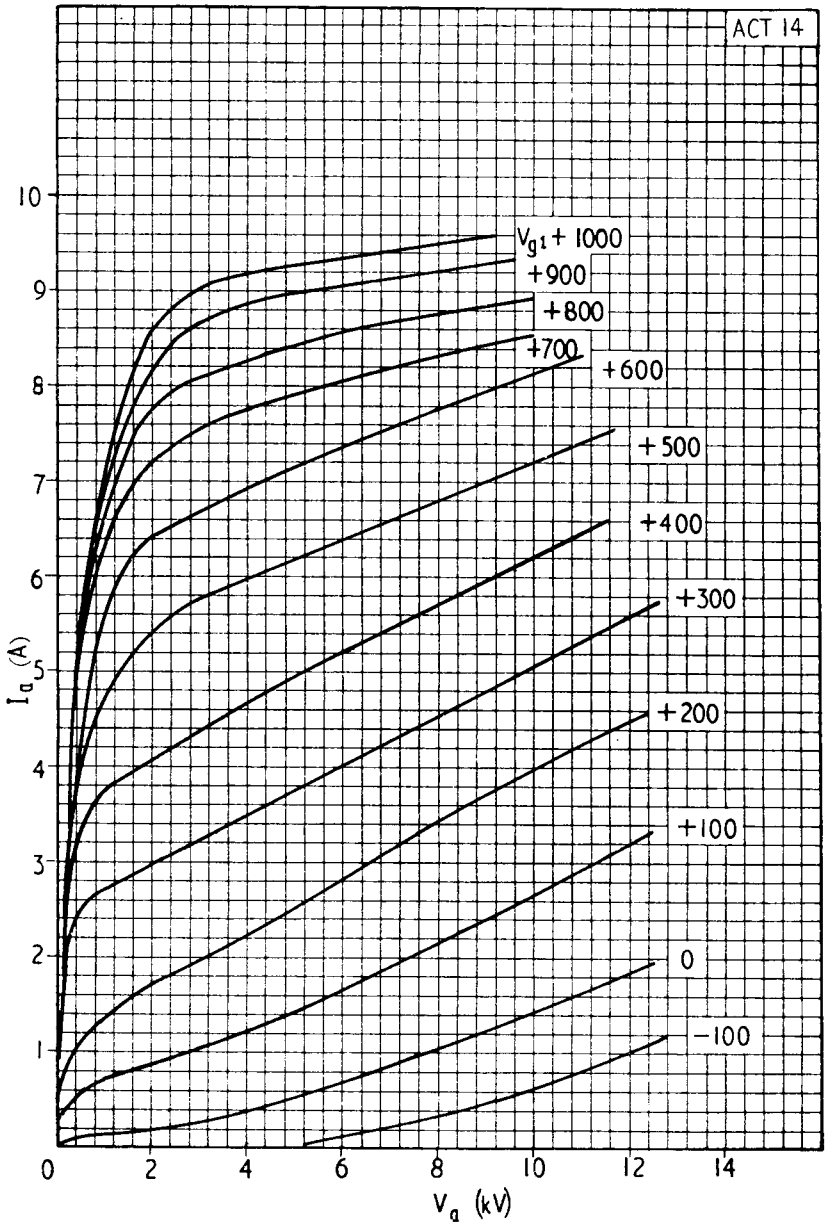
f (Mc/s)	15	20	25	40
$\%V_{a(max)}$	100	85	65	35

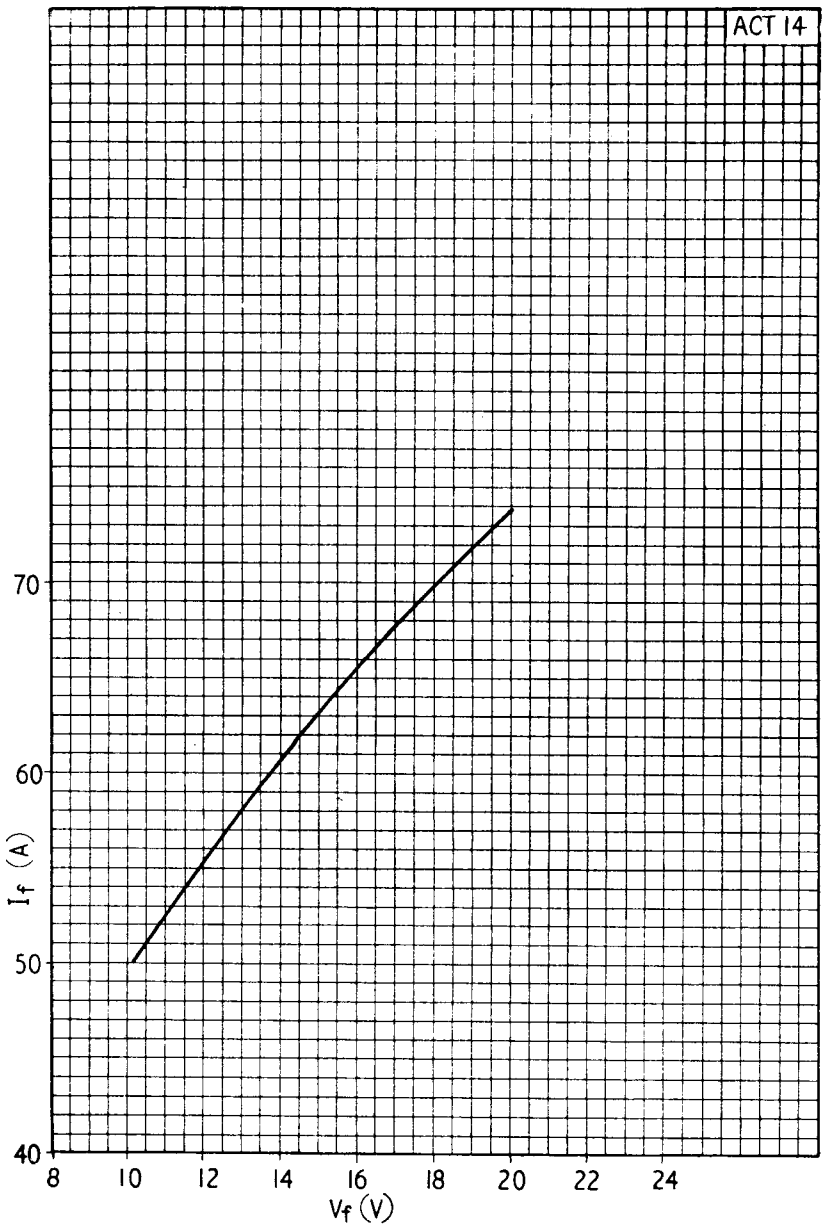
NOTES

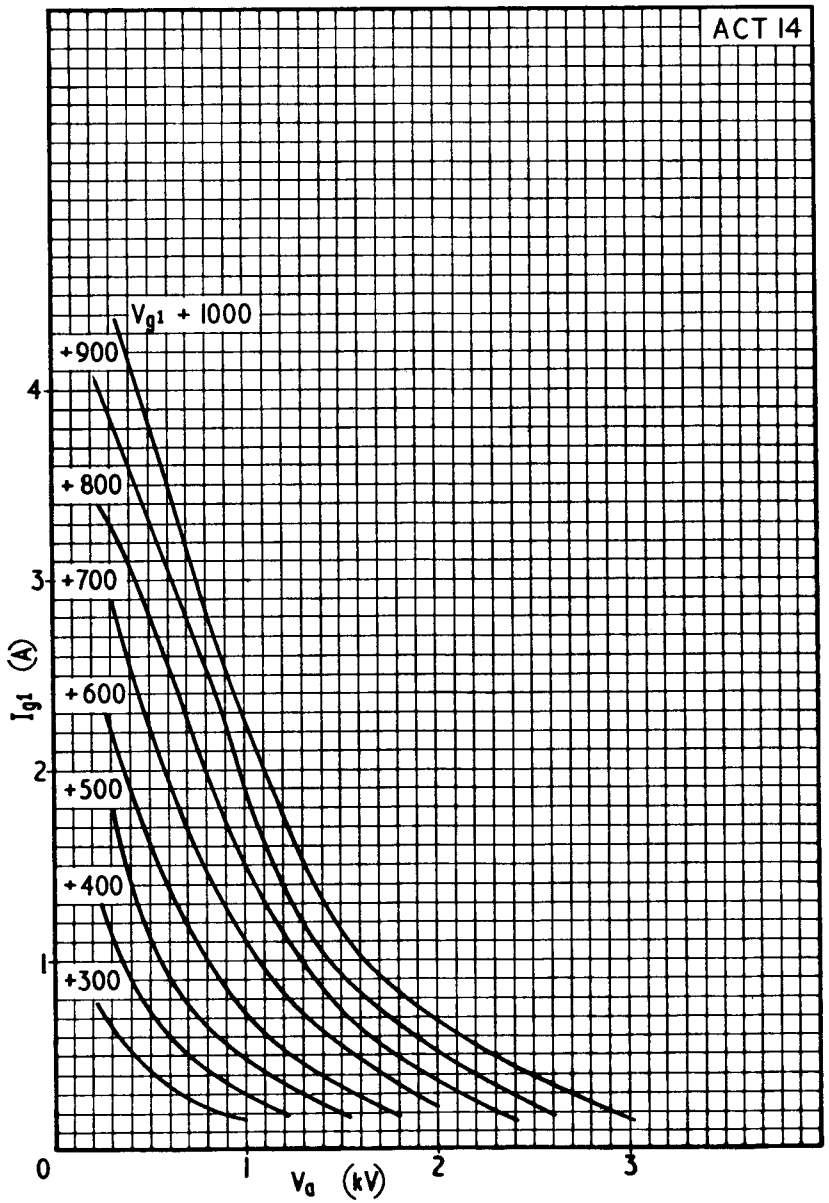
(a) Subject to wide variation. The figures are approximate only.
(b) At crest of audio cycle with 100% modulation.

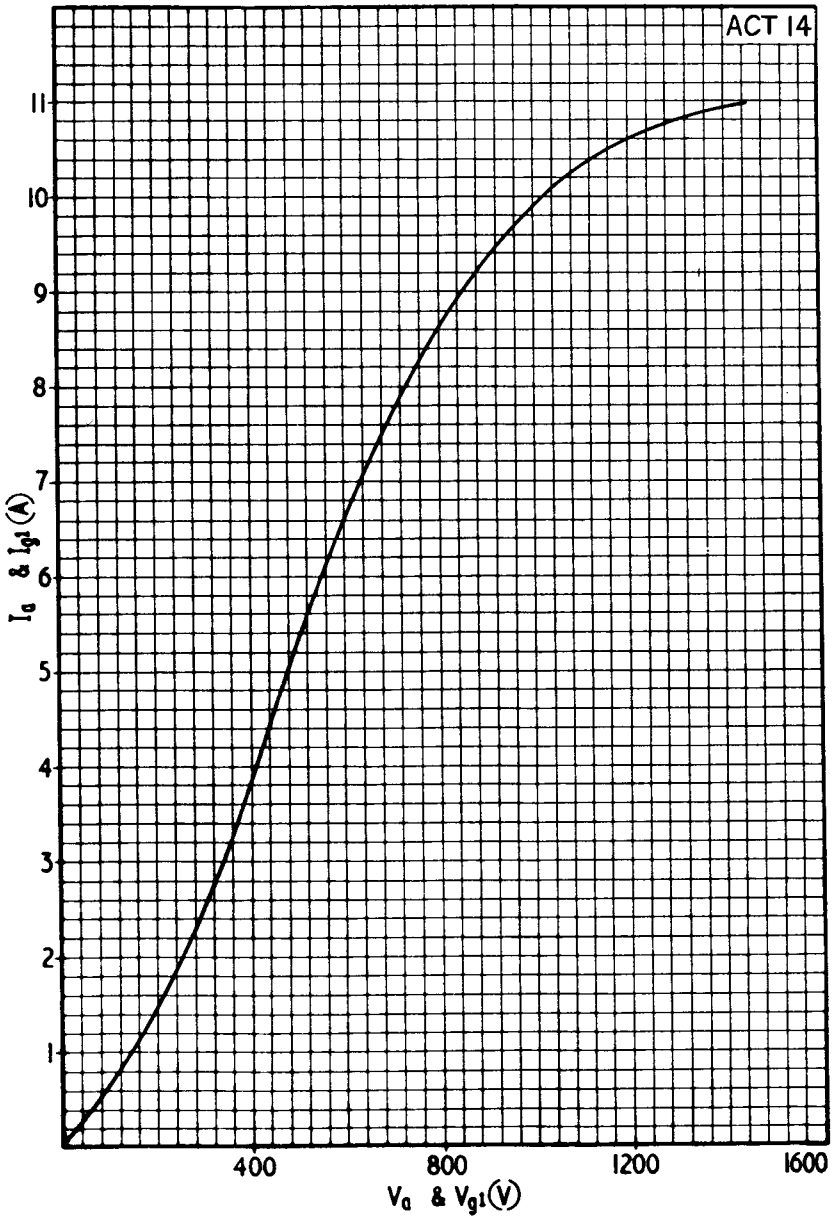

ACT 14
TAKEN AT V_f 18·5V V_a 3$_k$V
75
50
25
0
100
200
300
400
500
I_{g^1} (mA)
V_{g^1}(V)


ACT 14
100%
90%
80%
70%
60%
50%
DEGREE OF SATURATION
16
14
12
10
8
6
4
2
I_e (A)
4
3
2
1
0
1
DECREASE
V_f (MV)
INCREASE


ACT 14
V_{g1} + 1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
0
−100
I_a (A)
V_a (kV)
0
2
4
6
8
10
12
14
1
2
3
4
5
6
7
8
9
10


ACT 14
I_f (A)
V_f (V)
40
50
60
70
8
10
12
14
16
18
20
22
24


ACT 14
V_{g1} + 1000
+900
+800
+700
+600
+500
+400
+300
I_{g1} (A)
0
1
2
3
4
V_a (kV)


ACT 14
I_a & I_{g1} (A)
1
2
3
4
5
6
7
8
9
10
11
400
800
1200
1600
V_a & V_{g1} (V)



PRINTED IN ENGLAND

Triode *Type ACT16*

HF POWER AMPLIFIER AND OSCILLATOR

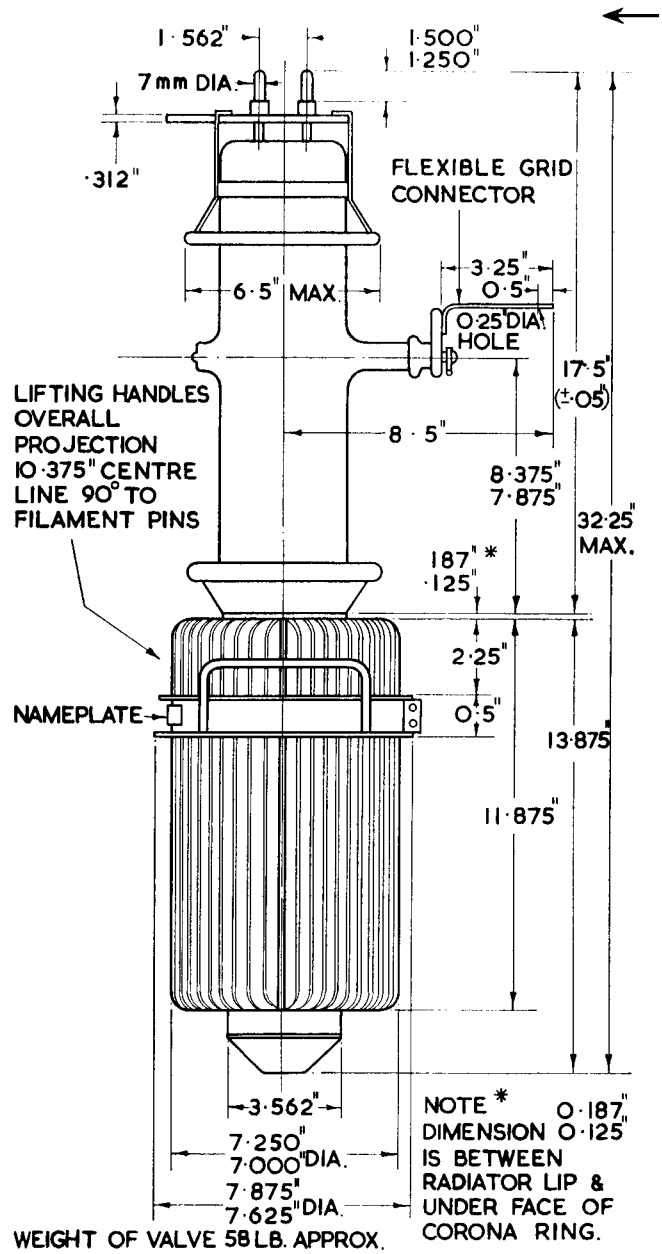
General. A forced-air cooled transmitting triode fitted with a tungsten filament.

Cooling. The anode requires cooling by air blast and the volume of air necessary is 600 cu. ft. per minute at a 10-in. head of water. The filament seal also requires to be cooled by air and the volume of air to the seal should be of the order of 4 cu. ft. perminute. All cooling supplies must be started before the application of any supply voltages, and the temperature of the air intake must not exceed 35°C (95°F).

Filament Starting. The cold resistance of the filament is approximately 0·0167 Ω. The filament current must never exceed 130 A at any time during the switching-on period. If the valve is operated for periods greater than 15 minutes without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during the standby period.

Mounting. The valve must be completely supported by its cooling jacket with its axis in a vertical position. Rigid connections must be made to the anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

APPROXIMATE DATA

V_f		18–20	V
I_f		100	A
$V_{a(max)}$		15	kV
$p_{a(max)}$		15	kW
$p_{gl(max)}$		500	W
$I_{gl(pk)\ (RF)\ (max)}$		30	A
μ	taken at Va 15 kV, V_{gl} 0	45	
r_a	taken at Va 15 kV, V_{gl} 0	4,500	Ω
g_m	taken at Va 15 kV, V_{gl} 0	10	mA/V
$f_{(max)}$		40	Mc/s
$c_{a\text{-}gl}$		20·2	pF
$c_{a\text{-}k}$		1·7	pF
$c_{gl\text{-}k}$		27·2	pF

Each valve is marked with the filament voltage to give 12 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

V_a		15·0	12·0	10·0	kV
I_a		2·65	2·6	2·4	A
V_{gl}		–450	–375	–440	V
I_{gl}	(a)	250	280	300	mA
$v_{gl(pk)}$		1,450	1,375	1,440	V
P_{dr}	(a)	350	400	420	W
Z_a		2,900	2,400	2,000	Ω
p_a		12·5	10	7·7	kW
P_{out}		27·3	21·2	16·3	kW

(2) HF POWER AMPLIFIER. CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%)

V_a		12·0	10·0	kV
I_a		1·05	1·1	A
V_{gl}		–740	–650	V
I_{gl}	(a)	70	72	mA
$v_{gl(pk)}$		1,230	1,140	V
P_{dr}	(a)	90	85	W
Z_a		5,200	4,150	Ω
p_a		3·0	3·2	kW
P_{out}		9·6	7·8	kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%)

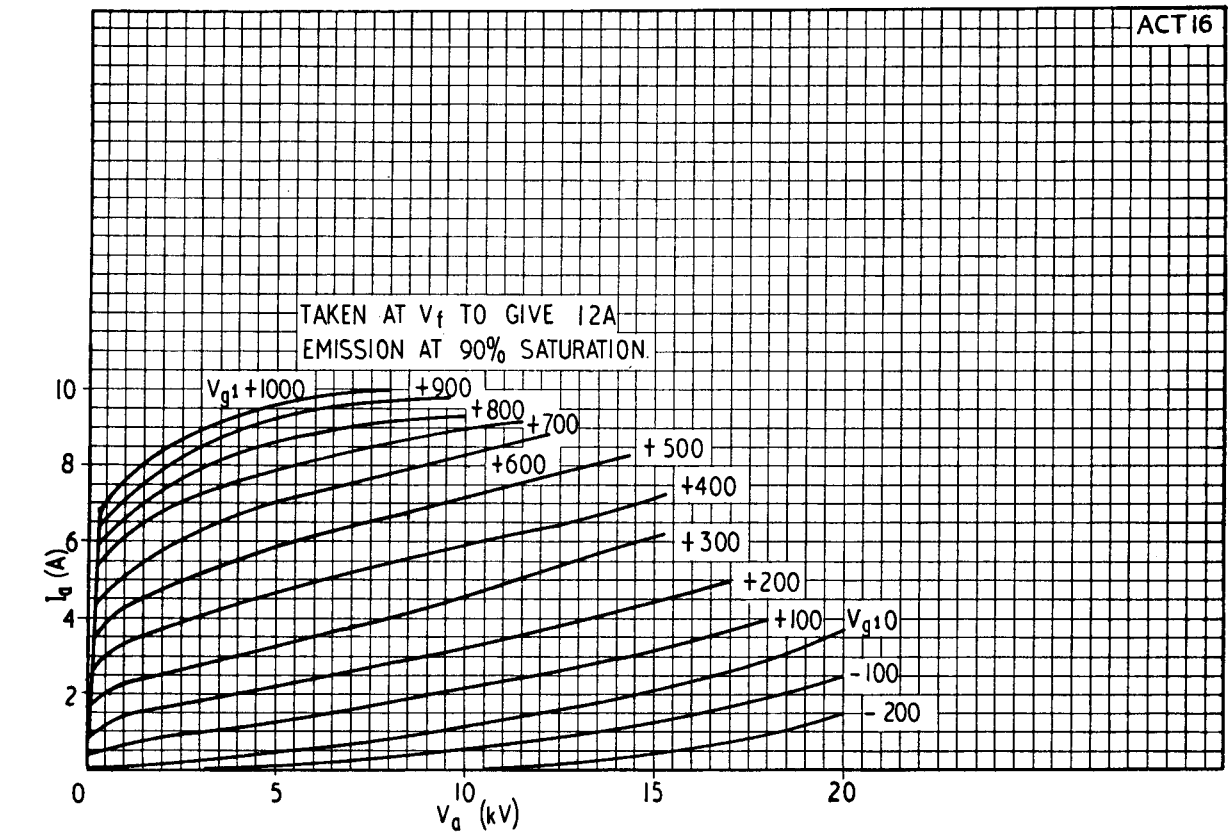
V_a			15·0	10·0	kV
I_a			1·2	1·2	A
V_{gl}			–330	–220	V
$v_{gl(pk)}$			570	510	V
P_{dr}	(a)	(b)	85	80	W
Z_a			3,240	1,900	Ω
p_a			12·4	8·75	kW
P_{out}			5·6	3·25	kW

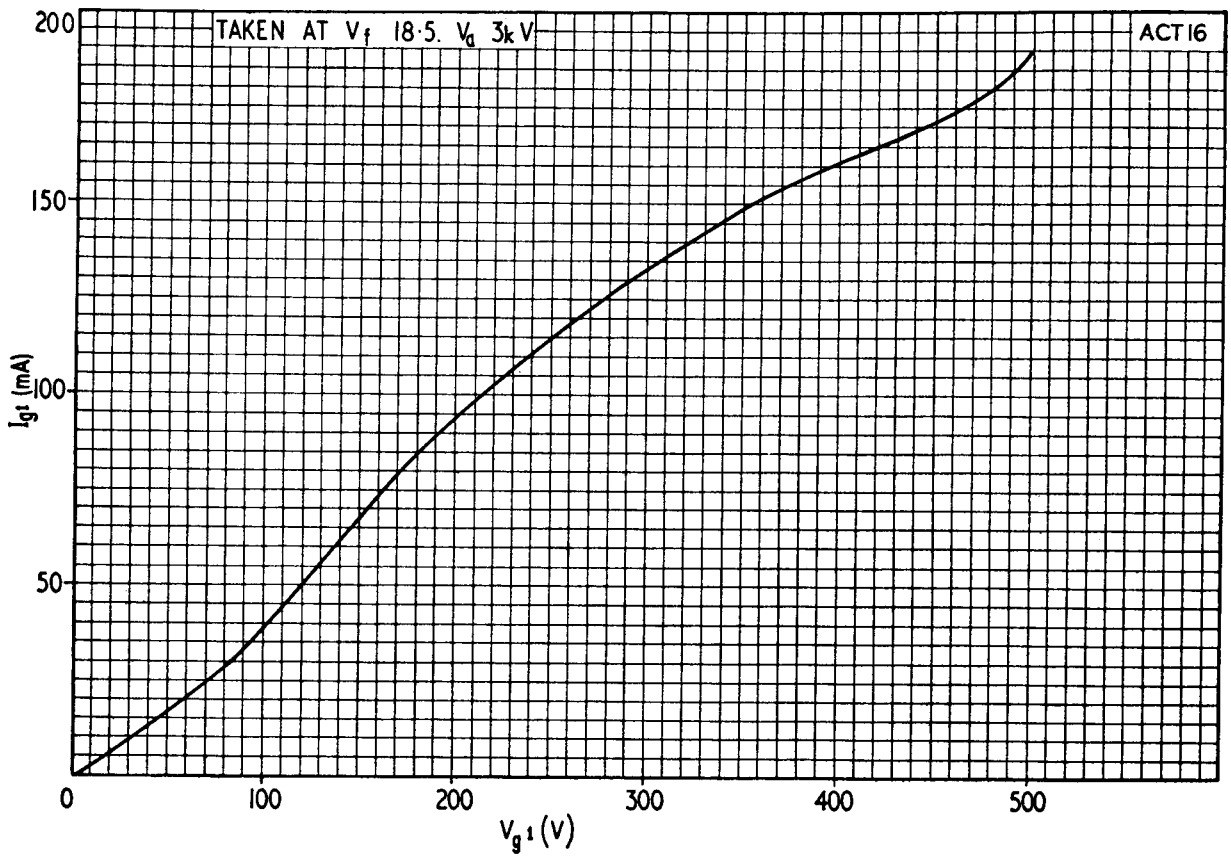
The figures quoted above are only applicable when operating at frequencies up to 20 Mc/s. At higher frequencies the anode voltage must be reduced to the following percentages of the maximum:

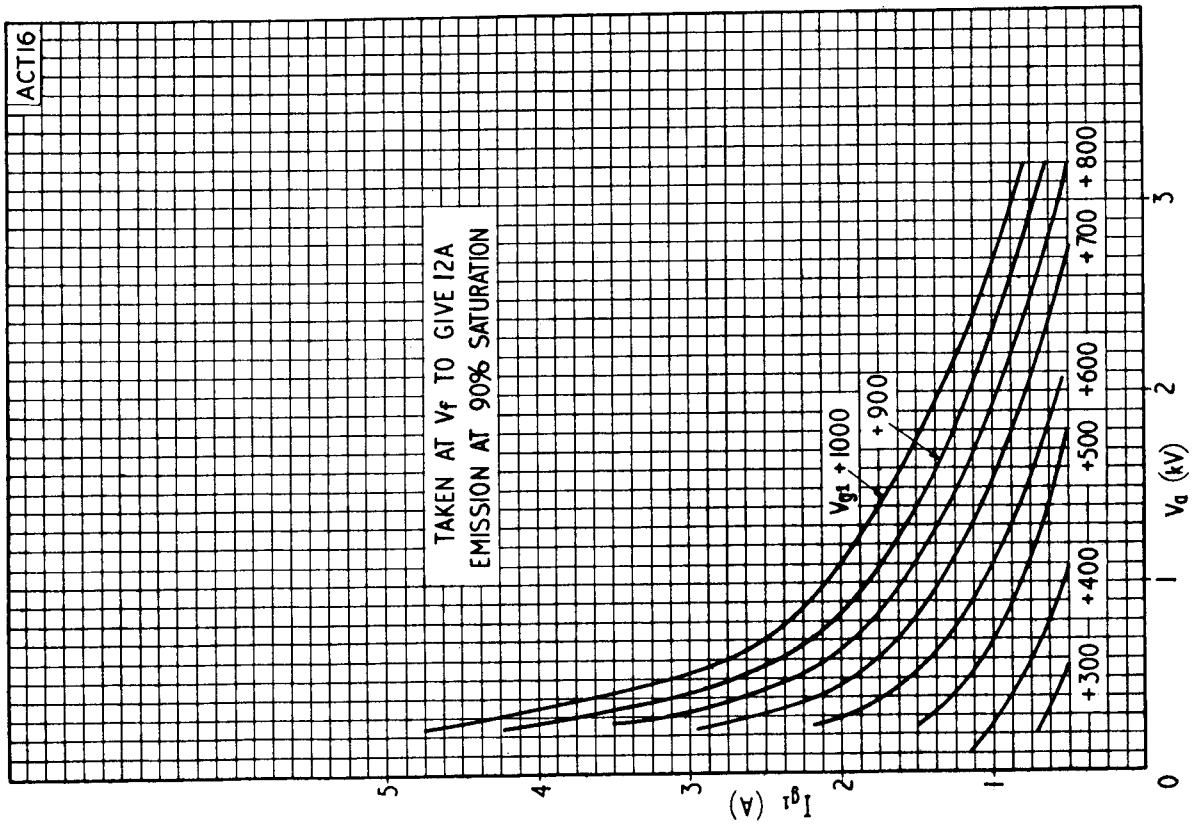
f (Mc/s)	20	25	30	40
$\%V_{a(max)}$	100	75	50	35

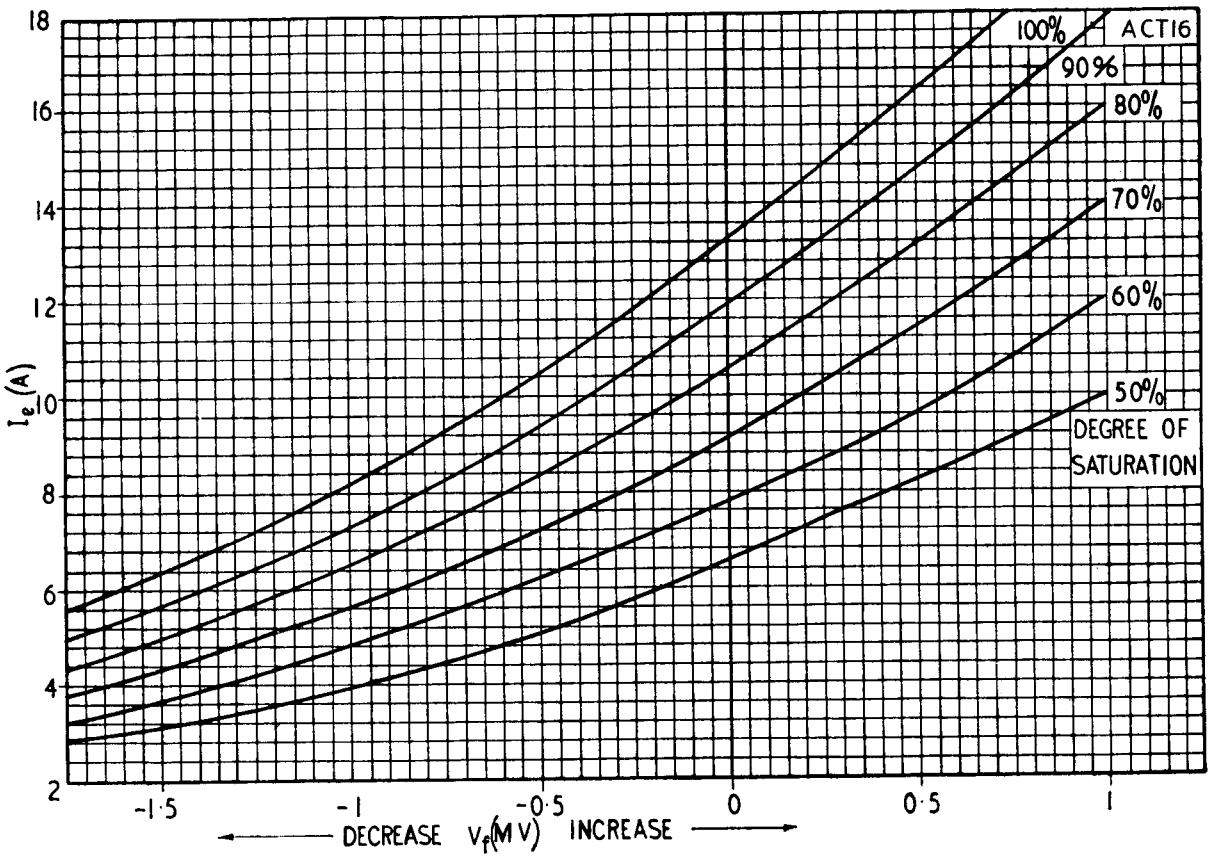
NOTES

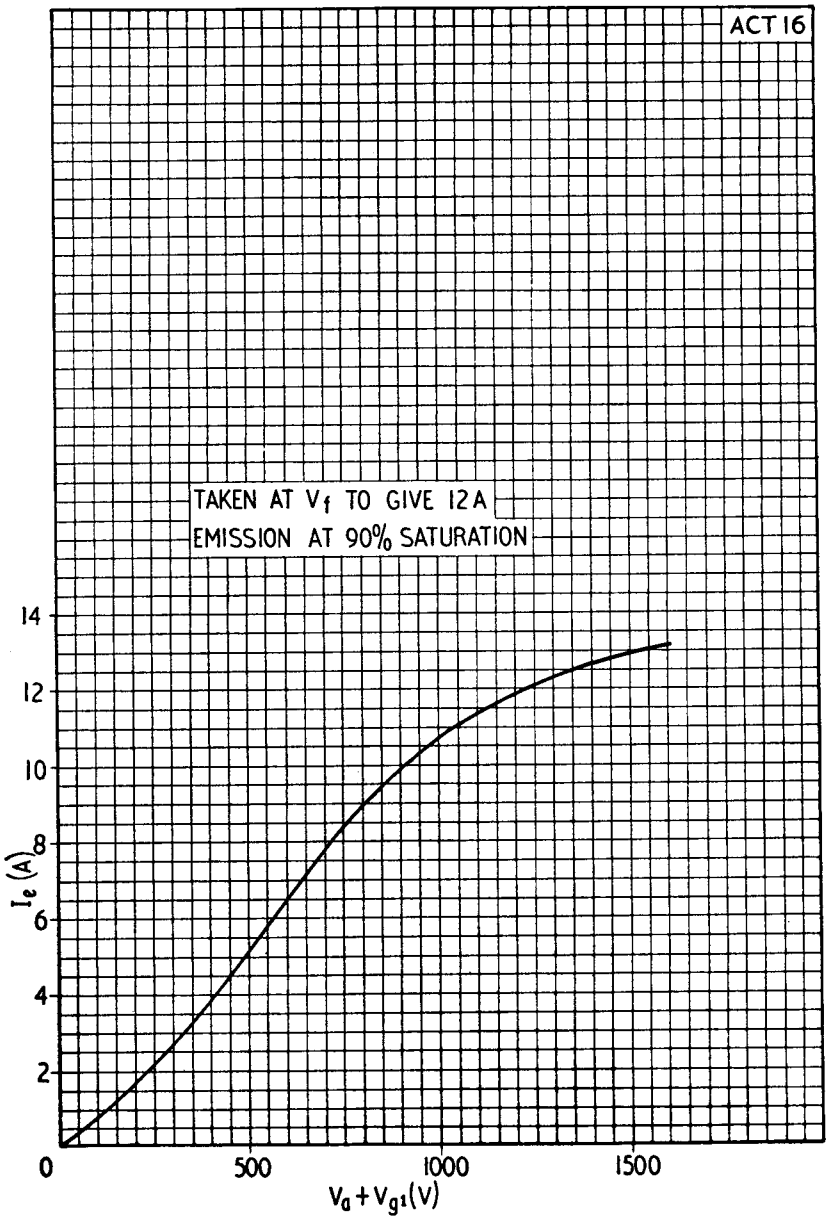
(a) Subject to wide variation. The figures are approximate only.
(b) At crest of audio cycle with 100% modulation.

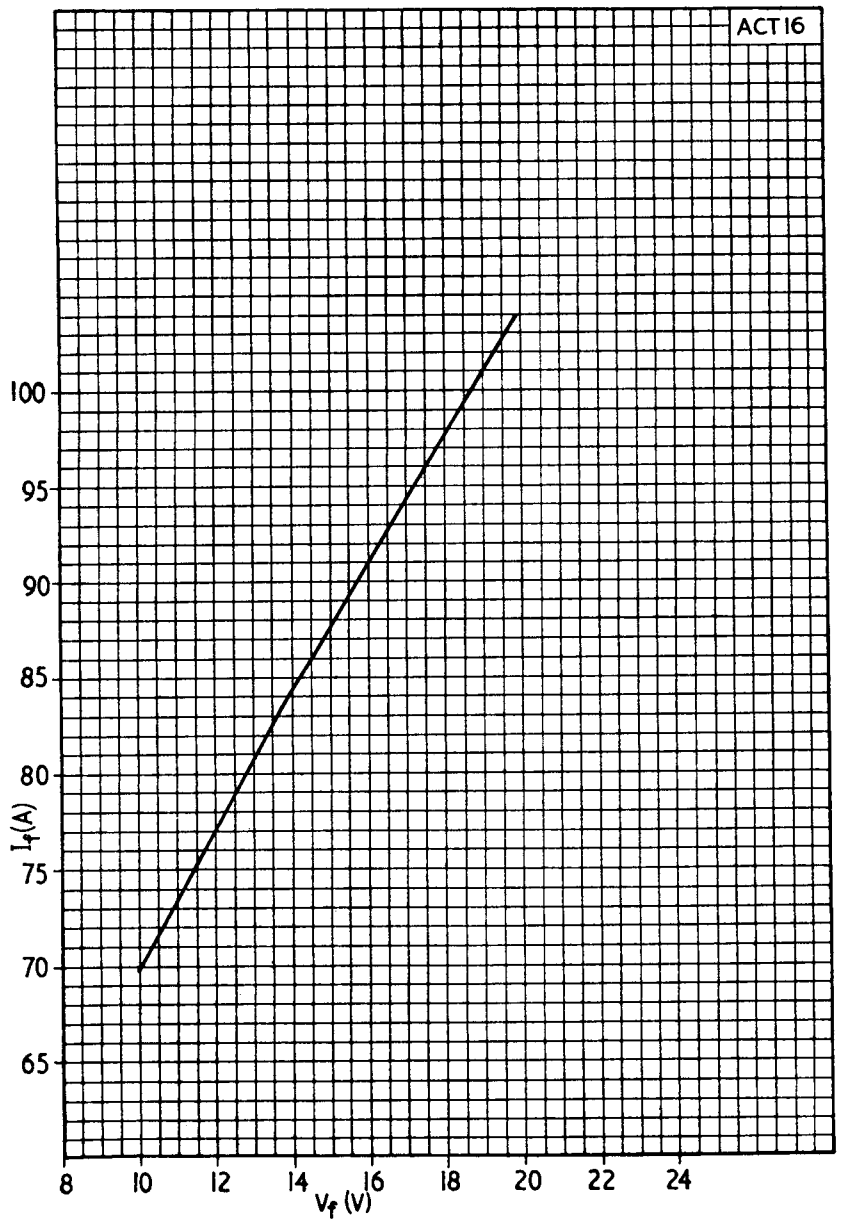

ACT16
TAKEN AT V_f TO GIVE 12A
EMISSION AT 90% SATURATION.
V_{g1} +1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
V_{g1} 0
-100
-200
I_a (A)
V_a (kV)
0
5
10
15
20
2
4
6
8
10


ACT16
TAKEN AT V_f 18·5. V_a 3k V
I_{g1} (mA)
V_{g1} (V)
0
100
200
300
400
500
50
100
150
200


ACT16
TAKEN AT Vf TO GIVE 12A
EMISSION AT 90% SATURATION
Vg1 +1000
+900
+800
+700
+600
+500
+400
+300
Va (kV)
Ig1 (A)


ACT16
100%
90%
80%
70%
60%
50%
DEGREE OF SATURATION
Ie (A)
DECREASE Vf (MV) INCREASE


ACT 16
TAKEN AT V_f TO GIVE 12A
EMISSION AT 90% SATURATION
I_e (A)
0
2
4
6
8
10
12
14
500
1000
1500
$V_a + V_{g1}$ (V)


ACT 16
I_f (A)
65
70
75
80
85
90
95
100
8
10
12
14
16
18
20
22
24
V_f (V)



PRINTED IN ENGLAND

Triode *Type ACT22*

UHF AMPLIFIER AND OSCILLATOR

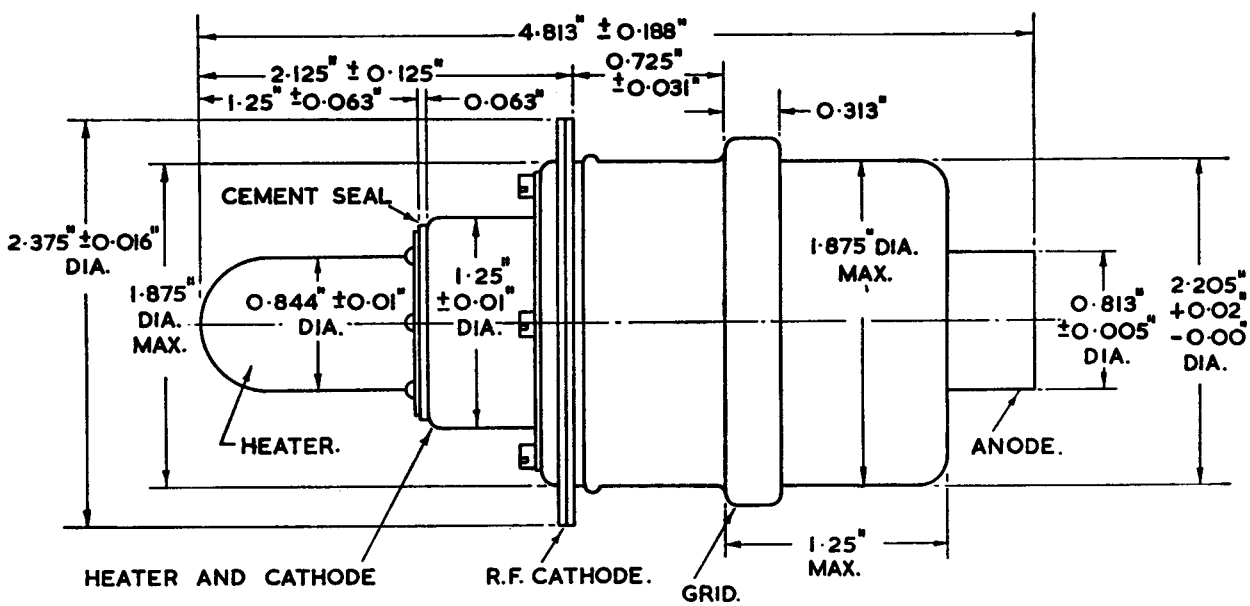
General. A forced-air-cooled disc-seal transmitting triode fitted with an indirectly-heated oxide-coated cathode. The valve is suitable for use as an amplifier or oscillator in co-axial line circuits at frequencies up to 1,000 Mc/s, and also for pulse operation.

Cooling. The anode requires cooling by air blast. The minimum volume of air necessary is 5 cu. ft. per minute at a pressure equal to a 2-in. head of water. The grid seal also requires to be cooled by air and the volume of air necessary is about 6 cu. ft. per minute at a pressure equal to a 1-in. head of water. All cooling supplies must be in operation before the application of any supply voltages, and must continue until after all voltages have been removed.

Mounting. The valve may be mounted in any position. Rigid connections may be made to one electrode only. It is essential that the valve holder is designed so that the valve can be inserted and withdrawn without imposing strain on the glass work or on the cemented seal.

APPROXIMATE DATA

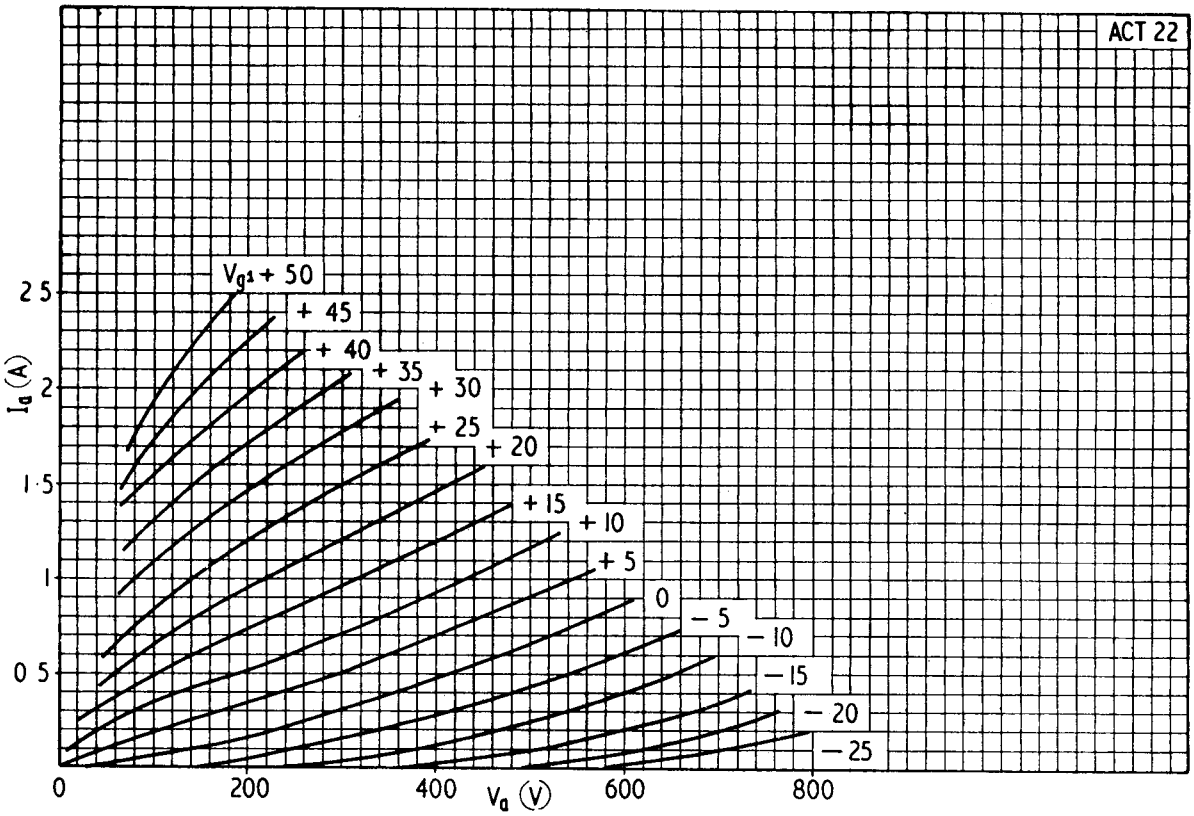
V_h	6·3	V	g_m (taken at V_a 500V, I_a 100mA)	20	mA/V
I_h	4	A	g_m (taken at $\frac{1}{2} I_{k(pk)}$)	50	mA/V
$V_{a\ (max)}$	600	V	$C_{a\text{-}gl}$	6·5	pF
$P_{a\ (max)}$	75	W	$C_{a\text{-}k}$	0·3	pF
$I_{k\ (pk)}$	1·5	A	$C_{gl\text{-}k}$	13·5	pF
$I_{gl\ (max)}$	60	mA			
μ	22				

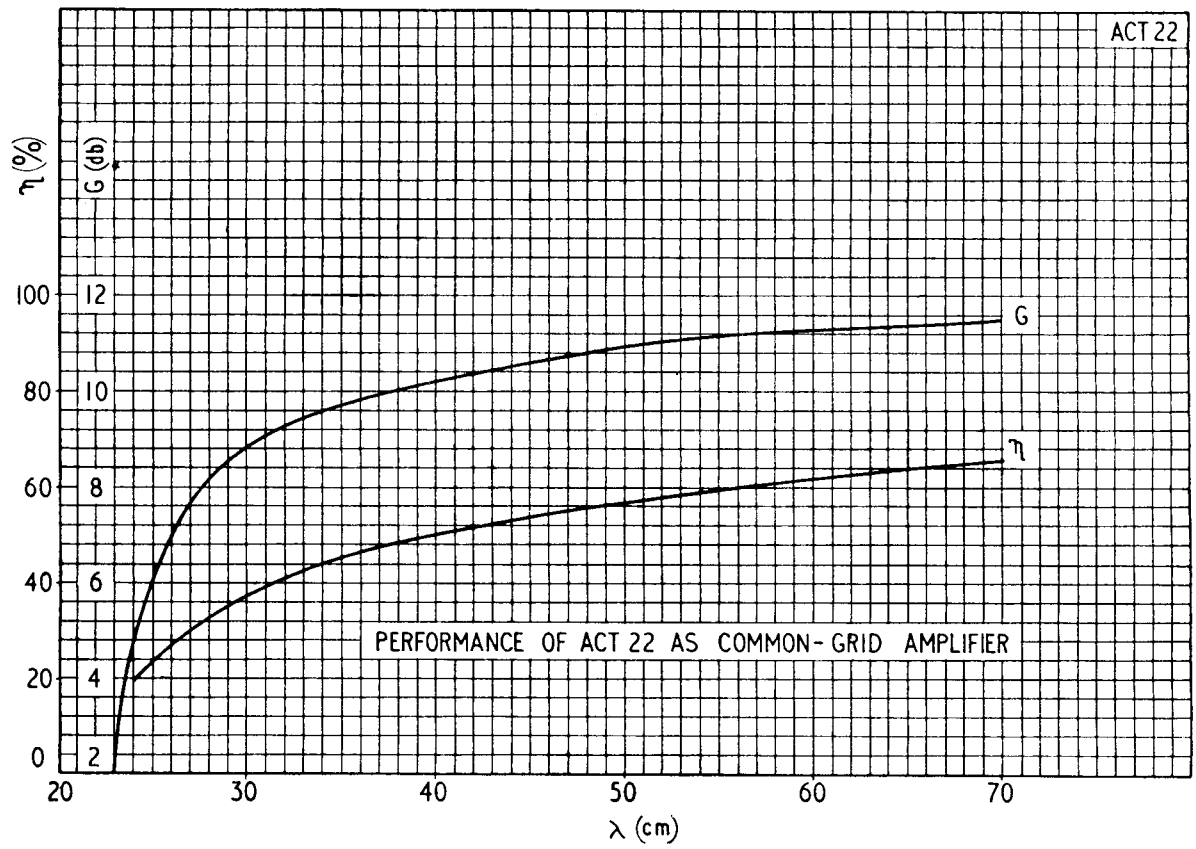


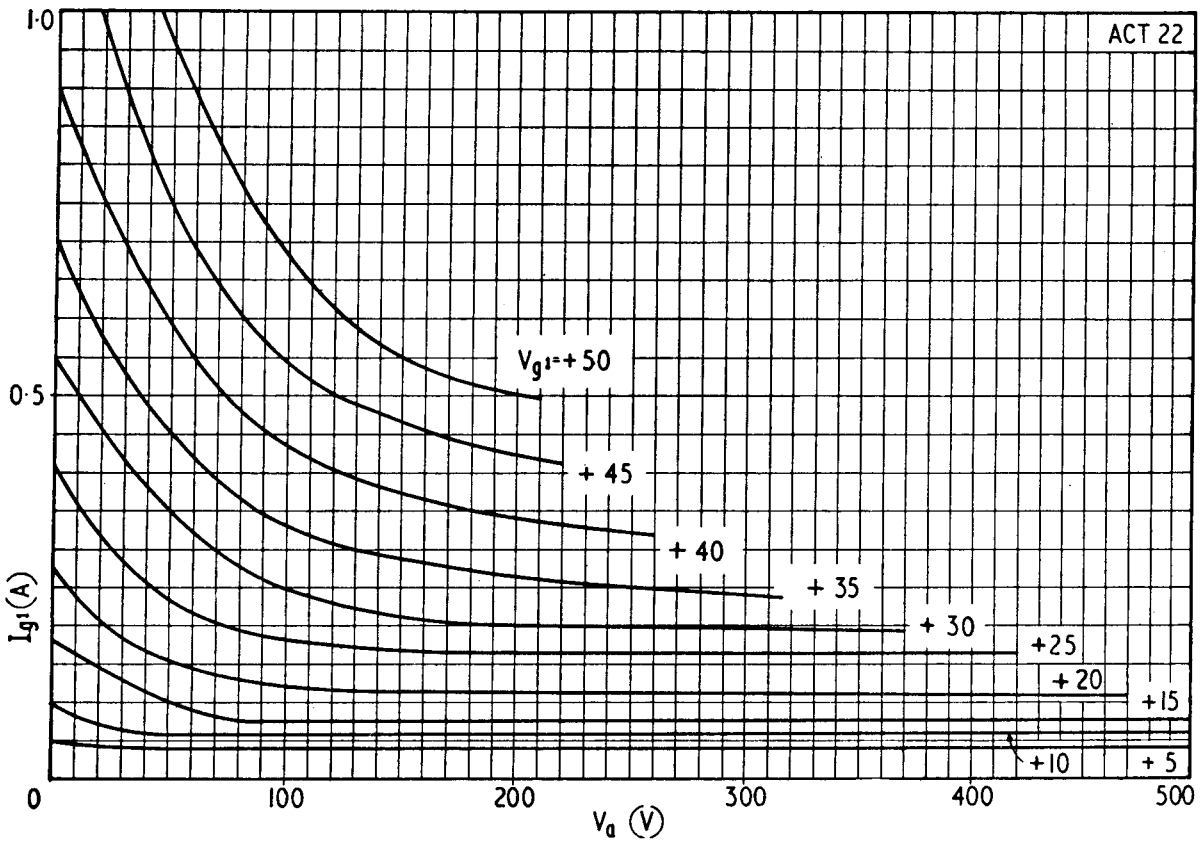
WEIGHT 0·75 lb. (0·3 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*


ACT 22
I_a (A)
2·5
2
1·5
1
0·5
V_{g1} + 50
+ 45
+ 40
+ 35
+ 30
+ 25
+ 20
+ 15
+ 10
+ 5
0
− 5
− 10
− 15
− 20
− 25
0
200
400
600
800
V_a (V)


ACT 22
η (%)
G (db)
100
80
60
40
20
0
12
10
8
6
4
2
G
η
PERFORMANCE OF ACT 22 AS COMMON-GRID AMPLIFIER
20
30
40
50
60
70
λ (cm)


ACT 22
1·0
0·5
0
I_{g1} (A)
V_{g1}=+50
+ 45
+ 40
+ 35
+ 30
+25
+ 20
+15
+10
+ 5
100
200
300
400
500
V_a (V)



PRINTED IN ENGLAND

Triode *Type ACT25*

UHF AMPLIFIER AND OSCILLATOR

General. A forced-air-cooled disc-seal transmitting triode suitable for use as an amplifier or oscillator in coaxial line or cavity circuits at frequencies up to 1,000 Mc/s. The ACT 25 is particularly suitable for wide band operation.

Cooling. The anode requires cooling by air blast. The volume of air necessary is about 30 cu. ft. per minute, at a pressure equal to a 2½-in. head of water. The grid seal also requires to be cooled by air and the volume of air necessary is about 5 cu. ft. per minute. All cooling supplies must be in operation before the application of any supply voltages, and must continue until after all voltages have been removed.

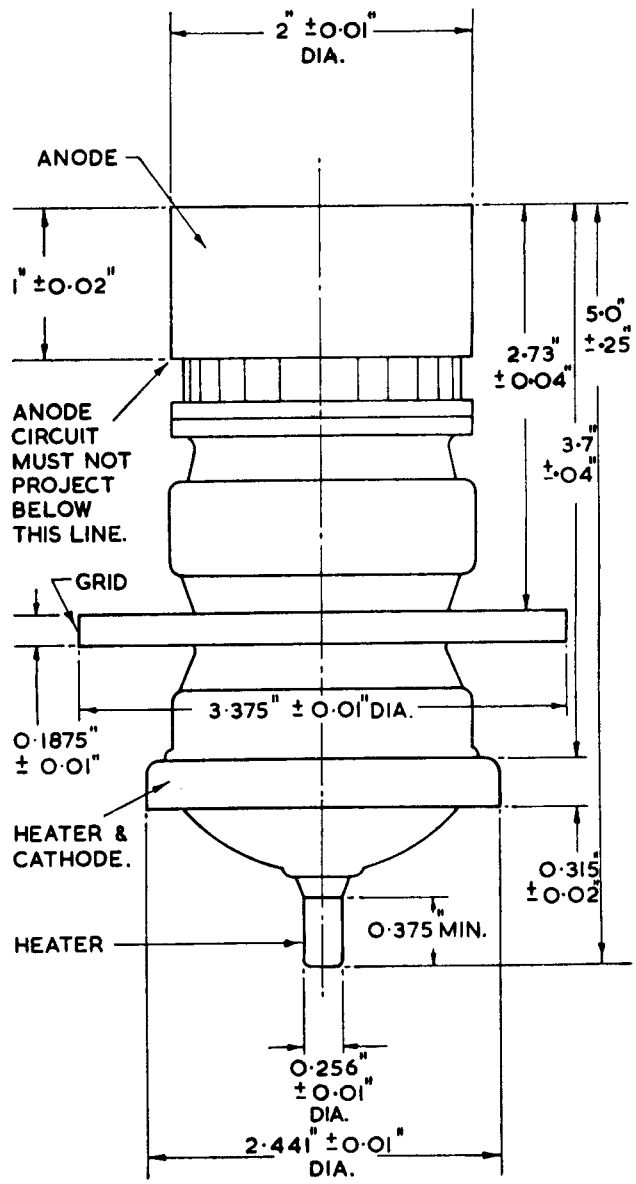
Mounting. The valve may be mounted in a vertical or a horizontal position. Rigid connections must be made to one electrode only and the valve must not be supported by bolts placed in the holes of the grid ring.

APPROXIMATE DATA

V_h	13·5	V
I_h	2·8	A
$V_{a\ (max)}$	1,000	V
$p_{a\ (max)}$	400	W
$I_{k\ (pk)\ (max)}$	5	A
I_{gl}	250	mA
μ	75	
g_m (taken at V_a 1000 V, I_a 250 mA)	35	mA/V
g_m (taken at ½ $I_{k\ (pk)}$)	70	mA/V
$c_{a\text{-}gl}$	13	pF
$c_{a\text{-}k}$	0·4	pF
$c_{gl\text{-}k}$	22	pF

Operating Data

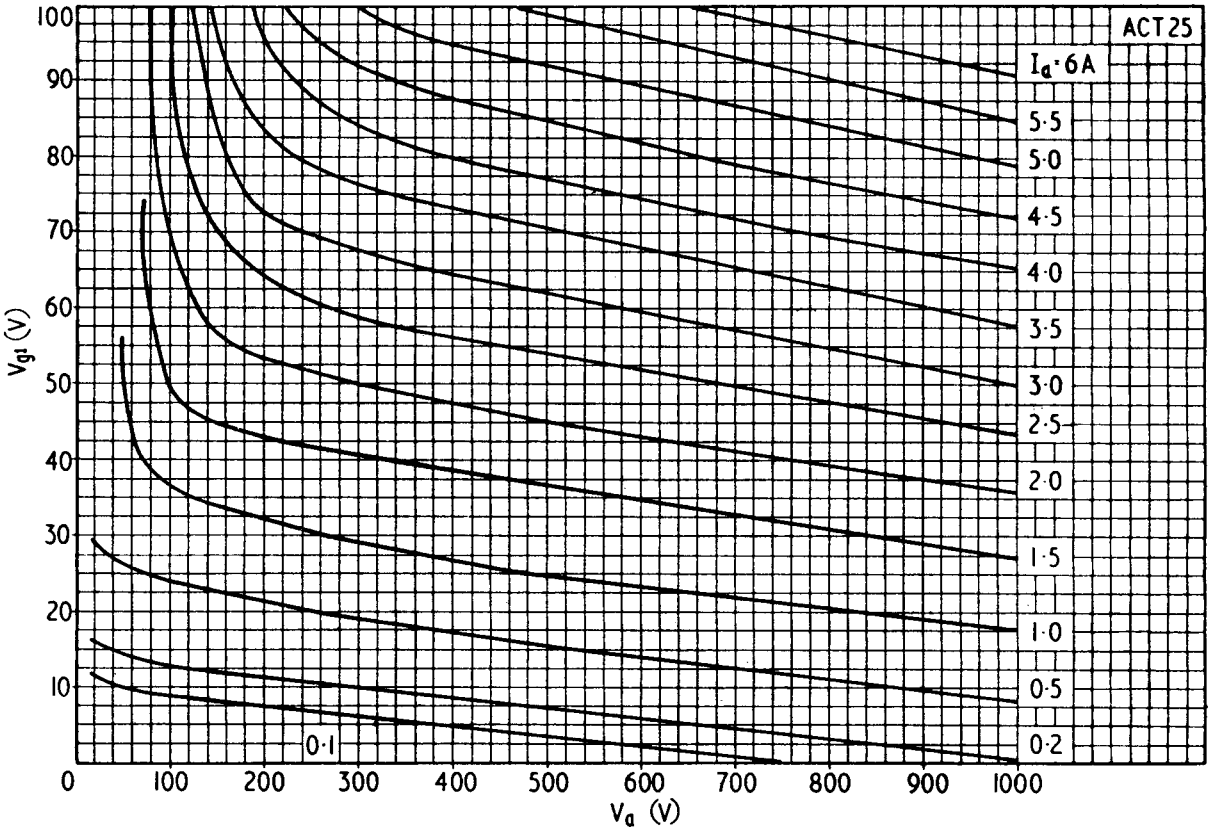
f	η	G as Common Grid Amplifier
<600 Mc/s	60%	7 db
1,000 Mc/s	30%	3 db

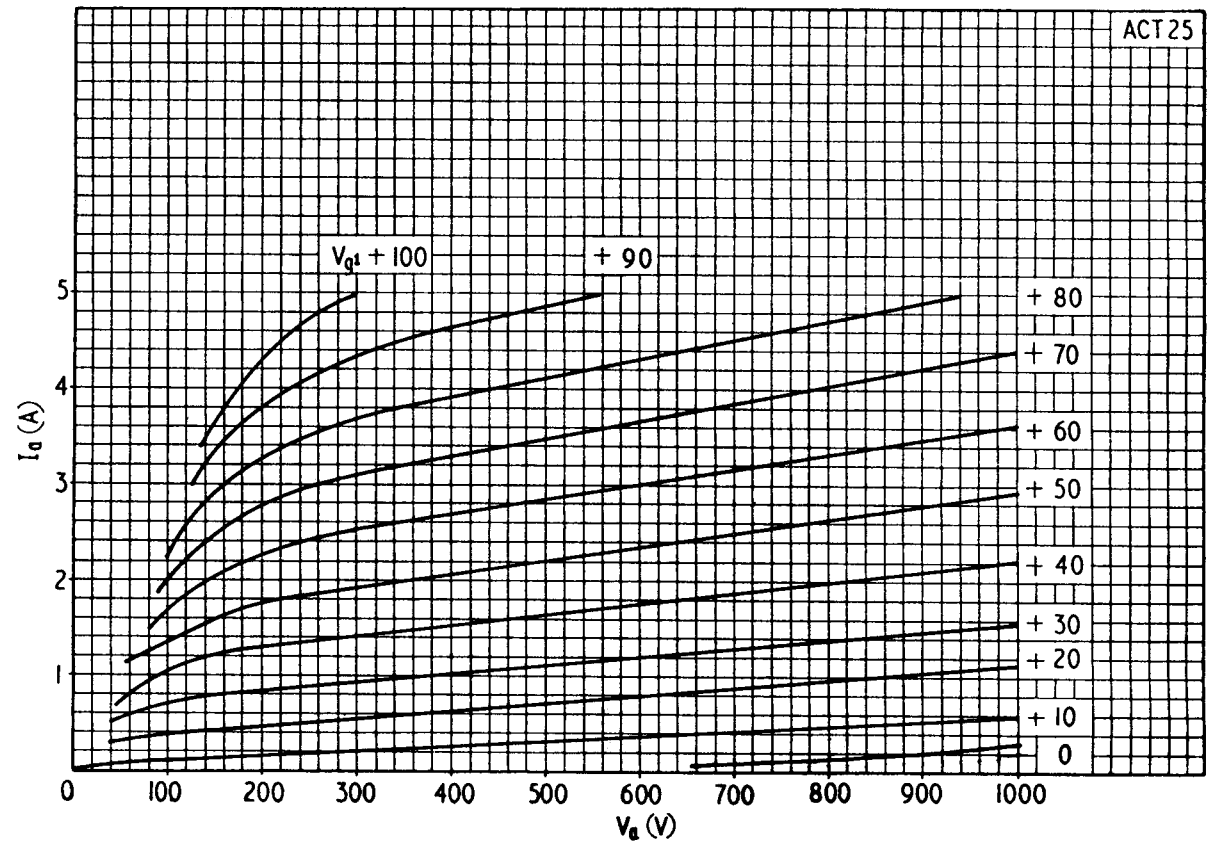


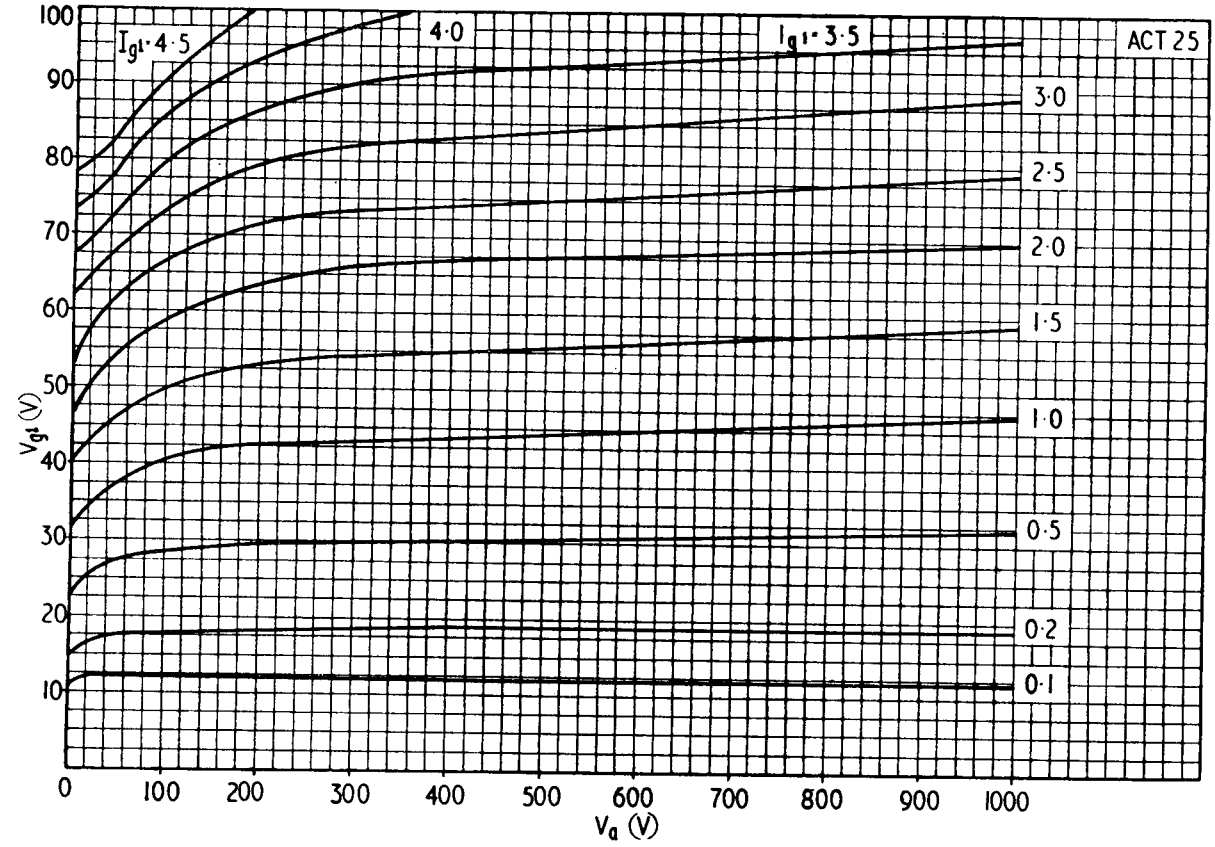
WEIGHT 1·3lb. (590 gm.)

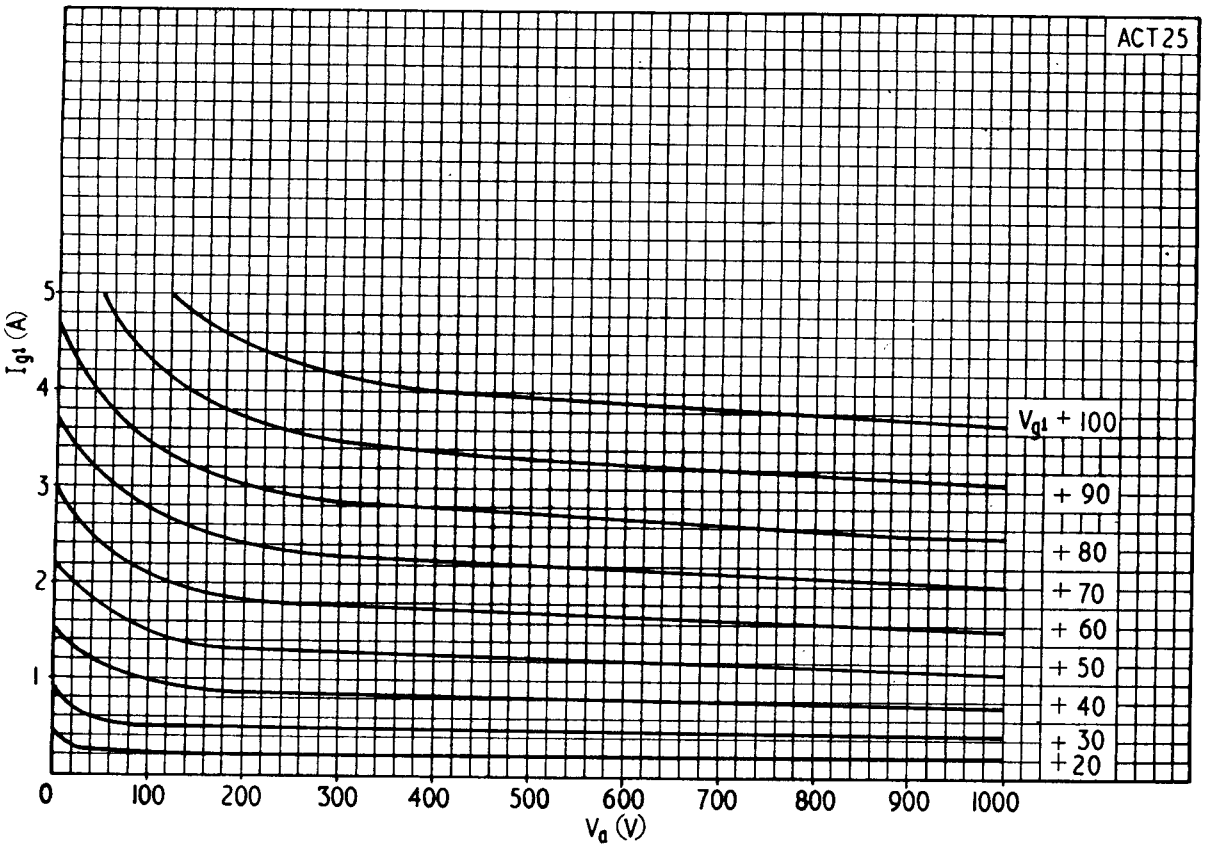
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*


ACT25
I_a 6A
5·5
5·0
4·5
4·0
3·5
3·0
2·5
2·0
1·5
1·0
0·5
0·2
0·1
V_{g1} (V)
V_a (V)
100
90
80
70
60
50
40
30
20
10
0
100
200
300
400
500
600
700
800
900
1000


ACT25
V_{g1} + 100
+ 90
+ 80
+ 70
+ 60
+ 50
+ 40
+ 30
+ 20
+ 10
0
I_a (A)
V_a (V)
5
4
3
2
1
0
100
200
300
400
500
600
700
800
900
1000


ACT 25
I_{g1} 4·5
4·0
I_{g1} 3·5
3·0
2·5
2·0
1·5
1·0
0·5
0·2
0·1
V_{g1} (V)
V_a (V)
100
90
80
70
60
50
40
30
20
10
0
100
200
300
400
500
600
700
800
900
1000


ACT 25
I_{g1} (A)
V_a (V)
V_{g1} + 100
+ 90
+ 80
+ 70
+ 60
+ 50
+ 40
+ 30
+ 20
5
4
3
2
1
0
100
200
300
400
500
600
700
800
900
1000



PRINTED IN ENGLAND

Triode *Type ACT 26*

VHF AMPLIFIER

General. A forced-air-cooled transmitting triode fitted with a thoriated tungsten filament, for use in common grid circuits at frequencies up to 300 Mc/s.

Cooling. The anode requires cooling by air blast. The volume of air necessary is about 300 cu. ft. per minute at a pressure equal to a 4-in. head of water. The filament seals also require to be cooled by air, and the volume of air necessary is 10 cu. ft. per minute supplied through a nozzle. The air inlet temperature should not exceed 35°C (95°F). All cooling supplies must be started before the application of any supply voltages, and should continue for at least 30 sec. after the removal of all supply voltages.

Filament Starting. The cold resistance of the filament is 0·0064 Ω. The filament current must never exceed 150 A during the switching on period. During operation the filament must be run at constant current.

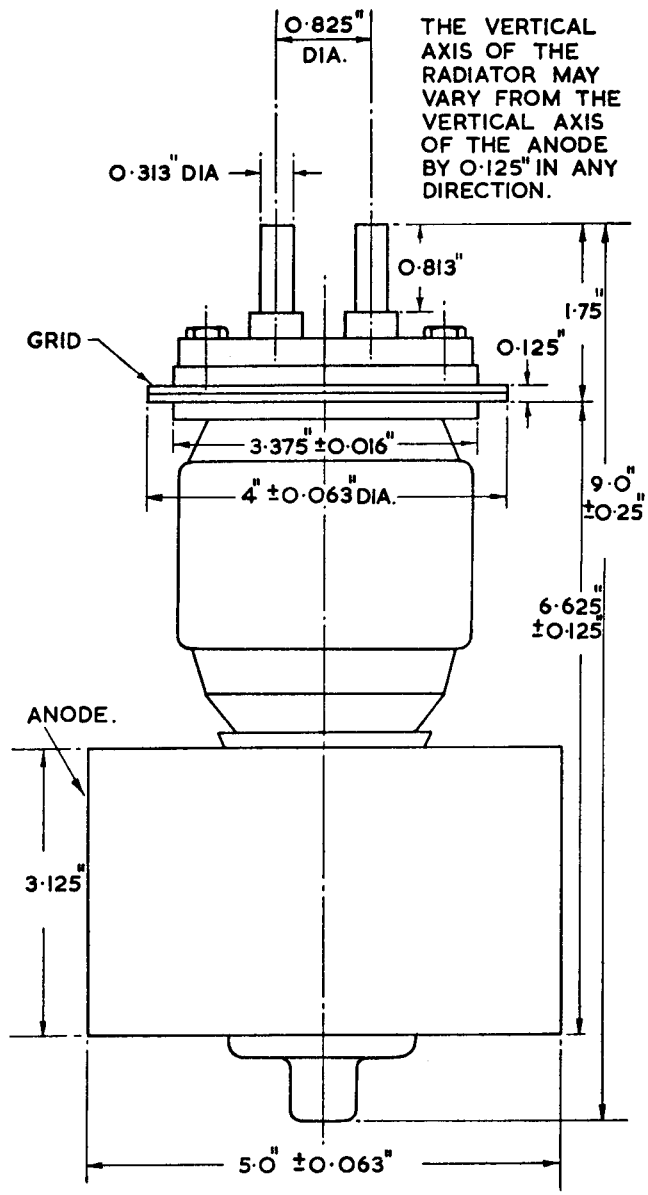
Mounting. The valve must be mounted with its axis vertical and the filament seals uppermost. Rigid connections must be made to one electrode only.

APPROXIMATE DATA

V_f		6·5	V
I_f		105	A
$V_{a\ (max)}$		5	kV
$p_{a\ (max)}$		5	kW
$p_{gl\ (max)}$		150	W
$I_{k\ (pk)\ (max)}$		15	A
μ	taken at V_a 2 kV and $\frac{1}{2}$ $I_{k\ (pk)}$	22	
r_a		490	Ω
g_m		45	mA/V
$c_{a\text{-}gl}$		18	pF
$c_{a\text{-}k}$		0·5	pF
$c_{gl\text{-}k}$		22	pF

At frequencies above 100 Mc/s the permissible anode voltage must be reduced to the following percentages of the maximum value.

f (Mc/s)	100	150	200	250	300
% $V_{a\ (max)}$	100	80	70	60	50

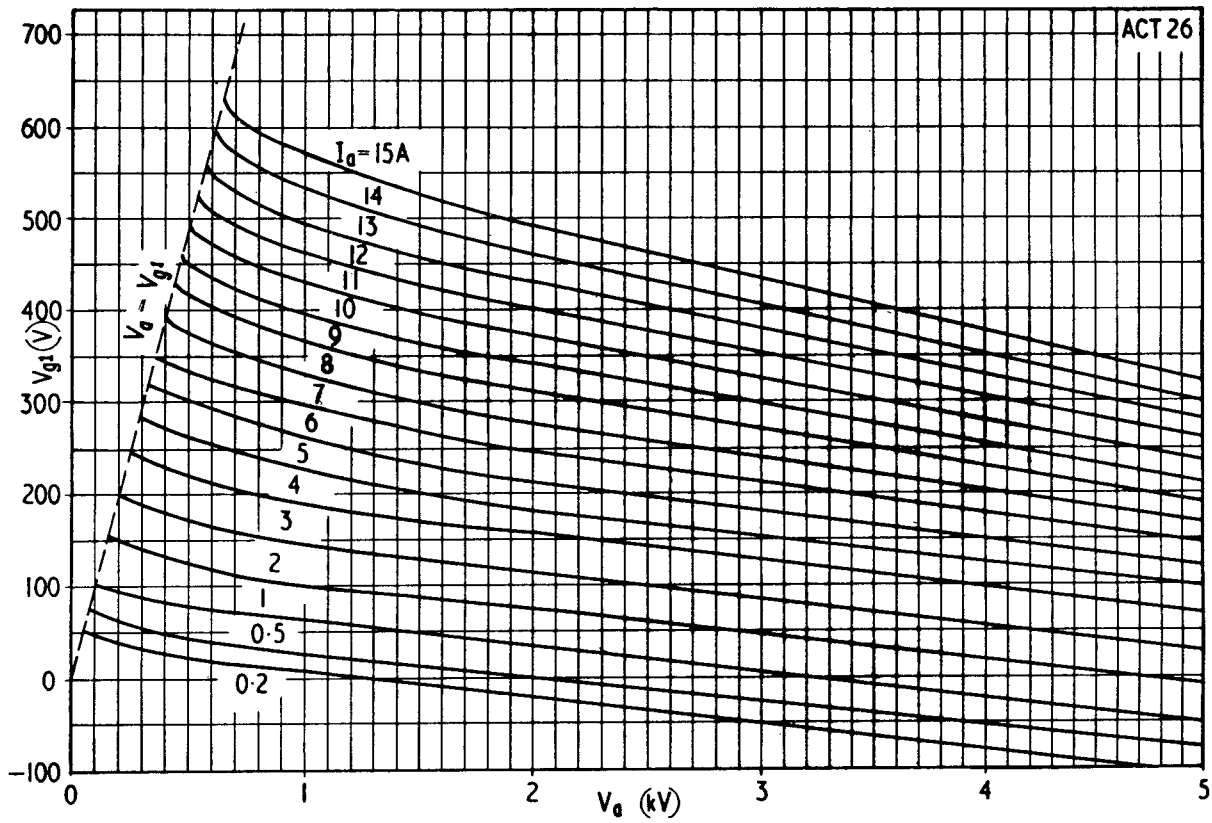


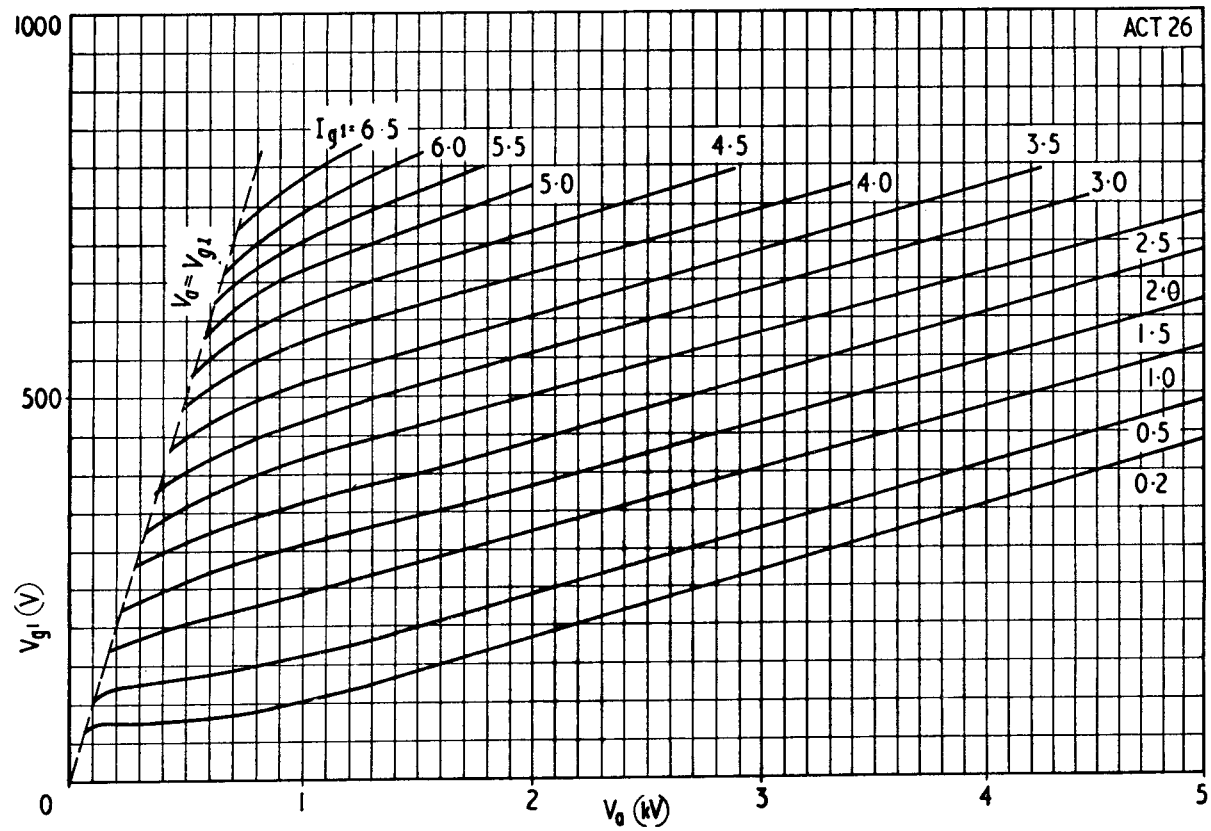
WEIGHT 8·5 lb. (3·7 kg.)

DIMENSIONS MEAN

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford





PRINTED IN ENGLAND

Triode *Type ACT 27*

UHF AMPLIFIER AND OSCILLATOR

General. The ACT 27 is a forced-air-cooled transmitting triode, fitted with an indirectly heated cathode, suitable for use in common-grid co-axial line circuits as an oscillator, at frequencies up to 400 Mc/s and as an amplifier up to 600 Mc/s.

Cooling. The flow of air required for cooling the anode is 150 cu. ft. per minute at a pressure equal to 3-in. water gauge.

The external grid seal also requires air cooling. The volume of air necessary is approximately 20 cu. ft. per minute.

All cooling supplies must be in operation before applying any voltage to the valve and should continue for at least 2 minutes after removal of all voltages.

HT Switching. The heater must be on for at least four minutes before the application of the HT voltage.

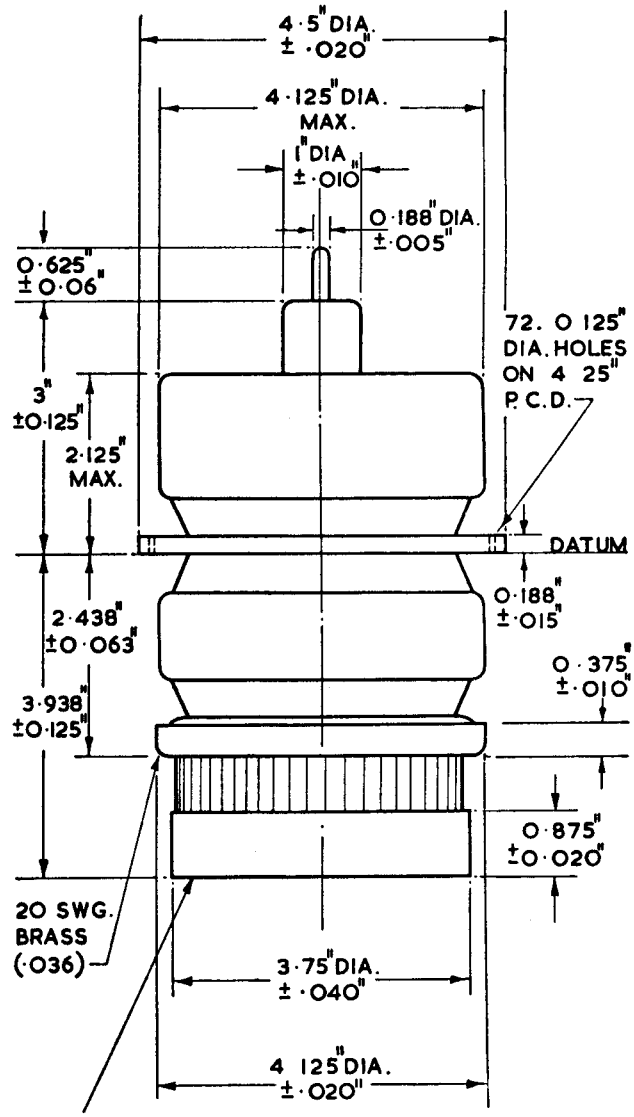
Mounting. The valve should be mounted in a vertical position. Rigid connections may be made to one electrode only.

The holes in the grid ring are provided for cooling and must not be used for fixing purposes.

Frequency. At frequencies above 350 Mc/s, the anode voltage must be reduced in accordance with the performance characteristics.

Dimensions of Circuit Elements. The following information about the dimensions of the circuits used to obtain the amplifier performance quoted overleaf, is given as a guide to designers.

Inside diameter of anode line					4⅜ in.
Outside diameter of grid line					4 in.
Characteristic impedance					10·5 Ω
Frequency	200	400	400	600	Mc/s.
Line Length	34	14	46	37·5	cm.
Mode	$\frac{\lambda}{4}$	$\frac{\lambda}{4}$	$\frac{3\lambda}{4}$	$\frac{3\lambda}{4}$	



WEIGHT 8¼ lb. (3·7 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

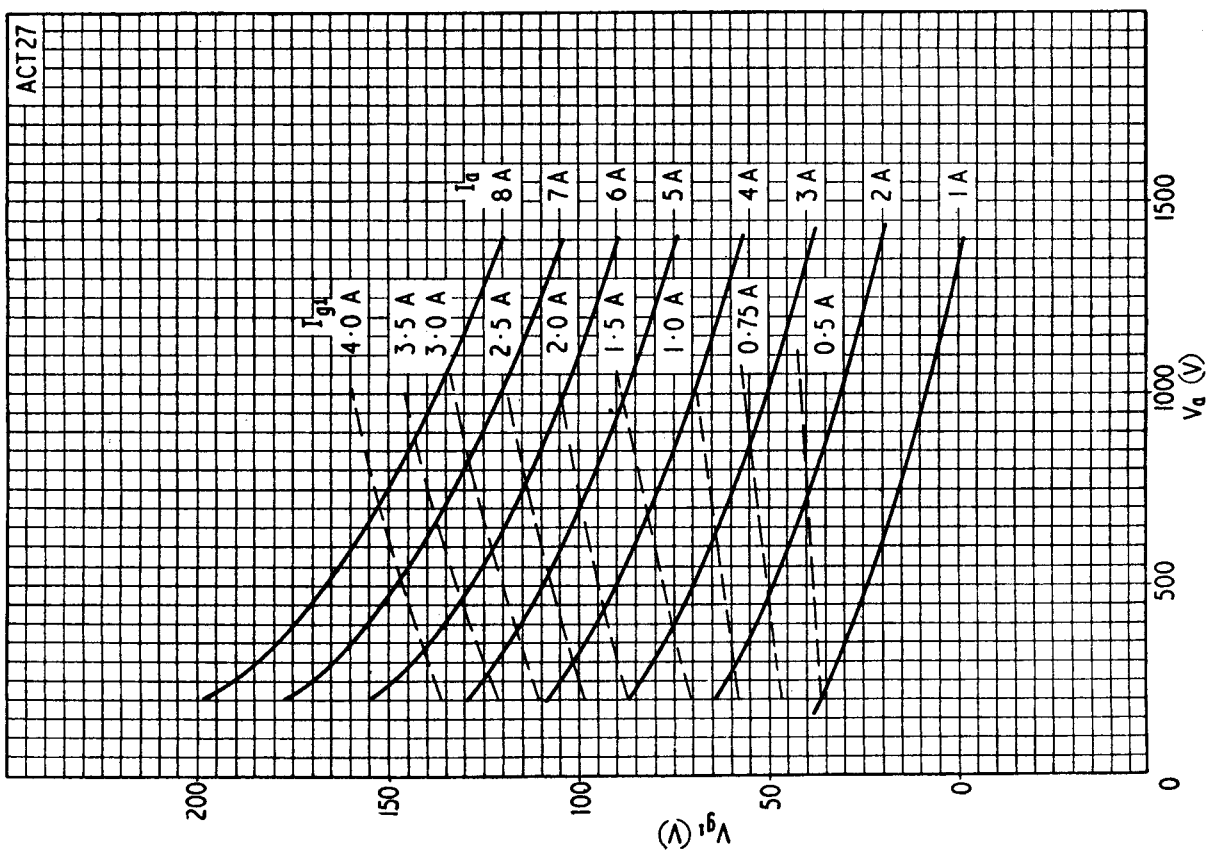
V_h		16	V
I_h (approx)		6·7	A
V_a (max)		1·5	kV
p_a (max)		1·5	kW
I_a (max)*		1·5	A
μ	taken at V_a 1·5 kV	50	
g_m	I_a 0·5 A	40	mA/V
$C_{a\text{-}g1}$		28	pF
$C_{a\text{-}k}$		0·5	pF
$C_{g1\text{-}k}$		30	pF

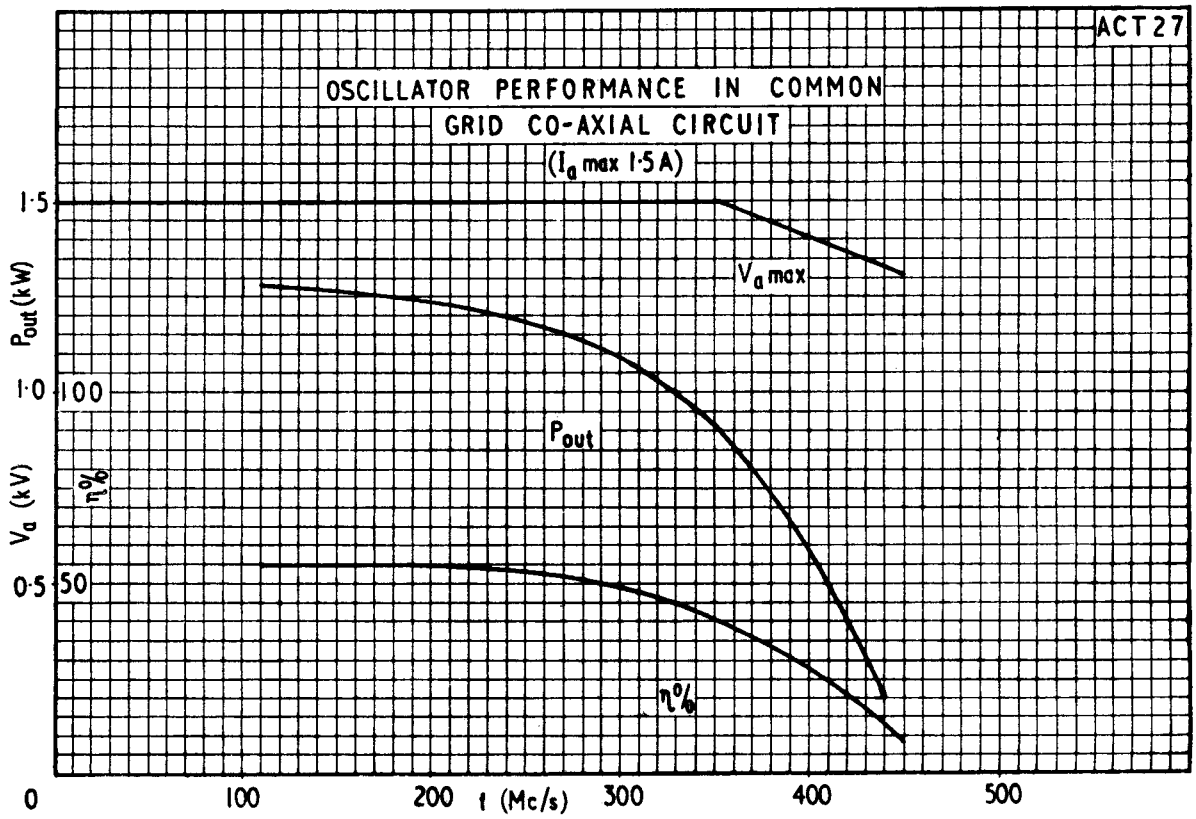
*With Television waveforms the value of I_a may reach 2A under peak white conditions.

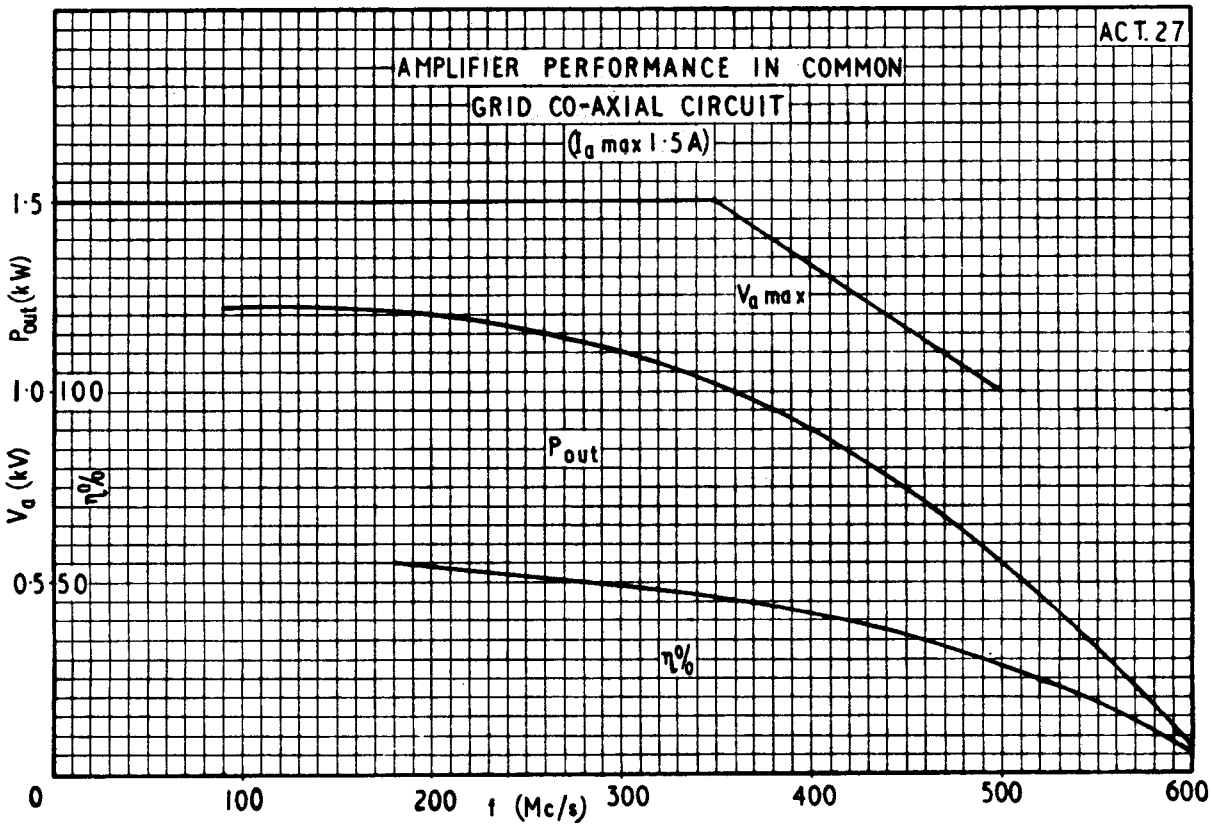
Typical Operation

RF Power Amplifier. CW operation

f	200	400	Mc/s
V_a	1·5	1·4	kV
I_a	1·5	1·5	A
V_{g1}	−50	−25	V
I_{g1}	0·75	0·75	A
P_{out}	1·2	0·9	kW




ACT 27
OSCILLATOR PERFORMANCE IN COMMON
GRID CO-AXIAL CIRCUIT
(I_a max 1·5A)
P_{out} (kW)
V_a (kV)
η%
1·5
1·0
0·5
100
50
0
V_a max
P_{out}
η%
100
200
f (Mc/s)
300
400
500


ACT. 27
AMPLIFIER PERFORMANCE IN COMMON
GRID CO-AXIAL CIRCUIT
(I_a max 1·5A)
P_{out} (kW)
V_a (kV)
η%
1·5
1·0
0·5
100
50
0
V_a max
P_{out}
η%
100
200
f (Mc/s)
300
400
500
600



PRINTED IN ENGLAND

Triode *Type ACT28*

UHF DISC SEAL PULSED OSCILLATOR

General. The ACT28 is a forced-air-cooled disc seal triode, fitted with an indirectly-heated oxide-coated cathode, intended for use as a pulsed oscillator in common grid co-axial circuits at frequencies up to 400 Mc/s.

Cooling. The flow of air to the anode should be 150 cu. ft. per minute at a pressure equal to 3 in. water gauge.

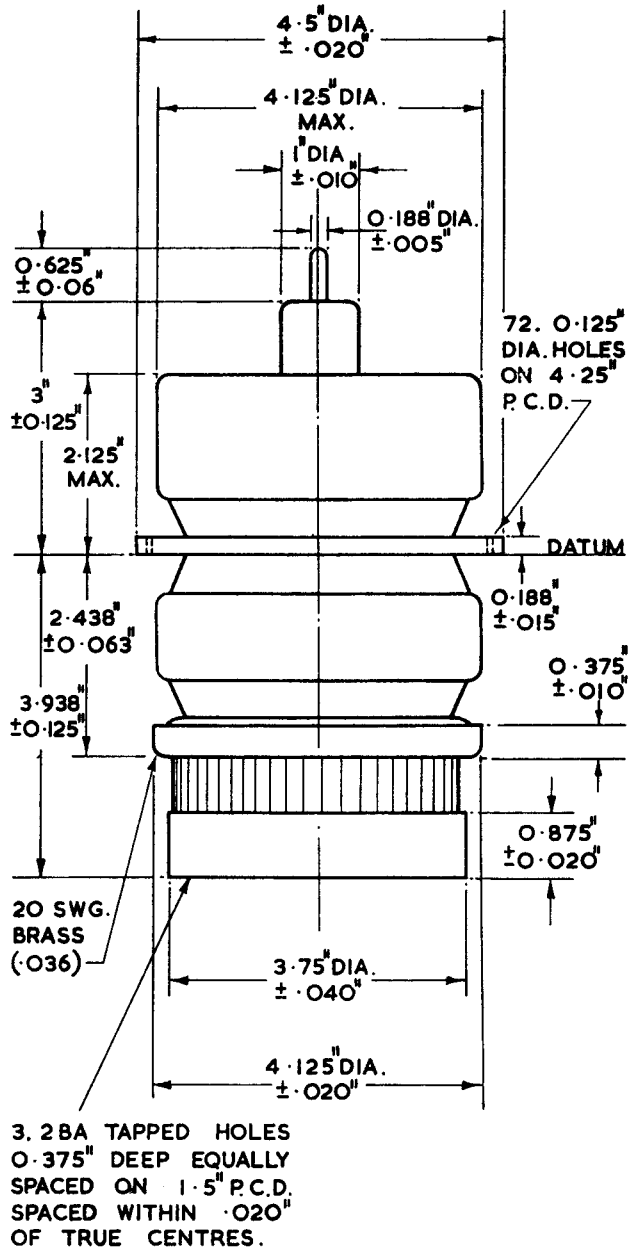
The external grid seal also requires air cooling. The volume of air necessary being approximately 20 cu. ft. per minute.

All cooling supplies must be in operation before applying any voltage to the valve and should continue for at least two minutes after the removal of all voltages.

H.T. Switching. The heater must be on for at least four minutes before the application of the anode voltage.

Mounting. The valve should be mounted in a vertical position. Rigid connections may be made to only one electrode.

The holes in the grid ring are provided for cooling and must not be used for fixing purposes.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Marconi House, Chelmsford. Telephone: Chelmsford 3221. Telex: 1953. Telegrams: Expanse Chelmsford Telex

Dimensions of Circuit Elements. The following information about suitable co-axial cavities is given as a guide to designers.

Inside diameter of anode line				4·75	in.
Outside diameter of grid line				4	in.
Characteristic impedance				10·5	Ω
Frequency	200	400	400	600	Mc/s.
Line length	34	14	46	37·5	cm.
Mode	λ/4	λ/4	3λ/4	3λ/4	

APPROXIMATE DATA

Heater

V_h	16	V
$I_{h\ approx.}$	7·3	A

Characteristics

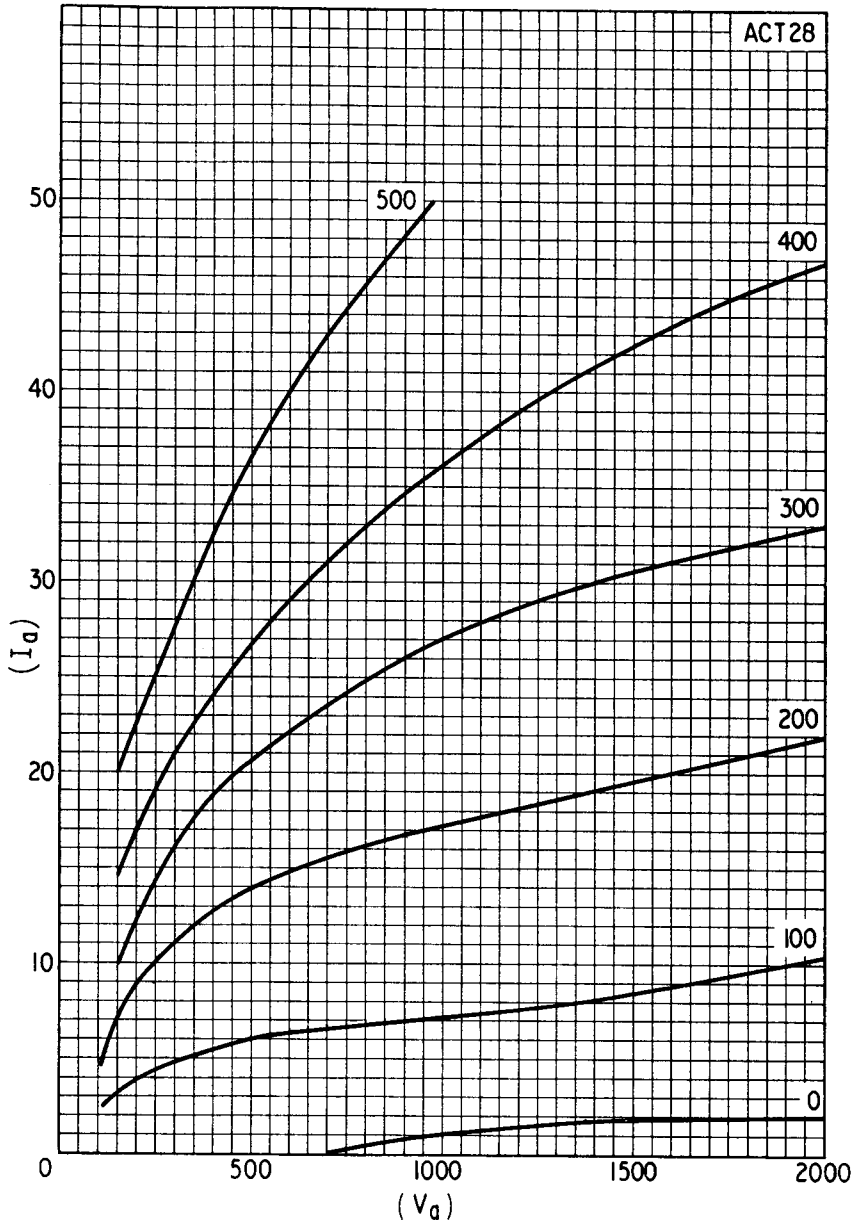
V_a	1·5	kV
I_a	0·8	A
g_m	50	mA/V
μ	45	

Maximum Ratings

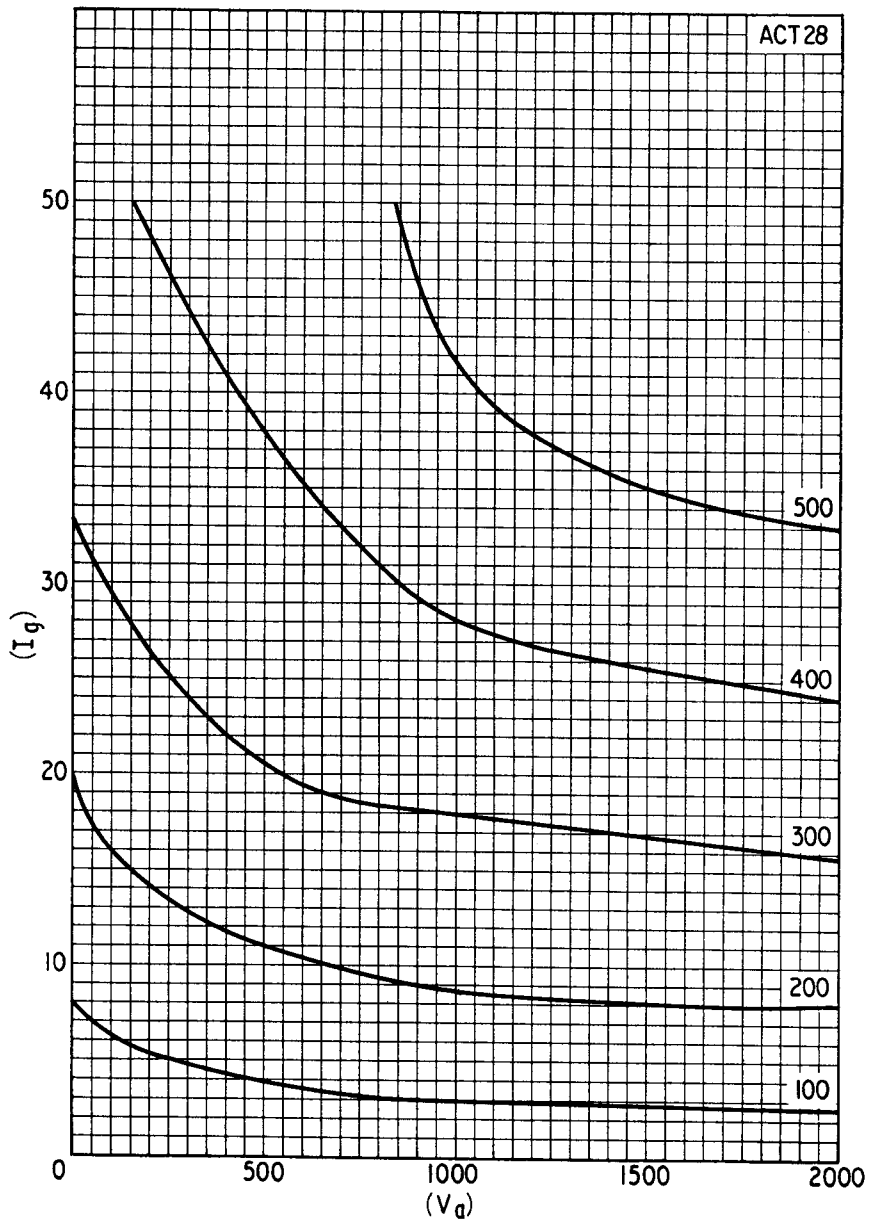
$V_{a\ (pulse)\ (max.)}$	11	kV
$p_{a\ (max.)}$	1·5	kW
$I_{a\ (av)\ (during\ pulse)\ (max.)}$	50	A
$t_{\ pulse\ (max.)}$	5	μs

Capacitances

c_{a-g}	28	pF
c_{g-k}	30	pF
c_{a-k}	0·5	pF



I_g/V_a characteristics for various values of V_g 1



I_g/V_a characteristics for various values of V_g 1



PRINTED IN ENGLAND

FORCED-AIR COOLED DISC SEAL PULSE OSCILLATOR TRIODE

ACT28A

ISSUE 1

The ACT28A is a triode with an indirectly heated oxide coated cathode intended for use as an oscillator at frequencies up to 600Mc/s under pulsed or c.w. conditions. A pulse output of about 300kW per valve is attainable at 220Mc/s.

HEATER

V_h	16	V
I_h	7·3 (approx)	A

The heater must be on for four minutes before anode voltage is applied.

MAXIMUM RATINGS (Absolute)

V_a (pulse)	13	kV
p_a	1·5	kW
$I_{a(av)}$ (during pulse)	50	A
t_p	10	μs

CAPACITANCES

c_{a-g}: 28pF; c_{g-k}: 30pF; c_{a-k}: 0·5pF

CHARACTERISTICS

V_a	1·5	kV
I_a	0·8	A
g_m	50	mA/V
μ	45	—

CIRCUIT DIMENSIONS

The following information is given as a guide to suitable coaxial cavities:

Anode line i.d.: 4·75in. Grid line o.d.: 4in.

Characteristic impedance: 10·5Ω

Frequency:	200	400	400	600	Mc/s
Line Length:	34	14	46	37·5	cm
Mode:	λ/4	λ/4	3λ/4	3λ/4	—

INSTALLATION

The valve must be mounted vertically and rigid connection made to one electrode only. The holes in the grid ring are provided for cooling: fixing bolts must not be placed in them.

COOLING

Before applying any voltages to the valve, all cooling supplies must be in operation. They should preferably continue for at least two minutes after removal of all voltages.

Air flow to anode: 150cu.ft./min. at 3in. water gauge

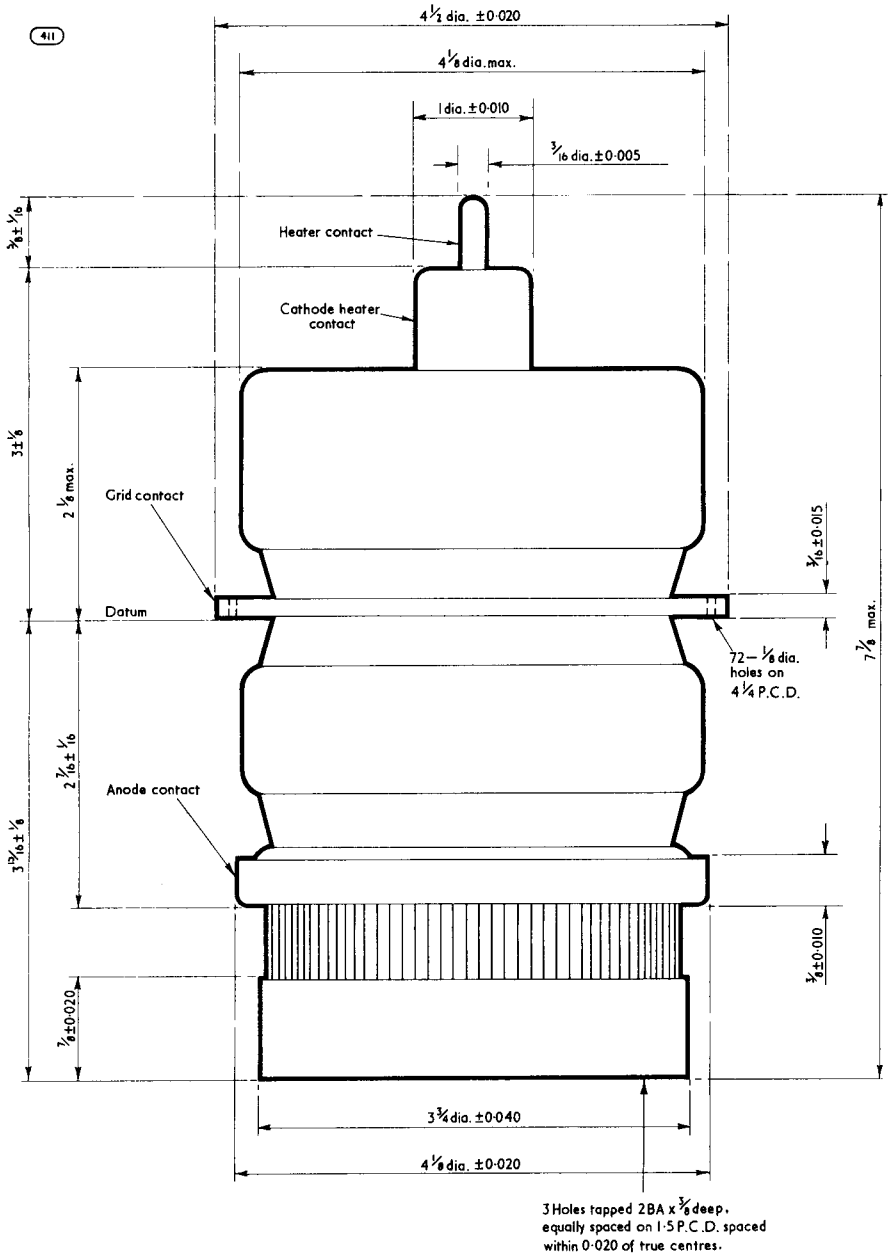
Air flow to grid seal: 20cu.ft./min.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

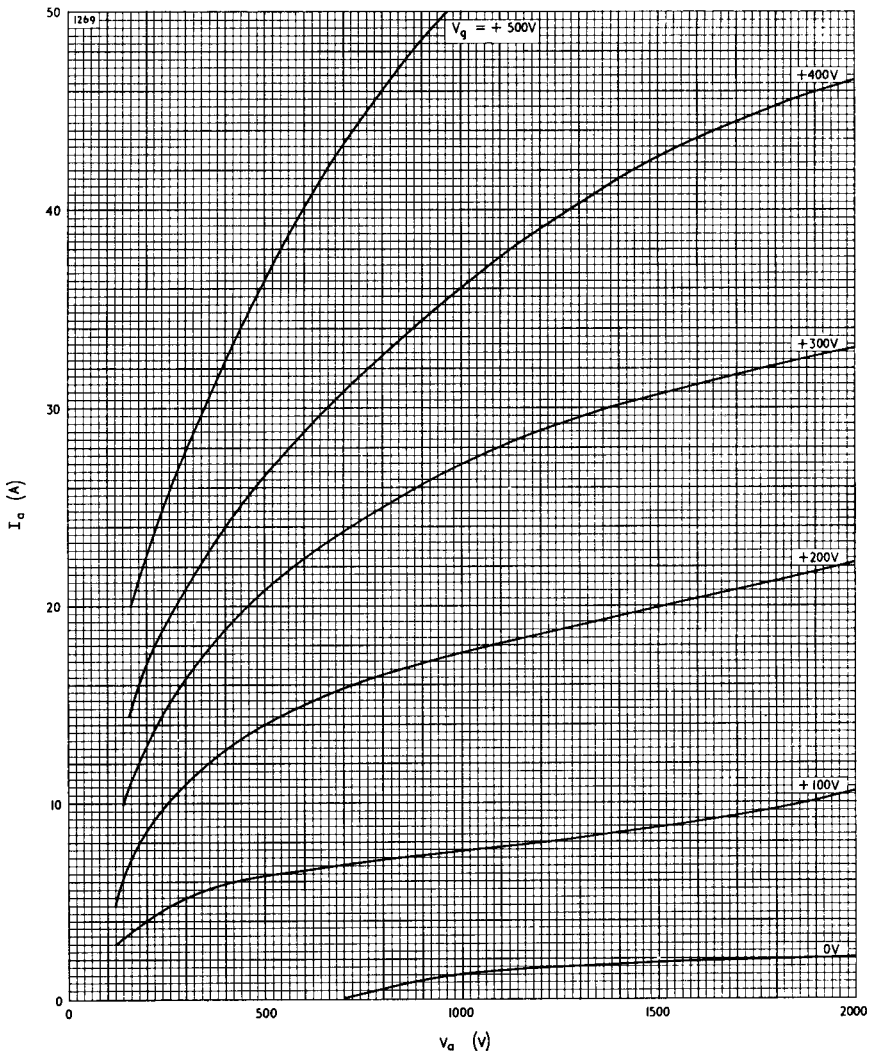
Chelmsford, Essex, England - Telephone: Chelmsford 3221 - Telex: 1953 - Telegrams: Expanse Chelmsford Telex

DECEMBER 1961

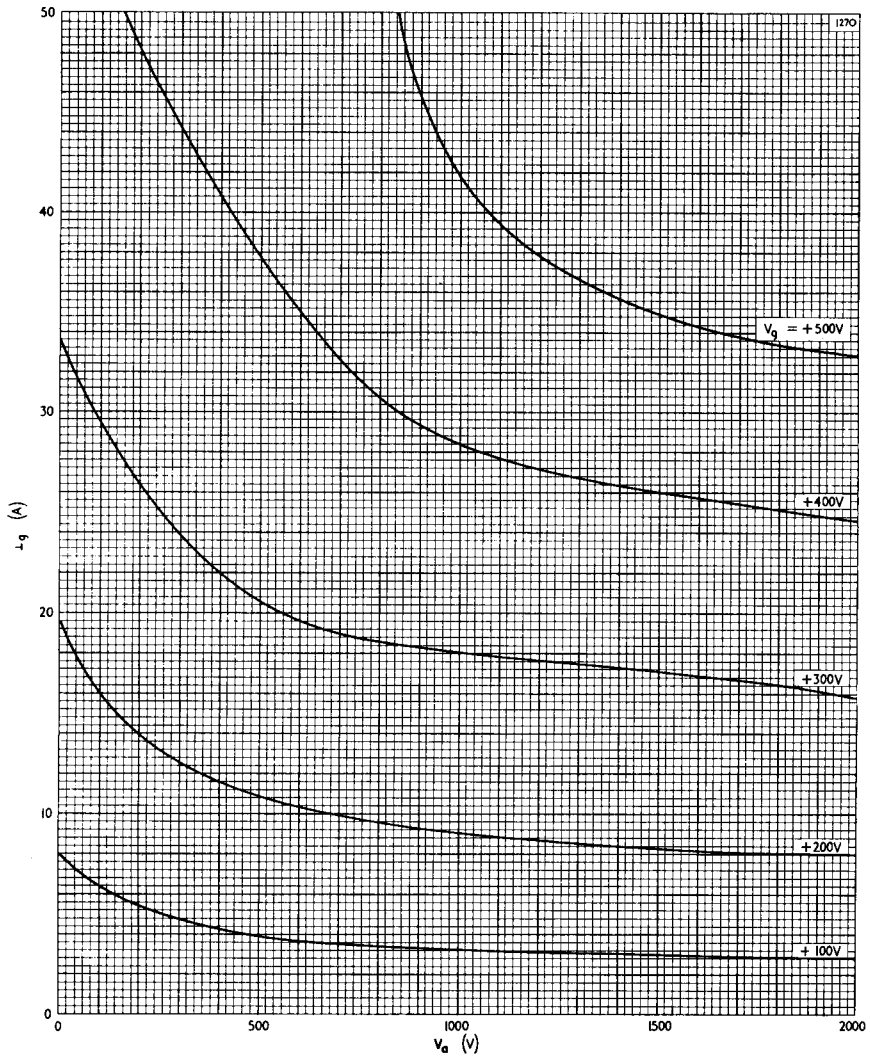
ACT28A



Dimensions in inches.


1269
V_g = + 500V
+400V
+300V
+200V
+100V
0V
I_a (A)
V_a (V)
0
10
20
30
40
50
500
1000
1500
2000

ACT28A



Printed in England K-C.—R.790

Triode *Type ACT 29*

(HF POWER AMPLIFIER AND OSCILLATOR)

General. An air-cooled transmitting triode fitted with a thoriated tungsten filament, suitable for use at frequencies up to 80 Mc/s. It is designed for use in communications or RF heating equipments.

Cooling. The temperature measured on the outer surface of the radiator must not exceed 150°C.

When the anode dissipation exceeds 1,000 watts or the air circulation around the valve is restricted, forced air cooling is required in order to keep the anode radiator temperature within the specified maximum.

When the anode dissipation is 1,000 watts or less convection cooling is generally adequate providing there is at least 12 in. free clearance all round the valve and the air circulation is unrestricted.

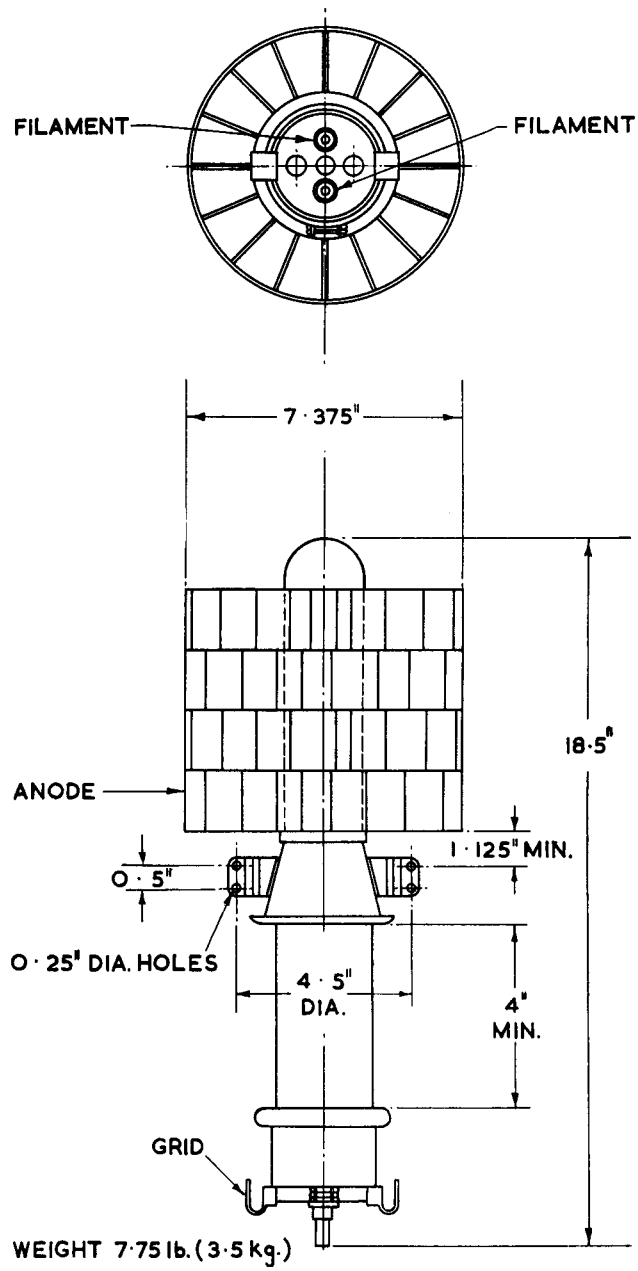
Mounting. The valve must be mounted vertically with the anode uppermost and may be conveniently supported by its radiator.

Storage. It is recommended that a valve in storage should be run under operating conditions for at least 2 hours in each period of 6 months.

Whenever a new valve or a valve which has been idle for more than 2 months is put into service it should be conditioned by operating for 1 hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value. During this process a resistance of at least 25 ohms should be connected into the anode supply lead, in order to limit the surge current in the event of a flashover inside the valve.

Standby Conditions with no anode current. If the valve is operated for periods greater than 15 minutes without anode current flowing the filament voltage should be reduced to one half the normal value during the standby period.

HT Switching. It is not permissible to apply directly HT voltage in excess of 7 kV. When the valve is to be operated at a higher voltage the HT should be gradually increased from a low value.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

APPROXIMATE DATA

V_f		8·5	V
I_f		20	A
$V_{a(max)}$		10	kV
$p_{a(max)}$	(convection cooling)	1	kW
	(forced air cooling)	1·25	kW
$p_{g(max)}$		80	W
$I_{k\ pk(max)}$		5	A
$I_{g(rf)(max)}$		14	A
$f_{(max)}$	(at max. rating)	15	Mc/s
	(at reduced rating)	80	Mc/s
μ	taken at Va 5 kV, Ia 0·2 A	40	–
r_a		12,900	Ω
g_m		3·1	mA/V
c_{g-f}		23·2	pF
c_{a-f}		1·6	pF
c_{g-a}		15·9	pF

Operating Conditions

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(*Unmodulated key-down conditions, per valve.*)
Maximum permissible conditions.

V_a		10	kV
V_g		–1000	V
p_a	(convection cooling)	1000	W
	(forced air cooling)	1250	W
p_{g1}		80	W

Typical operation

V_a	10	7·5	kV
V_{g1}	–460	–450	V
$v_{g1\ pk}$	810	900	V
I_a	500	600	mA
I_{g1} (a)	40	60	mA
Z_a	10,000	6,100	Ω
p_{dr} (a)	35	60	W
p_a	1000	1000	W
P_{out}	4	3·5	kW

(2) RF POWER AMPLIFIER. CLASS C ANODE MODULATED

(*Carrier conditions per valve.*)
Maximum permissible conditions.

V_a		8	kV
V_{g1}		–1000	V
p_a	(convection cooling)	650	W
	(forced air cooling)	825	W
p_{g1}		80	W
mod.		100	%

Typical operation

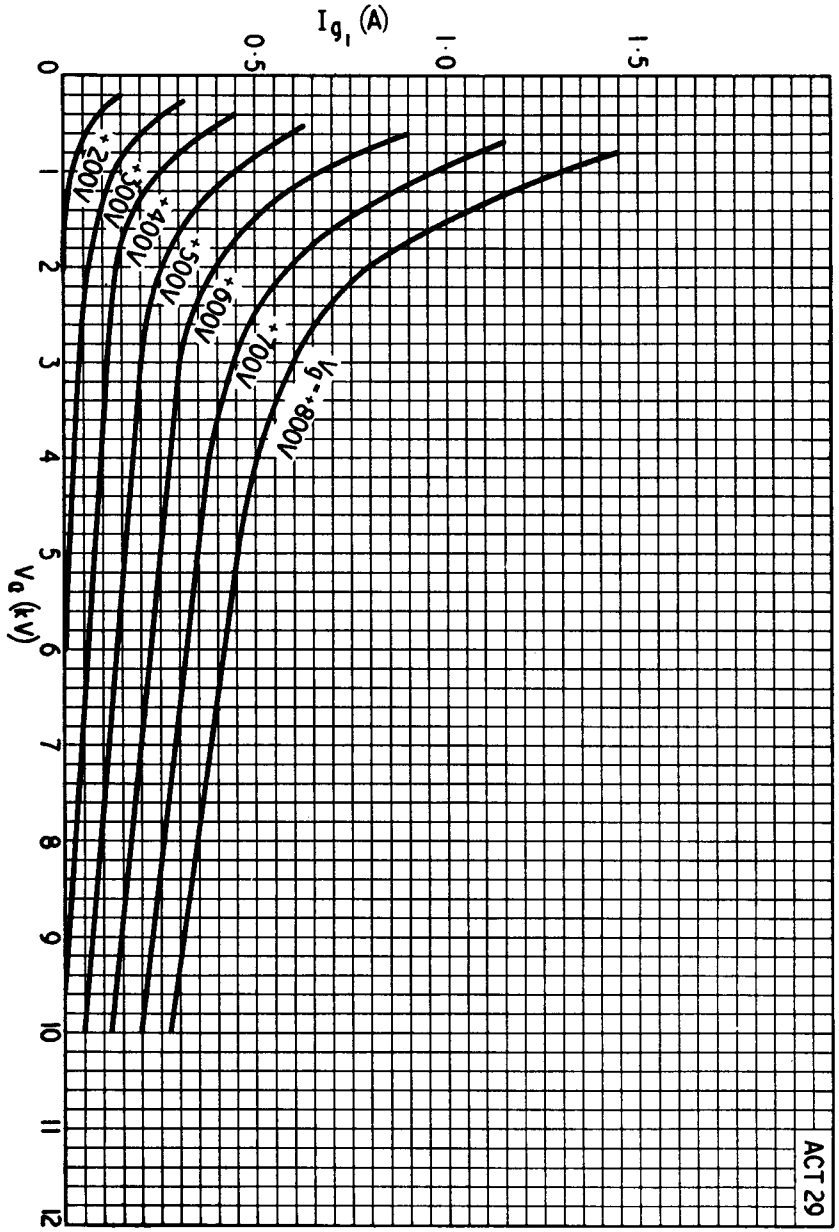
V_a	8	kV
V_{g1}	–470	V
$v_{g1\ pk}$	700	V
I_a	280	mA
I_{g1} (a)	20	mA
Z_a	13	kΩ
p_{dr} (a)	20	W
p_a	640	W
P_{out}	1·6	kW

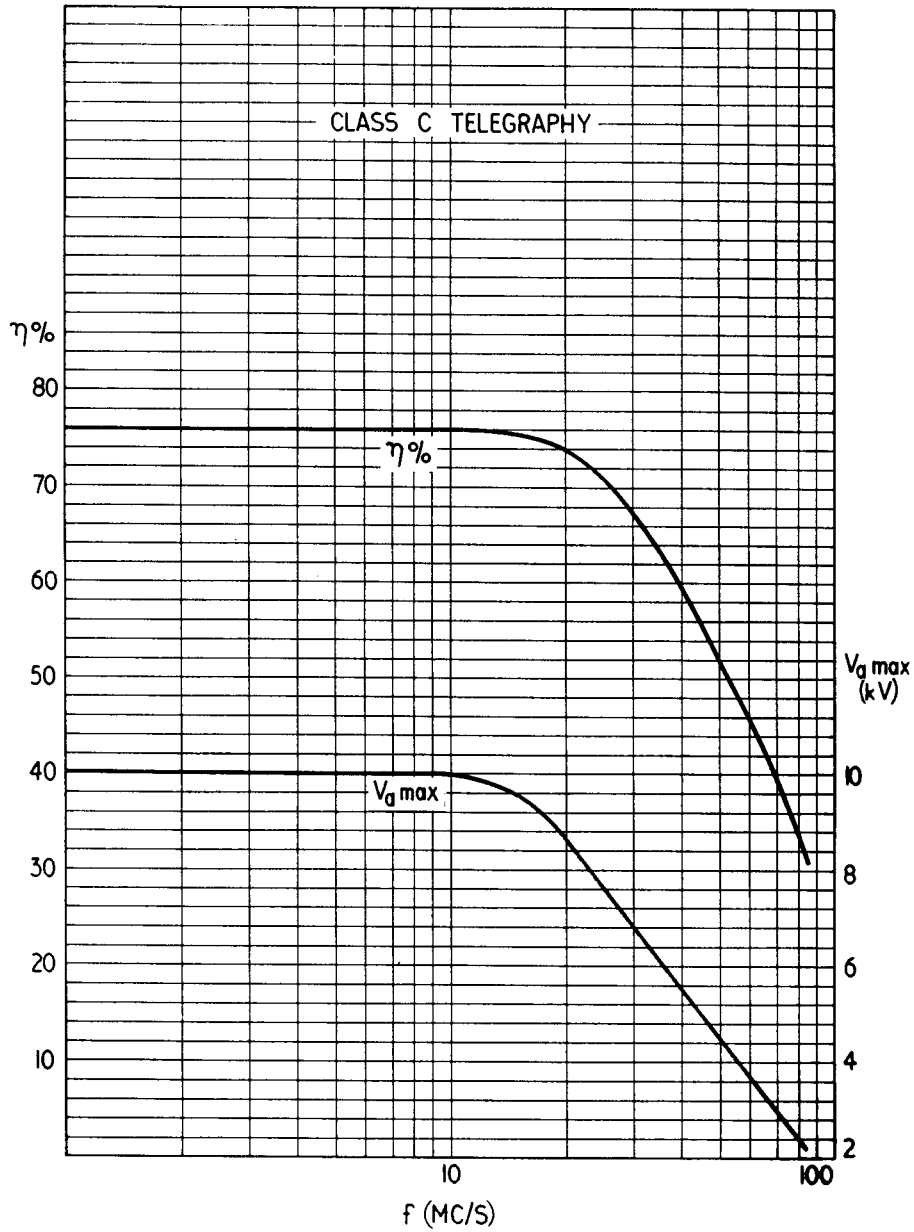
NOTE

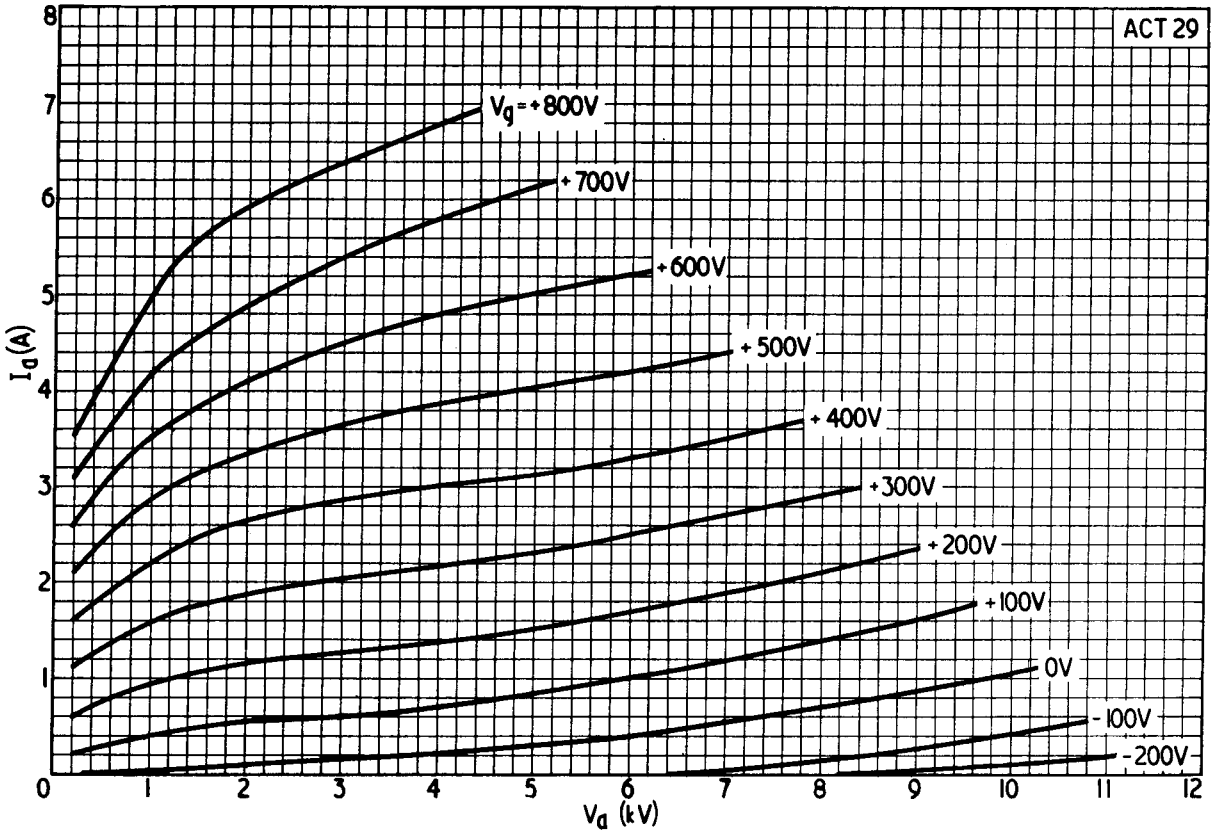
The figures quoted are only applicable when operating at frequencies up to 15 Mc/s. At higher frequencies the anode voltage must be reduced to the following table:

f (Mc/s)	15	25	50	80
$\%V_{a(max)}$	100	75	45	25

(*a*) Subject to wide variation.


I_{g_1} (A)
0·5
1·0
1·5
V_a (kV)
V_g=+2000V
+3000V
+4000V
+5000V
+6000V
+7000V
V_g=+8000V
ACT 29


CLASS C TELEGRAPHY
η%
80
70
60
50
40
30
20
10
V_g max (kV)
10
8
6
4
2
V_g max
10
100
f (MC/S)



PRINTED IN ENGLAND

Thyratron *Type AFX203*

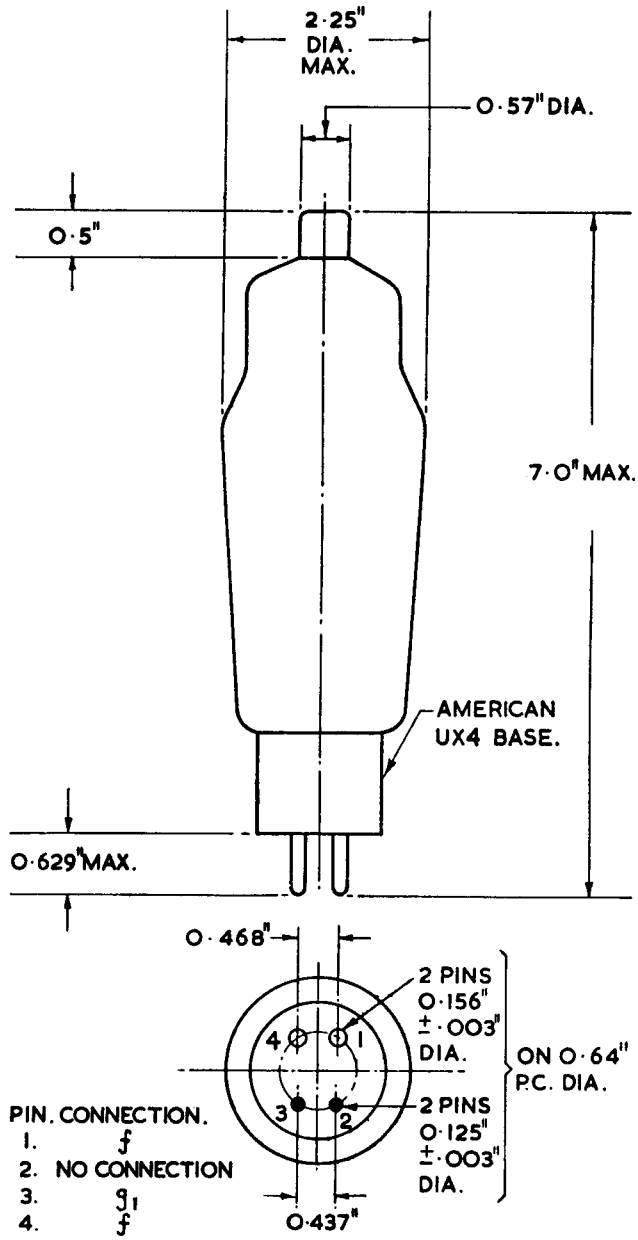
General. The AFX 203 is a directly-heated triode thyratron mounted in a glass envelope and fitted with a UX4 base. It is filled with Xenon and has, in consequence, characteristics which are little affected by changes in ambient temperature. It is, therefore, suitable for operation over a wide range of ambient temperatures.

A high filament efficiency is obtained by the use of heat shields. Control of the arc discharge path is ensured by the use of a grid structure which adequately screens the cathode from the anode. Owing to the absence of condensable vapour, only a very short period of pre-heating is necessary before the valve is put into operation.

The thyratron's characteristics are shown graphically in the form of control ratio curves (curves which relate the anode voltage to the grid voltage at which ignition just occurs). Since the control ratio varies appreciably from valve to valve, the characteristic curve is given in the form of a cross-hatched area within which the control ratio curves will lie. To the left of this area ignition cannot take place, while to the right of it ignition is certain. A typical individual curve is shown within this area. The abscissae represent DC grid voltages, and the ordinates the peak anode voltages (forward and inverse) for a sinusoidal anode voltage supply.

APPROXIMATE DATA

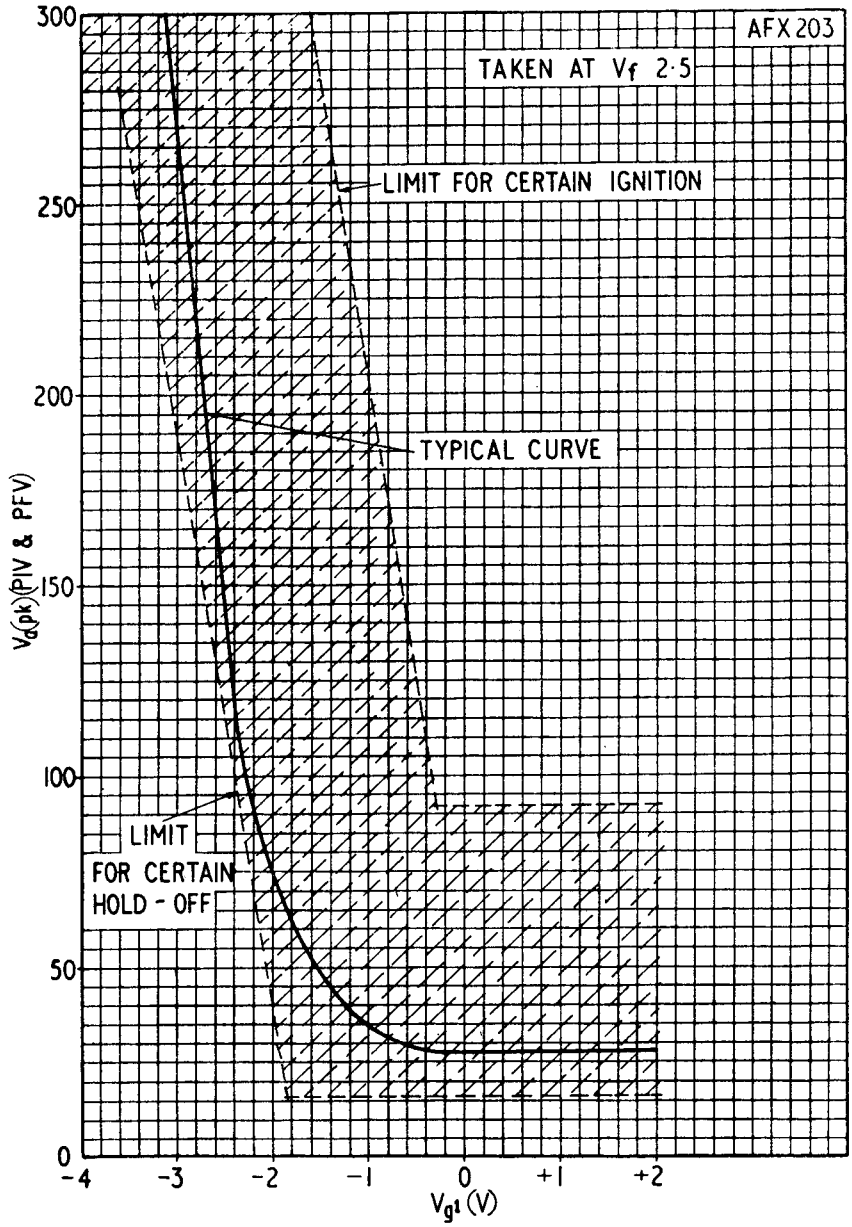
V_f	2·5	V	$I_{a\ (av)\ max.}$	0·64	A
I_f	4	A	V_{arc} at $I_{a\ (av)}$	0·4 A 11	V
PIV	300	V	T_{ext}	−40 to +65°C	
PFV	280	V	t_{hk}	20	sec.
$I_{a\ (pk)\ (max)}$	1·7	A	$c_{a\text{-}gl}$	1	pF
$I_{a\ (av)}$	0·4	A	$c_{gl\text{-}k}$	10·4	pF



WEIGHT 0·25 lb. (0·1 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford



PRINTED IN ENGLAND

Rectifier *Type AH 200*

General. The Type AH 200 valve is a hot-cathode mercury-vapour rectifier incorporating a domed anode and a shrouded cathode in a hard glass bulb. It is suitable for the supply of rectified currents up to 10 A at 15 kV depending upon the type of circuit used. The AH 200 valve should be operated with air blast (see details below). Care should be taken not to cool the anode portion of the valve, as this valve should be operated with the top of the bulb hot.

The cathode may be switched on in one operation. The ageing schedule (to be applied after transit or storage) is one hour at normal filament voltage, but with no anode voltage or air blast applied. The valve must always be shielded from draughts, though air circulation around the valve must not be impeded.

Conditions of Operation

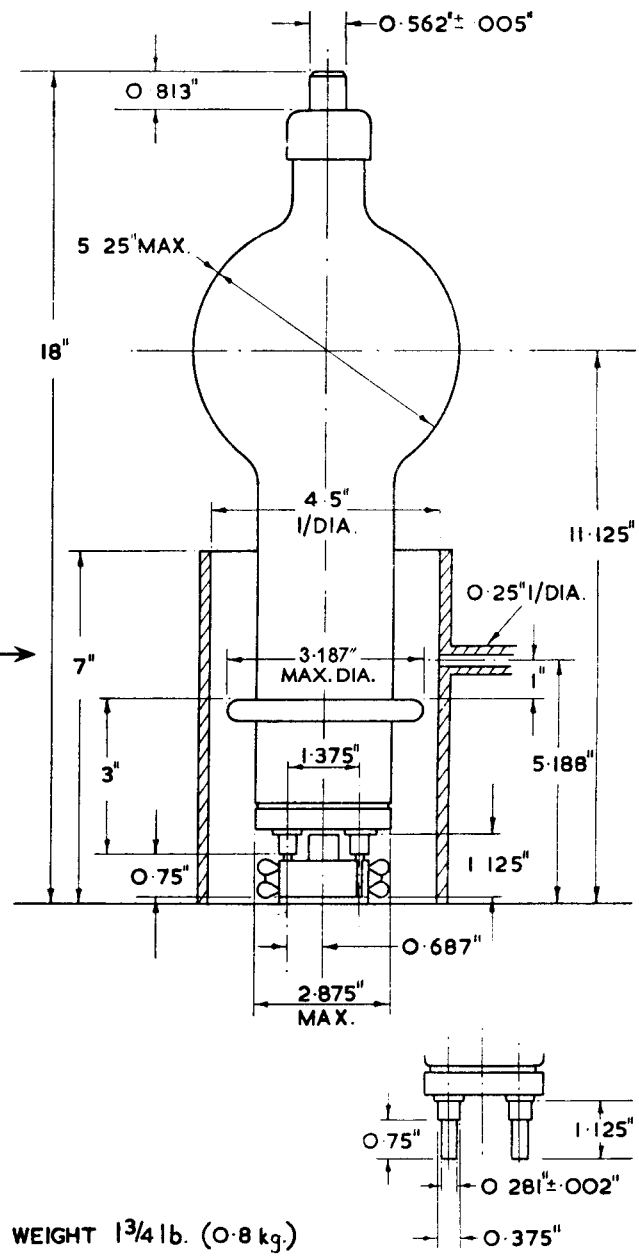
(a) *Continuous Air Blast at a Constant Temperature.*

With this arrangement the blower is operating continuously, and an air heater is switched on and off by a thermostat in the air supply to the valve, thus maintaining a constant temperature. It is imperative that the tube be fitted round the lower half of the valve as shown in the outline drawing. The optimum blast temperature is between 35°C and 40°C.

(b) *Thermostatically Switched Forced Air Blast at Ambient Temperature.*

As an alternative to the above arrangement, the air blast may be switched on and off by a thermostat which measures the ambient air temperature on a level with the top of the base of the valve, and 6 in. away from it.

The blower must be switched off between 5°C and 22°C, and must be on between 22°C and 40°C. The valve must never be operated when the ambient temperature is below 3°C. When operating under these conditions, no tube may be fitted round the valve, nor must any other obstruction be allowed to impede the free air circulation round the valve.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

Recommended Method of Applying Air Blast

For both the above conditions of operation it is best to use a $\frac{1}{4}$-in. bore air pipe delivering air at a pressure of $\frac{1}{2}$ in. The air tube should include a section of insulating material at least 12 in. long to avoid the danger of a flash-over between the filament cap and earth.

Tables of Pre-heating Times for Filaments

The mercury condensation temperature is raised approximately 20°C above the ambient temperature in free air by the power dissipated in the cathode.

The pre-heating time required before the condensation temperature rises to its working value is set out in the following table. No anode potential may be applied before this time has elapsed.

This table is applicable when either of the recommended types of air blast is used. The power supplied to the blower (and heater, if any) should be switched simultaneously with the filament supply.

Ambient Temperature (°C)	Pre-heating Time (Minutes)
20 or over	2
15 or over	14
10 or over	20
5 or over	30

APPROXIMATE DATA

V_f	2·5 V (+0·2 V, −0 V)			
I_f			40	A (a)
PIV (max)			16	kV
$I_{a\ (pk)\ (max)}$	8	A (b)	14	A (c)
$I_{a\ (av)\ (max)}$	2	A (b)	3·5	A (c)
T_{Hg}			25–45°C	

Maximum Outputs

(1) 3-phase half-wave

$V_{dc\ (max)}$	7·5	kV		
$I_{dc\ (max)}$	5·5	A (b)	10	A (c)

(2) 3-phase full-wave

$V_{dc\ (max)}$	15	kV		
$I_{dc\ (max)}$	5·5	A (b)	10	A (c)

NOTES

1. The valve must be screened against RF fields.
2. If a large smoothing capacitor is used, care should be taken not to exceed the maximum peak anode current.
3. Care must be taken to see that there is no condensation around the anode seal.

(a) The filament transformer should be rated for 50A.

(b) Filament voltage in phase with anode current.

(c) Filament voltage 60–120° out of phase with anode current.

PRINTED IN ENGLAND

Rectifier *Type AH 201*

General. The Type AH 201 valve is a hot-cathode mercury-vapour rectifier incorporating a domed anode and a shrouded cathode in a hard glass bulb. It is suitable for the supply of rectified currents up to 0·75 A at 10 kV depending upon the type of circuit used.

For most applications it is recommended that air-blast cooling should be used. The air blast should be directed against the bottom portion of the valve only. Further details are given below.

The filament may be switched on in one operation. The conditioning schedule, which should be performed after transit or storage, consists of a run at normal filament voltage for one hour, no anode voltage or air blast being applied during this time.

The valve must always be shielded from draughts, though no close-fitting tube may be used except under conditions of continuous air blast.

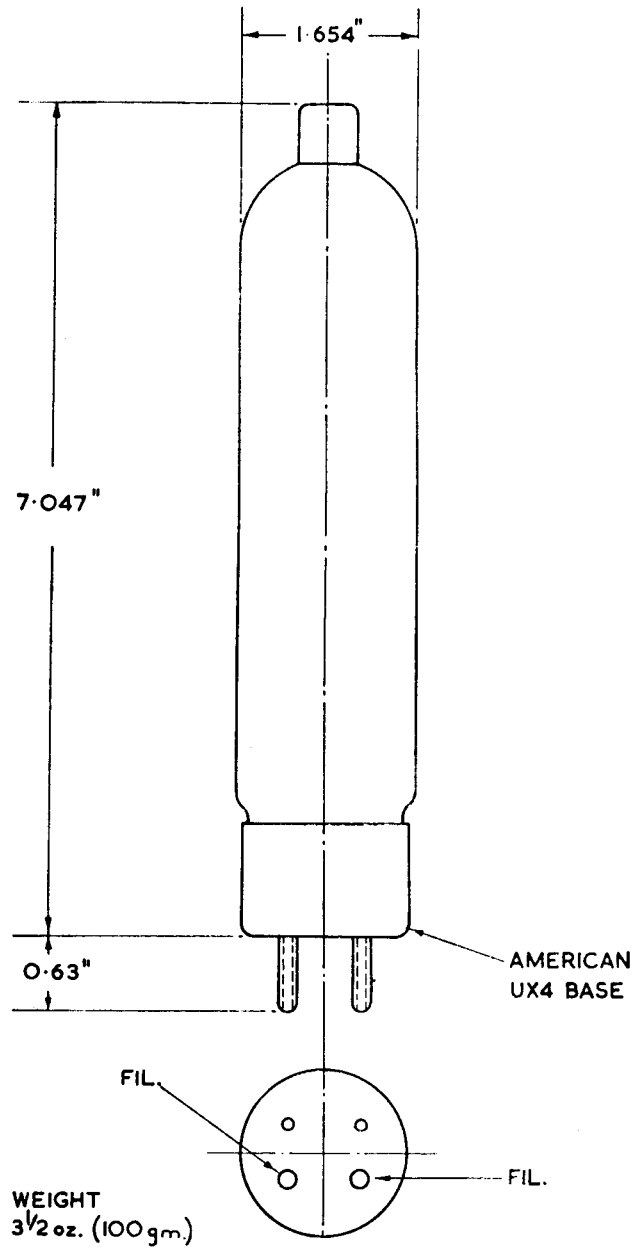
Conditions of Operation

(a) *In Still Air.*

The ambient air temperature should be measured with an alcohol thermometer, the bulb of which is placed ½ in. above the top of the filament cap, and distant 6 in. from it. Full output may be taken from the AH 201 rectifier if the ambient air temperature is between 12°C and 34°C provided that the pre-heating times given below are adhered to. If the valve is operated outside the given temperature limits, erratic operation and shortened life will result.

(b) *With Forced Air Blast at Ambient Air Temperature on the Base of the Valve.*

With forced air-cooling at ambient temperature the limits of air blast temperature are 26°C to 50°C. This temperature should be measured with a thermometer in the air blast.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

(c) *With Thermostatically Switched Forced Air Blast at Ambient Air Temperature.*

The air blast is best thermostatically controlled so that the blower is switched on at an ambient temperature of 30°C. Then for lower temperatures the valve runs in still air and for higher temperatures with forced air blast at ambient temperature. The range of temperatures over which the valve will operate in this way will thus be from 12°C to 50°C. In the event of the ambient temperature falling below the minimum temperature of 12°C heated air must be used.

Recommended Method of Applying Air Blast

A horizontal tube of $\frac{1}{4}$ in. diameter, placed with its end $\frac{1}{2}$ in. above the level of the top of the filament cap, and delivering air at a pressure of $\frac{1}{2}$ in. water gauge will give the necessary temperature control. The air tube should have at least a 3-in. length of insulating material included in it to avoid danger of flash-over between the filament cap connections and earth.

Tables of Pre-heating Times for Filaments

The mercury condensation temperature is raised approximately 15°C above the ambient temperature by the power dissipated in the cathode.

The pre-heating time required before the condensation temperature rises to its working value is set out in the following table. No anode potential must be applied before this time has elapsed.

TABLE 1. To be used when the valve is operated under conditions (a) or (c).

Ambient Temperature °C	Pre-heating Time (Minutes)
26	1
25	4
20	11
15	20
12	34

TABLE 2. When conditions are as in (b).

26–50	1

APPROXIMATE DATA

V_f	2·5±0·1	V
I_f	5	A
PIV (max)	11	kV
$I_{a\ (pk)\ (max)}$	1	A
$I_{a\ (av)\ (max)}$	0·25	A
TH_g	26–50	°C

Maximum Outputs

(1) 3-phase half-wave		
$V_{dc\ (max)}$	5	kV
$I_{dc\ (max)}$	0·75	A
(2) 3-phase full-wave		
$V_{dc\ (max)}$	10	kV
$I_{dc\ (max)}$	0·75	A

NOTES

1. With conditions of operation as in (b) or (c) the power supply to the blowers must be switched simultaneously with the filaments.
2. The valve must be screened against RF fields.
3. If a large smoothing condenser is used, care should be taken not to exceed the peak permissible anode current.

PRINTED IN ENGLAND

Rectifier *Type AH 205*

General. The Type AH 205 valve is a hot-cathode mercury-vapour rectifier incorporating a domed carbon anode and a shrouded oxide-coated cathode in a hard glass bulb. It is suitable for the supply of rectified currents up to 30 A at 21 kV depending upon the type of circuit used.

The AH 205 valve should be operated with air blast (see details below). Care should be taken not to cool the anode end of the valve, as the AH 205, in common with other glass mercury-vapour valves, should operate with the top of the bulb hot.

The cathode may be switched on in one operation. The ageing schedule (to be applied after transit or storage) is one hour at normal filament voltage but without anode voltage or air blast.

The valve must always be shielded from draughts, though air circulation around it must not be impeded.

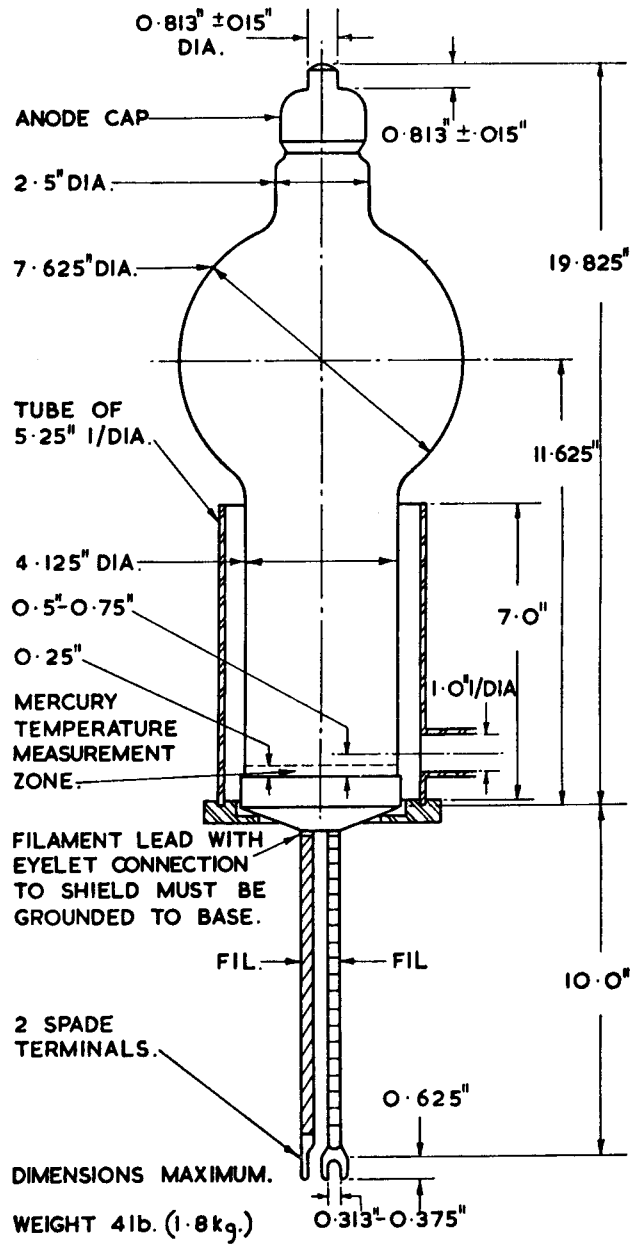
Conditions of Operation

(a) *Continuous Air Blast at Constant Temperature.*

With this arrangement the blower is operating continuously, and an air heater is switched on and off by a thermostat in the air supply to the valve, thus maintaining a constant temperature. It is imperative that a tube be fitted round the lower neck of the valve as illustrated. The forced air should be applied at a temperature of 35°C for operation at a condensed mercury temperature of 40°C at full load.

(b) *Thermostatically Switched Forced Air Blast at Ambient Temperature.*

As an alternative to the above arrangement the air blast may be switched on and off by a thermostat which measures the ambient air temperature on a level with the top of the base of the valve and 6 in. away from it.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

The blower must be switched off for ambient temperatures between 10°C and 25°C, and on for temperatures between 25°C and 45°C. The valve must never be operated when the ambient temperature is below 10°C. For condensed mercury temperatures below 30°C and above 40°C the peak inverse voltage must not exceed 10,000 volts. The equilibrium condensed mercury temperature rise above ambient temperature at full load is approximately 15°C.

Recommended Method of Applying Air Blast

For conditions of operation (a) and (b) above, the air blast is best applied through a pipe of 1-in. bore at a rate of 5 cu. ft./min. and directed at a point $\frac{1}{2}$ in. to $\frac{3}{4}$ in. above the base of the valve. It should be turned on at least 5 minutes before anode voltage is applied. The air pipe should include at least a 12-in. section of insulating material to avoid risk of flash-over between filament cap and earth.

Pre-heating Time for Filament

The mercury condensation temperature is raised approximately 11·5°C above the ambient temperature by the power dissipated in the filament.

The pre-heating time before the condensation temperature rises to its equilibrium working value varies according to the ambient temperature, and under average temperate conditions is of the order of 30 minutes. A table relating the ambient temperature to the pre-heating time, applicable to conditions where the valve is operated as in (b) above, is given below.

Ambient temperature (°C)	Pre-heating Time (Minutes)
15	70
20	45
25	20
30 and above	2

Under conditions as in (a) above, the filament should be switched on at least 2 minutes before HT is applied, provided that the warm air blast has been maintained continuously. If the air blast has been switched off, time, as in the table shown above, should be allowed.

After a short shut-down period, not exceeding one minute in duration, five minutes pre-heating should be allowed before application of anode voltage. For longer shut-down periods from at least 10 to 30 minutes should be allowed according to the duration of the shut-down and the ambient temperature.

APPROXIMATE DATA

V_f	5 V
I_f	30 (±3) A
PIV $_{(max)}$	10 kV, 22 kV
T_{Hg}	25 – 60°C, 30 – 40°C
$I_{a\ (pk)\ (max)}$	40 A
$I_{a\ (av)\ (max)}$	10 A
V_{arc} (at 10A $I_{a(av)}$)	15 V

Maximum Outputs

(1) 3-phase half-wave (*)	
$V_{dc\ (max)}$	10·5 kV
$I_{dc\ (max)}$	30 A
(2) 3-phase full-wave (*)	
$V_{dc\ (max)}$	21 kV
$I_{dc\ (max)}$	30 A
(3) Single-phase full-wave (†)	
$V_{dc\ (max)}$	7 kV
$I_{dc\ (max)}$	20 A

NOTES

1. The valve must be screened against RF fields.
2. If a large smoothing condenser is used, care should be taken not to exceed the maximum peak current on switching on.
3. Care must be taken to see that there is no mercury condensation on the anode or around the anode seal.

(*) With filament voltage obtained from one phase of three-phase supply.

(†) With filament voltage in phase with anode current.

PRINTED IN ENGLAND

Rectifier *Type AH213*

General. The AH213 is a hot-cathode mercury-vapour rectifier which incorporates a domed anode and a shrouded cathode in a hard glass bulb. It is suitable for the supply of rectified currents up to 10 A at 15 kV depending upon the circuit employed.

The valve should be operated with an air blast but care should be taken to ensure that the anode portion of the valve is not cooled, as this type of rectifier should be operated with the top of the bulb hot.

The filament may be switched on in one operation.

The conditioning schedule, to be followed after transit or storage, is one hour at normal filament voltage with neither anode voltage nor air blast applied to the valve.

The valve must always be shielded from draughts, though air circulation around the valve must not be impeded.

Conditions of Operation

(a) *Continuous Air Blast at Constant Temperature.*

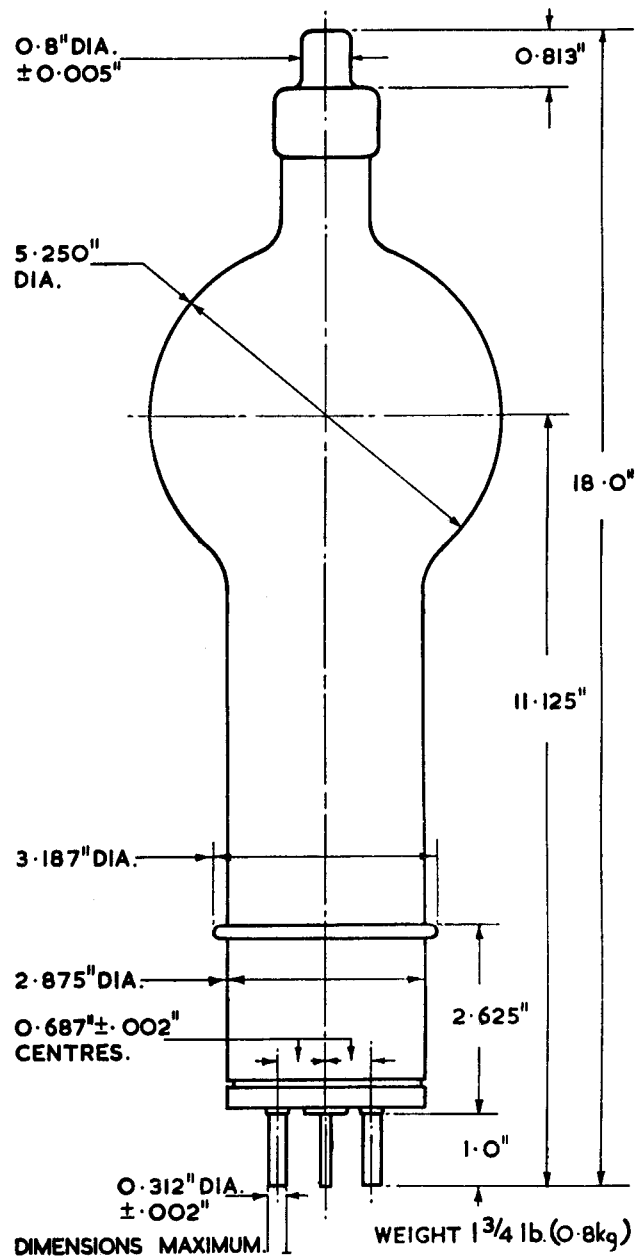
With this arrangement an air blower is operating continuously and a thermostatically controlled air heater is used to maintain a constant temperature. The optimum air blast temperature is between 35° and 40°C.

It is imperative that a tube be fitted round the lower half of the valve.

(b) *Thermostatically Controlled Forced Air Blast at Ambient Air Temperature.*

As an alternative to the above arrangement, the air blast may be switched on and off by a thermostat, which operates at the ambient air temperature measured at a point on a level with the base of the valve and 6 in. away from it.

The blower must be switched off between 5°C and 22°C and must be on between 22°C and 40°C. The valve must never be operated when the ambient temperature is below 3°C. When operating under these conditions



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

the rectifier must not be fitted into a tube nor must any obstruction be allowed to impede the free air circulation around the valve.

Recommended Method of Applying Air Blast

It is recommended, for both the above conditions of operation, that a $\frac{1}{4}$-in. bore air pipe be used to deliver the air blast at a pressure of $\frac{1}{2}$ in. water gauge. The air tube should include a section of insulating material at least 12 in. long to avoid the danger of a flash-over between the filament cap and earth.

Pre-heating of Filament

The mercury condensation temperature is raised approximately 20°C above the ambient temperature in free air by the power dissipated in the cathode.

The pre-heating time required to raise the condensation temperature to its working value is given in the following table. No anode potential may be applied before this time has elapsed. The table is applicable when either of the recommended types of air blast is used. The power supplied to the air blower (and heater, if used) should be switched simultaneously with the filament supply.

Ambient temperature (°C)	Pre-heating Time (Minutes)
20 or over	2
15 or over	14
10 or over	20
5 or over	30

APPROXIMATE DATA

V_f				5	V
I_f				19±2	A
$I_{a(pk)\ (max)}$	(a) 8	A	(b)	14	A
$I_{a\ (av)\ (max)}$	(a) 2	A	(b)	3·5	A
PIV $_{(max)}$				16	kV
T_{Hg}				25–45°	C

Maximum Outputs

(1) 3-phase full-wave					
$V_{dc\ (max)}$				15	kV
$I_{dc\ (max)}$	(a) 5·5	A	(b)	10	A
(2) 3-phase half-wave					
$V_{dc\ (max)}$				7·5	kV
$I_{dc\ (max)}$	(a) 5·5	A	(b)	10	A

NOTES

1. The valve must be screened against HF fields.
2. If a large smoothing capacitor is used, care should be taken not to exceed the maximum peak anode current.
3. Care must be taken to see that there is no mercury condensation round the anode seal.

(a) Filament voltage in phase with anode current.

(b) Filament voltage 60°–120° out of phase with the anode current.

PRINTED IN ENGLAND

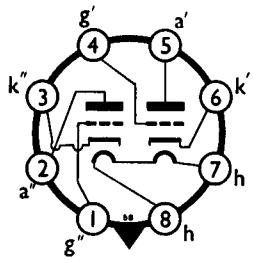
DOUBLE TRIODES
INDIRECTLY HEATED

B36
B65

AUGUST, 1953

The B36 and B65 are identical apart from their heater ratings.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International octal.
Bulb : Tubular.

Overall length :	81—91	mm.
Seated length :	67—77	mm.
Max. dia.	34	mm.

RATING

	B36			B65	
V_h	12·6			6·3	V
I_h	0·3			0·6	A
V_{h-k}		150	max.		V
Per system					
V_a		300	max.		V
V_g for cut-off (I_a=10 μA)		−17	approx.		V
p_a		2·5	max.		W
μ	at V_a=250 V_g=−8	20			
r_a		7·7			kΩ
g_m		2·6			mA/V

CAPACITANCES (of cold unscreened valve)

$c_{a'-g'}$	4·5	pF	$c_{a''-g''}$	4·5	pF
$c_{g'-k'}$	3·5	pF	$c_{g''-k''}$	3·7	pF
$c_{a'-k'}$	1·5	pF	$c_{a''-k''}$	1·2	pF
$c_{a'-a''}$	1·0	pF			

TYPICAL OPERATION

A.F. Amplifier. Class A.

Per system.

$V_{a(b)}$	250	250	V
V_g	−1·46	−2·52	V
v_{out}	18·5	32	V
V_{gain}	16	15·5	
I_a	6·65	5·75	mA
R_k	220	440	Ω
R_a	22	22	kΩ
D	1	2	%

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

GRID RESISTOR

Under maximum rated conditions the grid-cathode D.C. resistance must not exceed 1 MΩ per system.

MOUNTING

Any position.

RETAINING

No retaining device is normally necessary.

SCREENING

No internal or external screening is fitted to the valve. The use of an external screening can is not normally necessary.

VENTILATION

No special precautions are necessary.

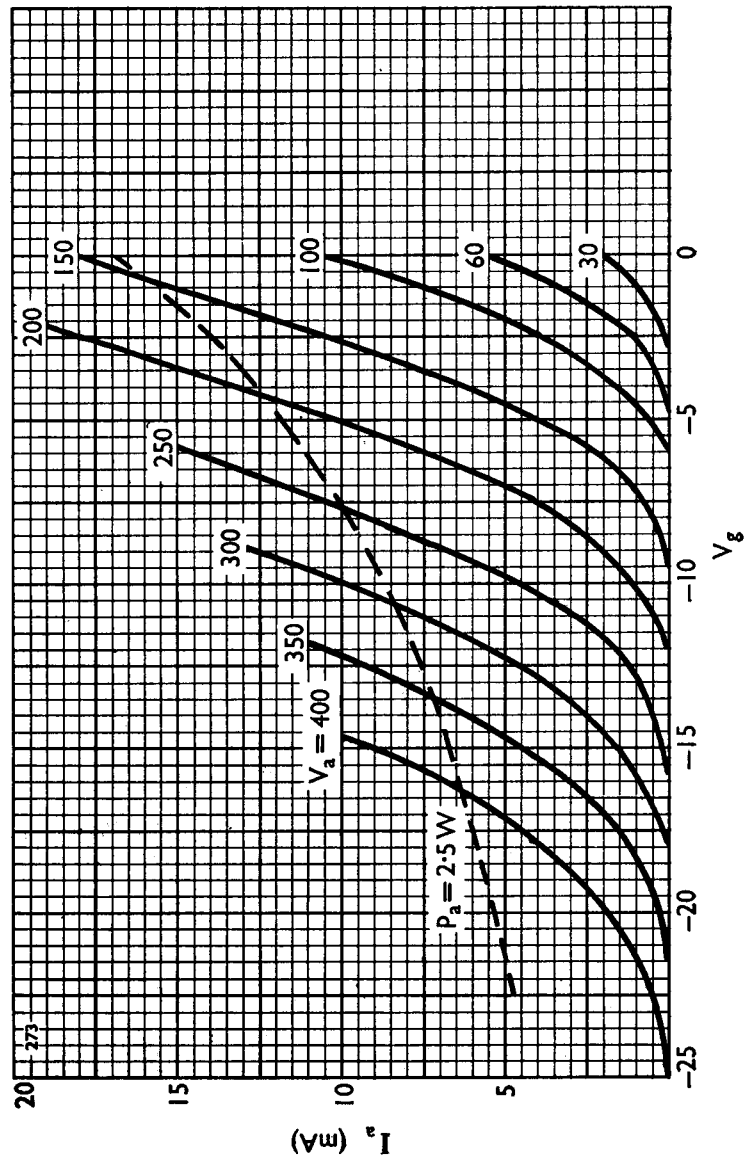
MICROPHONY

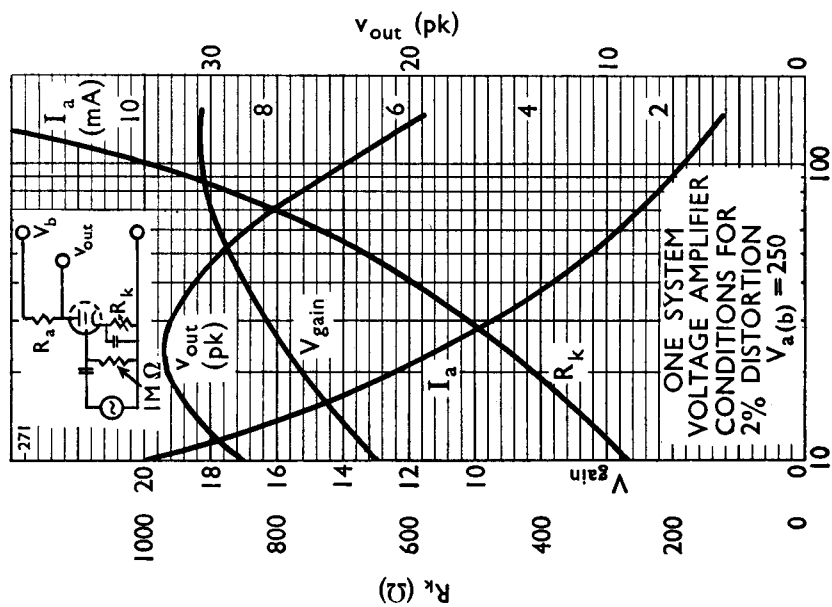
The valve is free from microphony in normal receiving applications.

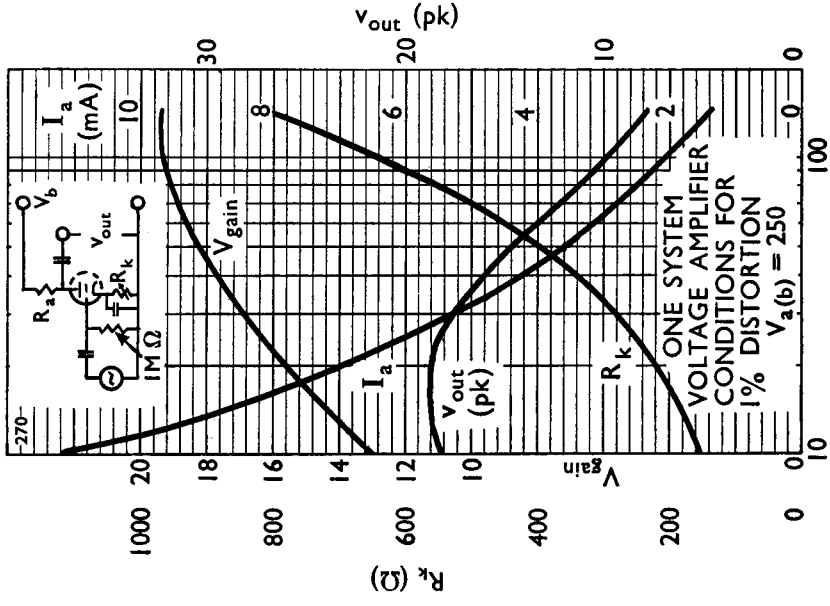
B36
B65

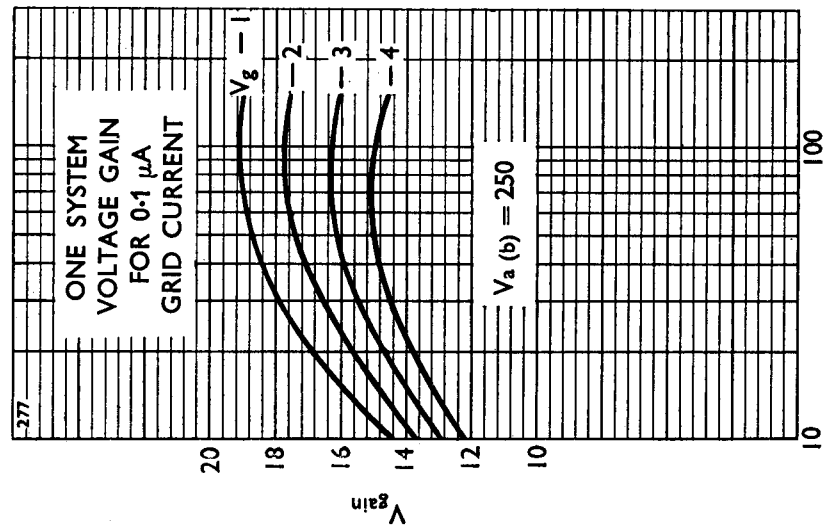
272
$V_g = 0$
$= -2$
$= -4$
$= -6$
$= -8$
$= -10$
$= -12$
$= -14$
$= -16$
$= -18$
$= -20$
$= -22$
$= -24$
16
12
8
4
0
100
200
300
400
500
I_a (mA)
V_a

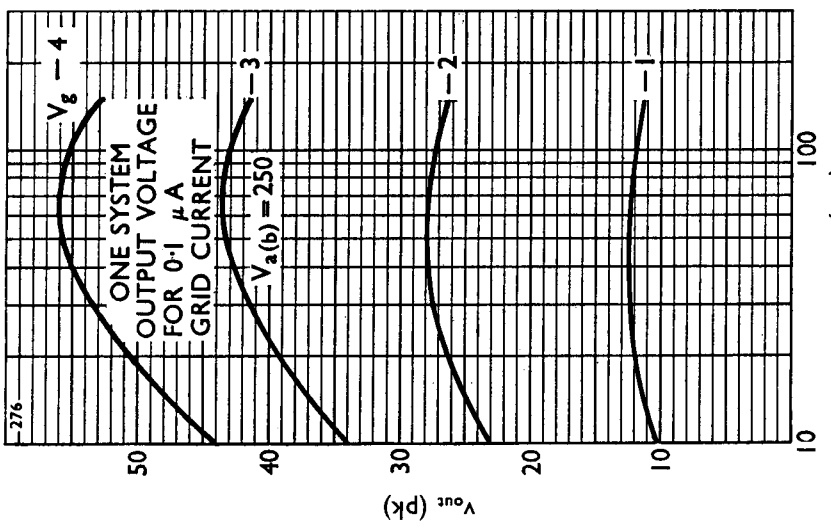
B36
B65

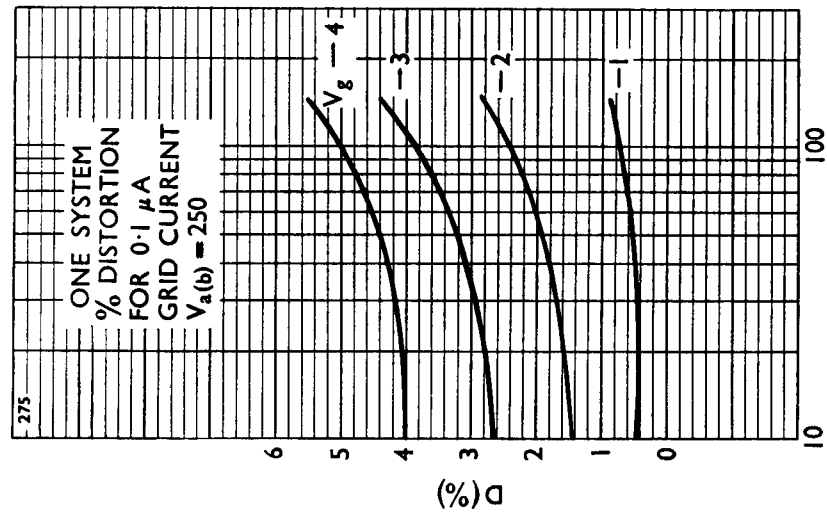

I_a (mA)
20
15
10
5
273
$V_a = 400$
350
300
250
200
150
100
60
30
$P_a = 2{\cdot}5$ W
0
−5
−10
−15
−20
−25
V_g

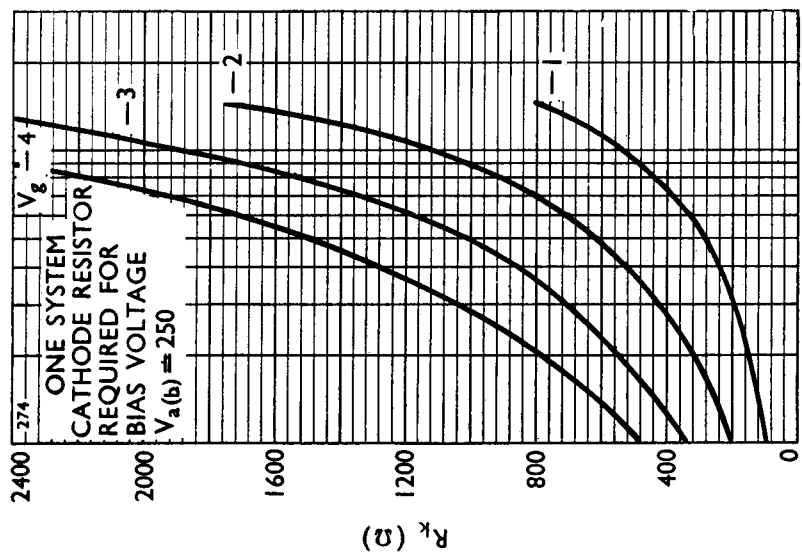

ONE SYSTEM
VOLTAGE AMPLIFIER
CONDITIONS FOR
2% DISTORTION
$V_{a(b)} = 250$
R_a (k Ω)
v_{out} (pk)
V_{gain}
I_a
R_k
I_a (mA)
V_b
R_a
R_k
1MΩ
271


ONE SYSTEM
VOLTAGE AMPLIFIER
CONDITIONS FOR
1% DISTORTION
$V_{a(b)} = 250$
R_a (k Ω)
v_{out} (pk)
V_{gain}
I_a
R_k
I_a (mA)
V_b
R_a
R_k
1MΩ
270


277
ONE SYSTEM
VOLTAGE GAIN
FOR 0·1 μA
GRID CURRENT
V_g — 1
— 2
— 3
— 4
$V_{a\,(b)} = 250$
V_{gain}
20
18
16
14
12
10
10
100
R_a (kΩ)


276
ONE SYSTEM
OUTPUT VOLTAGE
FOR 0·1 μA
GRID CURRENT
V_g — 4
— 3
$V_{a(b)} = 250$
— 2
— 1
V_{out} (pk)
50
40
30
20
10
10
100
R_a (kΩ)


275
ONE SYSTEM
% DISTORTION
FOR 0·1 μA
GRID CURRENT
$V_{a(b)}$ = 250
V_g — 4
— 3
— 2
— 1
D (%)
0
1
2
3
4
5
6
10
100
R_a (k Ω)


274
ONE SYSTEM
CATHODE RESISTOR
REQUIRED FOR
BIAS VOLTAGE
$V_{a(b)}$ = 250
V_g — 4
— 3
— 2
— 1
R_k (Ω)
0
400
800
1200
1600
2000
2400
10
100
R_a (k Ω)

OV.2024 C. Printed in England.

Triode *Type B 142*

HF AMPLIFIER, OSCILLATOR AND MODULATOR

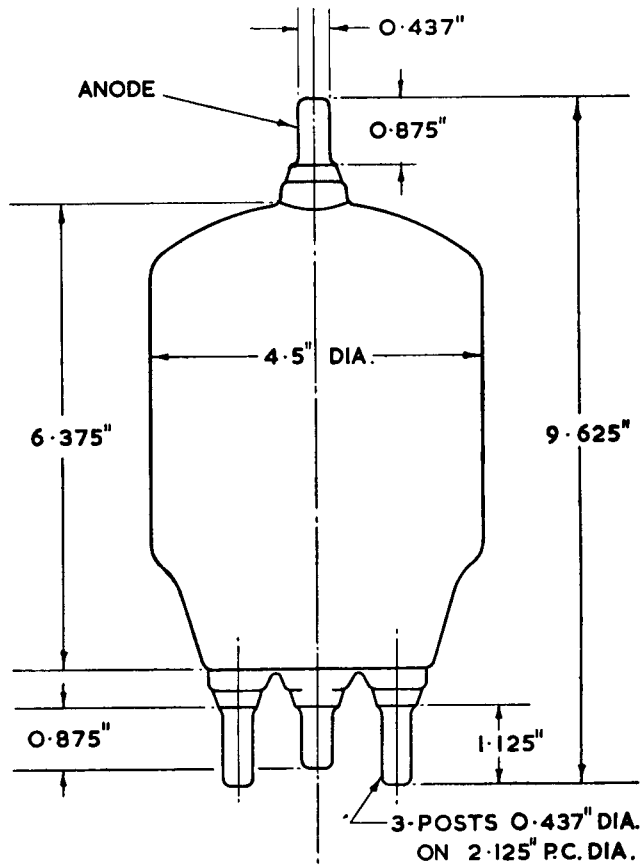
General. The valve type B 142 is a transmitting triode fitted with a thoriated tungsten filament. It is designed for use as high-frequency amplifier, oscillator, and Class B modulator.

Cooling. Requirements are indicated under Maximum Ratings for each class of service. Natural cooling means that adequate free circulation of air around the valve is necessary. When forced-air cooling is required, an air flow of 40 cu. ft. per minute from a 2-in. diameter nozzle directed vertically downwards on the anode seal is necessary. With forced-air cooling, bulb temperature in the vicinity of the anode seal must not exceed 145°C.

Mounting. Vertical. Filament posts up or down. Horizontal operation is permissible with the plane of electrodes vertical.

APPROXIMATE DATA

V_f	10	V
I_f	10	A
μ	35	
$f_{(max)}$ (at full ratings; natural cooling)	30	Mc/s
$f_{(max)}$ (at full ratings; forced cooling)	20	Mc/s
$f_{(max)}$ (at reduced rating, natural or forced cooling)	75	Mc/s
$C_{a\text{-}g1}$	5·6	pF
$C_{a\text{-}k}$	8·8	pF
$C_{g1\text{-}k}$	14	pF



WEIGHT 1½ lb. (0·7 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

(1) HF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

Maximum permissible ratings

	Natural Cooling	Forced-Air Cooling	
V_a	3,000	4,000	V
V_{g1}	−500	−500	V
I_a	500	500	mA
I_{g1}	100	100	mA
P_a	1,250	1,800	W
p_a	300	400	W

Typical Operation

V_a	3,000	4,000	V
V_{g1} (i) from a fixed supply of	−200	−200	V
(ii) via R_{g1}	3,500	2,650	Ω
(iii) via $R_{g1\text{-}k}$	425	380	Ω
$v_{g1\ (pk)}$	360	375	V
I_a	415	450	mA
$I_{g1\ (approx)}$*	55	75	mA
$P_{dr\ (approx)}$*	20	26	W
$P_{out\ (approx)}$*	1,000	1,440	W

(2) HF POWER AMPLIFIER CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%*)*

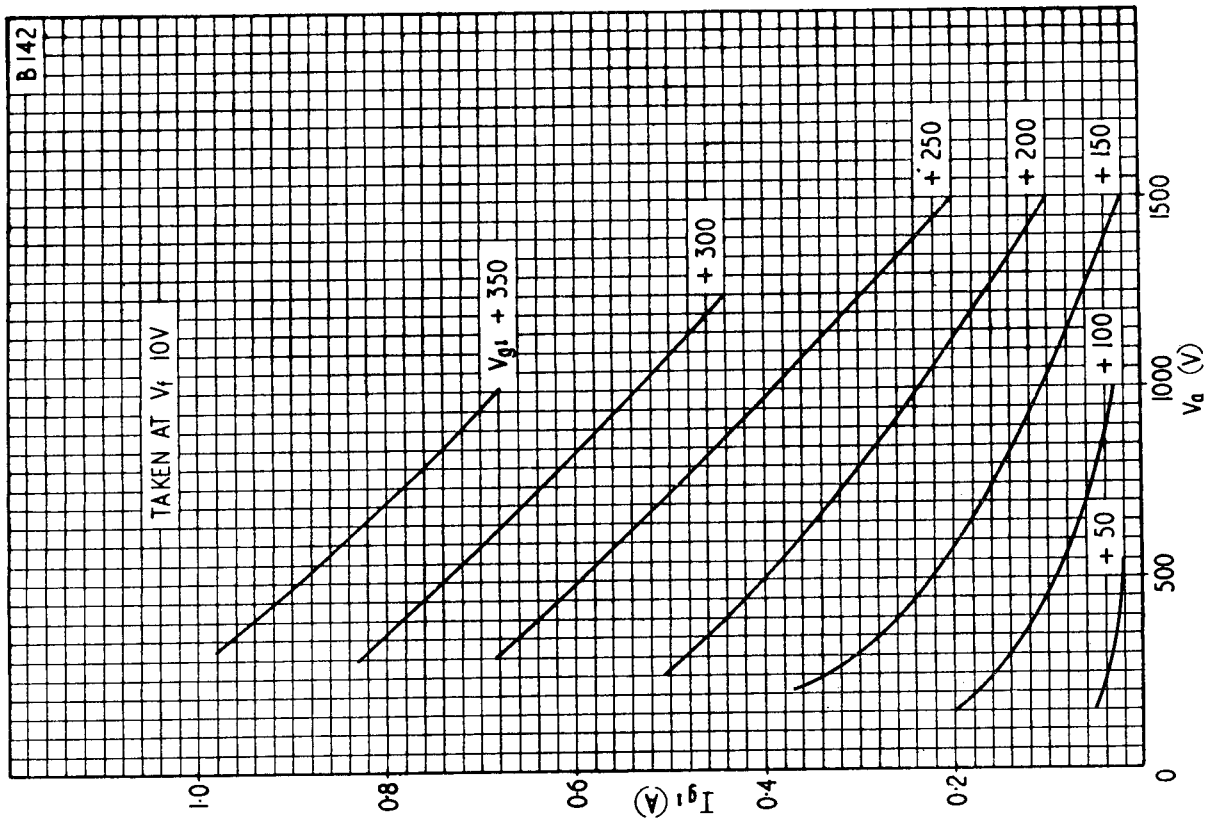
Maximum permissible ratings

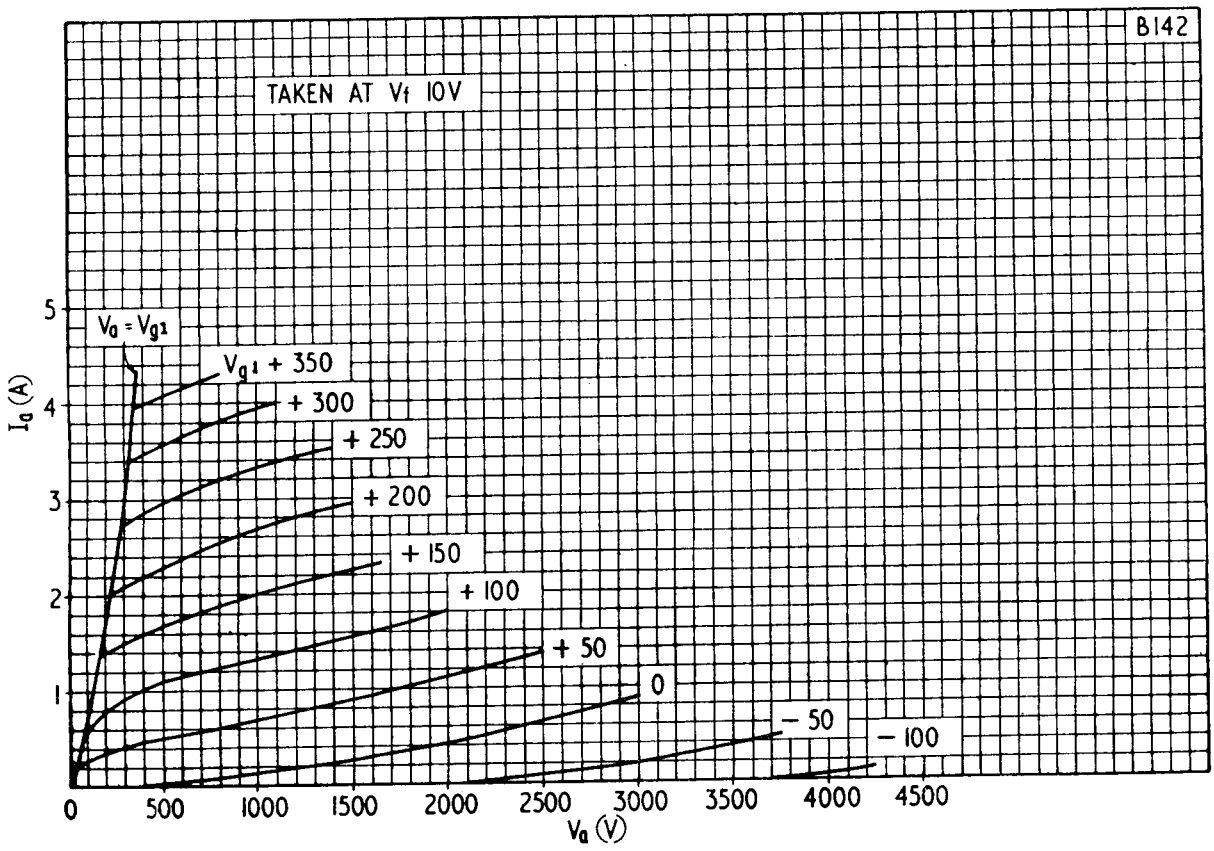
	Natural Cooling	Forced-Air Cooling	
V_a	2,500	3,000	V
V_{g1}	−500	−500	V
I_a	400	450	mA
I_{g1}	100	100	mA
P_a	835	1,250	W
p_a	200	270	W

Typical Operation

V_a	2,500	3,000	V
V_{g1} (i) from a fixed supply of	−300	−300	V
(ii) via R_{g1}	4,000	3,600	Ω
$v_{g1\ (pk)}$	460	490	V
I_a	335	415	mA
$I_{g1\ (approx)}$*	75	85	mA
$P_{dr\ (approx)}$*	30	37	W
$P_{out\ (approx)}$*	635	1,000	W

* Subject to wide variations depending on the impedance of the load circuit.


B142
TAKEN AT V_f 10V
V_{g1} + 350
+ 300
+ 250
+ 200
+ 150
+ 100
+ 50
0
1·0
0·8
0·6
0·4
0·2
I_{g1} (A)
1500
1000
500
V_a (V)


B142
TAKEN AT V_f 10V
$V_a = V_{g1}$
V_{g1} + 350
+ 300
+ 250
+ 200
+ 150
+ 100
+ 50
0
− 50
− 100
I_a (A)
5
4
3
2
1
0
500
1000
1500
2000
2500
3000
3500
4000
4500
V_a (V)



PRINTED IN ENGLAND

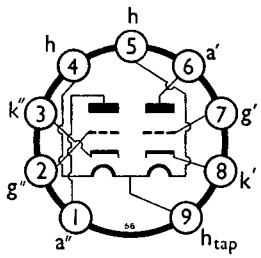
MINIATURE DOUBLE TRIODE 12·6V INDIRECTLY HEATED

B309

DECEMBER, 1954

The B309 is a commercial equivalent to the CV455.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. Diameter :	22	mm.

RATING

V_h	12·6	6·3	V
I_h	0·15	0·3	A
V_{h-k}		100 max.	V
V_a		300 max.	V
p_a (per system)		2·5 max.	W
μ	at V_a=250, V_g=−2	55	
r_a		10	kΩ
g_m		5·5	mA/V

CAPACITANCES (of unscreened valve)

$c_{a'-g'}$	1·6	pF	$c_{a''-g''}$	1·6	pF
$c_{g'-k'}$	2·5	pF	$c_{g''-k''}$	2·5	pF
$c_{a'-k'}$	0·4	pF			
$c_{a'-a''}$	0·4	pF	$c_{a''-k''}$	0·4	pF

TYPICAL OPERATION

A.F. amplifier. Class A

Per system

V_a (b)	250	V
V_g approx	−2	V
v_{out} (pk) (D=1%)	7	V
v_{out} (pk) (D=2%)	14	V
V_{gain}	37	
I_a	1·4	mA
R_k	1·2	kΩ
R_a	100	kΩ

Under maximum rated conditions, the grid-cathode D.C. resistance must not exceed 1MΩ per system.

MOUNTING

Any position.

SCREENING

No internal or external screening is fitted to the valve.

VENTILATION

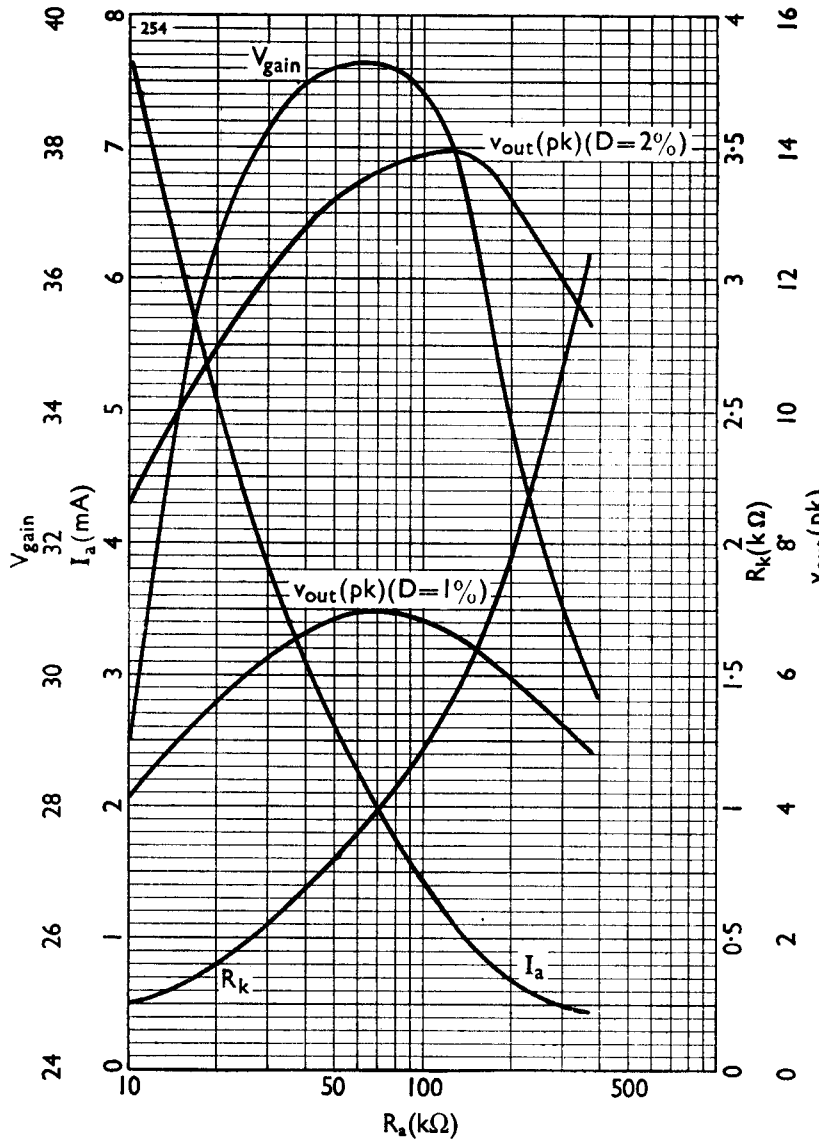
No special precautions.

MICROPHONY

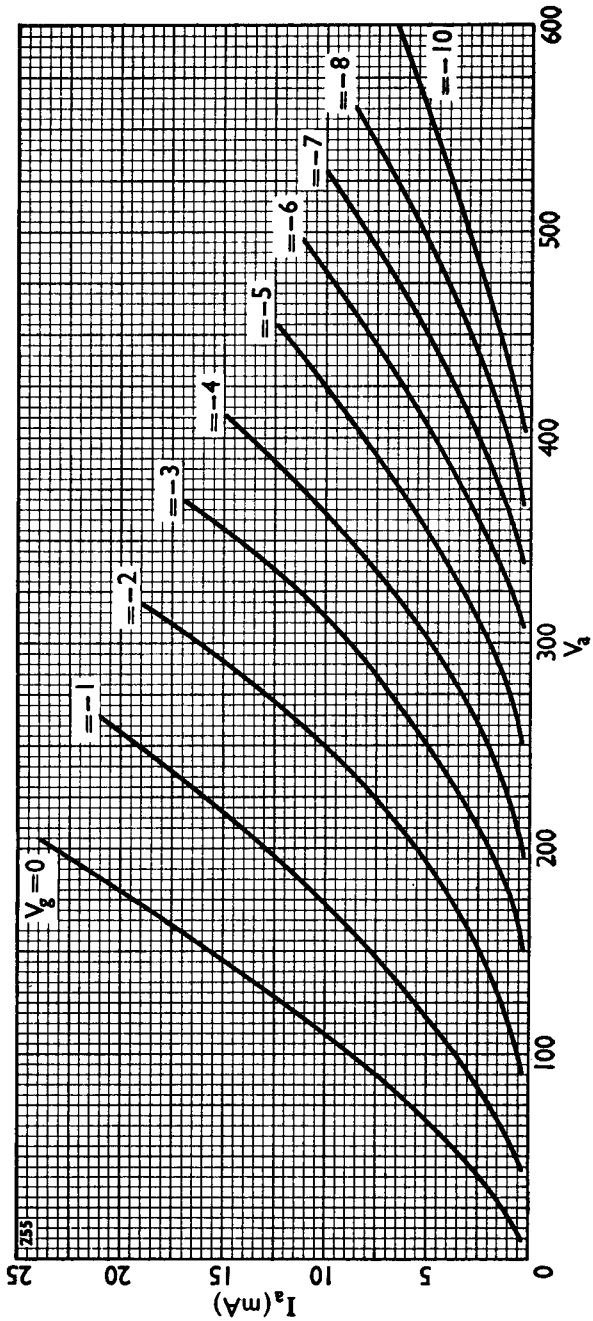
The valve should be free from microphony in normal receiver applications

CLASS A AF AMPLIFIER

following $R_{g1\text{-}k} = 470k\Omega$



B309


V_g=0
=−1
=−2
=−3
=−4
=−5
=−6
=−7
=−8
=−10
V_a
0
100
200
300
400
500
600
5
10
15
20
25
I_a(mA)
7355

CIRCUIT SUPPLEMENT

B309

NOVEMBER, 1954

The Rating and Characteristics of the B309 are given in the Technical Data Sheet.

The B309 is a commercial equivalent of CV455.

The B309 is a double triode suitable for use in a variety of circuits, the separate connections to the cathodes providing complete flexibility.

The valve is satisfactory as a multivibrator, and as such has applications in television receivers as a line or frame oscillator. It is also useful in many industrial applications.

AUDIO FREQUENCY AMPLIFICATION

The valve may be used either in push-pull or cascade in resistance or transformer coupled amplifiers. An anode load resistor of 33kΩ to 100kΩ is suitable, and a stage gain of the order of 40 is obtainable from each triode system. A circuit covering its use as a self-balancing phase inverter is shown in fig. 1 ; the gain of this circuit is 80 overall.

When the grid is earthed via a resistor of 250kΩ the hum voltage will not exceed 30 db below 1 mV, assuming a 6·3V heater supply and a hum-balancing resistor. The valve should not be used in the first stage of a high gain amplifier, but in the later stages its microphonic performance is satisfactory.

RADIO FREQUENCY AMPLIFICATION

The B309 may be used with either earthed cathode or earthed grid. In the former case neutralisation is necessary to prevent self-oscillation. Optimum results are obtained in a push-pull circuit and a stage gain of not less than 10 db is obtainable at frequencies up to 200 Mc/s. As a push-pull earthed grid amplifier it has an input impedance of 350 Ω. The recommended circuit is shown in fig. 2. Measurements made with the valve operating as a driven Class C amplifier with earthed cathodes show a stage gain of 7 to 10 db.

CLASS C OSCILLATOR

The following performance has been obtained using lumped circuits.

Frequency	Output
30 Mc/s	5·5W
125 Mc/s	2·5W
250 Mc/s	1·1W

Using lines an output of 2·5W can be obtained at 250 Mc/s. The recommended circuit is shown in fig. 3.

FREQUENCY CHANGER

As a mixer the B309 will operate satisfactorily with common grid injection at frequencies up to 400 Mc/s. A small capacitance connected between the signal grid and oscillator circuit is used to inject the oscillator voltage.

A voltage of 3 to 5 will give good conversion, and at the higher frequencies the stray capacitances between the signal and oscillator circuits enable the external capacitor to be omitted.

The choice of intermediate frequency is governed by the signal frequency. Serious pulling between the oscillator and signal circuits will result if the two frequencies are allowed to approach each other too closely.

The recommended circuit is shown in fig. 4. In this circuit the values of C1 and C2 will depend on the constants of the intermediate frequency transformer. C3, shown in dotted lines, is an alternative position for C1.

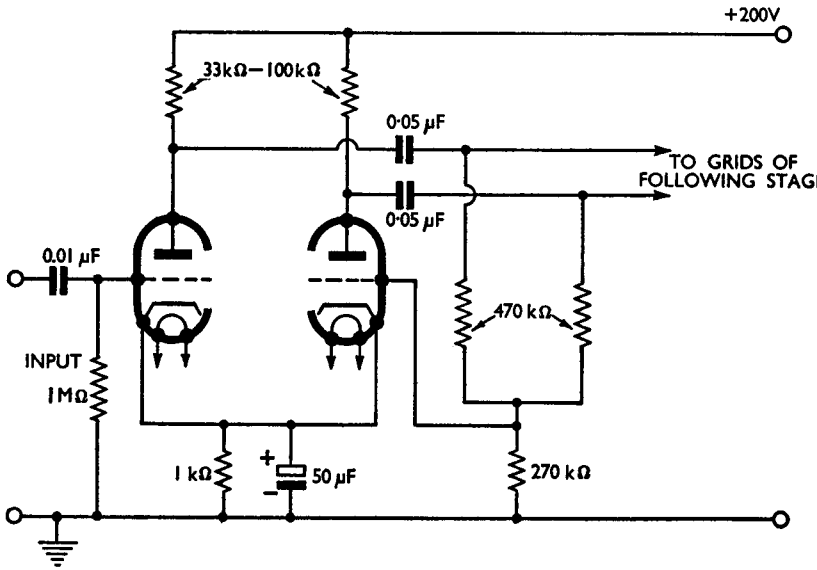


FIG. 1. Self-balancing phase inverter.

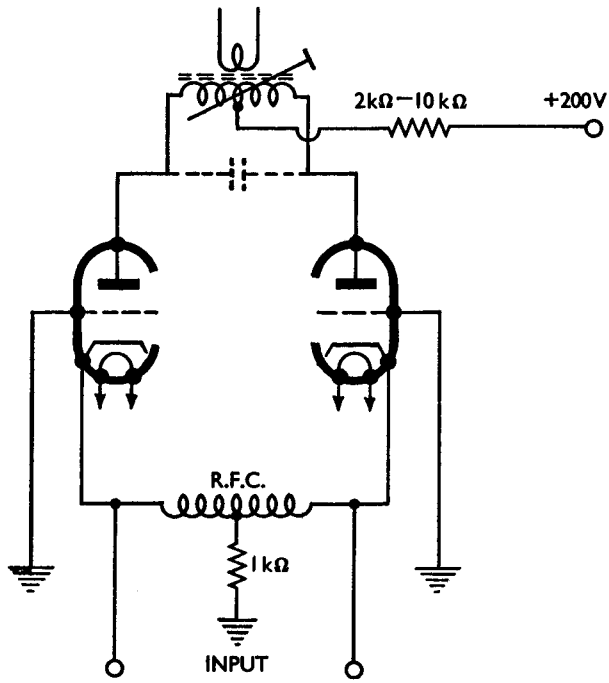


FIG. 2. Push-pull grid R.F. amplifier.

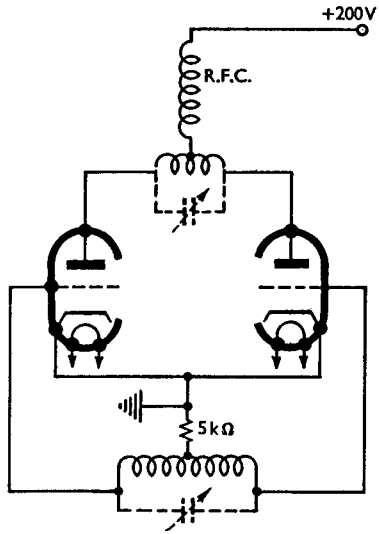


FIG. 3. Class C oscillator.

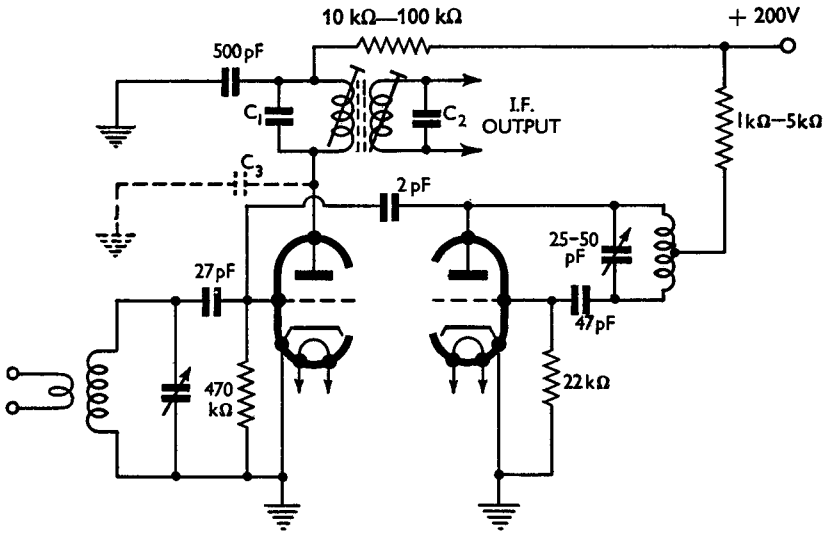


FIG. 4. V.H.F. frequency changer.

R.F. DOUBLE TRIODE

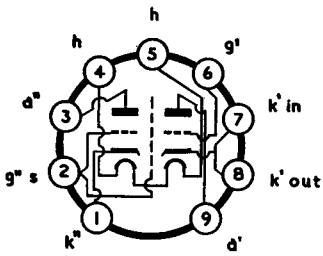
0.3A INDIRECTLY HEATED

B319

JULY, 1956

A double triode with separate cathodes, for use as a cascode RF amplifier at frequencies up to 250 Mc/s.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base

Base : B9A

Bulb : tubular

Overall length : 49 max. mm.

Seated length : 36 max. mm.

Diameter: 22·2 max. mm.

HEATER

I_h	0·3	A
V_h	7·4	V

RATING

(per system)

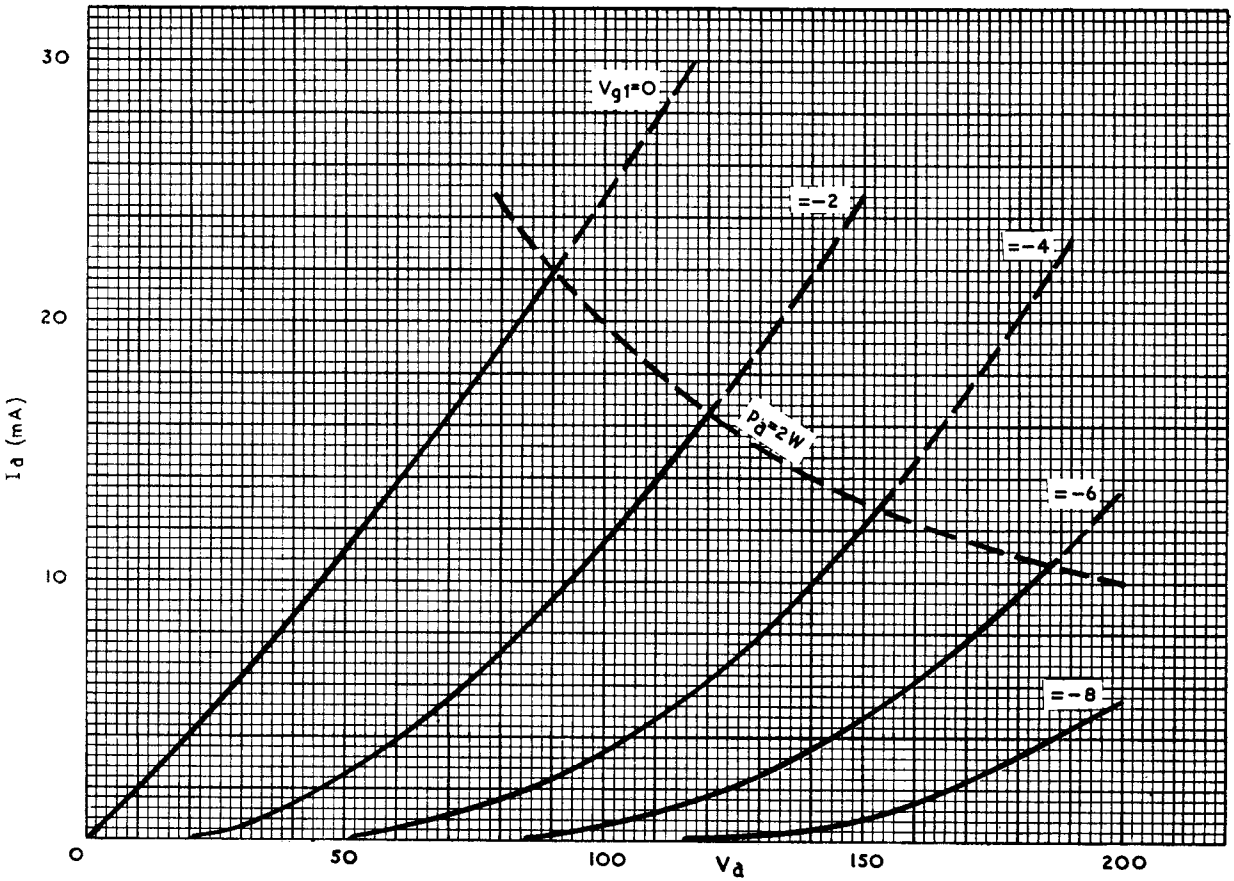
V_a		250	max.	V
V_{h-k}		250	max.	V
I_k		18		mA
p_a		2·0	max.	V
μ	at V_a=90	24		
r_a	V_g=−1·5	4		kΩ
g_m	I_a=12mA	6·0		mA/V

CAPACITANCES

$c_{a'-g'}$	1·1 pF	$c_{a''-g''}$	2·3 pF
$c_{g'-h}$	0·25 pF	$c_{a''-g''+h}$	2·5 pF
$c_{g'-a''}$	0·005 pF	$c_{a''-k''}$	0·17 pF
$c_{a'-a''}$	0·035 pF	$c_{a''-k''+h}$	4·9 pF
c_{in}	1·1 pF	$c_{h-k''}$	2·8 pF
c_{out}	2·3 pF		

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford


30
20
10
0
Ia (mA)
50
100
150
200
Va
Vg1=0
=-2
=-4
=-6
=-8
Pp=2W

DOUBLE TRIODE

12·6V INDIRECTLY HEATED

ISSUE 1

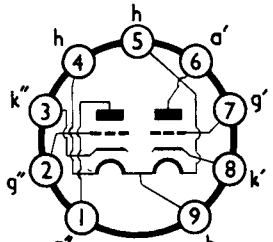
PROVISIONAL

B329/12AU7

AUGUST 1955

The B329/12AU7 is a commercial equivalent of Type CV491

BASE CONNECTIONS AND VALVE DIMENSIONS



VIEW FROM UNDERSIDE OF BASE

Base: B9A
Bulb: Tubular

Max. overall length: 56mm
Max. seated length: 49mm
Max. diameter: 22·2mm

HEATER

V_h	6·3	12.6	V
I_h	0·3	0·15	A

MAXIMUM RATINGS (Each section)

V_a	300	V
p_a	2·75	W
I_k	20	mA
V_{h-k}	180	V

CAPACITANCES

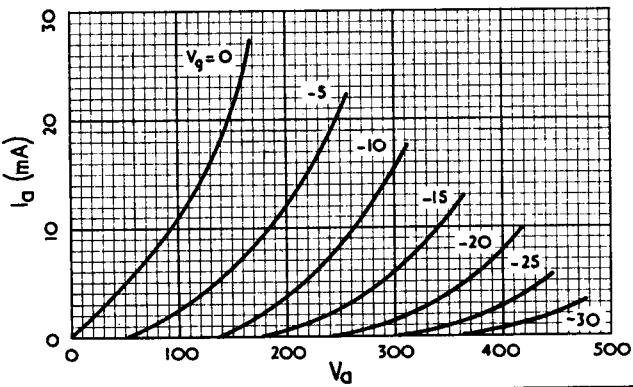
c_{a-g} (each section): 1·5pF. $c_{a'-k'}$ 0·5pF
c_{g-k} (each section): 1·6pF. $c_{a''-k''}$ 0·35pF

CHARACTERISTICS (Each section)

V_a	250	V
I_a	10·5	mA
V_g	-8·5	V
g_m	2·2	mA/V
μ	17	
r_a	7·7	kΩ

TYPICAL OPERATION

$V_{a(b)}$	250	V
R_a	100	kΩ
R_k	2·7	kΩ
V_{gain}	12	



HIGH-MU DOUBLE TRIODE

12·6V INDIRECTLY HEATED

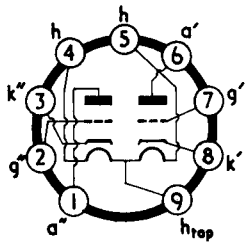
ISSUE 1

PROVISIONAL

B339/12AX7

AUGUST 1955

BASE CONNECTIONS AND VALVE DIMENSIONS



VIEW FROM UNDERSIDE OF BASE

Base: B9A
Bulb: Tubular

Max. overall length: 56mm
Max. seated length: 49mm
Max. diameter: 22·2mm

HEATER

V_h	12·6	6·3	V
I_h	0·15	0·3	A

MAXIMUM RATING (Per system)

V_a	300	V
P_a	1	W
I_k	8	mA
R_{g-k}	2·2	MΩ
V_{h-k}	180	V

CAPACITANCES (of unscreened valve)

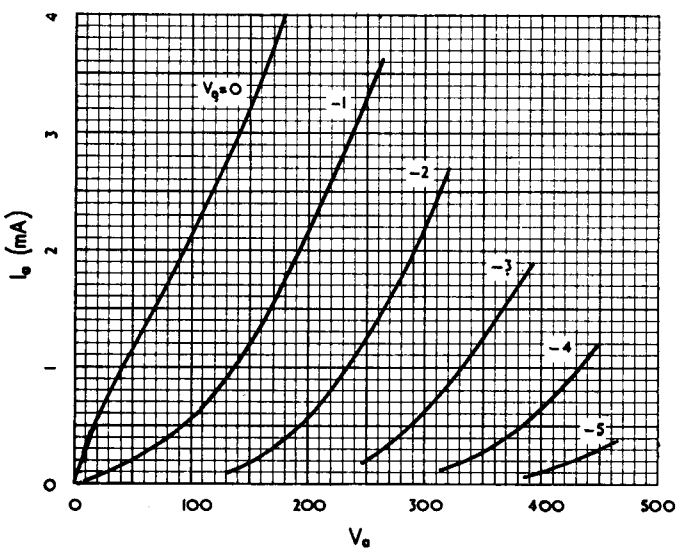
$c_{a'-g'}$	1·7pF	$c_{a"-g"}$	1·7pF
$c_{g'-k'}$	1·6pF	$c_{g"-k"}$	1·6pF
$c_{a'-k'}$	0·46pF	$c_{a"-k"}$	0·34pF
$c_{a'-a"}$	0·75pF		

Continued overleaf:

B339/12AX7

CHARACTERISTICS

V_a	250	100	V
V_g	-2	-1	V
I_a	1·2	0·5	mA
μ	100	100	
r_a	62·5	80	kΩ
g_m	1·6	1·25	mA/V



R.F. DOUBLE TRIODE

6·3V INDIRECTLY HEATED

ISSUE I

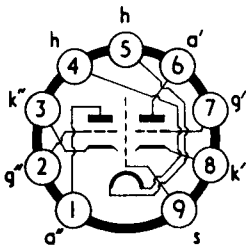
PROVISIONAL

B719/ECC85

AUGUST 1955

Primarily designed for use as an RF amplifier and mixer in FM receivers.

BASE CONNECTIONS AND VALVE DIMENSIONS



VIEW FROM UNDERSIDE OF BASE

Base: B9A
Bulb: Tubular

Max. overall length: 56mm
Max. seated length: 49mm
Max. diameter: 22·2mm

HEATER

V_h	6·3	V
I_h	0·435	A

MAXIMUM RATING (Per system unless otherwise indicated)

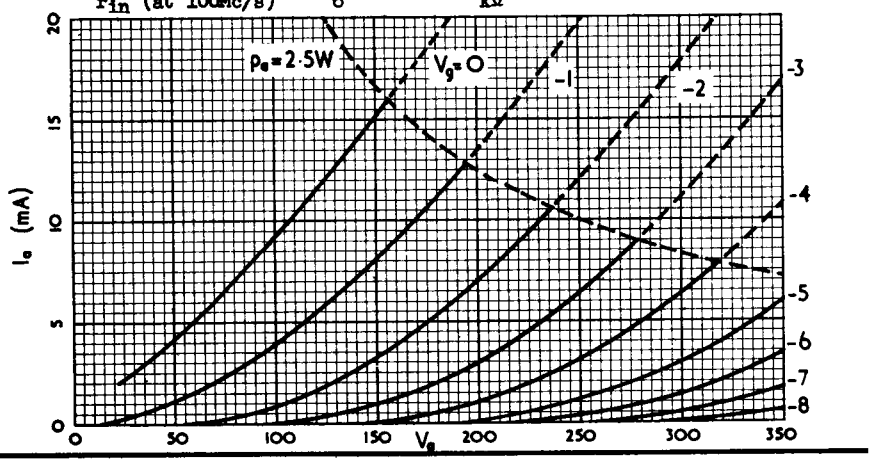
V_a	300	V
Pa	2·5	W
$Pa' + Pa''$	4·5	W
I_k	15	mA
R_{g-k}	1	MΩ
V_{h-k}	90	V

CAPACITANCES

c_{a-g} (each section): 1·5pF. c_{g-k} (each section): 0·18pF
$c_{a'-a''} < 0.04$pF. $c_{g'-k'} <$ 3pF. $c_{g''-k''} <$ 3pF

TYPICAL OPERATION (RF Amplifier)

V_a	230	V
I_a	10	mA
V_g	-2	V
g_m	6	mA/V
r_a	9·7	kΩ
μ	58	
r_{in} (at 100Mc/s)	6	kΩ



Triode *Type BR128*

VHF POWER AMPLIFIER AND OSCILLATOR

General. A forced-air-cooled transmitting triode fitted with a tungsten filament. Maximum operating frequency at full ratings is 100 Mc/s.

Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show the air inlet temperature °C/ anode + grid loss; and air flow/air pressure.

The external grid and filament seals also require air cooling. The volume of air necessary is approximately 20 cu. ft. per min. and should be directed on to the seals from above, through a 1-in. nozzle.

The temperature of the anode must not exceed 180°C and that of the grid and filament seals must not exceed 140°C.

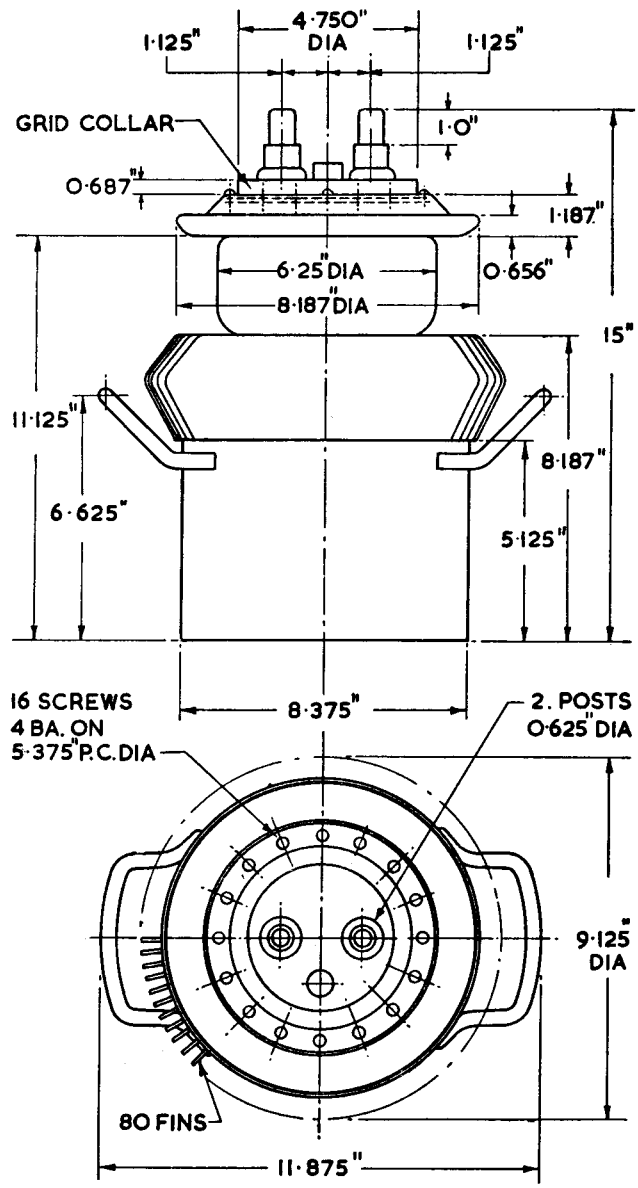
All air cooling supplies must be started before the application of any supply voltage and should be continued after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·0034 Ω. The filament current must not exceed 450A at any time during the switching-on period.

APPROXIMATE DATA

V_f	12·5 V	μ	taken at	V_a 10 kV	24
I_f	300 A	g_m		I_a 2 A	22mA/V
$V_{a\ (max)}$	12 kV	C_{gl-k}	44 pF		
$p_{a\ (max)}$	12 kW	C_{gl-a}	28 pF		
$p_{gl\ (max)}$	2 kW	C_{a-k}	1·5 pF		

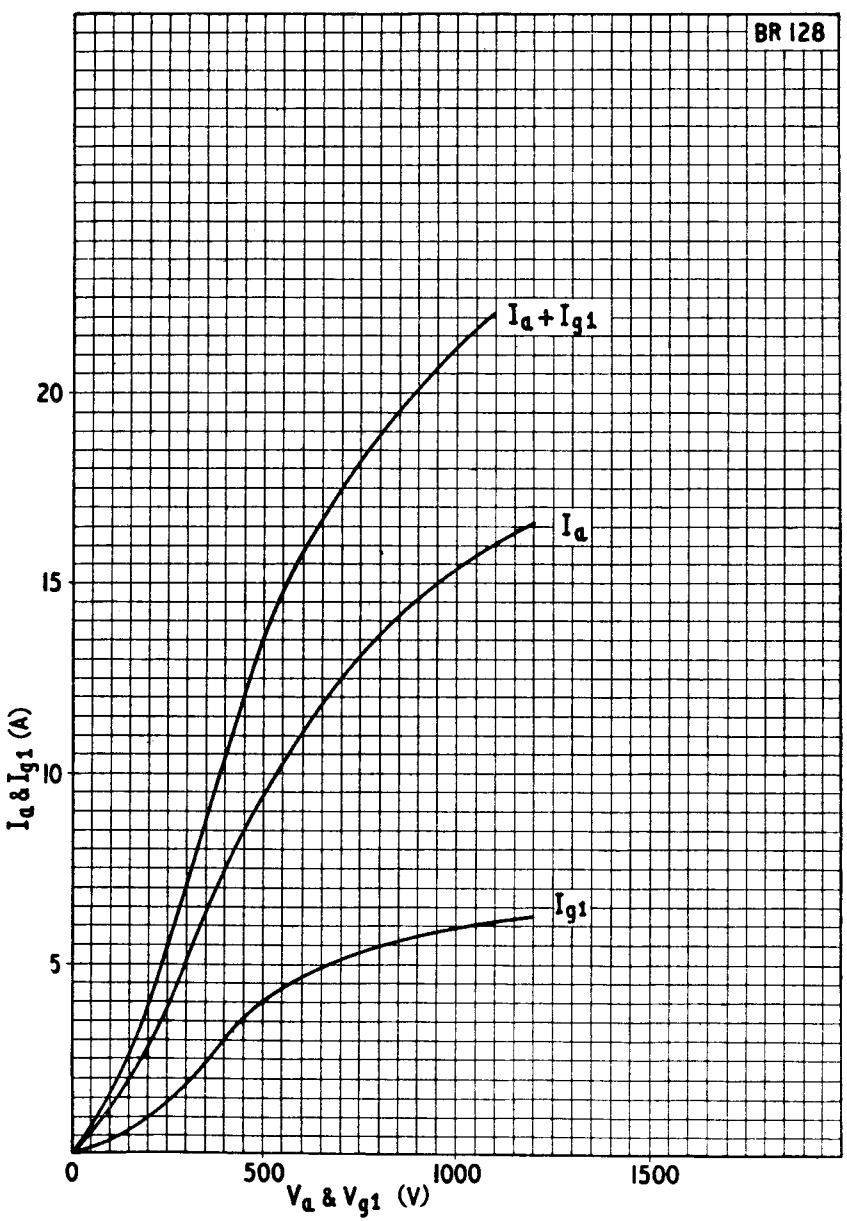
Marked Voltage. Each valve is marked with V_f to give 25 A peak emission at 90% saturation.

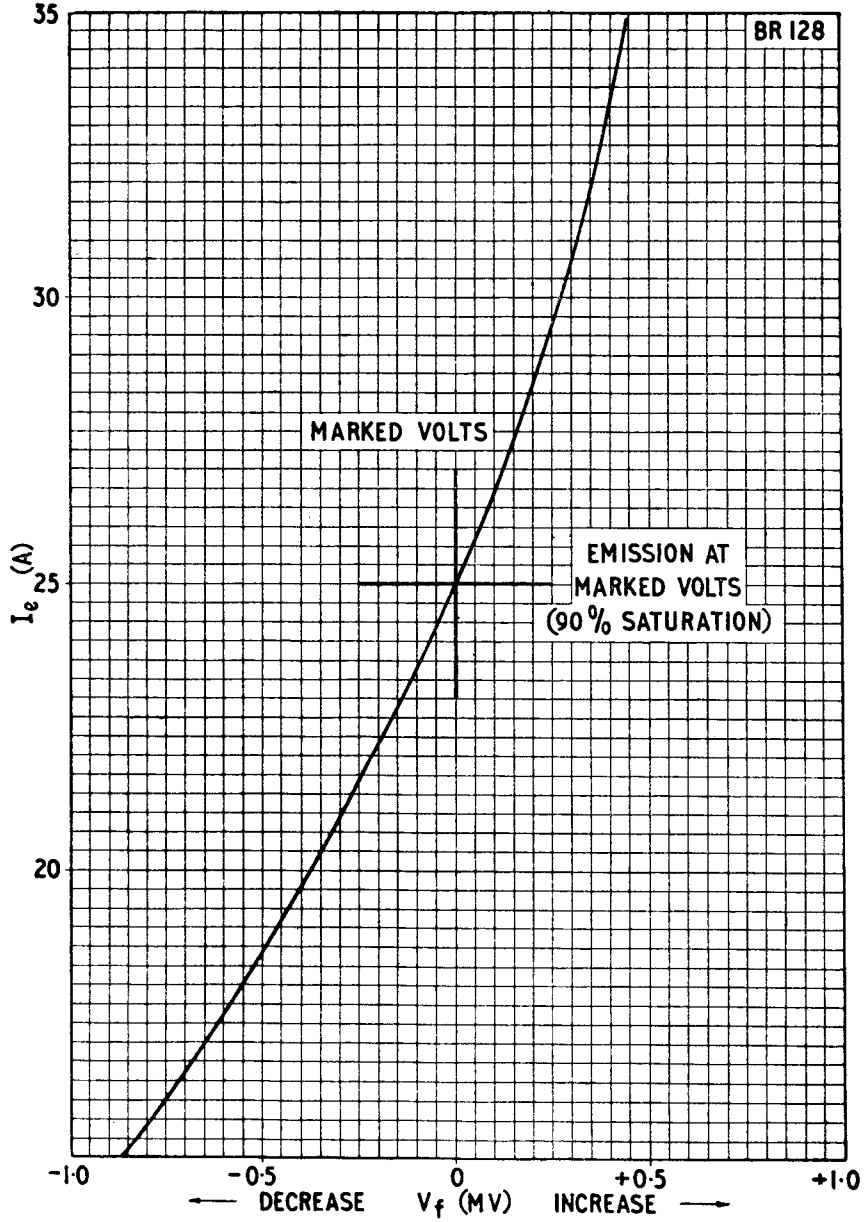


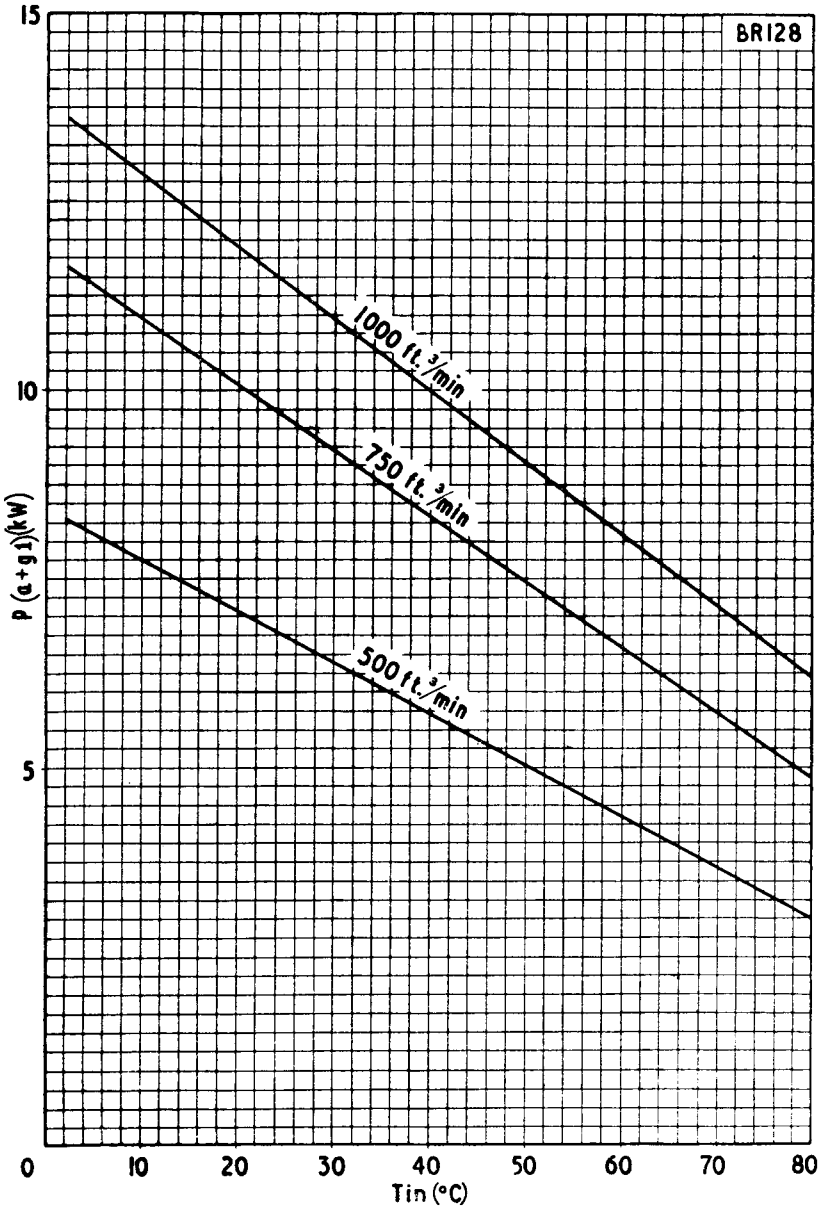
DIMENSIONS MAXIMUM WEIGHT 46lb (21kg)

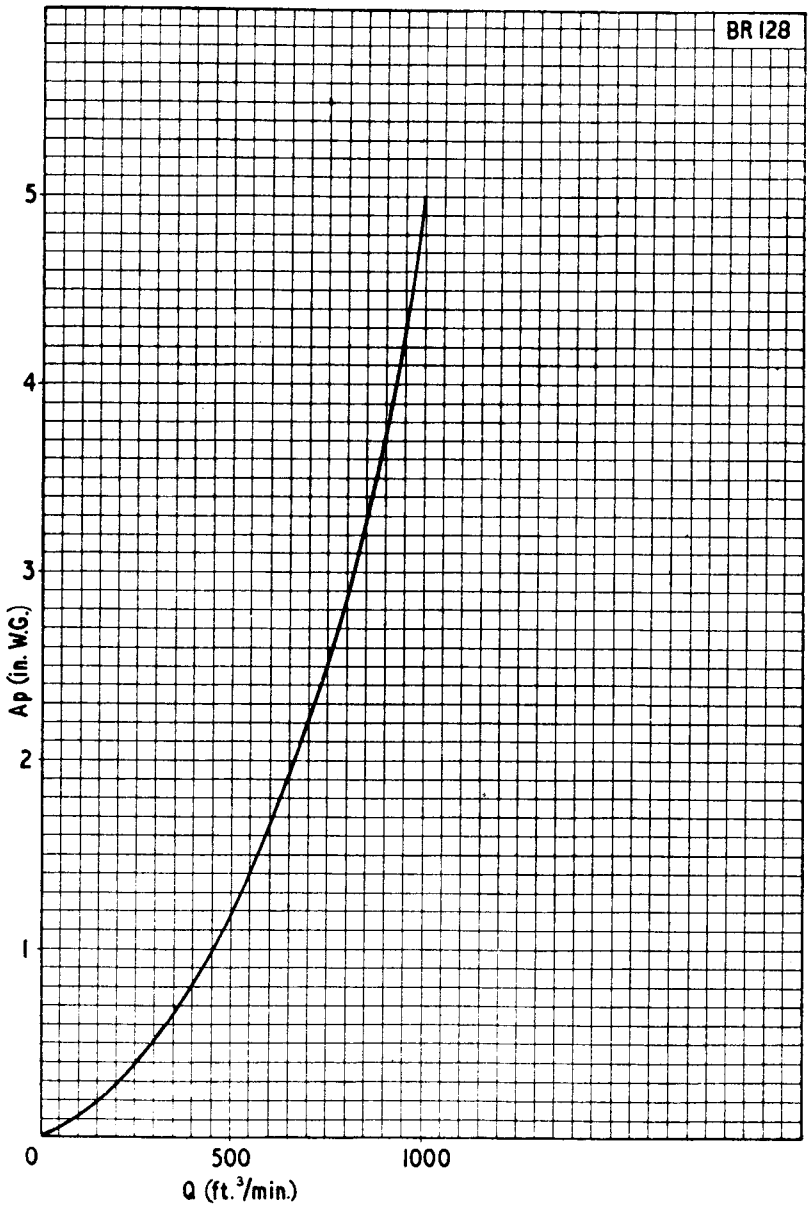
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

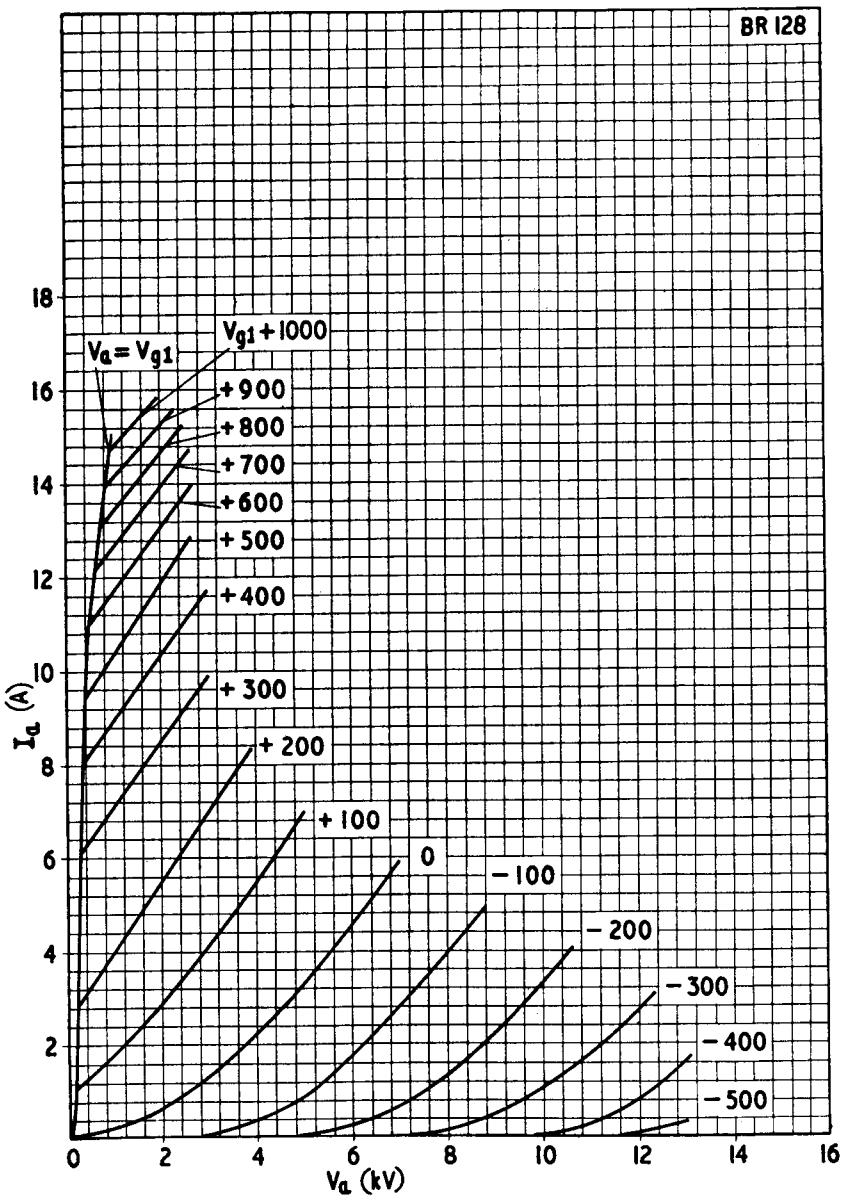
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

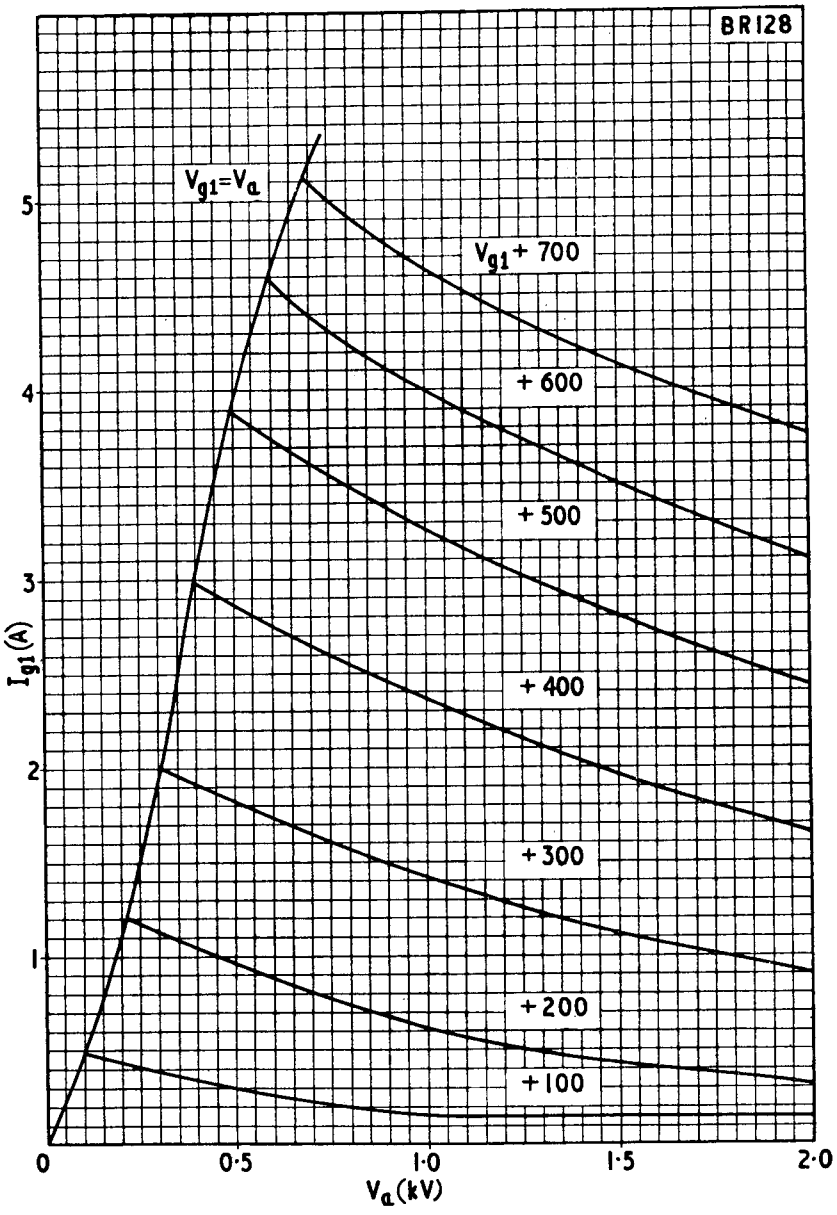

BR 128
$I_a + I_{g1}$
I_a
I_{g1}
20
15
10
5
0
500
1000
1500
I_a & I_{g1} (A)
V_a & V_{g1} (V)


BR 128
35
30
25
20
MARKED VOLTS
EMISSION AT
MARKED VOLTS
(90% SATURATION)
I_e (A)
-1·0
-0·5
0
+0·5
+1·0
← DECREASE
V_f (MV)
INCREASE →


BR128
15
10
5
0
10
20
30
40
50
60
70
80
Tin (°C)
P (a+g1)(kW)
1000 ft.³/min
750 ft.³/min
500 ft.³/min


BR 128
5
4
3
2
1
0
500
1000
Q (ft.³/min.)
Ap (in. W.G.)





PRINTED IN ENGLAND

Triode *Type BR 129*

HF AMPLIFIER AND OSCILLATOR

General. The BR 129 is a forced-air-cooled transmitting triode fitted with a tungsten filament.

Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show the air inlet temperature °C/anode+grid loss, and air flow/air pressure.

The grid and filament seals also require air cooling. The volume of air necessary is approximately 15 cu. ft. per minute, and should be directed on to the seals from above through a 1-in. nozzle. The temperature of the anode must not exceed 180°C and that of the seals must not exceed 140°C.

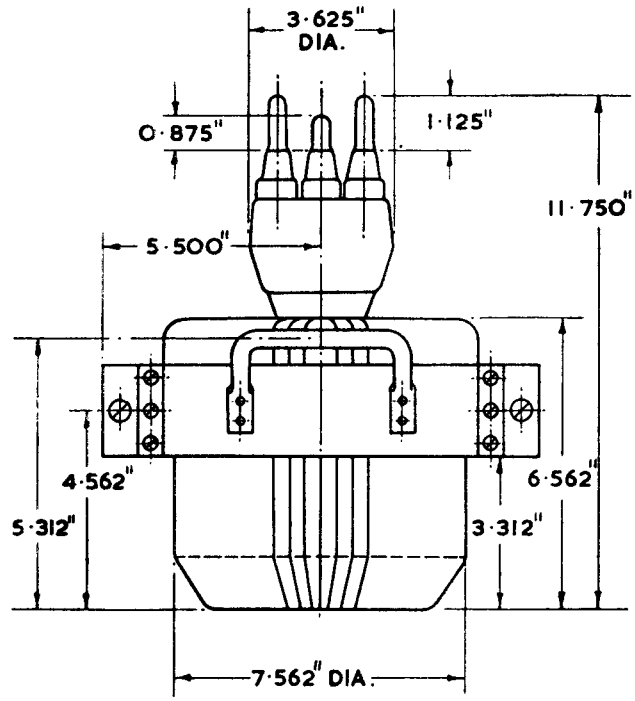
All air cooling supplies must be in operation before the application of any supply voltage and should be continued, for at least one minute, after the removal of all supply voltages.

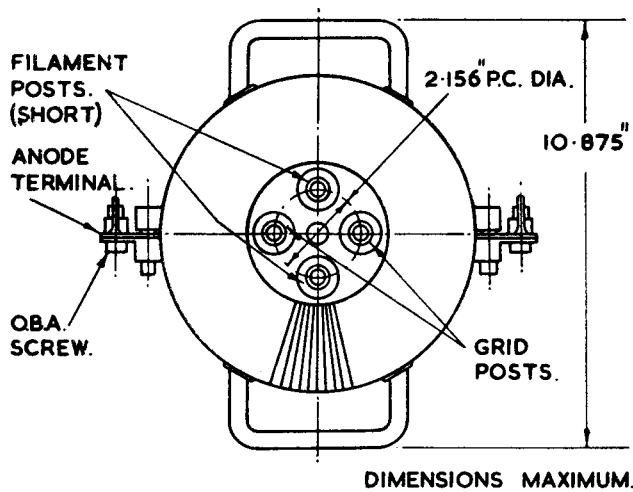
Filament Starting. The cold filament resistance is approximately 0·007 Ω. The filament current must not exceed 187 A at any time during the switching on period.

APPROXIMATE DATA

V_f		11	V
I_f		125	A
$V_{a\ (max)}$		8·5	kV
$p_{a\ (max)}$		5	kW
$p_{g1\ (max)}$		600	W
μ	taken at Va 5 kV, Ia 1A	21	
g_m	taken at Va 5 kV, Ia 1A	11	mA/V
$f_{(max)}$ (at full ratings)		40	Mc/s
$c_{a\text{-}g1}$		17·5	pF
$c_{a\text{-}k}$		2·7	pF
$c_{g1\text{-}k}$		23·3	pF

Marked Voltage. Each valve is marked with the filament voltage required to give 8·5 A peak emission at 90% saturation.

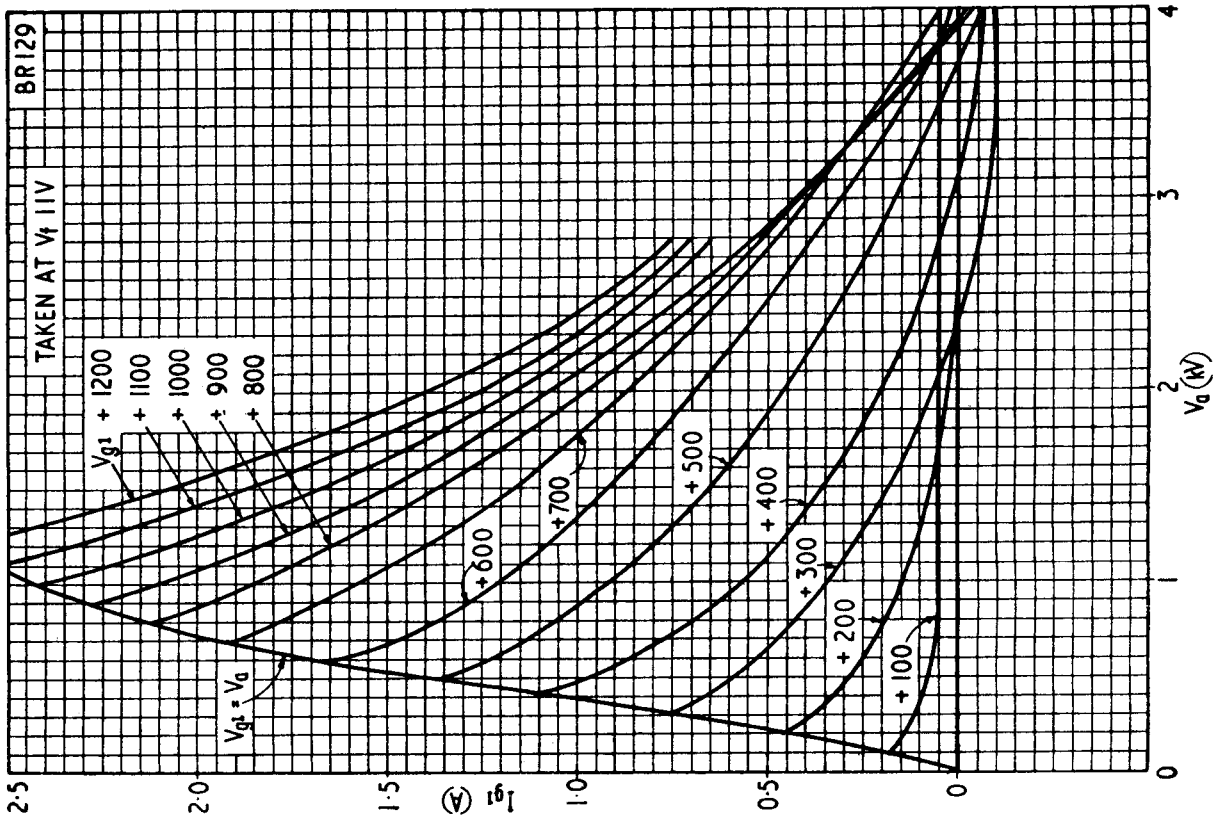


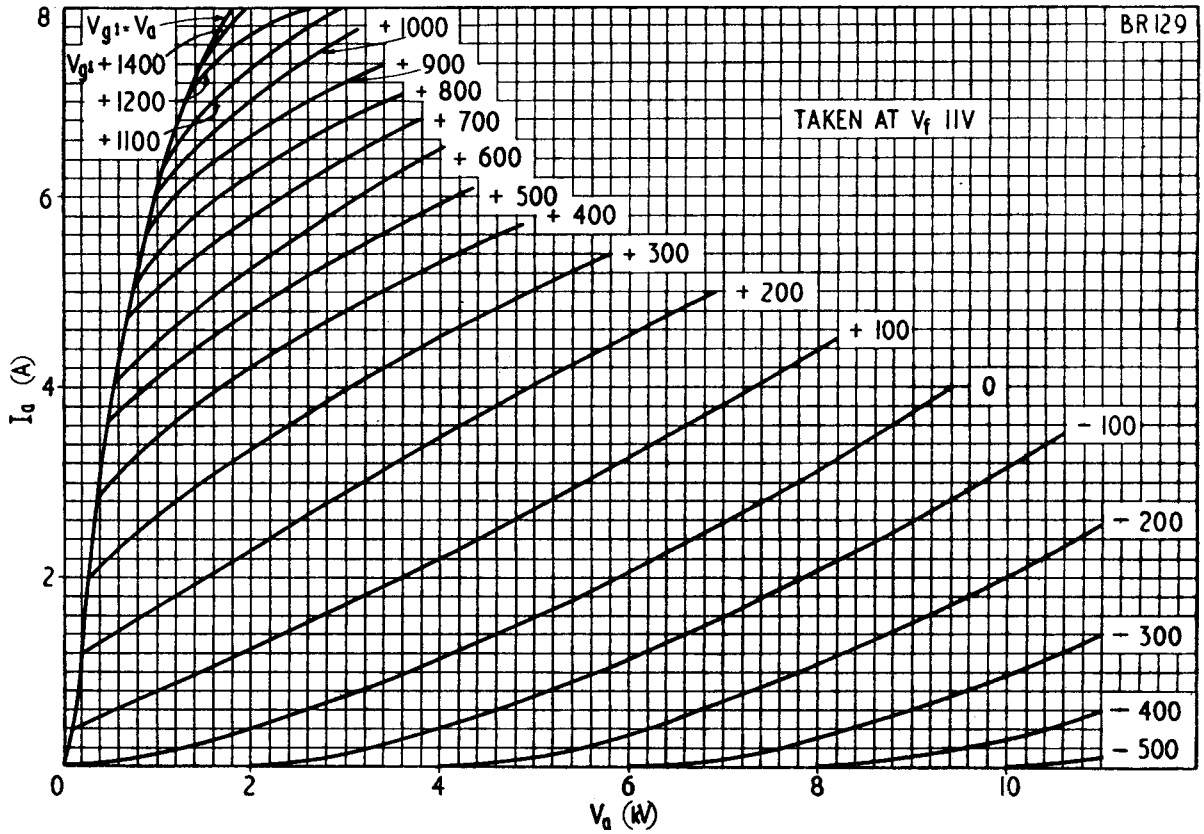


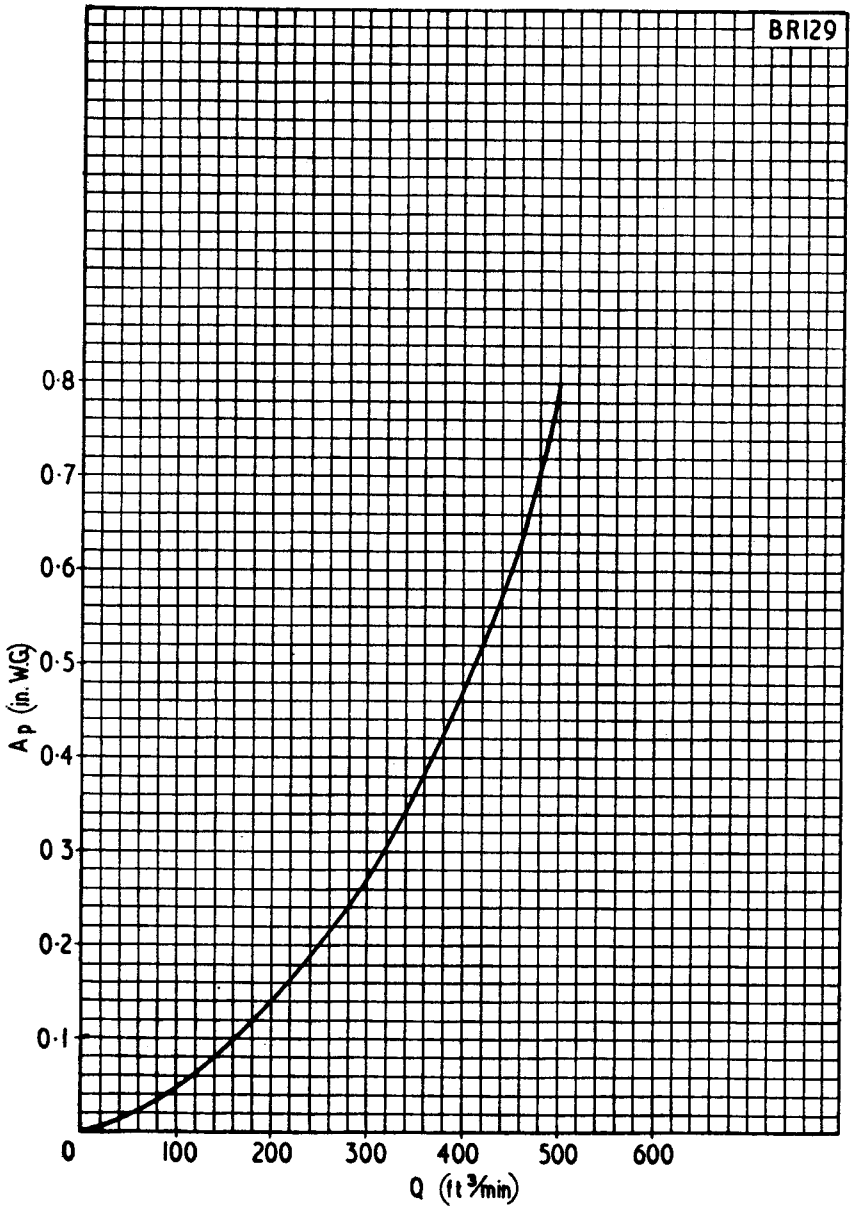
WEIGHT 37 lb. (16·8 kg.)

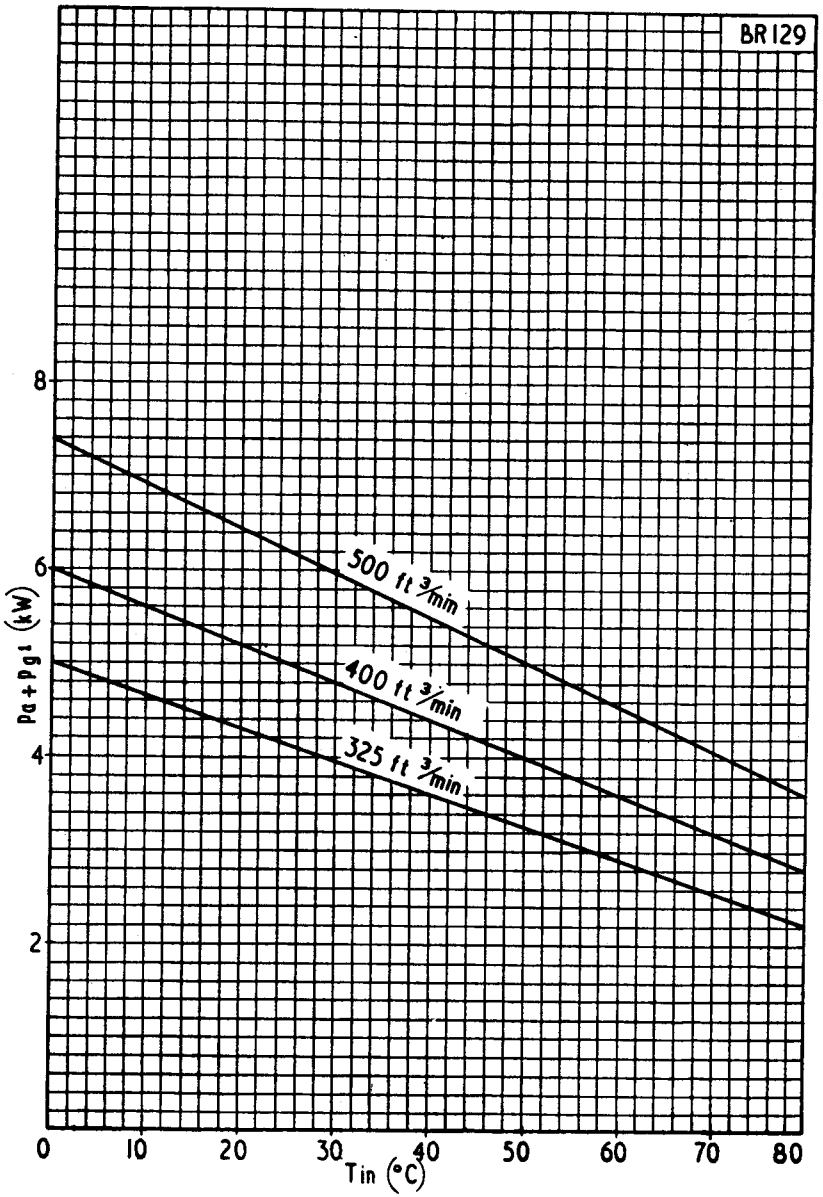
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

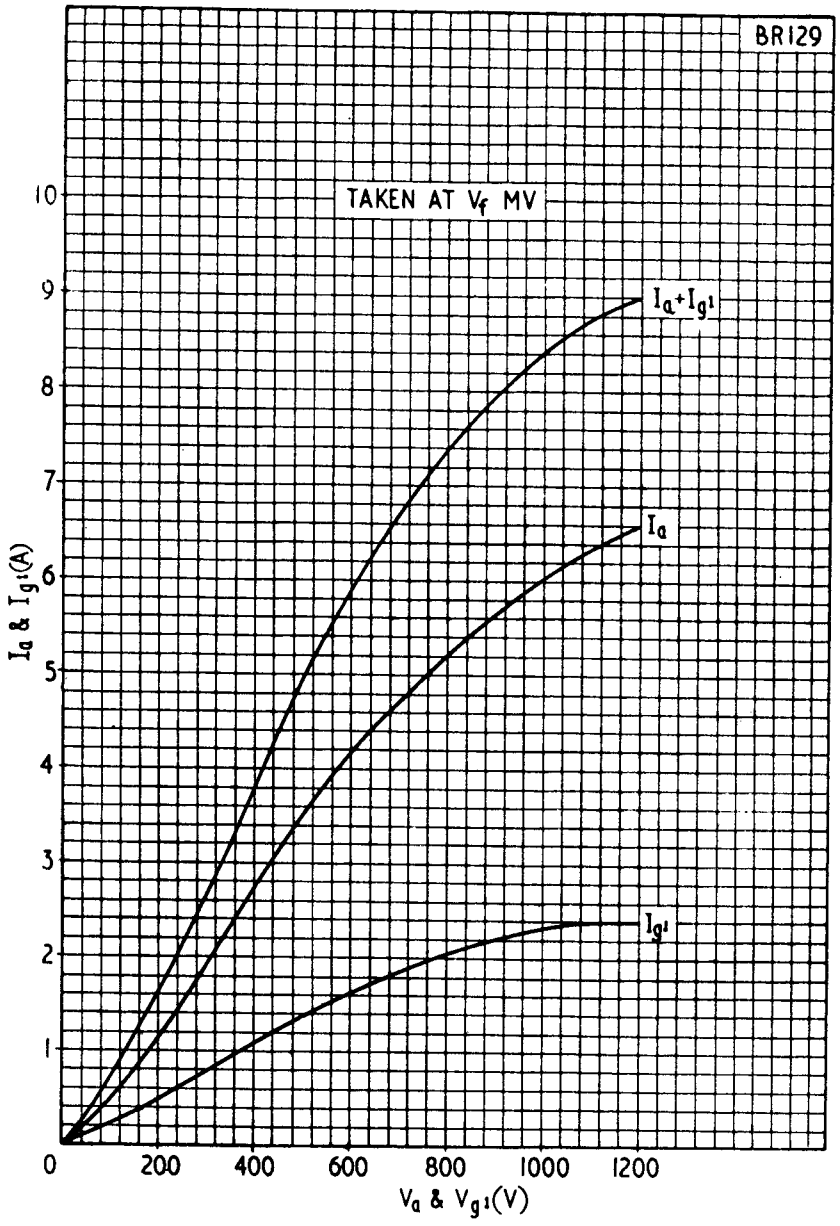
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

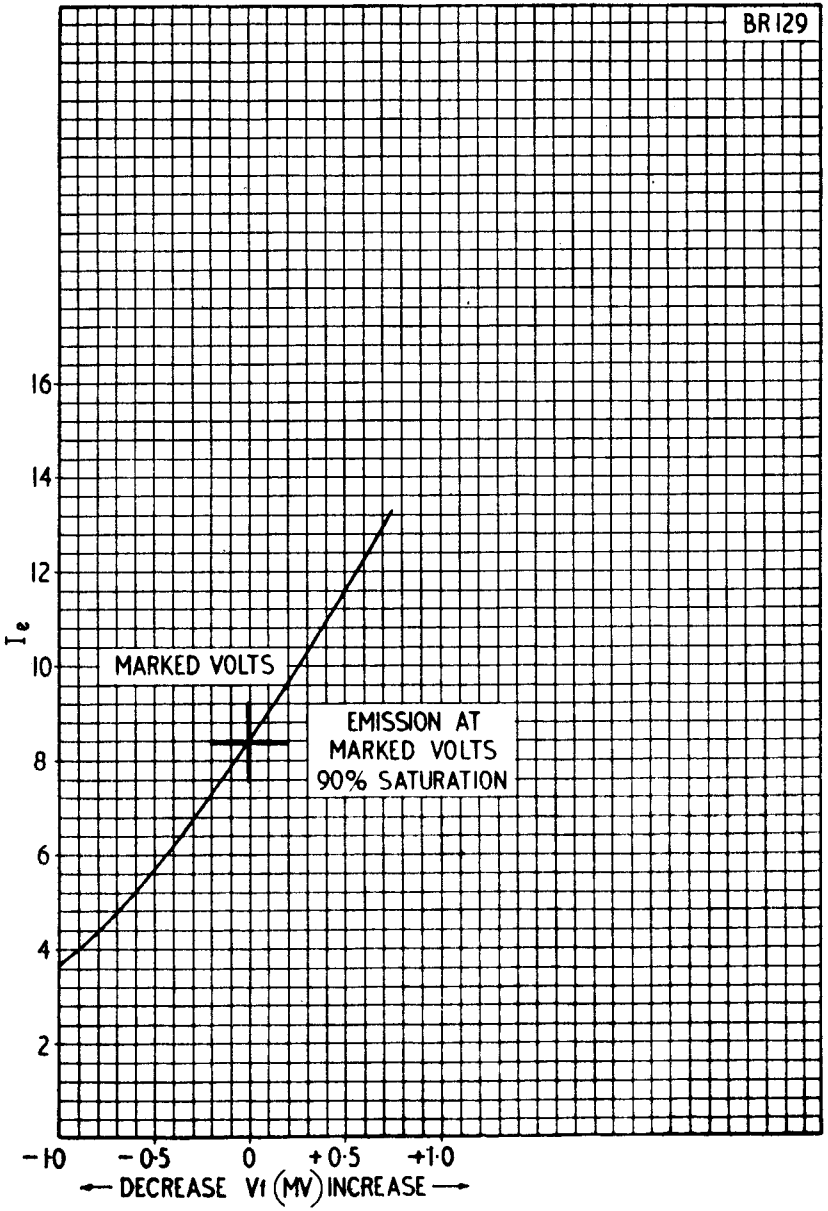

BR129
TAKEN AT V_f 11V
V_{g1} + 1200
+ 1100
+ 1000
+ 900
+ 800
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
$V_{g1} = V_a$
I_{g1} (A)
V_a (kV)


BR129
TAKEN AT V_f 11V
$V_{g1} = V_a$
V_{g1} + 1400
+ 1200
+ 1100
+ 1000
+ 900
+ 800
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
0
- 100
- 200
- 300
- 400
- 500
I_a (A)
V_a (kV)


BR129
0·8
0·7
0·6
0·5
0·4
0 3
0·2
0·1
0
100
200
300
400
500
600
Ap (in. WG)
Q (ft³/min)


BR129
8
6
4
2
0
10
20
30
40
50
60
70
80
Pa+Pg1 (kW)
Tin (°C)
500 ft³/min
400 ft³/min
325 ft³/min





PRINTED IN ENGLAND

Triode *Type BR 137*

HF AMPLIFIER AND OSCILLATOR

General. The BR 137 is a forced-air-cooled transmitting triode fitted with a tungsten filament.

Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show the air inlet temperature °C/anode+grid loss; and air flow/air pressure.

The external grid and filament seals also require air cooling. The volume of air necessary is approximately 20 cu. ft. per minute and should be directed into the seals from above through a 1 in. nozzle. The temperature of the seals must not exceed 140°C and that of the anode 180°C.

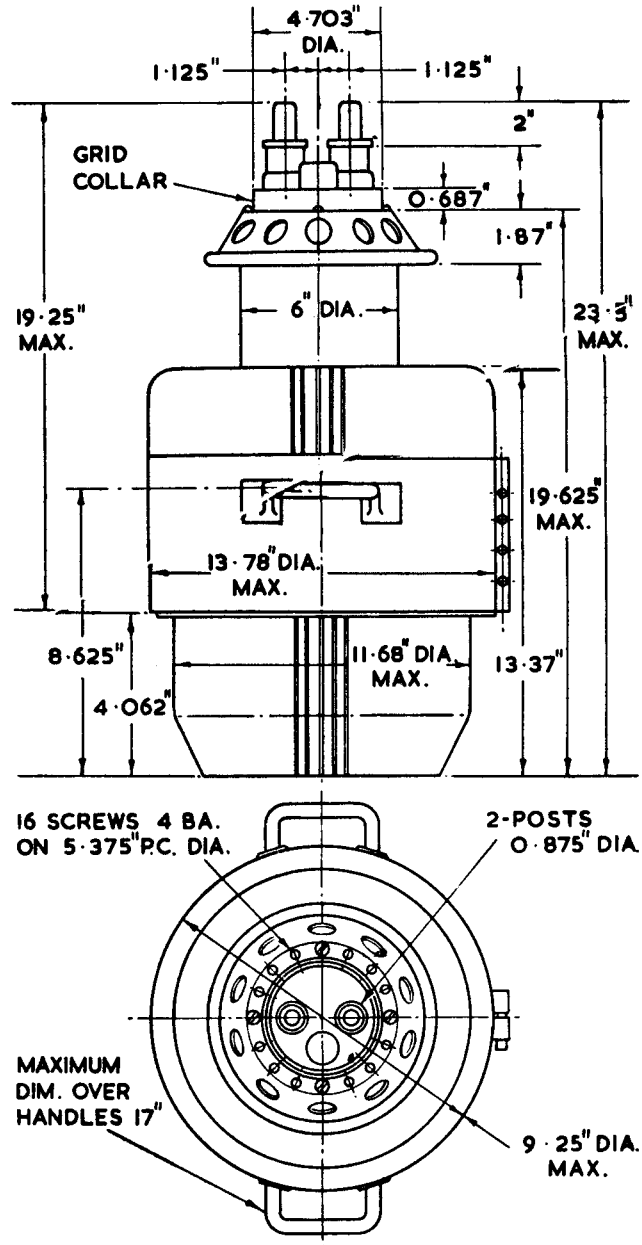
All air cooling supplies must be in operation before the application of any supply voltage and should be continued, for at least one minute, after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·0039 Ω. The filament current must not exceed 600 A at any time during the switching-on period.

APPROXIMATE DATA

V_f	18	V
I_f	400	A
$V_{a\ (max)}$	15	kV
$p_{a\ (max)}$	20	kW
$p_{g1\ (max)}$	3	kW
μ (taken at V_a 9 kV, I_a 2A)	40	
g_m (taken at V_a 10 kV, I_a 2A)	30	mA/V
$f_{(max)}$ (at full ratings)	50	Mc/s
$C_{a\text{-}g1}$	55	pF
$C_{a\text{-}k}$	2	pF
$C_{g1\text{-}k}$	80	pF

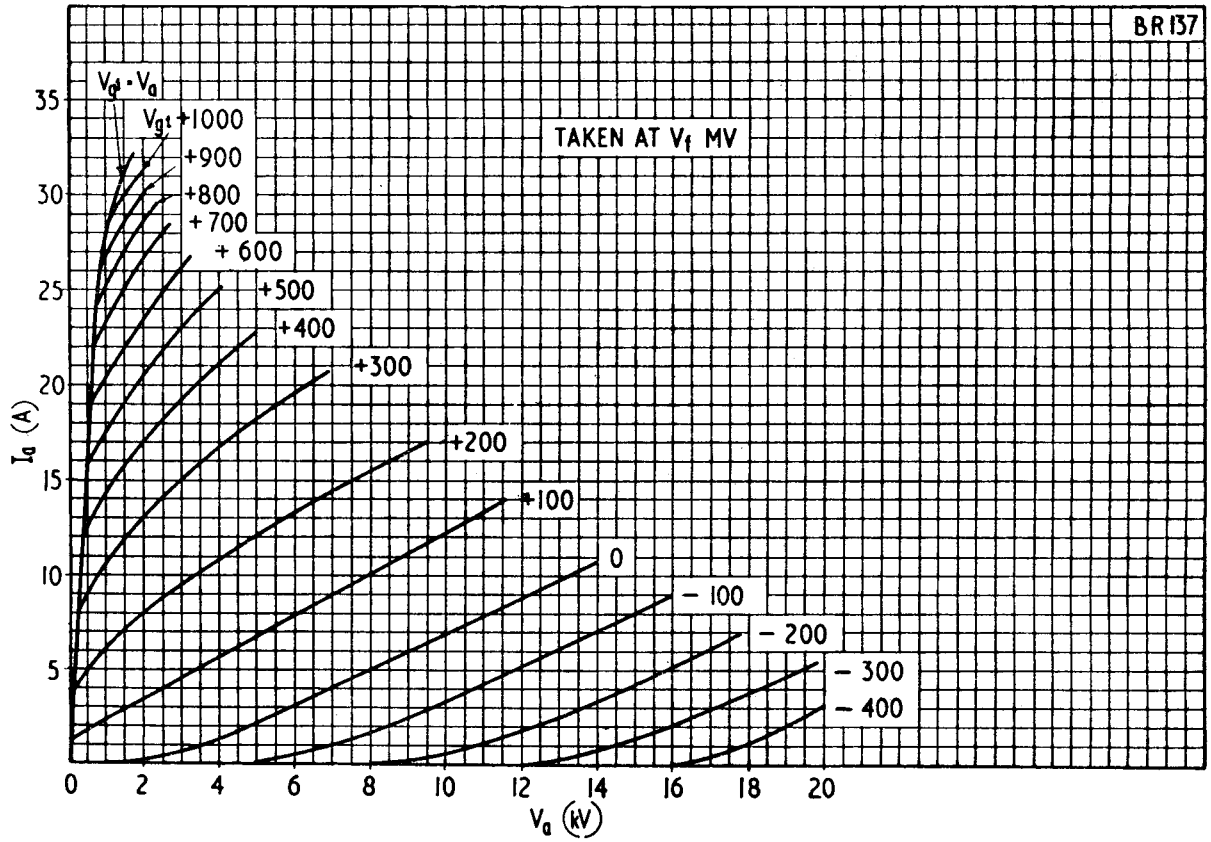
Marked Voltage. Each valve is marked with the filament voltage required to give 45 A peak emission at 90% saturation.

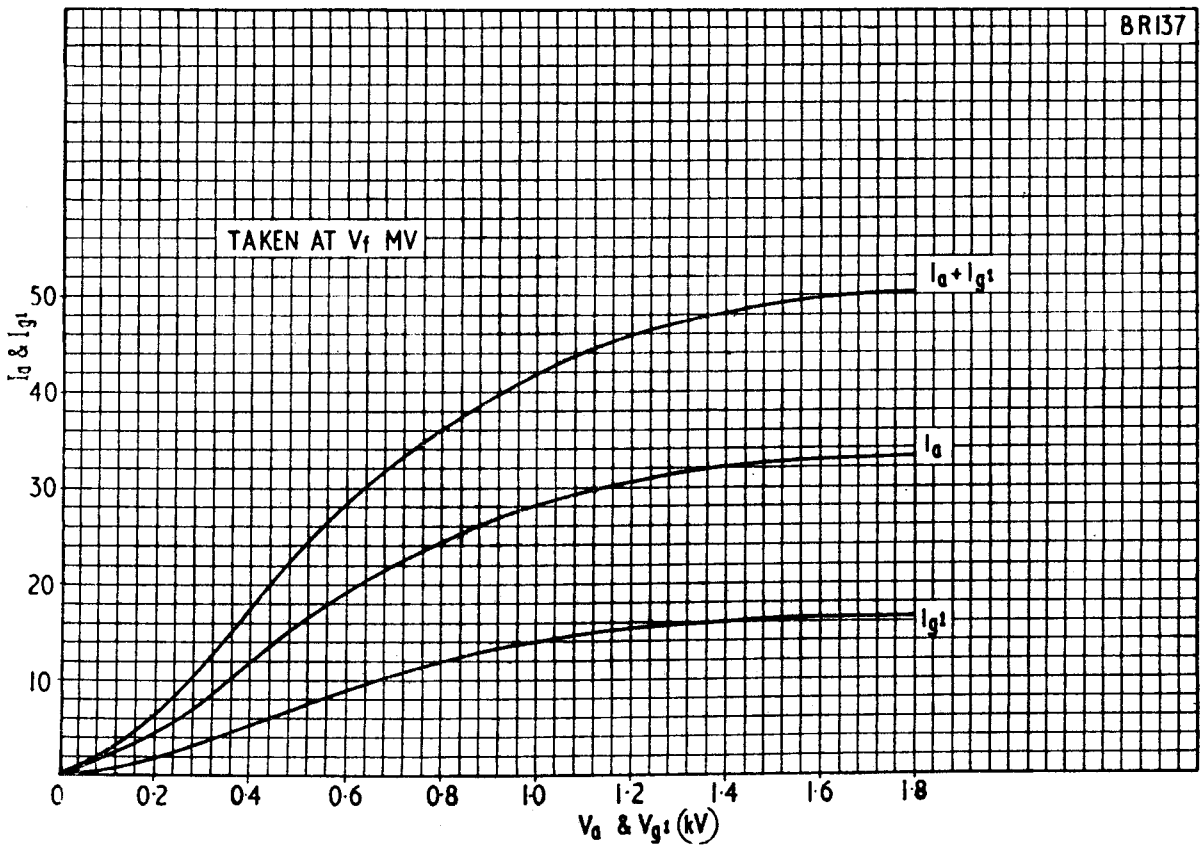


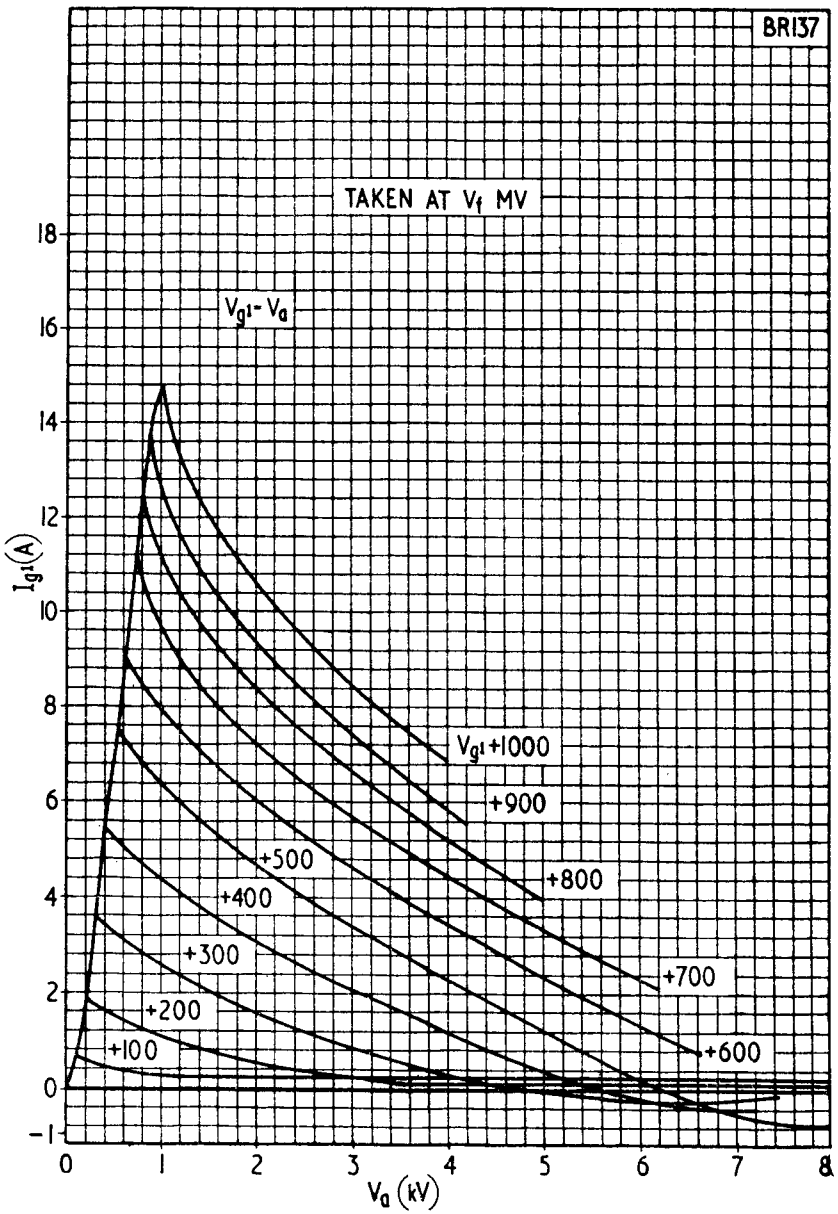
WEIGHT 196 lb. (89 kg.)

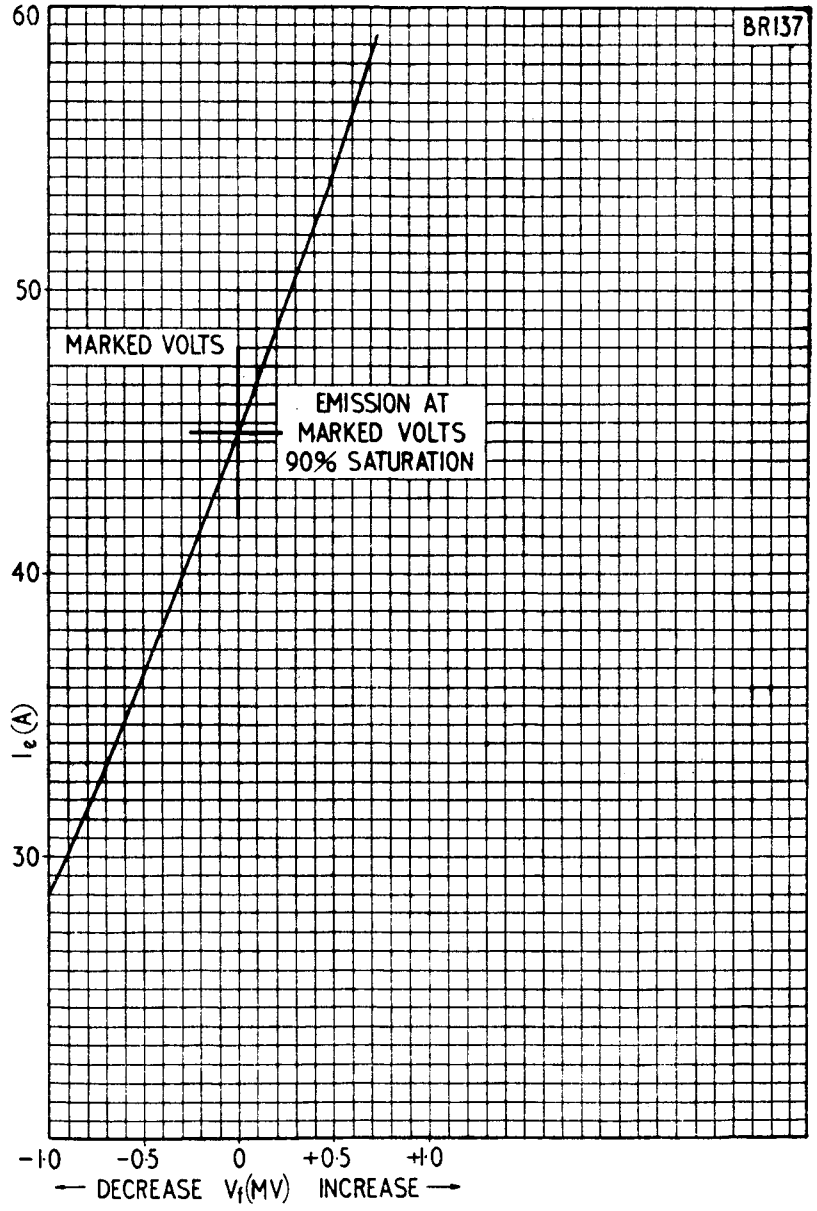
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

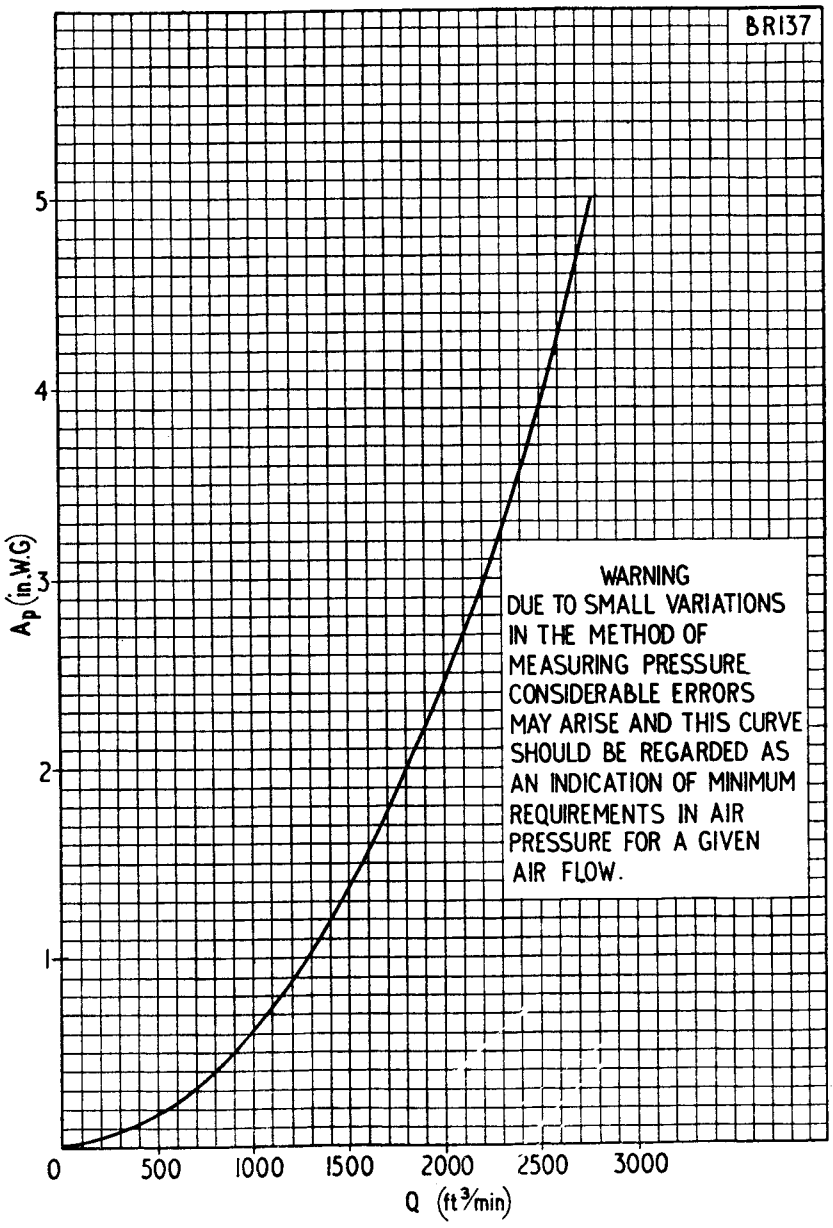
Head Office: Marconi House, Chelmsford, England, Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

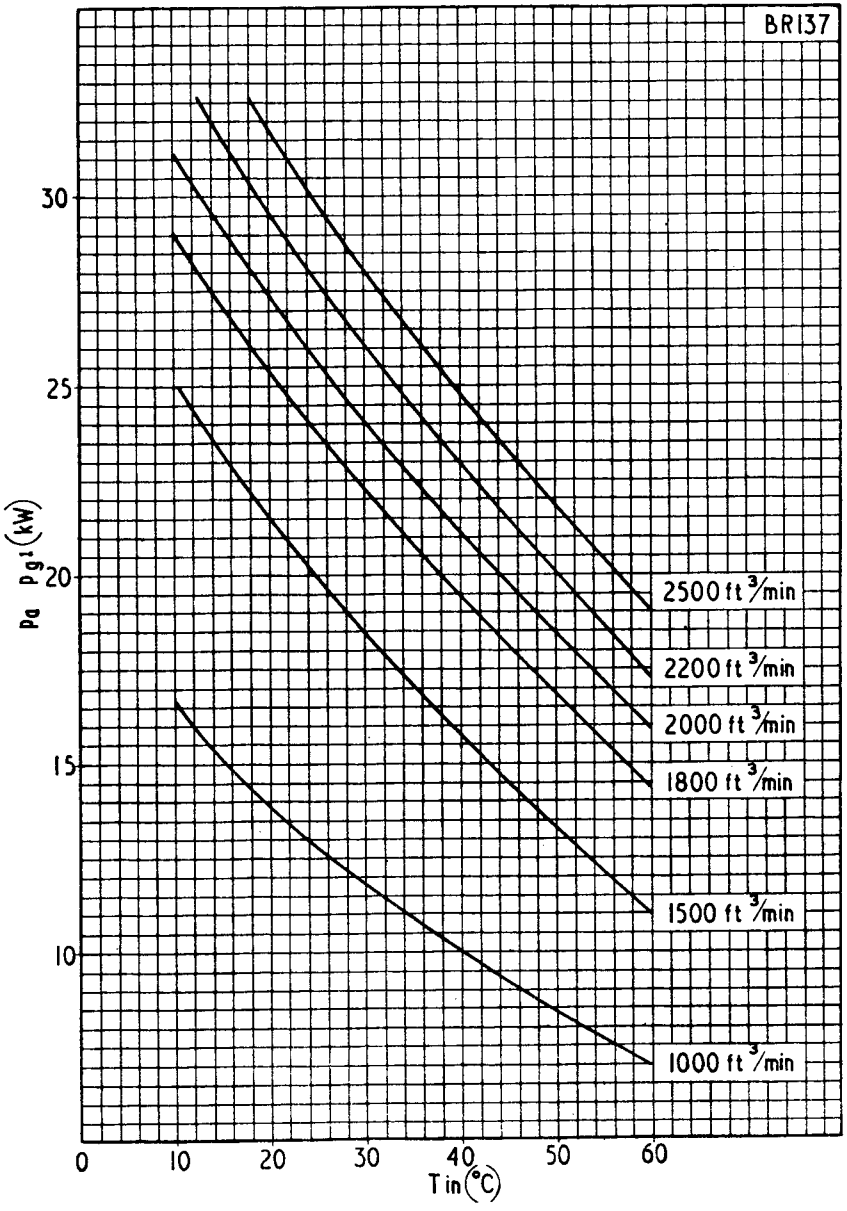

BR137
V_{g1} - V_a
V_{g1} +1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
0
− 100
− 200
− 300
− 400
TAKEN AT V_f MV
I_a (A)
V_a (kV)


BR137
TAKEN AT V_f MV
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1}
V_a & V_{g1} (kV)


BR137
TAKEN AT V_f MV
V_{g1}- V_a
I_{g1}(A)
V_a (kV)
V_{g1}+1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
18
16
14
12
10
8
6
4
2
0
-1
0
1
2
3
4
5
6
7
8


BR137
MARKED VOLTS
EMISSION AT
MARKED VOLTS
90% SATURATION
I_e(A)
60
50
40
30
-1·0
-0·5
0
+0·5
+1·0
← DECREASE V_f(MV) INCREASE →





PRINTED IN ENGLAND

Triode *Type BR 137B*

HF AMPLIFIER AND OSCILLATOR

General. The BR 137B is a forced-air-cooled transmitting triode fitted with a tungsten filament.

Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show the air inlet temperature °C/anode + grid loss; and air flow/air pressure. The temperature of the anode must not exceed 180°C.

The external grid and filament seals also require air cooling. The volume of air necessary is approximately 20 cu. ft. per minute, and should be directed on to the seals from above through a 1-in. nozzle. The temperature of the seals must not exceed 140°C.

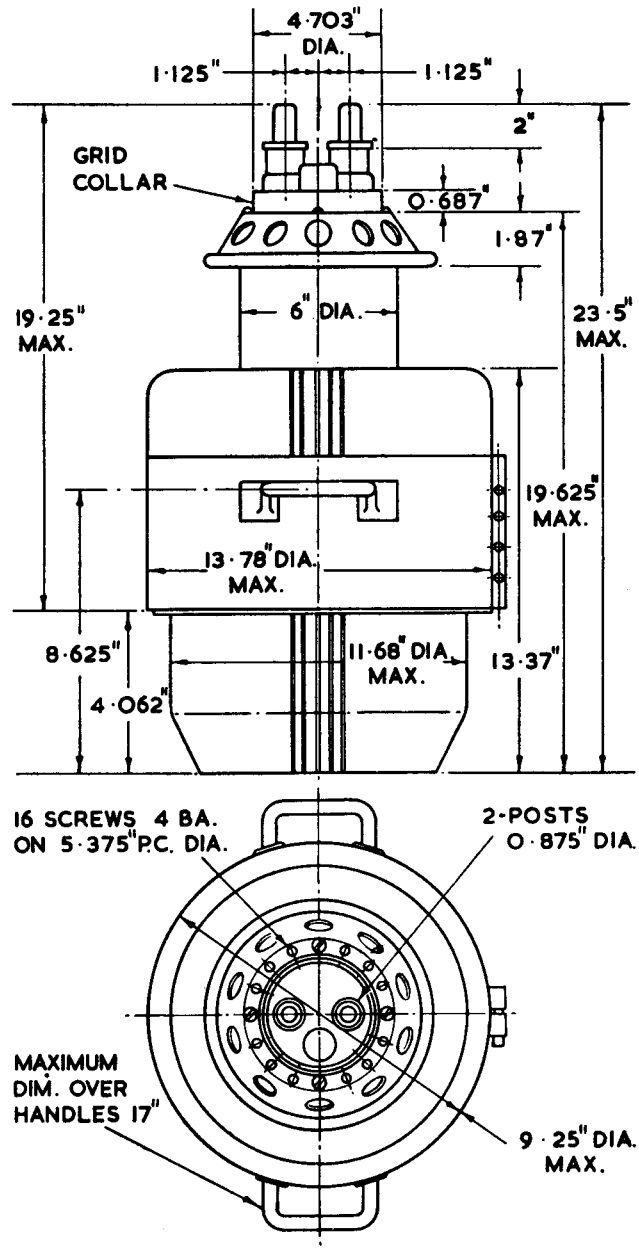
All air cooling supplies must be in operation before the application of any supply voltage and should be continued, for at least one minute, after the removal of all supply voltages.

Filament Starting. The filament current must not exceed 622 A, even momentarily, at any time.

APPROXIMATE DATA

V_f	19·5	V
I_f	415	A
$V_{a\ (max)}$	15	kV
$p_{a\ (max)}$	20	kW
$p_{gl\ (max)}$	3	kW
μ (taken at V_a 6 kV, I_a 2 A)	43	
g_m (taken at V_a 10 kV, I_a 1·5 A)	35	mA/V
$f_{(max)}$ (at full ratings)	50	Mc/s
$C_{a\text{-}gl}$	50	pF
$C_{a\text{-}k}$	3	pF
$C_{gl\text{-}k}$	100	pF

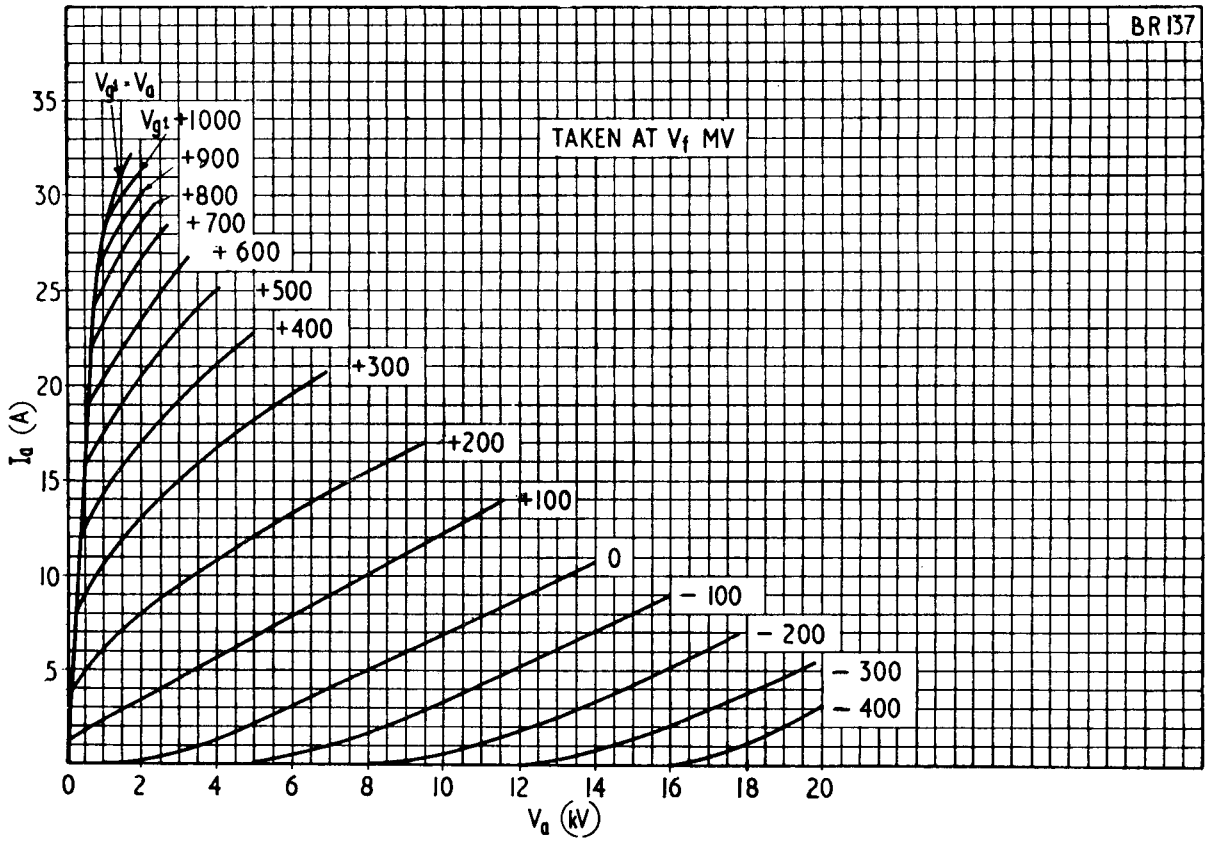
Marked Voltage. Each valve is marked with the filament voltage required to give 45 A peak emission at 90% saturation.

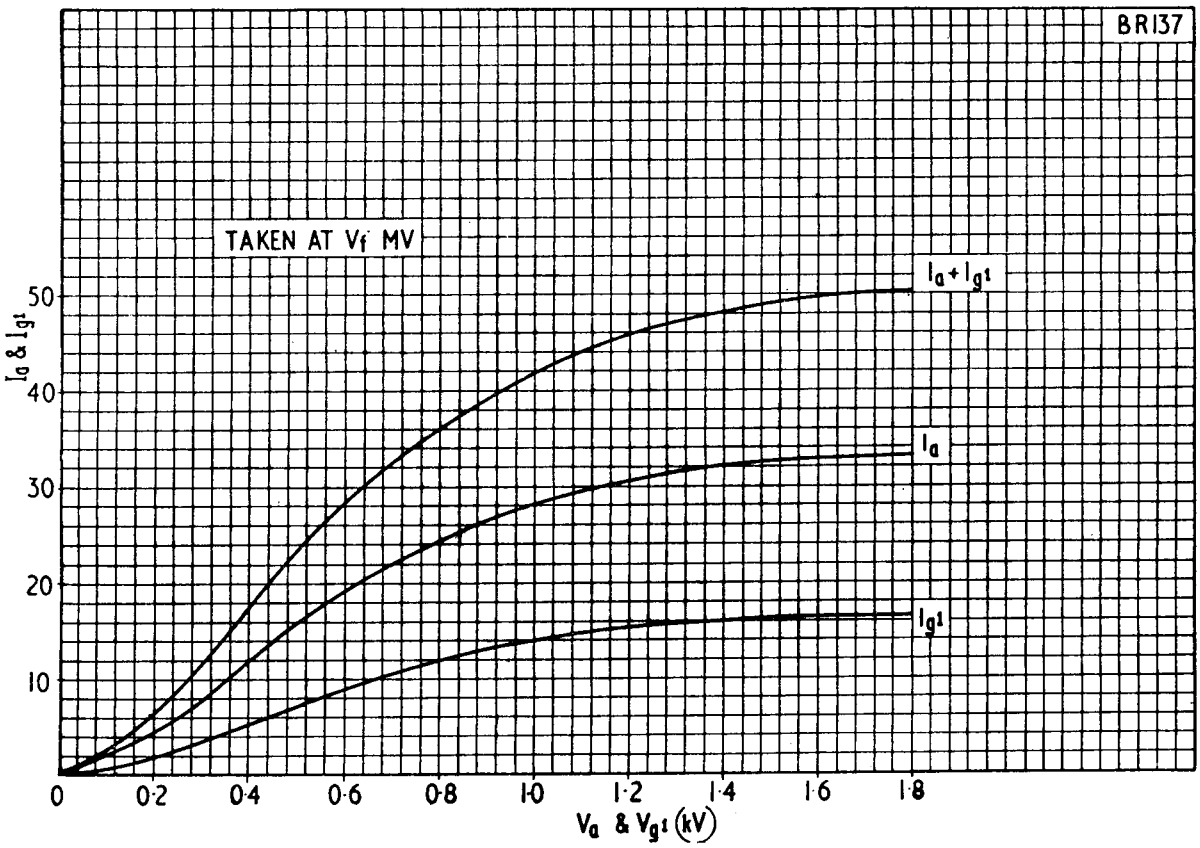


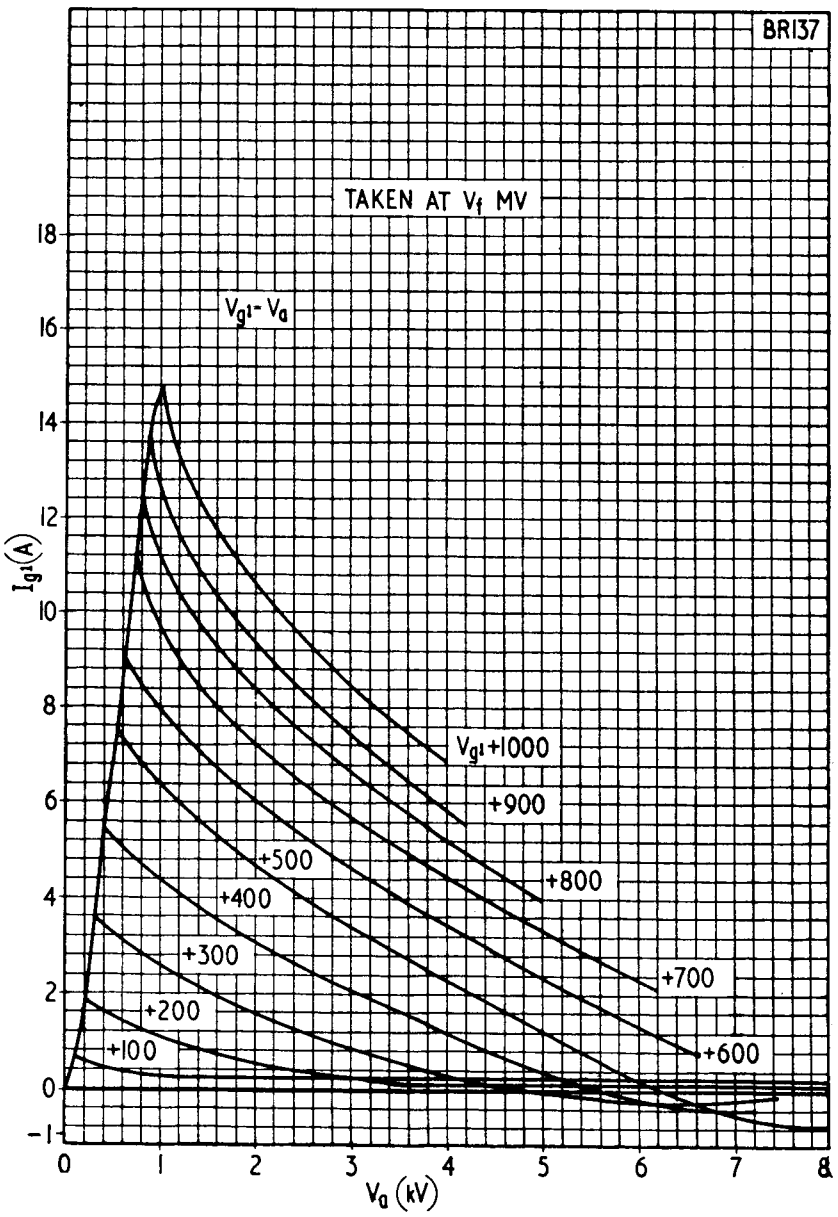
WEIGHT 196 lb. (89 kg.)

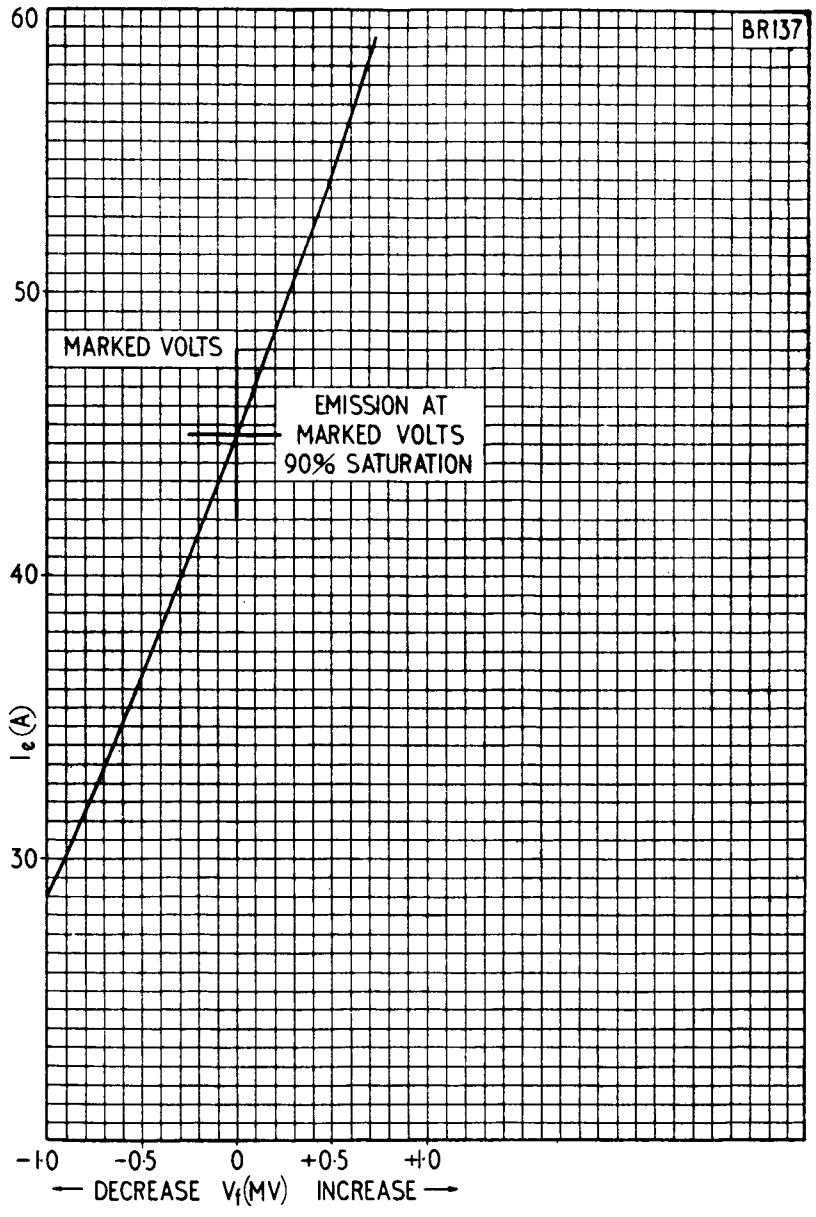
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

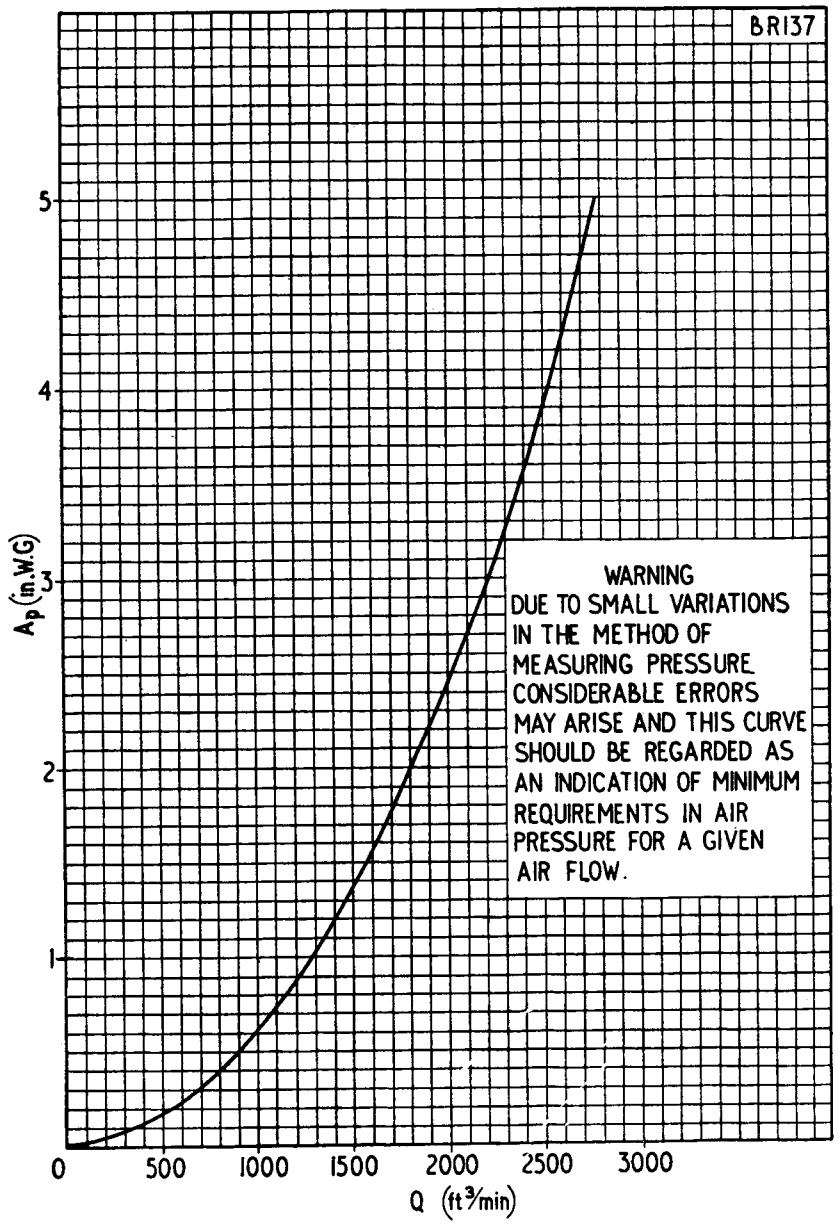
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

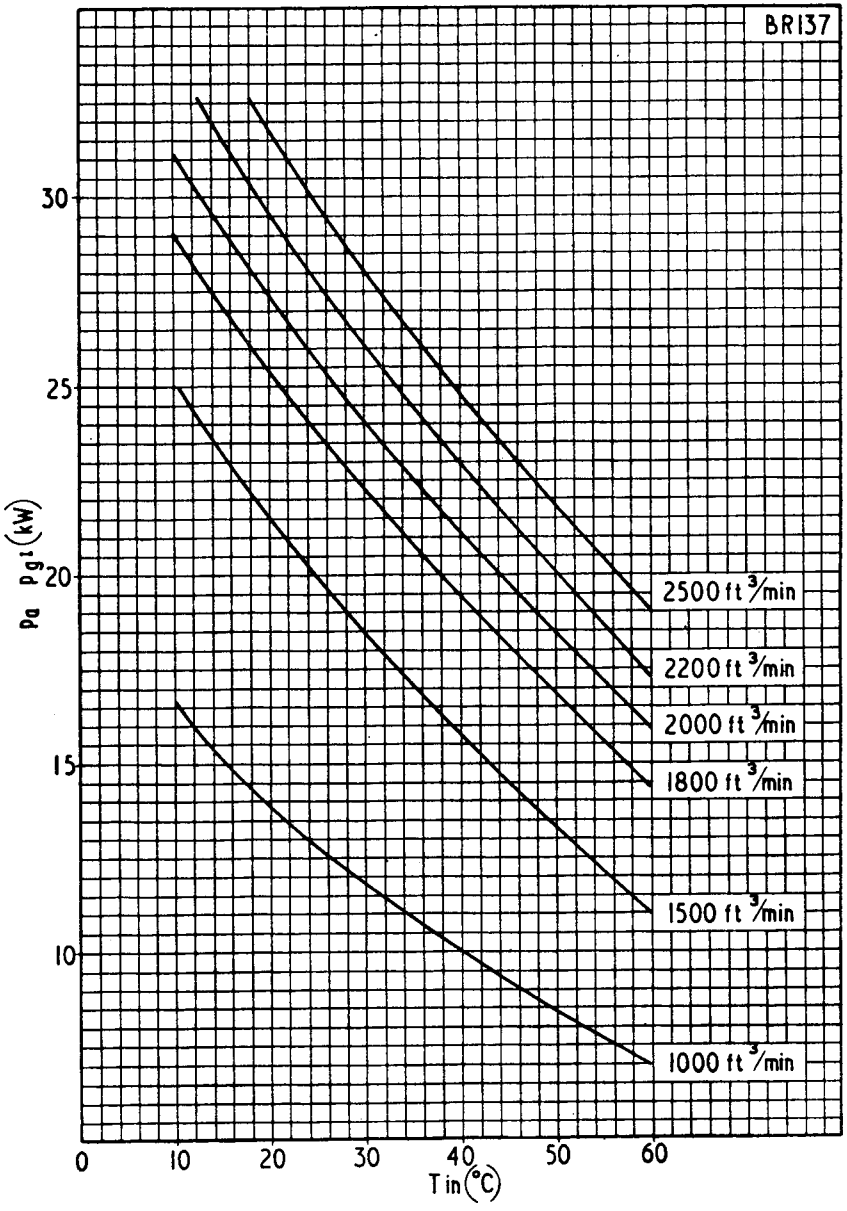

BR137
V_{g^1} - V_a
V_{g^1} +1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
0
− 100
− 200
− 300
− 400
TAKEN AT V_f MV
I_a (A)
V_a (kV)


BR137
TAKEN AT V_f MV
$I_a + I_{g^1}$
I_a
I_{g^1}
I_a & I_{g^1}
V_a & V_{g^1} (kV)


BR137
TAKEN AT V_f MV
V_{g1}-V_a
I_{g1}(A)
V_a (kV)
V_{g1}+1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
18
16
14
12
10
8
6
4
2
0
-1
0
1
2
3
4
5
6
7
8


BR137
I_e(A)
MARKED VOLTS
EMISSION AT
MARKED VOLTS
90% SATURATION
60
50
40
30
-1·0
-0·5
0
+0·5
+1·0
← DECREASE V_f(MV) INCREASE →





PRINTED IN ENGLAND

Triode *Type BR 154*

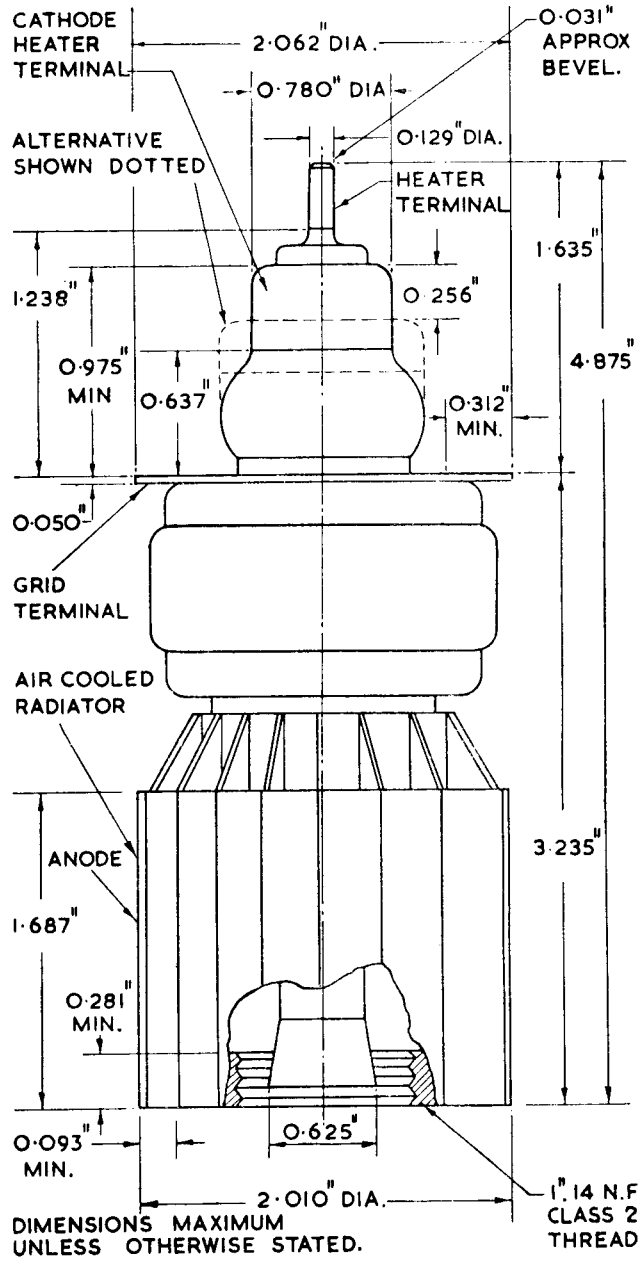
VHF AMPLIFIER

General. The BR 154 is a forced-air-cooled transmitting triode fitted with an indirectly heated oxide-coated cathode. The valve is particularly suitable for use in grounded-grid circuits.

Cooling. The anode requires forced air cooling. The air cooling characteristics given show radiator temperature rise °C/anode dissipation for various air-flow values. The following temperatures must not be exceeded.

Air inlet temperature	45°C
Radiator temperature (measured on the core at end away from incoming air)	180°C
Bulb temperature	180°C
Grid seal temperature	140°C

The air-flow should be directed towards the bulb and over the grid terminal. Air-flow should be started before the application of any supply voltage and should be continued for at least one minute after the removal of any supply voltages.



WEIGHT 1 lb. (0·5 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

APPROXIMATE DATA

V_h	3·3	V
I_h	11·5	A
$t_{k\ (min)}$	2	min.
μ	25	
$f_{(max)}$	220	Mc/s
$c_{a\text{-}g1}$	10·3	pF
$c_{a\text{-}k}$	0·5	pF
$c_{g1\text{-}k}$	26	pF

RF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY

(*Unmodulated, one valve, key down conditions*)

Maximum permissible ratings

V_a	1,500	V
V_{g1}	−250	V
I_a	300	mA
I_{g1}	50	mA
P_{in}	450	W
p_a	250	W

Typical Operation

Grounded-cathode circuit

f		220	Mc/s
V_a		1,500	V
V_{g1}	(i) from fixed supply of	−175	V
	(ii) via R_k	510	Ω
$v_{g1\ (pk)}$		210	V
I_a		300	mA
I_{g1} (a)		40	mA
P_{dr} (a)		8	W
P_{out} (a)		290	W

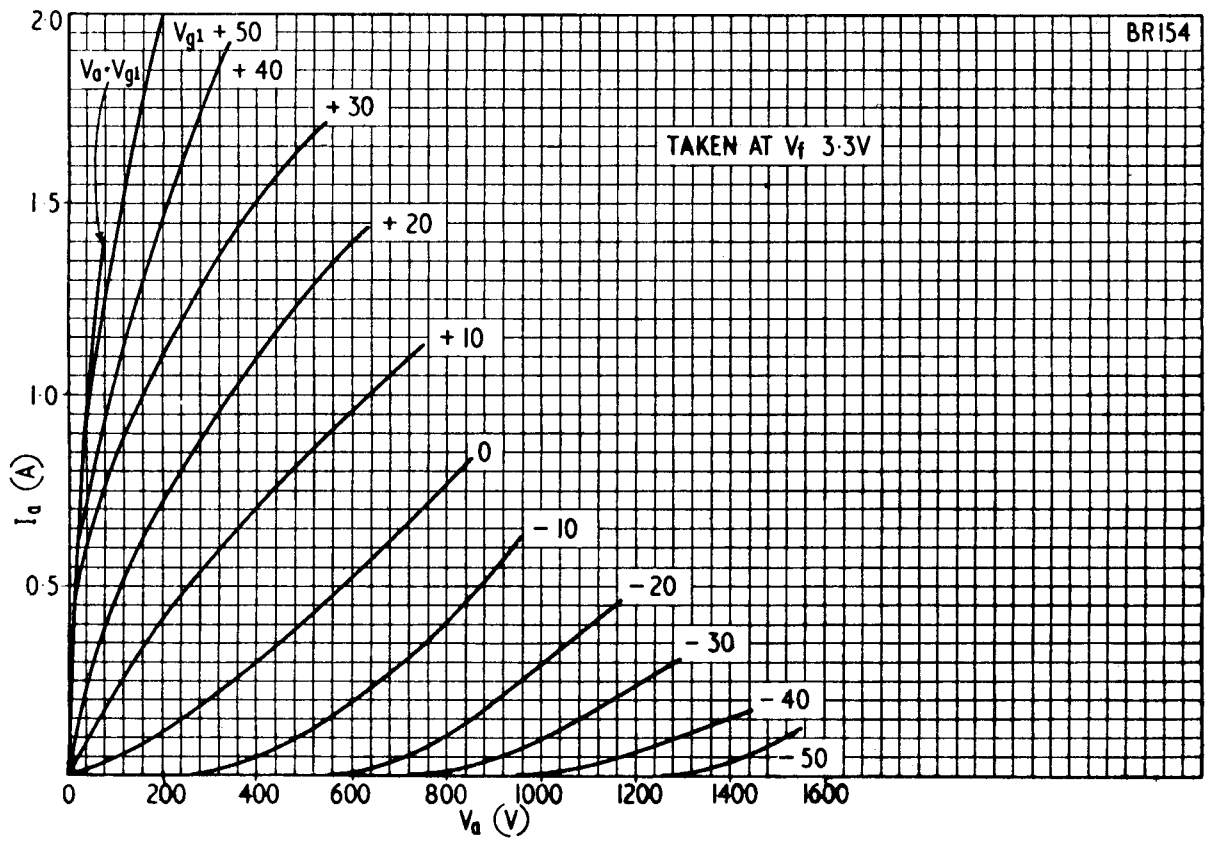
Grounded-grid circuit

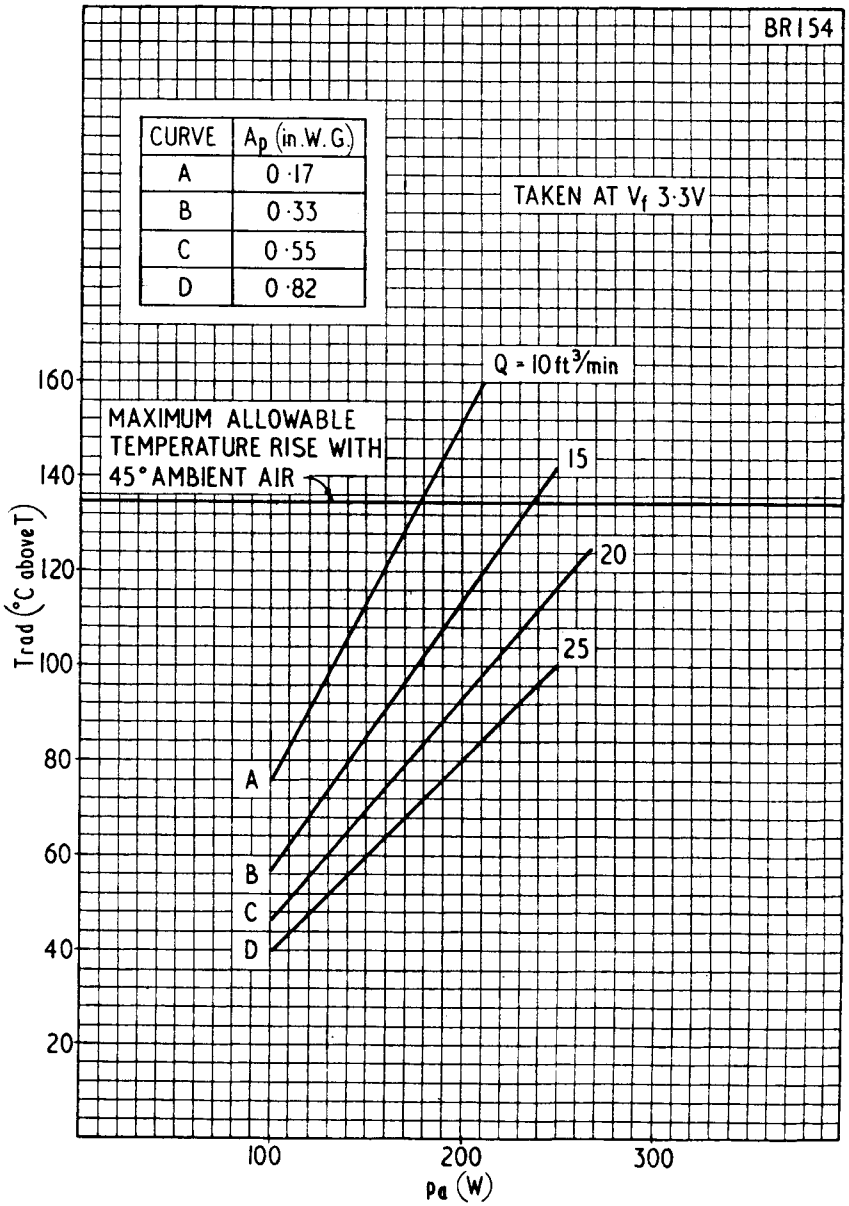
Same values as for grounded-cathode circuit but with following exceptions:

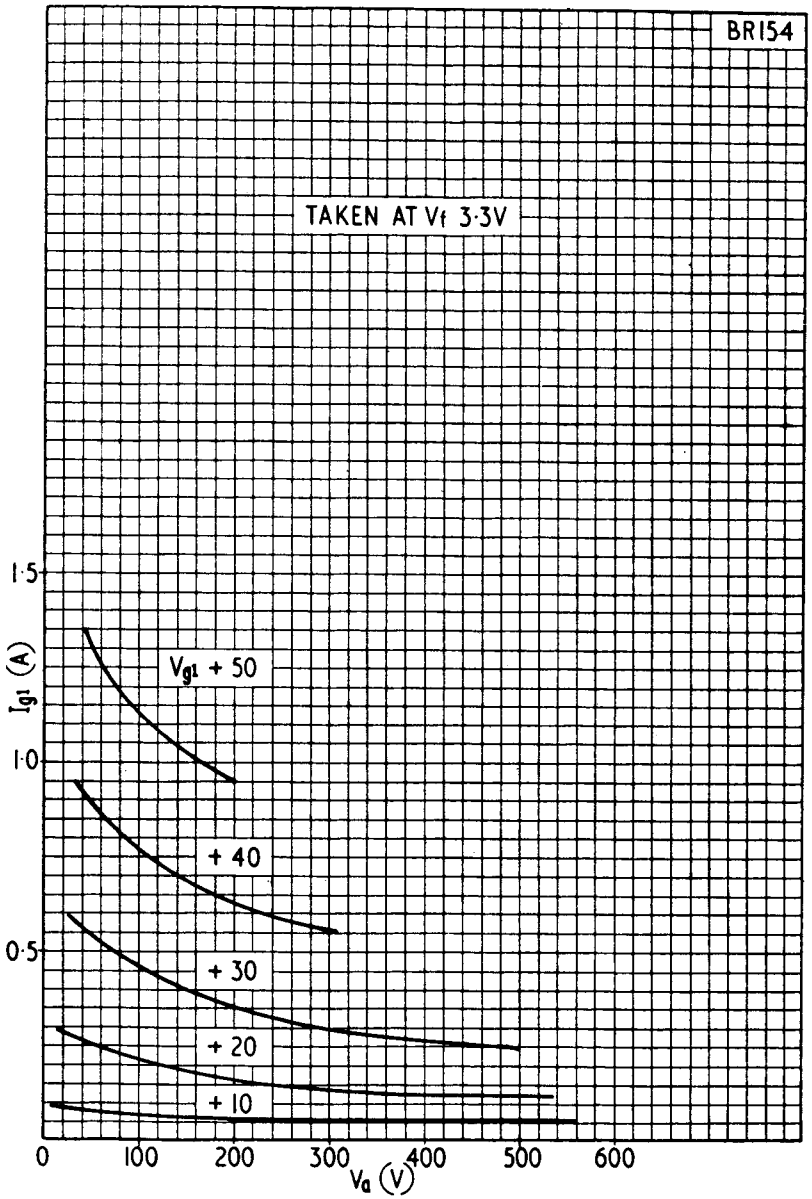
P_{dr} (a)	65	W
P_{out} (a)	325	W

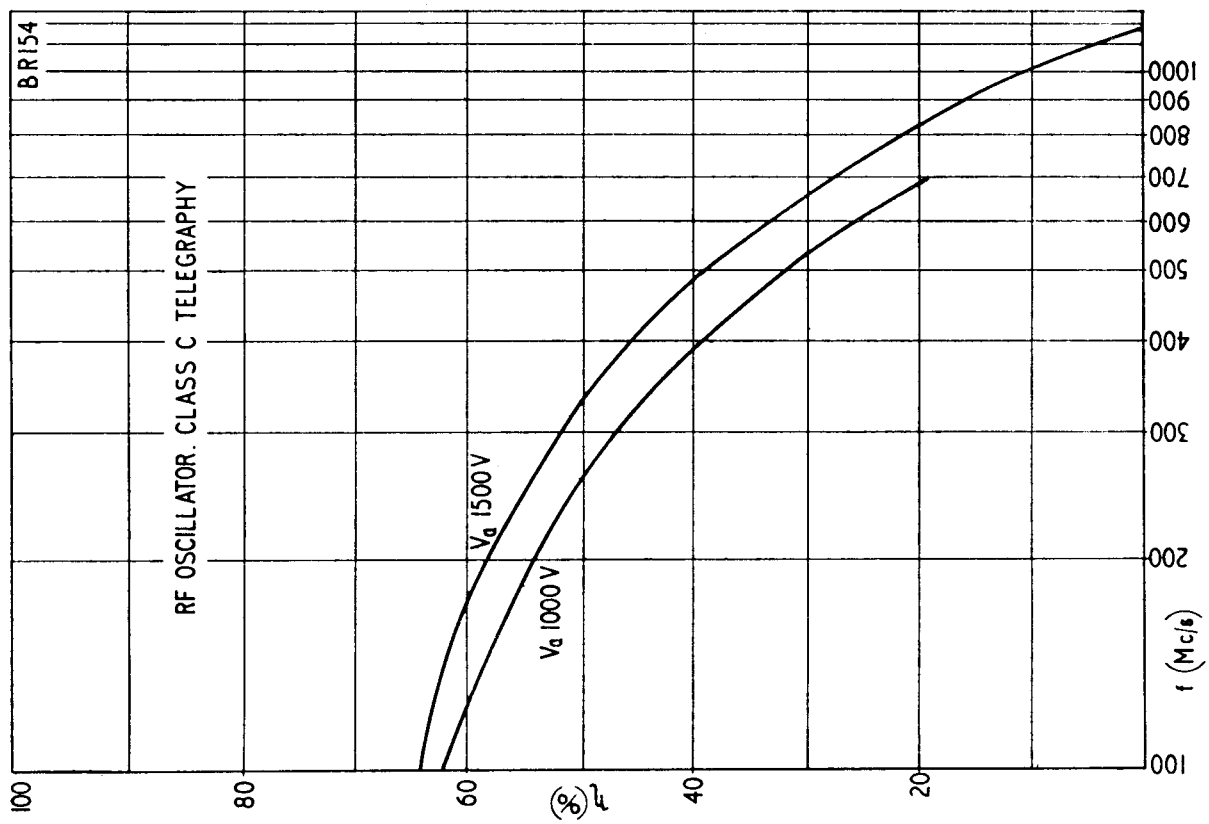
NOTES

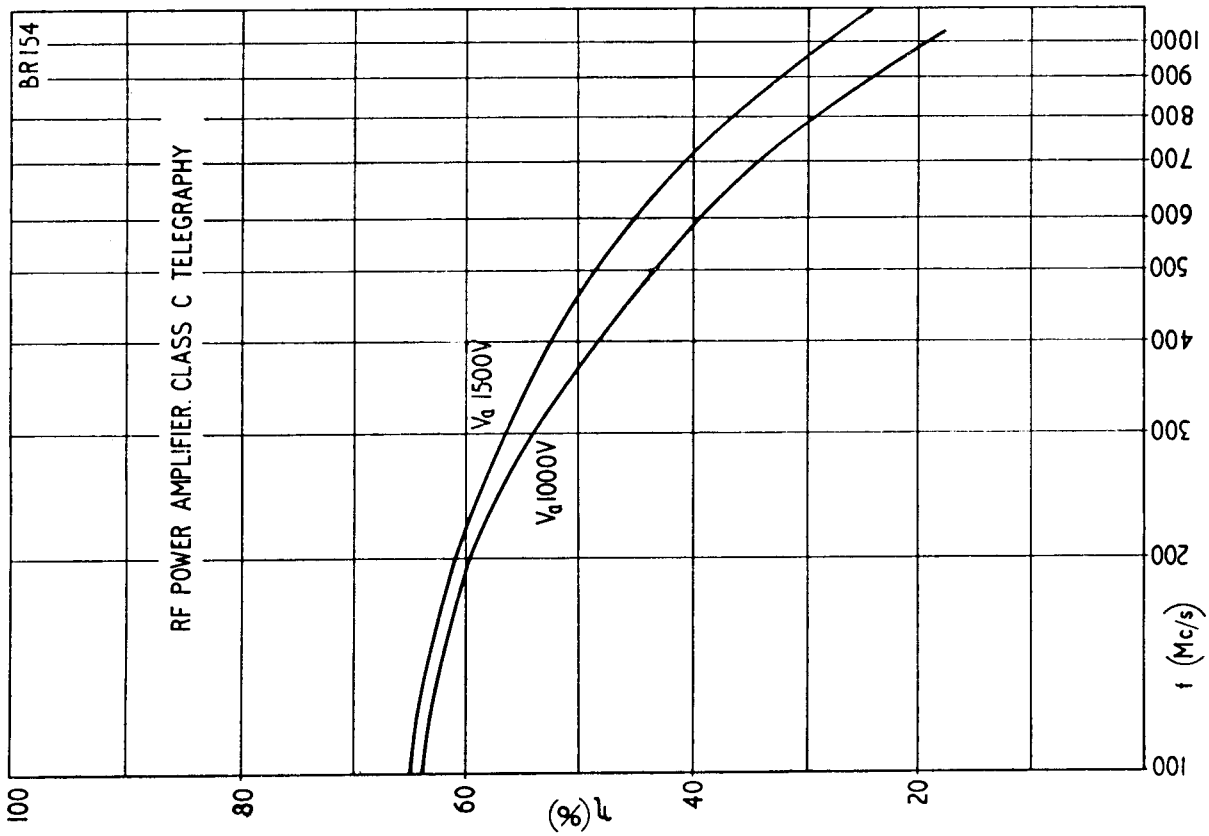
(a) Figures are approximate only.




BR154
TAKEN AT V_f 3·3V
CURVE | A_p (in.W.G.)
A | 0·17
B | 0·33
C | 0·55
D | 0·82
Q = 10ft³/min
15
20
25
MAXIMUM ALLOWABLE TEMPERATURE RISE WITH 45° AMBIENT AIR
A
B
C
D
Trad (°C above T)
160
140
120
100
80
60
40
20
100
200
300
Pa (W)


BR154
TAKEN AT V_f 3·3V
V_{g1} + 50
+ 40
+ 30
+ 20
+ 10
I_{g1} (A)
1·5
1·0
0·5
0
100
200
300
400
500
600
V_a (V)





PRINTED IN ENGLAND

Triode *Type BR 155*

VHF AMPLIFIER AND OSCILLATOR

General. The BR 155 is a forced-air-cooled transmitting triode fitted with a tungsten filament.

Filament Starting. The cold filament resistance is approximately 0·01 Ω. The filament current must not exceed 195 A at any time during the switching-on period.

Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show air inlet temperature °C/anode + grid loss; and air flow/air pressure.

The external grid and filament seals also require air cooling. The volume of air necessary will be approximately 10 cu. ft. per minute and should be directed vertically downwards on to the seals through a 1-in. nozzle.

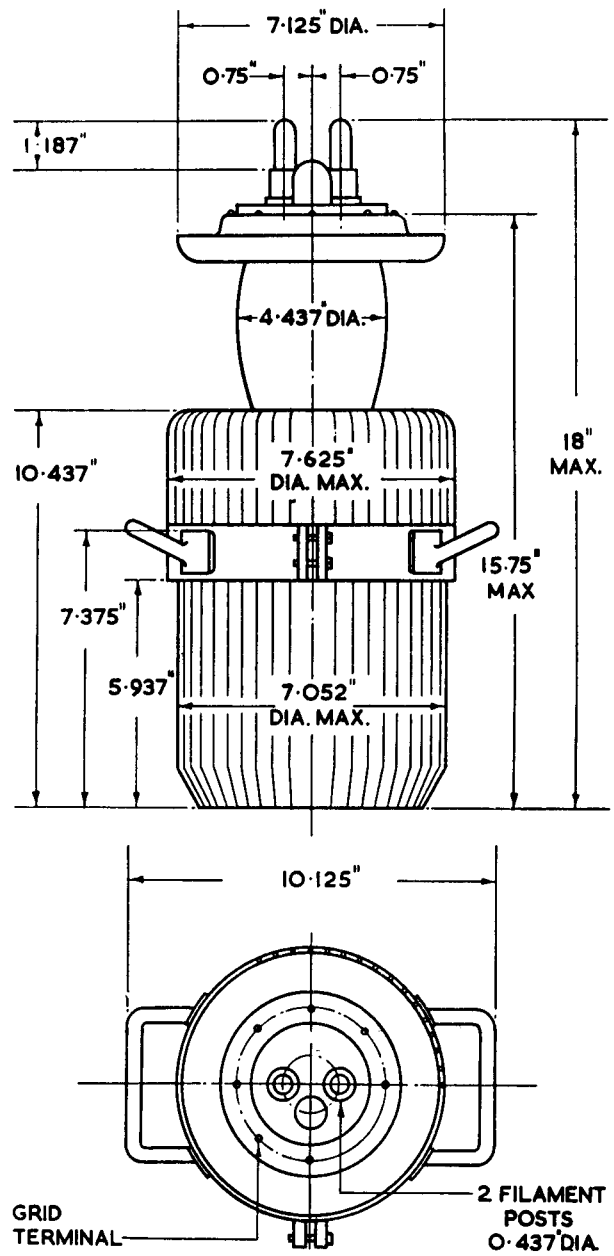
The temperature of the anode and that of the grid and filament seals must not exceed 180°C.

The air flow must be started before the application of any supply voltage and should be continued for at least one minute after the removal of all supply voltages.

APPROXIMATE DATA

V_f		17	V
I_f		130	A
$V_{a\ (max)}$	1. Class C RF Amplifier	10	kV
	2. Class C RF Amplifier Anode modulated	8	kV
$p_{a\ (max)}$		7·5	kW
$p_{gl\ (max)}$		0·35	kW
μ	taken at V_a 5 kV, I_a 1·5 A	50	
g_m	taken at V_a 5 kV, I_a 1·5 A	18	mA/V
$f_{(max)}$	(at full ratings)	100	Mc/s
$c_{a\text{-}gl}$		31	pF
$c_{a\text{-}k}$		3	pF
$c_{gl\text{-}k}$		44·5	pF

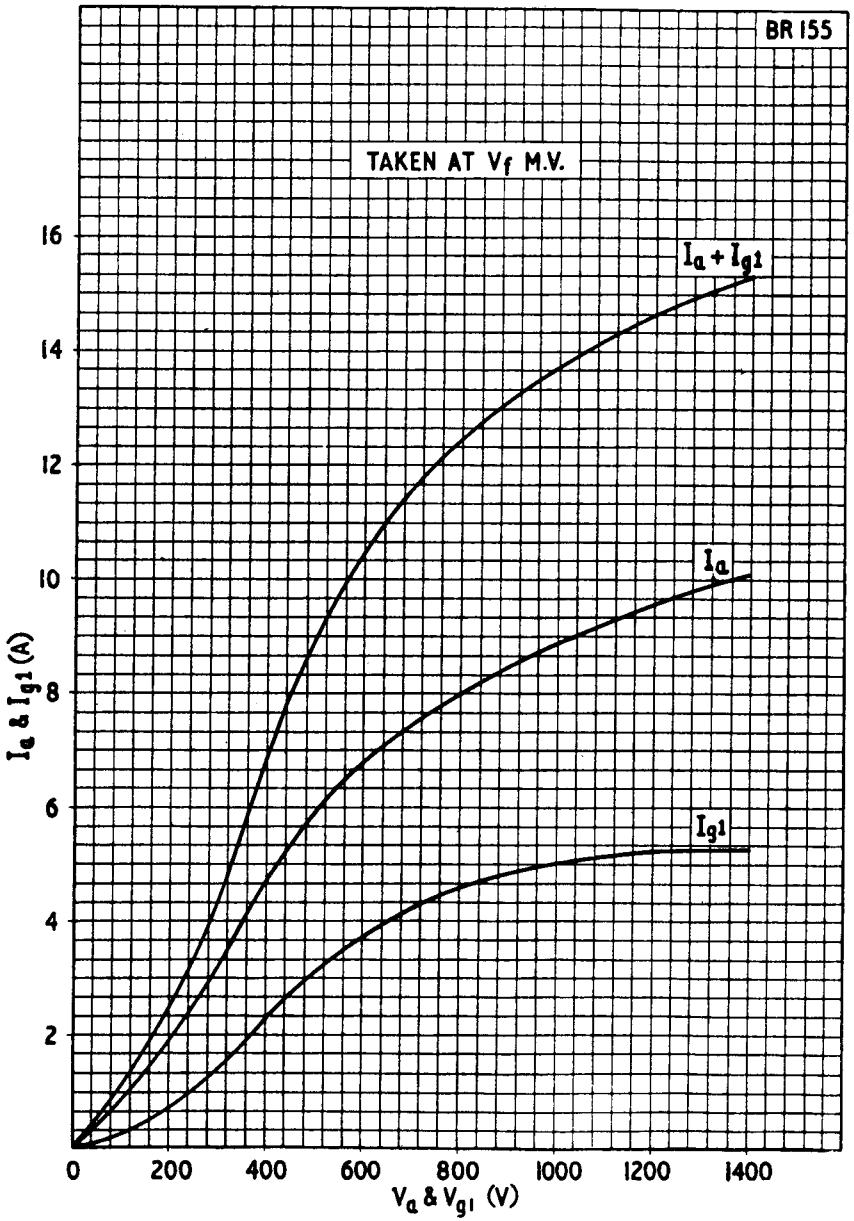
Marked Voltage. Each valve is marked with the filament voltage required to give 14 A peak emission at 90% saturation.

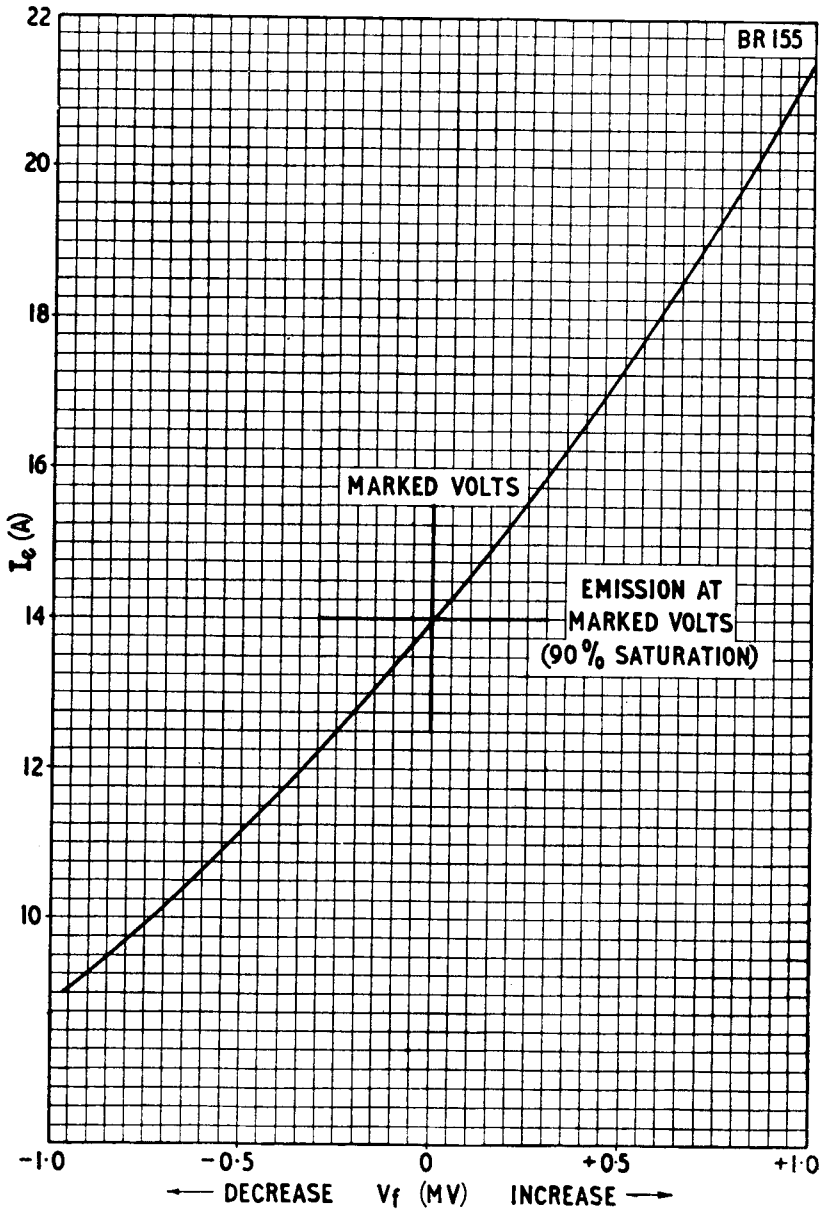


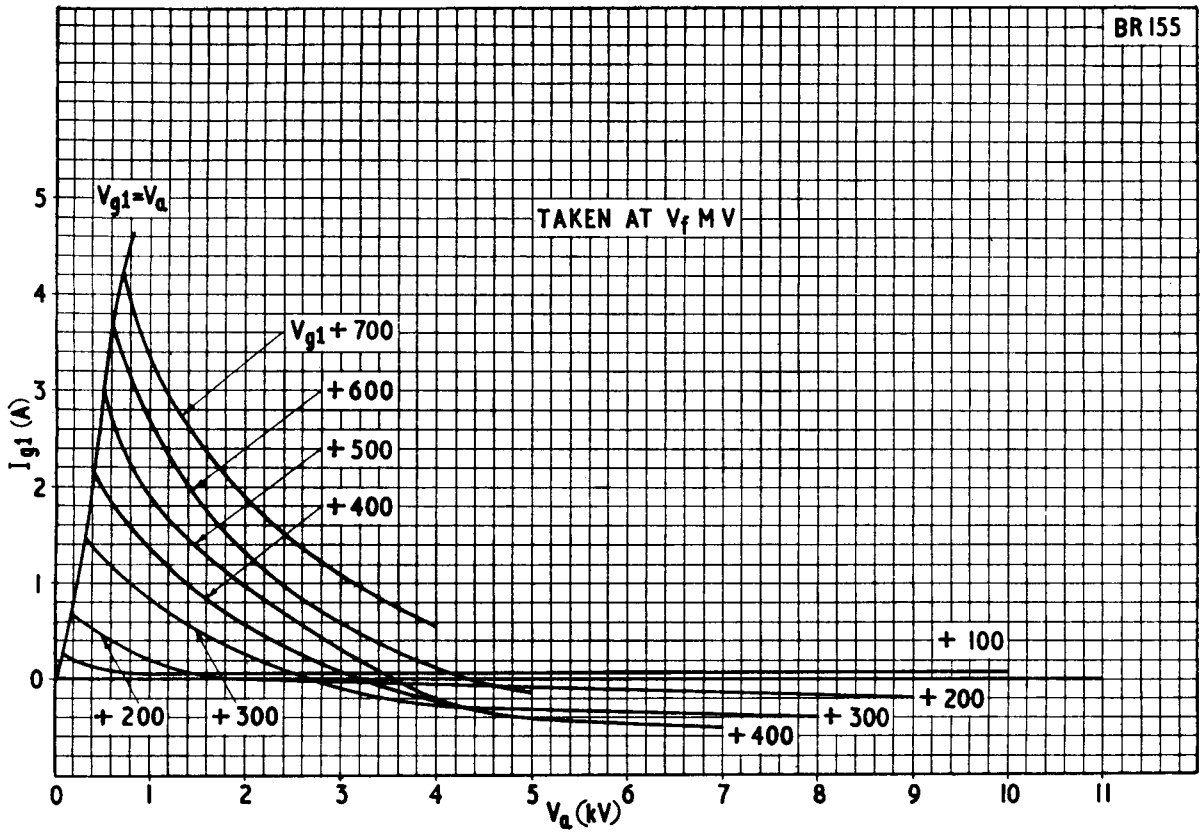
WEIGHT 28 lb. (12·7 kg.)

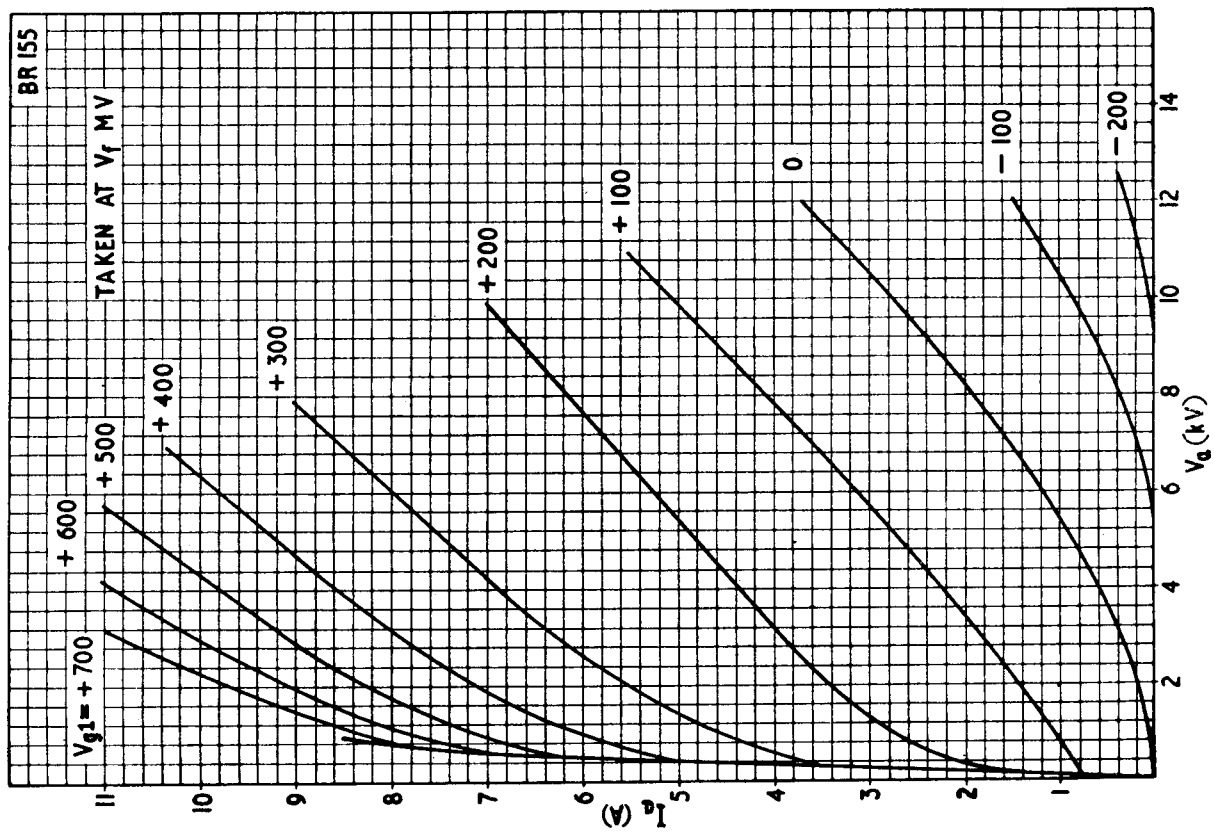
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

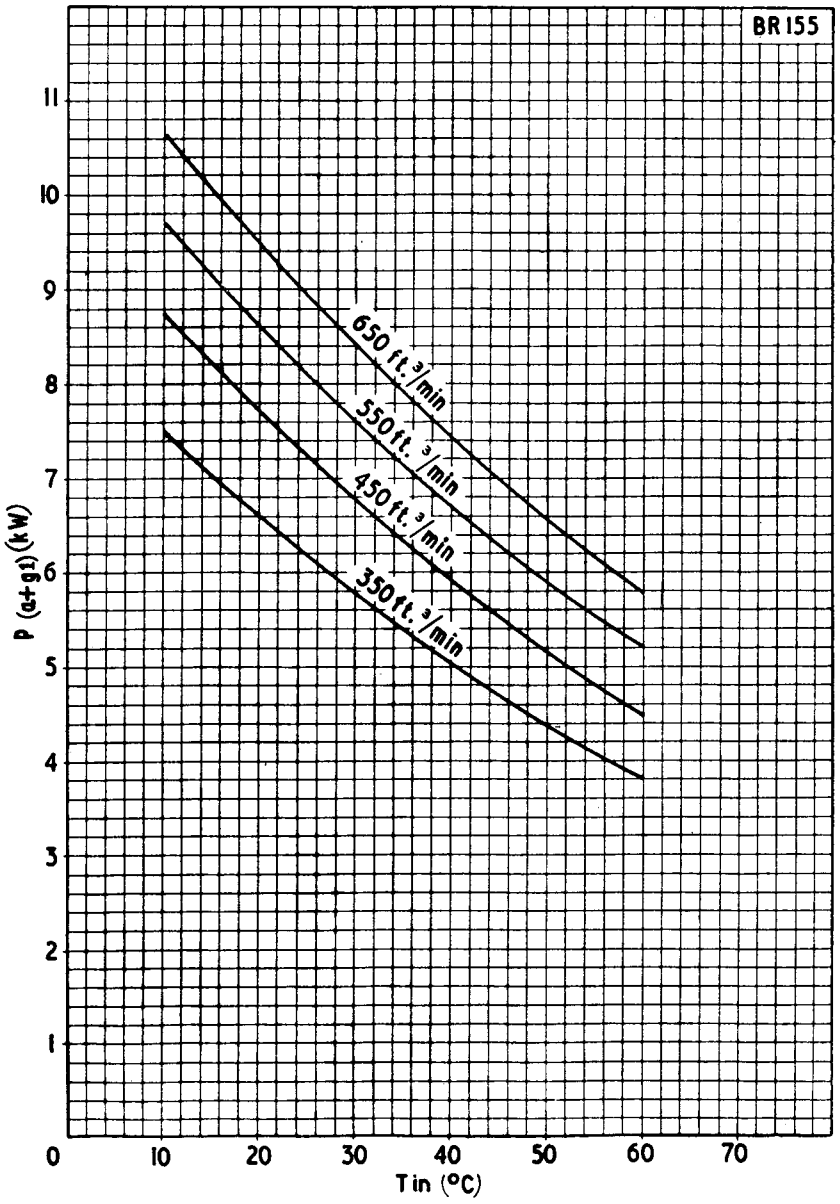
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

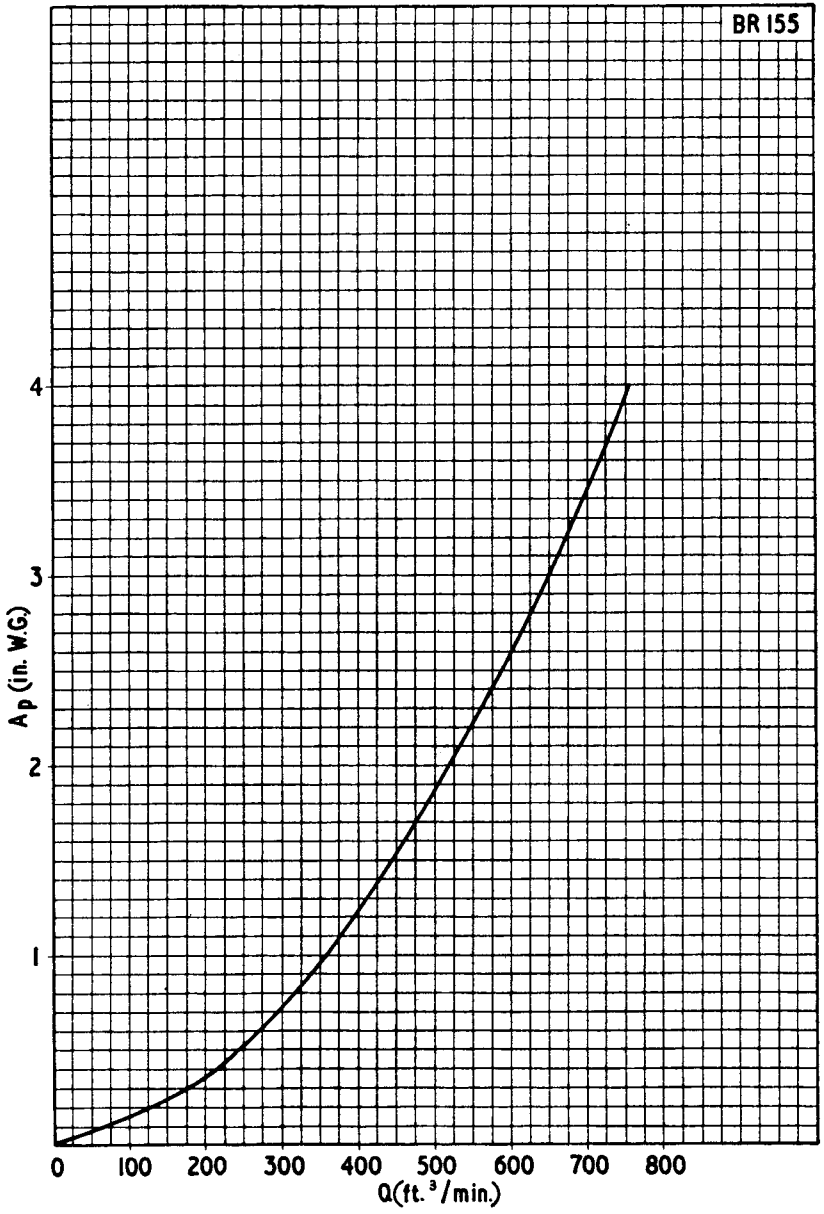

BR 155
TAKEN AT V_f M.V.
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1} (A)
16
14
12
10
8
6
4
2
0
200
400
600
800
1000
1200
1400
V_a & V_{g1} (V)


BR 155
MARKED VOLTS
EMISSION AT MARKED VOLTS (90% SATURATION)
I_e (A)
22
20
18
16
14
12
10
-1·0
-0·5
0
+0·5
+1·0
← DECREASE V_f (MV) INCREASE →


BR 155
TAKEN AT V_f M V
$V_{g1}=V_a$
V_{g1} + 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
I_{g1} (A)
V_a (kV)


BR 155
TAKEN AT V_f M V
V_{g1} = + 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
0
− 100
− 200
I_a (A)
V_a (kV)





PRINTED IN ENGLAND

Triode *Type BR 161*

HF AMPLIFIER AND OSCILLATOR

General. The BR 161 is a forced-air-cooled transmitting triode fitted with a thoriated tungsten filament.

Cooling. The anode requires forced air cooling. The air flow and air cooling characteristics given show air inlet temperature °C/anode + grid loss; and air flow/air pressure, for the conditions of suction air cooling.

The external grid and filament seals also require air cooling. The volume of air necessary is approximately 20 cu. ft. per minute and should be directed on to the seals from above through a 1-in. nozzle.

The temperature of the anode must not exceed 180°C and that of the grid and filament seals must not exceed 140°C.

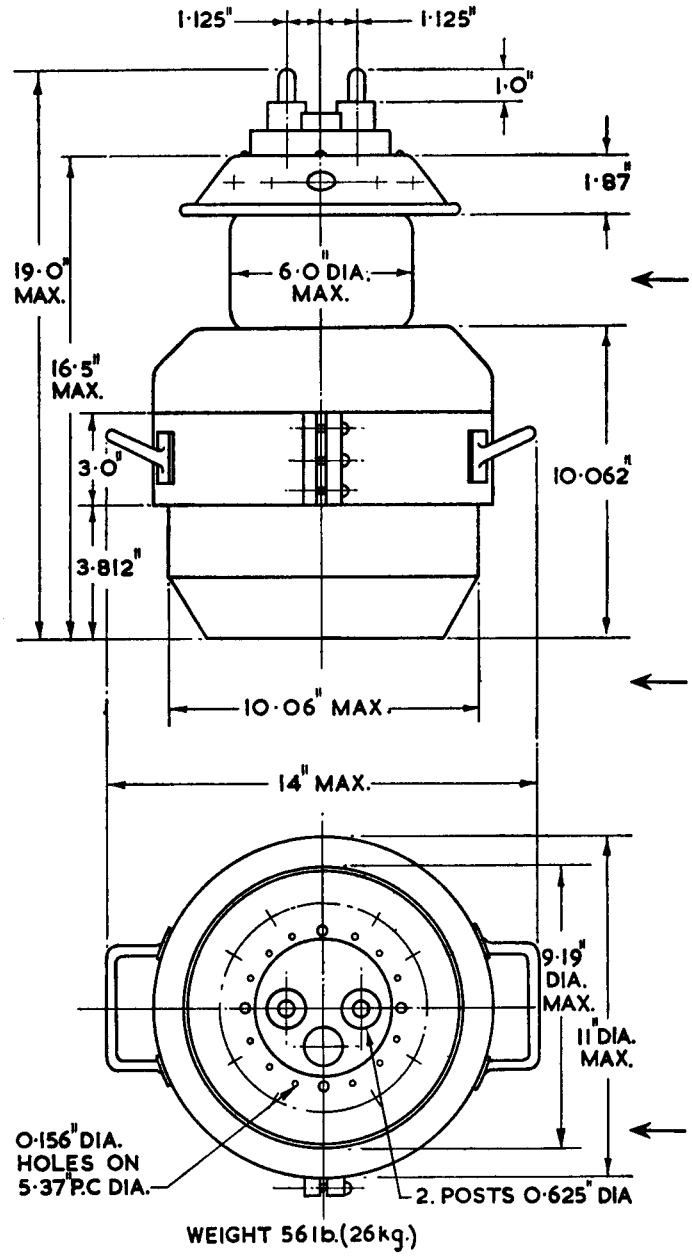
The air flow must be started before the application of any supply voltage and should be continued, for at least one minute, after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·0055 Ω. The filament current must not exceed 450 A at any time during the switching-on period.

APPROXIMATE DATA

V_f		9	V*
→ I_f		175	A
$V_{a\ (max)}$		12	kV
$p_{a\ (max)}$		15	kW
$p_{gl\ (max)}$		1	kW
μ	taken at V_a 9 kV,	45	
g_m	I_a 1·2 A	23	mA/V
$I_{k\ (pk)}$		45	A
$f_{(max)}$ (at full ratings)		50	Mc/s
$C_{a\text{-}gl}$		36	pF
$C_{a\text{-}k}$		1·5	pF
$C_{gl\text{-}k}$		57	pF

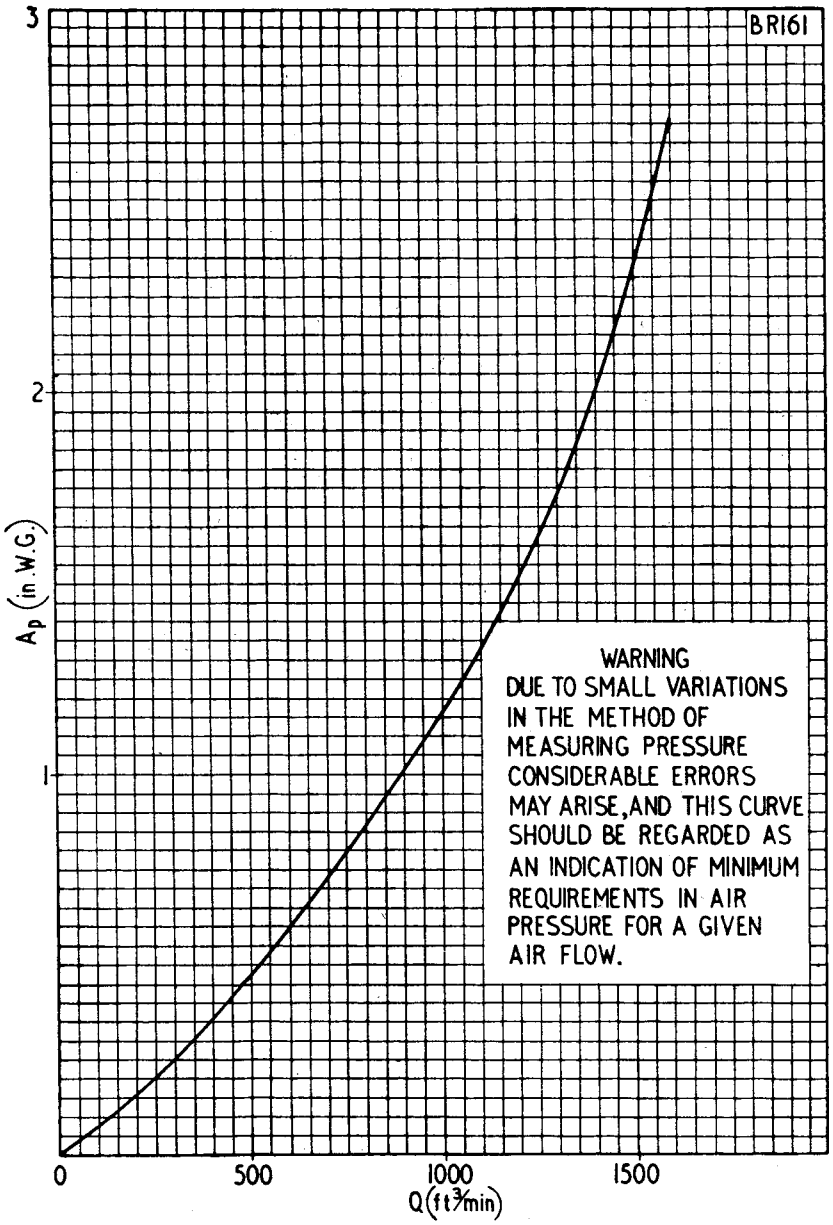
* This valve must be operated at the stated filament voltage.

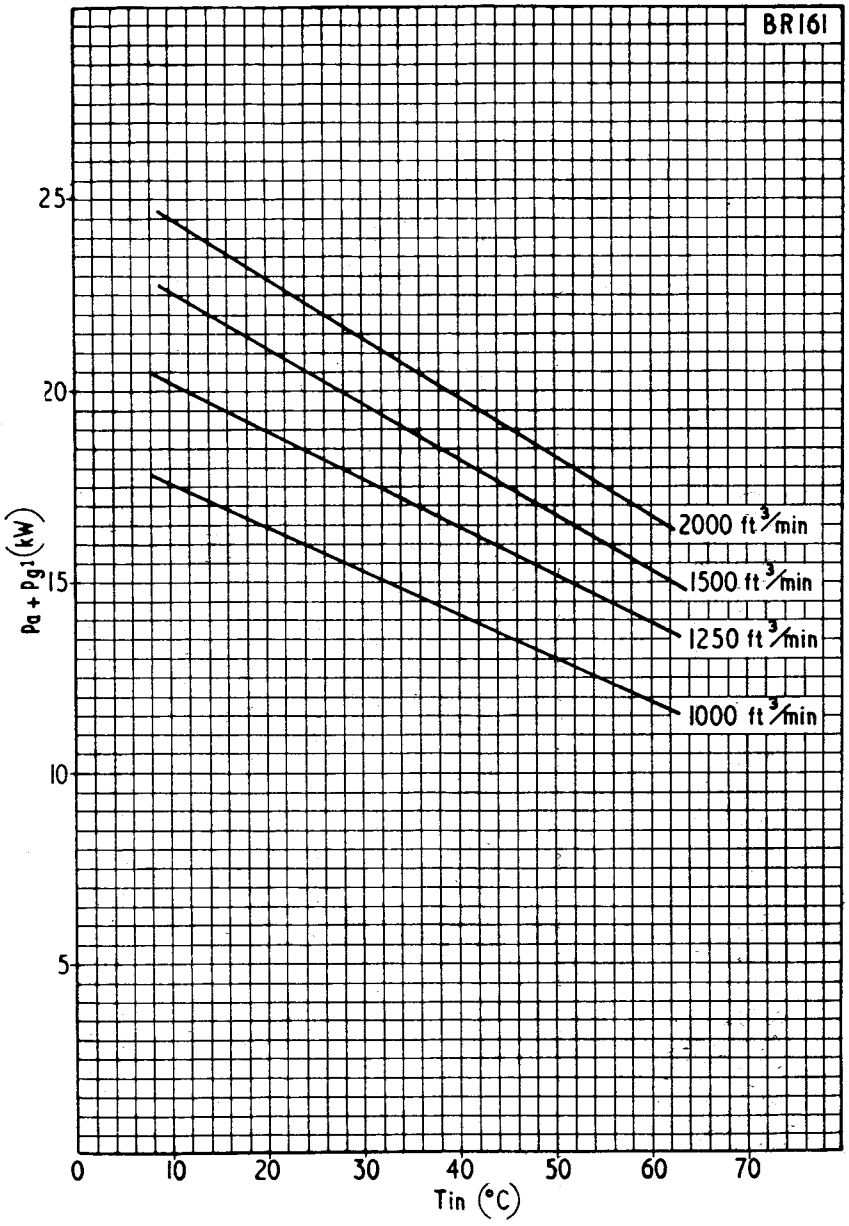


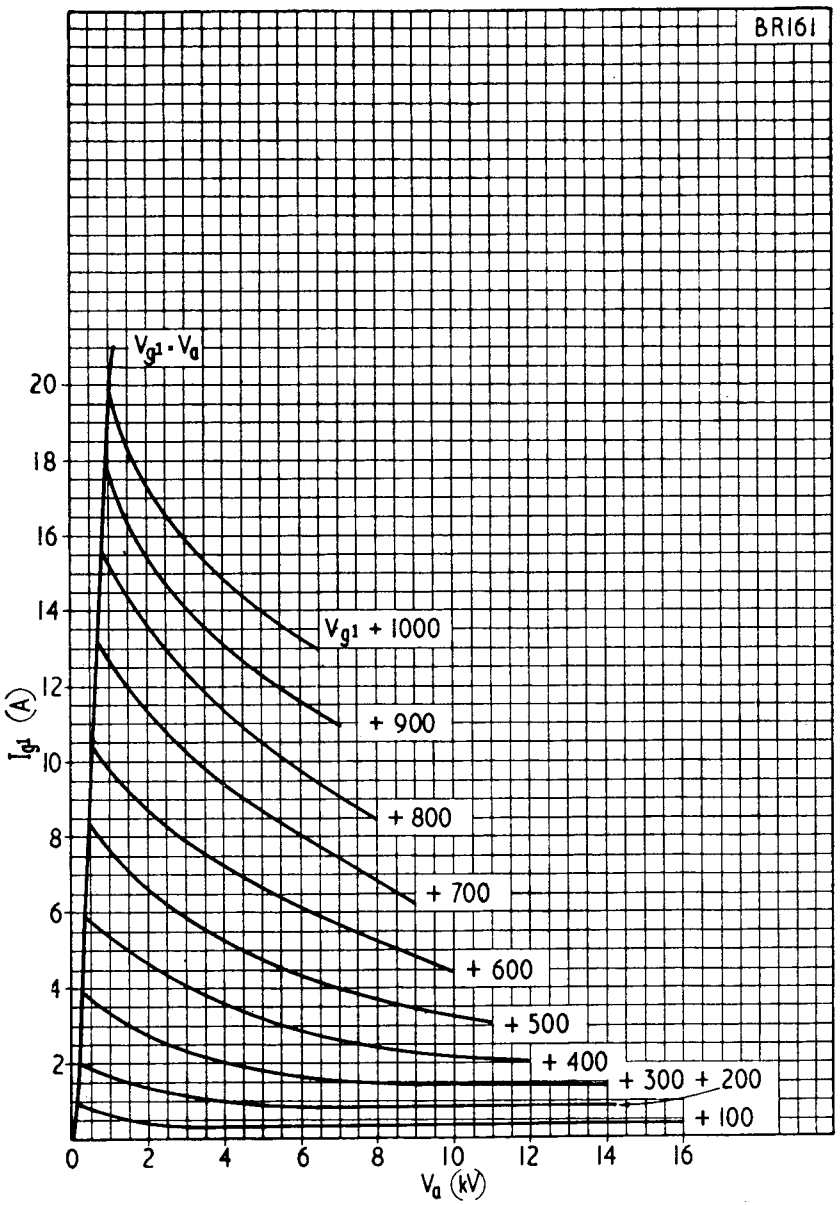
WEIGHT 56 lb. (26 kg.)

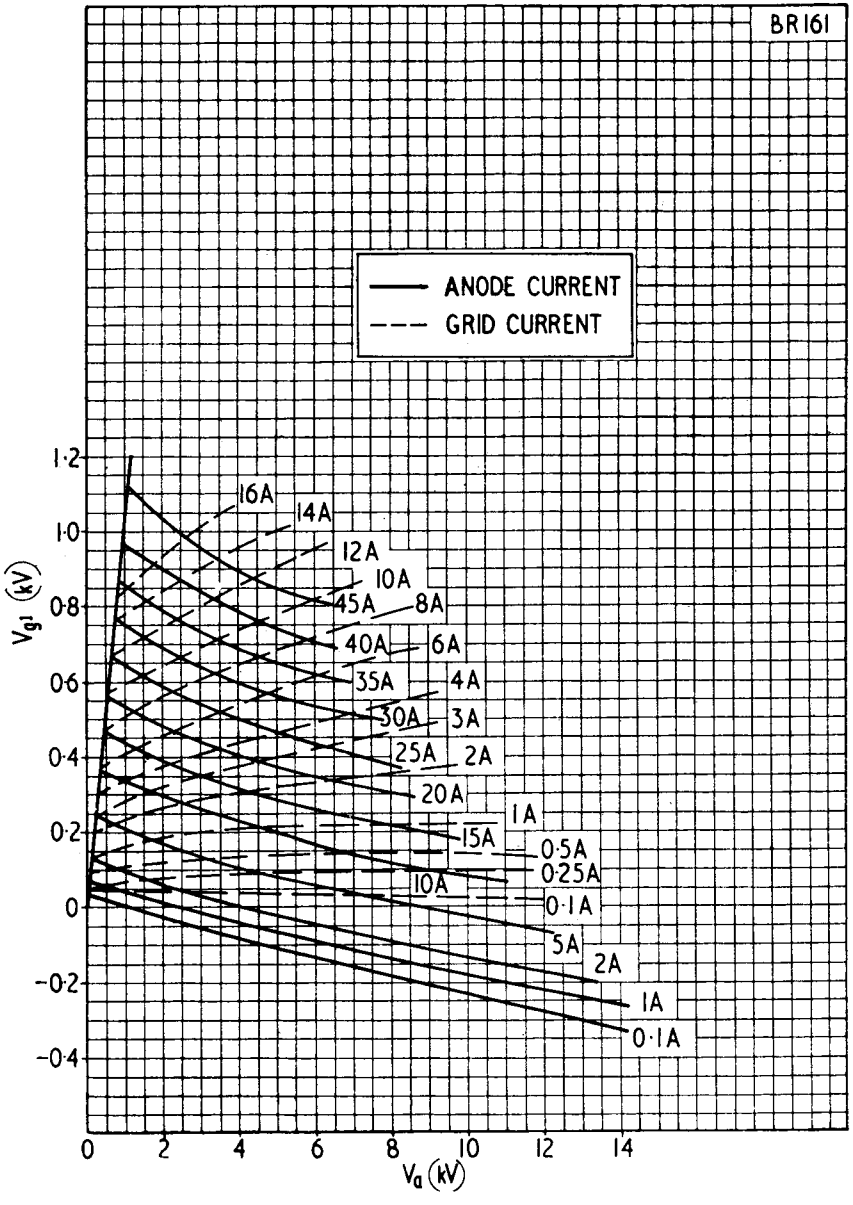
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

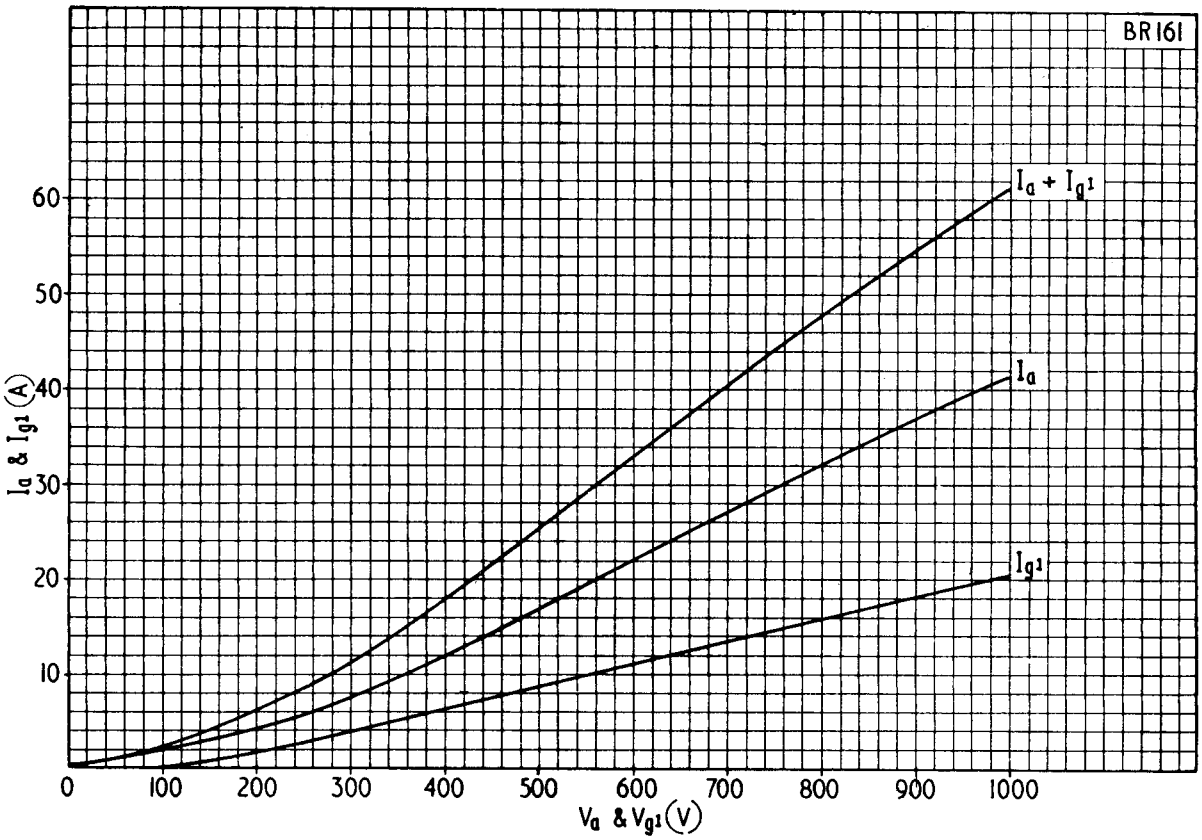
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

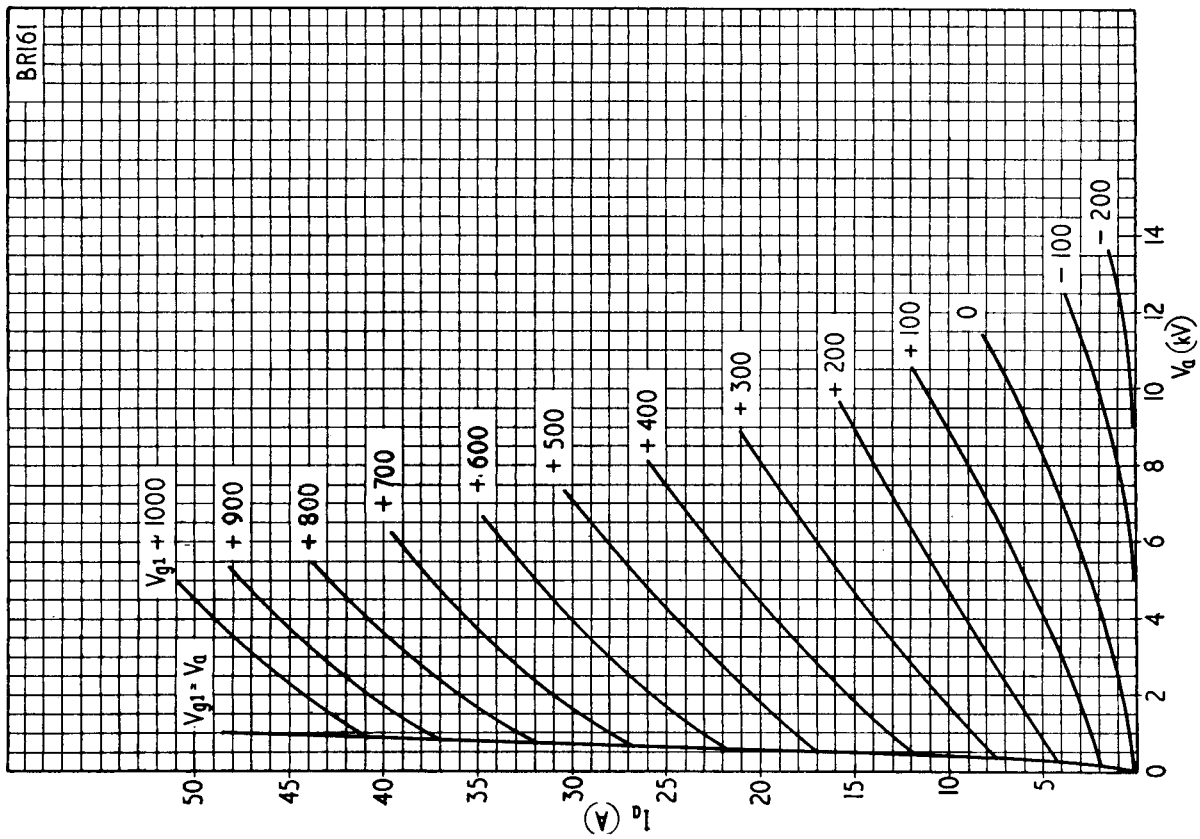

BR161
3
2
1
0
500
1000
1500
Ap (in.W.G.)
Q (ft³/min)
WARNING
DUE TO SMALL VARIATIONS IN THE METHOD OF MEASURING PRESSURE CONSIDERABLE ERRORS MAY ARISE, AND THIS CURVE SHOULD BE REGARDED AS AN INDICATION OF MINIMUM REQUIREMENTS IN AIR PRESSURE FOR A GIVEN AIR FLOW.


BR161
25
20
15
10
5
0
10
20
30
40
50
60
70
Pa + Pg1 (kW)
Tin (°C)
2000 ft³/min
1500 ft³/min
1250 ft³/min
1000 ft³/min


BR161
V_{g1} - V_a
V_{g1} + 1000
+ 900
+ 800
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
I_{g1} (A)
V_a (kV)


BR161
ANODE CURRENT
GRID CURRENT
16A
14A
12A
10A
45A
8A
40A
6A
35A
4A
30A
3A
25A
2A
20A
1A
15A
0·5A
0·25A
10A
0·1A
5A
2A
1A
0·1A
V_{g1} (kV)
V_a (kV)





PRINTED IN ENGLAND

Triode *Type BR 175*

HF AMPLIFIER AND OSCILLATOR

General. The BR 175 is a forced-air-cooled transmitting triode fitted with a tungsten filament.

Cooling. The anode requires forced air cooling. The characteristics given show the air inlet temperature °C/anode + grid loss, for the conditions of suction air cooling.

The temperature of the anode must not exceed 180°C.

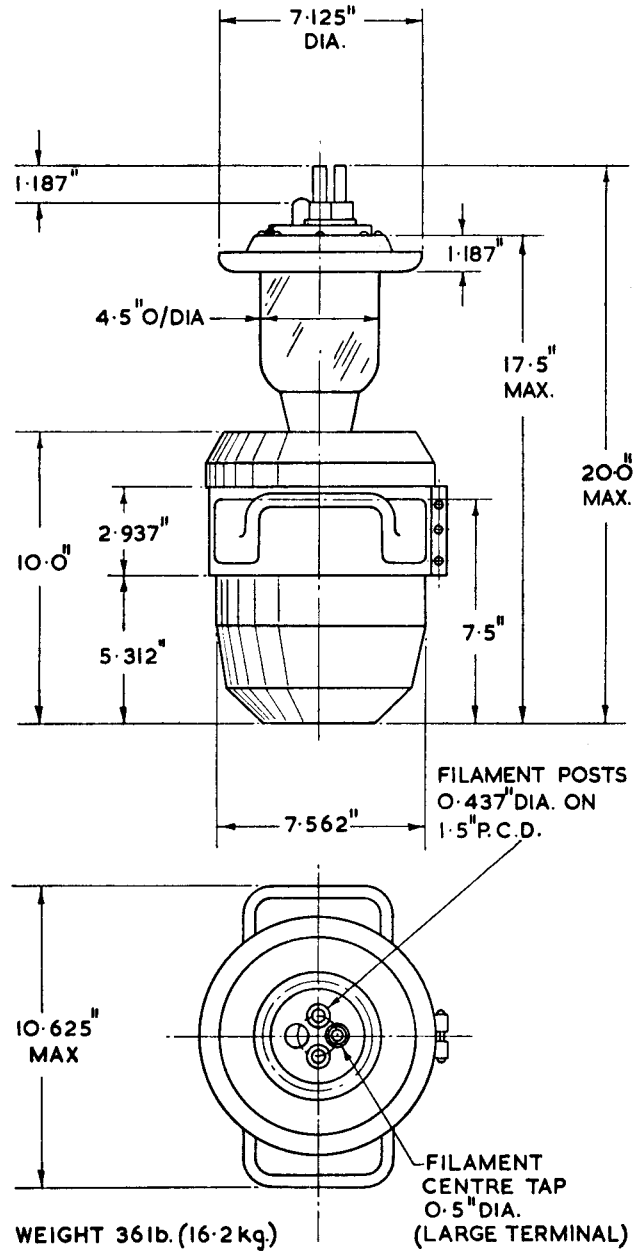
The air flow must be started before the application of any supply voltage and should be continued, for at least one minute, after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·031 Ω. The filament current must not exceed 90 A at any time during the switching-on period.

APPROXIMATE DATA

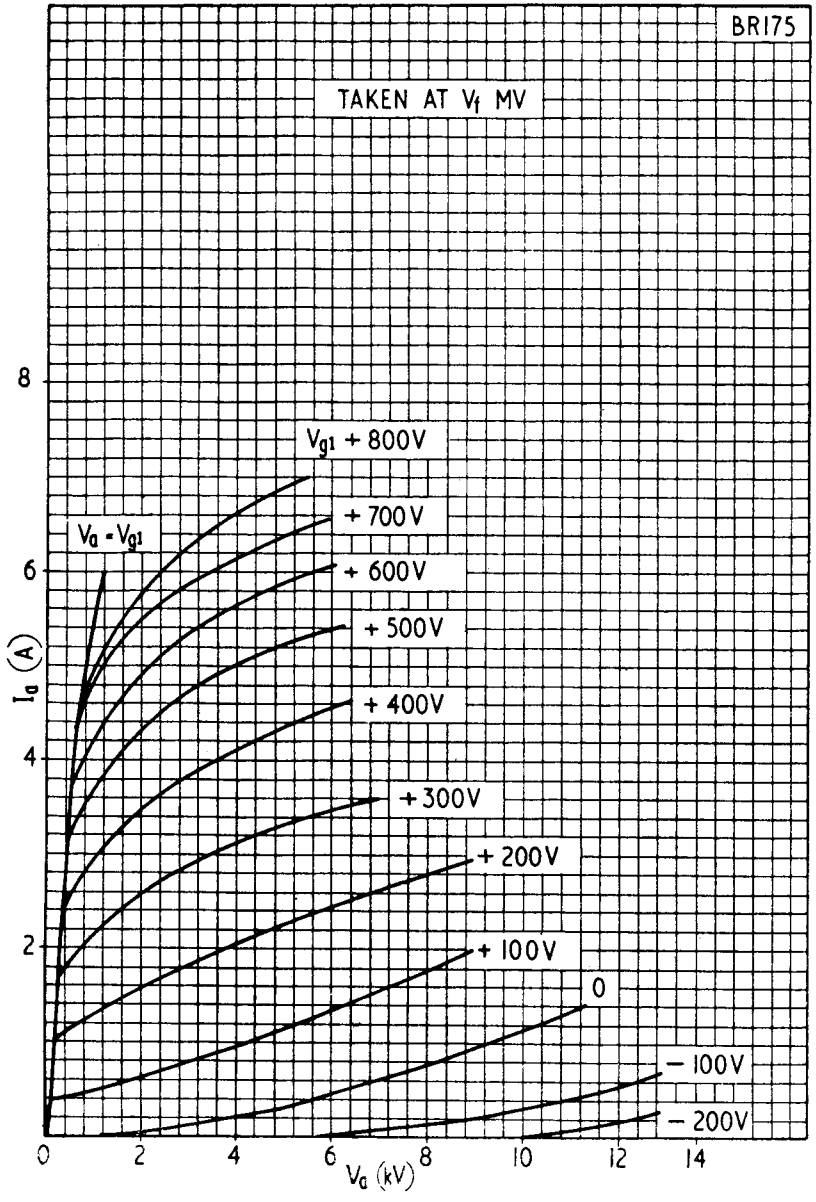
V_f	22	V
I_f	60	A
$V_{a\ (max)}$	12·5	kV
$p_{a\ (max)}$	4	kW
$p_{gl\ (max)}$	0·6	kW
μ (taken at V_a 8 kV, I_a 0·5 A)	50	
$f_{(max)\ (at\ full\ ratings)}$	50	Mc/s
$c_{a\text{-}gl}$	27	pF
$c_{a\text{-}k}$	1·5	pF
$c_{gl\text{-}k}$	39	pF

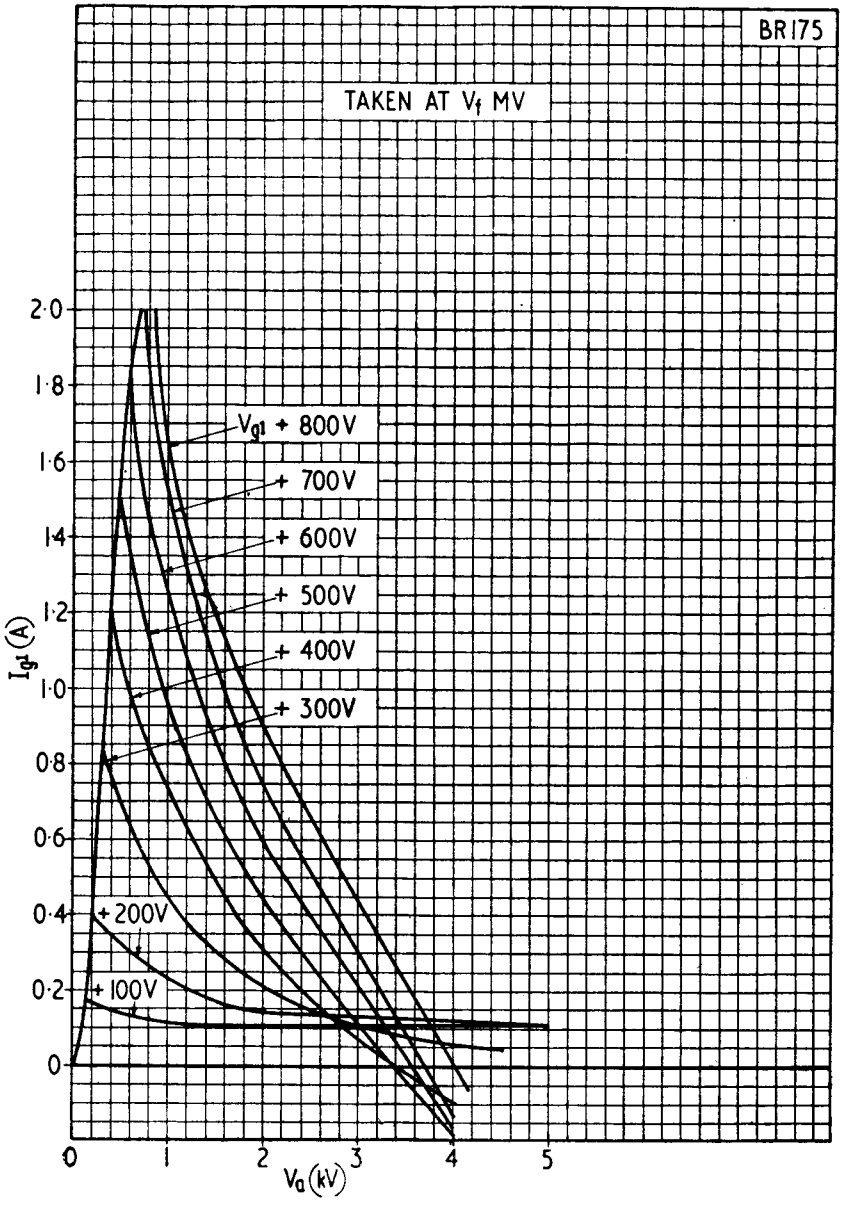
Marked Voltage. Each valve is marked with the filament voltage required to give 8·5 A peak emission at 90% saturation.

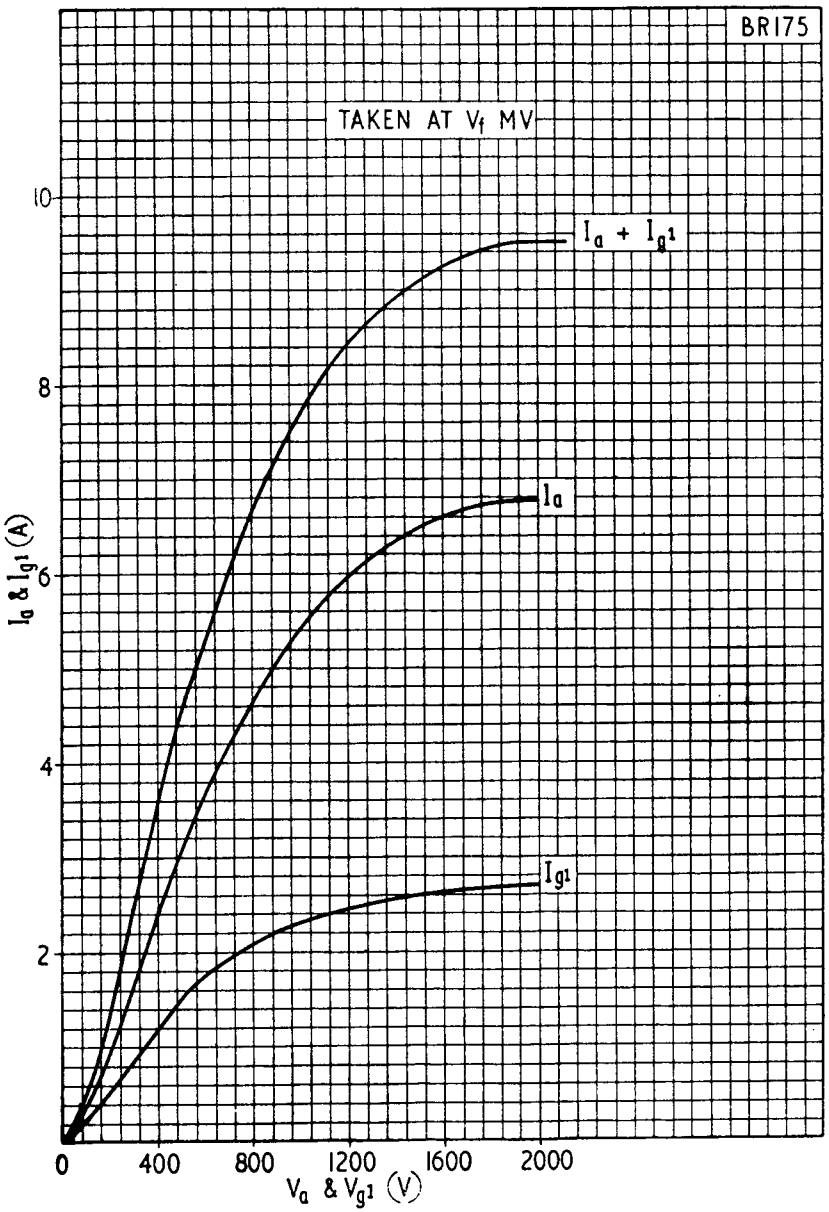


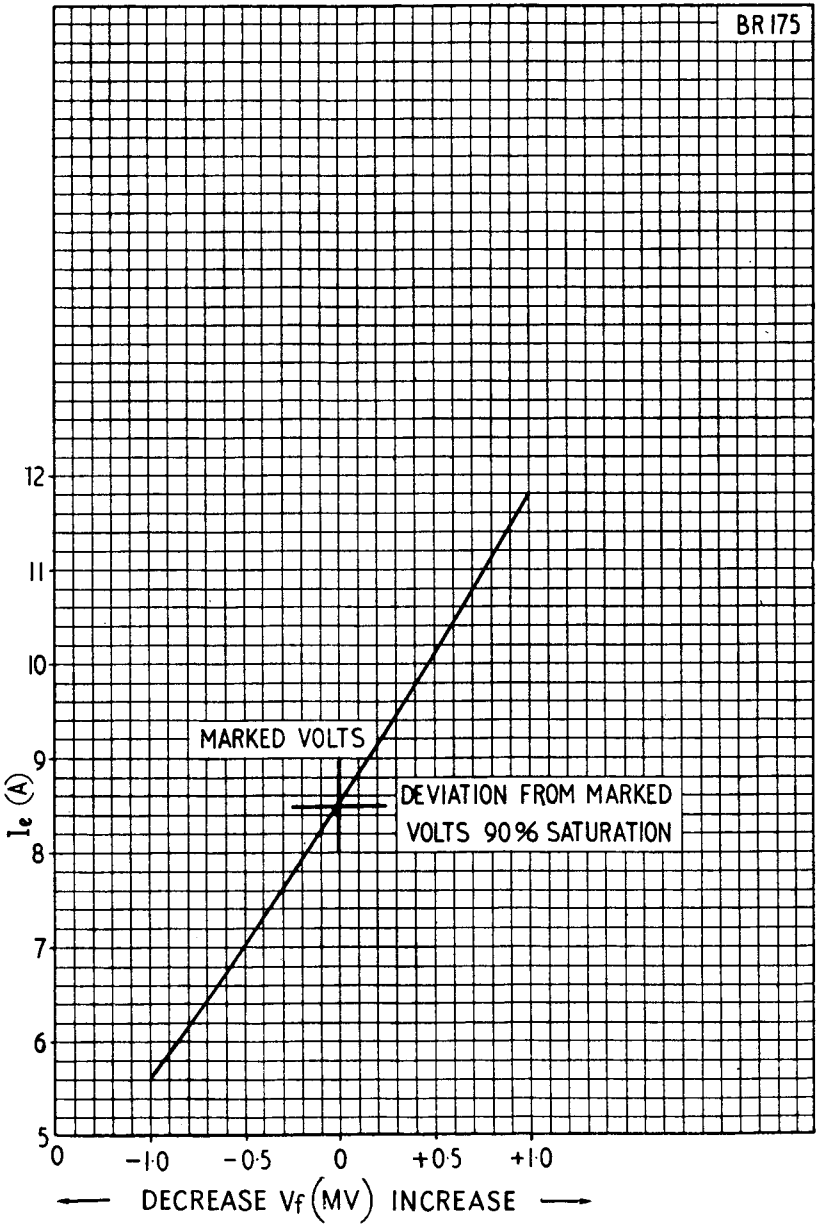
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

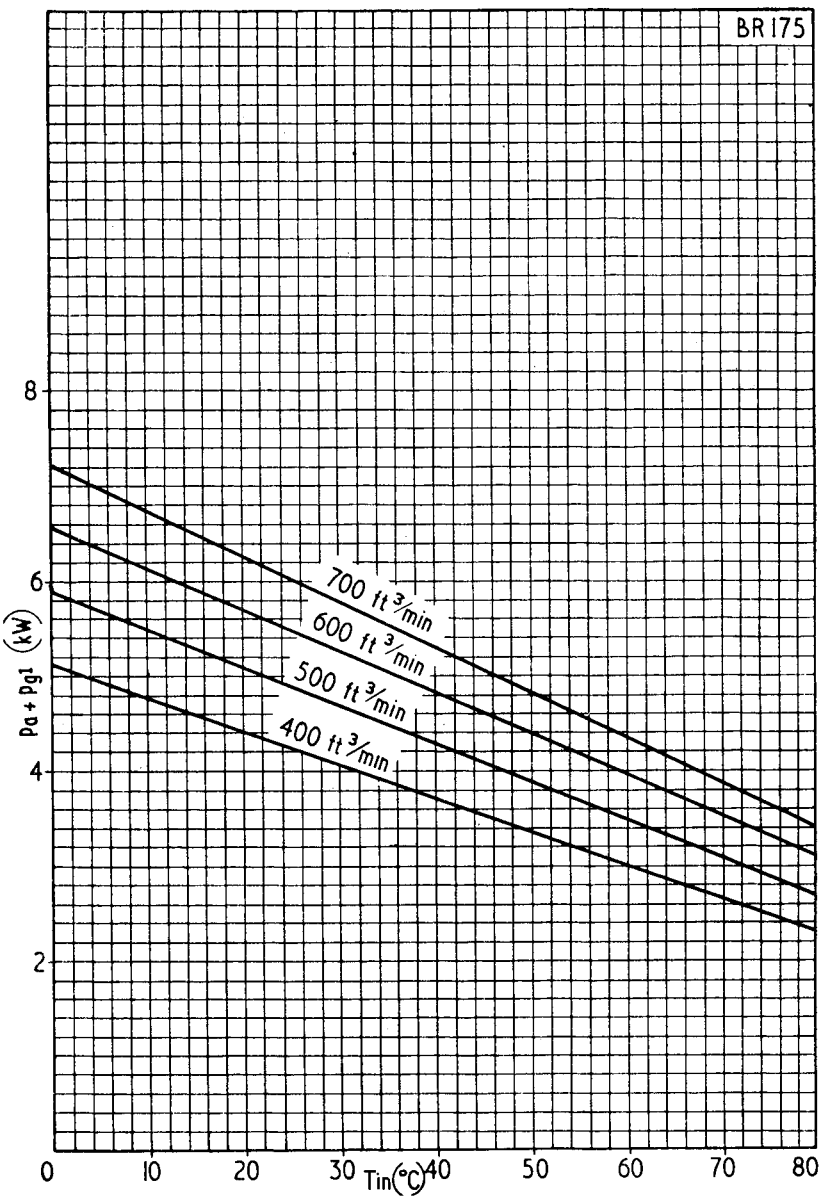
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


BR175
TAKEN AT V_f MV
I_a (A)
V_a (kV)
$V_a = V_{g1}$
V_{g1} + 800V
+ 700V
+ 600V
+ 500V
+ 400V
+ 300V
+ 200V
+ 100V
0
− 100V
− 200V
0
2
4
6
8
10
12
14


BR175
TAKEN AT V_f MV
I_{g1} (A)
V_a (kV)
V_{g1} + 800V
+ 700V
+ 600V
+ 500V
+ 400V
+ 300V
+ 200V
+ 100V
0
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1·6
1·8
2·0
0
1
2
3
4
5


BR175
TAKEN AT V_f MV
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1} (A)
10
8
6
4
2
0
400
800
1200
1600
2000
V_a & V_{g1} (V)


BR175
MARKED VOLTS
DEVIATION FROM MARKED VOLTS 90% SATURATION
I_e (A)
12
11
10
9
8
7
6
5
0
-1·0
-0·5
0
+0·5
+1·0
DECREASE V_f (MV) INCREASE



PRINTED IN ENGLAND

Triode *Type BR 179*

General. The BR 179 is a forced-air-cooled transmitting triode fitted with a thoriated tungsten filament.

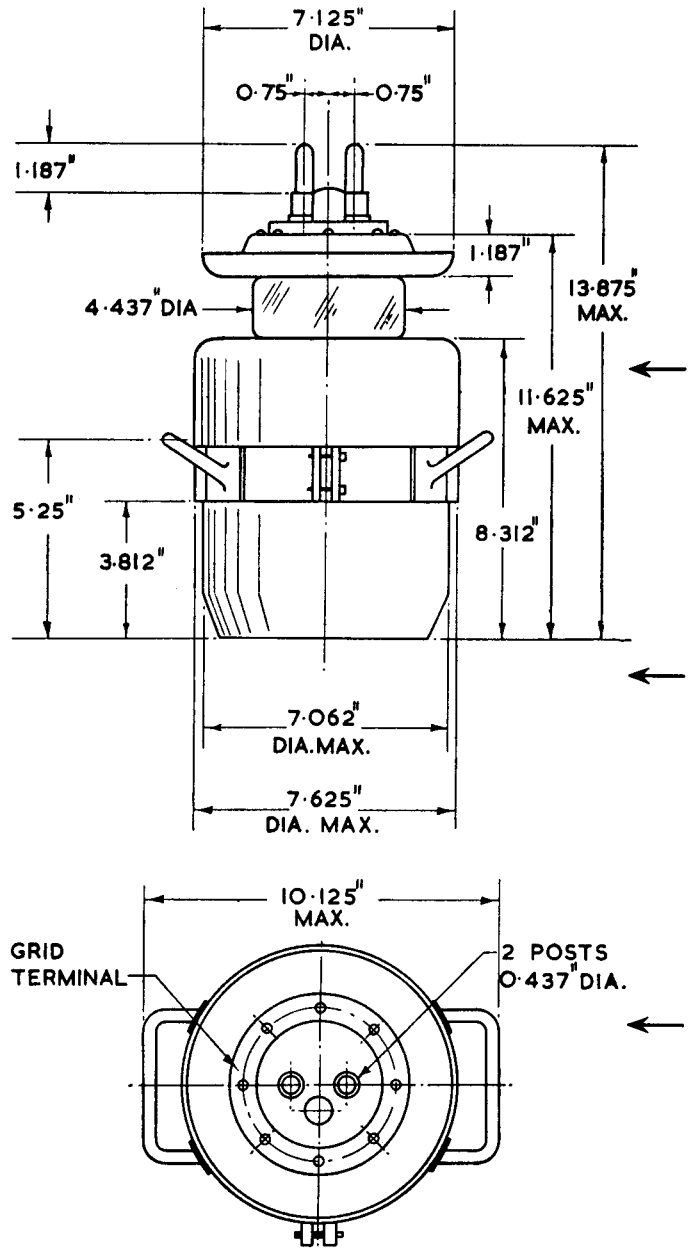
Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show the air inlet temperature °C/anode + grid loss; and air flow/air pressure, for the conditions of suction air cooling.

The external grid and filament seals also require air cooling. The volume of air necessary is approximately 15 cu. ft. per minute and should be directed on to the seals from above through a 1-in. nozzle.

The temperature of the anode must not exceed 180°C and that of the grid and filament seals must not exceed 140°C.

All air supplies must be started before the application of any supply voltage and should be continued, for at least one minute, after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·008 Ω. The filament current must not exceed 195 A at any time during the switching-on period.



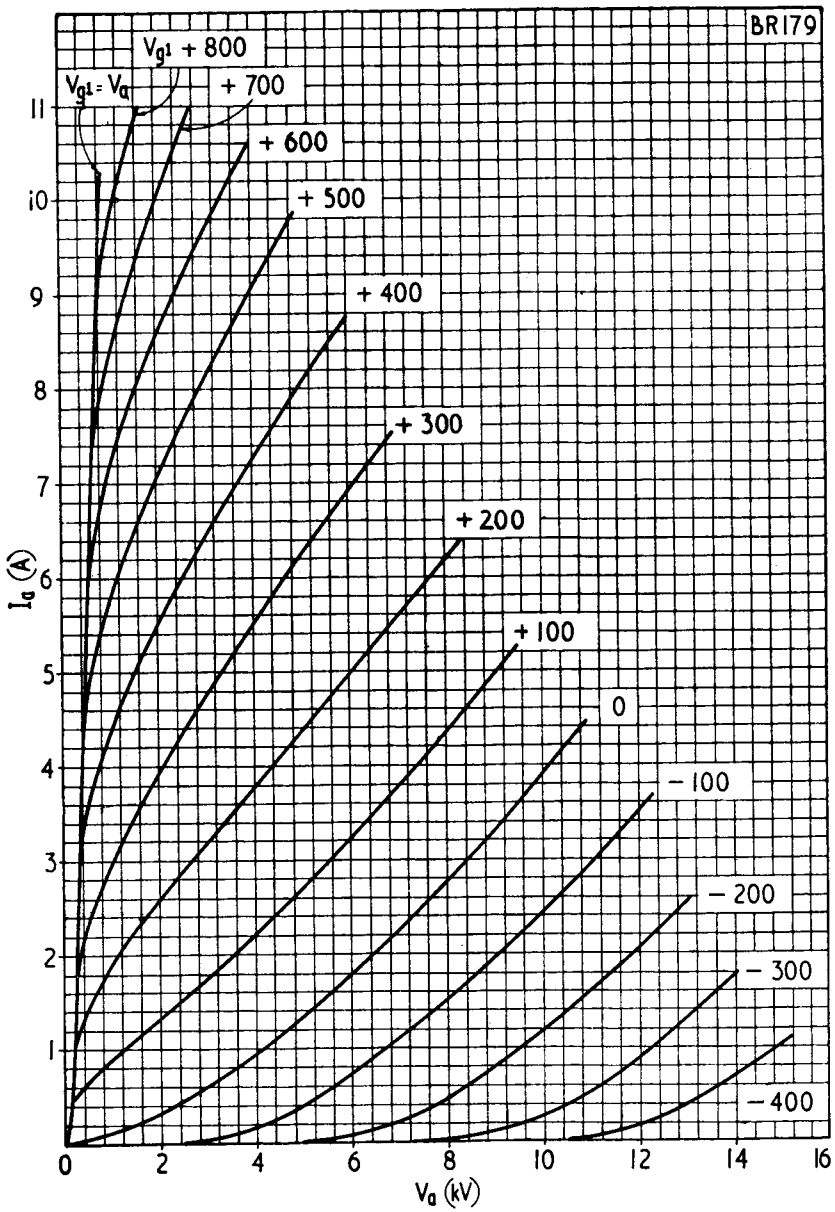
APPROXIMATE DATA

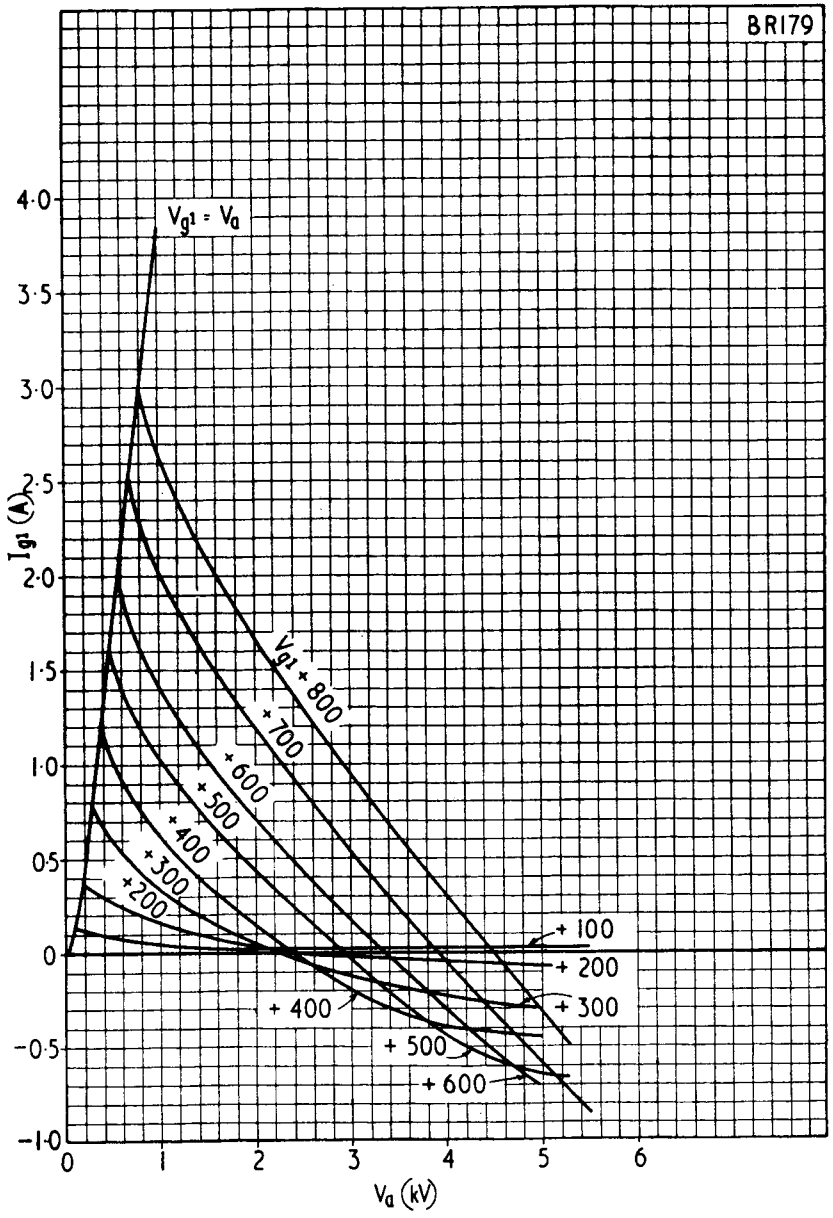
V_f		6·6	V*
I_f		90	A
$V_{a\ (max)}$		8·5	kV
$p_{a\ (max)}$		8	kW
$p_{gl\ (max)}$		0·6	kW
→ μ	taken at V_a 5 kV, I_a 1A	28	
→ g_m	taken at V_a 5 kV, I_a 1A	10	mA/V
$I_{k\ (pk)}$		16	A
$f_{(max)}$ (at full ratings)		100	Mc/s
→ $C_{a\text{-}gl}$		32	pF
$C_{a\text{-}k}$		1	pF
→ $C_{gl\text{-}k}$		33	pF

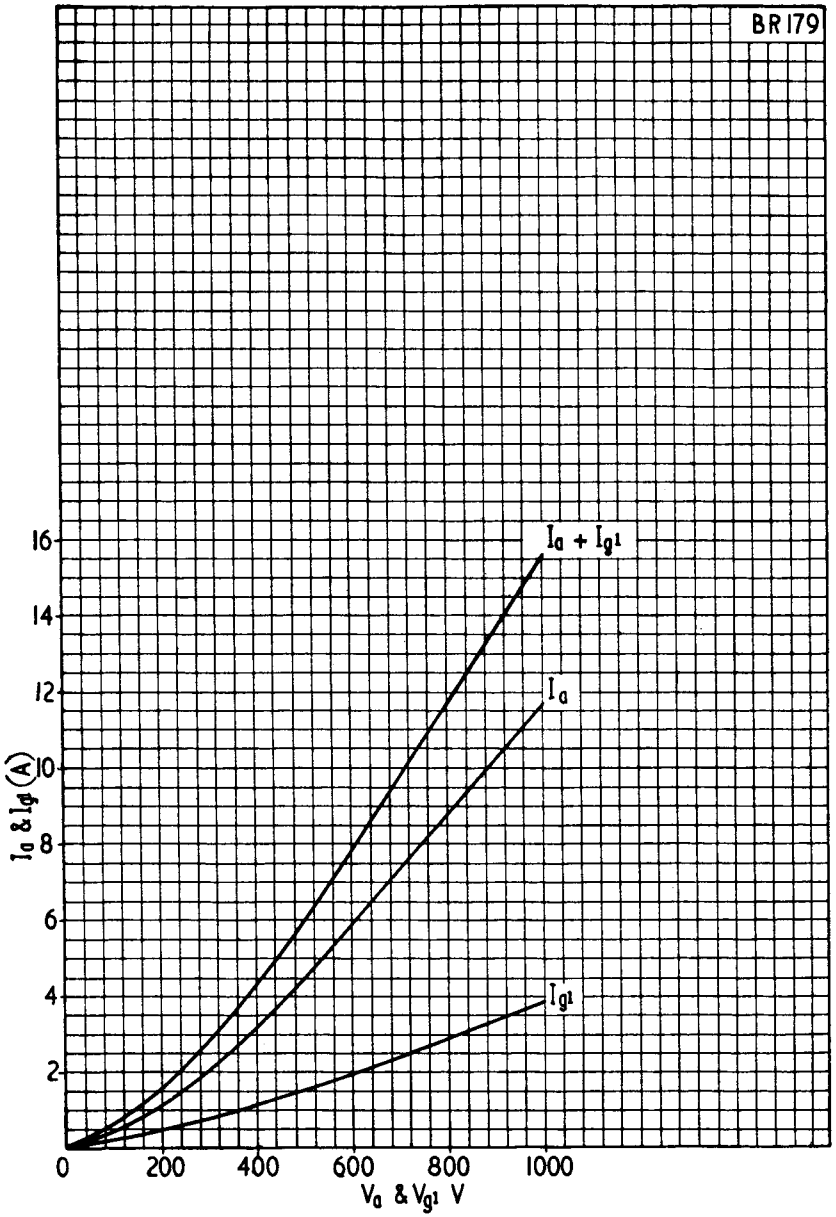
* This valve must be operated at the stated filament voltage.

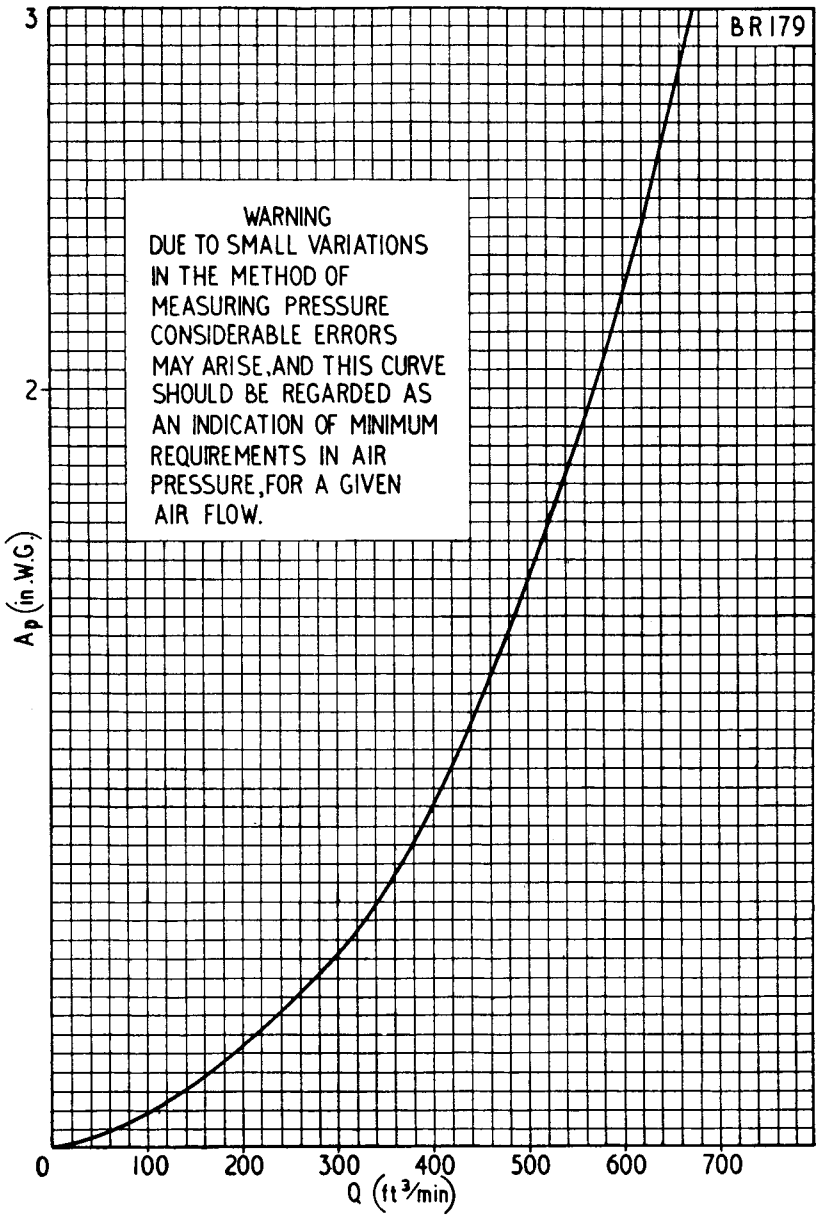
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

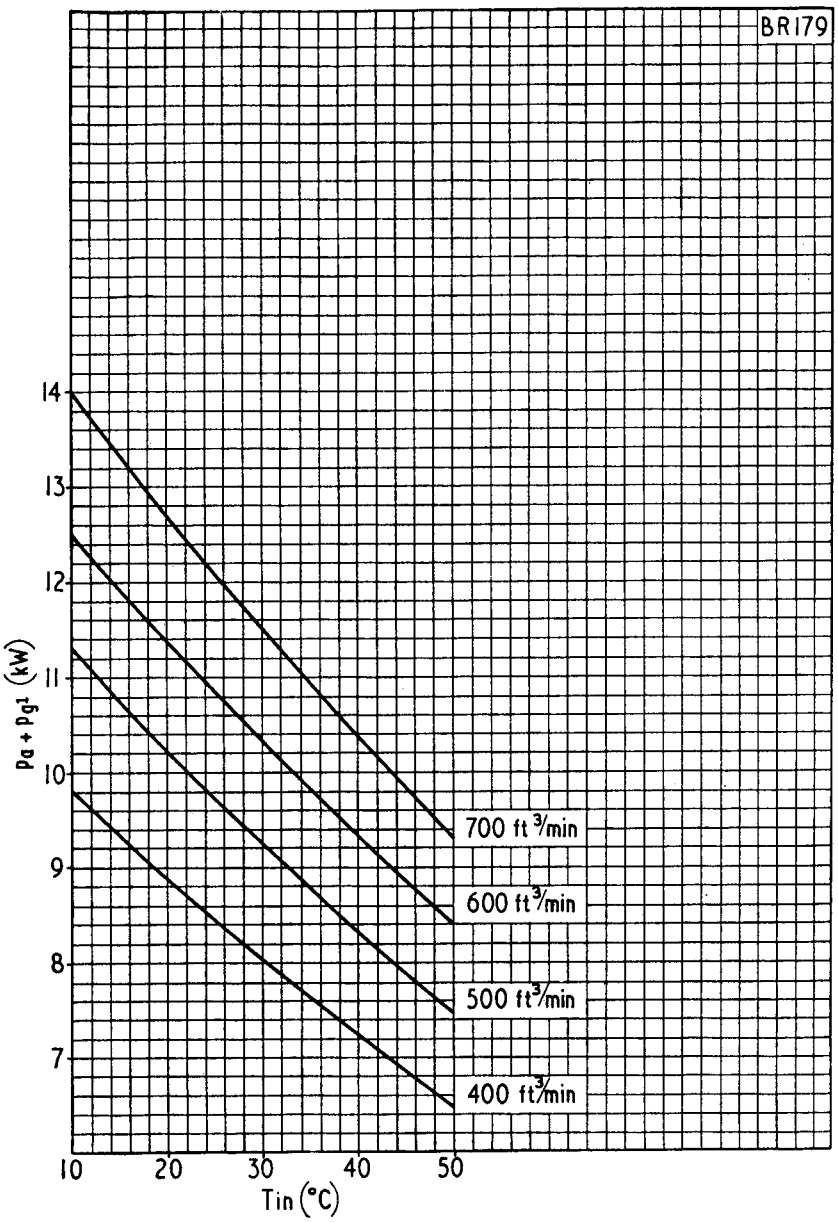
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


BR179
V_{g1} + 800
$V_{g1} = V_a$
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
0
− 100
− 200
− 300
− 400
I_a (A)
V_a (kV)


BR179
$V_{g1} = V_a$
V_{g1} + 800
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
+ 200
+ 300
+ 400
+ 500
+ 600
I_{g1} (A)
V_a (kV)


BR179
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1} (A)
16
14
12
10
8
6
4
2
0
200
400
600
800
1000
V_a & V_{g1} V


BR179
WARNING
DUE TO SMALL VARIATIONS IN THE METHOD OF MEASURING PRESSURE CONSIDERABLE ERRORS MAY ARISE, AND THIS CURVE SHOULD BE REGARDED AS AN INDICATION OF MINIMUM REQUIREMENTS IN AIR PRESSURE, FOR A GIVEN AIR FLOW.
A_p (in.W.G)
3
2
0
100
200
300
400
500
600
700
Q (ft^3/min)



PRINTED IN ENGLAND

Triode *Type BR 189*

HF AMPLIFIER AND OSCILLATOR

General. The BR 189 is a forced-air-cooled transmitting triode fitted with a thoriated tungsten filament.

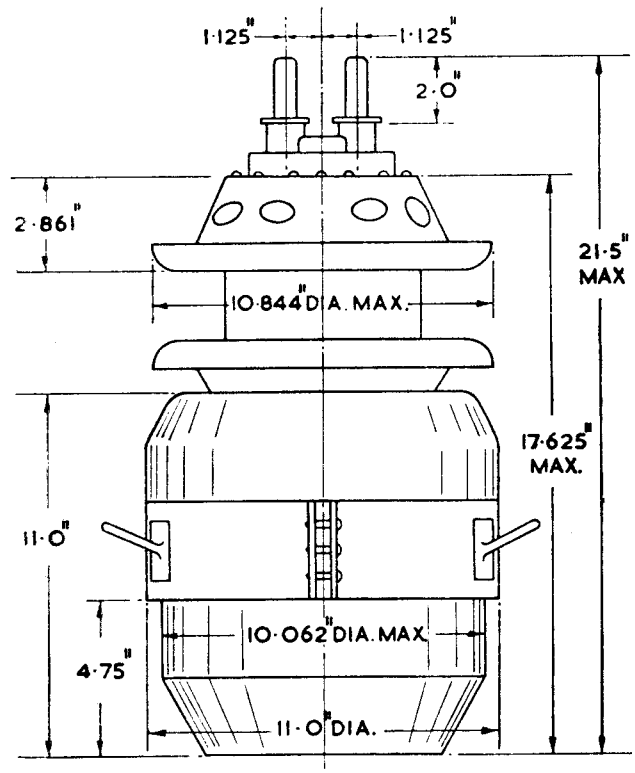
Cooling. The anode forms part of the valve envelope and is fitted with a radiator for forced air cooling. The characteristics given show the air inlet temperature °C/anode + grid loss for the conditions of suction air cooling.

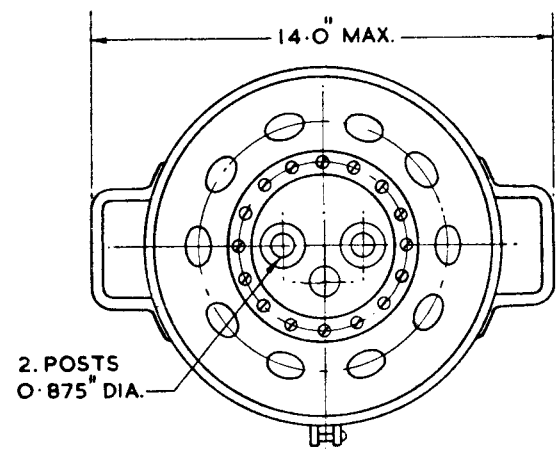
The external grid and filament seals also require air cooling. The air flow necessary is approximately 20 cu. ft. per minute and should be directed vertically downwards on to the valve from a 1-in. nozzle.

The temperature of the anode must not exceed 180°C and that of the grid and filament seals must not exceed 140°C.

The air flow must be started before the application of any supply voltage and must be continued for at least one minute after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·0042 Ω. The filament current must not exceed 600 A even momentarily, at any time.





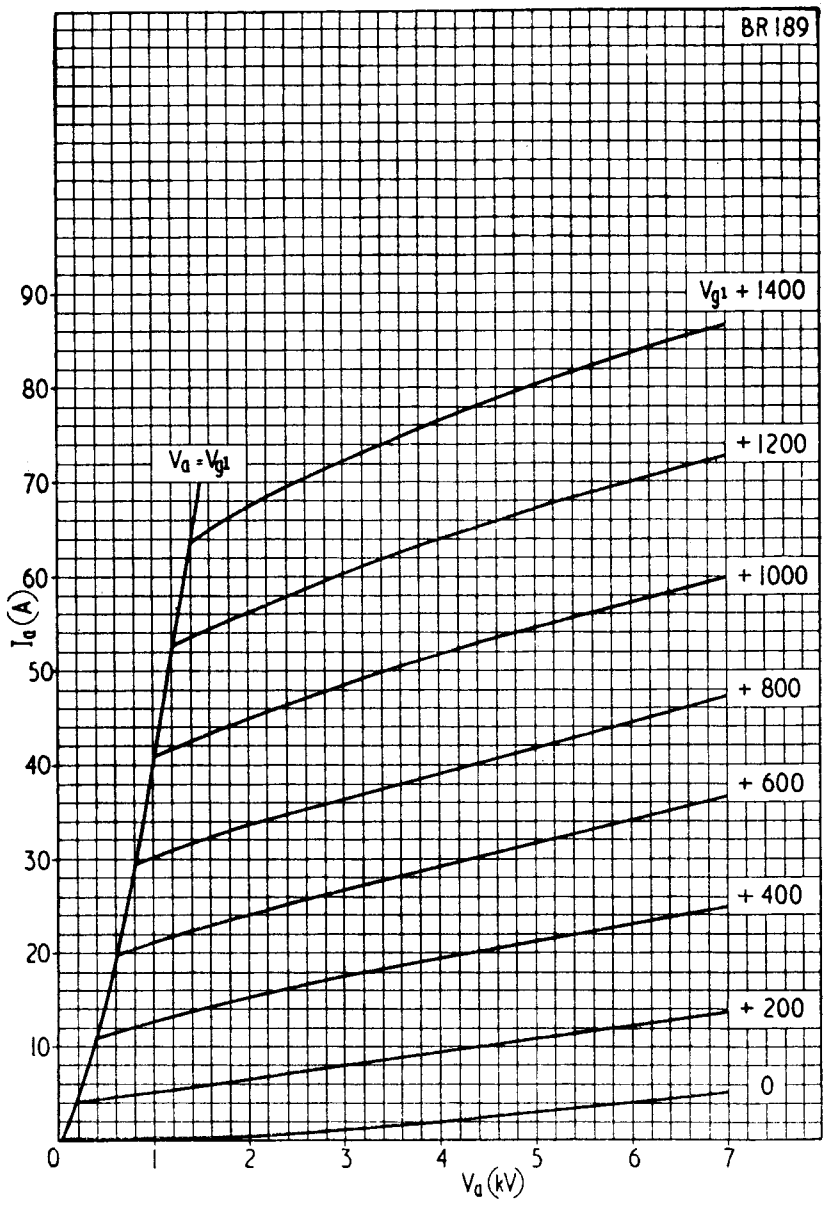
APPROXIMATE DATA

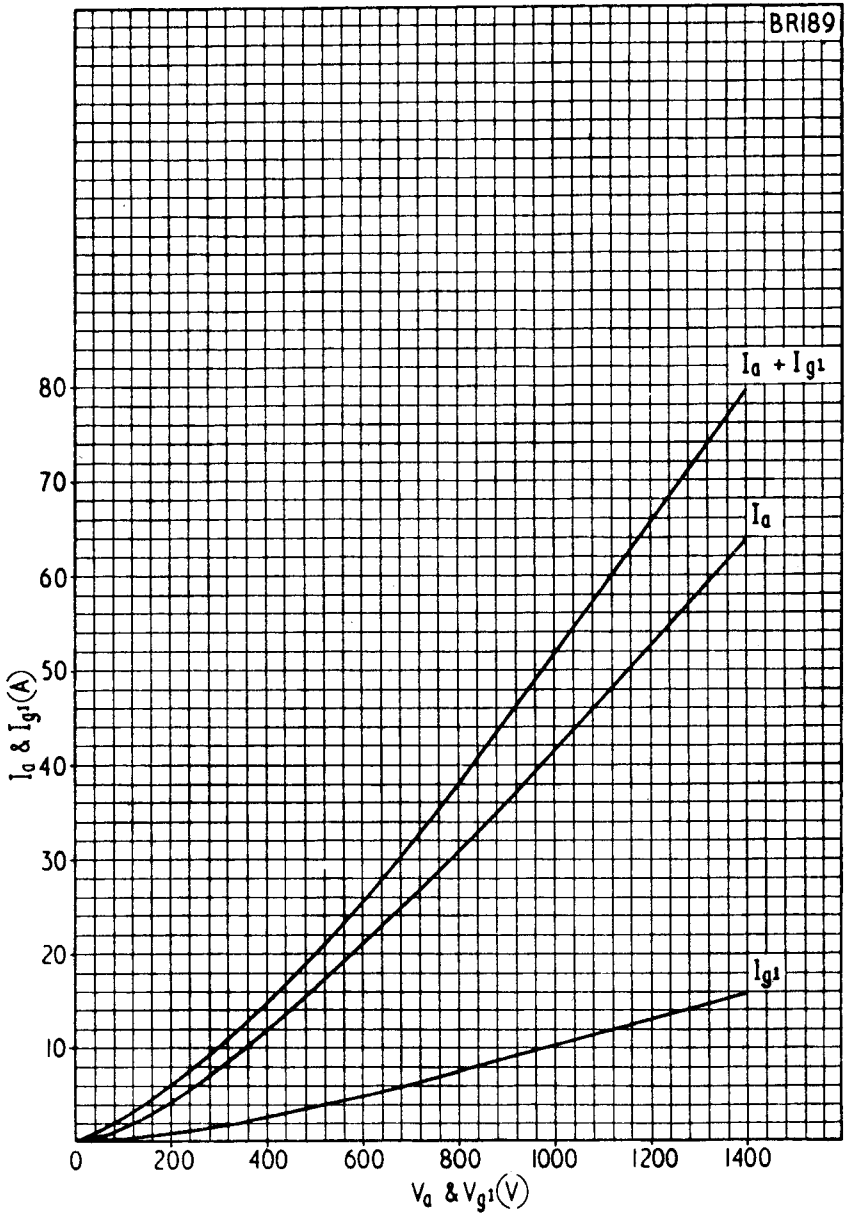
V_f		9	V*
I_f		240	A
$I_{k\ (pk)}$		70	A
$V_{a\ (max)}$		12	kV
p_a		27	kW
p_{gl}		1·25	kW
μ	(taken at V_a 9 kV, I_a 2 A)	34	
g_m	(taken at V_a 9 kV, I_a 2 A)	27·5	mA/V
$f_{(max)}$ (at full ratings)		50	Mc/s
$C_{a\text{-}gl}$		51	pF
$C_{a\text{-}k}$		1·5	pF
$C_{gl\text{-}k}$		68	pF

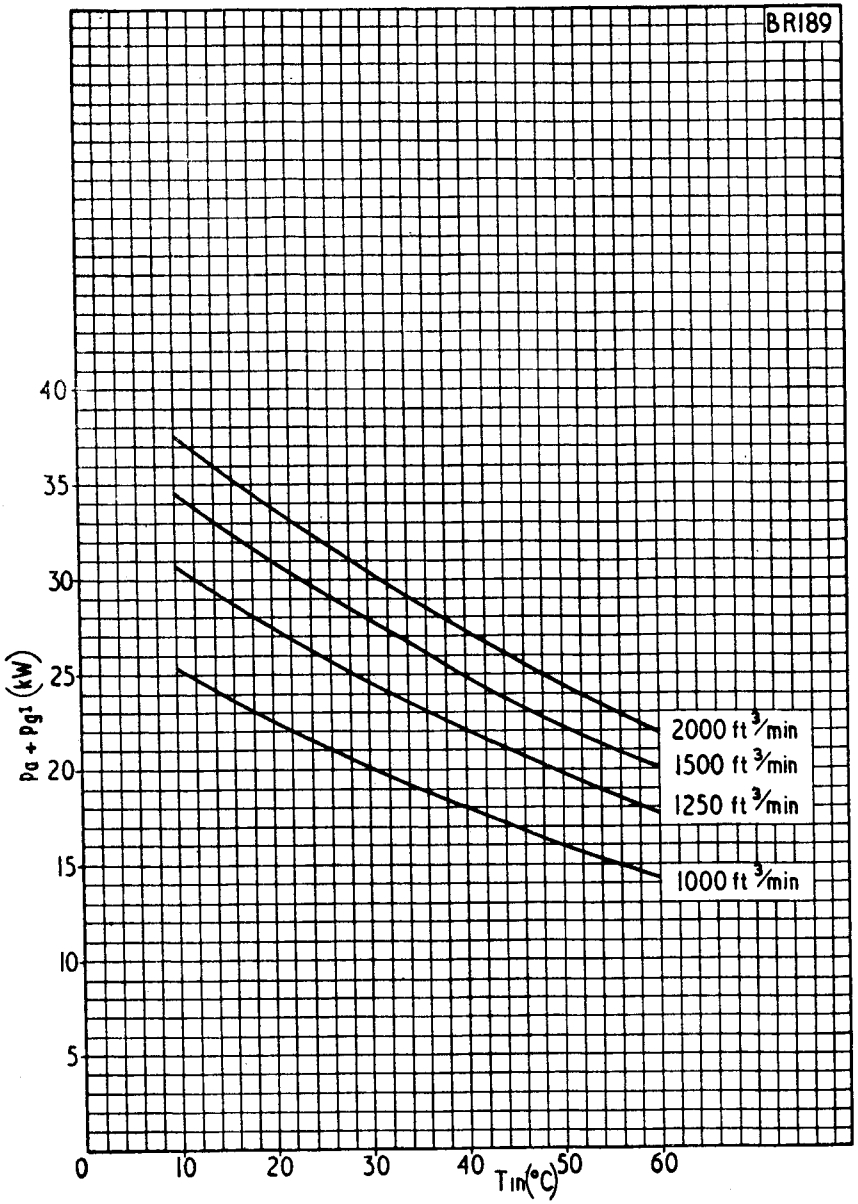
* The valve must be operated at the stated filament voltage.

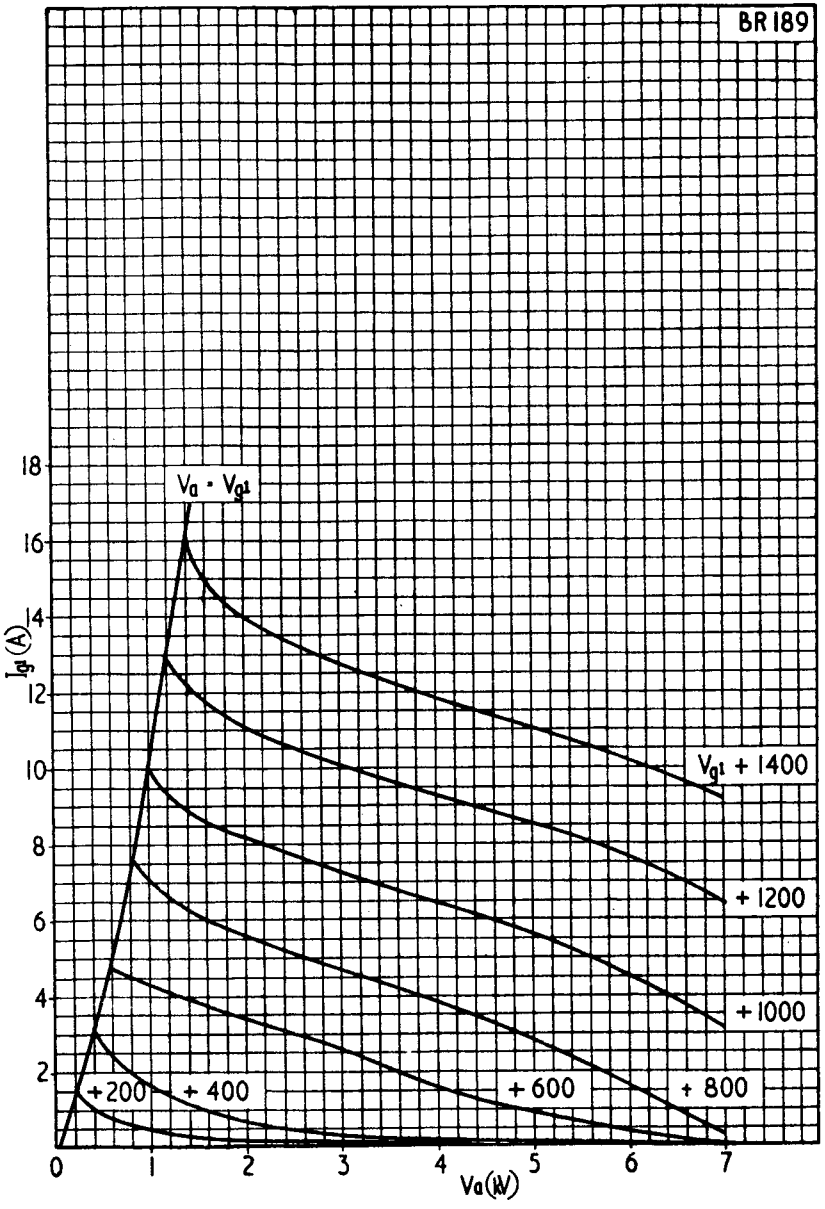
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

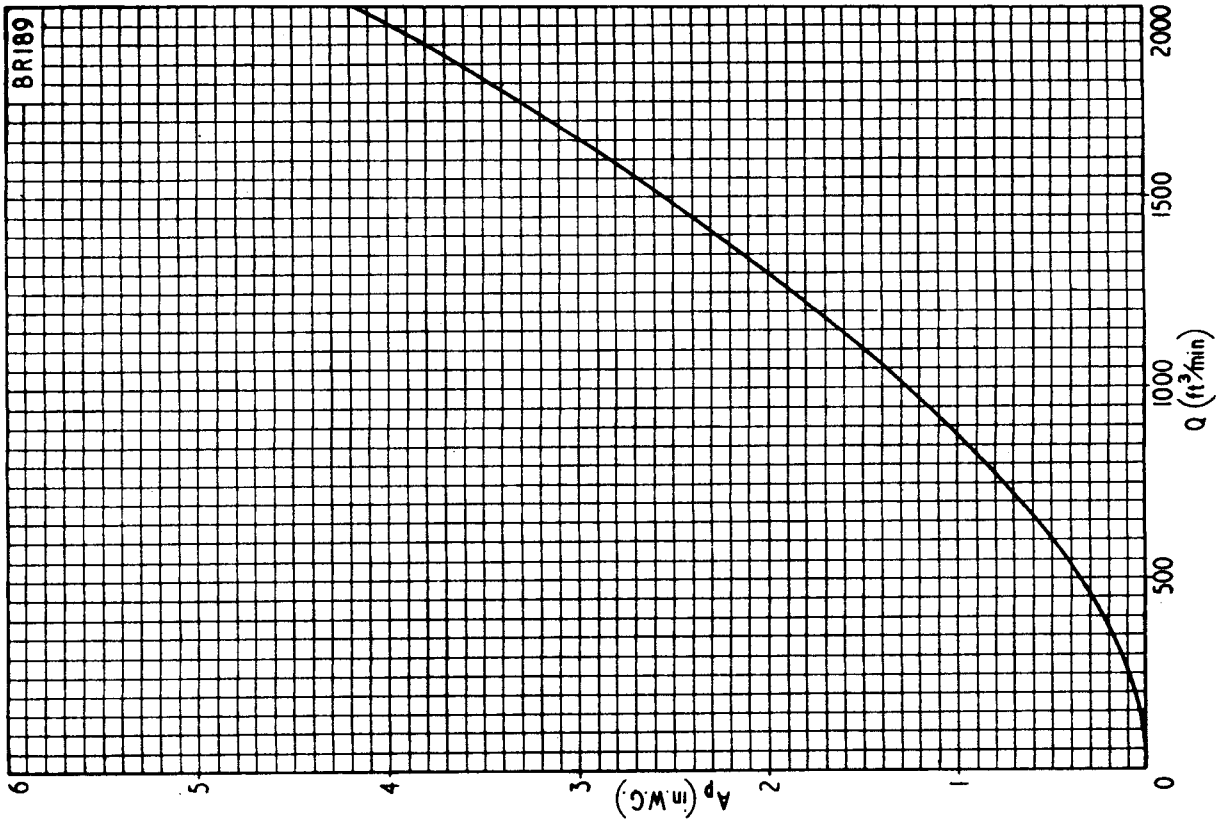
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

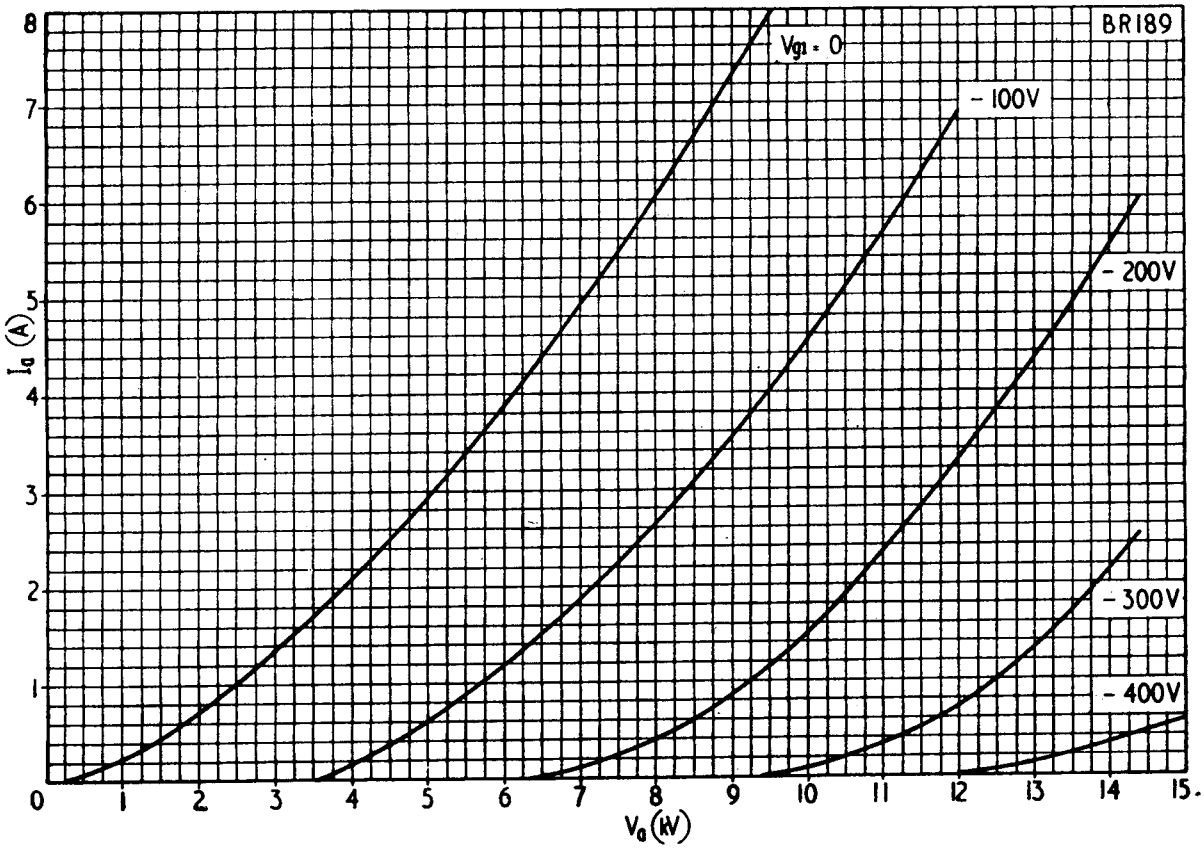

BR189
V_{g1} + 1400
+ 1200
+ 1000
+ 800
+ 600
+ 400
+ 200
0
$V_a = V_{g1}$
I_a (A)
V_a (kV)
0
1
2
3
4
5
6
7
10
20
30
40
50
60
70
80
90


BR189
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1} (A)
V_a & V_{g1} (V)
0
200
400
600
800
1000
1200
1400
10
20
30
40
50
60
70
80


BR189
Pa + Pg1 (kW)
40
35
30
25
20
15
10
5
0
10
20
30
40
50
60
Tin(°C)
2000 ft³/min
1500 ft³/min
1250 ft³/min
1000 ft³/min


BR189
Ig1 (A)
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
Va(kV)
Va - Vg1
Vg1 + 1400
+ 1200
+ 1000
+ 800
+ 600
+ 400
+ 200





PRINTED IN ENGLAND

Triode *Type BR 191B*

VHF AMPLIFIER AND OSCILLATOR

General. The BR 191B is a forced-air-cooled transmitting triode fitted with a thoriated tungsten filament designed for television, FM broadcast and industrial service.

It has a maximum anode dissipation of 3 kW and can be operated at 6·2 kV up to 30 Mc/s, 5·2 kV up to 110 Mc/s and 3·2 kV up to 220 Mc/s. Under grounded-grid Class C telegraphy conditions an output power of 5·5 kW is obtainable up to 110 Mc/s.

The flanged header grid terminal is a design feature of the BR 191B which is of particular value when used in grounded grid circuits. This terminal, when used with a large circular connector, effectively isolates the filament from the anode circuit and provides a direct low inductance path to the grid. As a result, neutralisation is generally unnecessary in grounded grid service.

Cooling. The anode requires forced-air-cooling. The curves given show the air inlet temperature °C/anode +grid loss; and air flow/air pressure characteristics. The header and filament seals also require air cooling. The volume of air necessary is approximately 10 cu. ft. per minute and should be directed on to the header from above through a 1-in. nozzle.

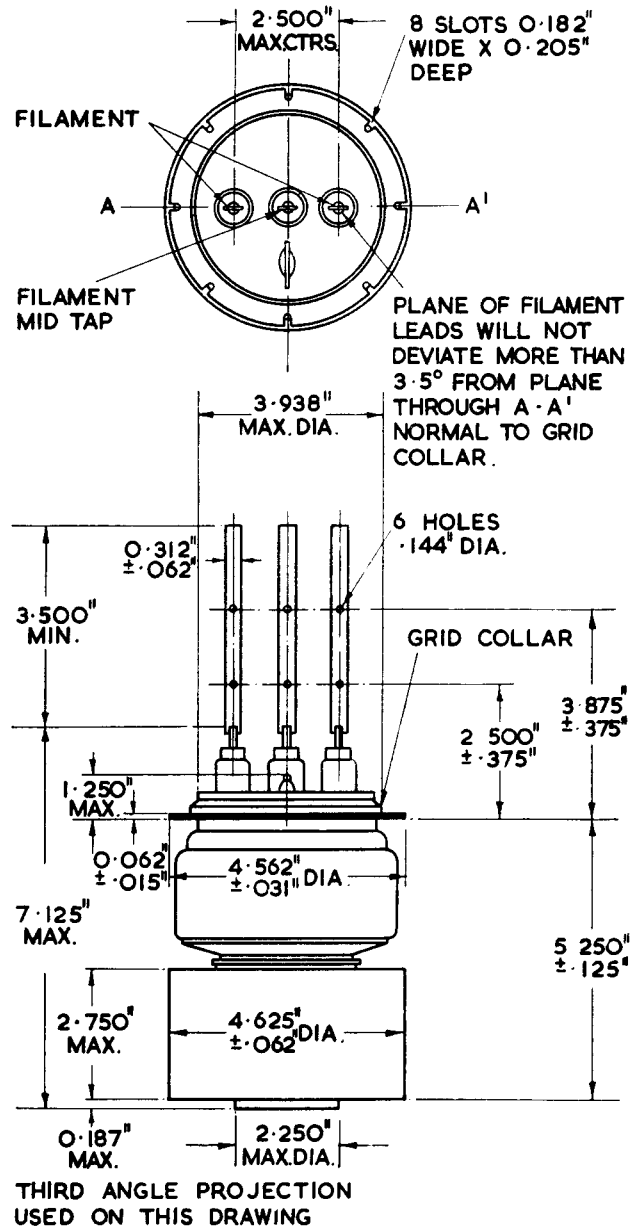
All air supplies must be started before the application of any supply voltage in order to limit the temperatures of the radiator and the grid and filament seals.

Filament power, anode power and air supplies may be removed simultaneously.

The incoming air temperature must not exceed 45°C. The radiator temperature (measured on the core at end away from incoming air) must not exceed 180°C. At the hottest part of the bulb the temperature must not be greater than 180°C. The temperature of the filament, grid and anode seals must not exceed 180°C.

Filament Starting. The cold filament resistance is approximately 0·052 Ω. The filament current must not exceed 175 A, even momentarily, at any time.

Mounting. The valve is to be mounted in a vertical position with the filament end to the top.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

APPROXIMATE DATA

V_f	12·6	V
I_f	29	A
μ	29	
$I_{k\ (pk)}$	10	A
$f_{(max)}$	220	Mc/s
$c_{a\text{-}gl}$	18·5	pF
$c_{a\text{-}k}$	0·5	pF
$c_{gl\text{-}k}$	19	pF

(1) RF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY AND CLASS C FM TELEPHONY

(*Unmodulated, one valve, key down conditions*)

Maximum permissible ratings (a)

f	<30	<110	<120	Mc/s
V_a	6·2	5·2	3·2	kV
V_{gl}	−1,000	−1,000	−600	V
I_a	1·4	1·4	1·4	A
I_{gl}	0·3	0·3	0·25	A
P_{in}	8·7	7·3	4·5	kW
p_a	3	3	3	kW

Typical Operation

Grounded-filament circuit

f		<30	<110	Mc/s
V_a		6	5	kV
V_{gl}	(i) from fixed supply of	−550	−525	V
	(ii) via $R_{gl\text{-}k}$	1,900	1,725	Ω
	(iii) via R_k	360	340	Ω
$v_{gl\ (pk)}$		875	850	V
I_a		1·25	1·25	A
I_{gl} (b)		0·29	0·29	A
P_{dr} (b)		225	225	W
P_{out}		6	4·8	kW

Grounded-grid circuit

f		< 30	< 110	< 220	Mc/s
V_a		6	5	3	kV
V_{gl}	(i) from fixed supply	−550	−1,000	−160	V
	(ii) via $R_{gl\text{-}k}$	1,900	4,100	670	Ω
	(iii) via R_k	360	740	110	Ω
$v_{gl\ (pk)}$		875	1,350	410	V
I_a		1·25	1·1	1·25	A
I_{gl} (b)		0·29	0·245	0·24	A
P_{dr} (b)		1,225	1,680	510	W
P_{out}		7	5·5	2·65	kW

(2) RF POWER AMPLIFIER CLASS C

(*Anode modulated, one valve, carrier conditions, permissible modulation* 100%)

Maximum permissible ratings

f	<30	<110	Mc/s
V_a	5	4·2	kV
V_{gl}	−1,000	−1,000	V
I_a	1	1	A
I_{gl}	0·3	0·3	A
P_{in}	5	4·2	kW
p_a	2	2	kW

Typical Operation

Grounded-filament circuit

f		< 30	< 110	Mc/s
V_a		4·7	4	kV
V_{gl}	(i) from fixed supply of	−400	−350	V
	(ii) via $R_{gl\text{-}k}$	1,425	1,460	Ω
$v_{gl\ (pk)}$ (c)		675	600	V
I_a		0·96	0·93	A
I_{gl} (b)		0·28	0·24	A
P_{dr} (b)		170	130	W
P_{out}		3·7	2·8	kW

(3) RF POWER AMPLIFIER CLASS C TELEVISION SERVICE (RMA System)

(*Grid modulated, one valve, synchronising level conditions unless otherwise stated*)

Maximum permissible ratings

f	54–216	Mc/s
V_a	3·7	kV
V_{gl} (white level)	−800	V
I_a	1·9	A
I_{gl} (pedestal level)	0·225	A
P_{in}	6·3	kW
p_a	3	kW

Typical Operation

Grounded-grid circuit

(*Key-down conditions without amplitude modulation*)

$\triangle f$ (d)		8·5	Mc/s
V_a		3·2	kV
V_{gl}	(i) Synchronising level	−110	V
	(ii) Pedestal level	−220	V
	(iii) White level	−520	V

$V_{g1\ (pk)}$		435	V
I_a	(i) Synchronising level	1·8	A
	(ii) Pedestal level	1·25	A
I_{g1} (b)	(i) Synchronising level	0·4	A
	(ii) Pedestal level	0·13	A
P_{dr} (Synchronising level) (c) (f)		770	W
P_{out} (b)	(i) Synchronising level	4	kW
	(ii) Pedestal level	2·3	kW

(4) RF POWER AMPLIFIER

CLASS B TELEVISION SERVICE (RMA System)

(One valve, synchronising level unless otherwise stated)

Maximum permissible ratings

f	54–216	Mc/s
V_a	3·7	kV
I_a	1·9	A
I_{g1} (pedestal level)	0·225	A
P_{in}	6·5	kW
p_a	3	kW

Typical Operation

Grounded-grid circuit

$\triangle f$ (d)		10	8·5	Mc/s
V_a		3	3·2	kV
V_{g1}		−105	−110	V
$V_{g1\ (pk)}$				
	(i) Synchronising level	380	435	V
	(ii) Pedestal level	290	310	V
I_a	(i) Synchronising level	1·8	1·8	A
	(ii) Pedestal level	1·36	1·35	A
I_{g1}	(i) Synchronising level	0·265	0·4	A
	(ii) Pedestal level	0·115	0·13	A
P_{dr} (Synchronising level) (d) (e)		625	770	W
P_{out}	(i) Synchronising level (d)	3·15	4	kW
	(ii) Pedestal level (d)	1·8	2·3	kW

NOTES

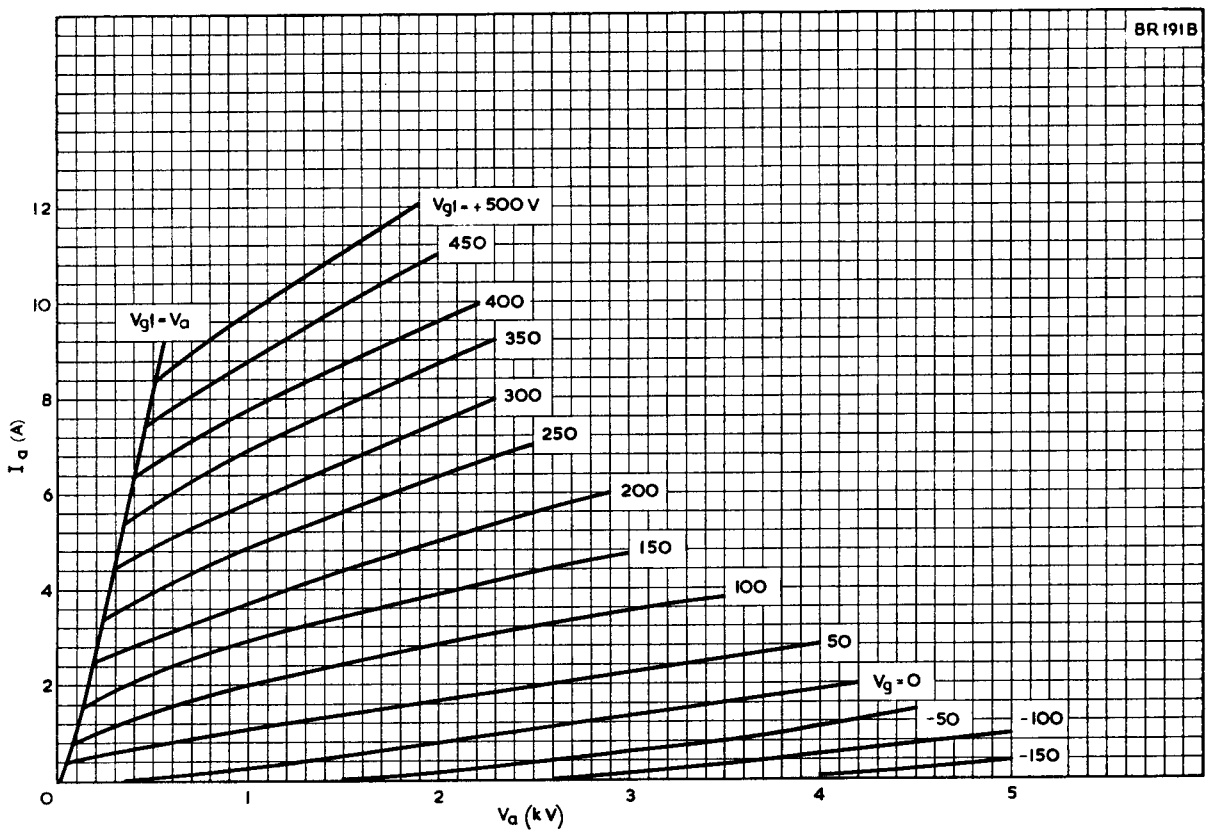
(a) Modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115% of carrier condition.

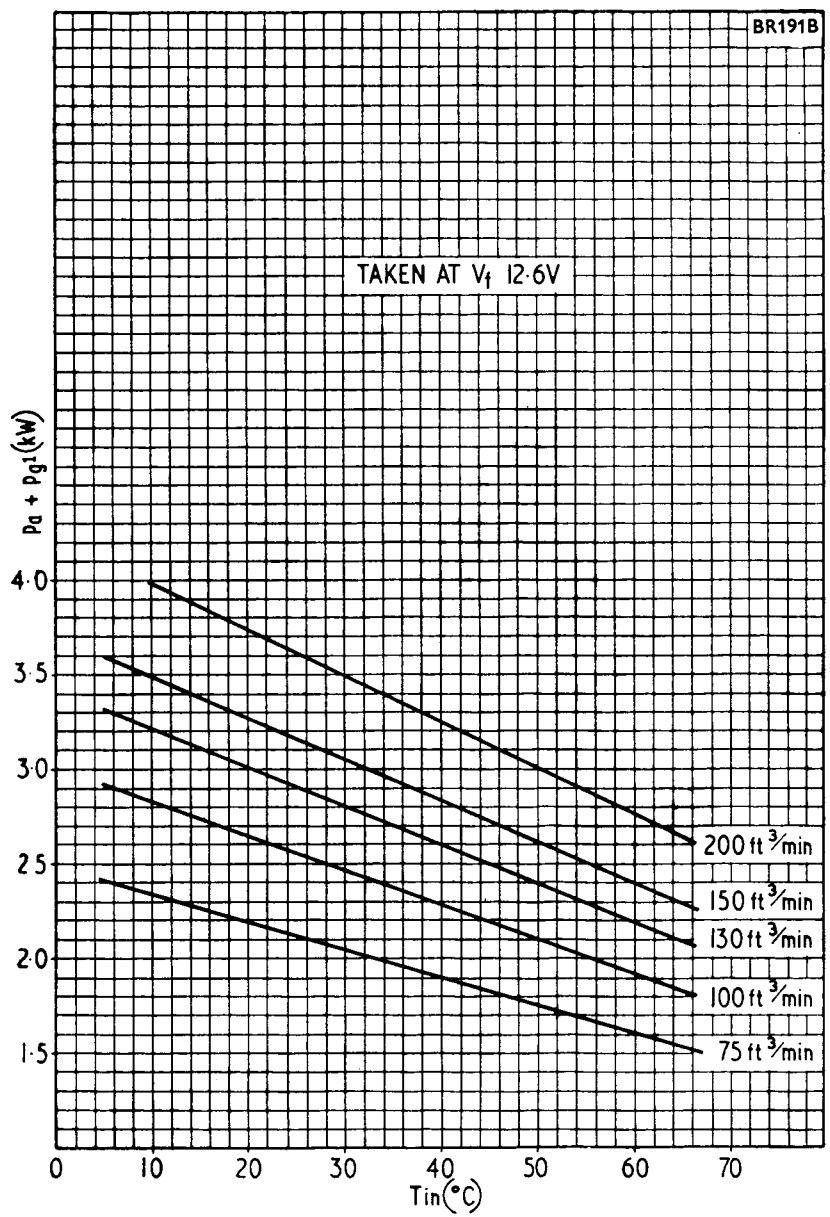
(b) Subject to wide variation. The figures given are approximate only.

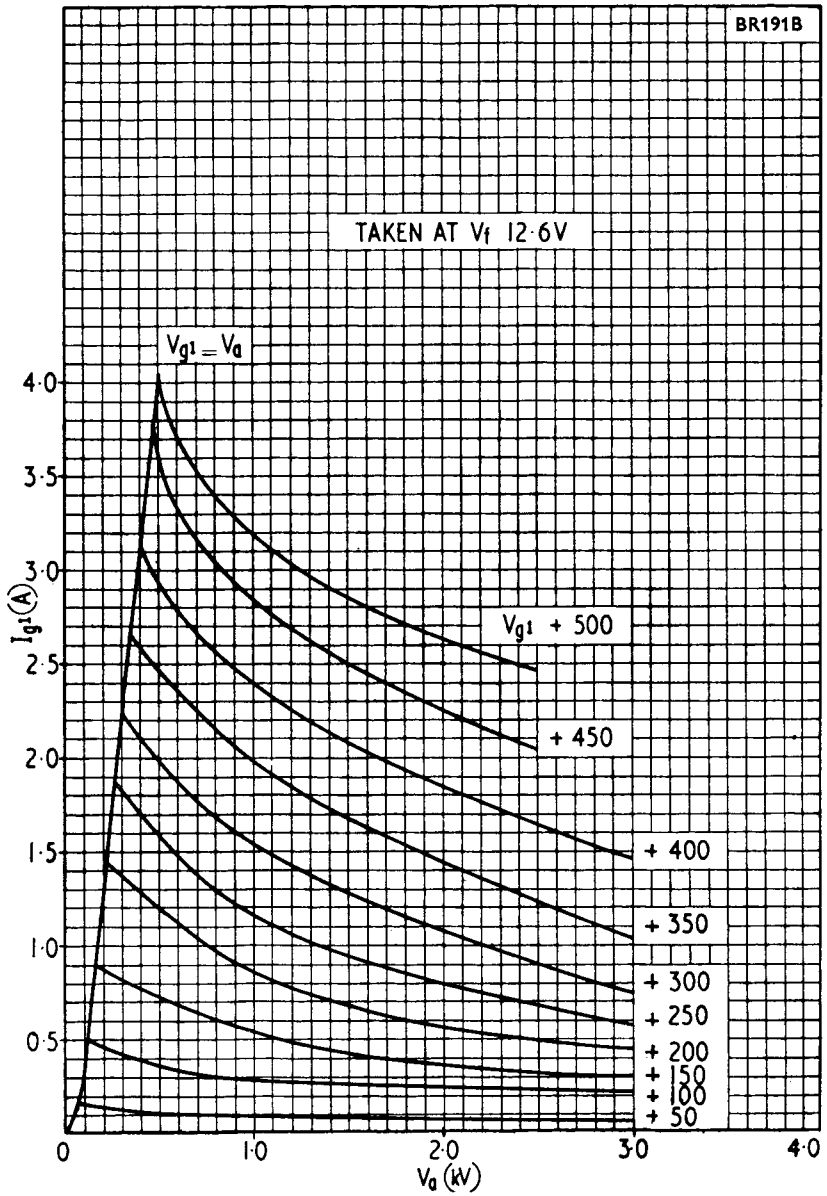
(c) Drive modulated approximately 30%.

(d) Computed between half power points and based on valve output capacitance only.

(e) Computed value to supply grid losses and feed-through power. Additional power will be required to supply circuit losses.







PRINTED IN ENGLAND

Triode *Type BR 194*

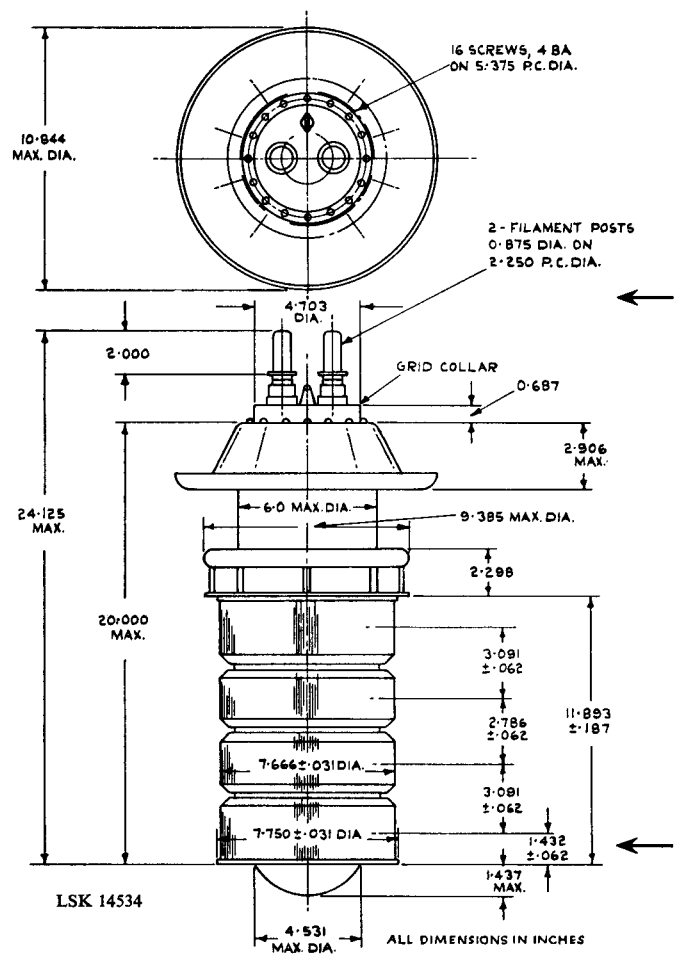
HF AMPLIFIER AND OSCILLATOR

General. The BR 194 is an air-cooled transmitting triode fitted with a thoriated tungsten filament.

Cooling. The anode, which forms part of the valve envelope, is fitted into a radiator for forced air cooling. The valve is used in conjunction with a special air duct to give the correct air distribution through the radiator. The volume of air necessary is approximately 2,100 cu. ft./min. at a pressure equal to an 8-in. head of water. The temperature of the anode must not exceed 180°C.

The external grid and filament seals also require air cooling. The volume of air necessary being approximately 20 cu. ft. per minute, and should be directed vertically downwards on to the valve through a 1 in. nozzle. The temperature of the seals must not exceed 140°C.

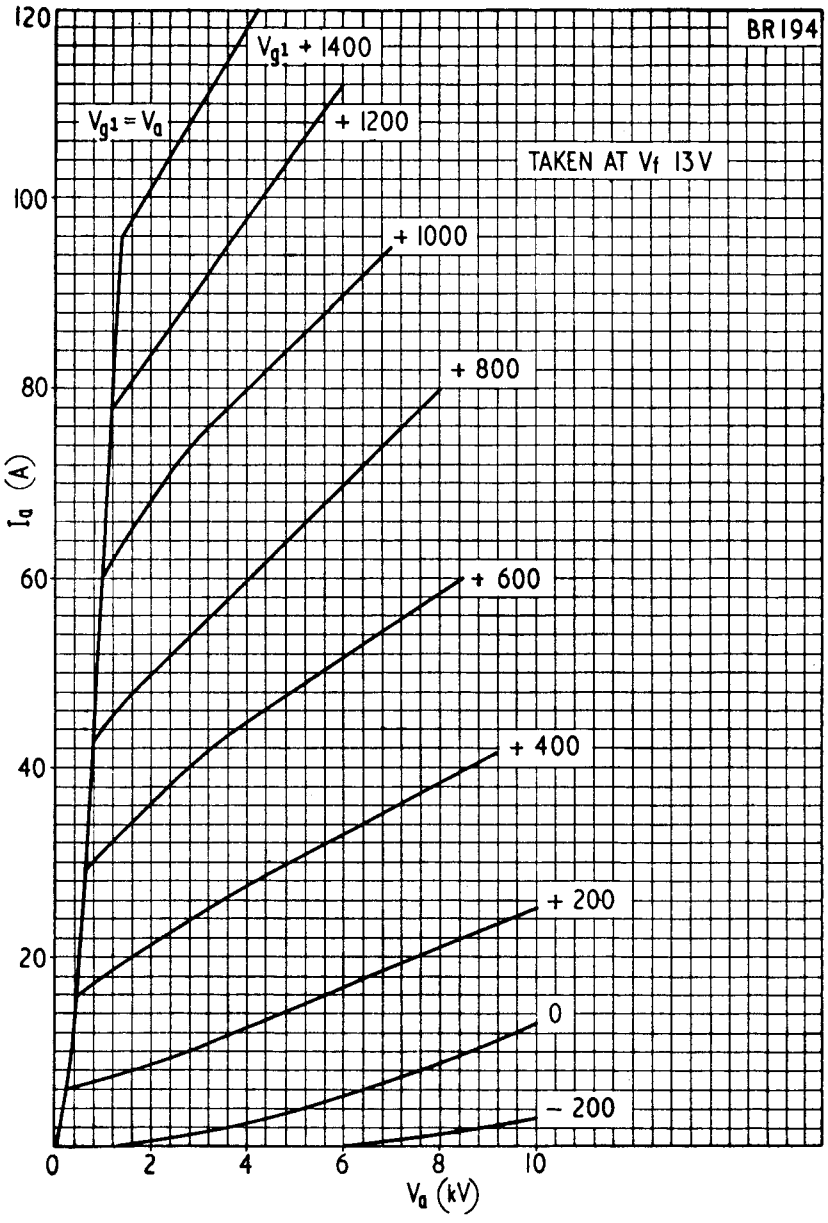
Filament Starting. The filament current must not exceed 600 A, even momentarily, at any time.

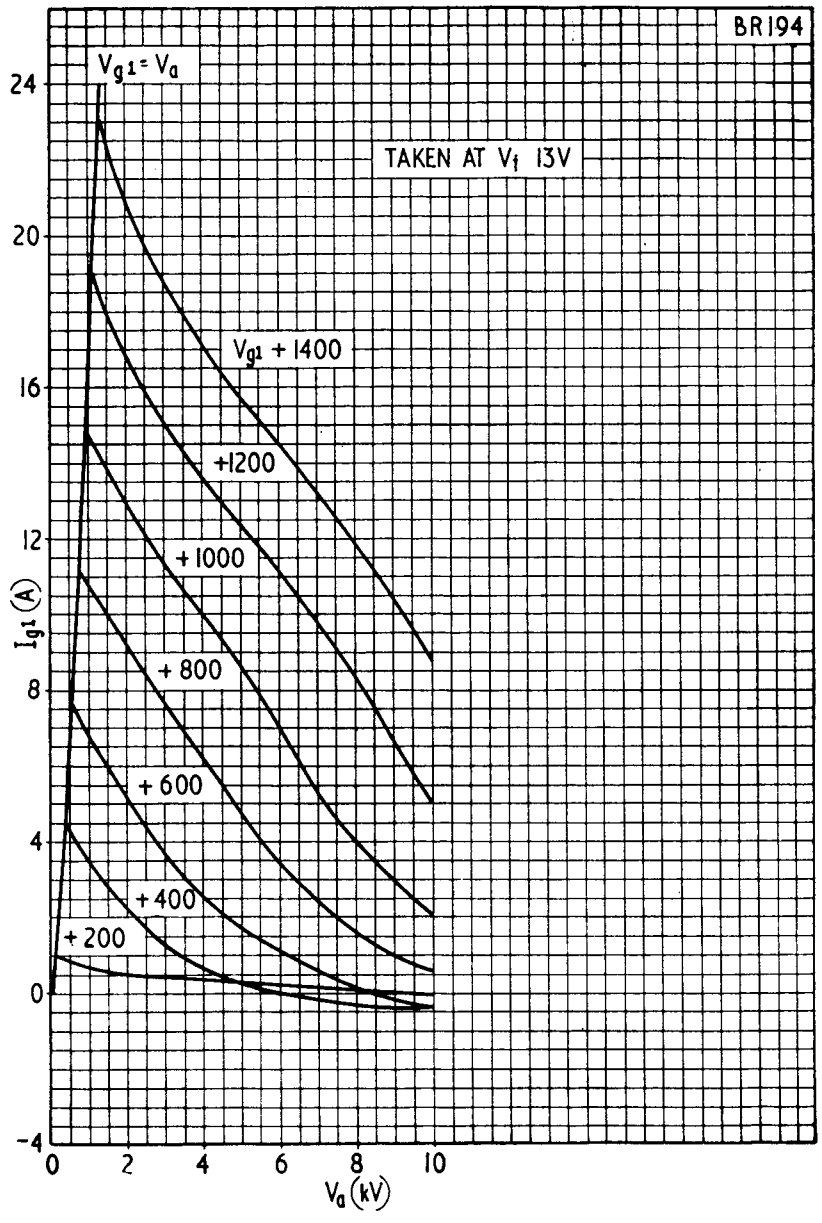


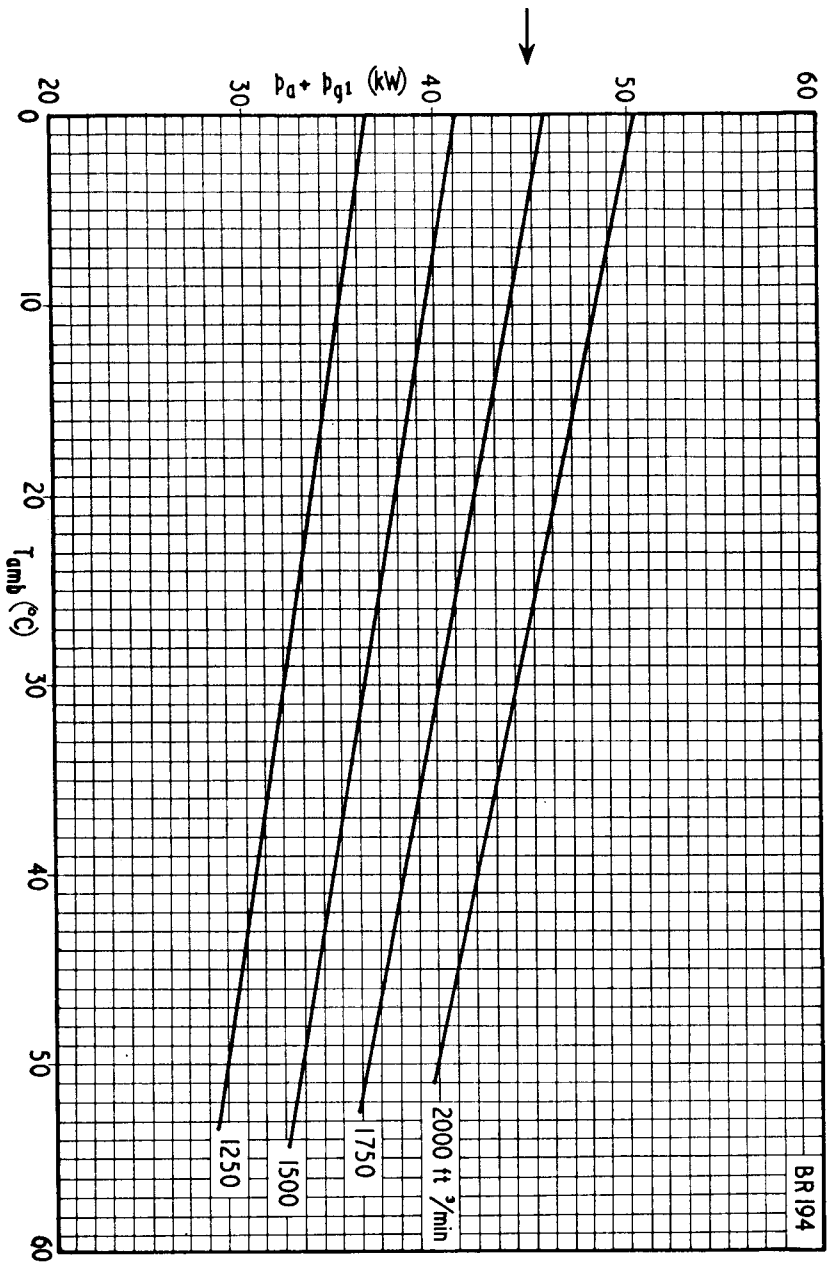
APPROXIMATE DATA

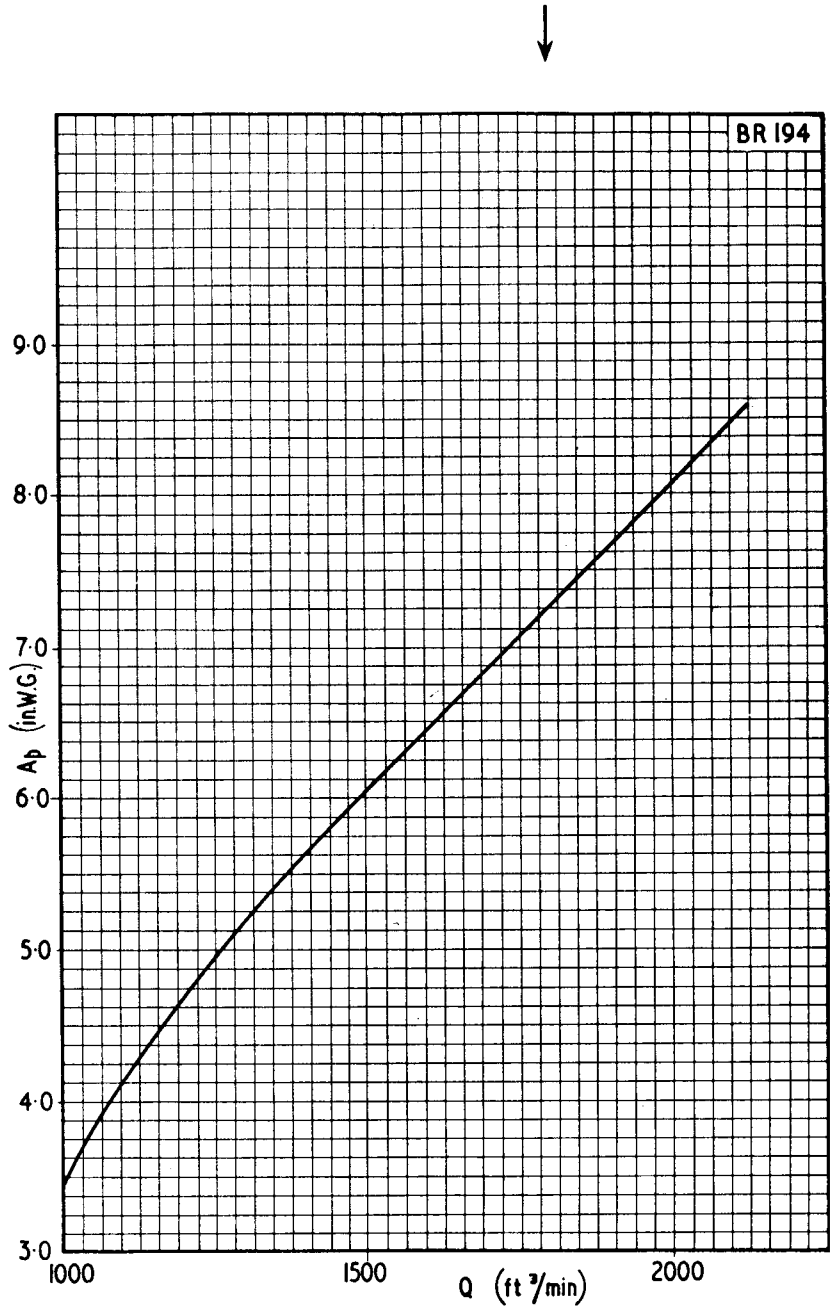
V_f		13	V*
I_f		240	A
$I_{k\ (pk)}$		100	A
$V_{a\ (max)}$		15	kV
$V_{a\ (max)}$ (100% mod)		12	kV
$p_{a\ (max)}$		40	kW
$p_{g1\ (max)}$		1·8	kW
μ	taken at V_a 9 kV, I_a 3·5 A	34	
g_m	taken at V_a 9 kV, I_a 3·5 A	38	mA/V
$f_{(max)}$		25	Mc/s
$C_{g1\text{-}k}$		95	pF
$C_{a\text{-}g1}$		60	pF
$C_{a\text{-}k}$		1·5	pF

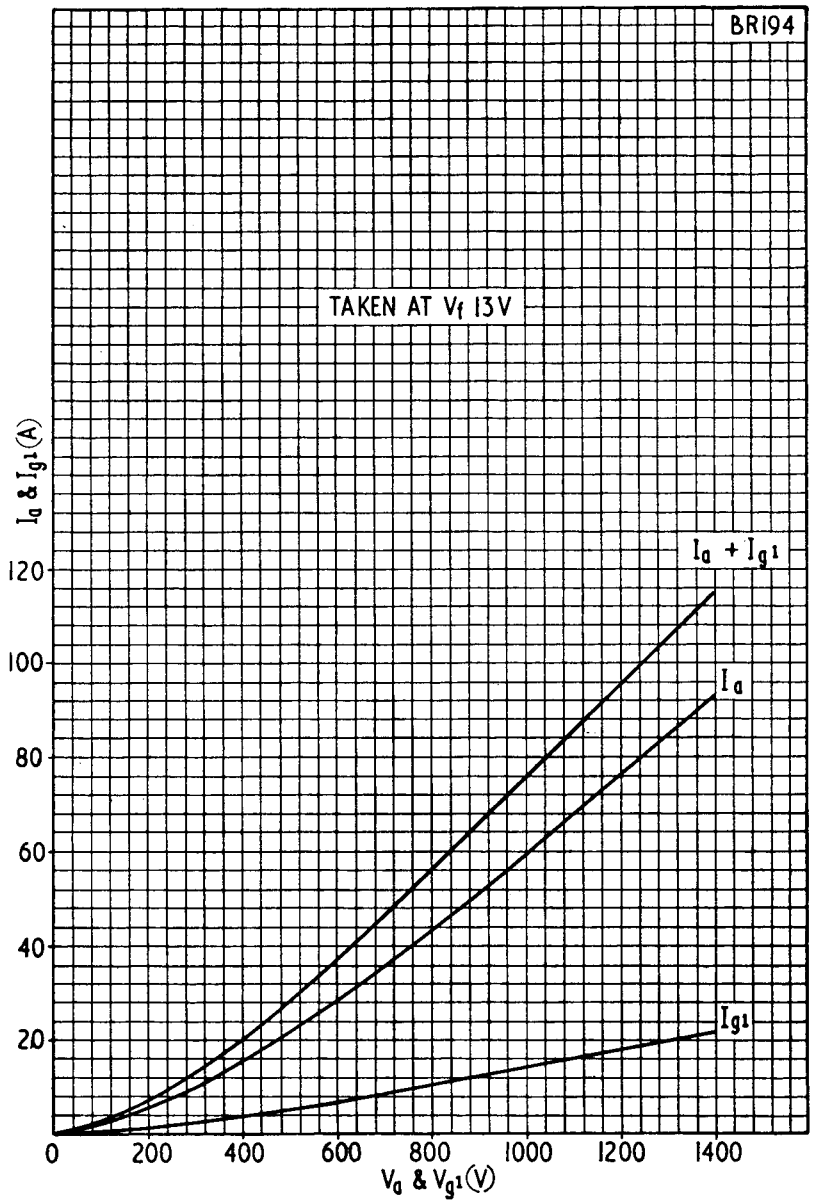
* This valve must be operated at the stated filament voltage.


BR194
TAKEN AT V_f 13V
$V_{g1} = V_a$
V_{g1} + 1400
+ 1200
+ 1000
+ 800
+ 600
+ 400
+ 200
0
− 200
I_a (A)
V_a (kV)
120
100
80
60
40
20
0
2
4
6
8
10


BR194
TAKEN AT V_f 13V
$V_{g1} = V_a$
V_{g1} + 1400
+1200
+ 1000
+ 800
+ 600
+ 400
+ 200
I_{g1} (A)
V_a (kV)
24
20
16
12
8
4
0
-4
0
2
4
6
8
10


$p_a + p_{g1}$ (kW)
20
30
40
50
60
0
10
20
30
40
50
60
T_{amb} (°C)
1250
1500
1750
2000 ft³/min
BR 194


BR 194
9·0
8·0
7·0
6·0
5·0
4·0
3·0
A_q (in W.G.)
1000
1500
2000
Q (ft³/min)



PRINTED IN ENGLAND

Triode *Type BR195*

(VHF AMPLIFIER)

General. The BR 195 is a forced air-cooled transmitting triode fitted with a thoriated tungsten filament. The valve is designed to operate at full ratings at frequencies up to 220 Mc/s.

Cooling. The anode requires forced air cooling. The air cooling and air flow characteristics given show the air inlet temperature °C/anode+grid loss; and air flow/air pressure. The temperature of the anode must not exceed 140°C.

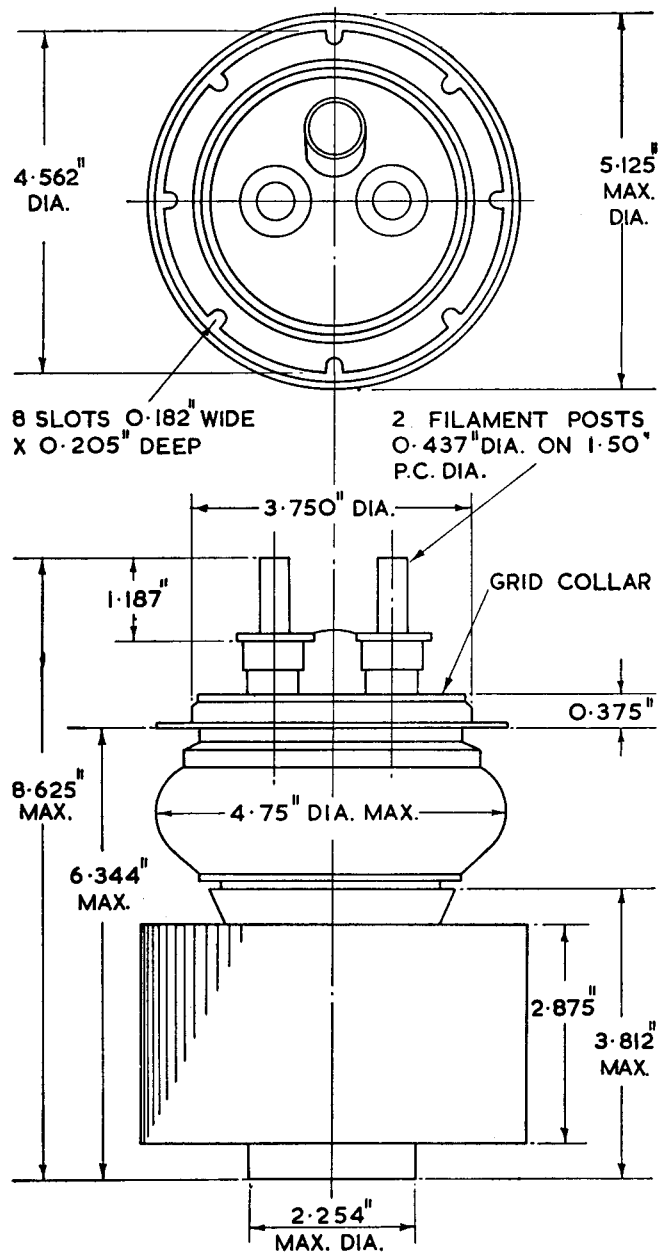
The external grid and filament seals also require air cooling. The volume of air necessary is approximately 10 cu. ft. per minute and should be directed on to the seals from above through a 1-in. nozzle. The temperature of the seals must not exceed 140°C.

Filament Starting. The filament current must not exceed 100 A, even momentarily, at any time. The cold filament resistance is approximately 0·0095Ω.

APPROXIMATE DATA

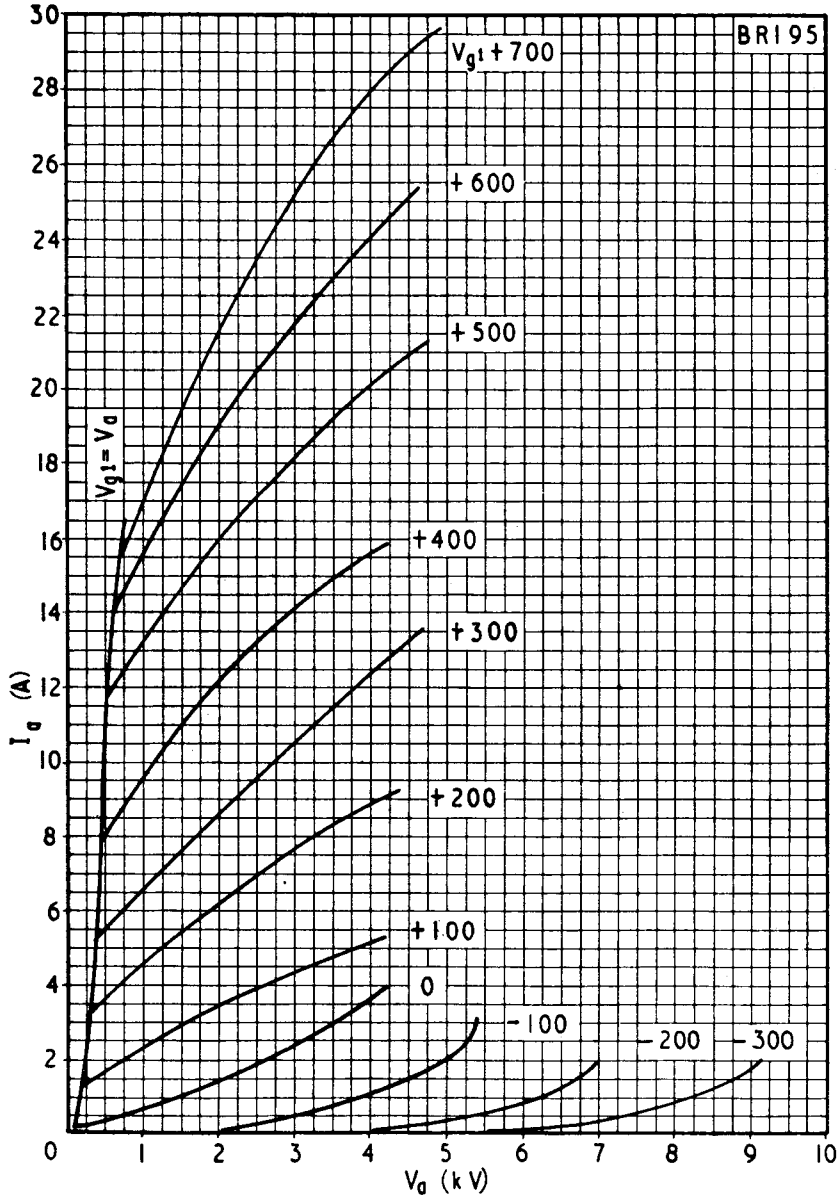
V_f		6	V*
I_f		67	A
$V_{a(max)}$		5	kW
$p_{a(max)}$		4	kW
$p_{gl(max)}$		0·25	kW
μ	taken at V_a 2·5 kV I_a 1A	25	
g_m	taken at V_a 2·5 kV I_a 1·125A	18	
f (at full ratings)		220	Mc/s
$c_{a\text{-}gl}$		16·5	pF
$c_{a\text{-}f}$		0·5	pF
$c_{gl\text{-}f}$		26·5	pF

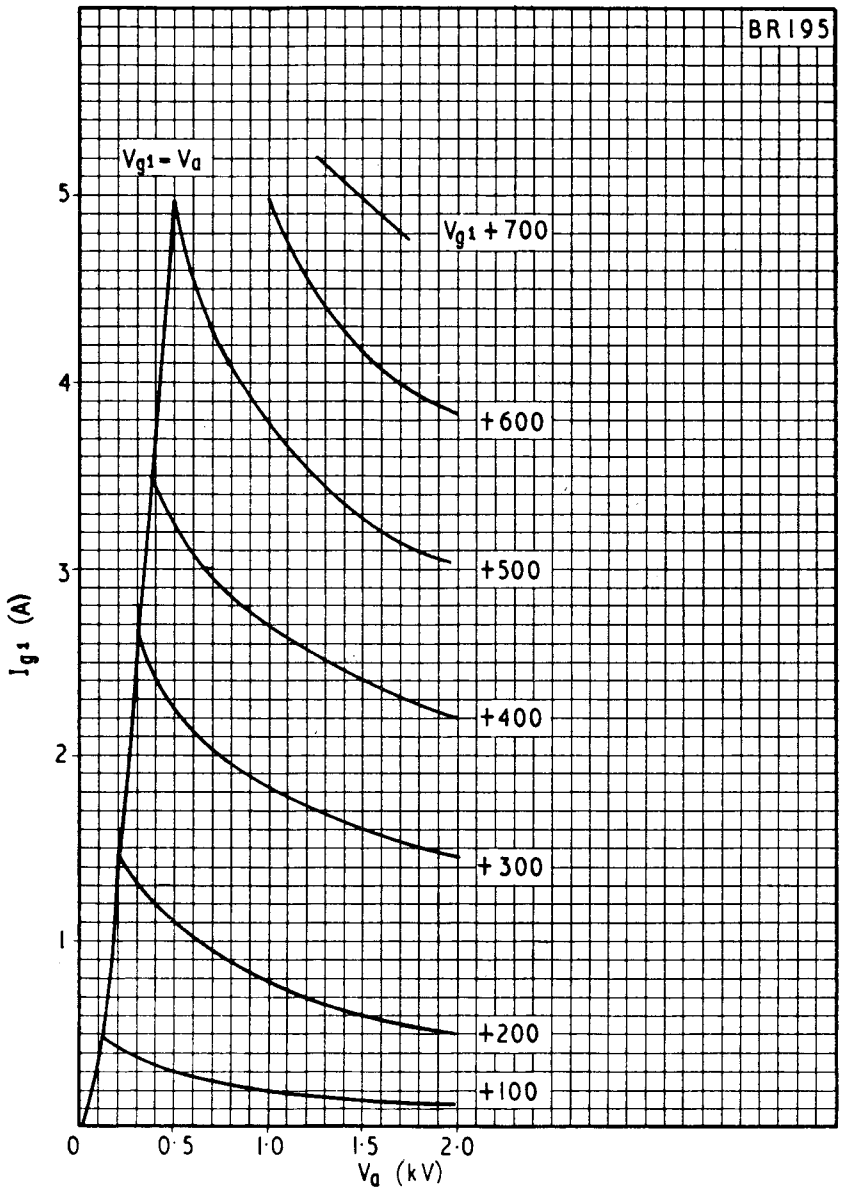
*The valve must be operated at the stated filament voltage.

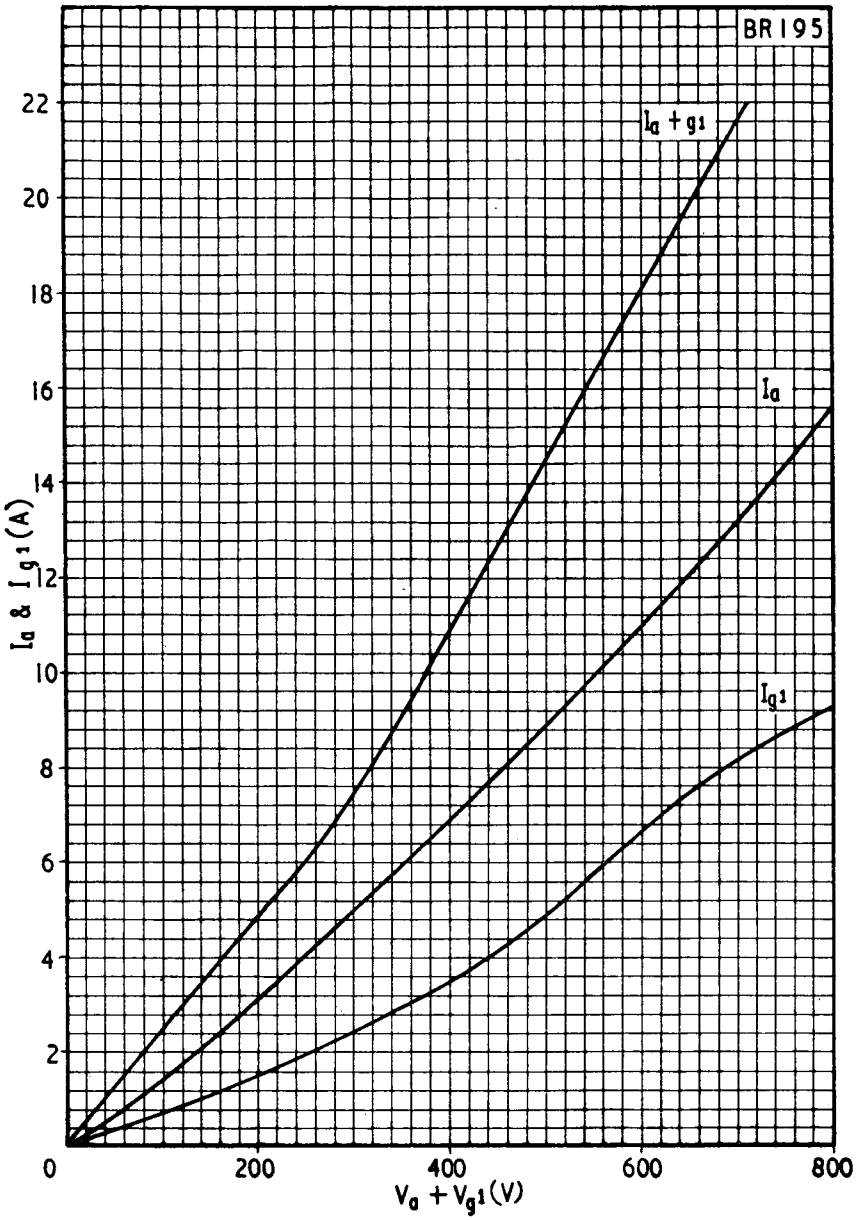


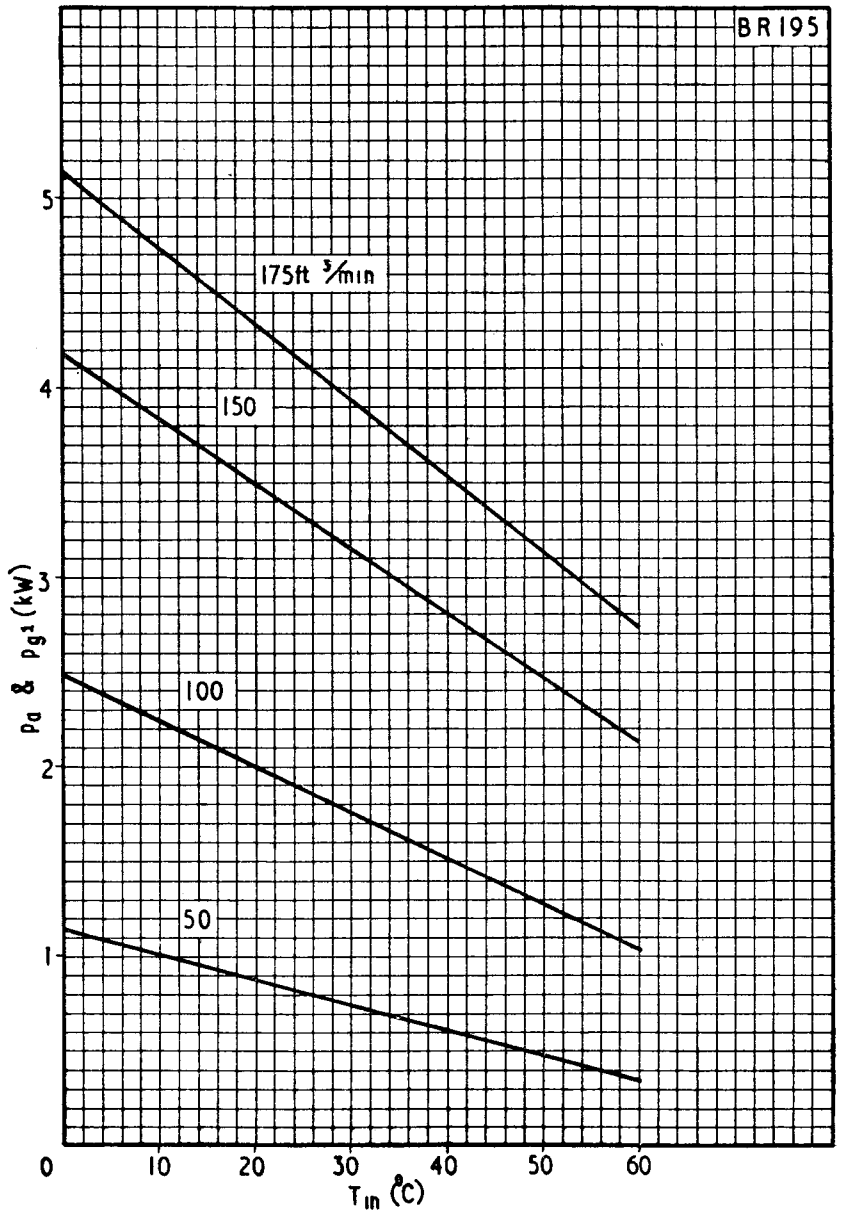
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

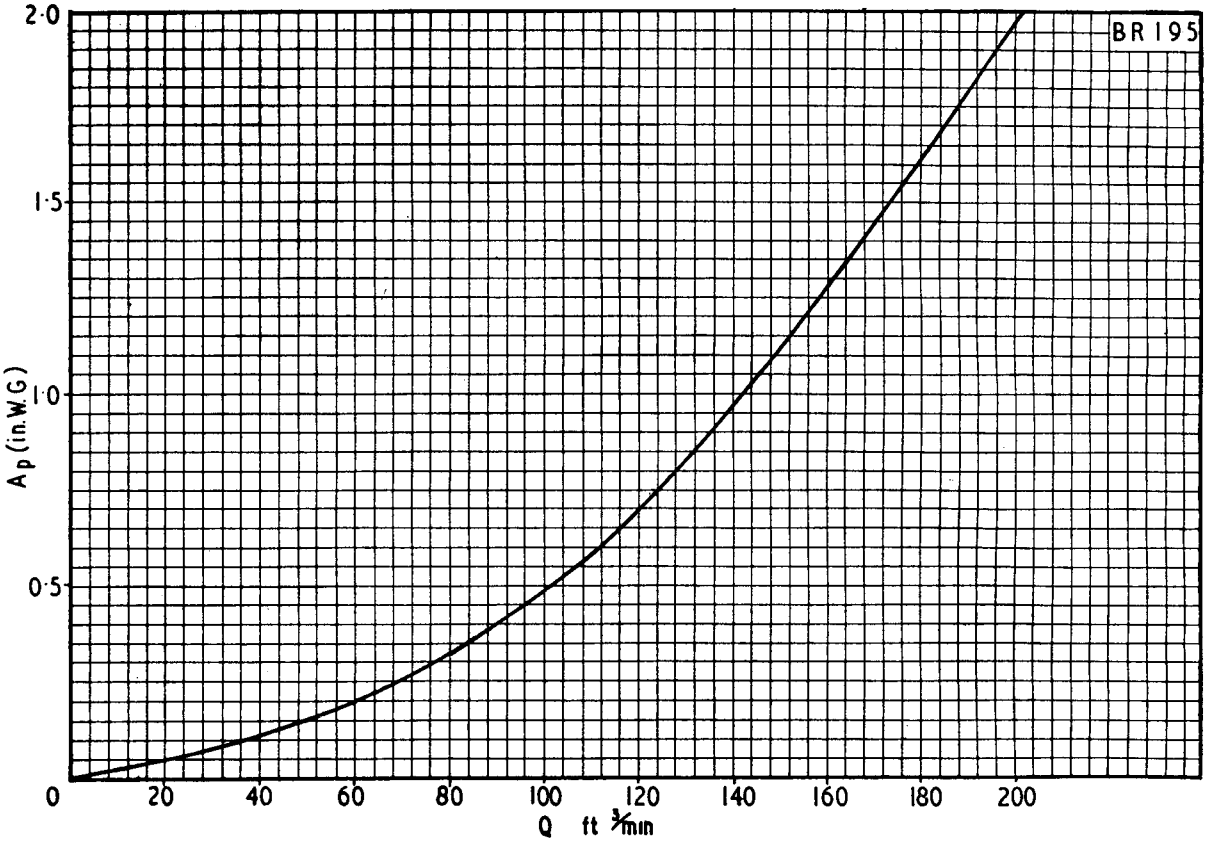
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


BR195
V_{g1} + 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
0
- 100
- 200
- 300
$V_{g1} = V_a$
I_a (A)
V_a (kV)
0
1
2
3
4
5
6
7
8
9
10
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30


BR195
$V_{g1} = V_a$
V_{g1} + 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
I_{g1} (A)
V_a (kV)
0
0·5
1·0
1·5
2·0
1
2
3
4
5


BR195
$I_a + g_1$
I_a
I_{g1}
I_a & I_{g1} (A)
$V_a + V_{g1}$ (V)
0
200
400
600
800
2
4
6
8
10
12
14
16
18
20
22


BR195
175ft ^{3}/min
150
100
50
P_a & P_{g1} (kW)
T_{in} (°C)
0
10
20
30
40
50
60
1
2
3
4
5



PRINTED IN ENGLAND

Triode *Type BW 137*

HF AMPLIFIER AND OSCILLATOR

General. The BW 137 is a single-ended cooled-anode transmitting triode fitted with a tungsten filament.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the envelope. The rated flow of cooling water is approximately 20 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 65°C and the temperature rise across the jacket should not exceed 15°C.

The external grid and filament seals require air cooling. The volume of air necessary is approximately 20 cu. ft. per minute and should be directed on to the grid and filament seals from above through a 1 in. nozzle. The temperature of the seals must not exceed 140°C.

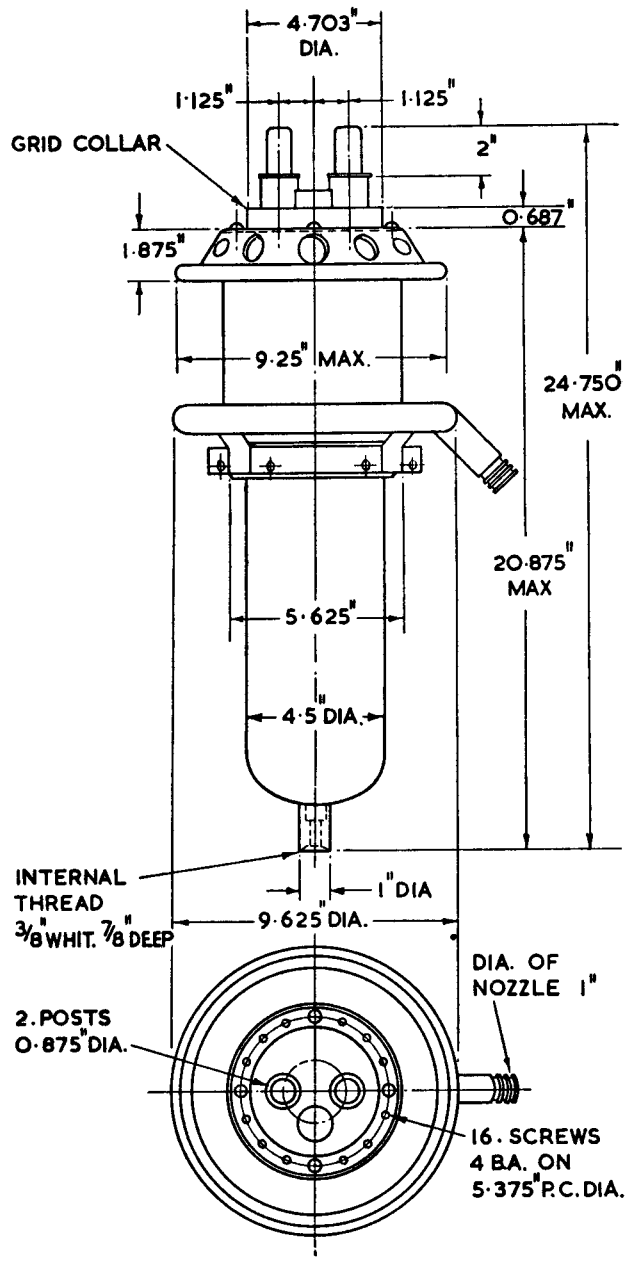
The anode seal also requires air cooling. An air blast should be connected to the corona ring which is fitted to the valve. The pressure at the ring is required to be 1 in. water gauge. The temperature of the anode must not exceed 180°C.

Filament Starting. The cold filament resistance is approximately 0·0039 Ω. The filament current must not exceed 600 A at any time during the switching-on period.

APPROXIMATE DATA

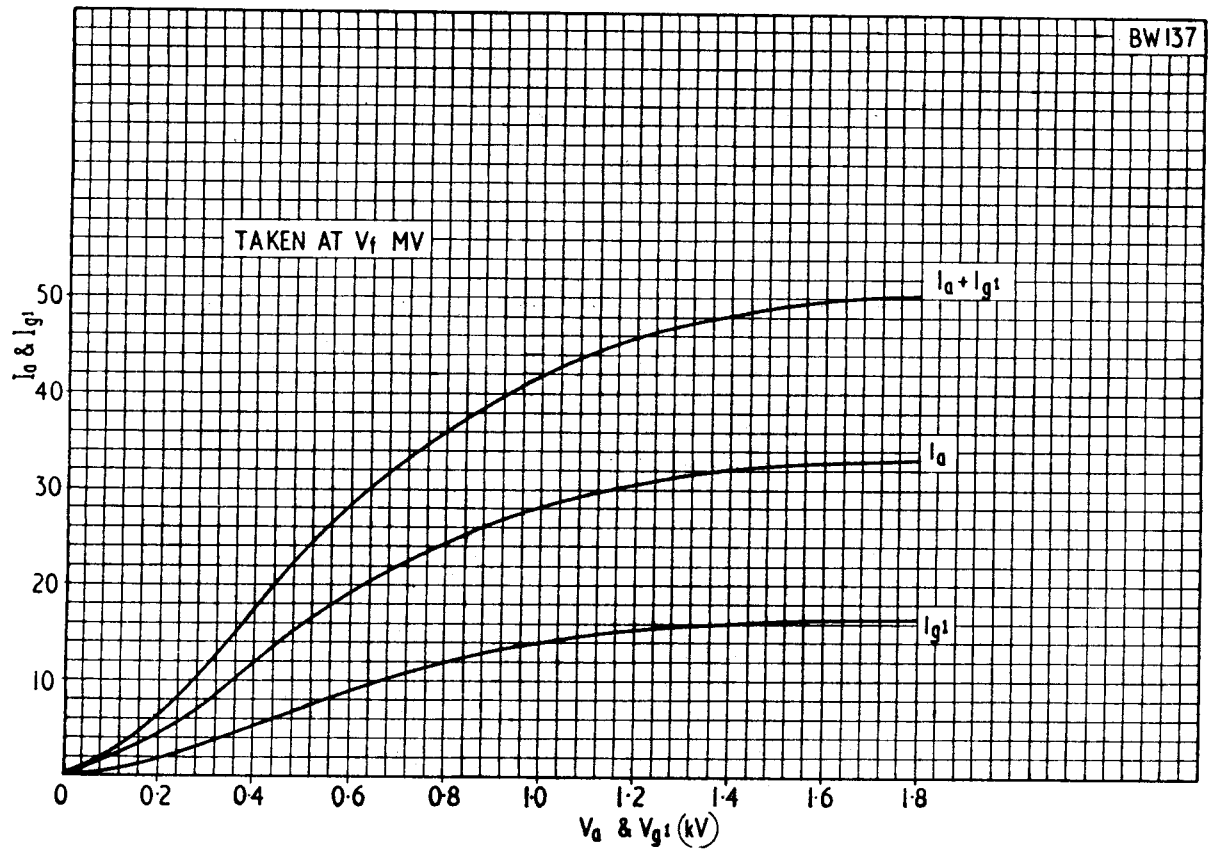
V_f		18	V
I_f		400	A
$V_{a\ (max)}$		15	kV
$p_{a\ (max)}$		40	kW
$p_{g1\ (max)}$		3	kW
μ	(taken at V_a 9 kV, I_a 2 A)	40	
g_m	(taken at V_a 10 kV, I_a 2 A)	30	mA/V
$f_{(max)}$ (at full ratings)		50	Mc/s
C_{a-g1}		55	pF
C_{a-k}		2	pF
C_{g1-k}		80	pF

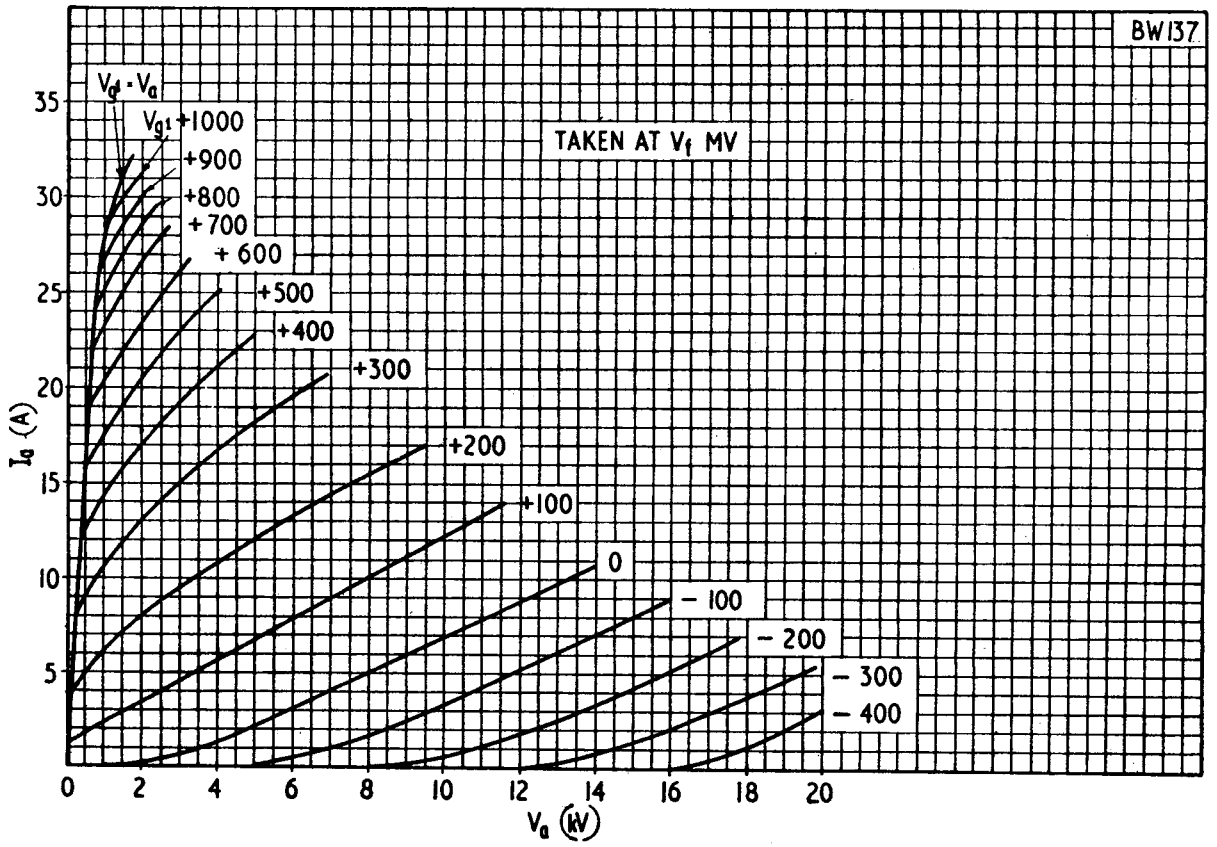
Marked Voltage. Each valve is marked with the filament voltage required to give 45 A peak emission at 90% saturation.

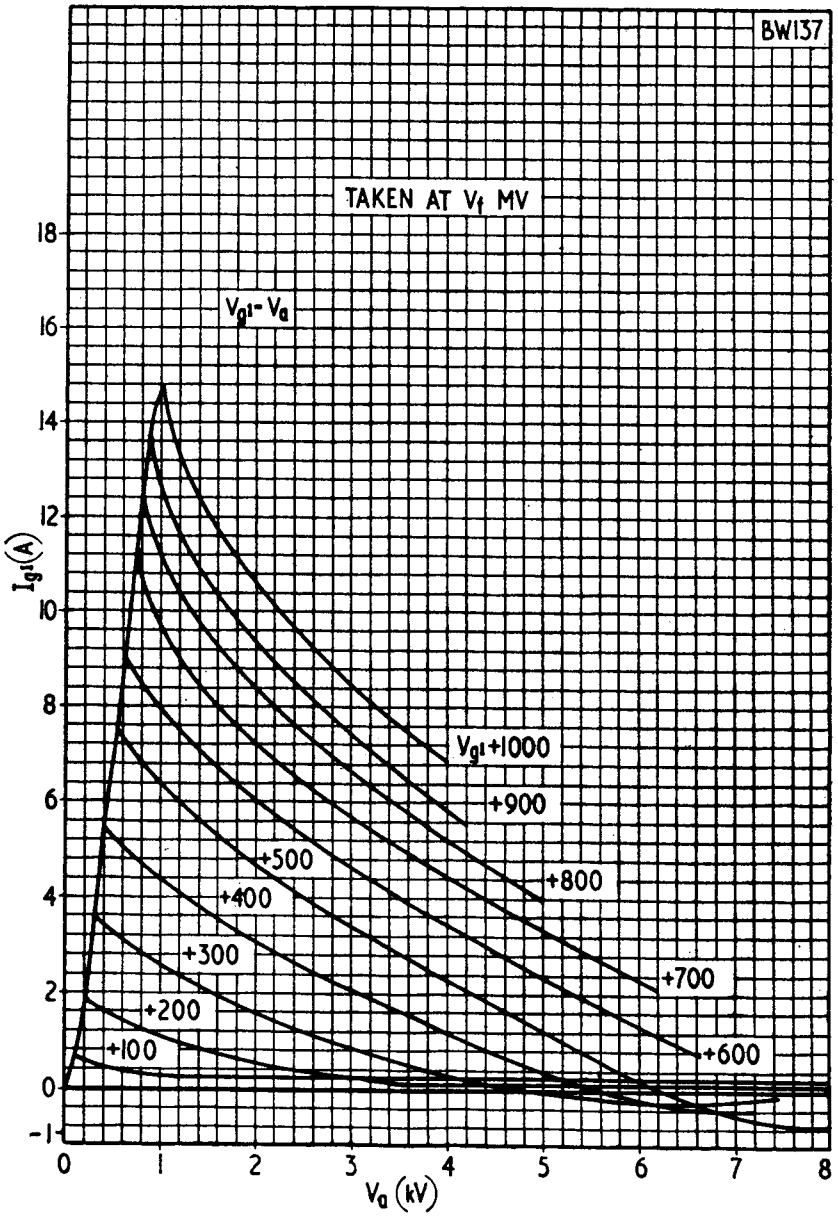


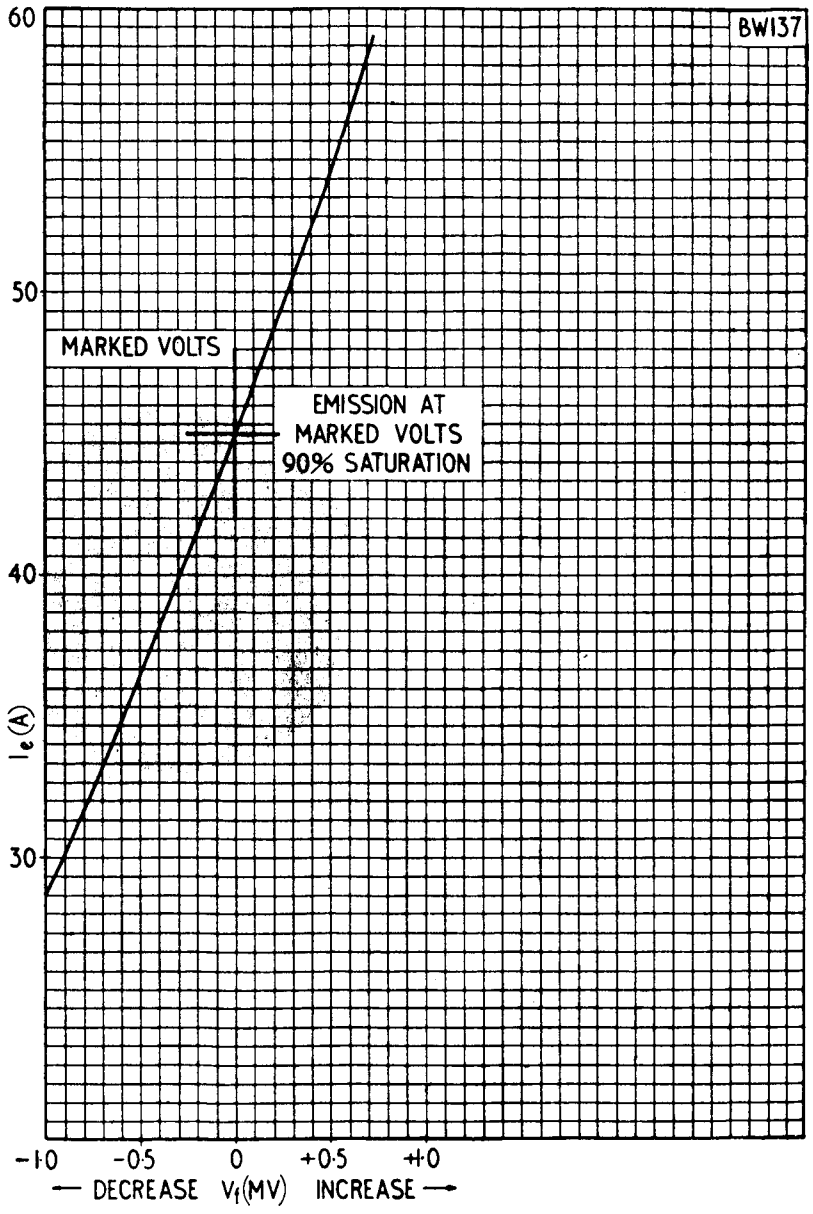
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


BW137
TAKEN AT V_f MV
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1}
50
40
30
20
10
0
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1·6
1·8
V_a & V_{g1} (kV)


BW137
TAKEN AT V_f MV
V_{g1} - V_a
V_{g1} +1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
0
− 100
− 200
− 300
− 400
I_a (A)
35
30
25
20
15
10
5
0
2
4
6
8
10
12
14
16
18
20
V_a (kV)


BW137
TAKEN AT V_f MV
V_{g1} - V_a
V_{g1} +1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
I_{g1}(A)
V_a (kV)
18
16
14
12
10
8
6
4
2
0
-1
0
1
2
3
4
5
6
7
8


BW137
MARKED VOLTS
EMISSION AT
MARKED VOLTS
90% SATURATION
I_e(A)
60
50
40
30
-1·0
-0·5
0
+0·5
+1·0
← DECREASE V_f(MV) INCREASE →



PRINTED IN ENGLAND

Triode *Type BW 165*

HF AMPLIFIER AND OSCILLATOR

General. The BW-165 is a water-cooled transmitting triode fitted with a thoriated tungsten filament.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the valve envelope. The rated flow of cooling water is approximately 8 gallons per minute. The temperature of the cooling water at the outlet must not exceed 65°C and the temperature rise across the jacket must not exceed 15°C.

The external grid and filament seals require air cooling, the volume of air necessary being 20 cu. ft. per minute, and should be directed vertically downwards on to the valve from a 1 in. nozzle. The temperature of the grid and filament seals must not exceed 140°C.

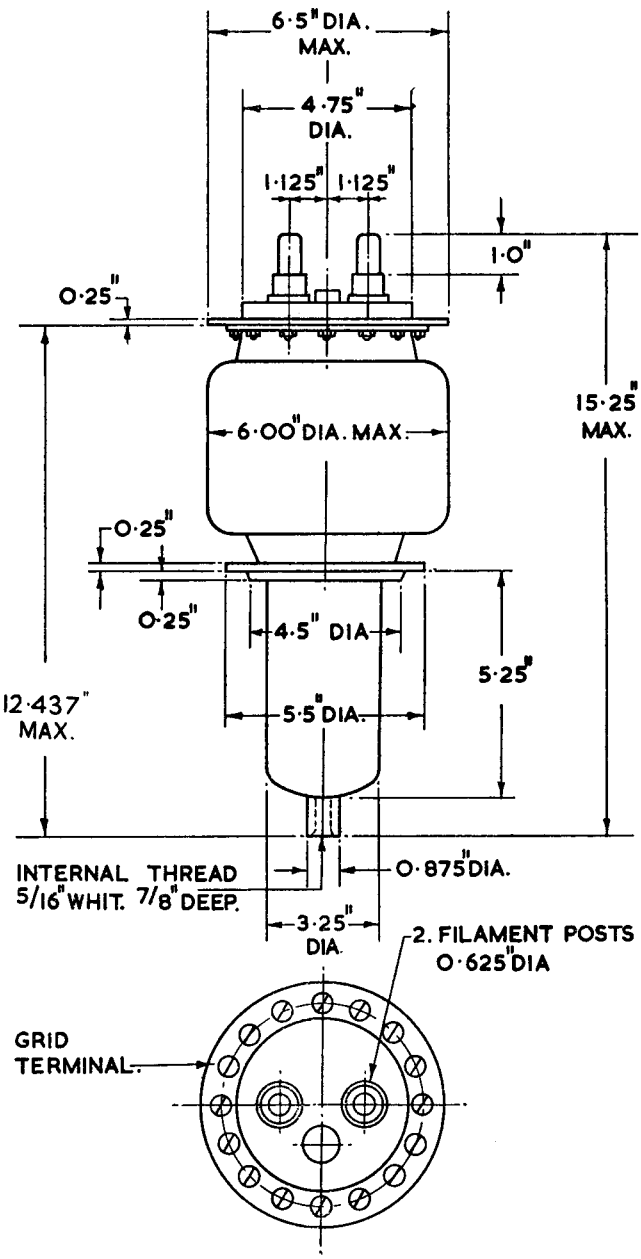
All cooling supplies must be started before the application of any supply voltage and must be continued for at least one minute after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·0045 Ω. The filament current must not exceed 450 A, even momentarily, at any time.

APPROXIMATE DATA

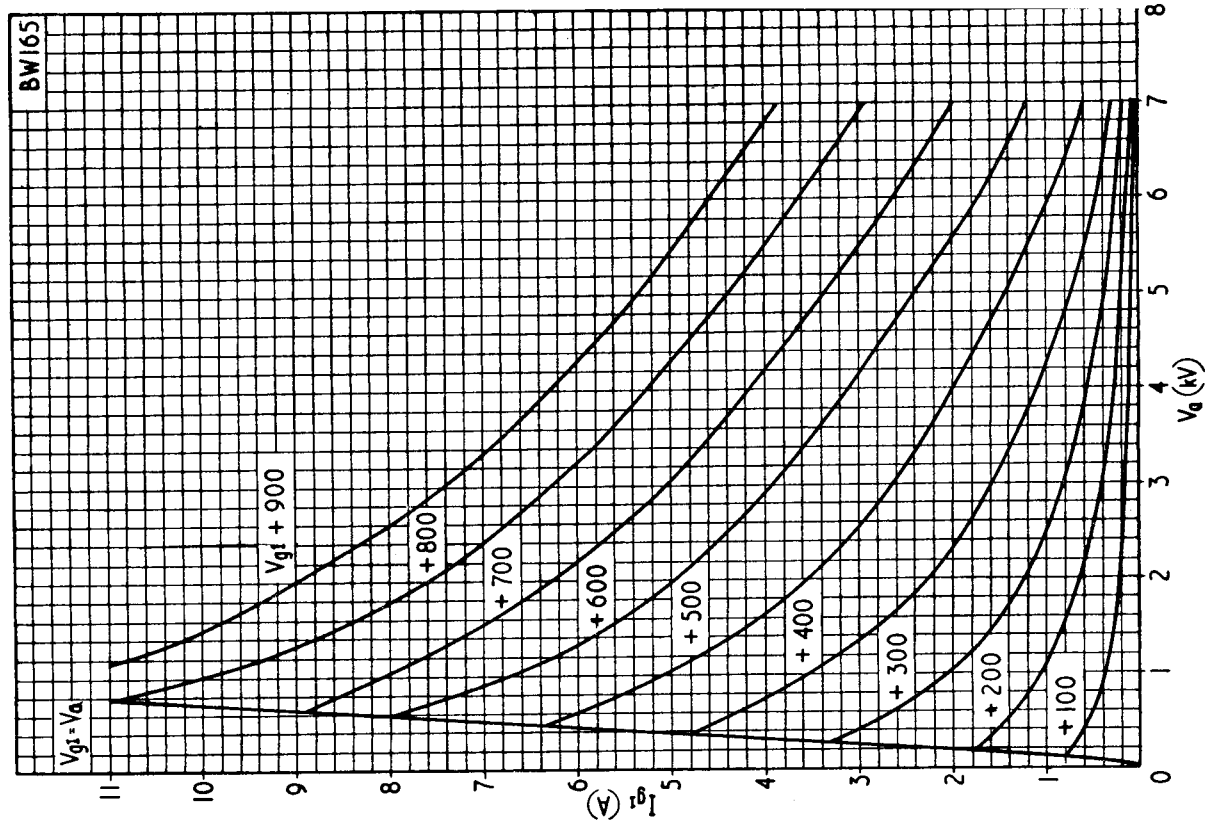
V_f		7·2	V*
I_f		170	A
V_a (max)		12	kV
p_a (max)		24	kW
p_{gl} (max)		1	kW
μ	(taken at V_a 9 kV, I_a 2A)	26	
g_m	(taken at V_a 10 kV, I_a 1·5A)	19	mA/V
I_k (pk)		35	A
f (max) (at full ratings)		50	Mc/s
$c_{a\text{-}gl}$		30	pF
$c_{a\text{-}k}$		1·5	pF
$c_{gl\text{-}k}$		46·5	pF

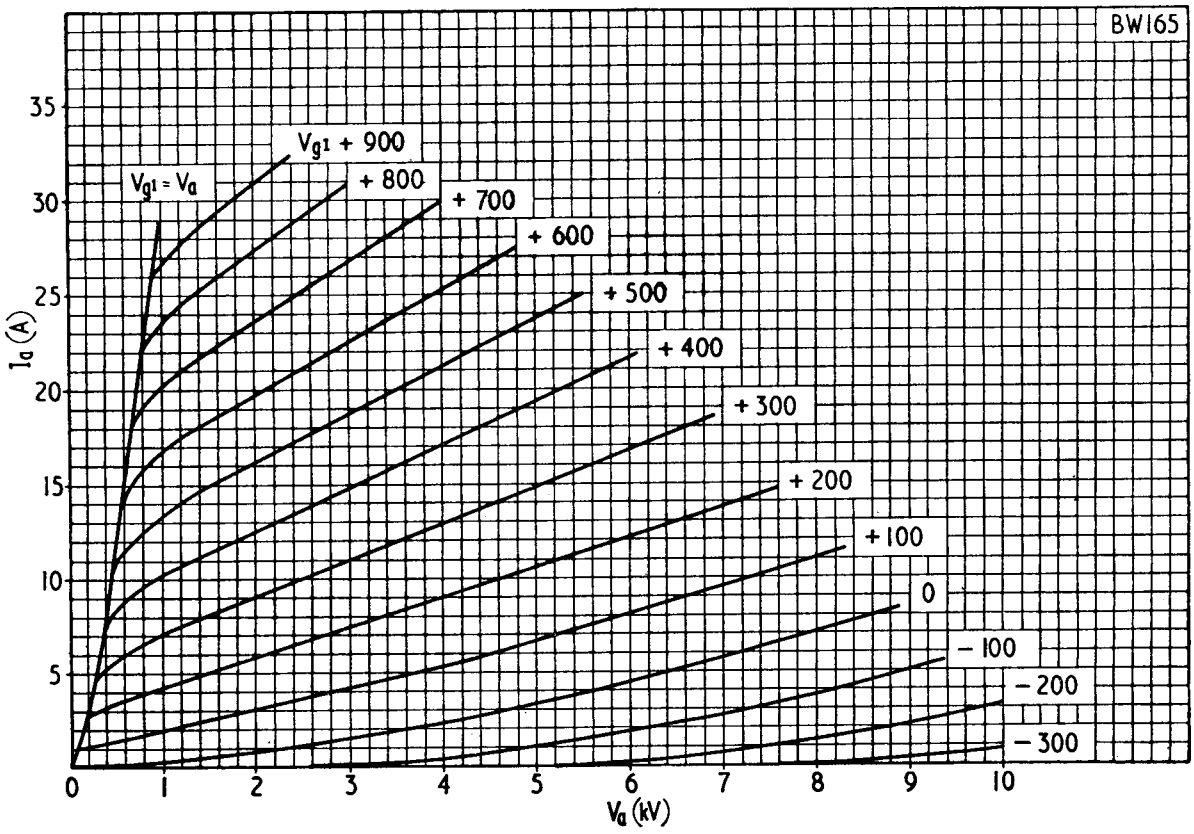
* The valve must be operated at the marked filament voltage.

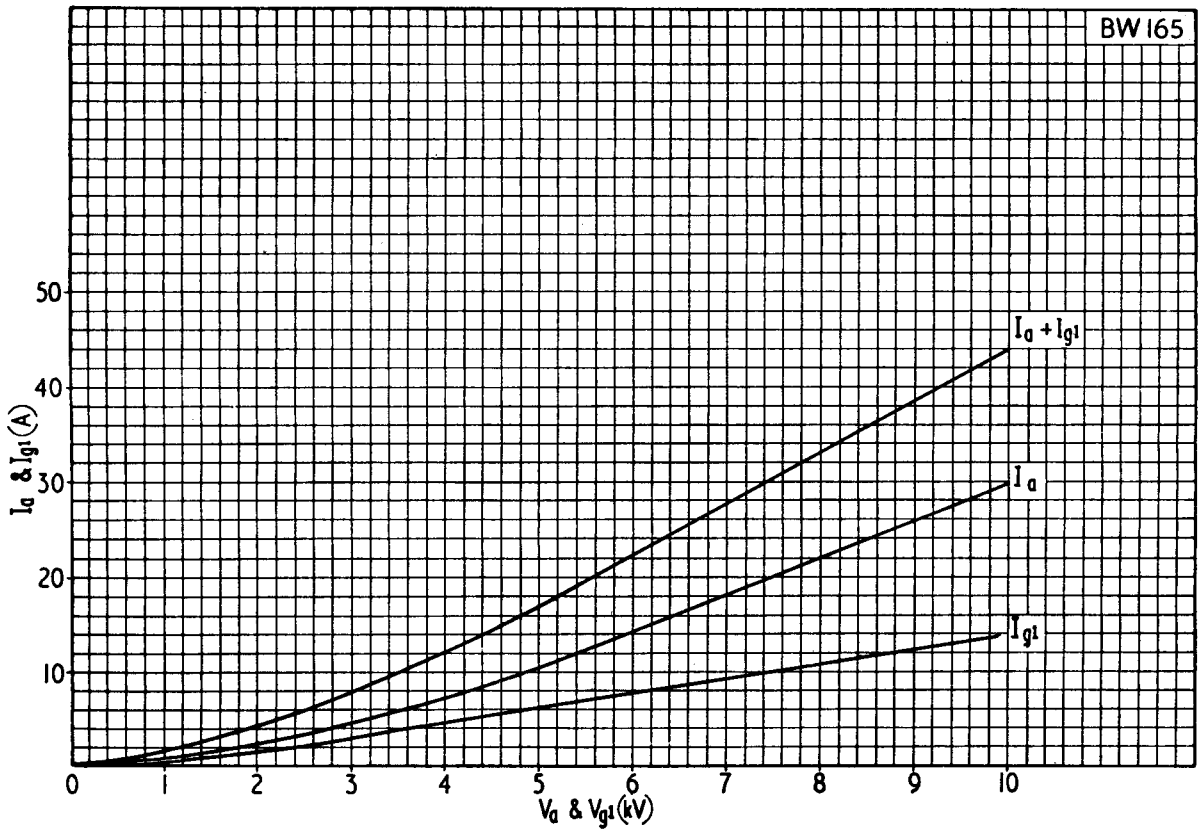


MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


BW165
V_{g1} + 900
+ 800
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
$V_{g1} = V_a$
I_{g1} (A)
V_a (kV)


BW165
V_{g1} + 900
+ 800
+ 700
+ 600
+ 500
+ 400
+ 300
+ 200
+ 100
0
− 100
− 200
− 300
$V_{g1} = V_a$
I_a (A)
V_a (kV)


BW 165
50
40
30
20
10
I_a & I_{g1} (A)
$I_a + I_{g1}$
I_a
I_{g1}
0
1
2
3
4
5
6
7
8
9
10
V_a & V_{g1} (kV)



PRINTED IN ENGLAND

Triode *Type BW 189*

HF AMPLIFIER AND OSCILLATOR

General. The BW 189 is a water-cooled transmitting triode fitted with a thoriated tungsten filament.

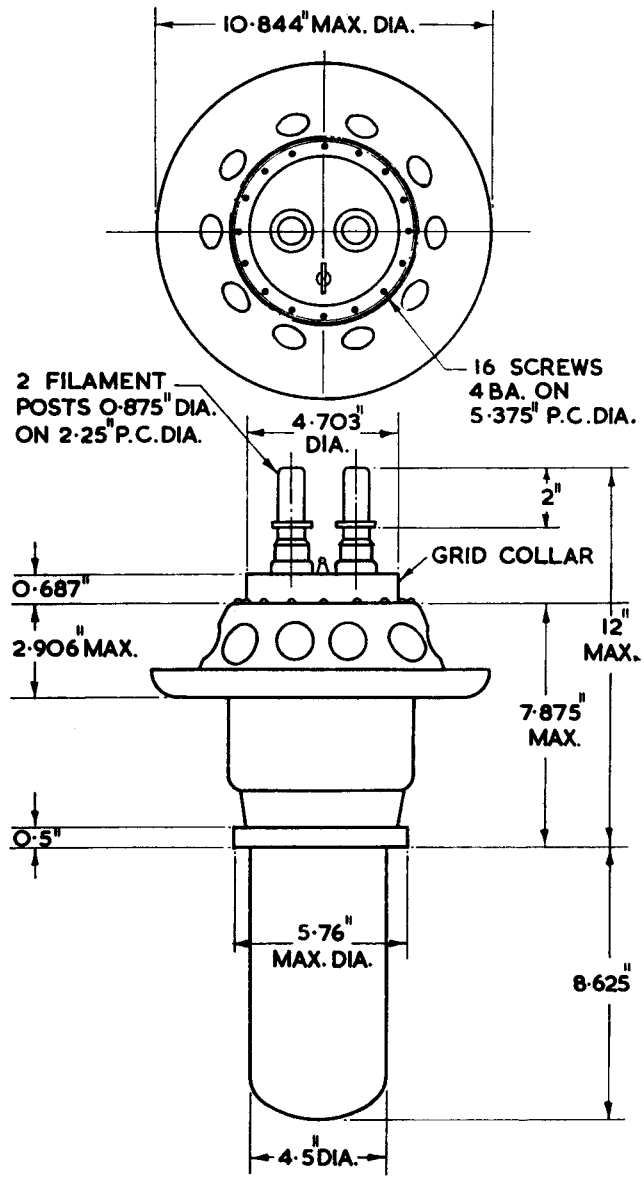
Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulating in direct contact with the valve envelope. The rated flow of the cooling water is 15–20 gallons per minute. The temperature of the cooling water at the outlet must not exceed 65°C and the temperature rise across the jacket must not exceed 15°C.

The external grid and filament seals require air cooling, the volume of air necessary being 20 cu. ft. per minute, directed vertically downward from a 1-in. nozzle. The temperature of the grid and filament seals must not exceed 140°C.

The anode seal also requires forced air cooling. An air blast must be supplied through the corona ring which is fitted to the valve jacket. The pressure at the ring is required to be 1 in. water gauge. The temperature of the anode seal must not exceed 180°C.

All cooling supplies must be started before the application of any supply voltage and must be continued for at least one minute after the removal of all supply voltages.

Filament Starting. The cold filament resistance is approximately 0·004Ω. The filament current must not exceed 600 A, even momentarily, at any time.



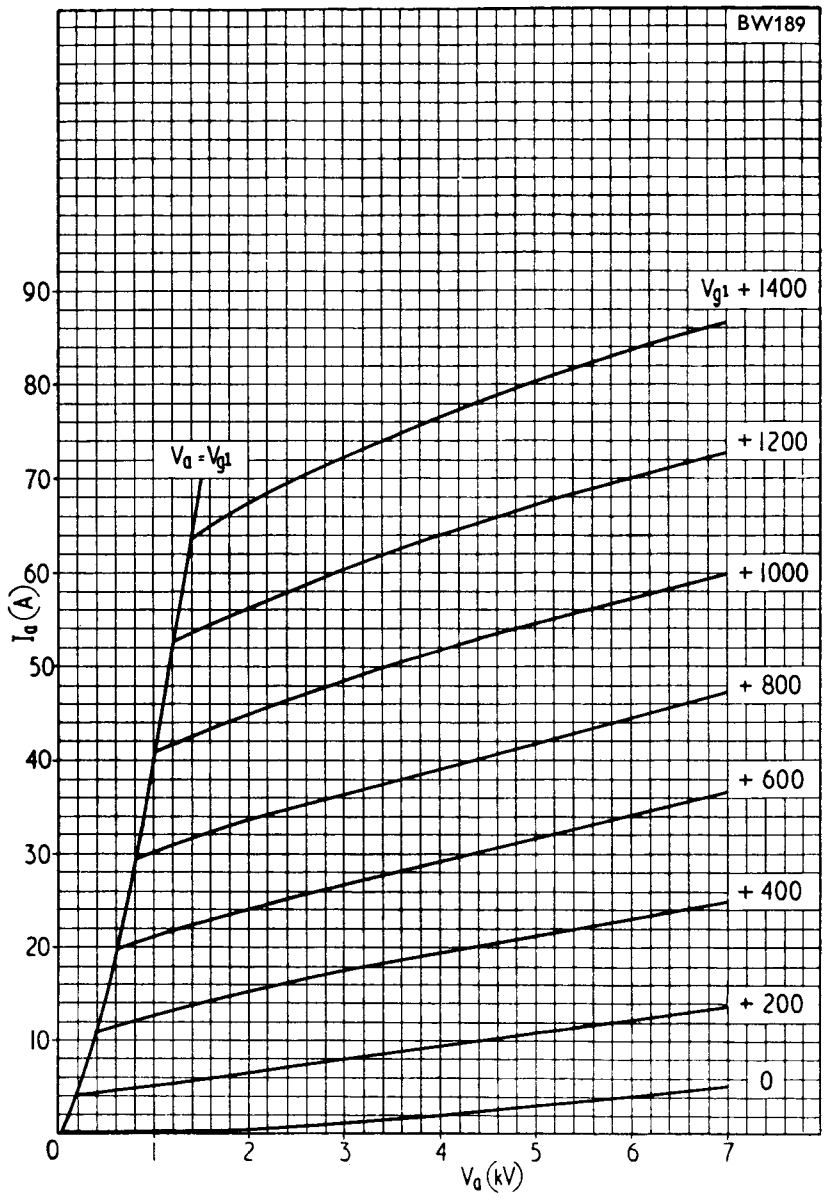
APPROXIMATE DATA

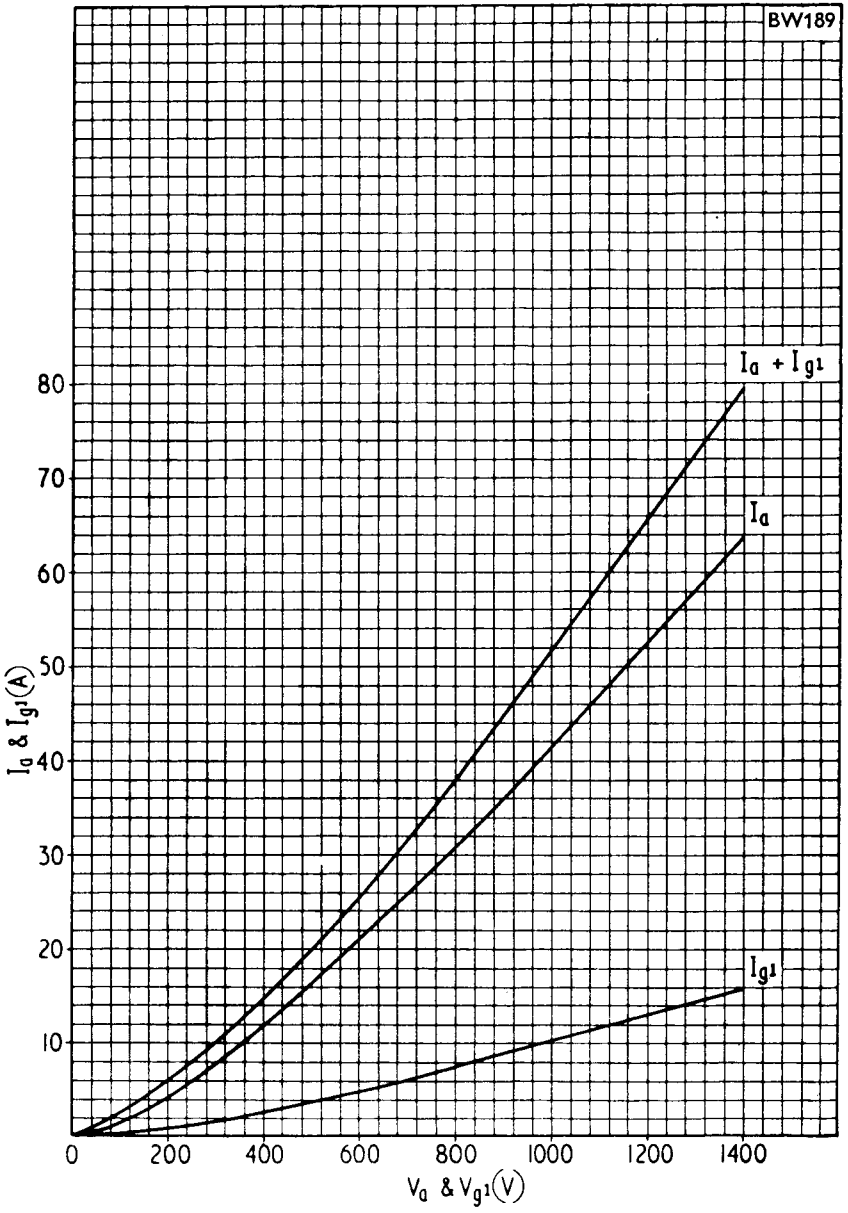
*V_f		9	V
I_f		240	A
$I_{k\ (pk)\ (max.)}$		70	A
$V_{a\ (max.)}$		12	kV
$p_{a+pgl\ (max.)}$		35	kW
$p_{gl\ (max.)}$		1·25	kW
μ	V_a=9 kV, I_a=2A	34	
g_m	V_a=9 kV, I_a=2A	27·5	mA/V
†$f_{(max.)}$	(at full ratings)	20	Mc/s
C_{a-gl}		61	pF
C_{a-k}		1·5	pF
C_{gl-k}		68	pF

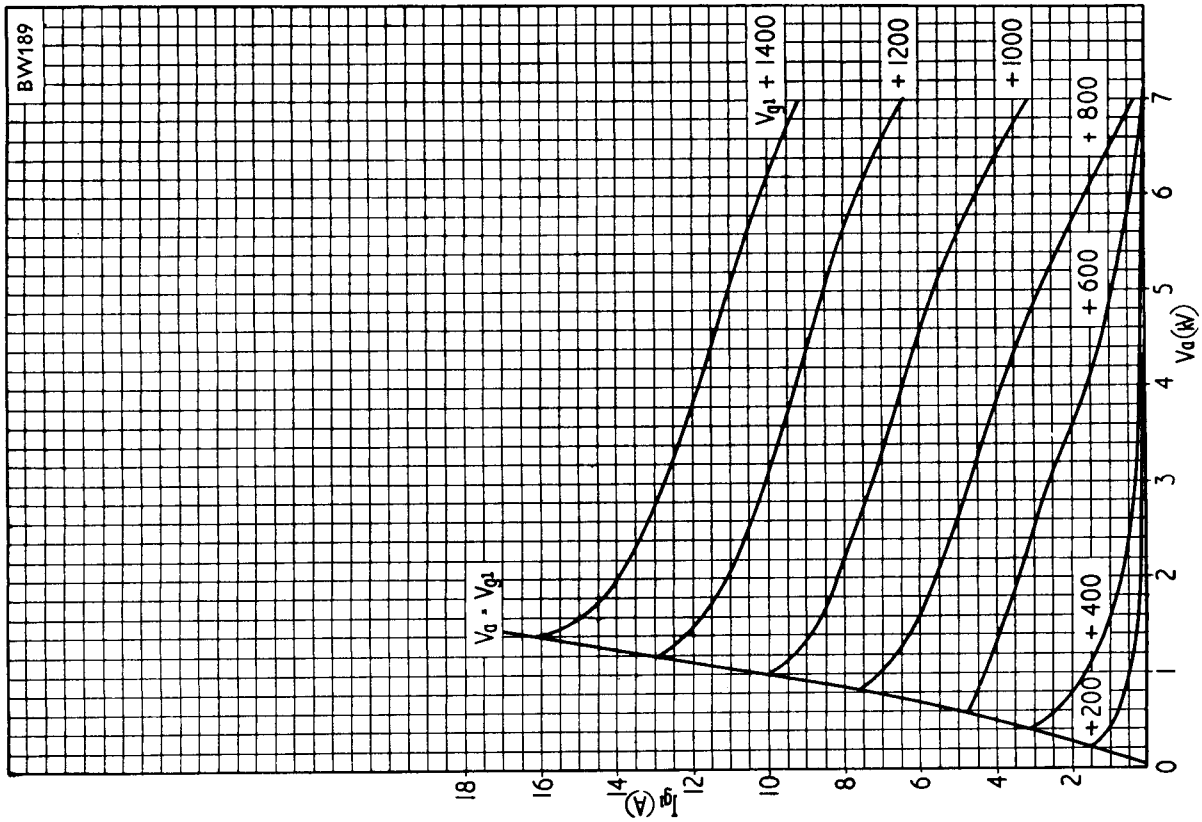
* The valve must be operated at marked filament voltage.
† Reduced ratings (V_a=8kV) up to 50 Mc/s.

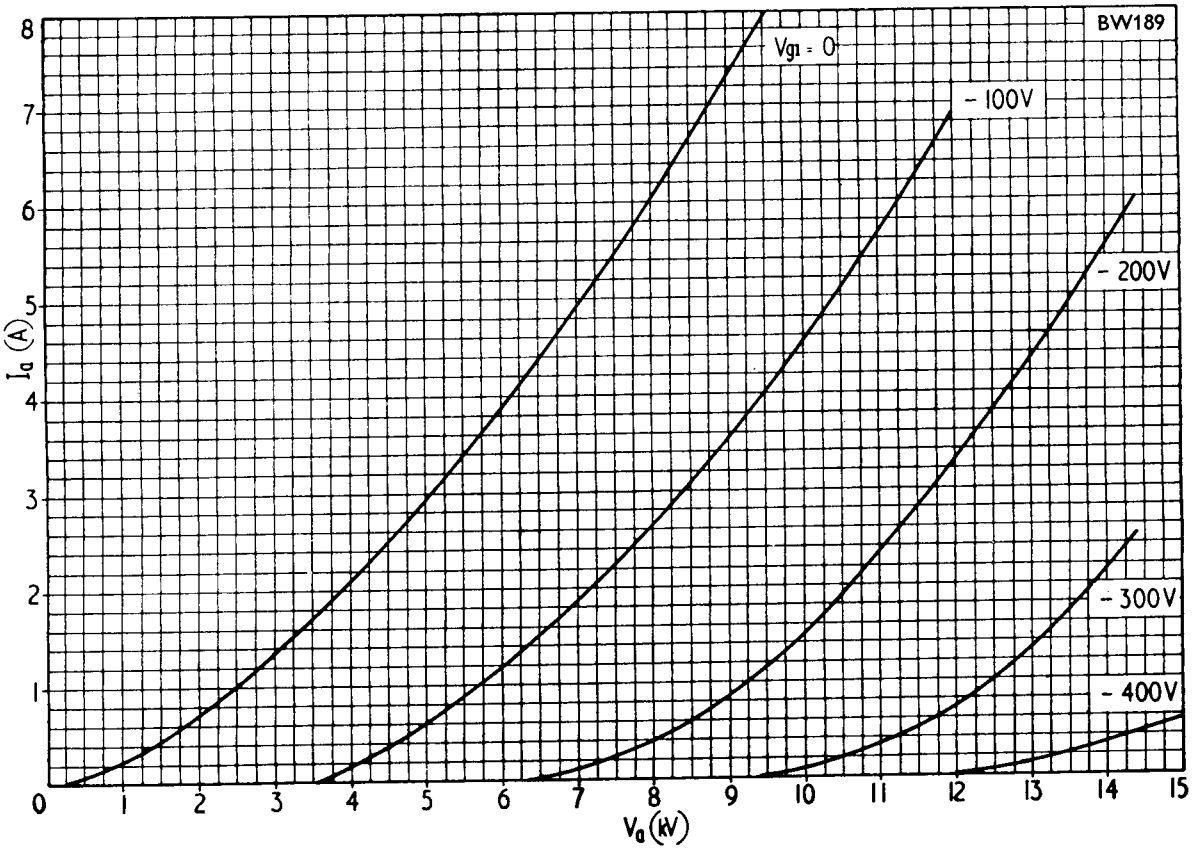
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*


BW189
V_{g1} + 1400
+ 1200
+ 1000
+ 800
+ 600
+ 400
+ 200
0
$V_a = V_{g1}$
I_a (A)
V_a (kV)
0
1
2
3
4
5
6
7
10
20
30
40
50
60
70
80
90


BW189
$I_a + I_{g1}$
I_a
I_{g1}
I_a & I_{g1} (A)
V_a & V_{g1} (V)
0
200
400
600
800
1000
1200
1400
10
20
30
40
50
60
70
80


BW189
V_{g1} + 1400
+ 1200
+ 1000
+ 800
+ 600
+ 400
+ 200
$V_a - V_{g1}$
I_g (A)
V_a (kV)


BW189
V_{g1} = 0
- 100V
- 200V
- 300V
- 400V
I_a (A)
V_a (kV)



PRINTED IN ENGLAND

Twin Tetrode *Type C144*

HF POWER AMPLIFIER

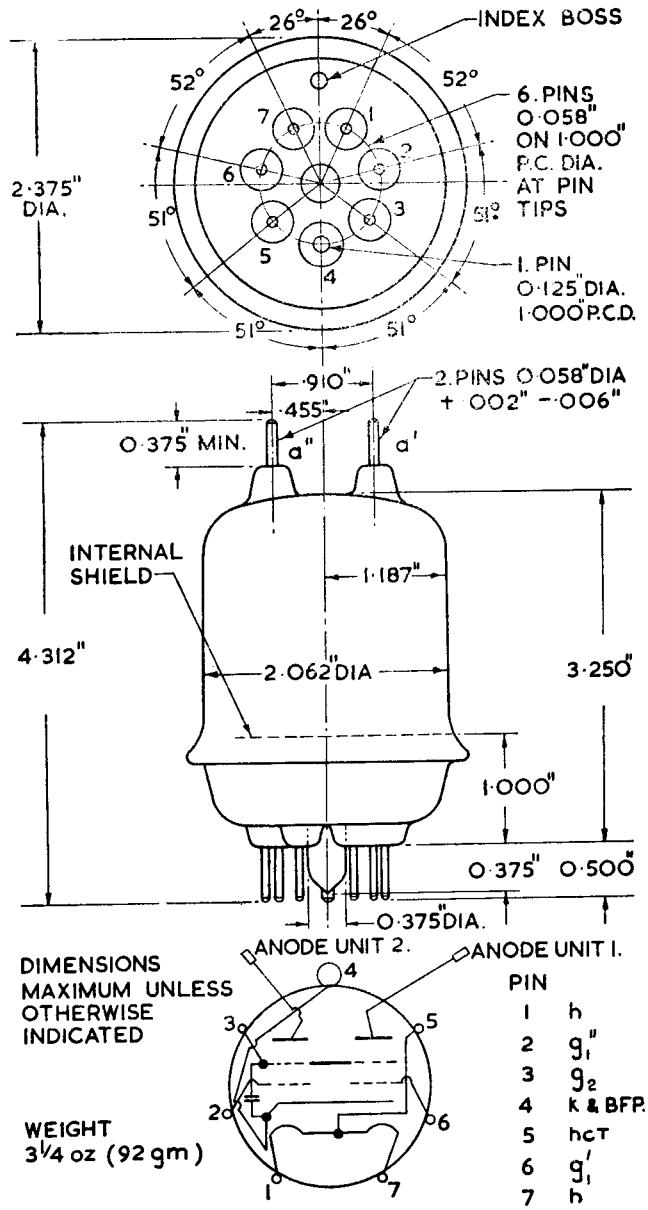
General. A push-pull beam tetrode fitted with an indirectly heated cathode, suitable for use as an HF power amplifier at frequencies up to 200 Mc/s.

Cooling. Forced air cooling is recommended to keep the bulb temperature below 175°C.

APPROXIMATE DATA

Unless otherwise stated values are for both units

	Series	*Parallel*
V_f	12·6	6·3 V
I_f	1·125	2·25 A
$V_{a\ (max)}$	750 V	
$V_{g2\ (max)}$	225 V	
$p_{a\ (max)}$	40 W	
$\mu_{g1\text{-}g2}$	Per unit	8·5 mA/V
g_m	taken at I_a 60 mA	9
$c_{g1\text{-}a}$ (with external shielding)	0·12 pF	
C_{in}	14·5 pF	
C_{out}	7·0 pF	
$c_{g2\text{-}k}$ (including internal screen by-pass condenser)	65 pF (approx.)	



BASE B7A (SEPTAR)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

APPLICATION DATA

PUSH-PULL RF POWER AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY

(One valve, unmodulated, key down conditions)

Maximum permissible ratings (a)

V_a	750	V
V_{g2}	225	V
V_{g1}	−175	V
I_a	240	mA
I_{g1}	15	mA
P_{in}	120	W
p_{g2}	7	W
p_a	40	W

Typical Operation

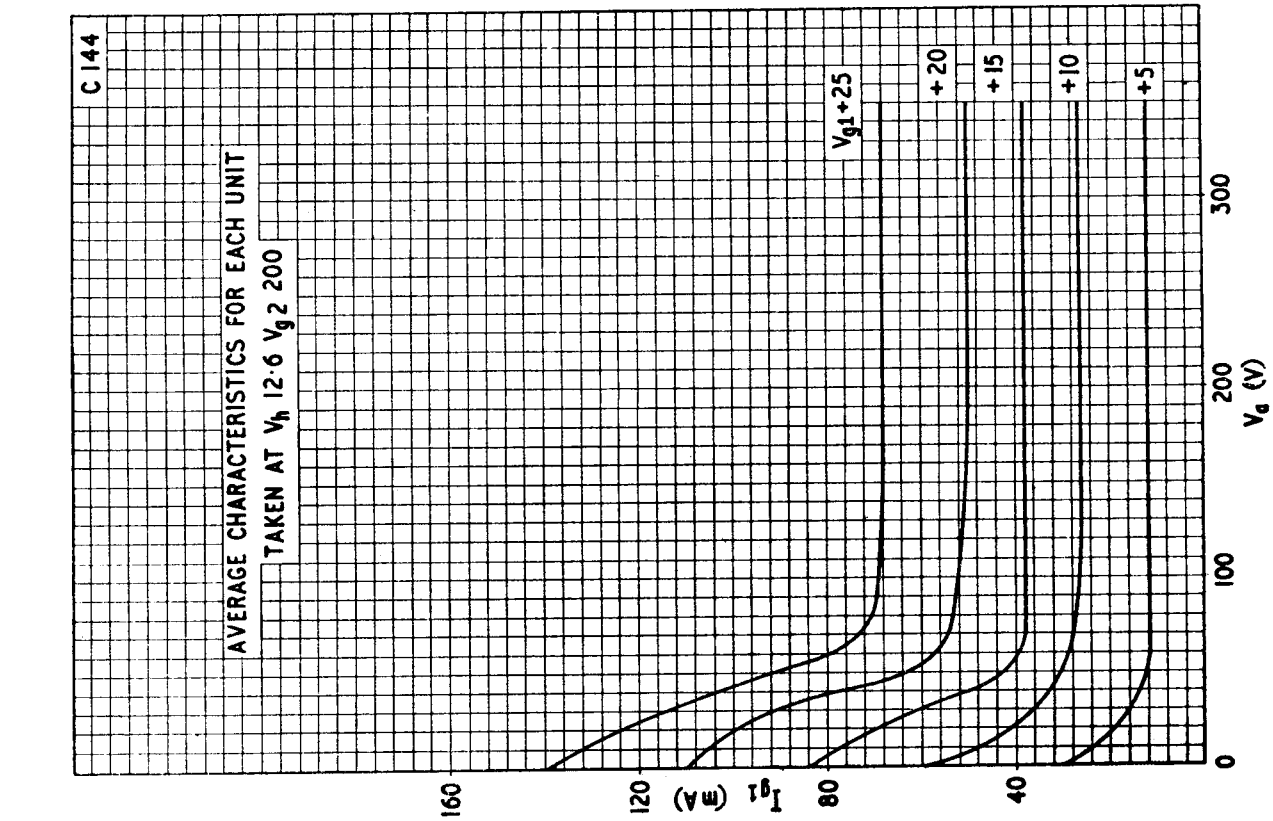
V_a	500	750	V
I_a	240	160	mA
V_{g2}			
from a fixed supply of	200	200	V
via R_{g1}	9,300	18,300	Ω
I_{g2}	32	30	mA
V_{g1}			
from a fixed supply of	−45	−55	V
via R_k	160	270	Ω
via R_{g1} (b)	3,750	4,600	Ω
I_{g1} (c)	12	12	mA
$v_{g1'-g1''(pk)}$	124	140	V
P_{dr} (c)	0·7	0·8	W
P_{out} (c)	83	87	W

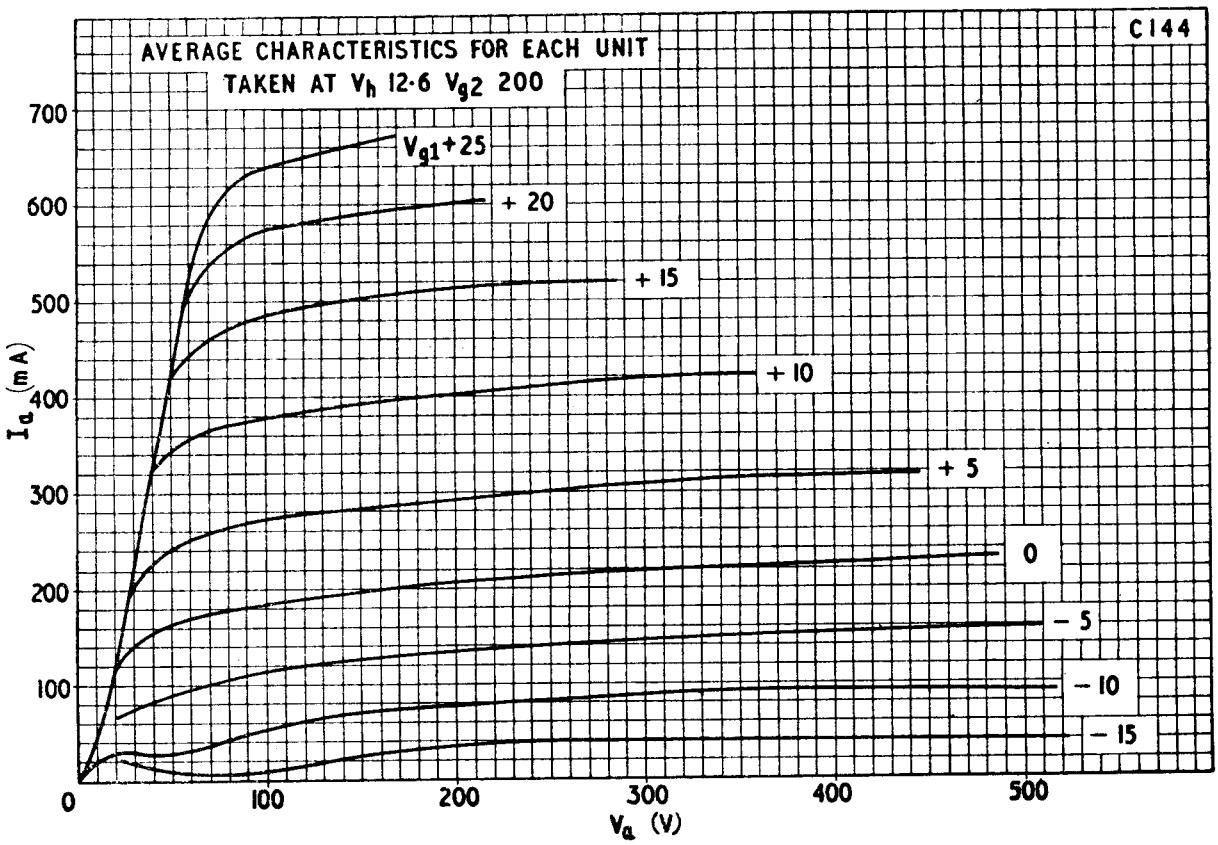
NOTES

(a) Modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier conditions.

(b) The grid circuit resistance should never exceed 15,000 Ω (total) per valve, or 30,000 Ω per unit. If additional bias is necessary, a cathode resistor or a fixed supply should be used.

(c) Subject to wide variation. The figures given are approximate only.


C144
AVERAGE CHARACTERISTICS FOR EACH UNIT
TAKEN AT V_h 12·6 V_{g2} 200
V_{g1}+25
+20
+15
+10
+5
I_{g1} (mA)
160
120
80
40
V_a (V)
0
100
200
300


C144
AVERAGE CHARACTERISTICS FOR EACH UNIT
TAKEN AT V_h 12·6 V_{g2} 200
V_{g1}+25
+20
+15
+10
+5
0
−5
−10
−15
I_a (mA)
700
600
500
400
300
200
100
0
100
200
300
400
500
V_a (V)



PRINTED IN ENGLAND

Twin Tetrode *Type C 178*

(VHF AMPLIFIER AND OSCILLATOR)

General. The Type C 178 is a double tetrode primarily intended for use as a Class 'C' amplifier or oscillator at frequencies up to 500 Mc/s. It is fitted with an indirectly heated cathode for series or parallel operation.

Cooling. Max. temperature of the base pins 180°C.
Max. temperature of bulb and anode seals 200°C.

Natural cooling is sufficient with:

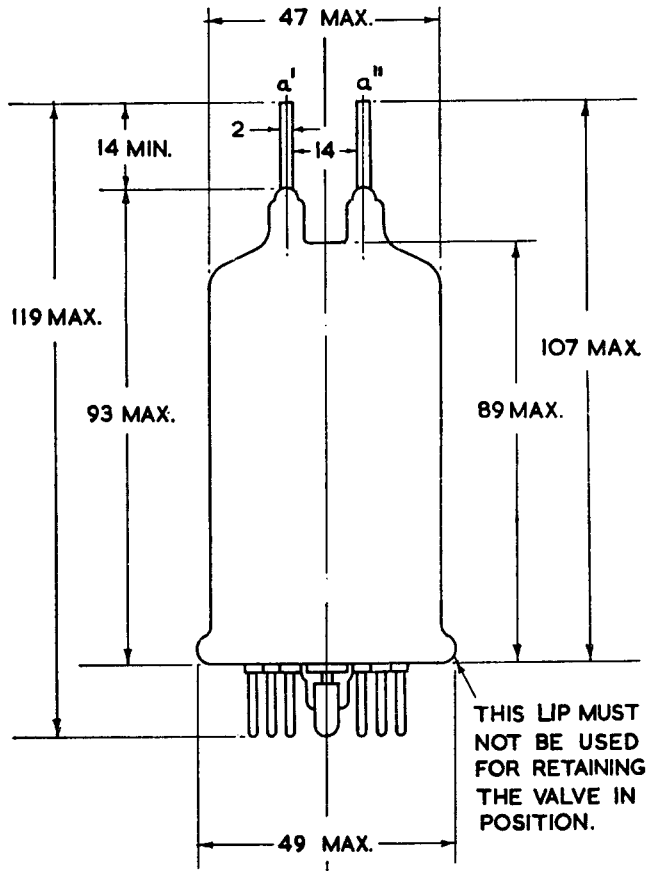
Va = 750 V at frequencies up to 100 Mc/s
Va = 600 V at frequencies up to 150 Mc/s
Va = 300 V at frequencies up to 400 Mc/s

When the above limits are exceeded or with high ambient temperatures it may be necessary to direct an airflow of up to 5 cu. ft. per minute onto the top of the bulb to keep the seal temperatures within the stated limit. Anode connectors, providing a high degree of heat transfer by radiation or by conduction should be used.

Mounting. The valve may be mounted vertically, with the base either upwards or downwards; or horizontally, with the anode pins in the horizontal plane.

APPROXIMATE DATA

	Series	Parallel	
V_h	12·6	6·3	V
I_h	0·9	1·8	A
g_m	4·5 mA/V	(each section)	
$\mu_{g1\text{-}g2}$	8	at Ia = 30 mA	
$V_{a(max)}$		750	V
$p_{a(max)}$		2×20	W
$V_{g2(max)}$		250	V



WEIGHT 2 1/4 oz. (60 gm.) DIMENSIONS IN MM

$p_{g2(max)}$	2×3·5	W	$R_{gl\text{-}k}$ auto bias			100	kΩ
$p_{gl(max)}$	2×1	W	$V_{h\text{-}k}$			100	V
$I_{gl(max)}$	2×5	mA	$c_{a\text{-}all}$	each section		3·2	pF
I_k	2×120	mA	$c_{a\text{-}gl}$	each section		internally neutralised	
$I_{k(pk)(max)}$	2×700	mA	$c_{gl\text{-}all}$	each section		10·5	pF
$V_{gl(max)}$	−175	V	c_{out}	two sections		2·1	pF
$R_{gl\text{-}k}$ fixed bias	50	kΩ	c_{in}	in push-pull		6·7	pF

Typical Operation

(1) RF POWER AMPLIFIER CLASS C TELEGRAPHY OR FM TELEPHONY

Maximum ratings

V_a	750	V	I_k	2×120	mA
p_a	2×20	W	$i_{k(pk)}$	2×700	mA
V_{g2}	250	V	V_{gl}	−80	V
p_{g2}	2×3·5	W	$R_{gl\text{-}k}$ (fixed bias)	50	kΩ
p_{gl}	2×1·0	W	$R_{gl\text{-}k}$ (auto bias)	100	kΩ
I_{gl}	2×5·0	mA	$V_{h\text{-}k}$	100	V

Typical Conditions

f	200	200	400	400	475	475	Mc/s
V_a	400	600	400	540	350	500	V
V_{g2}	250	250	250	250	250	250	V
V_{gl}	−60	−80	−50	−55	−45	−50	V
I_a	2×100	2×100	2×100	2×100	2×100	2×100	mA
I_{g2}	2×8·0	2×9·0	2×5·0	2×7·0	2×4·5	2×4·5	mA
I_{gl}	2×3·0	2×3·5	2×2·0	2×1·5	2×2·0	2×2·0	mA
P_{dr} (*a*)	3·0	3·0	11	12	10	12	W
p_a	2×12	2×15	2×15	2×20	2×15	2×20	W
P_{out}	56	90	50	68	40	60	W
P_{load} (*b*)	45	72	39	52	32	45	W

(2) RF POWER AMPLIFIER CLASS C ANODE AND SCREEN GRID MODULATION

Maximum ratings

V_a	600	V
p_a	2×20	W
V_{g2}	250	V
p_{g2}	2×3·0	W
p_{gl}	2×1·0	W
I_k	2×120	mA
$i_{k(pk)}$	2×1·0	A
V_{gl}	−100	V
$R_{gl\text{-}k}$ (fixed bias)	50	kΩ
$R_{gl\text{-}k}$ (auto bias)	100	kΩ
$V_{h\text{-}k}$	100	V

Typical Conditions

f	200	Mc/s
V_a	500	V
V_{g2}	250	V
V_{gl}	−100	V
I_a	2×90	mA
I_{g2}	2×8·0	mA
I_{gl}	2×1·5	mA
P_{out}	63	W
η	63	%
P_{load} (*c*) 100% modulation	50	W
P_{mod}	45	W
$V_{g2(pk)mod}$	185	V

(3) FREQUENCY TREBLER CLASS C

Maximum ratings

V_a	600	V
p_a	2×20	W
V_{g2}	250	V
p_{g2}	2×3·0	W
p_{g1}	2×1·0	W
I_k	2×100	mA
$i_{k(pk)}$	2×700	mA
V_{g1}	−175	V
$R_{g1\text{-}k}$ (fixed bias)	50	kΩ
$R_{g1\text{-}k}$ (auto bias)	100	kΩ
$V_{h\text{-}k}$	100	V

Typical Conditions

f_{in}	50	50	70	Mc/s
f_{out}	150	150	210	Mc/s
V_a	400	500	500	V
V_{g2}	250	250	250	V
V_{g1}	−150	−150	−150	V
I_a	2×73	2×60	2×65	mA
I_{g2}	2×8·0	2×5·0	2×10	mA
I_{g1}	2×2·5	2×3·0	2×1·5	mA
$v_{in(pk)}$	2×180	2×180	2×180	V
P_{out}	18	20	12	W
η	31	33	23	%
P_{load} (*c*)	14·5	16	10	W

(4) AF AMPLIFIER OR MODULATOR CLASS B

Maximum ratings

V_a	600	V
p_a	2×20	W
V_{g2}	250	V
p_{g2}	3·5	W
p_{g1}	2×1·0	W
I_k	2×140	mA
$i_{k(pk)}$	2×450	mA
$R_{g1\text{-}k}$ (fixed bias)	50	kΩ
$R_{g1\text{-}k}$ (auto bias)	100	kΩ
$V_{h\text{-}k}$	100	V

Typical Conditions Class B1

V_a	300	450	600	V
V_{g2}	250	250	250	V
V_{g1}	−26	−27	−27	V
$I_{a\ (zero\text{-}sig)}$	2×20	2×20	2×20	mA
$I_{a\ (max\text{-}sig)}$	2×56	2×58	2×62	mA
$I_{g2\ (max\text{-}sig)}$	2×14	2×13·5	2×11·5	mA
I_{g1}	0	0	0	mA
$v_{in\ (g1\text{–}g1)\ (r.m.s.)}$	36	38	39	V
p_a	2×5·6	2×8·5	2×12	W
$R_{a\text{–}a}$	6·5	10	12·5	kΩ
P_{out}	22·5	35	50	W
D_{tot}	2·9	3·1	2·4	%
η	67	67·5	67·5	%

Typical Conditions Class B2

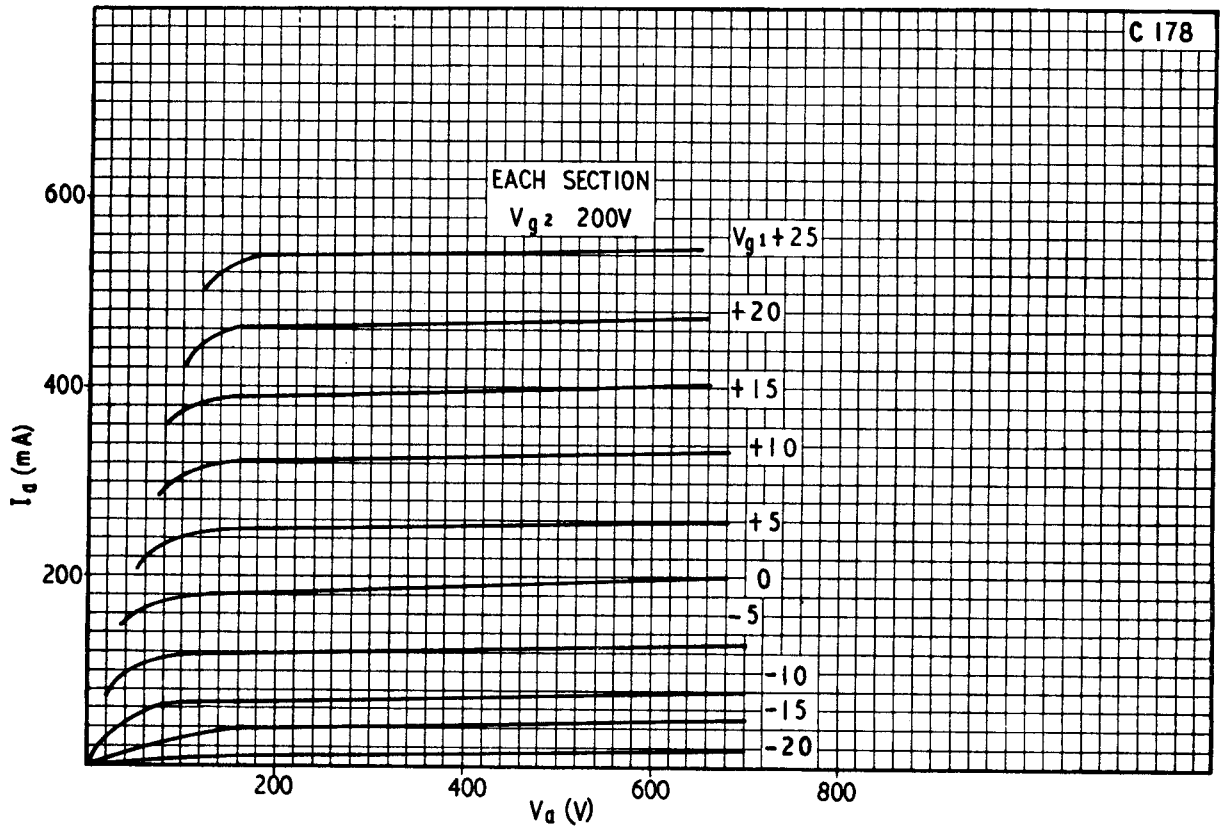
V_a	300	450	600	V
V_{g2}	250	250	250	V
V_{g1}	−25	−25	−25	V
$I_{a\ (zero\text{-}sig)}$	2×25	2×25	2×25	mA
$I_{a\ (max\text{-}sig)}$	2×94	2×97	2×100	mA
$I_{g2\ (max\text{-}sig)}$	2×14	2×14	2×13	mA
I_{g1}	2×2·6	2×2·6	2×2·6	mA
$v_{in\ (g1\text{-}g1)\ (r.m.s.)}$	52	54	55	V
p_a	2×9·7	2×13·5	2×17	W
$R_{a\text{-}a}$	4·0	6·0	8·0	kΩ
P_{out}	37	60	86	W
D_{tot}	5·0	5·0	5·0	%
η	65·5	69	71·5	%

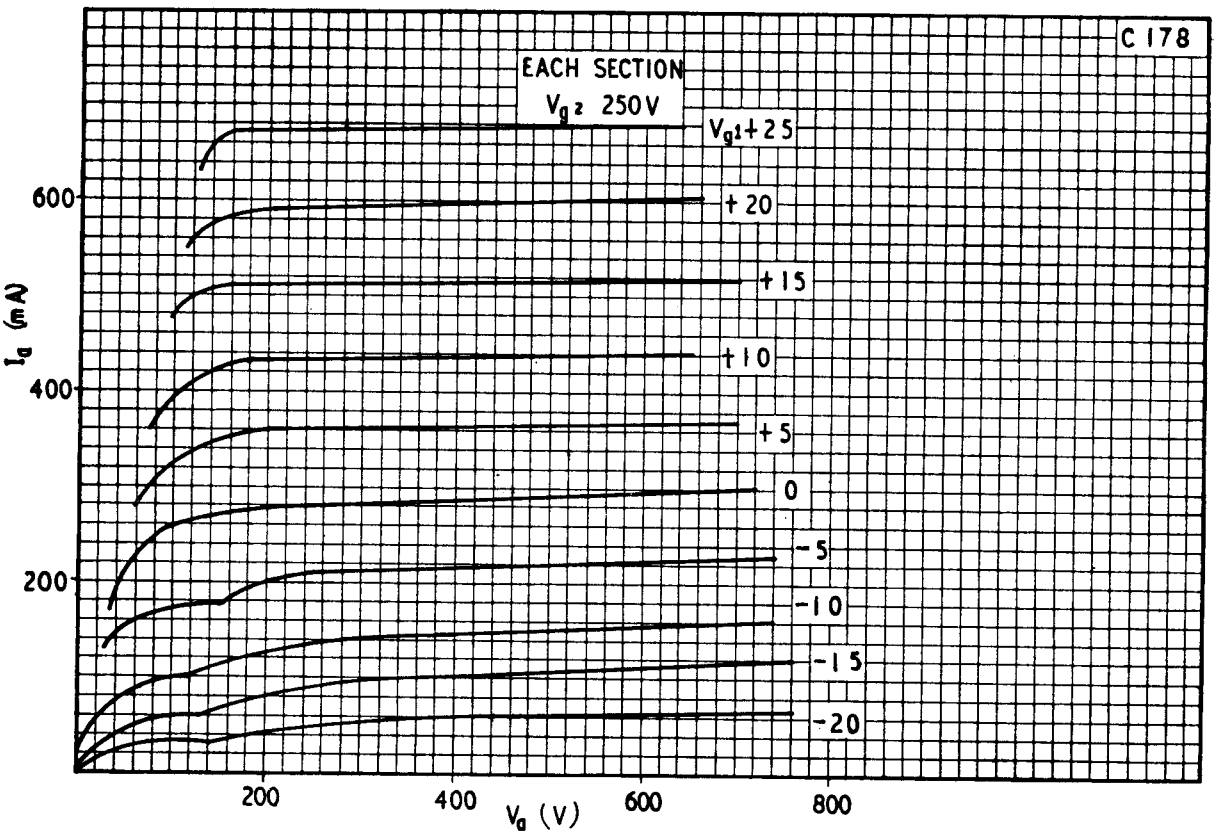
NOTES

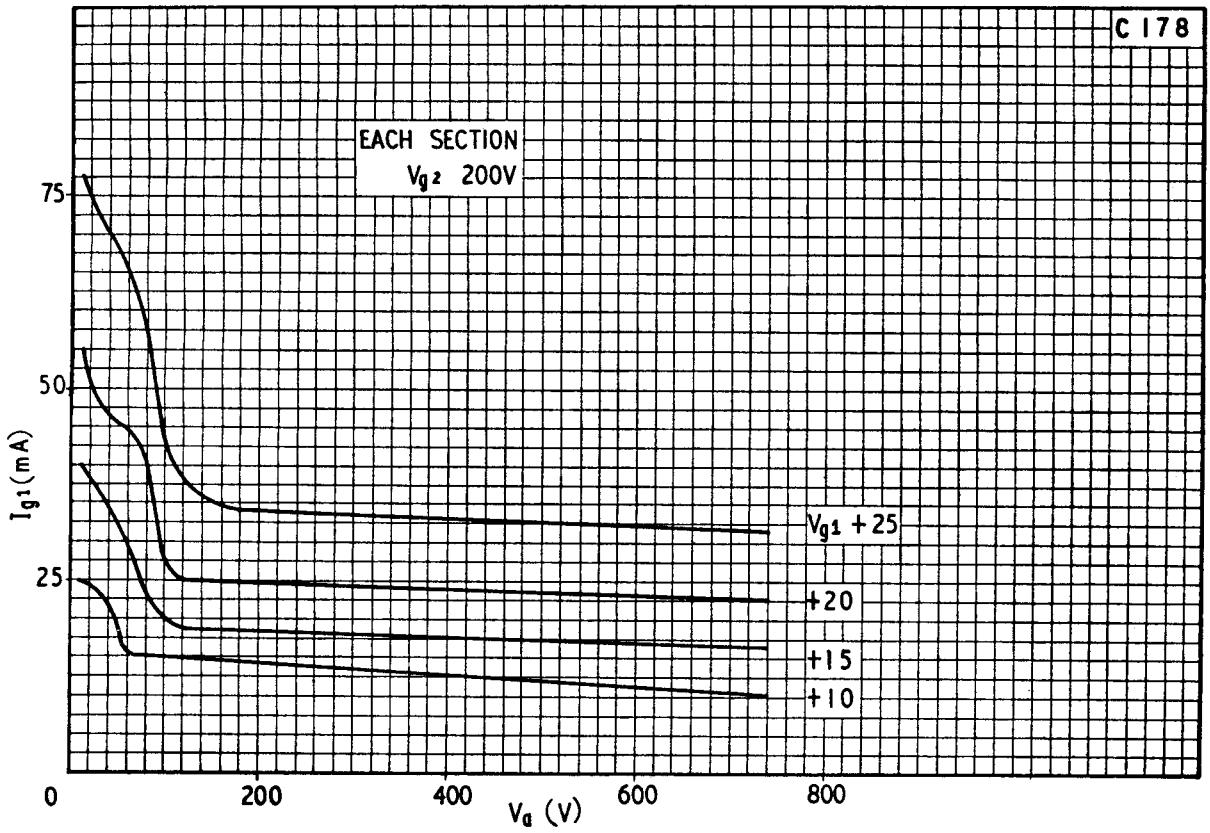
(*a*) Drive power includes typical fixed frequency grid-circuit loss.

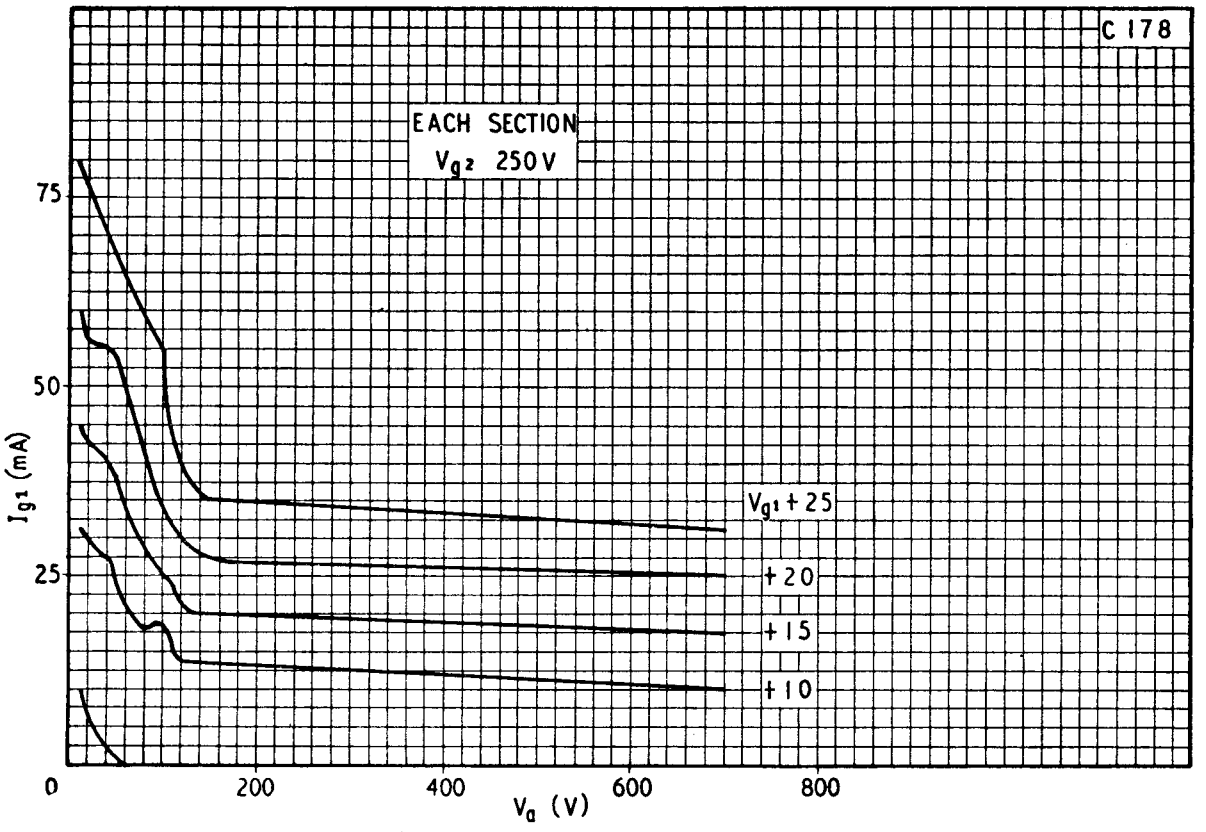
(*b*) Typical load powers.

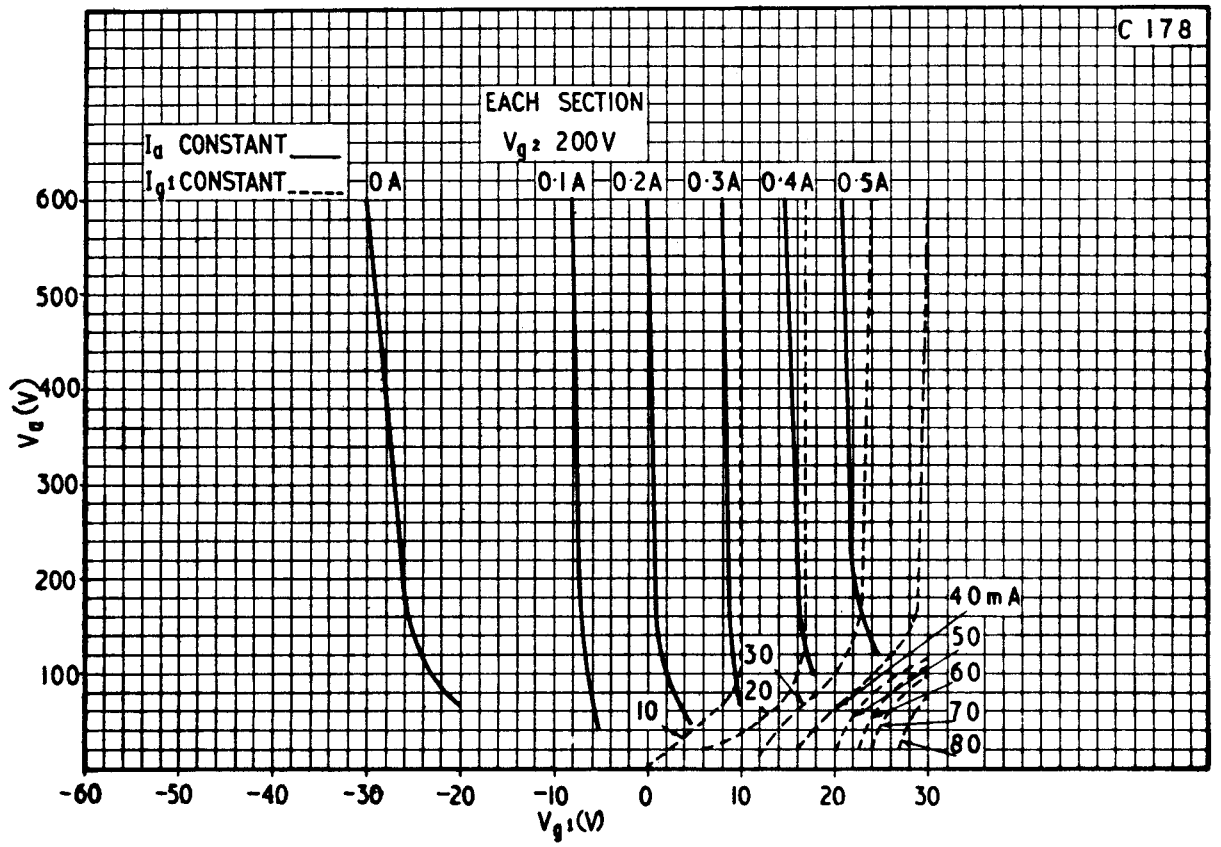
(*c*) With a circuit transfer efficiency of 80%.

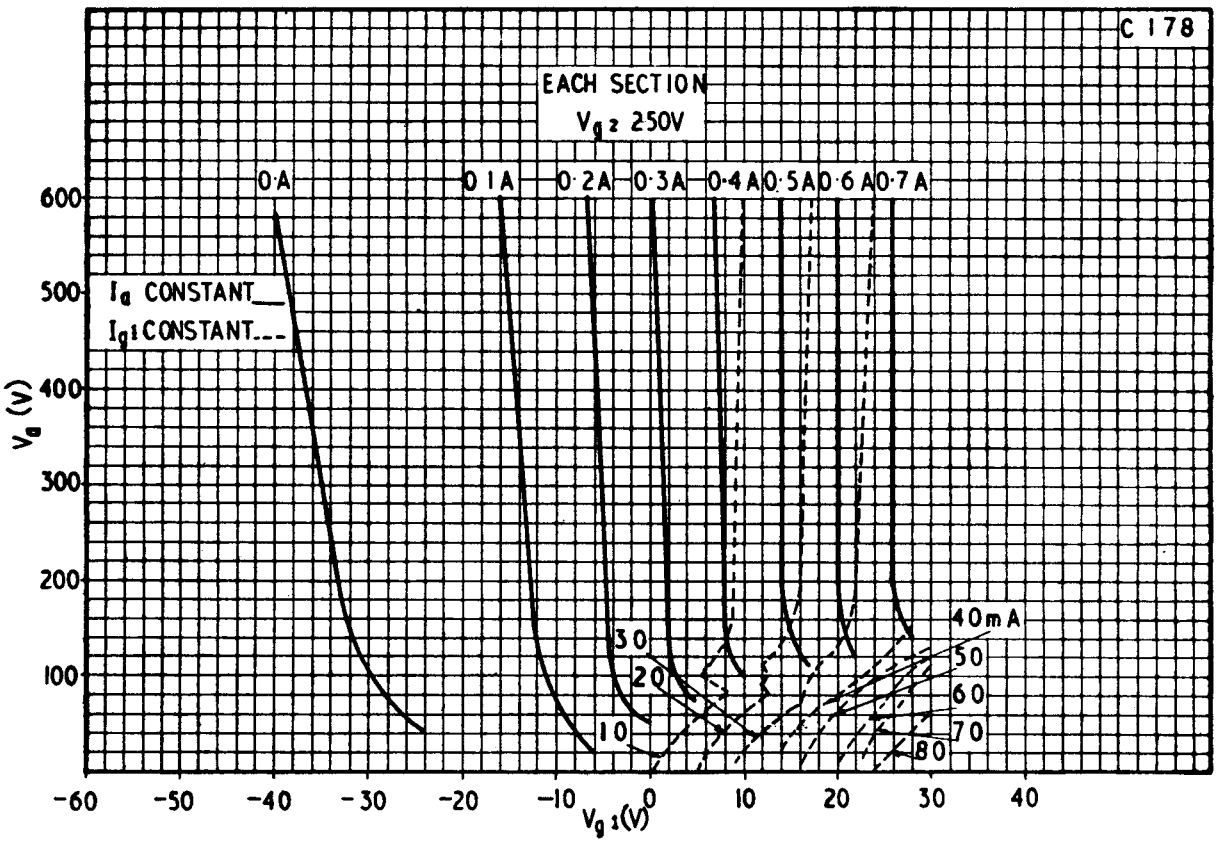

C 178
EACH SECTION
V_{g2} 200V
V_{g1} +25
+20
+15
+10
+5
0
-5
-10
-15
-20
600
400
200
I_a (mA)
200
400
600
800
V_a (V)

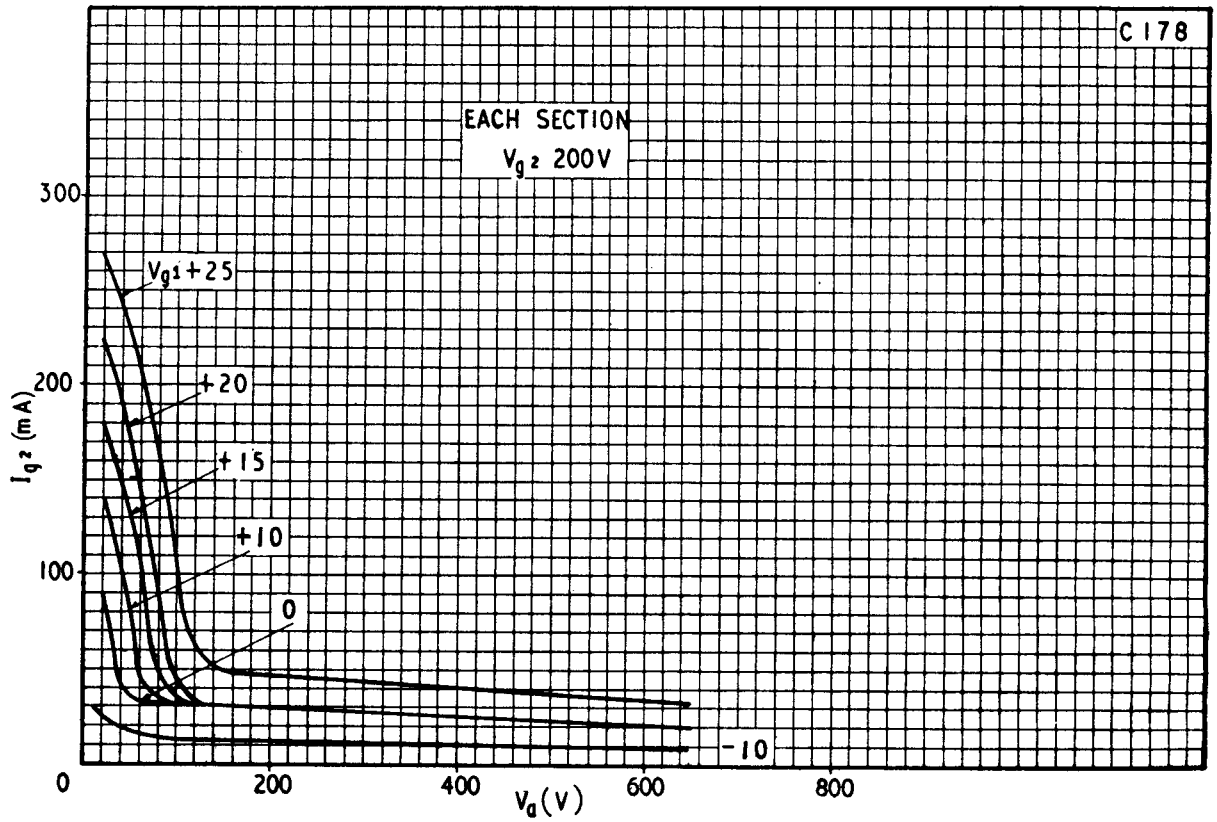

C 178
EACH SECTION
V_{g2} 250V
V_{g1} +25
+20
+15
+10
+5
0
-5
-10
-15
-20
600
400
200
I_a (mA)
200
400
600
800
V_a (V)

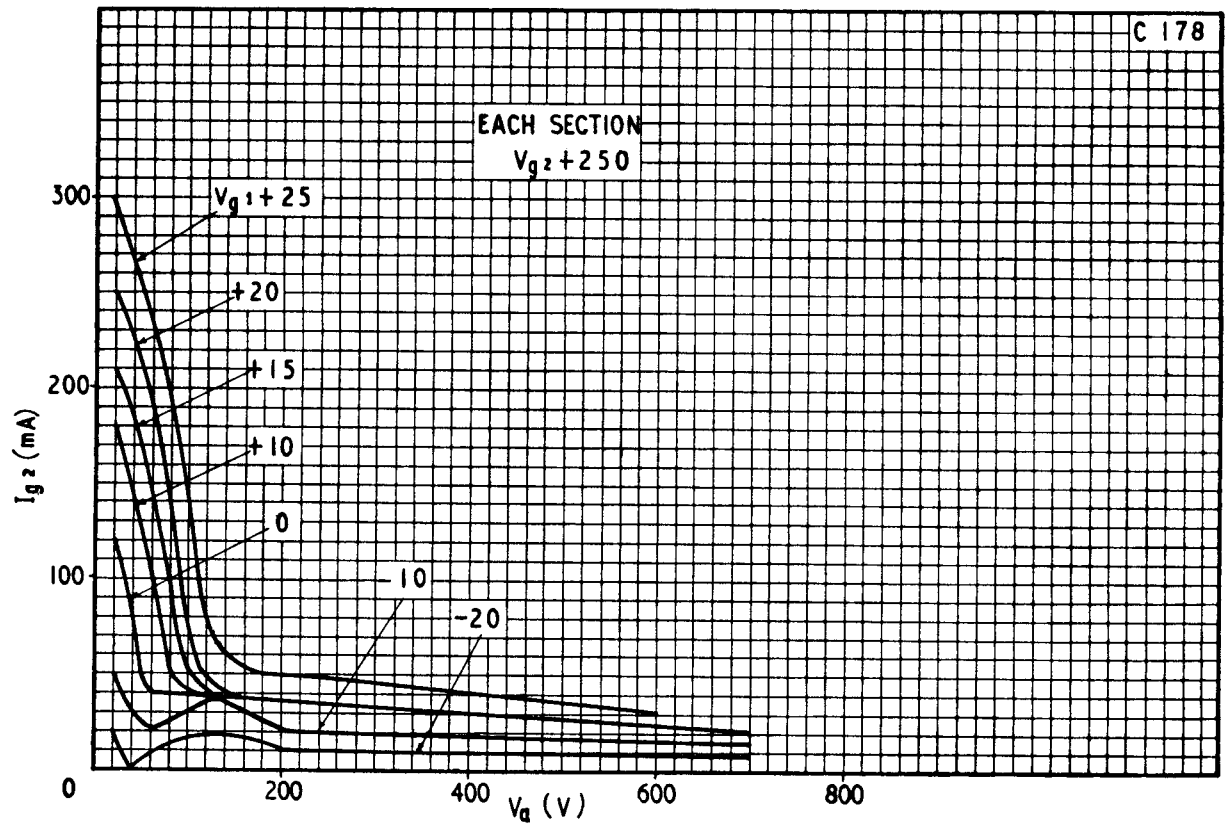

C 178
EACH SECTION
V_{g2} 200V
75
50
25
0
200
400
600
800
I_{g1}(mA)
V_a (V)
V_{g1} +25
+20
+15
+10

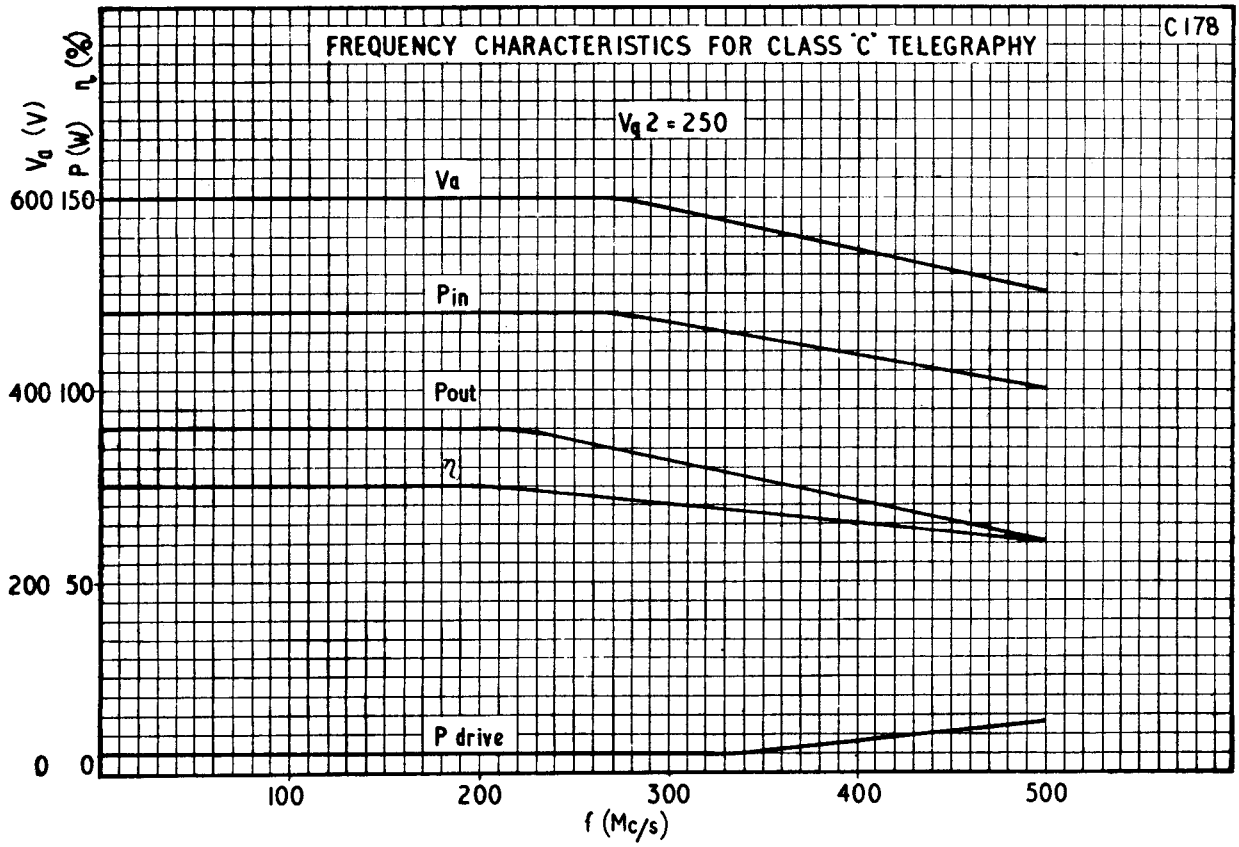

C 178
EACH SECTION
V_{g2} 250V
75
50
25
0
200
400
600
800
I_{g1} (mA)
V_a (V)
V_{g1} +25
+20
+15
+10


C 178
EACH SECTION
V_{g2} 200V
I_a CONSTANT____
I_{g1} CONSTANT_____
0A
0·1A
0·2A
0·3A
0·4A
0·5A
40mA
50
60
70
80
30
20
10
V_a (V)
600
500
400
300
200
100
-60
-50
-40
-30
-20
-10
0
10
20
30
V_{g1} (V)


C 178
EACH SECTION
V_{g2} 250V
I_a CONSTANT___
I_{g1} CONSTANT---
0A
0·1A
0·2A
0·3A
0·4A
0·5A
0·6A
0·7A
40mA
50
60
70
80
30
20
10
V_a (V)
600
500
400
300
200
100
-60
-50
-40
-30
-20
-10
0
10
20
30
40
V_{g1} (V)


C 178
EACH SECTION
V_{g2} 200V
300
200
100
0
I_{g2} (mA)
V_{g1} +25
+20
+15
+10
0
-10
200
400
600
800
V_a (V)


C 178
EACH SECTION
V_{g2} +250
300
200
100
0
I_{g2} (mA)
V_{g1} +25
+20
+15
+10
0
-10
-20
200
400
600
800
V_a (V)



PRINTED IN ENGLAND

Twin Tetrode *Type C 180*

VHF POWER AMPLIFIER

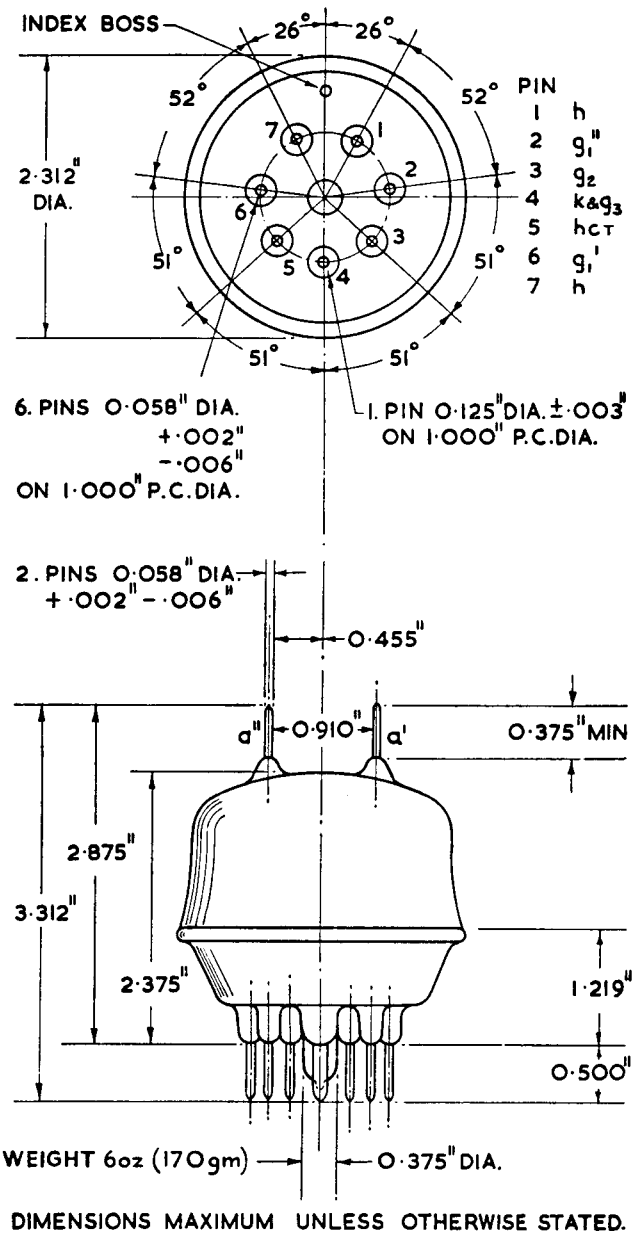
General. The C 180 is a twin tetrode, suitable for use as a push-pull beam power amplifier.

Cooling. The bulb temperature must not exceed 175°C and if necessary forced-air-cooling must be employed.

APPROXIMATE DATA

(values are for both units)

	Series	Parallel	
V_h	12·6	6·3	V
I_h	0·8	1·6	A
g_m (taken at I_a=30 mA) (per unit)	3·5		mA/V
$\mu_{g1\text{-}g2}$	6·5		
$c_{a\text{-}g1}$ (with external shielding)	0·07		pF
c_{in}	8		pF
c_{out}	3·8		pF
$c_{g2\text{-}k}$ (including internal screen by-pass capacitor) (approx.)	65		pF
$f_{(max)}$	250		Mc/s



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

(1) PUSH-PULL HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions) (a)

Maximum permissible ratings

V_a	750	V
V_{g2}	250	V
V_{g1}	−175	V
I_a	90	mA
I_{g1}	6	mA
$P_{a\ (in)}$	36	W
$P_{g2\ (in)}$	5	W
p_a	15	W
$V_{h\text{-}k\ (pk)}$ (b)	100	V

Typical Operation

V_a		500	750	V
V_{g2}	(i) from a fixed supply of	200	200	V
	(ii) via R_{g2}	21,000	37,000	Ω
V_{g1} (c)				
	(i) from a fixed supply of	−65	−65	V
	(ii) via R_k	730	1,000	Ω
	(iii) via $R_{g1\text{-}k}$	25,000	23,000	Ω
$v_{g1'\text{-}g1''\ (pk)}$		150	150	V
I_a		72	48	mA
I_{g2}		14	15	mA
I_{g1}*		2·6	2·8	mA
P_{dr}*		0·18	0·19	W
P_{out}*		26	26	W

(2) PUSH-PULL HF POWER AMPLIFIER CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%)

Maximum permissible ratings

V_a	600	V
V_{g2}	250	V
V_{g1}	−175	V
I_a	75	mA
I_{g1}	6	mA
$P_{a\ (in)}$	22	W
$P_{g2\ (in)}$	3·4	W
p_a	10	W
$v_{h\text{-}k\ (pk)}$ (b)	100	V

Typical Operation

V_a		425	600	V
V_{g2}	(i) from fixed supply of	200	200	V
	(ii) via R_{g2}	14,000	25,000	Ω
V_{g1} (c)	(i) from fixed supply of	−60	−65	V
	(ii) via $R_{g1\text{-}k}$	25,000	25,000	Ω
$v_{g1'\text{-}g1''\ (pk)}$		140	150	V
I_a		52	36	mA
I_{g2}		16	16	mA
I_{g1}*		2·4	2·6	mA
P_{dr}*		0·15	0·18	W
P_{out}*		16	17	W

The maximum permissible ratings given above apply to frequencies up to 200 Mc/s. For operation up to 250 Mc/s the values of V_a and $P_{a\ (in)}$ must be reduced to 89% of the maximum permissible ratings.

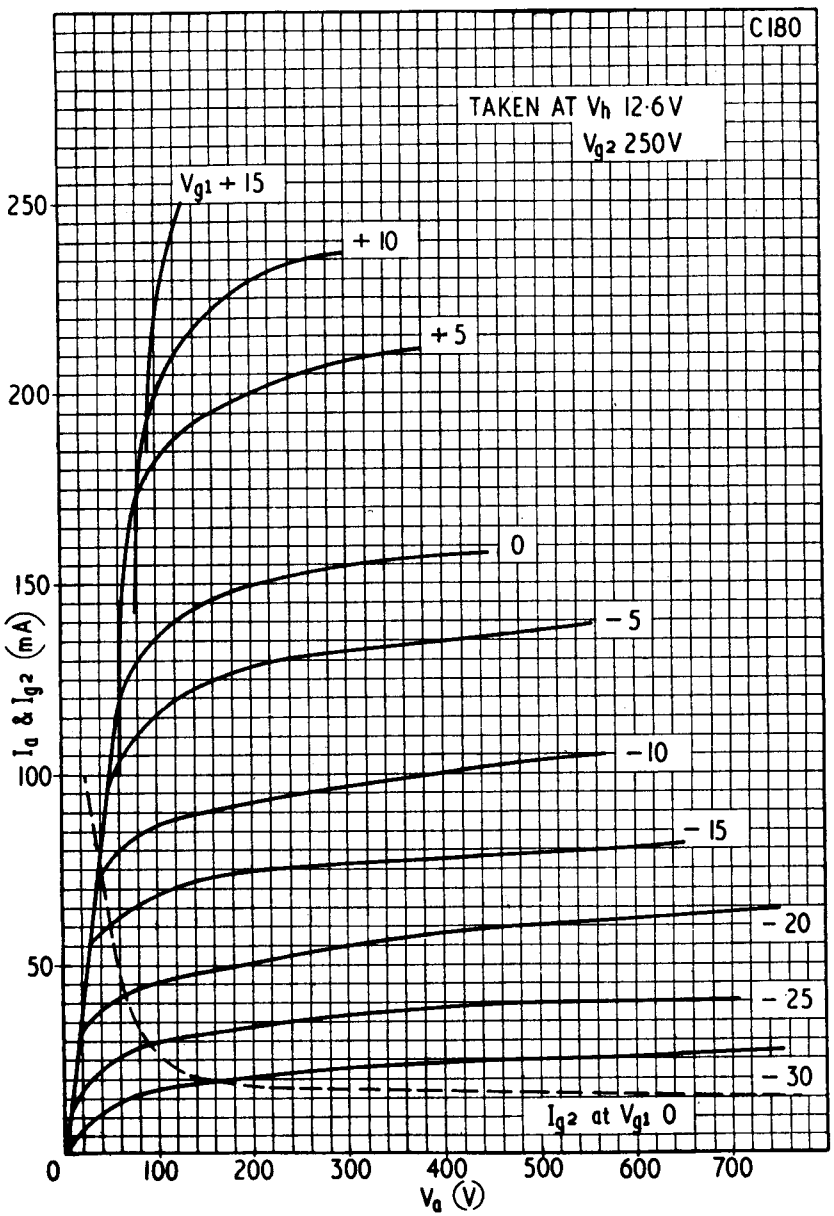
NOTES

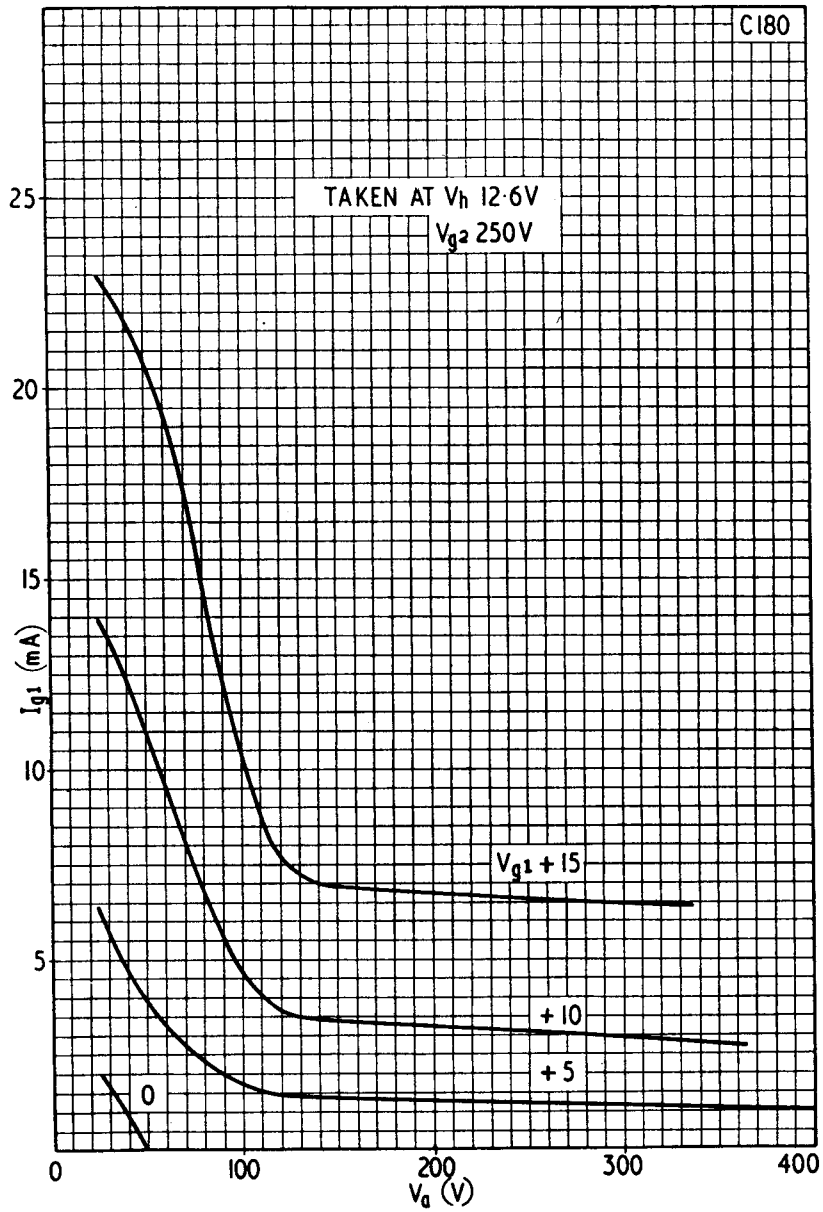
(a) Modulation essentially negative may be used if the positive peak of the audio frequency envelope does not exceed 115% of the carrier conditions.

(b) Heater either negative or positive with respect to cathode.

(c) The grid circuit resistance should never exceed 25,000 Ω (total) per valve, or 50,000 Ω per unit. If additional bias is necessary a cathode resistor or a fixed supply should be used.

* Subject to wide variation. Figures are approximate only.


C180
TAKEN AT Vh 12·6V
Vg2 250V
Vg1 + 15
+ 10
+ 5
0
− 5
− 10
− 15
− 20
− 25
− 30
Ig2 at Vg1 0
Ia & Ig2 (mA)
Va (V)
250
200
150
100
50
0
100
200
300
400
500
600
700


C180
TAKEN AT Vh 12·6V
Vg2 250V
Vg1 + 15
+ 10
+ 5
0
Ig1 (mA)
Va (V)
25
20
15
10
5
0
100
200
300
400



PRINTED IN ENGLAND

Triode *Type CAM 2*

ABSORBER OR MODULATING VALVE

General. A water-cooled triode fitted with a tungsten filament.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The rated flow should not be less than 2 gallons per minute. The temperature of the cooling water at the outlet must not exceed 65°C (150°F). The cooling supply must be started before the application of any supply voltages.

Filament Starting. The filament current must never exceed 36 A at any time during the switching-on period.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connections must be made to anode only.

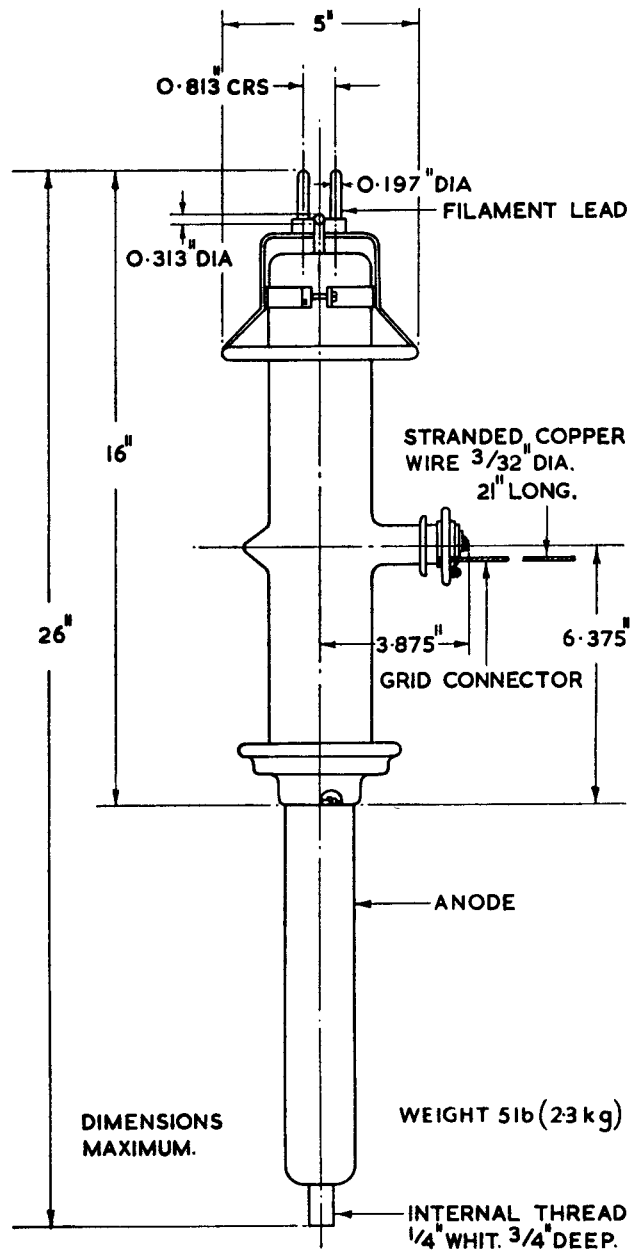
Operation. The valve is specially designed for use as an absorber, but is also suitable for use as a modulator. It is not recommended for use as a transmitting valve owing to the comparatively low filament voltage.

When the valve is used as an absorber care must be taken during the period it is conductive to prevent the grid being overloaded. The anode voltage should not be allowed to fall below 600 V or the grid voltage rise above +300 V.

APPROXIMATE DATA

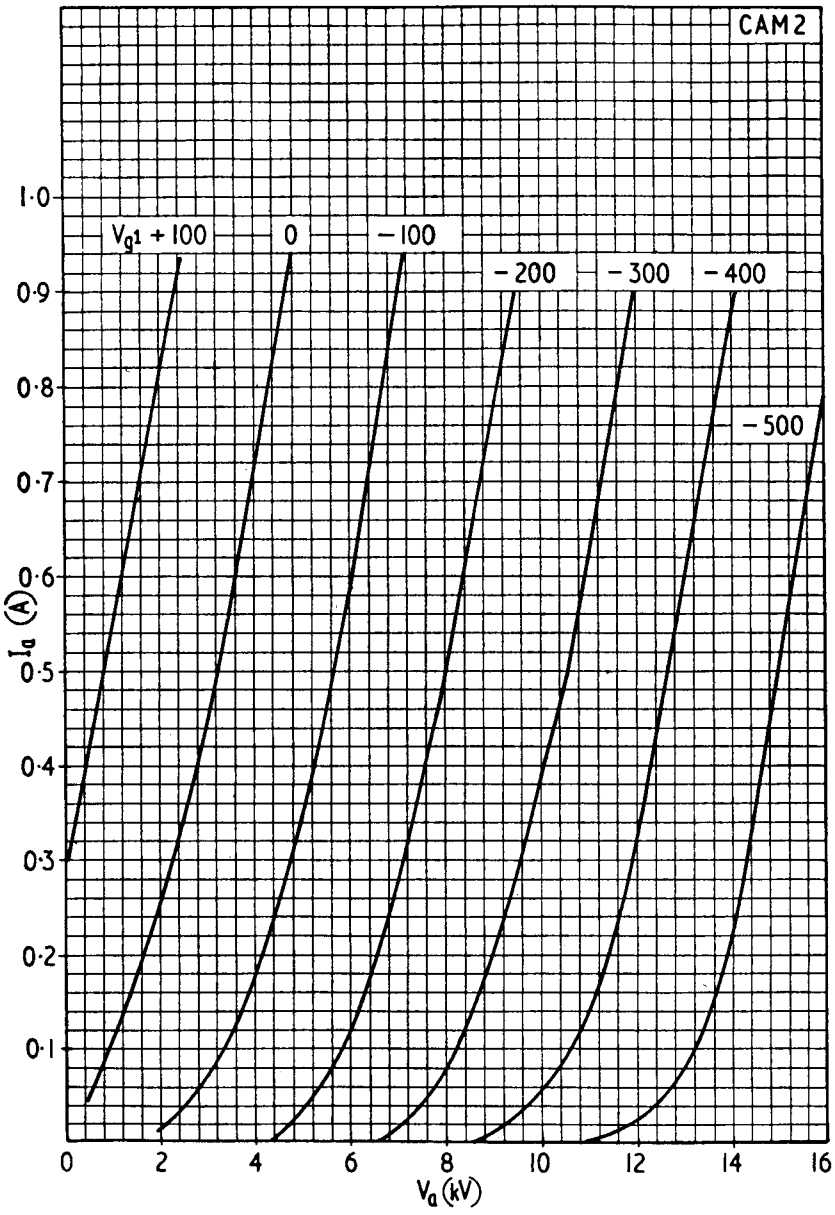
V_f		16·5 – 17·5	V
I_f		24	A
$V_{a\ (max)}$		12	kV
$p_{a\ (max)}$		5	kW
μ	taken at V_a 10 kV,	25	
r_a	V_{g1}–300 V	5,000	Ω
$c_{a\text{-}g1}$		18·0	pF
$c_{a\text{-}k}$		2·3	pF
$c_{g1\text{-}k}$		23·0	pF

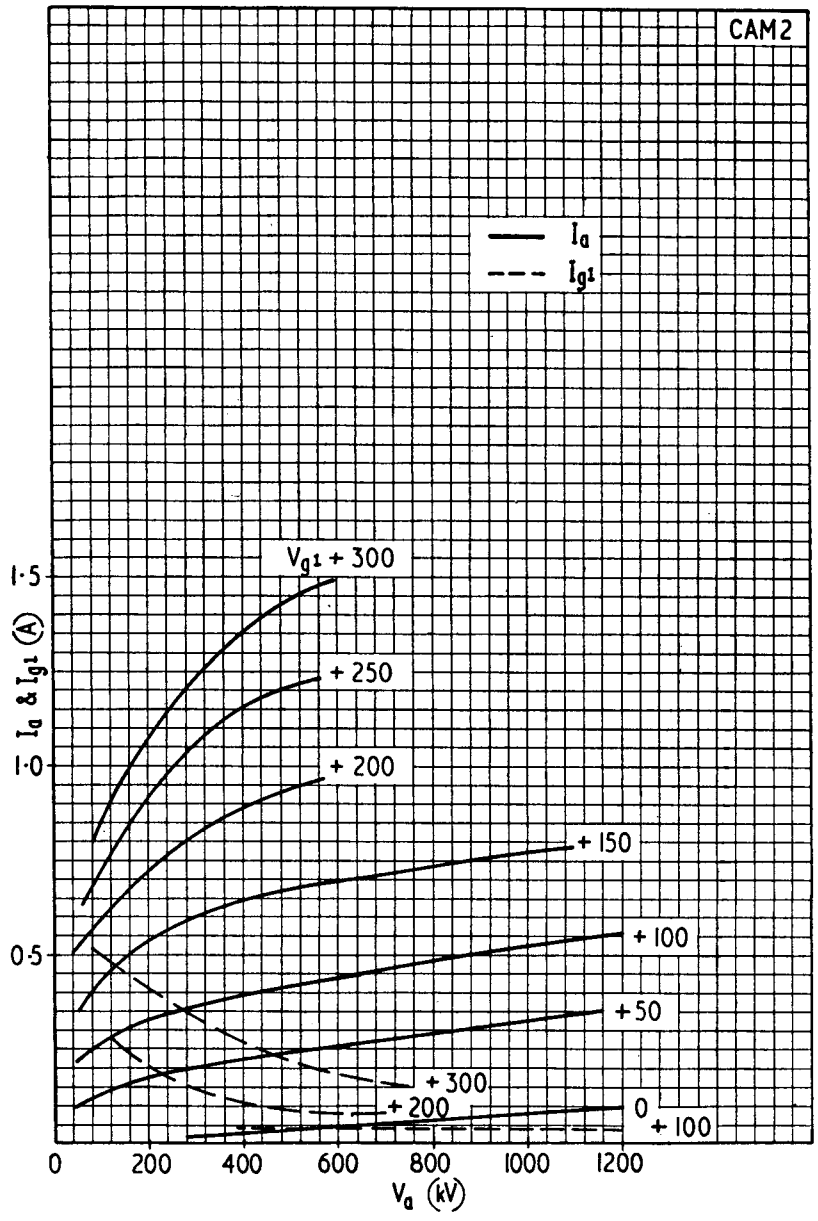
Each valve is marked with the filament voltage to give 2 A emission at 90% saturation.

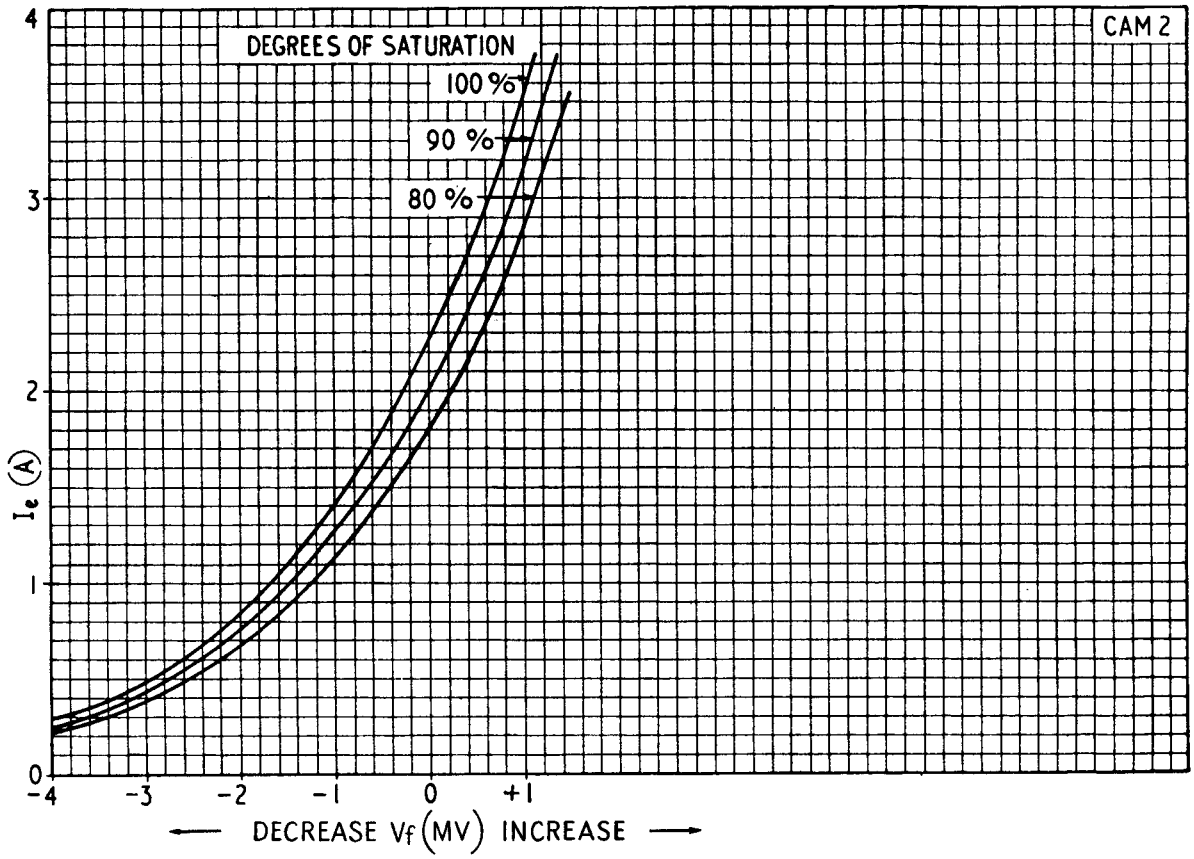


MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


CAM2
V_{g1} + 100
0
− 100
− 200
− 300
− 400
− 500
I_a (A)
1·0
0·9
0·8
0·7
0·6
0·5
0·4
0·3
0·2
0·1
0
2
4
6
8
10
12
14
16
V_a (kV)


CAM2
I_a
I_{g1}
V_{g1} + 300
+ 250
+ 200
+ 150
+ 100
+50
+ 300
+ 200
0
+ 100
I_a & I_{g1} (A)
1·5
1·0
0·5
0
200
400
600
800
1000
1200
V_a (kV)


CAM 2
DEGREES OF SATURATION
100 %
90 %
80 %
4
3
2
1
0
I_e (A)
−4
−3
−2
−1
0
+1
DECREASE V_f (MV) INCREASE



PRINTED IN ENGLAND

Triode *Type CAM 3*

MODULATING VALVE

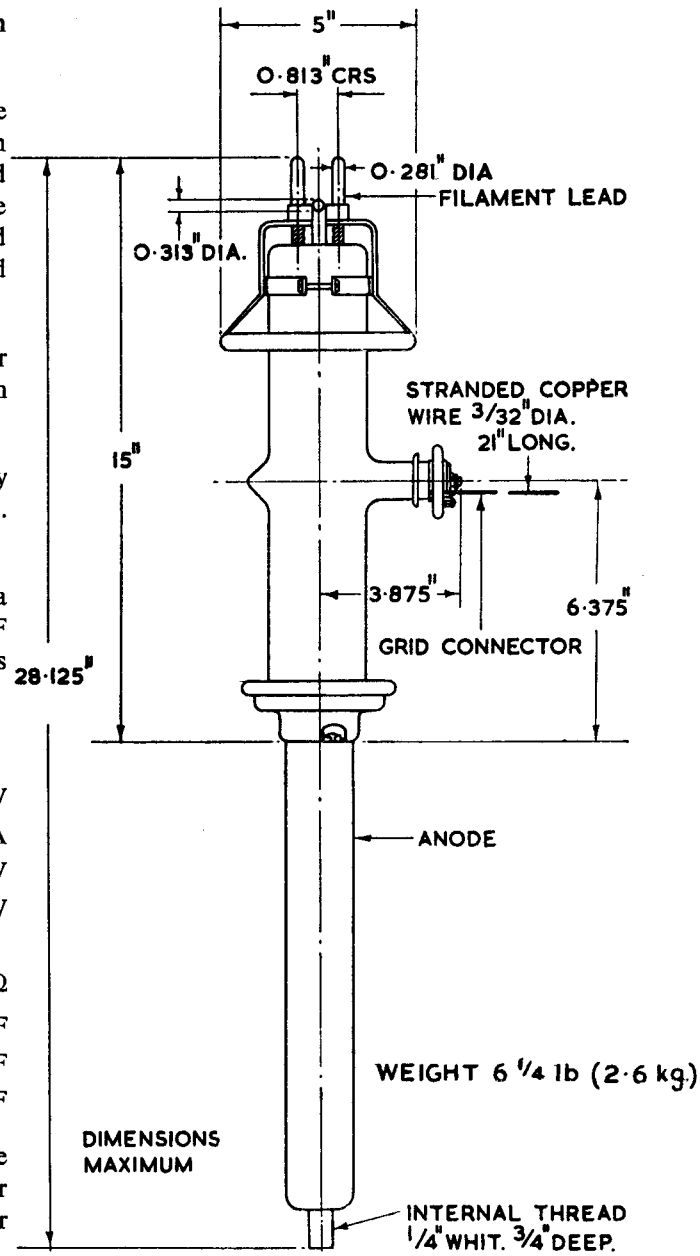
General. A water-cooled triode fitted with a tungsten filament.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The rated flow should not be less than 4 gallons per minute. The temperature of the cooling water at the outlet must not exceed 65°C (150°F). The cooling supply must be started before the application of any supply voltages.

Filament Starting. The filament current must never exceed 105A at any time during the switching-on period.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connections must be made to anode only.

Operation. The valve is specially designed for use as a modulator, but may also be used as a modulated HF amplifier. When operated under amplifier conditions the maximum anode voltage is 10 kV.



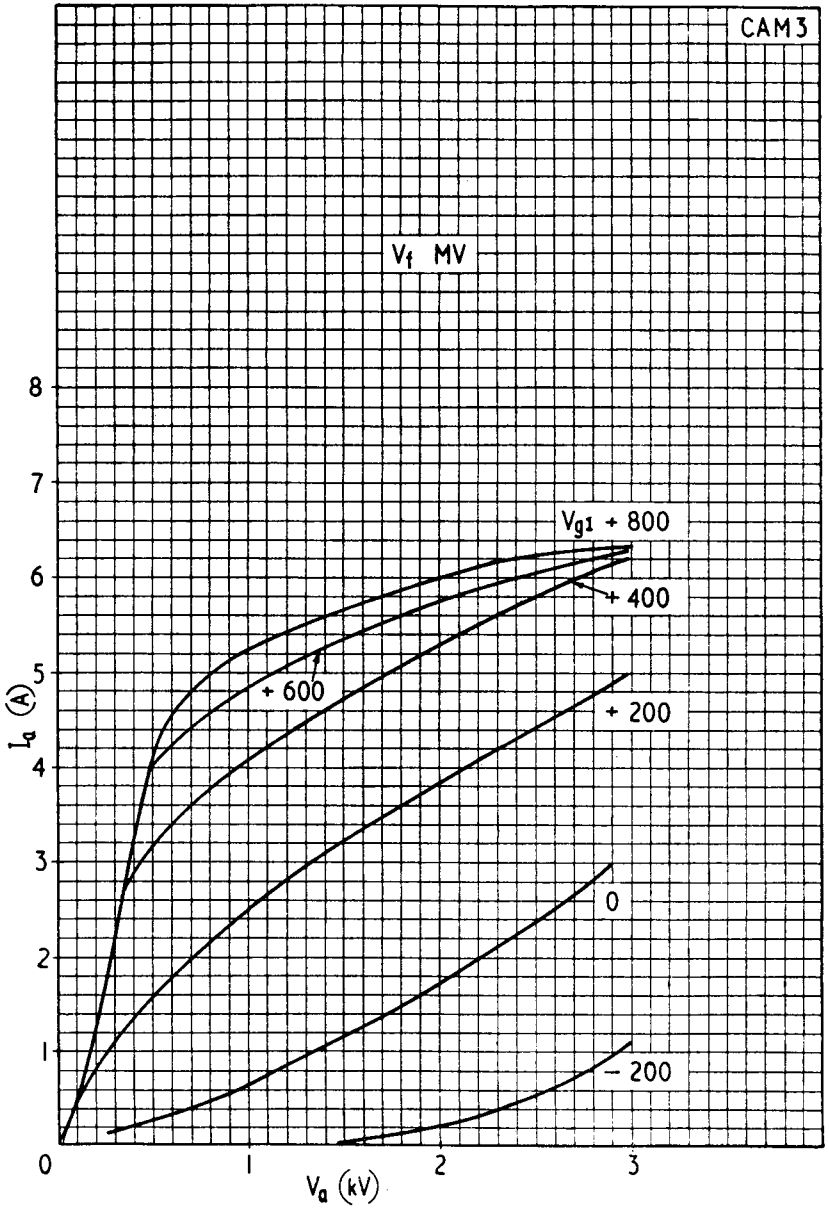
APPROXIMATE DATA

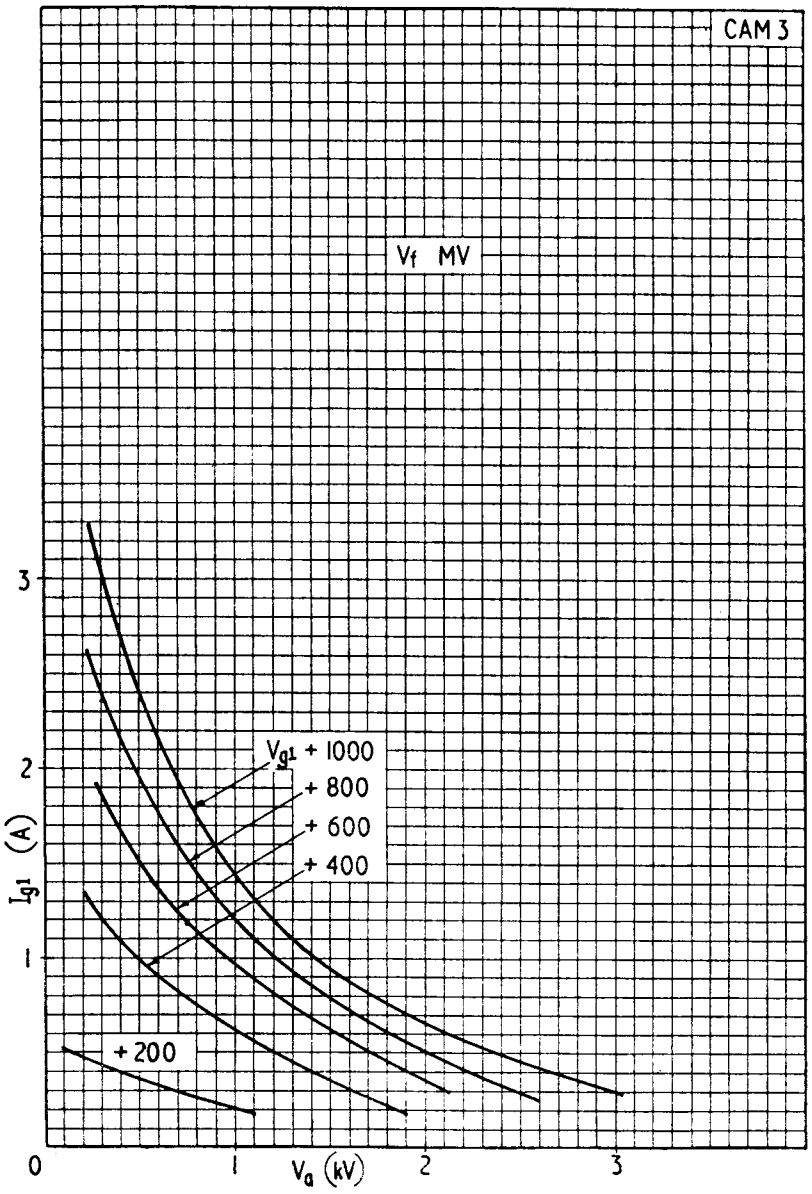
V_f		17	V
I_f		70	A
$V_{a\ (max)}$		12	kV
$p_{a\ (max)}$		12	kW
μ	taken at V_a 11 kV,	6·4	
r_a	V_{g1} −1,500 V	1,200	Ω
$c_{a\text{-}g1}$		25·5	pF
$c_{a\text{-}k}$		2·6	pF
$c_{g1\text{-}k}$		26·8	pF

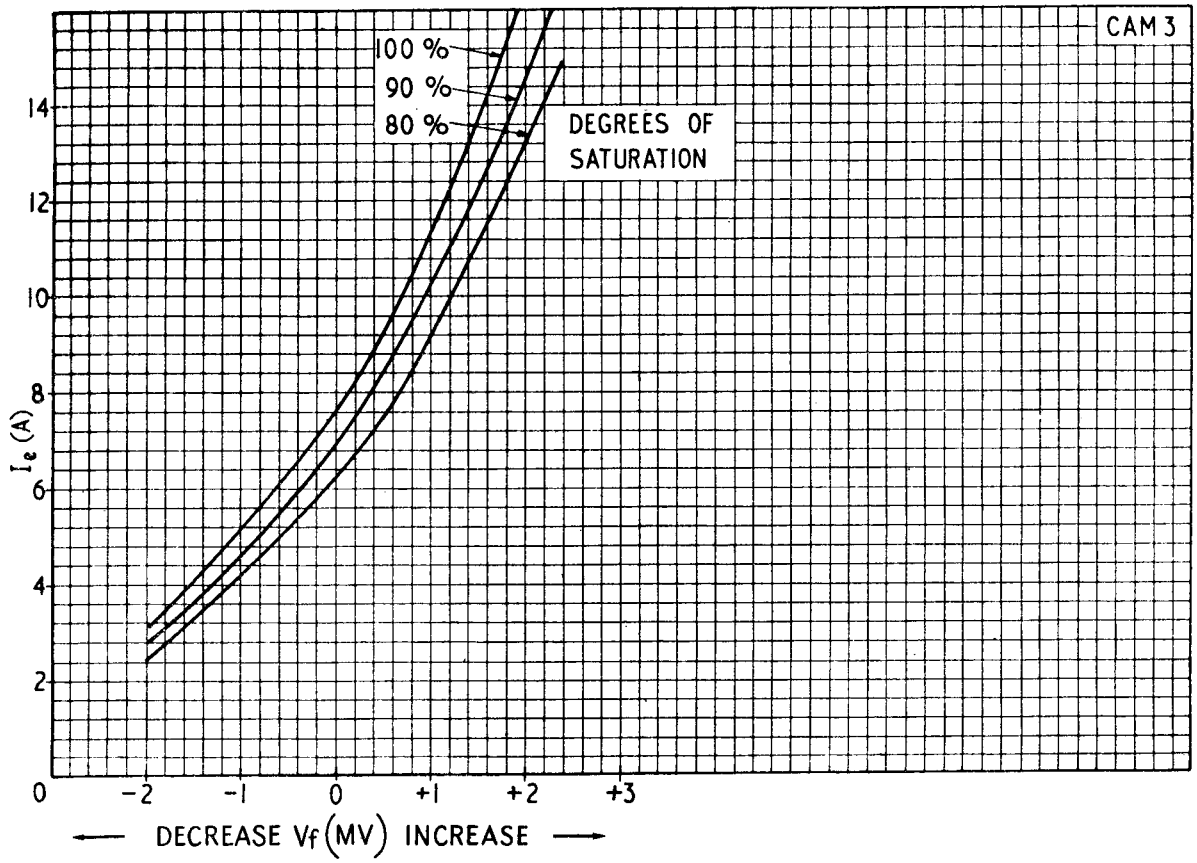
Each valve is marked with filament voltages to give 3A and 7A emission at 90% saturation. The lower value of marked voltage relates to modulator operation.

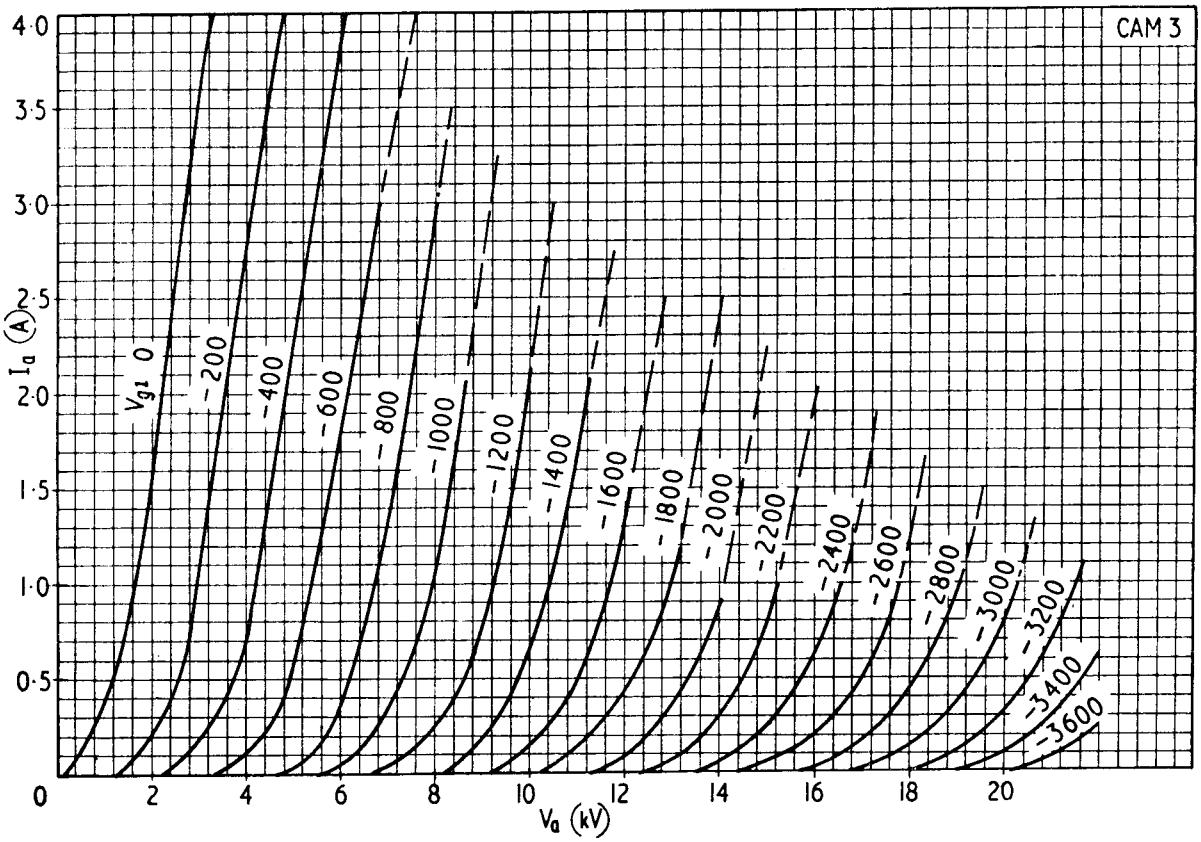
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


CAM 3
V_f MV
I_a (A)
V_a (kV)
V_{g1} + 800
+ 400
+ 600
+ 200
0
− 200
0
1
2
3
4
5
6
7
8


CAM 3
V_f MV
I_{g1} (A)
V_a (kV)
V_{g1} + 1000
+ 800
+ 600
+ 400
+ 200
0
1
2
3


CAM 3
100 %
90 %
80 %
DEGREES OF SATURATION
I_e (A)
0
2
4
6
8
10
12
14
−2
−1
0
+1
+2
+3
← DECREASE Vf (MV) INCREASE →

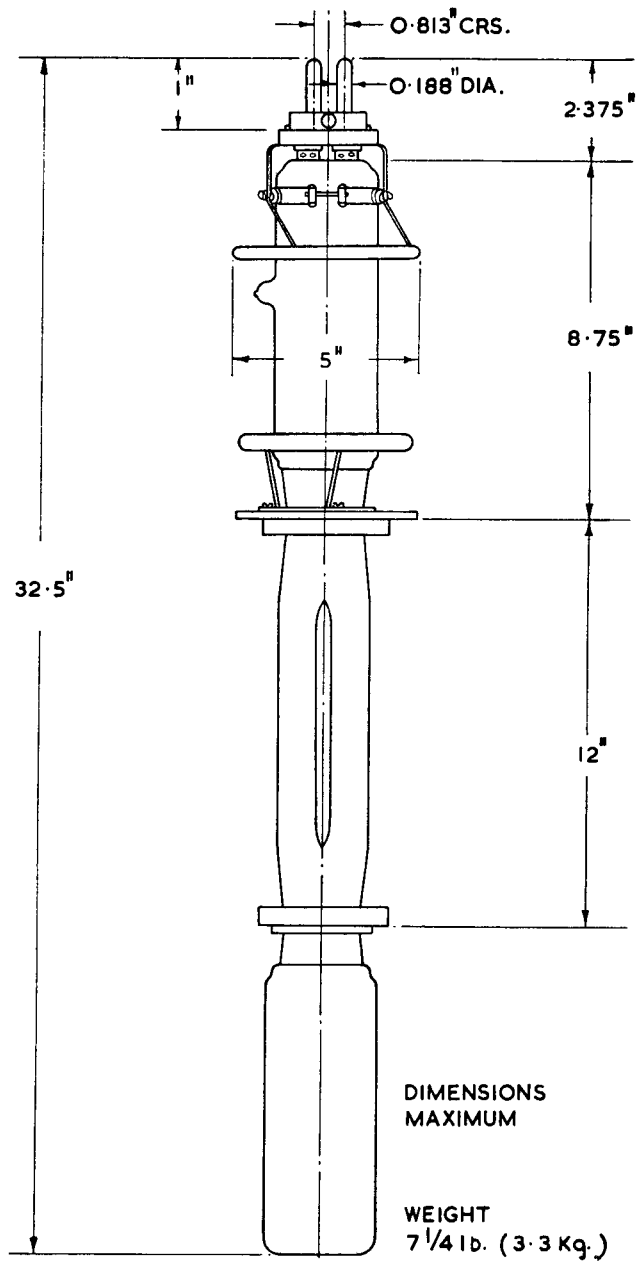

CAM 3
I_a (A)
0
0·5
1·0
1·5
2·0
2·5
3·0
3·5
4·0
V_{g1} 0
-200
-400
-600
-800
-1000
-1200
-1400
-1600
-1800
-2000
-2200
-2400
-2600
-2800
-3000
-3200
-3400
-3600
2
4
6
8
10
12
14
16
18
20
V_a (kV)



PRINTED IN ENGLAND

Diode *TypeCAR2*

POWER RECTIFIER



General. A double-ended rectifying valve fitted with a tungsten filament.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The rated flow must not be less than 2 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 65°C (150°F). All cooling supplies must be started before the application of any supply voltages.

Filament Starting. The cold resistance of the filament is approximately 0·03 Ω. The filament current must never exceed 75 A at any time during the switching-on period. It is not normally permissible to control the output by varying the filament voltage.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

HT Switching. It is not permissible to apply directly a peak inverse voltage in excess of 20 kV. At higher voltages the applied voltage should either be gradually increased from a low value, or two-position switching employed.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connection must be made to the anode only.

APPROXIMATE DATA

V_f	18–20	V
I_f	50	A
PIV (max)	40	kV
p_a (max)	5	kW

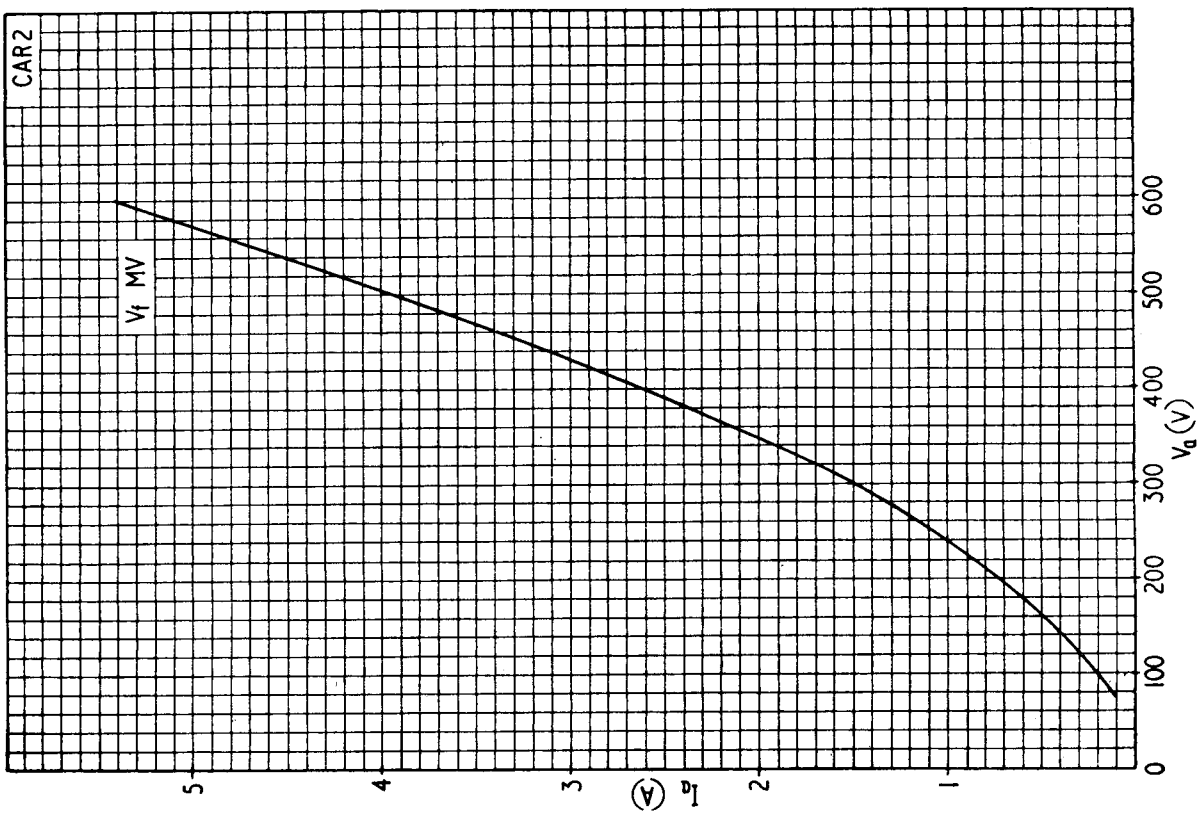
Each valve is marked with the filament voltage to give 4A emission at 90% saturation.

OPERATING DATA

(Full load conditions)

Circuit	No. of Valves	DC Output Voltage (kV)	DC Output Current (A)
Bi-phase half-wave	2	12·5	2·25
Single-phase full-wave	4	25	2·25
Three-phase half-wave	3	19	3·4
Three-phase full-wave	6	38	3·4
Double three-phase inter-connected	6	19	6·8

This data is based on the assumption that the filter circuit is designed so that the ratio of the peak anode current to the rectified output current does not exceed 3·5: 1.



PRINTED IN ENGLAND

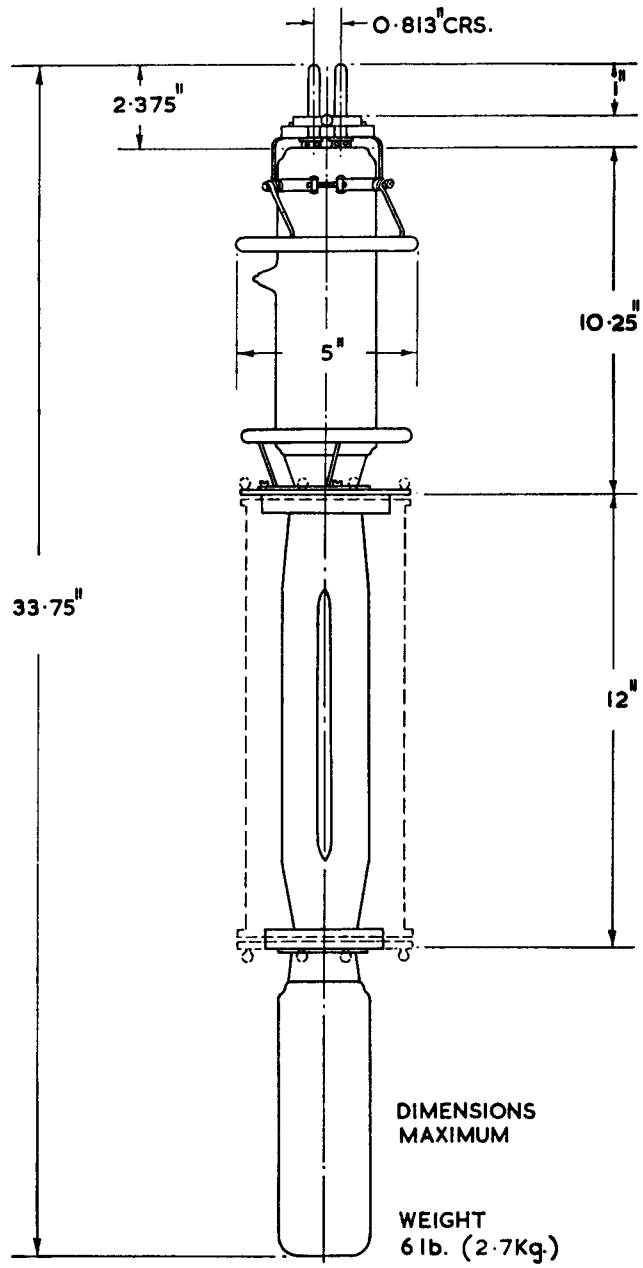
Diode *TypeCAR4*

POWER RECTIFIER

General. A double-ended rectifying valve fitted with a tungsten filament. The anode forms part of the envelope and must be fitted with a specially-designed water jacket.

Cooling. The cooling supply must be started before the application of any voltages. The water flow to the anode must not be less than 2 gallons per minute. The temperature of the cooling water must not be greater than 65°C (150°F) at the outlet.

Filament Starting. The cold resistance of the filament is approximately 0·022 Ω. The filament current must not exceed 105 A at any time. It is not normally permissible to control the output by varying the filament voltage.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

HT Switching. It is not permissible to apply directly a peak inverse voltage in excess of 20 kV. At higher voltages the applied voltage should either be gradually increased from a low value or two-position switching employed.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connection must be made to the anode only.

APPROXIMATE DATA

V_f	20	V*
I_f	75	A
PIV (max)	40	kV
p_a (max)	6	kW

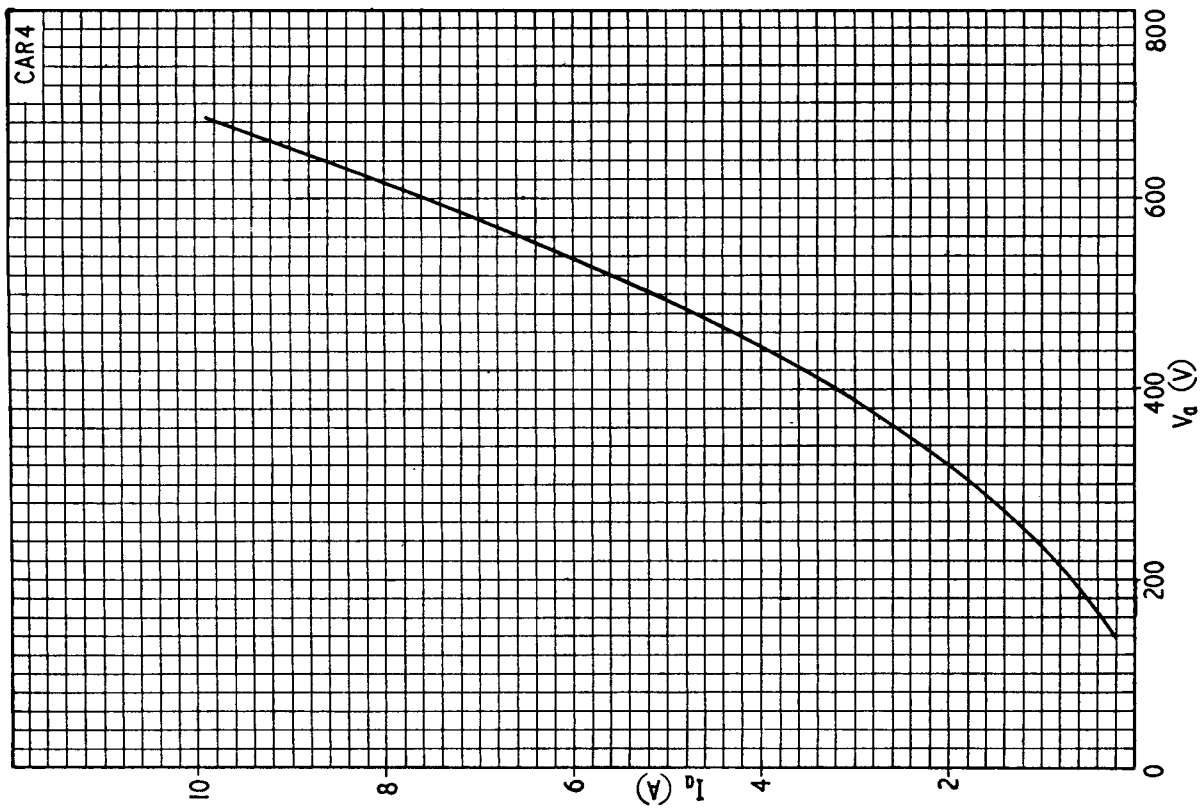
* The value of filament voltage for 7 A emission at 90% saturation is marked on each valve.

OPERATING DATA

(Full load conditions)

Circuit	No. of Valves	Output Voltage (kV)	Current (A)
Bi-phase half-wave	2	12·5	4
Single-phase full-wave	4	25	4
Three-phase half-wave	3	19	6
Three-phase full-wave	6	38	6
Double three-phase inter-connected	6	19	12

This data is based on the assumption that the filter circuit is designed so that the ratio of the peak anode current to the rectified output current does not exceed 3·5: 1.



PRINTED IN ENGLAND

Diode *Type CAR6*

POWER RECTIFIER

General. A double-ended rectifying valve fitted with a tungsten filament. The anode forms part of the envelope and must be fitted with specially designed water jacket.

Cooling. The cooling supply must be started before the application of any voltages. The water flow to the anode must not be less than 5 gallons per minute. The temperature of the cooling water must not be greater than 65°C (150°F) at the outlet.

Filament Starting. The cold resistance of the filament is approximately 0·014 Ω. The filament current must not exceed 150 A at any time. It is not normally permissible to control the output by varying the filament voltage.

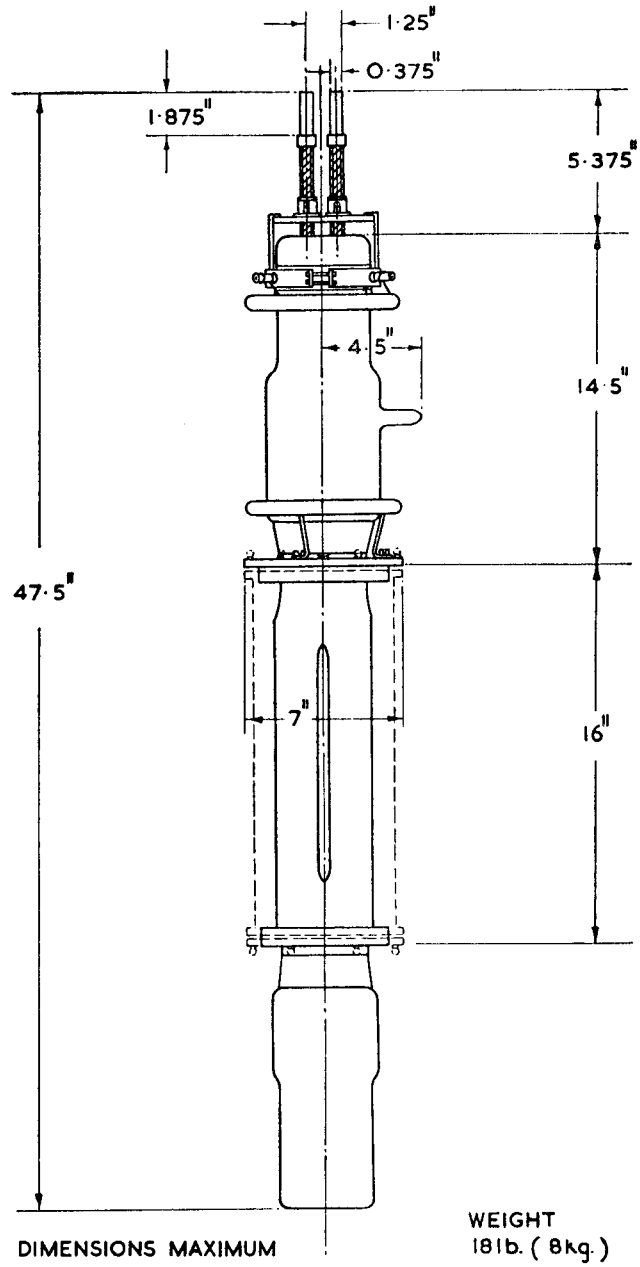
HT Switching. It is not permissible to apply directly a peak inverse voltage in excess of 25 kV. At higher voltages the applied voltage should either be gradually increased from a low value or two-position switching employed.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connection must be made to the anode only.

APPROXIMATE DATA

V_f	20	V*
I_f	120	A
PIV (max)	50	kV
p_a (max)	20	kW

* The value of filament voltage for 10 and 20 A emission at 90% saturation is marked on each valve.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

OPERATING DATA

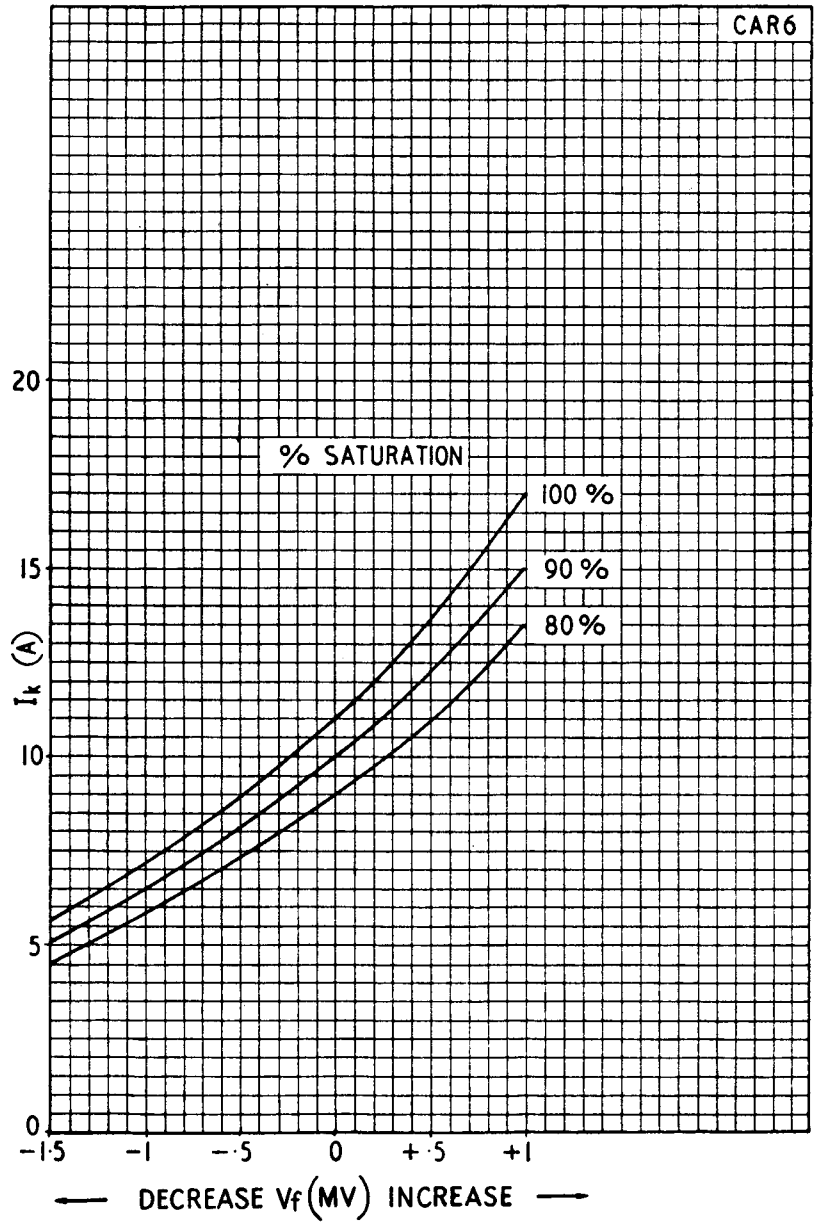
(Full load conditions)

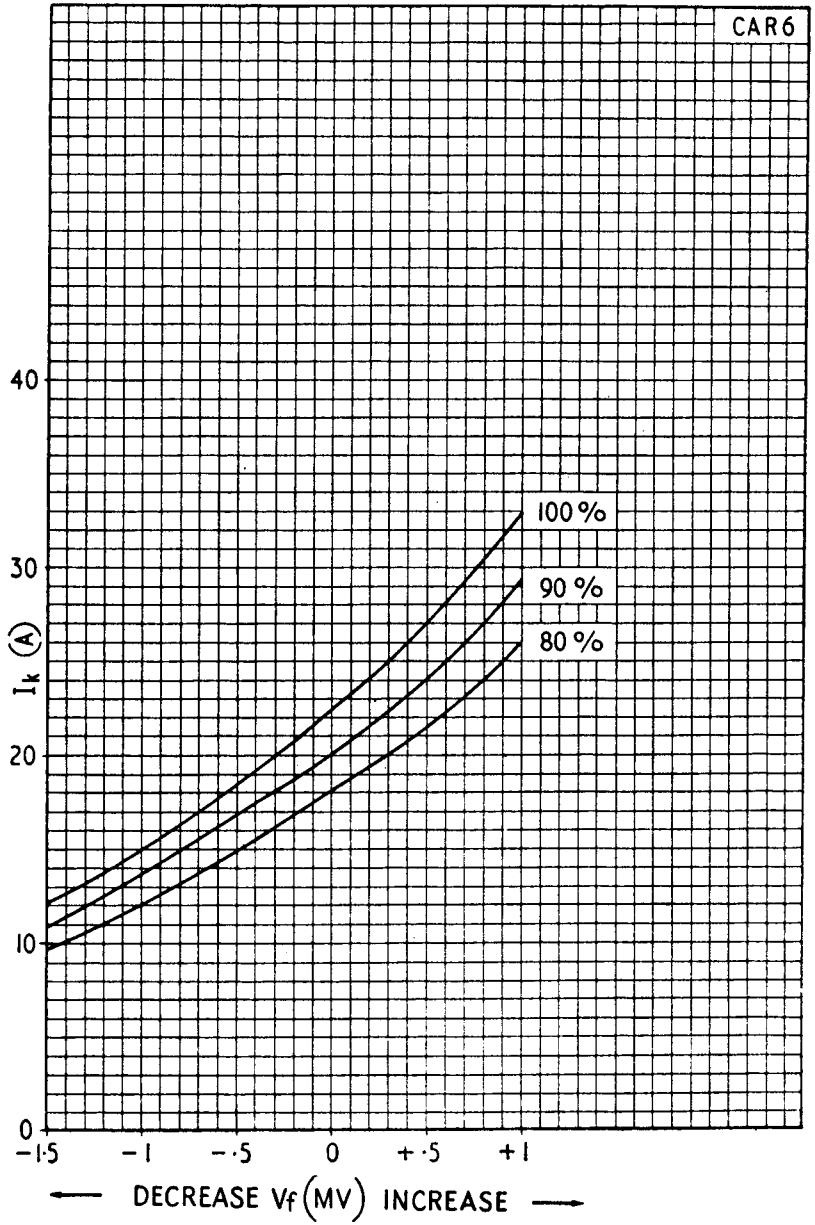
Circuit	No. of Valves	Output Voltage (kV)	Output (a) (A)	Current (b) (A)
Bi-phase half-wave	2	16	5·5	11
Single-phase full-wave	4	32	5·5	11
Three-phase half-wave	3	24	8·5	17
Three-phase full-wave	6	48	8·5	17
Double three-phase interconnected	6	24	17	34

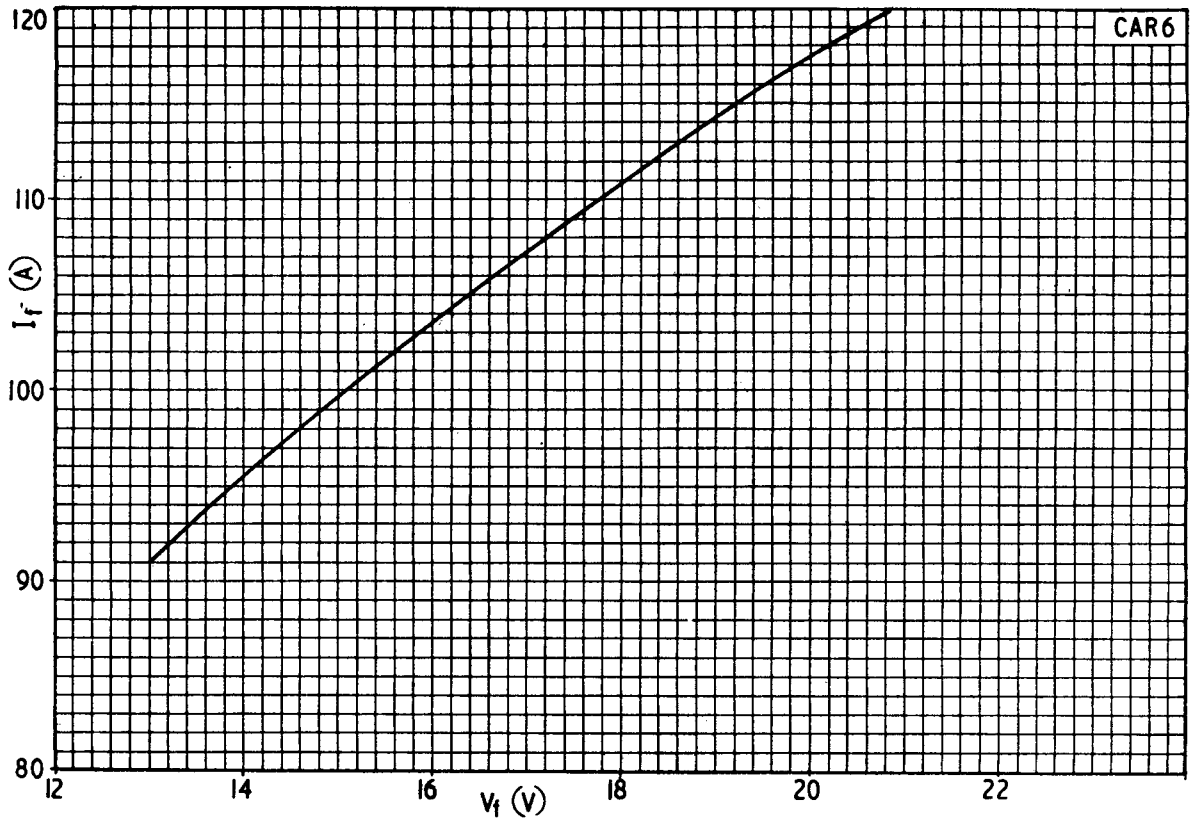
This data is based on the assumption that the filter circuit is designed so that the ratio of the peak anode current to the rectified output current does not exceed 3·5: 1.

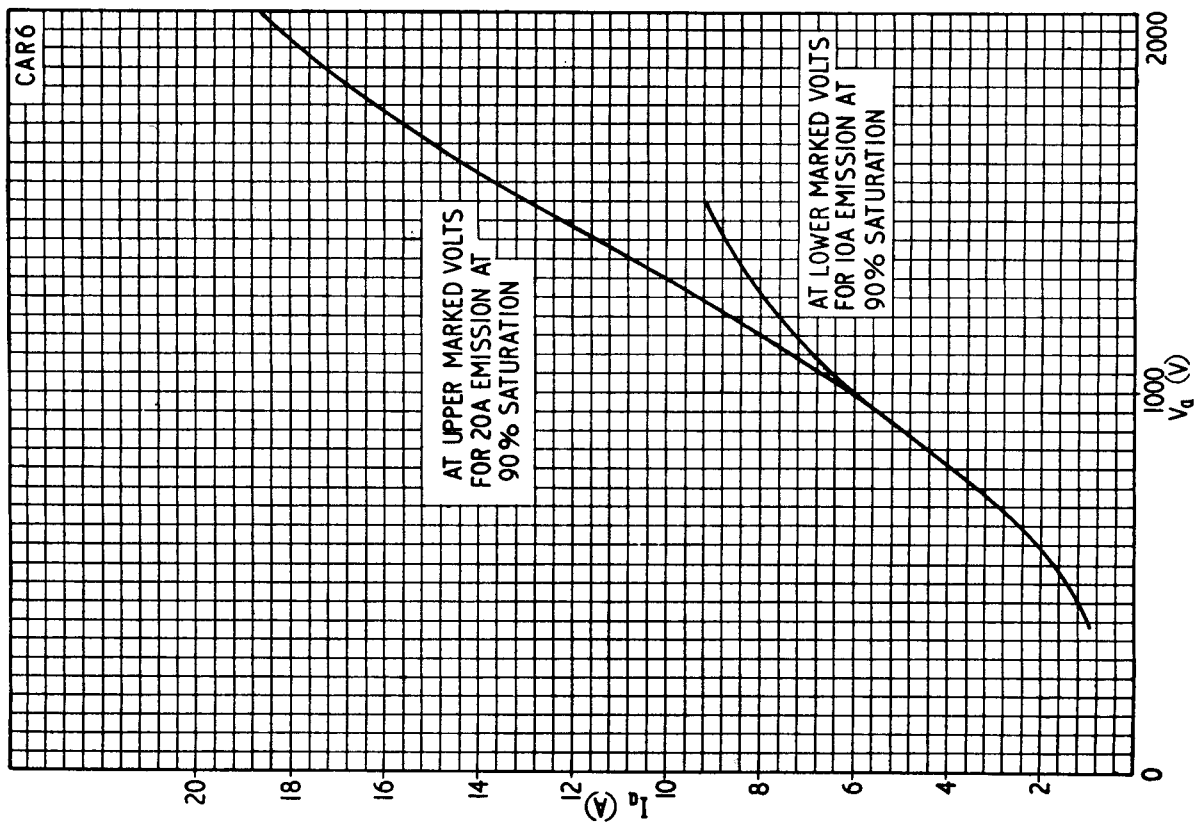
(a) V_f for $I_e = 10$ A.

(b) V_f for $I_e = 20$ A.


CAR6
% SATURATION
100 %
90 %
80 %
I_k (A)
0
5
10
15
20
−1·5
−1
−·5
0
+·5
+1
← DECREASE V_f (MV) INCREASE →


CAR6
100 %
90 %
80 %
I_k (A)
0
10
20
30
40
−1·5
−1
−·5
0
+·5
+1
← DECREASE V_f (MV) INCREASE →





PRINTED IN ENGLAND

Triode *Type CAT 3*

(RF AMPLIFIER AND OSCILLATOR)

General. The CAT 3 is a water-cooled anode transmitting triode fitted with a tungsten filament. It is suitable for use as an RF amplifier or oscillator at frequencies up to 20 Mc/s.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The flow of water should not be less than 2·5 gallons per minute. All cooling supplies must be started before the application of any supply voltages.

Filament Starting. The cold filament resistance is approximately 0·03Ω. The filament current must not exceed 75 A, even momentarily, at any time.

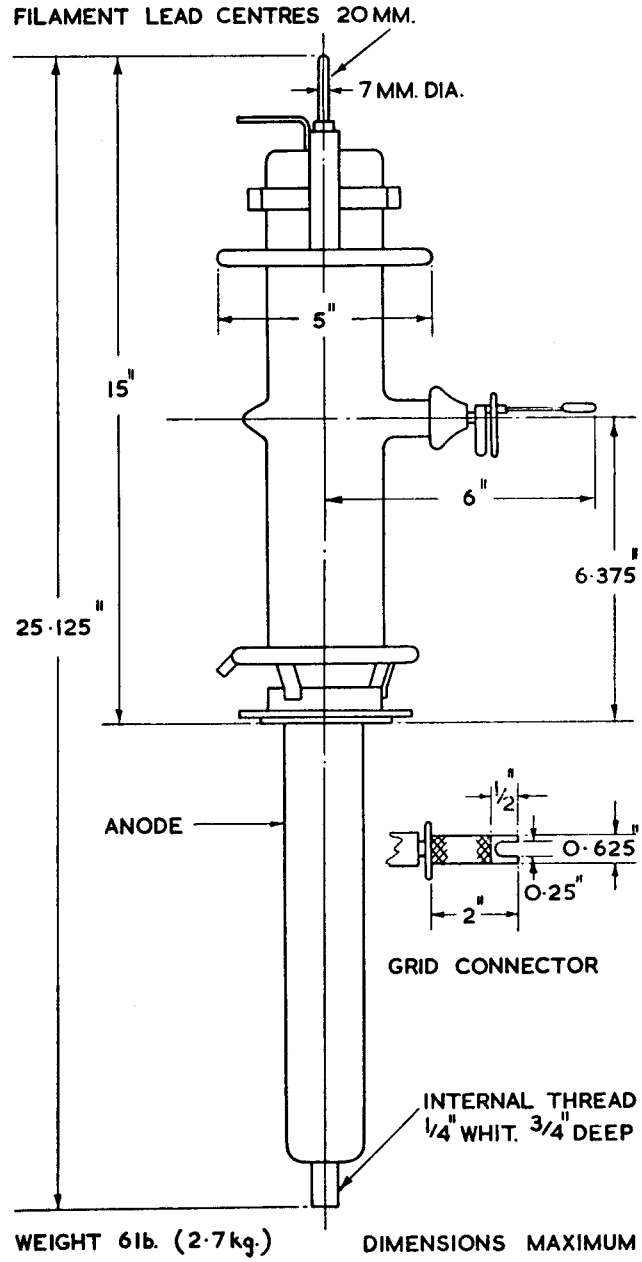
Mounting. The valve must be mounted with the anode in a vertical position and be completely supported by the water jacket. Rigid connections must be made to the anode only.

Seasoning. Whenever a new valve is put into service or when a valve has been idle for periods of approximately two months, it must be seasoned by operating, for at least one hour, at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value.

APPROXIMATE DATA

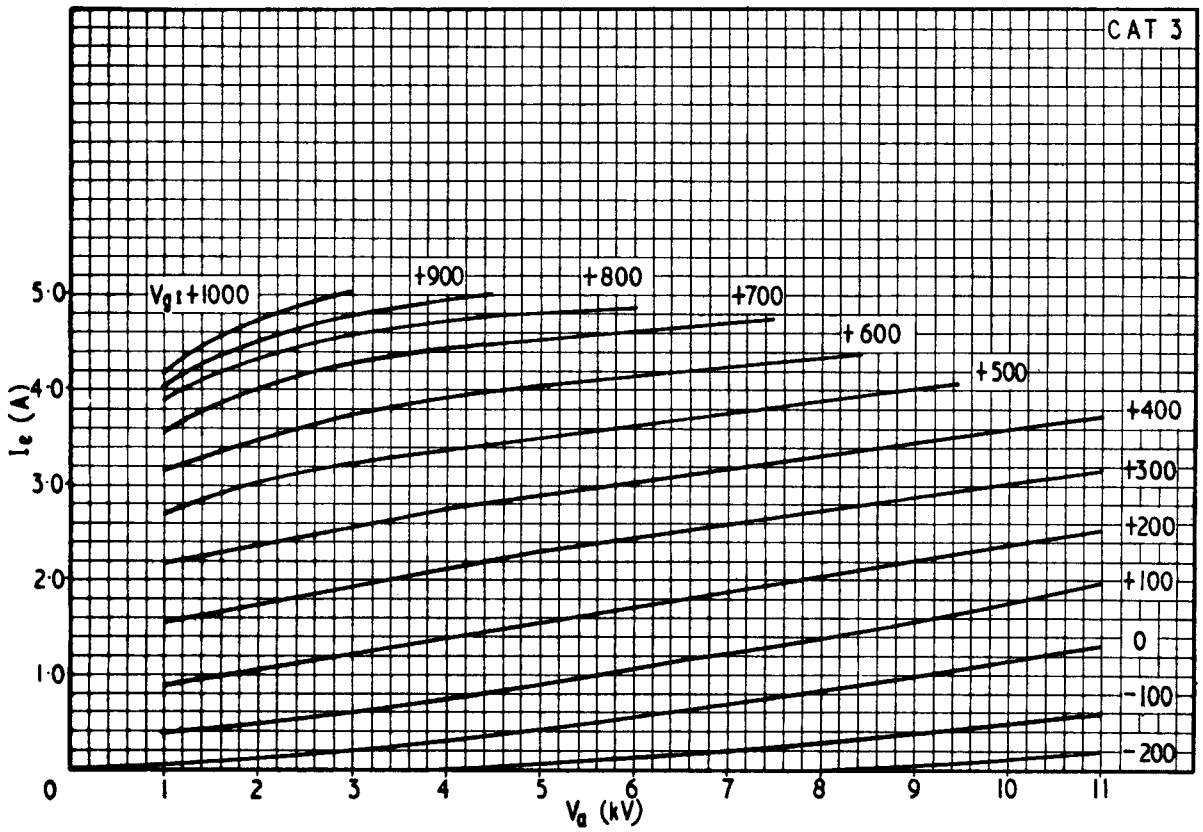
V_f		18–20	V*
I_f		50	A
I_e (at 90% saturation)		5	A
μ	taken at	40	
r_a	V_a 10 kV, V_{g1} 0 V	10,000	Ω
$V_{a(max)}$		10	kV
$p_{a(max)}$		5	kW
$p_{g1(max)}$		300	W
$f_{(max)}$		3	Mc/s
$c_{a\text{-}g1}$		23·1	pF
$c_{a\text{-}f}$		1·98	pF
$c_{g1\text{-}f}$		20·5	pF

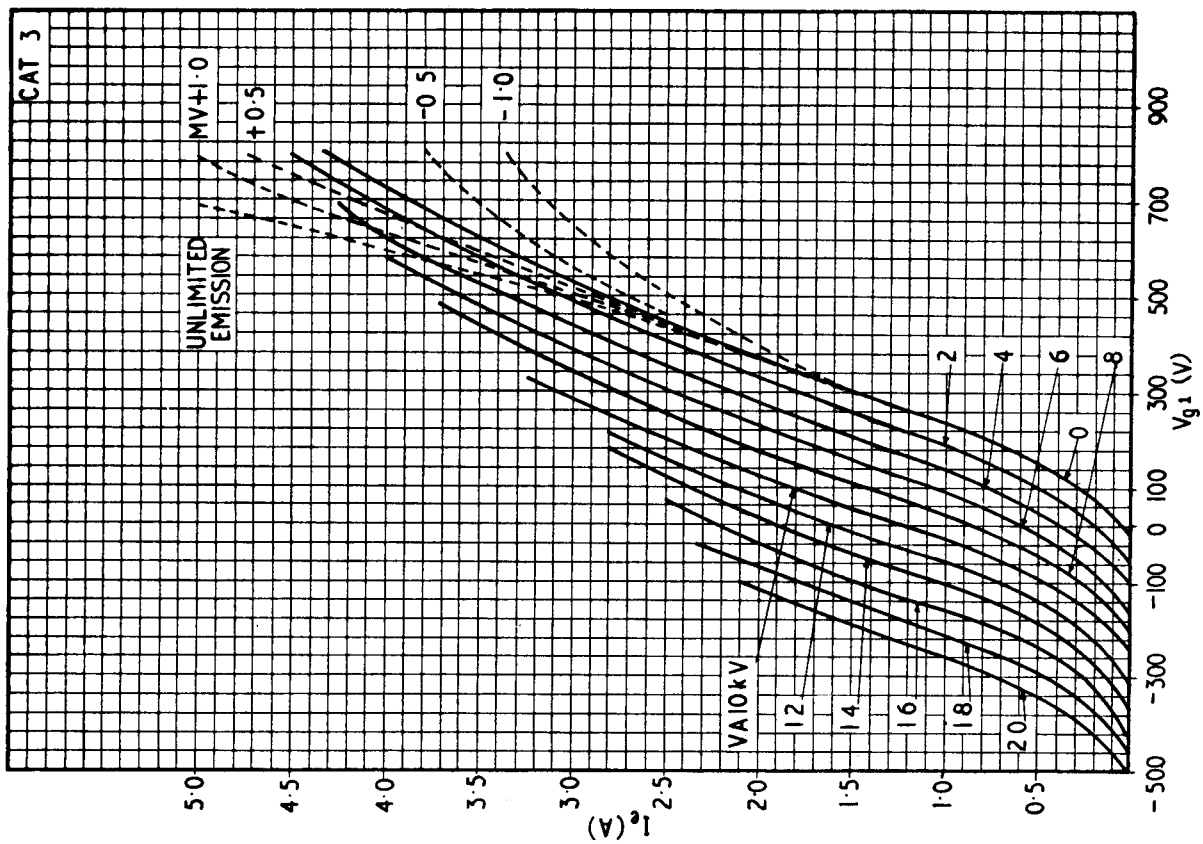
*Each valve is marked with the filament voltage to give 5 A emission at 90% saturation.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford





PRINTED IN ENGLAND

Triode *Type CAT6*

HF POWER AMPLIFIER AND OSCILLATOR

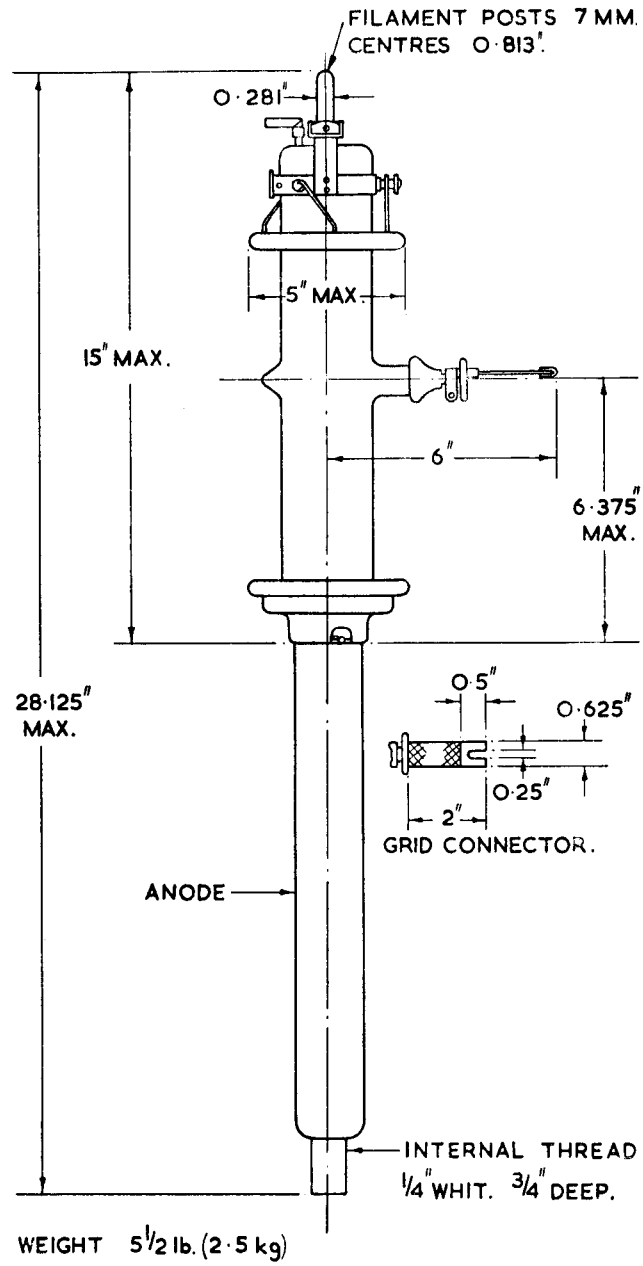
General. A water-cooled anode transmitting triode fitted with a tungsten filament.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The rated flow must not be less than 3 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 150°F (65°C). All cooling supplies must be started before the application of any supply voltage.

Filament Starting. The cold resistance of the filament is approximately 0·021 Ω. The filament current must never exceed 105 A at any time during the switching-on period. If the valve is operated for periods greater than 15 minutes without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during the standby period.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connection must be made to anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

V_f		18–20	V
I_f		72	A
$V_{a(max)}$		12	kV
$p_{a(max)}$		12	kW
$p_{gl(max)}$		350	W
$I_{gl(pk)\ (RF)\ (max)}$		30	A
μ	taken at Va 10 kV, V_{gl} 0	45	
r_a		5,000	Ω
g_m		9·0	mA/V
$f_{(max)}$		40	Mc/s
$c_{a\text{-}gl}$		30	pF
$c_{a\text{-}k}$		2·2	pF
$c_{gl\text{-}k}$		25	pF

Each valve is marked with the filament voltage to give 10 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

V_a		12·0	10·0	8·0	kV
I_a		2·6	2·5	2·4	A
V_{gl}		−375	−460	−290	V
I_{gl}	(a)	140	130	250	mA
$v_{gl(pk)}$		1,375	1,460	1,290	V
P_{dr}	(a)	200	200	320	W
Z_a		2,300	1,860	1,630	Ω
p_a		9·7	8·3	6·2	kW
P_{out}		21·5	16·7	13·0	kW

(2) HF POWER AMPLIFIER. CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%)

V_a	10·0	7·5		kV
I_a	1·05	1·0		A
V_{gl}	−685	−575		V
I_{gl} (a)	25	26		mA
$v_{gl(pk)}$	1,145	1,035		V
P_{dr} (a)	40	30		W
Z_a	4,480	3,160		Ω
p_a	2·2	2·0		kW
P_{out}	8·3	5·5		kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%)

V_a	12·0	10·0		kV
I_a	1·2	1·2		A
V_{gl}	−270	−220		V
$v_{gl(pk)}$	510	490		V
P_{dr} (a) (b)	20	20		W
Z_a	2,530	2,000		Ω
p_a	10·0	8·5		kW
P_{out}	4·4	3·5		kW

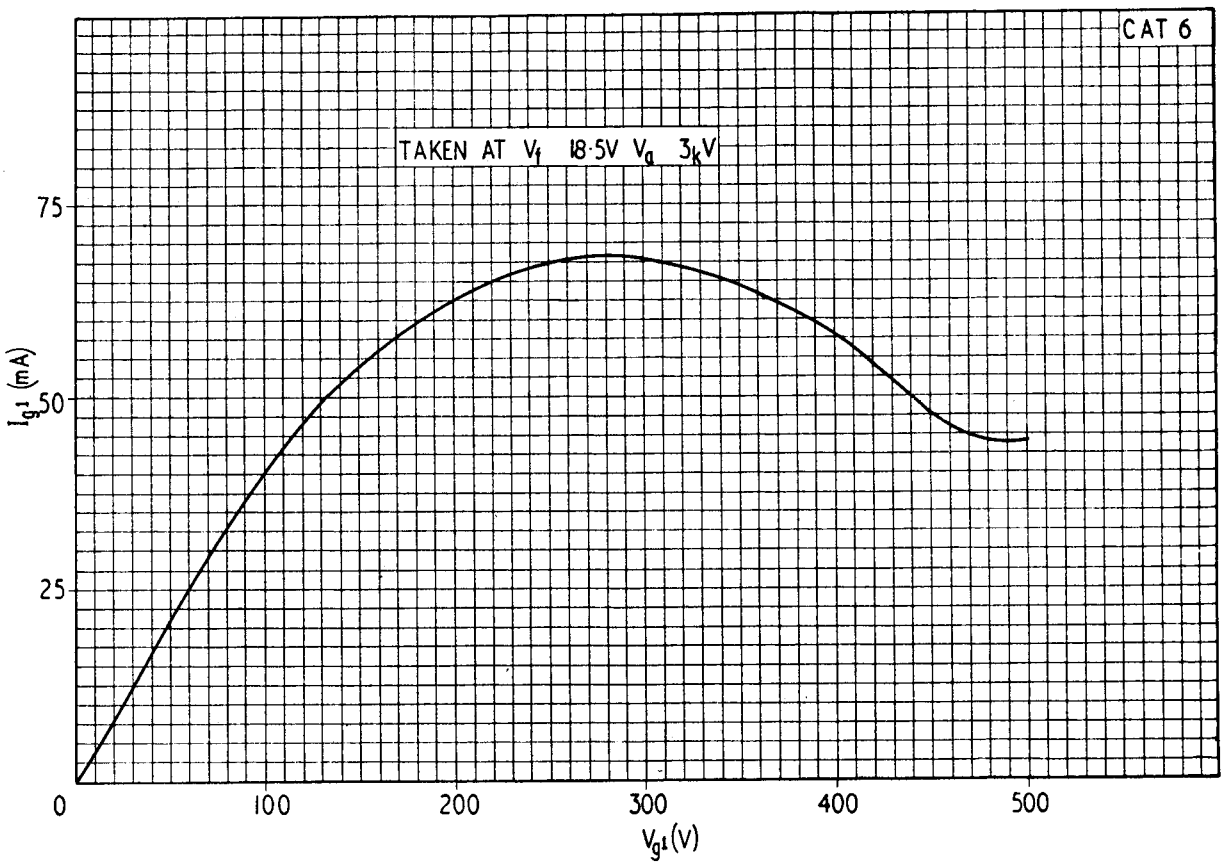
The figures quoted above are only applicable when operating at frequencies up to 15 Mc/s. At higher frequencies the anode voltage must be reduced according to the following table:

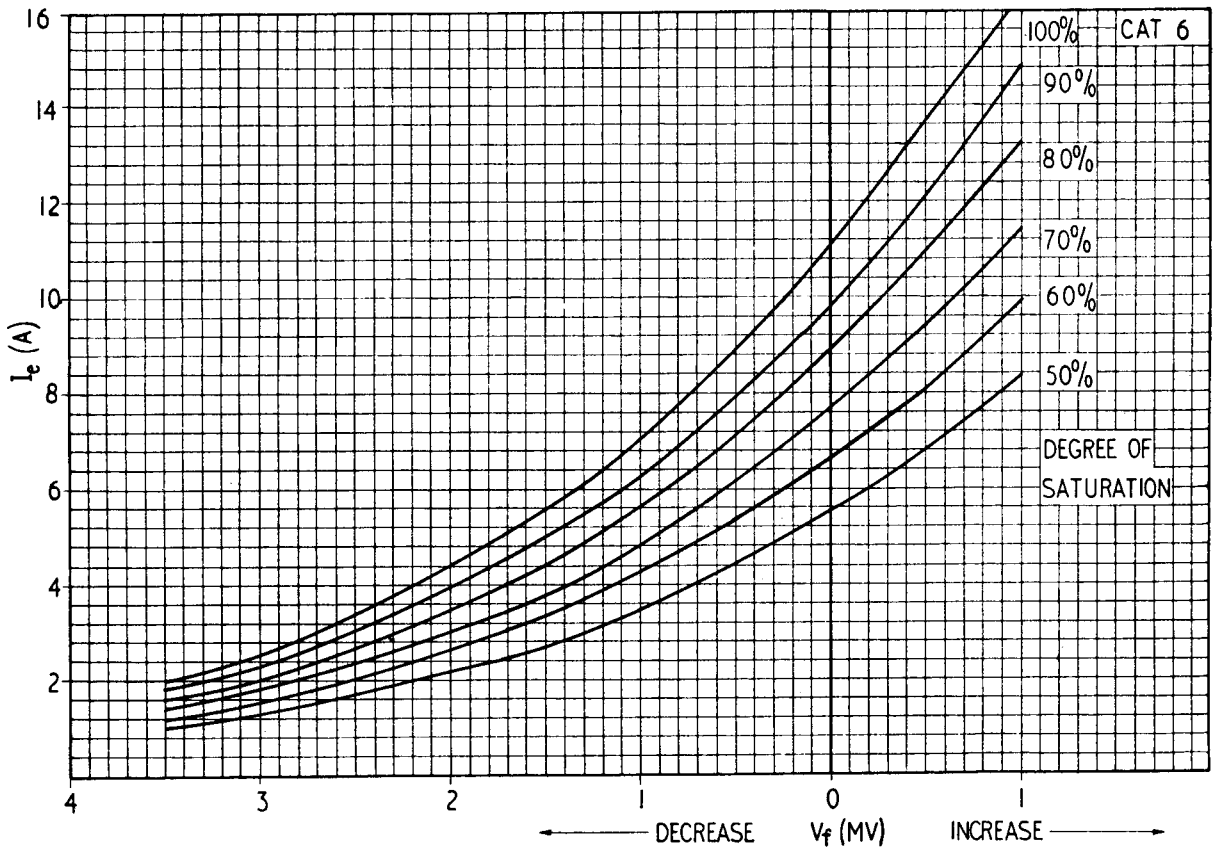
f (Mc/s)	15	20	25	40
$\%V_{a(max)}$	100	85	65	35

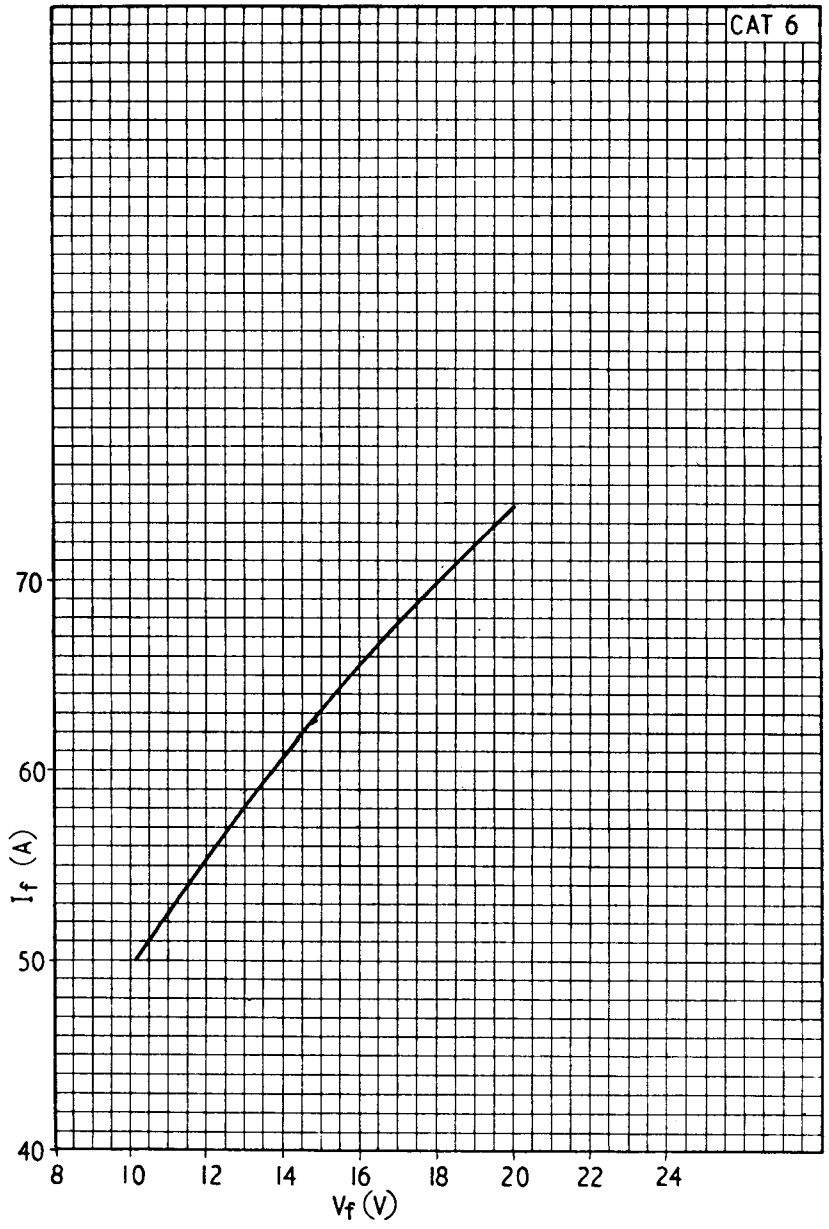
NOTES

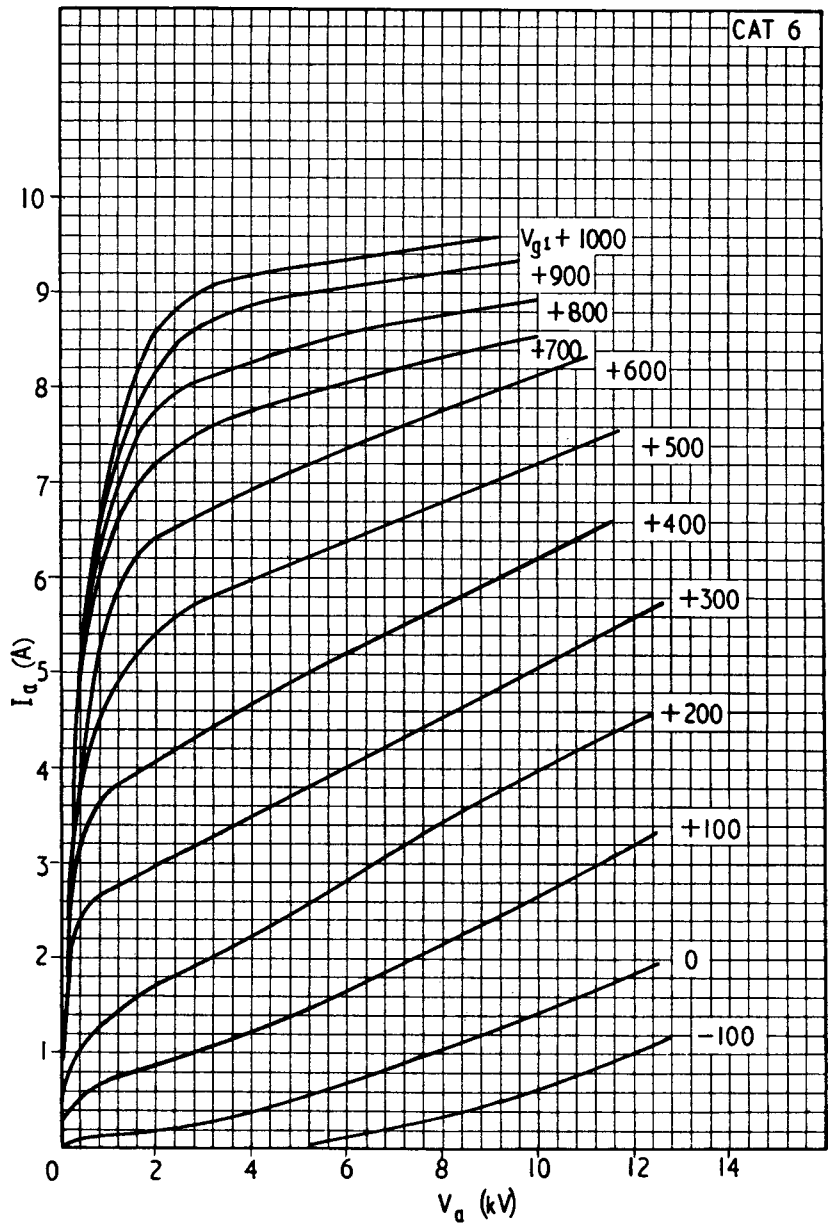
(a) Subject to wide variation. The figures are approximate only.

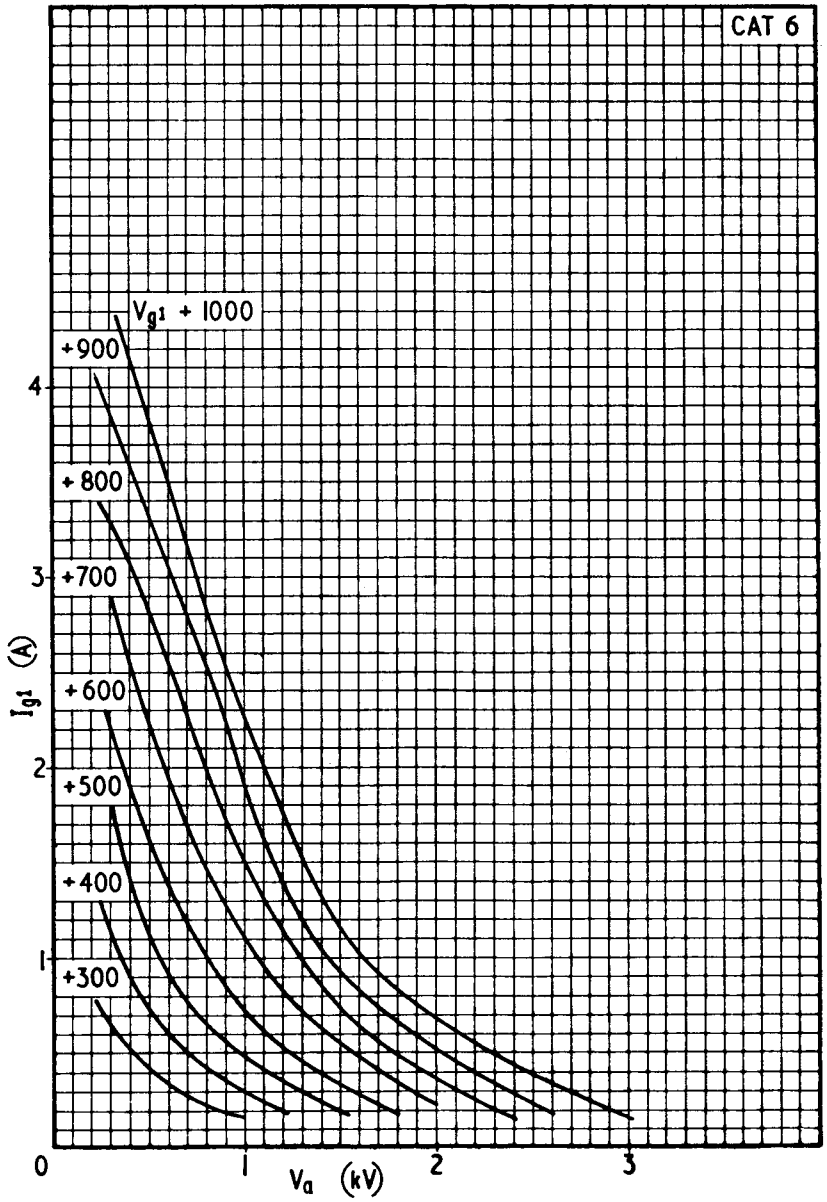
(b) At crest of audio cycle with 100% modulation.

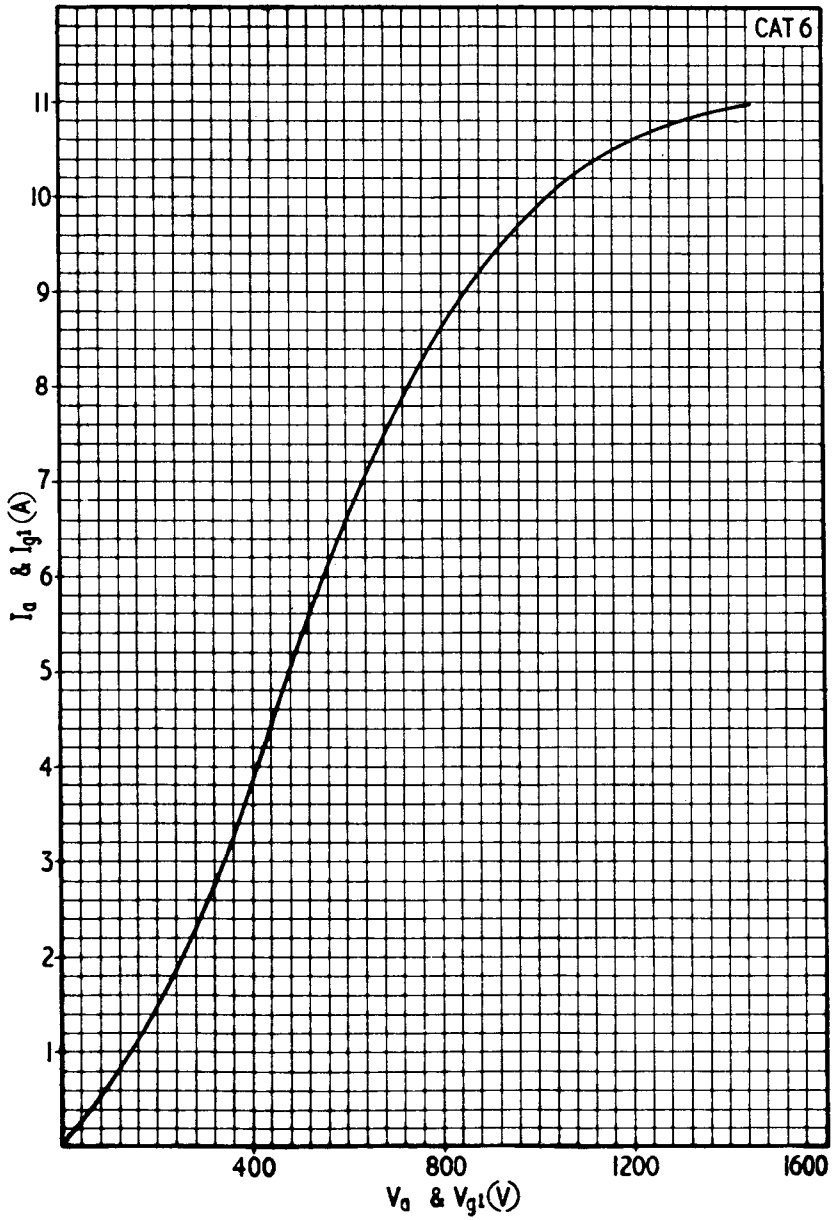

CAT 6
TAKEN AT V_f 18·5V V_a 3$_k$V
75
50
25
0
100
200
300
400
500
I_{g^1} (mA)
V_{g^1} (V)


CAT 6
100%
90%
80%
70%
60%
50%
DEGREE OF SATURATION
16
14
12
10
8
6
4
2
I_e (A)
4
3
2
1
0
1
DECREASE
V_f (MV)
INCREASE


CAT 6
70
60
50
40
I_f (A)
8
10
12
14
16
18
20
22
24
V_f (V)


CAT 6
10
9
8
7
6
5
4
3
2
1
I_a (A)
V_{g1} + 1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
0
−100
0
2
4
6
8
10
12
14
V_a (kV)


CAT 6
V_{g1} + 1000
+900
+800
+700
+600
+500
+400
+300
I_{g1} (A)
0
1
2
3
4
V_a (kV)


CAT 6
I_a & I_{g1} (A)
1
2
3
4
5
6
7
8
9
10
11
400
800
1200
1600
V_a & V_{g1} (V)



PRINTED IN ENGLAND

Triode *Type CAT 9*

HF POWER AMPLIFIER AND OSCILLATOR

General. A water-cooled anode transmitting triode fitted with a tungsten filament designed for use in communication or RF heating equipments.

The anode forms part of the envelope and must be fitted with a specially designed water jacket. The anode and filament seals require forced air cooling.

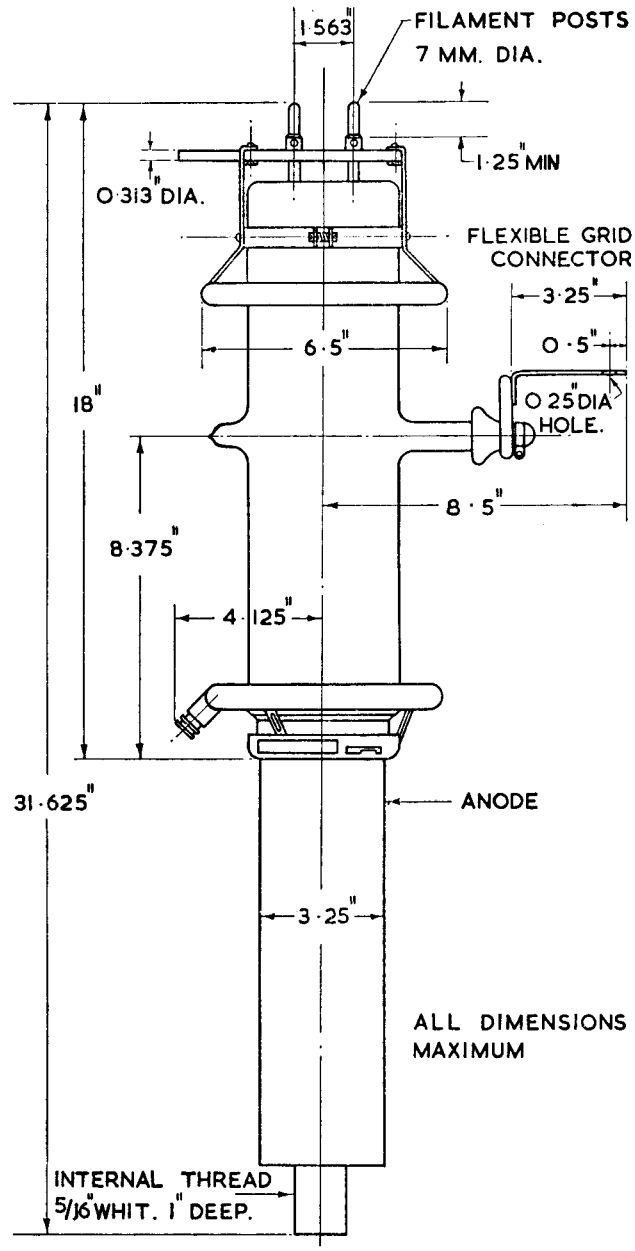
Cooling. All cooling supplies must be started before the application of any supply voltages.

The water flow to the anode must not be less than 4·5 gallons per minute. The temperature of the cooling water must not be greater than 65°C at the outlet. The air flow to the anode seal and to the filament seals should not be less than 4 cu. ft. per minute.

Filament Starting. The cold resistance of the filament is approximately 0·0167 Ω. The filament current must not exceed 130 A at any time. If the valve is operated for periods of greater than 15 minutes duration without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during these standby periods.

Mounting. The valve must be completely supported by its water jacket with its axis in a vertical position. Rigid connections must be made to the anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for a period of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltages should then be increased slowly to the normal value.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

APPROXIMATE DATA

V_f			18–20	V
I_f			100	A
$V_{a(max)}$			15	kV
$p_{a(max)}$			18	kW
$p_{gl(max)}$			500	W
$I_{gl(pk)\ (RF)\ (max)}$			30	A
μ	at Va	15 kV	45	
r_a	V_{gl}	0	4,500	Ω
g_m			10	mA/V
$f_{(max)}$			40	Mc/s
$C_{a\text{-}gl}$	*Taken without water jacket*		21	pF
$C_{a\text{-}k}$			1·9	pF
$C_{gl\text{-}k}$			29	pF

Each valve is marked with the filament voltage to give 12 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(*Unmodulated, one valve, key down conditions*)

V_a		15	12	10	kV
I_a		2·65	2·6	2·4	A
V_{gl}		–450	–375	–440	V
I_{gl}	(a)	250	280	300	mA
$v_{gl(pk)}$		1,450	1,375	1,440	V
P_{dr}	(a)	350	400	420	W
Z_a		2,900	2,400	2,000	Ω
p_a		12·5	10	7·7	kW
P_{out}		27·3	21·2	16·3	kW

(2) HF POWER AMPLIFIER. CLASS C

(*Anode modulated, one valve, carrier conditions, permissible modulation 100%*)

V_a		12	10	kV
I_a		1·05	1·1	A
V_{gl}		–740	–650	V
I_{gl}	(a)	70	72	mA
$v_{gl(pk)}$		1,230	1,140	V
P_{dr}	(a)	90	85	W
Z_a		5,200	4,150	Ω
p_a		3·0	3·2	kW
P_{out}		9·6	7·8	kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

(*One valve, carrier conditions, permissible modulation 100%*)

V_a			15	10	kV
I_a			1·2	1·2	A
V_{gl}			–330	–220	V
$v_{gl(pk)}$			570	510	V
P_{dr}	(a)	(b)	85	80	W
Z_a			3,240	1,900	Ω
p_a			12·4	8·75	kW
P_{out}			5·6	3·25	kW

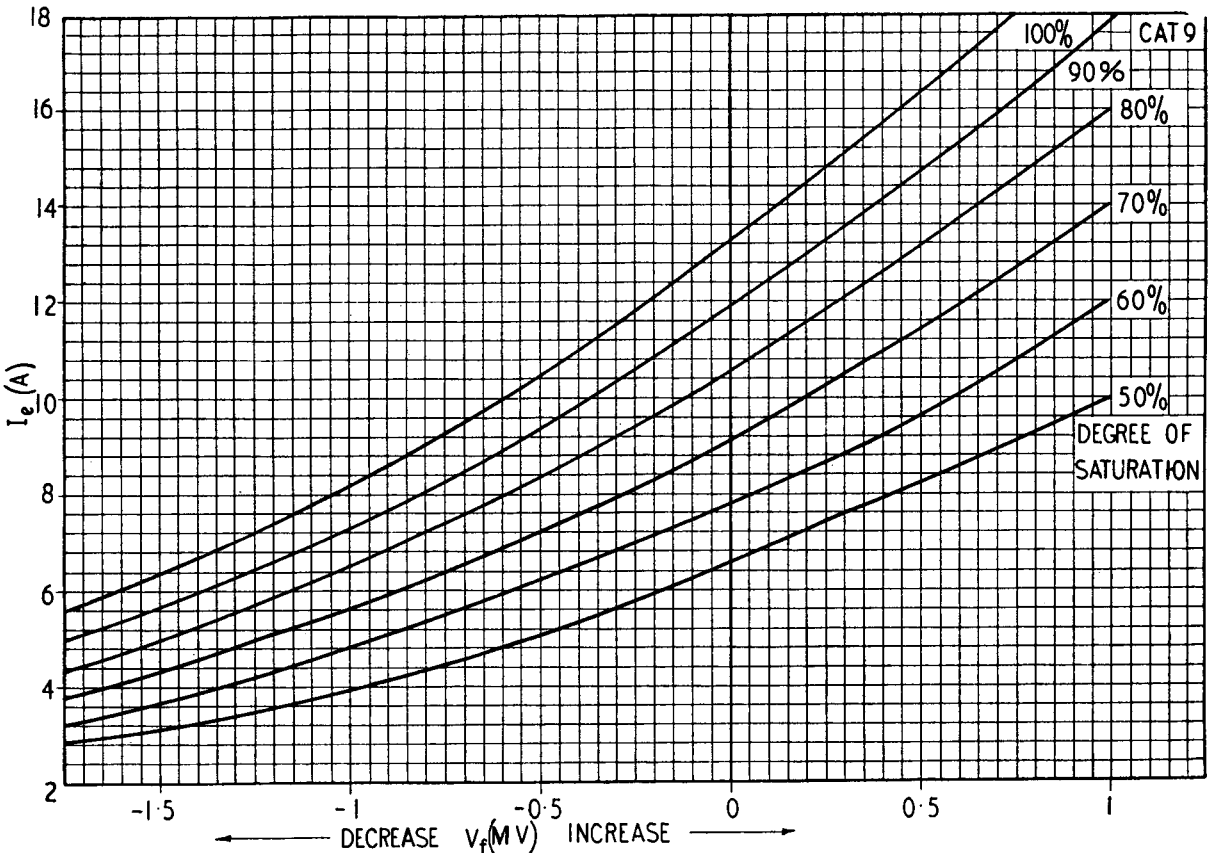
The figures given above are only applicable to operation at frequencies up to 20 Mc/s. Above 20 Mc/s the anode voltage must be reduced in accordance with the following table:

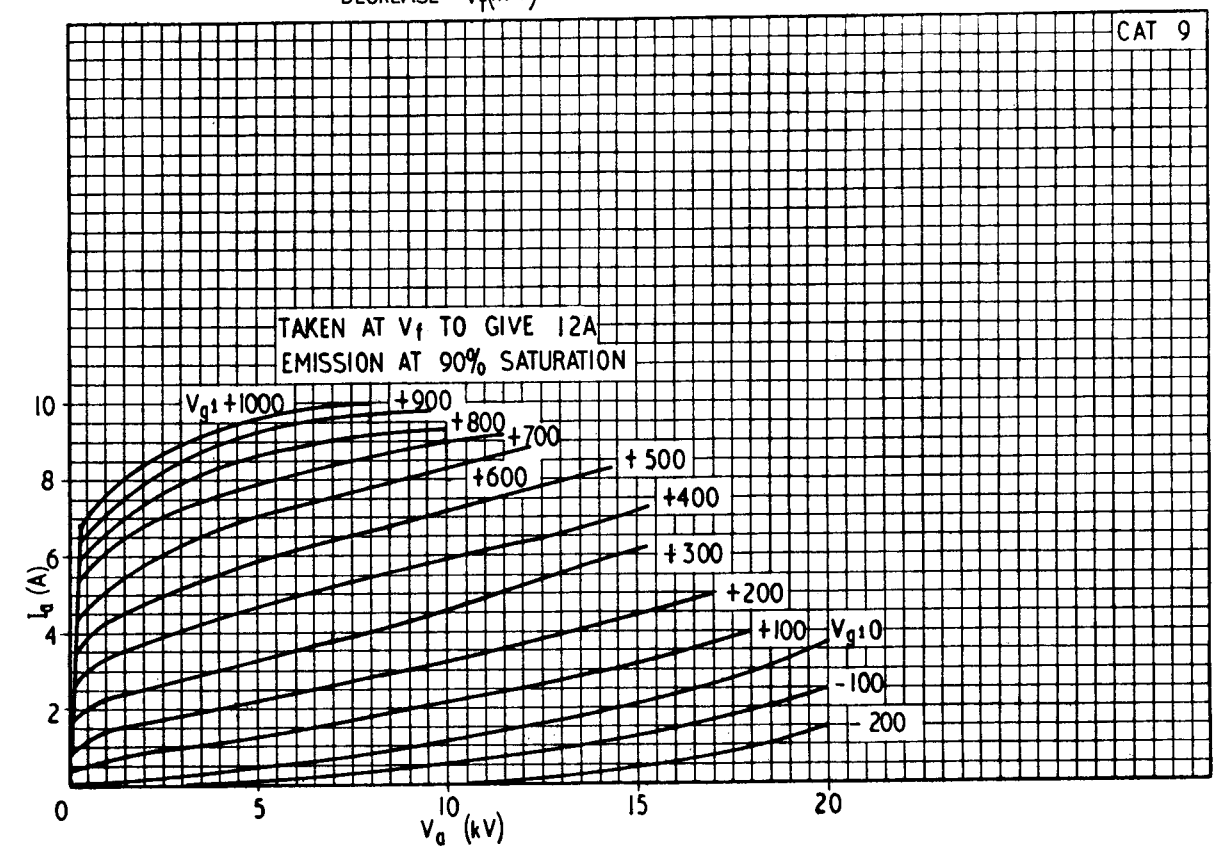
f (Mc/s)	20	25	30	40
$\%V_{a(max)}$	100	75	50	35

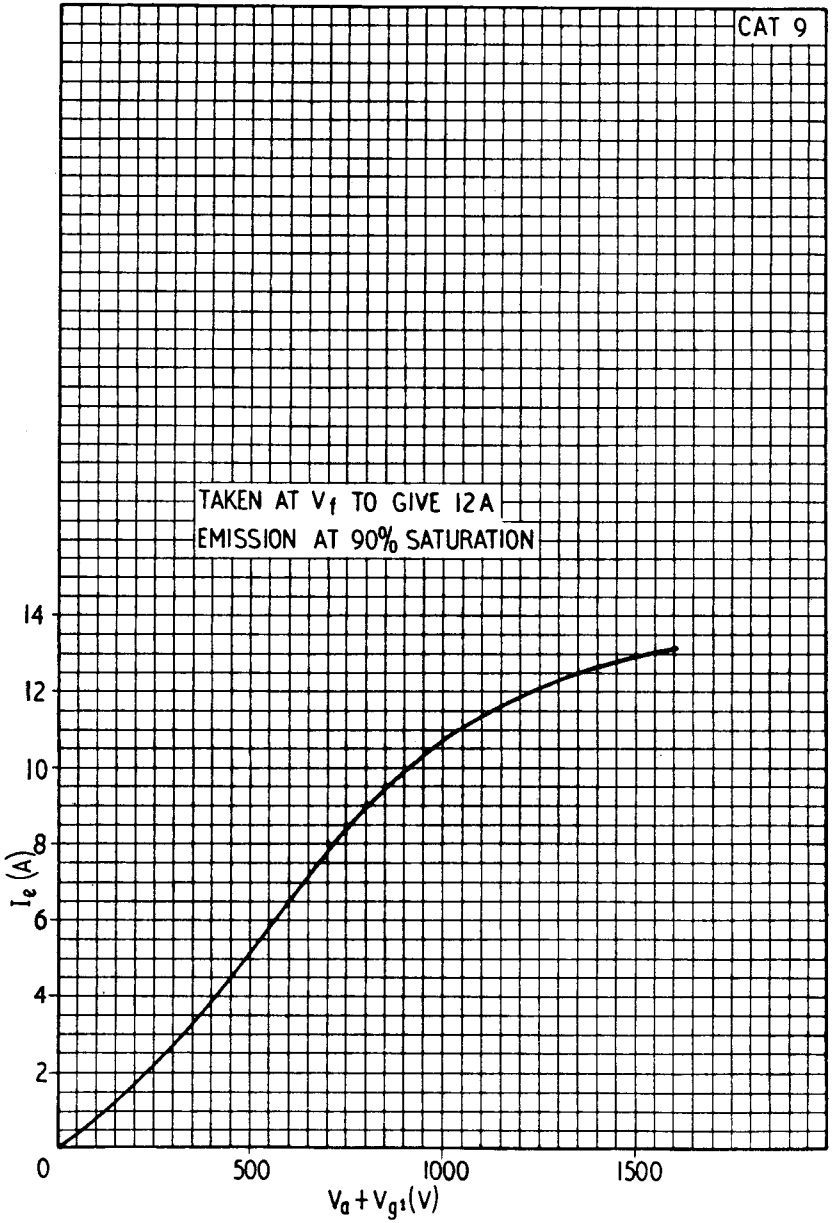
NOTES

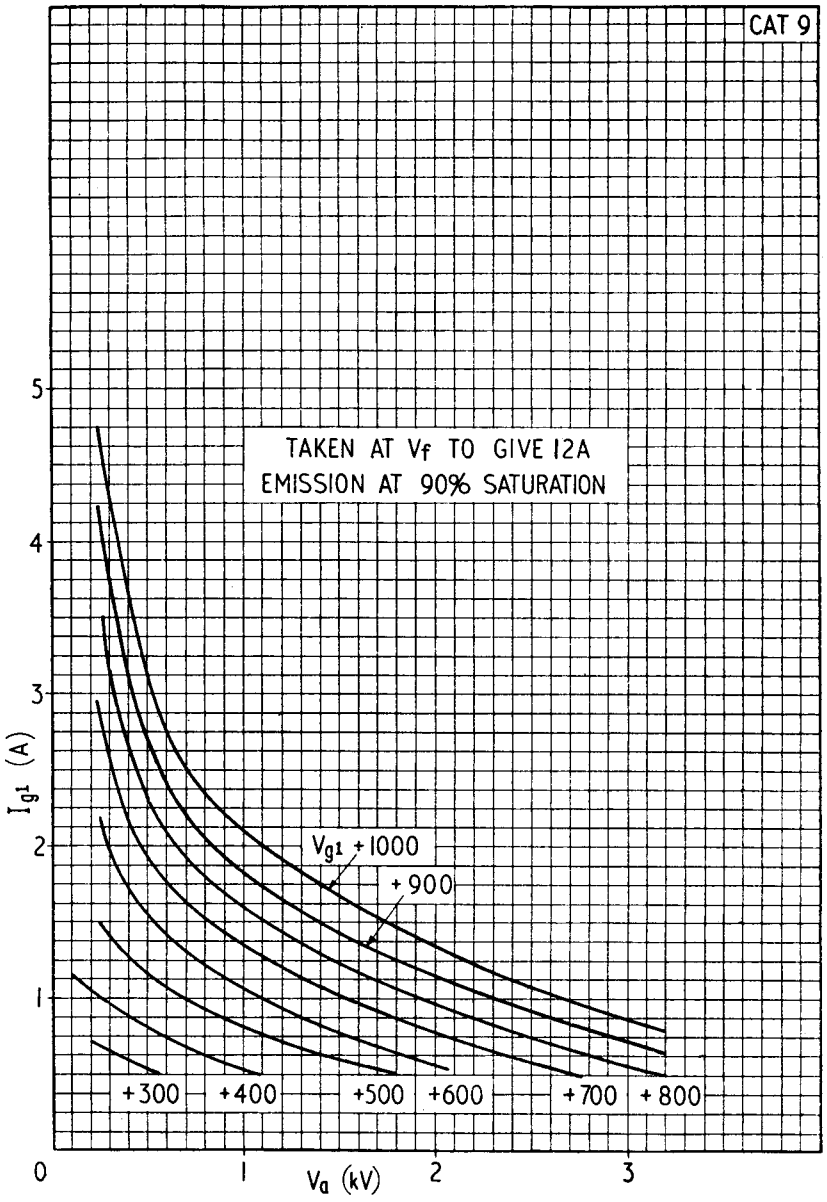
(a) Subject to wide variation. The figures are approximate only.

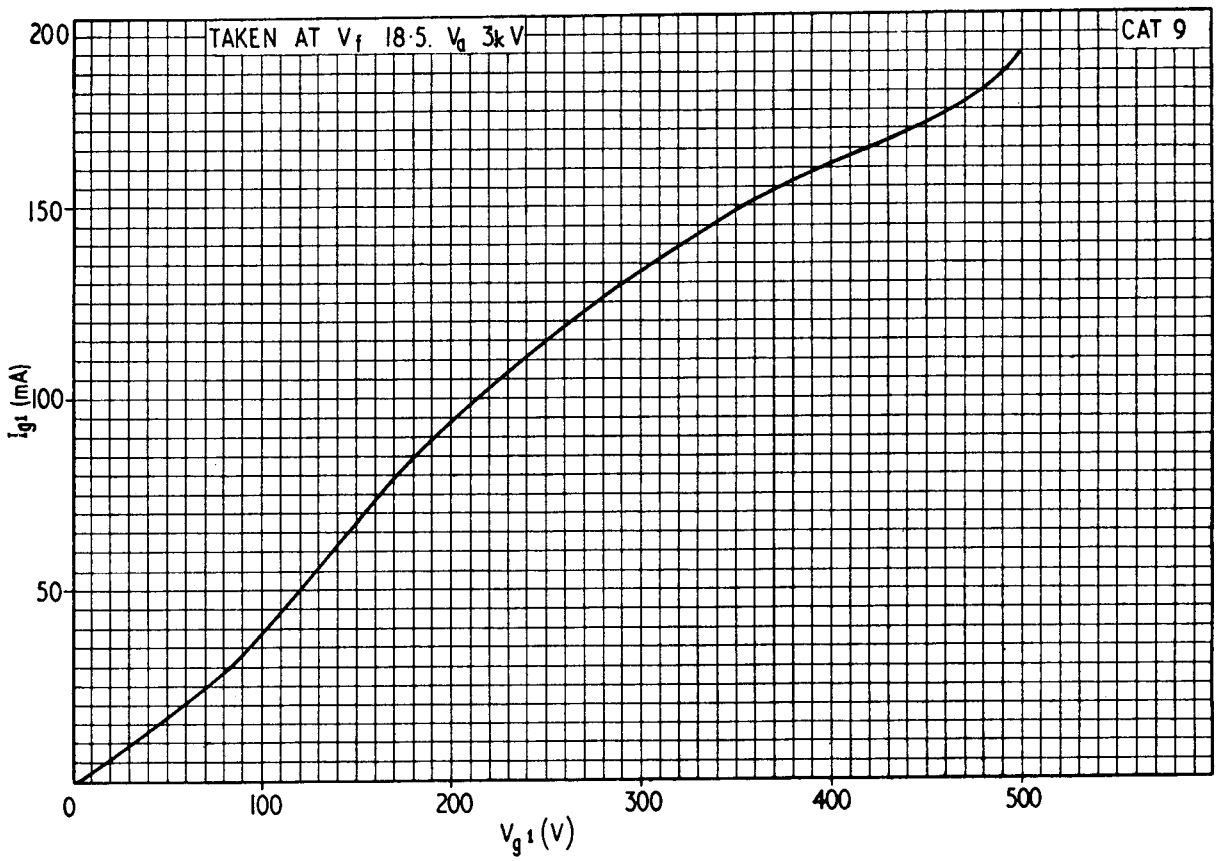
(b) At crest of audio cycle with 100% modulation.

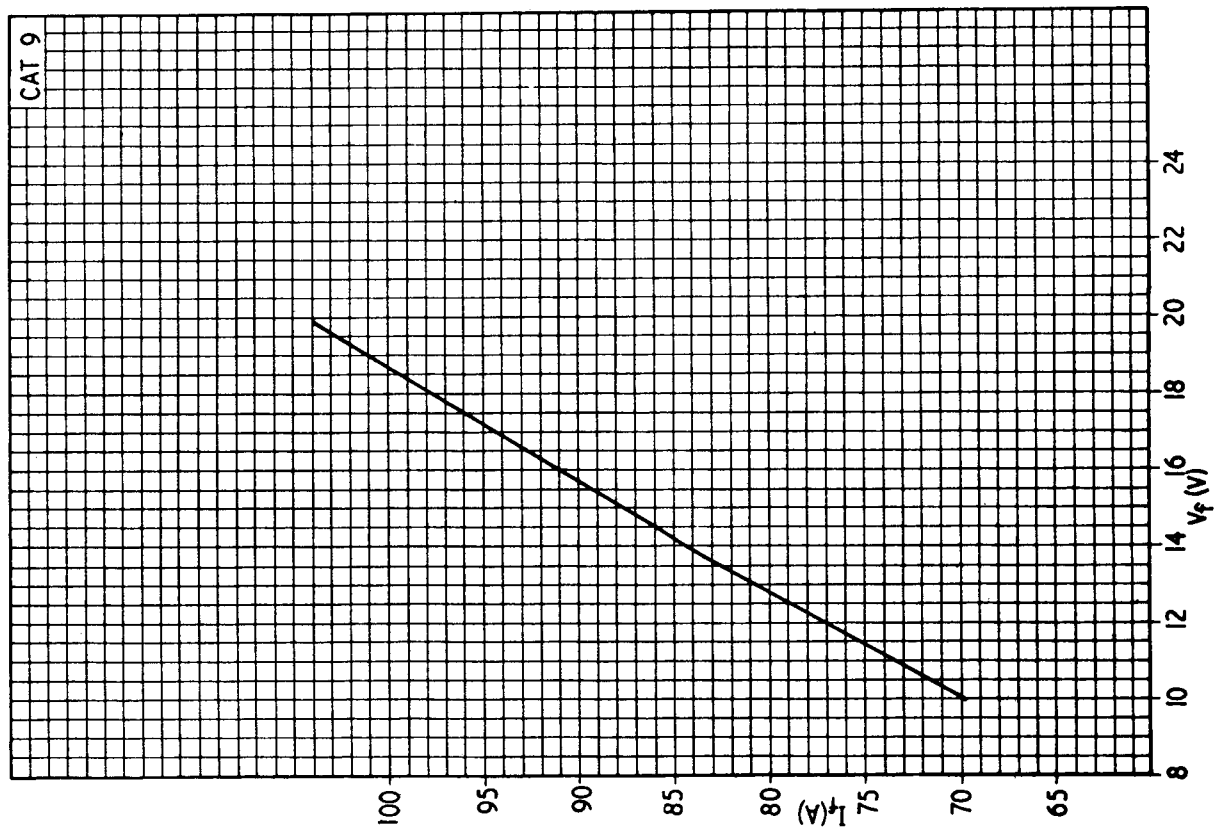

CAT 9
100%
90%
80%
70%
60%
50%
DEGREE OF SATURATION
I_e (A)
18
16
14
12
10
8
6
4
2
-1·5
-1
-0·5
0
0·5
1
DECREASE V_f (MV) INCREASE


CAT 9
TAKEN AT V_f TO GIVE 12A
EMISSION AT 90% SATURATION
V_g +1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
V_g 0
-100
-200
I_a (A)
10
8
6
4
2
0
5
10
15
20
V_a (kV)


CAT 9
TAKEN AT V_f TO GIVE 12A
EMISSION AT 90% SATURATION
I_e (A)
0
2
4
6
8
10
12
14
500
1000
1500
$V_a + V_{g1}$ (V)


CAT 9
TAKEN AT V_f TO GIVE 12A
EMISSION AT 90% SATURATION
I_{g1} (A)
0
1
2
3
4
5
1
2
3
V_a (kV)
V_{g1} +1000
+900
+300
+400
+500
+600
+700
+800


TAKEN AT V_f 18·5. V_a 3k V
CAT 9
200
150
100
50
0
100
200
300
400
500
I_{g1} (mA)
V_{g1} (V)


CAT 9
100
95
90
85
80
75
70
65
I_f(A)
8
10
12
14
16
18
20
22
24
V_f (V)



PRINTED IN ENGLAND

Triodes *Types CAT 14 and CAT 14C*

(HF AMPLIFIERS)

General. Water-cooled anode transmitting triodes, fitted with tungsten filaments, these valves are suitable for use as high frequency amplifiers at frequencies up to 10 Mc/s.

They are designed for use in communication or RF heating equipments.

The two valves are identical except for filament lead cooling, the CAT14C having air-cooled leads and the CAT14 water-cooled leads.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the envelope. The rated flow should not be less than 40 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 150°F (65°C).

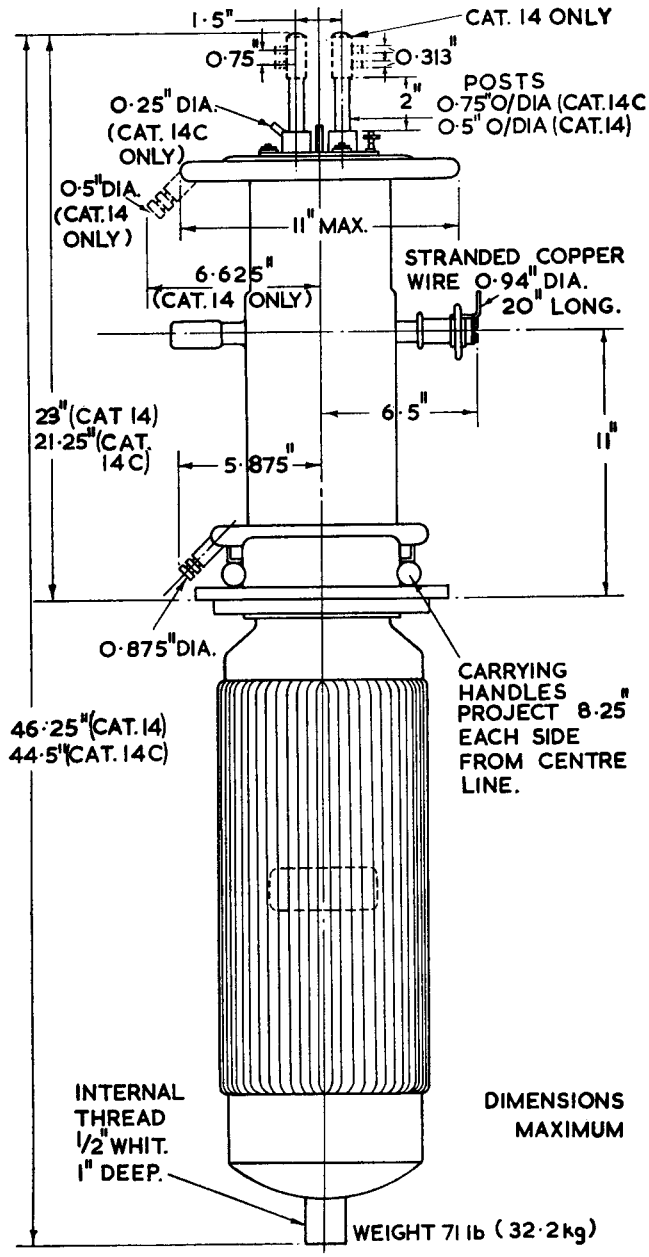
Each external valve filament lead of the CAT14 requires a water flow of 400 cc. per minute. The temperature of the cooling water must not exceed 122°F (50°C) at the outlet.

Each internal filament lead of the CAT14C requires a flow of air of approximately 8 cu. ft. per minute at a pressure equal to 5 in. water gauge.

The air flow to the anode seal cooling ring should be 4 cu. ft. per minute at a pressure equal to 4 in. water gauge.

All cooling supplies must be started before the application of any supply voltages, and must continue for at least 2 minutes after the removal of all supply voltages.

Filament Starting. The cold resistance of the filament is of the order of 0·0057 Ω. The filament current must never exceed 500 A at any time during the switching-on period. If the valve is operated for periods greater than 15 minutes without anode current flowing, the filament voltage must be reduced to one-half its normal value during the standby period.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Marconi House, Chelmsford. Telephone: Chelmsford 3221. Telex: 1953. Telegrams: Expanse Chelmsford Telex

HT Switching. It is not permissible to apply directly HT voltage in excess of one-third the maximum rated anode voltage. At higher voltages the HT should be either gradually increased from a low value or three-position switching should be employed.

Mounting. The valve must be completely supported by its water jacket, which should be capable of adjustment so that the axis of the valve is truly vertical. Rigid connections must be made to the anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to normal value.

APPROXIMATE DATA

V_f		32·5	V*
I_f		460	A
V_a		20	kV
p_a		150	kW
p_{gl}		8	kW
$I_{gl\ (pk)}$		30	A
μ	taken at V_a 15 kV, V_{gl} −100 V	45	
r_a		900	
g_m		50	mA/V
$c_{a\text{-}gl}$		52	pF
$c_{a\text{-}k}$		4·5	pF
$c_{gl\text{-}k}$		100	pF

*Each valve is marked with the filament voltage to give 100 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(*Unmodulated, one valve, key down conditions*)

V_a		15	18	20	kV
I_a		18·8	18·8	18·8	A
V_{gl}		−950	−1,030	−1,070	V
I_{gl}	(a)	4·3	4·3	4·2	A
$v_{gl\ (pk)}$		2,650	2,730	2,770	V
P_{dr}	(a)	11·5	11·6	11·6	kW
Z_a		400	490	550	Ω
p_a		74	80	104	kW
P_{out}		209	258	272	kW

(2) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C.

(*Anode modulated, one valve, carrier conditions, permissible modulation 100%*)

V_a		10	15	kV
I_a		9·6	9·8	A
V_{gl}		−895	−1,120	V
I_{gl}	(a)	1·9	1·8	A
$v_{gl\ (pk)}$		1,845	2,070	V
P_{dr}	(a) (b)	3·5	3·8	kW
Z_a		435	716	Ω
p_a		32	39	kW
P_{out}		64	108	kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

(*One valve, carrier conditions, permissible modulation 100%*)

V_a		10	15	kV
I_a		10·6	10·6	A
V_{gl}		−330	−440	V
$v_{gl\ (pk)}$		890	940	V
P_{dr}	(a) (b)	5·4	5·6	kW
Z_a		330	480	Ω
p_a		114	146	kW
P_{out}		46	67	kW

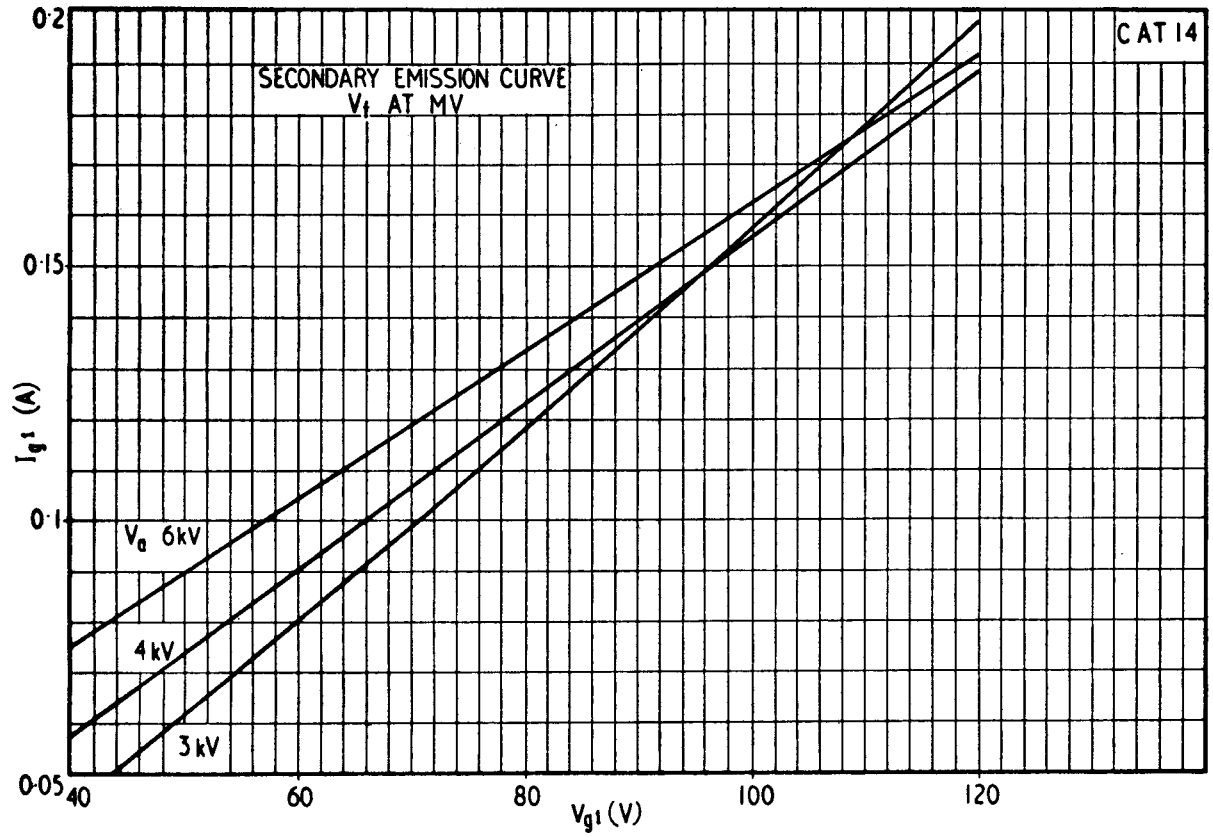
The figures quoted above are only applicable when operating at frequencies up to 3 Mc/s. At higher frequencies the anode voltage must be reduced according to the following table:

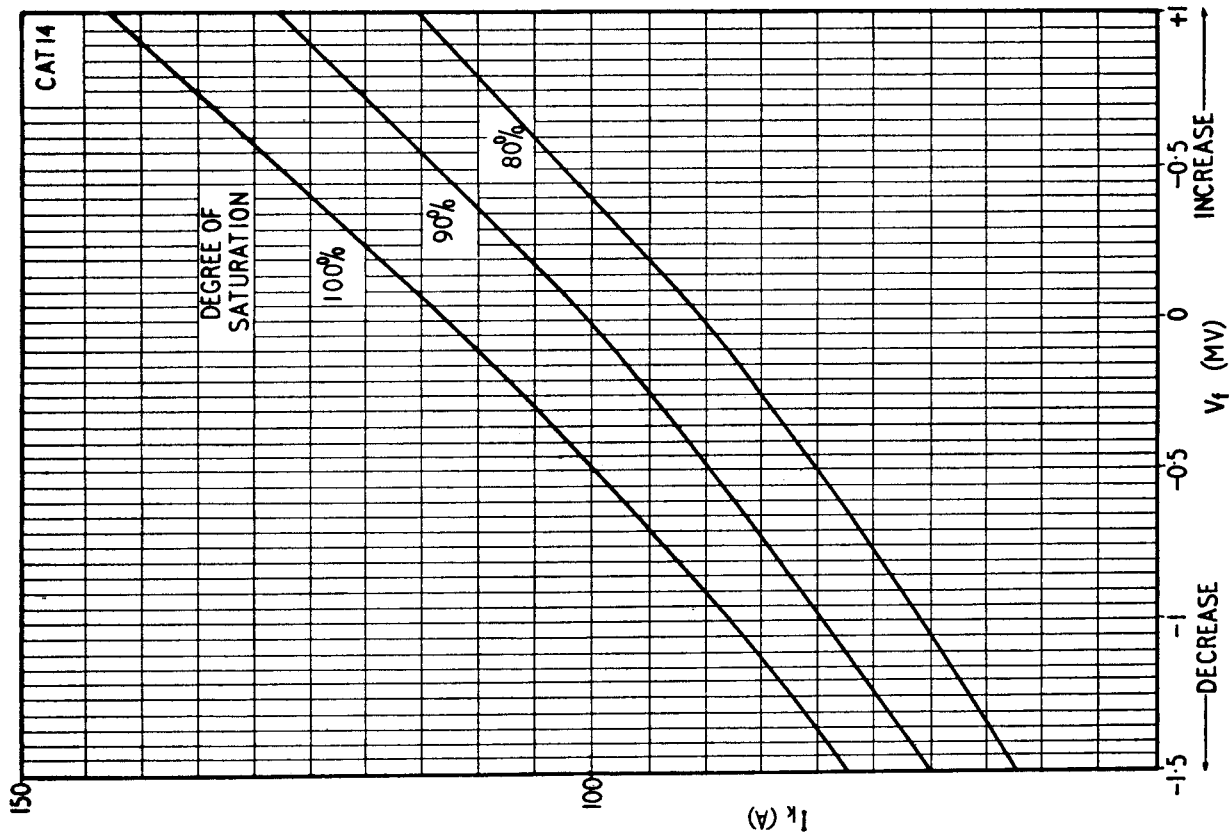
f (Mc/s)	3	5	10
% $V_{a(max)}$	100	80	60

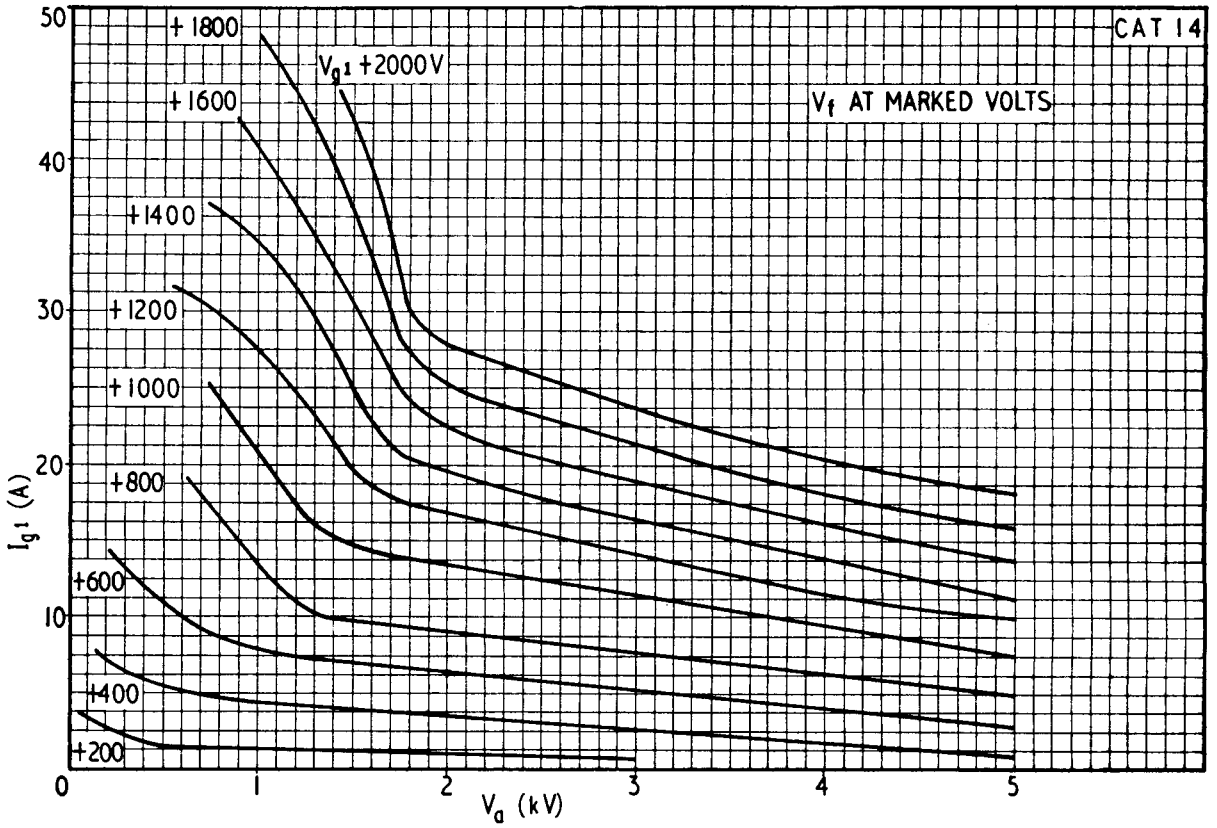
NOTES

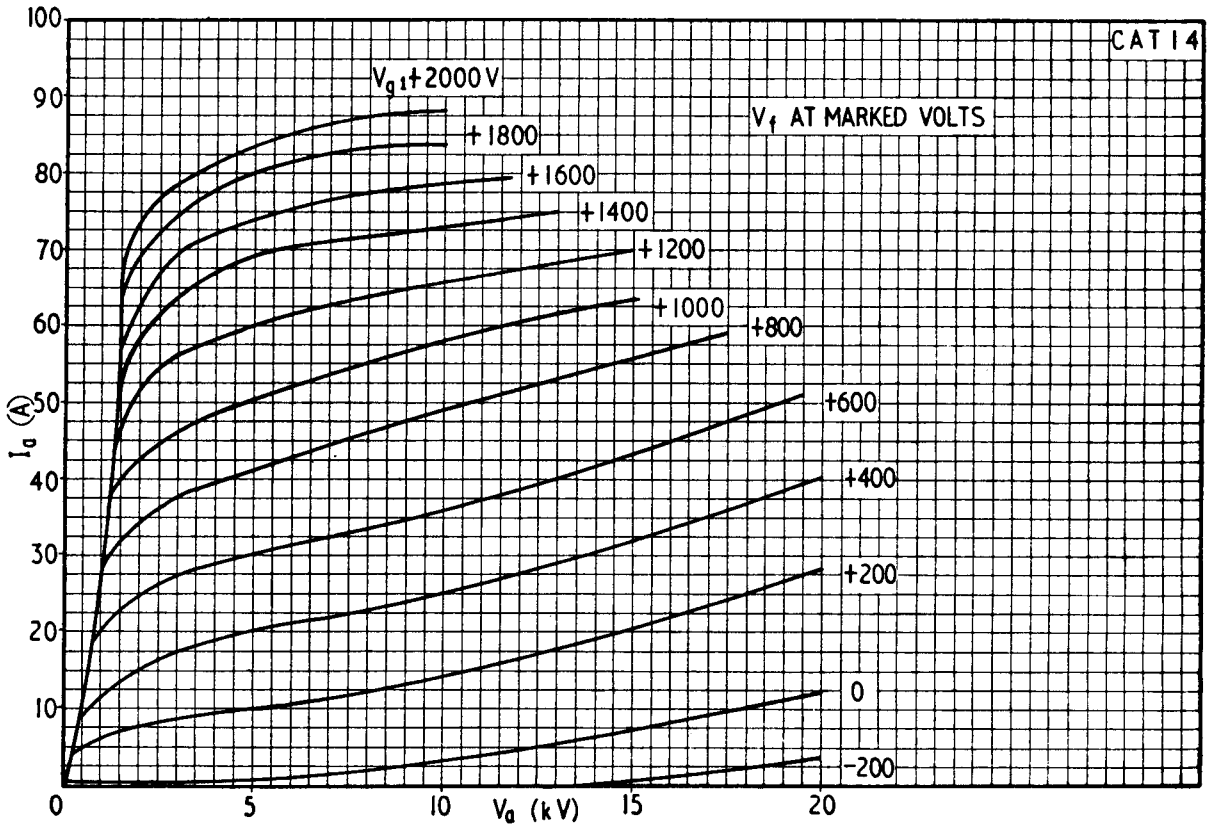
(a) Subject to wide variation. The figures given are approximate only.

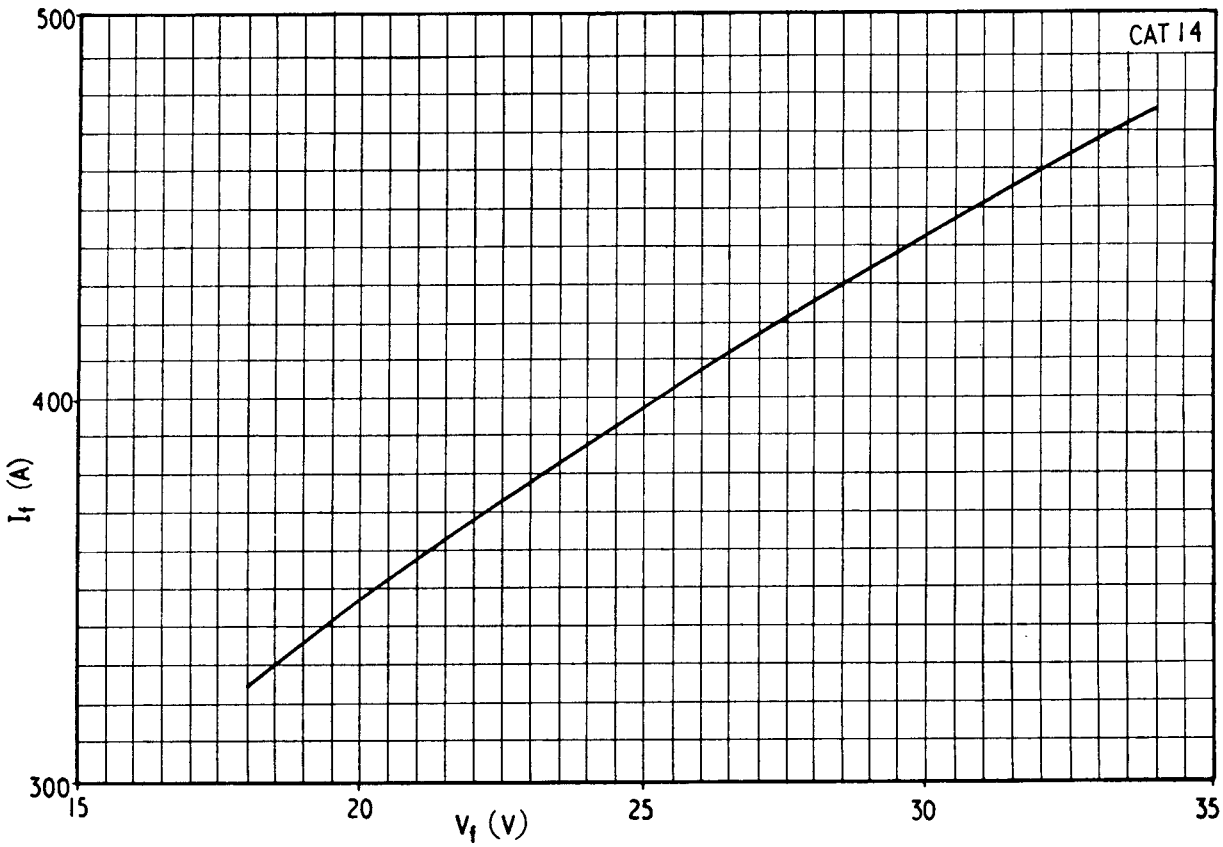
(b) At crest of audio cycle with 100% modulation.


CAT 14
SECONDARY EMISSION CURVE
V_f AT MV
0·2
0·15
0·1
0·05
I_{g^1} (A)
V_a 6kV
4kV
3kV
40
60
80
100
120
V_{g1} (V)


CAT 14
DEGREE OF SATURATION
100%
90%
80%
150
100
I_k (A)
+1
0·5
INCREASE
0
V_f (MV)
-0·5
-1
DECREASE
-1·5


CAT 14
V_{g1} +2000V
+1800
+1600
+1400
+1200
+1000
+800
+600
+400
+200
V_f AT MARKED VOLTS
I_{g1} (A)
V_a (kV)
0
1
2
3
4
5
10
20
30
40
50


CAT 14
V_{g1} +2000V
+1800
+1600
+1400
+1200
+1000
+800
+600
+400
+200
0
-200
V_f AT MARKED VOLTS
I_a (A)
V_a (kV)
0
5
10
15
20
10
20
30
40
50
60
70
80
90
100


CAT 14
500
400
300
I_f (A)
15
20
25
30
35
V_f (V)



PRINTED IN ENGLAND

Triodes *Types CAT17 and CAT17C*

HF AMPLIFIERS

General. A water-cooled anode transmitting triode fitted with a tungsten filament suitable for use as a high frequency amplifier at frequencies up to 25 Mc/s. The two valves are identical except for filament lead cooling, the CAT17C having air-cooled leads and the CAT17 water-cooled leads.

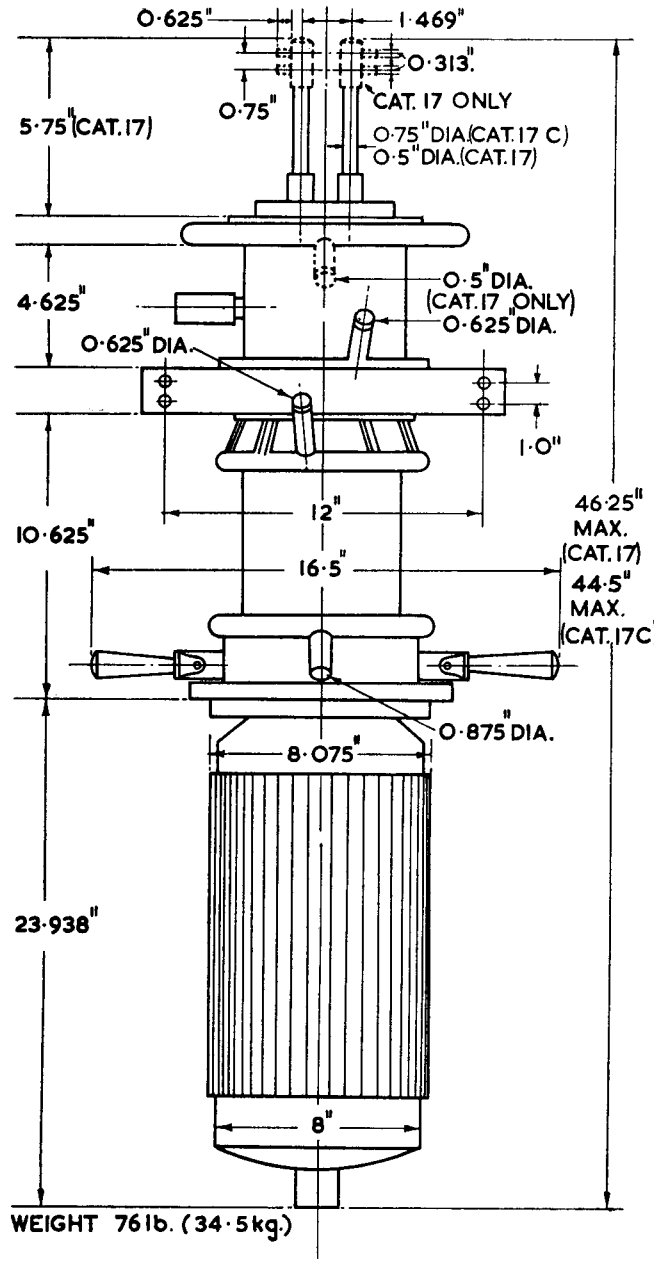
Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the envelope. The rated flow should be about 40 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 150°F (65°C). The temperature rise across the water jacket should not exceed 25°F (15°C).

The external valve filament leads of the CAT17 require to be cooled by circulating water. The rate of flow in this system should not be less than 400 c.c. per minute. At the normal flow the drop in pressure across the system is approximately 24 in. The temperature of the outlet water from this system should not be greater than 122°F (50°C).

Each external filament lead of the CAT17C requires a flow of air of approximately 8 cu. ft. per minute at a pressure equal to 5 in. water gauge.

Air cooling of the anode glass and grid seals is essential. There are two cooling rings at the grid seal, and one cooling ring at the anode-glass seal. A pressure equal to a 4-in. head of water is required at the inlet to each ring, and each ring requires a volume of air of approximately 4 cu. ft. per minute.

All cooling supplies must be started before the application of any supply voltages, and must continue for at least 2 minutes after the removal of all supply voltages.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Marconi House, Chelmsford. Telephone: Chelmsford 3221. Telex: 1953. Telegrams: Expanse Chelmsford Telex

Filament Starting. The cold resistance of the filament is of the order of 0·0057 Ω. The filament current must never exceed 500 A at any time during the switching-on period. If the valve is operated for periods greater than 15 minutes without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during the standby period.

HT Switching. It is not permissible to apply directly HT voltage in excess of one-third the maximum rated anode voltage. At higher voltages the HT should be either gradually increased from a low value or three-position switching employed.

Mounting. The valve must be completely supported by its water jacket, which should be capable of adjustment so that the axis of the valve is truly vertical. Rigid connections must be made to anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to normal value.

APPROXIMATE DATA

V_f		32·5	V
I_f		460	A
$V_{a\ (max)}$		20	kV
$p_{a\ (max)}$		150	kW
$p_{gl\ (max)}$		8·0	kW
$I_{gl\ (pk)(max)}$		100	A
μ	taken at V_a 15 kV, V_{gl} −100 V	45	
r_a		900	Ω
g_m		50	mA/V
$c_{a\text{-}gl}$		52	pF
$c_{a\text{-}k}$		4·5	pF
$c_{gl\text{-}k}$		100	pF

Each valve is marked with the filament voltage to give 100 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions.)

V_a		15	18	20	kV
I_a		18·8	18·8	18·8	A
V_{gl}		−950	−1,030	−1,070	V
I_{gl}	(a)	4·3	4·3	4·2	A
$v_{gl\ (pk)}$		2,650	2,730	2,770	V
P_{dr}	(a)	11·5	11·6	11·6	kW
Z_a		400	490	550	Ω
p_a		74	80	104	kW
P_{out}		209	258	272	kW

(2) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C

(Anode modulated, one valve, carrier conditions, permissible modulation 100%.)

V_a		10	15	kW
I_a		9·6	9·8	A
V_{gl}		−895	−1,120	V
I_{gl}	(a)	1·9	1·8	A
$v_{gl\ (pk)}$		1,845	2,070	V
P_{dr}	(a)	3·5	3·8	kW
Z_a		435	716	Ω
p_a		32	39	kW
P_{out}		64		kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

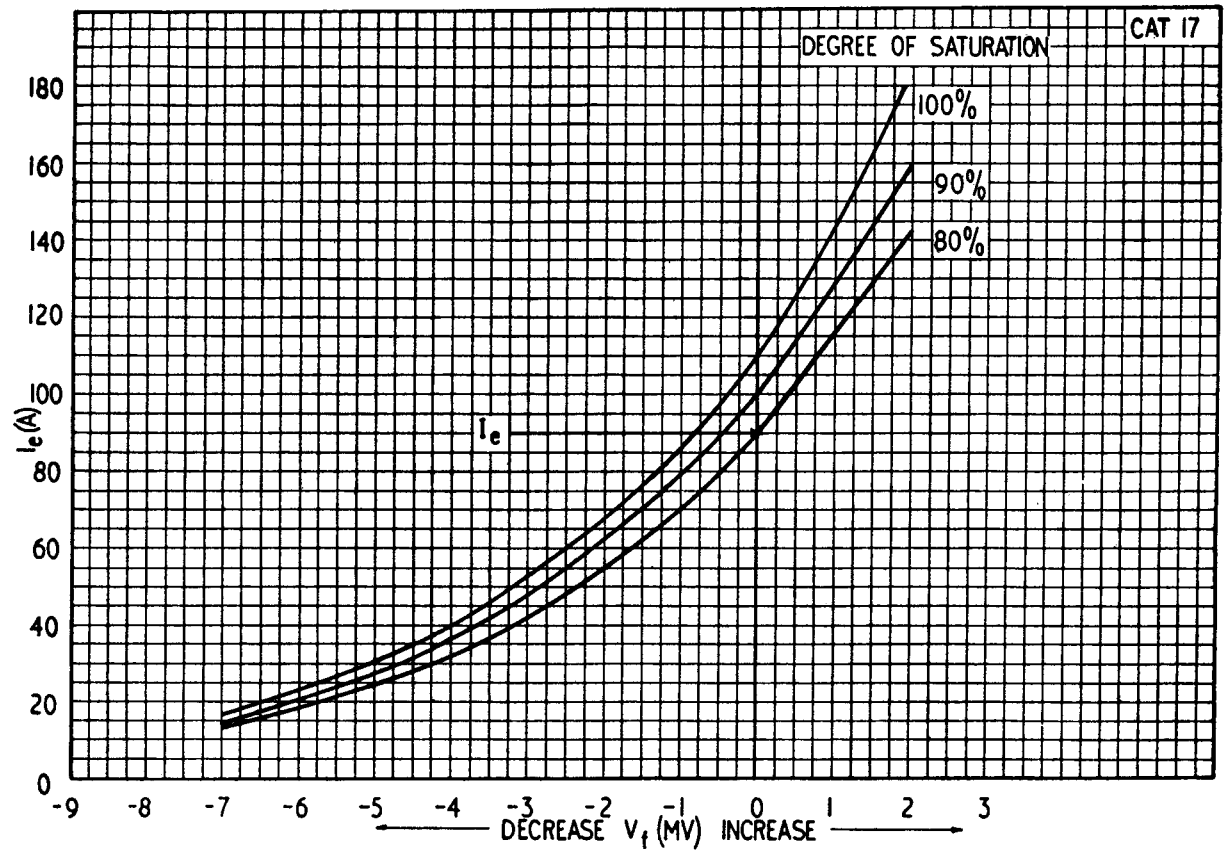
(One valve, carrier conditions, permissible modulation 100%.)

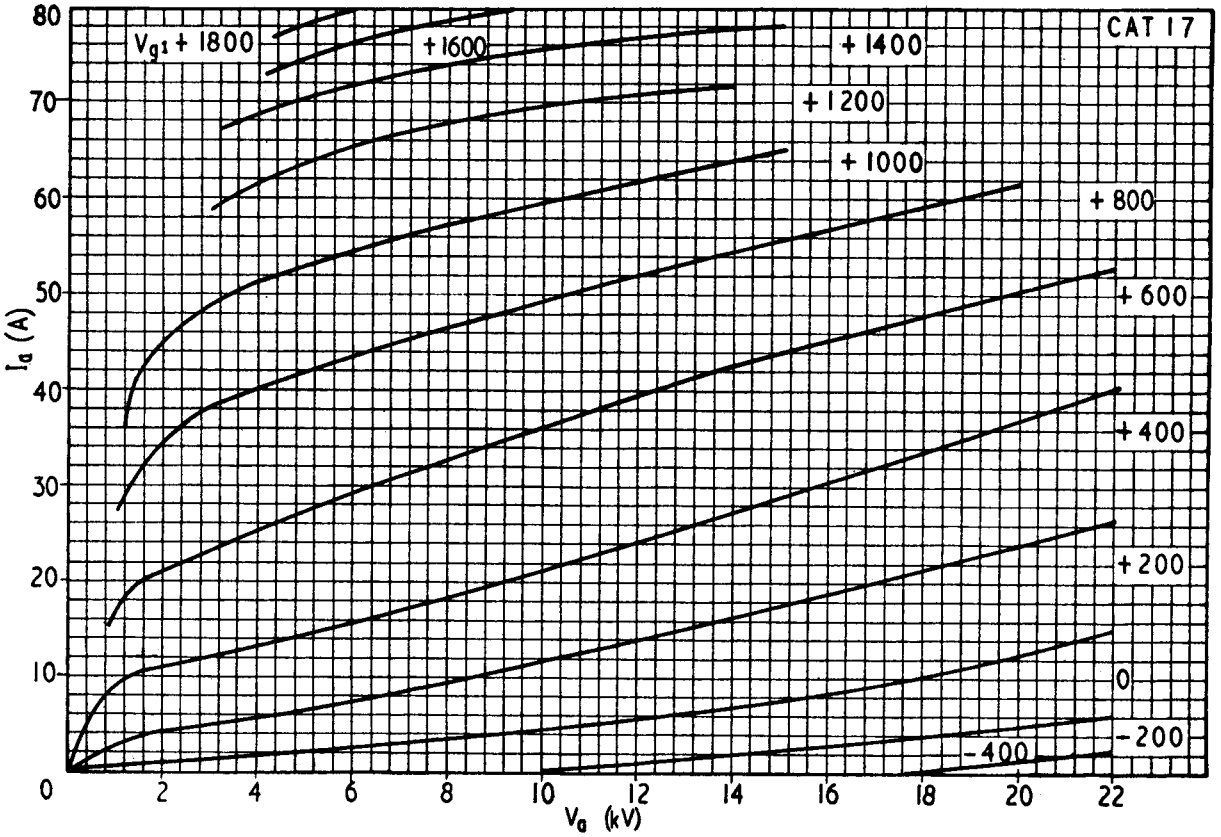
V_{gl}		15	20	kV
I_a		10·6	10·6	A
V_a		−330	−440	V
$v_{gl\ (pk)}$		890	940	V
P_{dr}	(a) (b)	5·4	5·6	kW
Z_a		330	480	Ω
p_a		114	146	kW
P_{out}		46	67	kW

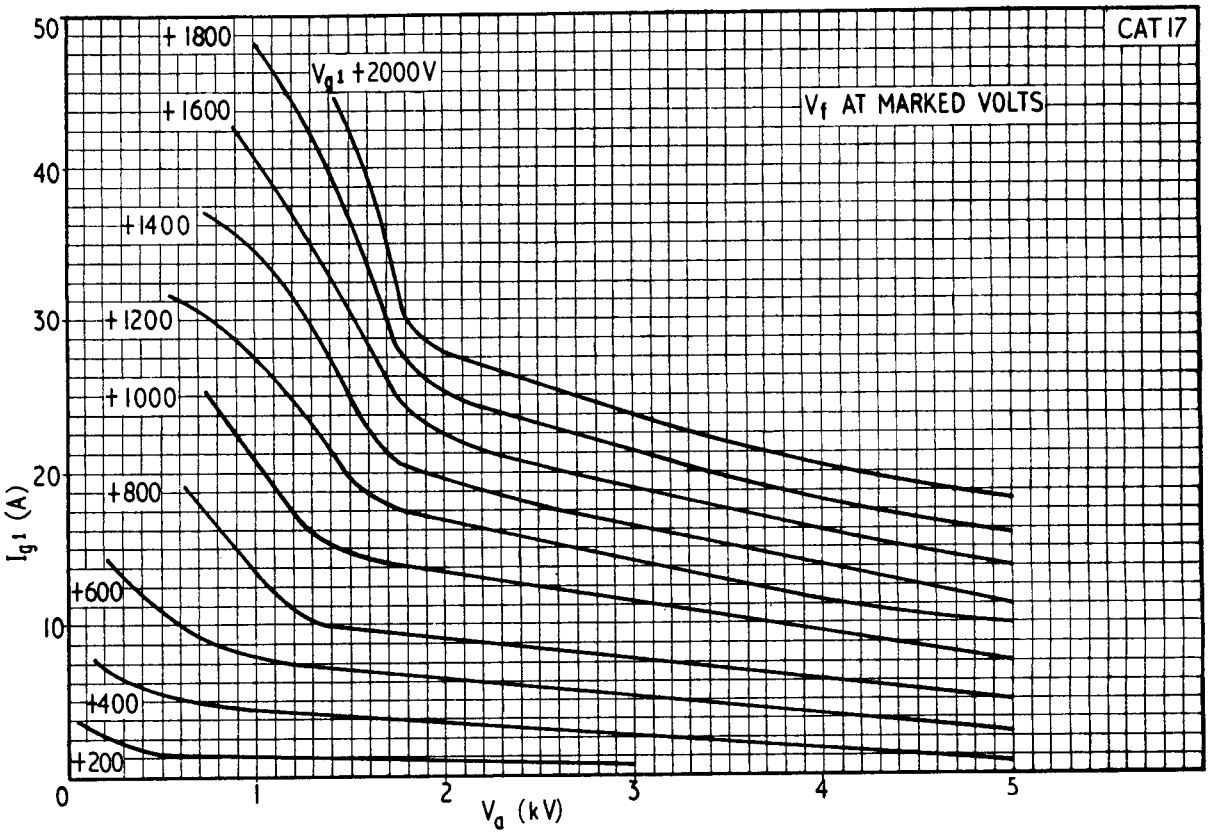
NOTES

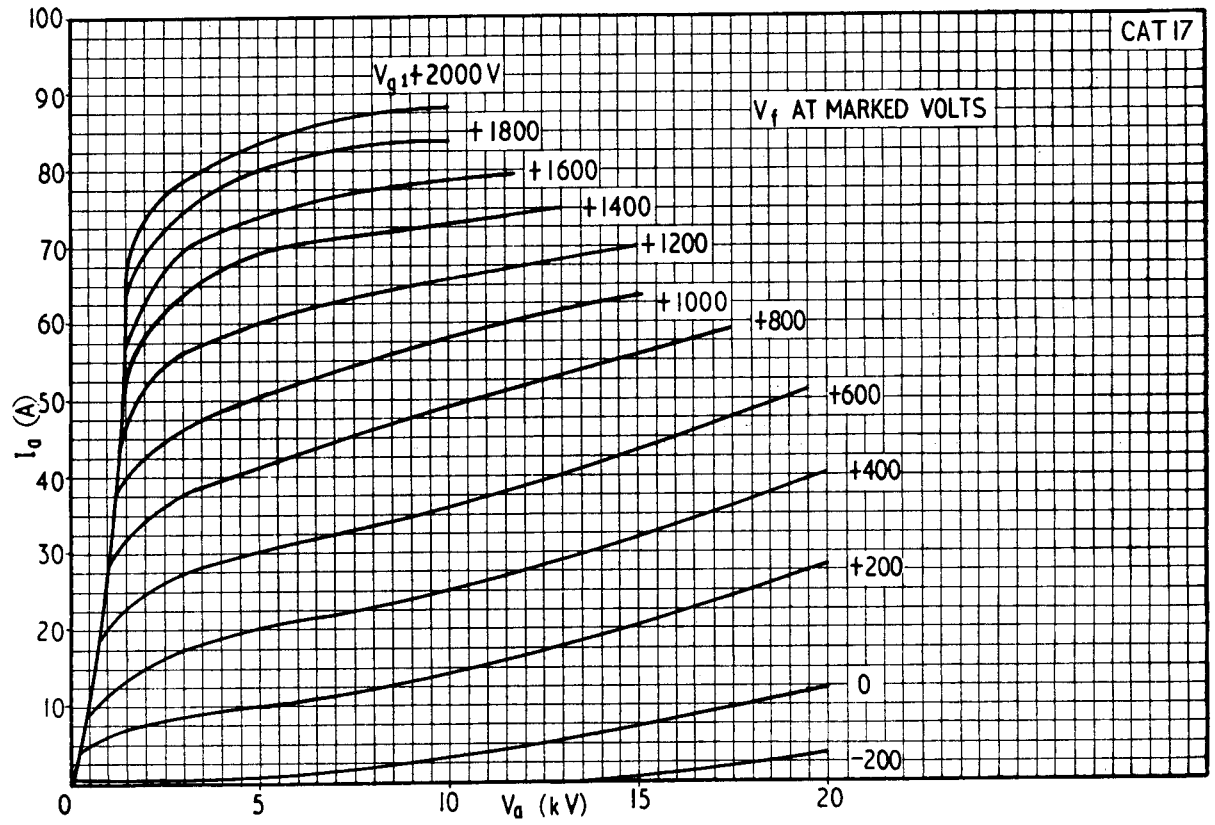
(a) Subject to wide variation. The figures are approximate only.

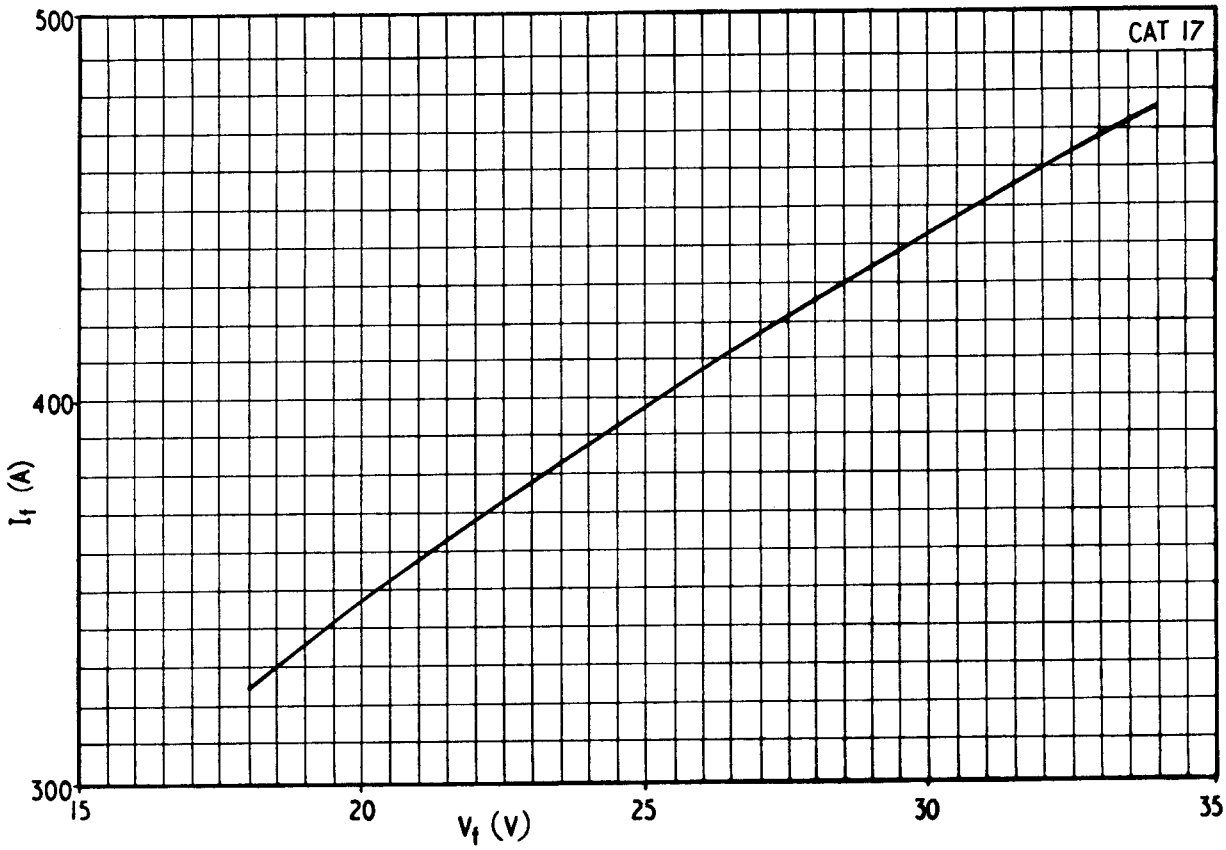
(b) At crest of audio cycle with 100% modulation.


CAT 17
DEGREE OF SATURATION
100%
90%
80%
I_e
I_e (A)
180
160
140
120
100
80
60
40
20
0
-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3
DECREASE V_f (MV) INCREASE


CAT 17
V_{g1} + 1800
+ 1600
+ 1400
+ 1200
+ 1000
+ 800
+ 600
+ 400
+ 200
0
- 200
- 400
I_a (A)
80
70
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20 22
V_a (kV)


CAT 17
V_f AT MARKED VOLTS
V_{g1} +2000 V
+1800
+1600
+1400
+1200
+1000
+800
+600
+400
+200
I_{g1} (A)
V_a (kV)
0
1
2
3
4
5
10
20
30
40
50


CAT 17
V_f AT MARKED VOLTS
V_{g1} +2000 V
+1800
+1600
+1400
+1200
+1000
+800
+600
+400
+200
0
-200
I_a (A)
V_a (kV)
0
5
10
15
20
10
20
30
40
50
60
70
80
90
100


CAT 17
500
400
300
I_f (A)
15
20
25
30
35
V_f (V)



PRINTED IN ENGLAND

Triodes *Types CAT20 and CAT20C*

(HF AMPLIFIERS AND MODULATORS)

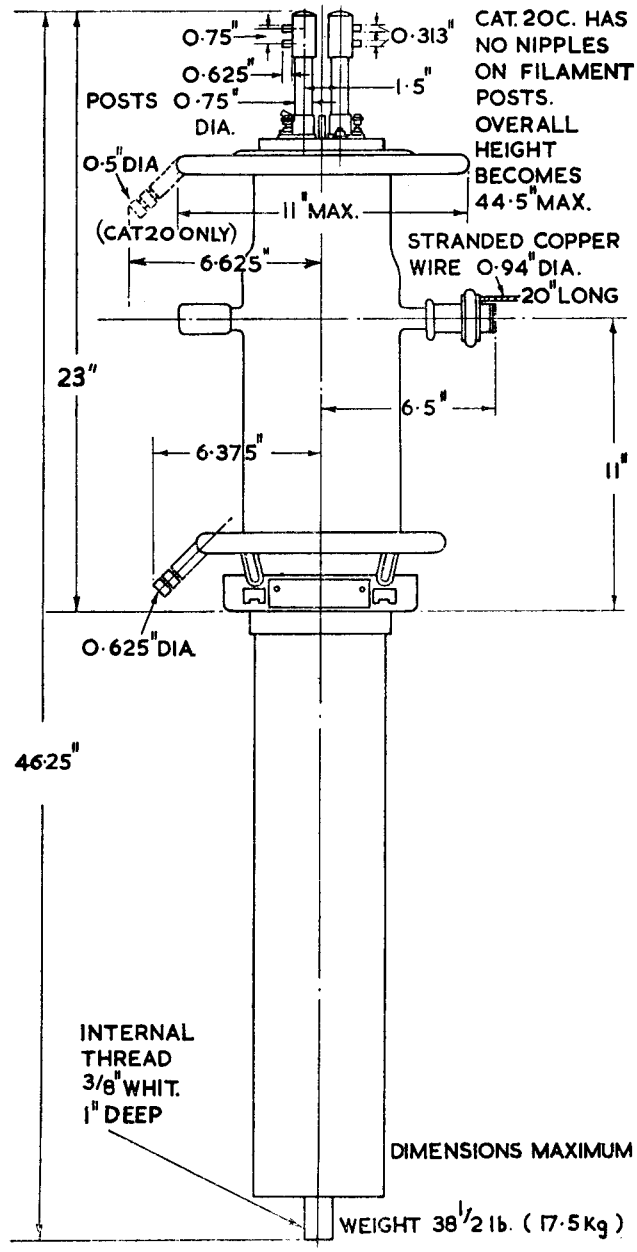
General. Water-cooled transmitting triodes fitted with tungsten filaments, suitable for use as high frequency amplifiers at frequencies up to 20 Mc/s. The valves are particularly suitable for use as a Class B modulator.

The two valves are identical except for filament lead cooling, the CAT 20C having air-cooled leads and the CAT 20 water-cooled leads.

Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The rated flow should not be less than 20 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 150°F (65°C). The water flow to the filament leads should be 400 cc. per minute. The temperature of the lead cooling water must not exceed 122°F (50°C) at the outlet. Air cooling of the anode-glass seal is essential. The cooling ring requires a volume of air of approximately 4 cu. ft. per minute at a pressure equal to 4 in. head of water. All cooling supplies must be started before the application of any supply voltages and must continue for at least 2 minutes after the removal of all supply voltages.

Filament Starting. The cold resistance of the filament is of the order of 0·011 Ω. The filament current must never exceed 225 A at any time during the switching-on period. If the valve is operated for periods greater than 15 minutes without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during the standby period.

HT Switching. It is not permissible to apply directly HT voltage in excess of one-third the maximum rated anode voltage. At higher voltages the HT should either be gradually increased from a low value or three-position switching should be employed.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Mounting. The valve must be completely supported by its water jacket, which should be capable of adjustment so that the axis of the valve is truly vertical. Rigid connections must be made to anode only.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to normal value.

APPROXIMATE DATA

$V_{f\ (nom)}$			31·5	V
I_f			230	A
$V_{a\ (max)}$			20	kV
$p_{a\ (max)}$			75	kW
$p_{gl\ (max)}$			3	kW
$I_{gl\ (pk)\ (max)}$			30	A
μ	taken at		35	
r_a	V_a	15 kV	1,450	Ω
g_m	I_a	5 A	24	mA/V
$c_{a\text{-}gl}$			40	pF
$c_{a\text{-}k}$			3	pF
$c_{gl\text{-}k}$			54	pF

Each valve is marked with the filament voltage to give 50 A emission at 90% saturation.

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(*Unmodulated, one valve, key down conditions*)

V_a		20	18	15	12	kV
I_a		11·4	11·4	10·7	10·7	A
V_{gl}		−930	−880	−1,040	−960	V
I_{gl}	(a)	1·85	1·8	1·7	1·7	A
$v_{gl\ (pk)}$		2,730	2,480	2,640	2,560	V
P_{dr}	(a)	5·5	4·6	4·7	4·6	kW
Z_a		740	650	580	420	Ω
p_a		67	64	50	47	kW
P_{out}		161	141	110	81	kW

(2) HF POWER AMPLIFIER. CLASS C

(*Anode modulation, one valve, carrier conditions, permissible modulation 100%*)

V_a		15	12	kV
I_a		4·4	4·5	A
V_{gl}		−1,170	−1,030	V
I_{gl}	(a)	0·6	0·6	A
$v_{gl\ (pk)}$		1,860	1,685	V
P_{dr}	(a)	1·1	1·0	kW
Z_a		1,510	1,140	Ω
p_a		14	15	kW
P_{out}		52	39	kW

(3) HF POWER AMPLIFIER. CLASS B TELEPHONY

(*One valve, carrier conditions, permissible modulation 100%*)

V_a	18	15	kV
I_a	5·3	5·3	A
V_{gl}	−515	−430	V
I_{gl}	895	830	V
P_{dr}	850	840	W
Z_a	780	600	Ω
p_a	68	58	kW
P_{out}	27	21	kW

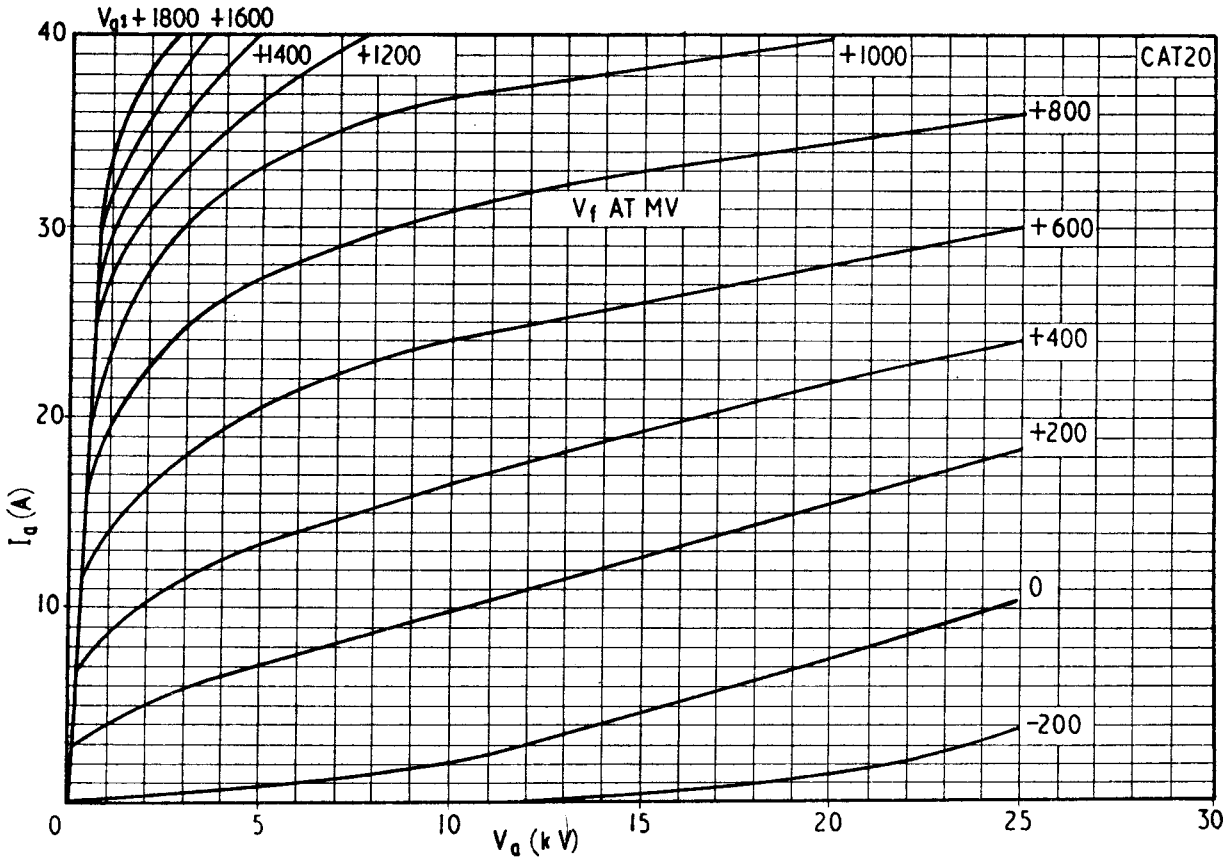
The figures quoted above apply only to operation at frequencies up to 5 Mc/s. At higher frequencies the anode voltage must be reduced according to the following table:

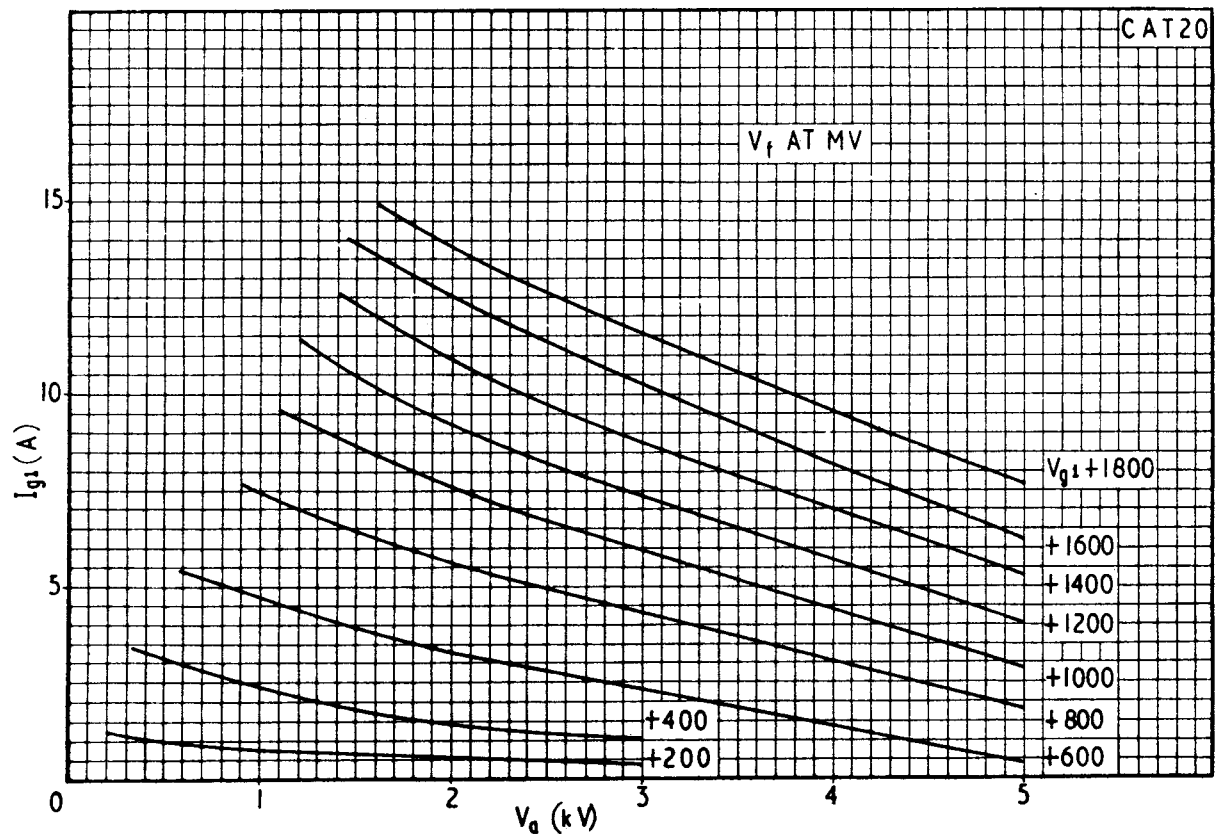
f (Mc/s)	5	10	15	20
% $V_{a(max)}$	100	90	75	50

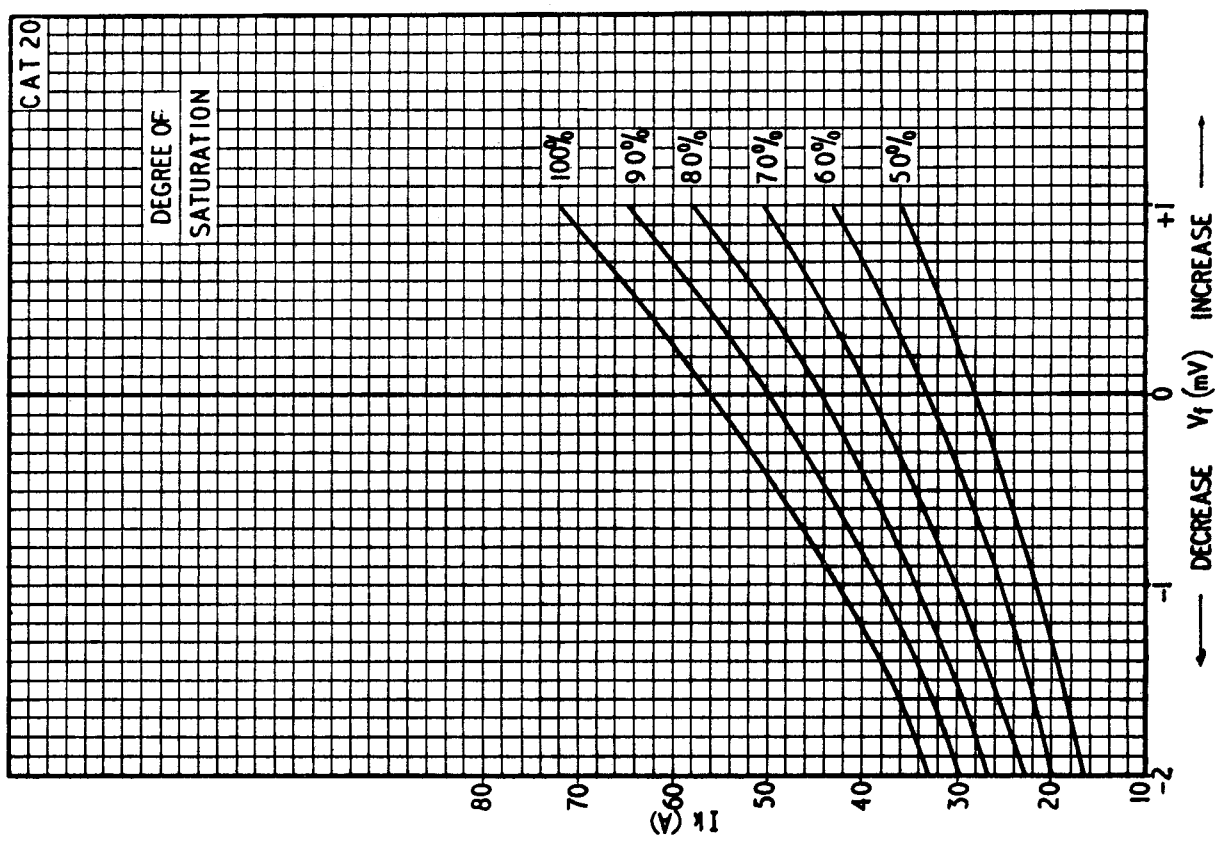
NOTES

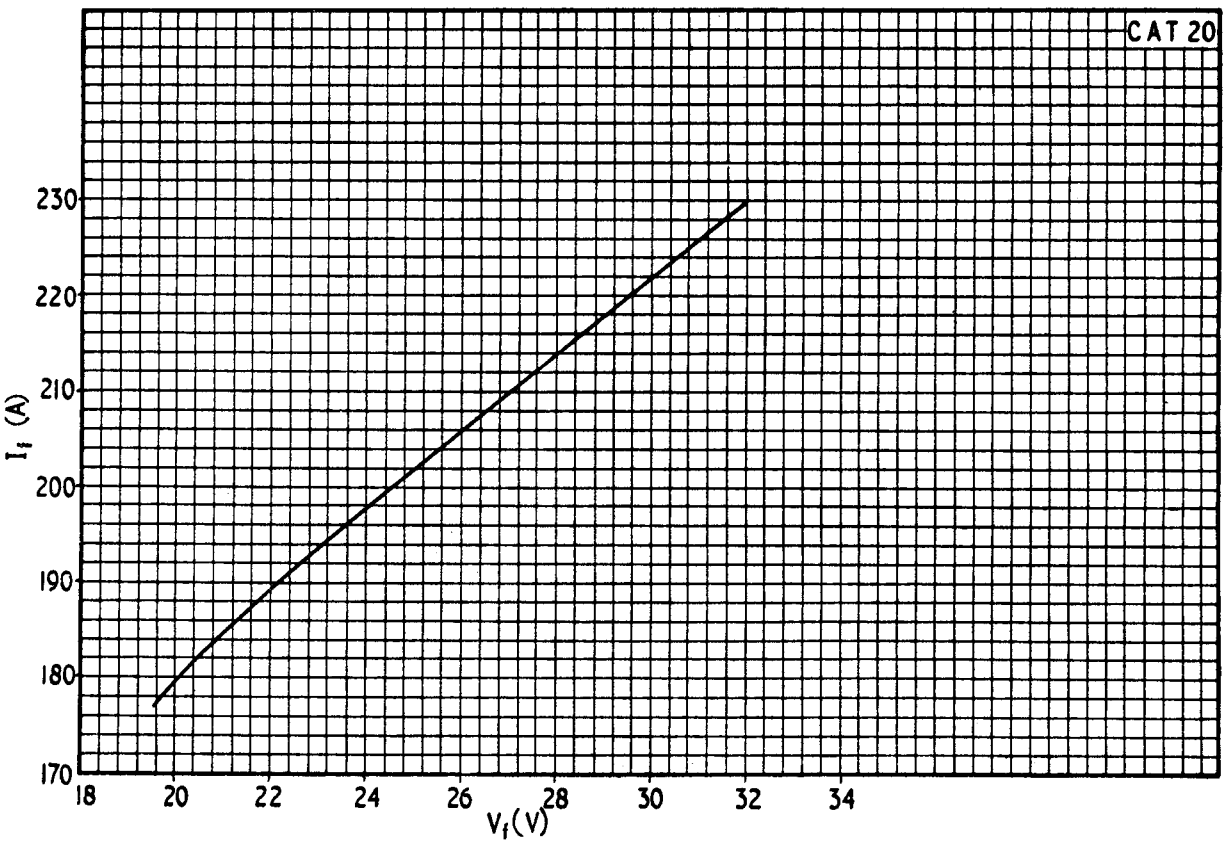
(a) Subject to wide variation. The figures given are approximate only.

(b) At crest of audio cycle with 100% modulation.


CAT20
V_{g1} +1800 +1600
+1400
+1200
+1000
+800
V_f AT MV
+600
+400
+200
0
-200
I_a (A)
V_a (kV)
0
5
10
15
20
25
30
10
20
30
40


CAT20
V_f AT MV
V_{g1} +1800
+1600
+1400
+1200
+1000
+800
+600
+400
+200
I_{g1} (A)
V_a (kV)
0
1
2
3
4
5
5
10
15





PRINTED IN ENGLAND

Triode *Type CAT 21*

(VHF AMPLIFIER)

General. A transmitting triode with a water-cooled anode and fitted with a pure tungsten filament. This valve is suitable for use as an amplifier at frequencies up to 100 Mc/s.

Cooling. The anode (which forms part of the valve envelope) must be fitted with a specially designed water jacket for cooling by direct contact with the circulating water. The rated flow should not be less than 8 gallons per minute. The temperature of the cooling water must not be greater than 150°F (65°C) at the outlet and the temperature rise should not exceed 27°F (15°C).

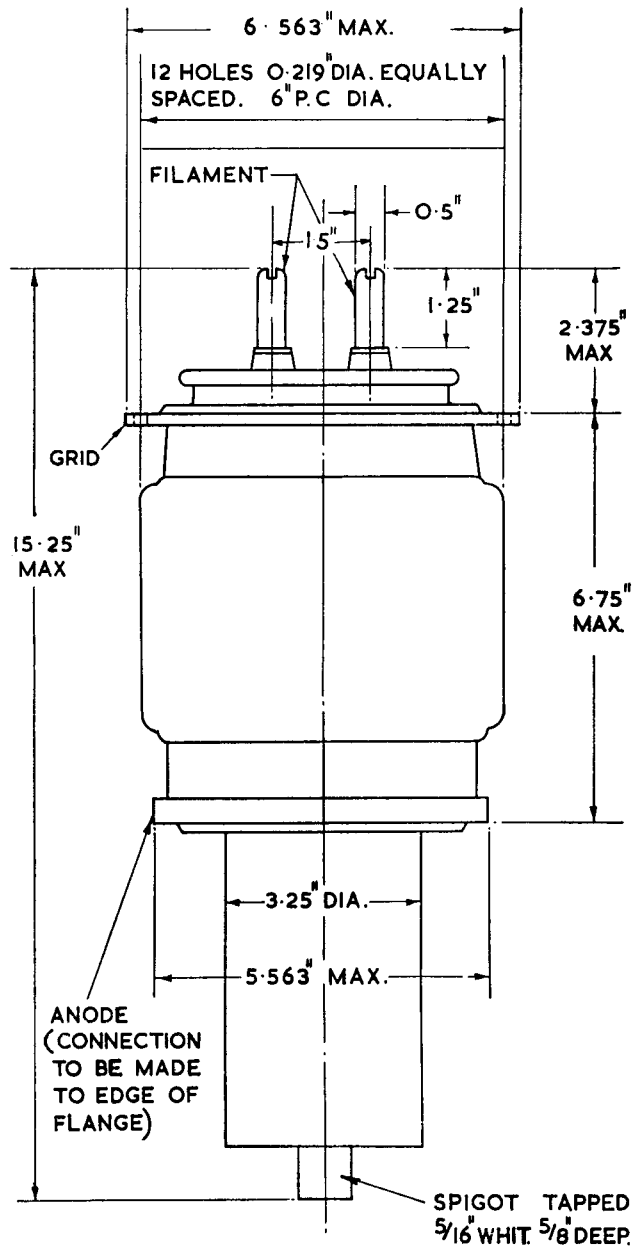
The anode and filament seals require forced air cooling. The air flow to the seals should be 30 cu. ft. per minute.

All cooling supplies must be in operation before any voltages are applied to the valve and must continue, for at least 15 minutes, after all voltages have been removed.

Filament Starting. The cold resistance of the filament is 0.0032 Ω. The filament current must not exceed 350 A at any time. If the valve is operated for periods greater than 5 minutes without anode voltage being applied, the filament voltage must be reduced to one-half its normal value during the standby period.

HT Switching. It is not permissible to apply directly HT voltage in excess of one-half of the maximum rated anode voltage. When the valve is to be operated at a higher voltage the HT should either be gradually increased from a low value or two-position switching employed.

Mounting. The valve must be completely supported by its water jacket, which should be adjustable so that the axis of the valve may be made truly vertical. Rigid connections must be made to the anode only.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for a period of approximately 2 months, it must be seasoned by operating for at least one hour at half the normal voltage and current. The anode voltage should then be increased slowly to the normal value.

APPROXIMATE DATA

V_f		12	V*
I_f		320	A
$V_{a(max)}$		10	kV
$p_{a(max)}$		20	kW
$p_{gl(max)}$		1·5	kW
$I_{gl(pk)\ (max)}$		100	A
μ	taken at Va 5 kV	21	
r_a	V_{gl} −50 V	1,050	Ω
g_m		20	mA/V
c_{a-g_1}		1·1	pF
c_{a-k}		32	pF
c_{gl-k}		42	pF

*The values of filament voltages for 25 A and 36 A emission at 90% saturation are marked on each valve.

Typical Operation

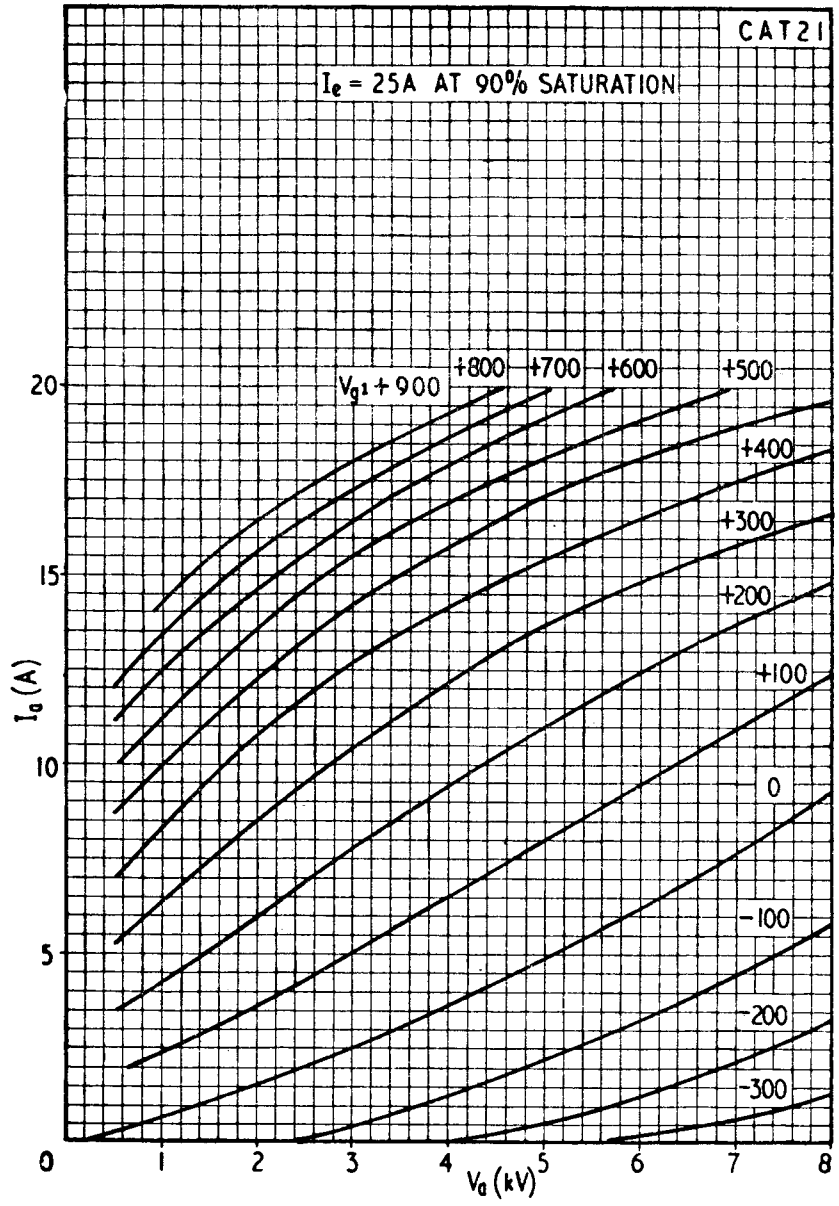
HF POWER AMPLIFIER. CLASS C TELEGRAPHY

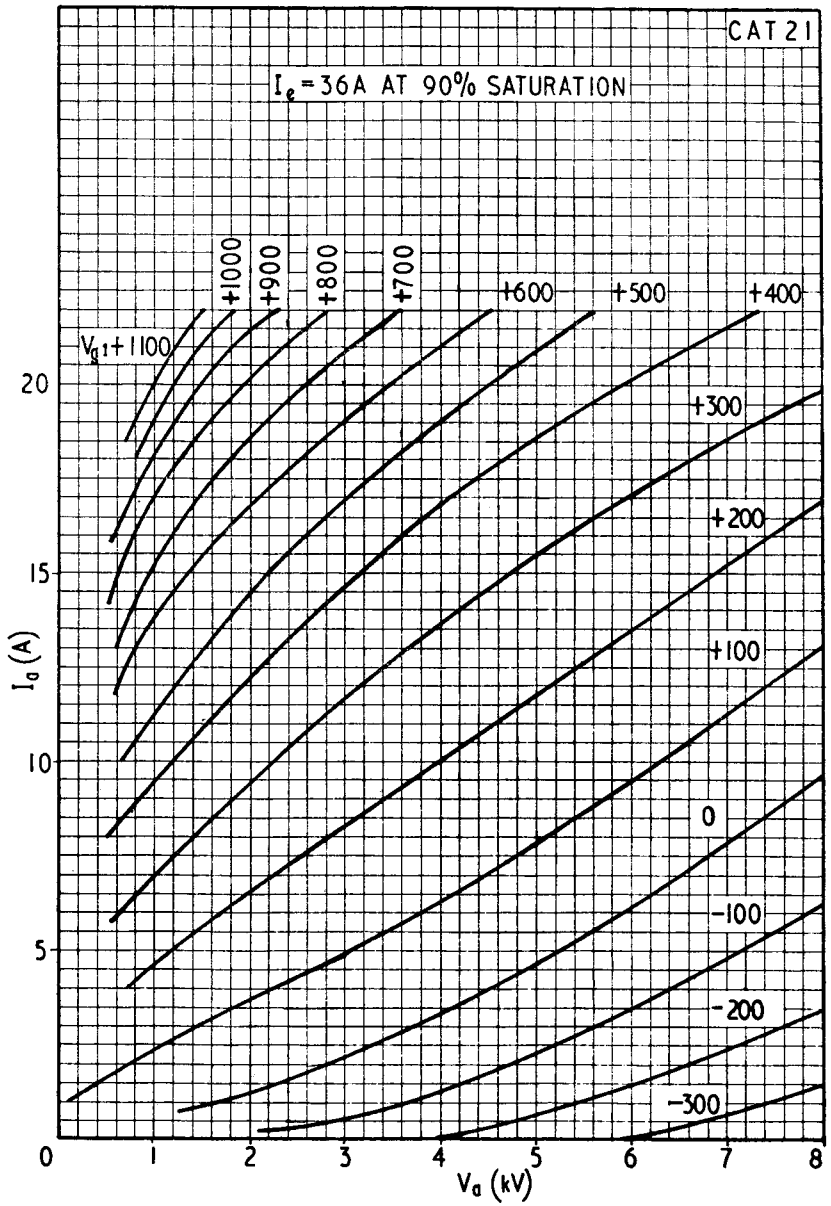
(One valve, key down conditions, unmodulated)

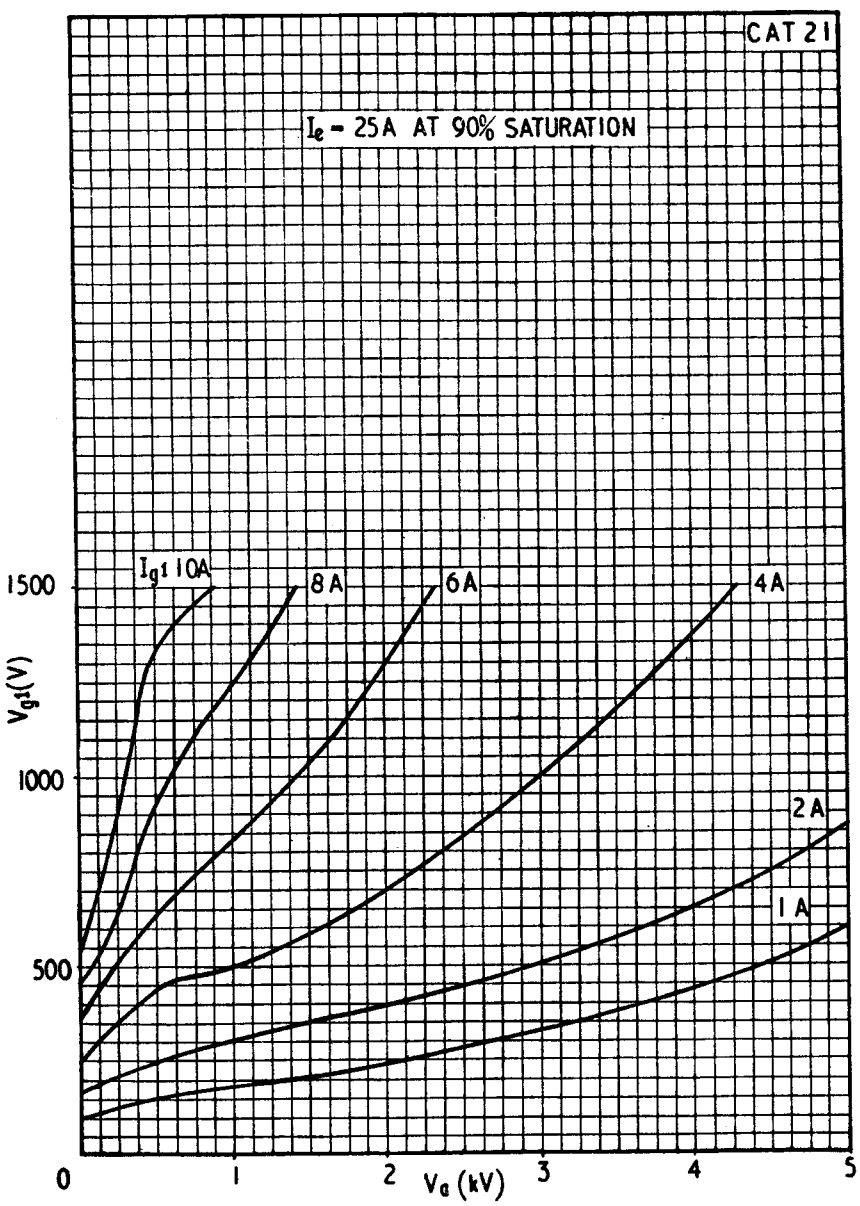
$I_{e(pk)}$		36	36	30	25	25	A
V_a		10	7	5	10	7	kV
I_a		5·6	5·6	5·9	4·6	4·6	A
V_{gl}		−1,440	−760	−510	−940	−630	V
$v_{gl(pk)}$		2,590	1,710	1,460	1,940	1,630	V
I_{gl}	(a)	1·3	1·5	1·6	0·9	1·2	A
P_{dr}	(a)	3·4	2·5	2·3	1·75	1·9	kW
p_a		16·6	13·3	12·7	14·7	11·2	kW
P_{out}		39·4	25·9	16·8	31·3	21·0	kW
Z_a		810	580	360	1,020	720	Ω

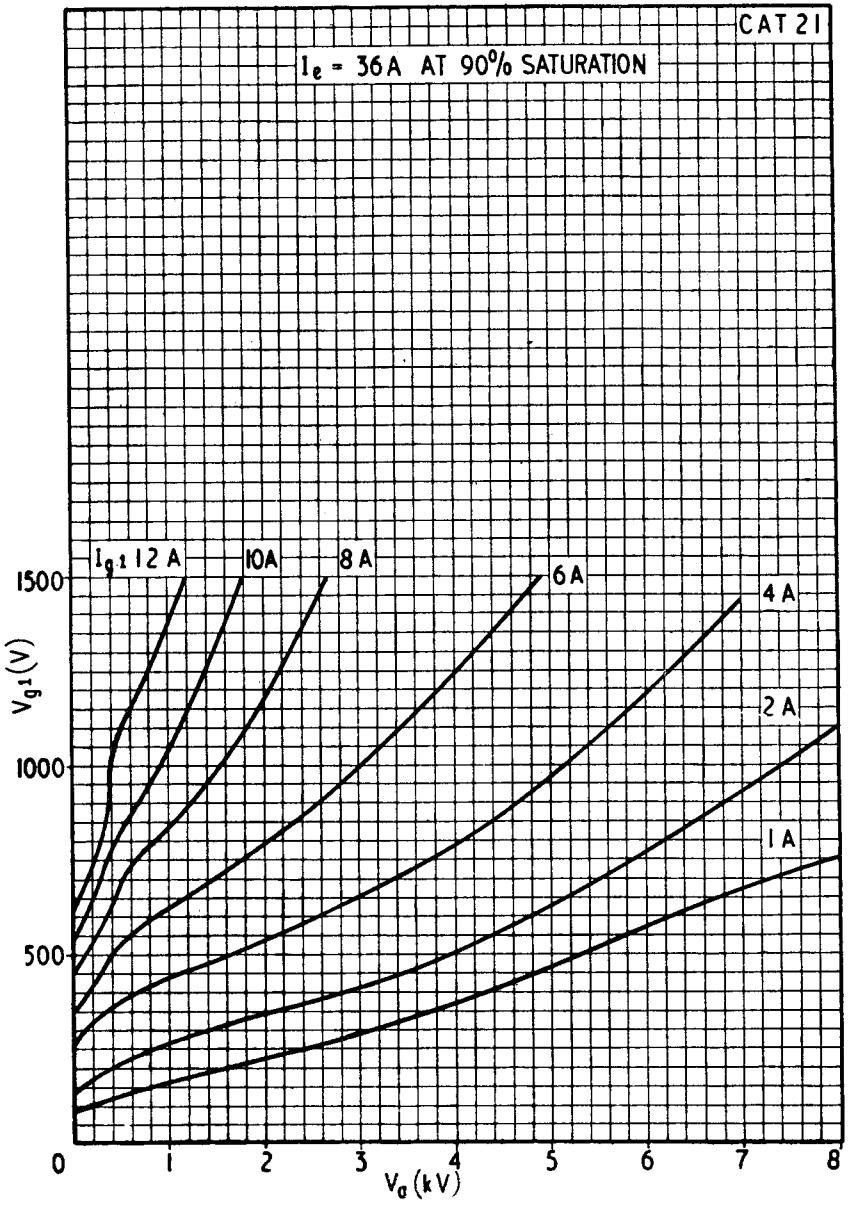
The data given for typical operating conditions applies to operation at frequencies up to 50 Mc/s. At higher frequencies the anode voltage must be reduced in accordance with the following table:

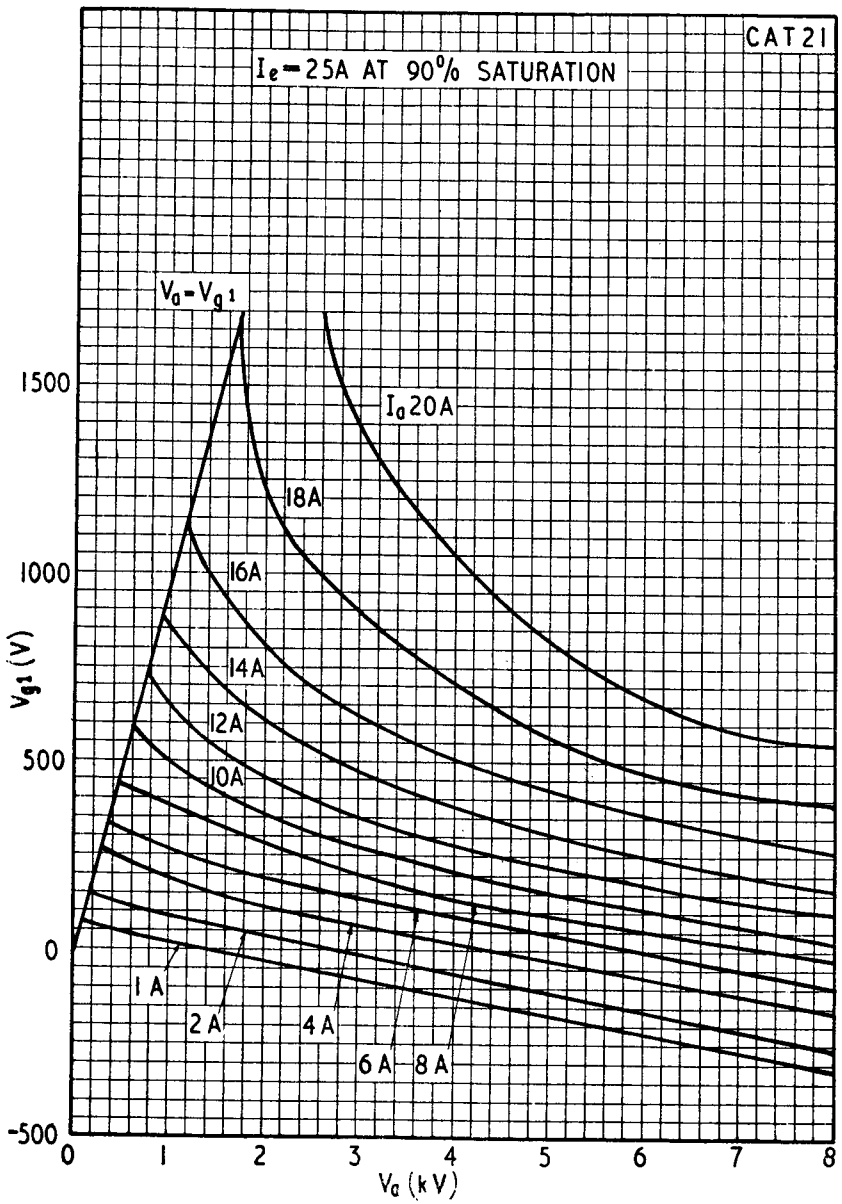
f (Mc/s)	50	75	100
% $V_{a(max)}$	100	68	60

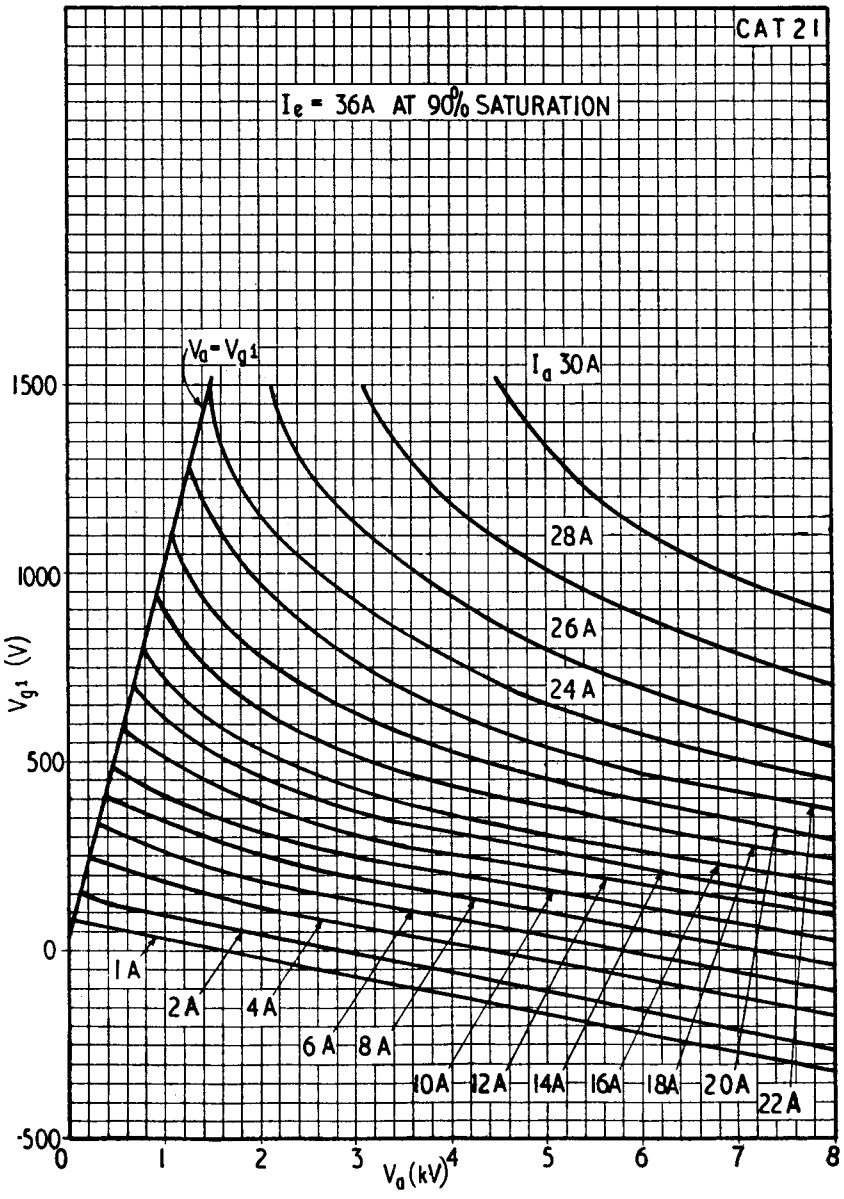

CAT21
I_e = 25A AT 90% SATURATION
V_{g1} +900
+800
+700
+600
+500
+400
+300
+200
+100
0
-100
-200
-300
I_a (A)
V_a (kV)
0
5
10
15
20
1
2
3
4
5
6
7
8

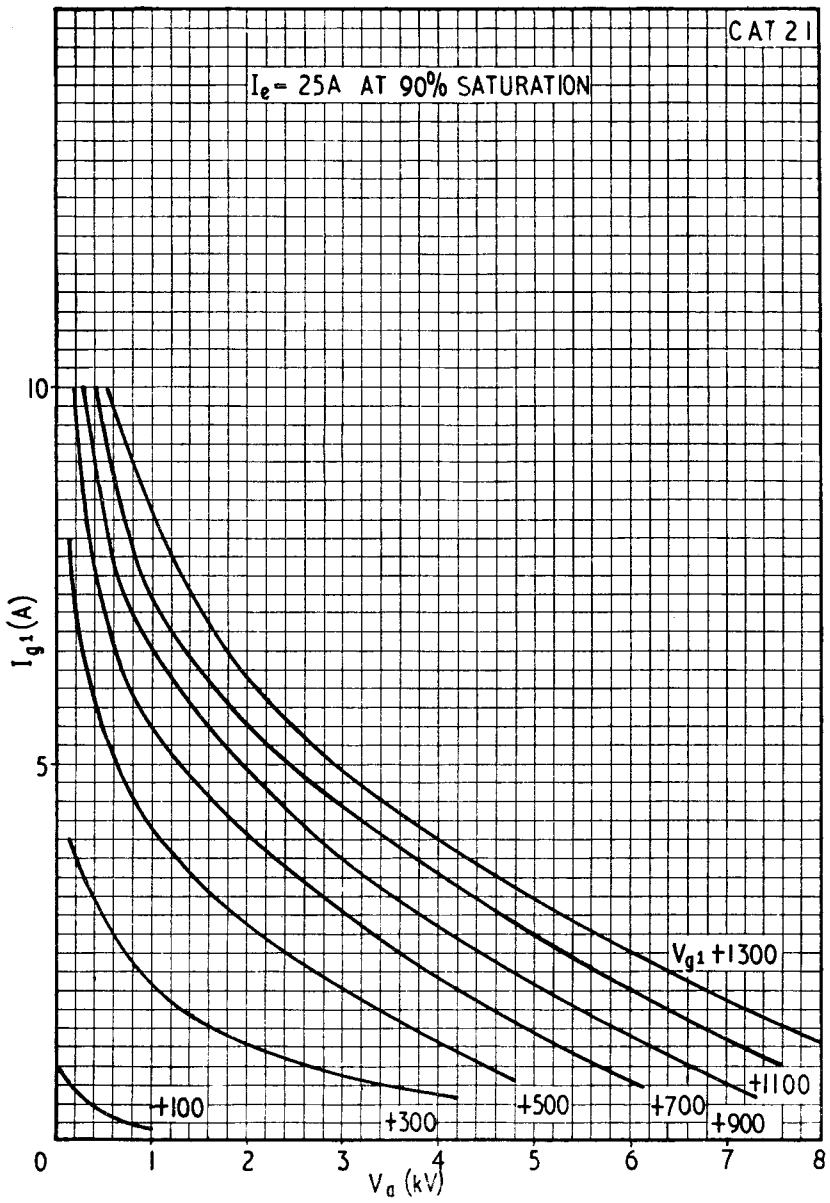

CAT21
I_e = 36A AT 90% SATURATION
V_{g1} +1100
+1000
+900
+800
+700
+600
+500
+400
+300
+200
+100
0
-100
-200
-300
I_a (A)
V_a (kV)
0
5
10
15
20
1
2
3
4
5
6
7
8

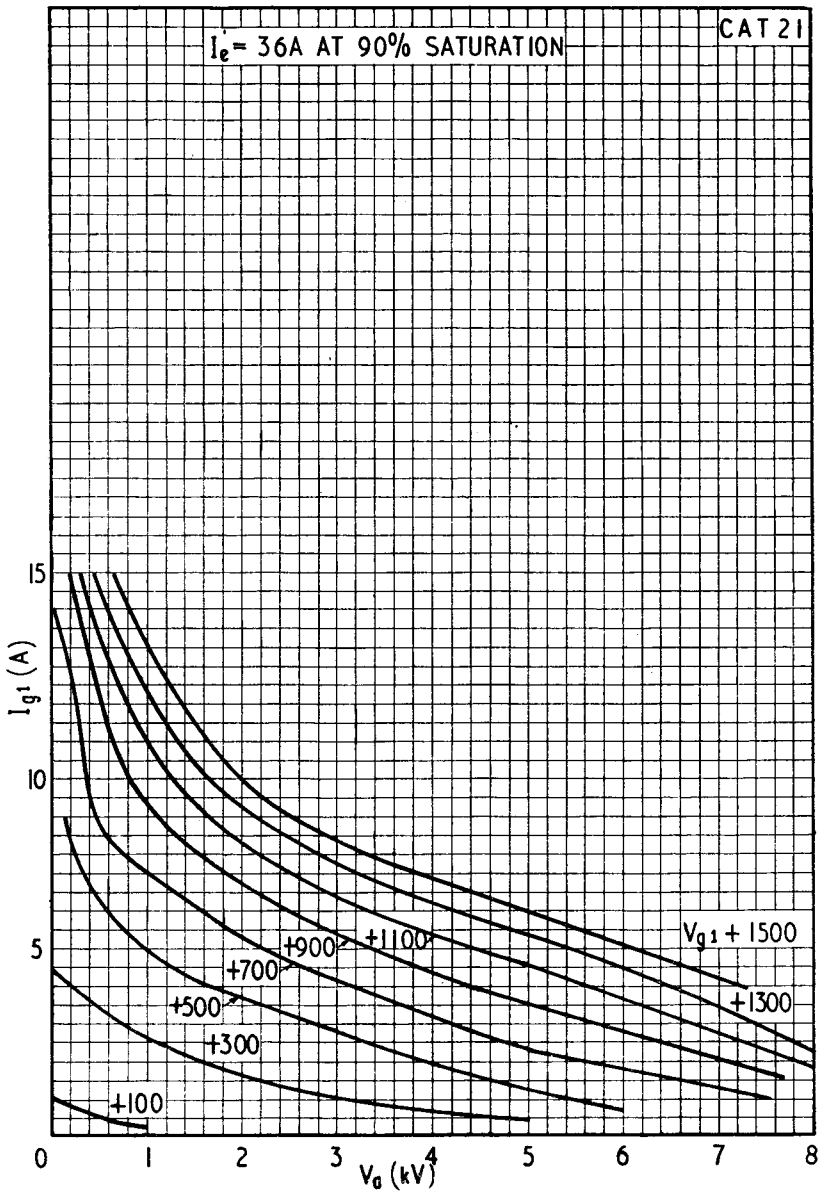

CAT 21
I_e = 25A AT 90% SATURATION
I_{g1} 10A
8A
6A
4A
2A
1A
1500
1000
500
0
V_{g1}(V)
1
2
3
4
5
V_a (kV)

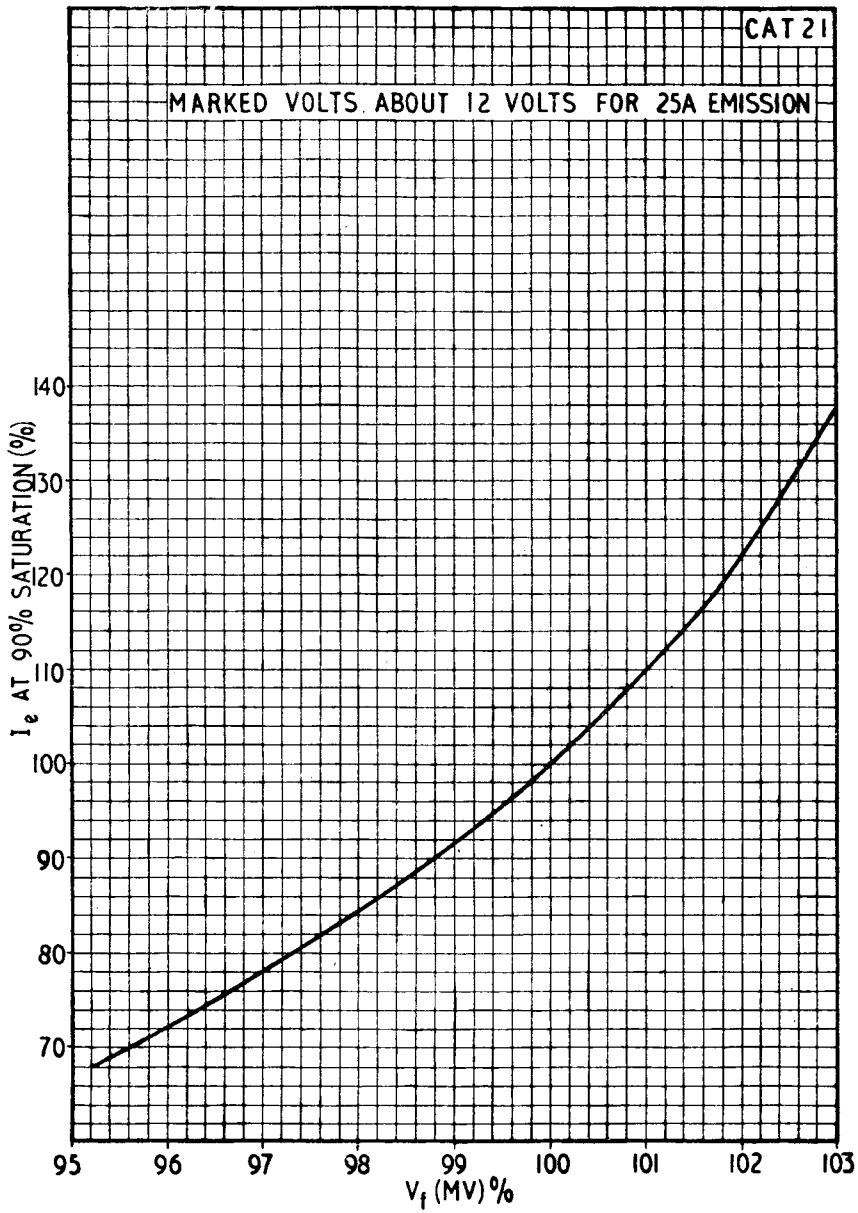

CAT 21
I_e = 36A AT 90% SATURATION
I_{g1} 12A
10A
8A
6A
4A
2A
1A
1500
1000
500
0
V_{g1}(V)
1
2
3
4
5
6
7
8
V_a (kV)

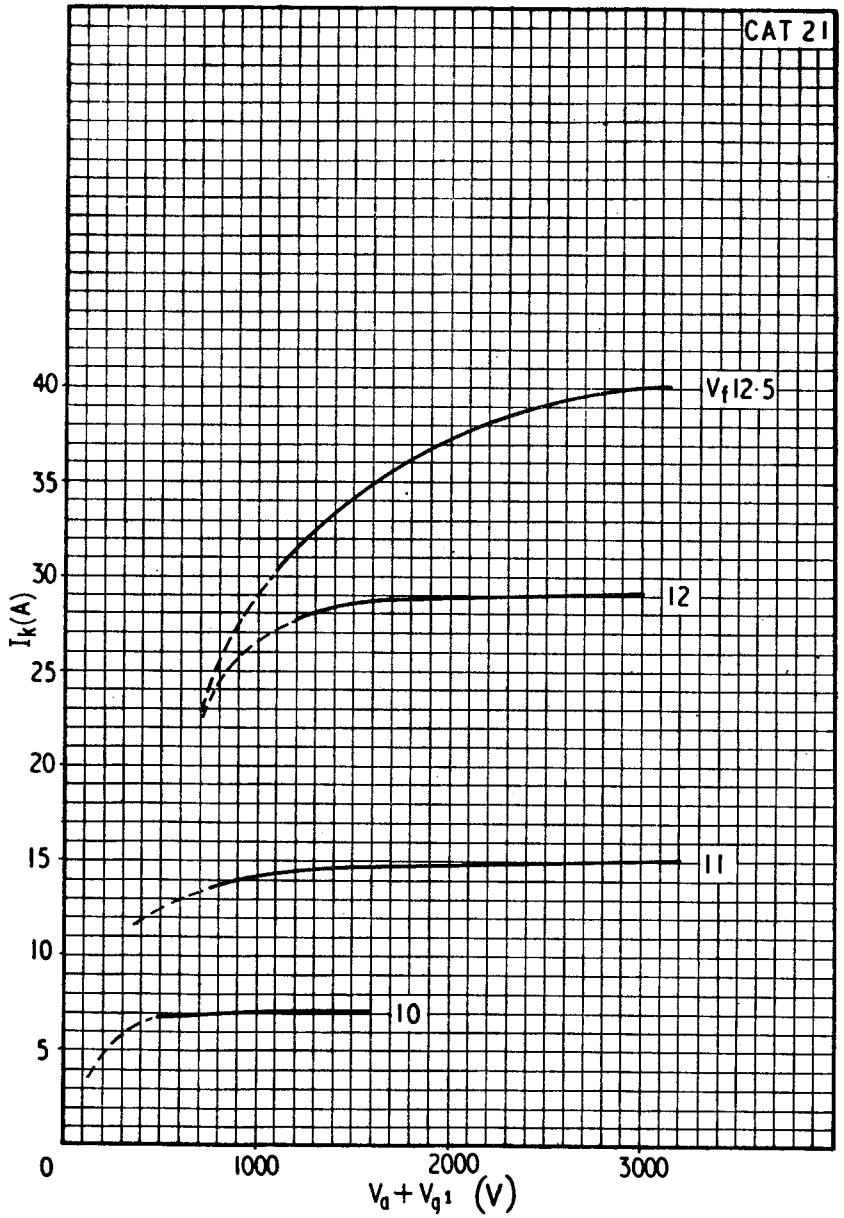

CAT 21
I_e = 25A AT 90% SATURATION
$V_a = V_{g1}$
I_a 20A
18A
16A
14A
12A
10A
1 A
2 A
4 A
6 A
8 A
1500
1000
500
0
-500
V_{g1} (V)
0
1
2
3
4
5
6
7
8
V_a (kV)

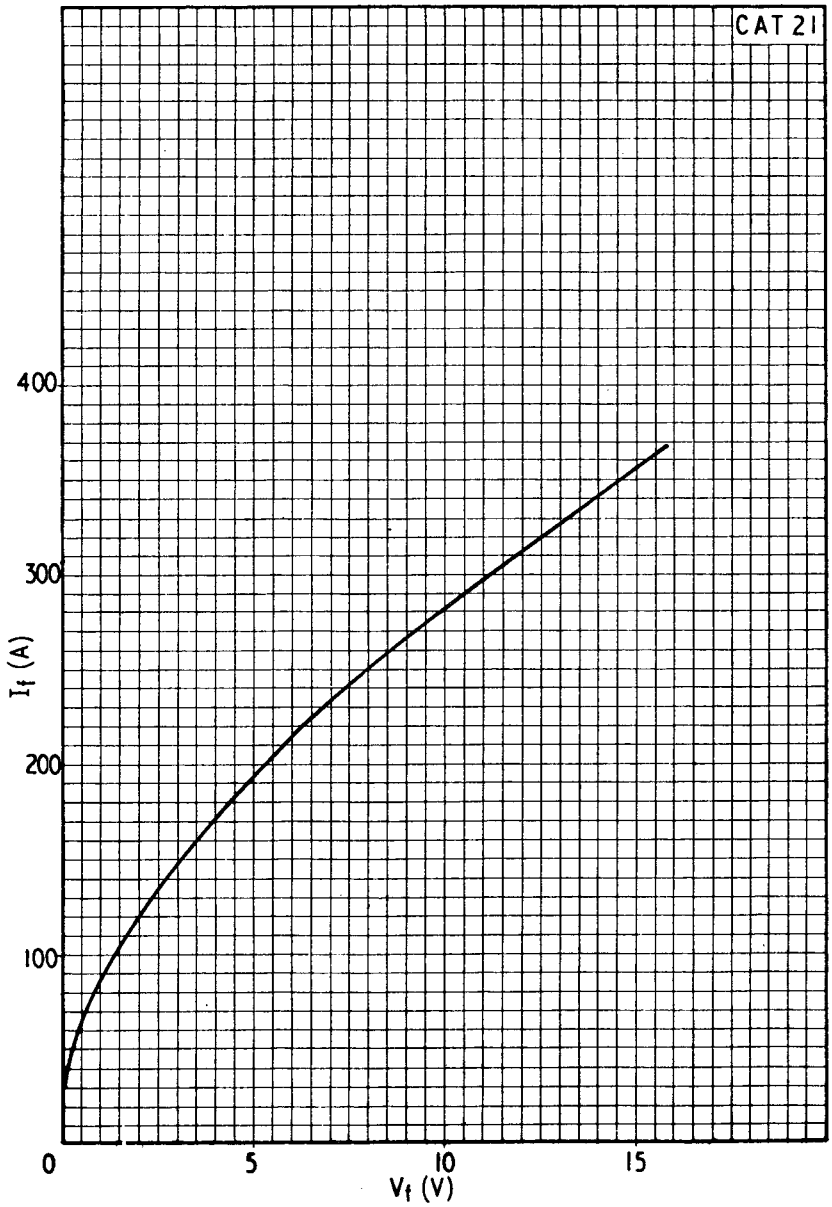

CAT 21
I_e = 36A AT 90% SATURATION
$V_a = V_{g1}$
I_a 30A
28A
26A
24A
1 A
2 A
4 A
6 A
8 A
10A
12A
14A
16A
18A
20A
22A
1500
1000
500
0
-500
V_{g1} (V)
0
1
2
3
4
5
6
7
8
V_a (kV)


CAT 21
I_e = 25A AT 90% SATURATION
I_{g1} (A)
V_a (kV)
V_{g1} +1300
+1100
+900
+700
+500
+300
+100


CAT 21
I_e = 36A AT 90% SATURATION
I_{g1} (A)
V_a (kV)
V_{g1} + 1500
+1300
+1100
+900
+700
+500
+300
+100


CAT 21
MARKED VOLTS. ABOUT 12 VOLTS FOR 25A EMISSION
I_e AT 90% SATURATION (%)
140
130
120
110
100
90
80
70
95
96
97
98
99
100
101
102
103
V_f (MV) %


CAT 21
I_k (A)
40
35
30
25
20
15
10
5
0
1000
2000
3000
$V_a + V_{g1}$ (V)
V_f 12·5
12
11
10



PRINTED IN ENGLAND

Triode *Type CAT 22*

HF POWER AMPLIFIER AND OSCILLATOR

General. A triode with a water cooled anode and fitted with a pure tungsten filament. This valve is suitable for use as a power amplifier or oscillator at frequencies up to 30 Mc/s.

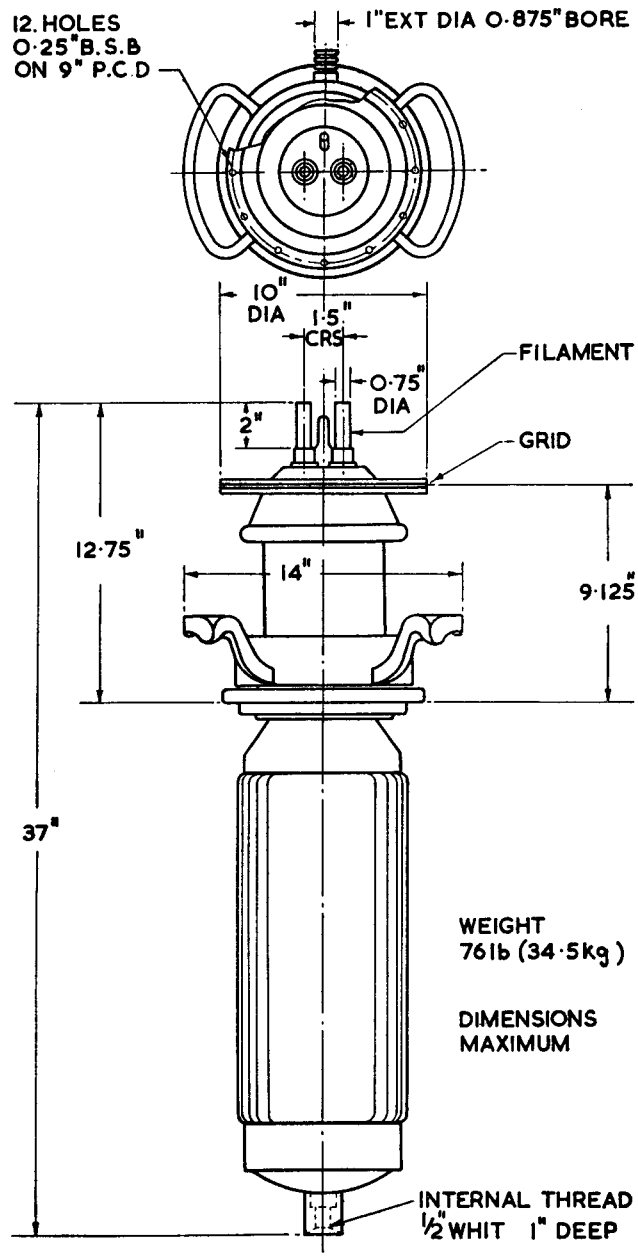
Cooling. The anode forms part of the valve envelope and must be fitted with a specially designed water jacket for cooling by circulating water in direct contact with the anode. The rated flow of water to the anode should not be less than 40 gallons per minute. The temperature of the cooling water must not exceed 150°F (65°C) at the outlet.

The anode and filament seals and filament leads require forced air cooling. The air flow to the seals should be 4 cu. ft. per min. at a pressure of 4 in. water gauge. The air flow to the filament leads should be from a nozzle placed vertically above the filament. The temperature of the leads must not exceed 100°C.

All cooling supplies must be in operation before applying any voltages to the valve and must continue for at least 2 minutes after their removal.

Filament Starting. The cold filament resistance is 0·0057 Ω. The filament current must not exceed 500 A at any time. If the valve is operated for periods of greater than 15 minutes' duration without anode voltage being applied, the filament voltage must be reduced to one-half the normal value during the standby period.

HT Switching. It is not permissible to apply directly an HT voltage in excess of one-third of the maximum rated anode voltage. When the valve is to be operated at a higher voltage the HT should either be gradually increased from a low value, or three-step switching be employed.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Mounting. The valve must be completely supported by its water jacket, which should be adjustable so that the axis of the valve may be made truly vertical. Rigid connection must be made to the anode only.

Seasoning. Whenever a new valve is put into service or when a valve has been idle for a period of approximately two months, it must be seasoned by operating, for at least one hour, at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value.

APPROXIMATE DATA

V_f (nominal)	32·5V	μ	taken at $\frac{1}{2} I_{e\,(pk)}$	45
I_f	460 A	g_m		50 mA/V
V_a	20 kV	r_a		900 Ω
p_a	150 kW	$c_{g1\text{-}k}$	taken without water jacket	100 pF
p_{g1}	8 kW	$c_{a\text{-}k}$		4·5 pF
$I_{g1(rf)}$	100 A	$c_{g1\text{-}a}$		52 pF

Each valve is marked with V_f to give 100A emission $I_{e\,(pk)}$ at 90% saturation.

(1) RF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(One valve, unmodulated conditions)

Maximum permissible ratings

V_a	20	kV
V_{g1}	–2	kV
I_a	20	A
p_a	150	kW
p_{g1}	8	kW

Typical Operation

V_a		15	18	20	kV
V_{g1}		–950	–1030	–1070	V
$v_{g1(pk)}$		2650	2730	2770	V
I_a		18·8	18·8	18·8	A
I_{g1}	(a)	4·3	4·3	4·2	A
Z_a		400	490	550	Ω
P_{dr}	(a)	11·5	11·6	11·6	kW
p_a		74	80	104	kW
P_{out}		209	258	272	kW

(2) RF POWER AMPLIFIER. CLASS C

Anode modulated. (One valve, carrier conditions)

Maximum permissible ratings

V_a	15	kV
V_{g1}	–2	kV
I_a	10	A
p_a	100	kW
p_{g1}	8	kW
$\%_{mod}$	100 %	

Typical Operation

V_a		10	15	kV
V_{g1}		–900	–1100	V
$v_{g1(pk)}$		1850	2050	V
I_a		9·6	9·8	A
I_{g1}	(a)	1·9	1·8	A
Z_a		435	715	Ω
P_{dr}		3·5	3·8	kW
p_a		32	39	kW
P_{out}		64	108	kW

(3) RF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions)

Maximum permissible ratings

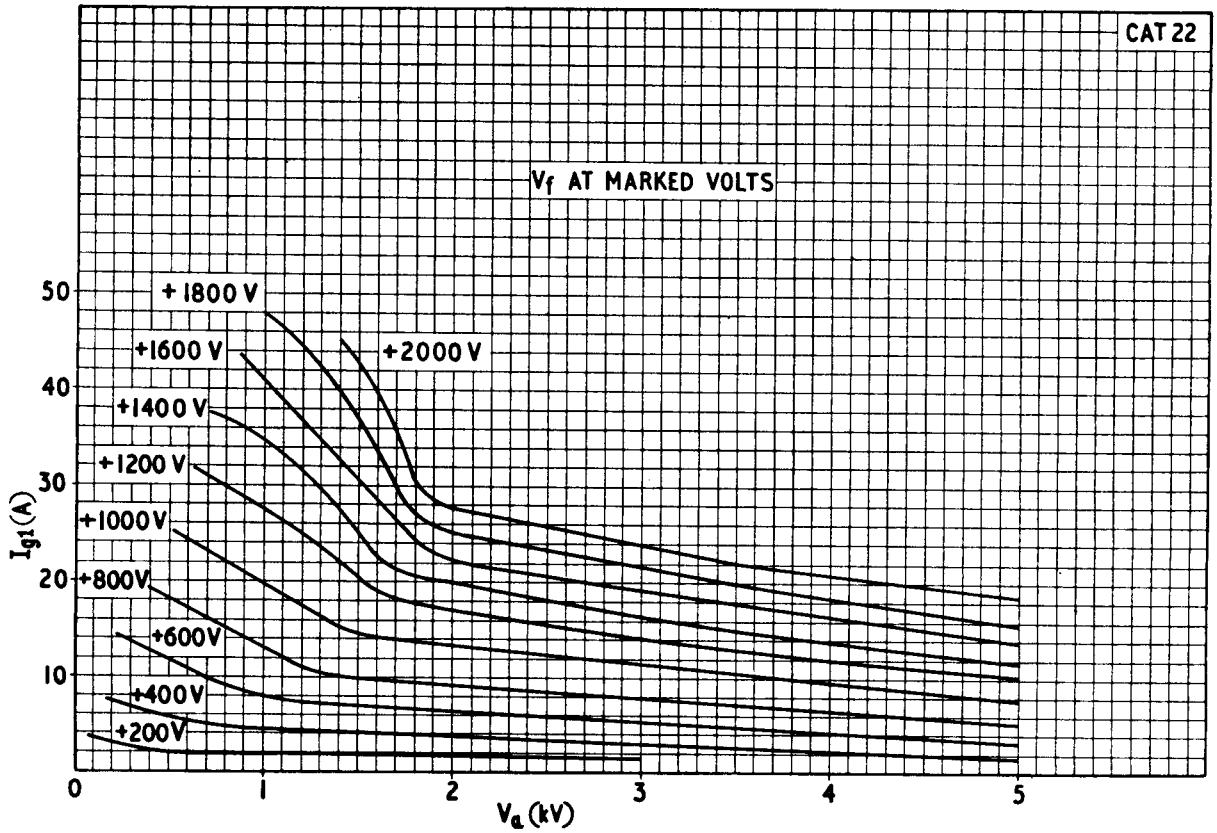
V_a	20	kV
V_{g1}	–1000	V
I_a	12	A
p_a	150	kW
$\%_{mod}$	100 %	

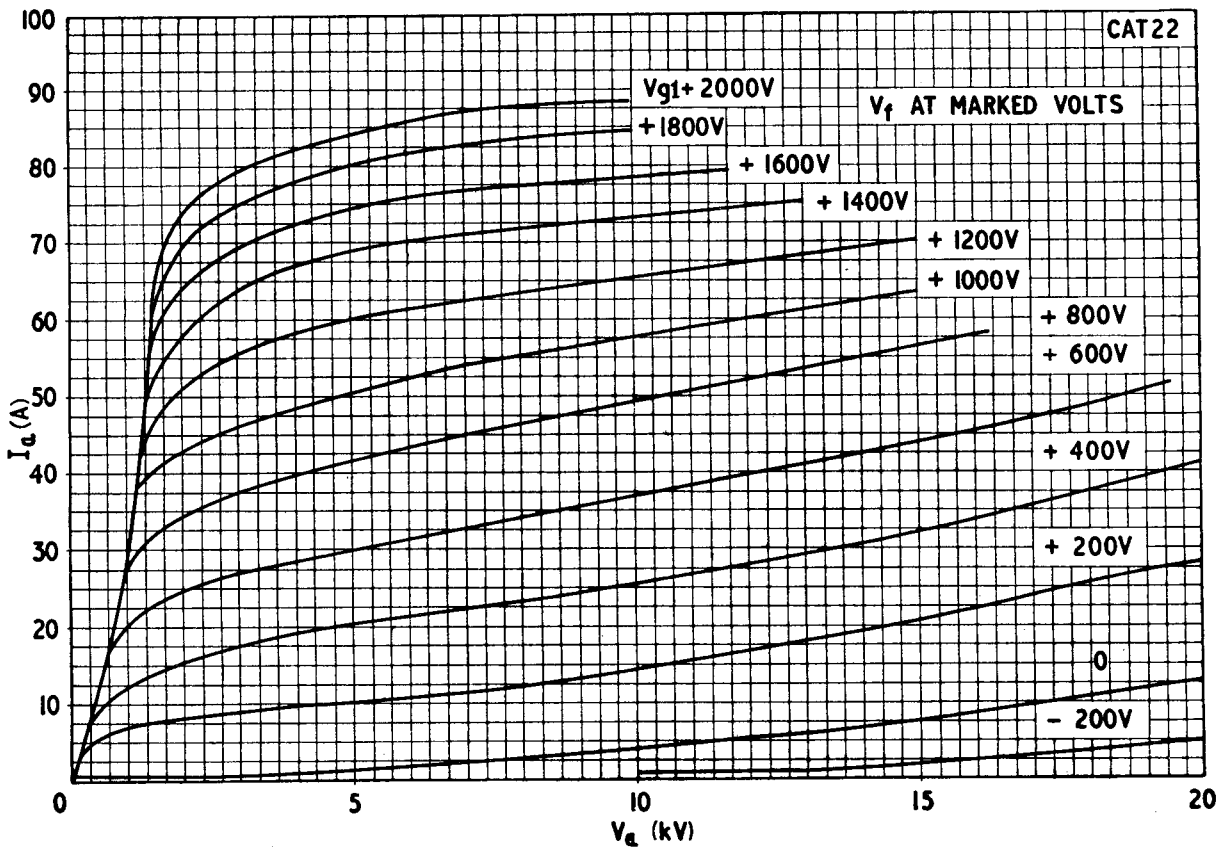
Typical Operation

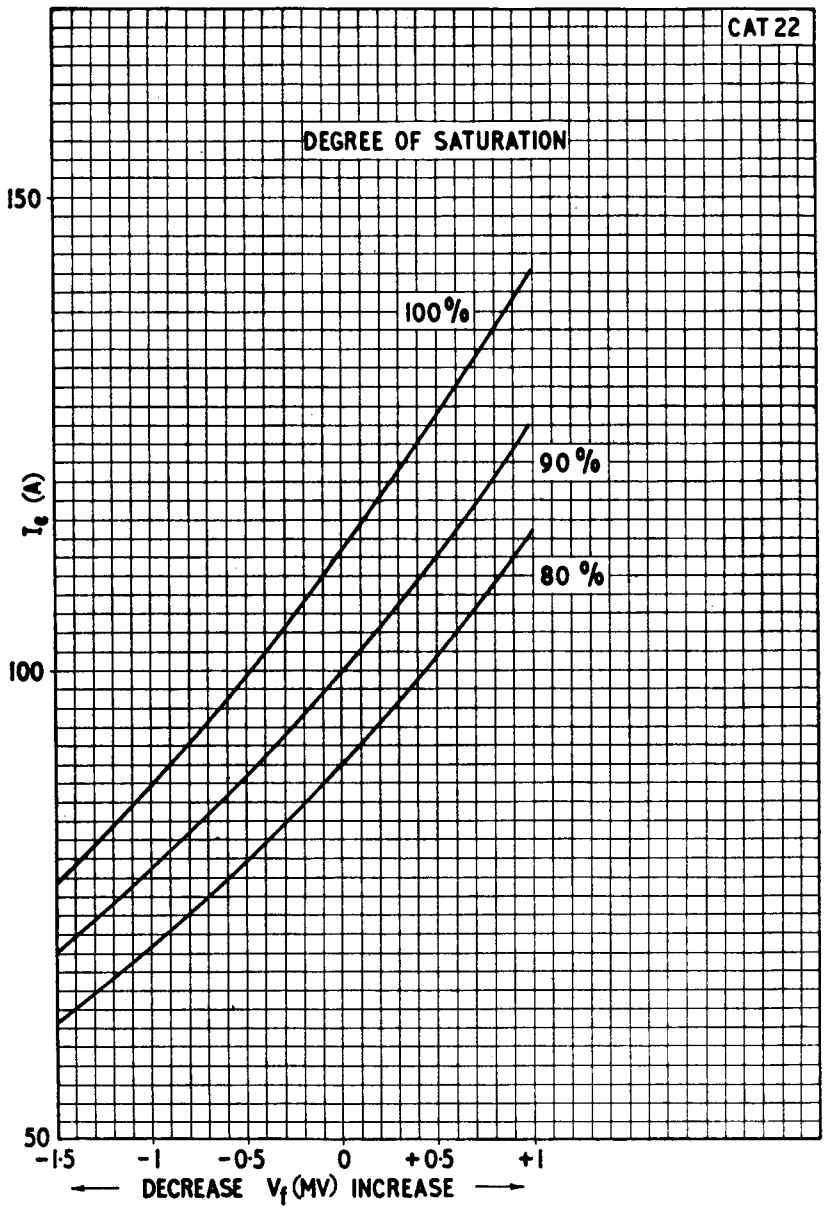
V_a		15	20	kV
V_{g1}		–330	–440	V
$v_{g1(pk)}$		900	940	V
I_a		10·6	10·6	A
Z_a		330	480	Ω
P_{dr}	(a) (b)	5·4	5·6	kW
p_a		114	146	kW
P_{out}		46	67	kW

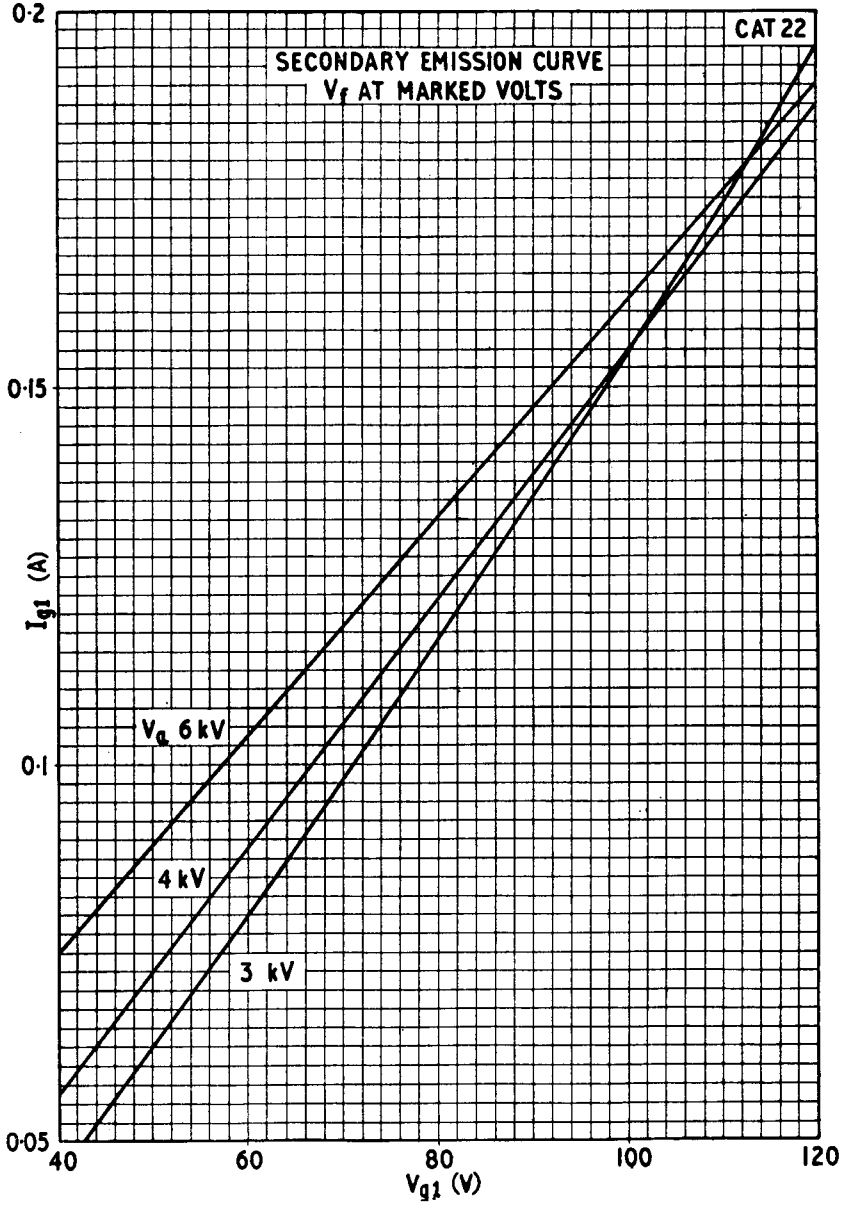
NOTES

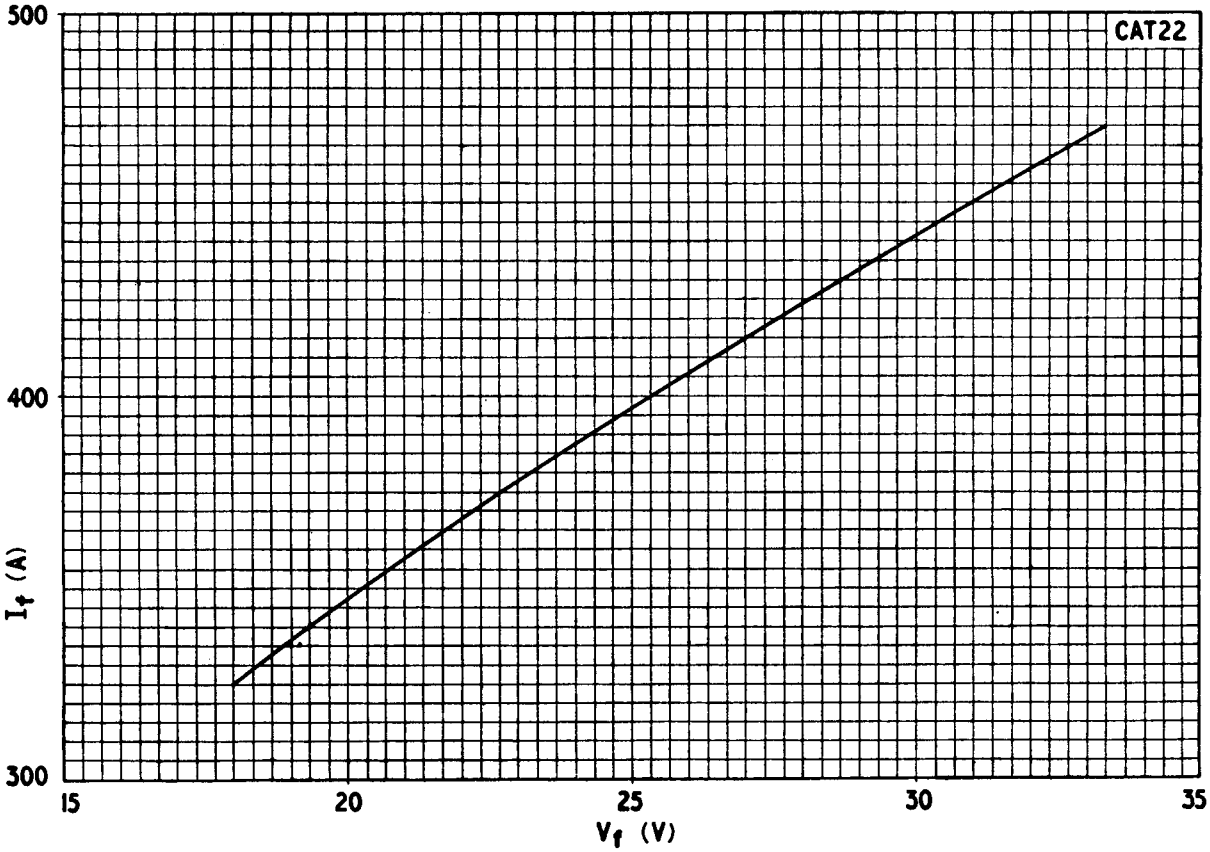
(a) Subject to wide variation. Figures are approximate only.
(b) At crest of audio cycle with 100% modulation.


CAT 22
V_f AT MARKED VOLTS
+1800 V
+1600 V
+1400 V
+1200 V
+1000V
+800V
+600V
+400V
+200V
+2000 V
I_{g1}(A)
V_a (kV)


CAT22
V_f AT MARKED VOLTS
Vg1+ 2000V
+1800V
+ 1600V
+ 1400V
+ 1200V
+ 1000V
+ 800V
+ 600V
+ 400V
+ 200V
0
- 200V
I_a (A)
V_a (kV)


CAT 22
DEGREE OF SATURATION
150
100
50
I_g (A)
100%
90%
80%
-1·5
-1
-0·5
0
+0·5
+1
← DECREASE V_f (MV) INCREASE →


CAT 22
SECONDARY EMISSION CURVE
V_f AT MARKED VOLTS
0·2
0·15
0·1
0·05
I_{g1} (A)
V_a 6 kV
4 kV
3 kV
40
60
80
100
120
V_{g1} (V)


CAT22
500
400
300
I_f (A)
15
20
25
30
35
V_f (V)



PRINTED IN ENGLAND

Triode *Type CAT 26*

(HP POWER AMPLIFIER OR OSCILLATOR)

General. A triode with a water cooled anode and fitted with a thoriated tungsten filament, this valve is suitable for use as a high frequency amplifier at frequencies up to 40 Mc/s. It is designed for use in communications or RF heating equipments.

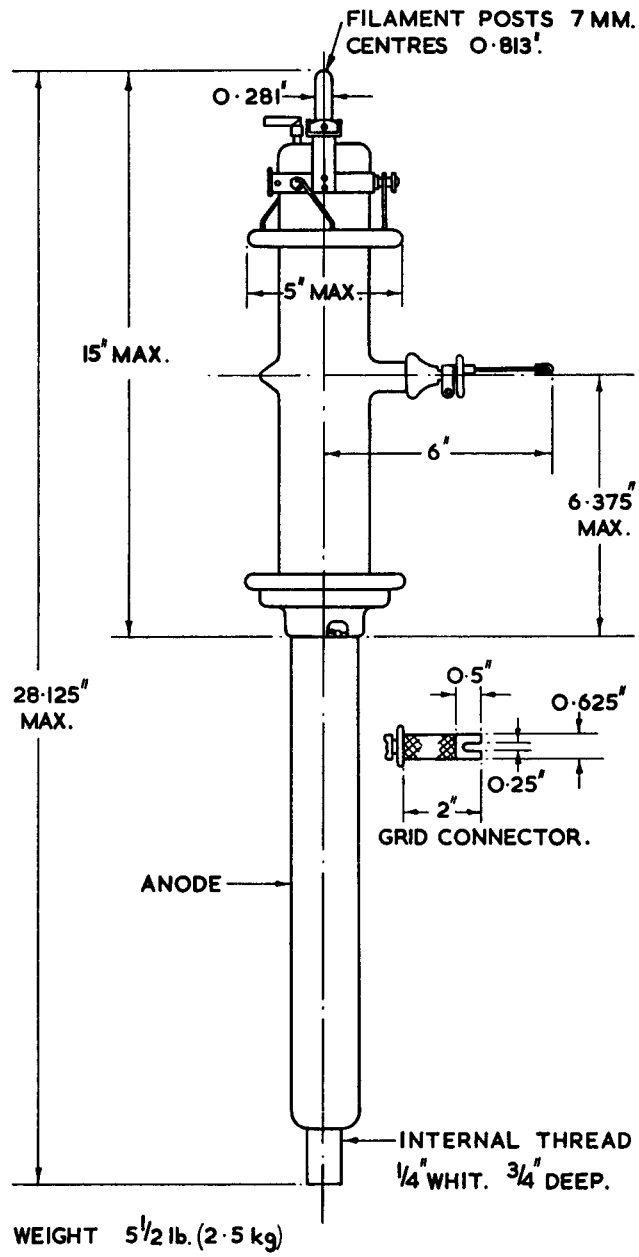
Cooling. The anode forms part of the valve envelope and is designed for cooling by water circulated in direct contact with the anode. The rated flow must not be less than 3 gallons per minute. The temperature of the cooling water at the outlet must not be greater than 150°F (65°C), and the temperature of all seals must not exceed 284°F (140°C). All cooling supplies must be started before the application of any supply voltage.

Filament Starting. The cold resistance of the filament is 0·021 Ω. The filament current must never exceed 80 A even instantaneously. It is recommended that a resistance of 0·128 Ω be placed in series with the filament and the normal filament voltage applied. After 30 seconds the series resistance should be cut out. When the filament supply is obtained from a transformer, it may be more convenient to place a resistance in the transformer primary, in which case the value given above should be multiplied by the square of the transformer ratio.

Mounting. The valve must be supported by its water jacket which should be capable of adjustment so that the axis of the valve is vertical. Rigid connections should be made to the anode only.

It is essential that the connections to the grid shall be sufficiently flexible to allow for the expansion of the valve without imposing mechanical strain on the glasswork.

Seasoning. Whenever a new valve is put into service, or when a valve has been idle for periods of approximately 2 months, it must be seasoned by operating



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

for at least 1 hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value. During this process a resistance of at least 25 Ω should be connected into the anode supply lead, in order to limit the surge current in the event of a flashover inside the valve.

It is recommended that a valve in storage should be run under operating conditions for at least 2 hours in each period of 6 months.

Standby conditions with no anode current. If the valve is operated for periods of greater than 15 minutes duration without anode current flowing, the filament voltage should be reduced to one half the normal value during the standby period. This may be achieved by switching in the starting resistance.

HT Switching. It is not permissible to apply directly an HT voltage in excess of 7 kV. When the valve is to be operated at a higher voltage the HT should be gradually increased from a low value.

APPROXIMATE DATA

V_f		10·5	V
I_f		57	A
$V_{a(max)}$		12	kV
$p_{a(max)}$		12	kW
$p_{g1(max)}$		700	W
$I_{k\ pk\ (max)}$		15	A
$I_{g1\ rf\ (max)}$		30	A
$f_{(max)}$	at full ratings	15	Mc/s
	at reduced ratings	40	Mc/s
μ	taken at V_a 10 kV, I_a 1A	45	–
r_a		4750	Ω
g_m		9·5	mA/V
c_{g1-f}		25	pF
c_{a-f}		2·2	pF
c_{g1-a}		30	pF

Operating Conditions

The figures quoted are only applicable when operating at frequencies up to 15 Mc/s. At higher frequencies the anode voltage must be reduced according to the following table.

f Mc/s	15	20	25	40
$\%V_{a(max)}$	100	85	65	35

(1) HF POWER AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY AND FM TELEPHONY

(*Unmodulated key-down conditions, per valve.*)
Maximum permissible conditions.

V_a	12	kV
V_{g1}	–1500	V
p_a	12	kW
p_{g1}	700	W

Typical Operation

V_a		12	8	kV
V_{g1}		–840	–750	V
$v_{g1(pk)}$		1840	1750	V
I_a		3	2·9	A
I_{g1}	(a)	0·46	0·55	A
Z_a		1900	1300	Ω
p_{dr}	(a)	900	960	W
p_a		10	7	kW
P_{out}		26	16·2	kW

(2) HF POWER AMPLIFIER, CLASS C ANODE MODULATED

(*Carrier conditions per valve.*)
Maximum permissible conditions.

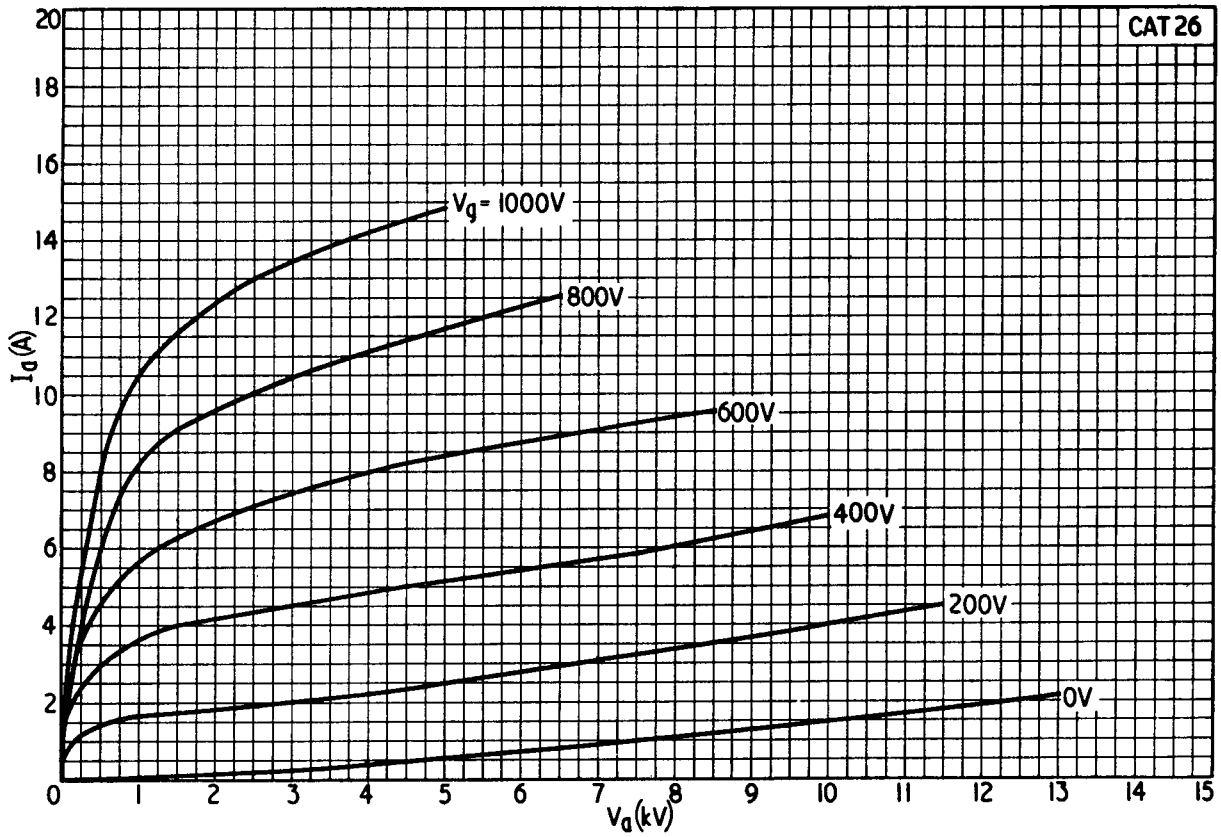
V_a	10	kV
V_{g1}	–1500	V
p_a	8	kW
p_{g1}	700	W
Mod.	100	%

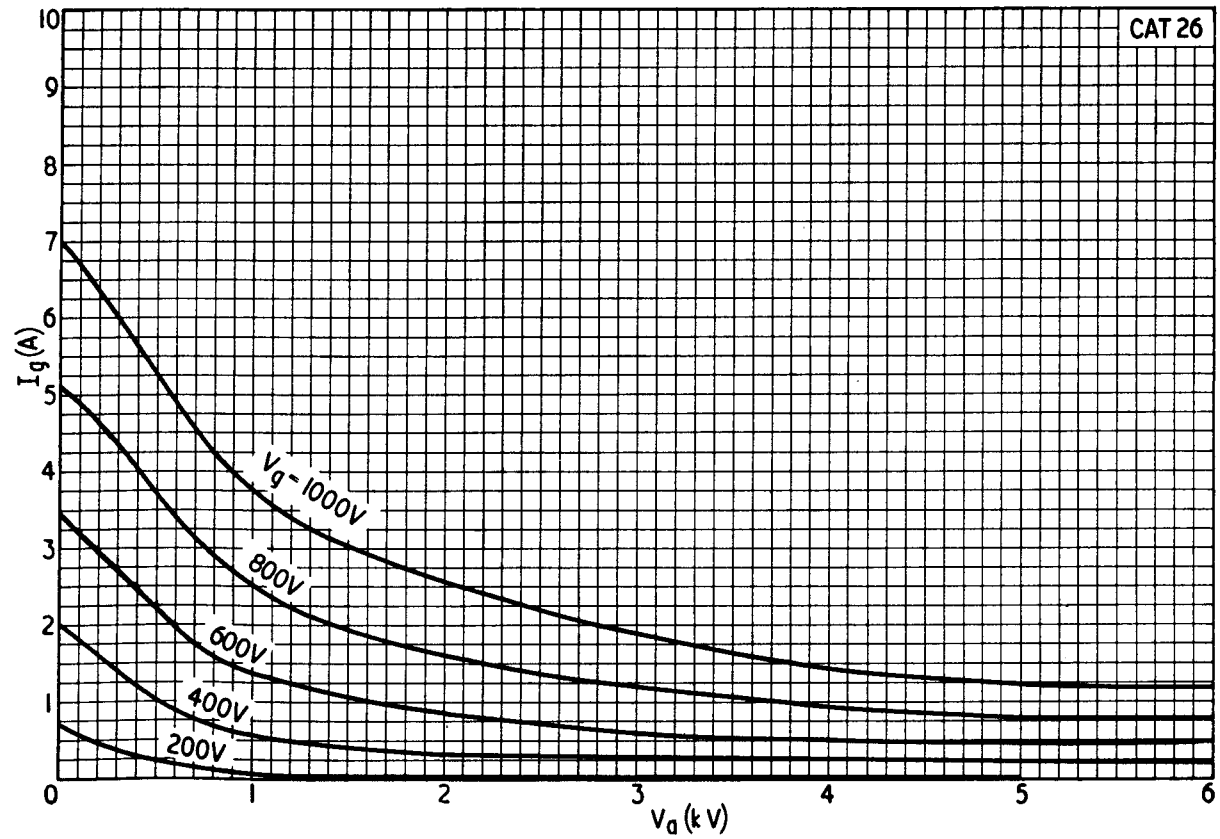
Typical Operation

V_a		10	7·5	kV
V_{g1}		–700	–580	V
$v_{g1(pk)}$		1400	1340	V
I_a		1·9	1·9	A
I_{g1}	(a)	0·22	0·34	V
Z_a		2400	1750	Ω
p_{dr}	(a)	350	500	W
p_a		5·5	4·25	kW
P_{out}		13·5	10	kW

NOTE

(a) subject to wide variation.


CAT 26
I_a(A)
V_a(kV)
V_g= 1000V
800V
600V
400V
200V
0V


CAT 26
I_g(A)
V_a(kV)
V_g - 1000V
800V
600V
400V
200V



PRINTED IN ENGLAND

Triode *Type CAT27*

(RF POWER AMPLIFIER)

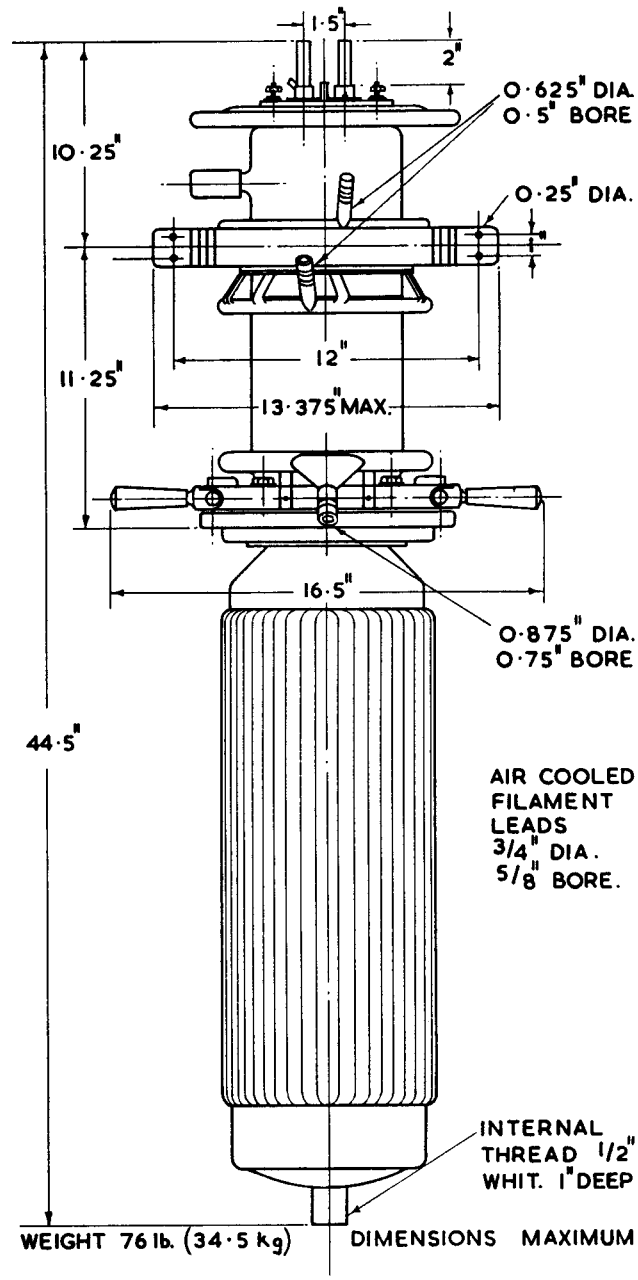
General. A triode with a water-cooled anode and fitted with a thoriated tungsten filament, this valve is suitable for use in communications equipment or RF heating applications. It is suitable for use at frequencies up to 26 Mc/s.

Cooling. The anode forms part of the valve envelope and must be fitted with a specially designed water jacket for cooling by circulating water in direct contact with the anode. The rated flow of water to the anode should not be less than 20 gallons per minute. The temperature of the cooling water must not exceed 150°F (65°C) at the outlet.

The anode and filament seals and filament leads require forced air cooling. The airflow to each of the seals should be not less than 4 cu. ft. per minute at a pressure of 4 in. water gauge and to each filament lead 6 cu. ft. per minute at 5 in. water gauge. The cooling supply must be started before the application of any supply voltage and must continue for 15 minutes after their removal.

Filament Switching. The cold filament resistance is 0·0057 ohms. The filament current must not exceed 375 A at any time, even instantaneously. An 0·042-ohm resistor should be placed in series with the filament and the normal voltage then applied. The resistor should be cut out after 30 seconds. It may be convenient to place the resistor in the primary of a supply transformer, in which case the above resistance value should be multiplied by the square of the transformation ratio. If the valve is operated for more then 15 minutes without anode current, the filament voltage must be reduced to one-half during the standby period, i.e. by reinserting the starting resistor.

Storage. It is recommended that a valve in storage should be run under operating conditions for at least 2 hours in each period of 6 months.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Whenever a new valve or a valve which has been idle for more than 2 months is put into service it must be conditioned by operating for 1 hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value. During this process a resistance of at least 25 ohms should be connected into the anode supply lead, in order to limit the surge current in the event of a flash-over inside the valve.

HT Switching. It is not permissible to apply directly HT voltage in excess of 7 kV. When the valve is to be operated at a higher voltage the HT should be gradually increased from a low value.

Mounting. The valve must be wholly supported by its water jacket which should be capable of adjustment so that the axis of the valve is truly vertical. Rigid connections should be made to the anode only.

It is essential that the connections to the grid ring shall be sufficiently flexible to allow for the expansion of the valve without imposing mechanical strain on the glass.

APPROXIMATE DATA

V_f		17·5	V
I_f (approx.)		285	A
$V_{a(max)}$		20	kV
$p_{a(max)}$		150	kW
$p_{g1(max)}$		8	kW
$I_{k(pk)(max)}$		120	A
$I_{g1(rf)(max)}$		100	A
$f_{(max)}$	(at max. ratings)	15	Mc/s
	(at reduced ratings)	26	Mc/s
μ	taken at Va 15 kV, V_{g1}–100 V	45	
r_a		900	Ω
g_m		50	mA/V
c_{a-f}	taken without water jacket	1·8	pF
c_{g-a}		56	pF
c_{g-f}		101	pF

(1) RF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY

(Unmodulated key-down conditions per valve.)
Maximum permissible ratings.

V_a	20	kV
V_{g1}	–2	kV
p_a	150	kW
p_{g1}	8	kW

Typical Operation

V_a		15	20	kV
V_{g1}		–1475	–1600	V
$v_{g1(pk)}$		3475	3600	V
I_a		22·3	23·4	A
I_g	(a)	4·6	4·1	A
Z_a		310	395	Ω
P_{dr}	(a)	16	14·6	kW
p_a		103	144	kW
P_{out}		232	324	kW

(2) RF POWER AMPLIFIER CLASS C ANODE MODULATED

(Carrier conditions, per valve, 100% modulation.)
Maximum permissible ratings.

V_a	14	kV
V_{g1}	–2	kV
p_a	100	kW
p_{g1}	8	kW

Typical Operation

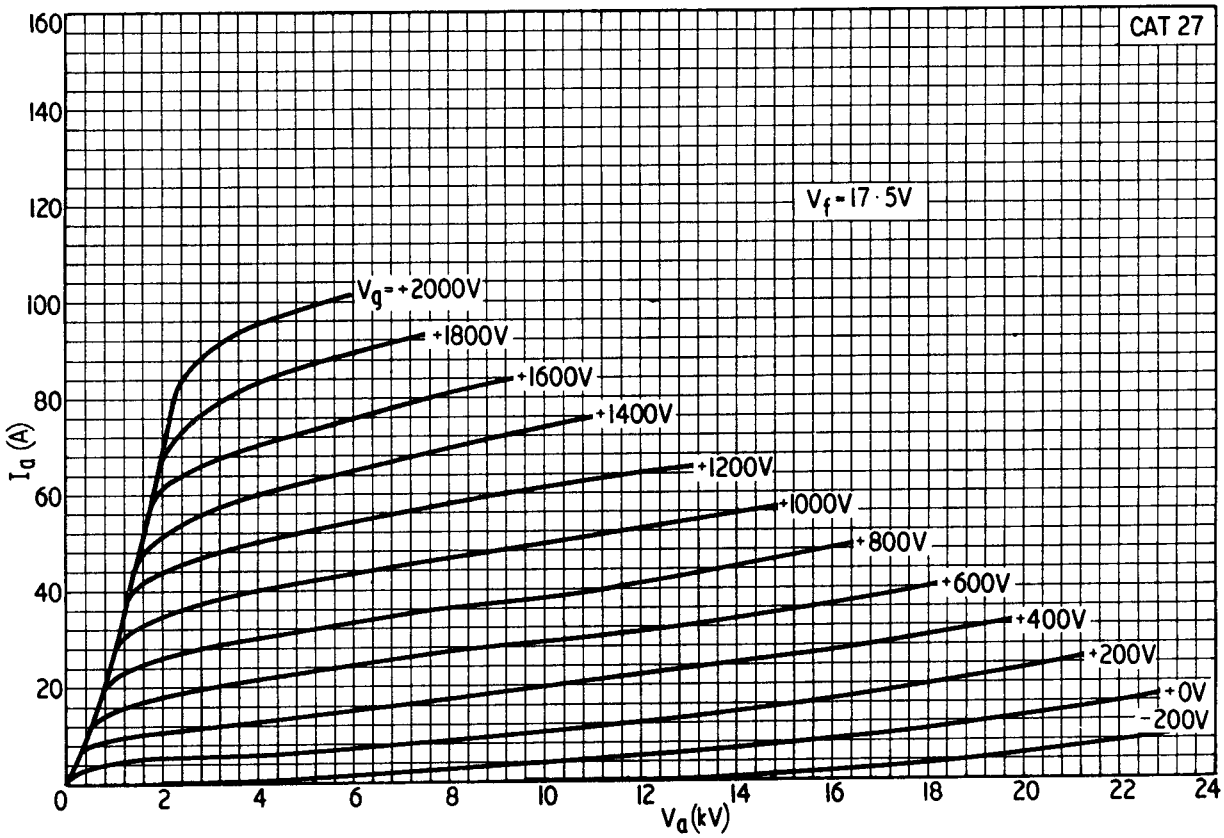
V_a		10	14	kV
V_{g1}		–1180	–1160	V
$v_{g1(pk)}$		2600	3060	V
I_a		13·5	14·3	A
I_{g1}	(a)	2·7	2·5	A
Z_a		305	440	Ω
P_{dr}	(a)	7	6·8	kW
p_a		43	62	kW
P_{out}		92	138	kW

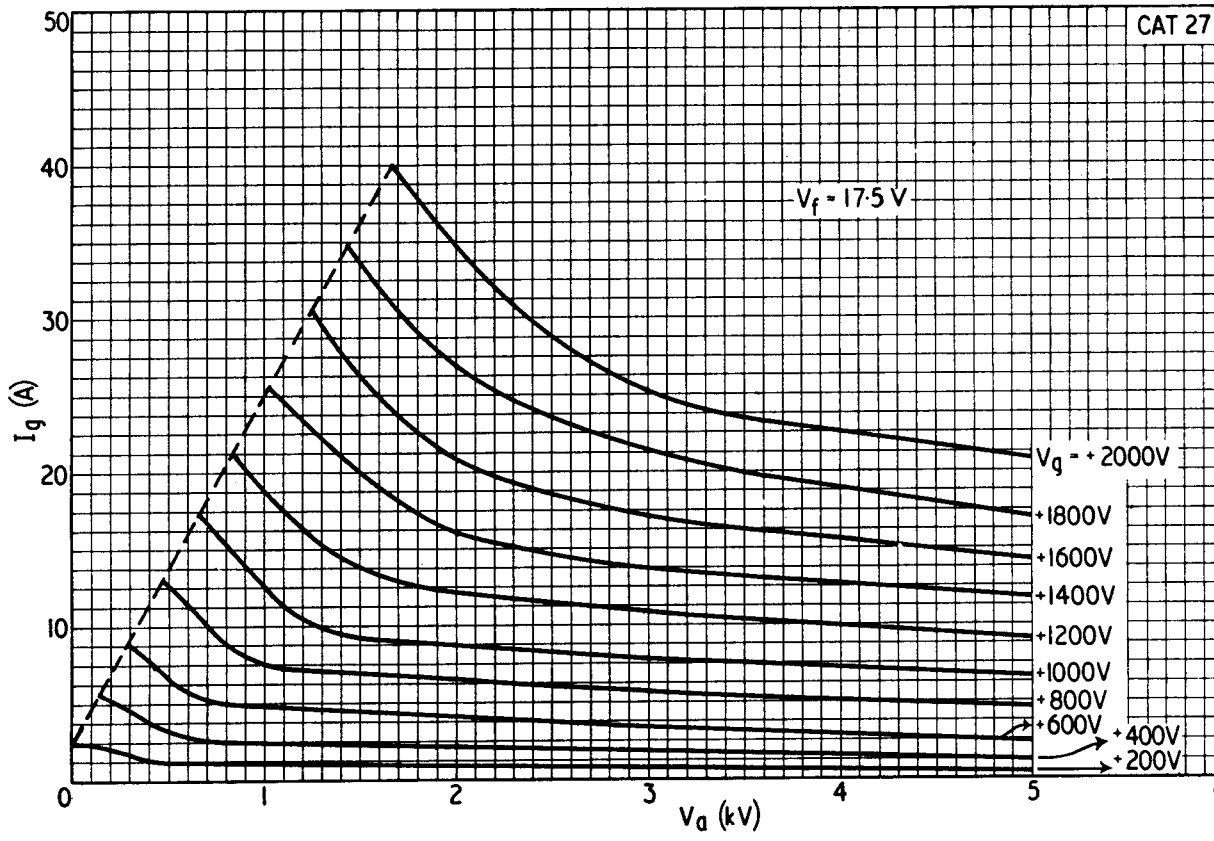
NOTE

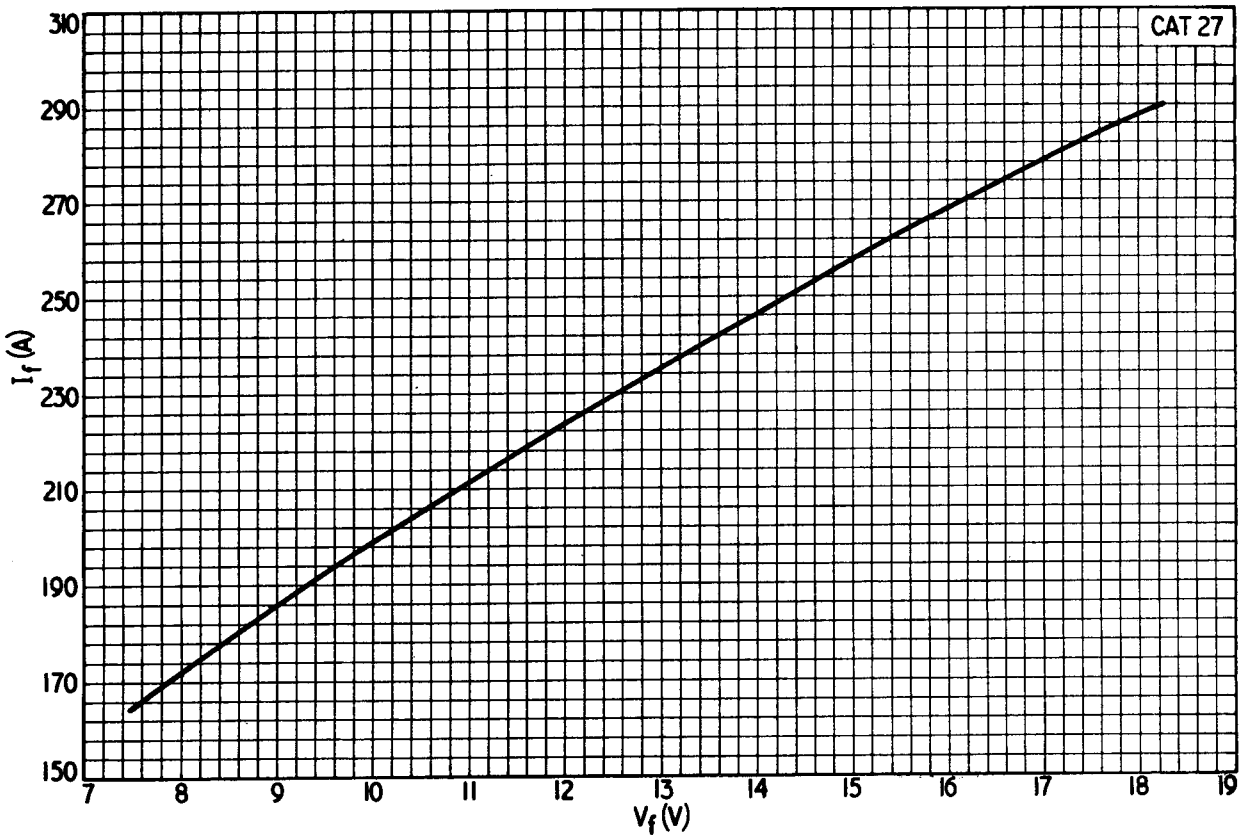
(*a*) Subject to wide variation.

At frequencies above 15 Mc/s the permissible anode voltage is reduced to the following % of maximum.

f	15	20	26 Mc/s
$\%V_{a(max)}$	100	87·5	72·5 %


CAT 27
V_f = 17·5V
V_g = +2000V
+1800V
+1600V
+1400V
+1200V
+1000V
+800V
+600V
+400V
+200V
+0V
-200V
I_a (A)
V_a (kV)
0
2
4
6
8
10
12
14
16
18
20
22
24
20
40
60
80
100
120
140
160


CAT 27
V_f = 17·5 V
V_g = +2000V
+1800V
+1600V
+1400V
+1200V
+1000V
+800V
+600V
+400V
+200V
I_g (A)
V_a (kV)
0
1
2
3
4
5
6
10
20
30
40
50



PRINTED IN ENGLAND

Triode *Type CAT 29*

(HF POWER AMPLIFIER AND OSCILLATOR)

General. A water-cooled anode transmitting triode fitted with a thoriated tungsten filament for use in communication or RF heating equipments.

The anode forms part of the envelope and must be fitted with a specially designed water jacket. The anode and filament seals require forced air cooling. This valve is suitable for use at frequencies up to 40 Mc/s.

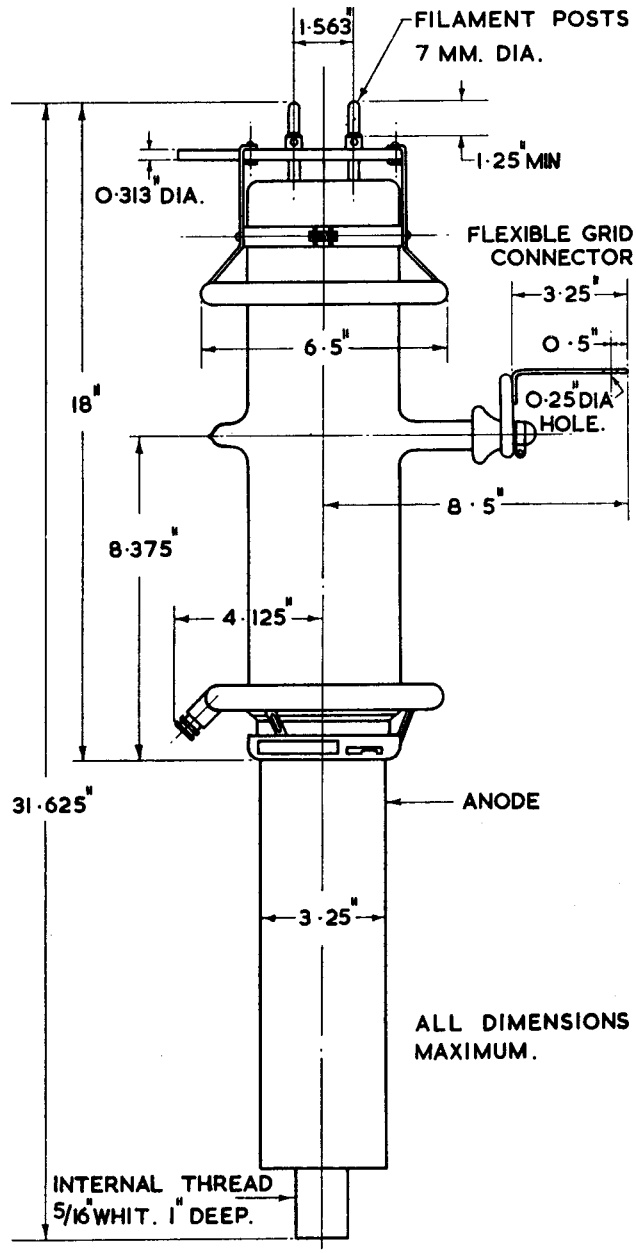
Cooling. All cooling supplies must be started before the application of any supply voltages.

The water flow to the anode must not be less than 4·5 gallons per minute. The temperature of the cooling water must not be greater than 65°C at the outlet. The air flow to the anode seal and to the filament seals should not be less than 4 cu. ft. per minute. The temperature of the anode and filament seals must not exceed 140°C.

Filament Starting. The cold resistance of the filament is 0·0225 ohms. The filament current must never exceed 90 A even instantaneously. It is recommended that a resistance of 0·14 ohms be placed in series with the filament and the normal filament voltage applied. After 30 seconds the series resistance should be cut out. When the filament supply is obtained from a transformer it may be more convenient to place a resistance in the transformer primary, in which case the value given above should be multiplied by the square of the transformer ratio.

Mounting. The valve must be supported by its water jacket which should be capable of adjustment so that the axis of the valve is vertical. Rigid connections should be made to the anode only.

It is essential that the connections to the grid shall be sufficiently flexible to allow for the expansion of the valve without imposing mechanical strain on the glass work.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Seasoning. It is recommended that a valve in storage should be run under operating conditions for at least 2 hours in each period of 6 months.

Whenever a new valve or a valve which has been idle for more than 2 months is put into service it must be conditioned by operating for 1 hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value. During this process a resistance of at least 25 ohms should be connected into the anode supply lead, in order to limit the surge current in the event of a flash-over inside the valve.

Standby conditions with no anode current. If the valve is operated for periods greater than 15 minutes without anode current flowing the filament voltage should be reduced to one half the normal value during the standby period. This can be achieved by switching in the starting resistance.

HT Switching. It is not permissible to apply directly HT voltage in excess of 7 kV. When the valve is to be operated at a higher voltage the HT should be gradually increased from a low value.

APPROXIMATE DATA

V_f		11·5	V
I_f		(approx.) 57	A
$V_{a(max)}$		15	kV
$p_{a(max)}$		18	kW
$p_{g1(max)}$		800	W
$I_{k(pk)(max)}$		20	A
$I_{g1(rf)(max)}$		30	A
$f_{(max)}$	at full ratings	20	Mc/s
	at reduced ratings	40	Mc/s
μ	taken at Va 12 kV, Ia 1 A	45	
r_a		4750	Ω
g_m		9·5	mA/V
c_{g-f}		29	pF
c_{a-f}		1·9	pF
c_{g-a}		21	pF

Operating Conditions

(1) HF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY AND FM TELEPHONY

(Unmodulated key-down conditions per valve.)

Maximum permissible ratings.

V_a	15	kV
V_{g1}	–2	kV
p_a	18	kW
p_{g1}	800	W

Typical conditions

V_a		15	10	kV
V_{g1}		–980	–850	V
$v_{g1(pk)}$		2080	1950	V
I_a		3·35	3·2	A
I_{g1}	(a)	0·5	0·58	A
Z_a		1970	1350	Ω
P_{dr}	(a)	1050	1150	W
p_a		13·7	8·8	kW
P_{out}		36·5	23·2	kW

(2) HF POWER AMPLIFIER CLASS C ANODE MODULATED

(Carrier conditions per valve.)

Maximum permissible ratings.

V_a	12	kV
V_{g1}	–2000	V
p_a	12	kW
p_{g1}	800	W
Mod.	100	%

Typical conditions

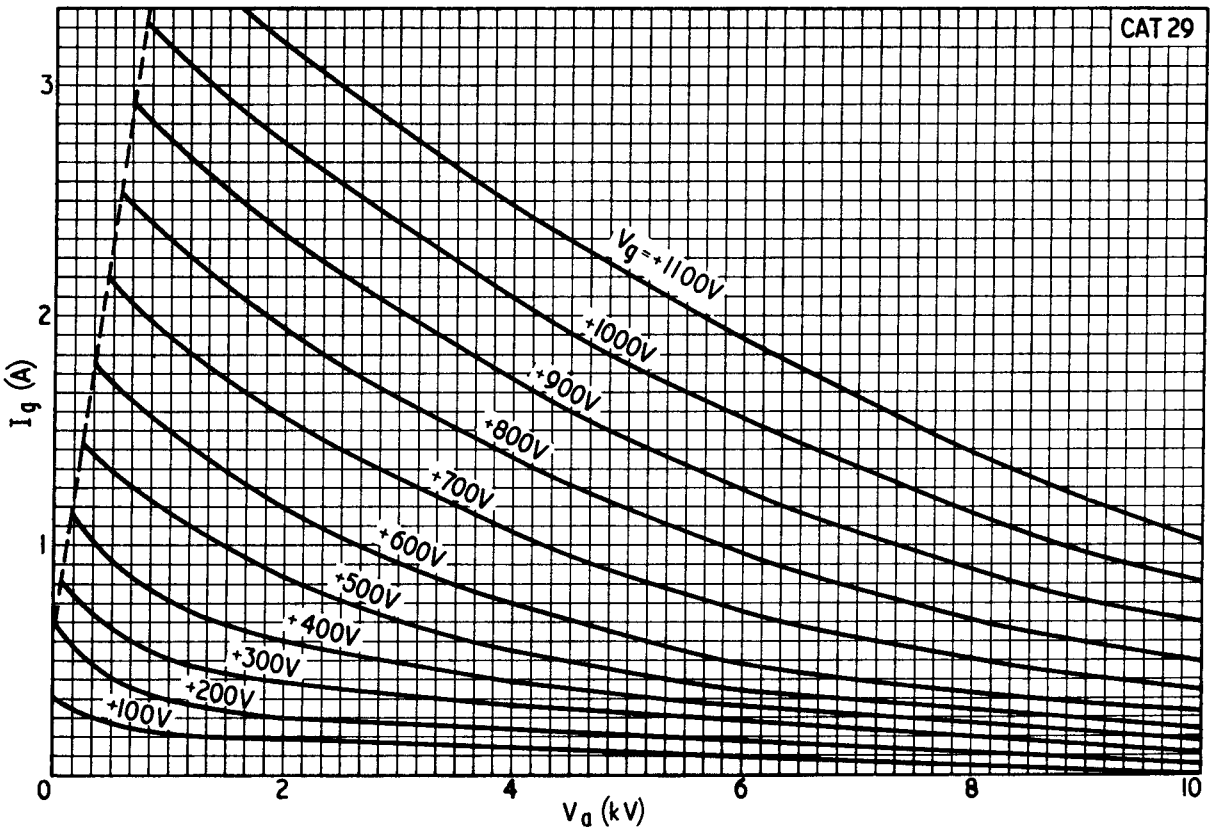
V_a		12	10	kV
V_{g1}		–850	–750	V
$v_{g1\ pk}$		1640	1540	V
I_a		2·05	2·0	A
I_{g1}	(a)	0·3	0·35	A
Z_a		2650	2300	Ω
P_{dr}	(a)	500	550	W
p_a		7·6	6	kW
P_{out}		17	14	kW

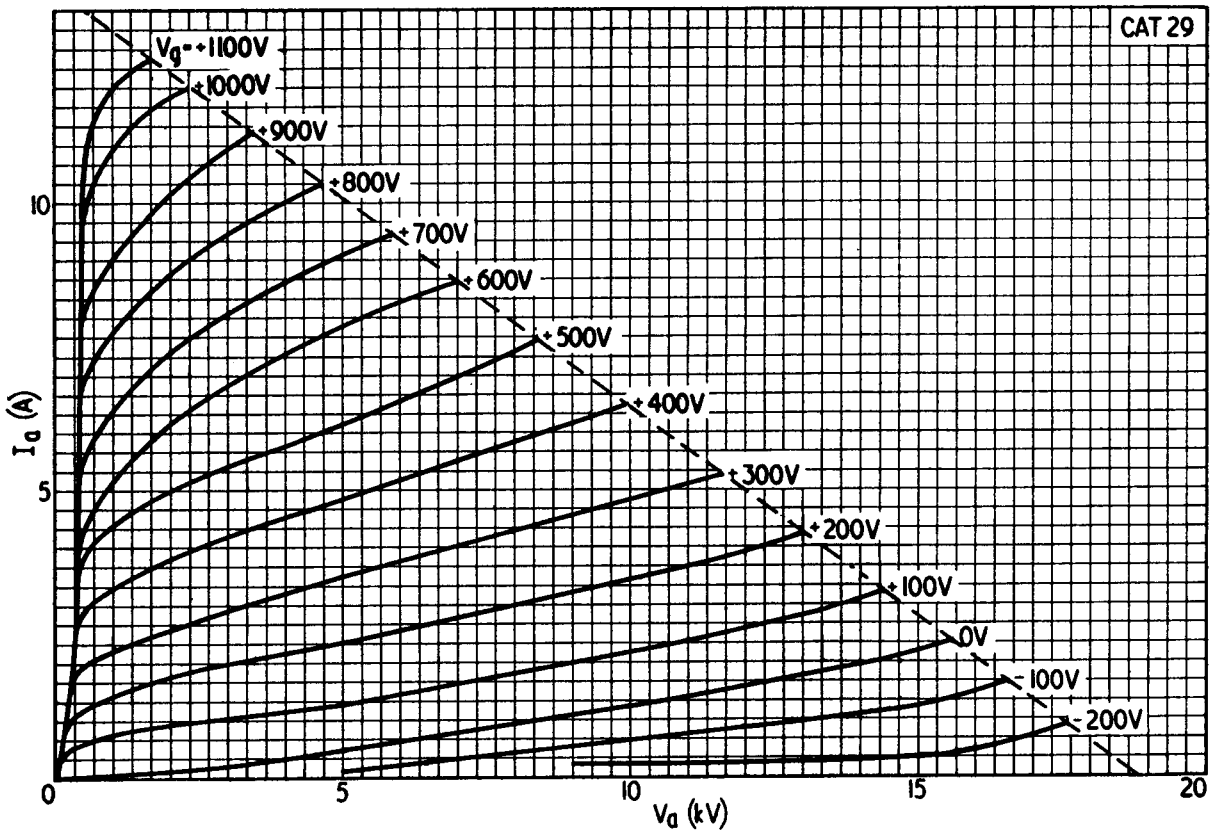
NOTE

The figures quoted above are only applicable when operating at frequencies up to 20 Mc/s. At higher frequencies the anode voltage must be reduced according to the following table.

f (Mc/s)	20	25	30	40
$\%V_{a(max)}$	100	75	50	35

(a) Subject to wide variations.


CAT 29
I_g (A)
V_a (kV)
V_g = +1100V
+1000V
+900V
+800V
+700V
+600V
+500V
+400V
+300V
+200V
+100V


CAT 29
I_a (A)
V_a (kV)
V_g = +1100V
+1000V
+900V
+800V
+700V
+600V
+500V
+400V
+300V
+200V
+100V
0V
-100V
-200V



PRINTED IN ENGLAND

Triode *Type CAT30*

(RF POWER AMPLIFIER)

General. A triode with a water-cooled anode and fitted with thoriated tungsten filament, this valve is suitable for use in communications equipment or RF heating applications at frequencies up to 26 Mc/s.

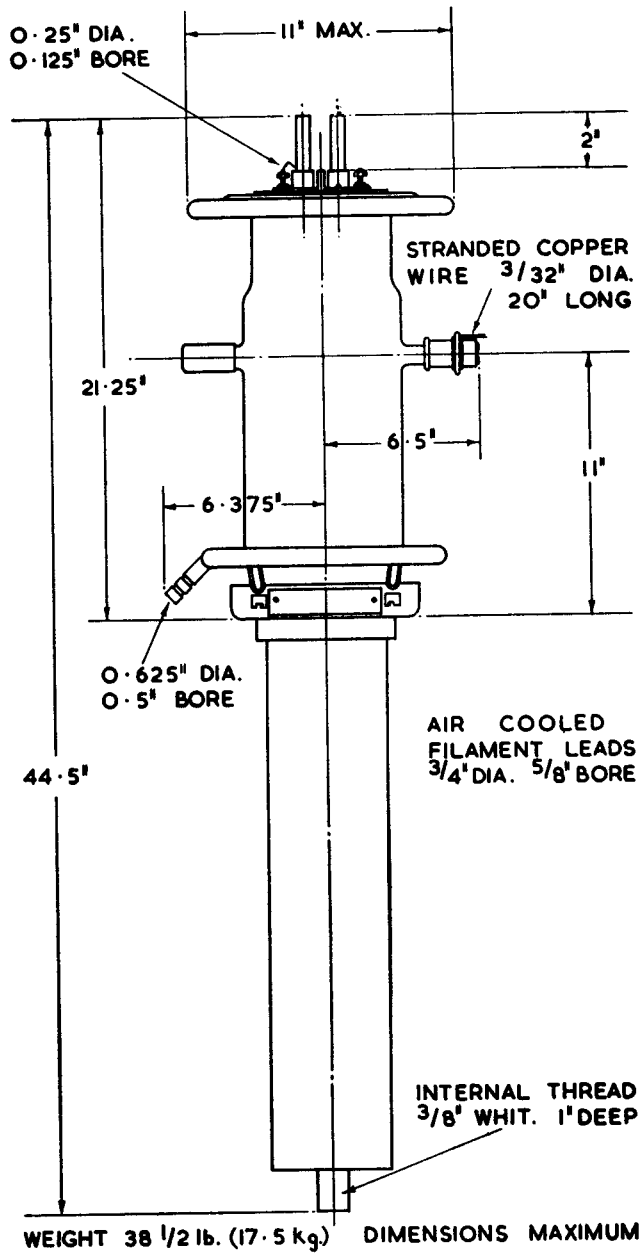
Cooling. The anode forms part of the valve envelope and must be fitted with a specially designed water jacket for cooling by circulating water in direct contact with the anode. The rated flow of water to the anode should not be less than 20 gallons per minute. The temperature of the cooling water must not exceed 150°F (65°C) at the outlet.

The anode and filament seals and filament leads require forced air cooling. The air flow to each of the seals should not be less than 4 cu. ft. per minute at a pressure of 4 in. water gauge and to each filament lead 6 cu. ft. per minute at 5 in. water gauge. The cooling system must be started before the application of any supply voltages and must continue for 15 minutes after their removal.

Filament Switching. The cold filament resistance is 0·009 ohms. The filament current must not exceed 250 A at any time, even instantaneously. An 0·07-ohm resistor should be placed in series with the filament and the normal voltage then applied. The resistor should be cut out after 30 seconds. It may be convenient to place the resistor in the primary of a supply transformer, in which case the above resistance value should be multiplied by the square of the transformation ratio. If the valve is operated for more than 15 minutes without anode current, the filament voltage must be reduced to one-half during the standby period, i.e. by reintroducing the starting resistor.

Storage. It is recommended that a valve in storage should be run under operating conditions for at least 2 hours in each period of 6 months.

Whenever a new valve or a valve which has been idle for more than 2 months is put into service it must be



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3321. *Telegraphic Address: Expanse, Chelmsford*

conditioned by operating for 1 hour at half the normal anode voltage and current. The anode voltage should then be increased slowly to the normal value. During this process a resistance of at least 25 ohms should be connected into the anode supply lead, in order to limit the surge current in the event of a flash-over inside the valve.

HT Switching. It is not permissible to apply directly HT voltage in excess of 7 kV. When the valve is to be operated at a higher voltage the HT should be gradually increased from a low value.

Mounting. The valve must be wholly supported by its water jacket which should be capable of adjustment so that the axis of the valve is truly vertical. Rigid connections should be made to the anode only.

It is essential that the connections to the grid ring shall be sufficiently flexible to allow for the expansion of the valve without imposing mechanical strain on the glass.

APPROXIMATE DATA

V_f		17·5	V
I_f		176	A
$V_{a(max)}$		20	kV
$p_{a(max)}$		75	kW
$p_{g1(max)}$		4	kW
$I_{k(pk)(max)}$		50	A
$I_{g1(rf)(max)}$		30	A
$f_{(max)}$	(at max. ratings)	5	Mc/s
	(at reduced ratings)	26	Mc/s
μ	taken at Va 9 kW, Ia 1·5 A	35	
r_a		1450	Ω
g_m		2·4	mA/V
c_{a-f}	taken without water jacket	1·8	pF
c_{g1-a}		56	pF
c_{g1-f}		101	pF

(1) RF POWER AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY

(*Unmodulated key-down conditions, per valve.*)

Maximum permissible ratings.

V_a	20	kV
V_{g1}	−2	kV
p_a	75	kW
p_{g1}	4	kW

Typical Operation

V_a	20	kV
V_{g1}	−1500	V
$v_{g1(pk)}$	3080	V
I_a	13·75	A
I_{g1} (a)	2·6	A
Z_a	677	Ω
P_{dr} (a)	7·7	kW
p_a	74	kW
P_{out}	195	kW

(2) RF POWER AMPLIFIER CLASS C ANODE MODULATED

(*Carrier conditions, per valve,* 100% *modulation.*)

Maximum permissible ratings.

V_a	16	kW
V_{g1}	−2	kV
p_a	50	kW
p_{g1}	4	kW

Typical Operation

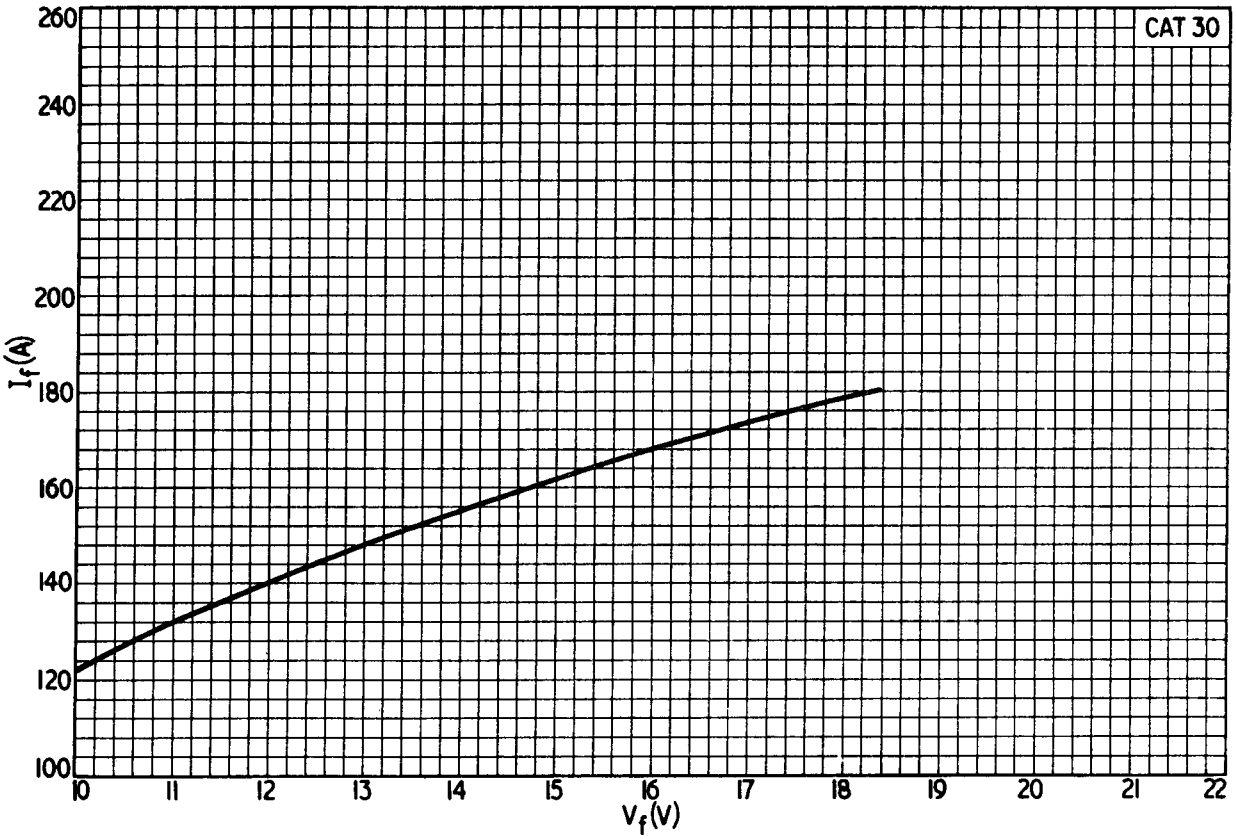
V_a	16	kV
V_{g1}	−1390	V
$v_{g1(pk)}$	2540	V
I_a	8·5	A
I_{g1} (a)	1·4	A
Z_a	855	Ω
P_{dr} (a)	3·4	kW
p_a	40	kW
P_{out}	96	kW

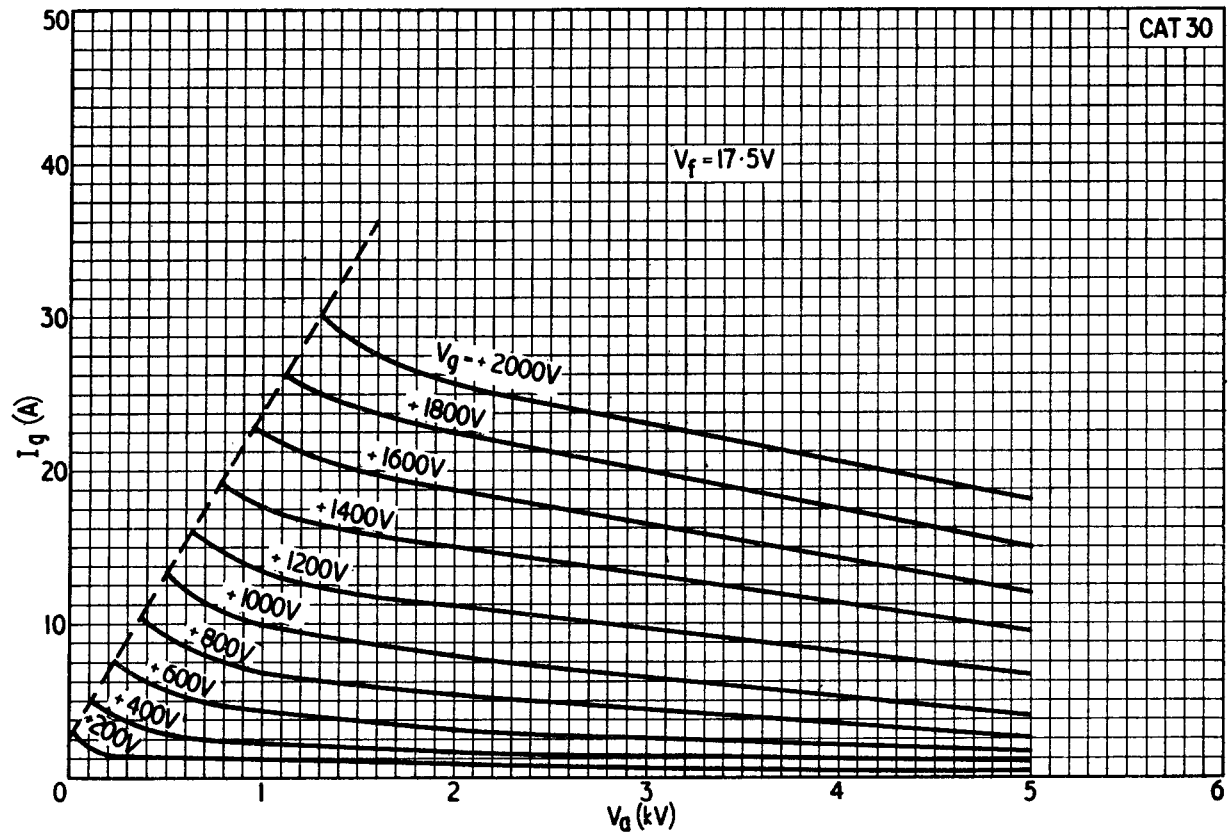
NOTE

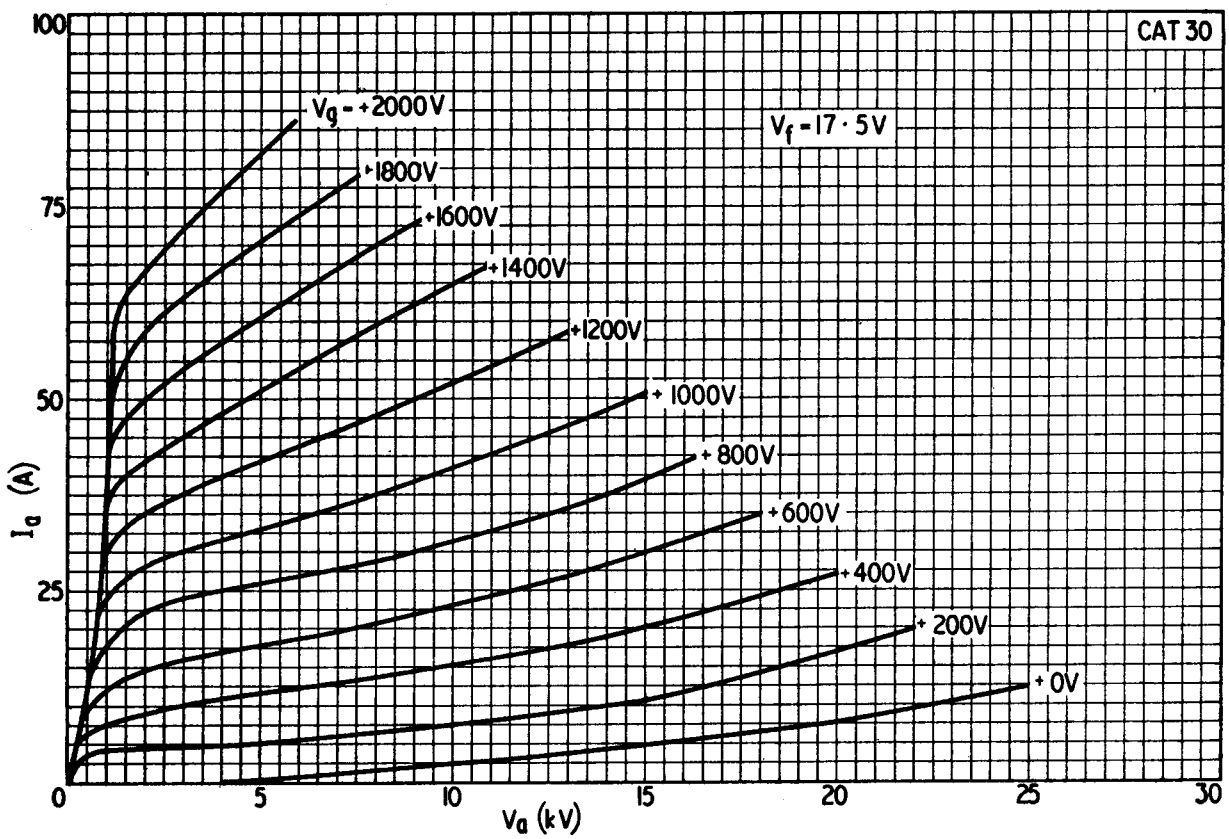
At frequencies above 5 Mc/s the permissible anode voltage is reduced to the following % of maximum.

f	5	10	15	20 Mc/s
$V_{a(max)}$	100	90	75	50 %

(*a*) Subject to wide variation.


CAT 30
260
240
220
200
180
160
140
120
100
I_f(A)
10
11
12
13
14
15
16
17
18
19
20
21
22
V_f(V)


CAT 30
V_f = 17·5V
V_g = +2000V
+1800V
+1600V
+1400V
+1200V
+1000V
+800V
+600V
+400V
+200V
50
40
30
20
10
0
I_g (A)
1
2
3
4
5
6
V_a (kV)



PRINTED IN ENGLAND

Tetrode *Type CR 176*

(HF POWER AMPLIFIER)

General. The CR 176 is a forced-air-cooled power tetrode. The anode, which forms part of the valve envelope, is fitted into a radiator for forced air-cooling. The screen grid is mounted from the metal header to provide efficient shielding and a low inductance connection.

The external grid and filament seals must not exceed a temperature of 140°C; cooling is not usually necessary to maintain these conditions.

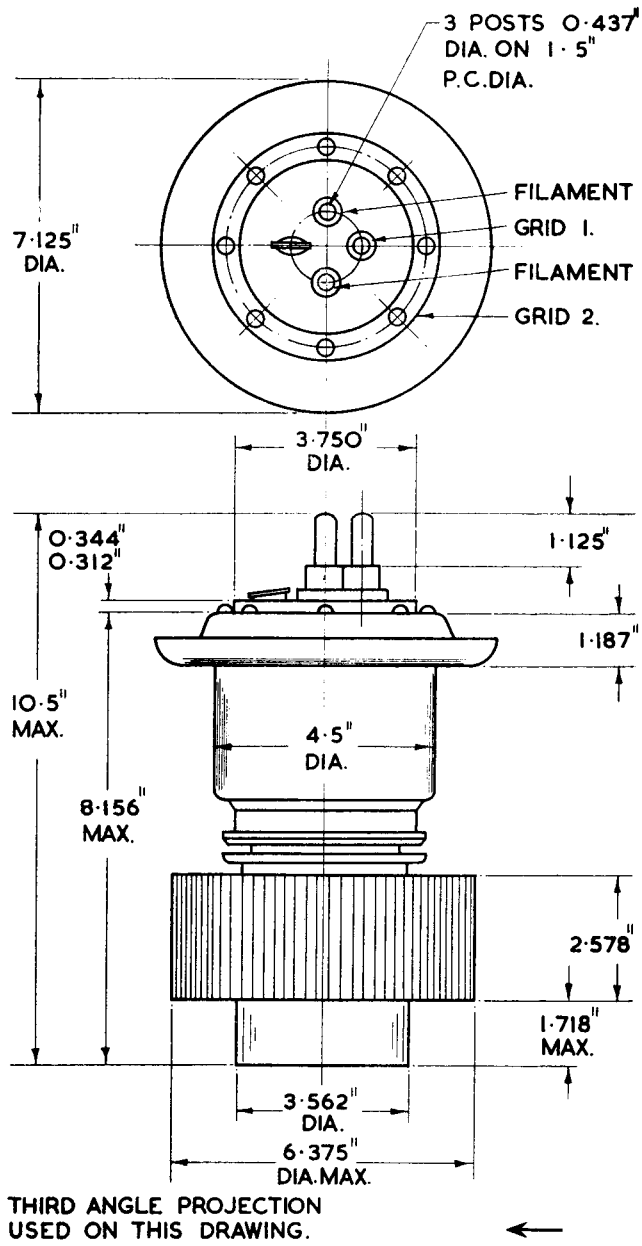
APPROXIMATE DATA

V_f		5	V
I_f		64	A
$I_{e(pk)}$		10	A
V_a		7·5	kV
p_a		3·5	kW
V_{g2}		1·5	kV
p_{g2}		200	W
p_{g1}		25	W
μ_{g1-g2}	taken at V_a 3 kV, I_a 1 A, V_{g2} 1·5 kV	4·4	mA/V
g_m		7	
f (at full ratings)		30	Mc/s
c_{in}		40	pF
c_{out}		14	pF
c_{a-g1}		0·4	pF

OPERATING NOTES

Thoriated Tungsten Filament. The valve must be operated at the stated filament voltage.

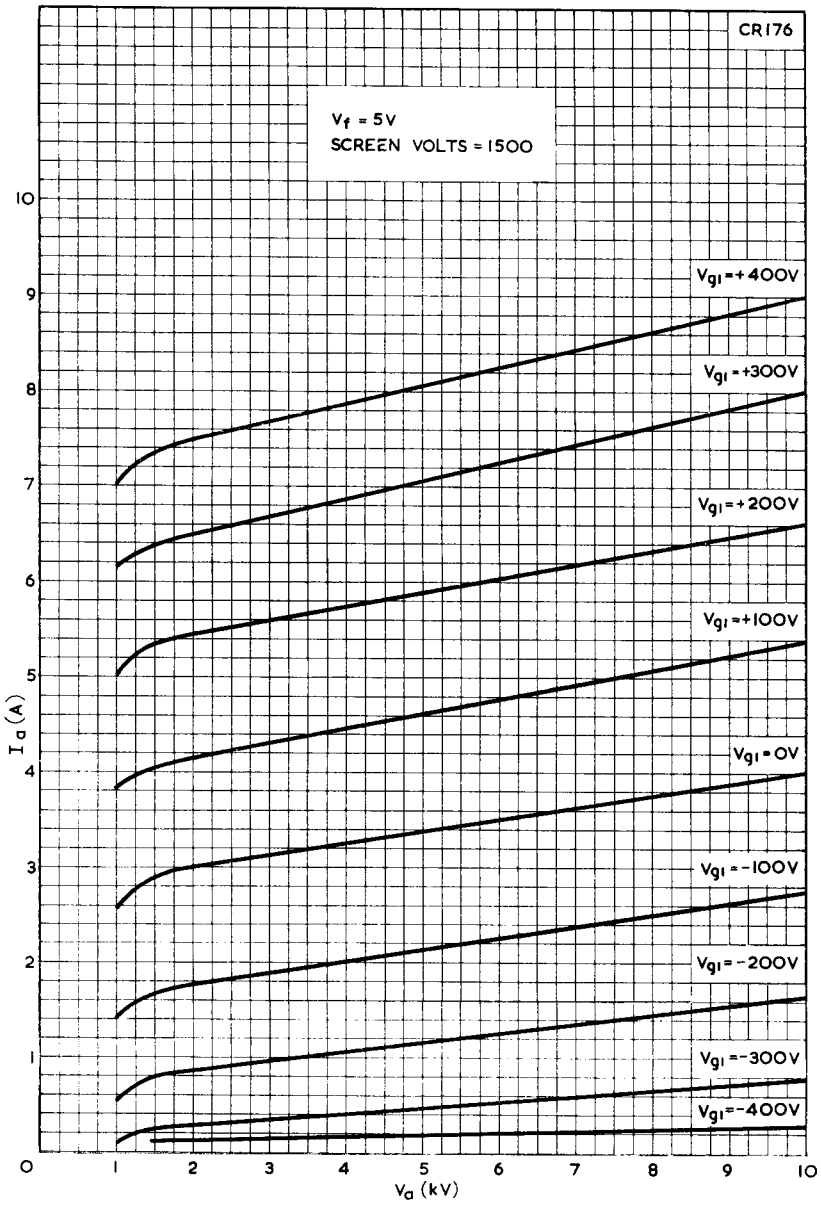
The filament current must not exceed 160 A, even momentarily, at any time.

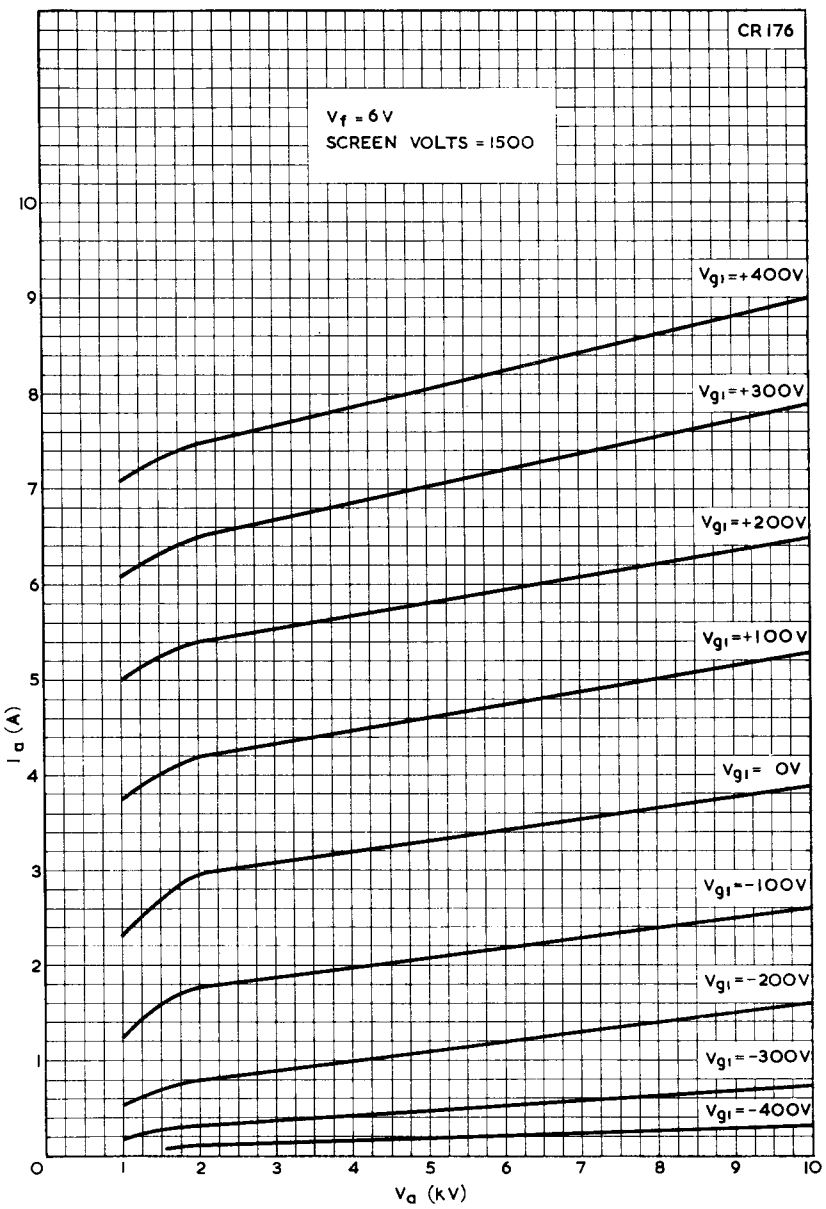


THIRD ANGLE PROJECTION USED ON THIS DRAWING.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*





PRINTED IN ENGLAND

COAXIAL NOISE DIODE TUNGSTEN FILAMENT

CV2341

ISSUE 2

A coaxial noise diode of 70Ω characteristic impedance suitable for use at frequencies up to 2500Mc/s with correction as specified and at currents up to 200 mA.

FILAMENT

*V_f (range)	0—4·7	V
I_f (at V_f=4·7)	3·8 (approx)	A

*The value of the saturated anode current is regulated by variation of the filament voltage.

An anode current of the order of 1mA is obtained at V_f=2V (approx).

MAXIMUM RATINGS (Absolute)

I_a	200	mA
V_a	400	V
p_a (convection cooled)	10	W
p_a (forced-air cooled)	40	W
V_f	5	V

CHARACTERISTICS

Characteristic impedance (Z_o)	70	(approx)	Ω
V_a	200		V
I_a (saturated)	23	(approx)	mA
V_f	3·5		V
I_f	3·2	(approx)	A

CAPACITANCE (Measured on a cold valve)

c_{a-f} 4·8 pF (approx)

TYPICAL OPERATION

V_a	180	V
V_f (range)	0—4·7 (approx)	V
I_a (saturated)	0—180	mA
Noise factor measurement (range) (uncorrected)	0—24	dB

When measuring the noise factor of an amplifier, using the technique of setting the value of I_a (saturated) to double the noise output power from the amplifier, the range of noise factor that can be measured is as shown.

Due to transit time effects, the noise factor given by the use of the formula:

$$\text{Noise factor} = 10 \log_{10} (20\, I_a\, Z_o)\ \text{dB}$$

where I_a=diode anode current in amperes
and Z_o=70Ω

will be greater than the true value. The correction will depend upon frequency and diode anode voltage. These corrections, which can only be calculated approximately, are shown in fig. 5. Better corrections can be obtained by comparison with other white noise generators. Fig. 6 shows the corrections obtained by comparison with a helically coupled argon discharge noise source and it is recommended that these corrections should normally be applied. In all cases the correction in decibels must be deducted from the noise factor obtained from the above formula.

The noise diode must be operated in a coaxial circuit as described overleaf and must be matched in this circuit into the amplifier under test with a VSWR better than 1·1:1.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England · Telephone: Chelmsford 3221 · Telex: 1953 · Telegrams: Expanse Chelmsford Telex

OCTOBER 1961

INSTALLATION AND CIRCUIT DETAILS

For use as a u.h.f. noise source, it is recommended that the valve be operated in a circuit similar to the one shown in figs. 2 and 3.

This circuit provides d.c. isolation for the applied anode voltage V_a, r.f. isolation for the applied filament power and the correct resistive termination to the line.

Isolation of V_a is obtained by separating the coaxial circuit into three parts A, B and C, (as shown in fig. 2) along the axis and joining the parts A to B and B to C with flanges separated by mica plates approximately 0·010in. thick, each forming a capacitor of at least 150pF with 500V insulation. V_a is applied to section B and thence via very flexible connectors to the valve anode.

Isolation of the heater supply is by chokes made by close-winding a length of 24 s.w.g. enamelled copper wire on a $\frac{1}{8}$in. dia. ceramic rod, the wire length being $\lambda/3$, where λ is the wavelength of the centre frequency required. These chokes feed the filament power via the inner conductors of the line through sections A and C and so to the two filament pins. Care must be taken to use very flexible finger connectors to these pins to prevent strain on the seals.

The correct resistive termination to the line is obtained by using a special resistor (Welwyn Electrical Laboratories Ltd., Type UD3611-71Ω) which forms part of the inner conductor in section A.

Noise output power is taken from the line at the end of section C which can be fitted with a suitable 70Ω coaxial connector.

The circuit should have a VSWR of less than 1·2:1 looking into section C, at the centre frequency chosen for the chokes and with the valve switched on.

The flexible connections to the anode and filament should extend round the complete circumference of the contacting surfaces and maintain the characteristic impedance of the coaxial line in these regions.

The temperature of the hottest part of the valve must not exceed 140°C. Forced-air cooling is not normally required for a p_a up to 10W. For a p_a greater than 10W, an air-flow of at least 2·5 cubic feet per minute is required, directed at right angles to the valve axis.

The valve may be mounted in any position.

Provision of circuit information in this publication does not imply a right to use any invention which may be involved and which is the subject of patents by whomsoever owned.

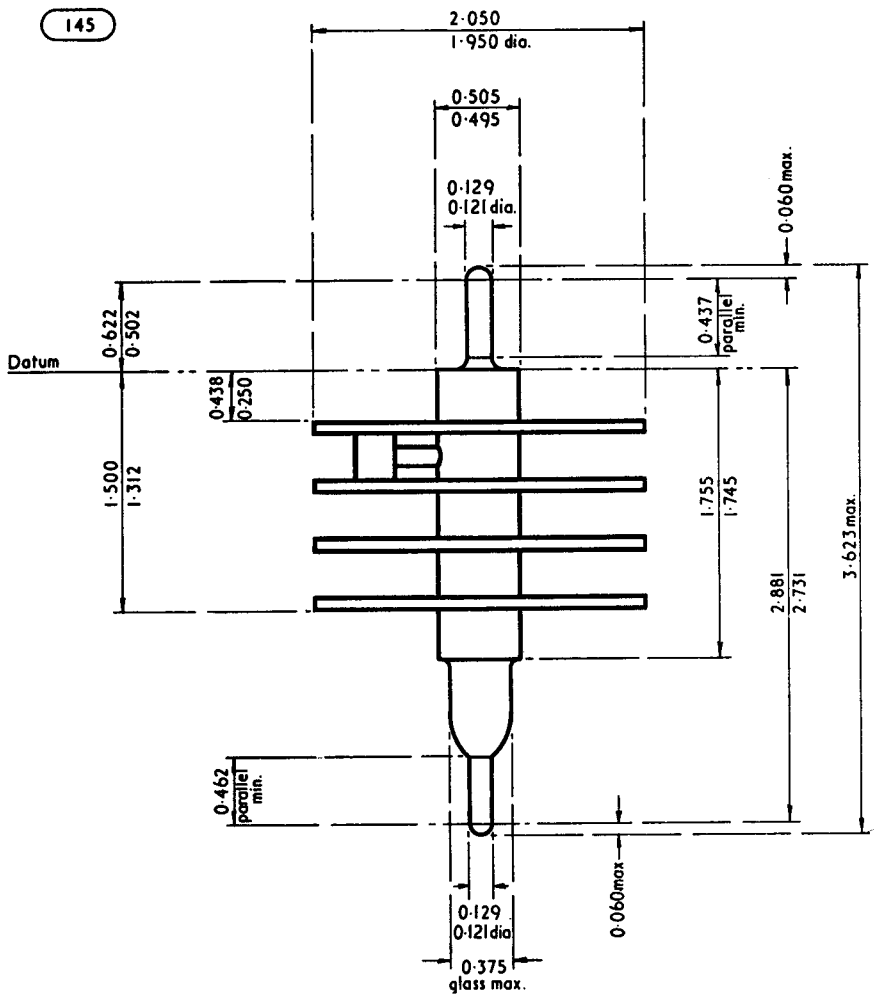


Fig. 1. Dimensions in inches.

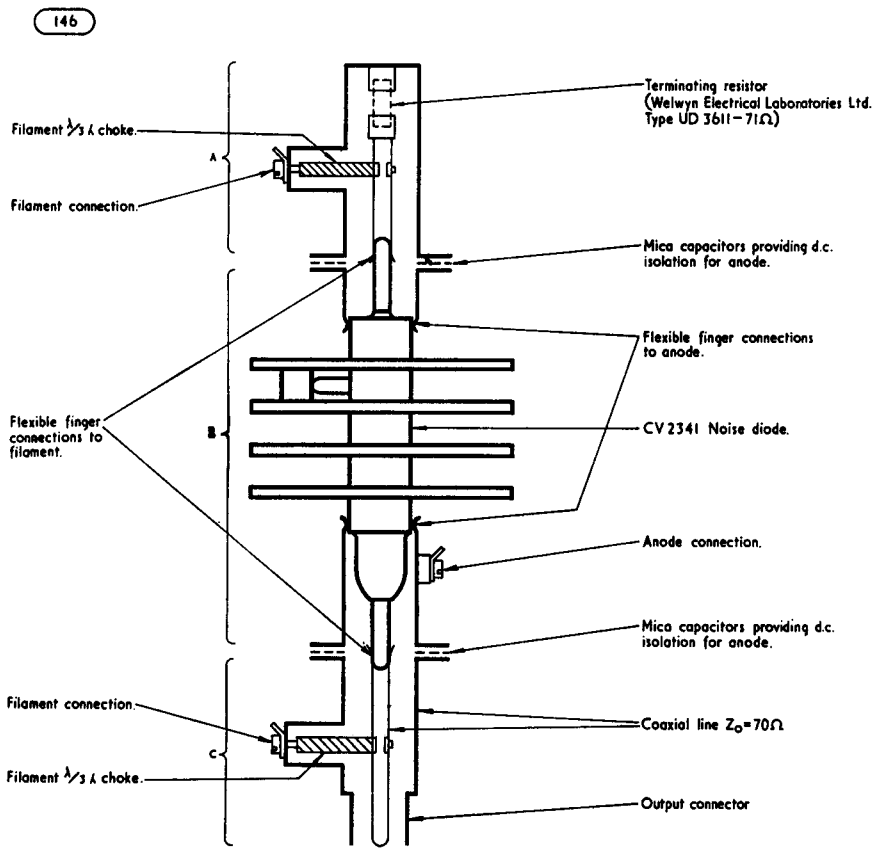


Fig. 2. Diagramatic section through coaxial noise diode circuit.

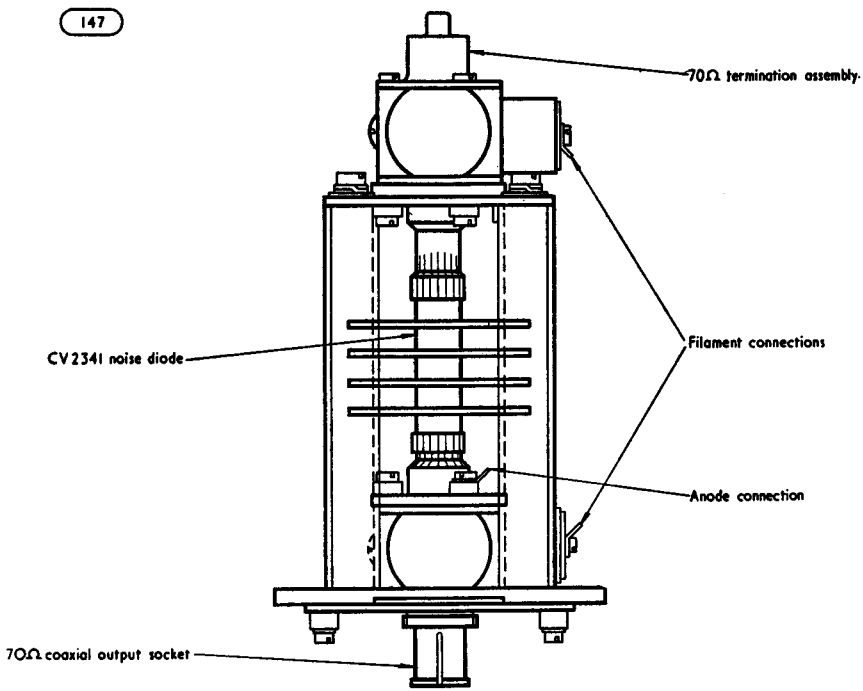


Fig. 3. External view of a typical circuit.

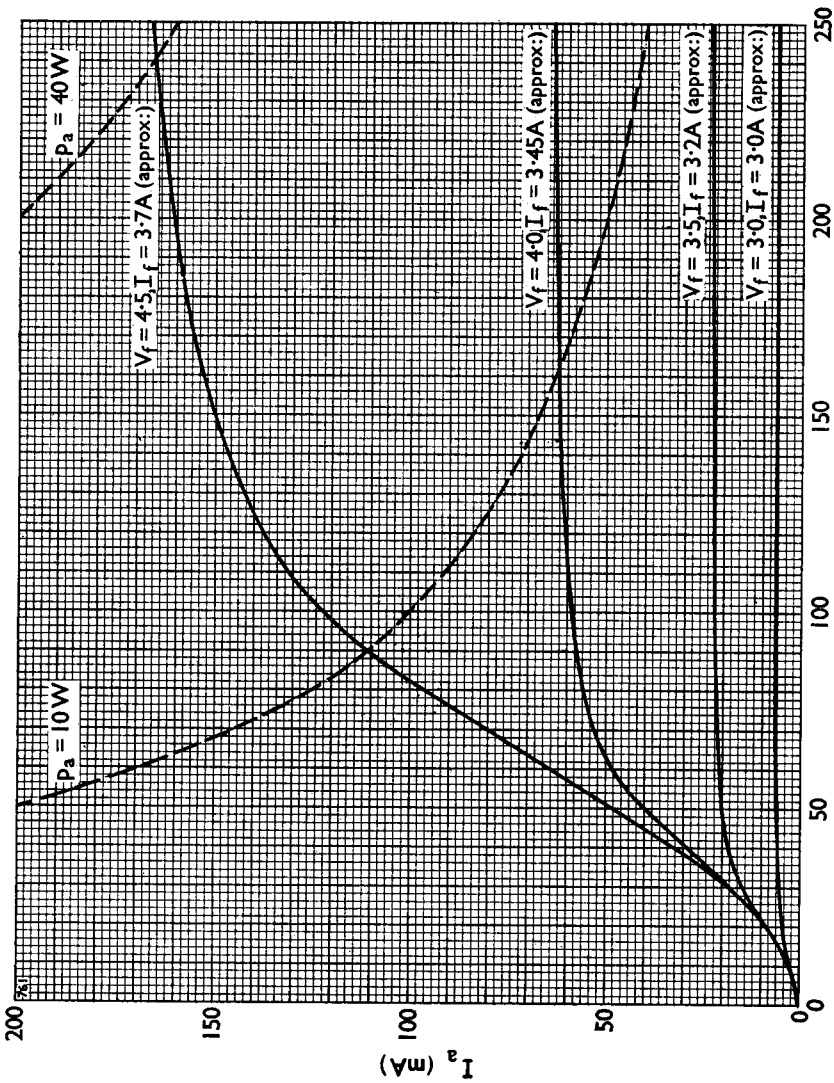

P_a = 40W
P_a = 10W
V_f = 4·5, I_f = 3·7A (approx:)
V_f = 4·0, I_f = 3·45A (approx:)
V_f = 3·5, I_f = 3·2A (approx:)
V_f = 3·0, I_f = 3·0A (approx:)
I_a (mA)
V_a
0
50
100
150
200
250

Fig. 4.

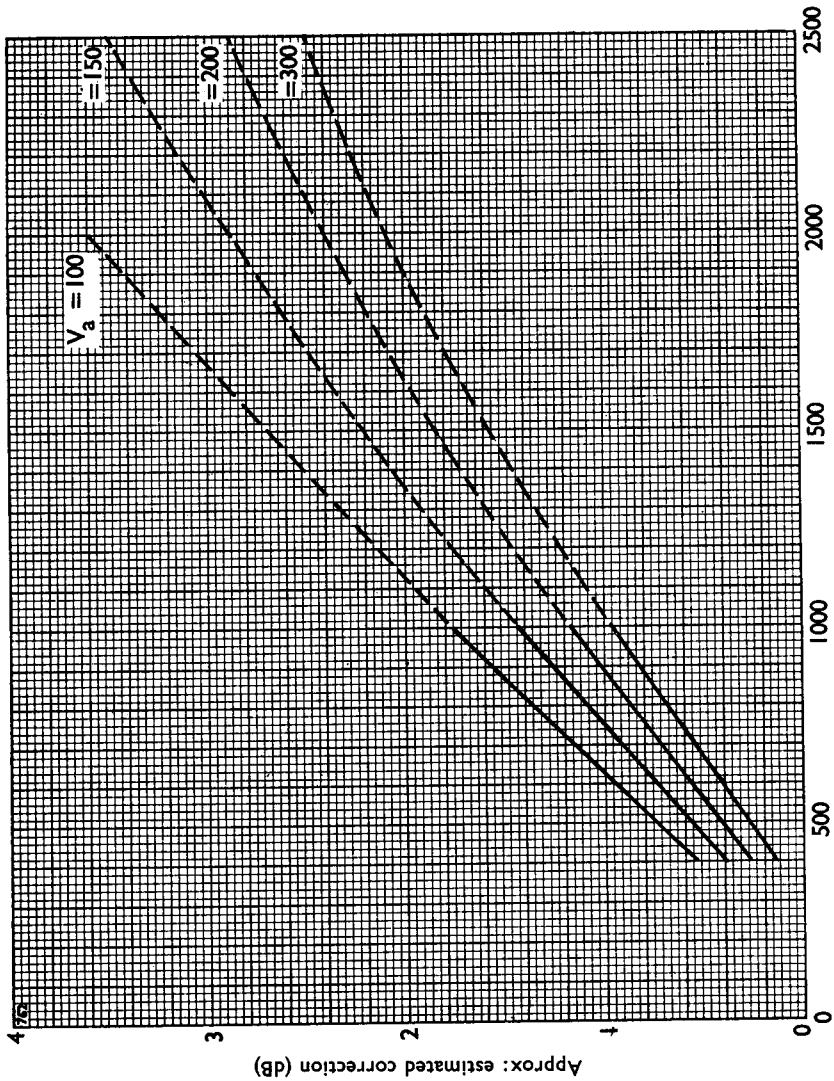


Fig. 5. Calculated corrections to noise factor measurements for frequency and anode voltage.

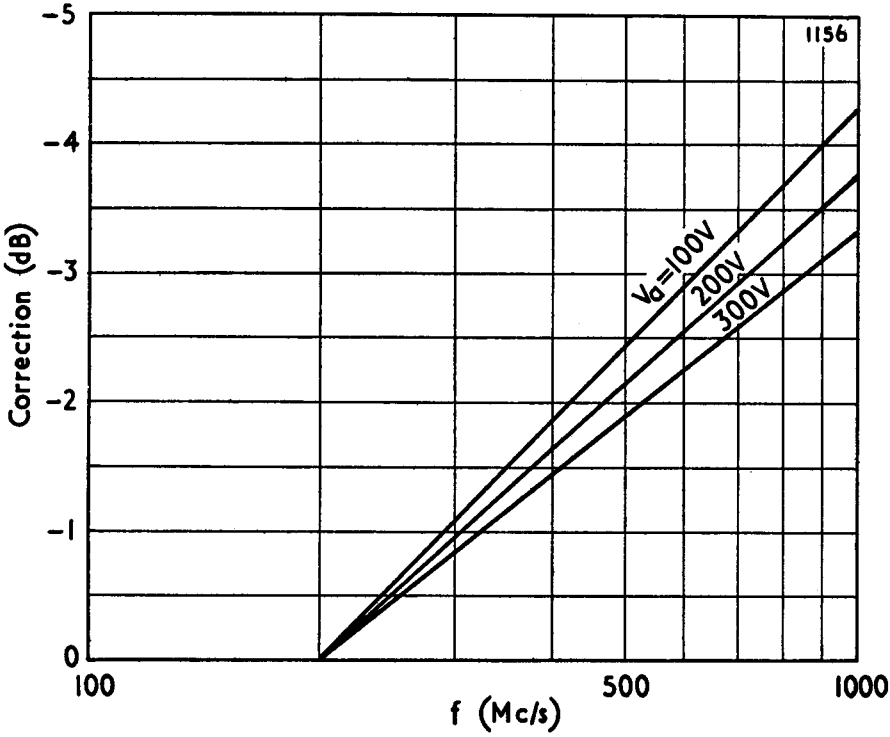


Fig. 6. Correction to be applied to noise factor measurements obtained from the CV2341 in recommended circuit based on gas-discharge noise source as reference, applying no coupling correction to gas-discharge source.

V_a = diode anode voltage

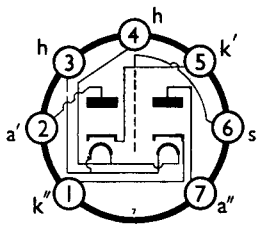
Printed in England—KC

MINIATURE
DOUBLE-DIODE
6·3V INDIRECTLY HEATED

D77

OCTOBER, 1951

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

V_h	6·3	V
I_h	0·3	A
P.I.V.	350 max.	V
I_a	5 max.	mA
i_a (pk)	50 max.	mA

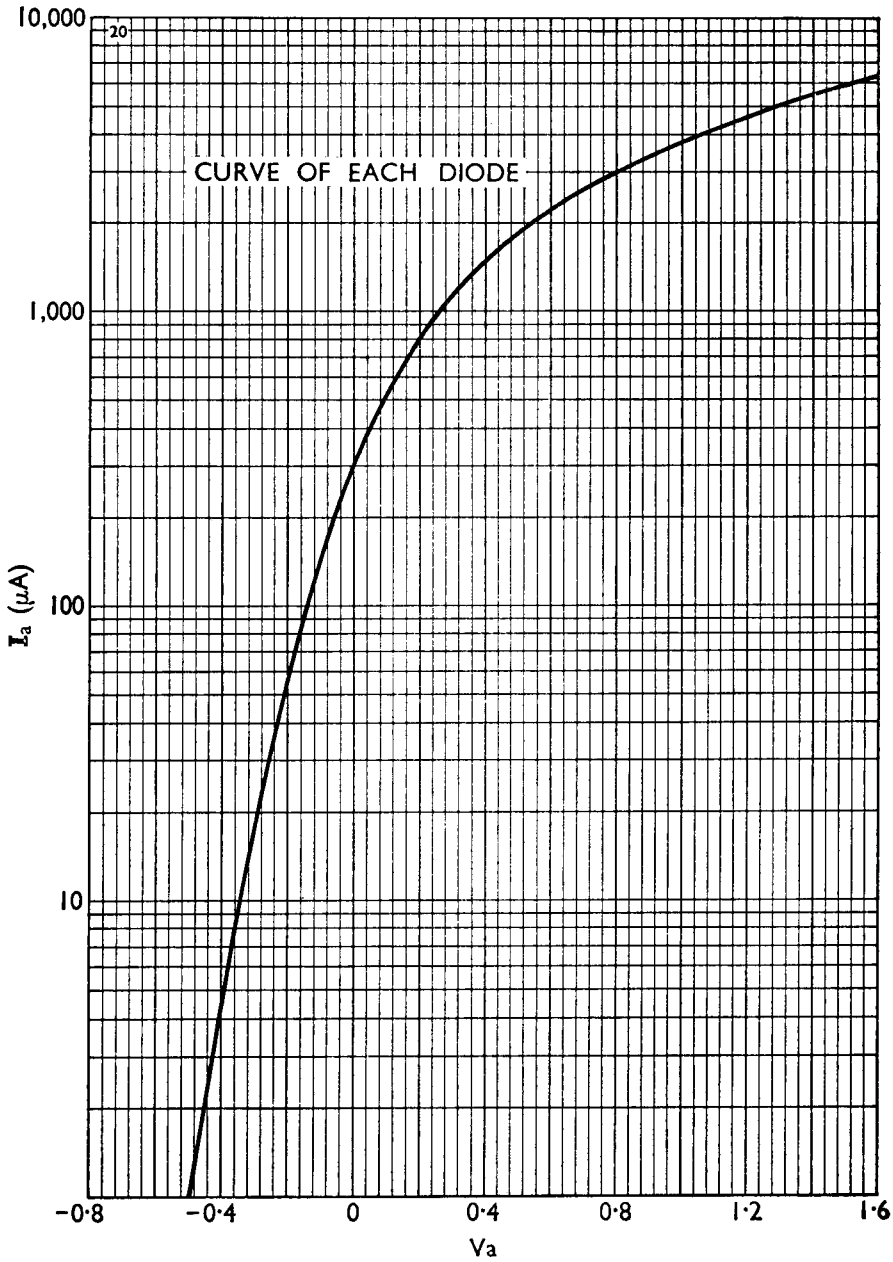
CAPACITANCES (of screened valve)

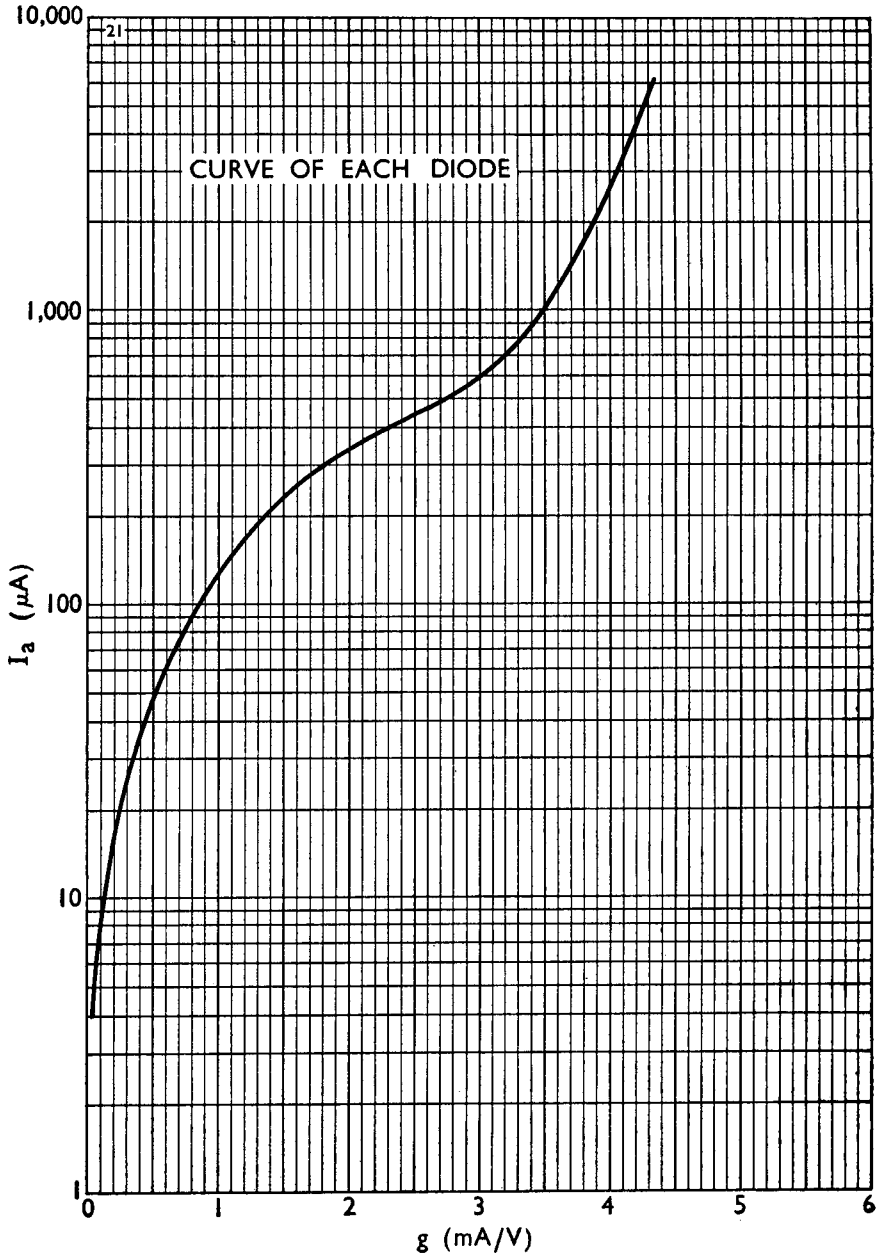
$C_{a'-k'}$	2·2	pF	$C_{a'-all}$	3·5	pF
$C_{a''-k''}$	2·2	pF	$C_{a''-all}$	3·5	pF
$C_{a'-a''}$	0·025	pF			

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

D77


10,000
20
CURVE OF EACH DIODE
1,000
100
10
I_a (μA)
−0·8
−0·4
0
0·4
0·8
1·2
1·6
Va

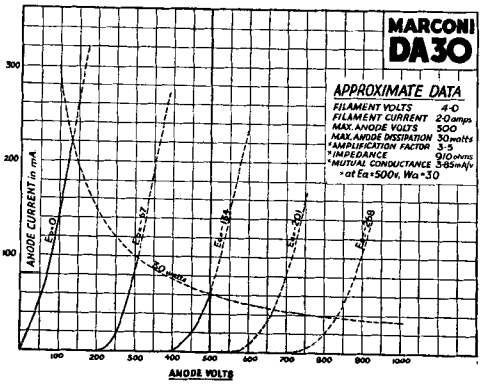

10,000
1,000
100
10
1
I_a (μA)
CURVE OF EACH DIODE
0
1
2
3
4
5
6
g (mA/V)

OV.1554 *Printed in England.* C. **October, 1951**

Marconi DA30

30 watt Triode.

Marconi DA30 is a low impedance triode specially intended for use in push pull circuits of the class A and A-B types. The output per pair in class A is 20 watts and in low loading class A-B 44-60 watts depending upon the amount of drive. The higher output necessarily increases the harmonic distortion to some extent. Circuit details, etc., on request.



Price **25/-**

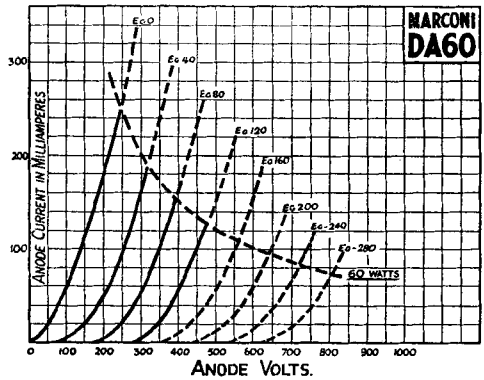
Overall Dimensions : 160×66 mm. 4 pin base.

Marconi DA60

60 watt Triode.

Marconi DA60 is a valve which has been very popular for relay, public address and other amplifiers, but is now seldom used for new apparatus owing to the introduction of the DA30, DA100 and other high efficiency types. Its chief use lies in class A circuits, either singly or in push-pull, the output being about 12 watts per valve.

Operating conditions available on request.



Price **110/-**

Overall Dimensions : 205×78 mm. Special 4 pin base.

Triode *Type DA41*

AF AMPLIFIER

General. The DA 41 is a triode valve fitted with a thoriated tungsten filament and a carbon anode. The valve was especially designed to operate in Class B audio amplifiers and a power output of 175 W may be obtained, with low distortion, from a pair of valves arranged in push-pull.

APPROXIMATE DATA

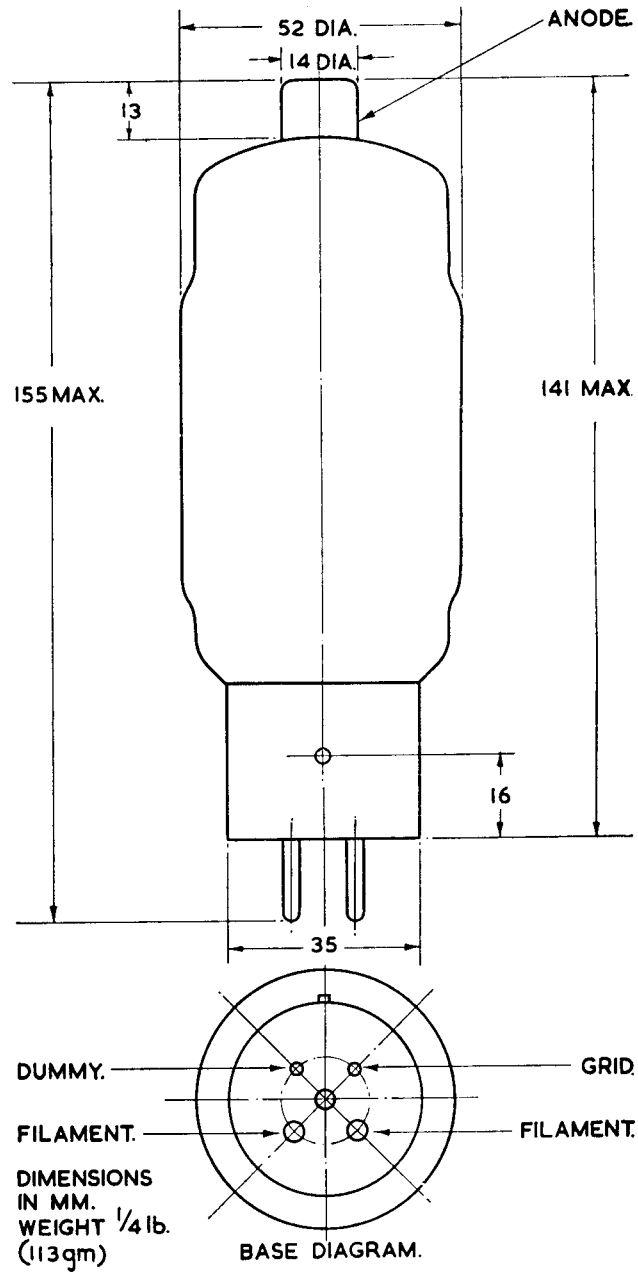
V_h		7·5	V
I_h		3·1	A
V_a		1	kV
p_a		40	W
μ	taken at V_a 1 kV	62	
g_m	p_a 40 W	3·6	mA/V
$C_{a\text{-}g1}$		5·9	pF
$C_{a\text{-}k}$		1·8	pF
$C_{g1\text{-}k}$		10	pF

Typical Operation

PUSH-PULL AUDIO AMPLIFIER. CLASS B

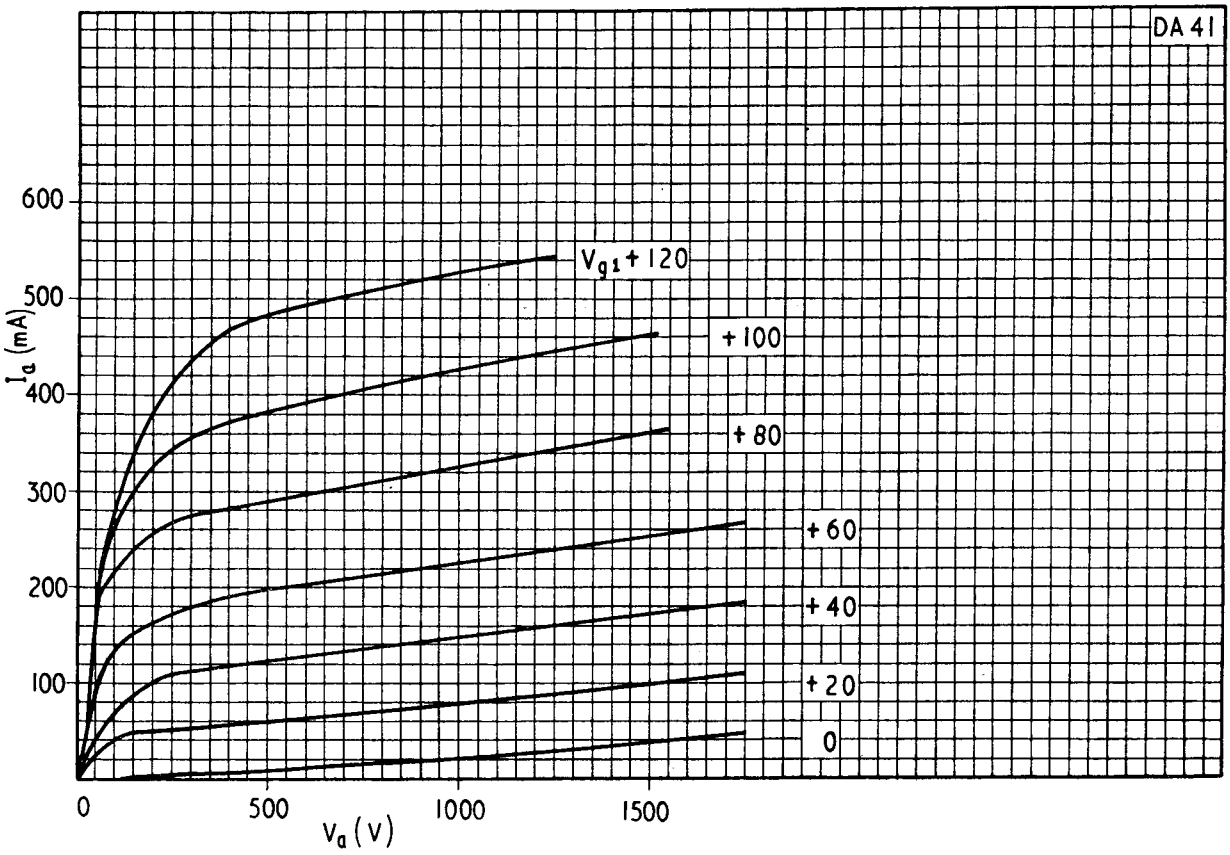
Per pair of valves

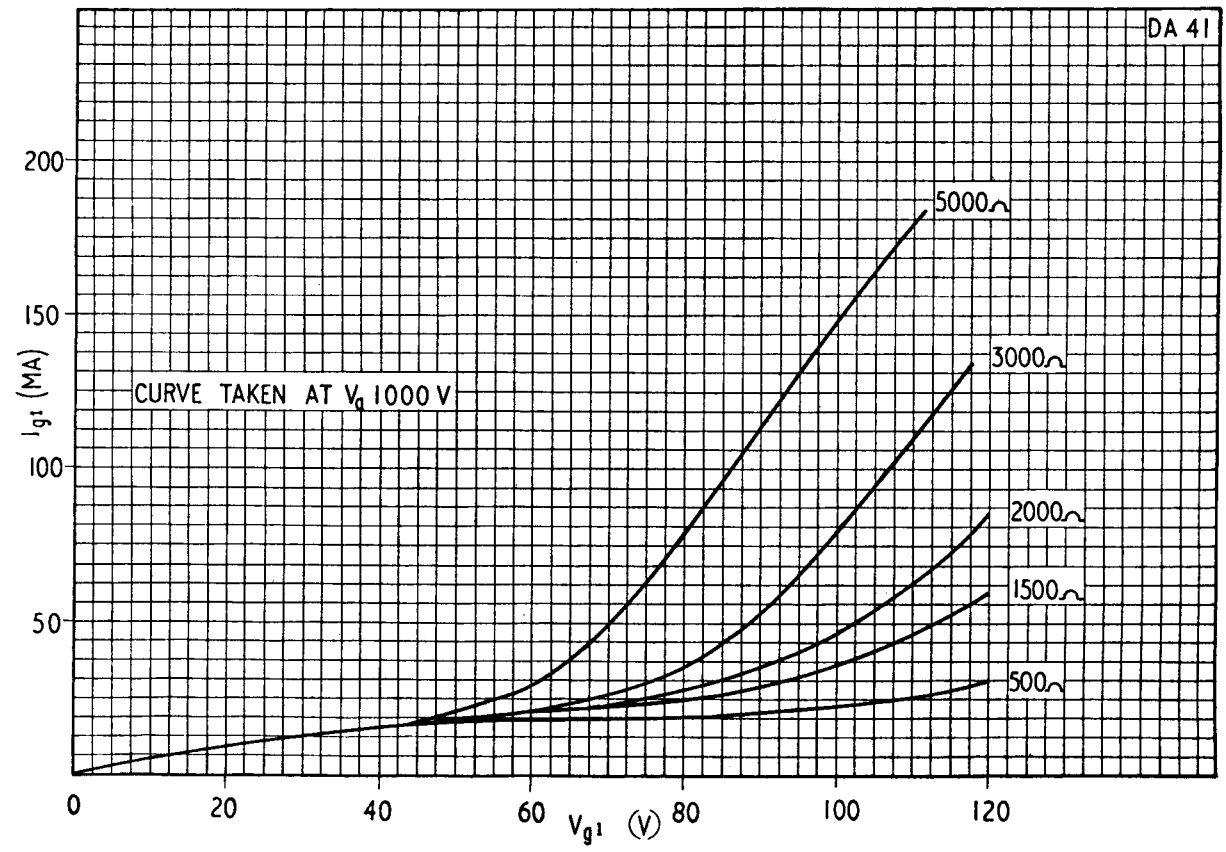
V_a	1	kV
V_{g1}	0	V
$I_{a(zero\text{-}sig)}$	44	mA
$I_{a(max\text{-}sig)}$	280	mA
$R_{L\ (a'\text{-}a'')}$	7	kΩ
$V_{in\ (pk)(g_1'\text{-}g_1'')}$	220	V
$I_{g1(max\text{-}sig)}$	30	mA
P_{out}	175	W
D	5	%

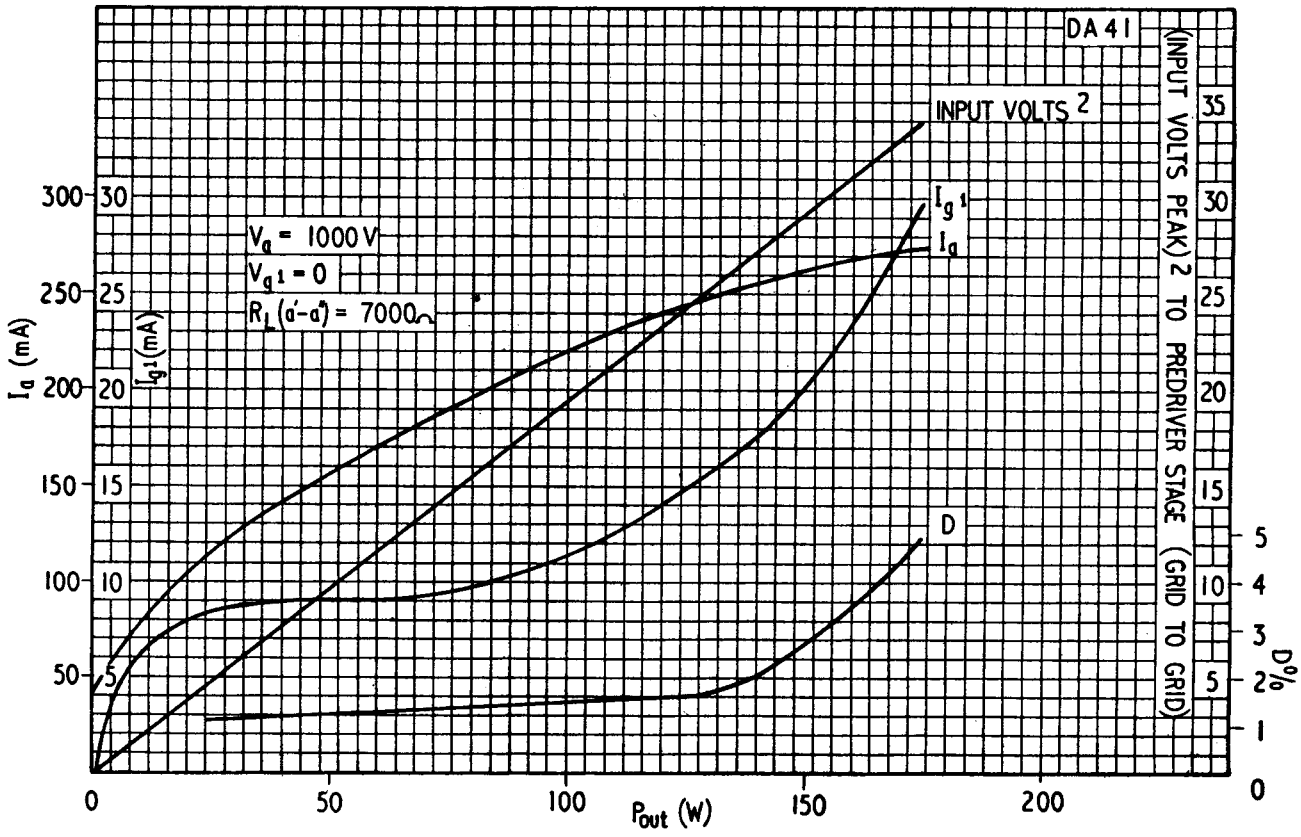


MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford


DA 41
600
500
400
300
200
100
I_a (mA)
V_{g1} + 120
+ 100
+ 80
+ 60
+ 40
+ 20
0
0
500
1000
1500
V_a (V)


DA 41
200
150
100
50
I_{g1} (MA)
CURVE TAKEN AT V_a 1000 V
5000Ω
3000Ω
2000Ω
1500Ω
500Ω
0
20
40
60
80
100
120
V_{g1} (V)


DA 41
INPUT VOLTS 2
I_{g1}
I_a
D
V_a = 1000 V
V_{g1} = 0
R_L (a'-a') = 7000Ω
I_a (mA)
I_{g1} (mA)
P_{out} (W)
(INPUT VOLTS PEAK) 2 TO PREDRIVER STAGE (GRID TO GRID)
D%
300
250
200
150
100
50
30
25
20
15
10
5
0
50
100
150
200
35
4
3
2
1



PRINTED IN ENGLAND

Triode *Type DA42*

AF AMPLIFIER

General. The DA42 is a power amplifying triode fitted with an indirectly heated cathode. The valve was especially designed to operate in Class B audio amplifiers and a power output of 175 W may be obtained, with low distortion, from a pair of valves arranged in push-pull.

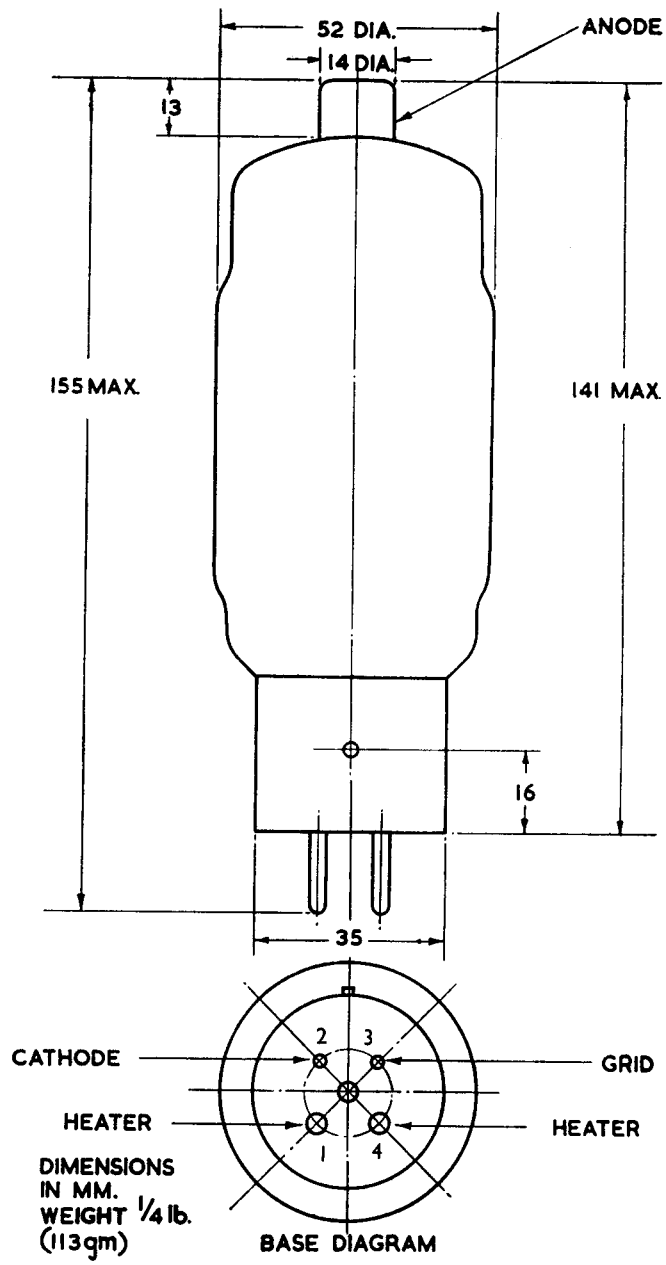
Cooling. The valve must be adequately ventilated although no special precautions are necessary except to ensure that the temperature of the hottest part of the bulb does not exceed 250°C.

Mounting. The valve should be mounted in a vertical position with the base downwards.

Microphony. The DA42 is free from microphony in normal receiver applications.

APPROXIMATE DATA

V_h		7·5	V
I_h		1·2	A
V_a		1	kV
p_a		40	W
I_a		40	mA
g_m	taken at V_a 1 kV	3	mA/V
r_a	I_a 40 mA	24	kΩ
μ		72	
$c_{a\text{-}g1}$		4	pF
$c_{a\text{-}k}$		1	pF
$c_{g1\text{-}k}$		5·2	pF



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Typical Operation

PUSH-PULL AUDIO AMPLIFIER. CLASS B

per pair of valves unless stated otherwise

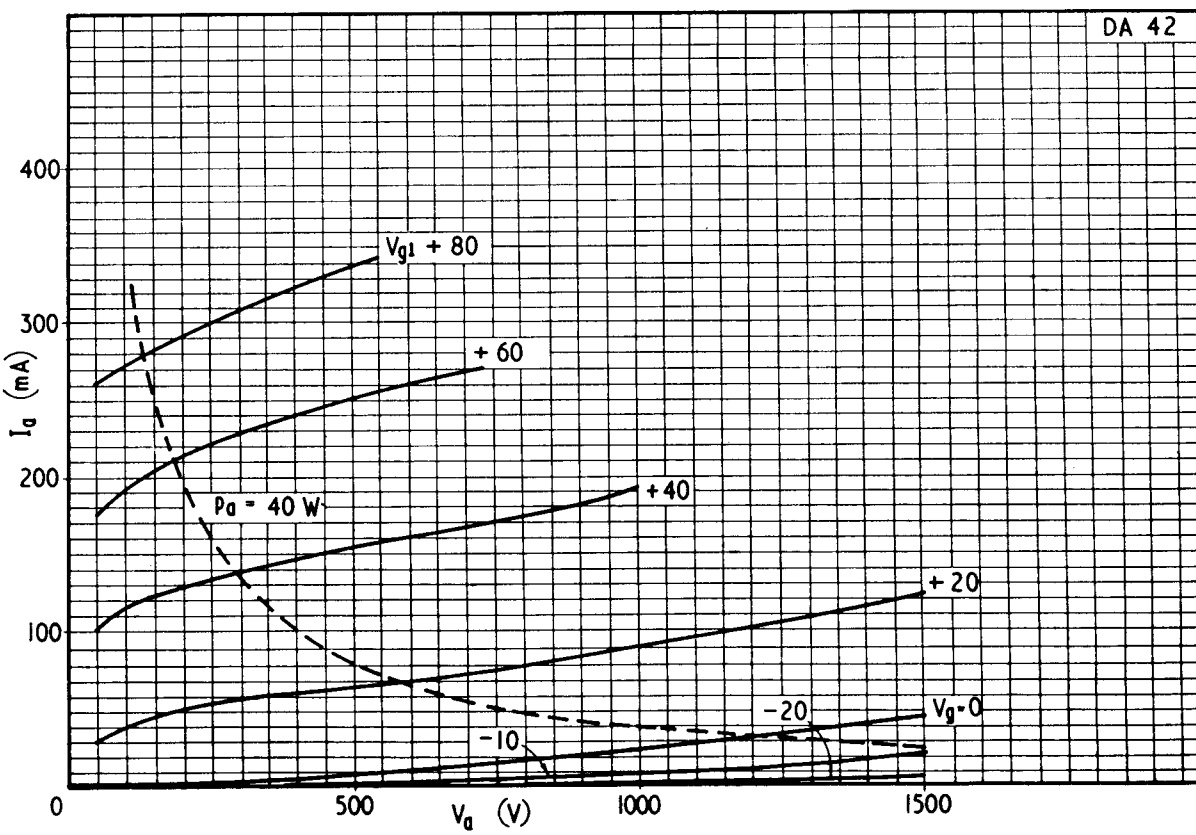
V_a	1	kV
V_{g1}	0	V
$I_{a\ (zero\text{-}sig)}$	50	mA
$I_{a\ (max\text{-}sig)}$	275	mA
→ $I_{g1\ (max\text{-}sig)}$	50	mA
→ $I_{g1\ (pk)}$ per valve	100	mA

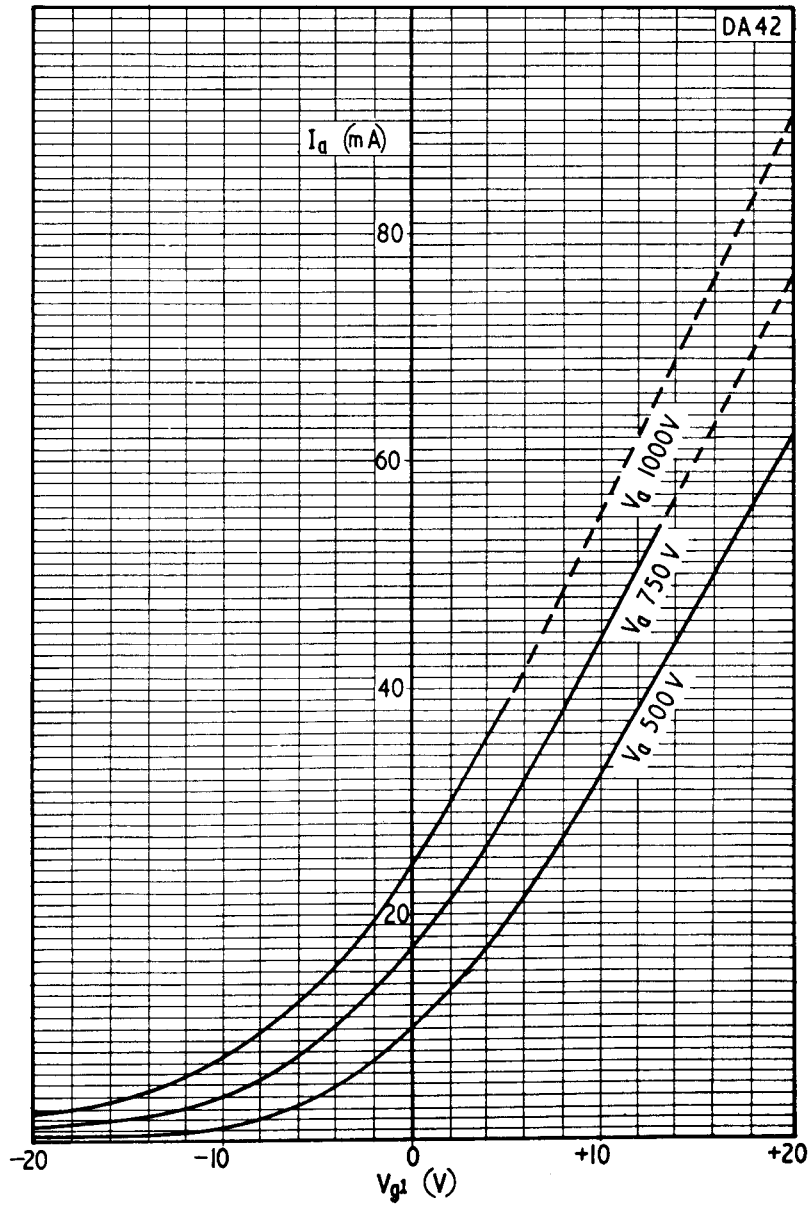
$R_{L\ (a'\text{-}a'')}$	10*	kΩ
$V_{in\ (pk)\ (g1'\text{-}g1'')}$	200	V ←
$Z_{in\ (g1'\text{-}g1'')}$	4	kΩ
Z_{out}	15	kΩ
P_{drive}	5	W
P_{out}	175*	W
$p_{a\ (zero\text{-}sig)}$ per valve	25	W
$p_{a\ (max\text{-}sig)}$ per valve	50	W
D	6	%

OPERATING NOTES

* The above values apply to normal operating (speech and music) conditions only. Continuous 100% tone modulation will result in excessive dissipation and, for such applications, the anode-anode load, $R_{L(a'\text{-}a'')}$, should be increased to 12 kΩ, resulting in a reduction of power output (P_{out}) to 150 W.

Where the valve DA 42 is used to replace a DA 41, it is necessary to earth pin 2.




DA42
I_a (mA)
80
60
40
20
V_a 1000V
V_a 750 V
V_a 500 V
-20
-10
0
+10
+20
V_{g1} (V)



PRINTED IN ENGLAND

Triode *DA42*

CIRCUIT SUPPLEMENT No. 1

The DA42 is a triode having an indirectly heated cathode. It is intended for use in pairs in Class B audio amplifiers to provide outputs of 175W.
The DA42 may replace the DA41 in existing equipment with slight wiring changes.

CLASS B AMPLIFIERS

The Class B amplifier is recognised as an economical method of obtaining a high audio output because of its high efficiency and the simplicity of the circuit arrangement. The absence of a grid bias supply renders the valve self-protective and no interlock is required to hold off the anode voltage until the bias voltage is established.
This report covers the design of a 175W amplifier and a simplified arrangement for the d.c. supply voltage is discussed.
The DA42 is normally suitable for use in existing amplifiers using the DA41, if the cathode (pin 2) is connected to earth. The anode connector may require replacement to fit the smaller 9mm. top cap. The separate cathode connection permits individual monitoring with a single heater supply.

TYPICAL OPERATION

Push-Pull Class B	**Two Valves**	**Data per Pair**	
V_a		1,000	V
V_g		0	V
$I_{a\ (o)}$		50	mA
$I_{a\ (max\text{-}sig)}$		275	mA
$I_{g\ (max\text{-}sig)}$		50	mA
$V_{in\ (pk)\ (g\text{-}g)}$		175	V
p_{dr}		5	W
$R_{L\ (a\text{-}a)}$		10	kΩ
P_{out}		170	W
D		6	%
Z_{out}		15	kΩ

The operation is shown in detail in the curves, Figs. 1 and 2. It will be seen from Fig. 1 that the anode dissipation rises if the load is reduced and the valves should not be used in the region shown dotted. Fig. 2 shows the performance at the selected 10kΩ load and Fig. 3 the valve's behaviour at various anode voltages.

CIRCUIT

The recommended circuit is shown in Fig. 4. The two DA42 valves are used in a push-pull Class B amplifier with zero grid bias. A low impedance driver stage is required and two KT66 valves are used in a cathode-coupled circuit with a bridged transformer T2. This arrangement preserves the wave-form in spite of the low and variable load reflected by the DA42.
With a 500V supply for the KT66 valves, a bias voltage of 45 would be required, giving an anode current of 70-80mA per pair. The effective cathode bias resistance per valve would be of the order of 1·2kΩ. A part of this resistance occurs in each half-primary of the transformer T2, but usually an additional resistor, R21, common to both valves, is necessary.
A suitable transformer design is shown in Fig. 9. The half-primary resistance is about 300Ω so that R21 has a value of 440Ω. The secondary resistance should be as low as possible.
The bridging capacitors C9 and C10 are not critical in value, but should be at least 8μF. If the capacitance is too low the distortion will increase.
The output transformer T1 should have low leakage reactance between the two half-primaries and between the primary and secondary. For the usual 100V output line, of 60Ω in this case, the primary-secondary ratio would be 13: 1.
An output voltage from the cathode-coupled stage of 75+75 rms is required to give full output from the DA42. A rather higher input to the cathode-coupled

stage is necessary, and the previous stage is called upon to provide 80+80V with low distortion. This is obtainable from two N709 valves acting as resistance-coupled pentodes, in view of the high anode supply voltage available, if the screen and bias resistors have optimum values.
The combined anode and screen current of each N709 is 6mA, the anode and screen voltages being 150 and 60, respectively. With an input of 1+1V rms an output of 80+80V is given at less than 2% distortion
The stage preceding the N709 voltage amplifiers may utilise any small triode. The DH77 is shown in Fig. 4. The anode current is approximately 1mA.

ADDITION OF DEGENERATION

When an improved performance is required degeneration may be incorporated (Fig. 5). The cathode-coupled, bridged transformer T2 causes negligible phase shift so that the degeneration may be taken from the secondary of the output transformer T1 to the cathodes of the N709 valves. The bias resistor R8 is replaced by two resistors R26, R27, and a resistor is connected to each side of the output transformer (R28, R29).
This arrangement will give 12-14db degeneration which is sufficient to provide a damping factor of about 4·5 to the load connected to the output transformer. The value of the resistors R28, R29 will depend on the load impedance used, but with the usual 100V output, *i.e.* 60Ω, the resistors may be 3·3kΩ each.
The overall performance with degeneration is as follows:

Power output	165W
Distortion	⩾2%
Input to DH77 stage	5V rms
Damping Factor	4·5 approx.

ANODE SUPPLY UNIT

The anode supply unit, Fig. 6, is somewhat unusual in that one set of rectifiers and one h.t. transformer are used to provide two d.c. voltages, one of which is twice the value of the other. It would seem that this circuit offers certain advantages over the conventional arrangement both in initial cost and in space required. The rectifiers are not equally loaded, two of them having to provide the low voltage current of 100mA in addition to the 275mA at 1000V required at full output. This the U19 is well able to do since its rated maximum in this type of circuit is 500mA at 4kV d.c. The operation of this circuit is shown more clearly in Fig. 7. Two of the U19 and the components shown dotted take no part in the low voltage supply and the circuit resolves into a two-valve, biphase half-wave arrangement with the valves inverted. The high voltage supply utilises the four U19 valves, but the components L2, L3, C15 and C16 take no part in the operation. The input choke L2 must not be omitted. Series-connected capacitors are recommended for C13 (a, b and c) and for C15 (a and b). In a Class B amplifier a very large variation of anode current occurs with a change in input signal. As the internal impedance of the power supply causes some interaction between the 1000V and 500V supplies, a sudden demand for maximum current would cause a reaction in the 500V supply if the conventional 4μF or 8μF capacitors were used for C13. The specified capacitor has a value of 160μF (450V) and three of these in series provide an effective 50-60μF with a working voltage of 1350. Resistors R30, R31 and R32 equalise the applied voltage. C15a and b are similar capacitors.
An interesting circuit developed from this arrangement is shown in Fig. 8 where three biphase rectifying valves are used. If the high and low d.c. outputs are similar each valve anode is equally loaded. Three U52 valves would provide 250mA at each of two voltages.

Fig. 1.

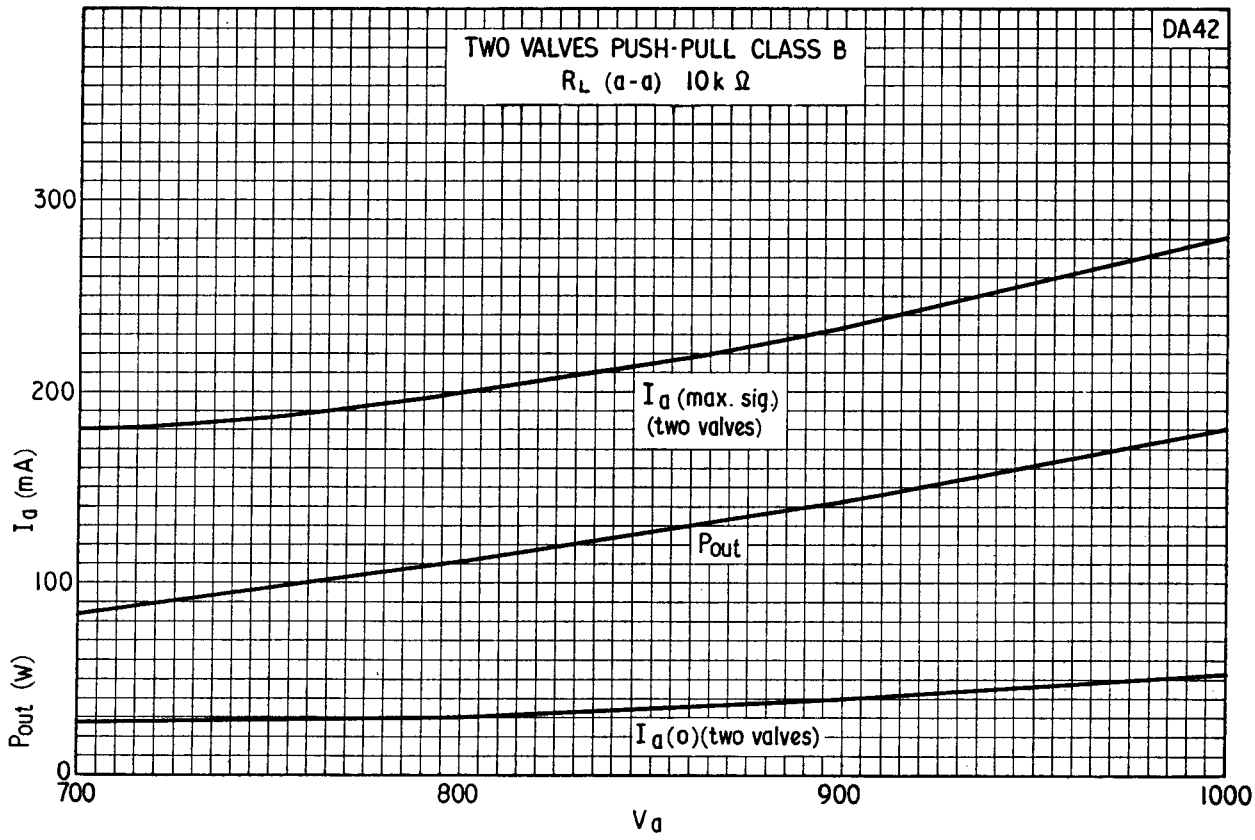

TWO VALVES PUSH-PULL CLASS B
R_L (a-a) 10k Ω
DA42
300
200
100
0
I_a (mA)
P_{out} (W)
I_a (max. sig.)
(two valves)
P_{out}
I_a(o)(two valves)
700
800
900
1000
V_a

Fig. 2.

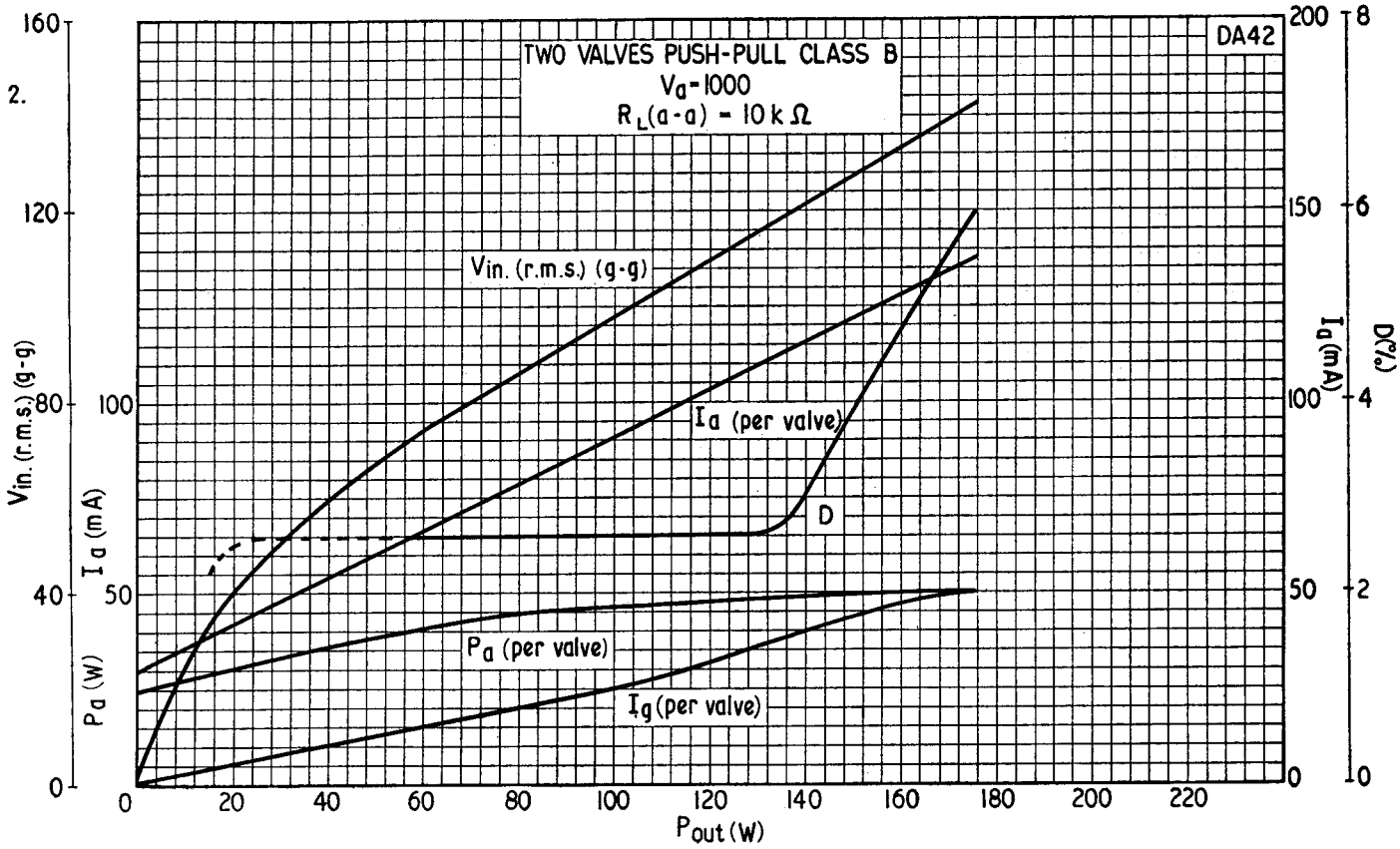
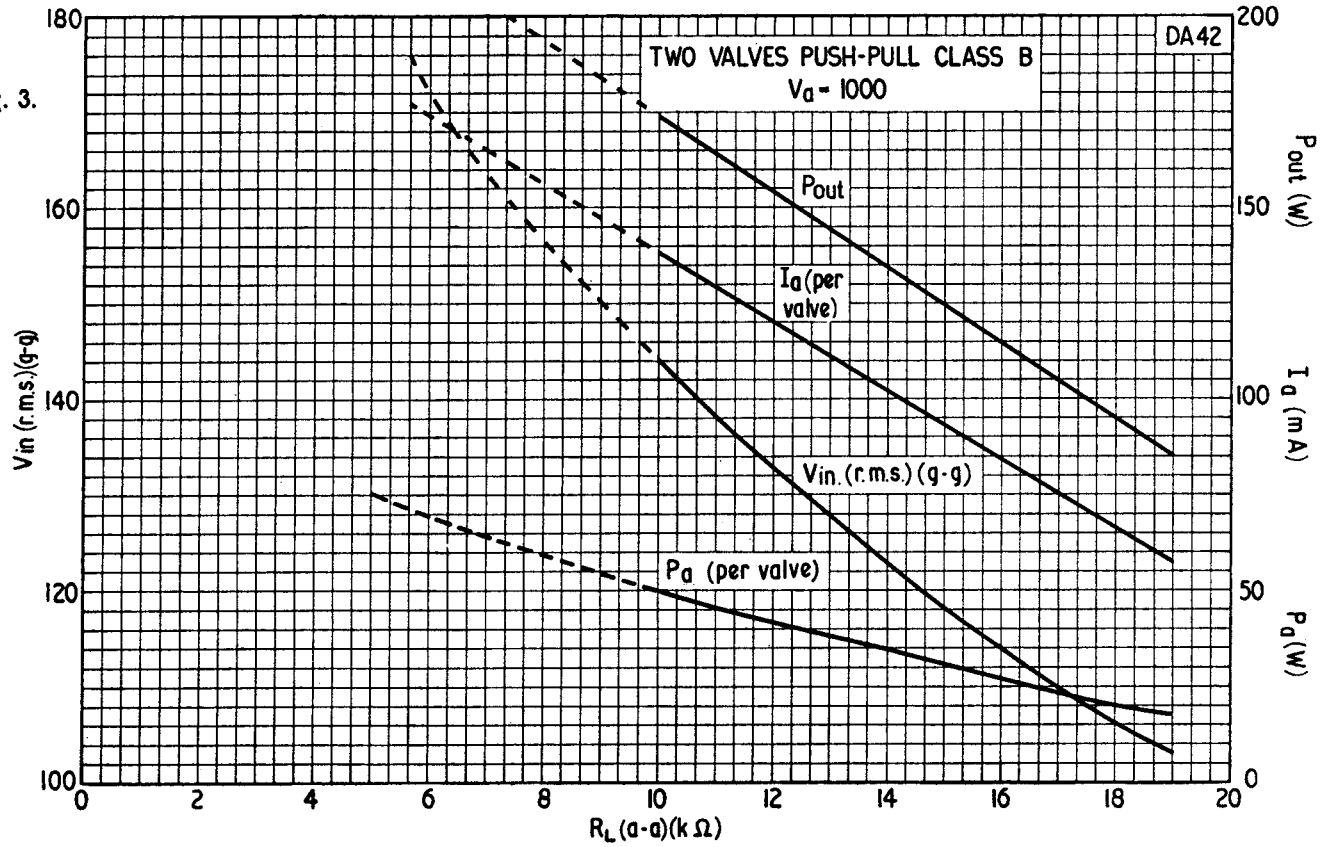

TWO VALVES PUSH-PULL CLASS B
V_a=1000
R_L(a-a) = 10 k Ω
DA42
160
120
80
40
0
$V_{in.}$ (r.m.s.) (g-g)
100
50
0
I_a (mA)
P_a (W)
200
150
100
50
0
I_a (mA)
8
6
4
2
0
D(%)
$V_{in.}$ (r.m.s.) (g-g)
I_a (per valve)
D
P_a (per valve)
I_g (per valve)
0
20
40
60
80
100
120
140
160
180
200
220
P_{out} (W)

Fig. 3.


TWO VALVES PUSH-PULL CLASS B
Va = 1000
DA42
Pout
Ia (per valve)
Vin. (r.m.s.) (g-g)
Pa (per valve)
Vin (r.m.s.)(g-g)
Pout (W)
Ia (mA)
Pa (W)
RL (a-a)(k Ω)
180
160
140
120
100
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
20

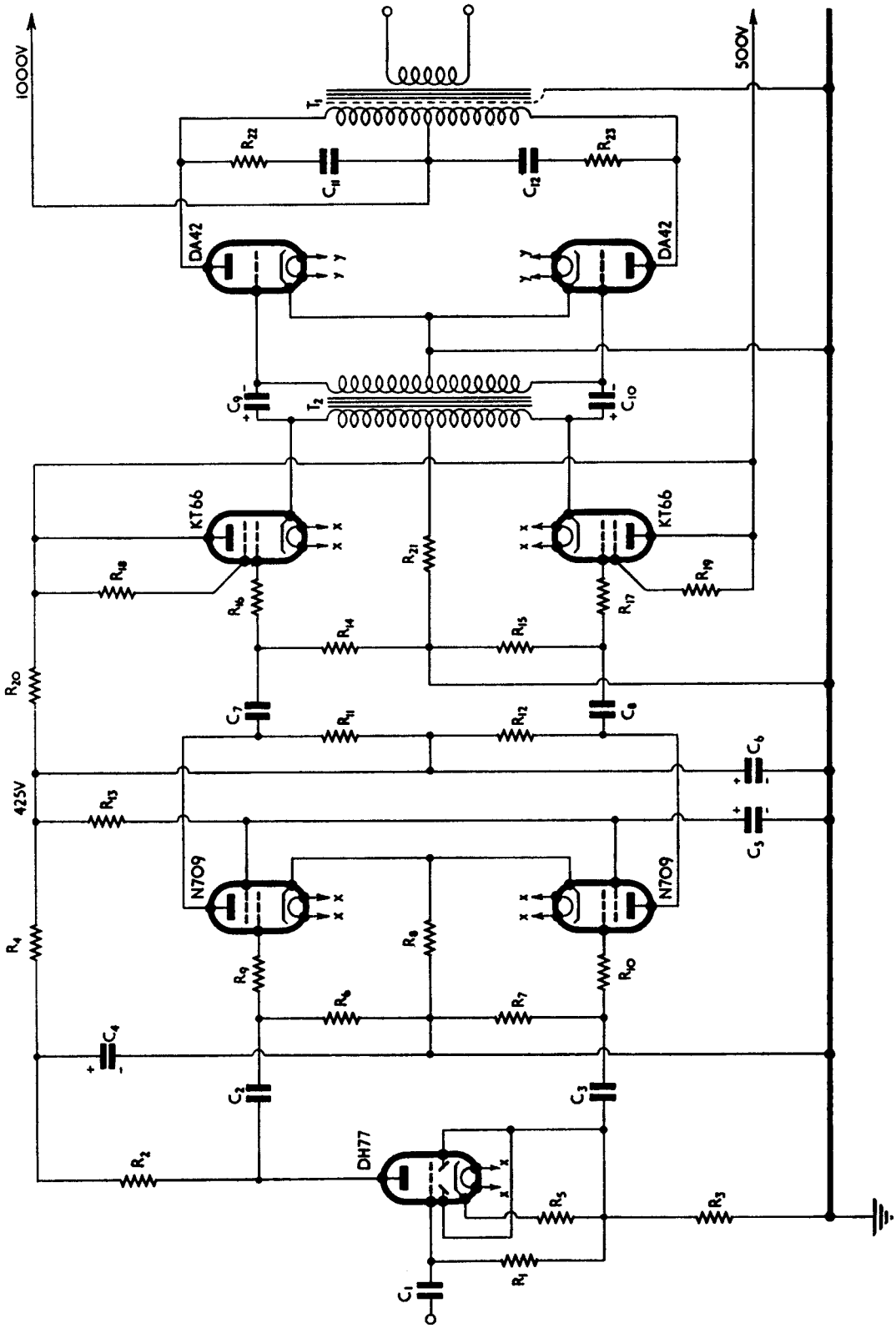


Fig. 4. 175W Class B Amplifier. Component values are given on page 8

Fig. 5. The addition of degeneration to the circuit of Fig. 4, as explained on page 2

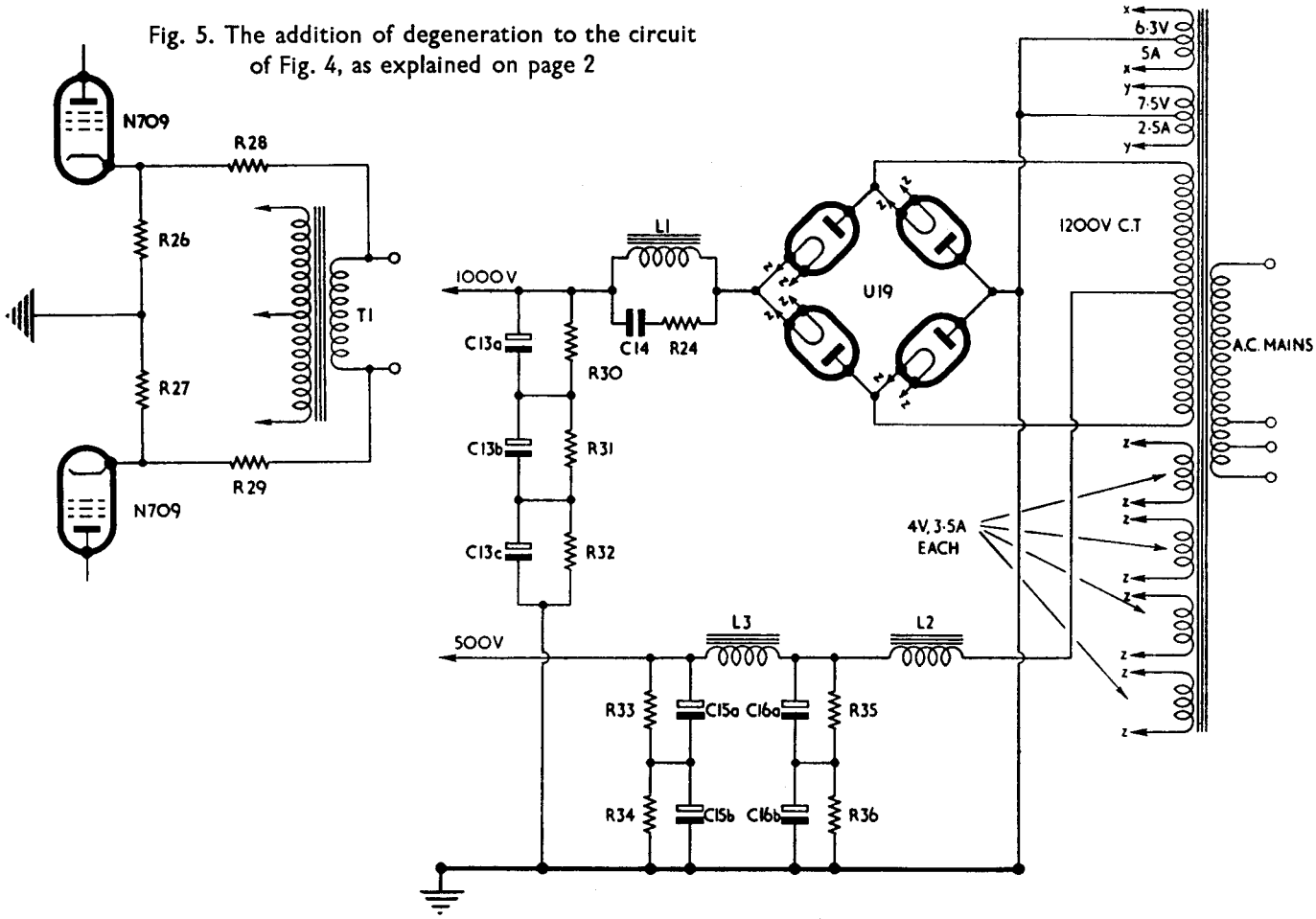


Fig. 6. Power supply unit. Component values are given on page 8

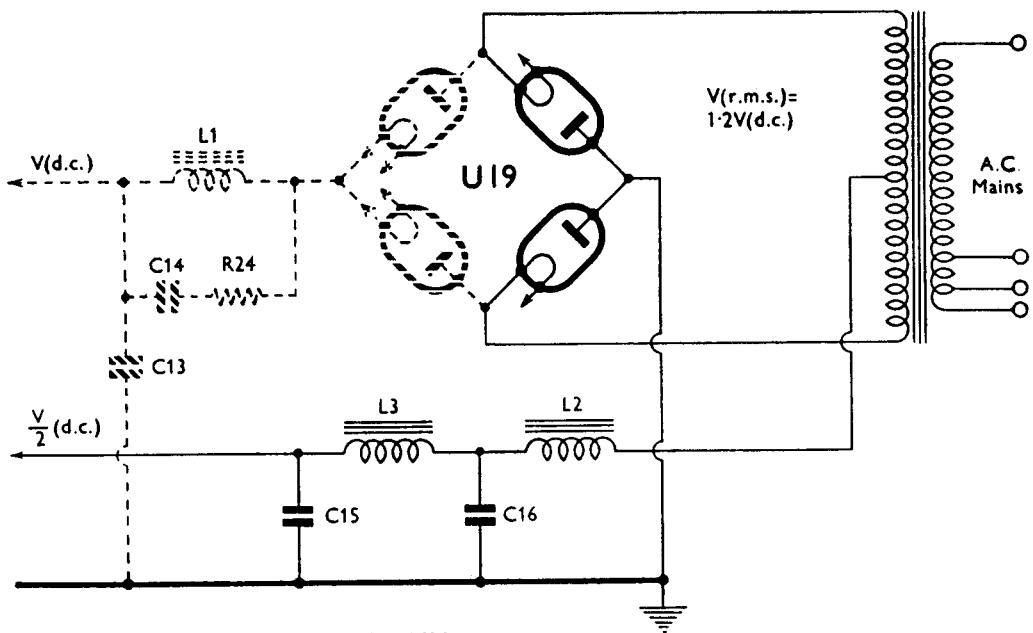


Fig. 7. Operation of the power supply of Fig. 6; 500V section.
See page 2

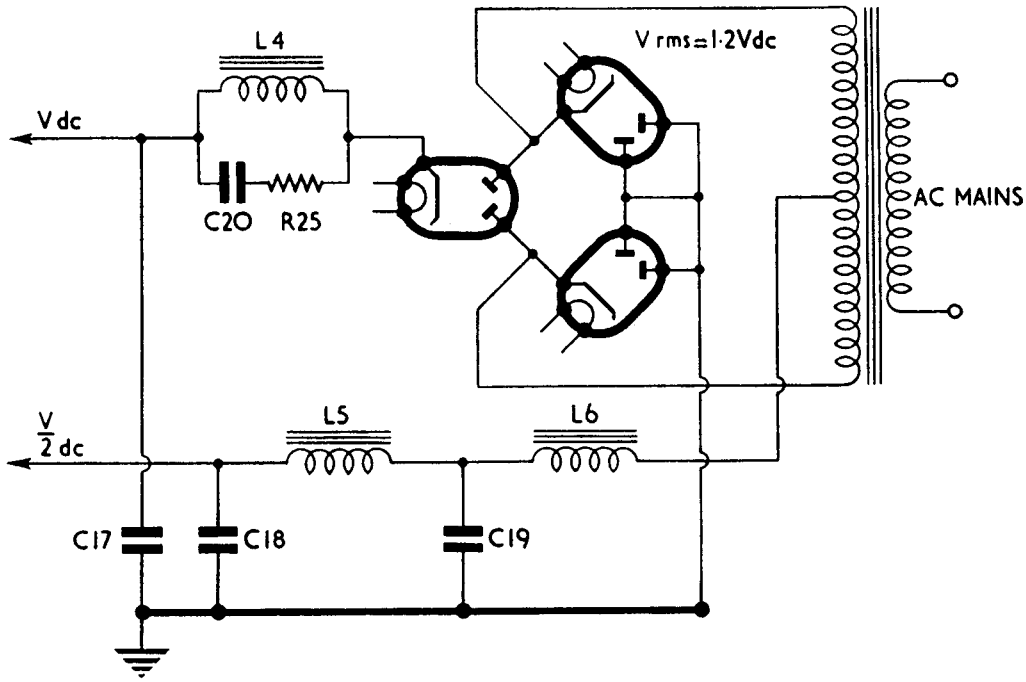


Fig. 8. Using three bi-phase rectifiers to give two output voltages

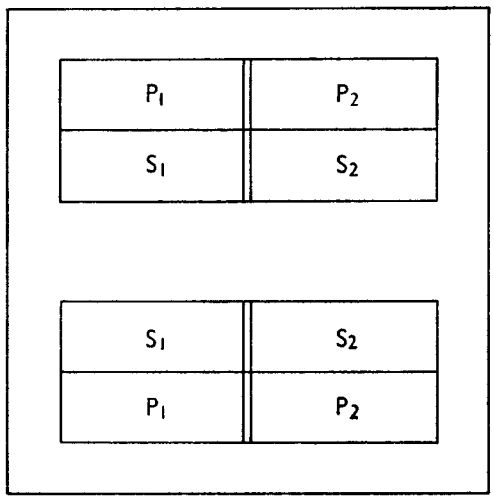


Fig. 9. Design of coupling transformer, T2

Core: Stalloy No. 4 square section, no gap.

Primary: 2000+2000 turns, 38 swg.

Secondary: 2000+2000 turns, 30 swg.

The two half-primary and secondary windings, P1, S1, are wound in the opposite direction to P2, S2, so that when the two inner connections are joined, the windings are series aiding. The number of turns must be identical in each of the four sections.

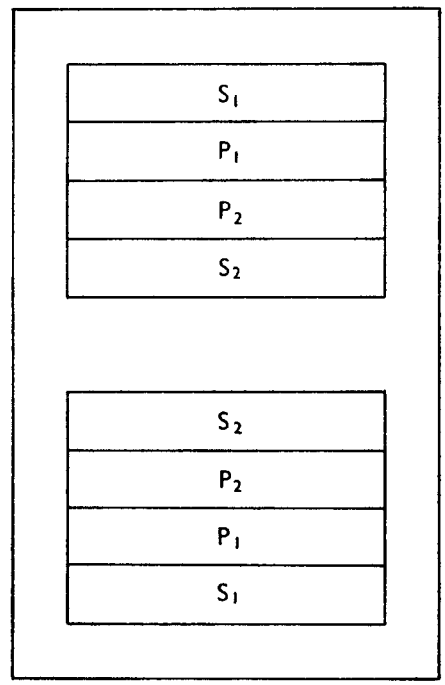


Fig. 10. Design of output transformer, T1

This transformer is suitable for a 60Ω line at 100V.

Core: Stalloy No. 66, square section, no gap.

Primary: 1250+1250 turns, 28 swg.

Secondary: 100+100 turns, 18 swg.

All windings are wound in the same direction. The secondary is connected in series aiding.

COMPONENT VALUES

Resistors (20% 0·25W unless otherwise indicated)

R1	470kΩ		R19	100kΩ	
R2	100kΩ	0·5W, matched	R20	4·7kΩ	10%, 1W
R3	100kΩ	within 5%	R21	440Ω	10%, 5W (see text page 1)
R4	47kΩ	0·5W	R22	5kΩ	10%, 10W
R5	1·5kΩ		R23	5kΩ	10%, 10W
R6	470kΩ	10%	R24	10kΩ	10%, 2W
R7	470kΩ	10%	R25	10kΩ	10%
R8	150kΩ	10%, 0·5W	R26	330Ω	10%, 0·5W
R9	10kΩ		R27	330Ω	10%, 0·5W
R10	10kΩ		R28	3·3kΩ	10%, 1W
R11	47kΩ	5%, 5W wirewound	R29	3·3kΩ	10%, 1W
R12	47kΩ	5%, 5W wirewound	R30	100kΩ	10%, 1W
R13	470kΩ	10%, 1W	R31	100kΩ	10%, 1W
R14	470kΩ		R32	100kΩ	10%, 1W
R15	470kΩ		R33	100kΩ	10%, 1W
R16	10kΩ		R34	100kΩ	10%, 1W
R17	10kΩ		R35	100kΩ	10%, 1W
R18	100kΩ		R36	100kΩ	10%, 1W

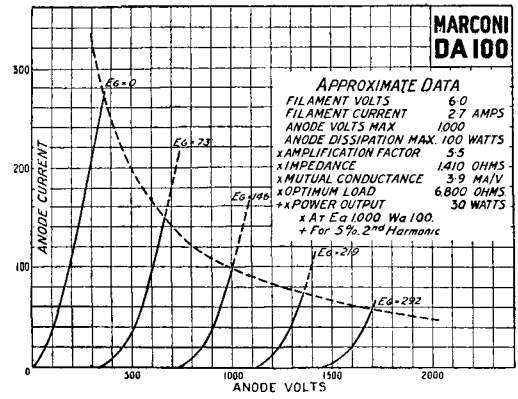
Capacitors

C1	0·01μF	500V	Paper	C13a	160μF	450V	Electrolytic
C2	0·01μF	500V	Paper	C13b	160μF	450V	Electrolytic
C3	0·01μF	500V	Paper	C13c	160μF	450V	Electrolytic
C4	4μF	450V	Electrolytic	C14	0·01μF	1500V	Paper
C5	1μF	350V	Paper	C15a	160μF	450V	Electrolytic
C6	160μF	450V	Electrolytic	C15b	160μF	450V	Electrolytic
C7	0·05μF	500V	Paper	C16a	160μF	450V	Electrolytic
C8	0·05μF	500V	Paper	C16b	160μF	450V	Electrolytic
C9	16μF	100V	Electrolytic	C17	—	Capacitance and rating according to circuit requirements.	
C10	16μF	100V	Electrolytic	C18	—		
C11	0·002μF	1000V	Paper	C19	—		
C12	0·002μF	1000V	Paper	C20	0·01μF		

Inductors

See page 7 for details of T1 and T2.

L1	10H	275mA
L2	10-20H	100mA
L3	10-20H	100mA
L4	10H	
L5	10-20H	
L6	10-20H	



Marconi DA100

100 watt Output Triode

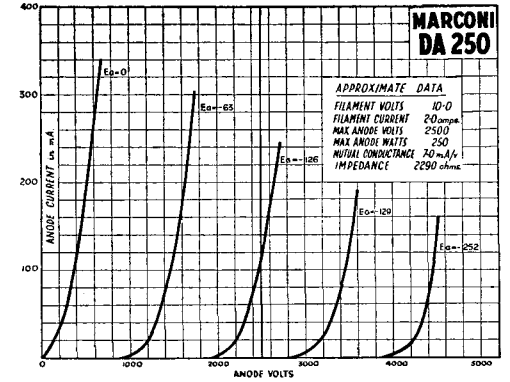
It is not possible to give here full details of this valve. Special advice is available on request to any user.

In a single class A circuit the output is 30 watts ; in push-pull class A, 90 watts per pair ; in push pull class A-B, with drive, 200 watts per pair.

Price - - 168/-

Overall Dimensions : 205×78 mm.

Special 4 pin base.



Marconi DA250

250 watt Output Triode

Here again, as with DA100, full information is available on request. This is a new valve of great interest for relay systems, as a pair in class A-B with positive drive will give 800 watts output. Without drive, over 400 watts are easily obtained.

Price - - 336/-

Overall Dimensions : 395×110 mm.

Large 4 pin bayonet cap.

Triode *Type DA 250*

(POWER AMPLIFIER)

General. The DA 250 is a power amplifying triode fitted with a directly heated oxide-coated cathode. The valve has been designed for use principally in push-pull amplifiers.

Cooling. Adequate ventilation must be provided.

Mounting. The valve must be mounted vertically with anode uppermost.

APPROXIMATE DATA

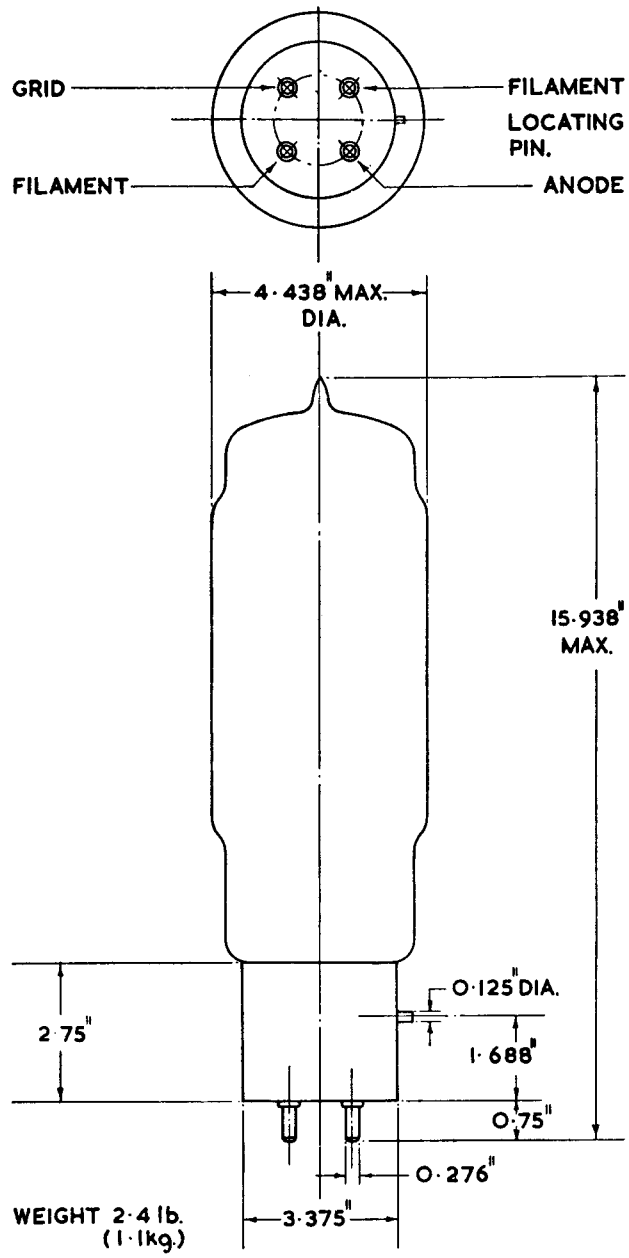
V_f		10·0	V
I_f		2·0	A
V_a		2,500	V
$p_{a(max)}$		250	W
μ	taken at V_a 2,500 V, p_a 250 W	16	
r_a		2,300	Ω
g_m		7·0	mA/V
$c_{a\text{-}g1}$		41	pF
$c_{a\text{-}k}$		6	pF
$c_{g1\text{-}k}$		21	pF

Typical Operation

(1) TWO VALVES. CLASS AB1. PUSH-PULL

(Operating data per pair of valves unless otherwise stated)

$V_{a(zero\text{-}sig)}$	2,700	V
$V_{a(max\text{-}sig)}$	2,500	V
$I_{a(zero\text{-}sig)}$	100	mA
$I_{a(max\text{-}sig)}$	360	mA
V_{g1}	−145	V
$V_{in(pk)}$ $(g_1'\text{-}g_1'')$	290	V
$R_{L(a'\text{-}a'')}$ per valve	12,000	Ω
$p_{a(zero\text{-}sig)}$ per valve	135	W
$p_{a(max\text{-}sig)}$ per valve	250	W
P_{out} (a)	400	W
$D_{(max)}$	5·0	%



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

(2) TWO VALVES. CLASS AB2. PUSH-PULL

(Operating data per pair of valves unless otherwise stated)

$V_{a(zero\text{-}sig)}$	2,700	V
$V_{a(max\text{-}sig)}$	2,500	V
$I_{a(zero\text{-}sig)}$	100	mA
$I_{a(max\text{-}sig)}$	500	mA
V_{g1}	−145	V
$I_{g1(max\text{-}sig)}$	20	mA
$V_{in(pk)\ (g_1'\text{-}g_1'')}$	400	V
$R_{L(a'\text{-}a'')}$	12,000	Ω
$P_{a(zero\text{-}sig)}$ per valve	135	W
$P_{a(max\text{-}sig)}$ per valve	190	W
P_{out} (a)	800	W
D	6·0	%

(3) OPERATION AT REDUCED ANODE VOLTAGES. TWO VALVES. CLASS AB2. PUSH-PULL

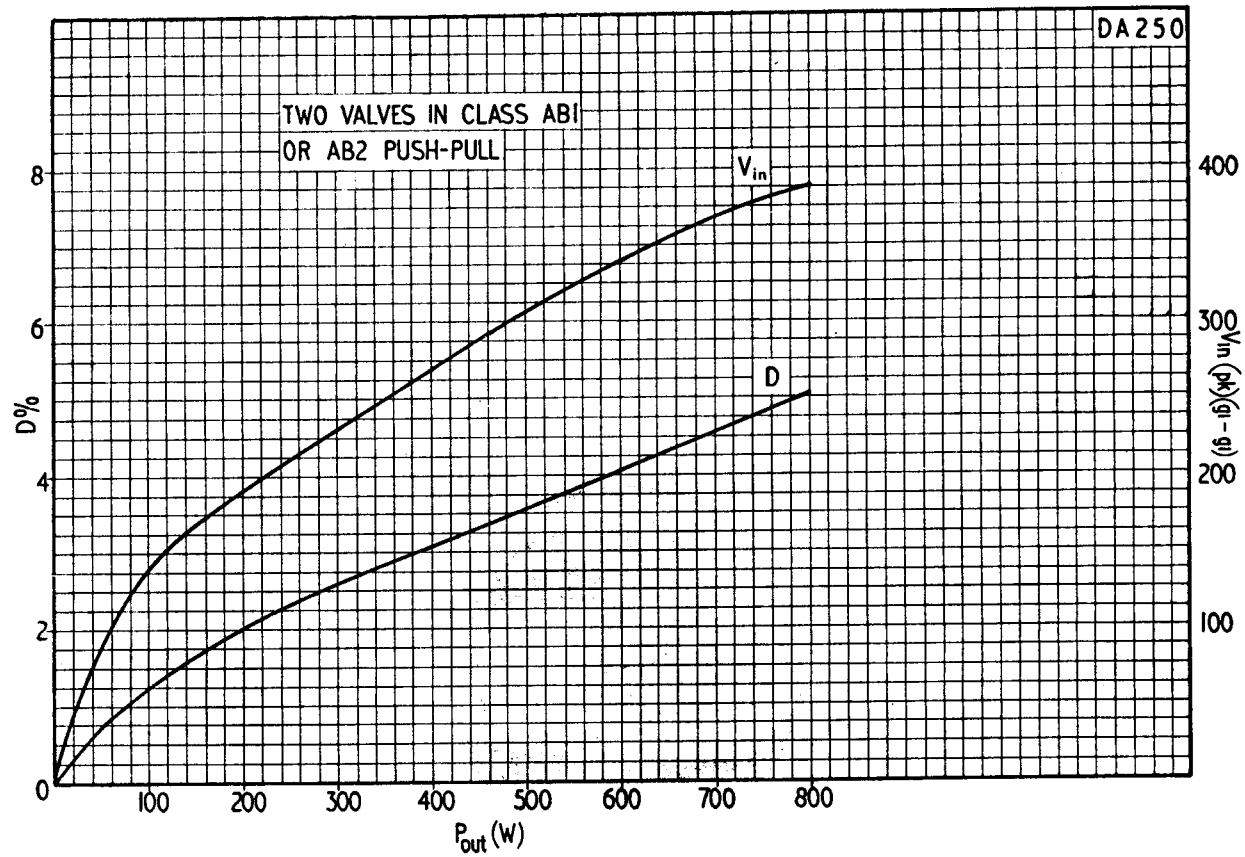
(Operating data per pdir of valves unless otherwise stated)

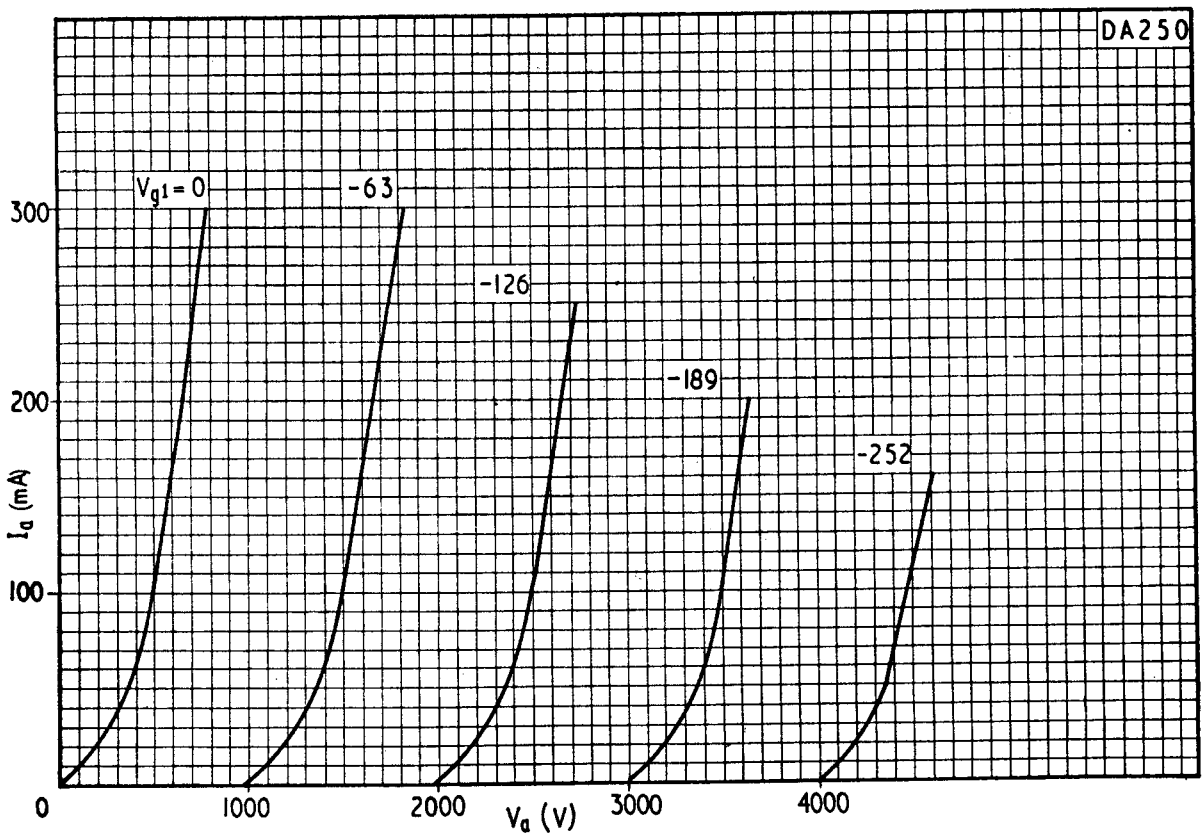
V_a	2,000	2,250	2,500	V
$I_{a(zero\text{-}sig)}$	100	100	100	mA
$I_{a(max\text{-}sig)}$	400	450	500	mA
V_{g1}	−115	130	−145	V
$V_{in(pk)\ (g_1'\text{-}g_1'')}$	330	370	400	V
$R_{L(a'\text{-}a'')}$	12,000	12,000	12,000	Ω
P_{out}	525	700	800	W

NOTES

(a) This value may vary by ±6%.

1. The outputs obtainable under reduced anode voltage Class AB1 conditions are approximately one-half of those given in Table 3.
2. The power supply should have an impedance not greater than 400 Ω.
3. The peak anode dissipation under Class AB2 push-pull conditions occurs at approximately half full output.


DA250
TWO VALVES IN CLASS AB1
OR AB2 PUSH-PULL
V_{in}
D
D%
V_{in} (dx)(g1 - g1)
P_{out} (W)
0
2
4
6
8
100
200
300
400
500
600
700
800


DA250
V_{g1} = 0
-63
-126
-189
-252
I_a (mA)
V_a (V)
0
100
200
300
1000
2000
3000
4000



PRINTED IN ENGLAND

Triode *Type DET3*

(MF AMPLIFIER)

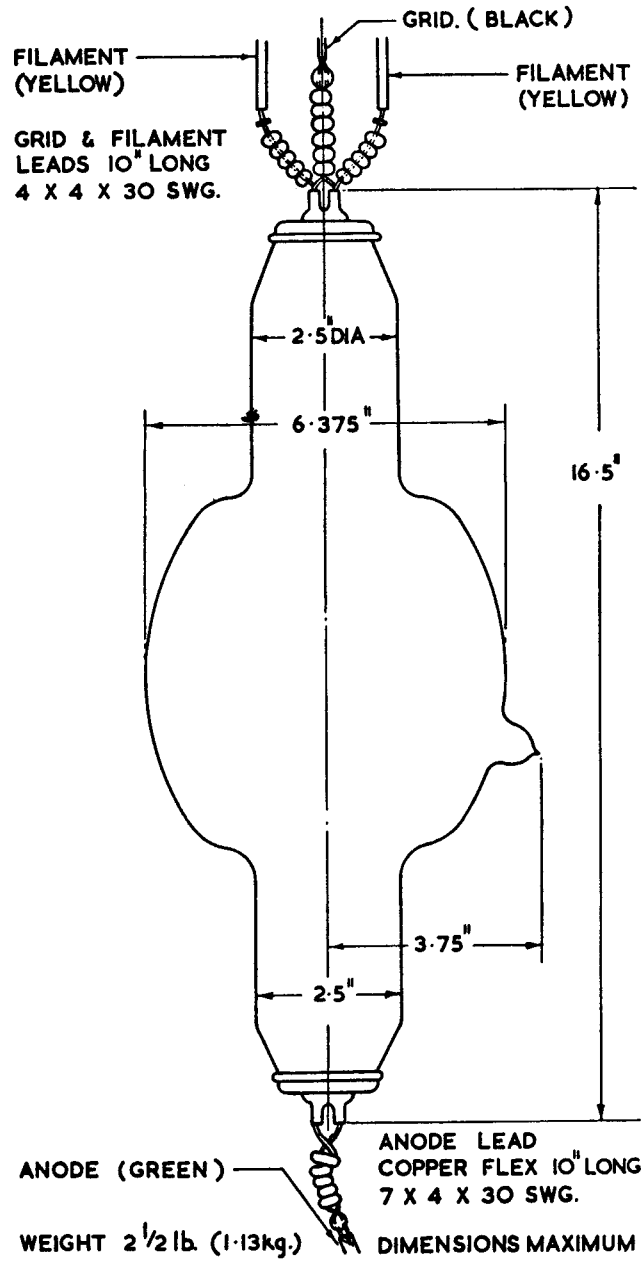
General. The DET 3 is a transmitting triode fitted with a thoriated tungsten filament, designed for use at frequencies up to 3 Mc/s.

Mounting. The valve must be mounted vertically with the anode seal either up or down.

APPROXIMATE DATA

V_f			15·0	V
I_f			4·0	A
$V_{a(max)}$			3·0	kV
$p_{a(max)}$			250	W
$I_{k\ (pk)}$			2·5	A
$I_{gl(max)}$			50	mA
μ	taken at V_a	1 kV	19	
g_m	p_a	200 W	6	mA/V
g_m *taken at $\frac{1}{2}$ $I_{k(pk)}$			9	mA/V
$c_{a\text{-}gl}$			17	pF
$c_{a\text{-}k}$			2	pF
$c_{gl\text{-}k}$			18	pF

*No attempt should be made to measure these figures statically.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Typical Operation

(1) RF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

V_a	2,000	2,500	3,000	V
V_{gl}	–240	–270	–300	V
$V_{gl\ (pk)}$	430	450	480	V
I_a	320	320	300	A
I_{gl}	37	32	30	mA
Z_a	2,700	3,500	4,750	Ω
R_{gl}	6,500	8,500	10,000	Ω
P_{dr}	20	20	20	W
p_a	220	240	240	W
P_{out}	420	560	660	W

(2) RF AMPLIFIER. CLASS C

(Grid modulated, one valve, carrier conditions, permissible modulation 100%)

V_a		2,000	2,500	3,000	V
V_{gl}		–185	–220	–250	V
$V_{gl(pk)}$		250	260	270	V
$V_{mod(pk)}$		100	100	105	V
I_a		170	150	130	mA
I_{gl}	(a)	3·5	2·5	1·8	mA
Z_a		2,750	3,850	5,500	Ω
$Z_{to\ mod}$		2,500	3,000	3,500	Ω
P_{dr}	(a) (b)	12	10	10	W
p_a		225	245	245	W
P_{mod}	(c)	2	1·7	1·5	W
P_{out}		115	130	145	W

(3) RF AMPLIFIER. CLASS C

(Anode modulated, one valve, permissible modulation 100%)

V_a		2,000	2,400	V
I_{gl}		–220	–250	V
$V_{gl(pk)}$		370	400	V
I_a		230	230	mA
I_{gl}	(a)	28	28	mA
Z_a		4,200	5,200	Ω
$Z_{to\ mod}$		8,700	10,500	Ω
P_{dr}	(a)	15	15	W
p_a		135	152	W
P_{mod}	(c)	230	276	W
P_{out}		325	400	W

(4) RF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%)

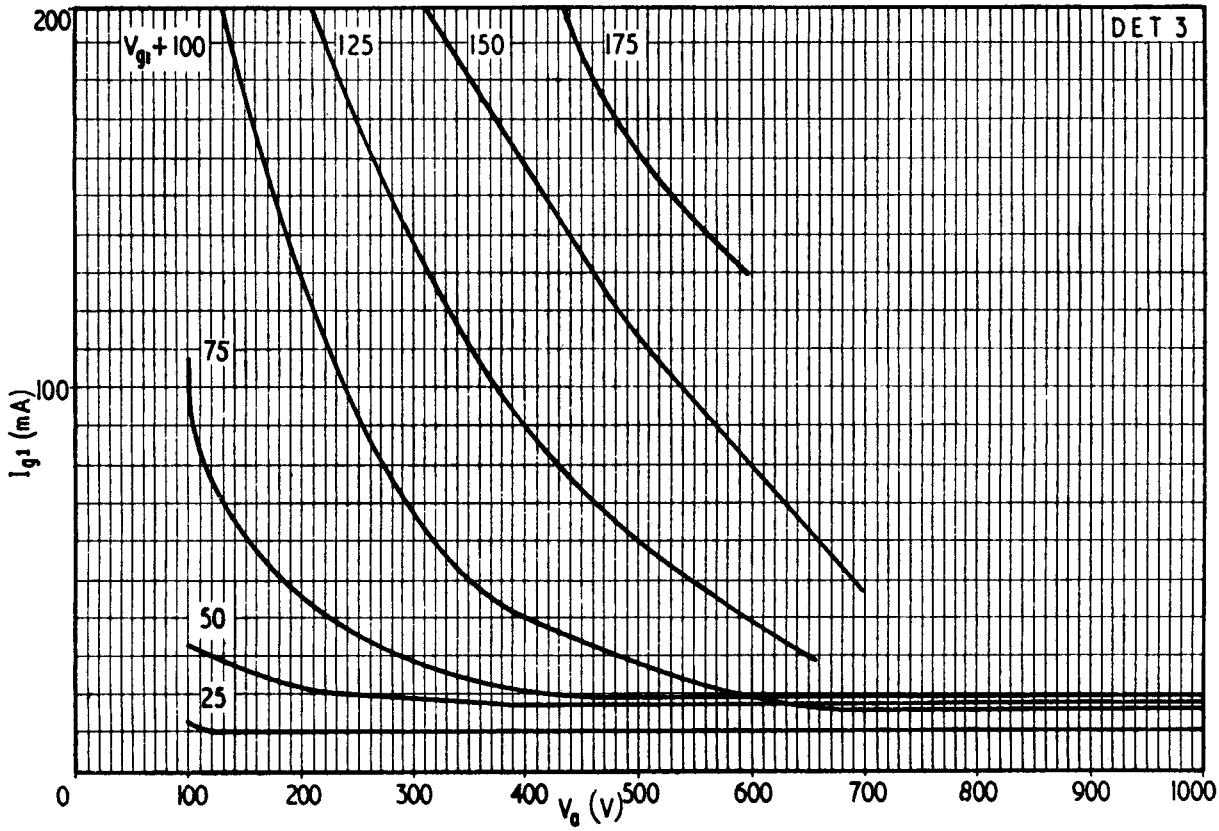
V_a		2,000	2,500	3,000	V
V_{gl}		–90	–120	–150	V
$V_{gl(pk)}$		127	132	135	V
I_a		175	145	120	mA
I_{gl}	(a)	3	1	0	mA
Z_a		3,000	5,000	7,000	Ω
P_{dr}	(a) (b)	10	7·5	7·5	W
p_a		245	247	244	W
P_{out}		105	115	116	W

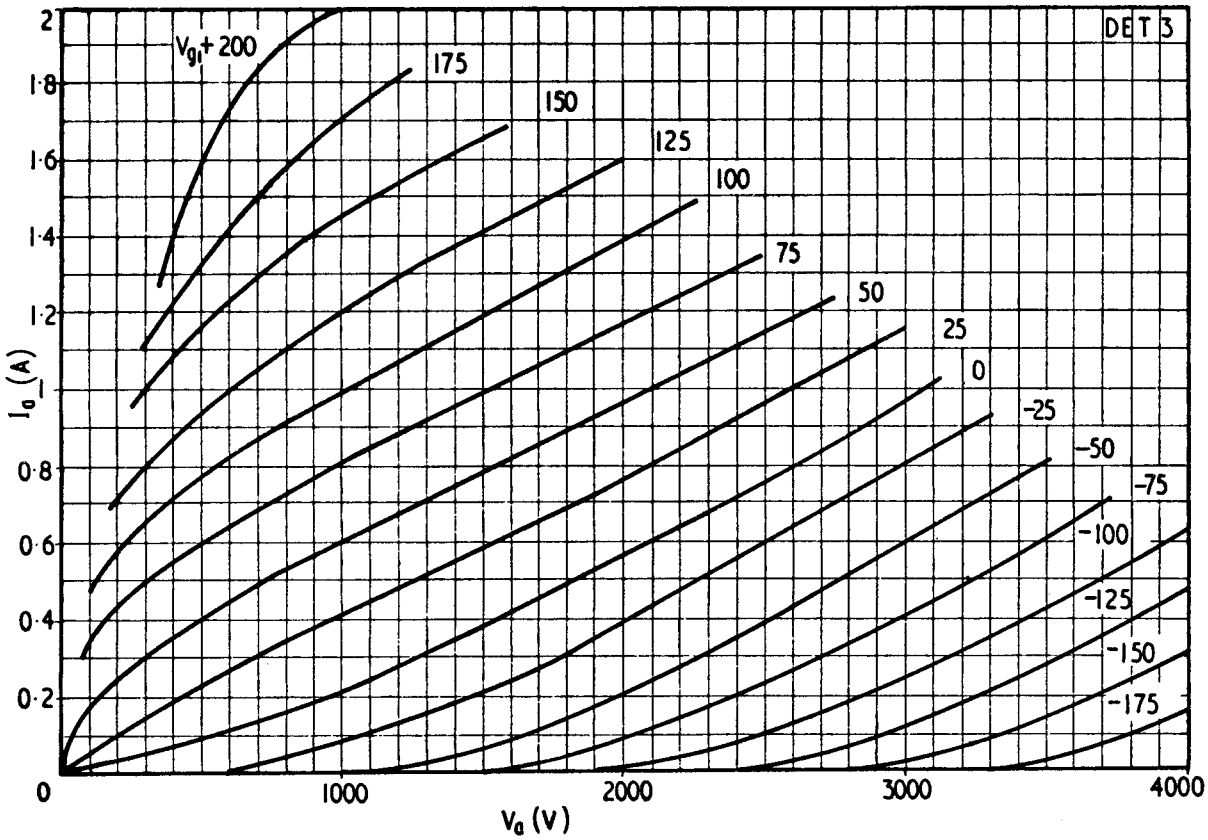
NOTES

(a) Subject to wide variation. The figures are approximate only.

(b) At crest of audio cycle with 100% modulation.

(c) 100% modulation.


DET 3
V_{g1} + 100
125
150
175
75
50
25
200
100
0
I_{g1} (mA)
100
200
300
400
500
600
700
800
900
1000
V_a (V)


DET 3
V_{g1} + 200
175
150
125
100
75
50
25
0
-25
-50
-75
-100
-125
-150
-175
2
1·8
1·6
1·4
1·2
1
0·8
0·6
0·4
0·2
0
I_a (A)
1000
2000
3000
4000
V_a (V)



PRINTED IN ENGLAND

Triode *Type DET 16*

(HF AMPLIFIER)

General. The DET 16 is a transmitting triode fitted with a thoriated tungsten filament and a carbon anode. It is suitable for use at frequencies up to 30 Mc/s. The valve may also be used as a zero bias Class B amplifier.

Cooling. As the valve runs hot in operation, free air circulation should be allowed.

Mounting. The valve must be mounted vertically.

APPROXIMATE DATA

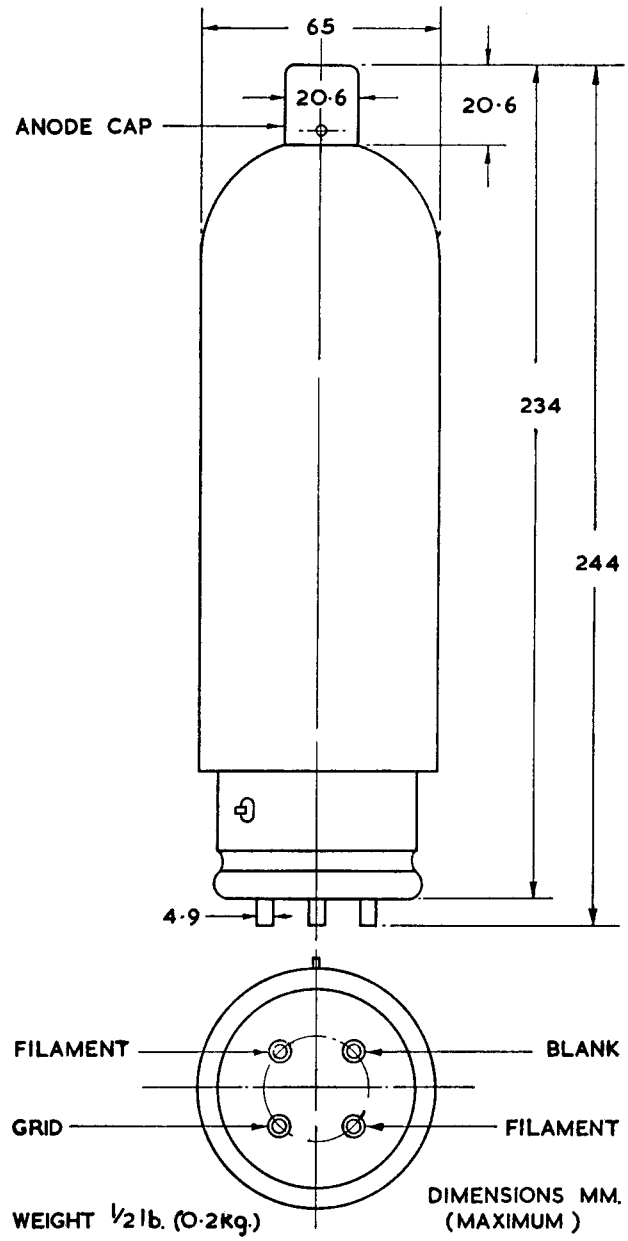
V_f		10·0	V
I_f		5·5	A
$V_{a(max)}$		3,000	V
$p_{a(max)}$		125	W
μ	taken at	61	
g_m	V_a 1,000 V	6·5	mA/V
r_a	I_a 125 mA	9,400	Ω
$c_{a\text{-}gl}$		18·25	pF
$c_{a\text{-}k}$		10·3	pF
$c_{gl\text{-}k}$		10	pF

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(*Unmodulated, one valve, key down conditions*)

V_a		3,000	V
I_a		125	mA
V_{gl}		−375	V
I_{gl}	(a)	25	mA
$R_{gl\text{-}k}$		15,000	Ω
p_a		125	W
P_{out}		250	W



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

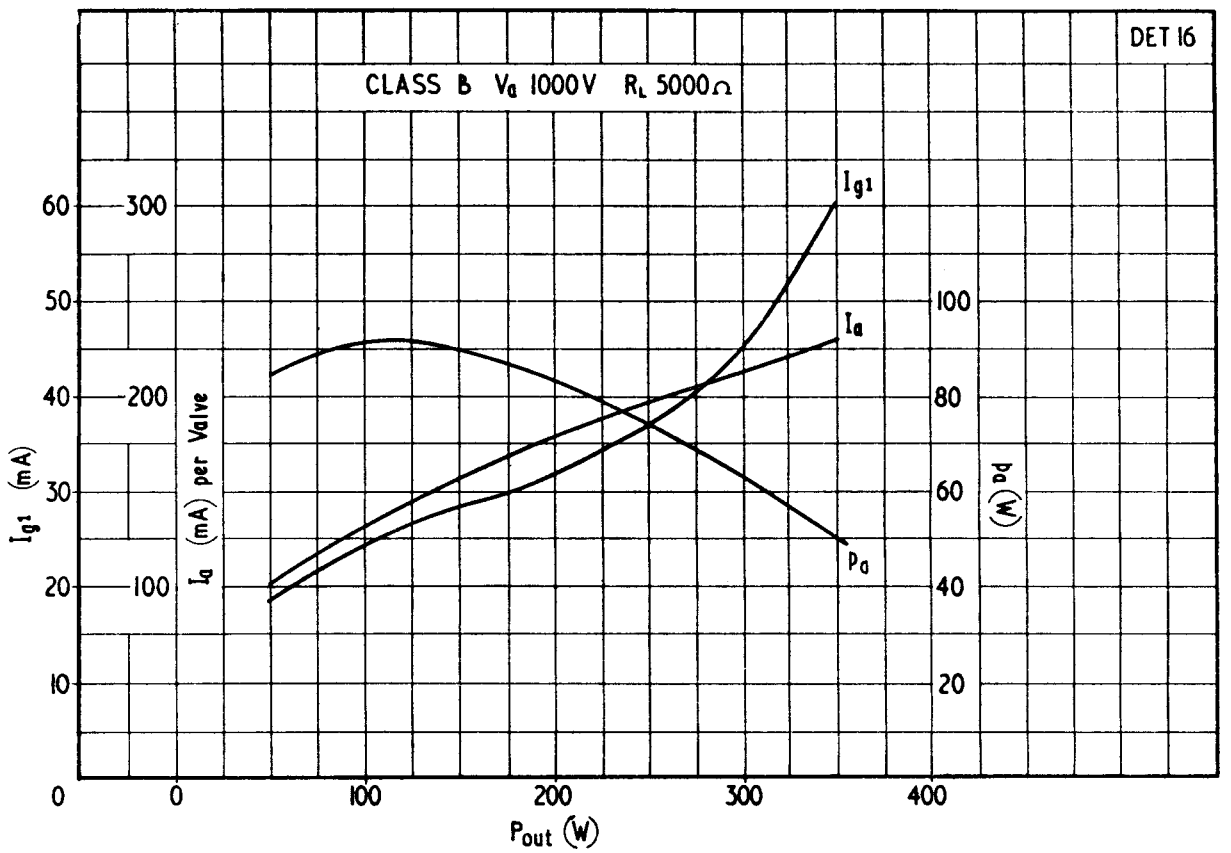
(2) PUSH-PULL AMPLIFIER. CLASS B

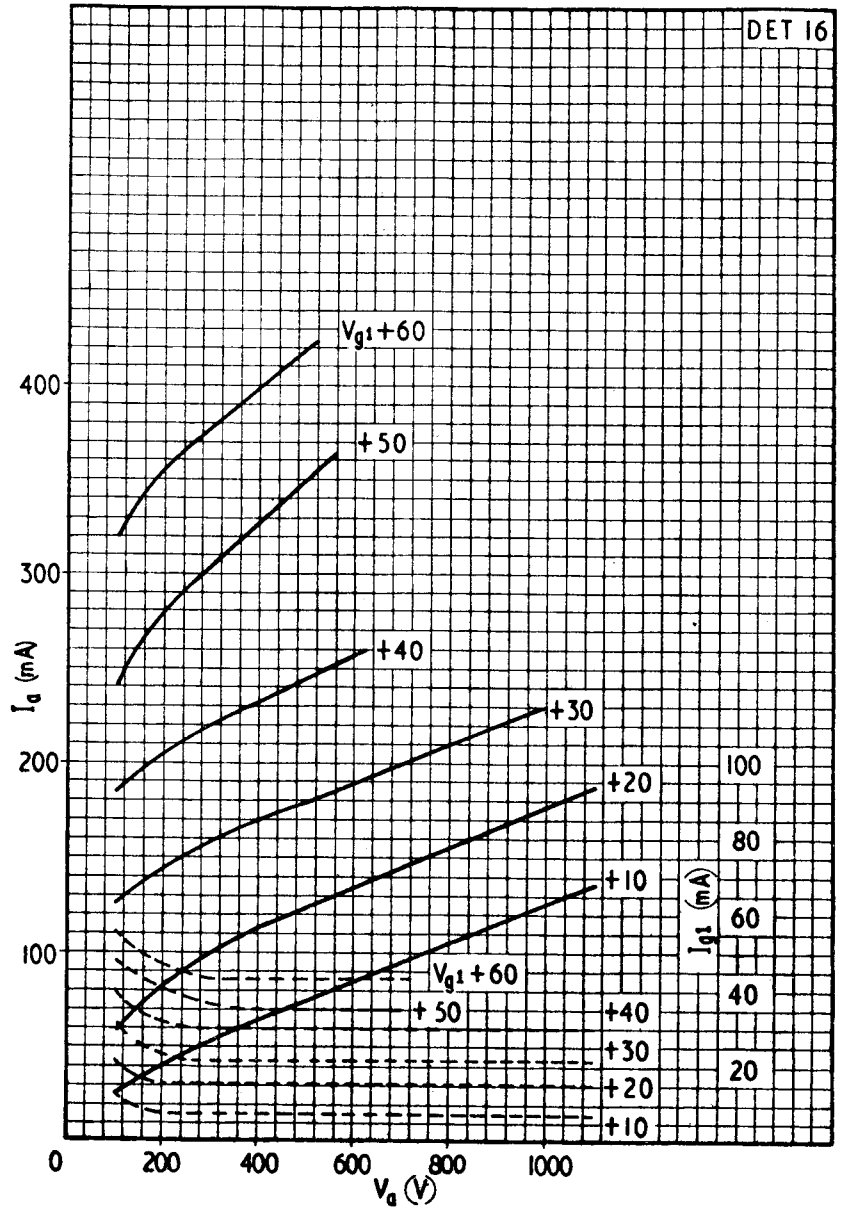
(Operating data per pair of valves unless otherwise stated)

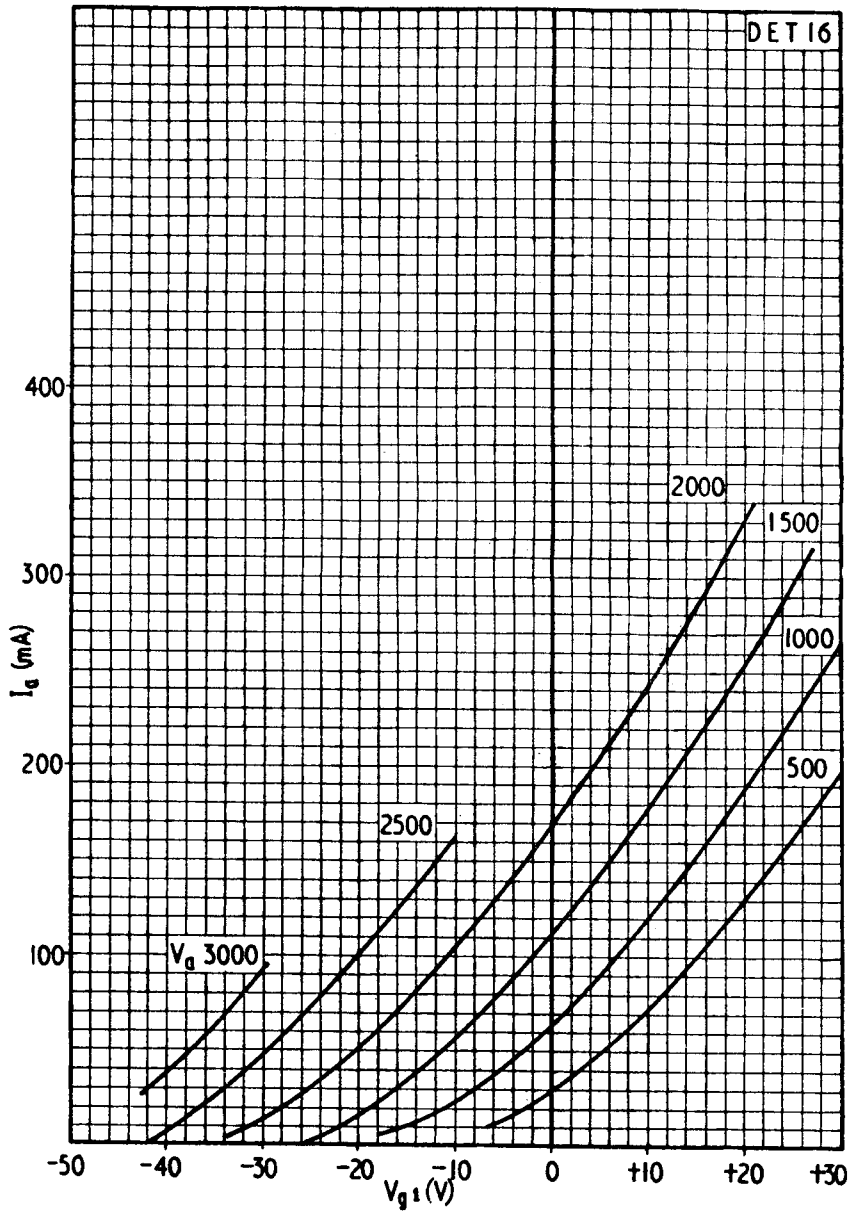
	Quiescent	Full Output	
V_a	1,150	1,000	V
V_{g1}	0	0	
I_a	160	460	mA
$R_{L(a'a'')}$	–	5,000	Ω
$V_{in(pk)\ (g_1'g_1'')}$	–	200	V
$I_{g1\ (mean)}$	–	60	mA
$p_{a\ (per\ valve)}$	92	55	W
P_{out}	–	350	W
D_{max}	–	5	%

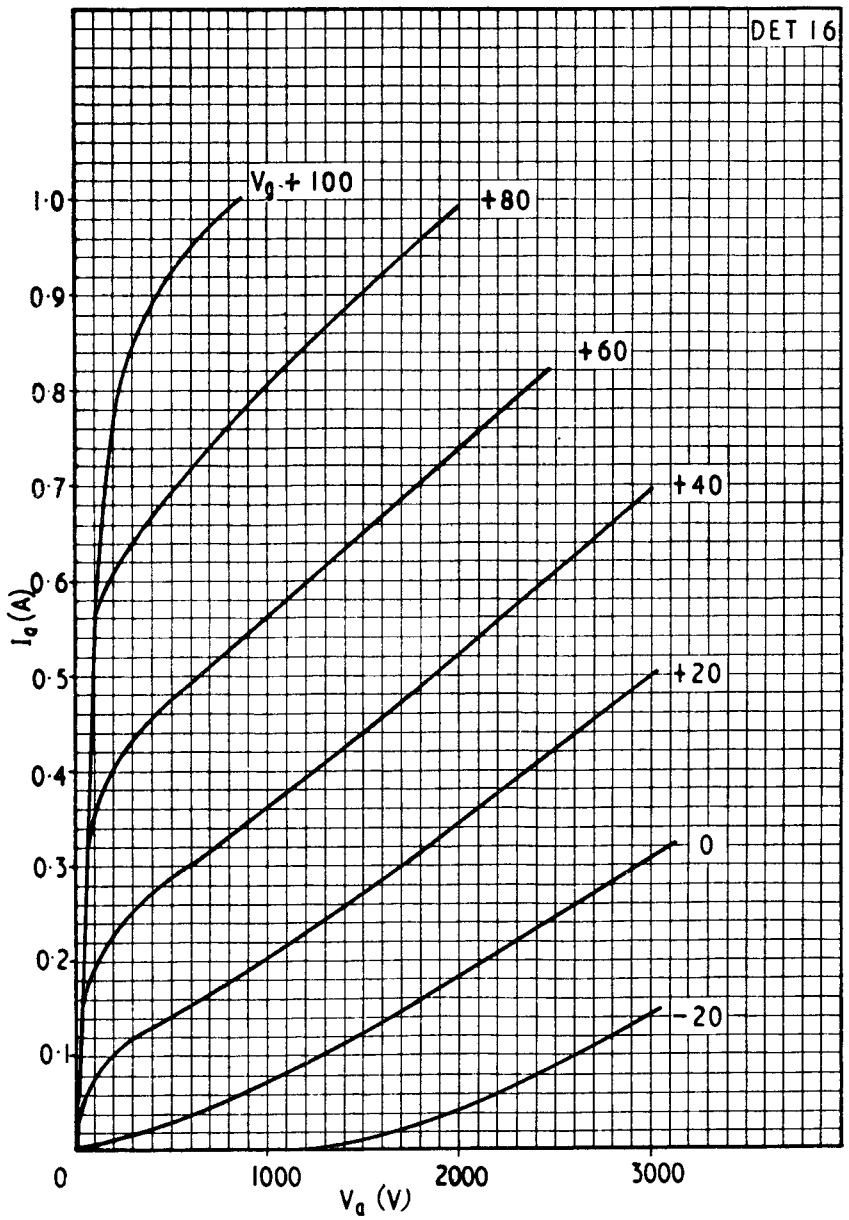
NOTE

(a) Subject to wide variation. The figures are approximate only.




DET 16
V_{g1} +60
+50
+40
+30
+20
+10
V_{g1} +60
+50
+40
+30
+20
+10
400
300
200
100
0
200
400
600
800
1000
I_a (mA)
V_a (V)
100
80
60
40
20
I_{g1} (mA)


DET 16
2000
1500
1000
500
2500
V_a 3000
400
300
200
100
-50
-40
-30
-20
-10
0
+10
+20
+30
I_a (mA)
V_{g1} (V)



PRINTED IN ENGLAND

Triode *Type DET 18*

(OSCILLATOR AND HF AMPLIFIER)

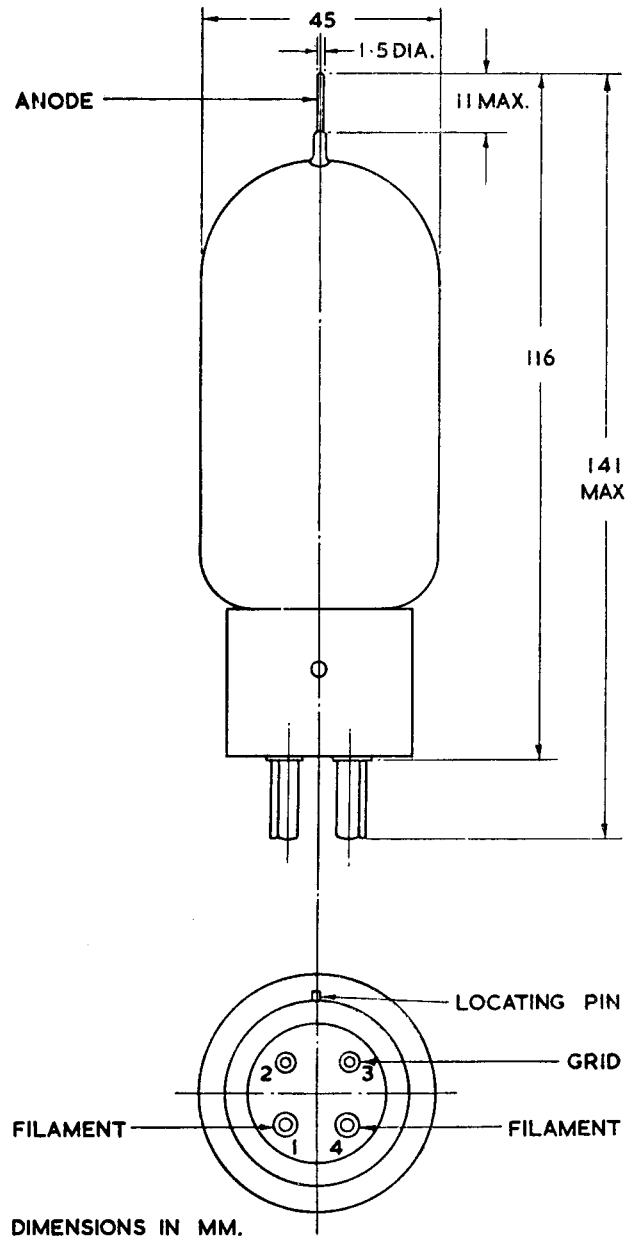
General. A transmitting triode fitted with a thoriated tungsten filament, suitable for use as an oscillator or high-frequency amplifier at frequencies up to 120 Mc/s.

Mounting. The valve must be mounted vertically. Connections should be made to the anode lead by means of a suitable clip. On no account should attempt be made to solder the lead itself.

APPROXIMATE DATA

V_f					5	V
I_f					4	A
$V_{a(max)}$					2	kV
$p_{a(max)}$					50	W
$p_{gl(max)}$					35	mA
$I_{e(pk)}{}^{*}{}_{(max)}$					2	A
$I^{*}_{(a+gl)}$					0·9	A
μ	taken at V_a	1,000	V		32·5	
g_m	I_a	35	mA		2·55	mA/V
g_m	taken at V_a	700	V		4·4	mA/V
	I_a	500	mA			
f					100	Mc/s
$c_{a\text{-}gl}$					1·7	pF
$c_{a\text{-}k}$					0·17	pF
$c_{gl\text{-}k}$					4·6	pF

*No attempt must be made to measure this figure statically.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Typical Operation

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

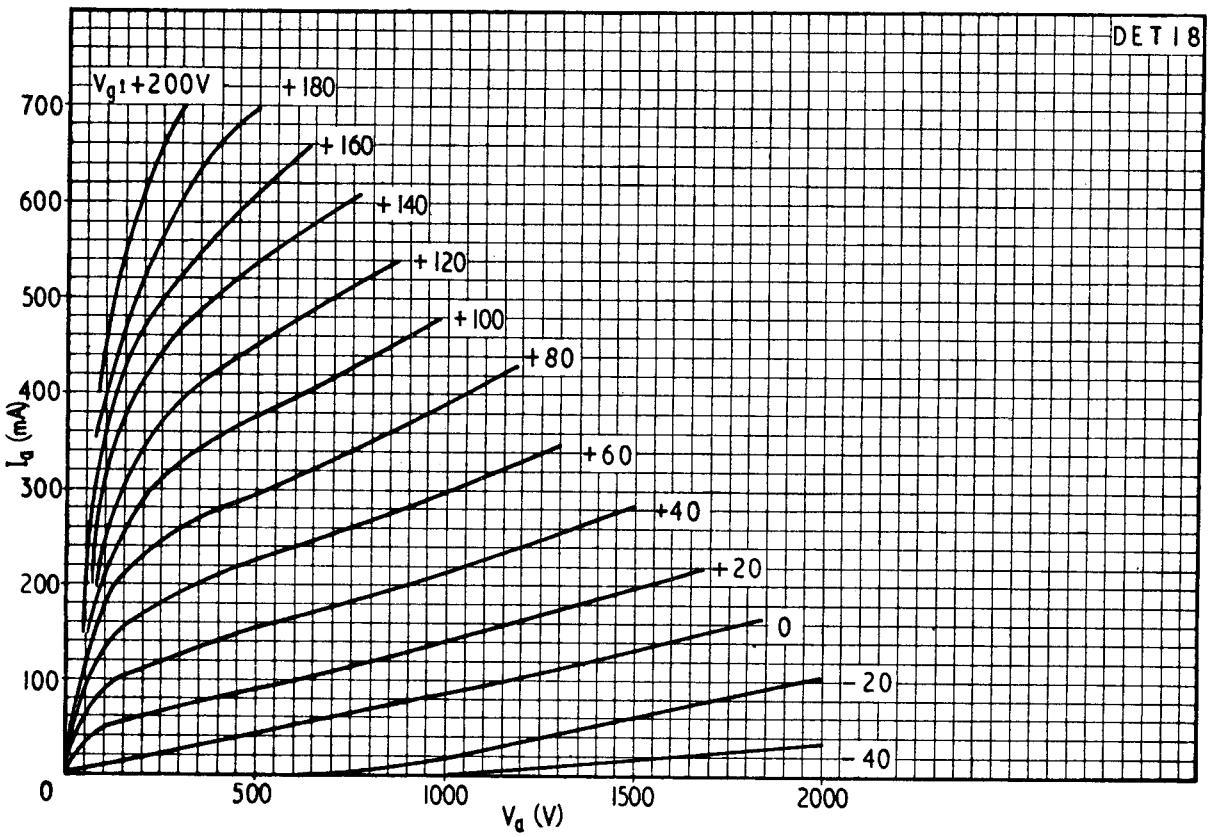
(*Unmodulated, one valve, key down conditions*)

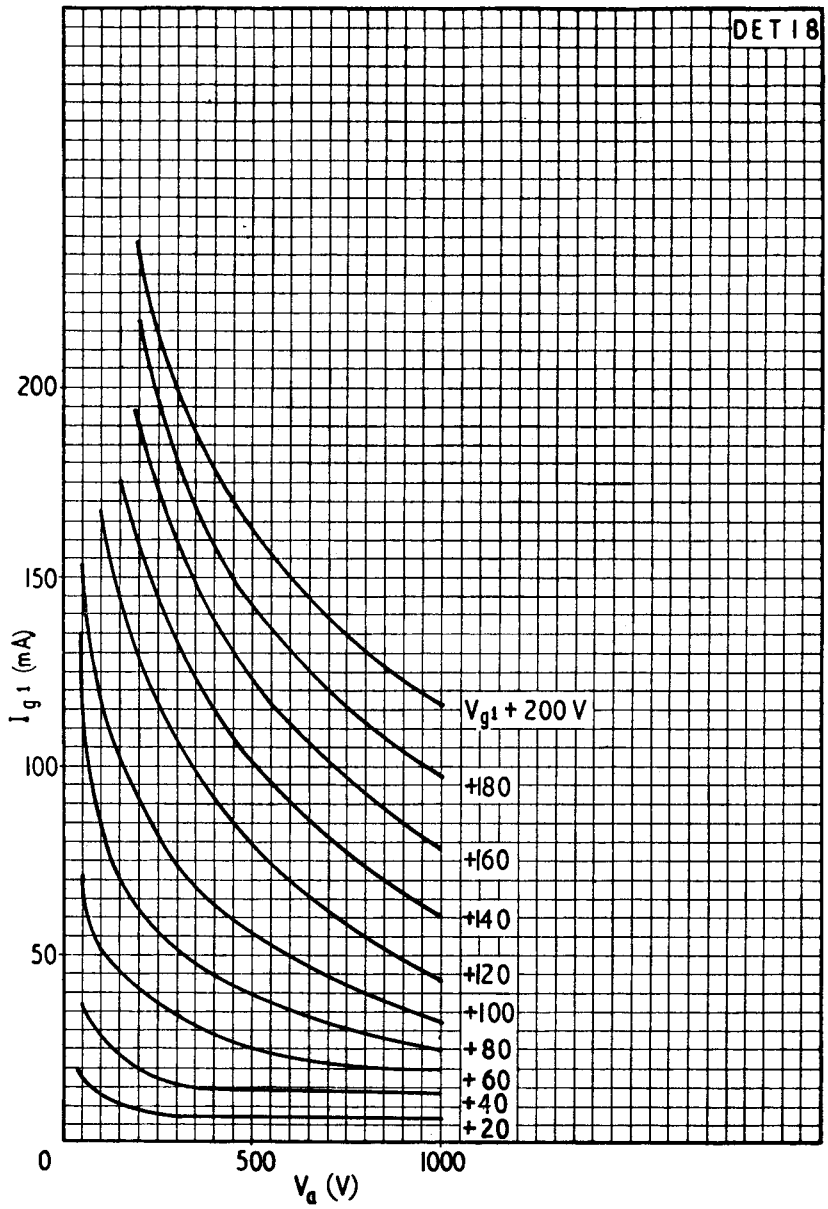
V_a		1,500	1,000	750	V
I_a		85	110	120	mA
V_{g1}		−170	−180	−160	V
I_{g1}	(a)	35	35	35	mA
P_{dr}	(a)	12	13	11	W
Z_a		9,000	4,200	2,400	Ω
P_{out}		77	63	45	W
$V_{g1(pk)}$		320	360	330	V

At frequencies above 75 Mc/s it is recommended that two valves are used in push-pull. At 100 Mc/s an output of 100 watts can be obtained from a pair of valves.

NOTES

(a) Subject to wide variation.




DET 18
200
150
100
50
0
500
1000
I_{g1} (mA)
V_a (V)
V_{g1} + 200 V
+180
+160
+140
+120
+100
+ 80
+ 60
+40
+ 20



PRINTED IN ENGLAND

Twin Triode *Type DET 19*

(POWER AMPLIFIER, OSCILLATOR AND MULTIPLIER)

General. The DET 19 is a low-power transmitting valve, consisting of two triodes in one envelope, suitable for use as a power amplifier, oscillator or frequency multiplier, at frequencies up to 250 Mc/s. It is necessary to neutralise the valve under all conditions of amplifier service; two capacitors which may each have a maximum value of 5 pF, are required for each valve.

Cooling. The valve must be adequately ventilated as it becomes very hot under normal operating conditions. No visible heating of the anodes should occur under any condition of operation.

APPROXIMATE DATA

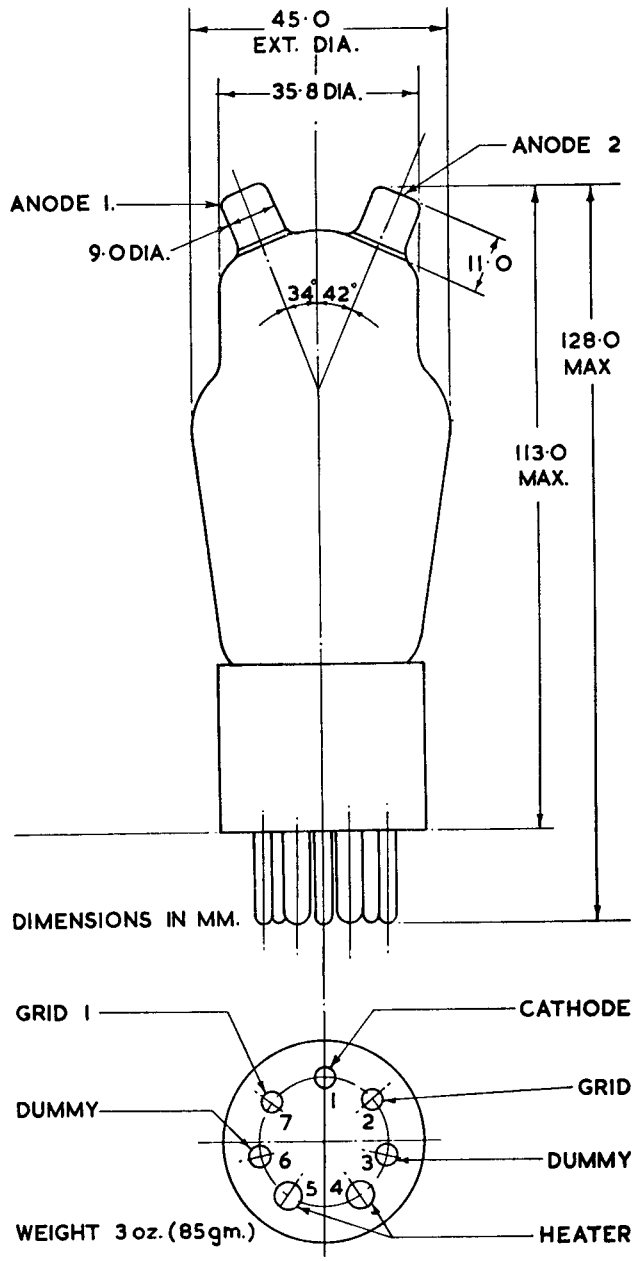
V_h		6·3	V
I_h		0·8	A
$V_{a(max)}$		300	V
$I_{a(max)}$ per anode		40	mA
$p_{a(max)}$ per anode		5	W
g_m	taken at	2·1	mA/V
μ	V_a 300 V	7	
r_a	I_a 25 mA	3,340	Ω
$V_{h\text{-}k(max)}$		100	V
$c_{a'\text{-}a''}$		1	pF
$c_{a\text{-}g1}$ (other electrodes earthed)		2·3	pF
$c_{a\text{-}k}$		0·6	pF
$c_{g1\text{-}k}$		4·2	pF

(1) PUSH-PULL RF AMPLIFIER. CLASS C TELEGRAPHY

(*Key down conditions, per valve, without modulation*)

Maximum permissible ratings

V_a		300	V
V_{g1}		−150	V
I_a	both triodes	80	mA
I_{g1}		25	mA
P_a		24	W
p_a		10	W



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Typical Operation

f	7	7	7	7	Mc/s
V_a	300	250	200	150	V
I_a	80	80	70	65	mA
V_{g_1} (i) from a fixed supply of	−50	−50	−50	−50	V
(ii) via R_k	625	625	715	770	Ω
(iii) via $R_{g_1\text{-}k}$	3,300	2,800	2,800	2,500	Ω
I_{g1} (a)	15	18	18	20	mA
$v_{g1'\text{-}g1''(pk)}$	210	220	220	230	V
P_{dr} (a)	2	2·5	2·5	3	W
P_{out}	15·9	12·5	8·5	5·4	W
η	66·5	62·5	60·5	55·5	%

(2) PUSH-PULL ANODE MODULATED RF AMPLIFIER. CLASS C TELEPHONY

(Carrier conditions, per valve, permissible modulation 100%)

Maximum permissible ratings

V_a	250	V
V_{g1}	−150	V
I_a	55	mA
I_{g1}	25	mA
P_a	13·5	W
p_a	6·5	W

Typical Operation

f	7	7	Mc/s
V_a	250	200	V
I_a	50	50	mA
V_g (i) from a fixed supply of	−45	−40	V
(ii) via R_k	900	800	Ω
(iii) via $R_{g_1\text{-}k}$	6,500	5,000	Ω
I_{g1}	7	8	mA
$v_{g1'\text{-}g1''(pk)}$	180	170	V
P_{dr} (a)	1	1	W
P_{out}	8·5	6·5	W
η	68	65	%

(3) PUSH-PULL RF AMPLIFIER. CLASS B TELEPHONY

(Carrier conditions, per valve, permissible modulation 100%)

Maximum permissible ratings

V_a	300	V
I_a	45	mA
I_{g1}	25	mA
P_a	13·5	W
p_a	10	W

Typical Operation

f	7	7	Mc/s
V_a	300	200	V
I_a	40	40	mA
V_g (i) from a fixed supply of (c)	−21	−13	V
(ii) via R_k (c)	525	325	Ω
I_{g1} (a)	1·8	3	mA
$v_{g1'\text{-}g1''(pk)}$	70	70	V
P_{dr} (a) (b)	1·5	2·2	W
P_{out}	3·5	2·3	W
η	29·3	28·3	%

(4) PUSH-PULL FREQUENCY DOUBLER

Maximum permissible ratings

V_a		300	V
V_{g1}		−150	V
I_a	both triodes	80	mA
I_{g1}	both triodes	25	mA
P_a	both triodes	24	W
p_a	both triodes	10	W

Typical Operation

$f_{(exc)}$	7	7	7	40	Mc/s
$f_{(out)}$	14	14	14	80	Mc/s
V_a	300	250	200	250	V
I_a	70	70	70	60	mA

V_{g_1}	(i) from a fixed supply of	−70	−70	−70	−150	V
	(ii) via R_k	1,000	1,000	1,000	—	Ω
	(iii) via $R_{g_1\text{-}k}$	5,800	4,400	3,900	30,000	Ω
I_{g1}	(a)	12	16	18	5	mA
$v_{g1'\text{-}g1''(pk)}$		240	250	250	—	V
P_{dr}		2·5	3	3	—	W
P_{out}		10·5	8	6·3	5·1	W
η		50	45·5	45	33	%

(5) CRYSTAL OSCILLATOR AND DOUBLER

Maximum permissible ratings

V_a	300	V
V_{g1}	−150	V
I_a	40	mA
p_a	5	W

Typical Operation

$f_{(xtal)}$	7	Mc/s
f_{out}	14	Mc/s
Triode (1) Crystal Oscillator		
V_a (d)	250	V
I_a	15	mA
V_{g1} via $R_{g_1\text{-}k}$	30,000	Ω
I_{g1}	0·8	mA
Triode (2) Frequency Doubler		
V_a	300	V
I_a	26	mA
V_{g_1} (i) from a fixed supply of	−90	V
(ii) via $R_{g_1\text{-}k}$	45,000	Ω
I_{g1}	2	mA
P_{out}	2·8	W

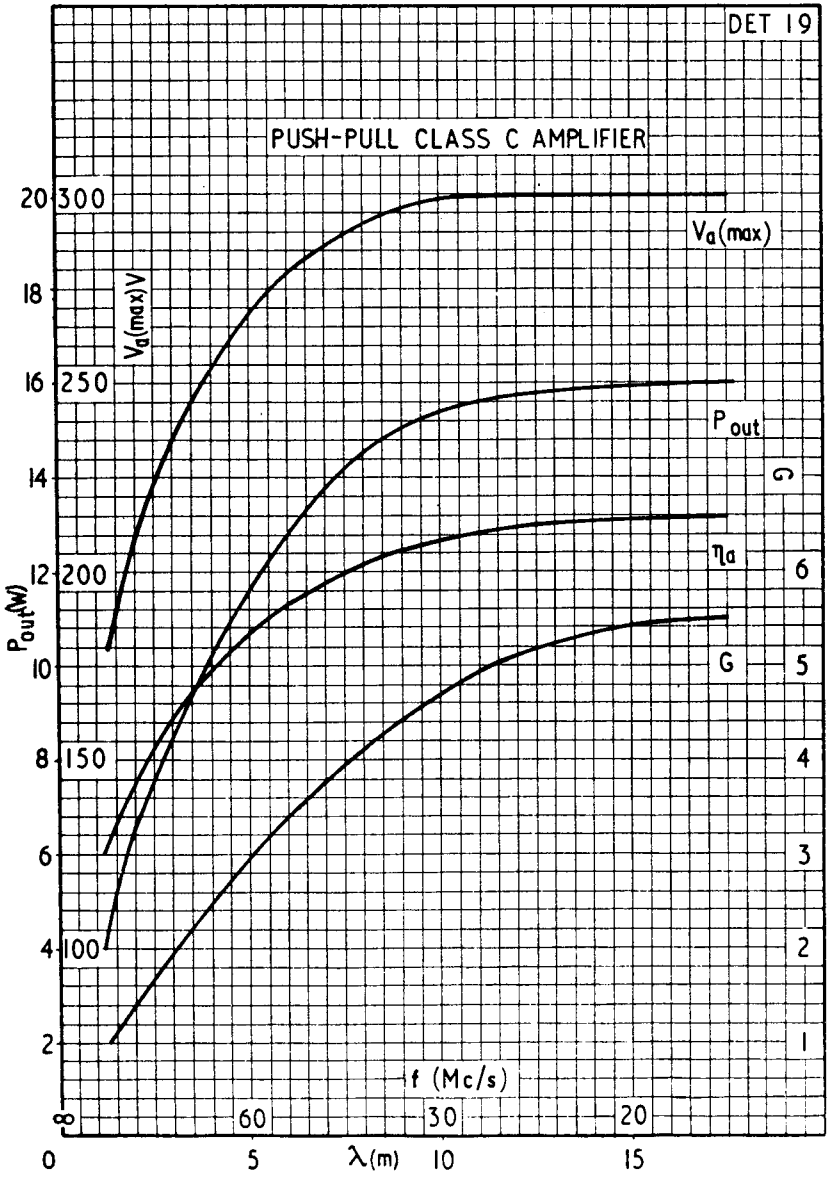
NOTES

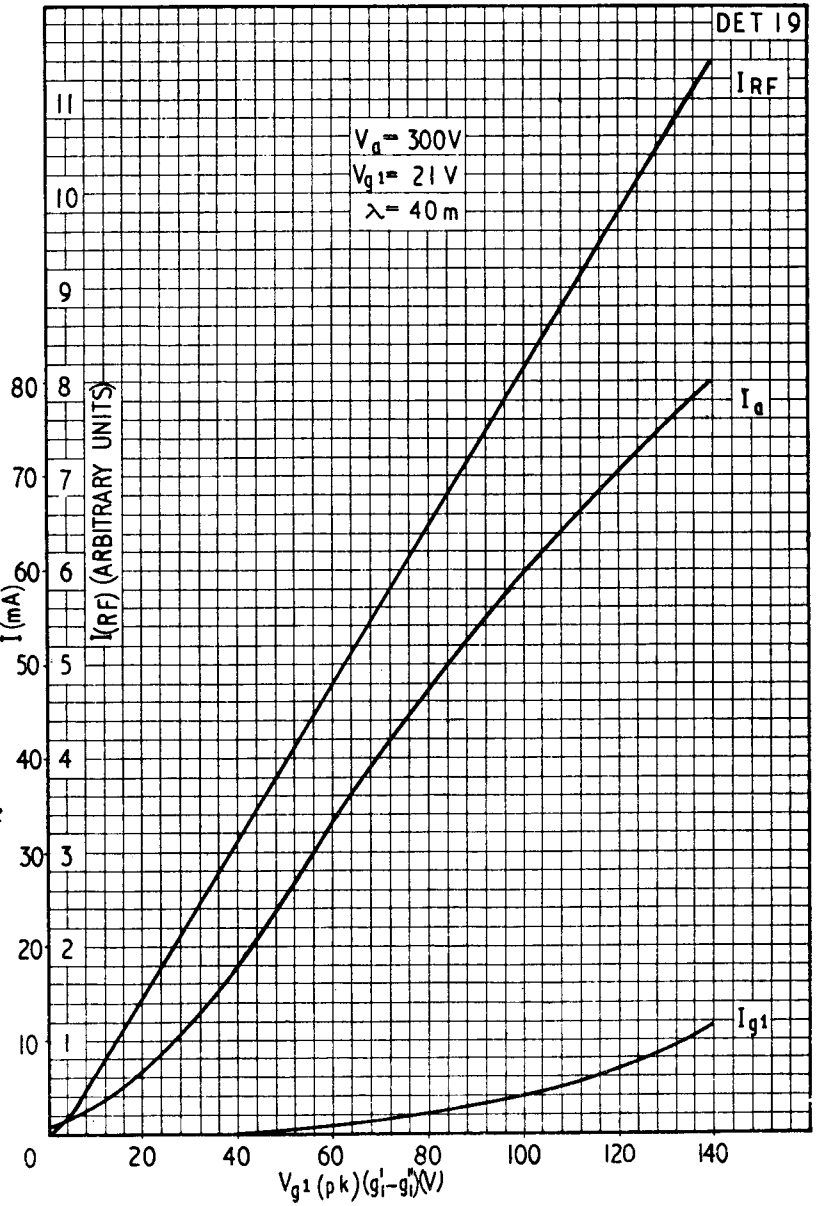
(a) Subject to wide variations depending on the impedance of the load circuit.

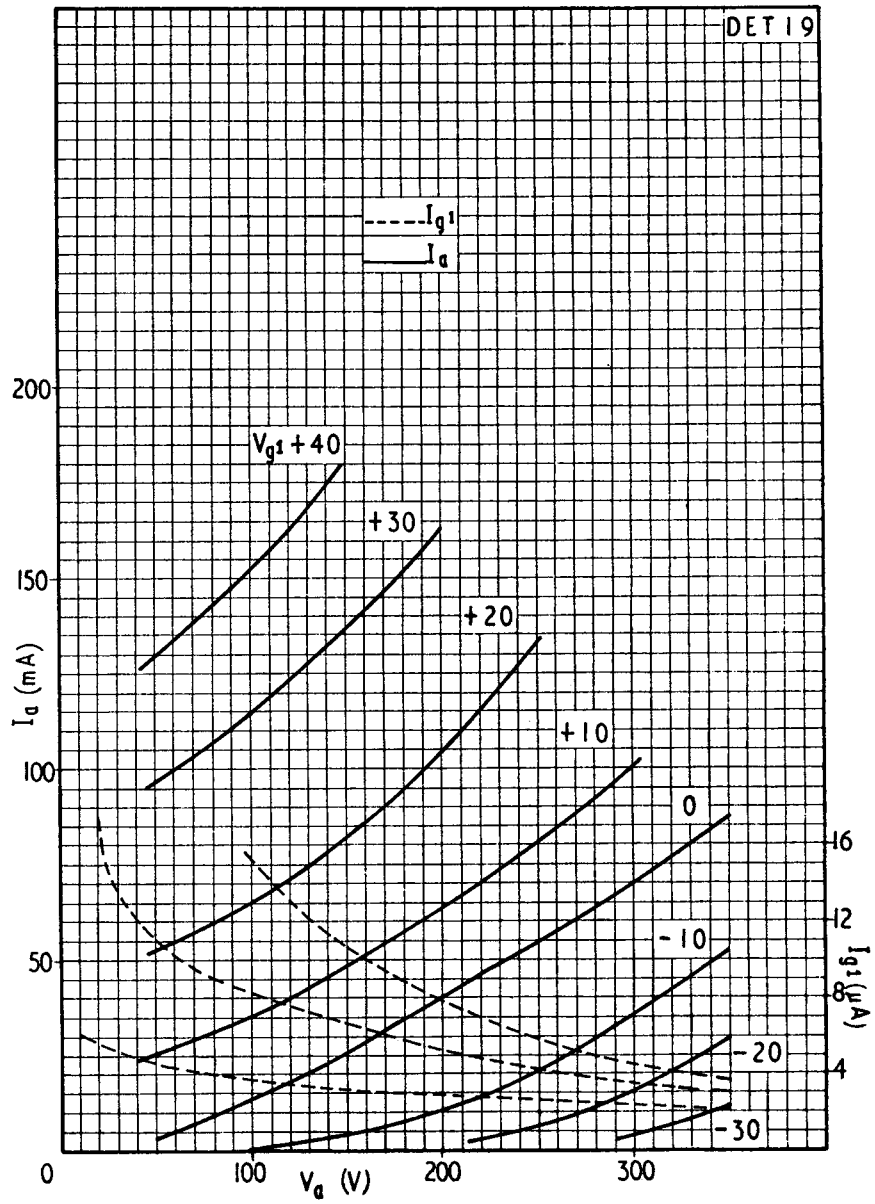
(b) At crest of modulation cycle.

(c) Grid leak operation is not permissible.

(d) The anode voltage applied to the first triode should be kept as low as is consistent with adequate output.


DET 19
PUSH-PULL CLASS C AMPLIFIER
V_a(max)V
P_{out}(W)
V_a(max)
P_{out}
η_a
G
%
f (Mc/s)
60
30
20
λ(m)
0
5
10
15


DET 19
V_a= 300V
V_{g1}= 21 V
λ= 40 m
I_{RF}
I_a
I_{g1}
I(RF) (ARBITRARY UNITS)
I (mA)
V_{g1} (pk) $(g_i'-g_i'')$(V)
0
20
40
60
80
100
120
140


DET 19
I_{g1}
I_a
V_{g1} +40
+30
+20
+10
0
-10
-20
-30
I_a (mA)
200
150
100
50
0
100
200
300
V_a (V)
16
12
8
4
I_{g1} (μA)



PRINTED IN ENGLAND

Triode *Type DET21*

(AF AMPLIFIER AND MODULATOR)

General. A low-frequency amplifying or modulating triode intended for Class A or Class B conditions of use.

Mounting. It is fitted with a thoriated filament and a carbon anode, the connection to which is by a top cap.

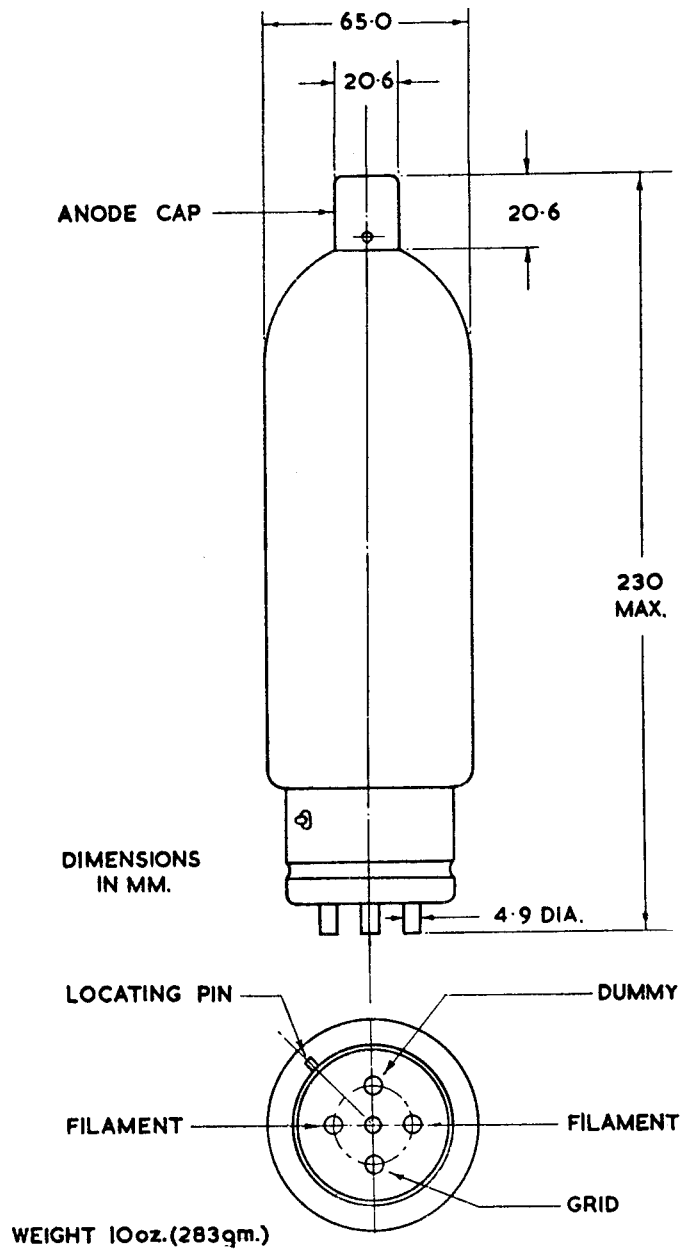
A standard 4-pin bayonet base is employed for the filament and grid connections.

Cooling. As the valve runs hot in operation, free air circulation should be allowed.

Warning. In no circumstances must the ratings of this valve be exceeded.

APPROXIMATE DATA

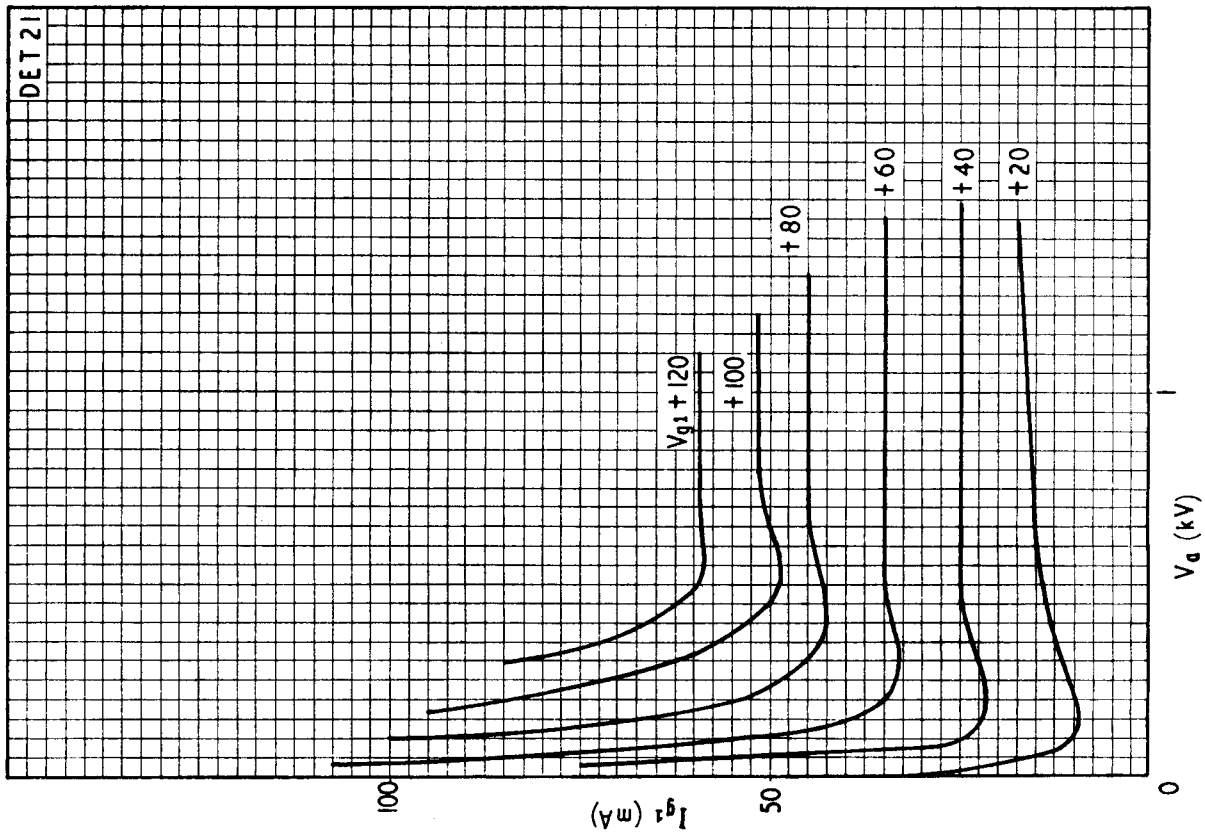
V_f				10·0	V
I_f				5·5	A
$V_{a(max)}$				3,000	V
$p_{a(max)}$				125	W
μ	taken at			12·5	
g_m	V_a	3,000	V	4·5	mA/V
r_a	p_a	125	W	2,800	Ω
$c_{a\text{-}gl}$				18·25	pF
$c_{a\text{-}k}$				10·3	pF
$c_{gl\text{-}k}$				10	pF

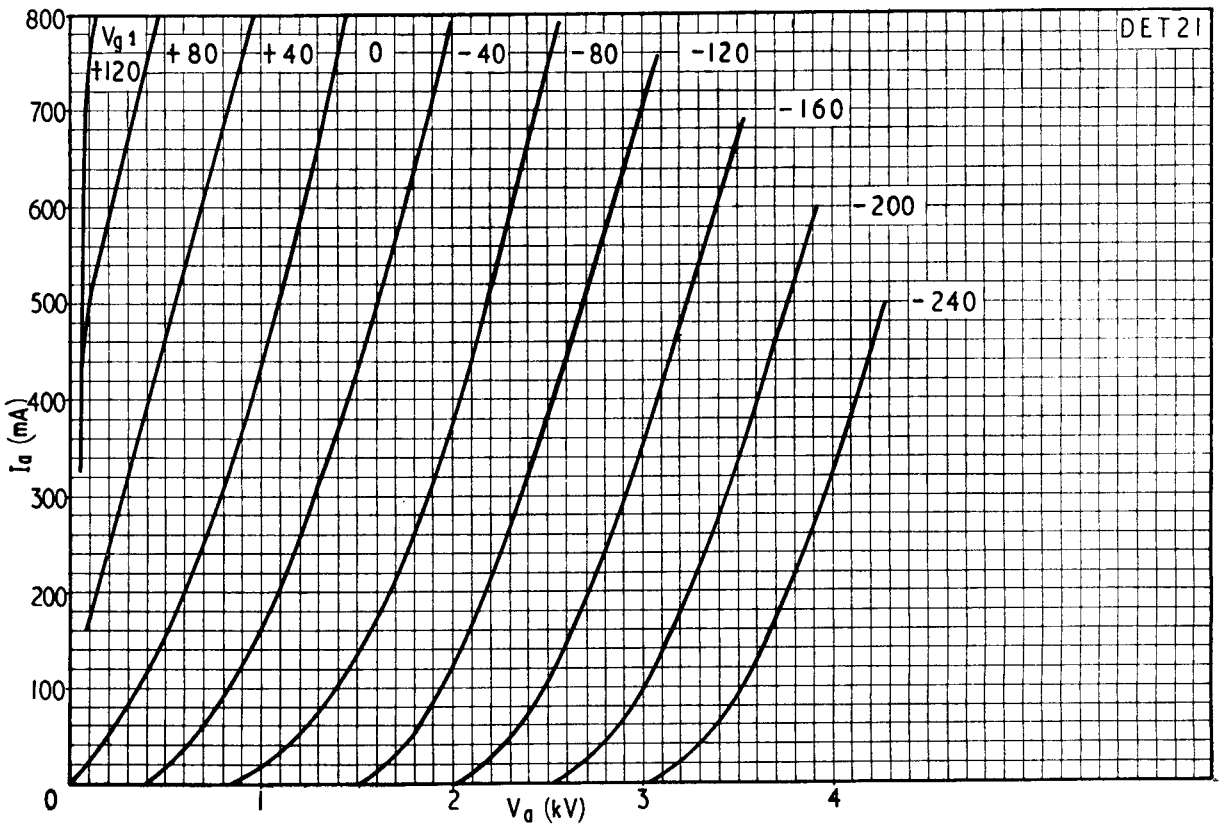


WEIGHT 10oz.(283gm.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford





PRINTED IN ENGLAND

Triode *Type DET22*

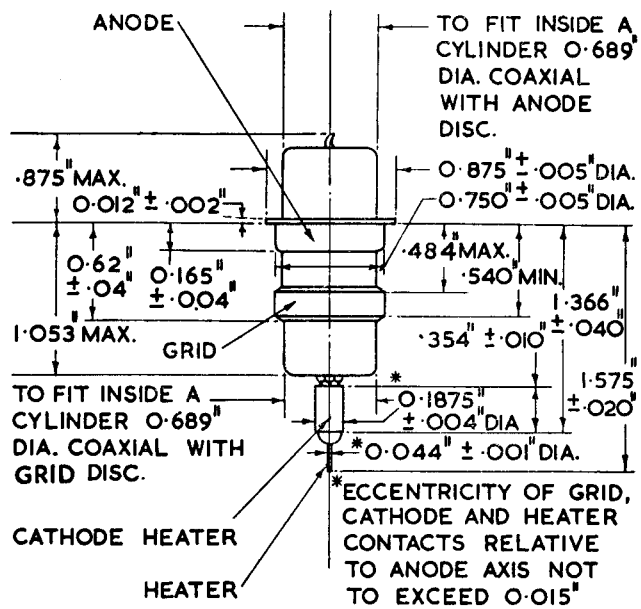
(OSCILLATOR AND VHF AMPLIFIER)

General. The DET 22 is a disc seal triode, without internal feedback, fitted with an indirectly heated oxide-coated cathode. It is intended mainly as a common-grid, earthed-anode, concentric-line oscillator, but may also be used as a power amplifier.

When used in a co-axial line circuit with an anode input of 10 W the output power is approximately 1 W at 10 cm. rising to 3 W at 30 cm. The lower limit of operating wavelength is 7 to 8 cm.

Cooling. The anode seal temperature must not exceed 284°F (140°C). In order to limit the temperature, and rate of change of temperature of the anode seal, it is necessary for the mass of metal in close thermal contact with the anode disc to be not less than 2 oz. (60 gm. approx.) of brass or its equivalent.

Mounting. The valve may be mounted in any position.



TYPICAL CIRCUIT ARRANGEMENT.

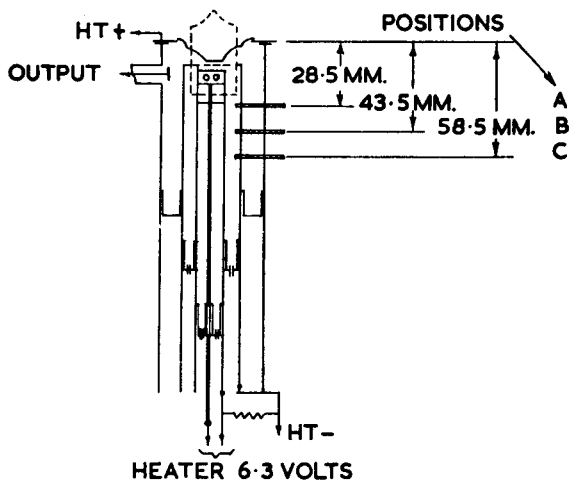


FIG. 1

RECOMMENDED CIRCUIT DIMENSIONS.

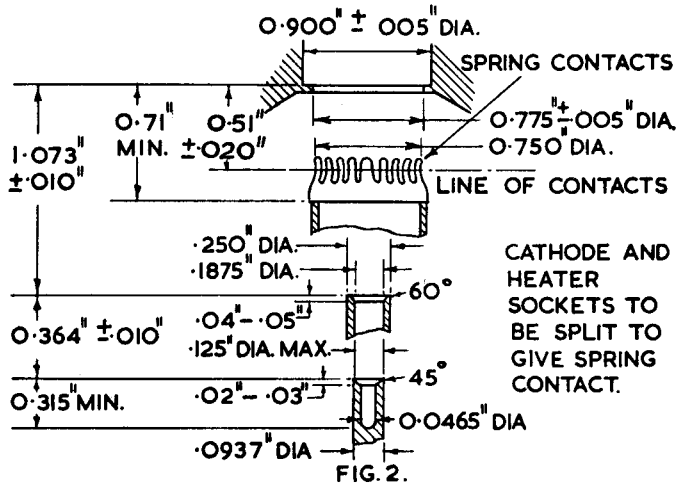


FIG. 2.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

APPROXIMATE DATA

V_f	6·3	V
I_f	0·4	A
$V_{a(max)}$	350	V
$p_{a(max)}$	10	W
$I_{a\ (pk)\ (max)}$	150	mA
$I_{a(max)}$	40	mA
μ	30	
g_m (taken at V_a 250 V, I_a 20 mA)	6	mA/V
$C_{a\text{-}gl}$	1·1	pF
$C_{a\text{-}k}$	0·02	pF
$C_{gl\text{-}k}$	2·2	pF

APPLICATION DATA

A typical circuit arrangement is shown in Fig. 1, where the anode-grid and grid-cathode circuits are both co-axial lines, the grid tube being common to both circuits.

The anode-grid and grid-cathode circuits are both tuned by means of movable bridges, and it is essential that good contact be maintained between these bridges and the tubes on which they slide. Ideally these bridges should be one-quarter of a wavelength in length, in order that the actual contact may occur at a current node, but over the wavelength range of 10-60 cm. a good compromise is effected with a bridge of 2·5 cm. in length. In order that bias may be used, a capacity is incorporated in the grid-cathode bridge.

When the valve is to be used as an oscillator, feed-back is obtained by means of a probe (6BA threaded rod) which makes contact with the anode line and passes through a $\frac{1}{4}$ in. diameter hole in the grid line. The displacement of the end of the probe from the cathode tube is thus readily adjustable. For wavelengths longer than 30 cm. it is desirable to terminate the probe by a small circular plate, but for wavelengths below 30 cm. the plate may be dispensed with, and for wavelengths around 10 cm. the increased capacitance prohibits its use.

The output may be taken from the oscillator into a 75 Ω cable by means of a capacity probe, as indicated in Fig. 1. The coupling can be adjusted to optimum by sliding the probe along the line or by varying the depth of penetration towards the grid line.

The complete range of oscillation between the lower wavelength limit (determined by the valve or the circuit) and the upper wavelength limit (determined by the circuit) is not possible with a single probe position. A complete range of oscillation can be obtained with three positions, and for a typical circuit and the probe positions marked A, B and C in Fig. 1, the range of wavelengths that was obtained is given in the following table:

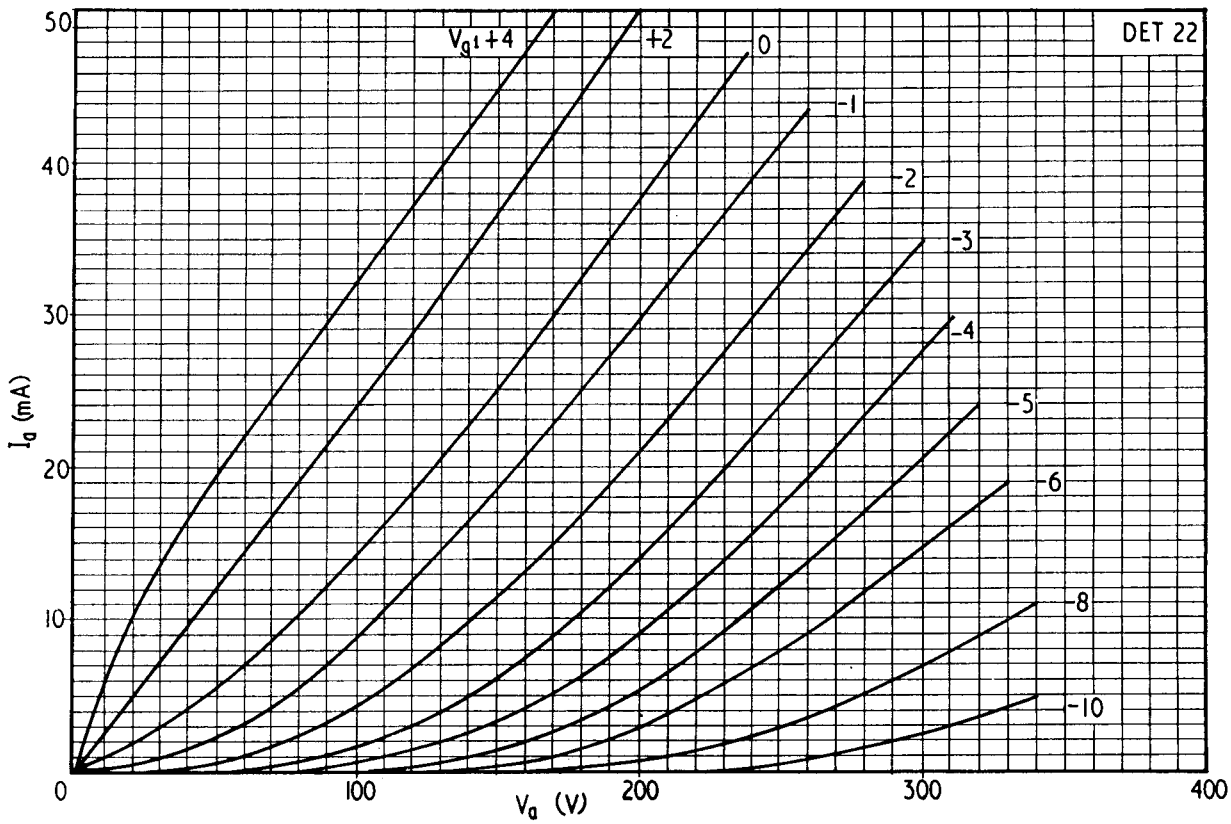
Probe position	Distance from anode plane	Range of λ with anode line on $\frac{3\lambda}{4}$ mode	Min. λ with anode line on λ/4 mode
A	28·5 mm.	9-14 cm.	24 cm.
B	43·5 mm.	11-19 cm.	29 cm.
C	58·5 mm.	21-24 cm.	35 cm.

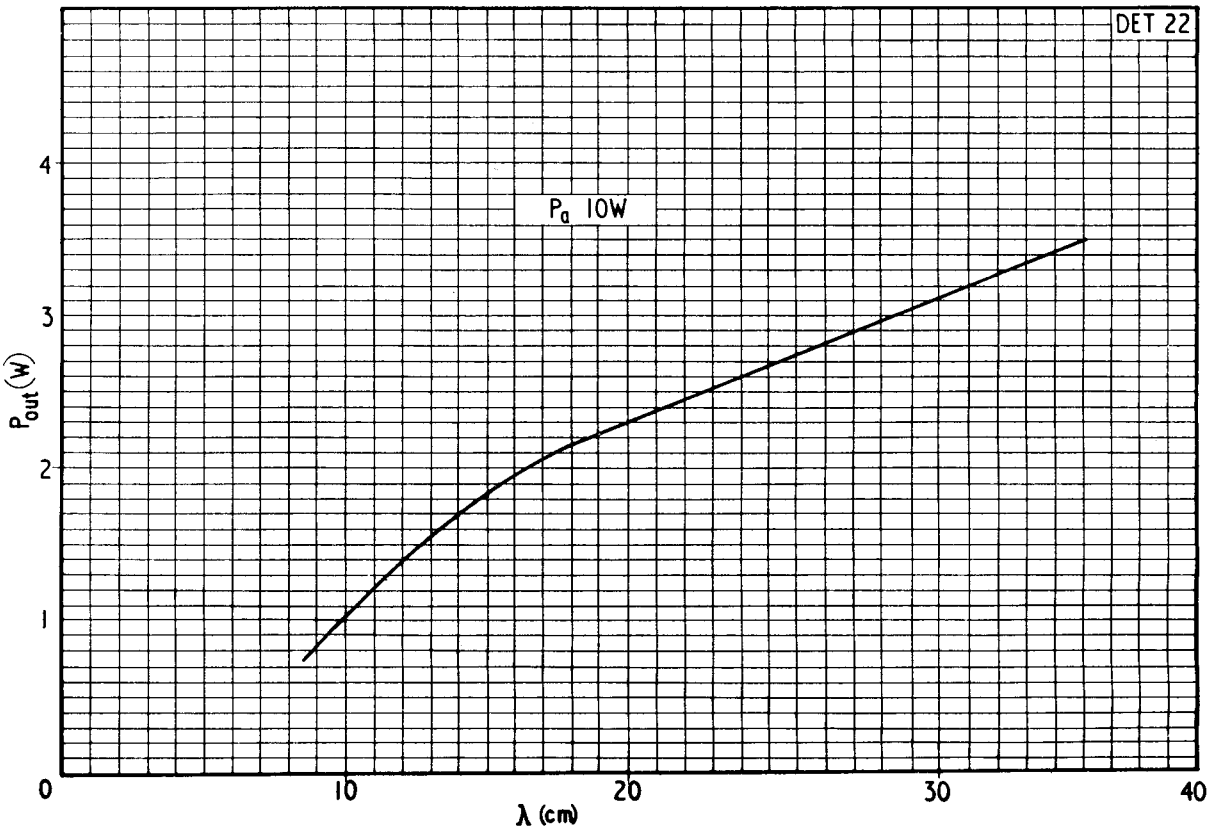
The heater-cathode circuit may be tuned by means of a capacity bridge. The tuning is not critical for the longer wavelengths, but it is necessary for wavelengths around 10 cm., and must be used if maximum efficiency is required. However, a bridge fixed 7·2 cm. from the valve end of the cathode line will give reasonable operation over the range 8-12 cm.

A curve shows the power output obtainable over the wavelength range of 10-35 cm., with a constant input power of 10 W, using the appropriate probe position and coupling, and with optimum grid bias. The optimum value of grid bias varies with the frequency, and the following table gives the approximate cathode bias resistance for various wavelengths.

λ	30	15	12 and less	cm.
R_k	300-350	100	Zero	Ω

The use of zero bias at a wavelength of 30 cm. may cause a reduction in efficiency of as much as 50%.


DET 22
V_{g1} +4
+2
0
-1
-2
-3
-4
-5
-6
-8
-10
I_a (mA)
50
40
30
20
10
0
100
200
300
400
V_a (V)


DET 22
P_a 10W
P_{out} (W)
4
3
2
1
0
10
20
30
40
λ (cm)



PRINTED IN ENGLAND

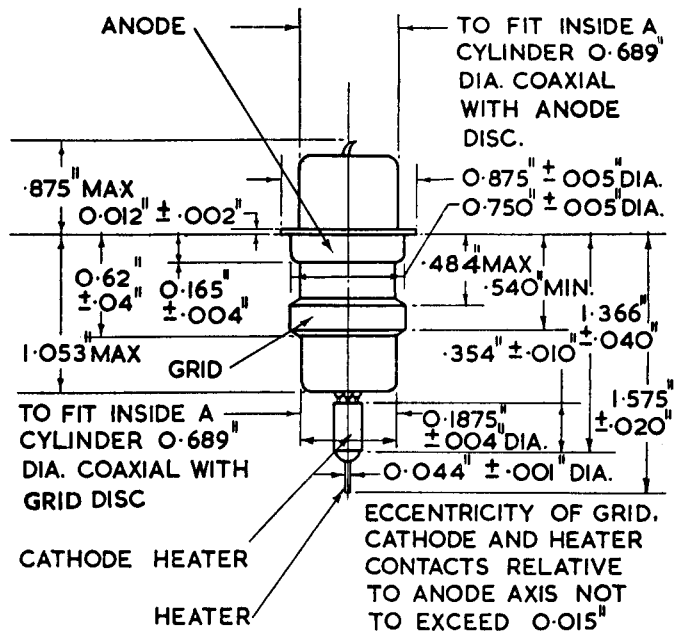
Triode *Type DET23*

(UHF AMPLIFIER)

General. The DET 23 is an indirectly-heated disc seal UHF triode, designed for use as a Class A amplifier in common-grid, earthed-anode, and concentric-line circuits.

Cooling. In order to limit the temperature and rate of change of temperature of the anode seal, it is necessary for the mass of metal in close thermal contact with the anode disc to be not less than 2 oz. (approx. 60 gm.) of brass or its equivalent. The anode seal temperature must not exceed 140°C.

Mounting. The valve may be mounted in any position. Rigid connection must be made to the anode flange only.



TYPICAL CIRCUIT ARRANGEMENT

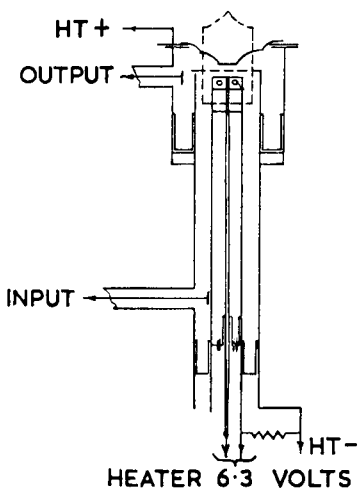


FIG. 1.

RECOMMENDED CIRCUIT DIMENSIONS

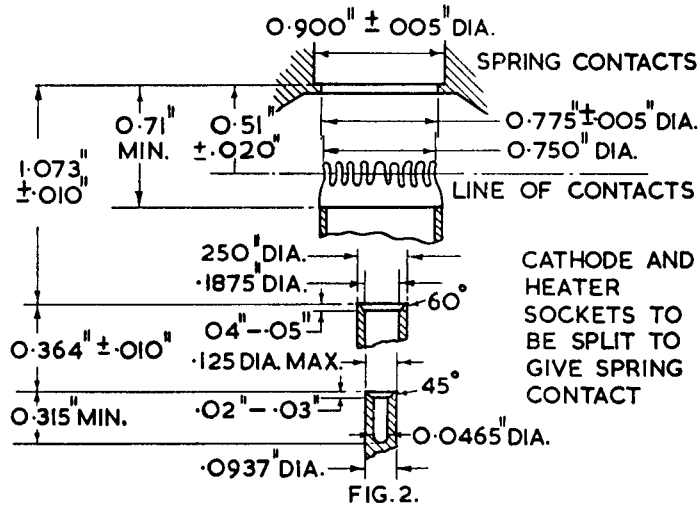


FIG. 2.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

V_h	6·3	V
I_h	0·4	A
$V_{a(max)}$	350	V
$p_{a(max)}$	5	W
μ	70	
g_m (taken at Va 250 V, Ia 10 mA)	7	mA/V
$c_{a\text{-}gl}$	0·9	pF
$c_{a\text{-}k}$	0·01	pF
$c_{gl\text{-}k}$	2·2	pF

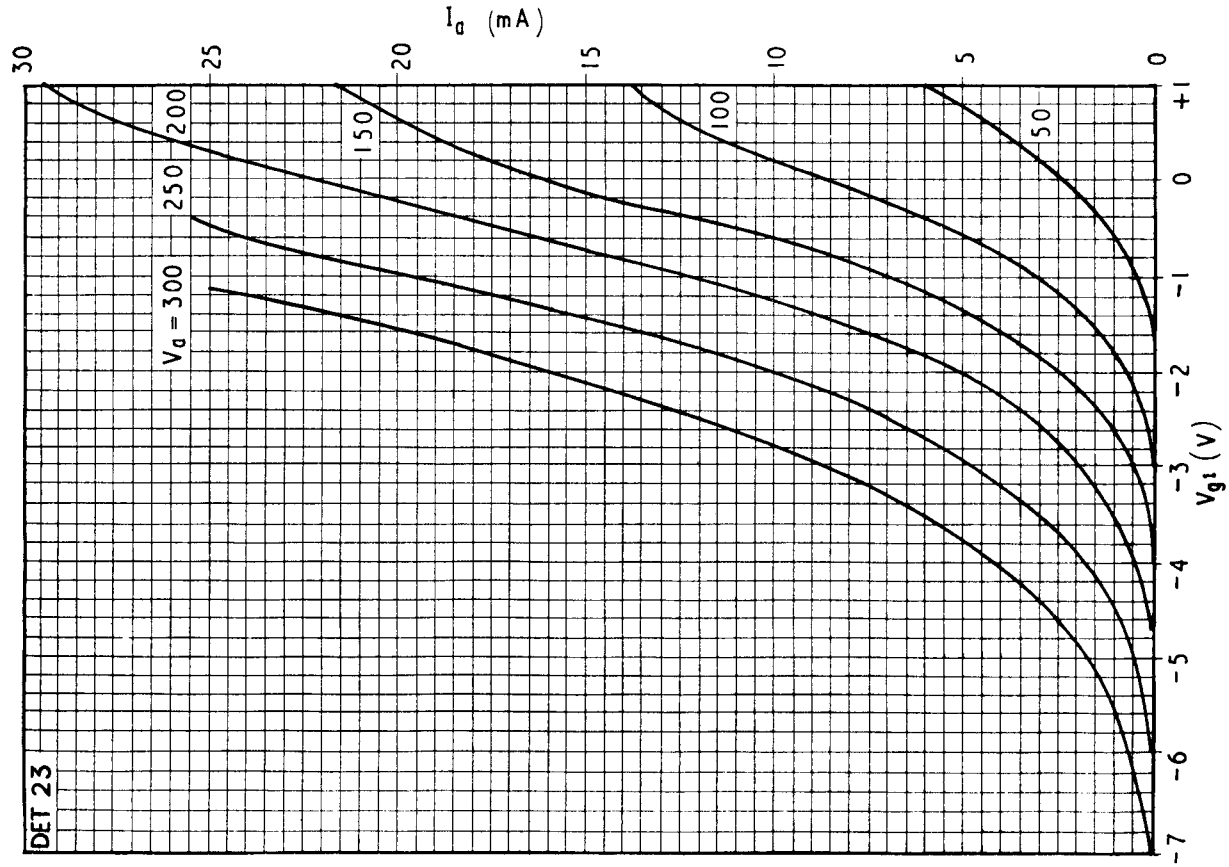
APPLICATION DATA

A typical circuit arrangement is shown where the anode-grid and grid-cathode circuits are both co-axial lines, the grid tube being common to both circuits.

The anode-grid and grid-cathode circuits are both tuned by means of movable bridges, and it is essential that there should be good contact between these bridges and the tubes on which they slide. In order that bias may be used, a capacitor is included in the grid-cathode bridge.

The output can be taken from the amplifier into a 75 Ω cable by means of a capacity probe as indicated. The coupling can be adjusted to optimum by sliding the probe along the line or by varying the depth of penetration towards the grid line.

Coupling to the input circuit may be made by a 75 Ω cable. Tight coupling being required, to match the cable to the valve, the inner conductor of the cable should make actual contact with the cathode line.



PRINTED IN ENGLAND

Triode *Type DET 24*

VHF AMPLIFIER AND OSCILLATOR

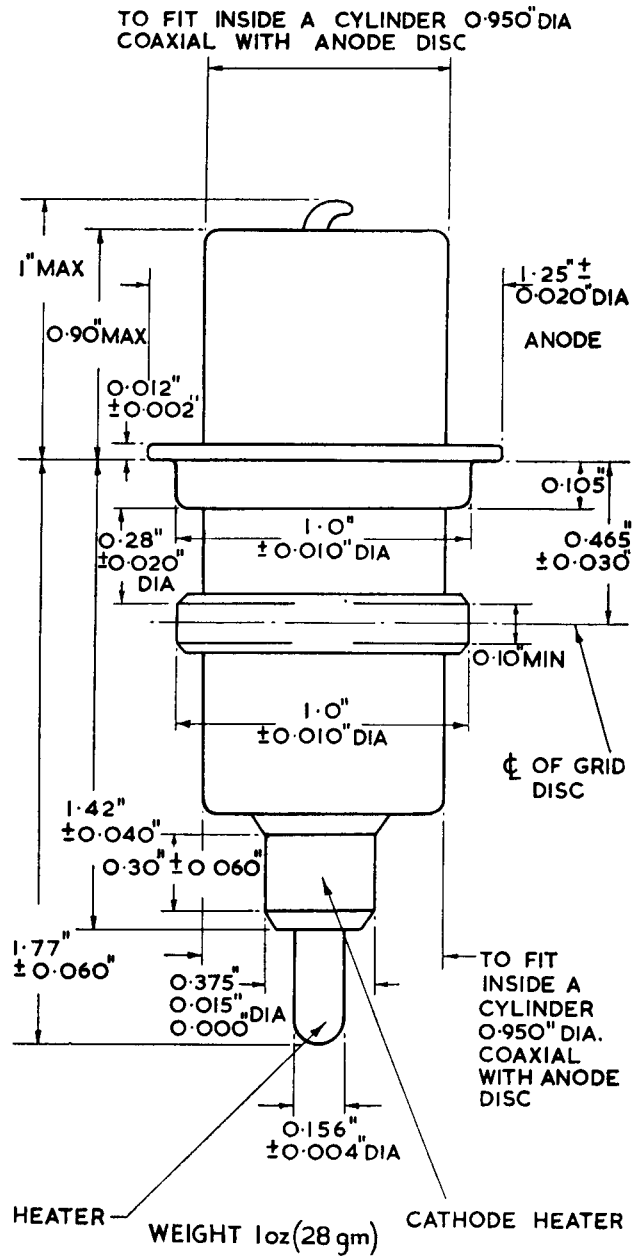
General. A disc seal triode intended for use as an oscillator or amplifier in co-axial line circuits at frequencies up to 2,000 Mc/s.

Cooling. The temperature of the metal to glass seals must not exceed 140°C. In order to limit the temperature and the rate of change of temperature, the mass of metal in close thermal contact with the anode disc must not be less than 120 gm.

Mounting. The valve may be mounted in any position. Rigid connection must be made to the anode flange only.

APPROXIMATE DATA

V_f		6·3	V
I_f		1	A
$V_{a\ (max)}$		400	V
$I_{k(pk)\ (max)}$		600	mA
$p_{a\ (max)}$		20	W
$p_{g1\ (max)}$		1	W
→ μ	taken at V_a 400 V	28	
→ g_m	I_a 50 mA	12	mA/V



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

APPLICATION DATA

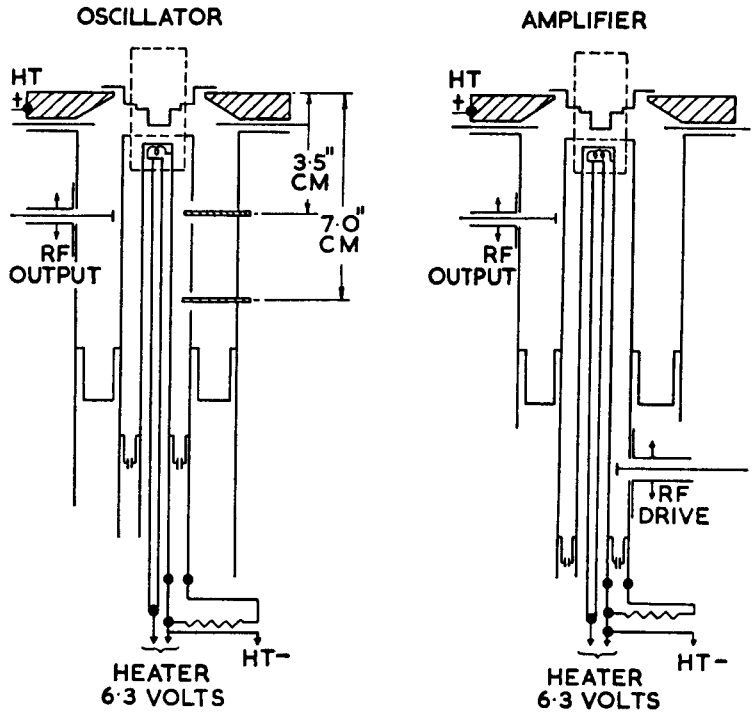
A typical circuit design for a self-oscillator is shown where the anode-grid and grid-cathode circuits are both co-axial lines, the grid tube being common to both circuits.

Movable bridges tune the anode-grid and grid-cathode lines. The grid-cathode bridge incorporates a capacitor so that grid bias may be used. Feedback is obtained by a probe which makes contact with the anode line and passes through a hole in the grid line to the grid-cathode space. To cover the ranges 25–90 cm and 15–30 cm two positions of the probe at distances of 3·5 cm and 7 cm respectively from the plane of the anode disc are necessary. For wavelengths greater than 25 cm the probe should carry an end plate, shaped to the curvature of the cathode line so as to obtain additional capacitance at a reasonable clearance. It is not necessary to tune the heater-cathode line at any wavelength. Output may be taken by means of a co-axial line with a capacity probe in the anode-grid space.

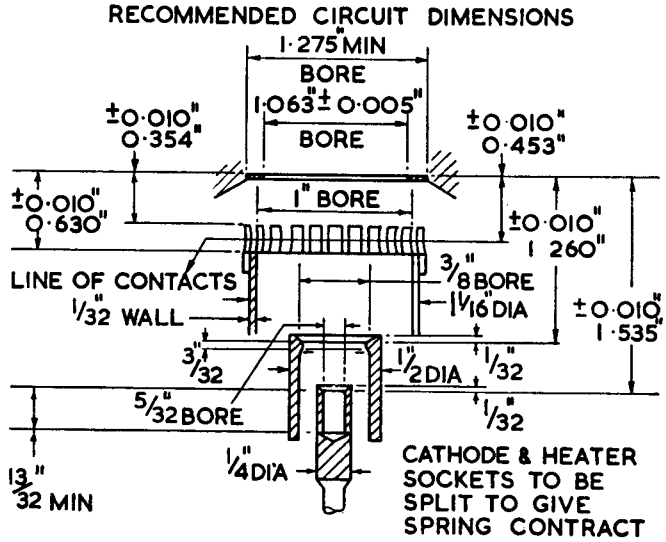
The lengths for anode and cathode lines for a range of wavelengths are shown in graphical form. The effect of loading on line length is very slight except when an end plate is used on the feedback probe; in this case the cathode line length is substantially reduced when the circuit is loaded.

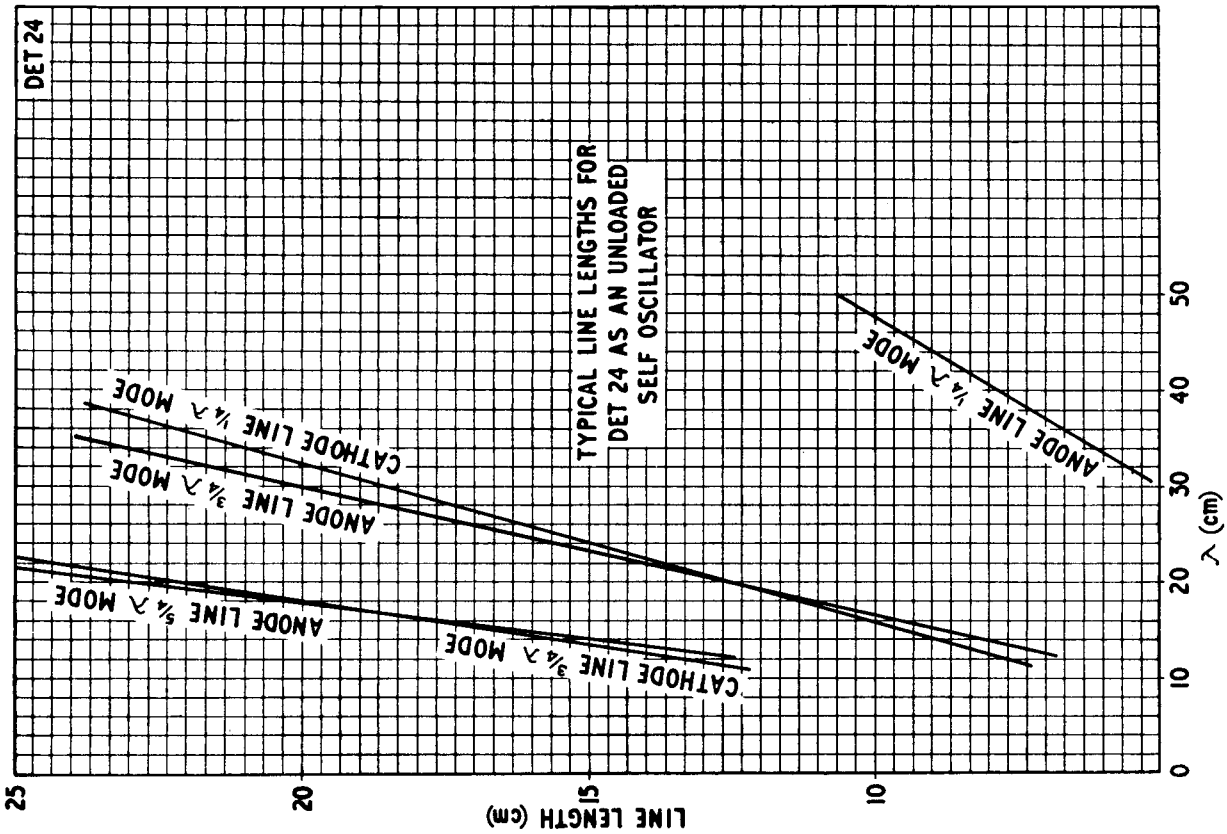
A typical circuit for an amplifier is also shown. The RF input is fed into the grid cathode line by a capacity probe. This line is operated on the 3/4 λ or 5/4 λ modes depending on the wavelength.

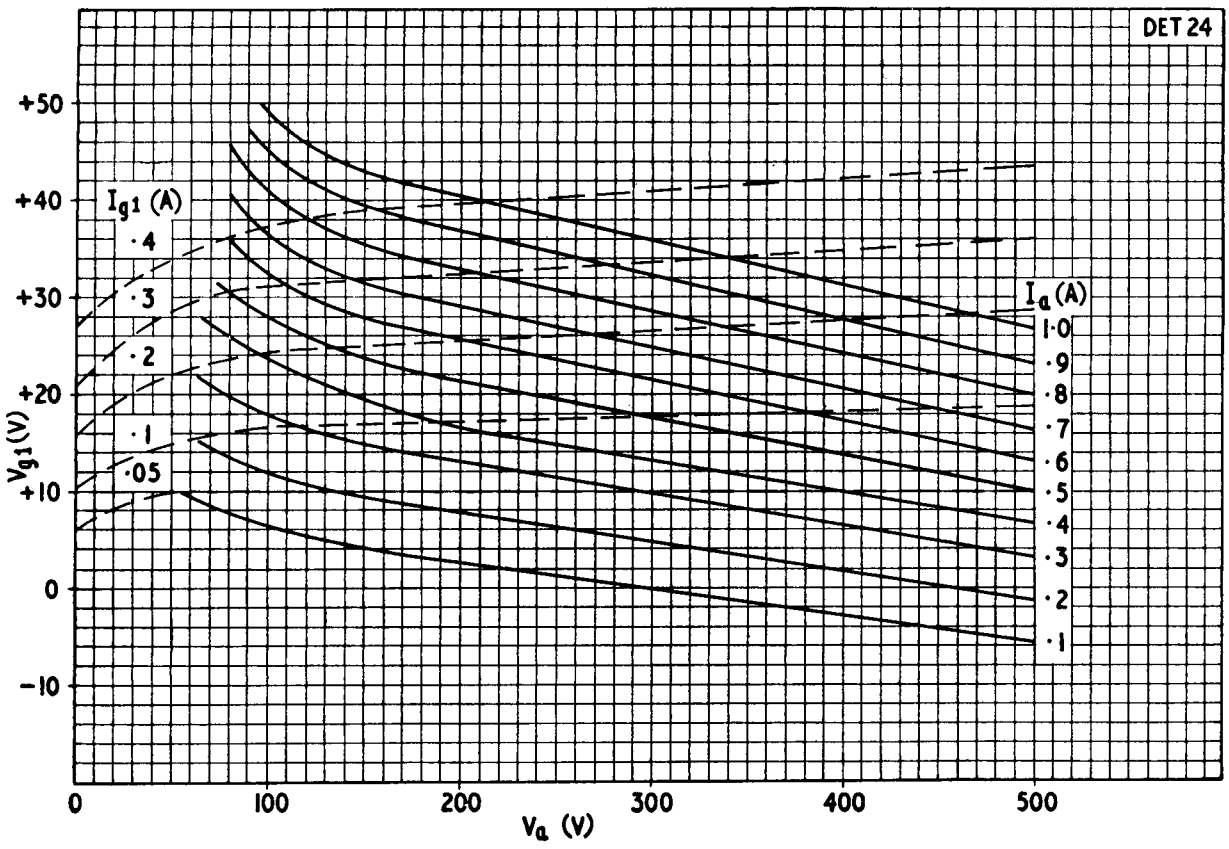
CIRCUIT ARRANGEMENTS

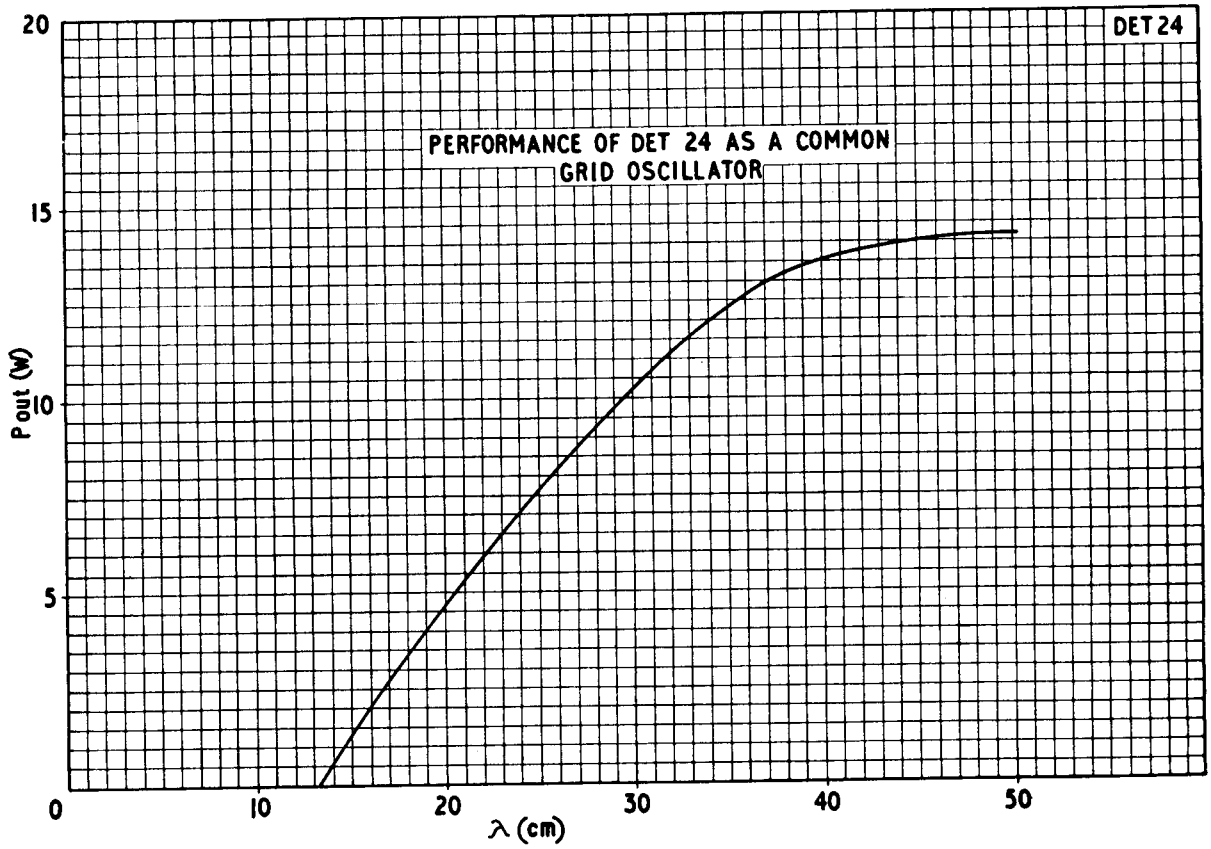


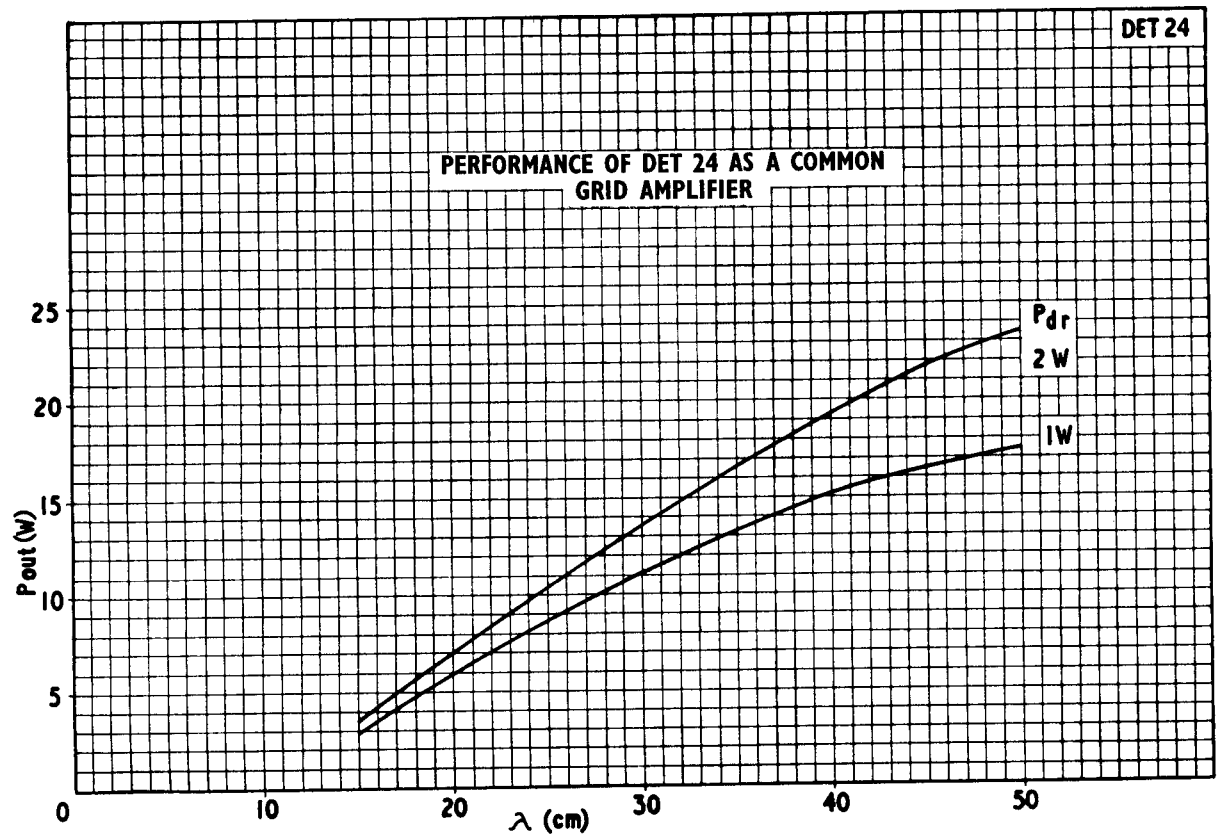
RECOMMENDED CIRCUIT DIMENSIONS




DET 24
TYPICAL LINE LENGTHS FOR
DET 24 AS AN UNLOADED
SELF OSCILLATOR
ANODE LINE ¼ λ MODE
CATHODE LINE ¼ λ MODE
ANODE LINE ¾ λ MODE
ANODE LINE ⅝ λ MODE
CATHODE LINE ¾ λ MODE
LINE LENGTH (cm)
λ (cm)
25
20
15
10
0
10
20
30
40
50


DET 24
I_{g1} (A)
·4
·3
·2
·1
·05
I_a (A)
1·0
·9
·8
·7
·6
·5
·4
·3
·2
·1
V_{g1} (V)
+50
+40
+30
+20
+10
0
−10
0
100
200
300
400
500
V_a (V)


DET 24
PERFORMANCE OF DET 24 AS A COMMON GRID OSCILLATOR
Pout (W)
20
15
10
5
0
10
20
30
40
50
λ (cm)


DET 24
PERFORMANCE OF DET 24 AS A COMMON GRID AMPLIFIER
Pout (W)
25
20
15
10
5
0
10
20
30
40
50
λ (cm)
Pdr
2 W
1W



PRINTED IN ENGLAND

Triode *Type DET 27*

(HF AMPLIFIER AND OSCILLATOR, AND AF AMPLIFIER)

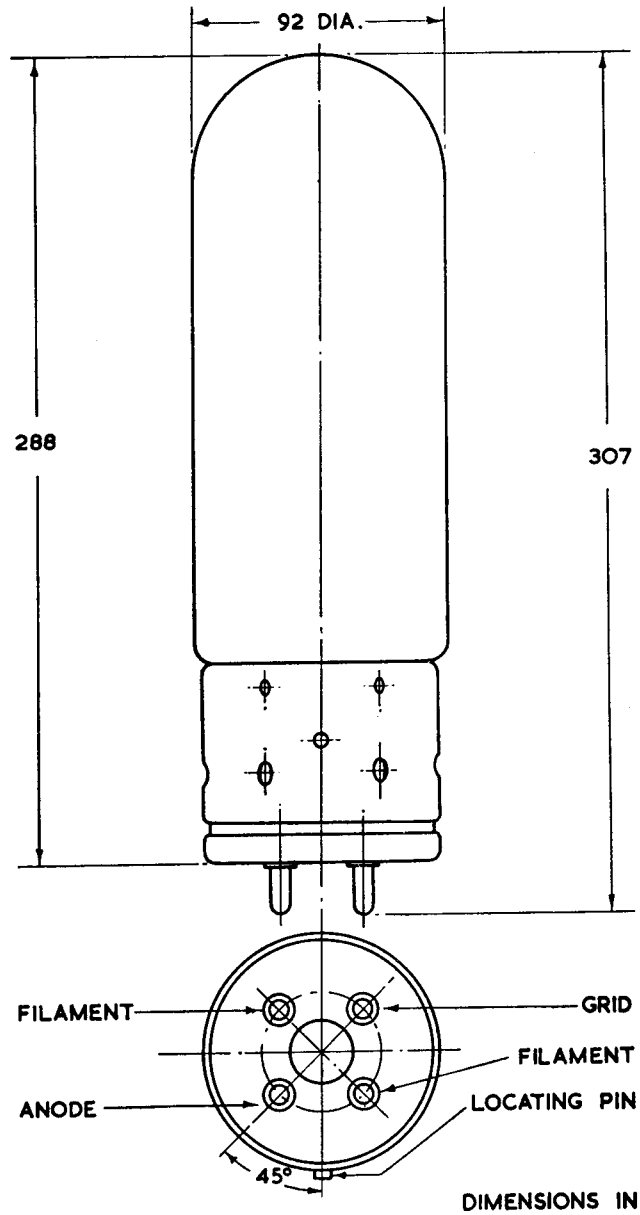
General. The DET 27 is a triode fitted with a thoriated tungsten filament. The valve is suitable for use as a power amplifier or oscillator at frequencies up to 3 Mc/s or as an audio power amplifier.

Cooling. Adequate ventilation must be provided. The temperature at the hottest part of the bulb must not exceed 250°C.

Mounting. The valve must be mounted vertically with the anode uppermost.

APPROXIMATE DATA

V_f			10	V
I_f			10	A
$V_{a(max)}$			2·7	kV
$V_{a(pk)(max)}$			6	kV
$I_{gl(rf)(max)}$			2	A
$p_{a(max)}$			250	W
$p_{gl(max)}$			20	W
$I_{k(pk)(max)}$			4	A
r_a	taken at V_a	700 V	2,450	Ω
μ	taken at V_a	700 V	22	
g_m	taken at I_a	150 V	9	mA/V
g_m (taken at $\frac{1}{2}$ $I_{k(pk)}$)			21	mA/V
$C_{a\text{-}f}$			7·5	pF
$C_{a\text{-}gl}$			24	pF
$C_{gl\text{-}f}$			14	pF



WEIGHT 23 oz. (0·65 kg.)

DIMENSIONS IN MM. MAXIMUM.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

(1) RF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions)

Maximum Ratings

V_a		2	kV
V_{g1}		−300	V
I_a		500	mA
p_a		250	W
p_{g1}		20	W

Typical Operation

V_a		2	kV
V_{g1}		−190	V
$v_{g1(pk)}$		315	V
I_a		450	mA
I_{g1}	(a)	40	mA
Z_a		2,100	Ω
P_{dr}	(a)	15	W
p_a		250	W
P_{out}		650	W
P_{load}	(b)	550	W

(2) RF POWER AMPLIFIER. CLASS C.

(Anode modulated, carrier conditions, one valve, 100% modulation.)

Maximum Ratings

V_a		1·6	kV
V_{g1}		−300	V
I_a		400	mA
p_a	(c)	165	W
p_{g1}		20	W

Typical Operation

V_a		1·6	kV
V_{g1}		−150	V
$v_{g1(pk)}$		260	V
I_a		325	mA
I_{g1}	(a)	30	mA
Z_a		2,400	Ω
P_{dr}	(a)	9	W
p_a		165	W
P_{out}		355	W
P_{load}	(b)	300	W

(3) AF AMPLIFIER. CLASS AB1

(Conditions per pair of valves unless otherwise stated.)

Note. The power supply impedance should not exceed 400 Ω.

$V_{a(zero\text{-}sig)}$	2·2	2·7	kV
$V_{a(max\text{-}sig)}$	2	2·5	kV
V_{g1}	−80	−115	V
$V_{in(pk)(g_1'\text{-}g_1'')}$	180	230	V
$I_{a\ (zero\text{-}sig)}$	100	120	mA
$I_{a\ (max\text{-}sig)}$	300	360	mA
$p_{a\ (zero\text{-}sig)}$ per valve	110	160	W
$p_{a\ (max\text{-}sig)}$ per valve	190	250	W
R_L	10	12	kΩ
P_{out}	250	400(d)	W
D	< 5	5	%

(4) AF AMPLIFIER. CLASS AB2

(Conditions per pair of valves unless otherwise stated.)

Note. The power supply impedance should not exceed 400 Ω.

$V_{a(zero\text{-}sig)}$	2·2	2·7	kV
$V_{a(max\text{-}sig)}$	2	2·5	kV
V_{g1}	−80	−115	V
$V_{in(pk)(g_1'\text{-}g_1'')}$	350	400	V
$I_{a(zero\text{-}sig)}$	100	120	mA
$I_{a(max\text{-}sig)}$	480	530	mA
$I_{g1(max\text{-}sig)}$	30	30	mA
$p_{a(zero\text{-}sig)}$ per valve	110	160	W
$p_{a(max\text{-}sig)}$ per valve (c)	160	210	W
R_L	10	12	kΩ
P_{out}	650	900(d)	W
D	< 6	6	%

NOTES

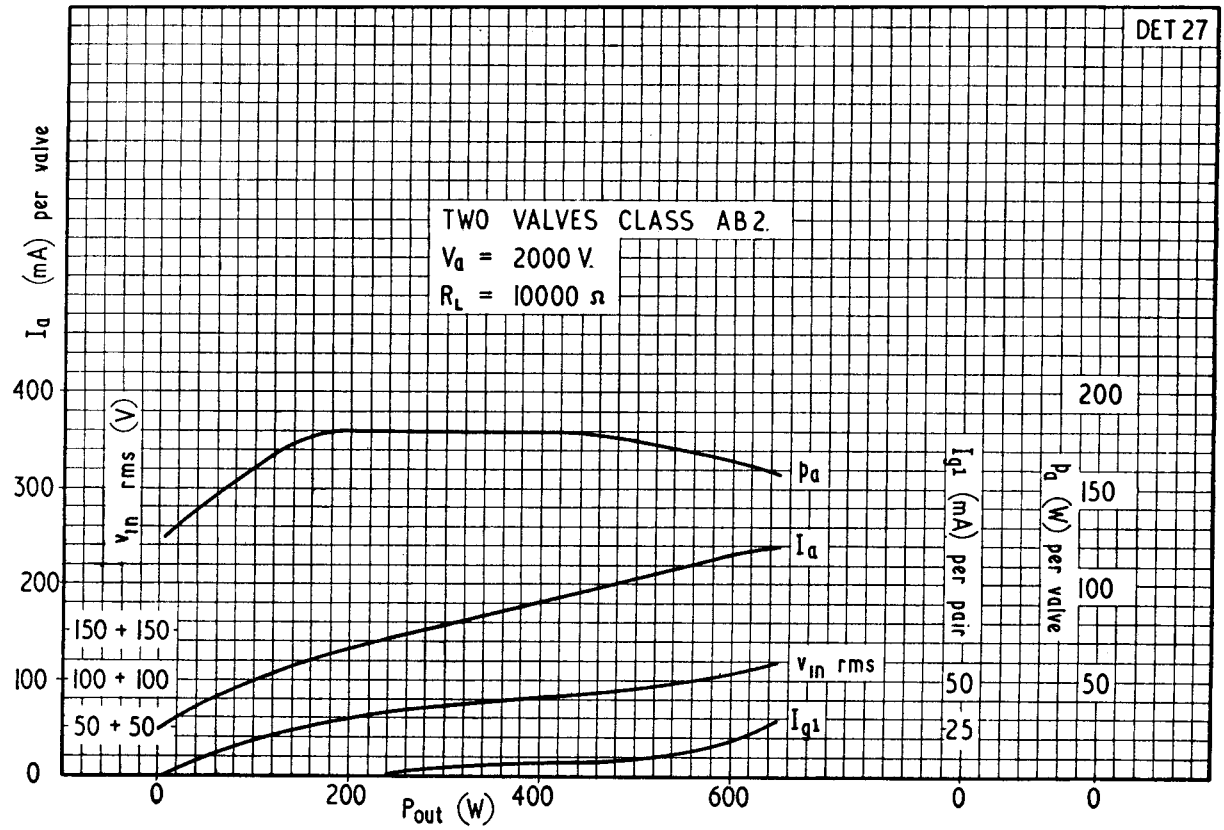
(*a*) Subject to wide variation.

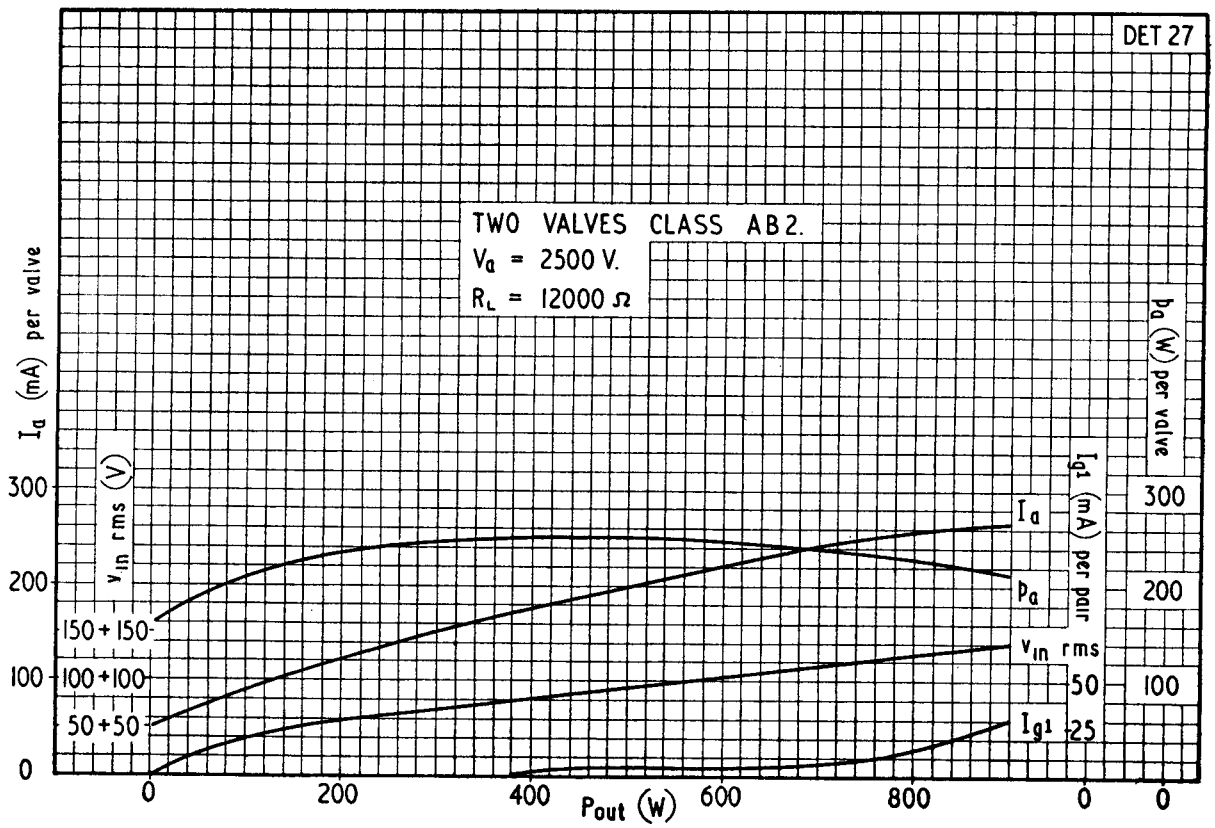
(*b*) Assuming a circuit transfer efficiency of 85%.

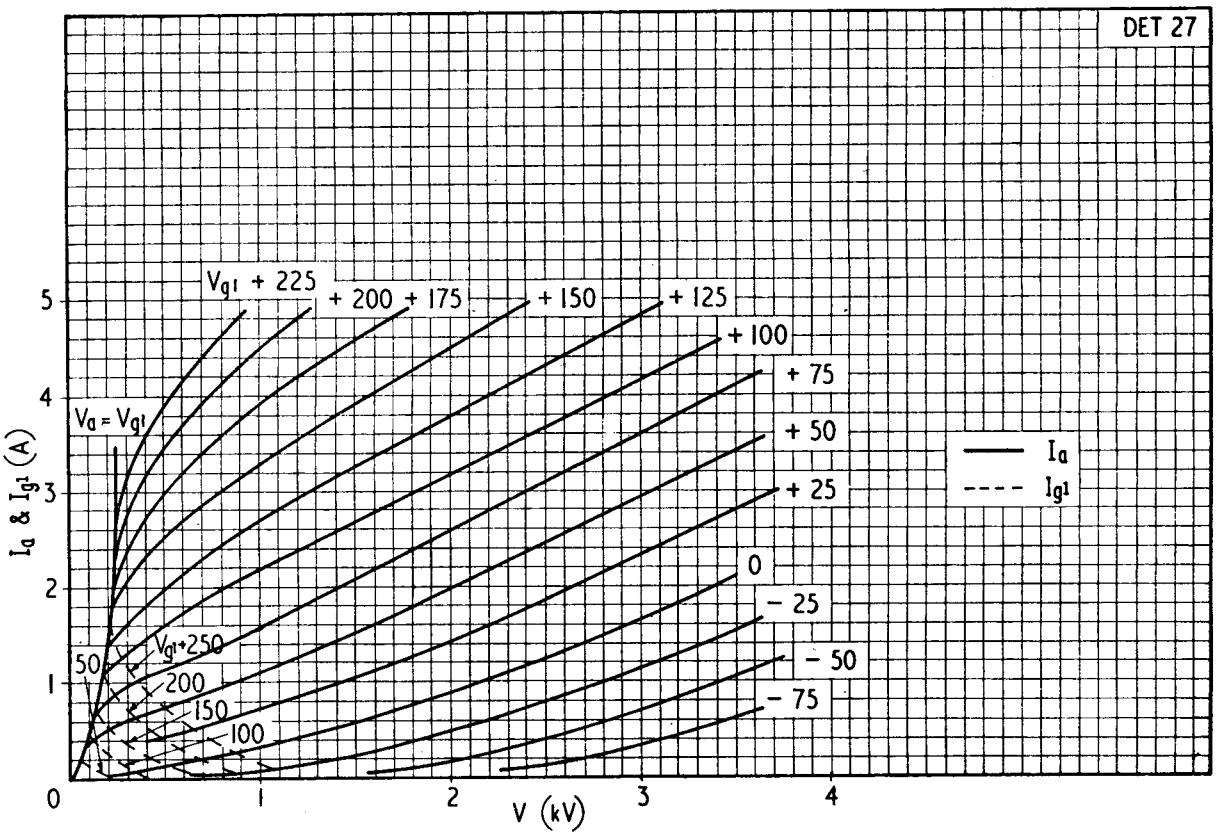
(*c*) If the mean depth of modulation is low, higher values of p_a may be permissible. The value of p_a under modulated conditions, must never exceed 250 W.

(*d*) This valve may vary by ±6%.

(*e*) $p_{a(max)}$, under class AB2 push-pull conditions, occurs at approximately half full output.


DET 27
TWO VALVES CLASS AB2.
V_a = 2000 V.
R_L = 10000 Ω
I_a (mA) per valve
400
300
200
100
0
v_{in} rms (V)
150 + 150
100 + 100
50 + 50
p_a
I_a
v_{in} rms
I_{g1}
0
200
400
600
P_{out} (W)
I_{g1} (mA) per pair
50
25
p_a (W) per valve
200
150
100
50
0
0


DET 27
TWO VALVES CLASS AB2.
V_a = 2500 V.
R_L = 12000 Ω
I_a (mA) per valve
300
200
100
0
v_{in} rms (V)
150+150
100+100
50+50
I_a
p_a
v_{in} rms
I_{g1}
0
200
400
600
800
P_{out} (W)
I_{g1} (mA) per pair
50
25
p_a (W) per valve
300
200
100
0
0



PRINTED IN ENGLAND

CONDUCTION COOLED MICROWAVE TRIODE OXIDE COATED CATHODE

DET29

ISSUE 2

The DET29 is a commercial equivalent of the CV2397. It is primarily for use in coaxial circuits as an oscillator or amplifier up to 5000Mc/s and as a frequency multiplier up to 7000Mc/s. The heater is not connected to the cathode.

HEATER

V_h	6·3	V
I_h	0·5 (approx)	A

MAXIMUM RATINGS (Absolute)

V_a	450	V
$v_{a(pk)}$	1	kV
$I_{a(mean)}$	40	mA
$i_{a(pk)}$	500	mA
I_g	6	mA
p_a	10	W
p_g	0·25	W
$-V_g$	20	V
T_{seal}	140	°C

CAPACITANCES (Cold)

$c_{g\text{-}a}$: 1·2pF; $c_{g\text{-}k}$: 3·4pF; $c_{a\text{-}k}$: 0·025pF.

CHARACTERISTICS

I_a	10	40	mA
$-V_g$	0·5	0·5	V
g_m	16	24	ma/V
μ	55	—	—

TYPICAL OPERATION

The typical performance at various frequencies as a power amplifier and oscillator and as a small signal amplifier are shown below. Above 1000Mc/s double concentric line circuits were used, with the output line of fixed length and the input line tunable. The 2300Mc/s amplifier has a $\lambda/4$ output circuit and all others a $3\lambda/4$ output circuit. The h.t. supply in all cases is 250V at 40mA.

Detailed descriptions of the circuits including line lengths for any frequency are given in the DET29 Application Report. Further information concerning the DET29 as a low noise amplifier is contained in the booklet 'Low Noise Amplifier Design'. Both publications are available upon request.

Frequency (Mc/s)	Operation	Output (W)	Gain (dB)	Noise Factor (dB)
400	Amplifier (<10mW drive)	—	16*	6·6
2300	Oscillator	3·5	—	—
	Amplifier (<10mW drive)	—	14†	12
	Amplifier (0·5—1W drive)	1·75†	—	—
		3·0‡	—	—
3800	Oscillator	1·5	—	—
	Amplifier (<10mW drive)	—	12†	17
	Amplifier (250—500mW drive)	1·5†	—	—

*Measured at 14Mc/s bandwidth.
†Measured at 50Mc/s bandwidth.
‡Measured at 20Mc/s bandwidth.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Chelmsford, Essex, England · Telephone: Chelmsford 3221 · Telex: 1953 · Telegrams: Expanse Chelmsford Telex

COOLING

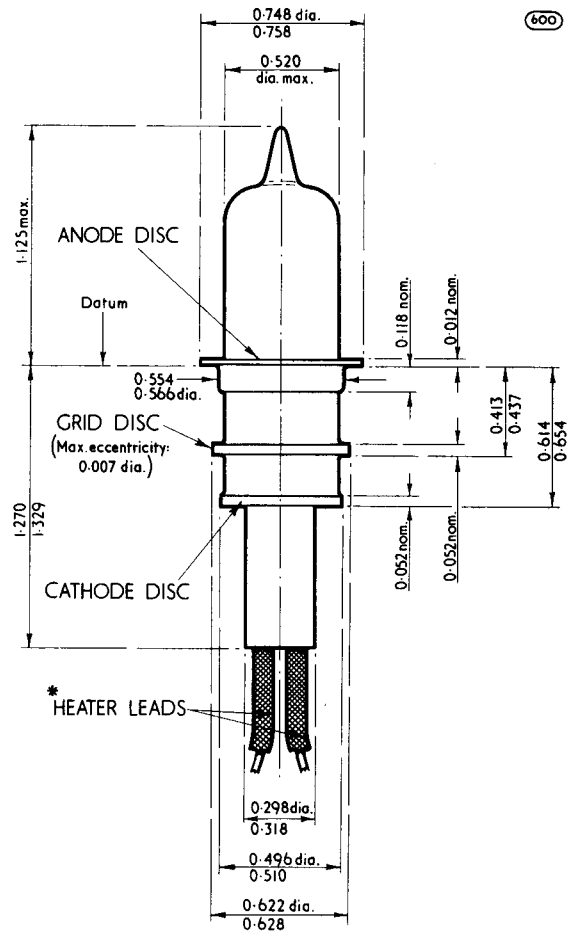
The maximum temperature of the glass to metal seals must not exceed 140°C.

In order to limit the rate of change of temperature of the anode seal, it is necessary for the mass of metal in close thermal contact with the anode disc to have a thermal capacity of not less than 5·5cal/°C. 60gm of brass or 26gm of aluminium are suitable. The anode disc must be clamped uniformly round its circumference in order that the rate of rise of temperature shall be uniformly distributed. To limit the maximum temperature of the anode seal, the loss of heat from the metal in contact with the seal must be adequate.

The seal temperature may be conveniently measured with a temperature sensitive paint.

INSTALLATION

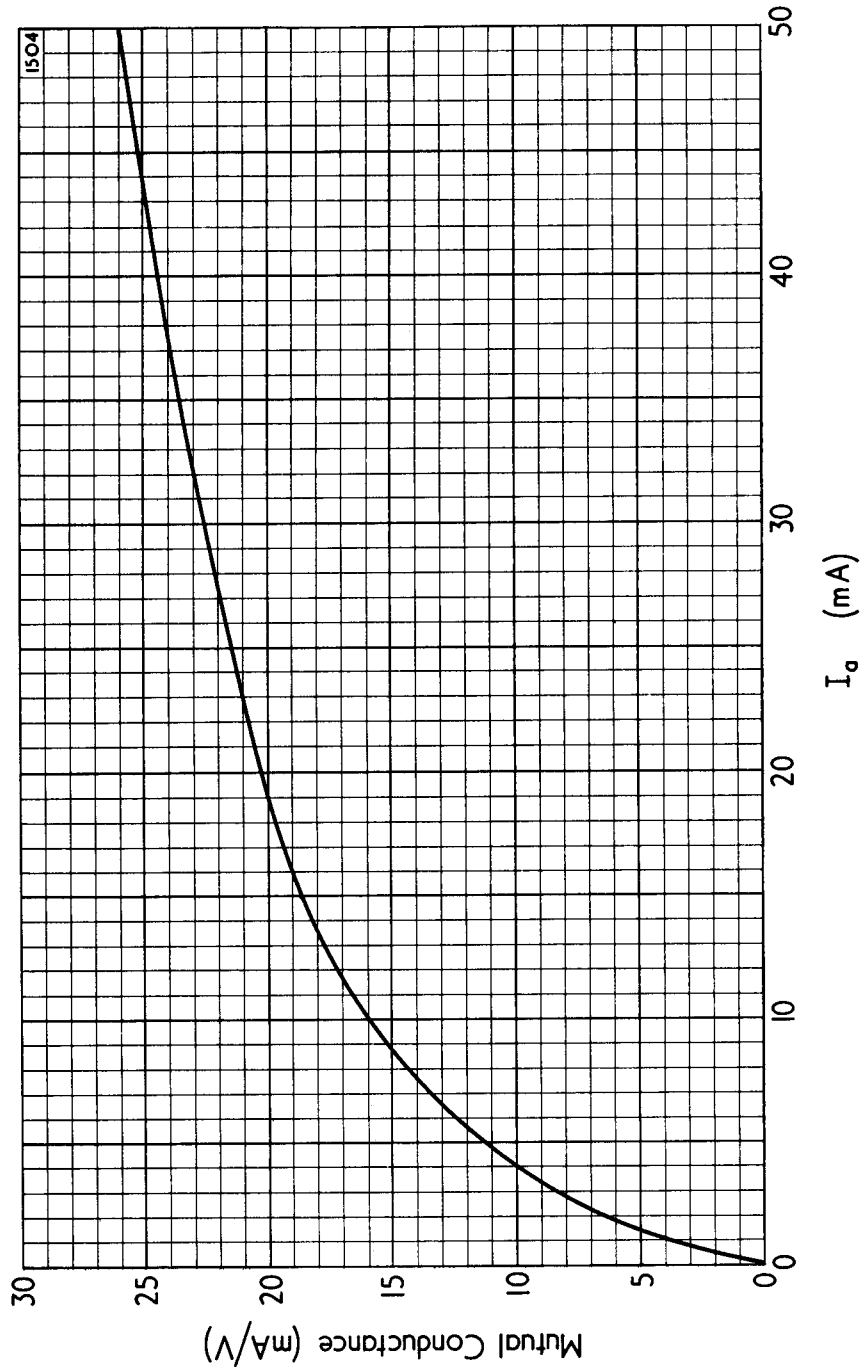
The valve may be mounted in any position. Rigid connection must be made to one electrode only.



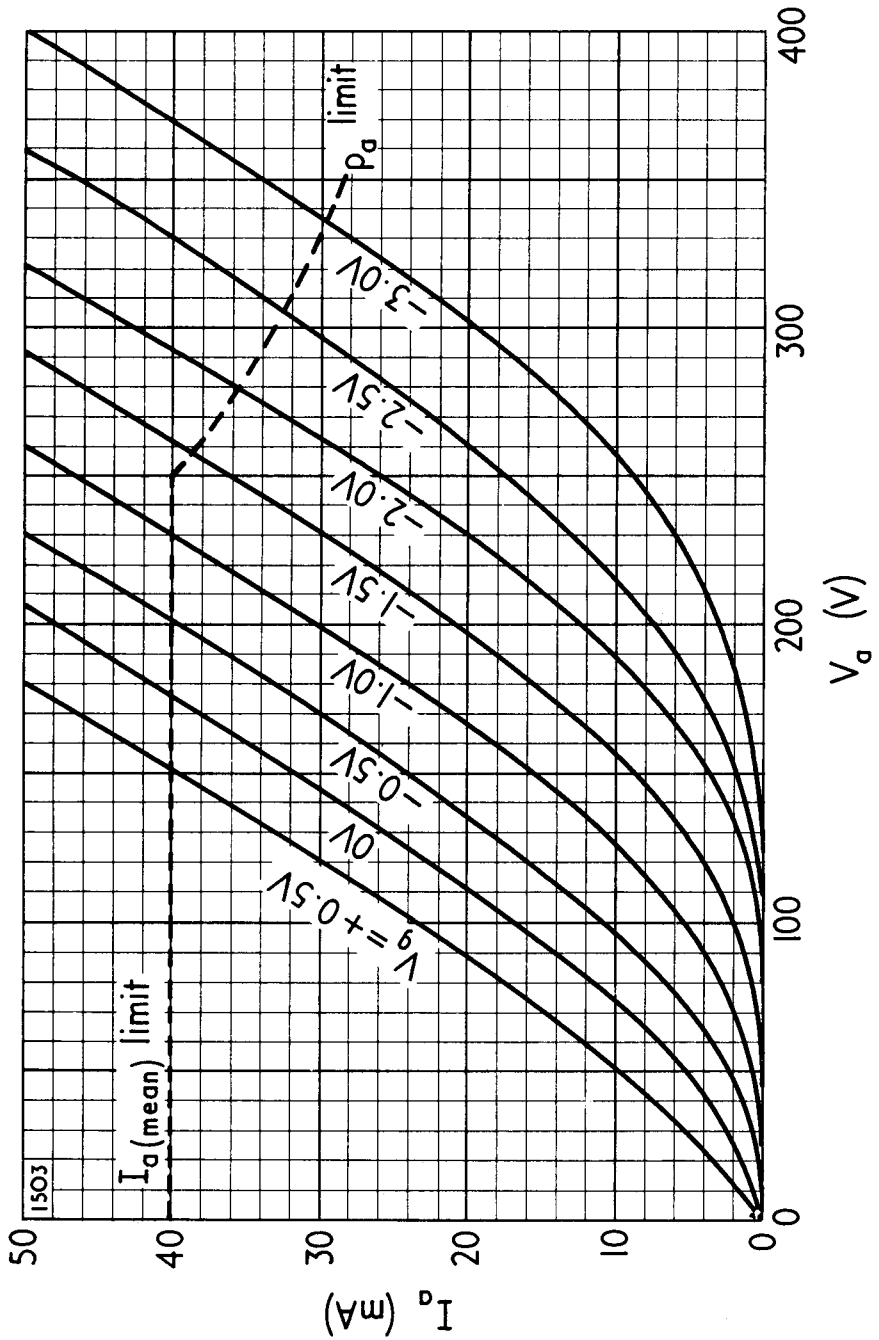
Dimensions in inches.

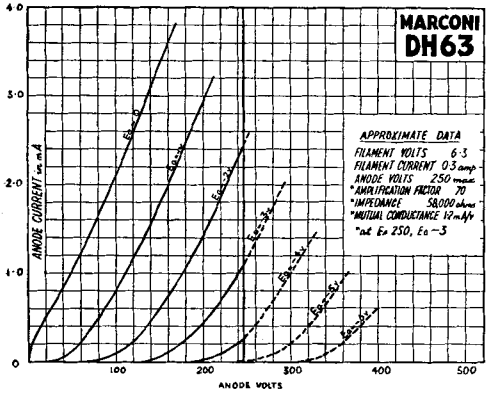
The heater wires should not be bent nearer than 0·2in. from the valve.

*The standard heater leads are 12in. long. An identical valve but with 18in. heater leads is available under the reference DET29M.


1504
Mutual Conductance (mA/V)
30
25
20
15
10
5
0
0
10
20
30
40
50
I_a (mA)

DET29


I_a (mA)
50
40
30
20
10
0
0
100
200
300
400
V_a (V)
$I_{a(mean)}$ limit
P_a limit
$V_g = +0.5V$
0V
−0.5V
−1.0V
−1.5V
−2.0V
−2.5V
−3.0V
1503



Marconi DH63

Double Diode Triode

Marconi DH63 is intended for detection, A.V.C. and resistance coupled L.F. amplification in superhet receivers.

Nominal rating, see curve.

Inter-electrode capacities
(*with screening can*)

A—G	1.7$\mu\mu$F
G—E	2.6$\mu\mu$F
A—E	6.2$\mu\mu$F
Diodes—E	7.8$\mu\mu$F

Dimensions : 114×40 mm. Octal base ; for connections see pages 4-5.

Typical Operating Data.

Anode supply voltage ...	340	340	275	275
Anode load resistance ...	.1 meg.	.25 meg.	.1 meg.	.25 meg.
Anode current	1.4 mA	0.7 mA	1.1 mA	0.6 mA
Bias resistance	1,500	3,000	2,000	3,000
Stage gain	29	32	28	32

Notes.

When used under the above conditions, the grid leak of the subsequent valve should not be less than 0.5 megohm. The total effective grid to cathode resistance of the DH63 should not exceed 4 megohms.

Price - - 9/6

Marconi D63

Double Diode

Marconi D63 is a double diode with heater rating 6.3 volts, 0.3 amp. The diodes have separate cathodes taken out to different pins.

Octal base.
Overall Dimensions,
99×36 mm.

Inter-electrode capacities
(*metallised valve*).

A_1—A_2	0.17$\mu\mu$F
A_1—C_1	2.76$\mu\mu$F
A_2—C_2	2.2$\mu\mu$F

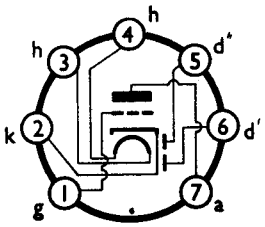
Price 5/6

MINIATURE
DOUBLE-DIODE-TRIODE
0·1A INDIRECTLY HEATED

DH77

OCTOBER, 1951

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

V_h	6·3	V
I_h	0·3	A
V_a	250 max.	V
μ	70	
r_a	58	kΩ
g_m	1·2	mA/V

at V_a=250, V_g=−3

CAPACITANCES (of unscreened valve)

$c_{g\text{-}a}$	1·9	pF	$c_{d''\text{-}k}$	1·5	pF	$c_{d'\text{-}g}$	0·04	pF
$c_{a\text{-}k}$	1·1	pF	$c_{d'\text{-}k}$	1·1	pF	$c_{d''\text{-}a}$	0·17	pF
$c_{g\text{-}k}$	2·0	pF	$c_{d''\text{-}d'}$	0·4	pF	$c_{d'\text{-}a}$	0·24	pF
			$c_{d''\text{-}g}$	0·05	pF			

TYPICAL OPERATION

V_a	250	V
I_a	1	mA
V_g	−3	V
R_k	2	kΩ
R_a	0·25	MΩ

SCREENING

No internal or external screening is fitted to the valve.

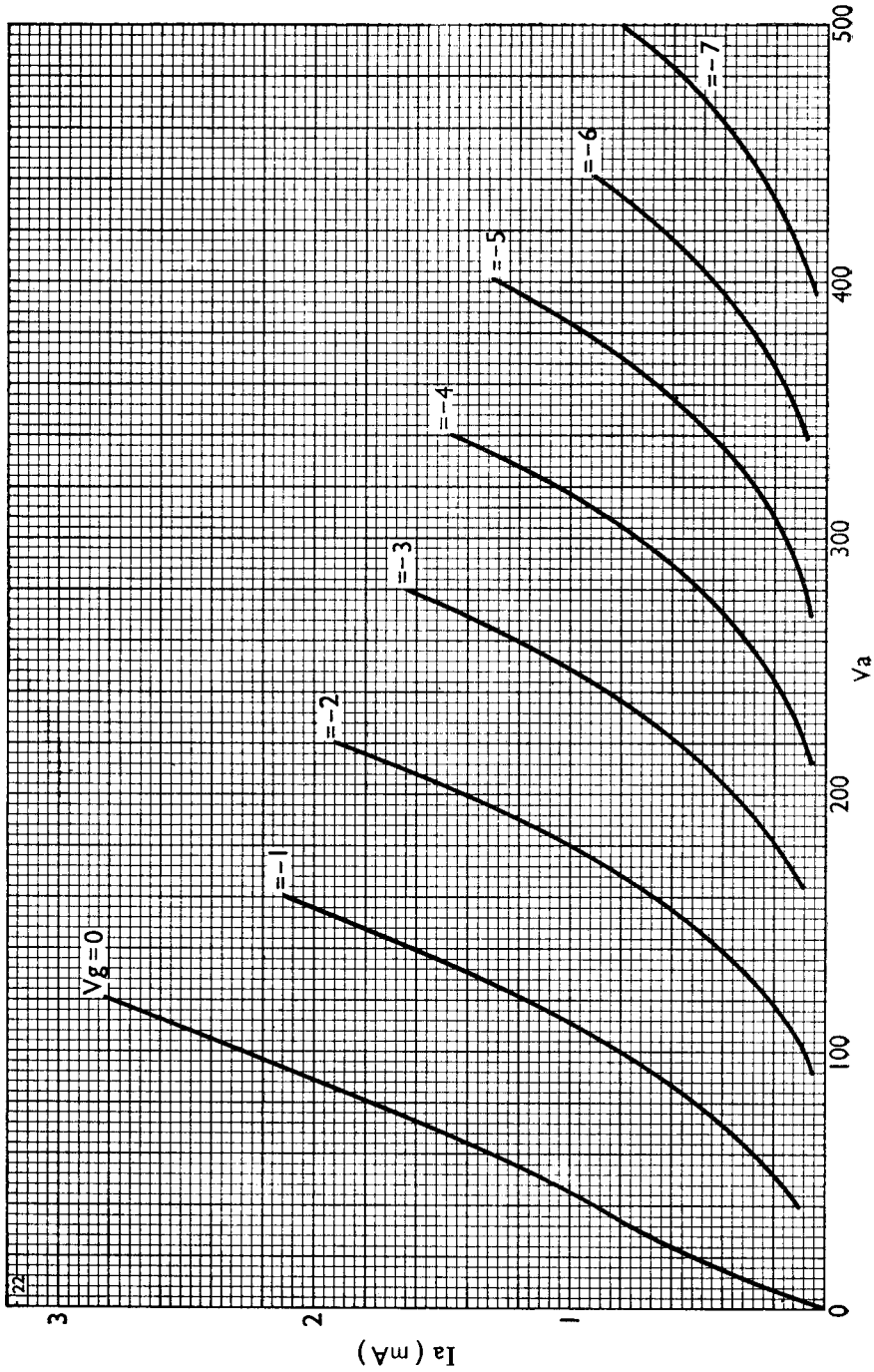
MOUNTING

Any position.

MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

DH77



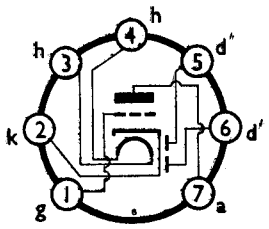
OV.1553 Printed in England. C. October, 1951

MINIATURE
DOUBLE-DIODE-TRIODE
0·1A INDIRECTLY HEATED

DH107

APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

V_h		0·1	A
I_h		19 approx.	V
V_a		250 max.	V
μ	at V_a = 250, V_g = −3	70	
r_a		58	kΩ
g_m		1·2	mA/V

CAPACITANCES (of unscreened valve)

$C_{g\text{-}a}$	1·35	pF	$C_{d'\text{-all (less d')}}$	2·2	pF
$C_{a\text{-all (les g)}}$	2·05	pF	$C_{d''\text{-}d'}$	0·64	pF
$C_{g\text{-all (less a)}}$	2·65	pF	$C_{d''\text{-}g}$	0·035	pE
$C_{d''\text{-all (less d')}}$	2·2	pF	$C_{d'\text{-}g}$	0·02	pF

TYPICAL OPERATION

V_a	250	V
I_a	1	mA
V_g	−3	V
R_k	2	kΩ
R_a	0·25	MΩ

SCREENING

No internal or external screening is fitted to the valve.

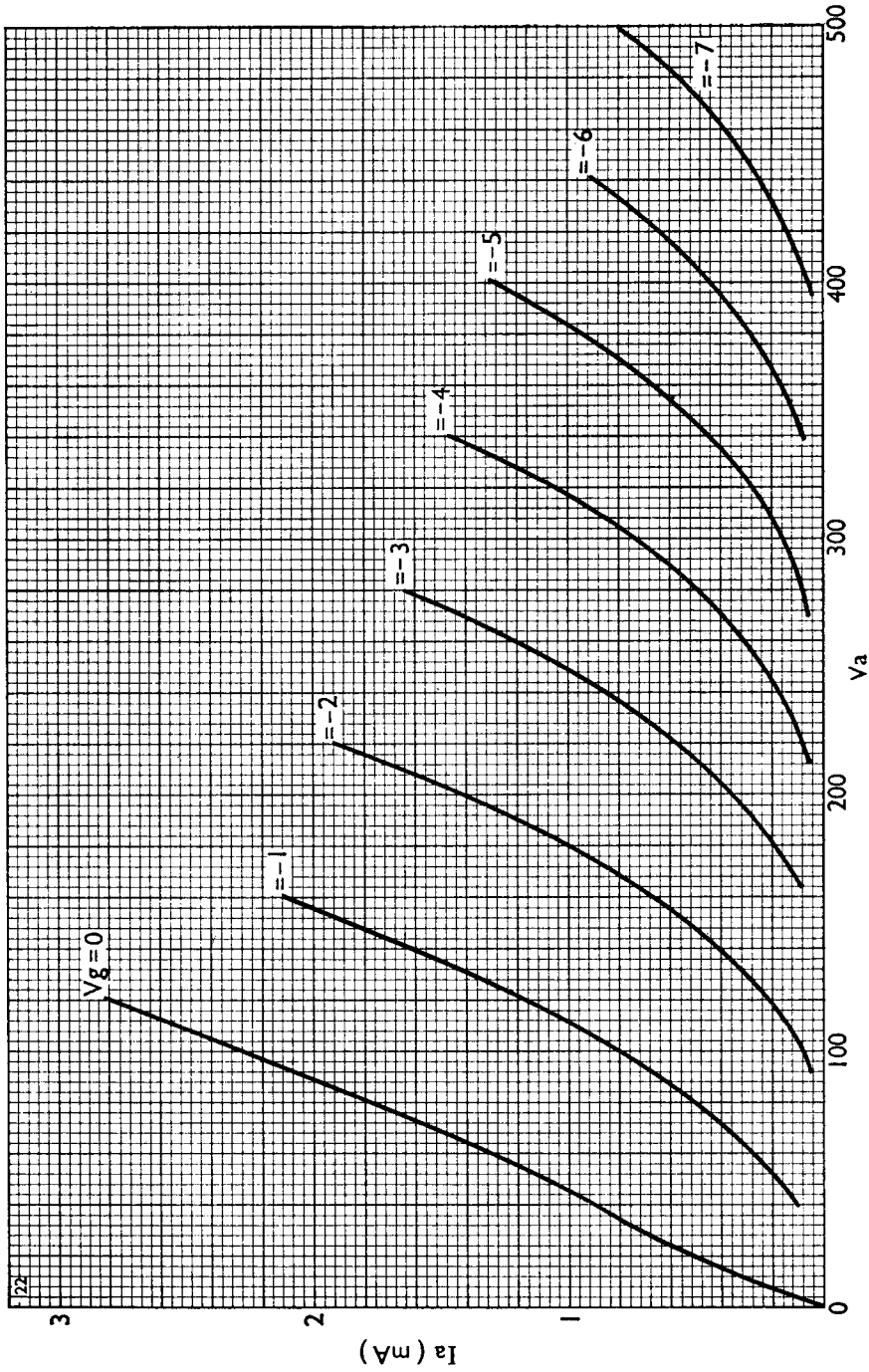
MOUNTING

Any position.

MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

DH107



Printed in England. C.

TRIPLE DIODE TRIODE

6·3V INDIRECTLY HEATED

ISSUE 1

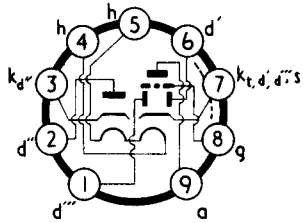
PROVISIONAL

DH719/EABC80

APRIL 1955

A triple-diode-triode with one diode (d″) having a separate cathode (k″). Designed for use primarily in FM and FM/AM receivers.

BASE CONNECTIONS AND VALVE DIMENSIONS



VIEW FROM UNDERSIDE OF BASE

Base: B9A.
Bulb: Tubular.

Max. overall length: 67mm.
Max. seated length: 60mm.
Max. diameter: 22mm.

RATING

V_h	6·3	V
I_h	0·45	A

TRIODE SECTION			DIODE SECTIONS		
V_a	300 max	V	PIV all sections	350 max	V
V_{h-k}	150 max	V	$I_{d'}$	1 max	mA
I_k	5 max	mA	$I_{d''}$	10 max	mA
p_a	1 max	W	$I_{d'''}$	10 max	mA
R_{g-k}	3 max	MΩ	$r_{d'}$ (at $V_{d'}$ = 10)	5	kΩ
μ (at V_a = 100)	70		$r_{d''}$ (at $V_{d''}$ = 5)	200	Ω
g_m (V_g = -1)	1·45	mA/V	$r_{d'''}$ (at $V_{d'''}$ = 5)	200	Ω
r_a (I_a = 0·8mA)	48	kΩ			

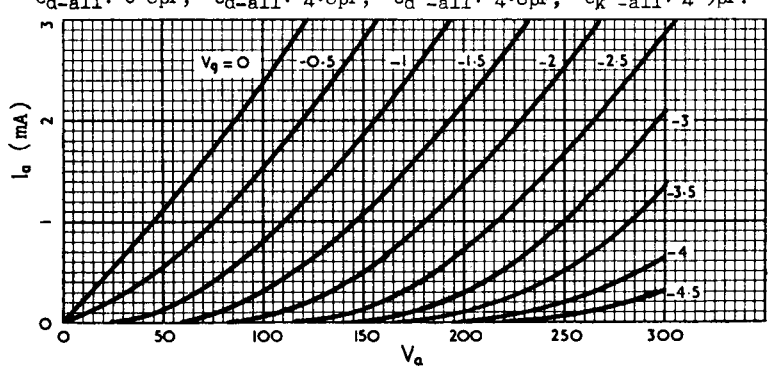
CAPACITANCES

Triode section:

$c_{g\text{-all (less a)}}$: 1·9pF. $c_{a\text{-all (less g)}}$: 1·4pF. c_{a-g}: 2·0pF.

Diode sections:

$c_{d'\text{-all}}$: 0·8pF; $c_{d''\text{-all}}$: 4·8pF; $c_{d'''\text{-all}}$: 4·8pF; $c_{k''\text{-all}}$: 4·9pF.



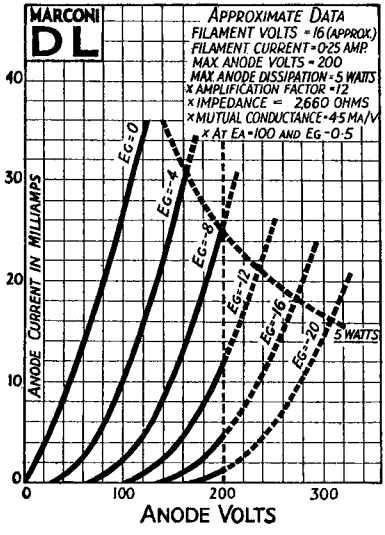
DL, Low Magnification, 17/6

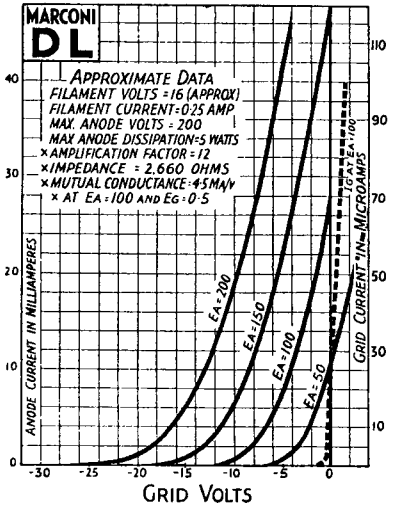
DL is a low impedance valve for use as a small output valve, initial L.F. amplifier or oscillator. The high conductance provides a considerable stage gain, so that DL can be recommended where sensitivity is required without the use of a pentode. The output is sufficient for average domestic volume with a moving iron speaker.

Approximate Operating Data.

Anode Volts.	Grid Bias.	Anode Current.
100	−4	10.5 m.a.
150	−6	18 m.a.
200	−8	25 m.a.

Anode Volts, Anode current curve for DL.



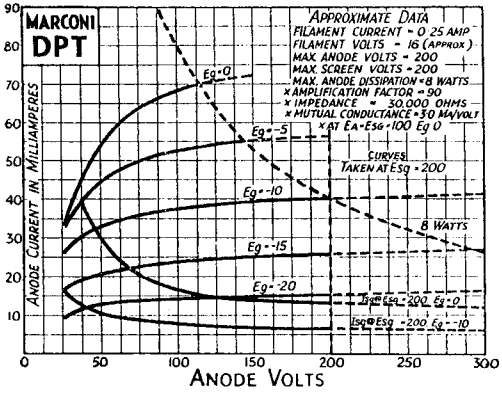


DPT, Pentode, 25/-

Marconi DPT is a new high efficiency indirectly heated pentode giving a large output at 200 volts, with a comparatively small input to the grid. It is an ideal output valve for the three or four-valve receiver having only one low frequency stage, and will operate moving coil or medium impedance moving iron speakers equally well.

Approximate Operating Data.

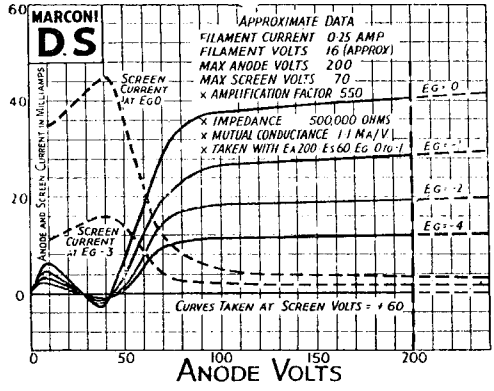
Anode Volts.	Screen Volts.	Grid Bias.	Anode Current.	Screen Current.
200	200	−10	40 m.a.	6 m.a.



DS, Screen Grid, 22/6

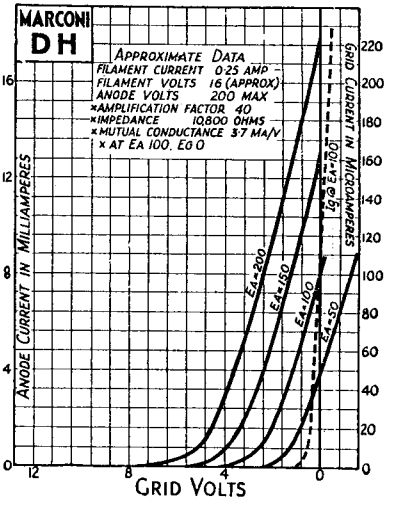
Marconi DS is a screen grid valve of high efficiency, having an exceptionally low anode-grid capacity — less than .002 micro-micro-farad —and specially suitable for use in the H.F. stage of all D.C. mains receivers. It is an excellent general purpose screen grid for H.F. or I.F. work, its robust construction ensuring consistently satisfactory service.

DS. is available with metallised bulb if desired.



Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.
200	50–80	$-1\frac{1}{2}$ to -3



DH, High Magnification, 15/-

DH is a high efficiency general purpose valve for use as a detector or first low frequency amplifier. It may be used with transformer or resistance coupling in the majority of modern circuits.

DH is available with metallised bulb if desired.

Approximate Operating Data.

Circuit.	Anode Volts	Grid Bias.
Leaky Grid or Power Grid Detector	50–150	Connect lower end of leak to Cathode
Anode Bend Detector	100–200	-2 to -6
Amplifier	100–200	$-1\frac{1}{2}$ to -3

Thyratron *Type FX 215*

General. The FX 215 is a hydrogen-filled thyratron designed for pulse applications, where high peak emission and high peak forward and inverse anode voltages are required. Due to the absence of condensable vapour, it is not necessary to provide thermostatic control of the bulb temperature by the use of an air-blast, and, for the same reason, the valve may be operated over a wide range of ambient air temperatures without any appreciable change in the characteristics. The use of a hydrogen filling permits the passage of high pulse currents at high arc-drop voltages without the risk of cathode disintegration.

Mounting. The valve may be mounted in any position but should be clamped by the base only. It should on no account be operated in the vicinity of strong fields which could ionise the gas filling.

APPROXIMATE DATA

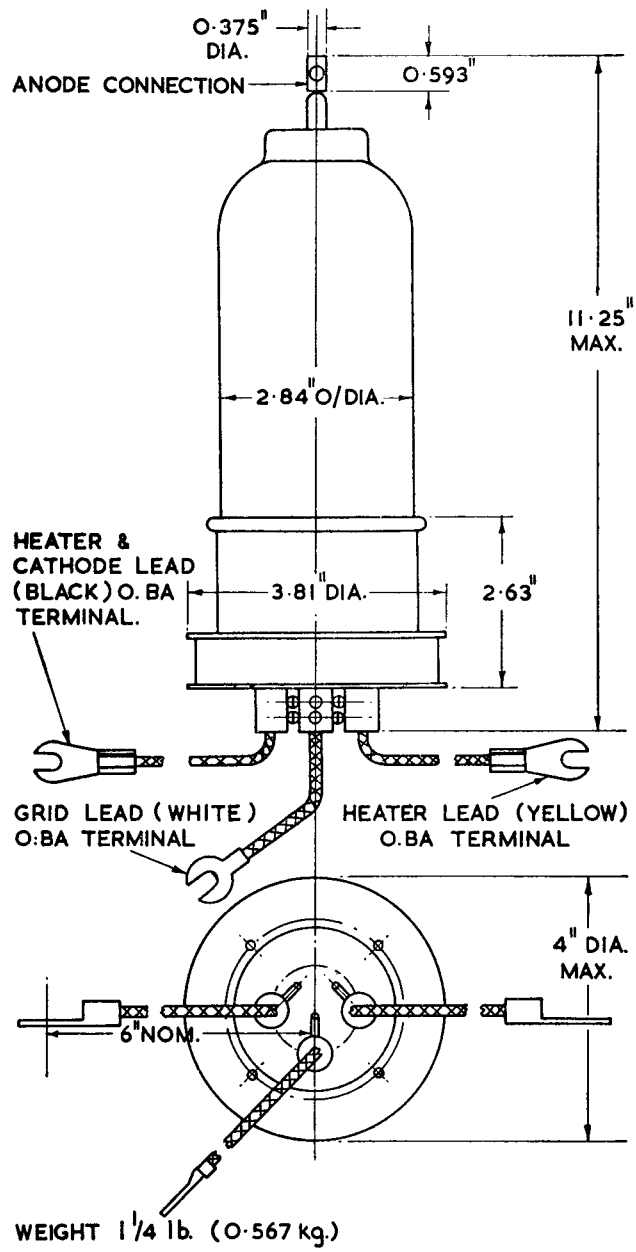
V_f	2·5 (±5%)	V
I_f	27·5	A
$V_{a(pk)\ (max)}$ (b)	16	kV
$I_{a(pk)\ (max)}$	200	A
$V_{p(min)}$ (trigger) (c)	150	V
$I_{a(max)}$	200	mA
V_{g1}	−60±10	V
$Z_{dr(max)}$	500	Ω
Duty cycle (max)	0·001	
Pre-heating time (min)	2	mins
T_{amb}	−50+90	°C

NOTES

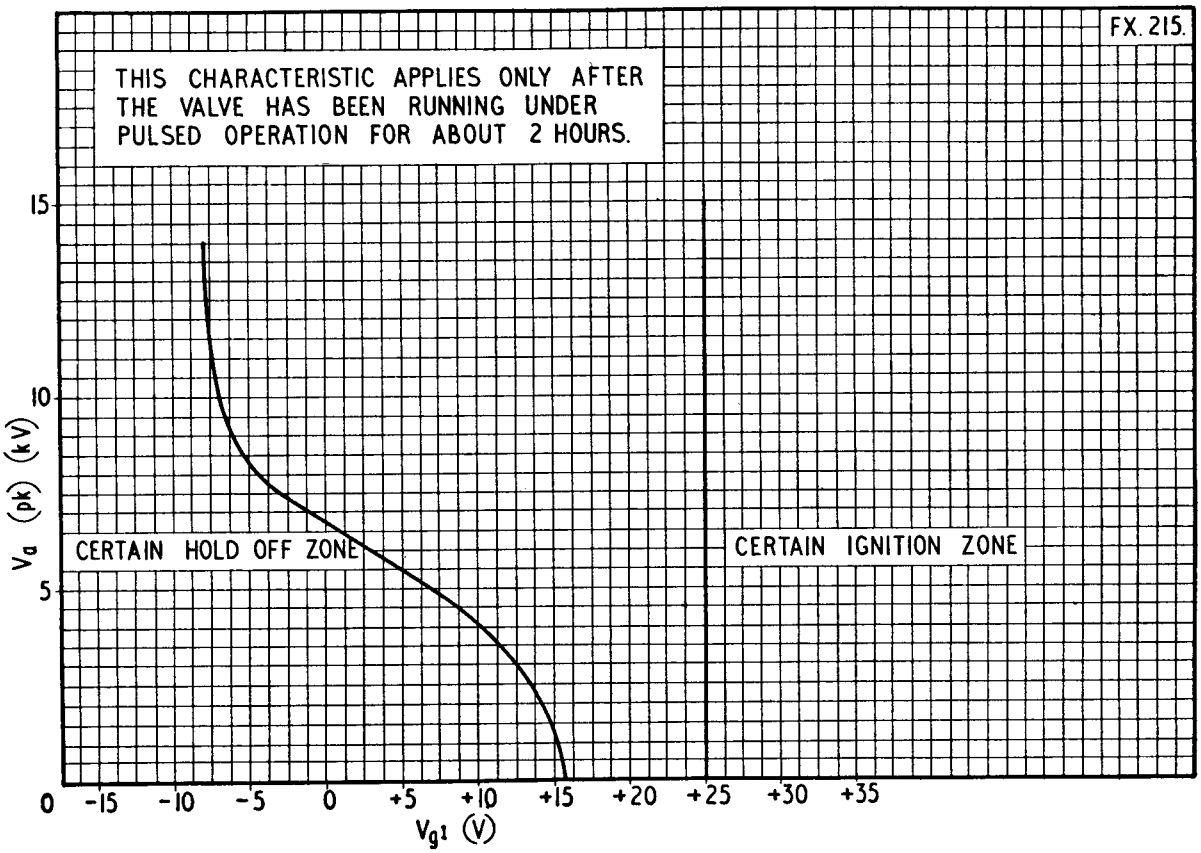
(a) (1) Repetition frequency, 500 pulses per second.
(2) Pulse length, 0·6, 1·4 or 2·0 μs.
(3) Pulse shape, sensibly square.
(4) Preferred load impedance of 37·5 Ω.
(5) Rate of rise of current, 600 A per μs.

(b) In pulsed operation the peak inverse voltage exclusive of a spike of 0·05 μs duration, shall not exceed 5 kV during the first 25 μs after the pulse.

(c) Grid pulse duration 2 μs (min.). Rise time 0·5 μs (max.).



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*



PRINTED IN ENGLAND

Thyratron *Type FX219*

General. The FX219 is a hydrogen filled thyratron primarily designed for pulse operation at high repetition frequencies.

APPROXIMATE DATA

V_h	6·3 (±0·5)	V
I_h	10·6	A
t_{hk}	5	Minutes
$V_{a\ (pk)\ (max)}$	16·0	kV
$PIV_{a\ (max)}$ (a)	16·0	kV
$PIV_{a\ (min)}$	5% of $V_{a\ (pk)}$	
$I_{a\ (pk)\ (max)}$	325	A
$I_{a\ (mean)\ (max)}$	200	mA
PRF	See Note (b)	
$PIV_{gl\ (max)}$	200	V
T_{amb}	−50 to +90°	C
→ $\frac{Si}{St}$ (max)	1,500	A/μ sec
$V_{gl\ (dr)}$ (c)		
(i) $V_{gl\ (pk)\ (min)}$	200	V
(ii) $t_{(rise)\ (max)}$	0·5	μ sec
(iii) $t_{p\ (min)}$ measured at 50 V min. amplitude	2·0	μ sec
(iv) $Z_{gl\ (dr)\ (max)}$	500	Ω

NOTES

(a) In pulse operation, the peak inverse voltage exclusive of a spike of 0·05 μ sec. duration shall not exceed 5 kV during the 25 μ sec. immediately following the pulse.

(b) Pulse repetition frequency, peak voltage and peak current are connected by the relationship.
$$PRF \times I_{pk} \times V_{pk} = 3{\cdot}2 \times 10^8.$$

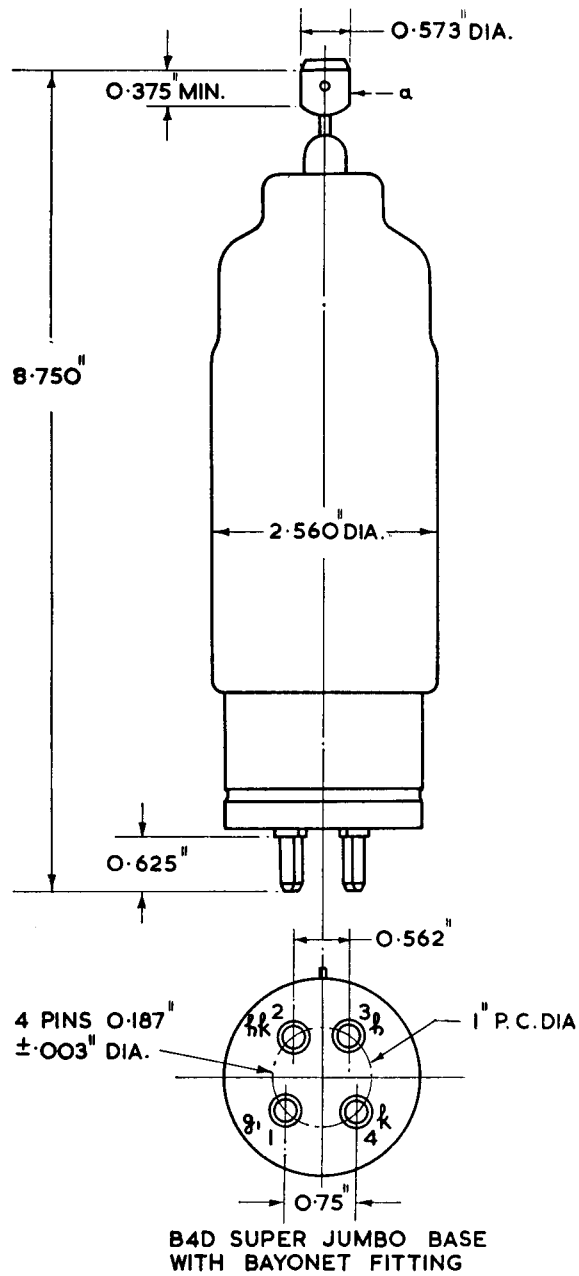
(c) Measured at tube socket with thyratron grid disconnected.

(d) The thyratron must be kept away from stray fields which could ionise the gas.

(e) Air cooling of the bulb is not permitted.

(f) Clamping must be by the base and/or bulb in the area up to 4¼ in. above the top of the base, only.

(g) The thyratron may be mounted in any position.



B4D SUPER JUMBO BASE WITH BAYONET FITTING

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*



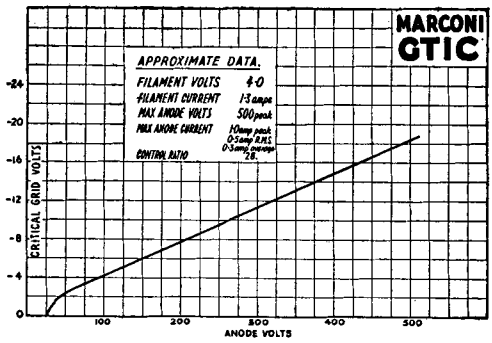
PRINTED IN ENGLAND

Marconi GTIC

Gas-filled Relay.

Marconi GTIC is an Argon filled relay capable of controlling currents up to 1 amp. (peak value).

Its design ensures constancy of operation under all variations of room temperature and a long life with freedom from clean-up.



5 pin base. Standard I.H.C. triode connections.

Nominal Rating.

Heater voltage	4.0 min.
Heater current	1.3 amps.
Max. anode voltage	500 peak
Max. anode current	1.0 amp peak 0.5 amp. R.M.S. 0.3 amp. average Measured on M.C. meter.
Anode—cathode voltage drop	16
Control ratio	28
Cathode heating time	30 secs. min.

Notes.

The impedance of the anode circuit should be such that the anode current can never exceed 1.0 amp. Special attention must be given to this point in circuits where the GTIC discharges a condenser.

1,000 ohms or more should be included in the grid circuit to limit the grid current but the grid circuit impedance should normally be kept low. An exception to this is the case where the grid is thrown highly negative immediately following the discharge. A high grid impedance is then necessary to protect the valve, but in no case should it exceed 1 megohm.

A large heater to cathode potential difference must be avoided and the two should where possible be connected together.

The de-ionisation time is from 10 to 1000 micro-seconds depending on circumstances.

Price - - 25/-

Rectifier *Type GU 7*

General. The GU 7 is a directly heated half-wave mercury vapour diode intended for use as a power rectifier.

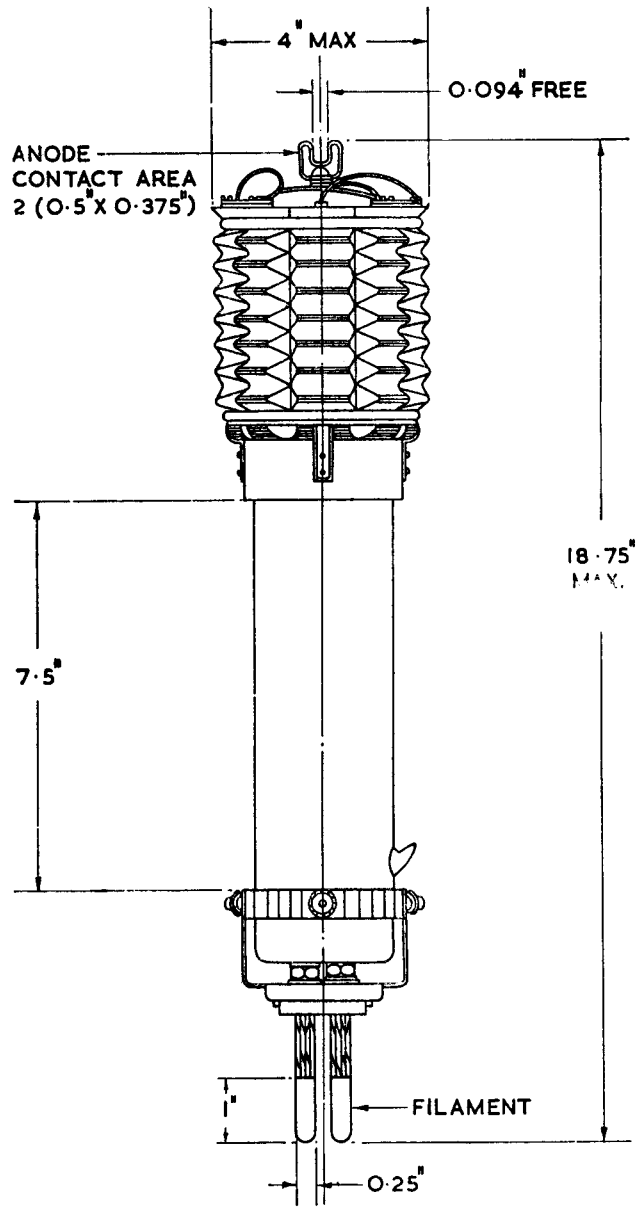
Cooling. The condensation temperature is the limiting factor. The range quoted is for the temperature at that part of the bulb where the mercury collects.

The temperature gradient should be so arranged that the coolest part of the bulb is at the base. The ambient temperature in still air should not exceed 38°C. If an air blast is used, the temperature may be raised to 58°C, the temperature being recorded on a thermometer suspended 6 in. from the valve and with its bulb level with the top of the filament cap.

HT Switching. There must be a time delay after switching on the filament supply in order that the filament may attain its working temperature and that the condensation temperature may be within the rated limits, before the anode voltage is applied. Provided that the ambient temperature is not less than 32°C, the minimum delay time should be one minute. At lower ambient temperatures, the delay time must be extended until the condensation temperature reaches the minimum value. If the ambient temperature is below 10°C, the delay time is likely to be inconveniently long, and a heated air blast may then be necessary.

Mounting. The valve must be mounted vertically with its anode uppermost. This position must be maintained during storage and transit in order to prevent mercury being deposited on the filament or anode.

Seasoning. Whenever a new valve is put into service, or when a valve has been transported or stored, the filament must be run for at least 30 minutes at normal filament voltage before anode voltage is applied.



WEIGHT 3·75 lb. (1·7 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

V_f	2·35	V
I_f	40	A
PIV $_{(max)}$	13·5	kV
$I_{k(pk)\ (max)}$	16	A
$I_{k(max)}$ (averaged over 15 secs.)	4	A
T_{Hg}	30 to 58	°C

OPERATING DATA

Full load conditions

Circuit	No. of Valves	Voltage Output kV	Current Output A
Bi-phase half-wave	2	4·3	8
Single-phase full-wave	4	8·6	8
Three-phase half-wave	3	6	12
Three-phase full-wave	6	12	12
Double three-phase inter-connected	6	6	24

These values assume that the smoothing circuit is so designed that the ratio of peak to mean cathode current does not exceed 4 to 1.

PRINTED IN ENGLAND

Rectifier *Type GU8*

General. The GU 8 is a directly heated half-wave mercury vapour diode intended for use as a power rectifier.

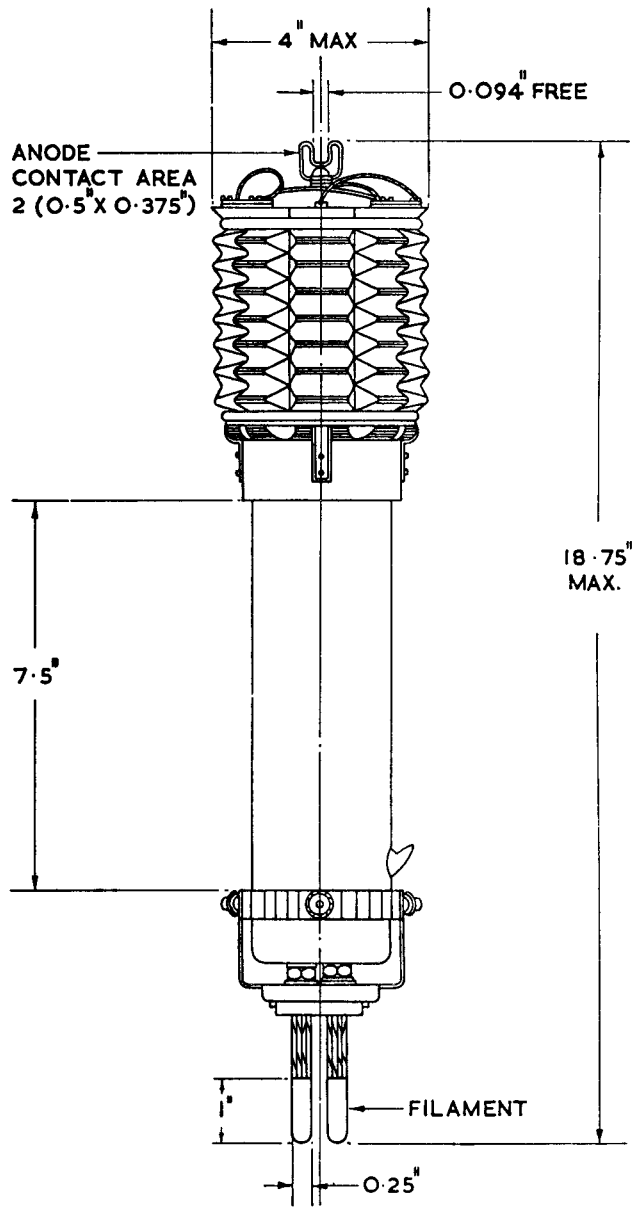
Cooling. The condensation temperature is the limiting factor. The range quoted is for the temperature at that part of the bulb where the mercury collects.

The temperature gradient should be so arranged that the coolest part of the bulb is at the base. The ambient temperature in still air should not exceed 34°C. If an air blast is used, the temperature may be raised to 54°C, the temperatures being recorded on a thermometer suspended 6 in. from the valve and with its bulb level with the top of the filament cap.

HT Switching. There must be a time delay after switching on the filament supply in order that the filament may attain its working temperature and that the condensation temperature may be within the rated limits before the anode voltage is applied. Provided that the ambient temperature is not less than 32°C, the minimum delay time should be one minute. At lower ambient temperatures, the delay time must be extended until the condensation temperature reaches the minimum value. If the ambient temperature is below 10°C, the delay time is likely to be inconveniently long, and a heated air blast may then be necessary.

Mounting. The valve must be mounted vertically with its anode cap uppermost. This position must be maintained during storage and transportation in order to prevent mercury being deposited on the filament or anode.

Seasoning. Whenever a new valve is put into service, or when a valve has been transported or stored, the filament must be run for at least 30 minutes at normal filament voltage before anode voltage is applied.



WEIGHT 3·75 lb. (1·7 kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

V_f	2·35	V
I_f	40	A
PIV $_{(max)}$	22	kV
$I_{k(pk)\ (max)}$	16	A
$I_{k\ (max)}$ (averaged over 15 secs.)	4	A
T_{Hg}	32 to 54	°C

OPERATING DATA

Full Load Conditions

Circuit	No. of Valves	Voltage Output kV	Current Output A
Bi-phase half-wave	2	7	8
Single-phase full-wave	4	14	8
Three-phase half-wave	3	10	12
Three-phase full-wave	6	20	12
Double three-phase inter-connected	6	10	24

These values assume that the smoothing circuit is so designed that the ratio of peak to mean cathode current does not exceed 4 to 1.

PRINTED IN ENGLAND

Rectifier *Type GU 11*

General. A hot-cathode mercury-vapour rectifier incorporating a domed anode and a shrouded cathode in a hard glass bulb. It is suitable for operation up to 6 A at 15 kV, depending upon the circuit.

For most applications it is recommended that air blast is used on the GU 11 valve. Care should be taken not to cool the anode portion of the valve as the GU 11, in common with other Marconi glass mercury vapour valves, operates best with the anode portion of the bulb hot.

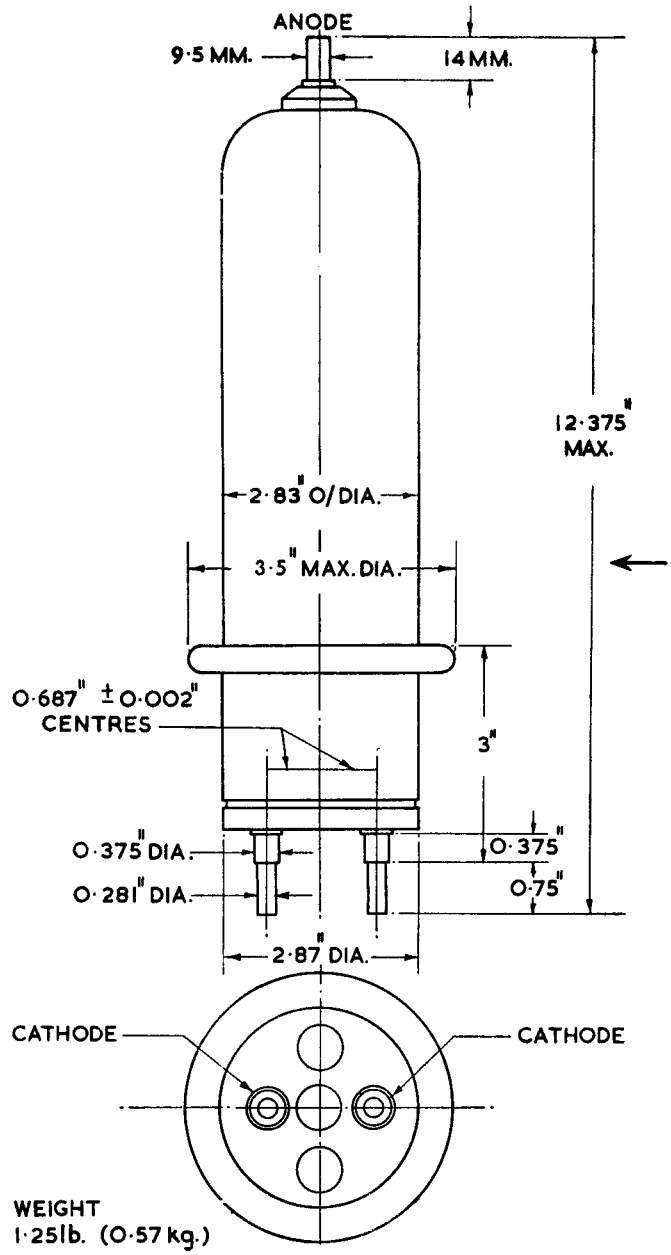
Seasoning. The cathode may be switched on in one operation. The ageing schedule (to be applied after transit or storage) is two hours at normal filament voltage but with no anode voltage or air blast. The valve must always be shielded from draughts, though no close-fitting tube of any sort may be used.

APPROXIMATE DATA

V_f	2·5 V	(+0·2, —0)
I_f	30	A
$I_{k\text{-}a(pk)\ (max)}$	8	A
PIV $_{(max)}$	16	kV
$I_{a\ (mean)}$ per valve	2	A
T_{Hg}	25 to 50°C	

Maximum Outputs :

3-phase full-wave	6 A at 15 kV DC
3-phase half-wave	6 A at 7·5 kV DC



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Conditions of Operation

(*a*) *In still air.* The ambient air temperature should be measured with an alcohol thermometer, the bulb of which should be placed level with the filament cap, and at a distance of 6 in. (152 mm.) from it. Full output may be taken from the GU 11 rectifier if the ambient temperature is between 7° and 30°C, provided that the heating times specified below are adhered to. Failure to do this will cause erratic operation and shortened life.

(*b*) *With forced air-blast, at ambient temperature, on base of valve.*

With forced air-cooling at ambient temperature the limits of air-blast temperatures are 25° to 50°C. This temperature should be measured with a thermometer in the air-blast.

(*c*) *Thermostatic forced air-blast at ambient temperature.*

The air-blast is best controlled thermostatically, so that the blower is switched on at an ambient temperature of 25°C, i.e. between 7° and 25°C the valve runs in still air, and between 25° and 50°C the valve operates with forced air-blast at ambient temperature. Air-blast applied in this way will enable the valve to operate between 7° and 50°C. If the temperature falls below 7°C, then heating must be applied to the air.

Recommended method of applying air-blast

A horizontal tube $\frac{1}{4}$ in. diameter placed with its end $\frac{1}{2}$ in. from the envelope and 1 in. above the level of the top of the filament cap, delivering air at a pressure of $\frac{1}{2}$ in. water gauge, will give the necessary temperature control. The air tube should have at least a 3 in. length of insulating material included in it to avoid danger of a flashover between the filament cap and earth.

The valve must under no circumstances be shrouded by a tube, or any other obstruction which would impede free air circulation round it, unless a heated air-blast is used; in which case advice will be given as to the best arrangement.

Pre-heating of filament.

The mercury condensation temperature is raised approximately 20°C above the ambient temperature by the power dissipated in the cathode.

The pre-heating time required before the condensation temperature rises to its working value is set out in the following tables. No anode potential must be applied before this time has elapsed.

TABLE I

To be used when the valve is operated under conditions (a) or (c).

Ambient temperature (°C)	Pre-heating time (minutes)
25	1
22	6
19	10
16	14
13	18
10	22
7	28

TABLE II

When conditions are as in (b).

Ambient temperature (°C)	Pre-heating time (minutes)
25–50	1

NOTES

(1) With conditions of operation as in (b) or (c) the power supply to the blowers must be switched simultaneously with the filaments.

(2) The valves must be screened against HF fields.

(3) If a large smoothing capacitor is used, care should be taken not to exceed the peak anode current.

PRINTED IN ENGLAND

Rectifying Valve *Type GU 20/21*

General. The GU 20/21 is a directly heated half-wave mercury-vapour diode intended for use as a power rectifier.

Cooling. The condensation temperature is the limiting factor. The range quoted is the temperature at that part of the bulb where the mercury collects.

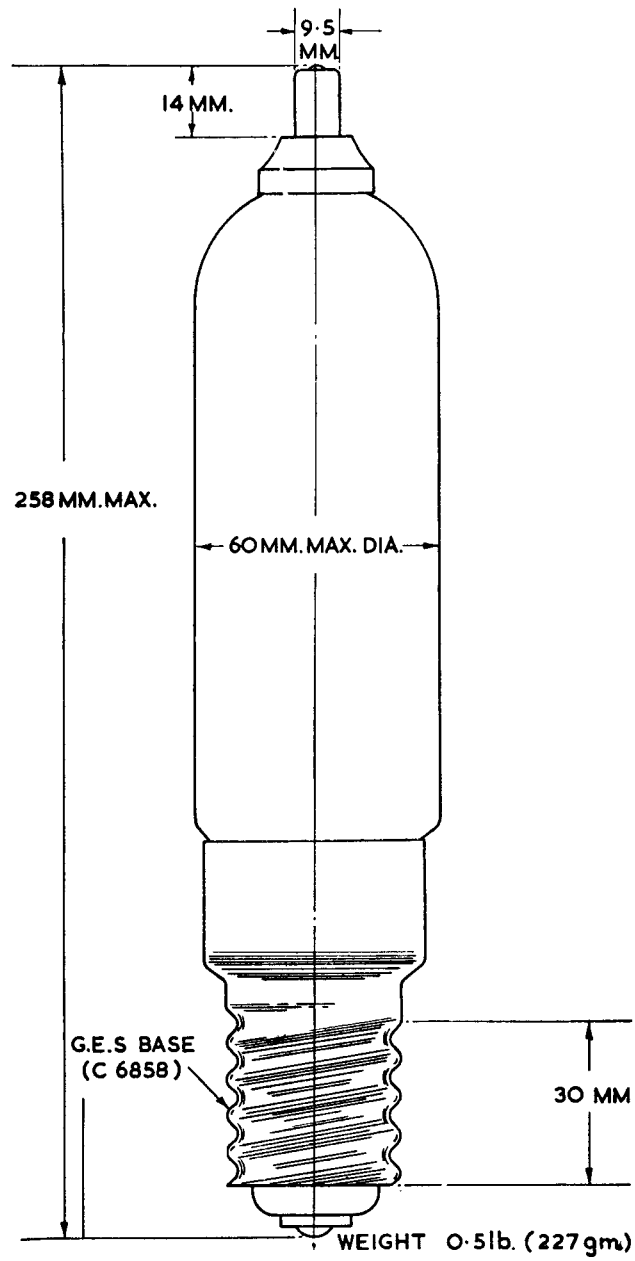
The temperature gradient should be arranged so that the coolest part of the bulb is at the base. The ambient temperature in still air should not exceed 35°C. If air-blast is used, the temperature may be raised to 60°C, the temperature being recorded on a thermometer suspended 6 in. from the valve and with its bulb level with the top of the filament cap.

HT Switching. In order that the filament may attain working temperature and that the condensation temperature may be within the rated limits, there must be a time delay between switching on the filament and applying the anode voltage.

The delay depends on the ambient temperature as follows:

Ambient temperature (°C)	Minimum delay time (minutes)
20	1
18	2
16	4
14	6
12	7
10	8
8	9
6	10

Delay time on restarting after valve has been shut down for a short time may be 1 minute, provided that the condensation temperature has not fallen below 20°C.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Mounting. The valves must be mounted vertically with anode cap uppermost. This position must be maintained during storage and transit in order to prevent mercury being deposited on the filament or anode.

Seasoning. Whenever a new valve is put into service or when a valve has been transported or stored, the filament must be run for at least 30 minutes at normal voltage before anode voltage is applied.

APPROXIMATE DATA

V_f	4	V
I_f	11	A
PIV $_{(max)}$	13	kV
$I_{k(pk)\ (max)}$	5	A
$I_{k\ (max)}$ (averaged over 15 secs.)	1·25	A
T_{Hg}	20 to 60°C	

OPERATING DATA

Circuit	No. of Valves	Output Voltage kV	Output Current A
Bi-phase half-wave	2	4	2·5
Single-phase full-wave	4	8	2·5
Three-phase half-wave	3	5·3	3·75
Three-phase full-wave	6	12·4	3·75
Double three-phase inter-connected	6	5·3	7·5

These values assume that the smoothing circuit is so designed that the ratio of peak to mean cathode current does not exceed 4 to 1.

PRINTED IN ENGLAND

Rectifier *Type GXU 1*

General. The GXU 1 is a xenon filled half-wave rectifier mounted on a 4-pin UX base and with characteristics as given below.

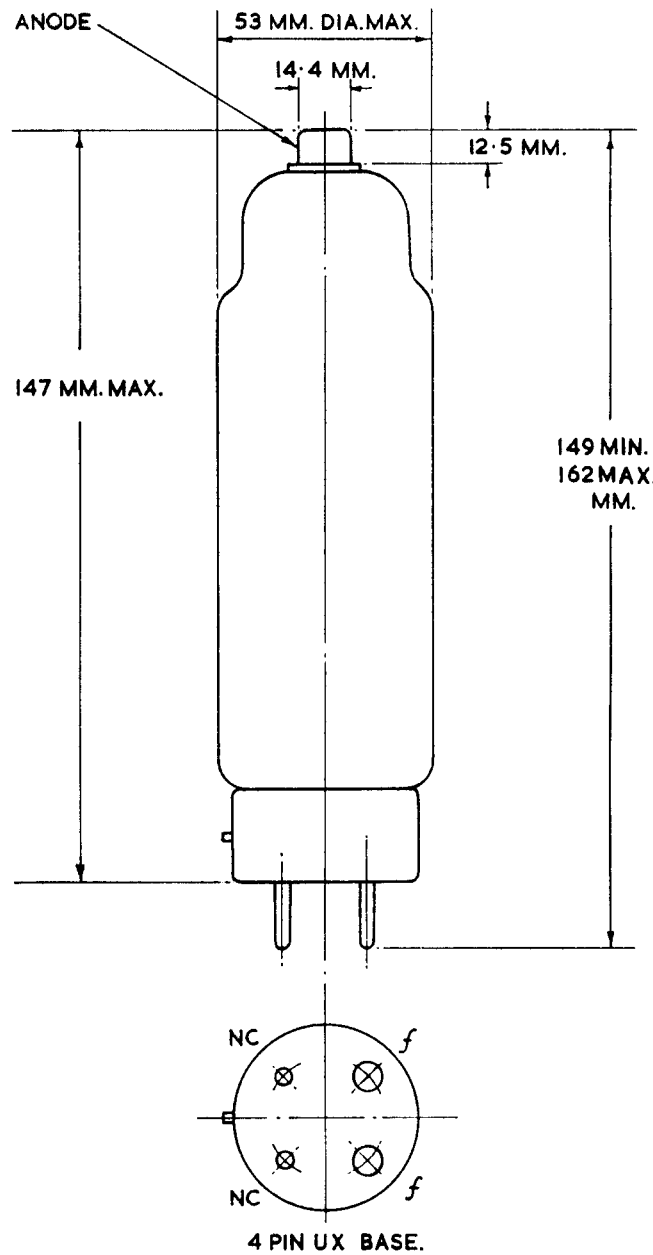
APPROXIMATE DATA

V_f		2·5	V
I_f		5·0	A
$PIV_{(max)}$	10,000	5,000	V
$I_{a(pk)(max)}$	1·0	2·0	A
$I_{a(max)}$ (a)	0·25	0·5	A
$f_{(max)}$	150	500	c/s
$I_{surge(pk)(max)}$ (b)	20	20	A
T_{amb}	−55/+75	−55/+75	°C
$V_{a\text{-}f}$ (I_a=0·5A)		12	V
$t_{hk(min)}$		10	secs

NOTES

(a) Maximum time of averaging 15 sec.

(b) Maximum surge duration 0·1 sec.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

OPERATING CONDITIONS (Full Load)

Circuit	No. of valves	PIV	Full load DC Output (V)	(A)	Applied AC voltage (V r.m.s.)
Single-phase full-wave	2	10,000	3,200	0·5	3,500 per valve
		5,000	1,600	1·0	1,800 per valve
Single-phase bridge	4	10,000	6,400	0·5	7,100 total
		5,000	3,200	1·0	3,500 total
Three-phase half-wave	3	10,000	4,800	0·75	4,100 per phase
		5,000	2,400	1·5	2,050 per phase
Three-phase full-wave	6	10,000	9,600	0·75	4,100 per phase
		5,000	4,800	1·5	2,050 per phase

Circuit Notes

When quadrature operation is used, the filament voltage (pin 1 with respect to pin 4) should be crossing zero from positive towards negative when the anode voltage is at the peak of the positive half cycle.

When quadrature operation is not practicable, filament pin 1 should be positive when the anode voltage is positive.

PRINTED IN ENGLAND

Rectifier *Type GXU2*

General. The GXU 2 is a xenon filled half-wave rectifier mounted on a 4-pin bayonet base and with characteristics as given below.

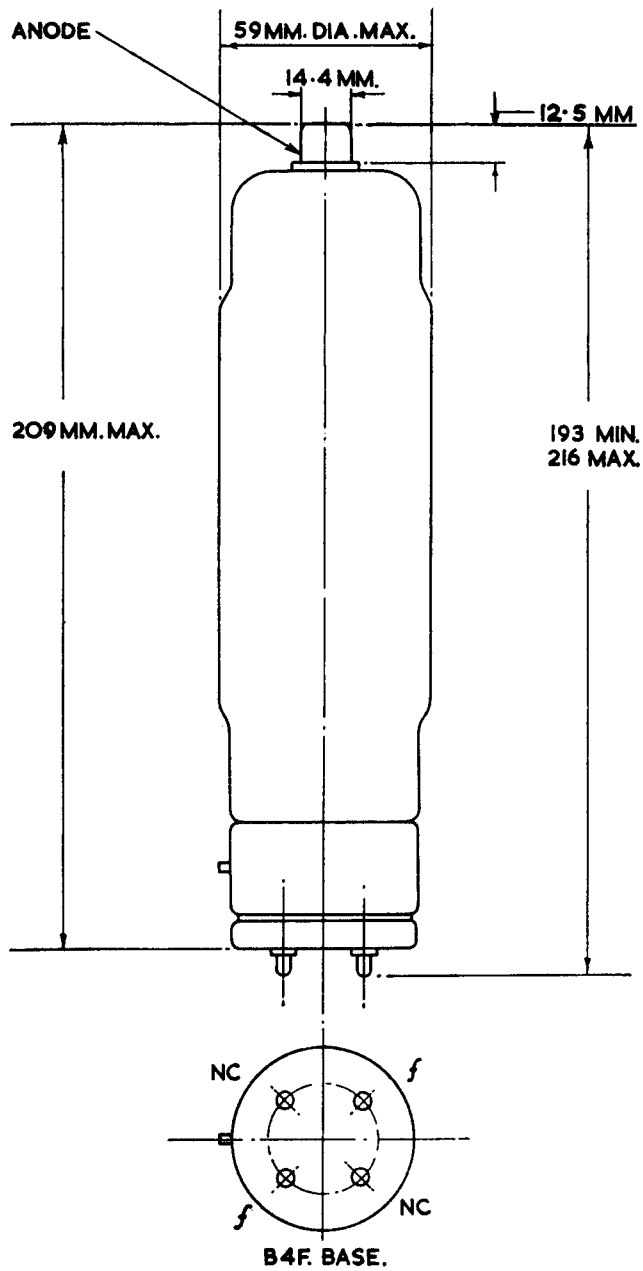
APPROXIMATE DATA

V_f	5·0	V
I_f	7·1	A
$PIV_{(max)}$	10,000	V
$I_{(surge)(pk)(max)}$ (a)	50	A
$I_{a(pk)(max)}$	5·0	A
$I_{a(max)}$ (b)	1·25	A
$f_{(max)}$	150	c/s
t_{hk}	30	secs
T_{amb}	−55/+75	°C
V_{a-f} (I_a=1·25A)	13·0	V

NOTES

(a) Maximum duration 0·1 sec.

(b) Maximum averaging time 15 secs.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

OPERATING CONDITIONS (Full Load)

Circuit	No. of valves	PIV	Full load DC Output (V)	(A)	Applied AC Voltage (V r.m.s.)
Single-phase full-wave	2	10,000	3,200	2·5	3,500 per valve
Single-phase bridge	4	10,000	6,400	2·5	7,100 per valve
Three-phase half-wave	3	10,000	4,800	3·75	4,100 per phase
→ Three-phase full-wave	6	10,000	9,600	3·75	4,100 per phase

Circuit Notes

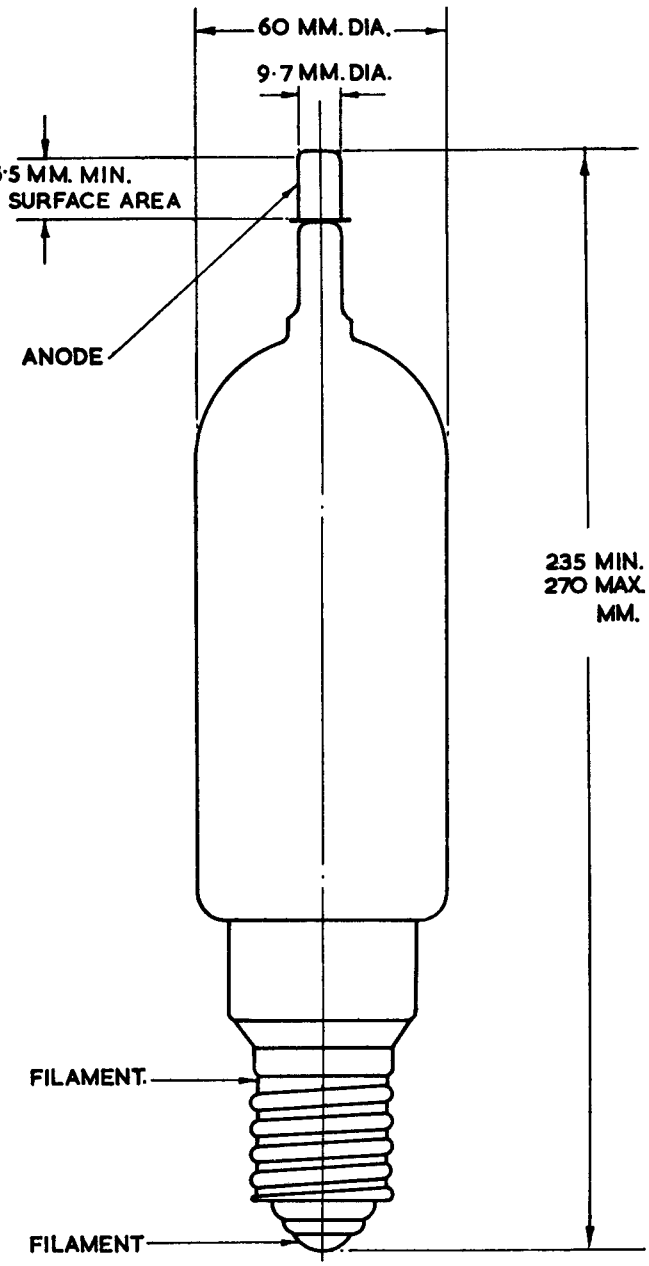
When quadrature operation is used, the filament voltage (pin 4 with respect to pin 2) should be crossing zero from positive towards negative when the anode voltage is at the peak of the positive half cycle.

When quadrature operation is not practicable filament pin 4 should be positive when the anode is positive.

PRINTED IN ENGLAND

Rectifier *Type GXU3*

General. The GXU3 is a xenon filled half-wave rectifier mounted on a G.E.S. base and with characteristics as given below.



APPROXIMATE DATA

V_f		4·0	V
I_f		11·0	A
$PIV_{(max)}$		13	kV
$I_{(surge)\ (pk)\ (max)}$	(a)	60	A
$I_{a\ (pk)\ (max)}$	(b)	6	A
$I_{a\ (av)}$	(b)	1·25	A
$I_{a\ (av)}$	(b) & (c)	1·5	A
T_{amb}		−55 to +70	°C
$t_{hk\ (min)}$		30	sec.
$f_{in\ (max)}$		150	c/s
$V_{a\text{-}f}$ (Ia=1·5A)		13·0	V

NOTES

(*a*) Maximum duration 0·1 secs.
(*b*) Maximum time of averaging 15 secs.
(*c*) PIV up to 10 kV (max.)

OPERATING CONDITIONS

Circuit	No. of Valves	Full load DC output			
		(kV)	(A)	(kV)	(A)
Bi-phase half-wave	2	3	3	4	2·5
Single-phase full-wave	4	6	3	8	2·5
Three-phase half-wave	3	4·75	4·5	6	3·75
Three-phase full-wave	6	9·5	4·5	12	3·75

Mounting. This valve can be mounted in any position.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Marconi House, Chelmsford. Telephone: Chelmsford 3221. Telex: 1953. Telegrams: Expanse Chelmsford Telex



PRINTED IN ENGLAND

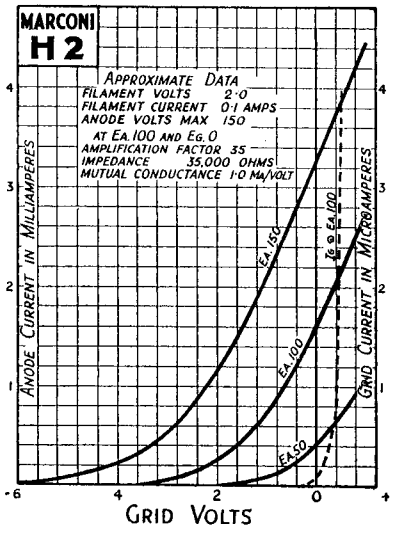
H 2, High Magnification, 8/6

H.2 is a high magnification valve suitable for the earlier stages and combining a large amplification factor with a moderate value of impedance. It is particularly suitable for the detector position in portable and other receivers, followed by resistance or transformer coupling, and for the initial L.F. stage.

H.2 is available with a metallised bulb if desired.

Approximate Operating Data.

Circuit.	Anode Volts.	Grid Bias.
Grid Leak Detector	50–120	0 to −1.5
L.F. Amplifier	100–150	−1.5



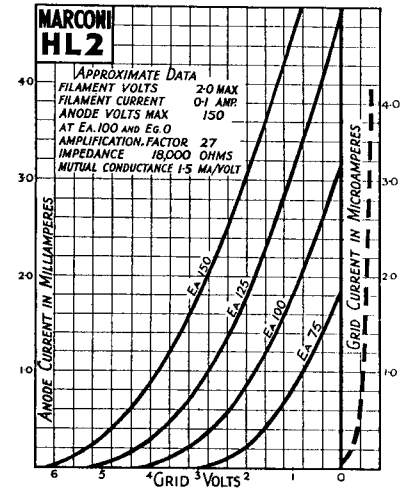
HL 2, Medium Magnification, 8/6

HL.2 is a general purpose valve of high efficiency, designed to provide greater amplification in modern circuits than is obtainable from Marconi HL.210. Its low impedance renders it of special value where transformer coupling is employed, maintaining reproduction of exceptional quality, while it also possesses definite anti-microphonic properties.

H.L.2 is available with a metallised bulb if desired.

Approximate Operating Data.

Anode Volts.	Grid Bias Volts.
As Grid Leak Detector	
50–150	Connect grid leak to positive end of filament
As Anode Bend Detector	
75–150	−1½ to −4½
In Low Frequency Amplifier	
100–150	−1½ to −3



Marconi H12

Midget Triode

Marconi H12 is intended for the early stages of deaf aid amplifiers or other apparatus where small size is of primary importance.

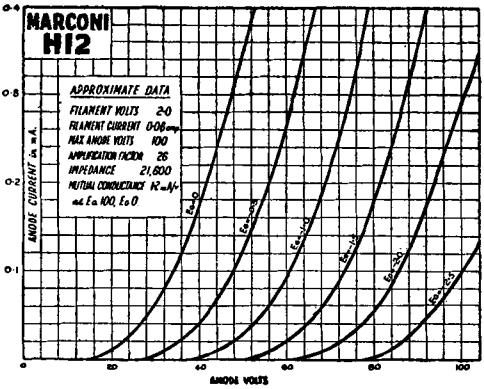
Nominal rating, see curve.

Inter-electrode capacities.

G—A	4.3μμF
G—E	2.5μμF
A—E	1.6μμF

Typical Operating Data.

H.T. voltage	... 36-52
Anode load resistance	.. 0.25 meg.
Grid bias	... zero
Voltage gain	... 15



Base connections, see page 57.

Dimensions : 75 × 17 mm.

Price - - 15/-

Marconi L12

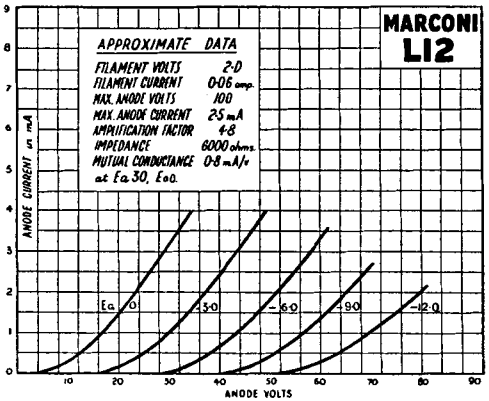
Midget Triode

Marconi L12 is designed for the output stage of deaf aid or similar amplifiers feeding headphones.

Nominal rating, see curve.

Inter-electrode capacities.

G—A	4.0μμF
G—E	2.0μμF
A—E	1.6μμF



Typical Operating Data.

Anode volts	45	30
Anode current	2.2	1.4 mA
Grid bias	−4.4	−2.8
Power output	12mW	5 mW
Optimum load	10,000 ohms	
Bias resistance	2,000 ohms	

Price 15/-

Dimensions : 75 × 17 mm. Base connections, see page 57.

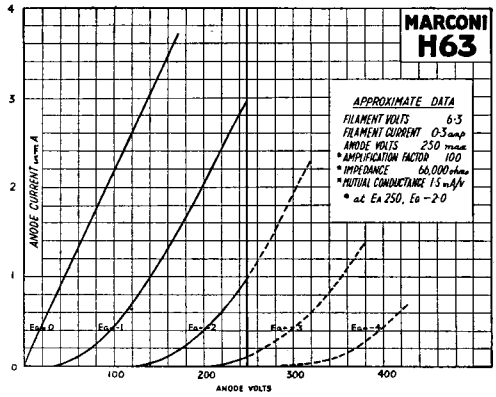
Marconi H63

Triode

Marconi H63 is intended mainly for L.F. amplification in resistance coupled circuits. An anode load of 0.25 megohm is suggested with a bias resistance of 2,000 ohms. The grid leak of the following stage should be .5 meg. where such a value is allowable.

Inter-electrode capacities.
(*metallised valve*).

A—G	2.3$\mu\mu$F
G—E	3.2$\mu\mu$F
A—E	7.3$\mu\mu$F



Dimensions : 114 × 40 mm. Octal base ; for connections see pages 4-5.

Price - - 7/6

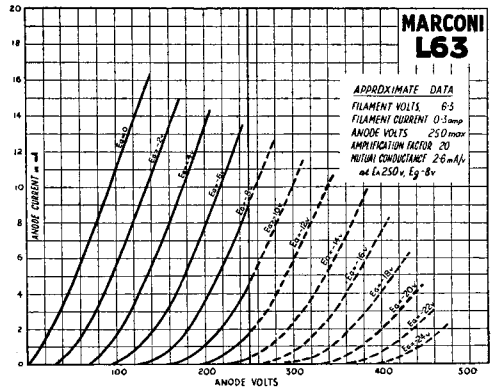
Marconi L63

Triode

Marconi L63 is suitable for L.F. amplification and due to its low impedance it may be followed by transformer coupling. It will find many applications in high quality amplifiers. A further use for the valve is as an oscillator.

Inter-electrode capacities.

G—A	4.3$\mu\mu$F
G—E	5.2$\mu\mu$F
A—E	4.0$\mu\mu$F



Dimensions : 105 × 40 mm. Octal base ; for connections see page 4-5.

Price - - 7/6

Marconi HA1

Acorn Triode.

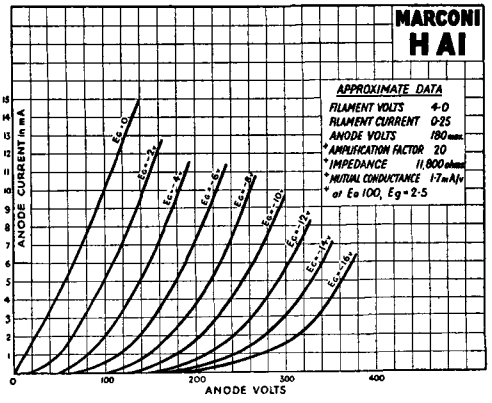
Marconi HA1 is a triode of normal slope but greatly reduced size and capacities. One of its chief uses is for ultra high frequency work.

Nominal rating, see curve.

Inter-electrode capacities.

G—E	1.0$\mu\mu$F
G—A	1.4$\mu\mu$F
A—E	0.6$\mu\mu$F

Connections and dimensions, see below.



Typical Operating Data.

As super regenerative detector up to 400 Mc.

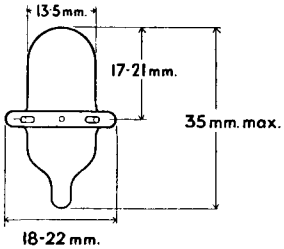
Anode volts	100—150
Anode current	4.5 mA max.
Grid condenser	50$\mu\mu$F
Grid leak	10 megohms

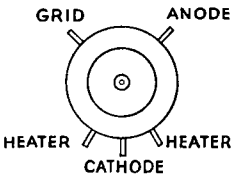
Notes.

It is important that the anode current should never be allowed to exceed 4.5 mA. As an oscillator the HA1 will operate up to 600 Mc, a suitable type of circuit being one employing parallel or concentric tubes.

Owing to its high input impedance the acorn triode is particularly suitable for valve voltmeter work with an anode bend circuit.

Soldered connections must not be made to the valve prongs.





VIEW FROM TOP

Price - - 5O/-

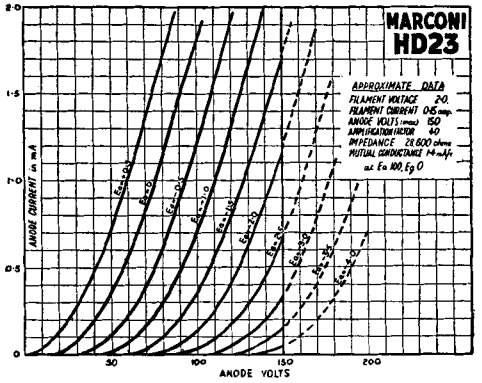
Marconi HD23

2 volt Double Diode Triode

Marconi HD23 embodies a new form of construction giving economy of filament current. It may be used in most cases to replace HD21 or HD22.

Inter-electrode capacities
(metallised valve)

G—E	2.75$\mu\mu$F
G—A	2.5$\mu\mu$F
A—E	10.0$\mu\mu$F
Diodes—G	.002$\mu\mu$F
Diodes—E	8.4$\mu\mu$F



Nominal Rating, see curve.

Dimensions : 120 × 42 mm. 5 pin base ; for connection see pages 4-5.

Typical Operating Data.

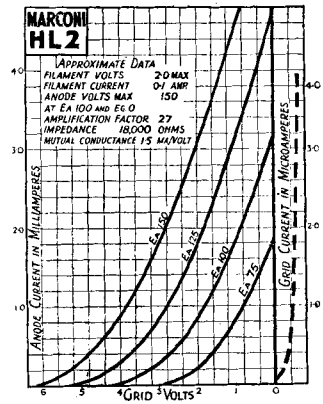
H.T. voltage	...	120	120	150	150
Anode load	...	50,000 ohms	0.25 megohms	50,000 ohms	0.25 megohms
Grid voltage	...	zero	zero	zero	zero
Anode current	...	1.0 mA	0.2 mA	1.5 mA	0.3 mA
Gain ...	...	22	27	22	28

Notes.

Owing to its high magnification factor the HD23 will usually be resistance capacity coupled to the subsequent valve. Its low impedance however makes transformer coupling quite possible, and in this case 1—1.5 volts grid bias is desirable.

The diode connected to pin No. 5 should be used for signal rectification.

Price - - 7/6



Marconi HL2

2 volt Triode

Marconi HL2 is normally used as LF amplifier or leaky grid detector. The anode load for R.C. coupling should be 50,000 ohms for 100-120 volt supplies, rising to 75,000 ohms when 150v. is available.

As an amplifier the grid bias should be $-1\frac{1}{2}$ volts.

Inter-electrode capacities

(metallised valve).

A—G	4.0$\mu\mu$F
A—E	9.0$\mu\mu$F
G—E	8.0$\mu\mu$F

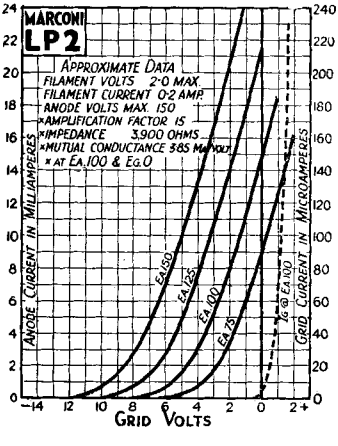
Price **4/9**

Marconi HL21

A special version of Marconi HL2 for the detector stage of portable receivers.

Price **5/3**

Dimensions : 105 × 42 m.m. 4 pin base ; for connections see pages 4-5.



Marconi LP2

2 volt Output Triode

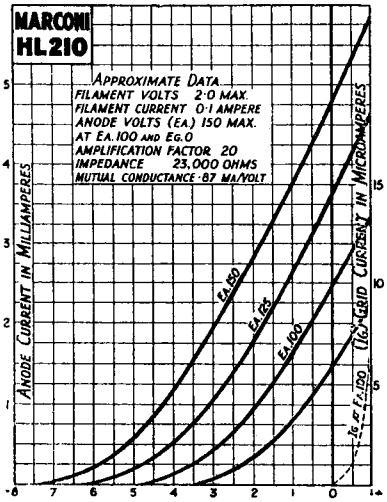
Marconi LP2 is a power output valve with a very high amplification factor combined with a normal value of impedance, thus providing stage magnification comparable with that of a pentode. Its high sensitivity and very small H.T. consumption render the LP2 ideal for the output stages of portable and similar receivers.
Optimum load, 9,700 ohms.

Overall Dimensions, 107×45 mm.

Price **6/-**

Anode Volts	Grid Bias	Anode Current
100	−3	5 mA.
120	−4½	6 mA.
150	−6	7 mA.

MARCONI 2-VOLT VALVES



HL210, Medium Magnification, 8/6

H.L. 210 is a general purpose valve of similar characteristics but rather lower mutual conductance than Marconi HL.2. In addition to its suitability for sets in which H.L.2 might, on account of its very high efficiency, cause instability, HL.210, having a small bulb, is particularly recommended for portable sets in which space is limited.

Approximate Operating Data.

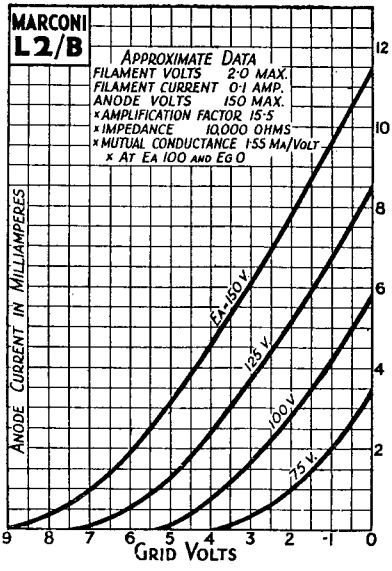
Circuit.	Anode Volts.	Grid Bias.
Grid leak detector	50–150	$-1\frac{1}{2}$
Anode Bend detector	100–150	–3 to –6
L.F. amplifier ...	75–150	$-1\frac{1}{2}$ to $-4\frac{1}{2}$
H.F. amplifier ...	50–150	Zero or negative according to circuit.

L 2/B, Low Magnification, 8/6

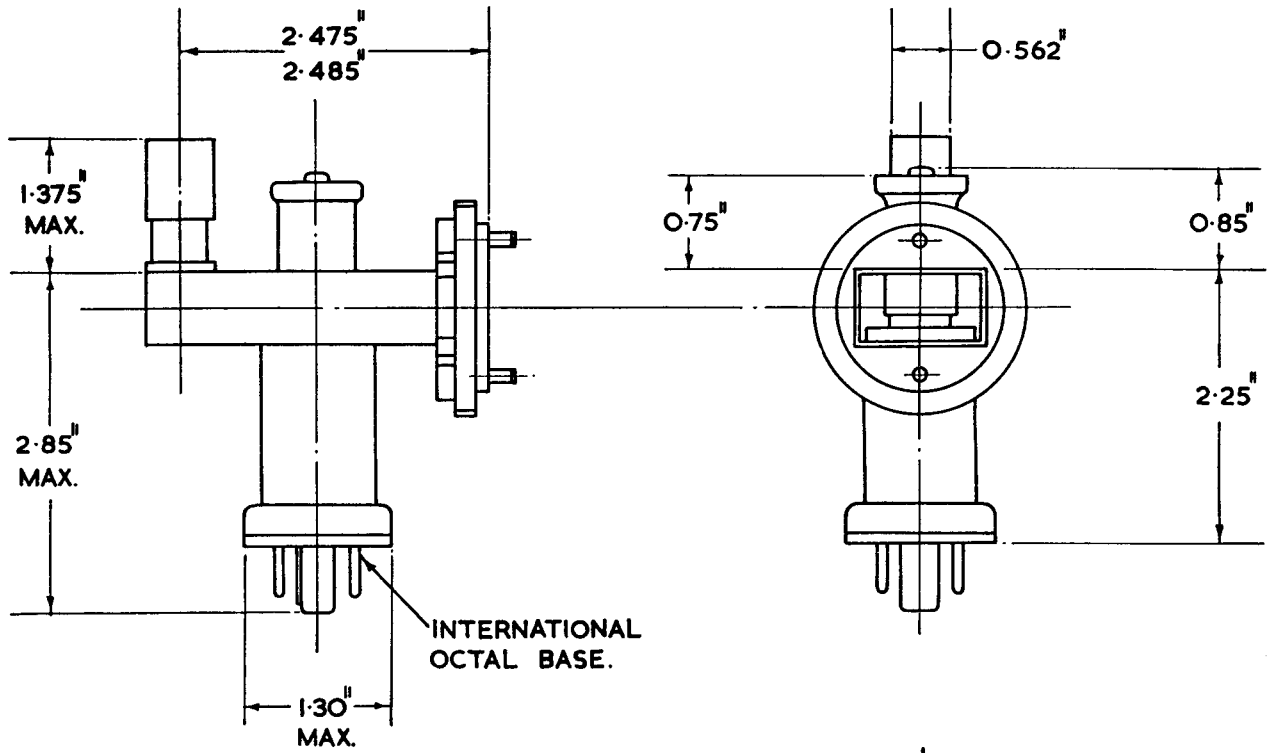
L2/b is primarily a low frequency amplifying valve of high efficiency which combines a large amplification factor with a comparatively low impedance. It provides a high stage gain with transformer coupling and will deal with large inputs without overloading. L2/b is also an excellent detector, either of the anode-bend or power-grid type when preceded by one or more H.F. stages.

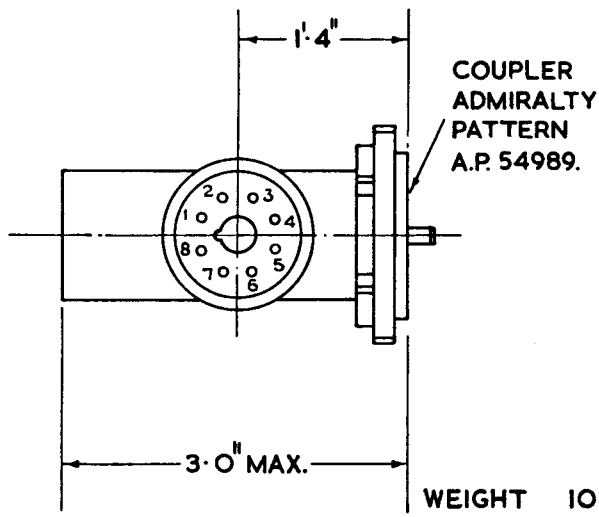
Approximate Operating Data.

Circuit.	Anode Volts.	Grid Bias.
Power-grid detector	80–150	Connect grid leak to positive end of filament.
Anode bend detector	50–150	$-1\frac{1}{2}$ to $-7\frac{1}{2}$
L.F. amplifier ...	75–150	$-1\frac{1}{2}$ to –6



Klystron *Type K300*





PIN No.	CONNECTIONS
1.	BLANK
2.	HEATER
3.	BLANK
4.	BLANK
5.	RESONATOR
6.	BLANK
7.	HEATER & CATHODE
8.	BLANK
CAP	REFLECTOR

WEIGHT 10 oz. (284 gm.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

General. The K 300 klystron has been designed for use as the local oscillator in a superheterodyne receiver operating in the band 9320–9500 Mc/s (the 3 cm. band). It is for use with systems using the standard British waveguides; the internal dimensions of which are 1 in. × 0·5 in.

APPROXIMATE DATA

V_h	6·3	V
I_h	0·6	A
V_{bm}	350	V
I_{bm}	35	mA
$V_{reflector}$ (max range)	—80 to 165	V
$P_{out\ (min)}$ (a)	15	mW
f (Mechanical tuning range)	9320 to 9500	Mc/s
f (Electronic tuning range) (b)	20	Mc/s

(a) At 350 V between cathode and resonator.

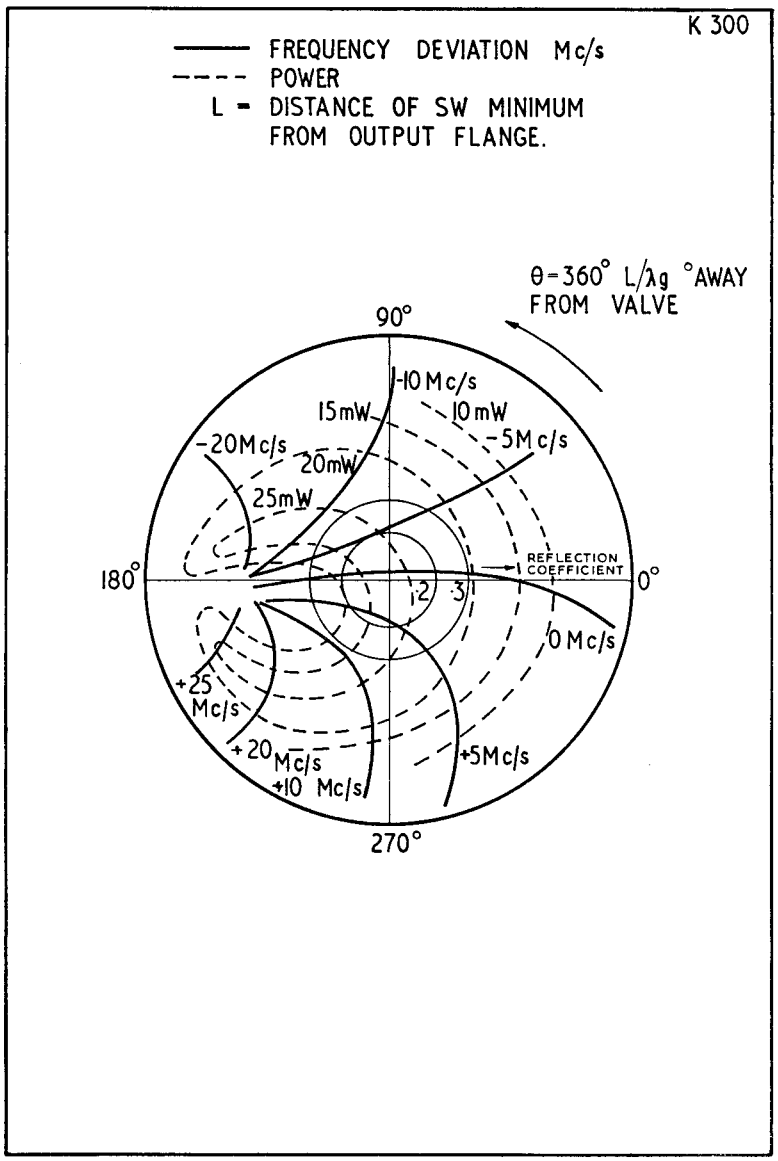
(b) The electronic tuning is obtained with a reflector voltage sweep of approximately 15 V.

NOTES

(1) Each klystron is marked with the reflector voltage at which it will oscillate and give an output power of at least 12 mW over the whole frequency band.

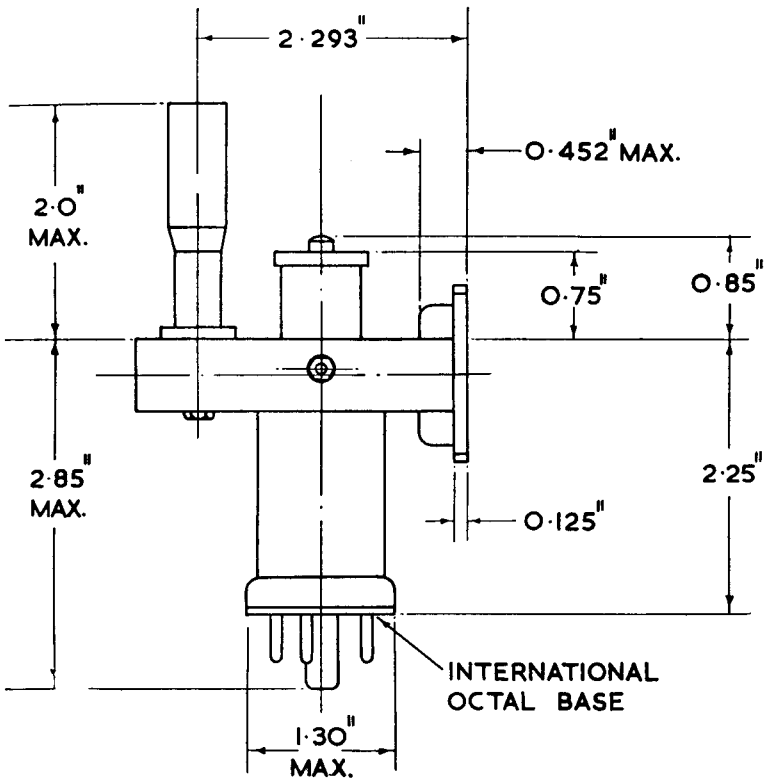
(2) At no time should the voltage of the reflector be allowed to become equal to or more positive than the cathode: if under AFC working there is any chance of this happening, a protective diode should be fitted at the reflector.

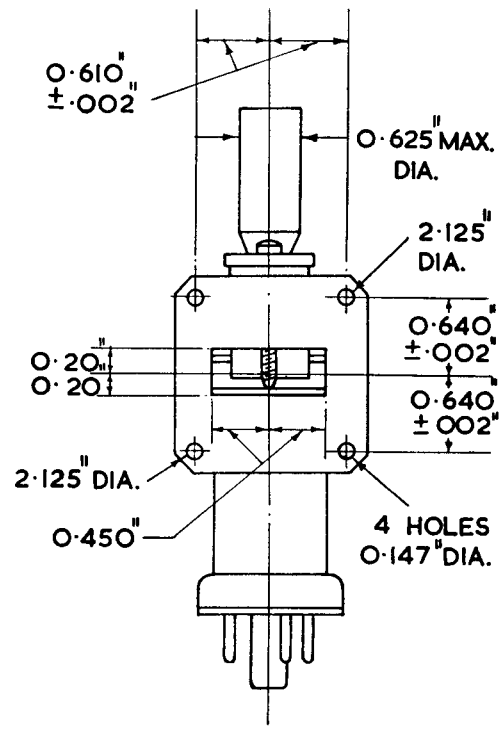
(3) Total impedance in the reflector to cathode circuit not to exceed 0·5 MΩ.

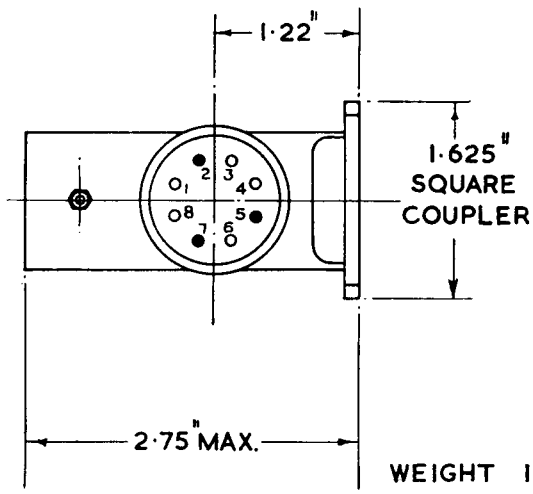


PRINTED IN ENGLAND

Klystron *Type K302*







PIN No.	CONNECTIONS
1.	BLANK
2.	HEATER
3.	BLANK
4.	BLANK
5.	RESONATOR
6.	BLANK
7.	HEATER & CATHODE
8.	BLANK
CAP	REFLECTOR

WEIGHT 1·75lb. (0·794 Kg.)

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. *Telex:* 1953. *Telegrams: Expanse Chelmsford Telex*

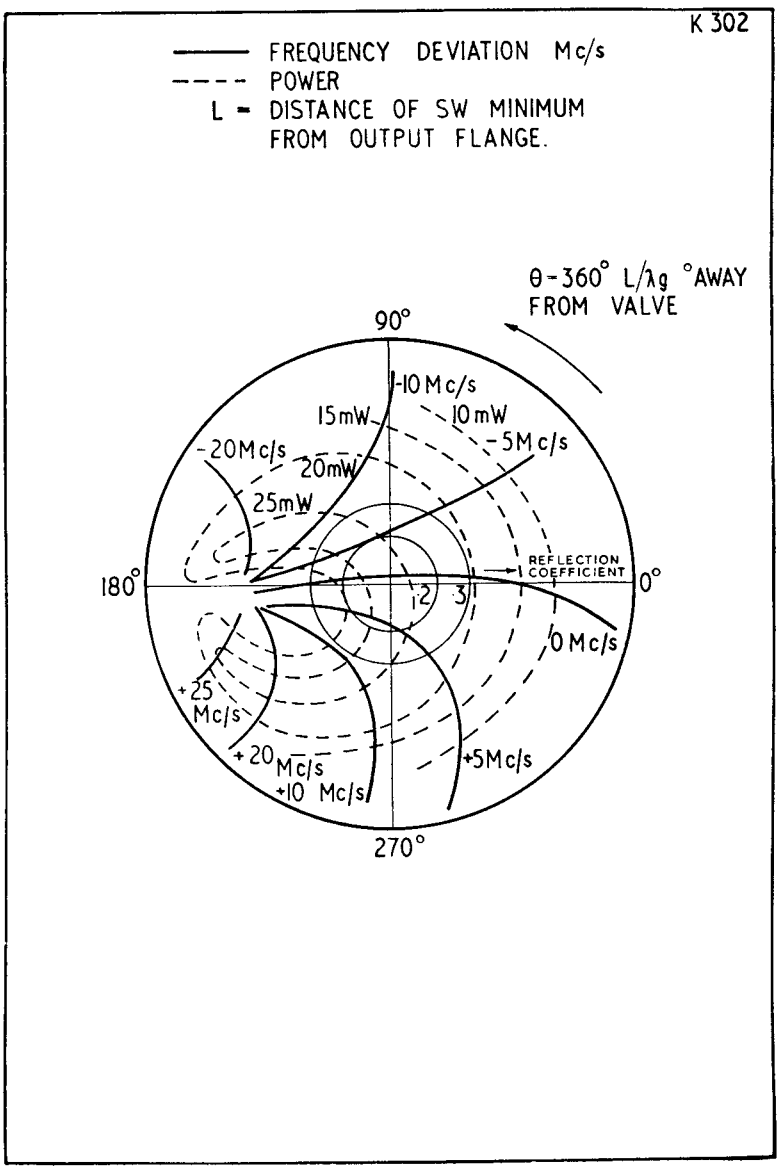
General. The K 302 klystron has been designed for use as the local oscillator in a superheterodyne receiver operating in the band 9320–9500 Mc/s (the 3 cm. band). It is for use with systems using the standard American waveguide; the internal dimensions of which are 0·9 in. ×0·4 in.

APPROXIMATE DATA

V_h	6·3	V
I_h	0·6	A
V_{bm}	350	V
I_{bm}	35	mA
$V_{reflector}$ (max range)	—90 to —155	V
$P_{out\ (min)}$ (a)	30	mW

f (Mechanical tuning range)	9320–9500	Mc/s
f (Electronic tuning range) (b)	30	Mc/s

(a) At 350 V between cathode and resonator.
(b) The electronic tuning is obtained with a reflector voltage sweep of approximately 20 V.



NOTES

(1) Each klystron is marked with the reflector voltage at which it will oscillate and give an output power of a least 12 mW over the whole frequency band.

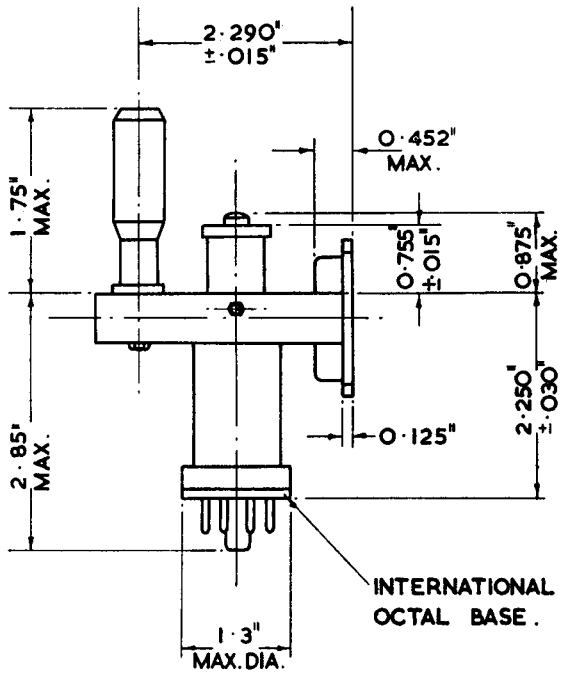
(2) At no time should the voltage of the reflector be allowed to become equal to or more positive than the cathode: if under AFC working there is any chance of this happening, a protective diode should be fitted at the reflector.

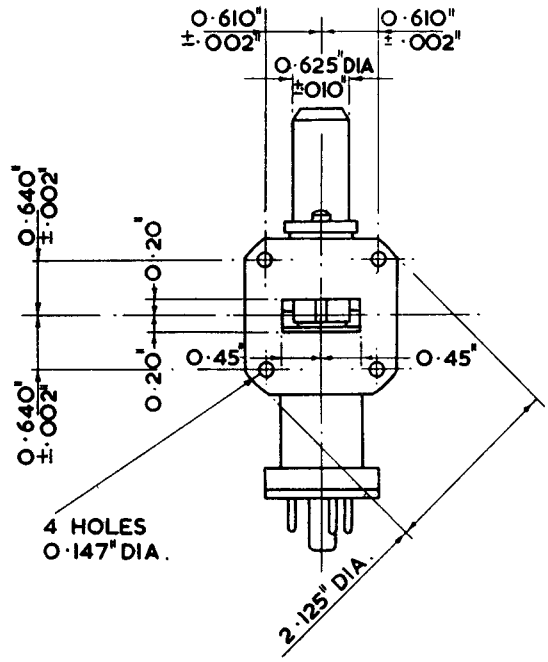
(3) The total impedance in the reflector to cathode circuit must not exceed 0·5 MΩ.

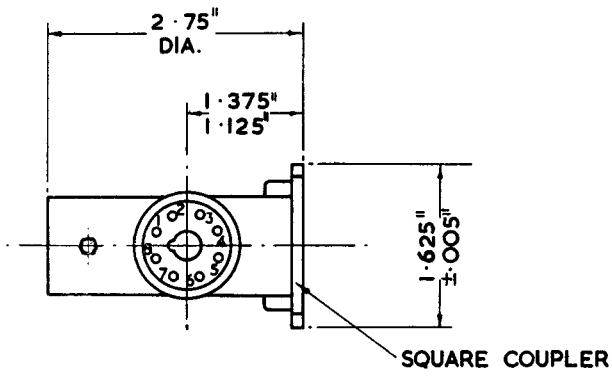
(4) Tuning is effected by means of a reactive stub intruding into the waveguide. This stub may be operated directly by means of the micrometer or remotely by means of a shaft engaging the $\frac{1}{16}$ in. dia. pin mounted across the diameter of a $\frac{1}{4}$ in. hole recessed in the micrometer.

PRINTED IN ENGLAND

Klystron *Type K312*







PIN No.	CONNECTIONS
1	BLANK
2	HEATER
3	BLANK
4	BLANK
5	RESONATOR
6	BLANK
7	HEATER & CATHODE
8	BLANK
CAP	REFLECTOR

General. The Klystron K312 has been designed for use with systems using standard American waveguides having internal dimensions of 0·9 in. × 0·4 in.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

APPROXIMATE DATA

V_h	6·3	V
I_h	0·6	A
V_{bm}	350	V
I_{bm}	35	mA
$V_{reflector}$	−110 to −180	V
P_{out} (a)	25	mW
f (mechanical tuning range)	9430 to 9650	Mc/s
f (electronic tuning range) (b)	30	Mc/s

(*a*) At 350 V between cathode and resonator.

(*b*) The electronic tuning is obtained with a reflector voltage sweep of approximately 15 V.

NOTES

1. Each klystron is marked with the reflector voltage at which the klystron will oscillate and give a power output of at least 10 mW over the whole mechanical tuning range.
2. The reflector voltage must always remain negative with respect to the cathode. If under AFC working there is any chance of the reflector voltage becoming equal to or more positive than the voltage of the cathode, a protective diode must be fitted at the reflector.
3. The total impedence in the reflector-cathode circuit must not exceed 0·5 Megohms.
4. Tuning is obtained by means of a reactive stub intruding into the waveguide. This stub may be operated by means of the micrometer (shown in the outline) or remotely by means of a shaft engaging the $\frac{1}{16}$ in. dia. pin mounted across the diameter of a $\frac{1}{4}$ in. hole recessed in the micrometer.

PRINTED IN ENGLAND

Marconi KT2

(replaces PT2)

2 volt Output Tetrode.

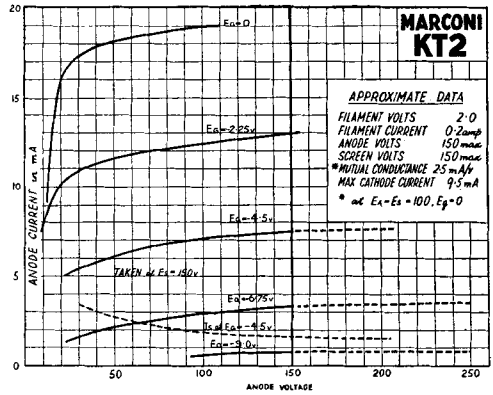
Marconi KT2 is suitable for receivers where a moderate output is required with H.T. and L.T. economy.

Nominal rating, see curve.

Inter-electrode capacities.

G—A	1.6$\mu\mu$F
A—E	13.1$\mu\mu$F
G—E	11.3$\mu\mu$F

Dimensions : 115 × 45 mm. 5 pin base ; for connections see pages 4-5.



Typical Operating Data.

Single Valve, Class A

Anode voltage ...	150	150	120	100
Screen voltage ...	150	120	120	100
Grid bias ...	—4.5	—3.0	—3.0	—3.0
Anode current ...	7.5 mA	6.4 mA	6.2 mA	3.8 mA
Screen current ...	1.7 mA	1.2 mA	1.3 mA	0.8 mA
Optimum load ...	17,000 ohms	16,000 ohms	12,000 ohms	16,000 ohms
Power output ...	500 mW	350 mW	250 mW	200 mW

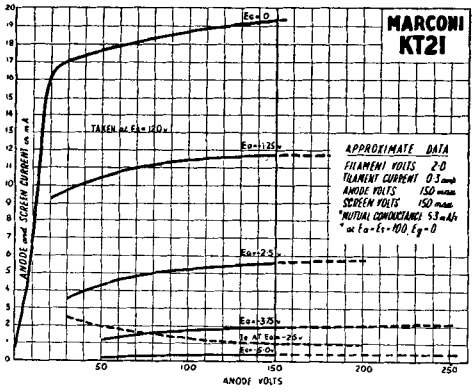
Two Valves, Class AB$_1$ (Q.P.P.)

Anode voltage	150	120
Screen voltage	V132	V112
	W140	W112
	X147	X120
Grid bias	—7.5	—6.0
Optimum load	25,000 ohms	35,000 ohms
Power output	1,000 mW	560 mW
Quiescent anode current, per pair	2.7 mA	1.6 mA
Quiescent screen current, per pair	0.5 mA	0.4 mA
Full drive anode current, per pair	12.0 mA	8.0 mA
Full drive screen current, per pair	2.7 mA	2.0 mA

Notes.

KT2 valves are graded V, W, X, so that any pair may be used for Q.P.P. by adjusting the screen voltages as given in the table above.

Price - - 9/-



Marconi KT21

2 volt Output Tetrode.

Marconi KT21 has an extremely high slope and should be used where the utmost amplification per stage is required.

Nominal rating, see curve.

Inter-electrode capacities.

A—G	1.14$\mu\mu$F
A—E	9.9$\mu\mu$F
G—A	12.0$\mu\mu$F

Dimensions : 118 × 45 mm. 5 pin base ; for connections see pages 4-5.

Typical Operating Data.

Single Valve. Class A.

Anode voltage	120	150	150
Screen voltage	120	120	150
Grid bias	−2.5	−2.5	−2.5
Anode current	5.0 mA	5.3 mA	10.0 mA
Screen current	1.2 mA	0.9 mA	2.3 mA
Optimum load	19,000 ohms	19,000 ohms	10,000 ohms
Power output	350 mW	425 mW	725 mW

Two Valves. Class AB₁ (Q.P.P.)

Anode voltage	150	120
Screen voltage	V 132	V 105.5
	W 140	W 112
	X 147	X 117.5
	Y 155	Y 124
	Z 162	Z 129.5
Grid bias	−5	−4
Optimum load	20,000	20,000
Power output	1,250 mW	610 mW
Quiescent anode current, per pair ...	3.0 mA	1.8 mA
Quiescent screen current, per pair ...	1.0 mA	0.6 mA
Full drive anode current, per pair ...	16.0 mA	10.6 mA
Full drive screen current, per pair ...	3.6 mA	2.8 mA

Notes.

KT21 valves are graded V, W, X, Y, Z so that any pair may be used for Q.P.P. by adjusting the screen voltages as given in the above table.

Price - - 9/-

Marconi KT32

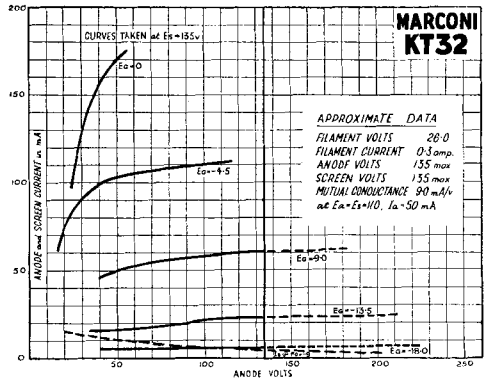
Output Tetrode

Marconi KT32 uses aligned grid construction. It is suitable for the output stage of A.C./D.C. receivers including those for 100 volt mains.

Nominal Rating, see curve.

Inter-electrode capacities.

A—G	1.4$\mu\mu$F
A—E	12.0$\mu\mu$F
G—E	21.0$\mu\mu$F



Dimensions : 119×45 mm. Octal base ; for connections see pages 4-5.

Typical Operating Data.

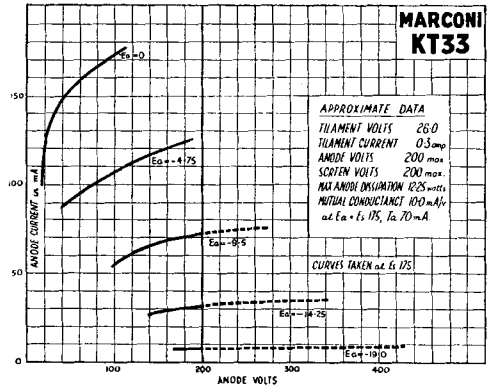
	Single Valve, Class A.				
Anode and Screen voltage	135	135	110	110	90
Anode current	75	60	60	50	44 mA
Screen current	5	5	4	4	4 mA
Optimum load	1300	1300	1600	1600	1600 ohms
Power output	3.5	2.8	2.3	2.3	1.2 watts
Bias resistance	95	145	95	130	95 ohms

Two Valves, Class AB1	
Anode and screen voltage	135
Combined anode and screen currents, no signal	100 mA and 8 mA
Combined anode and screen currents, full drive	135 mA and 20 mA
Anode—anode load	2,500 ohms
Power output	7.5 watts
Bias resistance, each valve	200 ohms

Notes.

To prevent parasitic oscillation grid and anode stoppers are recommended, 5000 and 25 ohms being suitable values. KT32 can also be used triode strapped for push-pull operation, in this case 100 ohm stoppers should be used in the screen connections.

Price - - 12/-



Nominal rating, see curve.

Marconi KT33

Output Tetrode.

Marconi KT33 is designed to give a large output in A.C./D.C. apparatus where the smoothed voltage is usually less than 200.

Inter-electrode capacities.

G—E	18.5$\mu\mu$F
A—E	11.5$\mu\mu$F
G—A	1.2$\mu\mu$F

Dimensions : 122×50.5 mm. Octal base ; for connections see pages 4-5.

Typical Operating Data.

Single Valve, Class A.

Anode and screen voltage ...	150	175	200	150	175	
Anode current	44	52	60	60	70	mA
Screen current	8	9	10	10	12	mA
Bias resistance	188	188	188	116	116	ohms
Optimum load	3,000	3,000	3,000	2,500	2,500	ohms
Power output	3	4	5	3.6	5.0	watts

Notes.

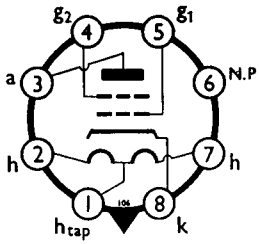
Owing to the high slope of the valve it is advisable to use anode or grid stoppers to prevent parasitic oscillation. An alternative method which is often very effective is to use a stopper (100 ohms or more) in the screen circuit. The total grid-cathode path should not exceed 0.5 megohm.

Price - - 12/-

OUTPUT TETRODE
25V INDIRECTLY HEATED

KT33C
NOVEMBER, 1955

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International octal.
Bulb : Dome top pear.

Max. overall length :	119 mm.
Max. seated length :	104 mm.
Max. diameter :	45 mm.

RATINGS

V_h	25	13	V
I_h	0·3	0·6	A
V_a		200 max.	V
V_{g2}		200 max.	V
p_a		13 max.	W
g_m { at $V_a = V_{g2} = 175$, $V_{g1} = -7$ }		10	mA/V

CAPACITANCES

c_{in}	19	pF	c_{out}	12	pF	$c_{a\text{-}g1}$	1·2 pF

TYPICAL OPERATION

Single valve Class A

Tetrode connection

V_a	200	150	V
V_{g2}	200	150	V
V_{g1}	−13·3	−9·9	V
$I_{a\ (o)}$	60	44	mA
$I_{g2\ (o)}$	10	8	mA
$v_{in\ (pk)}$	12·3	8·9	V
R_k	190	190	Ω
R_L	3	3	kΩ
P_{out}	5	3	W
D	8	8	%

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford

KT33C

Push-pull Class AB_1 Two valves

Tetrode connection

V_a	200	150	V
V_{g2}	200	150	V
V_{g1}	−19·1	−13·2	V
$I_{a\ (o)}$	113	80	mA
$I_{g2\ (o)}$	18	12	mA
$V_{in\ (pk)\ (g\text{-}g)}$	44	24	V
R_k (per valve)	240	240	Ω
$R_{L\ (a\text{-}a)}$	4	4	kΩ
P_{out}	15·5	7·5	W
D	7·5	3·9	%

GENERAL

For the prevention of parasitic oscillation a series resistor of 100Ω should be connected directly to the screen grid tag of the valve socket.

A control grid series resistor of 10/50kΩ is also recommended.

The maximum permissible D.C. resistance between control grid and anode is limited to 0·47MΩ for auto-bias, and 0·1MΩ for fixed bias operation.

MOUNTING

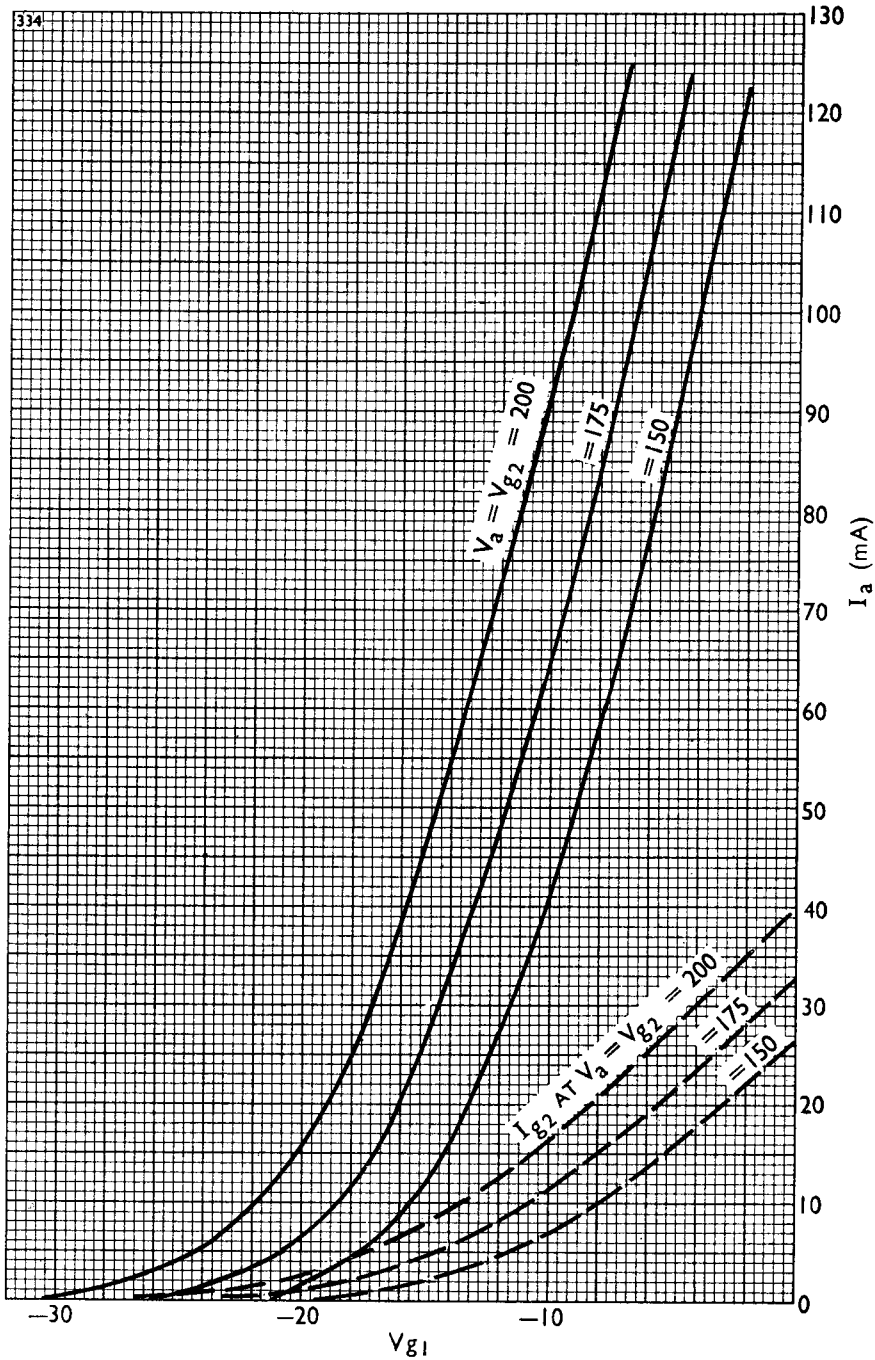
Any position.

RETAINING

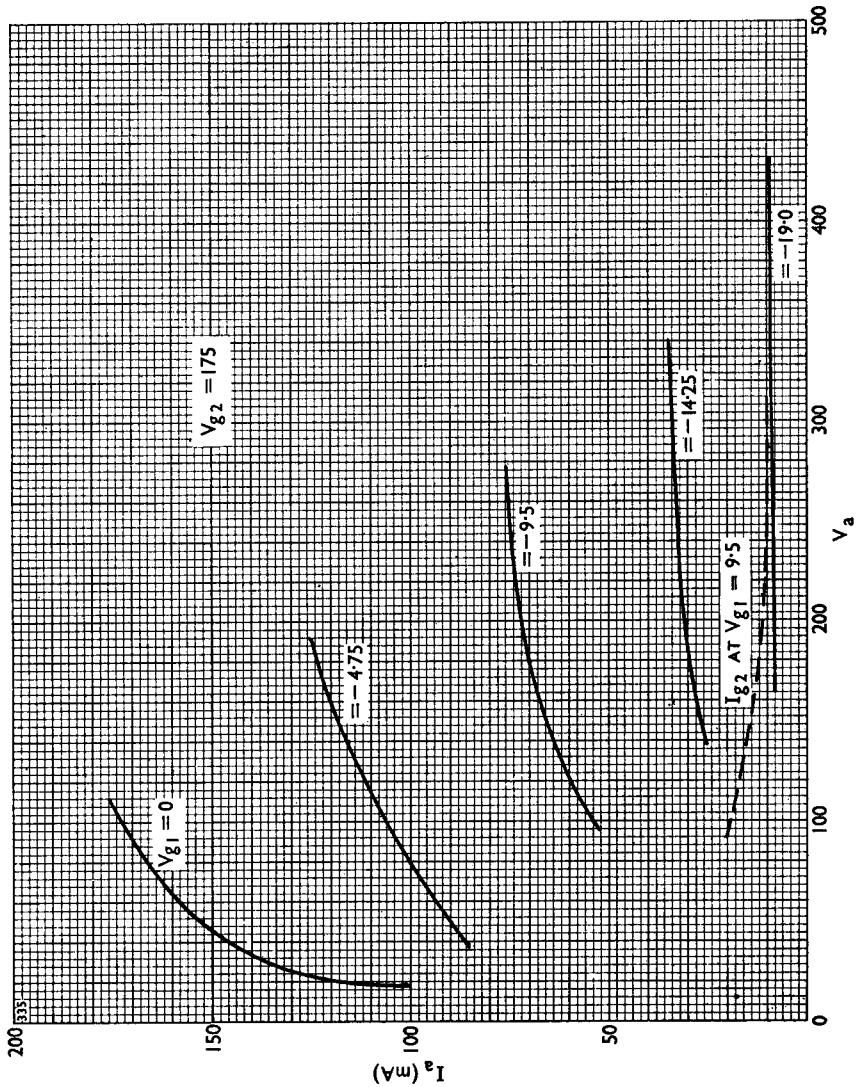
A retaining device is not normally necessary.

VENTILATION

Adequate ventilation around the bulb should be provided.


334
130
120
110
100
90
80
70
60
50
40
30
20
10
0
I_a (mA)
$V_a = V_{g2} = 200$
$= 175$
$= 150$
I_{g2} AT $V_a = V_{g2} = 200$
$= 175$
$= 150$
−30
−20
−10
V_{g1}

KT33C

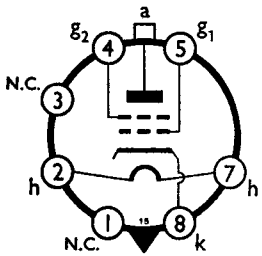


Printed in England. C.

OUTPUT TETRODE
0·3A INDIRECTLY HEATED

KT36
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International octal
Bulb : Dome top pear

Overall length :	123—133	mm.
Seated length :	109—119	mm.
Max. diameter :	45	mm.
Top cap :	CT1	

RATING

Pentode Connection

I_h	0·3		A
V_h	26	approx.	V
$V_{h\text{-}k}$ (r.m.s.)	200	max.	V
V_a	250		V
v_a (pk)	4	max.	kV
V_{g2}	200		V
p_a	10	max.	W
p_{g2}	3	max.	W
g_m at $V_a = V_{g2} = 150$, $V_{g1} = -10$	11		mA/V

Triode Connection

$V_{a,\,g2}$	200		V
$p_{a,\,g2}$	13	max.	W
μ	7·5		
r_a at $V_{a,g2} = 150$, $V_{g1} = -10$	800		Ω
g_m	10·5		mA/V

CAPACITANCES

$c_{g1\text{-}all}$	20	pF
$c_{a\text{-}all}$	12	pF
$c_{a\text{-}g1}$	1·2	pF

SCREENING

No screening is fitted to the valve and, generally, no screening is required.

MOUNTING

Any position.

RETAINING

No retaining device is necessary.

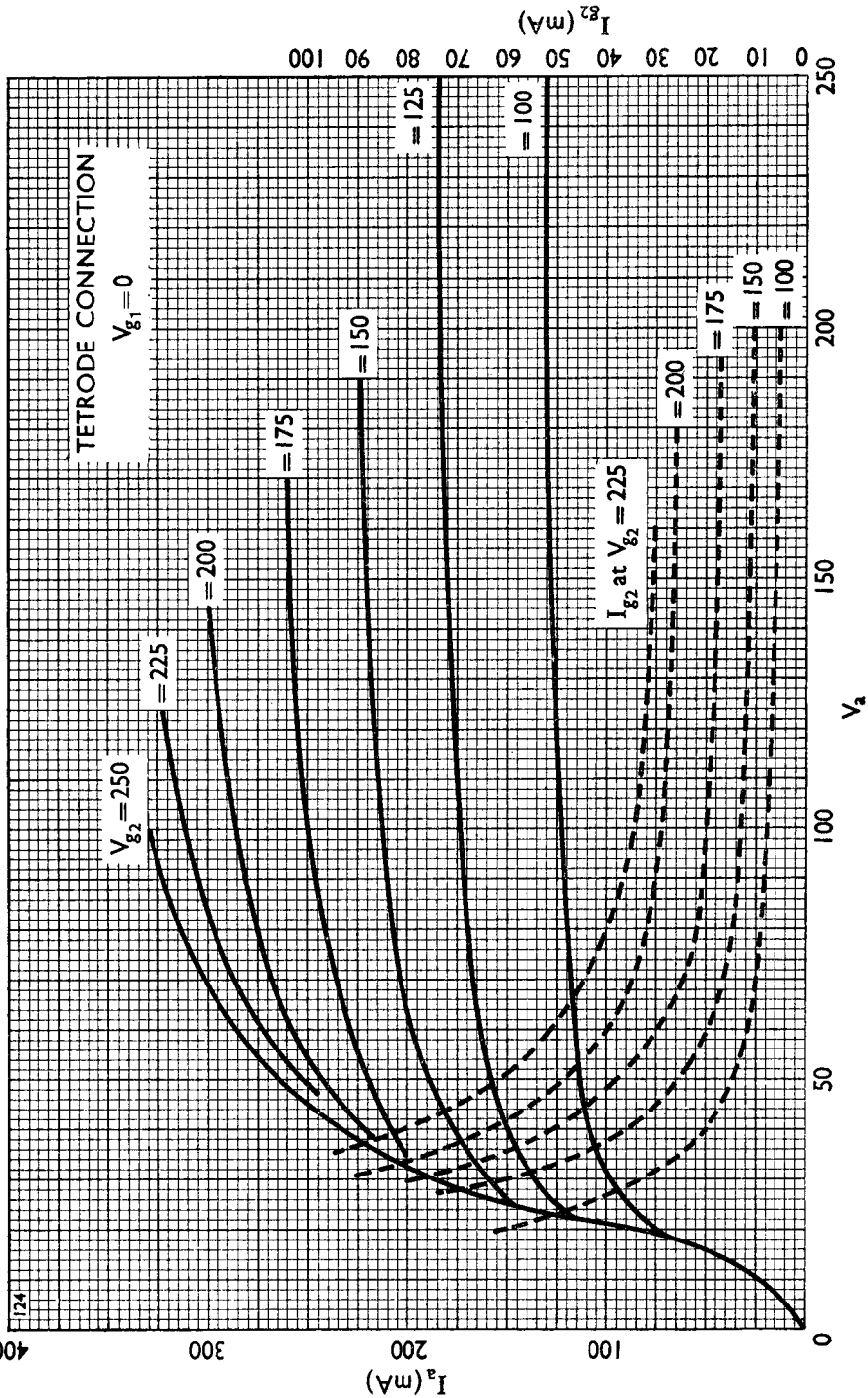
VENTILATION

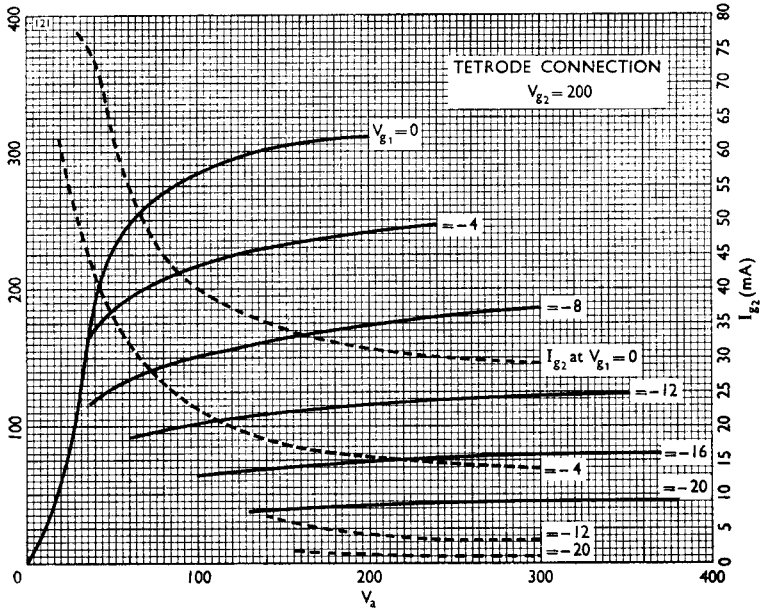
Adequate ventilation must be provided round the bulb.

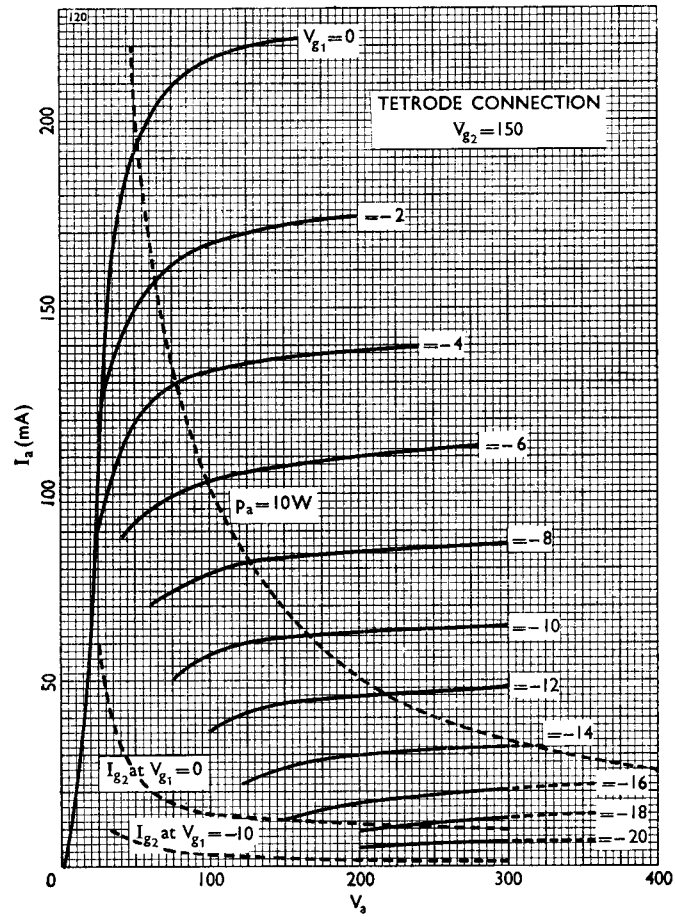
MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

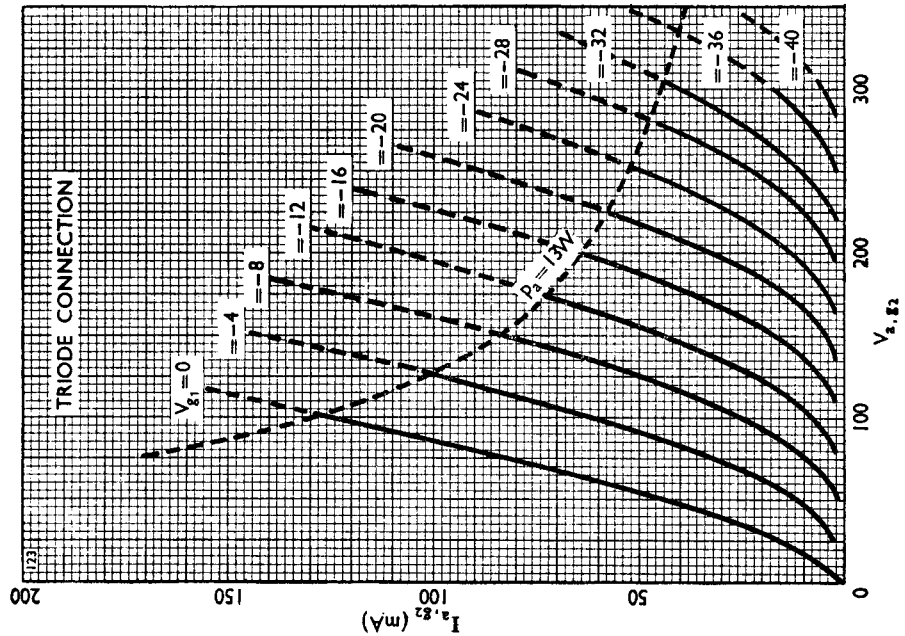
KT36

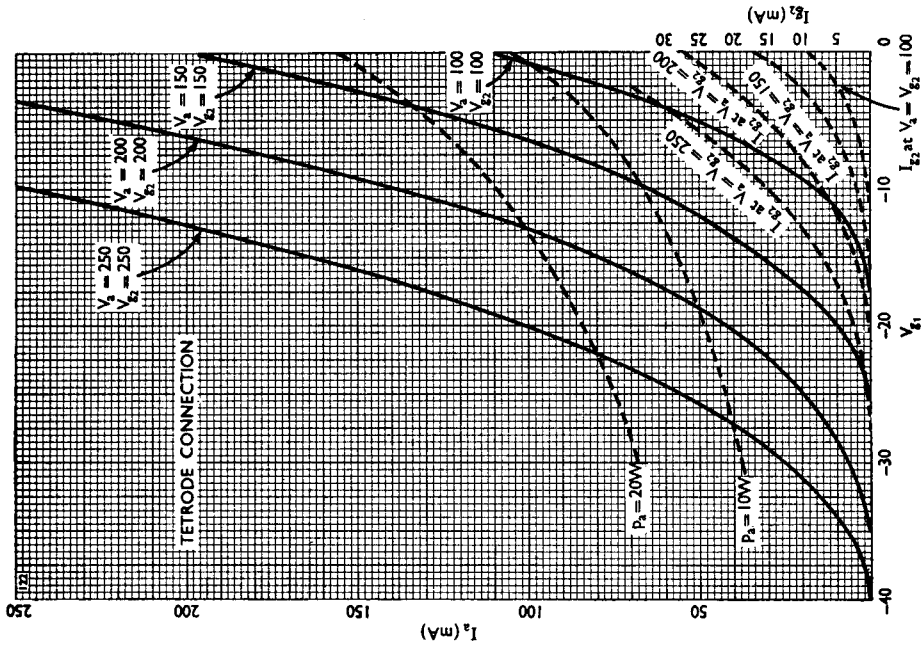

TETRODE CONNECTION
$V_{g_1} = 0$
$V_{g_2} = 250$
= 225
= 200
= 175
= 150
= 125
= 100
I_{g_2} at $V_{g_2} = 225$
= 200
= 175
= 150
= 100
I_a (mA)
I_{g_2} (mA)
V_a
124


121
TETRODE CONNECTION
$V_{g_2}=200$
$V_{g_1}=0$
=−4
=−8
I_{g_2} at $V_{g_1}=0$
=−12
=−16
=−4
=−20
=−12
=−20
I_{g_2} (mA)
V_a

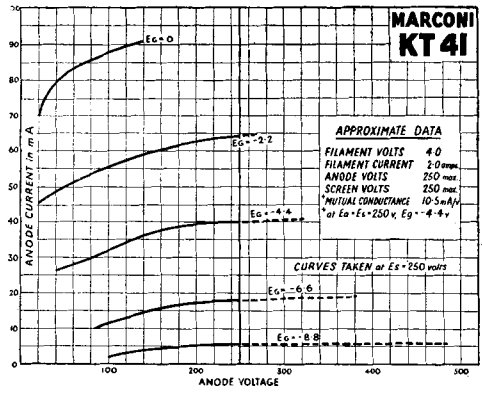

120
$V_{g_1}=0$
TETRODE CONNECTION
$V_{g_2}=150$
=−2
=−4
=−6
$P_a=10W$
=−8
=−10
=−12
=−14
=−16
=−18
=−20
I_{g_2} at $V_{g_1}=0$
I_{g_2} at $V_{g_1}=-10$
I_a (mA)
V_a

KT36





Printed in England C



Marconi KT41

(replaces N41)

Output Tetrode

Marconi KT41 is a high slope output valve giving a large output for a very small grid swing.

Nominal rating, see curve.

Inter-electrode capacities.

G—A	1.3$\mu\mu$F
A—E	11.3$\mu\mu$F
G—E	21.0$\mu\mu$F

Dimensions : 145×56.5 mm. 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

Single Valve, Class A.

Anode voltage	250	250	250
Screen voltage	200	225	250
Grid bias	−3.5	−4.0	−4.4
Anode current	32	35	40 mA
Screen current	6.5	7.5	8.5 mA
Power output	3.2	3.5	4.3 watts
Optimum load	8,500	7,500	6,000 ohms
Bias resistance	90	90	90 ohms

Two Valves, Class AB_1.

Anode voltage	250	
Screen voltage	250	
Anode current, per pair	56 mA, no signal	60 mA, full drive
Screen current, per pair	12 mA, no signal	20 mA, full drive
Power output	8.6 watts	
Optimum load	10,000 ohms	
Common bias resistance	90 ohms	

Notes.

Grid and anode stoppers of 10,000 and 100 ohms are recommended. The total resistance in the grid-cathode path should not exceed 0.5 megohm and full automatic bias should always be used. Owing to its high sensitivity this valve is particularly suitable for negative feed-back circuits.

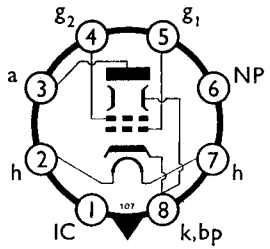
Price - - 10/6

BEAM TETRODE
0·3A INDIRECTLY HEATED

KT55
DECEMBER, 1955

The KT55 may be used as an audio output valve or as a series stabiliser.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International octal.
Bulb : Dome top tubular.

Max. overall length :	143	mm.
Max. seated length :	128	mm.
Max. diameter :	52	mm.

HEATER

I_h	0·3	A
V_h	52	V

MAXIMUM RATINGS

V_a	400	V
V_{g2}	300	V
$V_{h\text{-}k}$	250	V
$V_{h\text{-}k\ (pk)}$	350	V
P_a	25	W
P_{g2}	4·5	W
$P_a + g_2$	26·5	W

CAPACITANCES (of cold unscreened valve)

$C_{a\text{-all}}$	14	pF	$C_{g1\text{-all}}$	34	pF	$C_{a\text{-}g1}$	0·7	pF

CHARACTERISTICS

	Tetrode Connection	Triode Connection	
V_a	200	200	V
V_{g2}	150	—	V
V_{g1}	−13·5 approx.	−20 approx.	V
I_a	125	140	mA
I_{g2}	7·5	—	mA
μ	—	7·5	—
g_m	19	20	mA/V
r_a	5000	400	Ω

KT55

TYPICAL OPERATION

Tetrode Connection. Push-pull. Two Valves.

Data per pair unless otherwise stated.

	Quiescent	Max. signal	
$V_{a(b)}$	225	215	V
V_a	200	190	V
V_{g2}	200	190	V
$v_{in\ (g1\text{-}g1)}$ (pk)	—	28·8	V
V_{g1} (approx.)	−22	−25	V
I_a	220	225	mA
I_{g2}	15	45	mA
R_k (per valve)	185	185	Ω
$R_{L\ (a\text{-}a)}$	—	2	kΩ
P_{out}	—	25	W
D	—	2	%
z_{out}	—	9	kΩ

Triode Connection. Push-pull. Two Valves.

Data per pair unless otherwise stated.

$V_{a(b)}$	200	225	V
V_a	180	200	V
V_{g1}	−19	−22	—
I_a	205	240	mA
p_a (per valve)	18·5	22	W
R_k	185	185	Ω
$R_{L\ (a\text{-}a)}$	1·5	1·5	kΩ
P_{out}	11	15	W
$D_{max.}$	2	—	%
V_{in} (rms)	13+13	15+15	V
z_{out}	1	1	kΩ

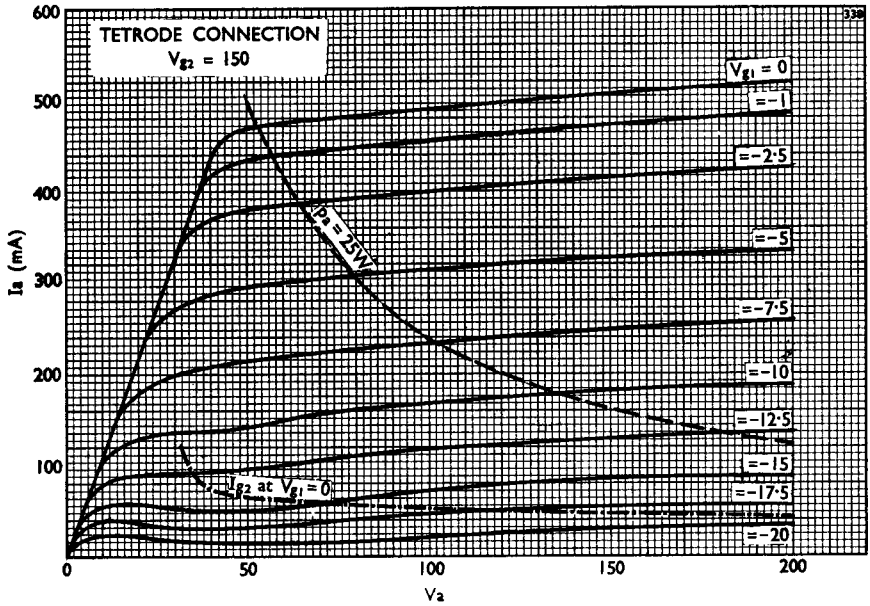
NOTE The anode current rises by about 10 mA for full output.

MOUNTING

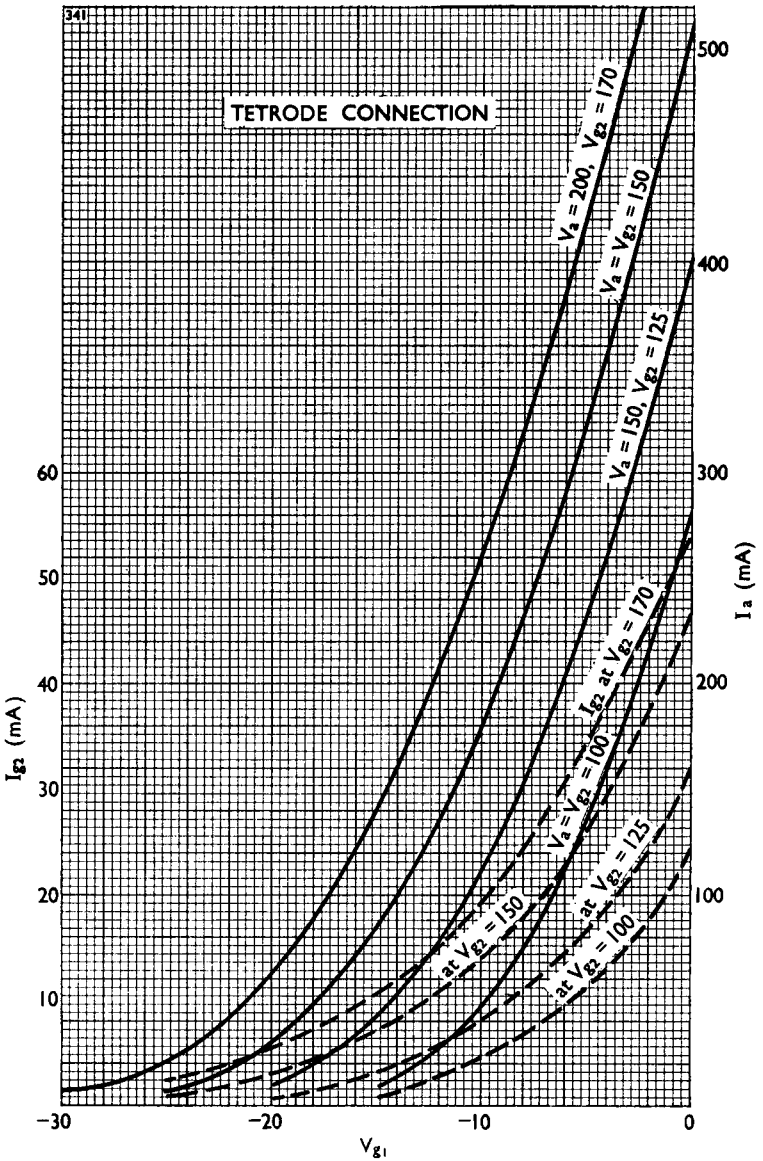
Vertical. Base down.

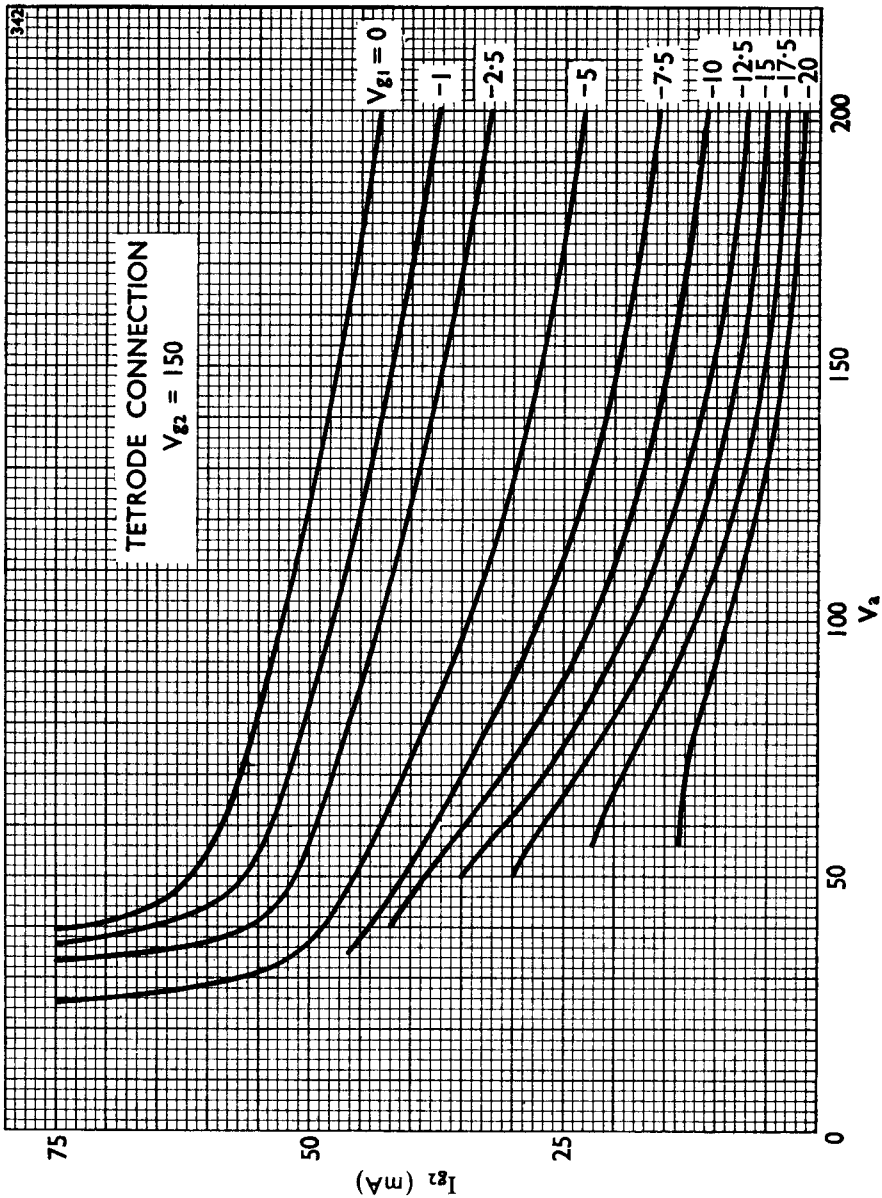
VENTILATION

Free air circulation is desirable. The temperature of the hottest part of the bulb must not exceed 225°C.

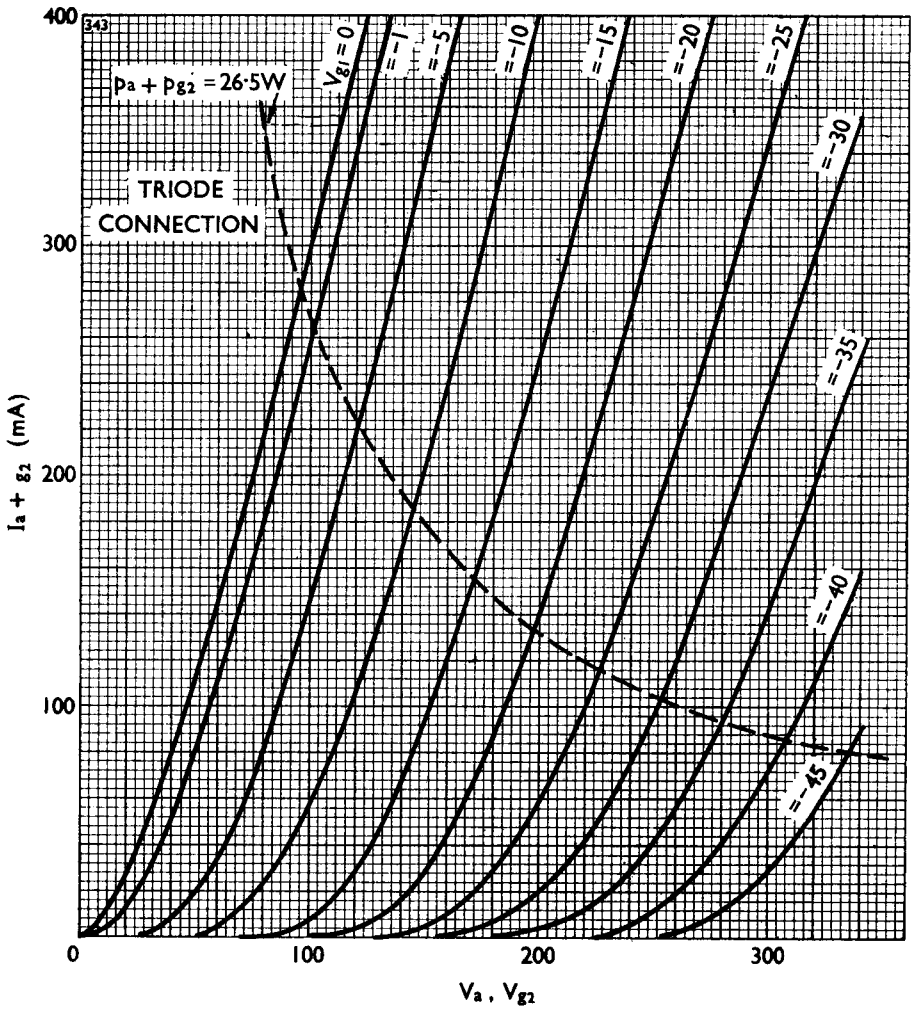

TETRODE CONNECTION
V_{g2} = 150
338
V_{g1} = 0
=-1
=-2·5
=-5
=-7·5
=-10
=-12·5
=-15
=-17·5
=-20
W_a = 25W
I_{g2} at V_{g1} = 0
I_a (mA)
600
500
400
300
200
100
0
50
100
150
200
V_a

KT55


341
TETRODE CONNECTION
Va = 200, Vg2 = 170
Va = Vg2 = 150
Va = 150, Vg2 = 125
Ig2 at Vg2 = 170
Va = Vg2 = 100
Ig2 at Vg2 = 150
Ig2 at Vg2 = 125
Ig2 at Vg2 = 100
Ig2 (mA)
Ia (mA)
Vg1
60
50
40
30
20
10
500
400
300
200
100
−30
−20
−10
0


342
TETRODE CONNECTION
V_{g2} = 150
V_{g1} = 0
-1
-2·5
-5
-7·5
-10
-12·5
-15
-17·5
-20
I_{g2} (mA)
75
50
25
0
50
100
150
200
V_a

KT55


343
Pa + Pg2 = 26·5W
TRIODE
CONNECTION
Vg1 = 0
= -1
= -5
= -10
= -15
= -20
= -25
= -30
= -35
= -40
= -45
400
300
200
100
0
100
200
300
Ia + g2 (mA)
Va , Vg2

KT55

OV.3256

Printed in England. C.

CONTENTS

	Page
Introduction	1
Ultra Linear Operation	1
Performance	2
Operation from Sub-Normal Mains Voltages ...	3
Other Applications	
DC-AC Converter	3
Series Heater Circuit	4
Series Stabiliser	4
Component Values	4

INTRODUCTION

The KT55 is primarily designed for use as an audio frequency amplifier in AC/DC equipment using a series connected heater chain. Two valves will provide an output of the order of 25W with a line voltage of 225V.

The recommended circuit is shown in fig. 1 and is designed round one Z729, one L63, and two KT55 valves, the H.T. supply being provided by a metal rectifier when the amplifier is operated on AC mains. The use of a thermionic rectifier is impracticable due to the high current required, which is about 275 mA.

The input signal is applied to a Z729 voltage amplifier. This is followed by an L63 phase splitter which provides two equal voltages of opposite phase to the two KT55 output valves.

The two KT55 valves, which must have separate cathode bias resistors, R16, R17, have their anodes connected to an output transformer, details of which are given later. The anode current is supplied by a low impedance rectifier and smoothing system which utilises components common in television receivers. A tapped resistor caters for various AC and DC mains voltages. The heater current is controlled by a barretter Type 303 and thermistor CZ1.

The basic sensitivity of this amplifier is high, full output being obtainable from an input of 55 mV. This is increased to 300 mV by the application of degeneration. The sum and noise level is 55db below full output before degeneration is applied, the volume control being at maximum.

Separate bias resistors, R16 R17, are essential due to the high mutual conductance. The 50 μF capacitors, C8 C9, permit a loss of 6db at 500 c/s. They may be increased to 250 μF where this loss is objectionable.

ULTRA LINEAR OPERATION

The output stage may be connected so that the valves operate either as pentodes or in the ultra linear mode. The latter is shown in fig. 1 but the resistors R14 R15 may be connected to C13 for pentode operation. The ultra linear circuit gives a reduction in output impedance from 9 kΩ to 2·35 kΩ, giving a unity ratio with the anode to anode load. The distortion falls from 2% to 1·5%. These advantages are accompanied by a slight increase in the input signal required.

The output transformer Ref. C2203, for the ultra linear circuit, is provided with a tap on each half-primary at one fifth of the turns, measured from the centre tap. Two small capacitors, C10 C11, are required to prevent self-oscillation under certain operating conditions.

Satisfactory performance as pentodes has been obtained either with the special output transformer Ref. C2203 or with PPO/15. Both are made by Partridge Transformers Ltd. Their characteristics are :

	C2203	PPO/15
Primary inductance	12·5 H	20 H
Primary resistance	52Ω	90Ω
Leakage inductance	15 mH	20 mH
Ratio	16 or 32 : 1	14 or 28 : 1

The output transformer ratio will depend on the impedance of the loudspeaker system and may be determined by $\sqrt{\frac{2000}{Z_s}}$ (Z_s=speech coil impedance) for the pentode and ultra linear circuits.

Degeneration is applied over three stages, about 14db giving a satisfactory reduction in distortion and output impedance without leading to oscillation. With the recommended transformers it is probable that more could be applied ; however, an output of 25W can be obtained with 0·5% distortion with the pentode connected circuit. The components, C14 R21, ensure stability by reducing the loop gain in the ultrasonic region, a loss of 6db at 20 kc/s is produced.

A low impedance power supply is required but this is easily provided by the use of components similar to those used in lower priced television receivers. The smoothing choke L1 has an inductance of about 2H with a DC resistance of 175Ω. This is used in conjunction with two electrolytic capacitors, C12 C13, having a total capacitance of 300 μF. A metal rectifier is used since the current at full output is 275 mA. A tapped resistor, R20, caters for AC and DC supply voltages up to 250. On DC mains this resistor is not in circuit and the metal rectifier protects the capacitors against reversed polarity.

PERFORMANCE

The performance of two KT55 valves connected as pentodes in the circuit shown in fig. 1, may be obtained from the curves shown in fig. 5. These curves are drawn to cover four different groups of mains voltages as follows :—

Curve A	AC, 180—215V
Curve B	AC, 200—240V
Curve C	AC, 220—265V
Curve D	DC, 200—265V

Two considerations were borne in mind when these curves were prepared, (*a*) the maximum dissipation of the KT55, and (*b*) the maximum rating of the metal rectifier.

For all DC supply voltages between 190 and 260 and for AC supply voltages between 190 and 215 no limiting resistance is required in series with the rectifier to meet the two conditions (*a*) and (*b*). With DC mains the rectifier to MR1 serves to protect the electrolytic capacitors against a reversed polarity. When an AC supply above 215V is used a series limiting resistor R20 is necessary and this is conveniently divided into two steps to cover operation up to 260V.

The curves are drawn with considerable overlap at the low voltage end in order to convey a complete picture of the performance, but it is suggested that the three mains taps be marked as follows :

1.	190—215V AC	190—260V DC
2.	215—235V AC	
3.	235—260V AC	

The heater current is maintained within the limits 285 mA to 315 mA by the G.E.C. barretter Type 303. A satisfactory performance will be obtained over a range rate more than the usual 200-250V without adjustment. The thermistor CZ1 controls the current during switching-on periods and prevents a surge of current when the valves are cold. No thermistor shunt is required.

OPERATION FROM SUB-NORMAL MAINS VOLTAGES

The KT55 may be used successfully when only a low DC mains voltage is available, as in some marine installations.

A curve (fig. 6) shows the expected output assuming DC mains voltages of 100-200.

The recommended circuit is similar to fig. 1 but, to prevent loss of voltage, the mains rectifier is omitted and the output transformer is connected to the live side of the smoothing choke. The capacitor C2 is also omitted and, C12 C13, become 4 μF paper capacitors.

The bias resistors are reduced to 150Ω and the optimum load is 1·5 kΩ.

The heater connections depend on the required operating voltage. From 150-200V the existing series arrangement may be used with a 305 barretter, this being replaced by a suitable resistor for 125-150V. Below 125V two chains will be used, the two KT55s being connected in series in one chain with a small resistor (if necessary) and a 303, 304 or 305 barretter with the remaining valves in the second chain. For low AC mains voltages an auto-transformer may be used for the anode supply, with the heaters connected as for DC mains.

An alternative method of supplying the anode voltage when low voltage AC mains are available is shown in fig. 4. A voltage doubler circuit is employed which gives a DC line voltage of 220 from 110V AC.

The smoothing choke used had a lower resistance of 20Ω and a rectifier Type RM5 replaced the RM4.

The performance obtained was as follows :

AC Voltage	*DC Line Voltage*	*Power Output*
110	200	19W
110	220	23W
120	235	27W

OTHER APPLICATIONS

D.C.-A.C. Converter

This unit is designed to supply about 25W at 200-250V, 50 c/s, from a DC mains output of 200-250V. The complete circuit arrangement is given in fig. 2.

The output stage consists of a pair of KT55s in push-pull using self bias. An output of between 20 and 25W is easily obtainable, depending on the mains supply voltage. For lower voltages, adjustment may be made by reducing the cathode bias resistors of the output valves to *not less than 150*Ω. For maximum output the 250 μF capacitors should be used.

A centre tapped inductor, or a transformer, may be used, with a suitable power-factor correcting capacitor when feeding a partly reactive load, such as a record-changer motor.

It is advisable to disconnect the HT supply when the load is removed, e.g., when an automatic record-changer is used. Current taken by the pair of valves is between 225 and 275 mA.

Considerable distortion of the output wave form may exist, especially with a motor as load, but this is of no consequence to the operation of the motor. The power factor correcting capacitor will be found to improve the waveform considerably. Some screen decoupling might be of advantage, especially when using rough or noisy DC mains.

The oscillator stage has a split load, part appearing between cathode and HT negative, part between anode and HT positive. This enables a push-pull signal to be obtained to drive the output valves.

A triode-connected Z77 is used as oscillator, with an R-C twin-T feedback network, tunable to 50 c/s. About 60V peak to peak is obtaintable across each half of the load.

Output may be adjusted by altering the value of the unbypassed cathode bias resistor. Between 33 and 47 kΩ should be used for each half load, larger values giving no increase in output.

Frequency stability is good, being little affected by supply voltage variations. Tests of short-period drift showed an increase in frequency of 0·25% after 40 minutes, when it appeared to have steadied. Long term stability has not been accurately measured, but appears good.

Series Heater Circuit

When the supply voltage lies between 220 and 225 the heaters of a group of four valves may be connected to it without an additional dropping resistor. If the voltage lies between 225 and 250, a tapped series resistor of 100Ω will be required. A thermistor, Type CZ1, shunted by 750Ω, is essential to restrain the cold switching current. The recommended arrangement is shown in fig. 3.

A Series Stabiliser

The KT55 is very suitable for use as a series stabiliser valve, the control or amplifier stage being a Z729. This application will be covered in a separate publication.

The circuit information given in this publication does not imply any licence under patents which may be involved.

COMPONENT VALUES

RESISTORS

(0·25W, 20% unless otherwise shown).

R1	2·2 kΩ		
R2	22 Ω		10%
R3	See text under "Operating Conditions."		
R4	220 kΩ	0·5W	10%
R5	1 MΩ		10%
R6	22 kΩ	0·5W } Matched	±5%
R7	22 kΩ	0·5W }	
R8	1·5 kΩ		
R9	1 MΩ		
R10	220 kΩ		
R11	220 kΩ		
R12	10 kΩ		
R13	10 kΩ		
R14	47 Ω		
R15	47 Ω		
R16	185 Ω	5W	5% w.w.
R17	185 Ω	5W	5% w.w.
R18	10 kΩ	1W	10%
R19	63 Ω	5W	5% w.w.
R20	30 Ω	10W	10% w.w. tapped at 15Ω
R21	10 kΩ		

CAPACITORS

C1	50 μF	12V	Electrolytic
C2	16 μF	350V	Electrolytic
C3	0·01 μF		Paper
C4	0·01 μF		Paper
C5	0·1 μF		Paper
C6	0·1 μF		Paper
C7	0·1 μF		Paper
C8	50 μF	25V	Electrolytic
C9	50 μF	25V	Electrolytic
C10	0·001 μF		Mica
C11	0·001 μF		Mica
C12	100 μF }	275V	Electrolytic
C13	200 μF }		
C14	50 pF		Mica
C15	200 μF	250V	Electrolytic

MISCELLANEOUS

L1	Smoothing choke 1·5-2H 300 mA 75Ω.
L2	Centre-tapped inductor 20H 50Ω
L3	Smoothing choke 1H 20Ω
MR1	Metal rectifier STC RM4
MR2	Metal rectifier STC RM5

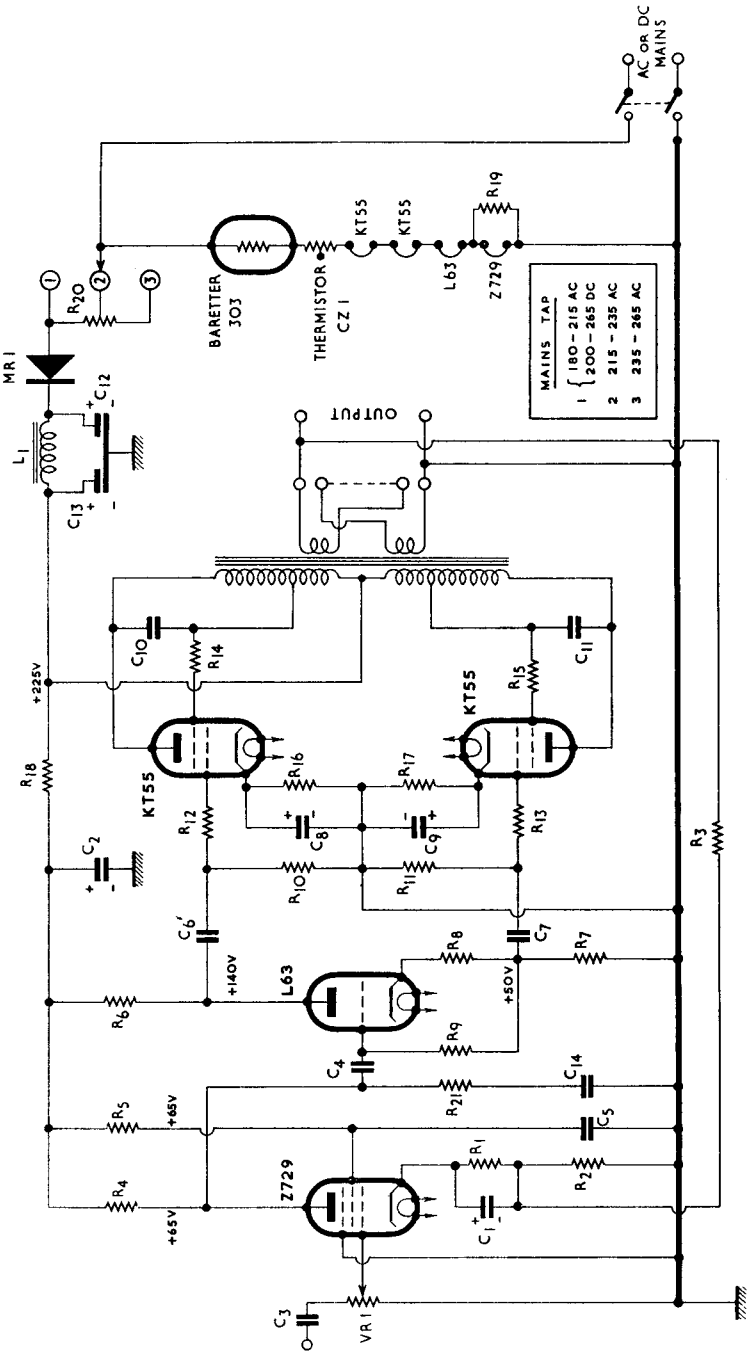


Fig. 1. 25W Ultra-linear amplifier. For pentode operation, resistors R14, R15, should be connected to C13.

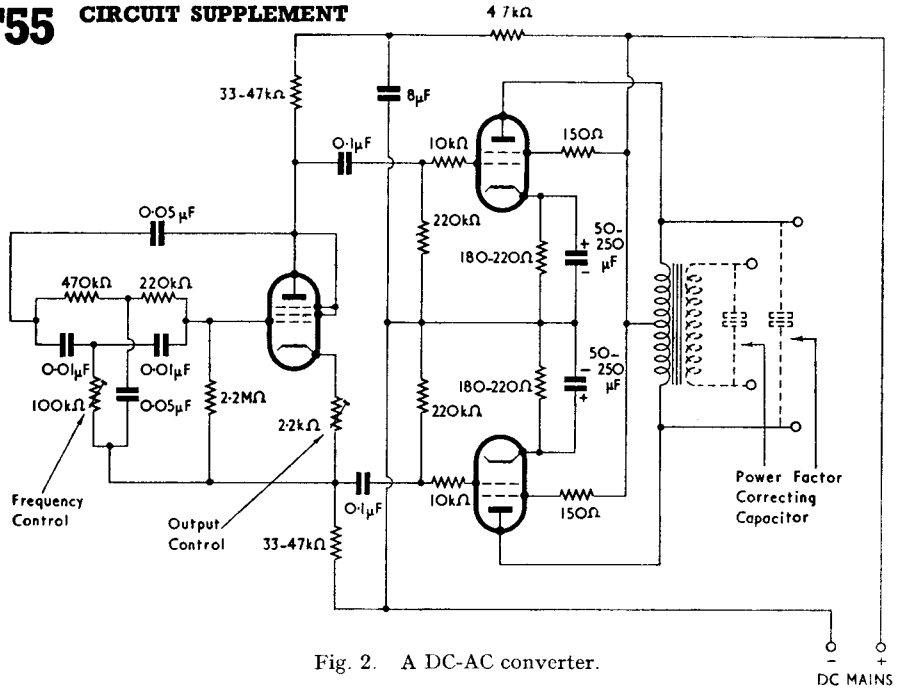


Fig. 2. A DC-AC converter.

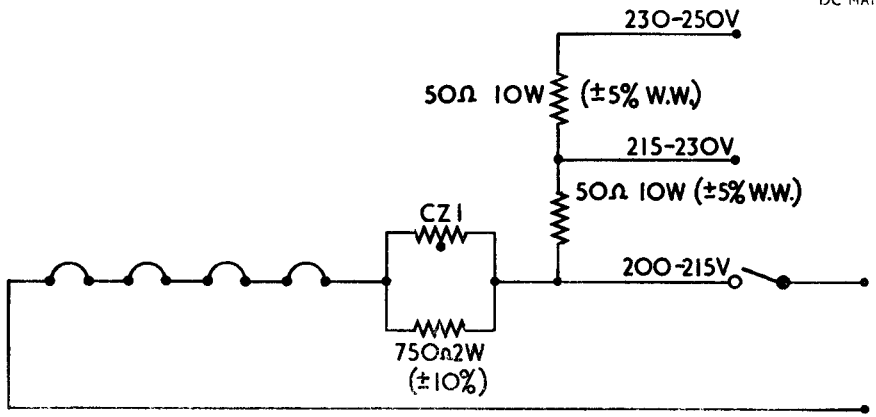


Fig. 3. Heater circuit for four KT55s.

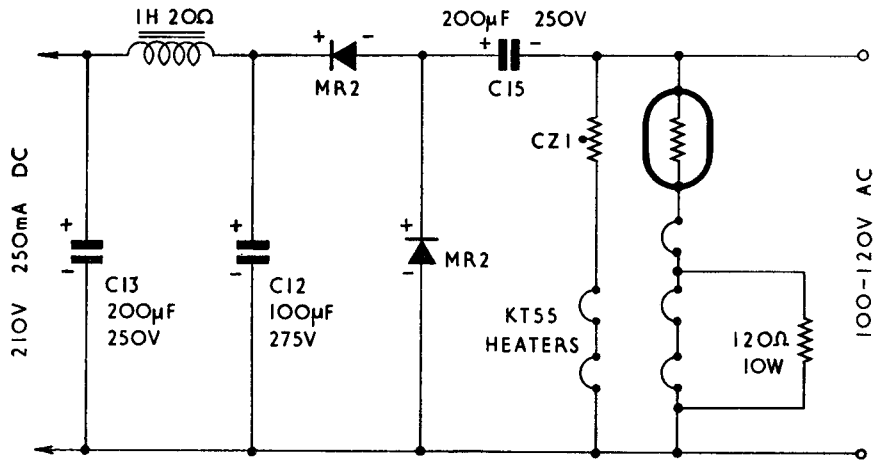


Fig. 4. Voltage-doubler circuit for 100-120V AC mains.

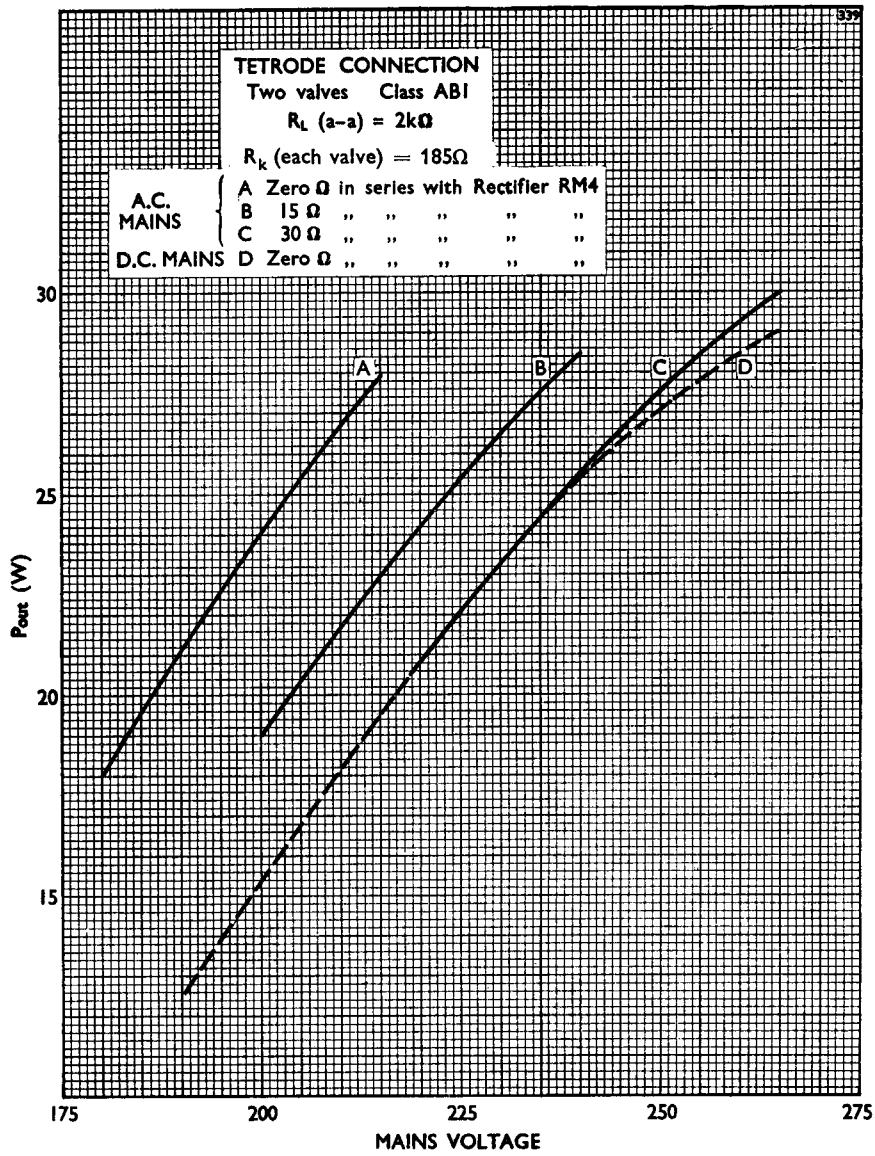

339
TETRODE CONNECTION
Two valves Class AB1
R_L (a-a) = 2kΩ
R_k (each valve) = 185Ω
A.C. MAINS
D.C. MAINS
A Zero Ω in series with Rectifier RM4
B 15 Ω ,, ,, ,, ,, ,,
C 30 Ω ,, ,, ,, ,, ,,
D Zero Ω ,, ,, ,, ,, ,,
A
B
C
D
30
25
20
15
P_{out} (W)
175
200
225
250
275
MAINS VOLTAGE

Fig. 5.

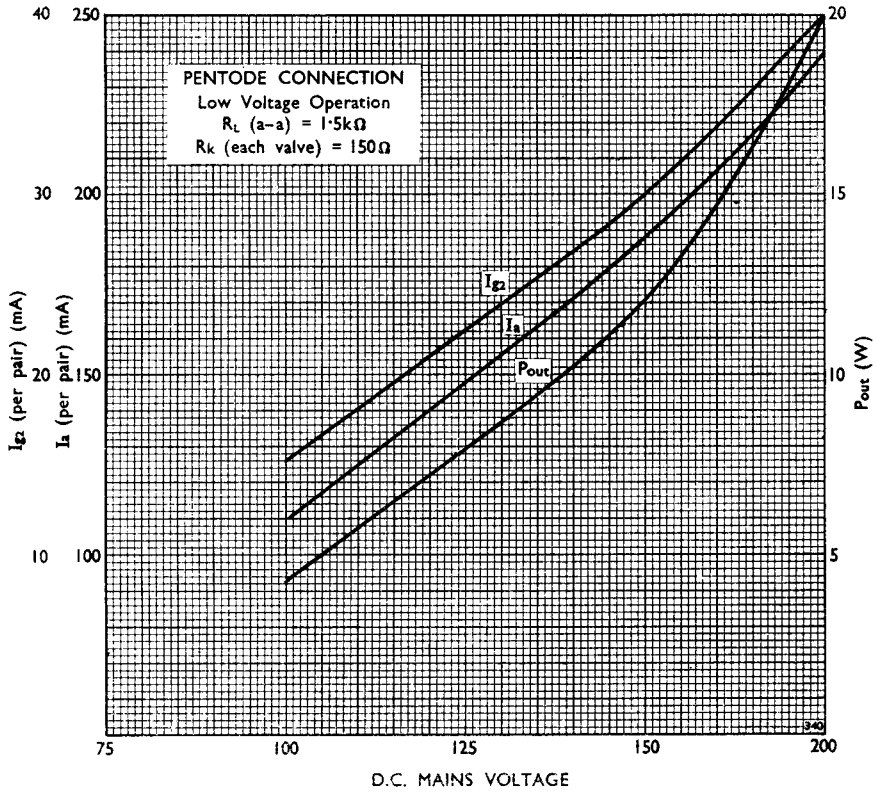

PENTODE CONNECTION
Low Voltage Operation
RL (a-a) = 1·5kΩ
Rk (each valve) = 150Ω
Ig2 (per pair) (mA)
Ia (per pair) (mA)
Pout (W)
Ig2
Ia
Pout
40
30
20
10
250
200
150
100
20
15
10
5
75
100
125
150
200
D.C. MAINS VOLTAGE

Fig. 6.

Marconi KT63

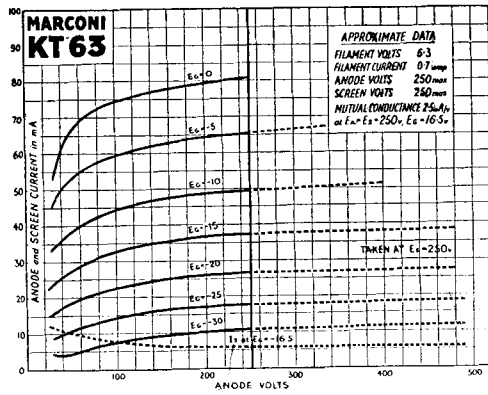
Output Tetrode

Marconi KT63 is a suitable output valve for all A.C. receivers where medium power is required with high efficiency.

Nominal Rating, see curve.

Inter-electrode capacities.

A—G	0.8$\mu\mu$F
G—E	9.8$\mu\mu$F
A—E	9.0$\mu\mu$F



Dimensions : 119×45 mm. Octal base ; for connections see pages 4-5.

Typical Operating Data.

Single Valve, Class A.

Anode and screen voltage	250
Anode current	34 mA
Screen current	5.5 mA
Power output	3.0 watts
Optimum load	7000 ohms
Bias resistance	420 ohms

Two Valves, Class AB1

Anode and screen voltage	250
Combined anode current	64 mA
Combined screen current...	14 mA
Power output	6 watts
Anode—anode load	12000 ohms
Common bias resistance	250 ohms

Notes.

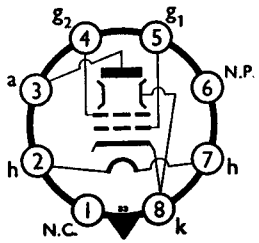
KT63 may be triode connected to form a small power valve suitable for driver stages. Used in this way its mutual conductance is 2.4 mA/V and its impedance 3200 ohms.

Price - - 10/6

BEAM PENTODE
6·3V INDIRECTLY HEATED

KT66
JUNE, 1956

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International Octal.
Bulb : Dome top tubular.

Overall length :	125—135	mm.
Seated length :	111—121	mm.
Max. diameter :	53	mm.

RATING

Pentode Connection

V_h	6·3	V
I_h	1·27	A
V_a	500	V
V_{g2}	400	V
p_a	25 max.	W
p_{g2}	3·5 max.	W
r_a at $V_a = V_{g2} = 250$, $V_{g1} = -15$	22·5	kΩ
g_m at $V_a = V_{g2} = 250$, $V_{g1} = -15$	6·3	mA/V

Triode Connection

V_a	400		250	V
p_a	28·5		28·5	W
r_a at $V_{g1} = -38$	1·45	at $V_{g1} = -19$	1·3	kΩ
g_m at $V_{g1} = -38$	5·5	at $V_{g1} = -19$	6·15	mA/V

CAPACITANCES (of unscreened valve)

$c_{g1\text{-all}}$	16	pF	$c_{a\text{-all}}$	11·5	pF	$c_{a\text{-}g1}$	1·1	pF

TYPICAL OPERATION

Single Valve. Class A. Triode Connection

V_a, $g2$	250	400	V
V_{g1} (approx)	−19	−38	V
I_a, $g2$	60	63	mA
v_{in} (pk)	19	38	V
p_a, $g2$ (o)	15	25	W
R_k	315	600	Ω
R_L	2·75	4·5	kΩ
P_{out}	2·2	5·8	W
D	6	7	%

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

KT66

Push-Pull. Class AB_1. Triode Connection (Two Valves)

Data per pair unless otherwise stated

$V_{a,\ g2}$	250	400	V
V_{g1}	−20	−38 approx.	V
$I_{a,\ g2}$	110	125	mA
$v_{in\ (pk)\ (g1\text{-}g1)}$	40	80	V
R_k (per valve)	360	600	Ω
$R_{L\ (a\text{-}a)}$	2·5	4	kΩ
P_{out}	4·5	14·5	W
D	2	3·5	%

Single Valve. Class A. Pentode Connection

V_a	250	V
V_{g2}	250	V
V_{g1}	−15 approx.	V
I_a	85	mA
I_{g2}	6·3	mA
$v_{in\ (pk)}$	15	V
$p_{a\ (o)}$	21·5	W
R_k	160	Ω
R_L	2·2	kΩ
P_{out}	7·25	W
D	9	%

Push-Pull. Class AB_1. Pentode Connection (Two Valves)

Data per pair unless otherwise stated.

	No signal	Max. signal	
V_a	250	250	V
V_{g2}	250	250	V
V_{g1}	−17·5 approx.	—	V
I_a	162	165	mA
I_{g2}	12	20	mA
$v_{in\ (pk)\ (g1\text{-}g1)}$	—	36	V
p_a (per valve)	20	12	W
p_{g2} (per valve)	1·5	2·5	W
R_k (per valve)	200	200	Ω
$R_{L\ (a\text{-}a)}$	—	4	kΩ
P_{out}	—	17	W
D	—	4	%

Push-Pull. Class AB_1. Pentode Connection (Two Valves)

Data per pair unless otherwise stated.

	No signal	Max. signal	
$V_{a\ (b)}$, $V_{g2\ (b)}$	450	425	V
V_a	415	390	V
V_{g2}	300	275	V
I_a	104	125	mA
I_{g2}	5	18	mA
$v_{in\ (pk)\ (g1\text{-}g1)}$	—	70	V
p_a (per valve)	21·5	9·5	W
p_{g2} (per valve)	0·75	2·5	W
R_k (per valve)	500	500	Ω
$R_{L\ (a\text{-}a)}$	—	8	kΩ
P_{out}	—	30	W
D	—	6	%
$V_{a\ (rms)}$ (to rectifier)	—	500+500	V
R_{source} (HT)	—	600	Ω

Push-Pull. Class AB_1. Pentode Connection. Fixed Bias (Two Valves)

Data per pair unless otherwise stated.

	No signal	Max. signal	
V_a	510	475	V
V_{g2}	395	360	V
V_{g1}	−40 approx.	—	V
I_a	80	175	mA
I_{g2}	3	19	mA
v_{in} (pk) (g1-g1)	—	80	V
p_a (per valve)	21	17	W
p_{g2} (per valve)	0·6	3·5	W
R_L (a-a)	—	5	kΩ
P_{out}	—	50	W
D	—	5	%

Screen grids supplied from stabilised source.

GENERAL

For the prevention of parasitic oscillation a series resistor of 100/300Ω should be connected close to the screen grid terminal of the valve socket. When the valve is triode connected, this resistor should be connected between screen grid and anode. A control grid series resistor of 10/50 kΩ is also recommended. In push-pull applications having a large change in anode current between the quiescent and full output conditions, an inductor input filter circuit of good regulation should be used. A badly regulated supply will cause a fall in power output and/or excessive quiescent anode dissipation.

The use of a common auto-bias resistor is not recommended except in applications where the maximum anode dissipation is not attained under any condition of operation.

The maximum permissible D.C. resistance between control grid and cathode is limited to 0·5 MΩ for auto-bias and 0·1 MΩ for fixed bias applications.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

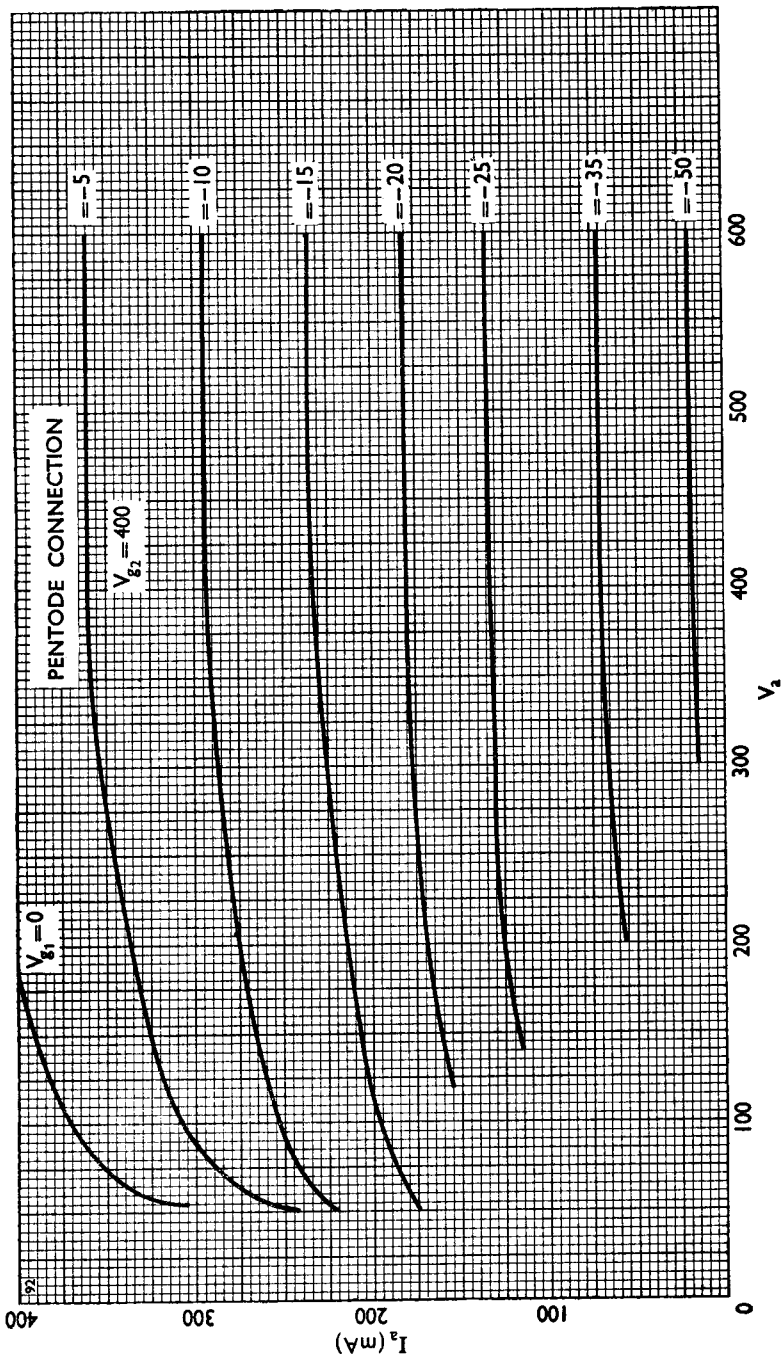
RETAINING

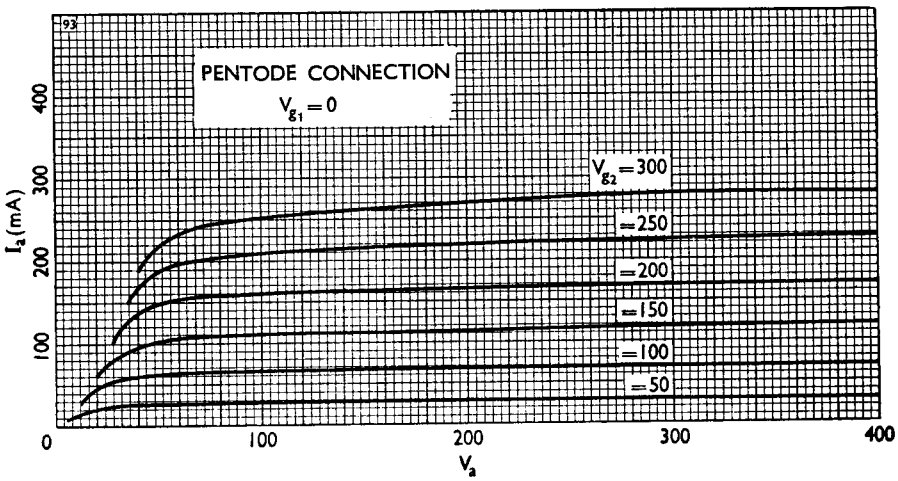
No retaining device is normally necessary.

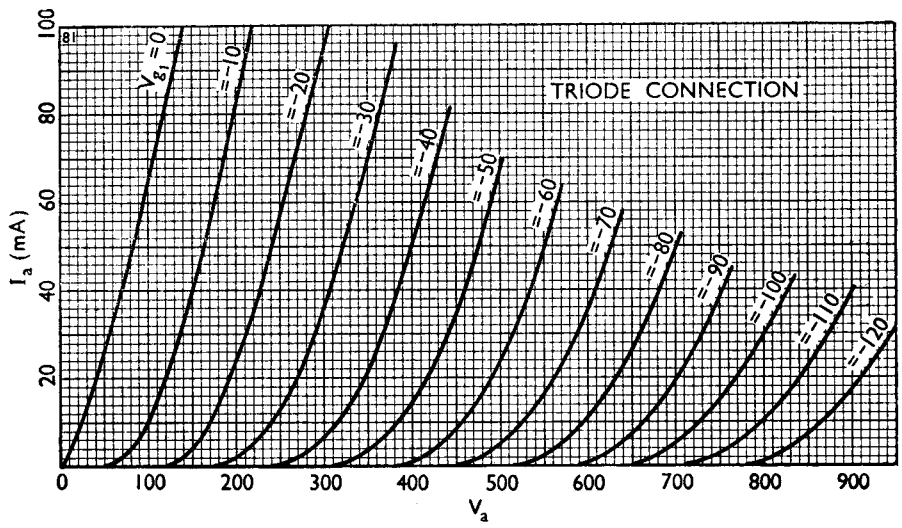
VENTILATION

Adequate ventilation around the bulb should be provided.

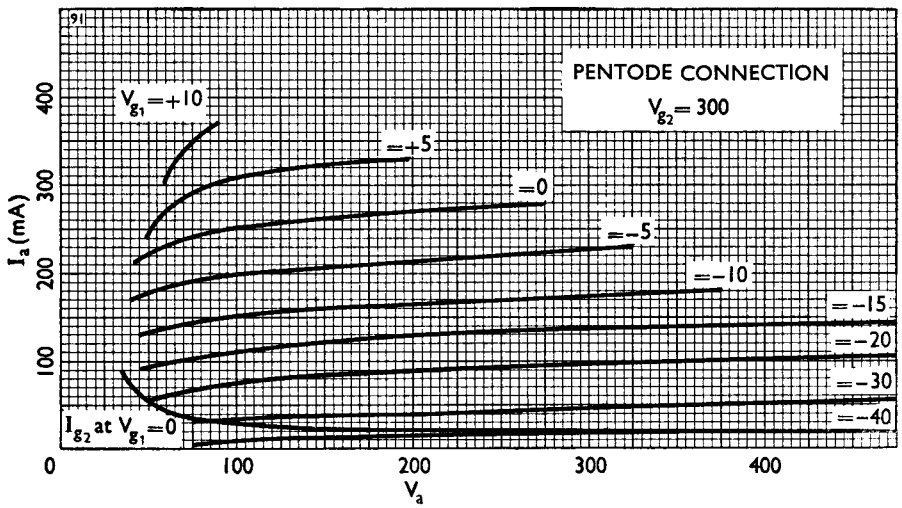
KT66

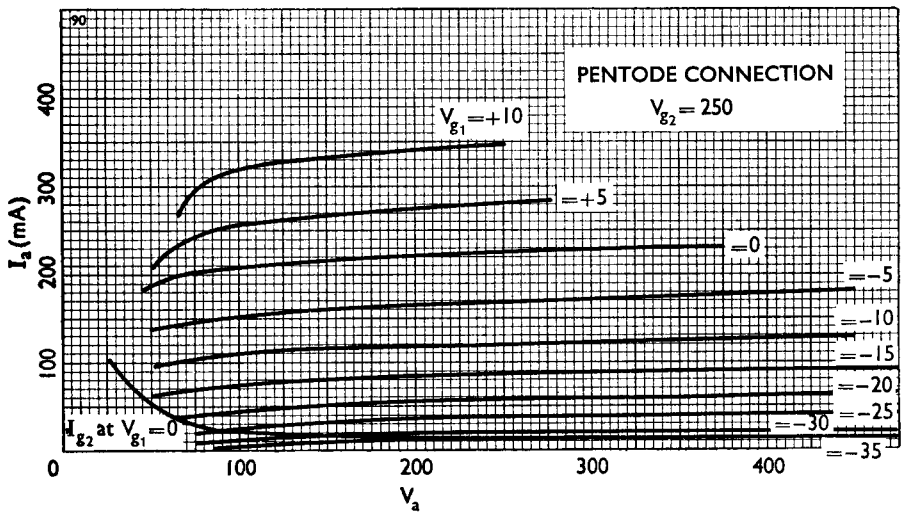

PENTODE CONNECTION
V_{g2}=400
V_{g1}=0
=-5
=-10
=-15
=-20
=-25
=-35
=-50
I_a (mA)
400
300
200
100
0
100
200
300
400
500
600
V_a

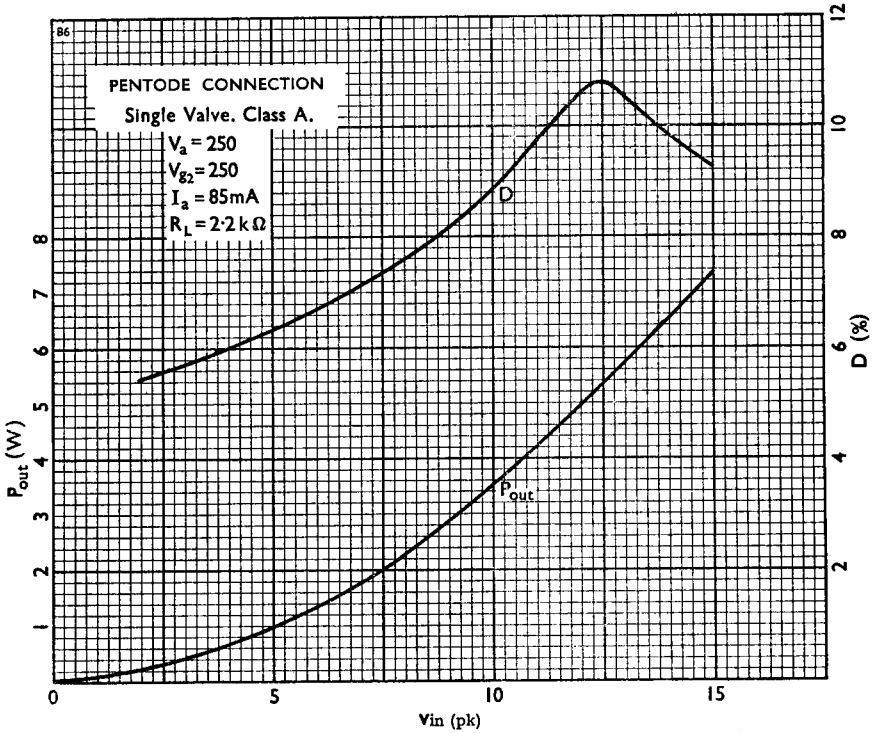

93
PENTODE CONNECTION
$V_{g_1} = 0$
$V_{g_2} = 300$
=250
=200
=150
=100
=50
I_a (mA)
0
100
200
300
400
V_a

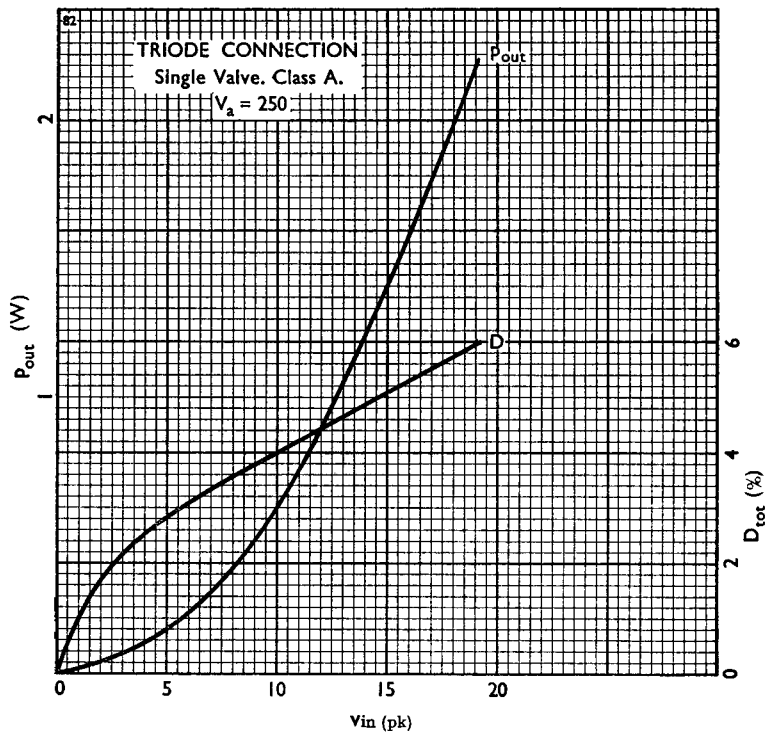

81
TRIODE CONNECTION
$V_{g_1} = 0$
=-10
=-20
=-30
=-40
=-50
=-60
=-70
=-80
=-90
=-100
=-110
=-120
I_a (mA)
20
40
60
80
100
0
100
200
300
400
500
600
700
800
900
V_a

KT66

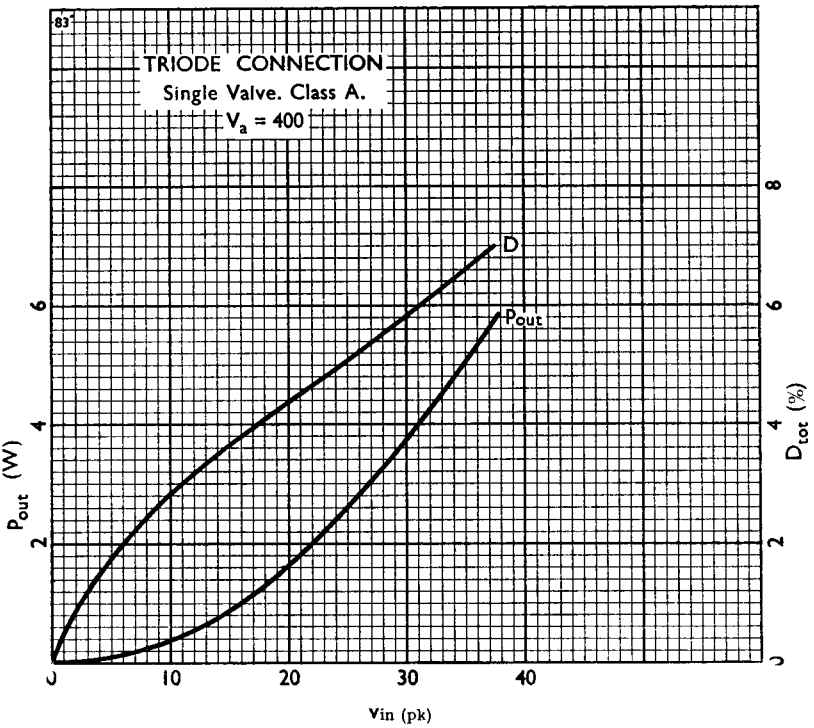

91
PENTODE CONNECTION
V_{g_2} = 300
V_{g_1} = +10
= +5
= 0
= −5
= −10
= −15
= −20
= −30
= −40
I_{g_2} at V_{g_1} = 0
I_a (mA)
400
300
200
100
0
100
200
300
400
V_a

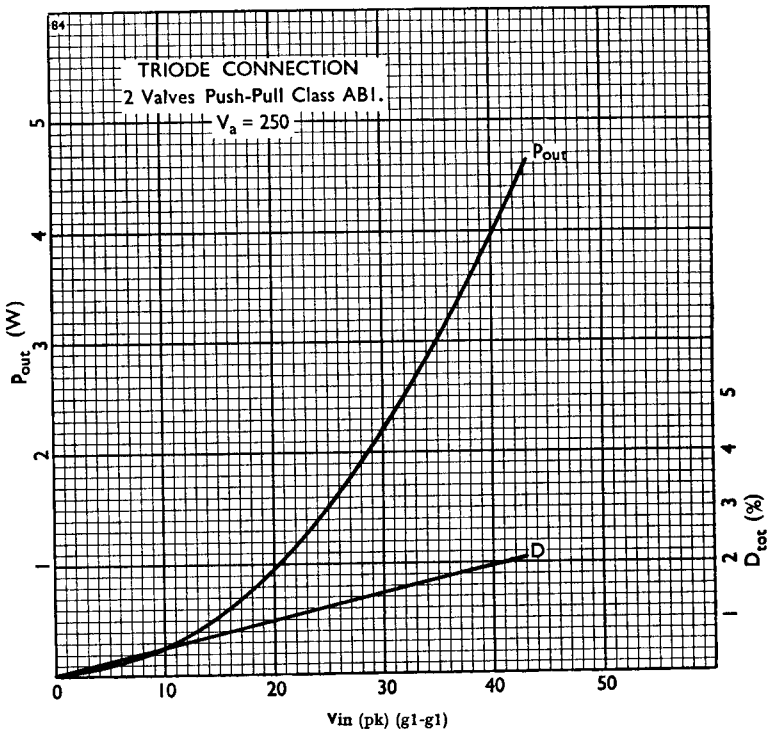

90
PENTODE CONNECTION
V_{g_2} = 250
V_{g_1} = +10
= +5
= 0
= −5
= −10
= −15
= −20
= −25
= −30
= −35
I_{g_2} at V_{g_1} = 0
I_a (mA)
400
300
200
100
0
100
200
300
400
V_a

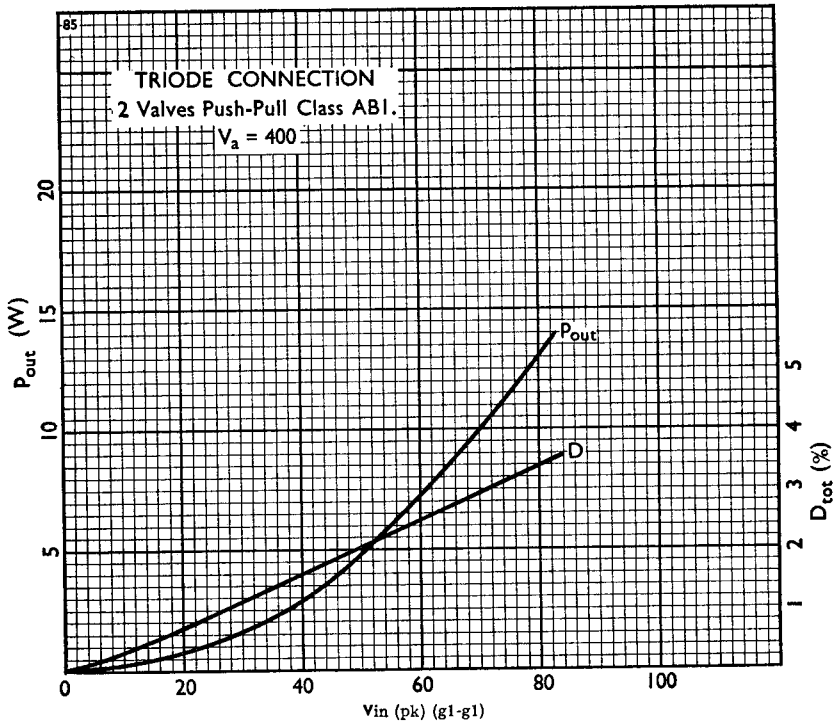

B6
PENTODE CONNECTION
Single Valve. Class A.
V_a = 250
V_{g2} = 250
I_a = 85mA
R_L = 2·2 kΩ
D
P_{out}
P_{out} (W)
D (%)
Vin (pk)
0
5
10
15
1
2
3
4
5
6
7
8
2
4
6
8
10
12


B2
TRIODE CONNECTION
Single Valve. Class A.
V_a = 250
P_{out}
D
P_{out} (W)
D_{tot} (%)
Vin (pk)
0
5
10
15
20
1
2
0
2
4
6

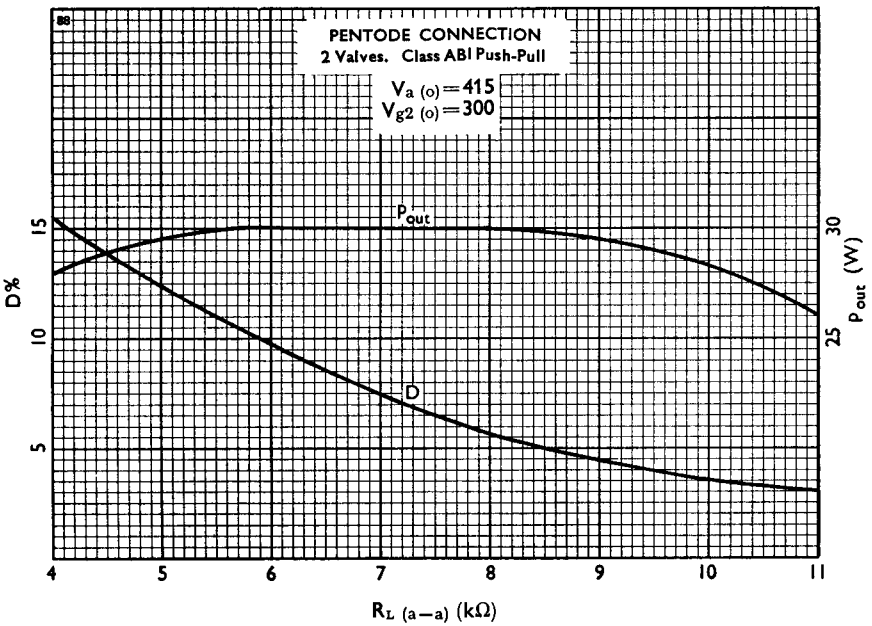
KT66

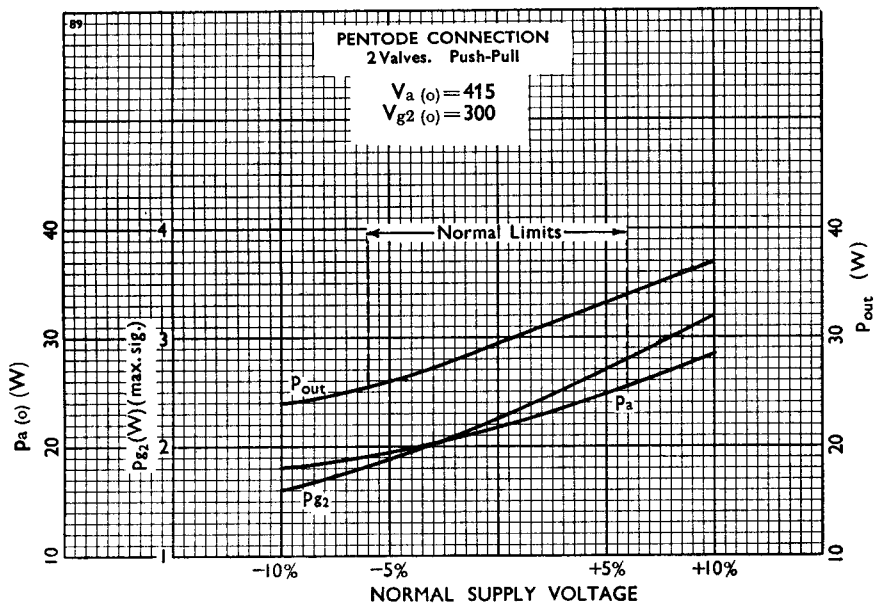

83
TRIODE CONNECTION
Single Valve. Class A.
V_a = 400
D
P_{out}
P_{out} (W)
D_{tot} (%)
0
2
4
6
8
10
20
30
40
Vin (pk)


84
TRIODE CONNECTION
2 Valves Push-Pull Class AB1.
V_a = 250
P_{out}
D
P_{out} (W)
D_{tot} (%)
0
10
20
30
40
50
1
2
3
4
5
Vin (pk) (g1-g1)


85
TRIODE CONNECTION
2 Valves Push-Pull Class AB1.
V_a = 400
P_{out}
D
P_{out} (W)
D_{tot} (%)
0
20
40
60
80
100
5
10
15
20
1
2
3
4
5
Vin (pk) (g1-g1)

KT66





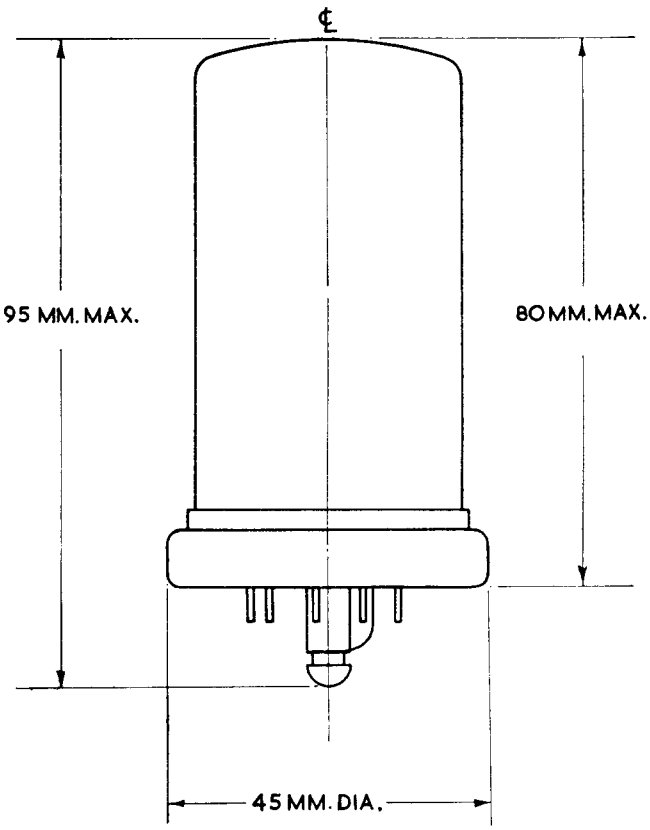
Printed in England. C.

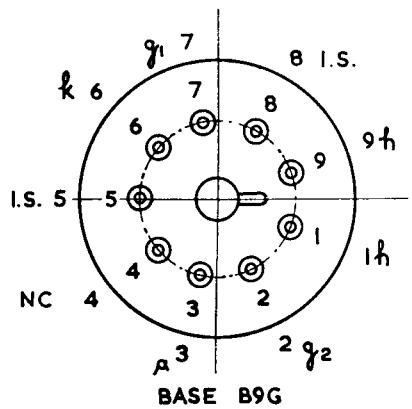
Tetrode *Type KT67*

HIGH SLOPE OUTPUT TETRODE

General. The KT67 is an indirectly heated high slope HF tetrode, suitable for use as a series stabilizer, video amplifier or cathode follower.

→ **Mounting.** The valve may be mounted in any position.





APPROXIMATE DATA

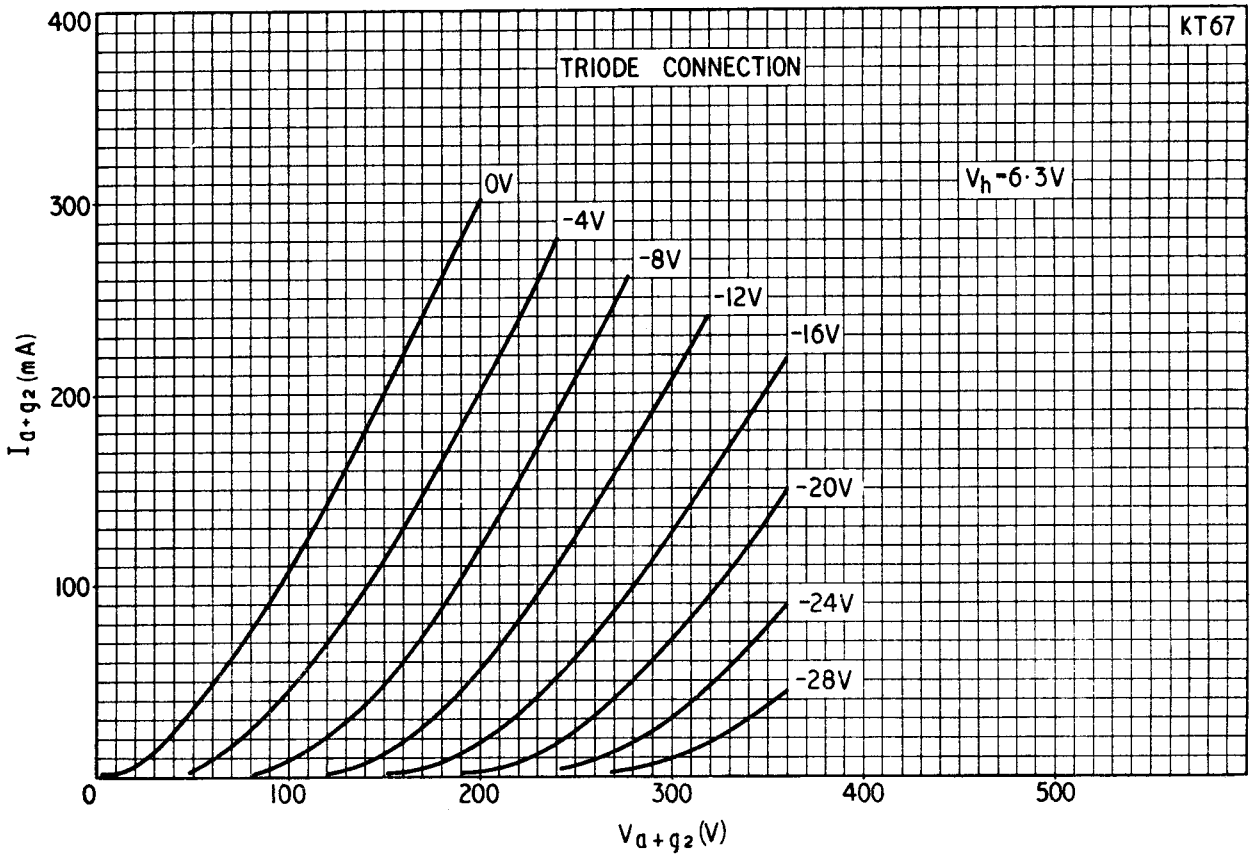
V_h	6·3	V
I_h	1·5	A
$V_{a\ (max)}$	600	V
$V_{g2\ (max)}$	300	V
$p_{a\ (max)}$	22	W
$p_{g2\ (max)}$	3	W
→ $R_{g1\text{-}k}$ (fixed bias)	100	kΩ
→ $R_{g1\text{-}k}$ (auto bias)	270	kΩ
→ R_{in} at 45 Mc/s	5	kΩ
g_m (taken at V_a 250V V_{g2} 180V I_a 80 mA)	13	mA/V
$c_{a\text{-}g1}$	0·08	pF
c_{in}	17·5	pF
c_{out}	9	pF

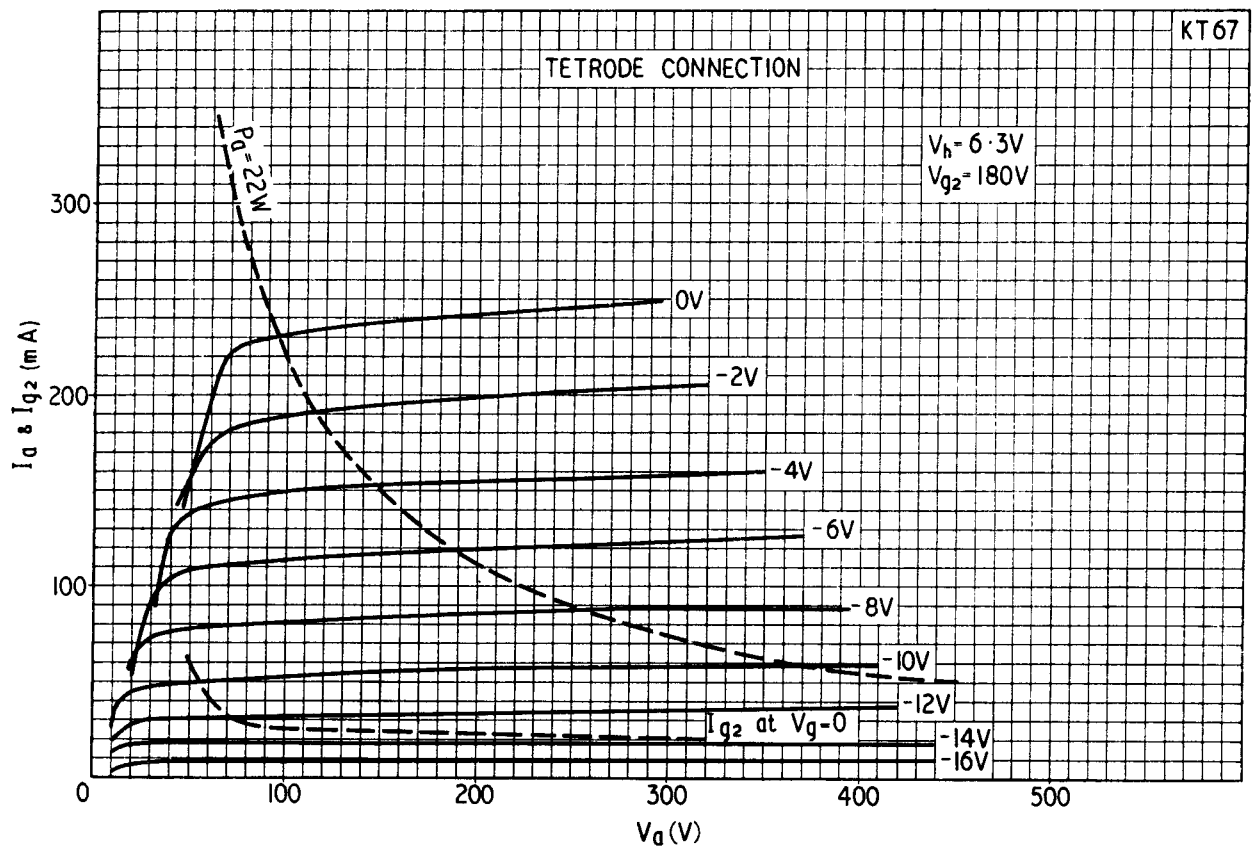
In applications where the valve is used triode connected the following maximum ratings will apply:

$V_{(a+g2)}$	300	V
$p_{(a+g2)}$	25	W

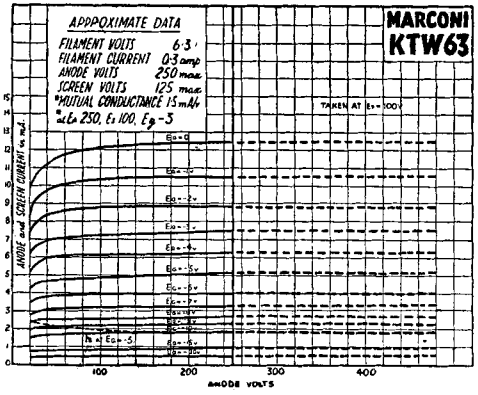
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford





PRINTED IN ENGLAND



Nominal Rating, see curve

Marconi KTW63

Variable Mu H.F. Tetrode

Marconi KTW63 is a kinkless tetrode for H.F. and I.F. amplification. It replaces the pentode type W63.

Inter-electrode capacities
(with screening can)

G—A	.0035$\mu\mu$F
A—E	10.0$\mu\mu$F
G—E	4.9$\mu\mu$F

Dimensions : 120×40 mm. Octal base ; for connections see pages 4-5.

Typical Operating Data.

As H.F. amplifier

Anode Voltage	250
Screen voltage	100
Grid bias	−3
Bias resistance	300 ohms

Notes.

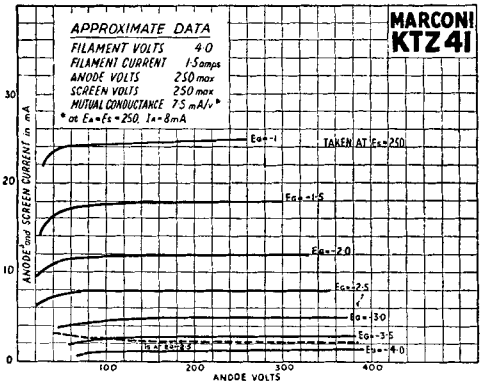
The grid base with fixed screen voltage is 40 v. This may be extended by feeding the screen from a series resistance so that the screen voltage rises as the negative bias is increased. A 50,000 ohm screen feed gives a grid base of 150 volts. Intermediate values can be obtained by using high resistance potentiometers. The total effective resistance between cathode and grid should not exceed 2 megohms. The valve is not metallised and where screening is required a can should be used.

Price - - 10/6

Marconi KTZ41

H.F. Tetrode

Marconi KTZ41 is intended for wide-band amplification, particularly in Television receivers. It has an extremely high slope (12.0 mA/V. at Eg −1.5) and comparatively low input and output capacities.



Inter-electrode capacities.

G—A	.008$\mu\mu$F
A—E	10.5$\mu\mu$F
G—E	14.0$\mu\mu$F

Nominal rating, see curve.

Dimensions : 120×42 mm. 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

Anode volts	250
Screen volts	250
Grid volts...	−2.5
Bias resistance	250 ohms
Impedance	1 megohm

Notes.

The normal use for the KTZ41 is for H.F. or I.F. amplification in television receivers where its characteristics enable a high stage gain to be obtained with adequate band width. The valve may also be used for L.F. work where its high slope results in an exceptional order of gain.

Price - - 12/6

SCREENED DETECTOR AND AMPLIFYING VALVE

KTZ63/ 6J7G

JULY, 1956

DESCRIPTION

Type KTZ63/6J7G is an indirectly heated Pentode suitable for use as a Detector or in an H.F. or L.F. amplifier. The type may also be employed as a Triode by external connection of the screen grid and anode, in cases where a Triode of medium impedance is desired. The control grid is taken to a top cap connection.

Type KTZ63/6J7G may also be used as an oscillator and as such is of great use in ultra-short wave super-heterodyne receivers.

RATINGS

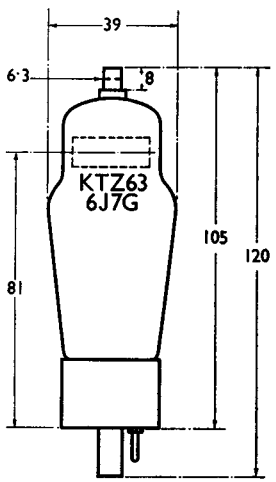
Heater Voltage	6·3	
Heater Current	0·3	amp. approx.
Anode Voltage	250	max.
Screen Voltage	125	max.
Mutual Conductance*	1·23	mA/volt

*measured at Va 250 ; Vg2 100 ; Vg1 –3.

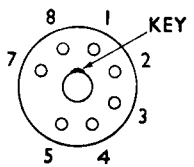
Capacitances (As pentode) :

Grid to All	4·7	pF approx.
Anode to All	9·9	,, ,,
Anode to Grid	0·0038	,, ,,

DIMENSIONS



BASE



View looking on underside of base.

7 Pin " Octal "

1 : Internal Metallic Screen
2 : Heater
3 : Anode
4 : Screen Grid g2
5 : Suppressor Grid g3 (6J7G only)
7 : Heater
8 : Cathode
Top Cap : Control Grid g1

Note : Care should be taken to note the difference in pin connections between type KTZ63/6J7G and the " Kinkless tetrode " type KTZ63. The latter has suppressor plates joined internally to cathode, pin 5 in this case having no connection.

Supplied with unmetallised bulb only.

All dimensions are in m/m and are max. except where otherwise stated.

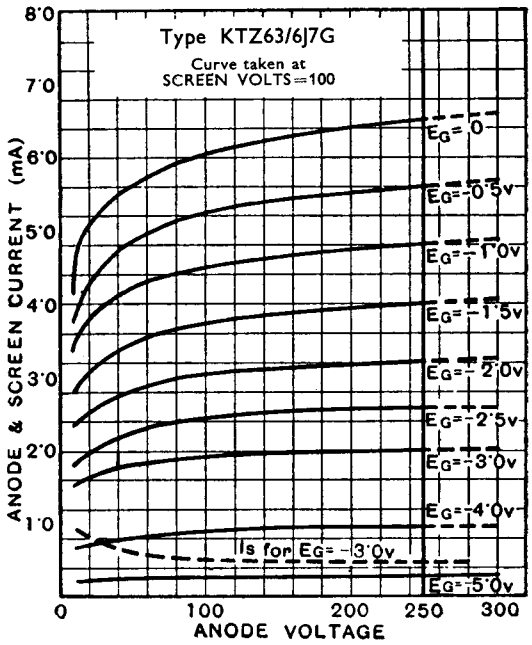
OPERATING CONDITIONS

	Pentode connected	Triode connected G2 to A G3 to K
Anode Voltage	250	250
Screen Voltage	100	—
Anode Current, mA	1·0	3
Screen Current, mA	0·25	—
Grid Bias Voltage	–2	–3
Impedance, ohms	1·5 meg.	10,500
Cathode Bias Resistance, ohms	2,200	1,000
Optimum Load in Resistance Amplifier, ohms	250,000	50,000
Screen Resistance, ohms	1 meg.	—

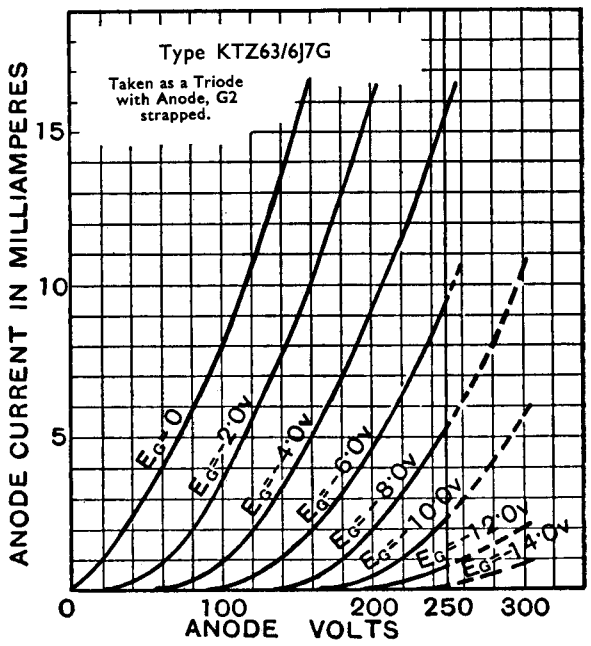
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

KTZ63/ 6J7G



CHARACTERISTIC CURVES OF AVERAGE VALVE.

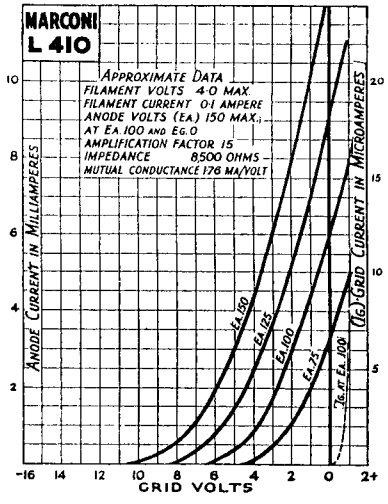


Printed in England. C.

MARCONI 4-VOLT VALVES

L 410, Low Magnification, 8/6

L410 is primarily a low frequency amplifying valve for use with transformer coupling. It may also be employed as detector when preceded by one or more H.F. stages.

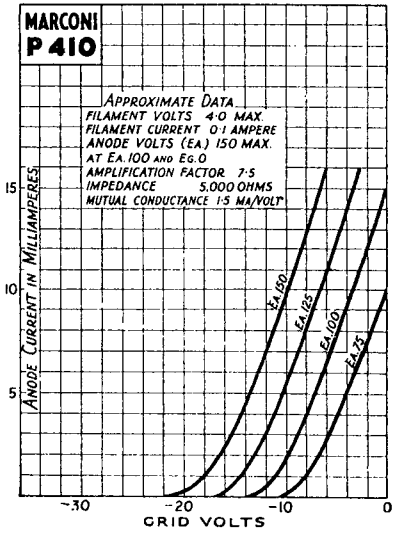


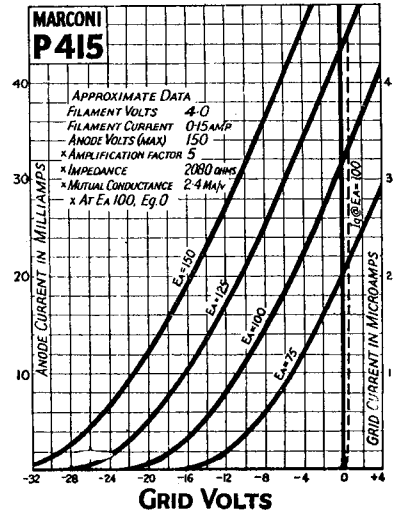
P 410, Power, 10/6

P410 is a power output valve for operating moving iron and similar speakers Its small current consumption renders it particularly valuable for entirely battery operated receivers.

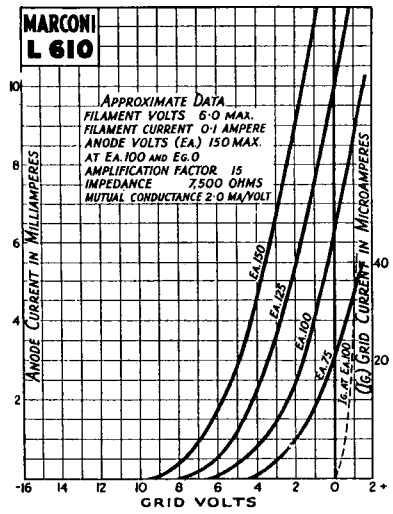
P 415, Super Power, 13/6

P415 is a super-power output valve providing sufficient volume for use with sensitive moving coil speakers.





MARCONI 6-VOLT VALVES



L 610, Low Magnification, 8/6

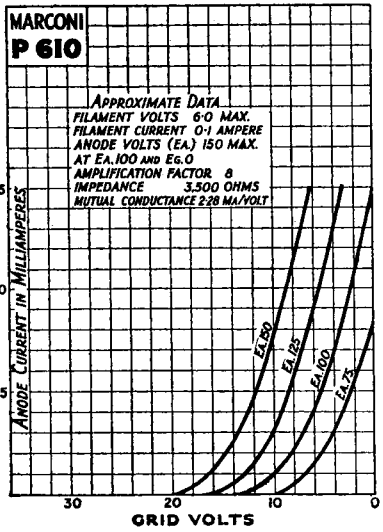
L610 is primarily a low frequency amplifying valve for first stage use, but is also largely used as detector when preceded by several H.F. stages.

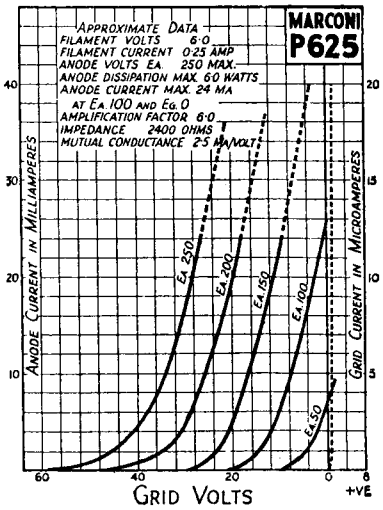
P 610, Power, 10/6

P610 is a power output valve of modest current requirements and providing sufficient volume for most purposes.

P 625, Super-Power, 13/6

P625 is a super-power output valve for anode voltages up to 250. It is suitable for operating moving coil speakers at sufficient volume for a large room.



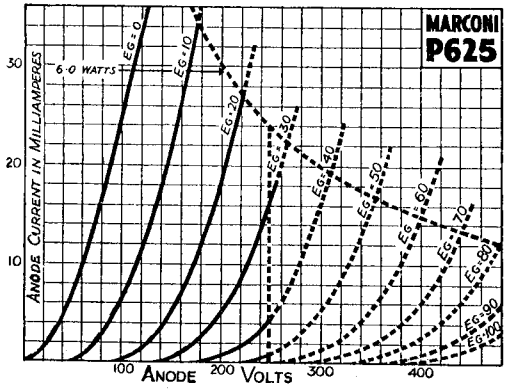


MARCONI 6-VOLT VALVES

P 625A, Super Power, 13/6

P625A is a super-power valve of similar design to P625 but for anode voltages not exceeding 200. The power output is sufficient for moving coil volume in a large room.

Anode Volts.	Grid Bias.	Average Anode Current.
120	$-19\frac{1}{2}$	16 m.a.
160	$-28\frac{1}{2}$	20 m.a.
200	-39	25 m.a.



Anode Volts, Anode Current Curve for P 625.

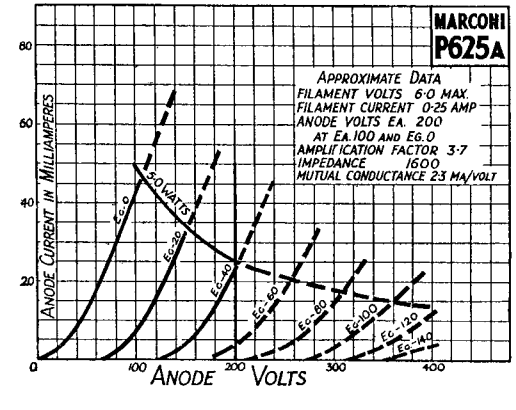
Approx. Operating Data.

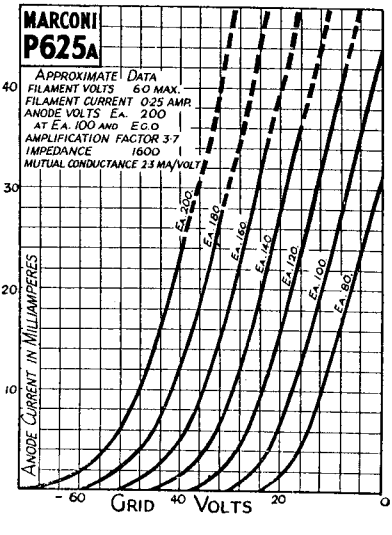
P625A, above.

P625, right.

Anode Volts.	Grid Bias.	Average Anode Current.
250	-26	24 m.a.
200	-20	19 m.a.
150	-14	14 m.a.
100	-7	10 m.a.

Anode Volts, Anode Current Curve for P625A





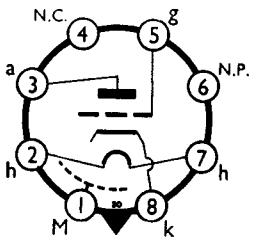
TRIODE

6·3V INDIRECTLY HEATED

L63

APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International Octal.
Bulb : Tubular.

Overall length :	88—98	mm.
Seated length :	74—84	mm.
Max. diameter :	34	mm.

RATING

V_h		6·3	V
I_h		0·3	A
V_a		250 max.	V
p_a		2·5 max.	W
μ	At $V_a = 250$, $V_g = -8$	20	
r_a		7·7	kΩ
g_m		2·6	mA/V

CAPACITANCES (of screened valve)

c_{g-k}	3·7	pF	c_{a-k}	2·9	pF	c_{g-a}	4·2	pF

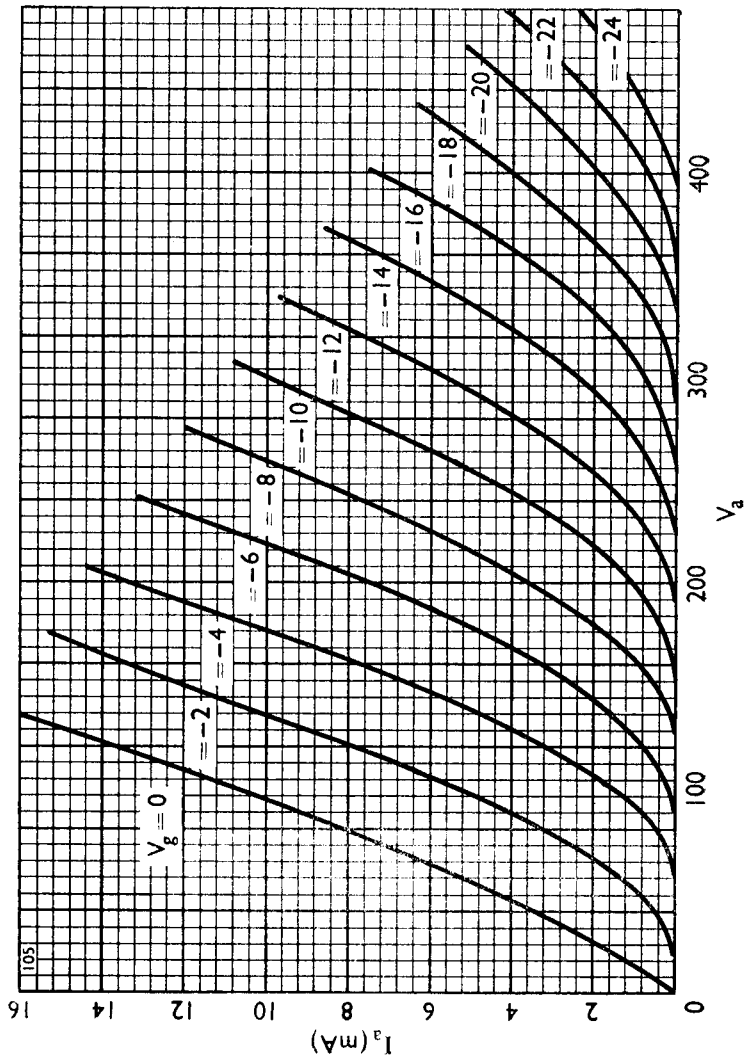
TYPICAL OPERATION

V_a (b)	250	250	V
R_L	50	50	kΩ
V_g	−1·9	−1·9	V
I_a	3·2	3·2	mA
R_k	600	600	Ω
v_{out} (pk)	35	55	V
D_{tot}	2	5	%
V_{gain}	16	16	

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford

L63



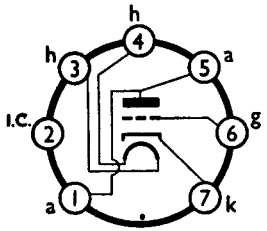
Printed in England. C.

MINIATURE TRIODE
6·3V INDIRECTLY HEATED

L77

OCTOBER, 1951

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Bulb : B7G
Base : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter	19	mm.

RATING

V_h	6·3		V
I_h	0·15		A
V_{h-k}	150	max.	V
V_a	300	max.	V
p_a	3·5	max.	W

CAPACITANCES (of screened valve)

c_{g-k}	1·7	pF	c_{a-k}	2·6	pF	c_{g-a}	2·0	pF

TYPICAL OPERATION

Class A Amplifier :

V_a	100	250	V
V_g	0	−8·5	V
I_a	12	10·5	mA
μ	19·5	17	
r_a	6·25	7·7	kΩ
g_m	3·1	2·2	mA/V

R.F. Power Amplifier and Oscillator, Class C Telegraphy

V_a	300	V
V_g	−27	V
I_a	25	mA
I_g	7	mA
P_{drive}	0·35	W
P_{out}	5·5	W

Under maximum rated conditions, the grid circuit resistance must not exceed 0·25 MΩ with fixed bias or 1 MΩ with cathode bias.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

SCREENING

No internal or external screening is fitted to the valve.

MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

RETAINING

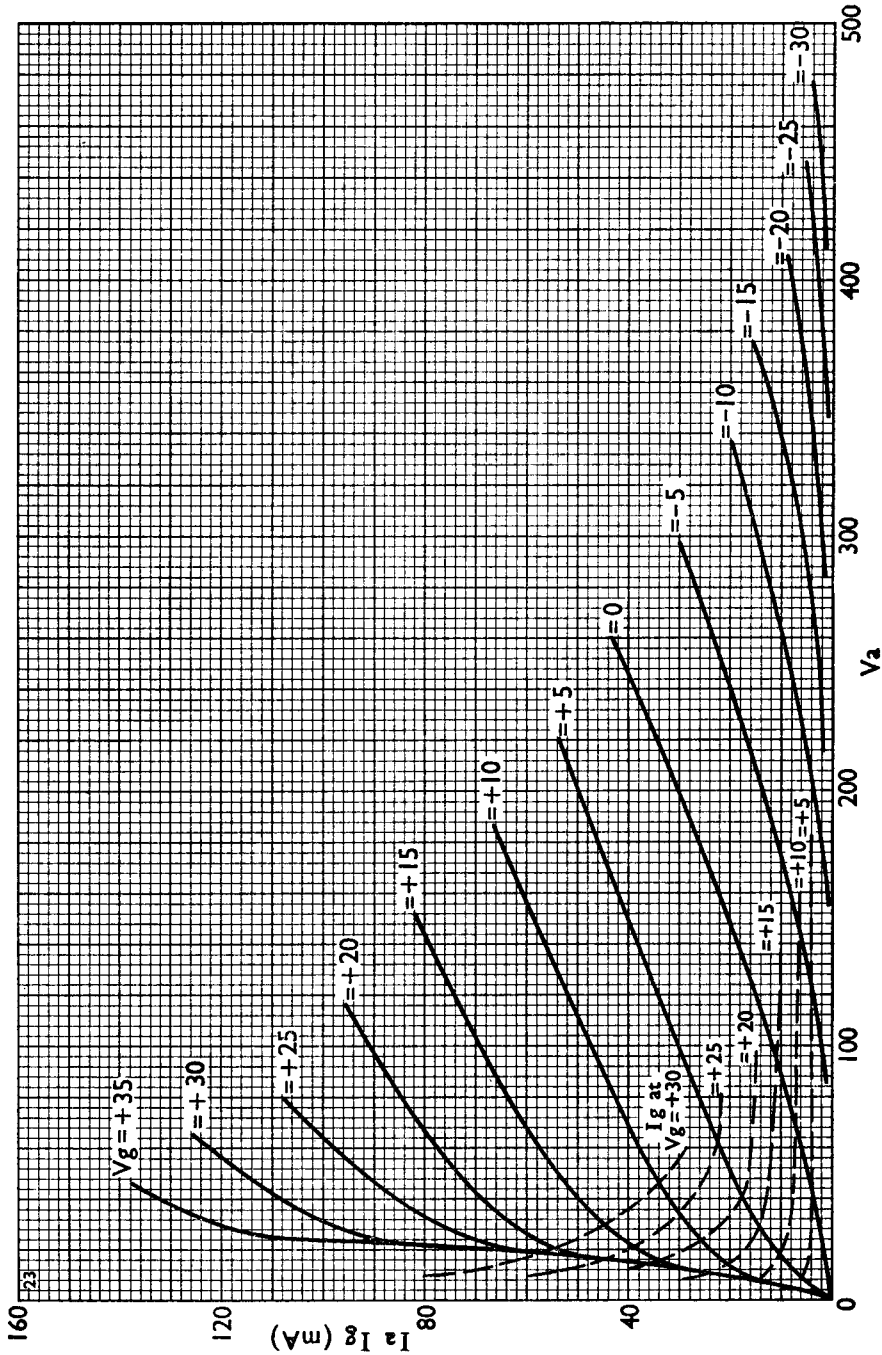
A retaining device should be used.

VENTILATION

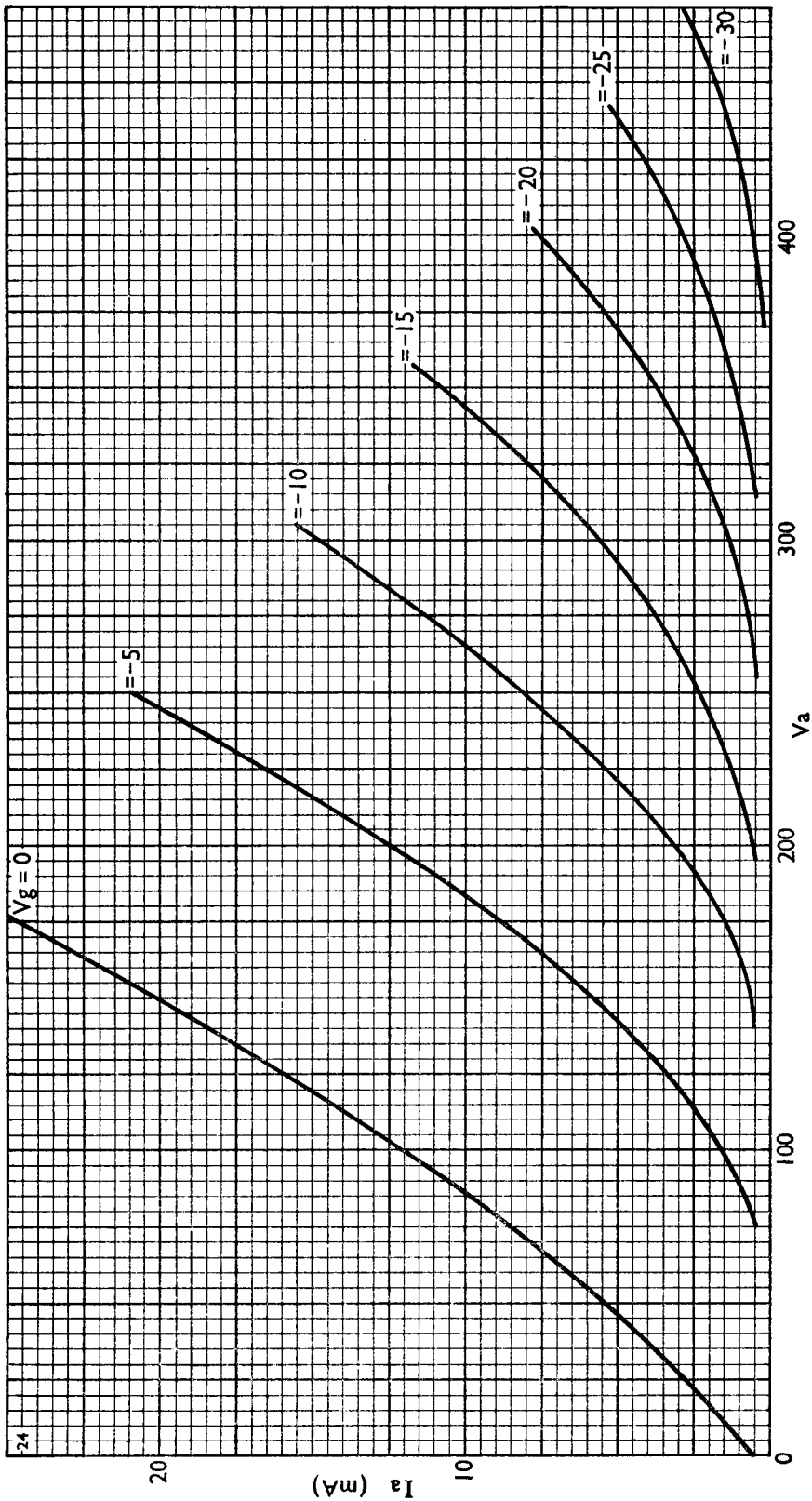
No special precautions.

MOUNTING

Any position.


Ia Ig (mA)
Va
Vg=+35
=+30
=+25
=+20
=+15
=+10
=+5
=0
=-5
=-10
=-15
=-20
=-25
=-30
Ig at Vg=+30
=+25
=+20
=+15
=+10
=+5
160
120
80
40
0
100
200
300
400
500
23

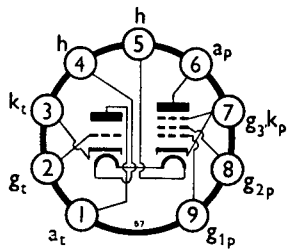
L77



TRIODE PENTODE
0·3A INDIRECTLY HEATED

LN309
OCTOBER, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	22	mm.

RATINGS

I_h	0·3	A
V_h	12·6 approx.	V
$v_{h\,k\,(pk)}$	150 max.	V

PENTODE SYSTEM

Pentode connection

V_a	250 max.		V
V_{g2}	250 max.		V
p_a	5·4 max.		W
p_{g2}	1·2 max.		W
r_a, g_m at $V_a=V_{g2}=165$, $V_{g1}=-9$	45		kΩ
	4·7		mA/V

Triode connection

V_a+g2	250 max.		V
p_a+g2	6·6 max.		W
μ, r_a, g_m at $V_{a,g2}=165$, $V_{g1}=-9$	9·5		
	1·7		kΩ
	5·6		mA/V

TRIODE SYSTEM

V_a	250 max.		V
p_a	3·5 max.		W
μ, r_a, g_m at $V_a=250$, $V_g=-8·5$	17		
	7·7		kΩ
	2·2		mA/V

CAPACITANCES

$C_{gt\text{-}ap}$	0·05	pF	$C_{at\text{-}ap}$	1·9	pF
$C_{gt\text{-}g1p}$	0·03	pF	$C_{at\text{-}g1p}$	0·12	pF
$C_{g1p\text{-}all}$ (less ap)	6	pF	$C_{ap\text{-}all}$ (less g1p)	6·9	pF
$C_{ap\text{-}g1p}$	0·2	pF	$C_{gt\text{-}kt}$	1·7	pF
$C_{at\text{-}kt}$	0·3	pF	$C_{at\text{-}gt}$	1·5	pF

TYPICAL OPERATION

PENTODE SYSTEM. PENTODE CONNECTION.

A.F. amplifier. Class A. Single valve.

V_a	100	165	V
V_{g2}	100	165	V
$V_{g1\,(o)}$ approx.	−5	−8·4	V
$v_{g1\,(pk)}$	4	6·5	V
$I_{a\,(o)}$	20	32	mA
$I_{g2\,(o)}$	3	6	mA
R_k	220	220	Ω
R_L	5	6	kΩ
P_{out}	0·8	2·1	W
D	10	10	%

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

LN309

A.F. amplifier. Class AB1 push-pull. Two valves.

Data per pair unless otherwise stated.

V_a	165	200	V
V_{g2}	165	160	V
V_{g1} (o) approx	−11·5	−11·5	V
$v_{g1\text{-}g1}$ (pk)	28	27	V
I_a (o)	46	46	mA
I_a (max. sig)	56	54	mA
I_{g2} (o)	6	6	mA
I_{g2} (max. sig)	12	11	mA
R_k	220	220	Ω
R_L (a-a)	6	6	kΩ
P_{out}	5·2	5·4	W
D	2·3	2·6	%

The external grid circuit resistance should be kept as low as possible and must not exceed 270kΩ+20% with auto bias, or 100kΩ+20% with fixed bias.

The application of this valve should be limited to normal broadcast receivers in which the average modulation does not exceed 40% on full drive; otherwise the maximum screen grid dissipation will be exceeded.

TRIODE SYSTEM

A.F. amplifier. Class A.

V_a	165	200	V
V_g approx	−3	−4·3	V
v_g (pk) (D=1%)	0·48	0·68	V
v_g (pk) (D=2%)	1·04	1·33	V
v_{out} (pk) (D=1%)	5·4	8·1	V
v_{out} (pk) (D=2%)	12·5	16	V
I_a	1·1	1·3	mA
R_k	2·7	3·3	kΩ
R_a	100	100	kΩ
Gain	12	12	

CASCADE A.F. AMPLIFIER

Triode system driving pentode system

Single valve. Class A.

V_a (b)	177	V
V_{ap}	165	V
V_{g2p}	165	V
V_{g1p} (o) (approx)	−9	V
V_{gt} (approx)	−3	V
v_{gt} (pk)	0·63	V
I_{ap} (o)	32	mA
I_{g2p} (o)	6	mA
I_{at}	1·1	mA
R_{Lp}	6	kΩ
R_{at}	100	kΩ
R_{kp}	220	Ω
R_{kt}	2·7	kΩ
P_{out}	2·1	W
D	10	%

MOUNTING

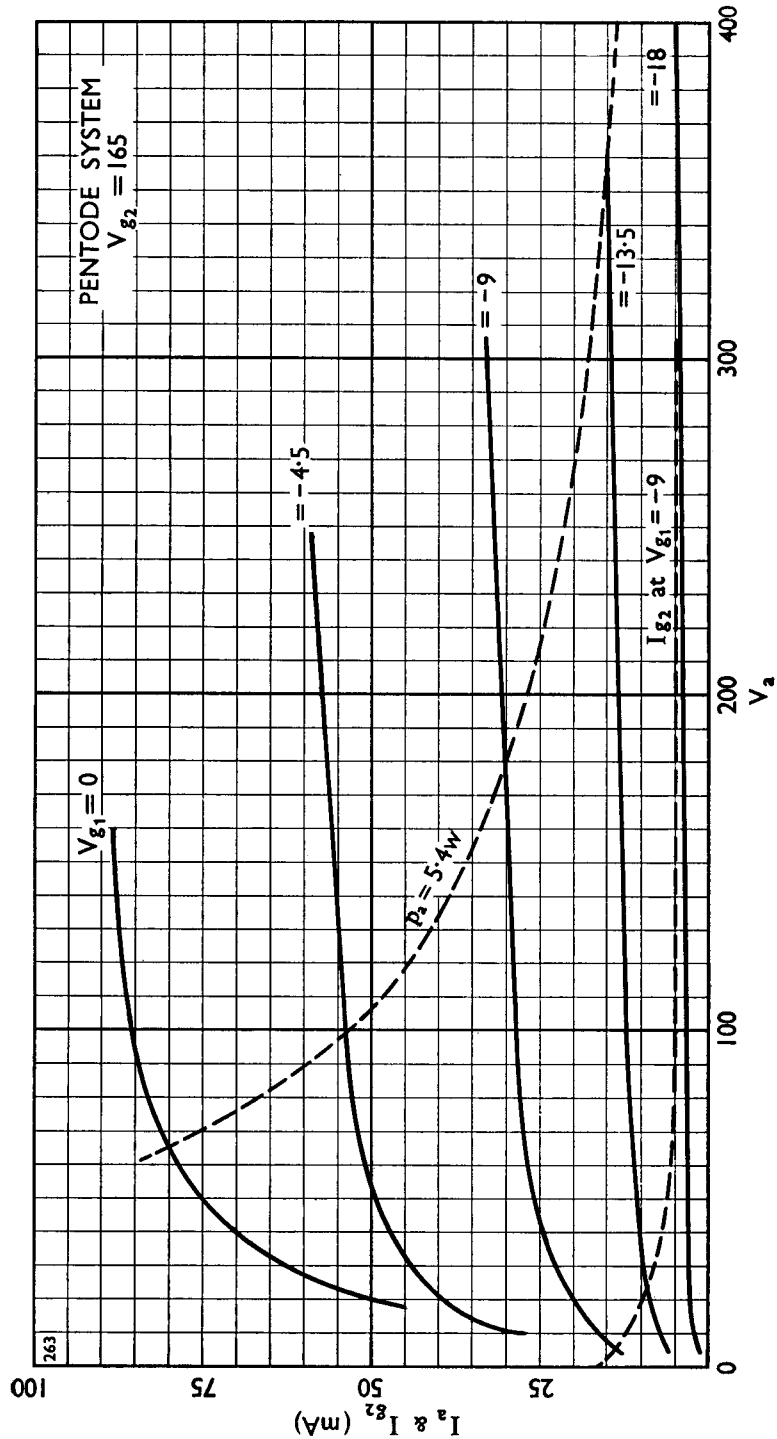
Any position.

SCREENING

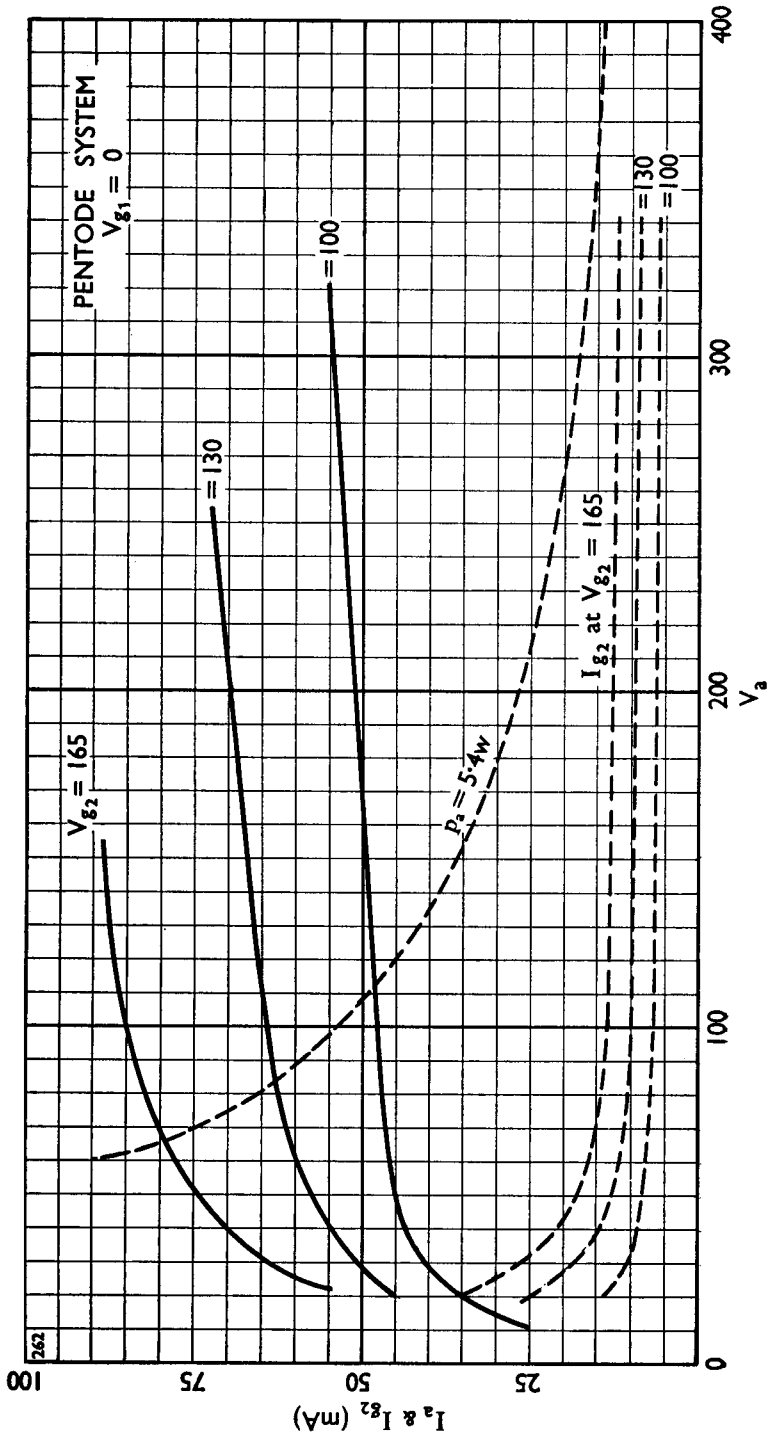
No internal or external screening is fitted to the valve.

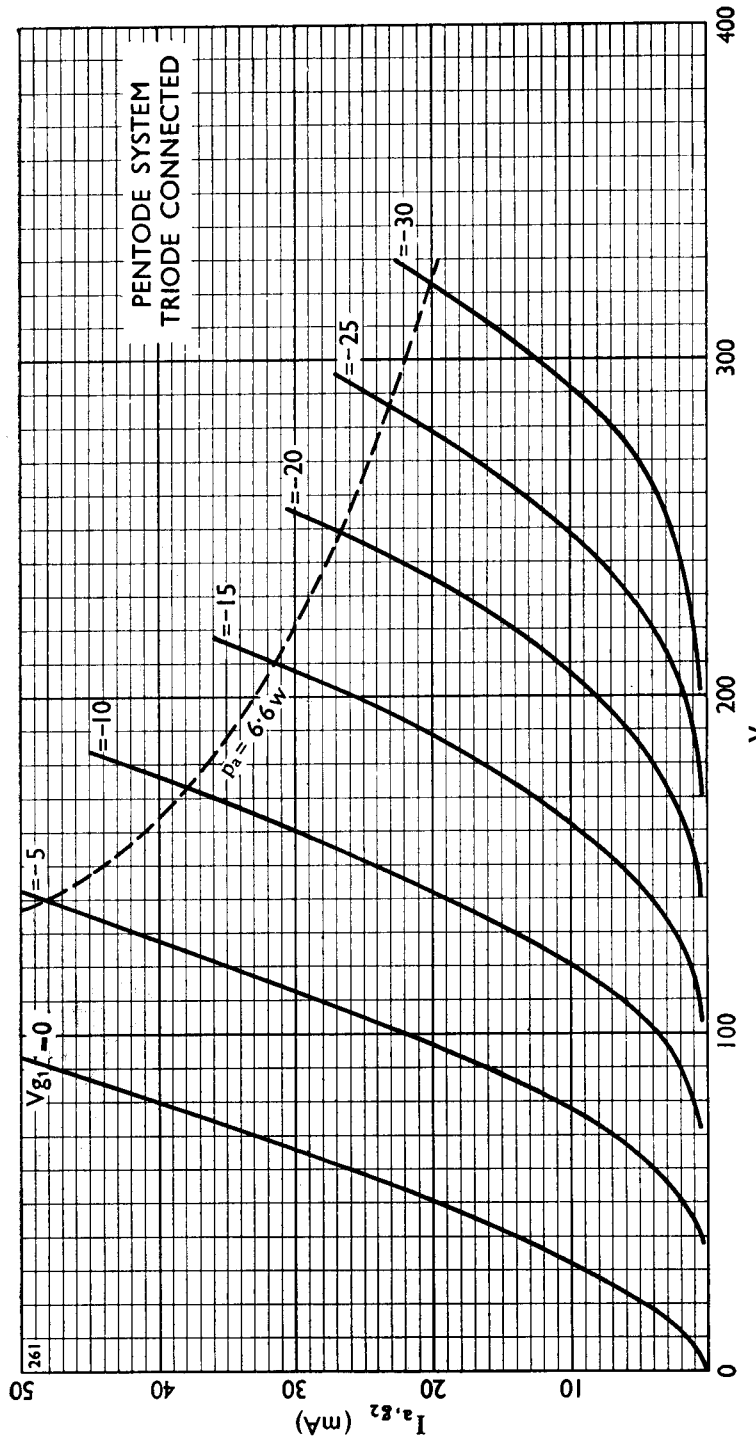
VENTILATION

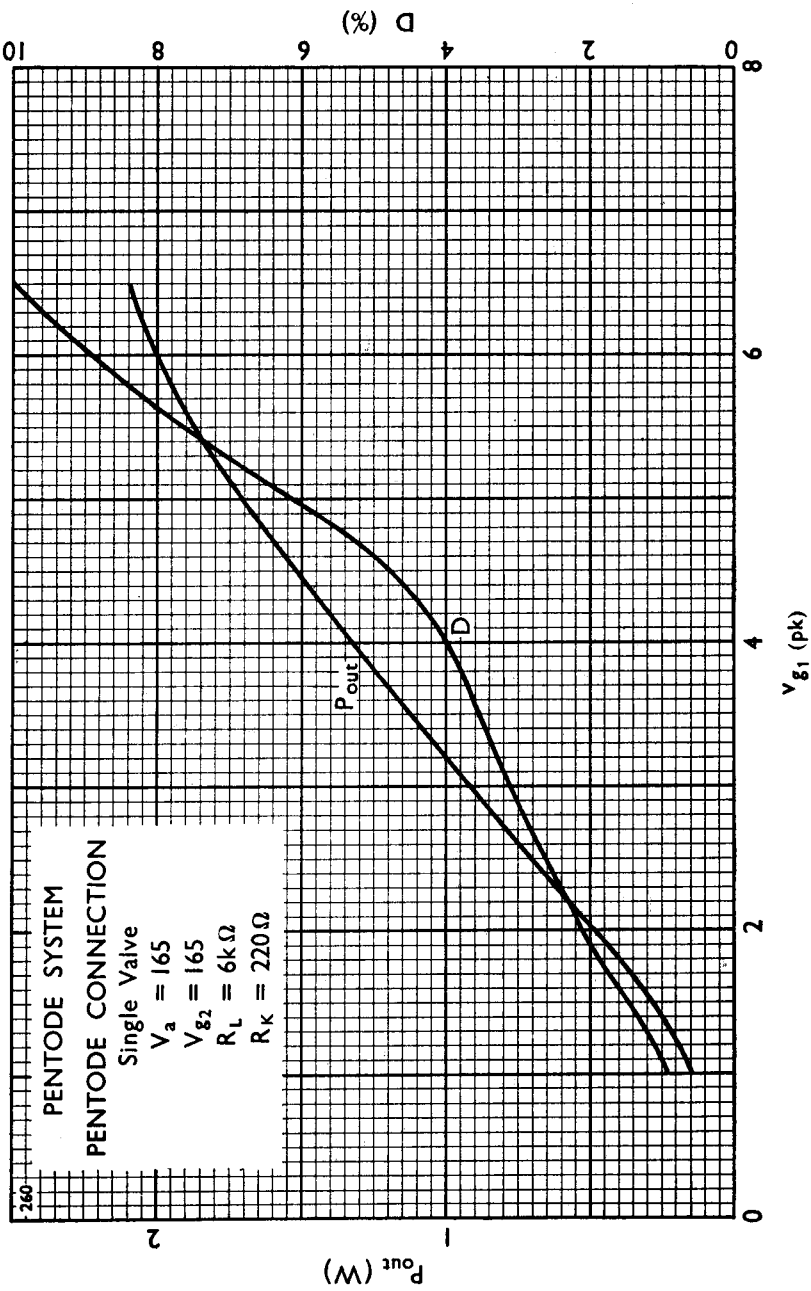
Free air circulation is preferable. If a retaining device in the form of a canister is employed, its surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 200°C.

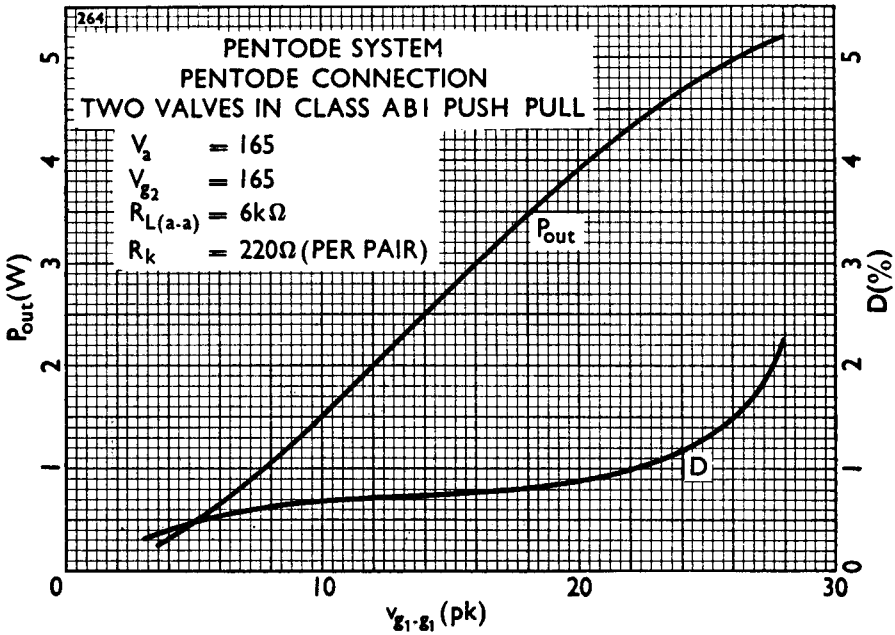

PENTODE SYSTEM
V_{g_2} = 165
V_{g_1} = 0
= −4·5
= −9
= −13·5
= −18
I_{g_2} at V_{g_1} = −9
P_a = 5·4W
263
I_a & I_{g_2} (mA)
100
75
50
25
0
100
200
300
400
V_a

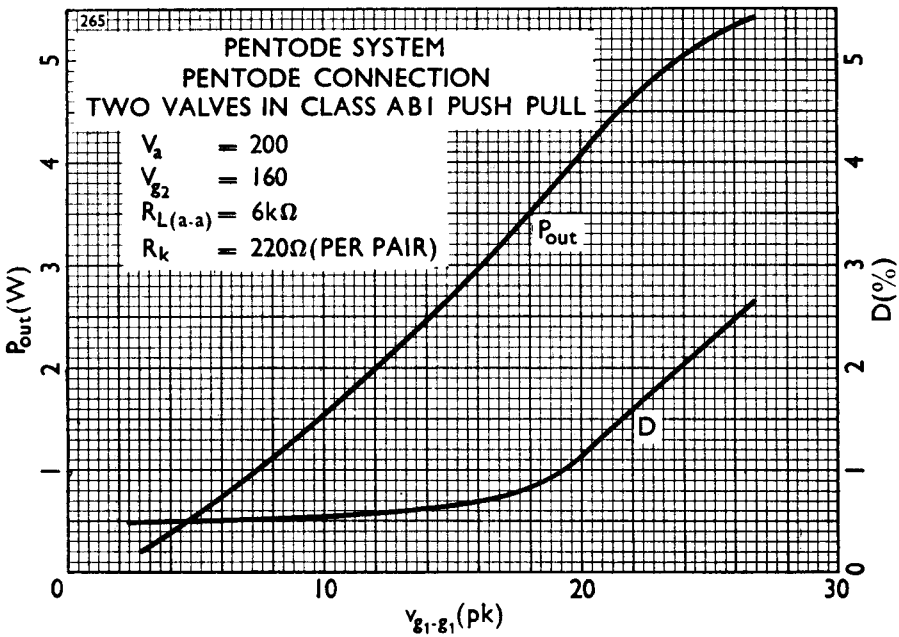
LN309


PENTODE SYSTEM
$V_{g_1} = 0$
$V_{g_2} = 165$
= 130
= 100
$P_a = 5{\cdot}4w$
I_{g_2} at $V_{g_2} = 165$
= 130
= 100
I_a & I_{g_2} (mA)
V_a
100
75
50
25
0
100
200
300
400
262

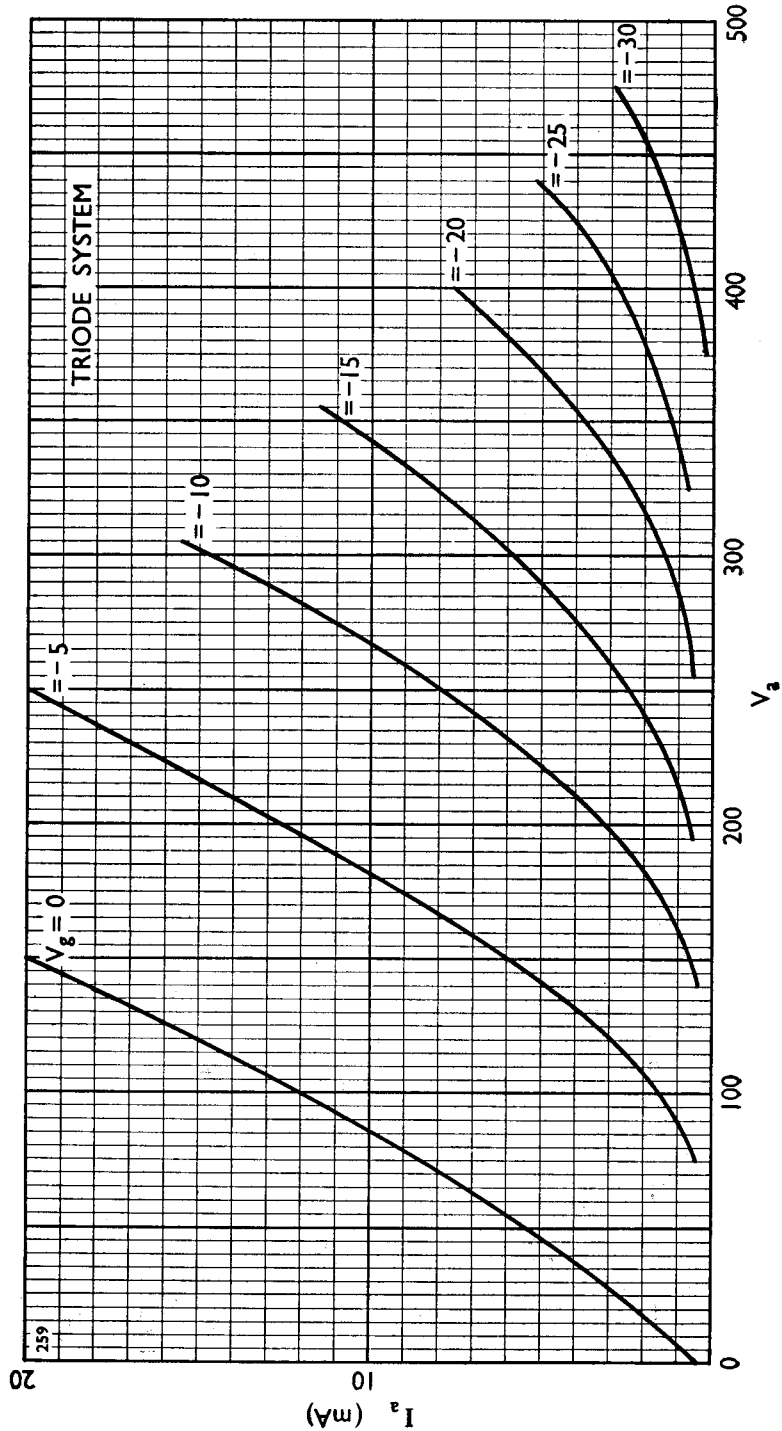

PENTODE SYSTEM
TRIODE CONNECTED
V_{g1} = -0
= -5
= -10
= -15
= -20
= -25
= -30
P_a = 6·6 W
261
$I_{a,g2}$ (mA)
0
10
20
30
40
50
100
200
300
400
V_{a+g2}

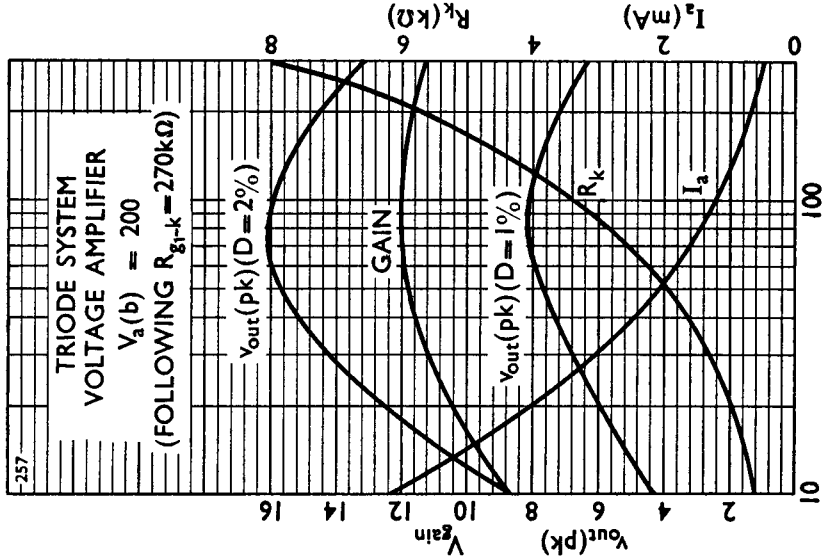

PENTODE SYSTEM
PENTODE CONNECTION
Single Valve
V_a = 165
V_{g2} = 165
R_L = 6kΩ
R_K = 220Ω
260
P_{out}
D
P_{out} (W)
D (%)
V_{g1} (pk)
0
1
2
0
2
4
6
8
10
0
2
4
6
8

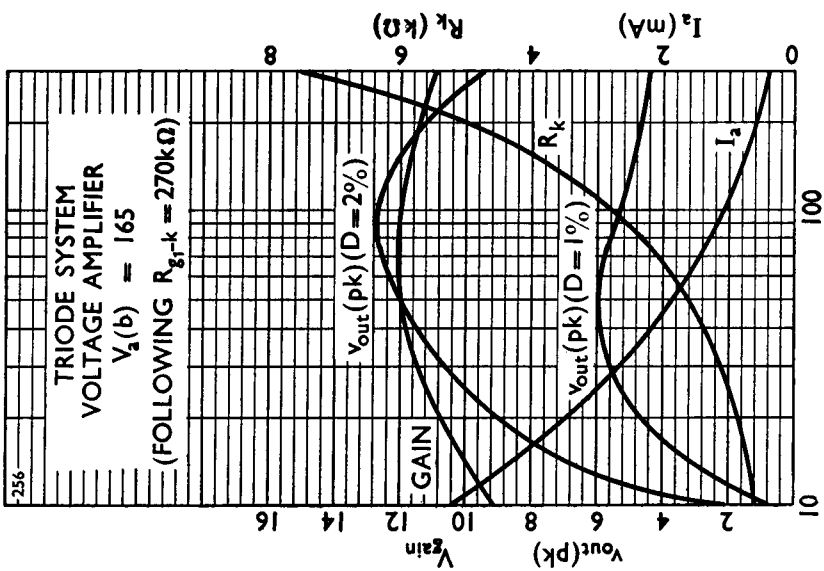

264
PENTODE SYSTEM
PENTODE CONNECTION
TWO VALVES IN CLASS AB1 PUSH PULL
V_a = 165
V_{g_2} = 165
$R_{L(a-a)}$ = 6kΩ
R_k = 220Ω (PER PAIR)
P_{out}
D
P_{out}(W)
D(%)
$V_{g_1-g_1}$(pk)
0
10
20
30
1
2
3
4
5

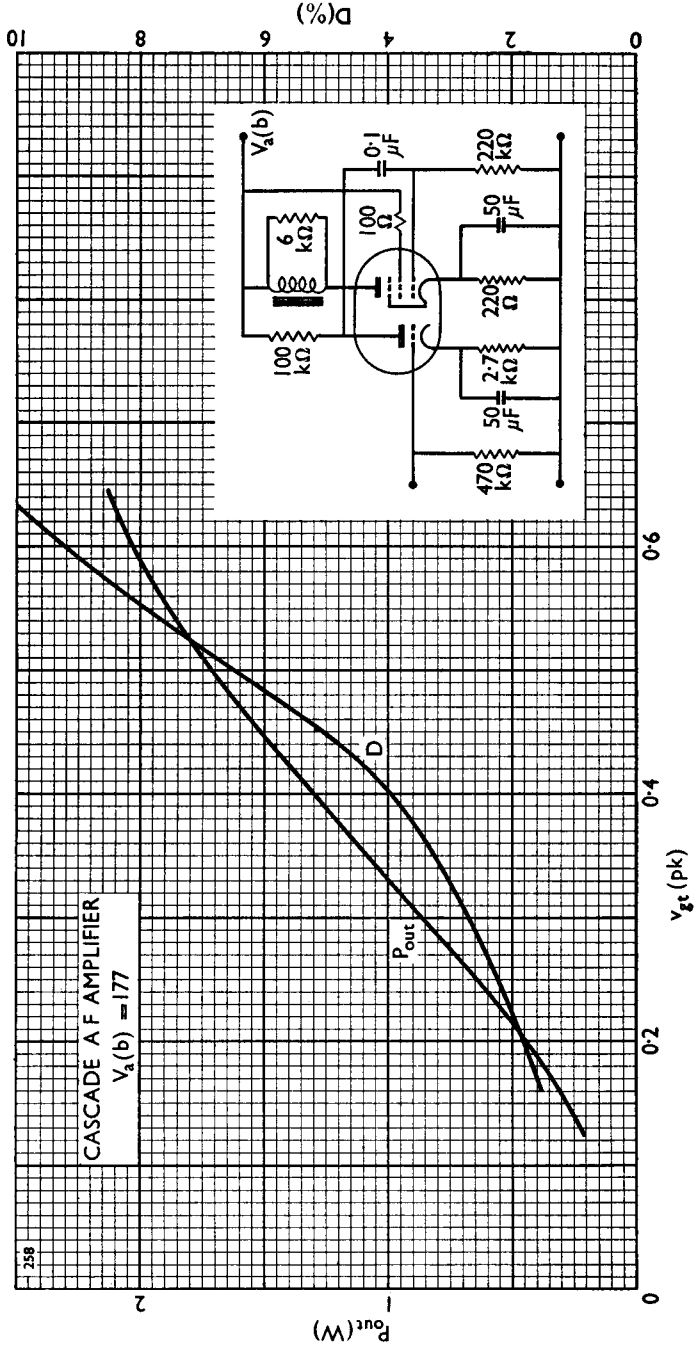

265
PENTODE SYSTEM
PENTODE CONNECTION
TWO VALVES IN CLASS AB1 PUSH PULL
V_a = 200
V_{g_2} = 160
$R_{L(a-a)}$ = 6kΩ
R_k = 220Ω (PER PAIR)
P_{out}
D
P_{out}(W)
D(%)
$V_{g_1-g_1}$(pk)
0
10
20
30
1
2
3
4
5

LN309


TRIODE SYSTEM
$V_g = 0$
$= -5$
$= -10$
$= -15$
$= -20$
$= -25$
$= -30$
259
0
100
200
300
400
500
V_a
20
10
I_a (mA)


TRIODE SYSTEM
VOLTAGE AMPLIFIER
$V_a(b)$ = 200
(FOLLOWING R_{g_1-k} = 270kΩ)
257
v_{out}(pk)(D = 2%)
v_{out}(pk)(D = 1%)
GAIN
R_k
I_a
V_{gain}
V_{out}(pk)
R_k(kΩ)
I_a(mA)
R_a(kΩ)
10
100
0
2
4
6
8
10
12
14
16


TRIODE SYSTEM
VOLTAGE AMPLIFIER
$V_a(b)$ = 165
(FOLLOWING R_{g_1-k} = 270kΩ)
256
v_{out}(pk)(D = 2%)
v_{out}(pk)(D = 1%)
GAIN
R_k
I_a
V_{gain}
V_{out}(pk)
R_k (kΩ)
I_a (mA)
R_a(kΩ)
10
100
0
2
4
6
8
10
12
14
16


D(%)
0
2
4
6
8
10
P_{out}(W)
0
1
2
V_{g1}(pk)
0·2
0·4
0·6
CASCADE A F AMPLIFIER
V_a(b) = 177
D
P_{out}
258
V_a(b)
0·1 μF
220 kΩ
6 kΩ
100 Ω
50 μF
220 Ω
100 kΩ
2·7 kΩ
50 μF
470 kΩ

OV.1835 C. Printed in England.

The rating and characteristics of the LN309 are given in the Technical Data Sheet.

The LN309 is suitable for many classes of operation, more general uses being :—

	Pentode	Triode
1.	Audio output	1st Audio stage
2.	Frame output	Frame oscillator
3.	Sync. separator	Line oscillator

AUDIO AMPLIFICATION

As an audio amplifier an output of 2 watts is obtainable, adequate for television receivers or for the smaller table radio sets. Where a greater output is required two valves may be employed to give output of the order of 5·5 watts. The two triodes then perform as first audio and phase inverting stages. An input voltage to the triode grid of less than 0·5 volt r.m.s. will provide full output in both cases.

Typical circuits are shown in Figures 1 and 2. That shown in fig. 2 uses a self-balancing arrangement which is capable of providing the inputs for the two pentodes with a phase difference of 180°. Small differences in triode characteristics have no effect on the circuit performance.

The use of separate cathodes for the pentode and triode sections prevents instability. A bias capacitor is necessary to give minimum distortion in the pentodes, but it may be omitted from the triode cathodes unless hum is experienced due to a high A.C. heater to cathode voltage.

FRAME TIME-BASE APPLICATIONS

As a frame oscillator and output valve sufficient scanning power should be available for 70° tubes operating up to 12 kV, assuming that an efficient transformer and scanning coils are used.

SYNC. SEPARATION

As a sync. separator the pentode section of the LN309 operates satisfactorily with a low screen voltage of the order of 10/20 volts. A suitable circuit is shown in fig. 3. The triode section is not shown, it being presumed that this will be used as the line oscillator. The characteristics are such that it will work with normal components and provide sufficient output to drive the line output stage.

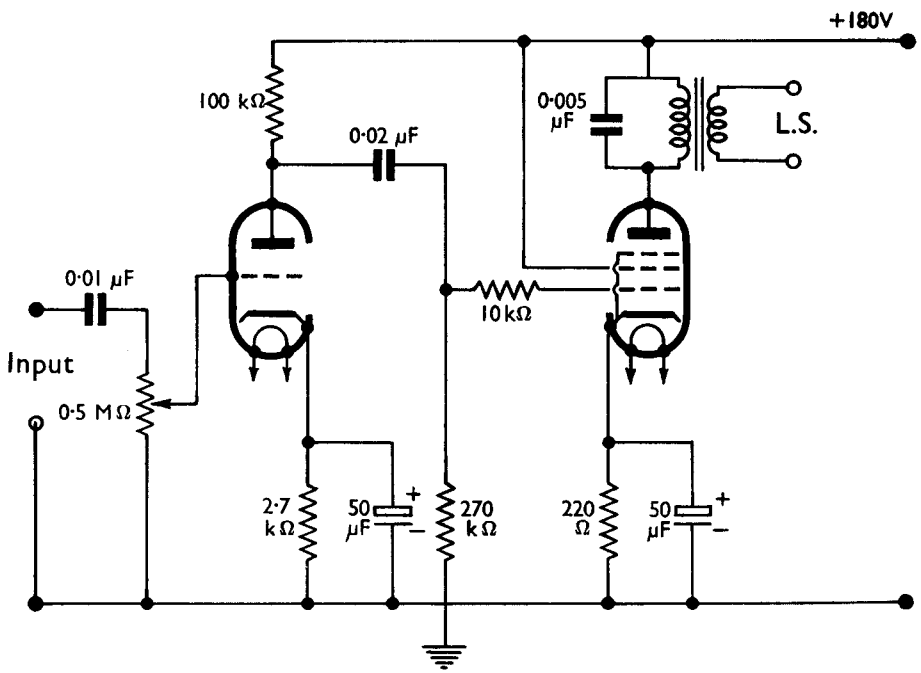


FIG. 1. Two stage audio amplifier.

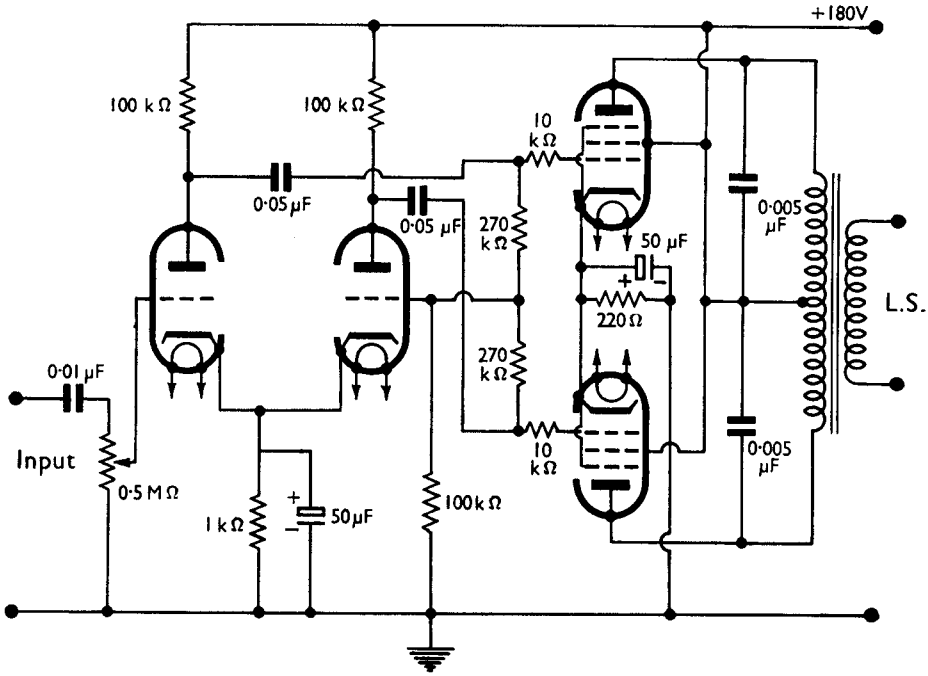


FIG. 2. Push-pull amplifier.

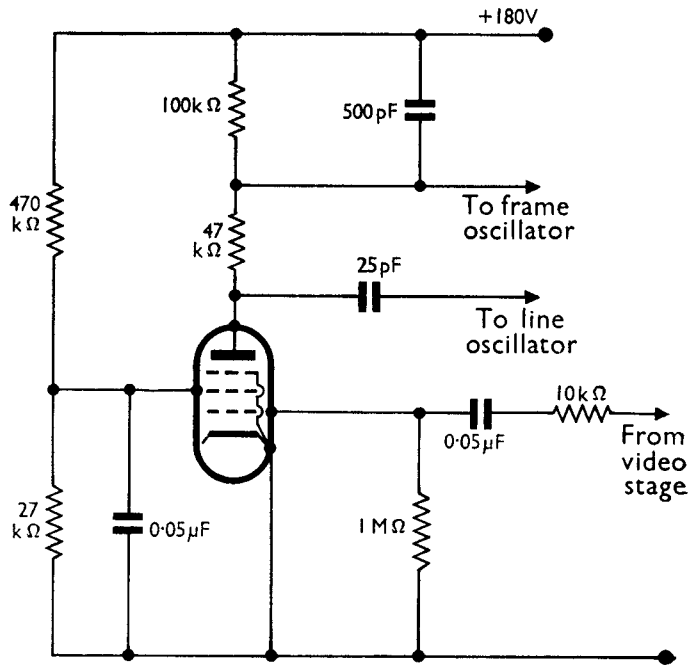


FIG. 3.

Pentode section as sync. separator.

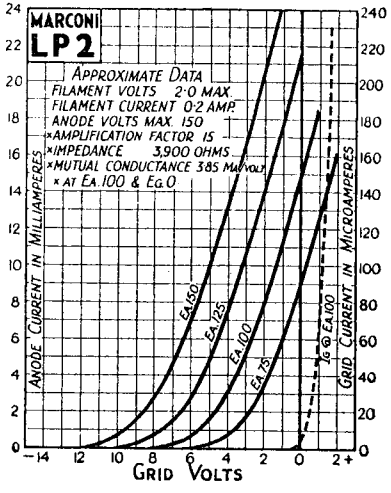
LN309 CIRCUIT SUPPLEMENT

Printed in England C

MARCONI 2-VOLT VALVES

LP 2, Power, 10/6

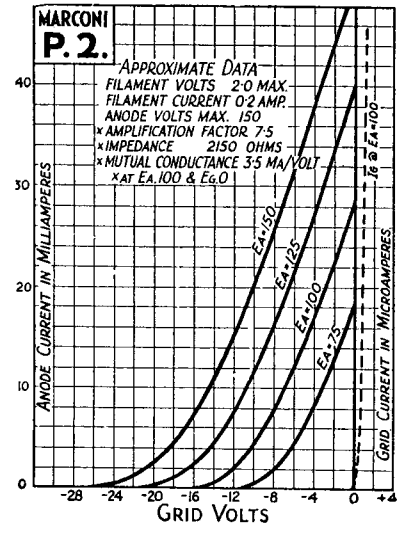
LP.2 is a power output valve uniting a very high amplification factor with a normal value of impedance, and thus providing stage magnification comparable with that of a pentode. Its very small consumption of H.T. current renders LP.2 ideal for the output stages of portable and similar receivers.



Approximate Operating Data.

Anode Volts.	Negative Grid Bias Volts.	Average Anode Current in Milliamperes.
150	4½	11.5
150	*6	6.8
125	4½	6.0
100	3	5.2
75	1½	4.3

* For economy in H.T. current.



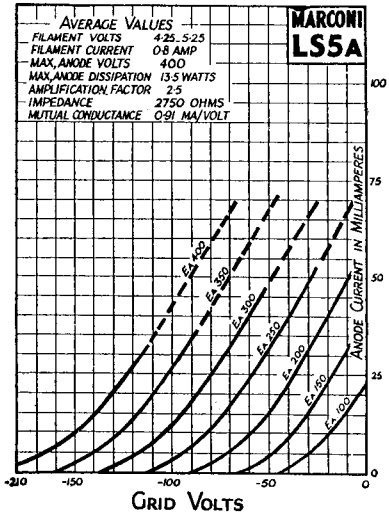
P 2, Super-Power, 13/6

P.2 is an improved type of super-power output valve, modest in its requirements for H.T. current and providing excellent amplification. It is exceptionally suitable for the operation of sensitive moving coil speakers, its impedance generally matching the average instrument of this type.

Approximate Operating Data.

Anode Volts.	Grid Bias Volts.	Average Anode Current in Milliamperes.
150	−10½	17
125	−9	12.5
100	−6	11.2
75	−4½	7.2

MARCONI 6-VOLT VALVES



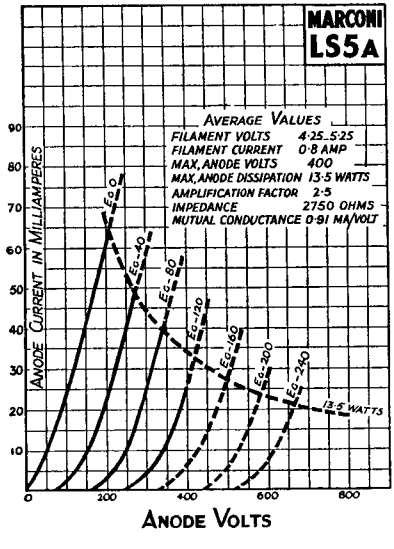
Anode Volts—Anode current curve for LS5A

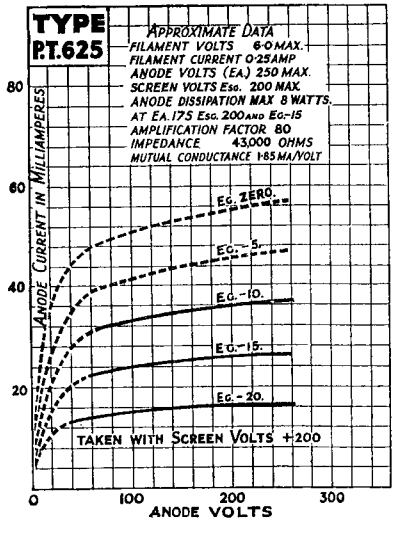
LS5A, High Power, 25/-

LS5A is a high power output valve for anode voltages up to 400.
The output is sufficient to operate a moving coil speaker at considerable volume, the filament being heated from an accumulator or by alternating current.

PT 625, Pentode, 25/-

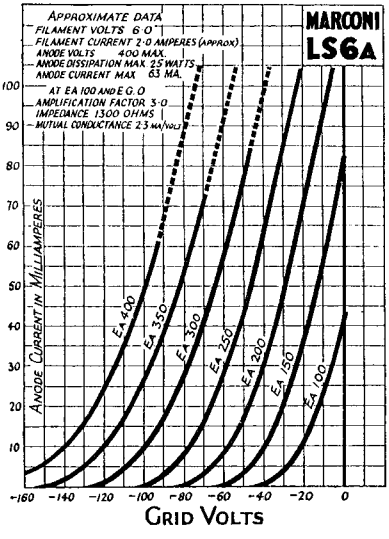
PT625 is a super-power pentode for anode voltages up to 250. The filament may be heated by an accumulator or by alternating current, while the output is ample for operating moving coil speakers.





LS 6A, High Power, 30/-

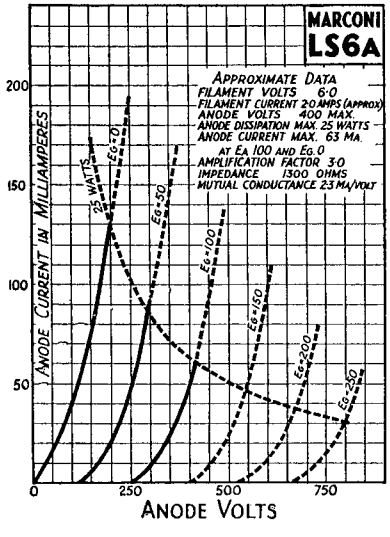
LS6A is a high power output valve for use in large receivers, radio grams, public address equipments, etc., providing output enough for several speakers. The maximum anode voltage is 400 while the filament may be heated by alternating current if desired. It is generally advisable to operate LS6A entirely from a mains supply.



Anode Volts, Anode current curve for LS6A

Approximate Operating Data for LS6A.

Anode Volts.	Grid Bias.	Average Anode Current.
200	—34	40 m.a.
250	—48	47 m.a.
300	—60	55 m.a.
350	—76	60 m.a.
400	—91	63 m.a.



Provisional Data

R.F. TRIODE PENTODE

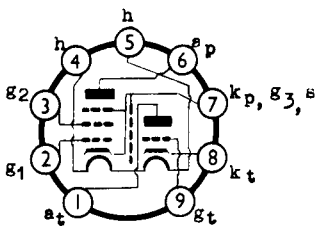
O·3A INDIRECTLY HEATED

LZ319

issue. 1. MARCH 1954.

A combined high slope R.F. pentode and low -μ triode primarily designed for use as a frequency changer at frequencies up to 250 Mc/s.

BASE CONNECTIONS & VALVE DIMENSIONS



View from underside of base.

Base - B9A

Bulb - tubular

Overall length: 56 max. mm

Seated length: 49 max. mm

Diameter: 22.2 max. mm

HEATER

I_h	0.3	A
V_h	9.0	V

RATING

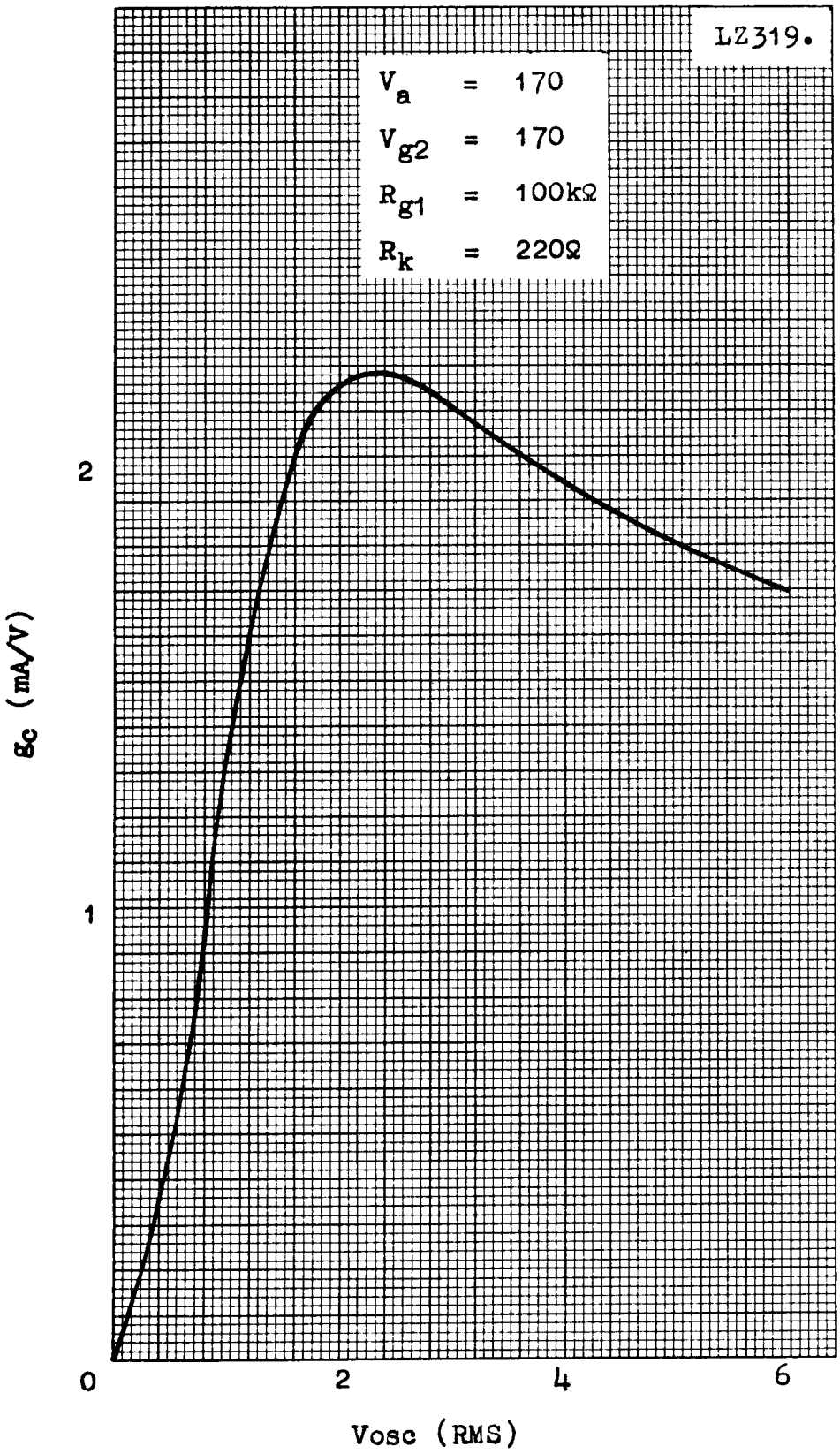
	(Pentode system)	(Triode system)	
V_a	250 max.	250 max.	V
V_{g2}	200 max.		V
V_{h-k}	150 max.	150 max.	V
I_k	14 max.	14 max	mA
p_a	1.7 max.	1.1 max.	W
p_{g2}	0.5 max.		W

CHARACTERISTICS

	(Pentode system)	(Triode system)	
V_a	170	100	V
V_{g2}	170		V
V_{g1}	- 2	-2	V
I_a	10	14	mA
$\mu_{(g1-g2)}$	50		
μ		20	
r_a		4	kΩ
g_m	6.0	5.0	mA/V

CAPACITANCES

c_{g1-all}	4.5 approx.	pF	c_{gt-kt}	3.0	pF
c_{ap-all}	4.0 approx.	pF	c_{at-kt}	0.5	pF
c_{ap-g1}	$\gtrless$ 0.02	pF	c_{at-gt}	2.0	pF


LZ319.
V_a = 170
V_{g2} = 170
R_{g1} = 100kΩ
R_k = 220Ω
2
1
0
g_c (mA/V)
2
4
6
Vosc (RMS)

CIRCUIT SUPPLEMENT

ISSUE 1

PROVISIONAL

LZ319/PCF80

SEPTEMBER 1955

The Osram LZ319/PCF80 is a triode-pentode designed principally for use as a frequency changer for signal frequencies up to 250Mc/s and it is therefore suitable for use in Band III television receivers and converters.

Both triode and pentode sections have high mutual conductance and, consequently may be used for a variety of applications. This supplement describes its use as frequency-changer.

The circuit given has been designed for optimum performance with signal frequencies of the order of 250Mc/s and an IF of 34Mc/s approx.

The triode section oscillates at a frequency equal to the incoming signal frequency plus the IF and, normally, a grid current of 200-400μA is to be expected through the oscillator grid resistor R5. The oscillator voltage is fed to the pentode signal grid via the 2pF capacitor, C6, and here it mixes with the input signal from the tuned circuit composed of L1 and the input capacitance of the LZ319/PCF80. A grid current of approximately 5μA will flow through the mixer signal grid resistor R1, due to the voltage produced by the oscillator and this permits a convenient measurement of oscillator voltage, which should be between 2 and 3V rms.

The screen grid is supplied by a series resistor of 56kΩ, R3, and tied to the chassis by a 1000pF capacitor, C3. It is essential that this capacitor and C2 be non-inductive; the feed-through type have been found satisfactory.

The 100Ω cathode resistor, R2, and the 1000pF cathode by-bass capacitor are not essential and satisfactory results have been obtained without them, provided the screen is fed through a series resistor (R3) of 56kΩ.

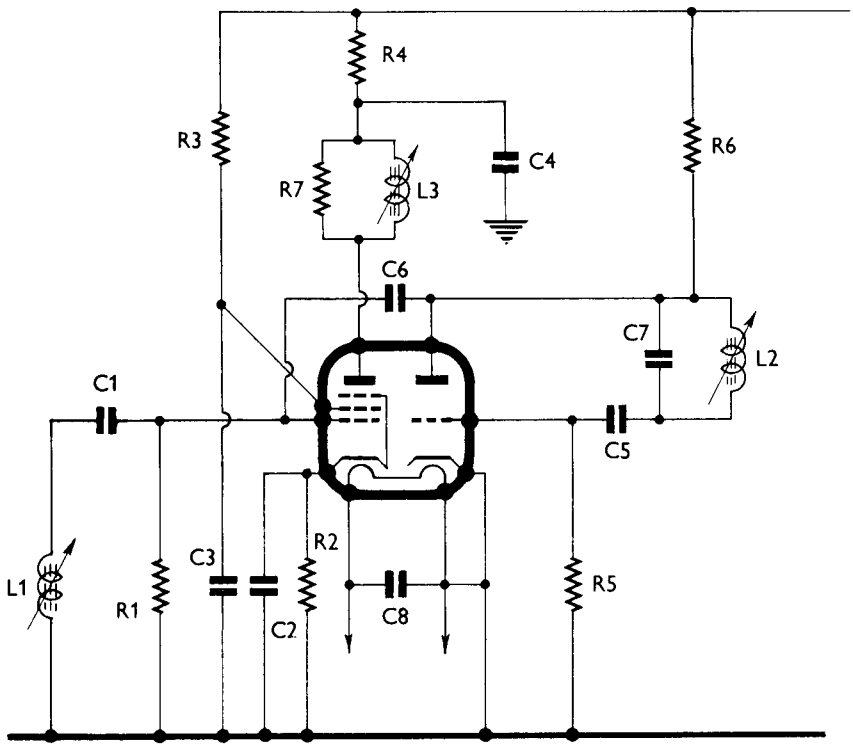
The anode of the pentode is connected to HT via a circuit tuned to the required IF. A damping resistor, the value of which is decided by the degree of damping required, is shown connected across the tuned circuit to maintain the desired bandwidth.

The oscillator frequency is determined by the inductor L2 and capacitor C7. Different values will be required according to the frequency desired, but for an oscillator frequency of 220-250Mc/s, a 4·7pF capacitor is suitable. L2 will then be formed of 2¼ turns of 16 or 18 swg wire on a 7mm dia. former (Neosid 351/8BA) with a dust core (Neosid 500/901).

It is essential in the interests of frequency stability to use adequate capacitance; however, a balance must be struck between frequency stability and oscillator voltage since too high a capacitance will prevent satisfactory oscillation.

All connecting leads, particularly the cathode and screen connections, should be of minimum length.

LZ319/PCF80

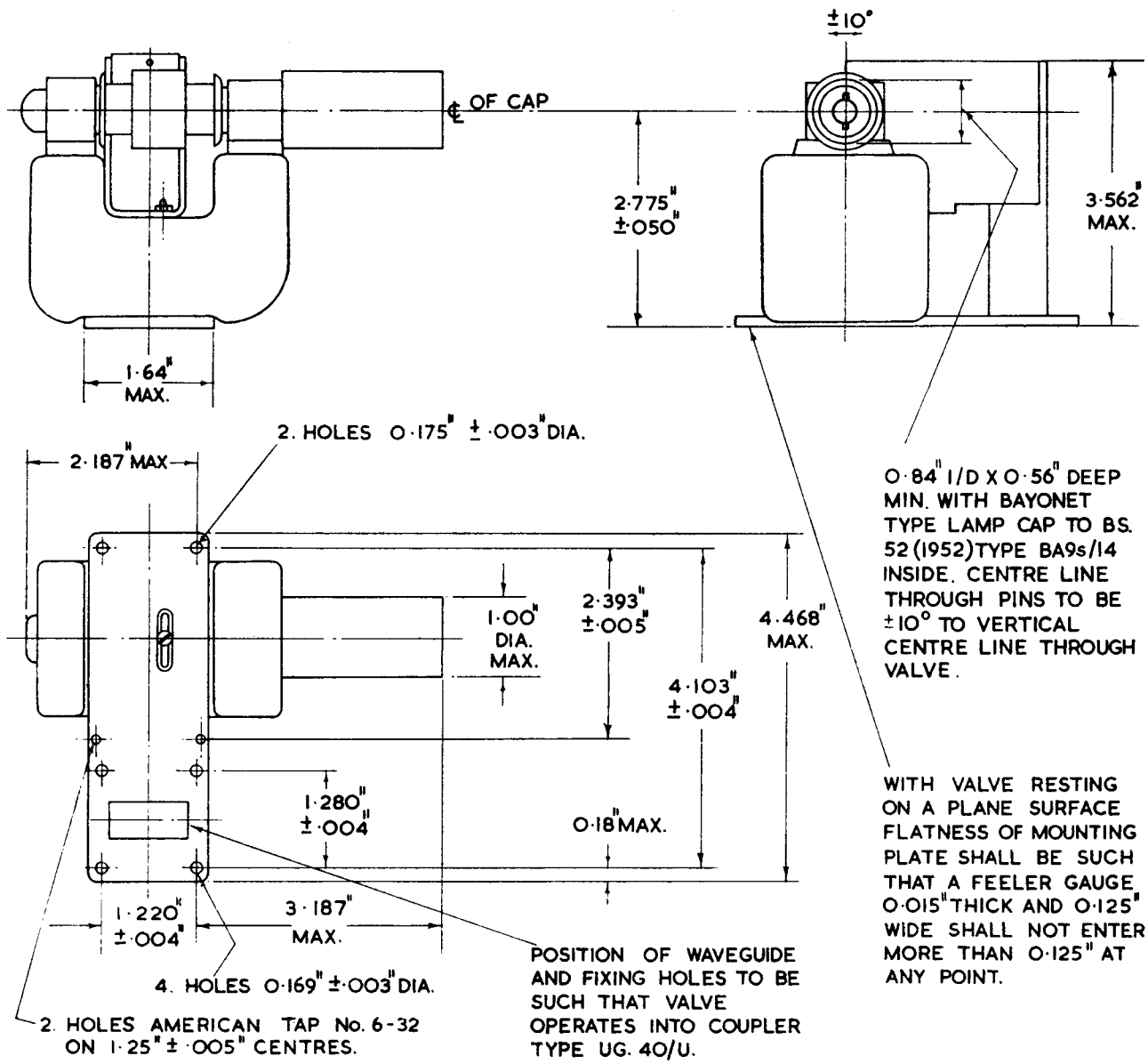


R1	470kΩ	20%	C1	47pF	
R2	100Ω	10%	C2	1000pF	Feed-through.
R3	56kΩ	10%	C3	1000pF	Feed-through.
R4	1kΩ	20%	C4	1000pF	Silvered mica.
R5	33kΩ	20%	C5	100pF	
R6	10kΩ	10%	C6	2pF	
R7	Damping resistor.		C7	4·7pF	High stability.
(All resistors: 0·25W)			C8	47pF	

See text for L1, L2, L3.

The circuit information given in this publication does not imply any licence under patents which may be involved.

Magnetron *Type M 503*



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England. Telephone: Chelmsford 3221. Telex: 1953. Telegrams: Expanse Chelmsford Telex

General. The M 503 is an air-cooled multi-resonator packaged magnetron, with a pre-plumbed waveguide output circuit. It has been designed for operation in the 3 cm band and is for use with systems using the standard American waveguide; the internal dimensions of which are 0·9 × 0·4 in.

Cold Impedance. The impedance of the valve at its operating frequency when not oscillating will be such as to give a standing wave ratio of at least 8:1 with a minimum distance of 16·5–22·5 mm from the flange towards the anode.

APPROXIMATE DATA

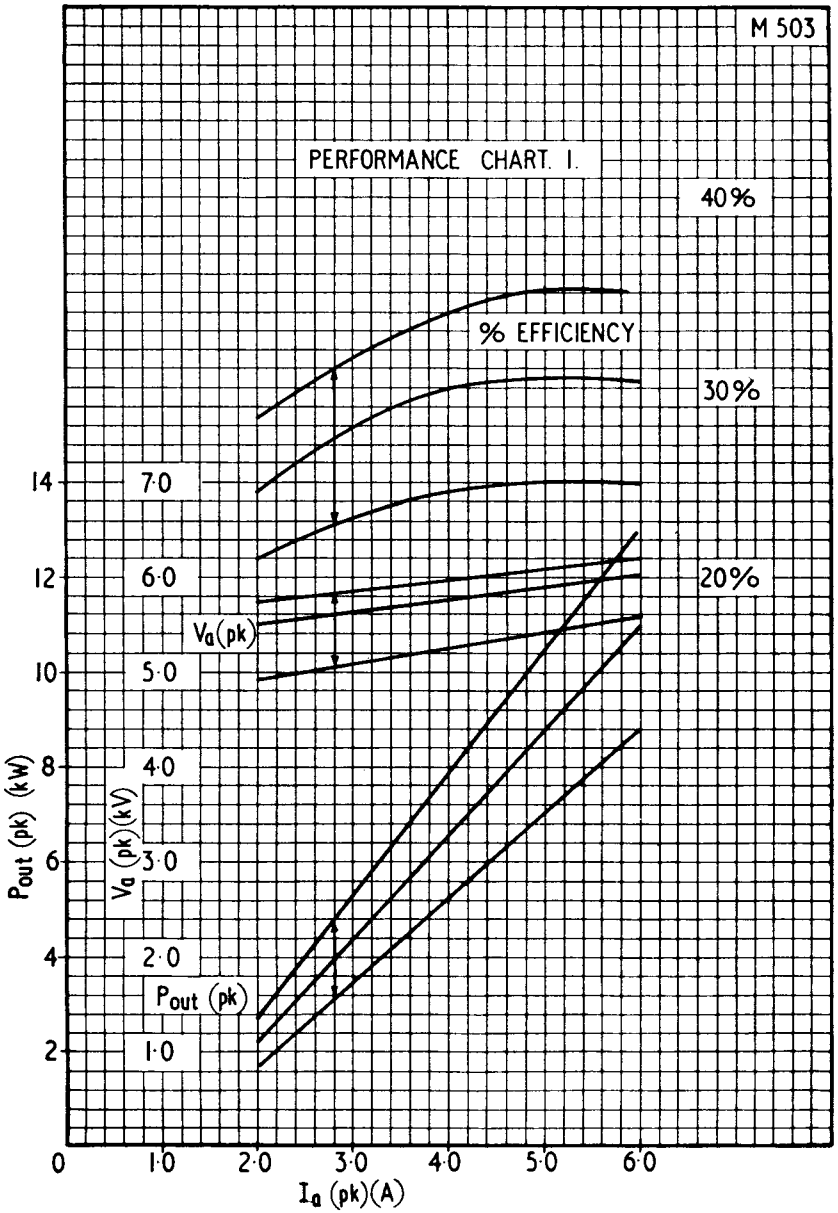
V_h (a)		6·3	V
I_h		0·5	A
f	9,345–9,405		Mc/s
$f_{pulling}$ (standing wave ratio 1·5:1 in all phases)		14	Mc/s
Rate of rise of voltage (max) (at 4·5 A peak)		60	kV/μs
Duty cycle (a)		0·001	
H_{int}		4,800	Oersteds
η_{min}		25	%

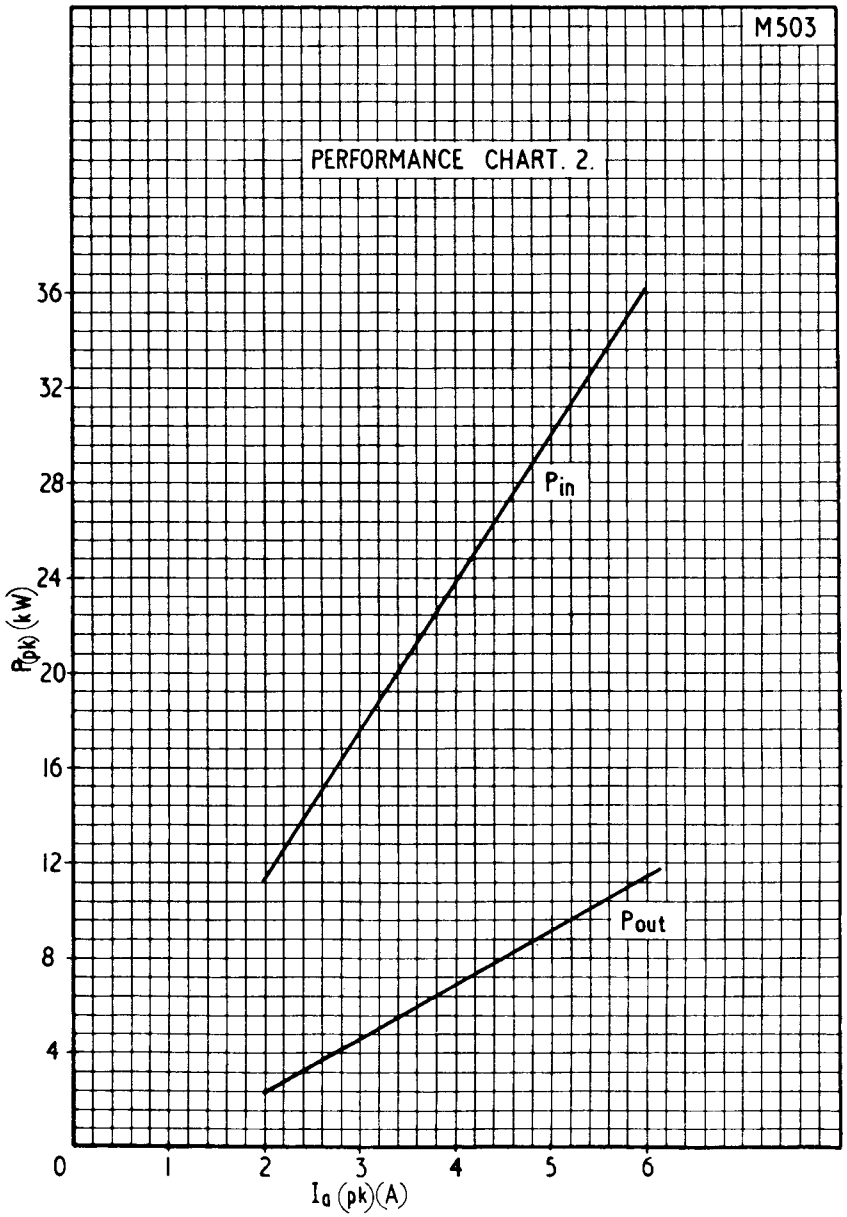
Typical Operation

V_a pk		5·5	kV
I_a pk		5	A
t_p	1	0·1	μs
PRF	1,000	1,000	pps
P_{out} (pk)		8	kW

NOTE

(a) The heater voltage should be maintained at 6·3 V for at least 2 minutes before switching on the HT. For duty cycles greater than 0·001 the heater voltage should be reduced to 4·5 V after switching on the HT.

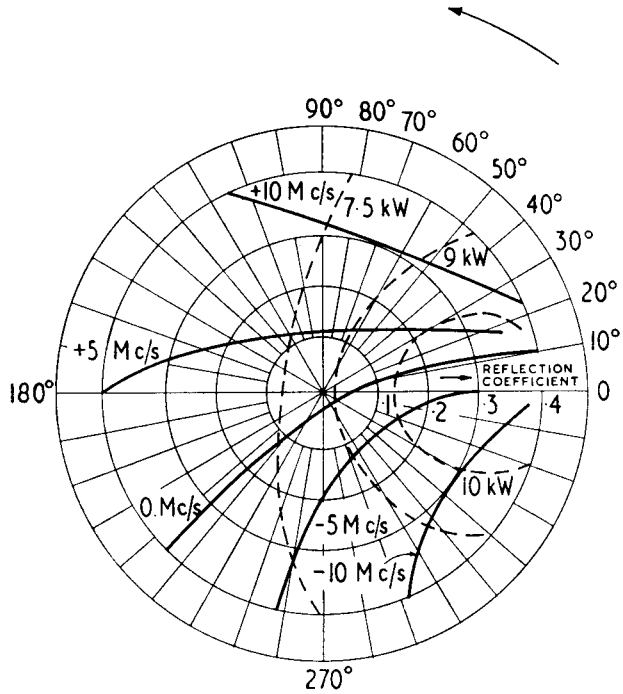

M 503
PERFORMANCE CHART. 1.
40%
% EFFICIENCY
30%
20%
7·0
6·0
5·0
4·0
3·0
2·0
1·0
Va(pk)
Pout (pk)
Pout (pk) (kW)
Va (pk)(kV)
14
12
10
8
6
4
2
0
1·0
2·0
3·0
4·0
5·0
6·0
Ia (pk)(A)


M503
PERFORMANCE CHART. 2.
Pin
Pout
P(pk) (kW)
36
32
28
24
20
16
12
8
4
0
1
2
3
4
5
6
Ia (pk)(A)

M 503

TAKEN AT 5A PULLING
FIGURE 14 M c/s.

$\theta = 360^\circ L/\lambda_g^\circ$ AWAY
FROM VALVE.

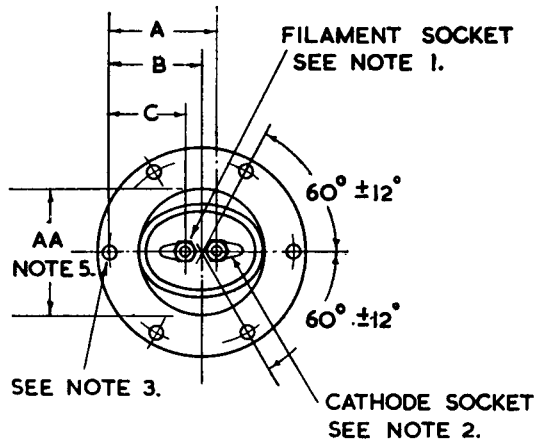


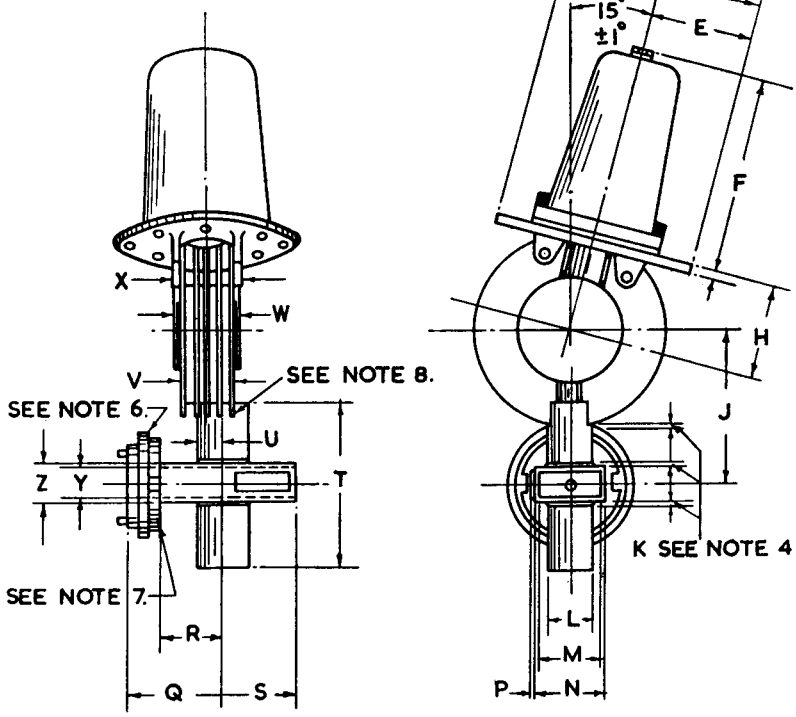
——— FREQUENCY DEVIATION M c/s
– – – – PEAK POWER IN kW
L = DISTANCE OF SW MINIMUM FROM OUTPUT FLANGE.

PRINTED IN ENGLAND

Magnetron *Type M505*

Dimension	Nominal	Minimum	Maximum	Remarks
A	1·687	—	—	Note 10
B	1·437	—	—	Note 10
C	1·187	—	—	Note 10
D	3·25	3·218	3·281	Dia.
E	1·625	—	—	
F	2·984	2·922	3·046	
G	0·125	—	—	
H	1·500	1·480	1·520	
J	2·437	2·417	2·457	
K	—	—	0·125	Solder
L	0·875	—	0·880	Dia.
M	1·0	—	—	Inside
N	1·094	1·075	1·116	
P	0·062	—	—	
Q	1·500	1·490	1·510	
R	—	0·938	—	
S	—	—	1·438	
T	—	—	2·812	
U	0·219	—	—	
V	0·807	0·8025	0·812	
W	—	—	0·974	
X	—	—	1·107	
Y	0·500	—	—	Inside
Z	0·594	0·581	0·611	
AA	—	—	2·218	Note 5





Note 1. Filament hole in Pin Jack is 0·123–0·127 dia.

Note 2. Cathode hole in Pin Jack is 0·167–0·171 dia.

Note 3. 6-holes, 0·193±0·003 dia., equally spaced on 2·875±0·006 P.C. dia.

Note 4. Allowances for solder fillets.

Note 5. From this diameter to outer edge of Mounting Plate is flat to within 0·010.

Note 6. Face of Flange may deviate 1° from nominal position relative to axis of Radiator Flange No. AP 54989.

Note 7. No solder fillets.

Note 8. Position of Radiator Fin assembly may vary ±0·020 from centre-line through valve.

Note 9. Radiator diameter equals 2·990–3·000.

Note 10. Centre-line to be within 0.023 of nominal position and spacing between Pin Jacks to be 0·500±0·010.

Note 11. Normal Magnet air gap equals 0·984 minimum.

Note 12. Radiator Housing width equals 0·8225 minimum.

Note 13. All dimensions in inches.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

General. The M 505 is an air-cooled multi-resonator magnetron fitted with a pre-plumbed waveguide output circuit. The cathode is oxide coated and indirectly heated. It has been designed for operation in the 3 cm band and is for use with systems using the standard British waveguide; the internal dimensions of which are $1 \times 0{\cdot}5$ in.

Cold Impedance. The impedance of the valve at its operating frequency when not oscillating will be such as to give a standing wave ratio of at least 8:1 with a minimum distance of 4·5–10·5 mm from the flange towards the anode.

APPROXIMATE DATA

V_h starting (a)	3·7–3·3	V
$V_{h(max)}$ oscillating at maximum input	2	V
I_h (at V_h=3 V)	3·5	A
f	9,360–9,460	Mc/s
$f_{pulling}$ (standing wave ratio 1·5:1 in all phases)	14	Mc/s
Rate of rise of voltage (max)	100	kV/μs
Duty cycle	0·001	
H	3,200–3,300	Oersteds
P_{in} (max)	150	W
I_a (pk)(max)	12	A
t_p (max)	1	μs
T_a (max)	140°	C

Typical Operation

V_h	2	V
I_h	2·5	A
V_a (pk)	12	kV
I_a (pk)	12	A
H	3,250	Oersteds
t_p	1	μs
PRF	1,000	pps
P_{out} (pk)	60	kW

NOTE

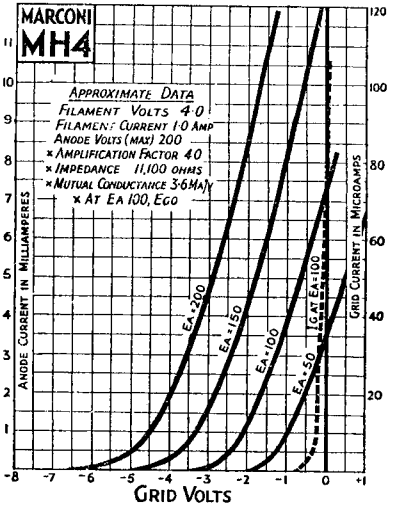
(a) The heater voltage should be applied for at least 2 minutes before switching on the HT.

PRINTED IN ENGLAND

MH 4, High Magnification, 15/-

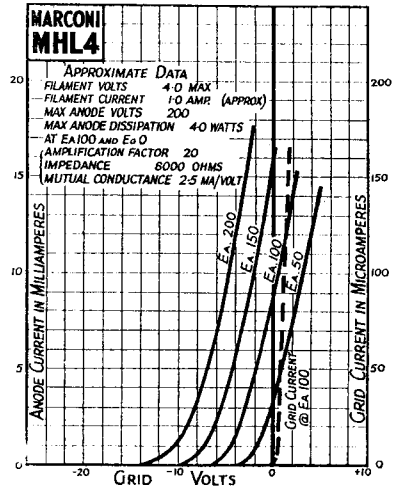
Marconi MH.4 is a high efficiency general purpose valve for use as detector or first low frequency amplifier. It may be used with transformer or resistance coupling in the majority of modern circuits.

MH.4 is available with metallised bulb if desired.



Approximate Operating Data.

Circuit.	Anode Volts.	Grid Bias.
Grid leak detector	50–150	Zero
Anode bend detector	50–200	$-1\frac{1}{2}$ to -6
L.F. amplifier	150–200	-2 to -3



MHL 4, Medium Magnification, 15/-

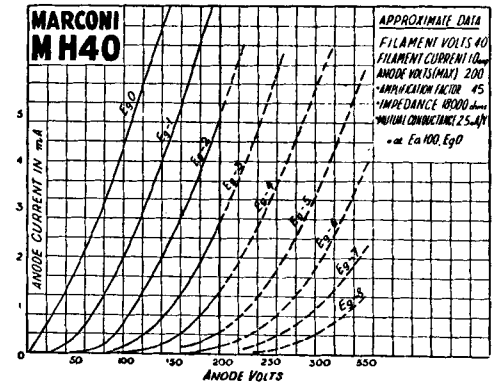
Marconi MHL.4 is a medium impedance valve used as detector, first L.F. amplifier, or oscillator. In general it will be followed by transformer coupling. May also be employed in neutralised H.F. stages.

MHL.4 is available with metallised bulb if desired.

Approximate Operating Data.

Circuit.	Anode Volts.	Grid Bias.
Grid Leak Det.	50–100	0 to $+1\frac{1}{2}$
Anode Bend Det.	100–200	-6 to -12
L.F. Amplifier.	150–200	$-4\frac{1}{2}$ to -6

Marconi Valves for Special Uses



Dimensions : 125×51 mm. 5 pin base.

Price **5O/-**

Marconi MH40

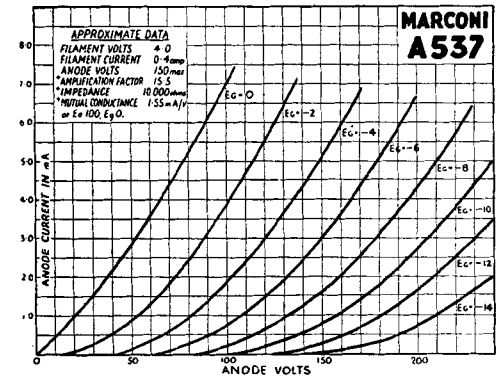
Low Noise Level Triode

MH40 is intended for the early stages of high gain amplifiers. A rigid electrode system with special steatite insulators ensures a consistently low order of microphony and noise, the latter approaching closely to the theoretical shot noise limit.

In general, the valve should be operated with the lowest anode current possible, consistent with the gain required. MH40 is supplied in clear glass form only.

Inter-electrode capacities.

G—A	7.3μμF
A—E	4.0μμF
G—E	6.0μμF



Dimensions : 77×29 mm.

Special side contact base, and grid to top of bulb.

Price **5O/-**

Marconi A537

Small Low Noise Level Triode

A537 is a low noise level valve designed for use in microphone sound heads, where size and filament current are considerations.

When the subsequent gain is very high ; and low frequencies are transmitted, the filament should be heated by an accumulator or smoothed D.C. at 4 volts, in order to avoid hum. This also applies to MH40.

A suitable working point is at anode volts 50, grid bias 1.75 volts.

Inter-electrode capacities.

G—A	1.7μμF
G—E	1.4μμF
A—E	1.5μμF

Marconi MHD4

Double Diode Triode.

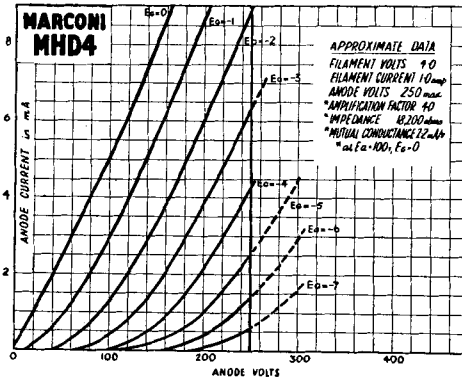
Marconi MHD4 is intended for detection, A.V.C. and L.F. amplification in straight or super-het receivers.

Nominal rating, see curve.

Inter-electrode capacities

(*metallised valve*)

G—A	3.8$\mu\mu$F
G—E	2.4$\mu\mu$F
A—E	4.7$\mu\mu$F
G—each diode	0.15$\mu\mu$F
Diodes—E	12.7$\mu\mu$F



Dimensions : 125×44.5 mm. 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

H.T. voltage	350	250	250	250	
Anode load resistance ...	50,000	50,000	50,000	50,000	ohms
Bias resistance	400	750	400	750	ohms
Anode current	4.0	3.2	2.8	2.2	mA
Voltage output (R.M.S.) ...	34	21	25	15	

Notes.

The high amplification factor of MHD4 allows good gain to be obtained with R.C. coupling, but its impedance is moderate so that transformer coupling can be used with success where extra gain is required.

Price - - 9/6

Marconi D41

Double Diode.

A double diode having a 4 volt 0.3 amp. heater, suitable for use with the A.C. or Universal range.

5 pin base.

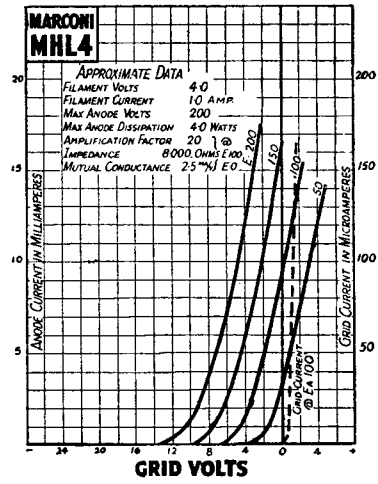
Dimensions : 100×35.5 mm.

Inter-electrode Capacities

(*metallised valve*).

D_1—E	3.5 $\mu\mu$F
D_2—E	2.5$\mu\mu$F
D_1—D_2	0.5$\mu\mu$F

Price 5/6



Marconi MHL4

Triode

Marconi MHL4 is a medium impedance triode used as audio frequency amplifier, phase reversing valve, oscillator, etc. In general, its chief use lies in stages where the M valve of the MH41 or MH4 is too high for the circuit requirements. Bias resistance 850 ohms.

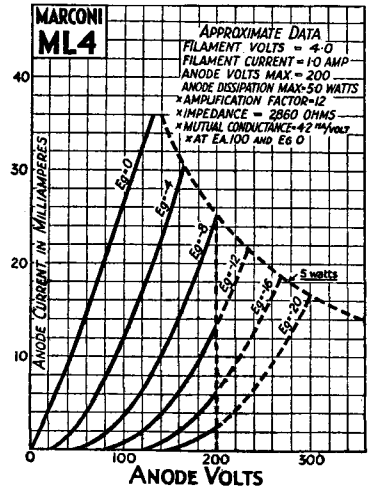
Interelectrode capacities

(metallised valve).

G—E	4.27$\mu\mu$F
G—A	3.37$\mu\mu$F
A—E	1.8$\mu\mu$F

Dimensions : 115 × 44.5 mm.
5 pin base.

Price **7/6**



Marconi ML4

Triode

Marconi ML4 is a small power output valve. Its chief use is as a driver in large power amplifiers. Other uses are oscillator and valve voltmeter (for L.F. only).

As an output valve the bias resistance should be 650 ohms and the optimum load 7000 ohms.

Inter-electrode capacities.

G—E	7.2$\mu\mu$F
G—A	6.3$\mu\mu$F
A—E	4.5$\mu\mu$F

Dimensions : 115 × 44.5 mm.
5 pin base.

Price **10/-**

Marconi MKT4

(replaces MPT4)

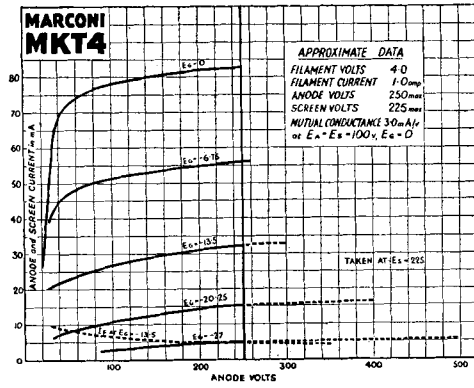
Output Tetrode

Marconi MKT4 is a suitable output valve for all A.C. receivers where medium power is required with high efficiency.

Nominal rating, see curve.

Inter-electrode capacities.

A—G	0.8μμF
G—E	11.0μμF
A—E	9.1μμF



Dimensions : 118×45 mm. 5 or 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

Single Valve, Class A.

Anode voltage	250	250
Screen voltage	200	225
Grid bias	−10.5	−13.5
Anode current	32	32
Screen current	4.0	5.0
Power output	2.5 watts	3.2 watts
Optimum load	8000 ohms.	7000 ohms.
Bias resistance	270 ohms.	360 ohms.

Two Valves, Class AB₁

Anode voltage	250
Screen voltage	225
Grid bias	−15
Anode current, per pair	64 mA
Screen current, per pair	12 mA full drive
Power output	6.5 watts
Optimum load	11,000 ohms
Common bias resistance	200 ohms

Notes.

There is some variation in screen current with signals and for maximum output it is therefore desirable to feed the screen from a potentiometer instead of a series resistance. In practice the feed to the earlier stages can be made to take the place of the lower element. The total resistance in the grid cathode path should not exceed 0.5 megohm.

Price - - 10/6

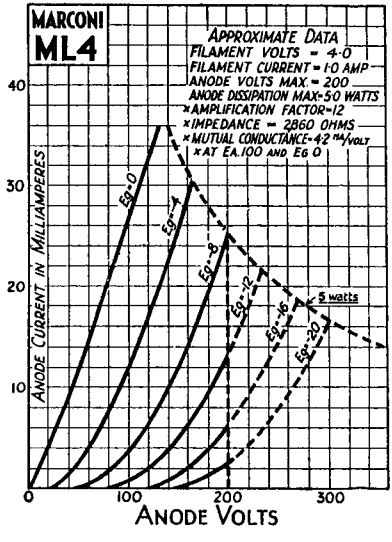
ML 4, Low Magnification, 17/6

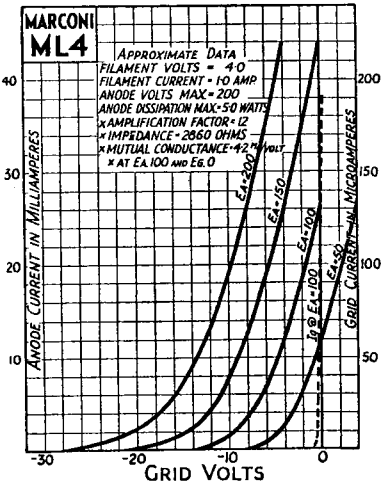
ML.4 is a low impedance valve for use as a small output valve, initial L.F. amplifier, or oscillator. The high conductance provides a considerable stage gain, so that ML.4 can be recommended where sensitivity is required without the use of a pentode. The output is sufficient for average domestic volume with a moving iron speaker.

Approximate Operating Data.

Anode Volts.	Grid Bias.	Anode Current.
100	—4	12 m.a.
150	—6	18 m.a.
200	—8	25 m.a.

Anode Volts—
Anode Current curve for ML 4.





Ignitron *Type MPS 1A*

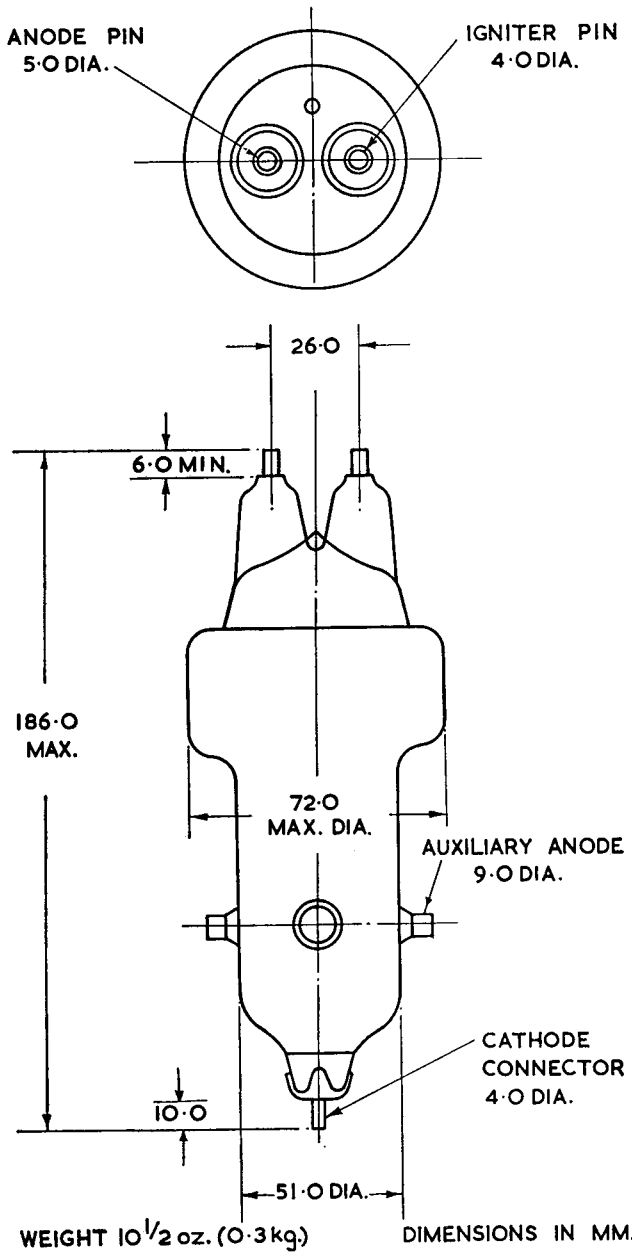
General. The Type MPS 1A is a mercury-pool ignitron, employing an electrostatic ignition electrode. It is fitted with a main anode and four auxiliary anodes. The main anode is screened from the cathode by a metal shroud which is connected to the ignition electrode. The cathode is a mercury-pool into which the ignition electrode dips. The area of the insulated surface of the ignition electrode in contact with the mercury meniscus is large, in order to ensure regular ignition and long life in the presence of a film of contamination which is apt to develop on the surface of the mercury in this type of tube after many hundreds of hours of use. The valve is of compact design and is mounted in a hard glass envelope.

The MPS 1A, in addition to its use as a mercury-pool switch (in which it functions as a relay through which energy is provided for the operation of the main anode and auxiliary circuits) may also be employed as a grid controlled rectifier for forward voltages up to 6 kV.

IMPORTANT NOTE

The mercury switch, by nature of its design, is unsuited to ordinary methods of transport. In order to ensure against mechanical damage the following points must be rigidly observed:

1. The switch is normally packed inverted in a sprung crate. No alteration to this packing must be made and the crate must always remain in an upright position.
2. During transport the crate must not be subjected to severe vibration or shocks.
3. When the switch is unpacked it must be inverted to obtain its operating position. When this is done mercury will flow to the opposite end of the switch, and care must be taken to see this is done slowly to prevent damage to the ignitor electrode through violent contact.



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

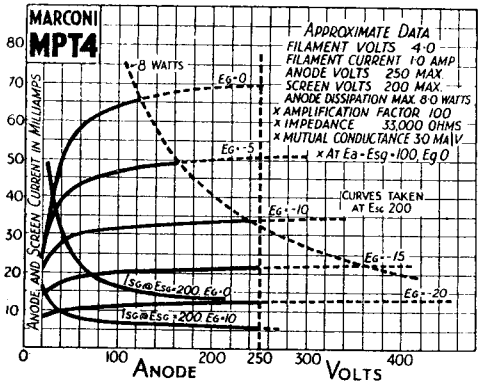
Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

APPROXIMATE DATA

PFV	6	kV
PIV	6	kV
$V_{(ign)(pk)}$ for T_{amb} 15-50°C	9·5	kV
for T_{amb} 20-50°C	8	kV
Permissible negative ignitor voltage	1	kV
I_{pk} (normal)	500	A
$I_{r.m.s.}$ (normal)	1	A
Normal duty factor	2×10^{-3}	
Maximum permissible duty factor (at 1,000 A pk)	$0{\cdot}625 \times 10^{-3}$	

PRINTED IN ENGLAND

MARCONI A.C. MAINS VALVES



MPT 4, Pentode, 25/-

Marconi MPT.4 is a new high efficiency indirectly heated pentode giving a large output with a comparatively small input to the grid. It is an ideal output valve for three or four valve receivers having only one low frequency stage, and will operate moving coil or medium impedance moving iron speakers equally well.

Approximate Operating Data.

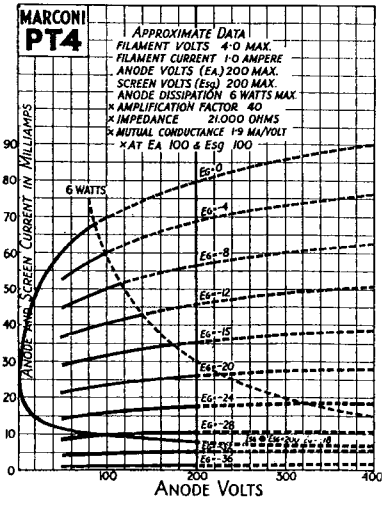
Anode Volts.	Screen Volts.	Grid Bias.	Anode Current.	Screen Current.
250	200	—10.5	32 m.a.	5.5 m.a.

PT 4, Pentode, 25/-

Marconi PT.4 is a medium size directly heated pentode having slightly less output than MPT.4, and recommended where an indirectly heated valve cannot be used.

Approximate Operating Data.

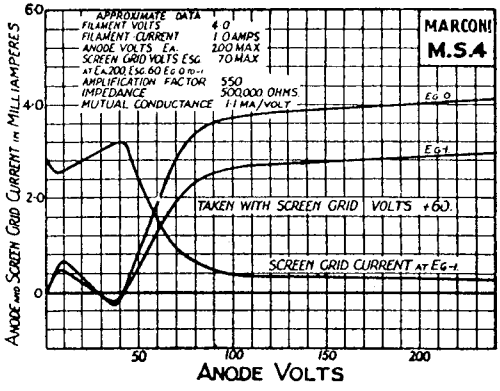
Anode Volts.	Screen Volts.	Grid Bias.	Anode Current.	Screen Current.
200	200	—18	30 m.a.	7.5 m.a.



MS 4, Screen Grid, 22/6

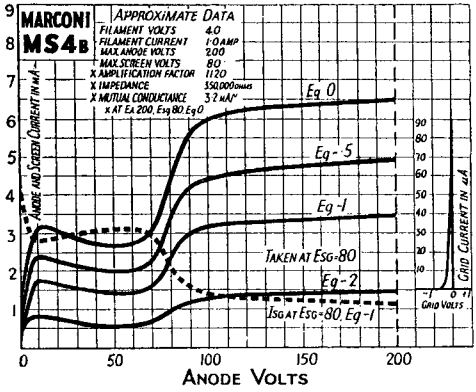
Marconi MS.4 is a "general purpose" screen grid valve for universal use. Possessing an extremely low capacity—less than .002 micro-microfarad — it ensures stable amplification where high conductance valves will not operate, as in many circuits with more than one H.F. stage.

MS.4 is available with metallised bulb if desired.



Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.
150–200	50–60	$-1\frac{1}{2}$ to -3



MS4B, Screen Grid, 22/6

Marconi MS4B is a high conductance screen grid valve especially designed for maximum amplification in single H.F. stage receivers, or in multi-stage circuits where very careful stabilising and screening is used.

MS4B is available with metallised bulb if desired.

Approximate Operating Data.

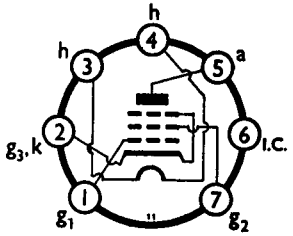
Anode Volts.	Screen Volts.	Grid Bias.
50–100	60–80	—1 to —2

MINIATURE
OUTPUT PENTODE
0·1A INDIRECTLY HEATED

N108

APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	64—70	mm.
Seated length :	58—64	mm.
Max. diameter :	19	mm.

RATING

Pentode Connection

I_h	0·1		A
V_h	40	approx.	V
v_{h-k} (pk)	150	max.	V
V_a	165	max.	V
V_{g2}	165	max.	V
p_a	9	max.	W
p_{g2}	3	max.	W
μ	220		
r_a	23·2		kΩ
g_m	9·5		mA/V

at V_a, $= V_{g2} = 165$, $V_{g1} = -9$

Triode Connection

$V_{a,\,g2}$	165	max.	V
$p_{a,\,g2}$	12	max.	W
μ	10		
r_a	835		Ω
g_m	12		mA/V

at $V_{a,\,g2} = 165$, $V_{g1} = -9$

CAPACITANCES (of unscreened valve) :

$c_{a\text{-all}}$ 10 pF $c_{g1\text{-all}}$ 10 pF $c_{a\text{-}g1}$ 0·3 pF

TYPICAL OPERATION

Single Valve. Class A, Pentode Connection

% full input	45	100	100	75	50	%
V_a	100	150	165	165	165	V
V_{g2}	100	150	165	165	165	V
V_{g1} (approx.)	−4·6	−7·8	−9·3	−10	−11·4	V
I_a (o)	39	56	53	40	29	mA
I_{g2} (o)	6·5	9·5	9	7·2	5·4	mA
R_k	100	120	150	220	330	Ω
v_{in} (pk)	5	7	8·5	6·7	4·7	V
R_L	2·5	3	3	4	6	kΩ
P_{out}	1·45	3·5	4·1	2·84	2·3	W
D	8·6	11	10	10	10	%

The conditions given in the last two columns are those obtained when the valve is over-biased. They are useful when H.T. power is limited and reduced power output can be tolerated.

Two Valves. Push-pull, Class AB_1, Pentode Connection

Data per pair unless otherwise stated.

V_a	100	165	200	250	V
V_{g2}	100	165	165	165	V
V_{g1} (approx.)	−5	−11·9	−10	−11·2	V
I_a (o)	70	107	87	66	mA
I_a (max. sig.)	73	110	100	80	mA
I_{g2} (o)	12	18	14	10	mA
I_{g2} (max. sig.)	15	36	25	24	mA
R_k (per valve)	120	150	200	300	Ω
v_{in} (pk) (g_1-g_1)	11	20	25	30	V
R_L (a−a)	3	3	4·5	7·5	kΩ
P_{out}	2·25	9	11·5	13·3	W
D	3·3	4·6	4	4·5	%

Two Valves. Push-pull, Class AB_1, Triode Connection

Data per pair unless otherwise stated.

$V_{a,g2}$	165	V
V_{g1} (approx.)	−10·5	V
$I_{a,g2}$ (o)	65	mA
$I_{a,g2}$ (max. sig.)	74	mA
R_k (per valve)	330	Ω
v_{in} (pk) (g_1-g_1)	24	V
R_L (a−a)	3	kΩ
P_{out}	2·6	W
D	1·4	%

GRID RESISTOR

The maximum permissible D.C. resistance from control grid to cathode is limited to 0·27 MΩ ±20% for auto-bias and 0·1 MΩ for fixed bias applications.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

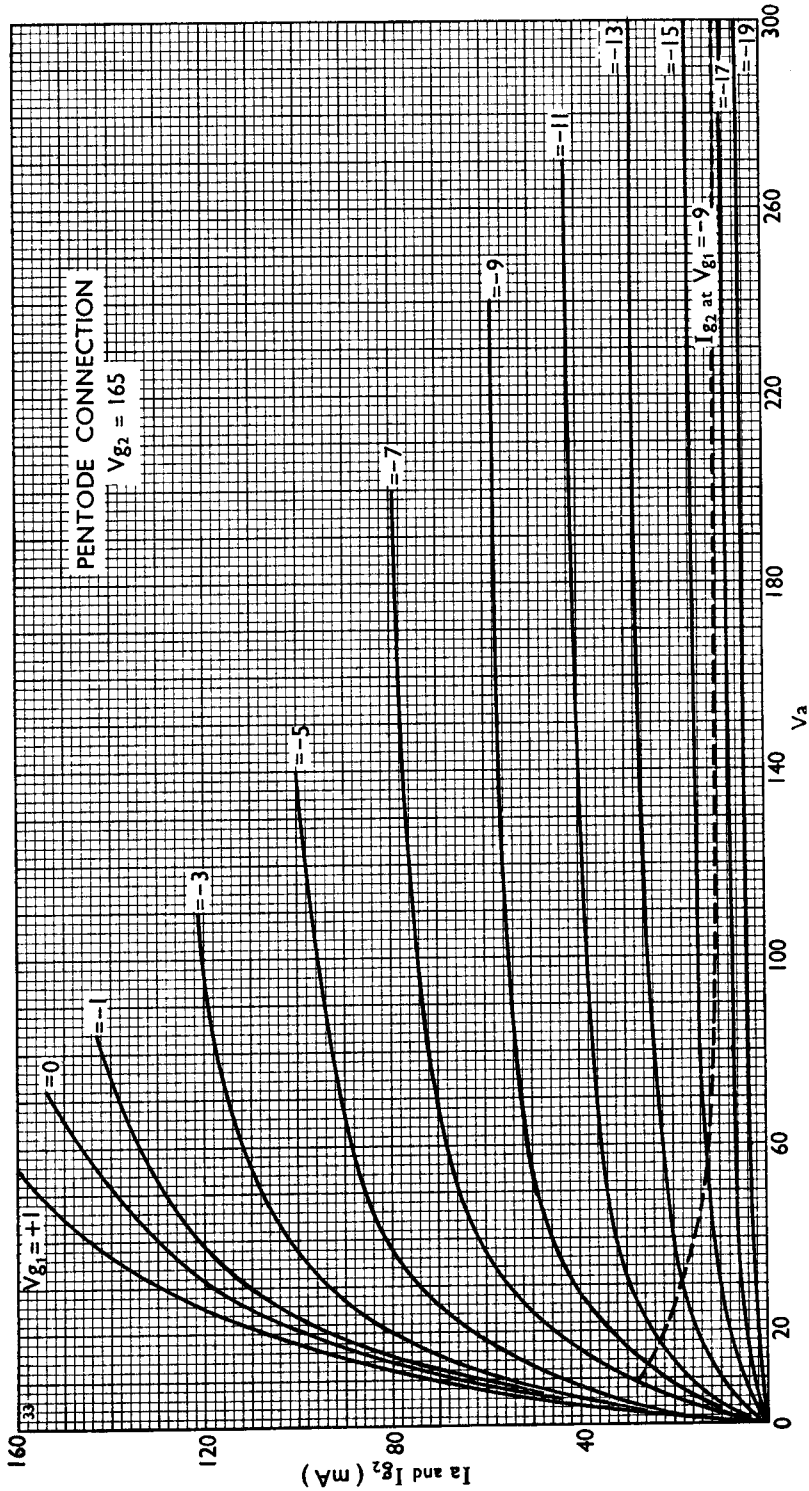
The use of a retaining device is recommended.

VENTILATION

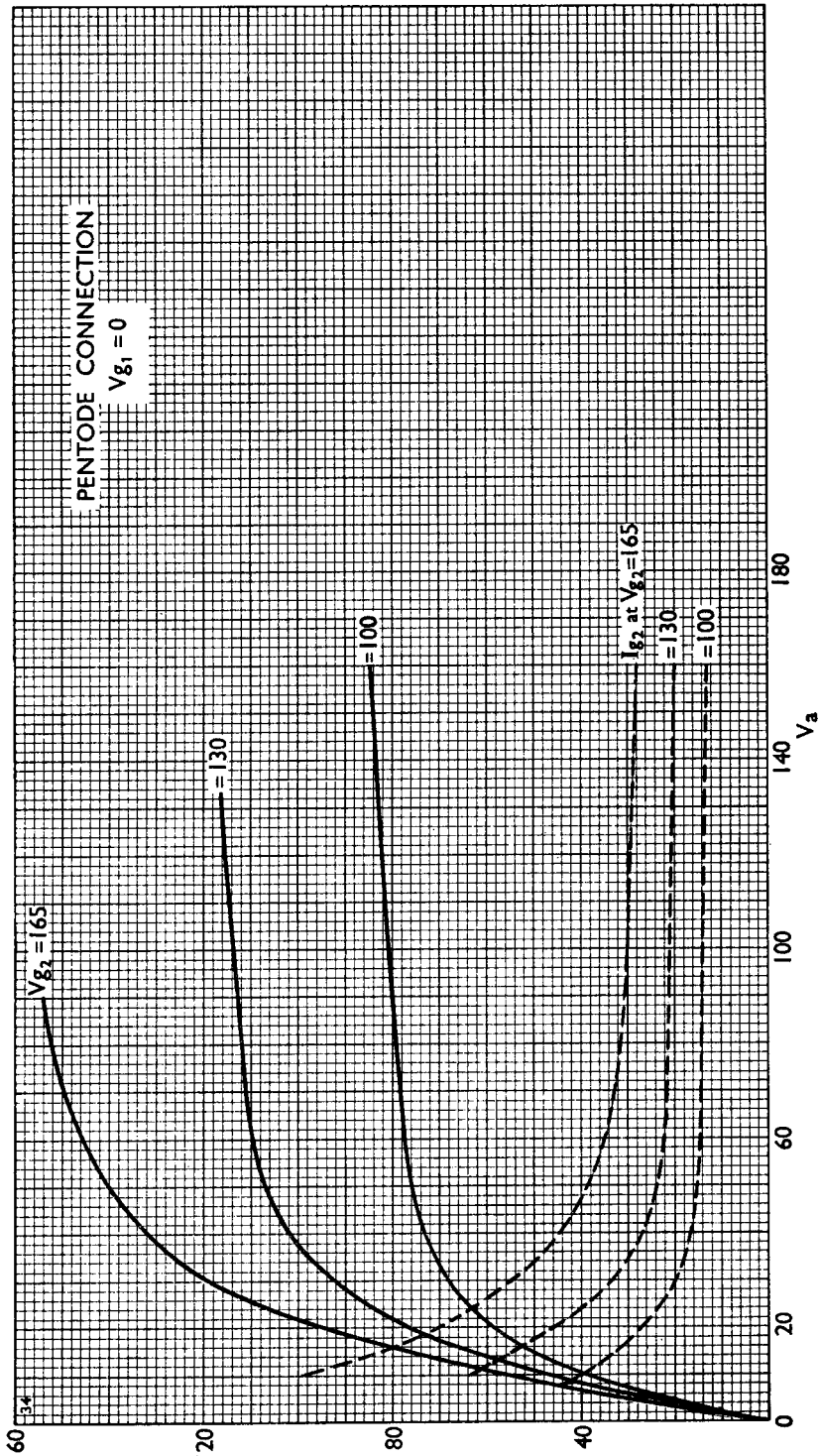
Free air circulation around the bulb is preferable. If a retaining device in the form of a canister is employed, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

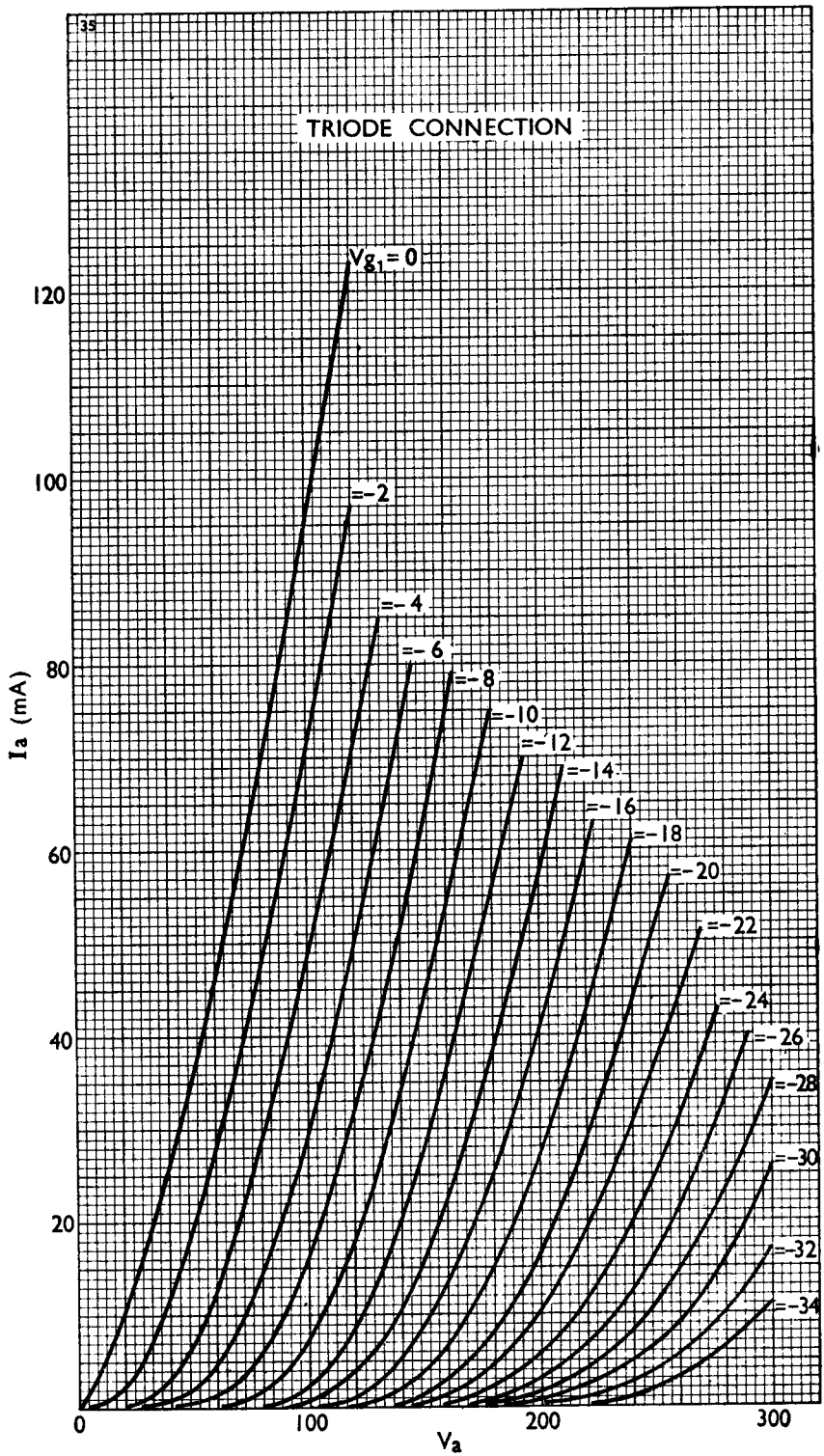
MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

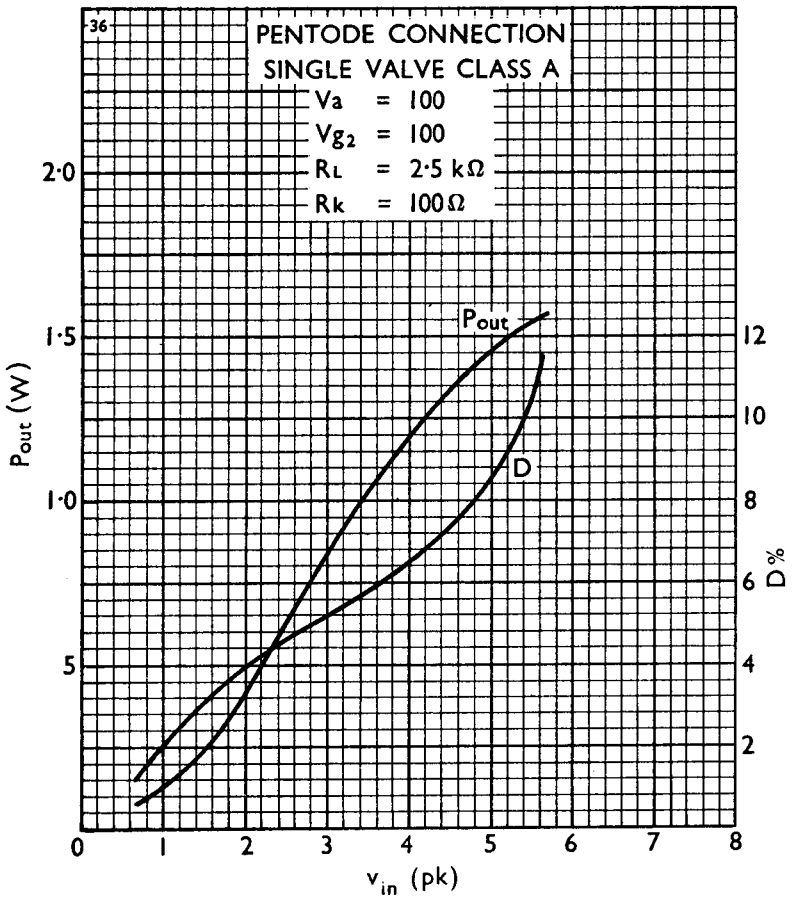

PENTODE CONNECTION
V_{g2} = 165
V_{g1} = +1
=0
=-1
=-3
=-5
=-7
=-9
=-11
=-13
=-15
=-17
=-19
I_{g2} at V_{g1} = -9
Ia and I_{g2} (mA)
Va
0
20
40
60
80
100
120
140
160
180
220
260
300
33

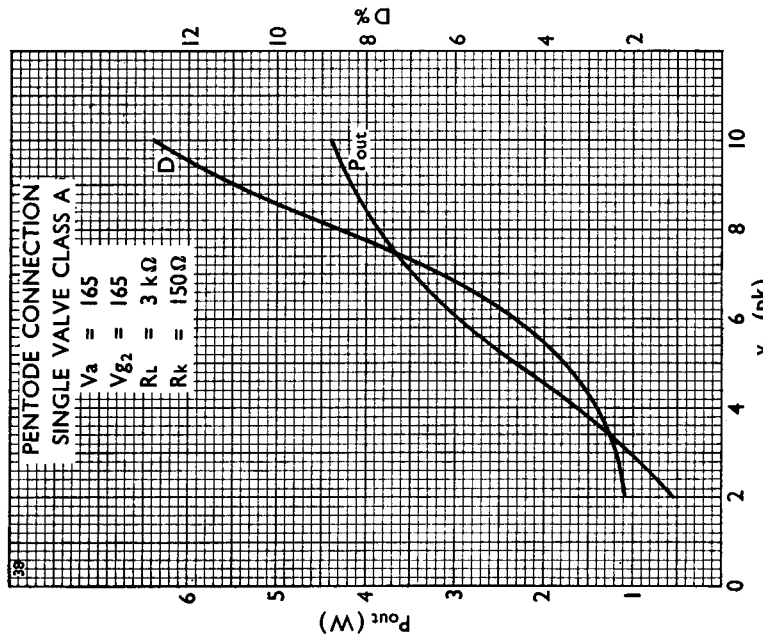
N108

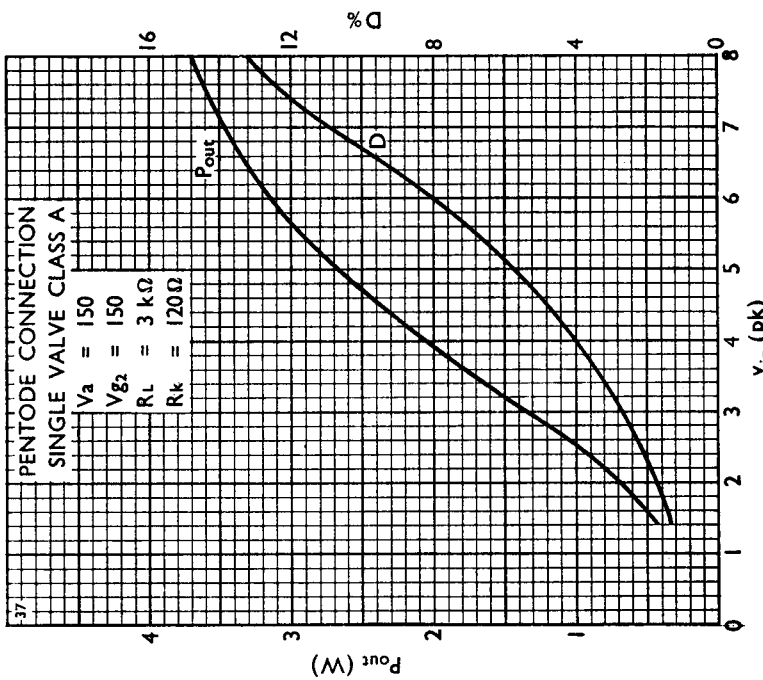

PENTODE CONNECTION
$V_{g_1} = 0$
$V_{g_2} = 165$
= 130
= 100
I_{g_2} at V_{g_2}=165
= 130
= 100
I_a and I_{g_2} (mA)
V_a
160
120
80
40
0
20
60
100
140
180


35
TRIODE CONNECTION
$V_{g_1} = 0$
=-2
=-4
=-6
=-8
=-10
=-12
=-14
=-16
=-18
=-20
=-22
=-24
=-26
=-28
=-30
=-32
=-34
120
100
80
60
40
20
0
100
200
300
Ia (mA)
Va

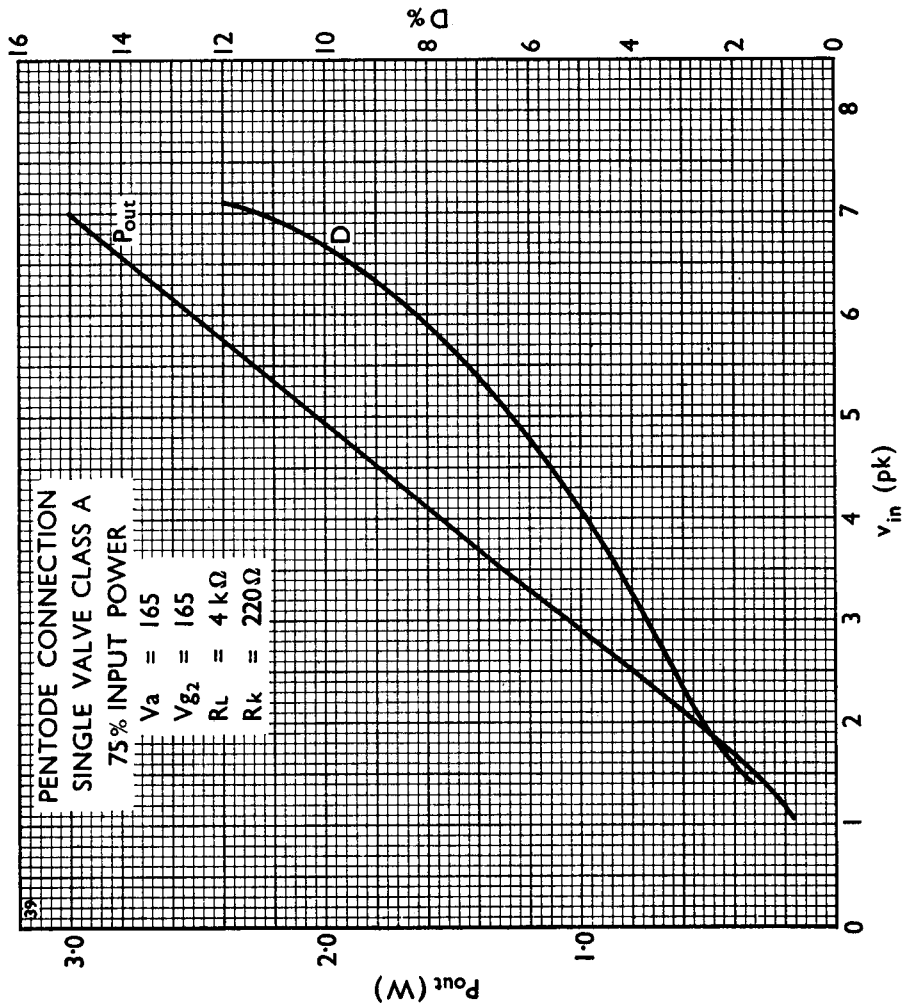
N108

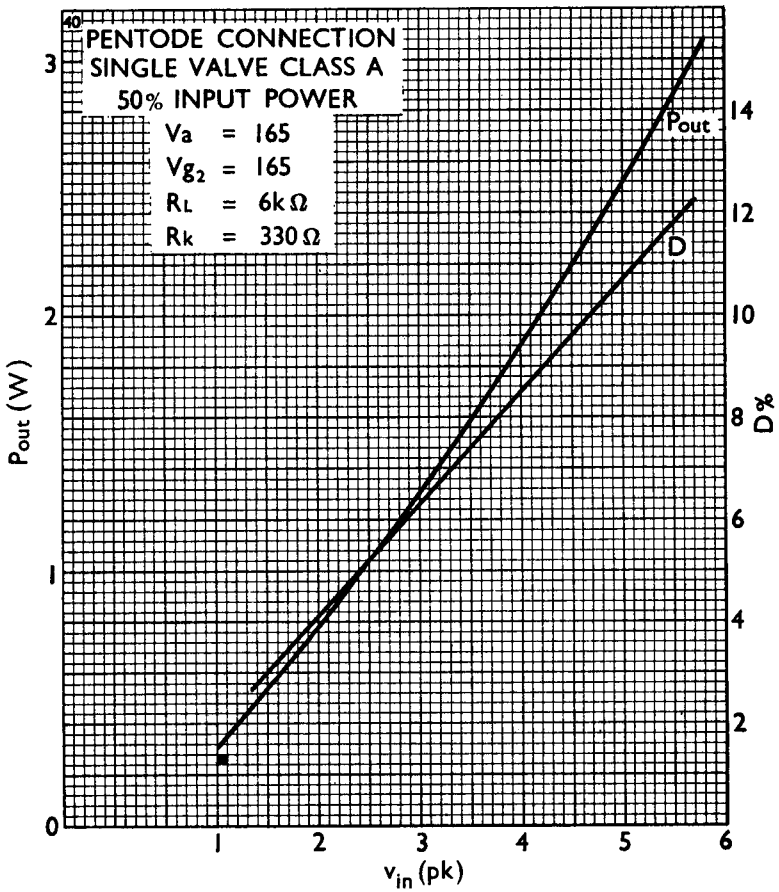

36
PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 100
Vg2 = 100
RL = 2·5 kΩ
Rk = 100Ω
Pout
D
Pout (W)
D %
vin (pk)
2·0
1·5
1·0
5
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8


PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 165
Vg2 = 165
RL = 3 kΩ
Rk = 150Ω
D
Pout
D%
Pout (W)
Vin (pk)
38

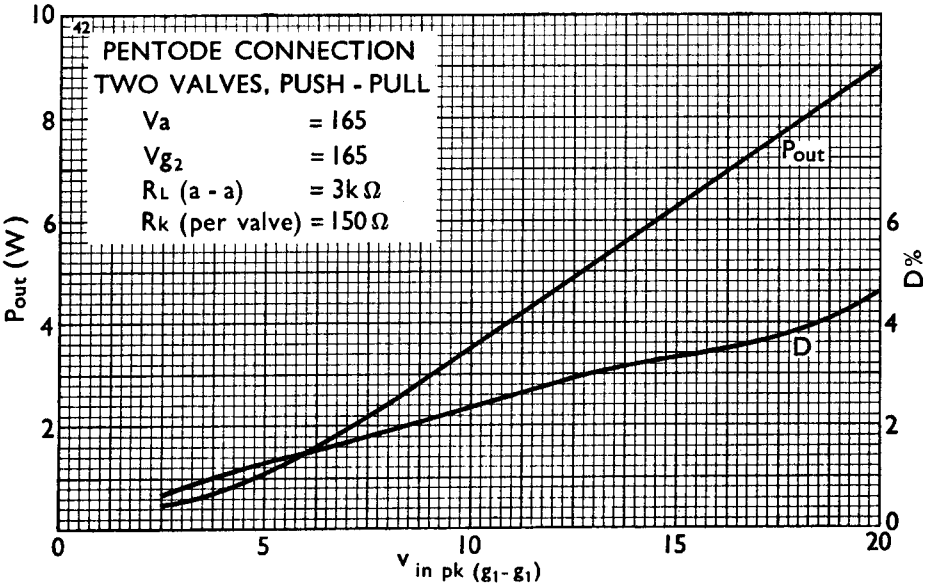

PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 150
Vg2 = 150
RL = 3 kΩ
Rk = 120Ω
Pout
D
D%
Pout (W)
Vin (pk)
37

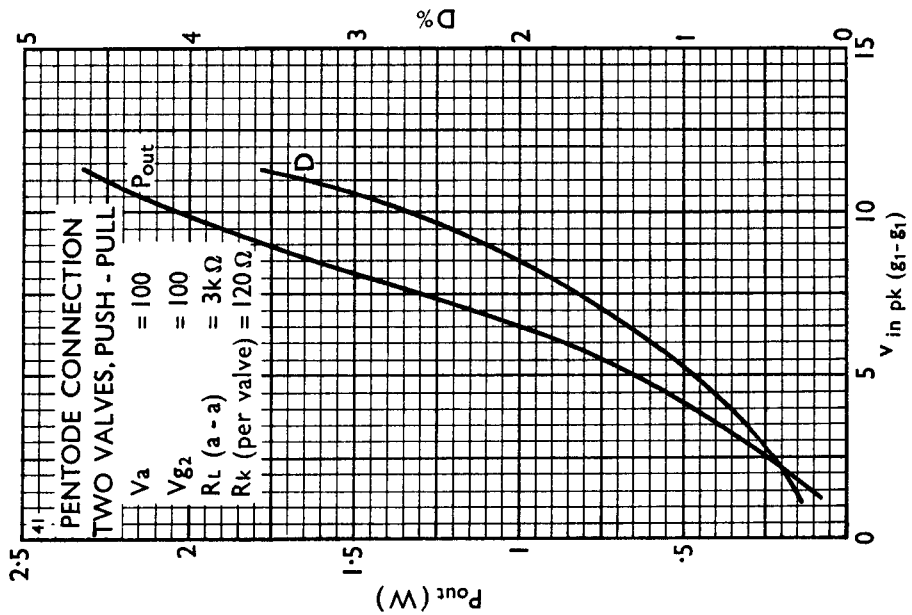
N108

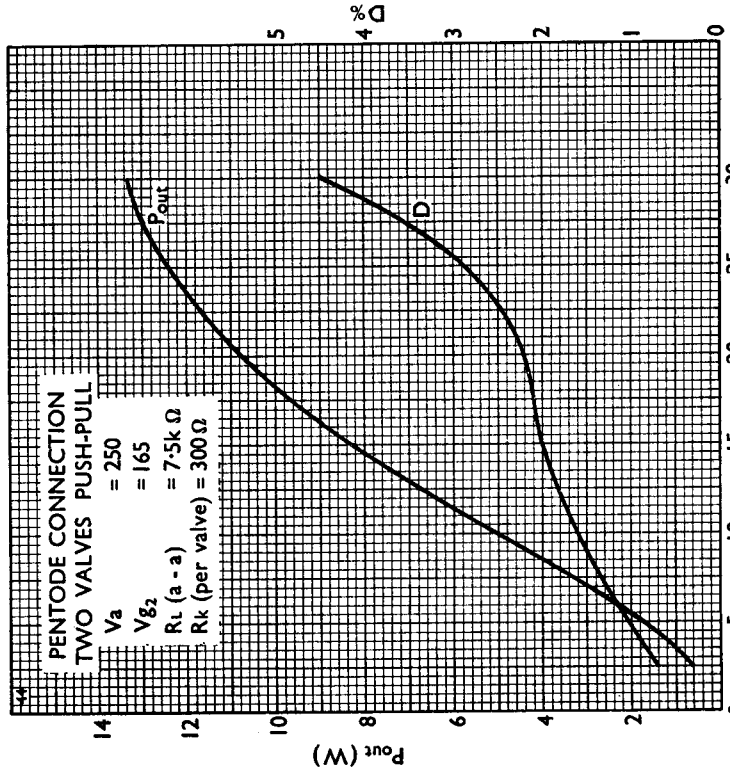

PENTODE CONNECTION
SINGLE VALVE CLASS A
75% INPUT POWER
Va = 165
Vg2 = 165
RL = 4 kΩ
Rk = 220Ω
Pout
D
Pout (W)
D %
Vin (pk)
3·0
2·0
1·0
16
14
12
10
8
6
4
2
0
0
1
2
3
4
5
6
7
8
39

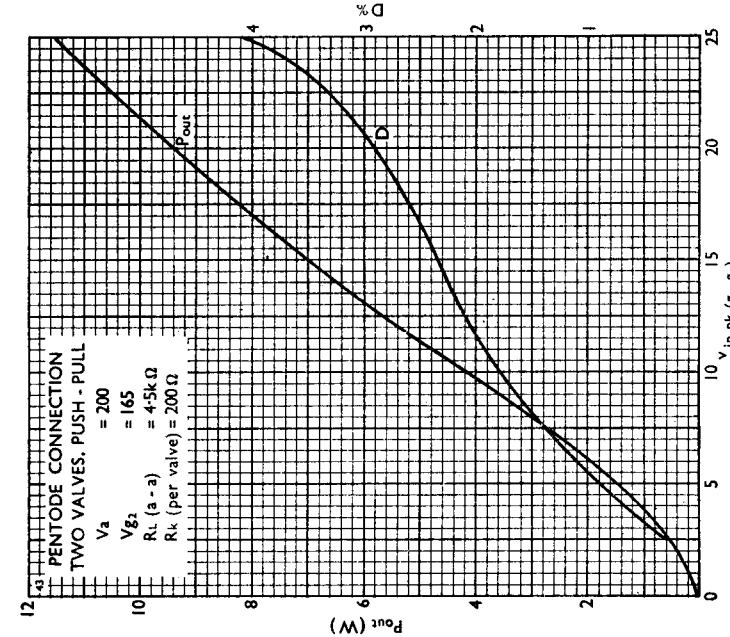

PENTODE CONNECTION
SINGLE VALVE CLASS A
50% INPUT POWER
Va = 165
Vg2 = 165
RL = 6kΩ
Rk = 330Ω
Pout
D
Pout (W)
D%
vin (pk)
0
1
2
3
4
5
6
2
4
6
8
10
12
14

N108

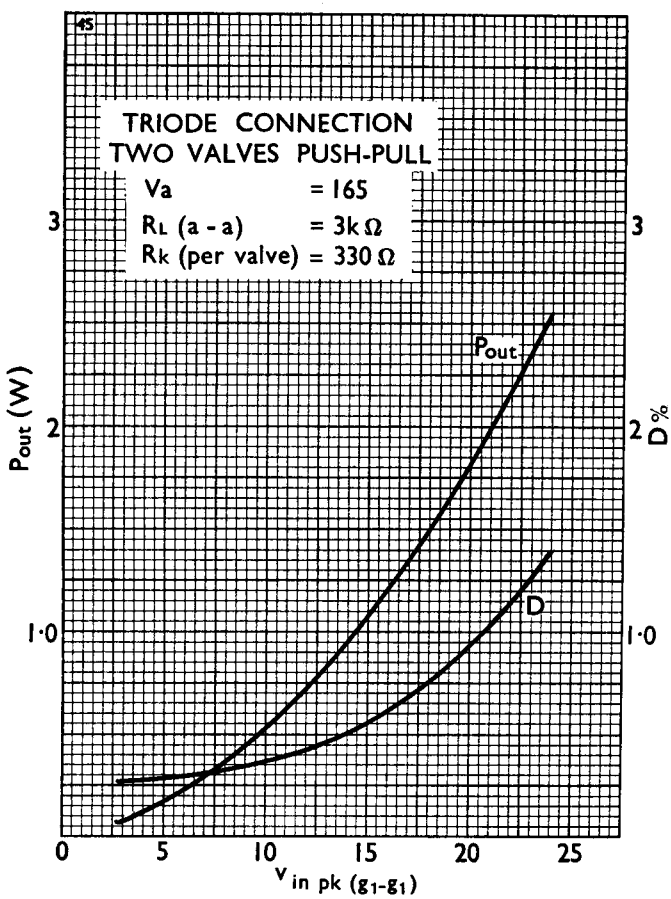

42
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 165
Vg2 = 165
RL (a - a) = 3kΩ
Rk (per valve) = 150Ω
Pout
D
Pout (W)
D%
v in pk (g1-g1)
0
2
4
6
8
10
5
15
20


41
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 100
Vg2 = 100
RL (a - a) = 3kΩ
Rk (per valve) = 120Ω
Pout
D
D%
Pout (W)
v in pk (g1-g1)
0
1
2
3
4
5
·5
1·5
2·5
10
15


PENTODE CONNECTION
TWO VALVES PUSH-PULL
Va = 250
Vg2 = 165
RL (a - a) = 7·5k Ω
Rk (per valve) = 300 Ω
Pout
D
Pout (W)
D%
Vin pk (g1-g1)


PENTODE CONNECTION
TWO VALVES. PUSH - PULL
Va = 200
Vg2 = 165
RL (a - a) = 4·5k Ω
Rk (per valve) = 200 Ω
Pout
D
Pout (W)
D%
Vin pk (g1-g1)

N108



Printed in England. C.

OUTPUT PENTODE

N17

JULY, 1956

DESCRIPTION

Type N17 is a miniature output pentode fitted with a centre-tapped filament for series or parallel operation. The valve is interchangeable with the American type 3S4.

RATINGS

	Series	Parallel	
Filament Voltage	2·8	1·4	volts
Filament Current	0·05	0·10	approx. amp
Anode Voltage	90	90	max. volts
Screen Voltage	67·5	67·5	max. volts
Cathode Current, no load†	4·5	4·5	max. mA
Cathode Current, full load†	5·5	5·5	max. mA
Mutual Conductance*	1·425	1·575	mA/V

* measured at Va = 90 ; Vg_2 = 67·5 ; Vg_1 = –7.

† for each 1·4v. filament section.

Capacitances (taken on valve with external screening) :

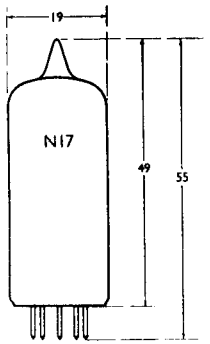
Control Grid to all other electrodes	5·2	approx. pF
Anode to all other electrodes	4·6	,, ,,
Anode to Control Grid	0·35	,, ,,

OPERATING CONDITIONS

Class A Amplifier

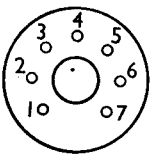
	Series		Parallel		
Anode Voltage	90	67·5	90	67·5	volts
Anode Current, no load	6·1	6·0	7·4	7·2	mA
Screen Voltage	67·5	67·5	67·5	67·5	volts
Screen Current, no load	1·1	1·2	1·4	1·5	mA
Control Grid Voltage	–7	–7	–7	–7	volts
Input Signal Voltage	7	7	7	7	peak volts
Anode Load Resistance	8,000	5,000	8,000	5,000	ohms
Distortion	13	12	12	10	%
Power Output	235	160	270	180	mW

DIMENSIONS



All dimensions are in mm and are the maximum except where otherwise stated.

BASE



View looking on underside of base

B7G

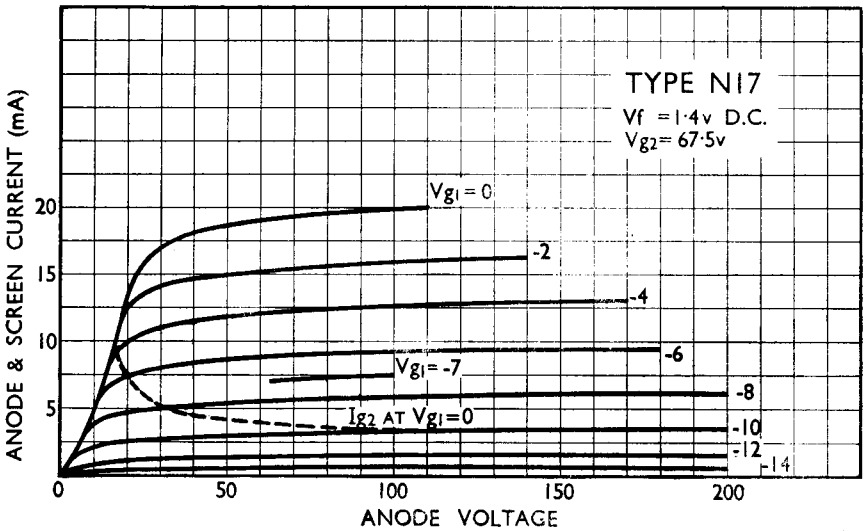
Pin 1 : Filament (–series)
2 : Anode
3 : Control Grid, g_1
4 : Screen Grid, g_2
5 : Filament (–parallel)
6 : Anode
7 : Filament (+)

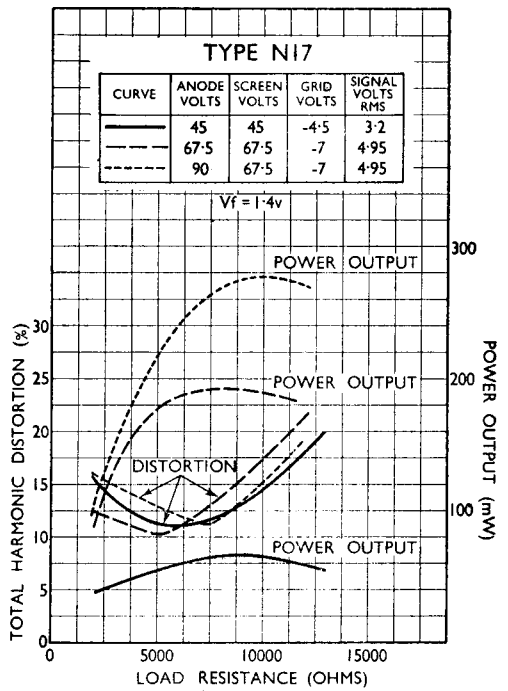
For parallel operation use pins 1 and 7 strapped, and 5.

For series operation use pins 1 and 7 only.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 Telegraphic Address: Expanse, Chelmsford





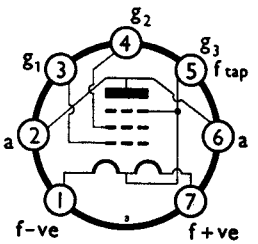
CHARACTERISTIC CURVES OF AVERAGE VALVE.

Printed in England. C.

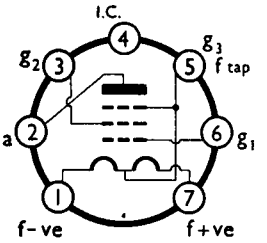
MINIATURE
OUTPUT PENTODES
1·4/2·8V DIRECTLY HEATED

N18
N19
OCTOBER, 1951

BASE CONNECTIONS AND VALVE DIMENSIONS



N18



N19

View from underside of bases.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

	Series		Parallel		
V_f	2·8		1·4		V
I_f	0·05	approx.	0·1	approx.	A
V_a	90	max.	90	max.	V
V_{g2}	90	max.	90	max.	V
*I_k	6	max.	6	max.	mA

*For each 1·4 volt filament section.

CAPACITANCES (of cold unscreened valve)

$c_{a—all}$	5·3	pF	$c_{g1—all}$	5·6	pF	$c_{a—g1}$	0·35	pF

TYPICAL OPERATION

Pentode connection :

	Series	Parallel		
V_a	90	85	90	V
V_{g2}	90	85	90	V
V_{g1}	−4·5	−5	−4·5	V
v_{in} (pk)	4·5	5	4·5	V
I_a (o)	7·7	6·9	9·5	mA
I_{g2} (o)	1·7	1·5	2·1	mA
r_a	0·12	0·12	0·1	MΩ
g_m	2	1·9	2·1	mA/V
R_a	10	10	10	kΩ
D	7	10	7	%
P_{out} (max. sig.)	240	250	270	mW

FILAMENT OPERATION

For parallel operation, pins 1 and 7 should be positive and pin 5 negative.

When operating the filament from a mains supply, the voltage should be adjusted to 1·3 per filament section or the current to 47·5 mA mean. Under certain conditions, particularly when series operated, a suitable shunt resistor will be required.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

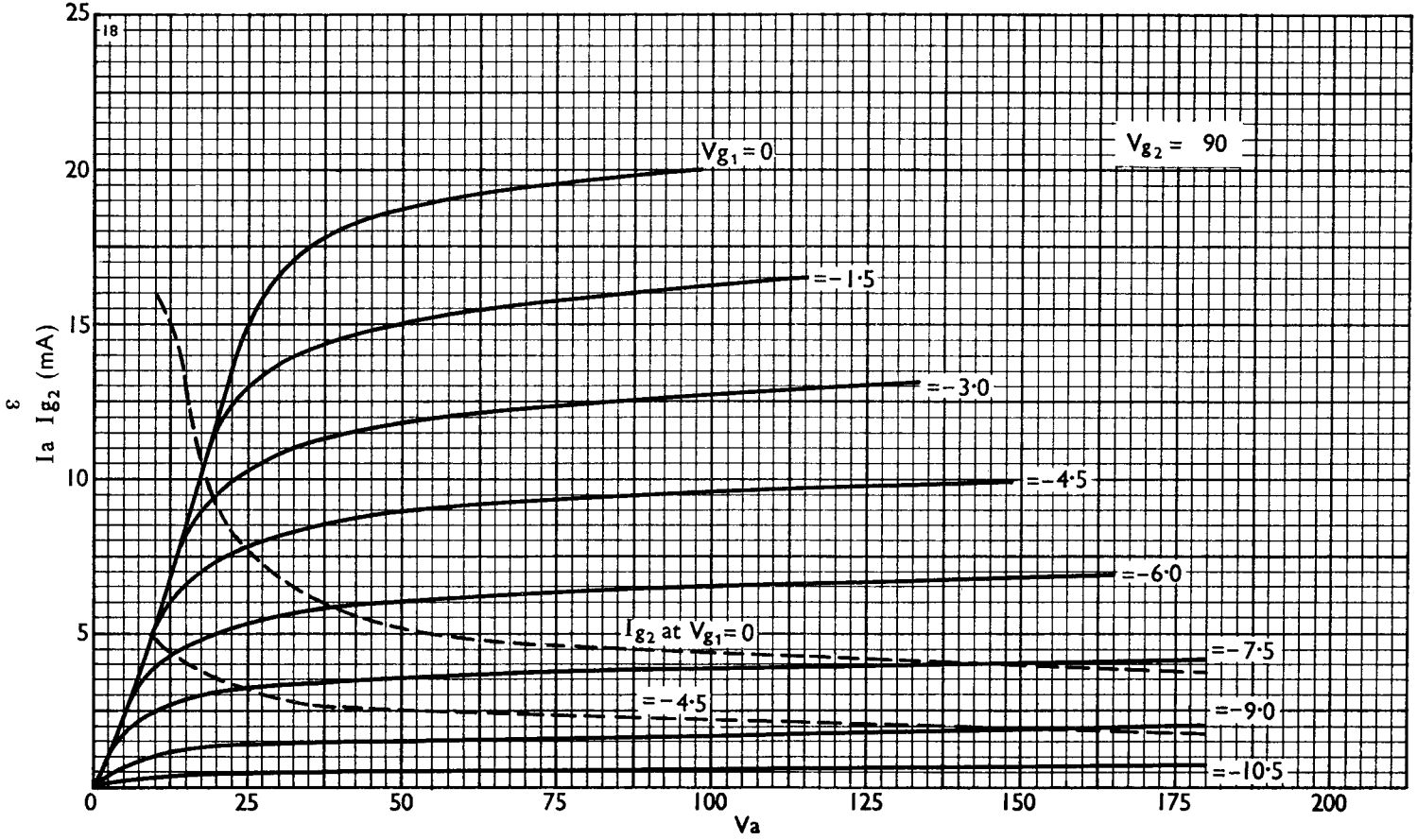
A retaining device should be used.

VENTILATION

No special precautions.

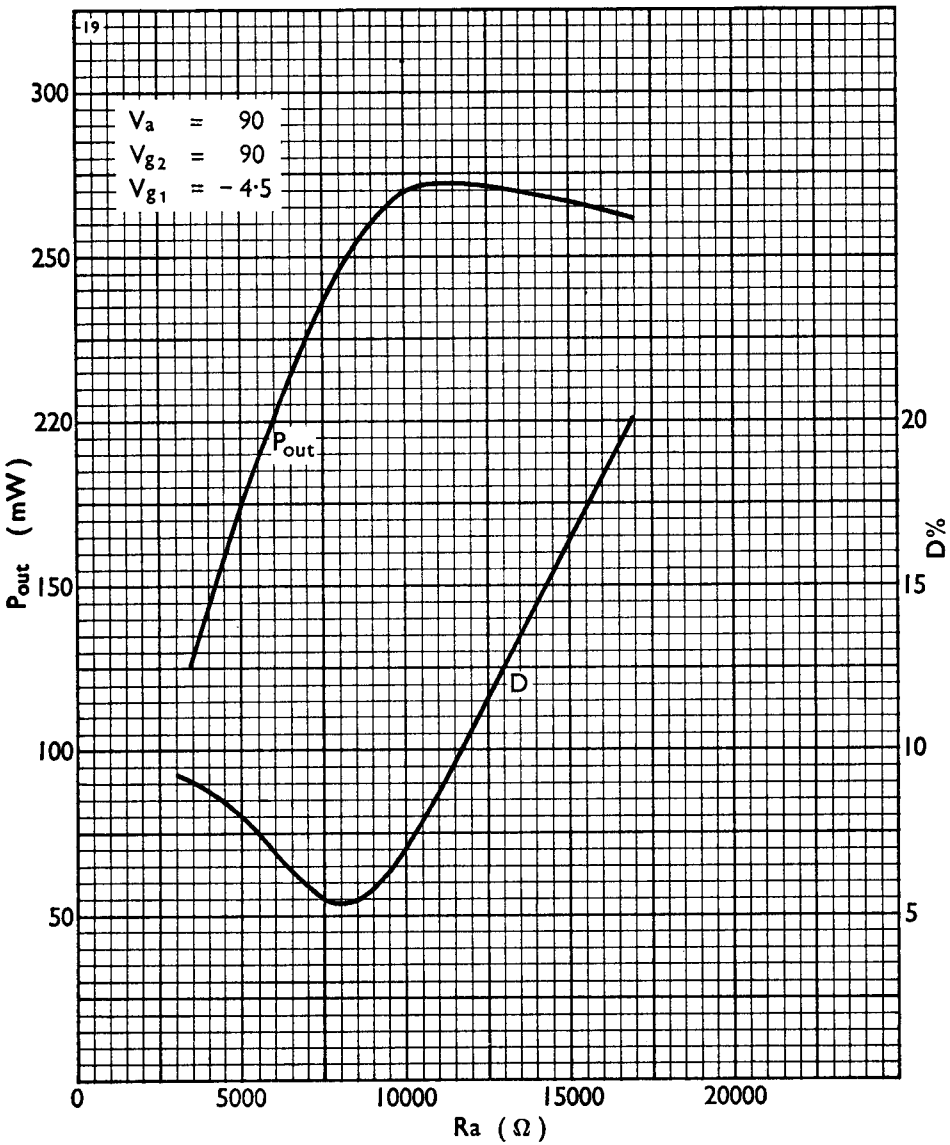
MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.


18
25
20
15
10
5
0
25
50
75
100
125
150
175
200
Va
ε
Ia Ig2 (mA)
Vg2 = 90
Vg1 = 0
=-1·5
=-3·0
=-4·5
=-6·0
=-7·5
=-9·0
=-10·5
Ig2 at Vg1 = 0
=-4·5

N18
N19

N18
N19


19
300
250
220
150
100
50
V_a = 90
V_{g2} = 90
V_{g1} = −4·5
P_{out}
D
P_{out} (mW)
D%
20
15
10
5
0
5000
10000
15000
20000
Ra (Ω)

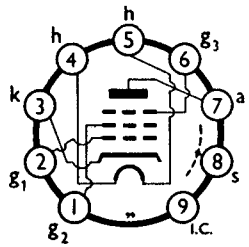
VIDEO POWER PENTODE

N309/PL83

FEBRUARY, 1956

A power pentode of high mutual conductance primarily designed for use as a video output valve in television receivers.

BASE CONNECTIONS AND VALVE DIMENSIONS



External view

Base Type : B9A
Bulb : Tubular.

Maximum Dimensions

Overall Length :	78	mm
Seated Length	72	mm
Diameter	22	mm

HEATER

I_h	0·3	A
V_h	15	V

MAXIMUM RATINGS

$V_{h\text{-}k}$	150	V
V_a	250	V
V_{g2}	250	V
p_a	9	W
p_{g2}	2	W

CHARACTERISTICS

Pentode Connection

V_a	170	200	250	V
V_{g2}	170	200	250	V
V_{g1} approx.	−2·3	−3·5	−5·8	V
I_a	36	40	36	mA
I_{g2}	5	5·5	5	mA
μ	410	450	840	
r_a	41	42	75	kΩ
g_m	10	10·7	11·2	mA/V

Triode Connection

$V_{a,\ g2}$*	170	200	V
V_{g1} approx.	−2·4	−3·4	V
$I_{a,\ g2}$	40	45	mA
μ	24	25	—
$r_{a,\ g2}$	1·92	1·84	kΩ
g_m	12·5	13·5	mA/V

* g_2 connected to anode through 100 ohms resistor.

TYPICAL OPERATION

Pentode Connection
Class A Amplifier. Single Valve

V_a	170	200	250	V
V_{g2}	170	200	250	V
V_{g1} (no sig.) approx.	−2·5	−3·0	−5·5	V
I_a (no sig.)	32	39	33	mA
I_{g2} (no sig.)	4·2	5·0	4·2	mA
r_a	5·0	5·0	5·0	kΩ
R_k	68	68	150	Ω
P_{out}	1·65	2·72	3·45	W
D	7·8	10·0	10·0	%

CAPACITANCES

Taken on an unscreened valve.

c_{in} 10·8 pF c_{out} 6 pF $c_{a\text{-}g}$ <0·1 pF

MOUNTING

Any position.

SCREENING

No internal or external screening is fitted to the valve.

RETAINING

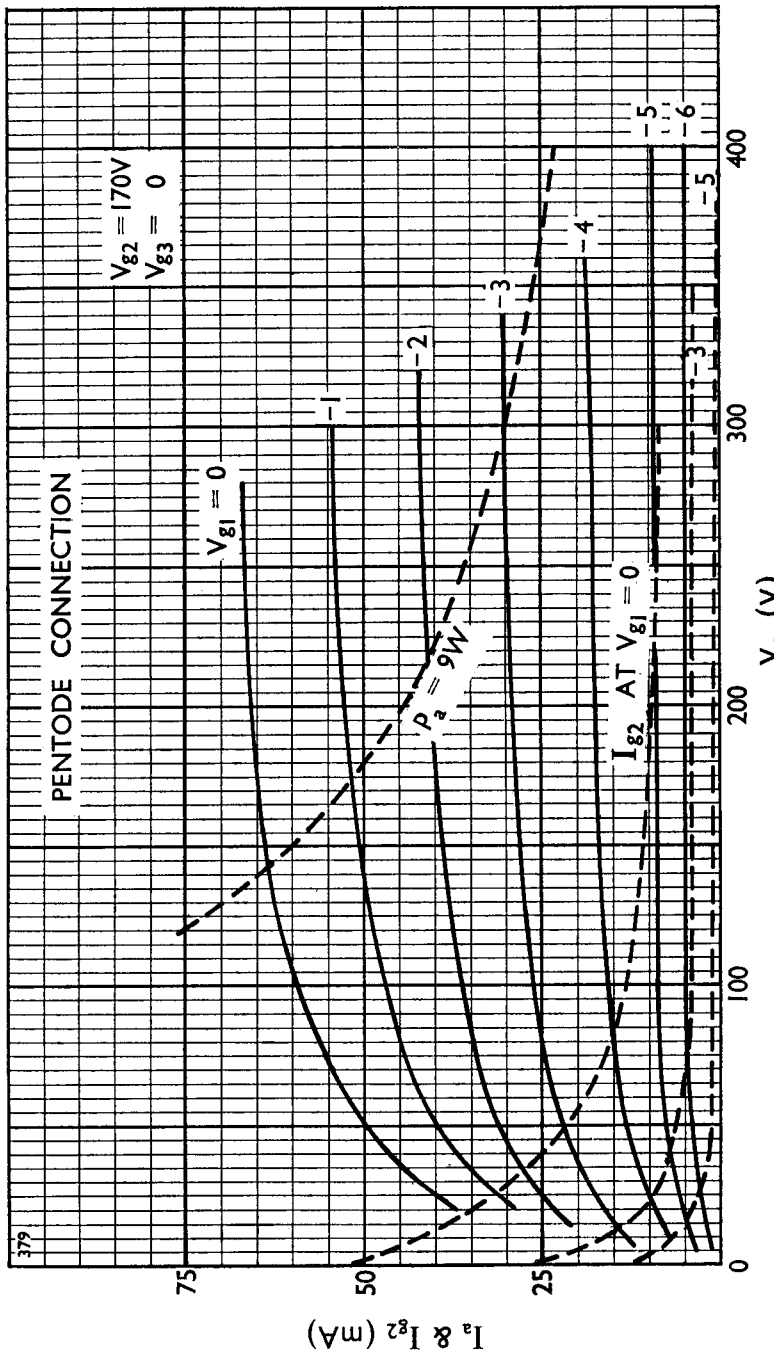
In equipment subject to vibration or shock a retainer is required.

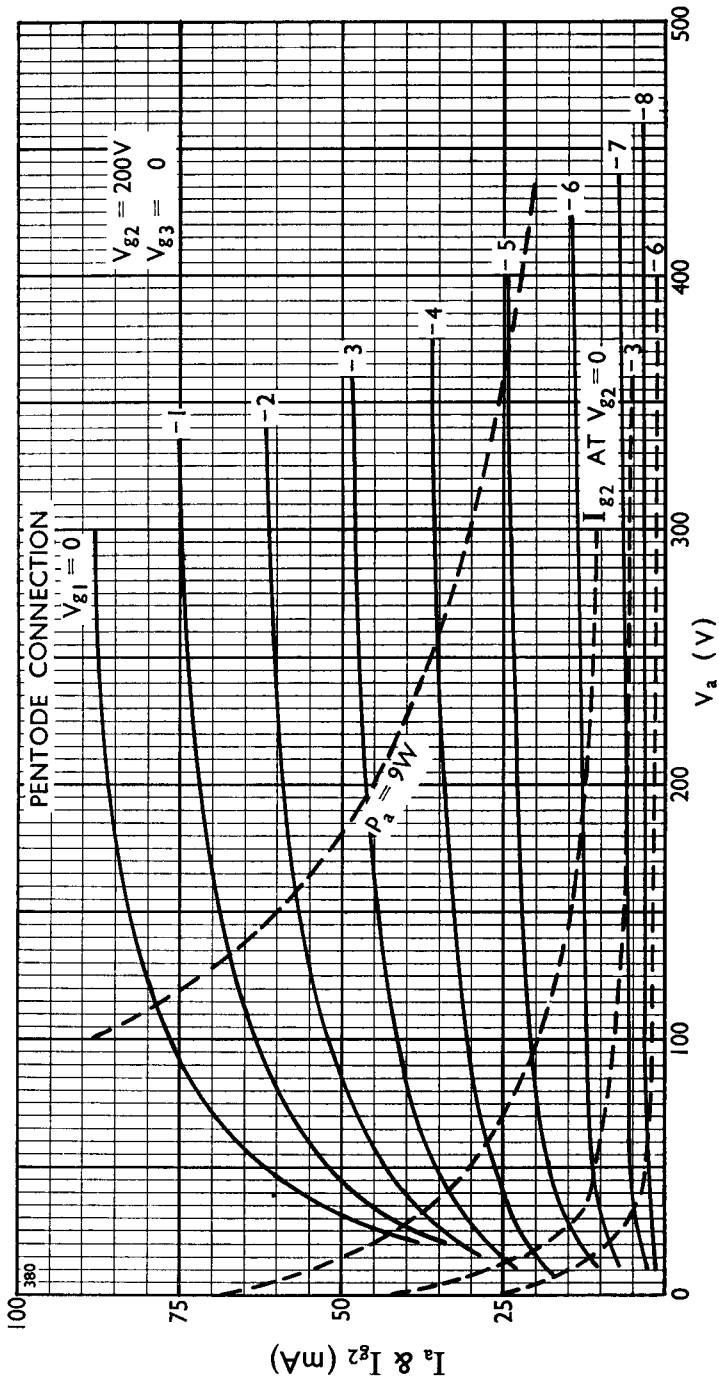
VENTILATION

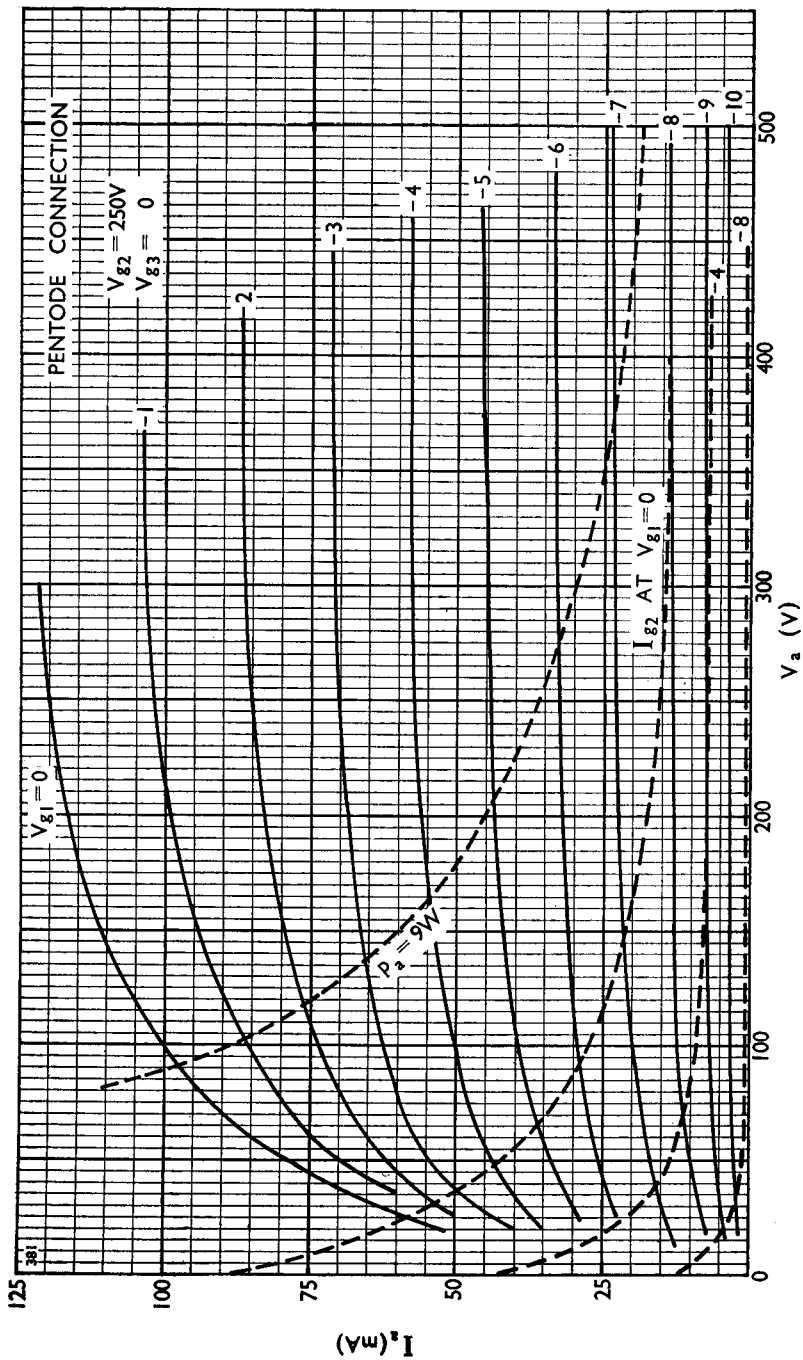
Free air circulation is preferable. The temperature of the hottest part of the bulb must not exceed 200°C.

MICROPHONY

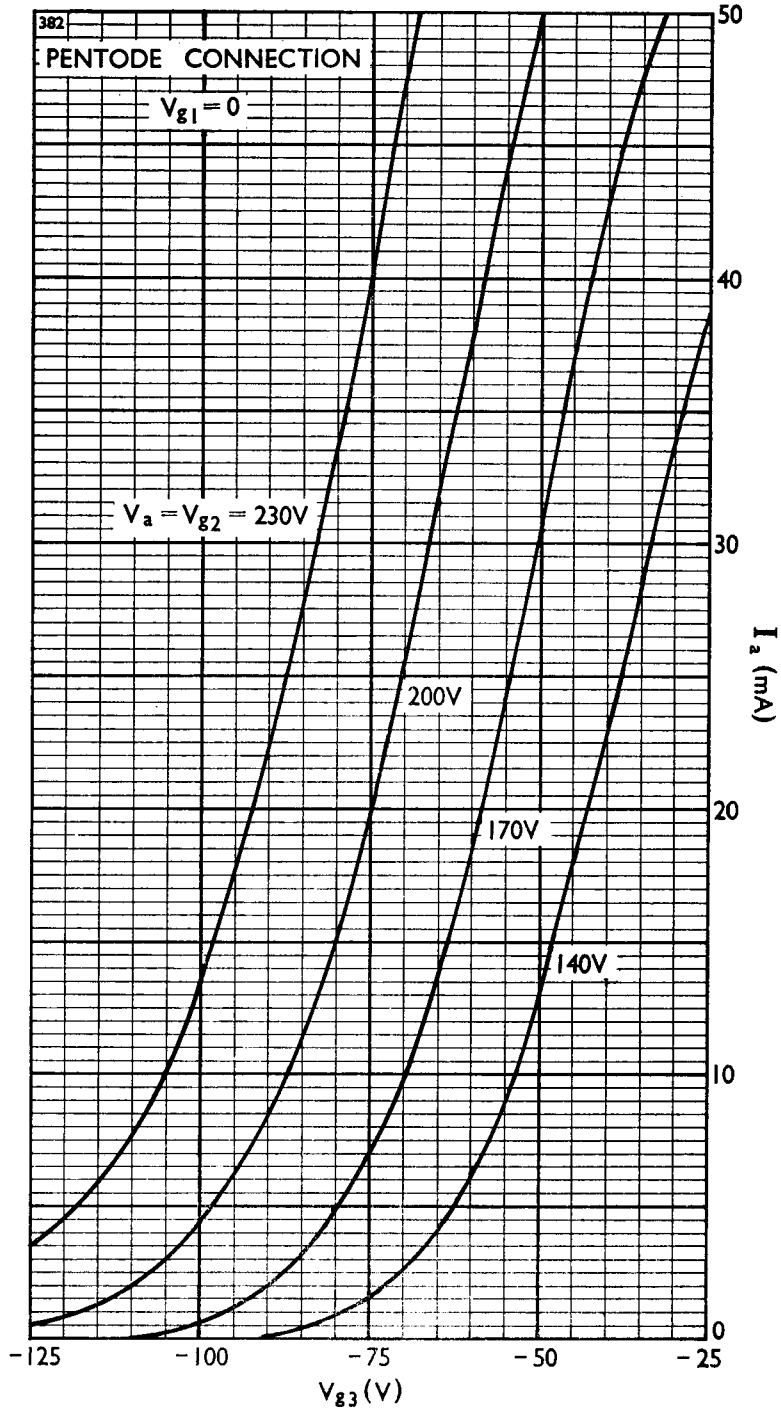
This type is free from microphony in normal receiver application.

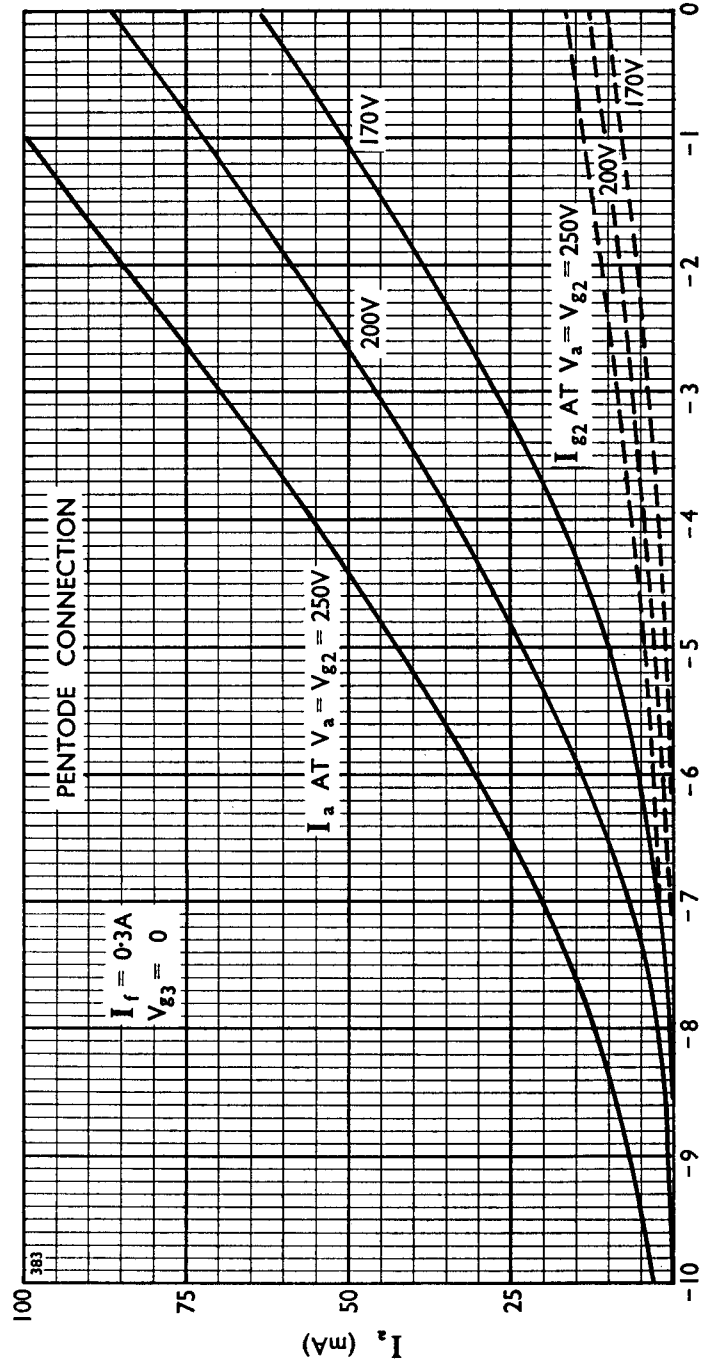

PENTODE CONNECTION
V_{g2} = 170V
V_{g3} = 0
V_{g1} = 0
-1
-2
-3
-4
-5
-6
-5
-3
P_a = 9W
I_{g2} AT V_{g1} = 0
379
75
50
25
0
100
200
300
400
V_a (V)
I_a & I_{g2} (mA)

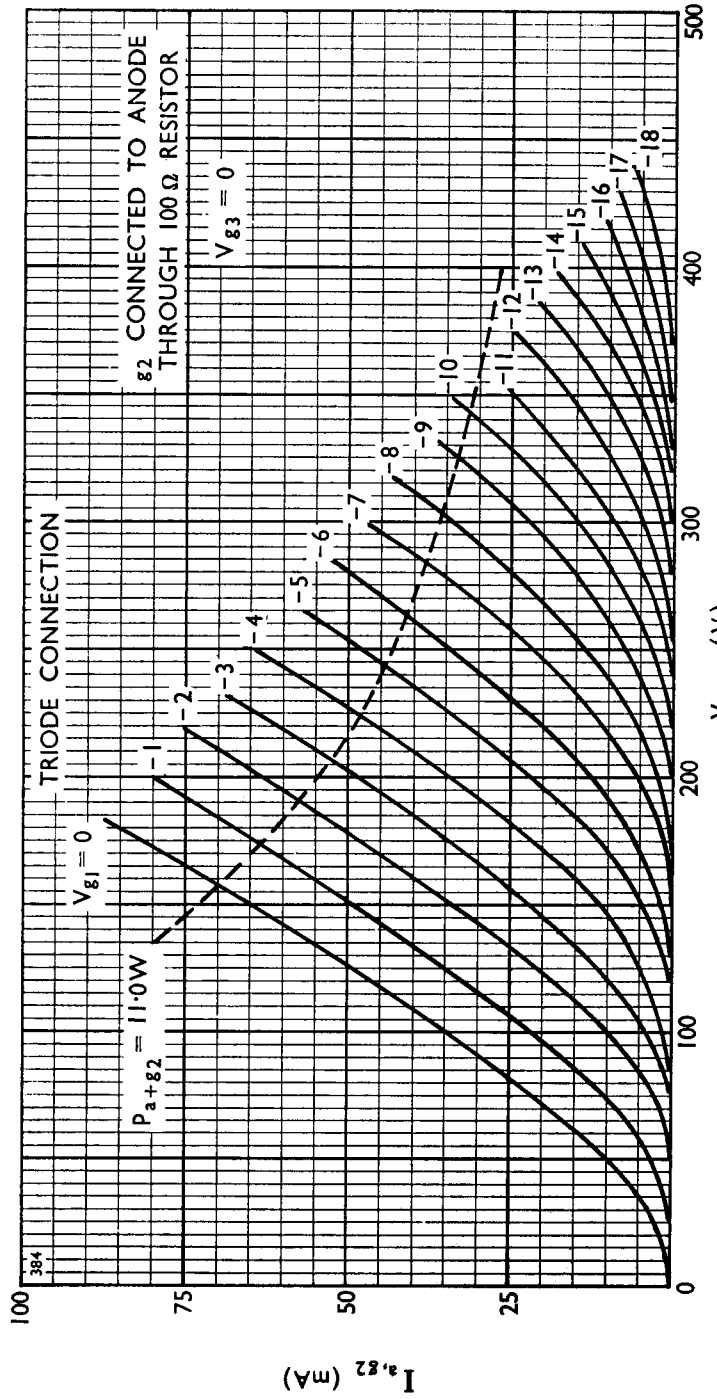

PENTODE CONNECTION
$V_{g1} = 0$
$V_{g2} = 200V$
$V_{g3} = 0$
I_{g2} AT $V_{g2} = 0$
$\mu_{a_{g2}} = 4.6$
I_a & I_{g2} (mA)
V_a (V)
380
100
75
50
25
0
100
200
300
400
500
-1
-2
-3
-4
-5
-6
-7
-8
-3
-6

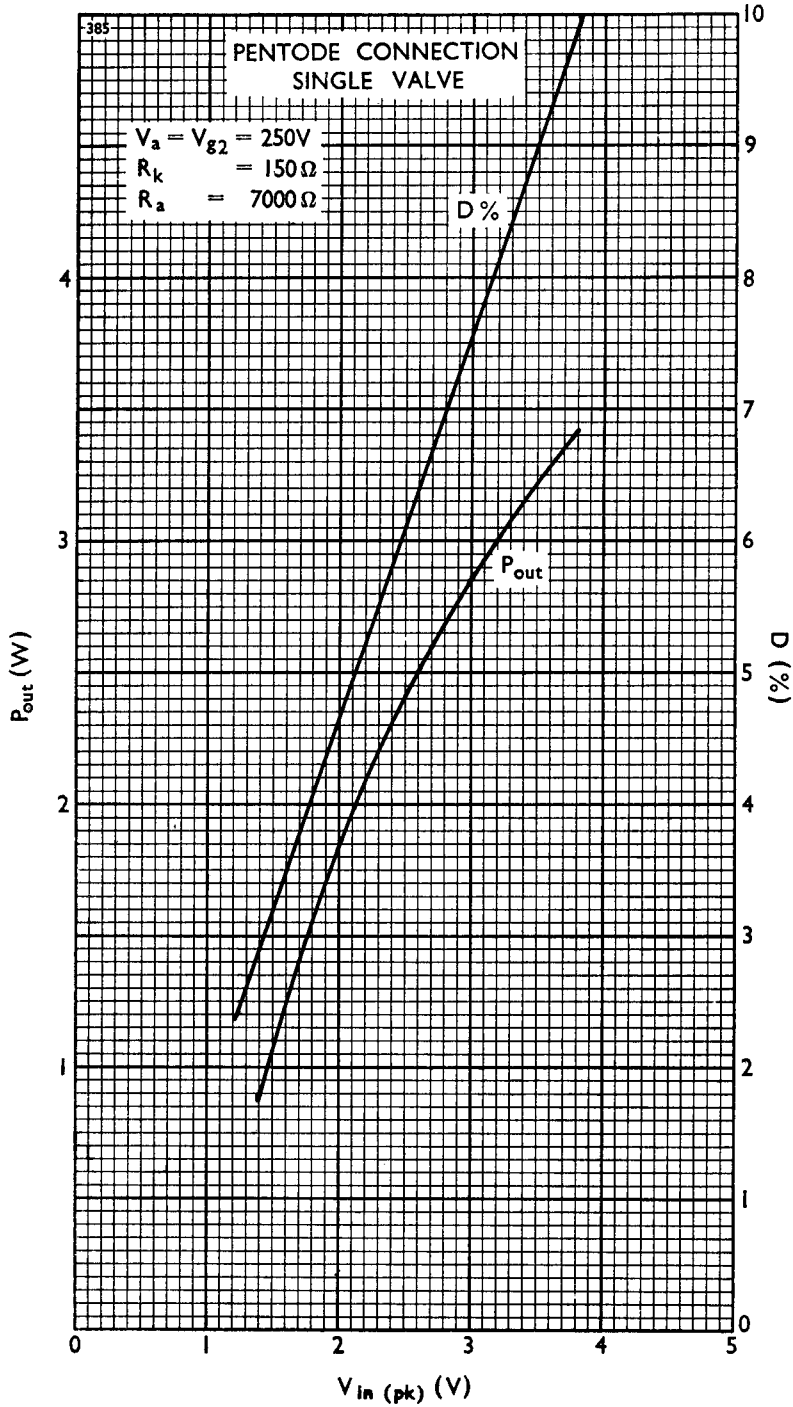

PENTODE CONNECTION
$V_{g2} = 250V$
$V_{g3} = 0$
$V_{g1} = 0$
-1
2
-3
-4
-5
-6
-7
-8
-9
-10
-8
-4
$P_a = 9W$
I_{g2} AT $V_{g1} = 0$
I_a (mA)
V_a (V)
125
100
75
50
25
0
100
200
300
400
500

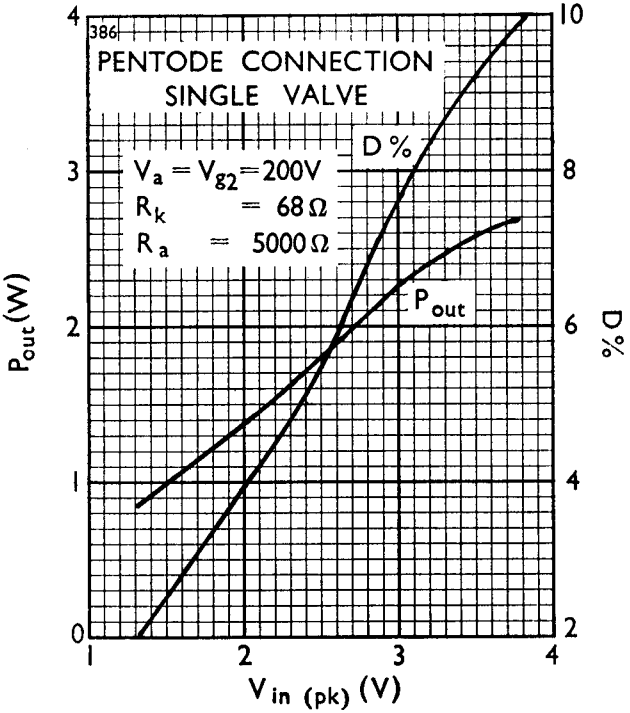
N309/PL83

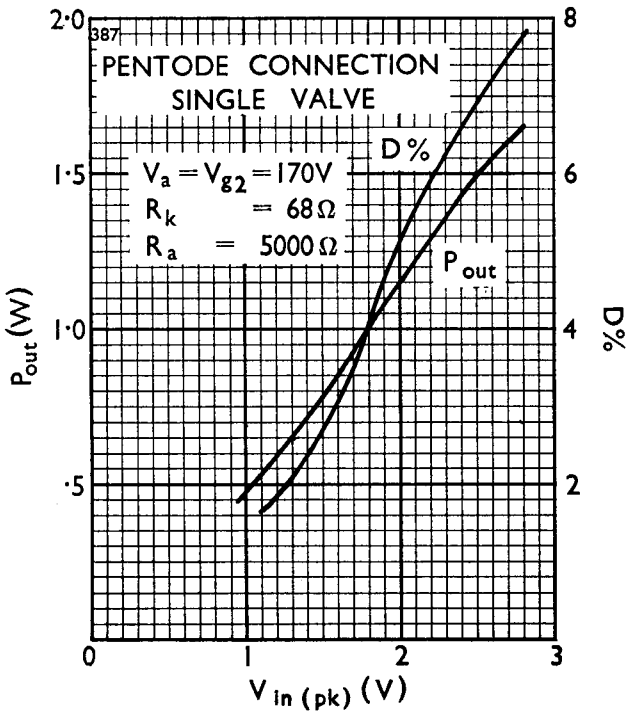

382
PENTODE CONNECTION
$V_{g1} = 0$
$V_a = V_{g2} = 230V$
200V
170V
140V
50
40
30
20
10
0
I_a (mA)
−125
−100
−75
−50
−25
V_{g3} (V)


PENTODE CONNECTION
$I_f = 0{\cdot}3A$
$V_{g3} = 0$
I_a AT $V_a = V_{g2} = 250V$
I_{g2} AT $V_a = V_{g2} = 250V$
170V
200V
200V
170V
I_a (mA)
100
75
50
25
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
V_{g1} (V)
383


TRIODE CONNECTION
$V_{g1} = 0$
$P_{a+g2} = 11{\cdot}0W$
g_2 CONNECTED TO ANODE THROUGH 100 Ω RESISTOR
$V_{g3} = 0$
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
384
100
75
50
25
0
100
200
300
400
500
$I_{a,g2}$ (mA)
$V_{a,g2}$ (V)


385
PENTODE CONNECTION
SINGLE VALVE
$V_a = V_{g2} = 250V$
$R_k = 150\Omega$
$R_a = 7000\Omega$
D %
P_{out}
P_{out} (W)
D (%)
$V_{in\ (pk)}$ (V)
0
1
2
3
4
5
6
7
8
9
10


386
PENTODE CONNECTION
SINGLE VALVE
$V_a = V_{g2} = 200V$
$R_k = 68\Omega$
$R_a = 5000\Omega$
D %
P_{out}
P_{out} (W)
D %
$V_{in\ (pk)}$ (V)
0
1
2
3
4
2
4
6
8
10


387
PENTODE CONNECTION
SINGLE VALVE
$V_a = V_{g2} = 170V$
$R_k = 68\Omega$
$R_a = 5000\Omega$
D %
P_{out}
P_{out} (W)
D %
$V_{in\ (pk)}$ (V)
0
·5
1·0
1·5
2·0
1
2
3
2
4
6
8

N309/PL83

OV.3270

Printed in England. C.

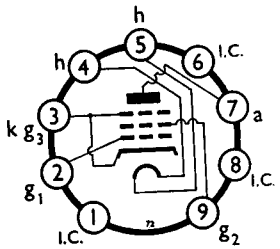
MINIATURE OUTPUT PENTODE 0·3A INDIRECTLY HEATED

N329

MARCH, 1954

A high slope pentode suitable for use as an audio and frame time base output valve.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	78·5 max.	mm.
Seated length :	71·5 max.	mm.
Diameter :	22·2 max.	mm.

HEATER

I_h	0·3	A
V_h	16·5	V

MAXIMUM RATINGS (design centre)

V_a (b)	550	V	V_{h-k}	250	V
V_{g2} (b)	550	V	I_k	75	mA
V_a	250	V			
*V_a (pk) pulse	2,500	V	p_a	9	W
V_{g2}	250	V	p_{g2}	2·5	W

*Maximum pulse duration 10% of one cycle with a maximum of 2 m sec.

CHARACTERISTICS

V_a	170	V	g_m	9·0	mA/V
V_{g2}	170	V	r_a	20,000	kΩ
V_{g1}	−10·4	V			
I_a	53	mA	$\mu_{(g1-g2)}$	10	

CAPACITANCES (of cold valve)

c_{g1-a} 1·0 pF c_{g1-all} 11 pF c_{a-all} 6·2 pF

TYPICAL OPERATION. Pentode Connection.

Single Valve. Class A. Audio Amplifier.

V_a	170	200	V
V_{g2}	170	200	V
V_{g1} (o)	−10·6 approx.	−14·4 (approx.)	V
v_{in} pk	8·5	9·9	V
i_a (o)	50	45·0	mA
i_{g2} (o)	9	8·5	mA
R_k	180	270	Ω
R_L	3	4	kΩ
P_{out}	4·0	4·2	W
D	10	10	%

MOUNTING Any position.

SCREENING None normally required.

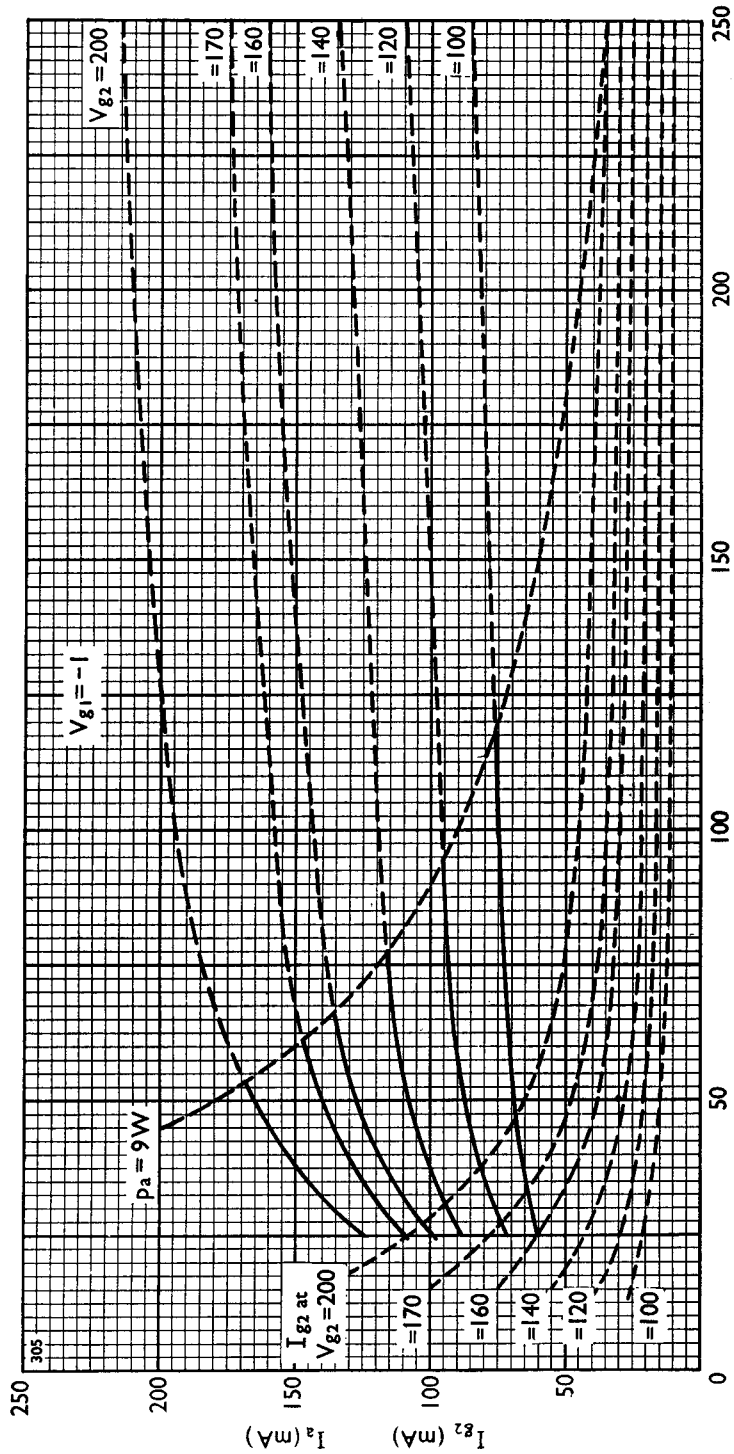
RETAINING The use of a retaining device is recommended.

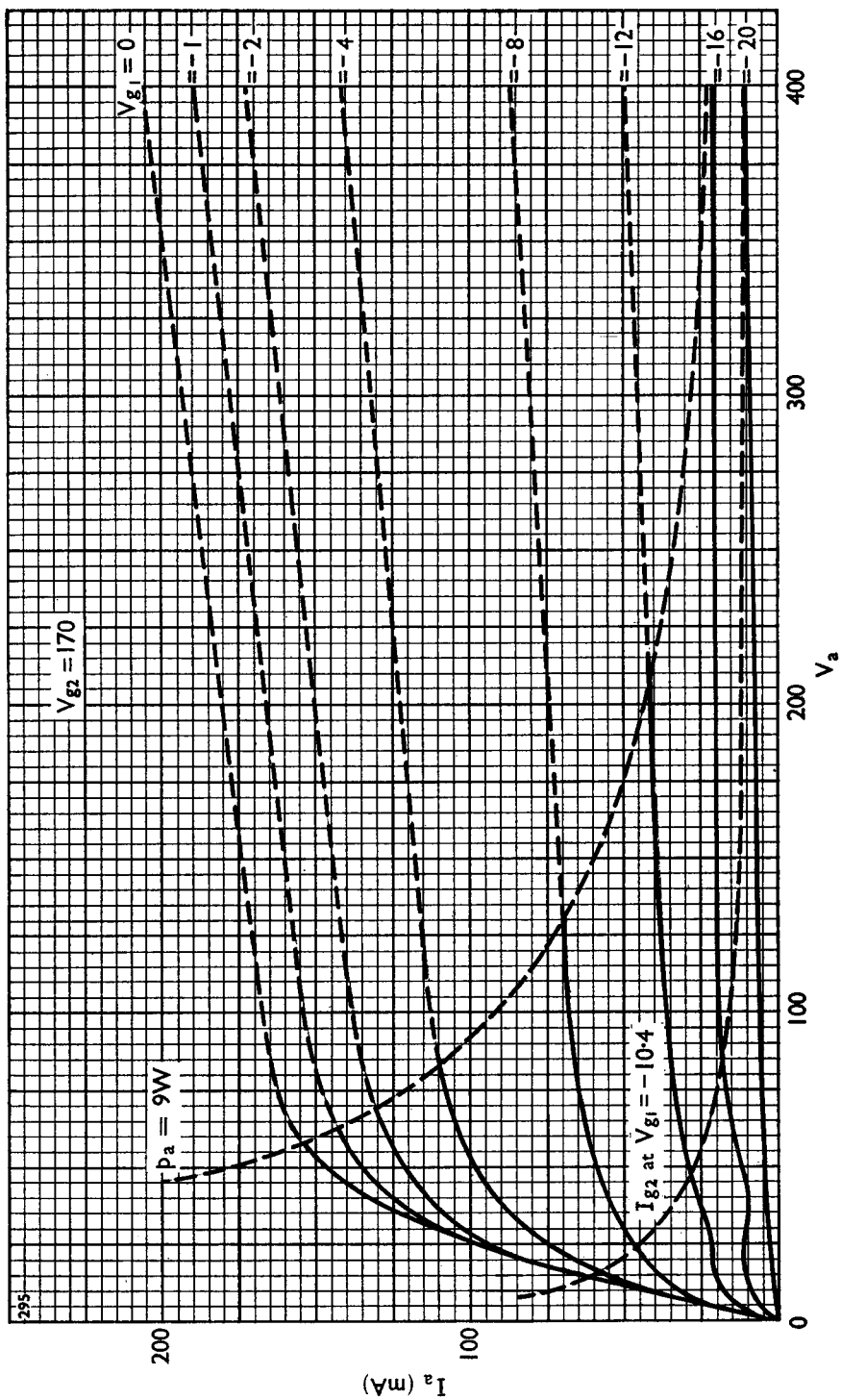
VENTILATION

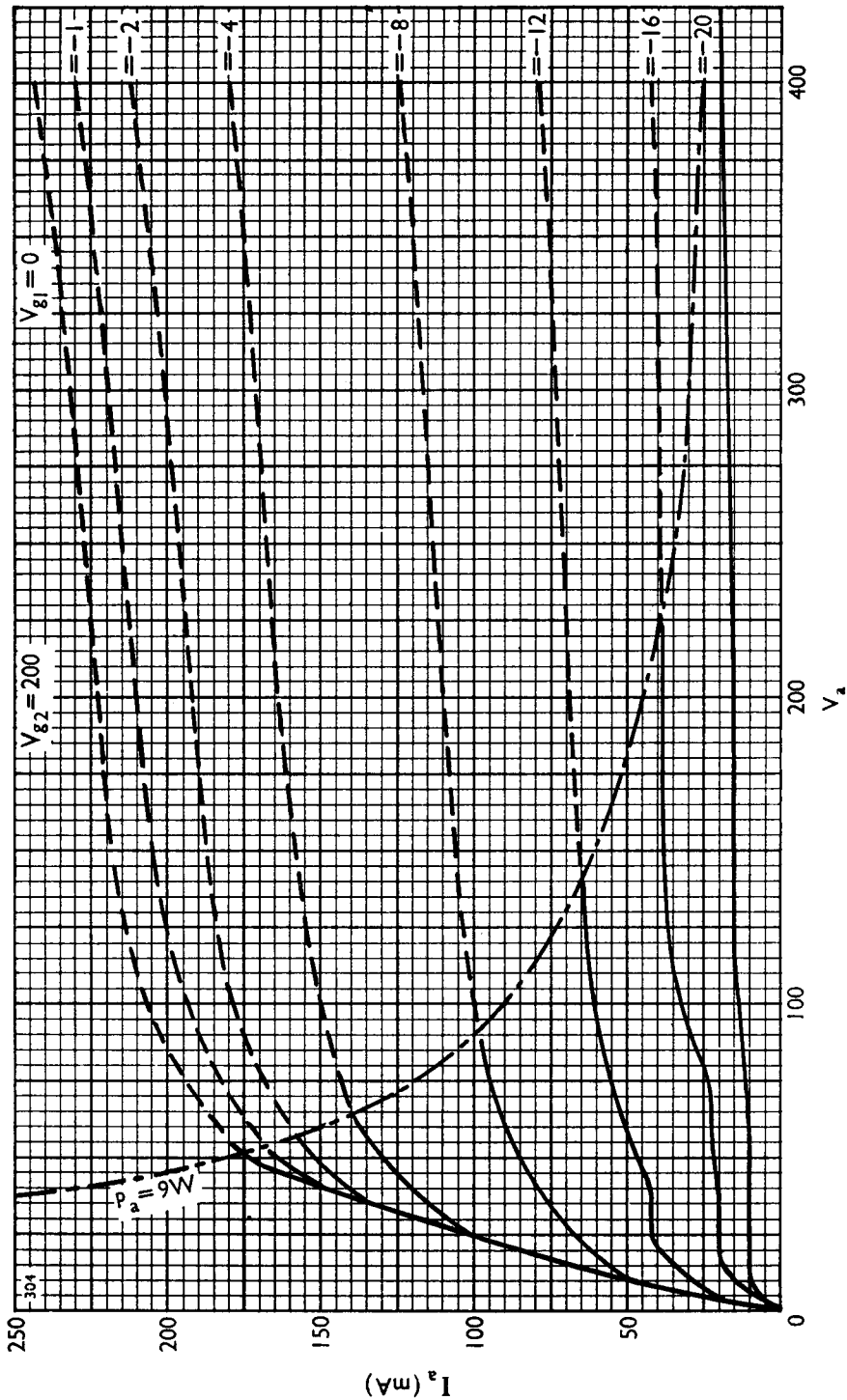
Free air circulation around the bulb is preferable. The temperature of the hottest part of the bulb must not exceed 250°C.

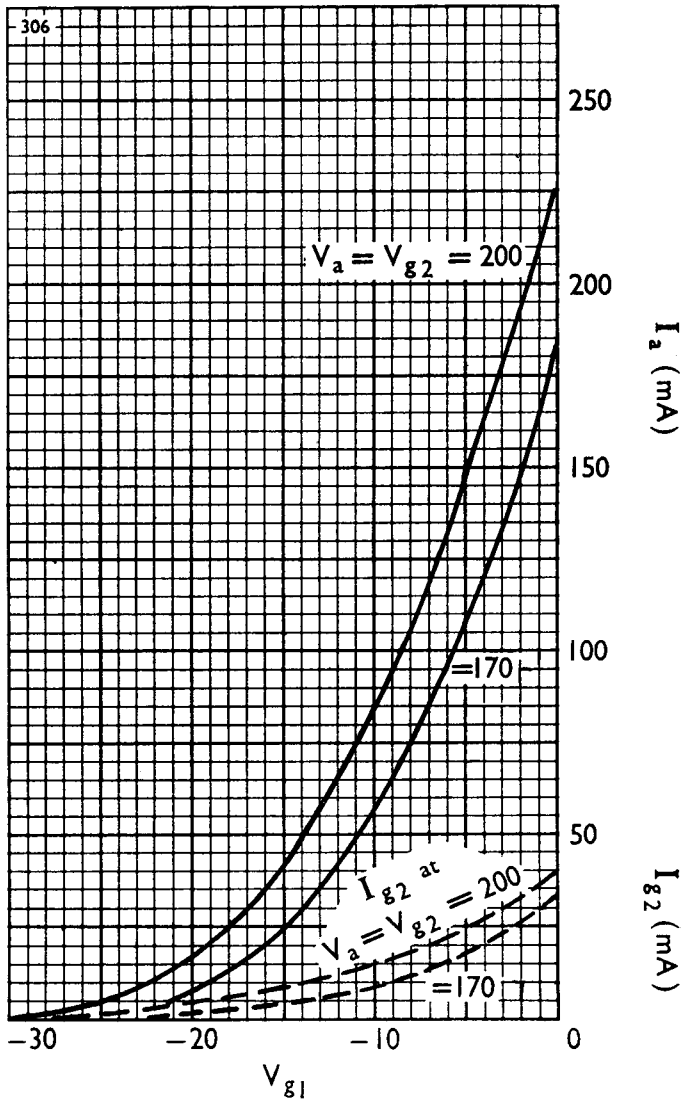
MICROPHONY

The valve is free from microphony in normal receiver application.


V_{g2}=200
=170
=160
=140
=120
=100
V_{g1}=-1
p_a=9W
I_{g2} at V_{g2}=200
=170
=160
=140
=120
=100
305
250
200
150
100
50
0
I_a (mA)
I_{g2} (mA)
250
200
150
100
50
0
V_a


$V_{g1} = 0$
$= -1$
$= -2$
$= -4$
$= -8$
$= -12$
$= -16$
$= -20$
$V_{g2} = 170$
$P_a = 9W$
I_{g2} at $V_{g1} = -10{\cdot}4$
295
200
100
0
I_a (mA)
100
200
300
400
V_a


$V_{g1}=0$
$V_{g2}=200$
$P_a=6W$
-1
-2
-4
-8
-12
-16
-20
-304
250
200
150
100
50
0
100
200
300
400
I_a (mA)
V_a


306
250
200
150
100
50
$V_a = V_{g2} = 200$
=170
I_{g2} at
$V_a = V_{g2}$ = 200
=170
−30
−20
−10
0
V_{g1}
I_a (mA)
I_{g2} (mA)

OV.2388

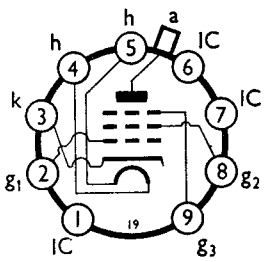
Printed in England. C.

POWER PENTODE
0·3A INDIRECTLY HEATED

N339
NOVEMBER, 1955

For use as a line time base output valve in D.C./A.C. television receivers.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	76—82	mm.
Seated length :	70—75	mm.
Max. diameter :	22	mm.
Top cap :	CT1	

HEATER

I_h	0·3	A
V_h	20 approx.	V

MAXIMUM RATINGS

$V_{h\text{-}k}$ rms 230 V

Pentode Connection			Triode Connection		
V_a	300	V	$V_{a,\,g2}$	200	V
V_a (pk) (pulse) *	7·5	kV	$p_{a,\,g2}$	12·5	W
V_{g2}	200	V			
p_a	12	W			
p_{g2}†	4·5	W			

* Maximum pulse duration : 18% of one cycle, with a maximum of 18 μs.
† Subject to $p_a + p_{g2}$ not exceeding 12·5W.

CAPACITANCES (of unscreened valve).

C_{a}-all less g1	7·3	pF
C_{g1}-all less a	13	pF
$C_{a\text{-}g1}$	0·38	pF

TYPICAL OPERATION

Pentode Connection			Triode Connection		
V_a	150	V	$V_{a,\,g2}$	150	V
V_{g2}	150	V	V_{g1}	−12·5	V
I_a	50	mA	μ	8·5	
r_a	30	kΩ	r_a	810	Ω
g_m	8·5	mA/V	g_m	10·5	mA/V

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position, provided pins 1 and 6 are in a vertical plane when the valve is horizontal.

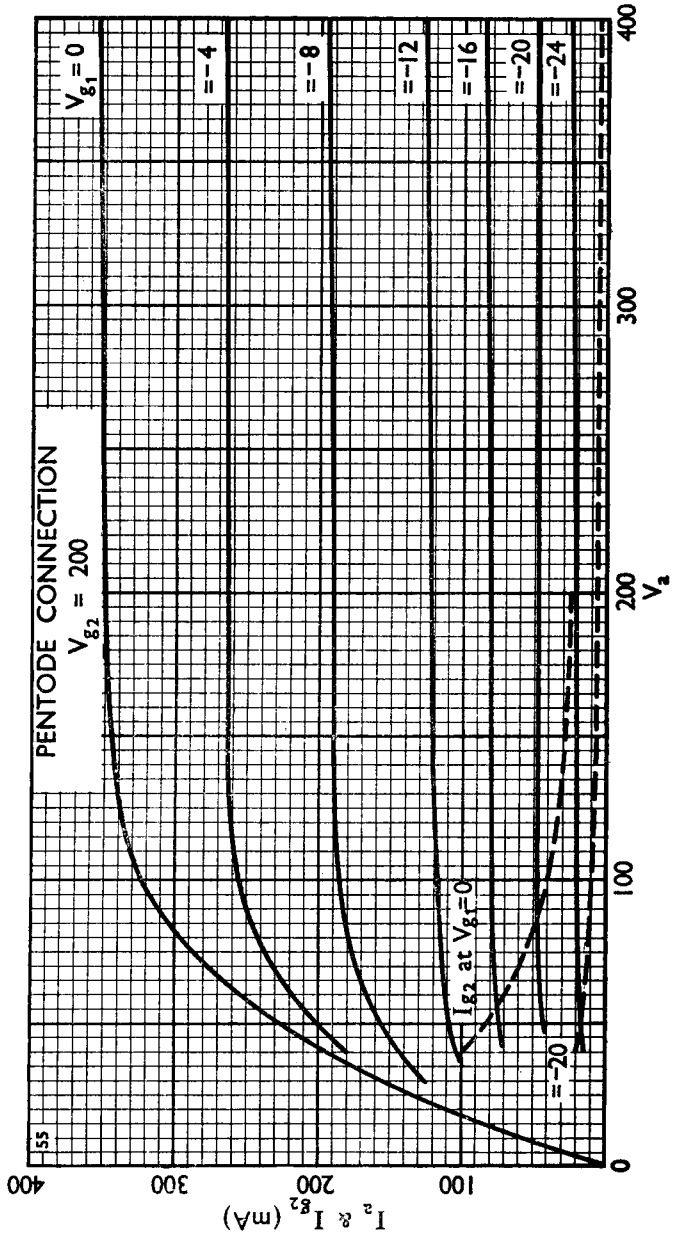
RETAINING

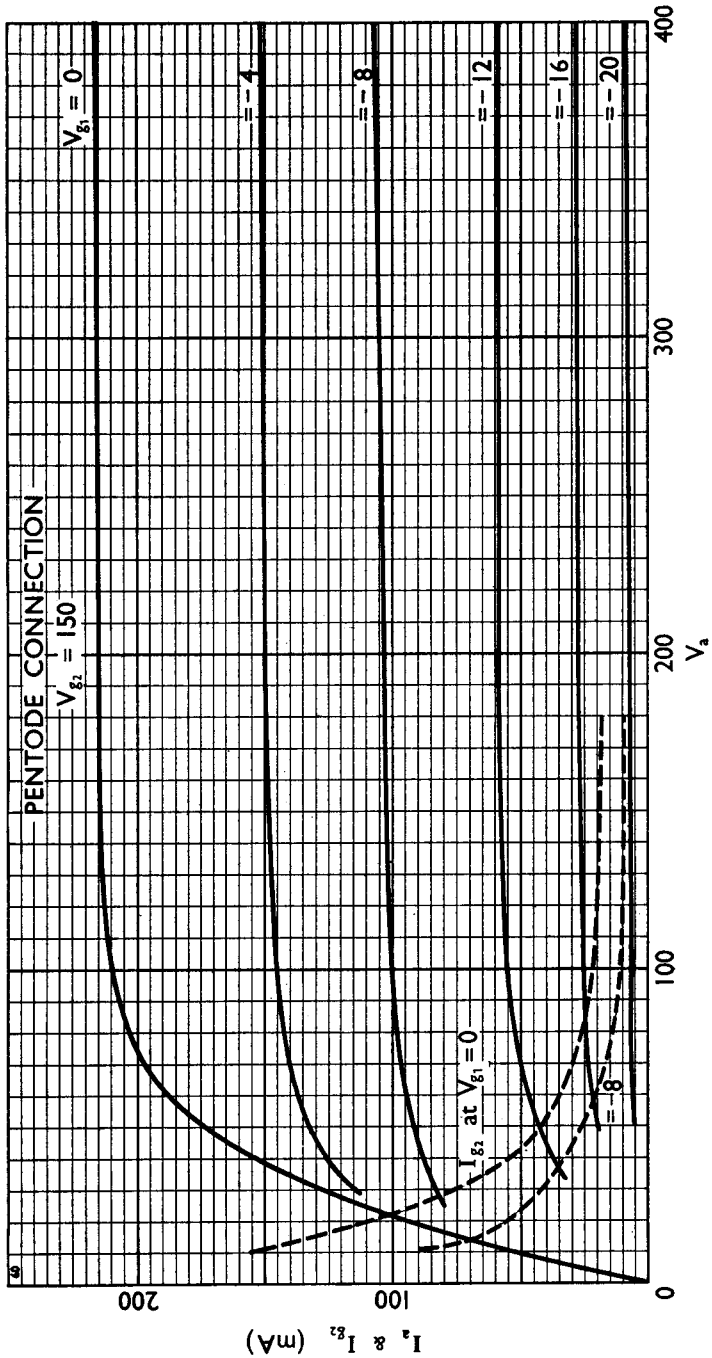
A retaining device should be used in equipment subject to vibration or shock.

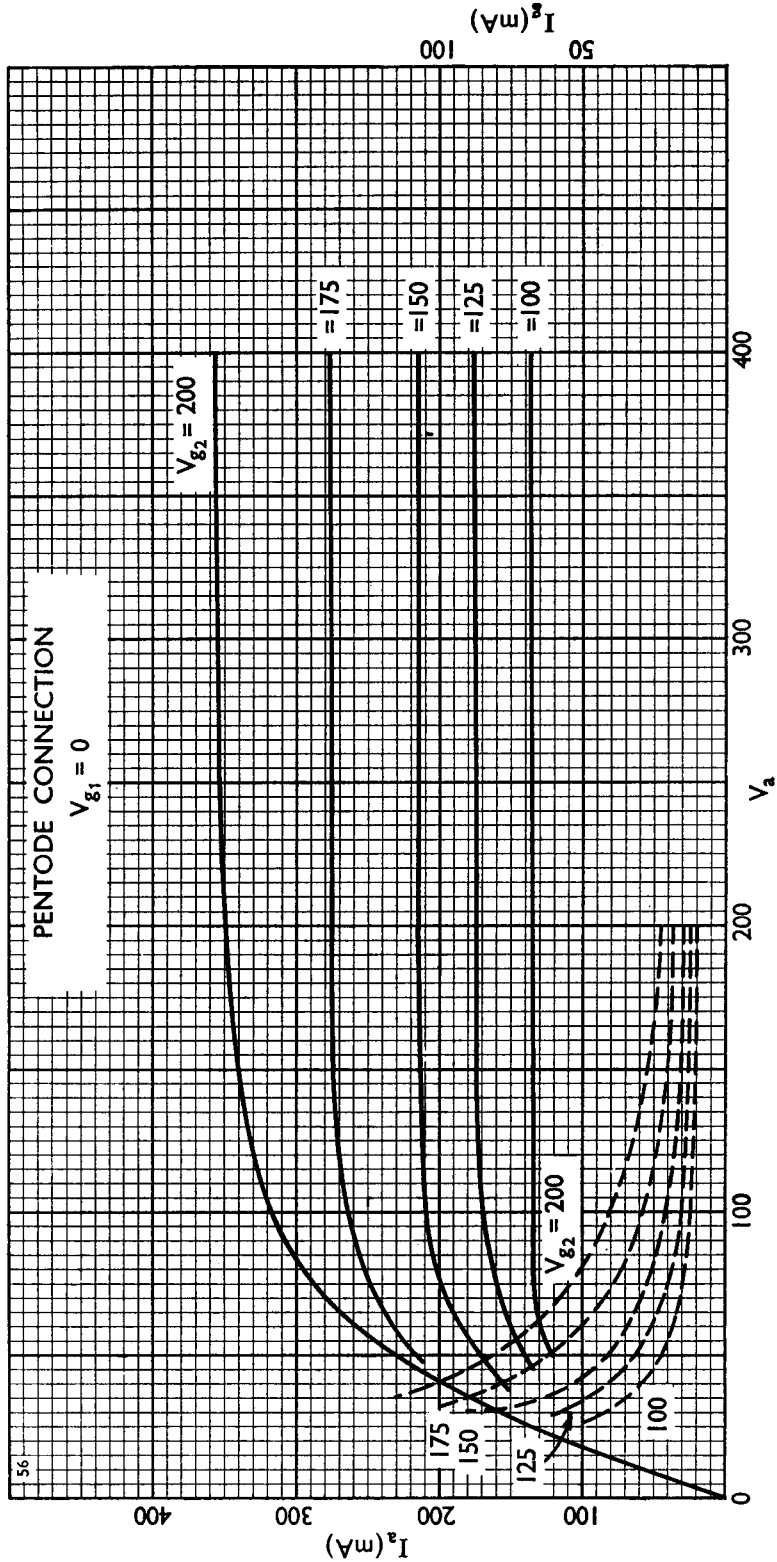
VENTILATION

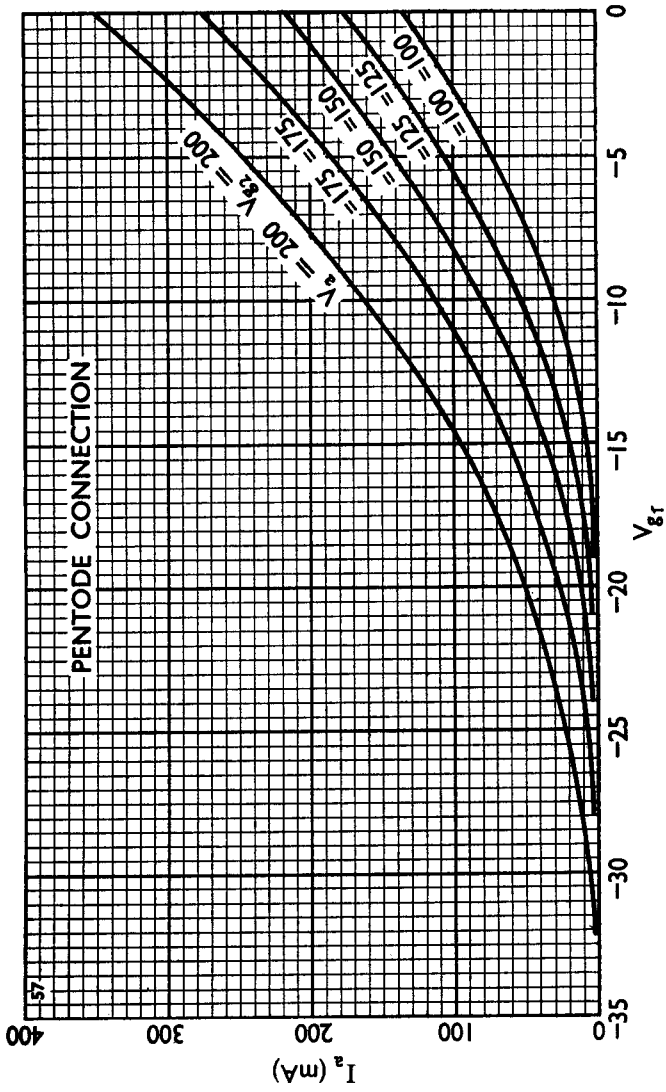
Free air circulation is preferable. The temperature of the hottest part of the bulb must not exceed 200°C.

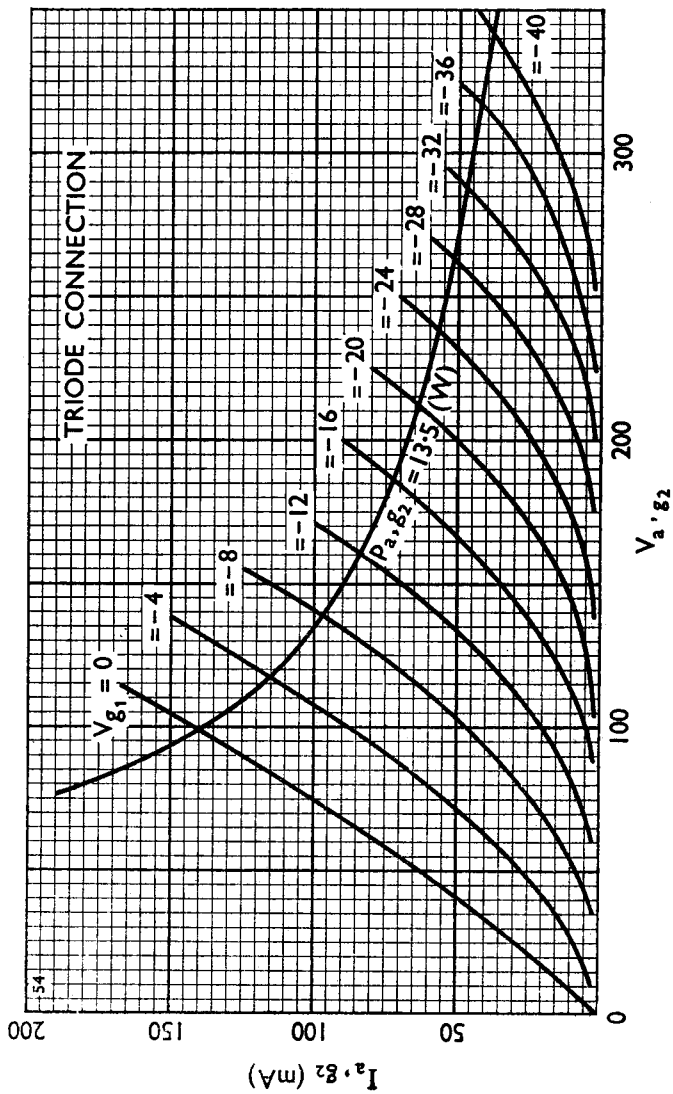
N339

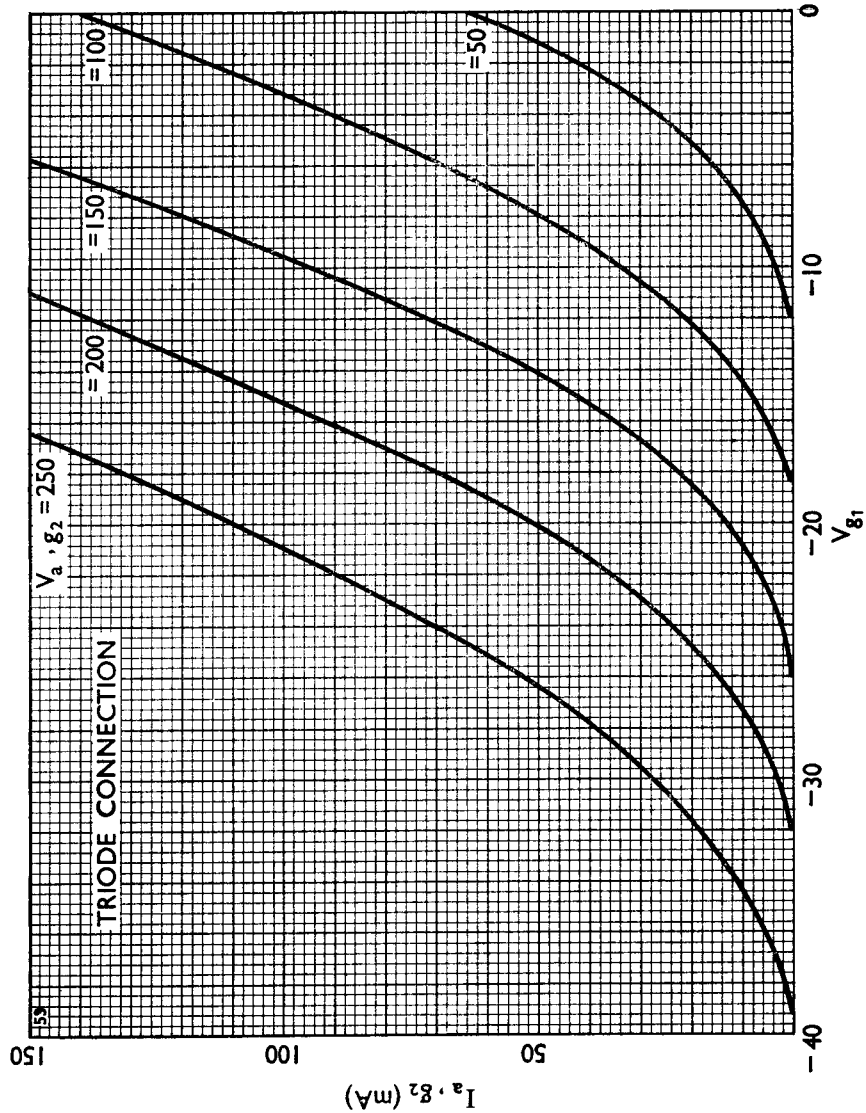

PENTODE CONNECTION
V_{g_2} = 200
V_{g_1} = 0
= -4
= -8
= -12
= -16
= -20
= -24
I_{g_2} at V_{g_1} = 0
= -20
55
0
100
200
300
400
V_a
I_a & I_{g_2} (mA)


PENTODE CONNECTION
V_{g_2} = 150
V_{g_1} = 0
= -4
= -8
= -12
= -16
= -20
I_{g_2} at V_{g_1} = 0
= -8
0
100
200
300
400
V_a
200
100
I_a & I_{g_2} (mA)


PENTODE CONNECTION
$V_{g_1} = 0$
$V_{g2} = 200$
=175
=150
=125
=100
I_a(mA)
I_g(mA)
V_a
0
100
200
300
400
50
100
175
150
125
100
$V_{g2} = 200$
56


PENTODE CONNECTION
V_{g2} = 200
= 175
= 150
= 125
= 100
I_a (mA)
V_{g1}
0
100
200
300
400
0
-5
-10
-15
-20
-25
-30
-35


TRIODE CONNECTION
$V_{g_1} = 0$
$= -4$
$= -8$
$= -12$
$= -16$
$= -20$
$= -24$
$= -28$
$= -32$
$= -36$
$= -40$
$P_{a,g_2} = 13{\cdot}5$ (W)
I_{a,g_2} (mA)
V_{a,g_2}
200
150
100
50
0
100
200
300
54


TRIODE CONNECTION
V_a , g_2 = 250
= 200
= 150
= 100
= 50
V_{g_1}
0
−10
−20
−30
−40
150
100
50
I_a , g_2 (mA)

OV.1689

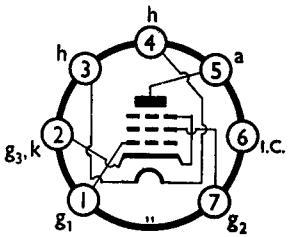
Printed in England. C.

MINIATURE
OUTPUT PENTODE
0·3A INDIRECTLY HEATED

N37

APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	64—70	mm.
Seated length :	58—64	mm.
Max. diameter	19	mm.

RATING

Pentode Connection

I_h	0·3		A
V_h	13	approx.	V
v_{h-k} (pk)	150	max.	V
V_a	165	max.	V
V_{g2}	165	max.	V
p_a	9	max.	W
p_{g2}	3	max.	W
μ	220		
r_a	23·2		kΩ
g_m	9·5		mA/V

at V_a, = V_{g2} = 165, V_{g1} = −9

Triode Connection

$V_{a,\,g2}$	165	max.	V
$p_{a,\,g2}$	12	max.	W
μ	10		
r_a	835		Ω
g_m	12		mA/V

at $V_{a,\,g2}$ = 165, V_{g1} = −9

CAPACITANCES (of unscreened valve) :

$c_{a\text{-all}}$ 10 pF $c_{g1\text{-all}}$ 10 pF $c_{a\text{-}g1}$ 0·3 pF

TYPICAL OPERATION

Single Valve. Class A, Pentode Connection

% full input	45	100	100	75	50	%
V_a	100	150	165	165	165	V
V_{g2}	100	150	165	165	165	V
V_{g1}	−4·6	−7·8	−9·3	−10	−11·4 approx.	V
I_a (o)	39	56	53	40	29	mA
I_{g2} (o)	6·5	9·5	9	7·2	5·4	mA
R_k	100	120	150	220	330	Ω
v_{in} (pk)	5	7	8·5	6·7	4·7	V
R_L	2·5	3	3	4	6	kΩ
P_{out}	1·45	3·5	4·1	2·84	2·3	W
D	8·6	11	10	10	10	%

The conditions given in the last two columns are those obtained when the valve is over-biased. They are useful when H.T. power is limited and reduced power output can be tolerated.

Two Valves. Push-pull, Class AB_1, Pentode Connection

Data per pair unless otherwise stated.

V_a	100	165	200	250	V
V_{g2}	100	165	165	165	V
V_{g1}	−5	−11·9	−10	−11·2 approx.	V
I_a (o)	70	107	87	66	mA
I_a (max. sig.)	73	110	100	80	mA
I_{g2} (o)	12	18	14	10	mA
I_{g2} (max. sig.)	15	36	25	24	mA
R_k (per valve)	120	150	200	300	Ω
v_{in} (pk) (g_1−g_1)	11	20	25	30	V
R_L (a−a)	3	3	4·5	7·5	kΩ
P_{out}	2·25	9	11·5	13·3	W
D	3·3	4·6	4	4·5	%

Two Valves. Push-pull, Class AB_1, Triode Connection

Data per pair unless otherwise stated.

$V_{a,g2}$	165	V
V_{g1}	−10·5 approx.	V
$I_{a,g2}$ (o)	65	mA
$I_{a,g2}$ (max. sig.)	74	mA
R_k (per valve)	330	Ω
v_{in} (pk) (g_1−g_1)	24	V
R_L (a−a)	3	kΩ
P_{out}	2·6	W
D	1·4	%

GRID RESISTOR

The maximum permissible D.C. resistance from control grid to cathode is limited to 0·27 MΩ±20% for auto-bias and 0·1 MΩ for fixed bias applications.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

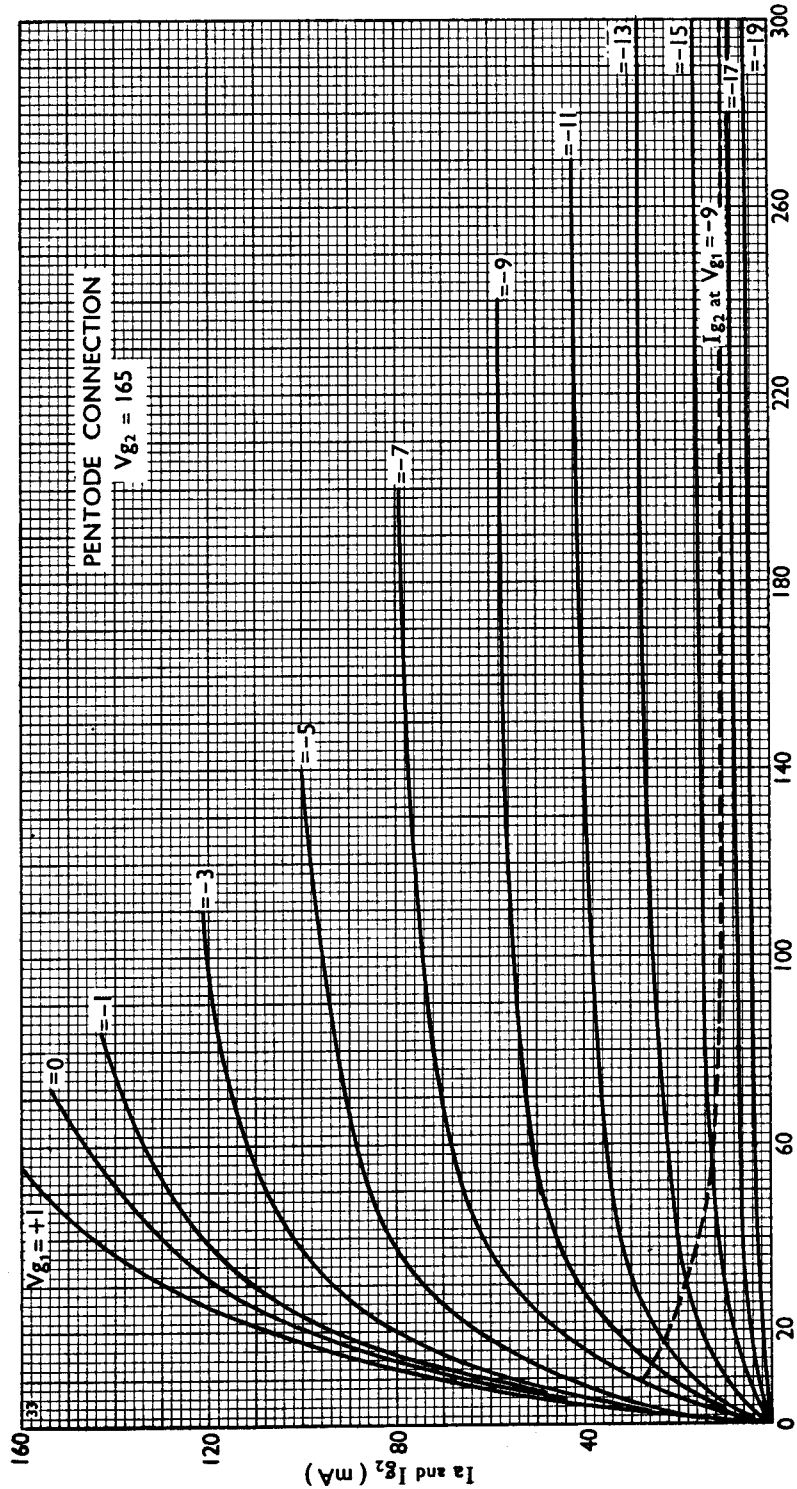
The use of a retaining device is recommended.

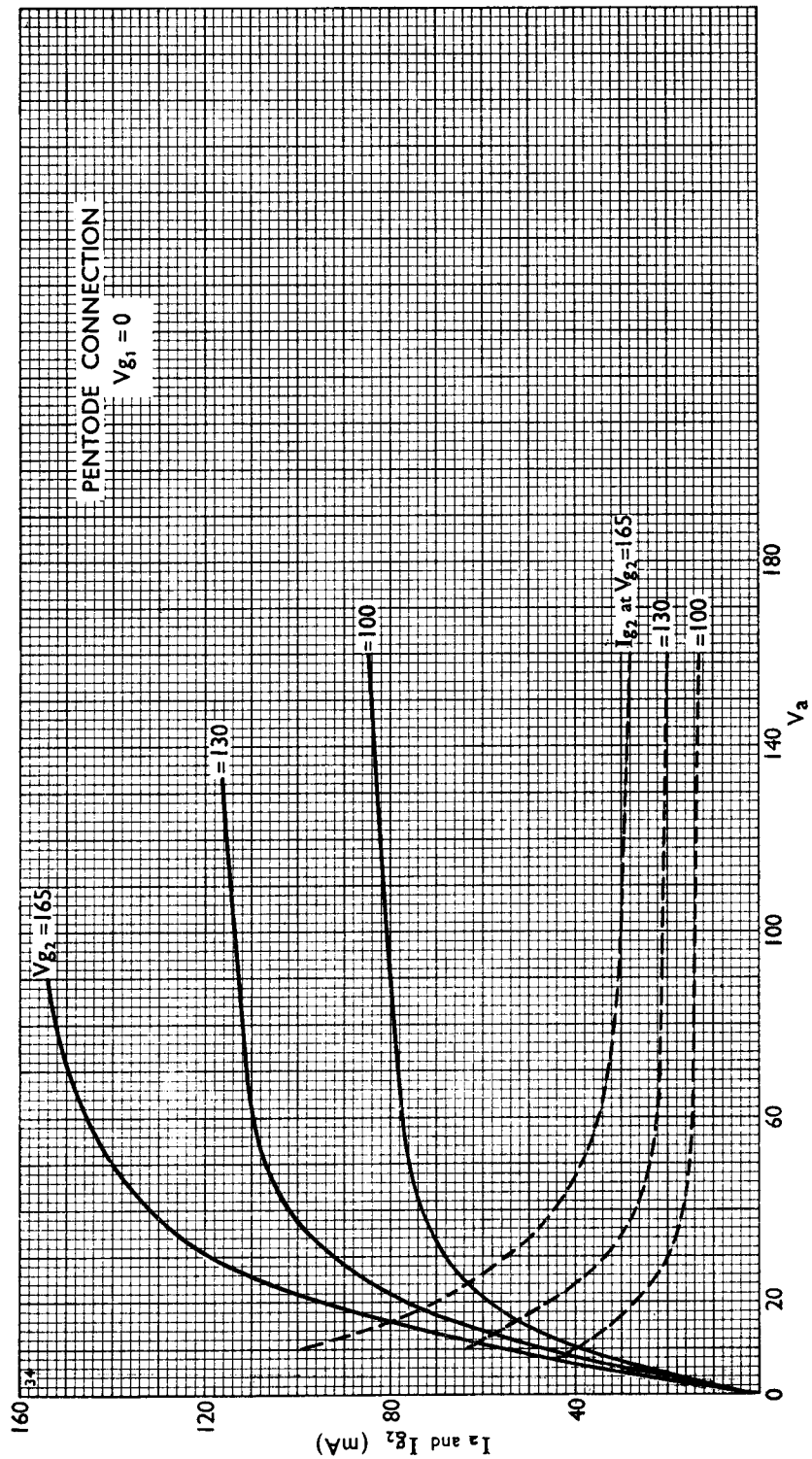
VENTILATION

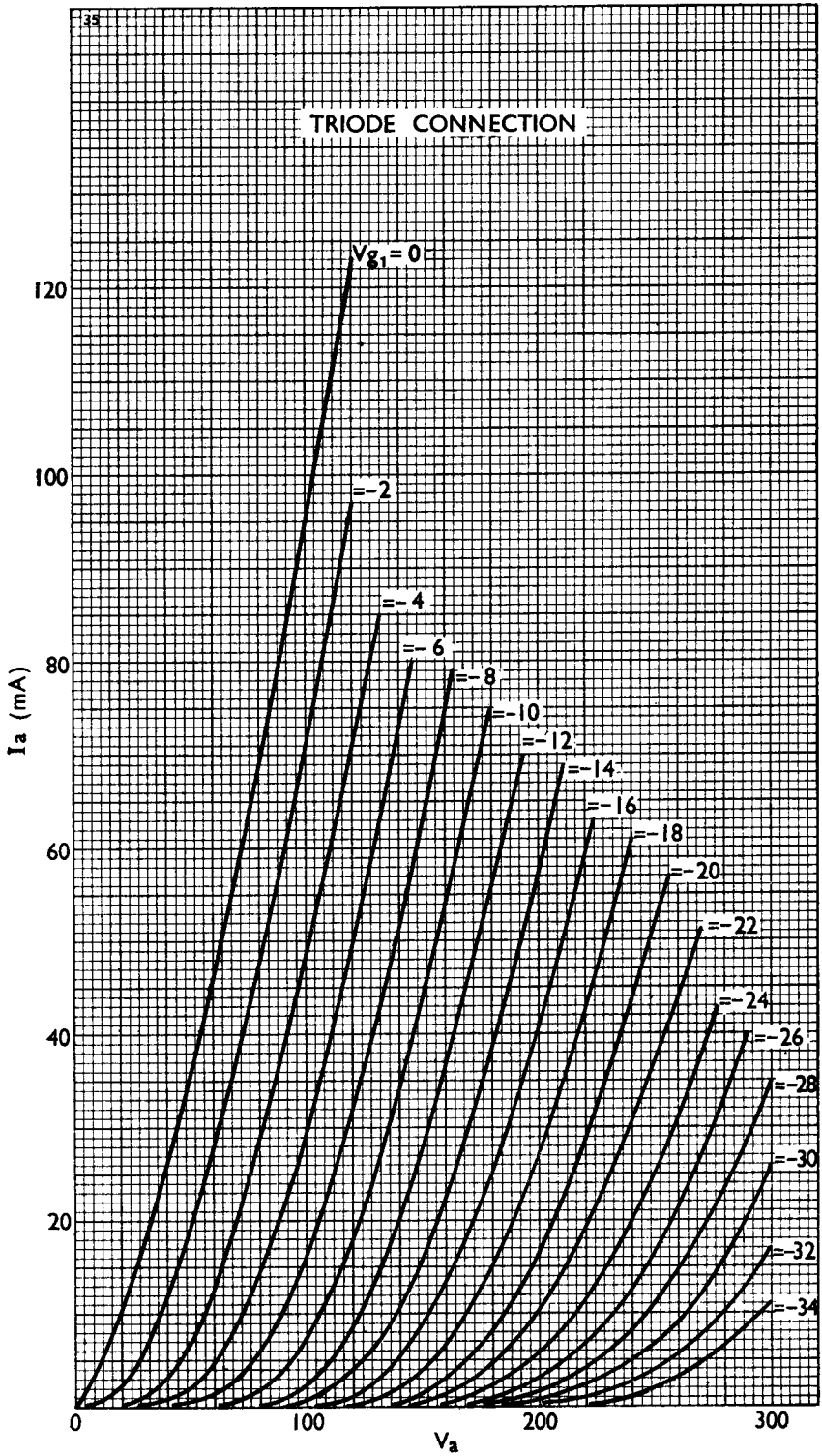
Free air circulation around the bulb is preferable. If a retaining device in the form of a canister is employed, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

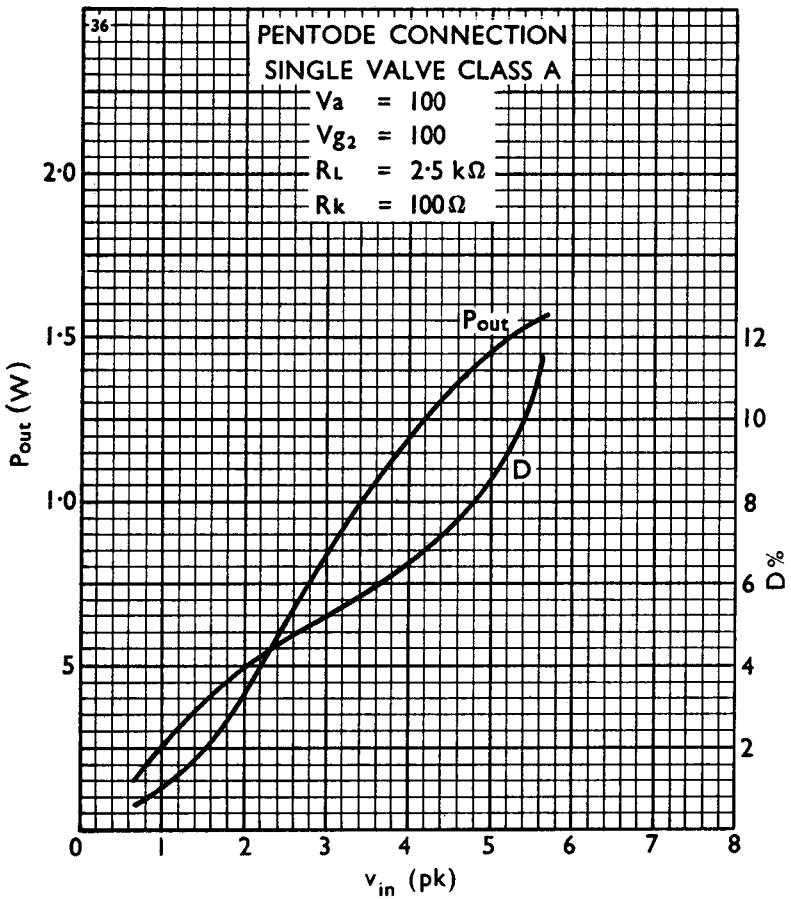
MICROPHONY

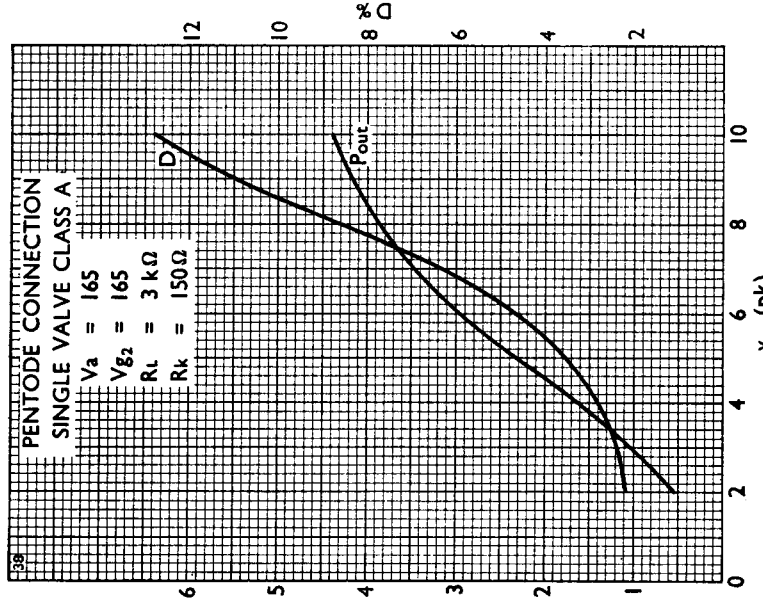
Although this is of a very low order, equipment should be designed to minimise microphony.

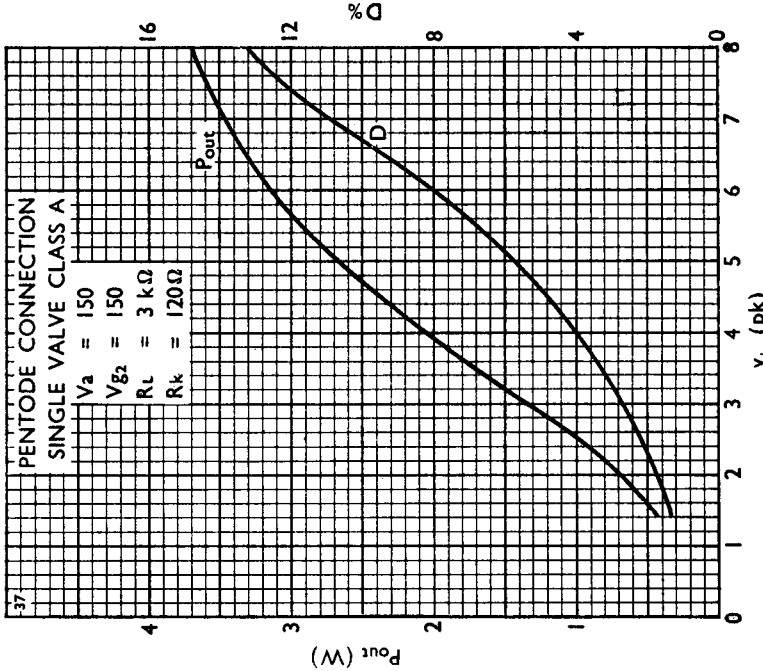

PENTODE CONNECTION
V_{g_2} = 165
V_{g_1} = +1
=0
=-1
=-3
=-5
=-7
=-9
=-11
=-13
=-15
=-17
=-19
I_{g_2} at V_{g_1} = -9
Ia and I_{g_2} (mA)
Va
0
20
60
100
140
180
220
260
300
40
80
120
160

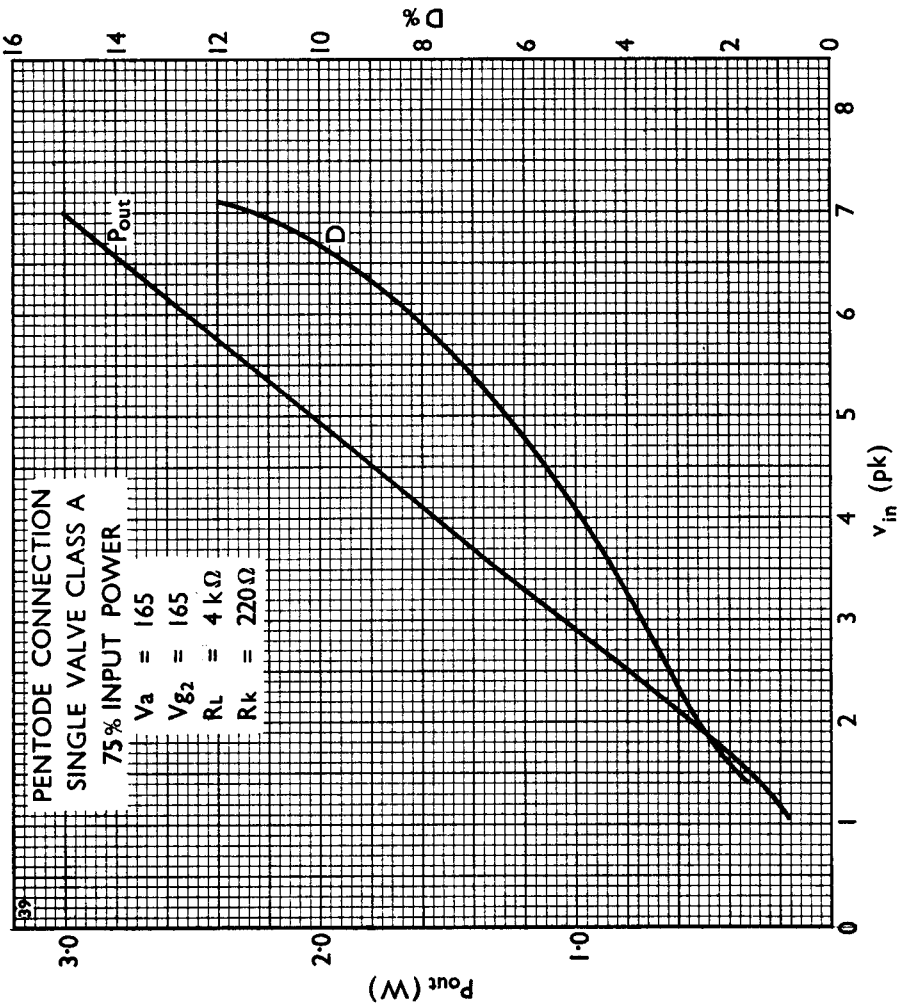

PENTODE CONNECTION
$V_{g_1} = 0$
$V_{g_2} = 165$
= 130
= 100
I_{g_2} at V_{g_2}=165
= 130
= 100
I_a and I_{g_2} (mA)
V_a
160
120
80
40
0
20
60
100
140
180
34

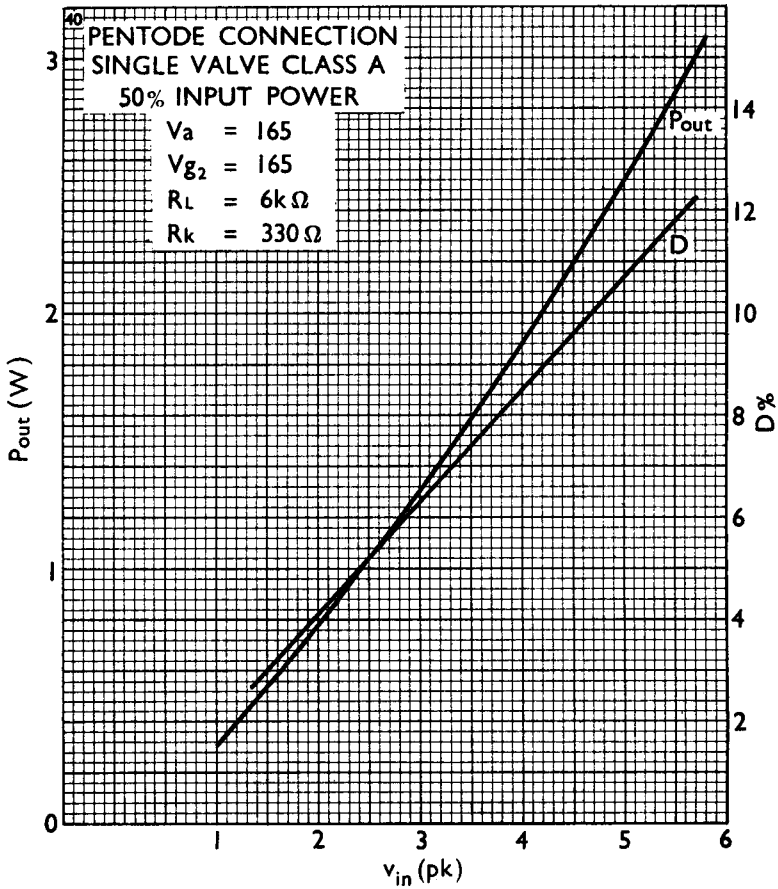

35
TRIODE CONNECTION
$V_{g_1} = 0$
=-2
=-4
=-6
=-8
=-10
=-12
=-14
=-16
=-18
=-20
=-22
=-24
=-26
=-28
=-30
=-32
=-34
120
100
80
60
40
20
0
100
200
300
I_a (mA)
V_a


36
PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 100
Vg2 = 100
RL = 2·5 kΩ
Rk = 100Ω
Pout
D
Pout (W)
D%
vin (pk)
2·0
1·5
1·0
5
0
1
2
3
4
5
6
7
8
12
10
8
6
4
2

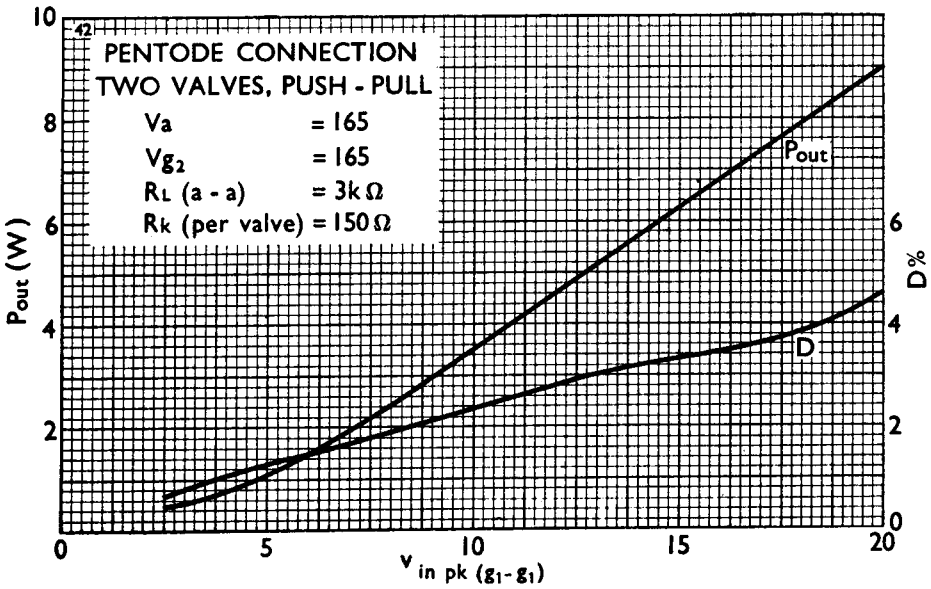

PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 165
Vg2 = 165
RL = 3 kΩ
Rk = 150Ω
38
D
Pout
D %
Pout (W)
Vin (pk)

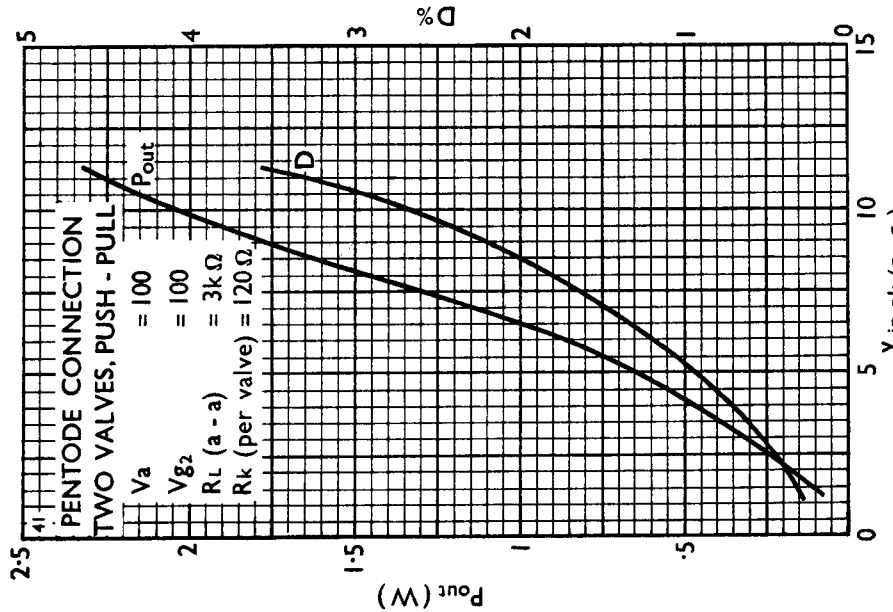

PENTODE CONNECTION
SINGLE VALVE CLASS A
Va = 150
Vg2 = 150
RL = 3 kΩ
Rk = 120Ω
37
Pout
D
D %
Pout (W)
Vin (pk)

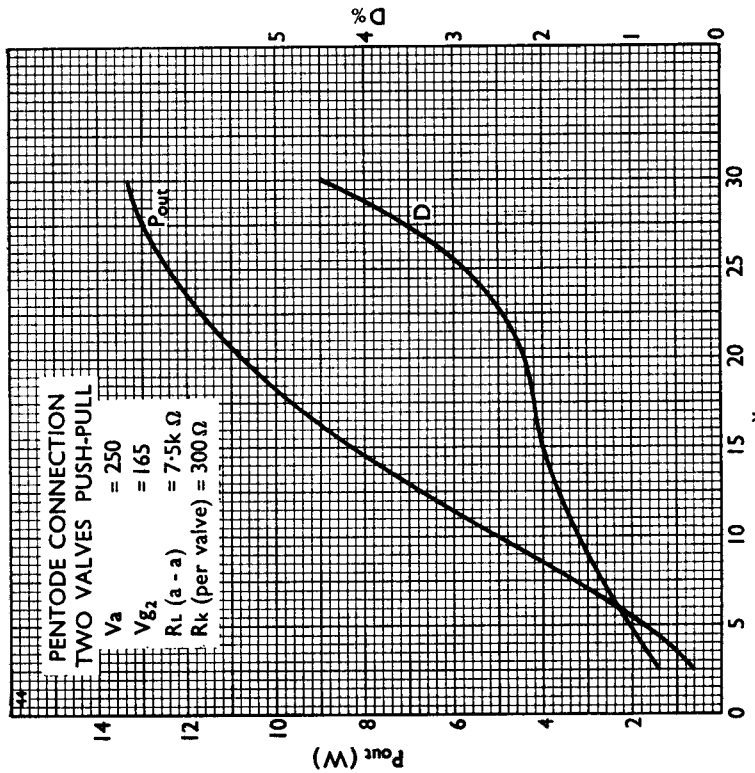

PENTODE CONNECTION
SINGLE VALVE CLASS A
75% INPUT POWER
Va = 165
Vg2 = 165
RL = 4 kΩ
Rk = 220Ω
Pout
D
Pout (W)
D %
Vin (pk)
3·0
2·0
1·0
0
1
2
3
4
5
6
7
8
10
12
14
16

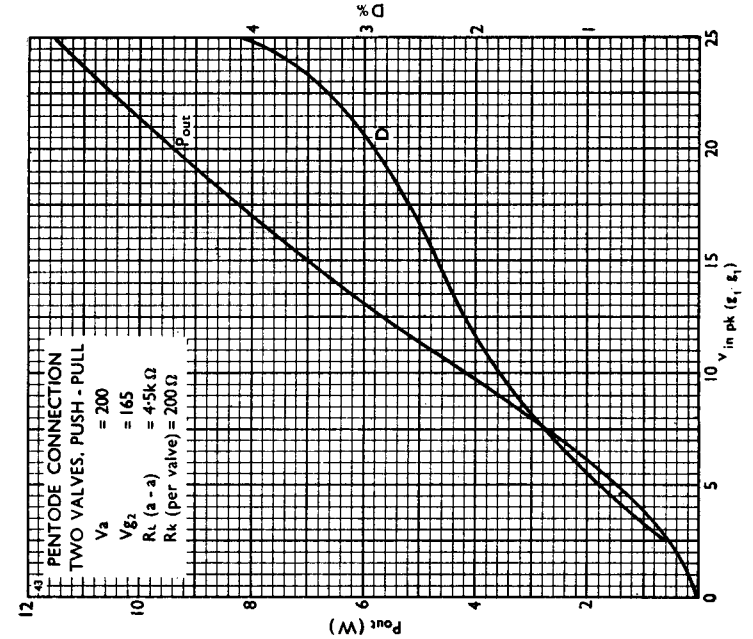

PENTODE CONNECTION
SINGLE VALVE CLASS A
50% INPUT POWER
Va = 165
Vg2 = 165
RL = 6kΩ
Rk = 330Ω
Pout
D
Pout (W)
D%
vin (pk)
0
1
2
3
4
5
6
2
4
6
8
10
12
14

N37

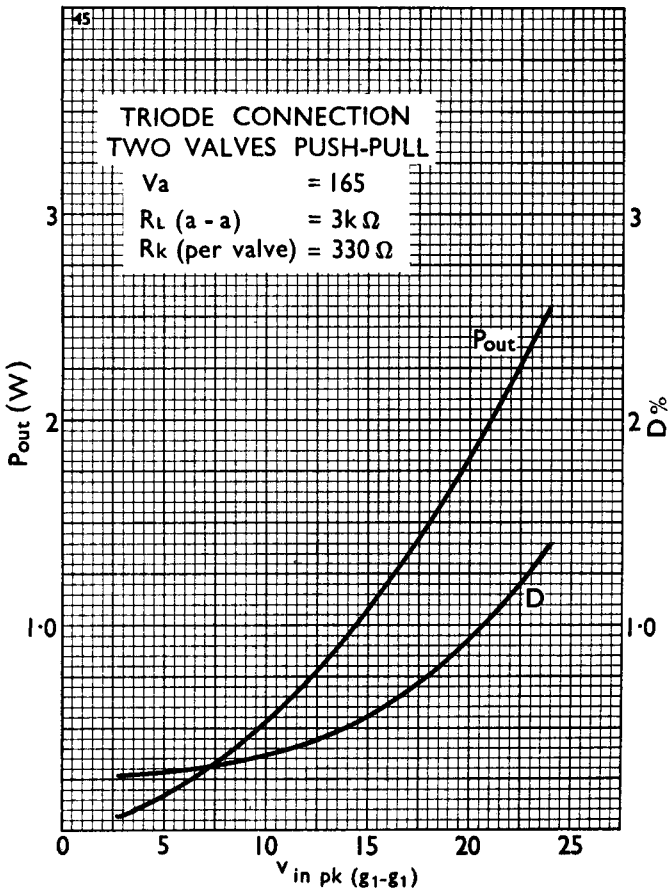

42
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 165
Vg2 = 165
RL (a - a) = 3kΩ
Rk (per valve) = 150Ω
Pout
D
Pout (W)
D%
V in pk (g1-g1)
0
2
4
6
8
10
0
5
10
15
20


41
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 100
Vg2 = 100
RL (a - a) = 3kΩ
Rk (per valve) = 120Ω
Pout
D
D%
V in pk (g1-g1)
Pout (W)
0
1
2
3
4
5
0
5
10
15
2·5
2
1·5
1
·5


44
PENTODE CONNECTION
TWO VALVES PUSH-PULL
Va = 250
Vg2 = 165
RL (a - a) = 7·5k Ω
Rk (per valve) = 300 Ω
Pout
D
Pout (W)
D %
V in pk (g1-g1)


43
PENTODE CONNECTION
TWO VALVES, PUSH - PULL
Va = 200
Vg2 = 165
RL (a - a) = 4·5k Ω
Rk (per valve) = 200 Ω
Pout
D
Pout (W)
D %
V in pk (g1 g1)

N37



Printed in England. C.

OUTPUT PENTODE

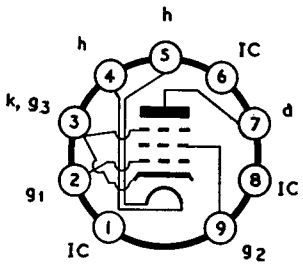
6·3 INDIRECTLY HEATED

N709

JULY, 1956

A high slope pentode primarily designed for use in the output stage of AC receivers and amplifiers.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base

Base : B9A

Bulb : Tubular

Overall length : 78 max. mm.

Seated length : 71 max. mm.

Diameter : 22·2 max. mm.

HEATER

V_h	6·3	V
I_h	0·76	A

RATING

V_a	300 max.		V
V_{g2}	300 max.		V
V_{h-k}	150 max.		V
I_k	65 max.		mA
p_a	12 max.		W
p_{g2}	2·0 max.		W
μ_{g1-g2} at $V_a=V_{g2}=250$, $V_{g1}=-7·3$, $I_a=48$mA	19		
r_a	38		kΩ
g_m	11·3		mA/V

TYPICAL OPERATION

Single Valve. Class A. Audio Amplifier.

V_a	250	V
V_{g2}	250	V
V_{g1}	−7·5 approx.	V
I_a	48	mA
I_{g2}	5·5	mA
$V_{in(pk)}$	6·5	V
R_a	5	kΩ
P_{out}	6·0	W
D	10	%

CAPACITANCES

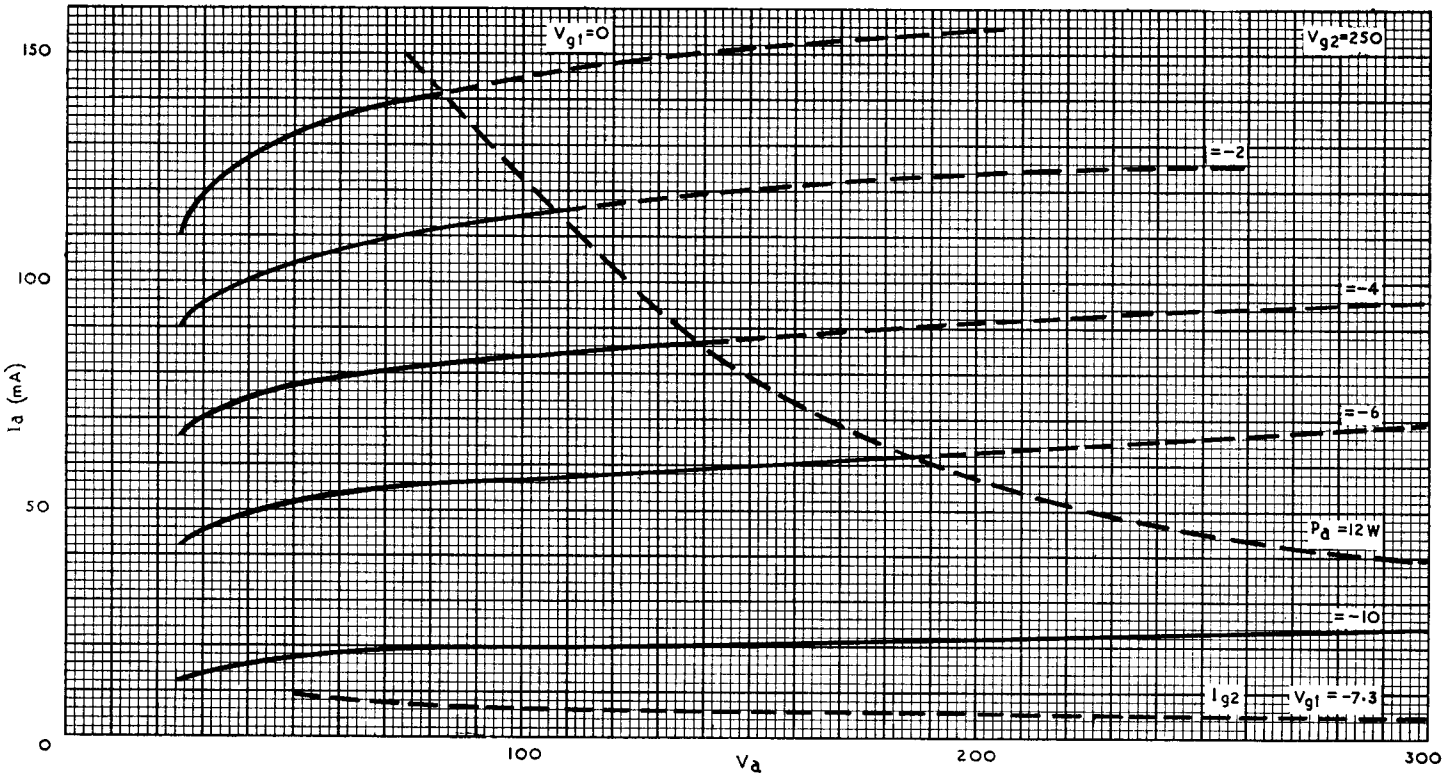
c_{in}	11 pF	c_{a-g1}	≯0·5 pF
c_{out}	6 pF	c_{g1-h}	≯0·25 pF

VENTILATION

Free air circulation round the bulb is preferable. The temperature of the hottest part of the bulb must not exceed 250° C.

MOUNTING

Any position.


150
100
50
0
Ia (mA)
100
200
300
Va
Vg1=0
Vg2=250
=-2
=-4
=-6
Pd =12W
=-10
Ig2
Vg1 = -7.3

CIRCUIT SUPPLEMENT

N709

JUNE, 1956
SECOND EDITION

N709 ULTRA-LINEAR AMPLIFIER

The full circuit diagram is shown in fig. 1, where two N709 valves are preceded by a pair of Z729 valves to form an amplifier having a basic sensitivity rather better than 50 mV for full output. Approximately 10 db feedback has been added, resulting in an input requirement of 150 mV.

As shown, the output valves are connected in the " ultra linear " circuit which provides a lower distortion and output impedance than the normal pentode arrangement together with a higher power output than triode connected valves. With the addition of a small amount of degeneration the distortion at 10W is below 0·1%.

The circuit requires little explanation. The use of a Z729 in the first stage ensures complete freedom from unwanted hum and microphony. The valve is internally screened and no external can is required but one may be added to act as a retainer if desired. A second Z729 is used in the phase-splitting stage but, alternatively, a DH77 may be used with diodes earthed ; in this case the values of R5, R6 and R7 should be doubled.

The output transformer primary is tapped at 20% of the turns on each half-winding for the screen supply. An extremely low order of leakage inductance between primary and secondary is not necessary as the overall feedback is only about 10 db, but this may be increased optionally. The degree of feedback is determined by the resistors R15 and R16. Assuming R15 has a value of 22Ω, the value of R16 is given by $650\sqrt{Z_s}$ where Z_s is the loudspeaker speech coil impedance. The nearest standard values may be used and close tolerance resistors are not required.

The ratio of the output transformer is given by $\sqrt{R_L/Z_s}$ where R_L is the specified anode to anode load. According to the operating conditions the optimum load varies from 6 kΩ to 7 kΩ. However, 7 kΩ is a good compromise and a satisfactory performance will be obtained with a transformer providing this impedance. The recommended type will therefore have a ratio of 21·5 : 1 for a 15Ω loudspeaker. If the secondary is wound in two halves, either a 15Ω or 3·5-4Ω loudspeaker may be used by a series or parallel arrangement of the windings. Each half-primary should have a tapping point at 20% of the turns measured from the centre for the screen grid connection.

The capacitors, C11 C12, are usually necessary to prevent parasitic oscillation with the ultra linear circuit and should not be omitted, although the value is not critical. The same applies to the grid and screen resistors, R10, R11, R12, R13.

ULTRA LINEAR OPERATION (See figs. 2 and 3)

Data per pair unless otherwise indicated.

$V_{a(b)}$	315	V
$V_{a,g2}$	300	V
I_a+_{g2} (o)	88	mA
I_a+_{g2} (max. sig.)	100	mA
R_k (per valve)	270	Ω
V_k	13	V
p_a+_{g2} (o)	13	W
p_a+_{g2} (max. sig.)	8	W
P_{out}	14	W
*D_{tot}	1	%
R_L (a−a)	7	kΩ
V_{in} (g1−g1) (rms)	18	V
*Z_{out}	9	kΩ

* Basic circuit without feedback.

With resistors R15 R16 added, the following data is obtainable (Curve B, fig 3).

D_{tot}	0·1	0·25	0·5	%
P_{out}	11	12	13·5	W
Z_{out}		1800		Ω
V_{in} to Z729 (rms)		150		mV

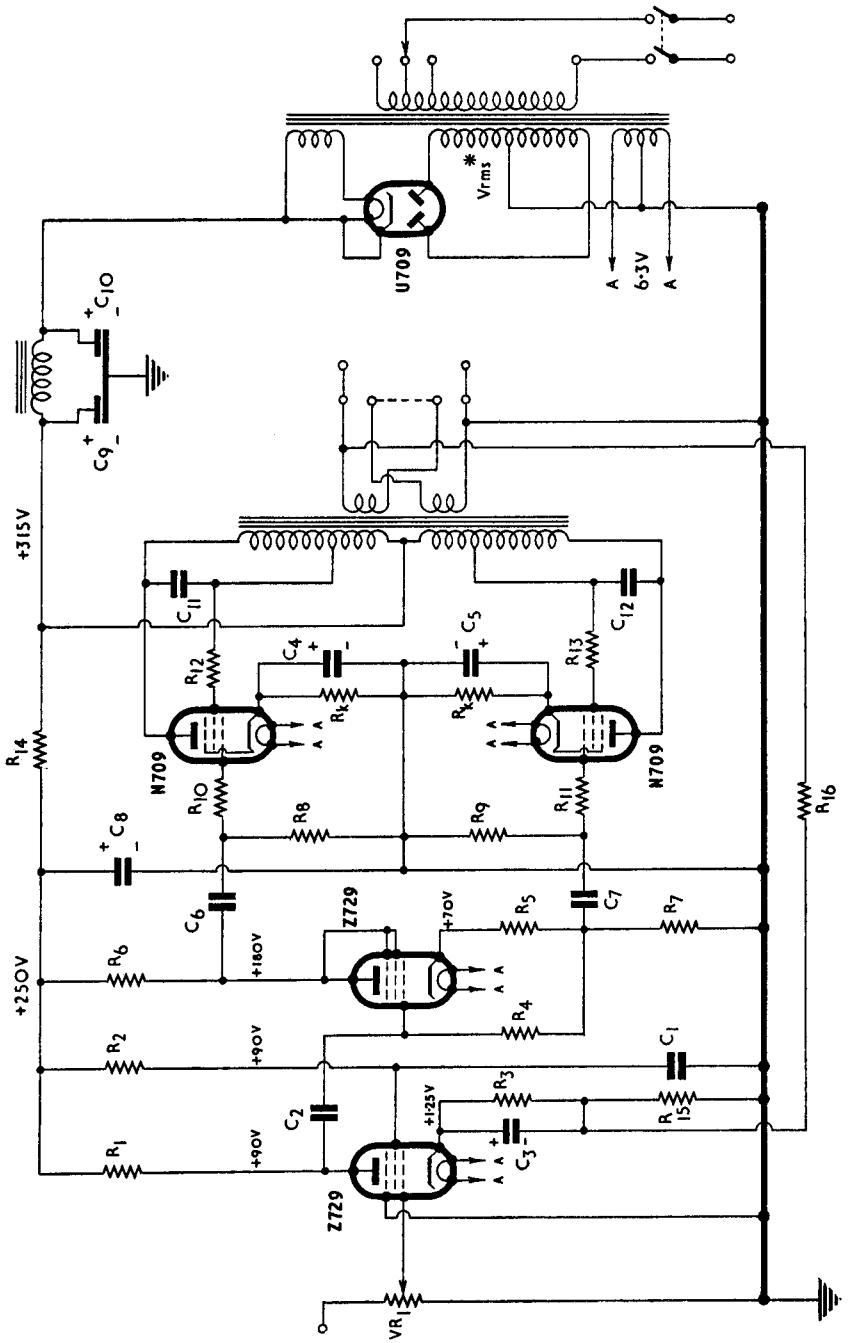


Fig. 1. See page 3 for component values.
* $V_{rms} = 300 - 0 - 300V$.

COMPONENT VALUES

RESISTORS

(0·25W, 20% unless otherwise indicated)

R1	220 kΩ		10%
R2	1 MΩ		10%
R3	2·2 kΩ		
R4	1 MΩ		
R5	1 kΩ		
R6	33 kΩ	0·5W } Matched to	
R7	33 kΩ	0·5W } 5%	
R8	220 kΩ		10%
R9	220 kΩ		10%
R10	10 kΩ		
R11	10 kΩ		
R12	100 Ω		
R13	100 Ω		
R14	15 kΩ	0·5W	10%
R15	22 Ω		10%
R16	1·5 or 2·7 kΩ for Z_s equal to 4 or 15 Ω respectively.		
R_k	270 Ω	0·5W	5%
VR1	0·5 MΩ (or higher) variable.		

CAPACITORS

C1	0·1 μF	Paper	
C2	0·01 μF	Paper	
C3	50 μF	Electrolytic	12V
C4	50 μF	Electrolytic	25V
C5	50 μF	Electrolytic	25V
C6	0·05 μF	Paper	
C7	0·05 μF	Paper	
C8	8 μF	Electrolytic	350V
C9	16 μF	Electrolytic	450V
C10	16 μF	Electrolytic	450V
C11	0·001 μF	Paper or Mica	
C12	0·001 μF	Paper or Mica	

L1 Smoothing Choke : 10-20H 100 Ω

T1 Output transformer : 21·5 : 1 or 43 : 1. Primaries to be tapped at 20% of turns in each half.

T2 Mains transformer :

Secondary :	6·3V, 3A	
	6·3V, 1A	
	300 — 0 — 300V	120mA

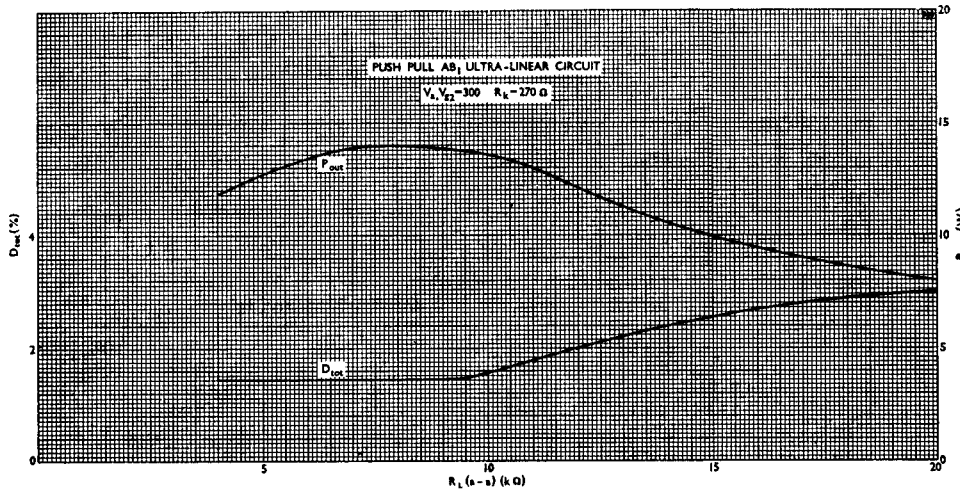

PUSH PULL AB1 ULTRA-LINEAR CIRCUIT
Va, Vg2=300 Rk=270 Ω
Pout
Dtot
Dtot (%)
Pout (W)
RL (a-a) (kΩ)
0
2
4
5
10
15
20

Fig. 2.

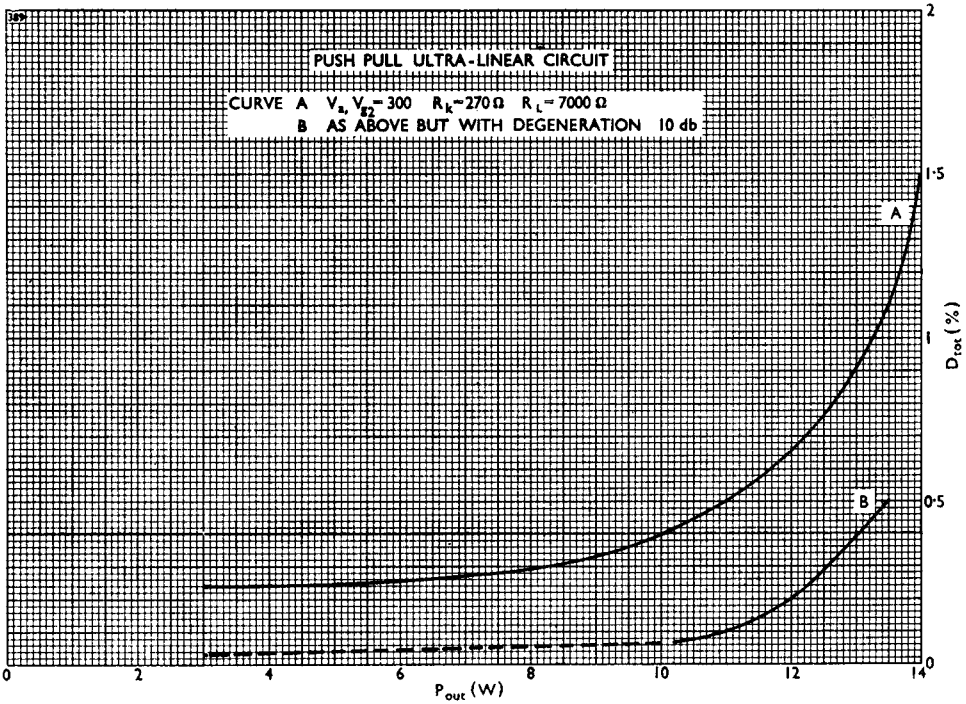

PUSH PULL ULTRA-LINEAR CIRCUIT
CURVE A Va, Vg2=300 Rk=270 Ω RL=7000 Ω
B AS ABOVE BUT WITH DEGENERATION 10 db
A
B
Dtot (%)
Pout (W)
0
0·5
1
1·5
2
4
6
8
10
12
14

Fig. 3.

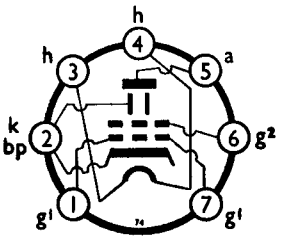
OUTPUT BEAM TETRODE
6·3V INDIRECTLY HEATED

N727/6AQ5

NOVEMBER, 1954

The N727/6AQ5 is a commercial equivalent of CV1862.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	70·5 max.	mm.
Seated length :	63·5 max.	mm.
Diameter	19 max.	mm.

HEATER

V_h	6·3	V
I_h	0·45	A

MAXIMUM RATINGS (design centre)

Pentode connection

V_a	250	V
V_{g2}	250	V
$V_{h\text{-}k}$	150	V
p_a	12	W
p_{g2}	2	W

Triode connection

V_{a+g2}	250	V
p_{a+g2}	14	W

CHARACTERISTICS

Pentode connection

V_a	180	250	V
V_{g2}	180	250	V
V_{g1}	−8·5	−12·5	V
I_a	29	45	mA
I_{g2}	3	4·5	mA
g_m	3·7	4·1	mA/V
r_a	58	52	kΩ
μ (g1-g2)	10	10	

Triode connection

V_{a+g2}	250		V
V_{g1}	−12·5		V
I_{a+g2}	49·5		mA
g_m	5·0		mA/V
r_a	1·9		kΩ
μ	9·5		

CAPACITANCES (of cold valve)

c_{in} 8·3 pF c_{out} 8·2 pF $c_{a\text{-}g1}$ 0·35 pF

TYPICAL OPERATION

Pentode connection

Single valve Class A

V_a	180	250	V
V_{g2}	180	250	V
V_{g1}	−8·5	−12·5	V
I_a	29	45	mA
I_{g2}	3	4·5	mA
v_{in} (pk)	8·5	12·5	V
R_k	270	240	Ω
R_L	5·5	5	kΩ
P_{out}	2	4·5	W
D	8	8	%

Push-pull. Class AB_1. Two valves.

Data per pair unless otherwise stated.

	No signal	Max signal	
V_a	250	250	V
V_{g2}	250	250	V
V_{g1}	−15	—	V
I_a	70	79	mA
I_{g2}	5	13	mA
v_{in} (pk) (g_1-g_1)	—	30	V
R_k (per valve)	390	—	Ω
R_L (a-a)	10	10	kΩ
P_{out}	—	10	W
D	—	5	%

GENERAL

The maximum permissible D.C. grid resistance between control grid and cathode is limited to 0·5 MΩ for auto-bias and 0·1 MΩ for fixed bias applications.

MOUNTING

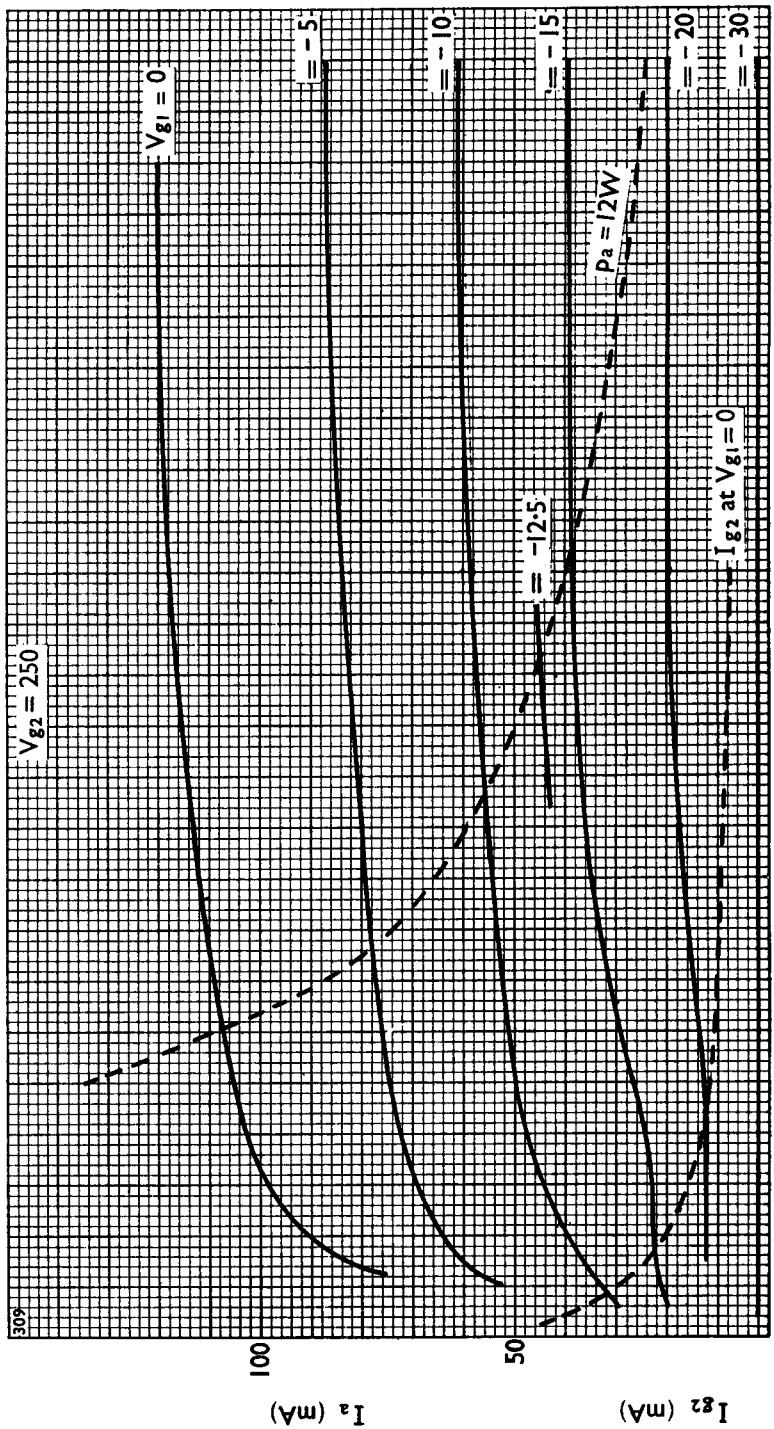
Any position.

RETAINING

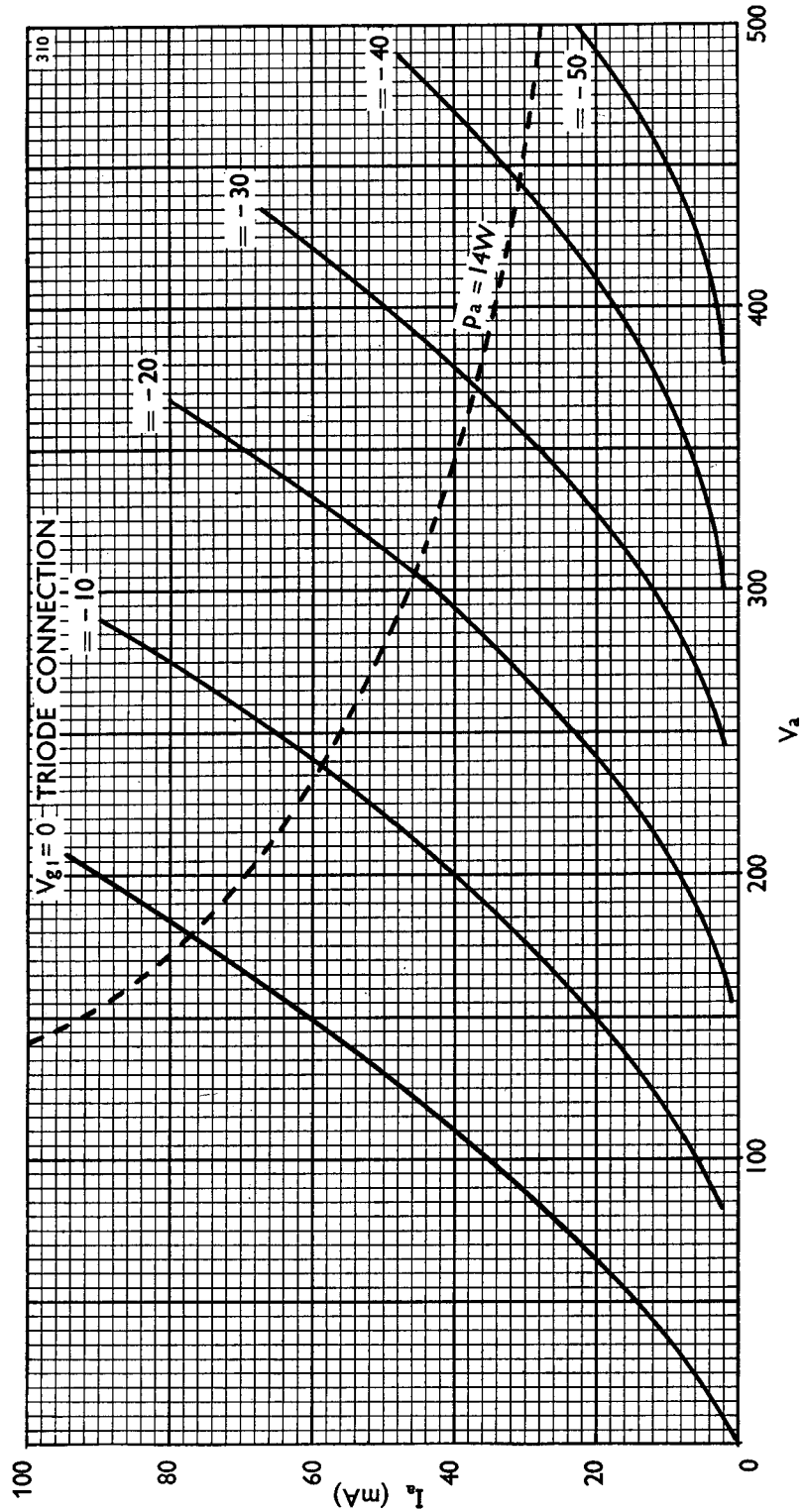
It is recommended that a retaining device is used.

VENTILATION

Free air circulation around the bulb is preferable. The temperature of the hottest part of the bulb must not exceed 250°C.


309
V_{g2} = 250
V_{g1} = 0
= - 5
= - 10
= - 15
= - 20
= - 30
= -12.5
P_a = 12W
I_{g2} at V_{g1} = 0
100
50
0
100
200
300
400
500
V_a
I_a (mA)
I_{g2} (mA)

N727/6AQ5



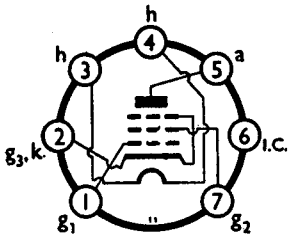
Printed in England. C.

MINIATURE
OUTPUT PENTODE
6·3V INDIRECTLY HEATED

N77

SEPTEMBER, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

Pentode connection

V_h	6·3		V
I_h	0·2		A
$V_{h\text{-}k}$ (pk)	150	max.	V
V_a	250	max.	V
V_{g2}	250	max.	V
p_a	4	max.	W
p_{g2}	0·6	max.	W
r_a at $V_a = V_g$ 250 I_a = 16mA	130		kΩ
g_m at $V_a = V_g$ 250 I_a = 16mA	2·6		mA/V

Triode connection

$V_{a\ g2}$	250	max.	V
$p_{a\ g2}$	4·6	max.	W
μ at $V_{a\ g2}$ = 250 I_a = 16 mA	11·5		
r_a at $V_{a\ g2}$ = 250 I_a = 16 mA	3·85		kΩ
g_m at $V_{a\ g2}$ = 250 I_a = 16 mA	3		mA/V

CAPACITANCES (of cold unscreened valve)

$c_{a\text{-}all}$ 4·2 pF $c_{g1\text{-}all}$ 3·2 pF $c_{a\text{-}g1} < 0{\cdot}5$ pF

TYPICAL OPERATION

Single valve. Class A. Pentode connection.

V_a	250	V
V_{g2}	250	V
I_a	16	mA
I_{g2}	2·4	mA
R_k	680	Ω
v_{in} (pk)	7·5	V
R_L	16	kΩ
P_{out}	1·4	W
D	10	%

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford

Push-pull. Class AB_1. Self bias.

Data per pair unless otherwise stated.

V_a	250		V
V_{g2}	250		V
V_{g1} (0)	15	approx.	V
I_a (0)	22		mA
I_a (max. sig.)	25·6		mA
I_{g2} (0)	3·2		mA
I_{g2} (max. sig.)	8·2		mA
R_k	600		Ω
v_{in} (pk) (g_1-g_1)	34		V
R_L (a—a)	24		kΩ
P_{out}	4		W
D	3·2		%

Push-pull. Class AB_1. Fixed bias.

Data per pair unless otherwise stated.

V_a	250	V
V_{g2}	250	V
V_{g1}	−19	V
I_a (0)	10	mA
I_a (max. sig.)	32	mA
I_{g2} (0)	1·3	mA
I_{g2} (max. sig.)	9	mA
v_{in} (pk) (g_1-g_1)	37	V
R_L	20	kΩ
P_{out}	4·8	W
D	3·3	%

GRID RESISTOR

The maximum permissible D.C. resistance between control grid and cathode is limited to 470 kΩ ± 20% with auto-bias, and 100 kΩ ± 20% with fixed bias operation.

MOUNTING

Any position.

RETAINING

A retaining device should be used.

SCREENING

No internal or external screening is fitted to the valve.

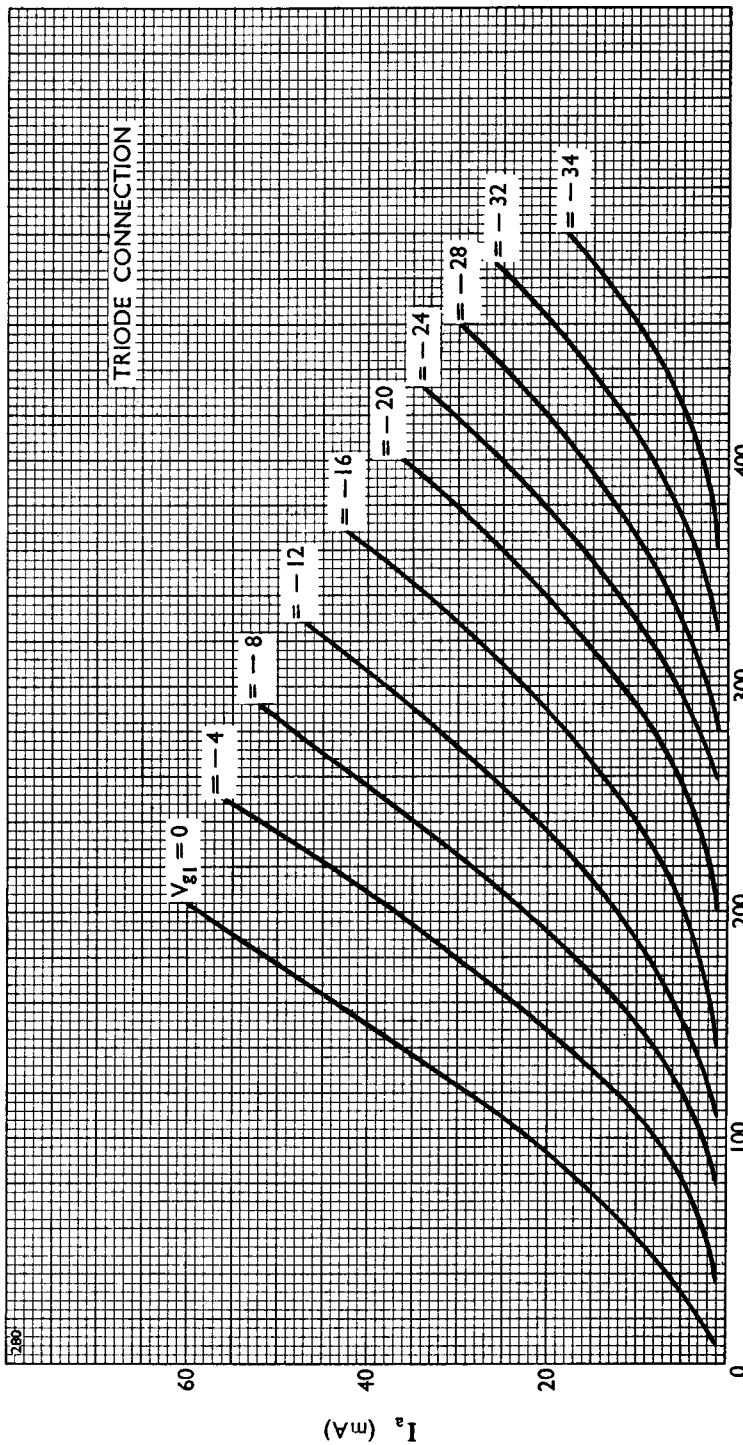
VENTILATION

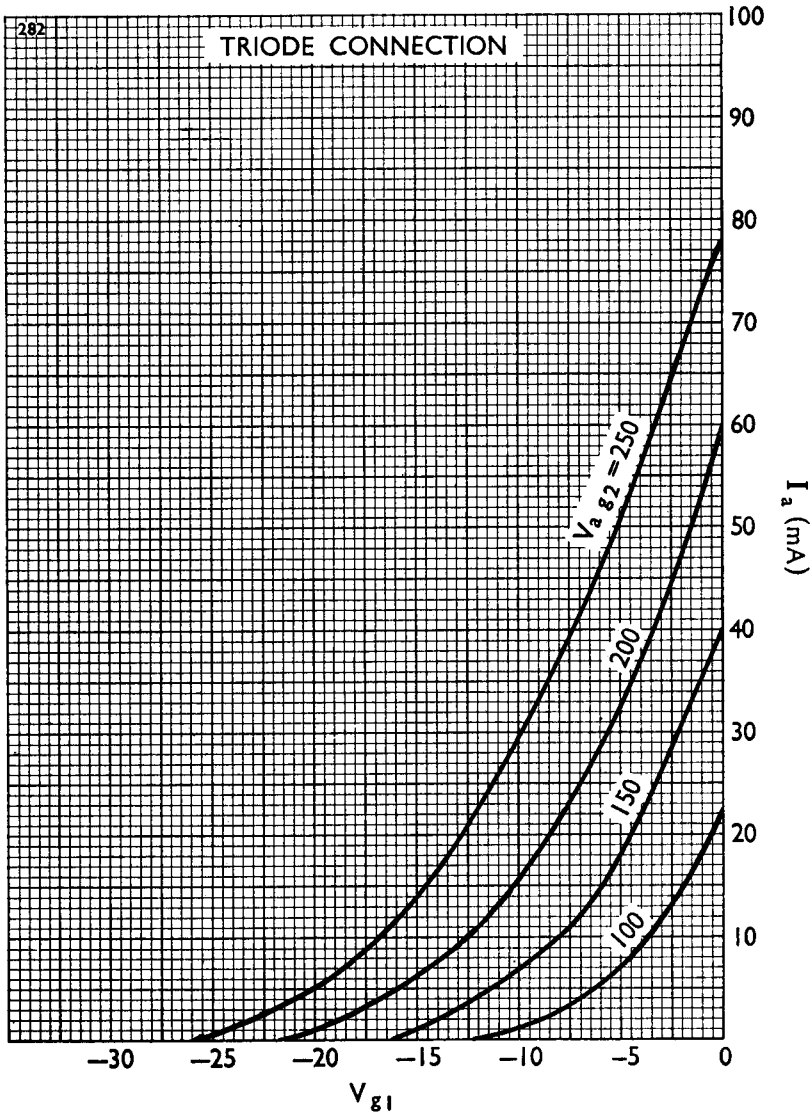
Free air circulation around the bulb should be allowed.

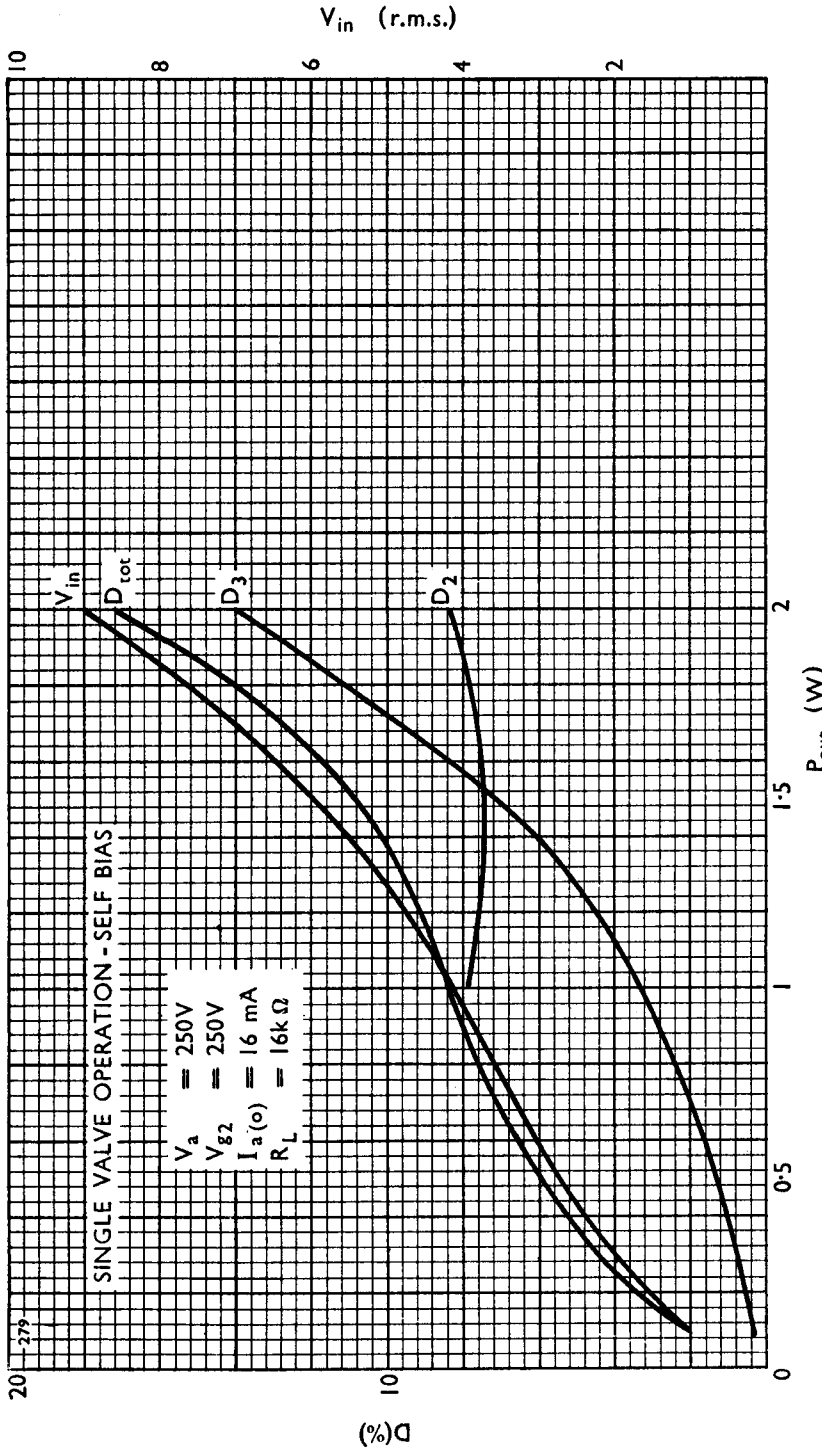
MICROPHONY

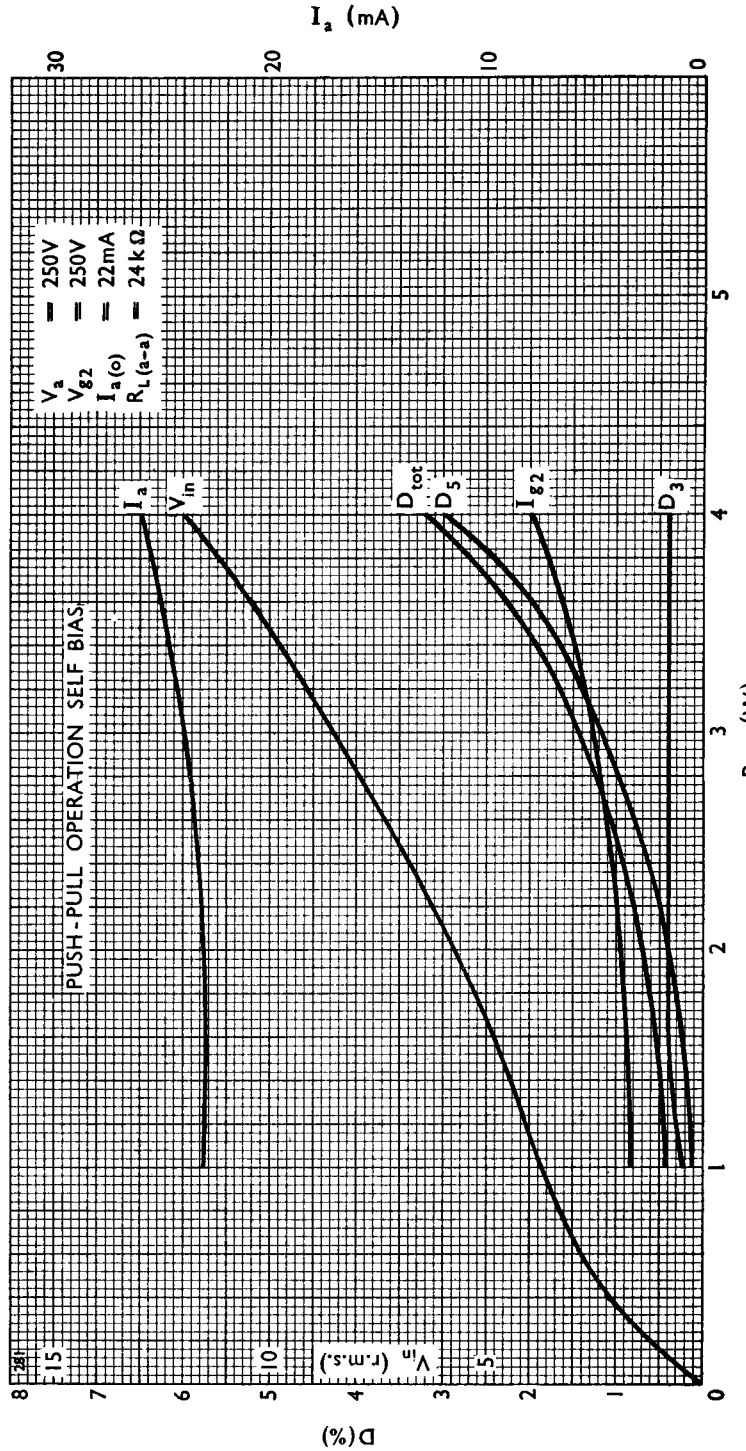
Although of a very low order, equipment should be designed to minimise microphony.

PENTODE CONNECTION
$V_{g2} = 250$
$V_{g1} = 0$
$P_a = 4$ W
$= -1{\cdot}5$
$= -3{\cdot}0$
$= -4{\cdot}5$
$= -6{\cdot}0$
$= -7{\cdot}5$
$= -9{\cdot}0$
$= -10{\cdot}5$
$= -12{\cdot}0$
$= -13{\cdot}5$
$= -15{\cdot}0$
$= -16{\cdot}5$
$= -18{\cdot}0$
$= -19{\cdot}5$
278
I_a (mA)
V_a
0
10
20
30
40
50
60
100
200
300
400
500


TRIODE CONNECTION
$V_{g1} = 0$
$= -4$
$= -8$
$= -12$
$= -16$
$= -20$
$= -24$
$= -28$
$= -32$
$= -34$
0
20
40
60
100
200
300
400
I_a (mA)
V_a
280


282
TRIODE CONNECTION
100
90
80
70
60
50
40
30
20
10
I_a (mA)
$V_{a\,g2}$ = 250
200
150
100
−30
−25
−20
−15
−10
−5
0
V_{g1}


V_{in} (r.m.s.)
10
8
6
4
2
V_{in}
D_{tot}
D_3
D_2
SINGLE VALVE OPERATION - SELF BIAS
V_a = 250V
V_{g2} = 250V
$I_{a(o)}$ = 16 mA
R_L = 16k Ω
279
20
10
0
D(%)
0
0·5
1
1·5
2
P_{out} (W)


I_a (mA)
30
20
10
0
V_a = 250V
V_{g2} = 250V
$I_{a(o)}$ = 22mA
$R_{L(a-a)}$ = 24 kΩ
PUSH-PULL OPERATION SELF BIAS
I_a
V_{in}
D_{tot}
D_5
I_{g2}
D_3
V_{in} (r.m.s.)
D(%)
P_{out} (W)
0
1
2
3
4
5
8
15
7
10
6
5
4
3
2
1
0
5

N77

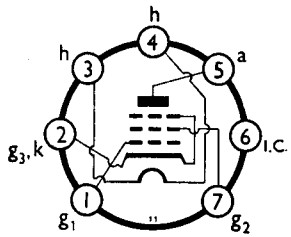
OV.2023 C. Printed in England.

MINIATURE
OUTPUT PENTODE
6·3V INDIRECTLY HEATED

N78

NOVEMBER, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	64—70	mm.
Seated length :	58—64	mm.
Max. diameter :	19	mm.

RATING

Pentode Connection

V_h	6·3		V
I_h	0·64	approx.	A
v_{h-k} (pk)	150	max.	V
V_a	250	max.	V
V_{g2}	250	max.	V
p_a	9	max.	W
p_{g2}	3	max.	W
μ	420		
r_a	40		kΩ
g_m	10·5		mA/V

at $V_a = V_{g2} = 250$, $V_{g1} = -5$

Triode Connection

$V_{a, g2}$	250	max.	V
$p_{a, g2}$	12	max.	W
μ	24		
r_a	2·1		kΩ
g_m	11·4		mA/V

at $V_{a, g2} = 250$, $V_{g1} = -5$

CAPACITANCES (of cold unscreened valve)

$c_{a\text{-all}}$	10·5	pF	$c_{g1\text{-all}}$	11·5	pF	$c_{a\text{-}g1}$	0·3	pF

TYPICAL OPERATION

Single Valve, Class A, Pentode Connection

V_a	250		V
V_{g2}	250		V
V_{g1} (o)	−5	approx.	V
I_a (o)	35		mA
I_{g2} (o)	5·5		mA
R_k	120		Ω
v_{in} (pk)	5		V
R_L	7		kΩ
P_{out}	4		W
D	9·2		%

Push-pull, Class AB_1, Pentode Connection

Data per pair unless otherwise stated

V_a	220	250	350	V
V_{g2}	220	250	275	V
V_{g1} (o) approx.	−3·2	−5	−7·1	V
I_a (o)	82	70	46	mA
I_a (max. sig)	82	73	51	mA
I_{g2} (o)	13	11	6·5	mA
I_{g2} (max. sig)	16·5	16·5	20	mA
R_k (per valve)	68	120	270	Ω
v_{in} (pk) (g_1-g_1)	7	11·2	20	V
R_L (a-a)	9	9	18	kΩ
P_{out}	5	9	12·6	W
D	3	4·6	4·8	%

Push-pull, Class AB_1. Triode Connection

Data per pair unless otherwise stated

$V_{a,\,g2}$	300	350	V
V_{g1} (o) approx.	−7·5	−9·5	V
$I_{a,\,g1}$ (o)	67	57	mA
$I_{a,\,g2}$ (max. sig)	73	64·5	mA
R_k (per valve)	220	330	Ω
v_{in} (pk) (g_1-g_1)	15·5	21	V
R_L (a-a)	5	8	kΩ
P_{out}	4·4	6·3	W
D	1·5	1·6	%

R.F. Power Amplifier and Oscillator, Single Valve. Class C Telegraphy

Pentode Connection. (Unmodulated key-down conditions)

V_a	300	V
V_{g2}	150	V
V_{g1}	−25	V
I_a	65	mA
I_{g2}	14	mA
*I_{g1}	5	mA
R_L	1·65	kΩ
p_a	9	W
P_{out}	10·5	W

* Subject to wide variation.

Frequency Multiplier. Single Valve. Pentode Connection.

Key-down conditions.

f_{in}	20	50	20	Mc/s
f_{out}	40	100	60	Mc/s
V_a	350	260	270	V
V_{g2}	150	200	160	V
V_{g1}	−60	−100	−120	V
I_a	52	55	52	mA
I_{g2}	14	9	12	mA
*I_{g1}	3	5	6	mA
R_L	2·2	1·1	1·18	kΩ
p_a	9	9	9	W
P_{out}	9·2	5·3	5·1	W

* Subject to wide variation.

GRID RESISTOR

The maximum permissible D.C. resistance between control grid and cathode is limited to 0·27 MΩ ± 20% with auto-bias, and 0·1 MΩ with fixed bias.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

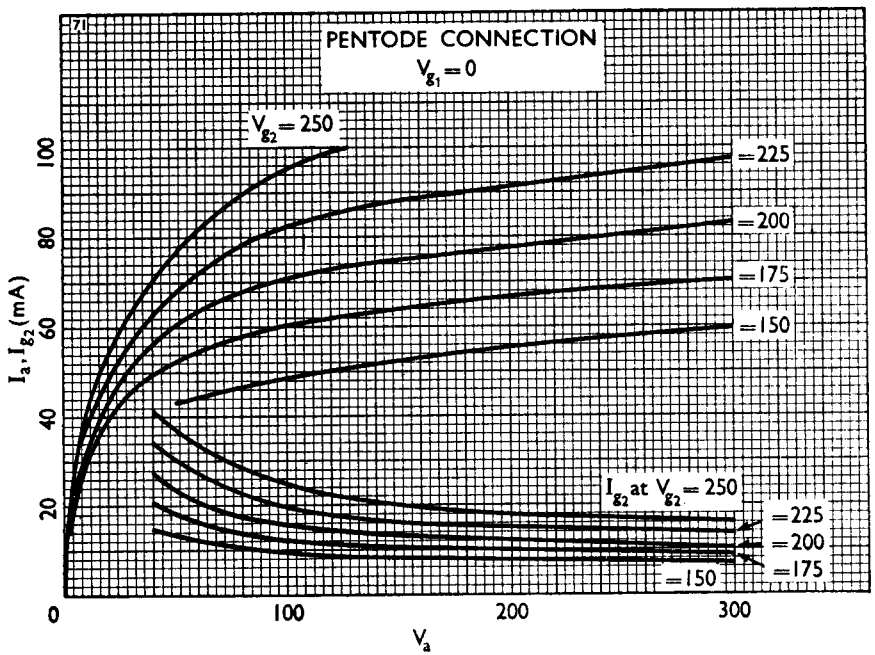
A retaining device should be used.

VENTILATION

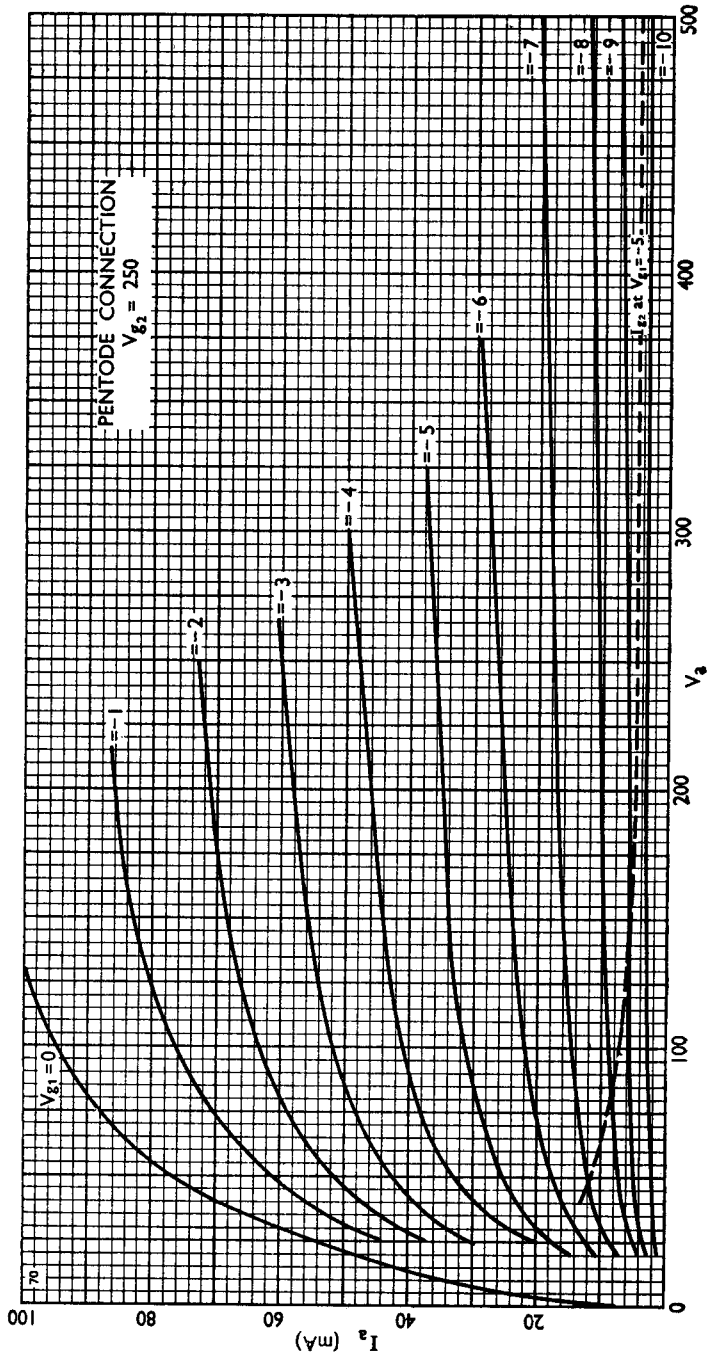
Free air circulation round the bulb is preferable. If a retaining device in the form of a canister is used, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

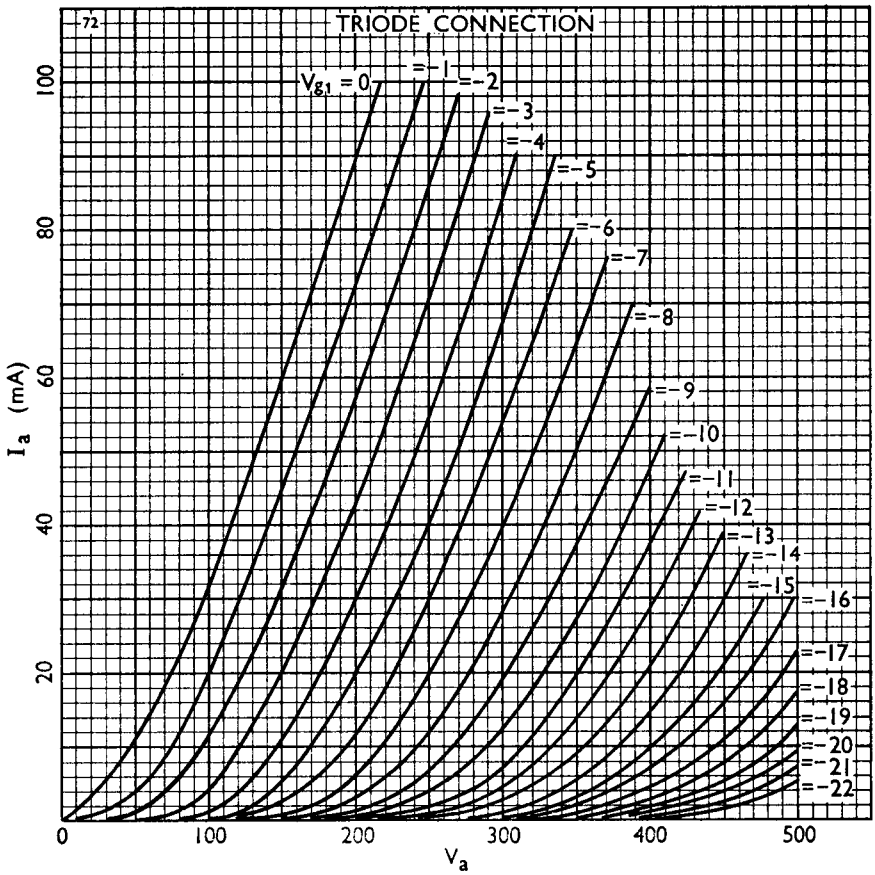
MICROPHONY

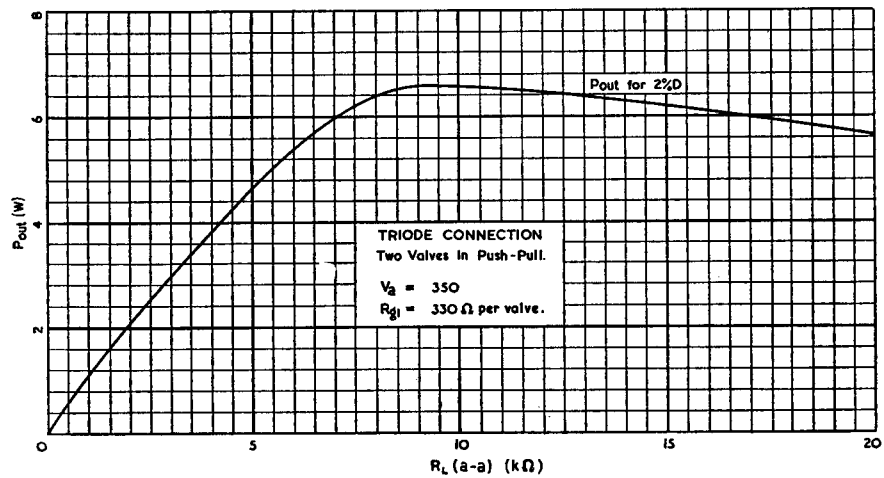
Although this is of a very low order, equipment should be designed to minimise microphony.



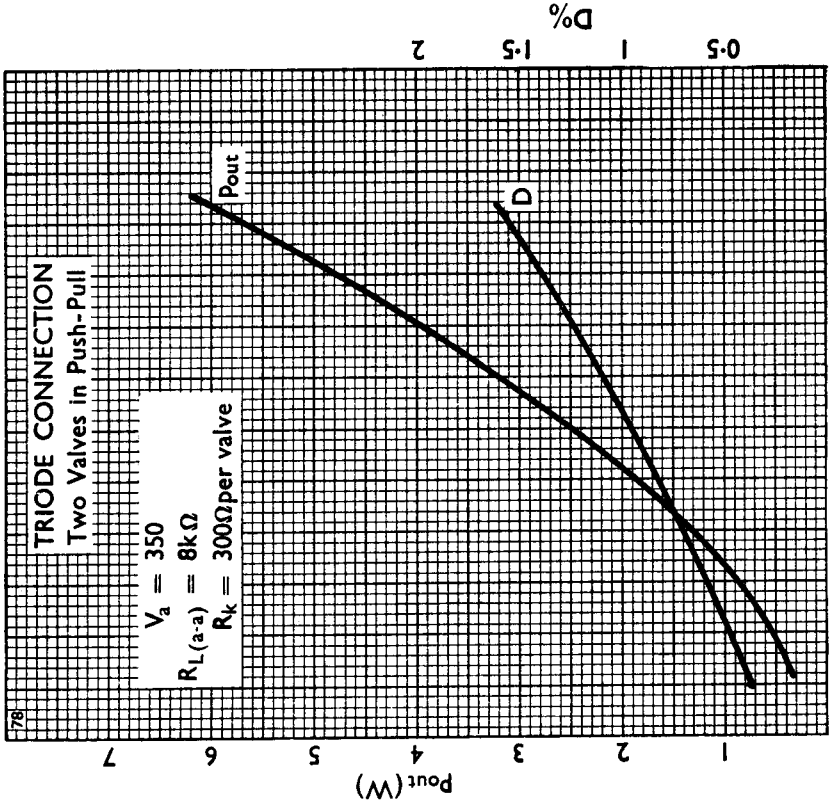
N78

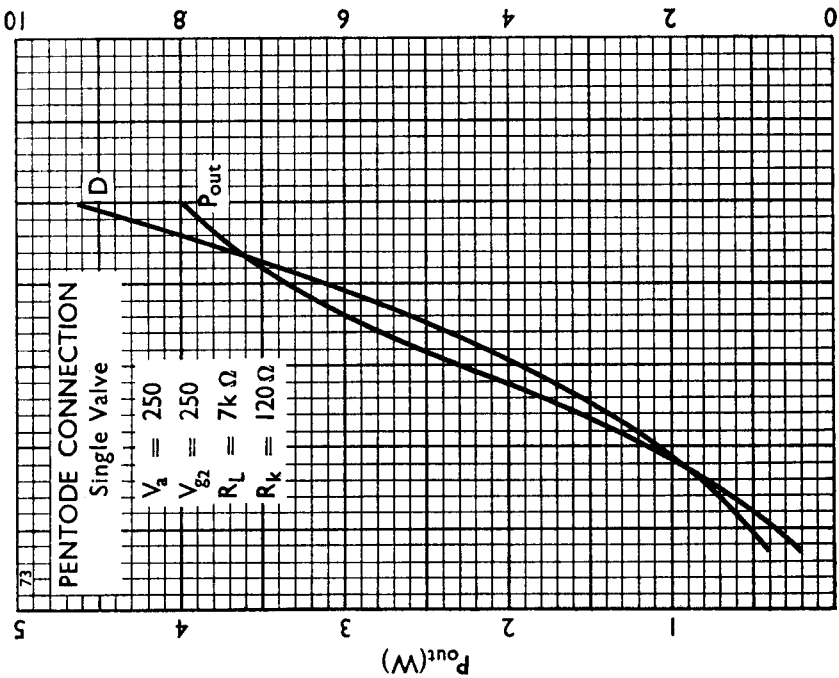

PENTODE CONNECTION
V_{g2} = 250
V_{g1} = 0
=-1
=-2
=-3
=-4
=-5
=-6
=-7
=-8
=-9
=-10
V_{g1}=-5
I_{g2} at
I_a (mA)
V_a
0
100
200
300
400
500
20
40
60
80
100

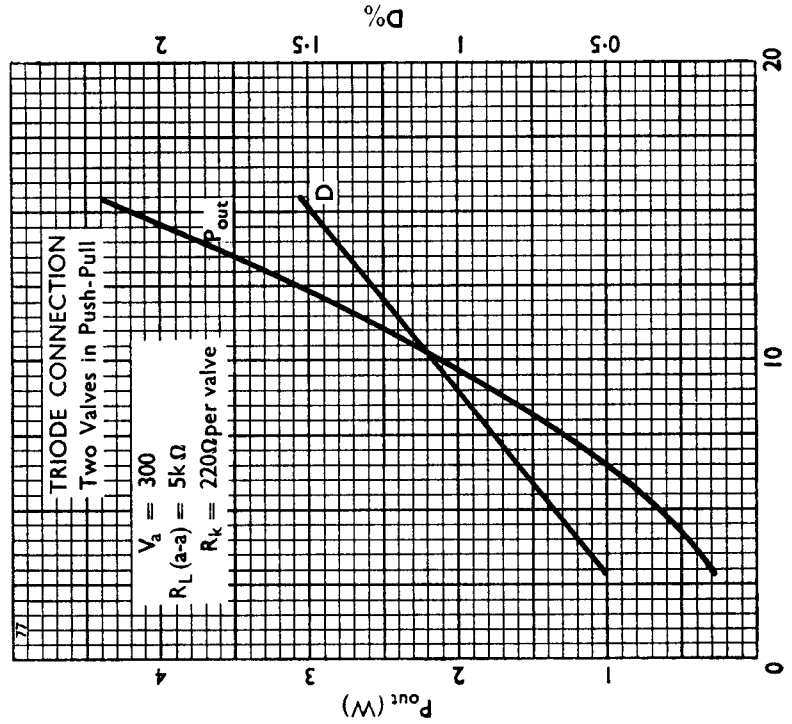

72
TRIODE CONNECTION
Vg1 = 0
=-1
=-2
=-3
=-4
=-5
=-6
=-7
=-8
=-9
=-10
=-11
=-12
=-13
=-14
=-15
=-16
=-17
=-18
=-19
=-20
=-21
=-22
Ia (mA)
Va
0
100
200
300
400
500
20
40
60
80
100

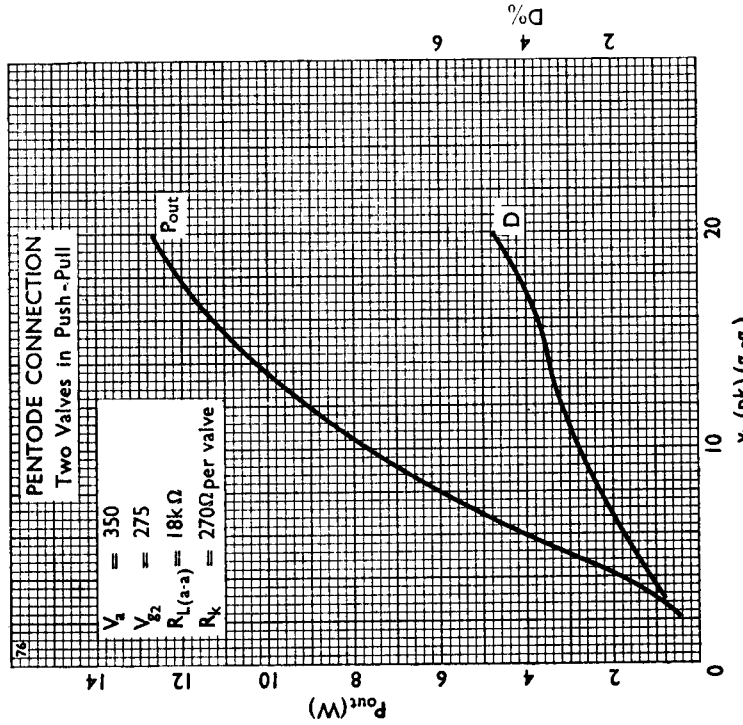

Pout for 2%D
TRIODE CONNECTION
Two Valves in Push-Pull.
Va = 350
Rgl = 330 Ω per valve.
Pout (W)
RL (a-a) (kΩ)
0
5
10
15
20
2
4
6
8

N78

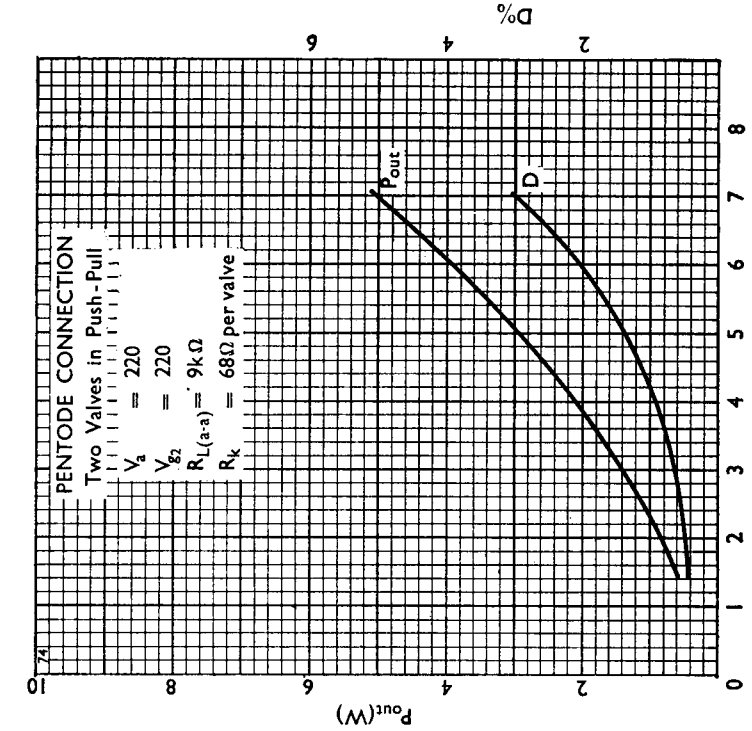

TRIODE CONNECTION
Two Valves in Push-Pull
V_a = 350
$R_{L(a-a)}$ = 8kΩ
R_k = 300Ω per valve
Pout
D
78
Pout (W)
D%
v_{in} (pk) (g_1-g_1)

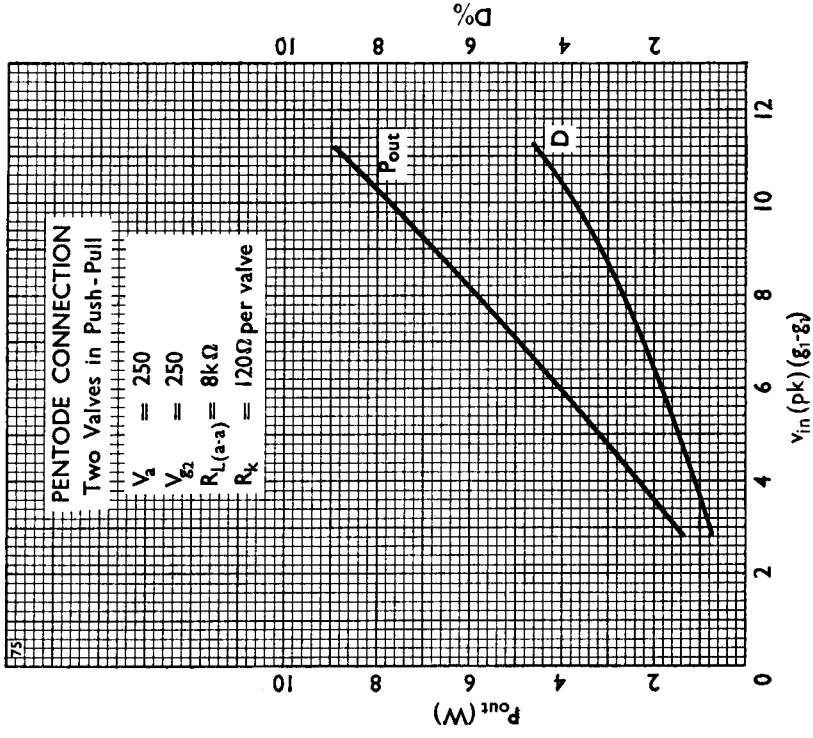

PENTODE CONNECTION
Single Valve
V_a = 250
V_{g2} = 250
R_L = 7k Ω
R_k = 120 Ω
D
Pout
73
Pout(W)
D%
v_{in}(pk)


TRIODE CONNECTION
Two Valves in Push-Pull
V_a = 300
R_L (a-a) = 5k Ω
R_k = 220Ω per valve
P_{out}
D
77
P_{out} (W)
D%
v_{in} (pk) (g_1-g_1)


PENTODE CONNECTION
Two Valves in Push-Pull
V_a = 350
V_{g2} = 275
$R_{L(a-a)}$ = 18k Ω
R_k = 270Ω per valve
P_{out}
D
76
P_{out} (W)
D%
v_{in} (pk) (g_1-g_1)

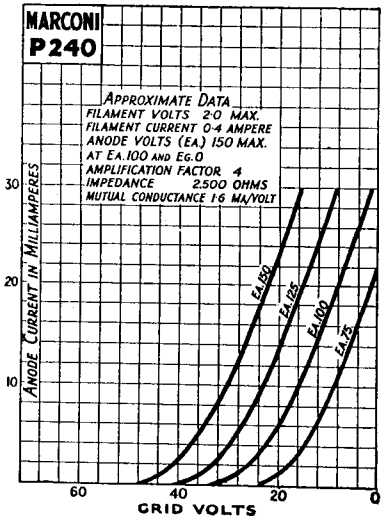
N78





Printed in England. C.

MARCONI 2-VOLT VALVES



P 240, Super-Power, 13/6

P.240 is a super-power output valve which provides rather greater volume than is obtainable from Marconi P.2. P.240 should thus be used when the available input is sufficient to overload P.2 and when increased output is required. It is an ideal final stage valve for operating a moving coil speaker at moderate volume.

Approximate Operating Data.

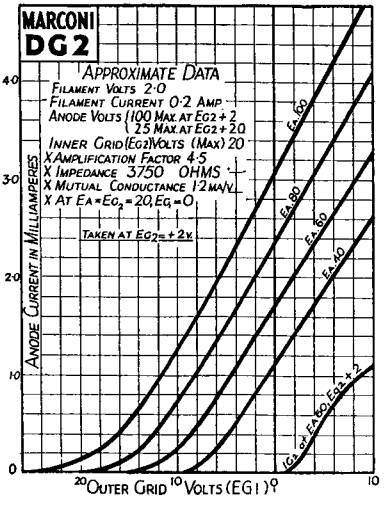
Anode Volts.	Grid Bias.	Average Anode Current.
150	−24	17 m.a.
125	−19.5	14 m.a.
100	−15	11 m.a.

DG 2, Double Grid, 20/-

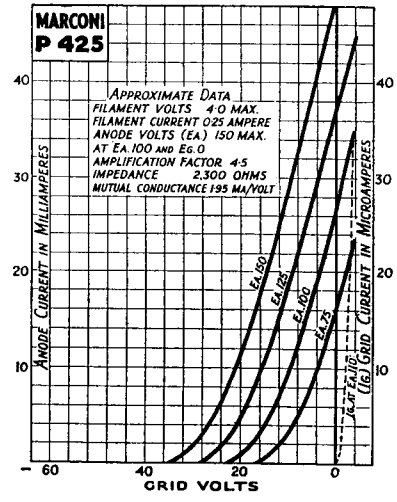
DG.2 is a new four-electrode, double grid valve of special design, intended particularly for use in super-heterodyne receivers, principally of the portable type. Its main application is as a combined detector-oscillator, in which position it performs a dual functicn, thus eliminating the space and current requirements of one valve.

Approximate Operating Data.

Anode Volts.	Outer Grid Volts.	Inner Grid Volts.	Anode Current	Inner Grid Current.
+40 to 80	−6 to 15	+ 2	.25 to .5 m.a.	Almost nil.
+20 to 25	13 to 5	+20	1.5 to 2.0	10 to 12



MARCONI 4-VOLT VALVES



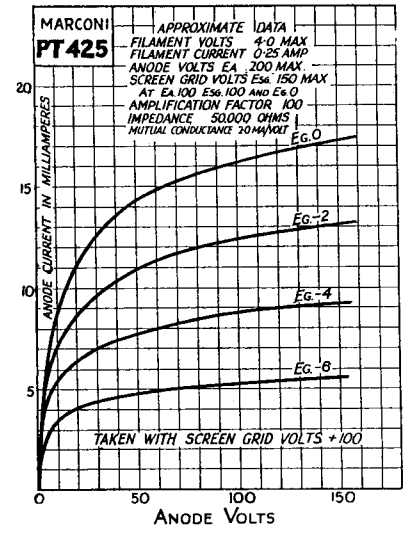
P 425, Super Power, 13/6

P425 is a super-power output valve for use with moving coil and similar speakers, providing adequate volume for most purposes. The filament may if desired be heated by alternating current in a suitable circuit without producing hum.

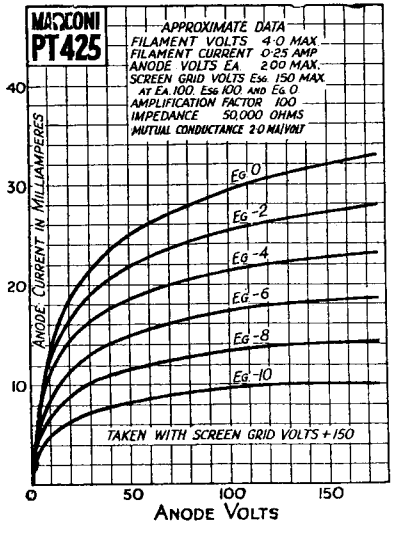
PT 425, Pentode, 20/-

PT425 is a power pentode valve for receivers having a single L.F. stage. It provides high stage gain and ample output for most purposes.

Screen Volts 100



Screen Volts 150



Pentode *Type PT15*

(RF AMPLIFIER)

General. The PT 15 is a radio-frequency transmitting pentode with an oxide-coated dull emitter filament.

The valve is suitable for use as an oscillator, radio-frequency amplifier or frequency multiplier, and for telephony.

Modulation may be applied to the control grid, suppressor grid, or to the anode and screen grids.

APPROXIMATE DATA

V_f	6·3	V
I_f	1·3	A
g_m taken at V_a 1,000 V, V_{g2} 300 V, p_a 30 W	2·8	mA/V
g_m (taken at $\frac{1}{2}$ $I_{e(pk)}$)	7·0	mA/V*
$I_{e(pk)}$	0·7	A*
$c_{a\text{-}g1}$	0·035	pF
c_{in}	22·0	pF
c_{out}	14·5	pF

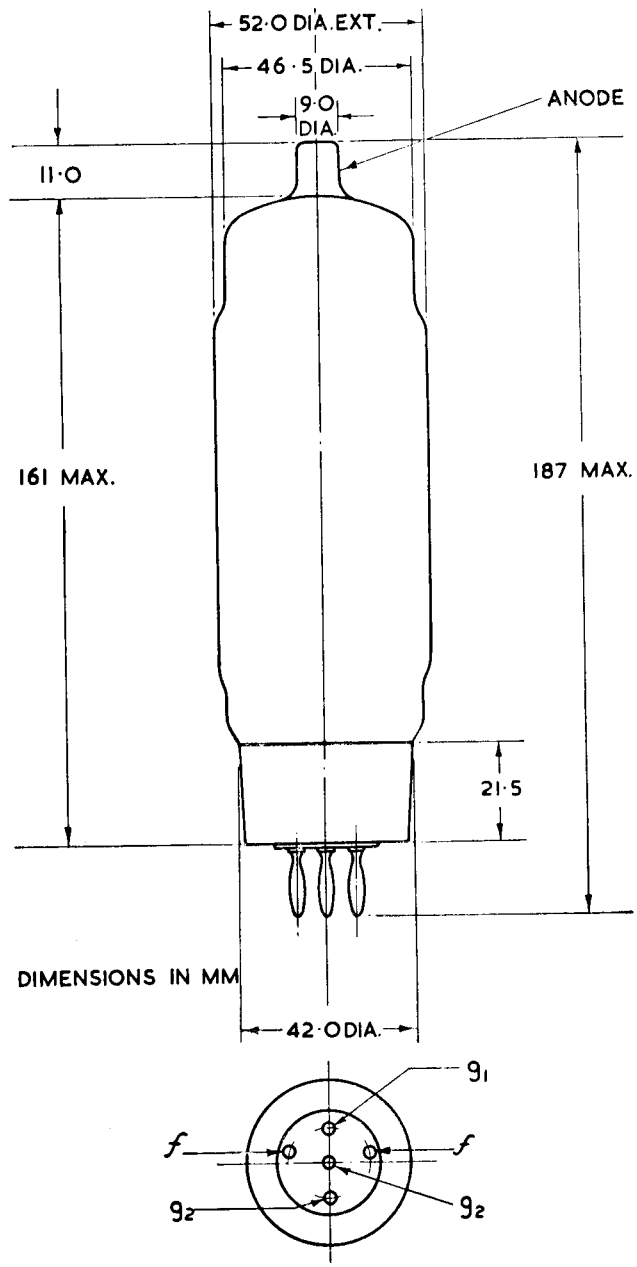
*No attempt must be made to measure this figure statically.

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(*Unmodulated, one valve, key down conditions.*)

Maximum permissible ratings

V_a		1,250	V
I_a		100	mA
P_{in}	(V_{g3} +40 V)	115	W
	(V_{g3} 0 V)	90	W
V_{g1}		−200	V
I_{g1}		10	mA
V_{g2}		300	V
p_{g2}		10	W
p_a		30	W



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Typical Operation

V_a	1,250	1,000	750	1,250	1,000	V
I_a	90	100	95	70	70	mA
V_{g2}	290	290	290	290	290	V
I_{g2}	25	30	30	18	25	V
p_{g2}	7·3	8·7	8·7	5·2	7·3	W
V_{g3}	+40	+40	+40	0	0	V
V_{g1}	−90	−90	−90	−90	−90	V
I_{g1} (a)	7·0	7·5	7·0	4·6	5·0	mA
R_{g1}	12,500	12,500	12,500	20,000	20,000	Ω
$v_{g1(pk)}$	140	150	148	129	132	V
P_{dr} (a)	1·0	1·2	1·1	0·6	0·65	W
Z_a	6,600	4,500	3,600	7,600	5,600	Ω
p_a	30	30	21·4	29·5	28	W
P_{out}	82·5	70	50	58	42	W
η_a	73·5	70	70	66	60	%

(2) HF POWER AMPLIFIER. CLASS C

(*Anode modulated, one valve, carrier conditions, permissible modulation 100%.*)

Maximum permissible ratings

V_a		1,000	V
I_a		80	mA
P_{in}	(V_{g3} +40 V)	80	W
	(V_{g3} 0 V)	60	W
I_{g1}		10	mA
V_{g2}		300	V
p_{g2}		7·5	W
p_a		20	W

Typical Operation

V_a	1,000	750	1,000	750	V
I_a	80	80	60	60	mA
V_{g2}	300	300	300	270	V
I_{g2}	23	22·5	23	24	mA
R_{g2}	30,000	20,000	30,000	20,000	Ω
p_{g2}	6·9	6·75	6·9	6·5	W
V_{g3}	+40	+40	0	0	V
V_{g1}	−70	−70	−70	−70	V
I_{g1} (a)	6·0	6·0	4·5	5·0	mA
$v_{g1(pk)}$	115	120	108	110	V
P_{dr} (a)	0·7	0·75	0·5	0·6	W
$P_{audio\,mod}$ (c)	40	30	30	22·5	W
$Z_{to\,mod}$	9,900	7,300	12,000	9,000	Ω
Z_a	6,300	4,700	7,600	5,600	Ω
p_a	20	15	19	15	W
P_{out}	60	45	41	30	W
η_a	75	75	68	66	%

(3) HF POWER AMPLIFIER. CLASS C

(*Grid modulated, one valve, carrier conditions, permissible modulation 100%.*)

Maximum permissible ratings

V_a		1,250	V
I_a		60	mA
P_{in}	(V_{g3} +40 V)	48	W
	(V_{g3} 0 V)	45	W
I_{g1}		10	mA
V_{g2}		300	V
p_{g2}		10	W
p_a		30	W

Typical Operation

V_a	1,250	1,000	1,250	1,000	V
I_a	37	46	36	36	mA
V_{g2}	300	300	300	300	V
I_{g2}	5·5	6·0	5·0	5·0	mA
p_{g2}	1·7	1·8	1·5	1·5	W
V_{g3}	+40	+40	0	0	V
V_{g1}	−62	−63	−65	−65	V
I_{g1} (a)	0·25	0·75	0	0	mA
$v_{g1(pk)}$	66	73	65	65	V
P_{dr} (a) (b)	0·4	0·4	0·4	0·4	W
$v_{mod(pk)}$ (c)	25	26	28	28	V
$P_{audio\,mod}$ (c)	0·06	0·08	0·08	0·08	W
$Z_{to\,mod}$	5,600	4,400	5,400	5,400	Ω
Z_a	8,300	5,200	8,000	5,900	Ω
p_a	29·8	30	30	25	W
P_{out}	16·5	16	15	11	W
η_a	36	35	33	31	%

(4) HF POWER AMPLIFIER

(Suppressor modulated, one valve, carrier conditions, permissible modulation 100%.)

Maximum permissible ratings

V_a	1,250	V
I_a	50	mA
P_{in}	45	W
I_{g1}	10	mA
V_{g2}	300	V
p_{g2}	10	W
p_a	30	W

Typical Operation

V_a	1,250	V
I_a	35	mA
V_{g2}	275	V
R_{g2}	50,000	Ω
I_{g2}	19·5	mA
p_{g2}	5·4	W
V_{g3}	−78	V
V_{g1}	−90	V
I_{g1} (a)	4·5	mA
R_{g1}	20,000	Ω
$v_{g1(pk)}$	135	V
P_{dr} (a)	0·7	W
$v_{mod(pk)}$ (c)	78	V
$P_{audio\ mod}$ (c)	Negligible	
Z_a	7,600	Ω
p_a	30	W
P_{out}	14	W
η_a	32	%

(5) HF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%.)

Maximum permissible ratings

V_a	1,250	V
I_a	60	mA
P_{in} (Vg_3 0 and +40 V)	45	W
I_{g1}	10	mA
V_{g2}	300	V
p_{g2}	10	W
p_a	30	W

Typical Operation

V_a	1,250	1,000	750	1,250	1,000	V
I_a	35	45	56	35	42	mA
V_{g2}	300	300	300	300	300	V
I_{g2}	3	6	7	3	6	mA
p_{g2}	0·9	1·8	2·1	0·9	1·8	W
V_{g3}	+40	+40	+40	0	0	V
V_{g1}	−35	−35	−33	−35	−35	V
I_{g1} (a)	—	—	0·25	—	—	mA
$v_{g1(pk)}$	27	28	35	27	29	V
P_{dr}(a)(b)	0·2	0·25	0·5	0·2	0·3	W
Z_a	9,800	6,000	3,600	9,200	5,500	Ω
p_a	29	30	28	30	30	W
P_{out}	15	15	14	14	12	W
η_a	34	33	33	32	29	%

The figures quoted for maximum permissible ratings apply only to operation at wavelengths down to 20 m. (15 Mc/s).

At shorter wavelengths the anode voltage must be reduced and curves are given showing the maximum permissible anode voltages against wavelength.

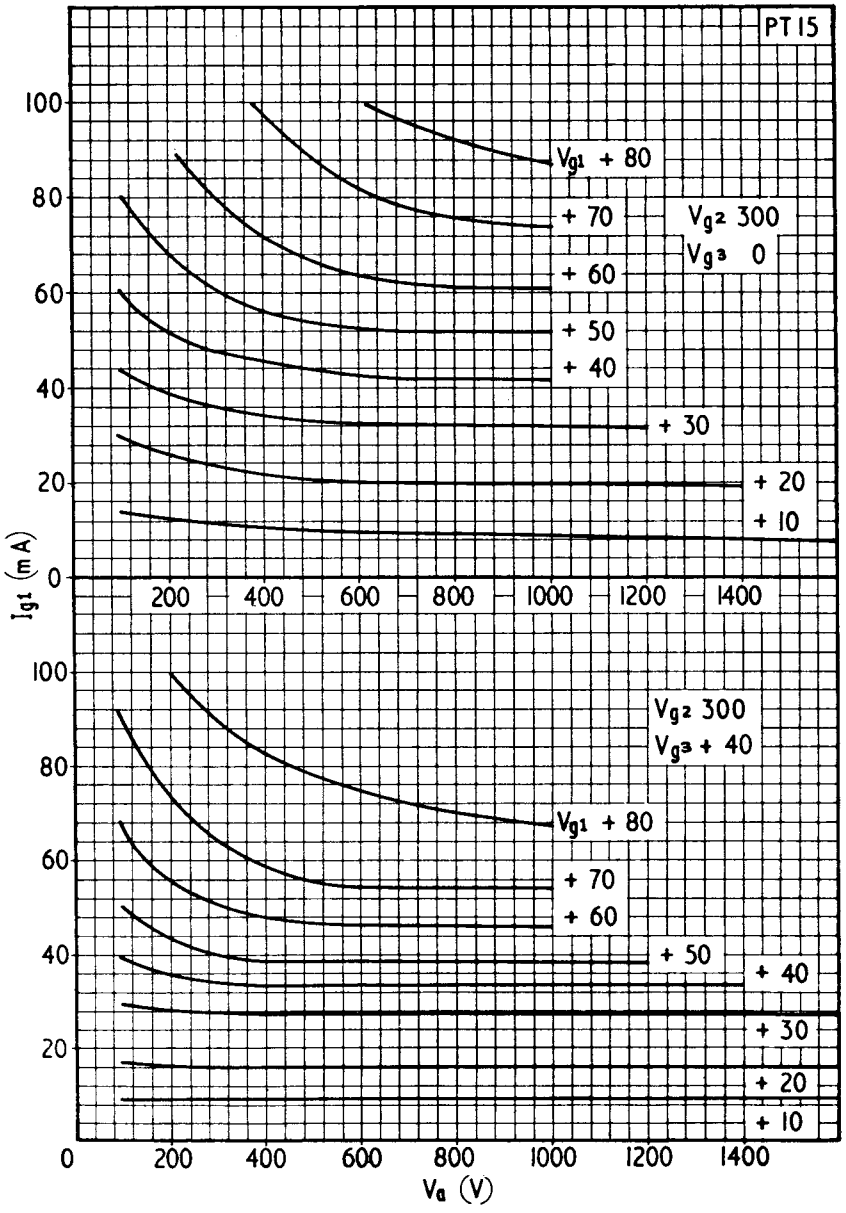
As the efficiency falls with decrease of wavelength the input must be reduced in order to avoid exceeding the permissible anode dissipation.

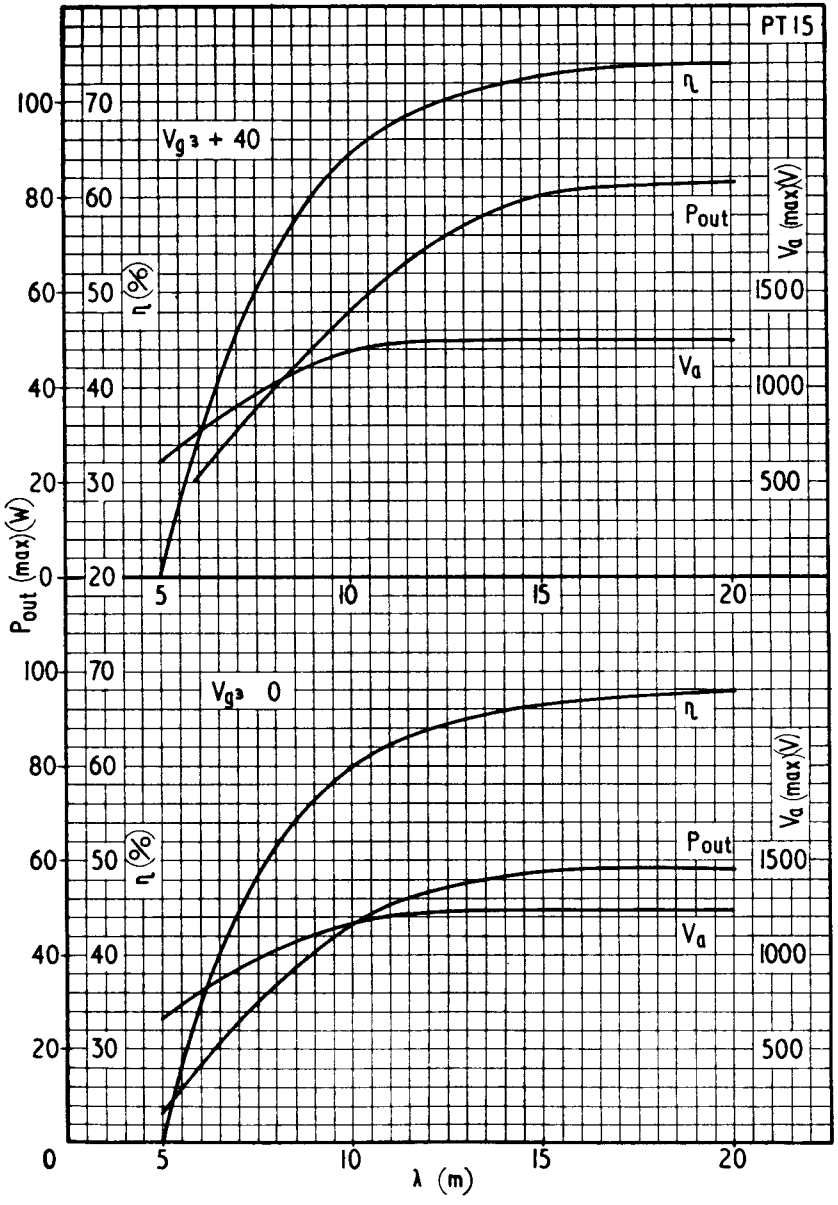
NOTES

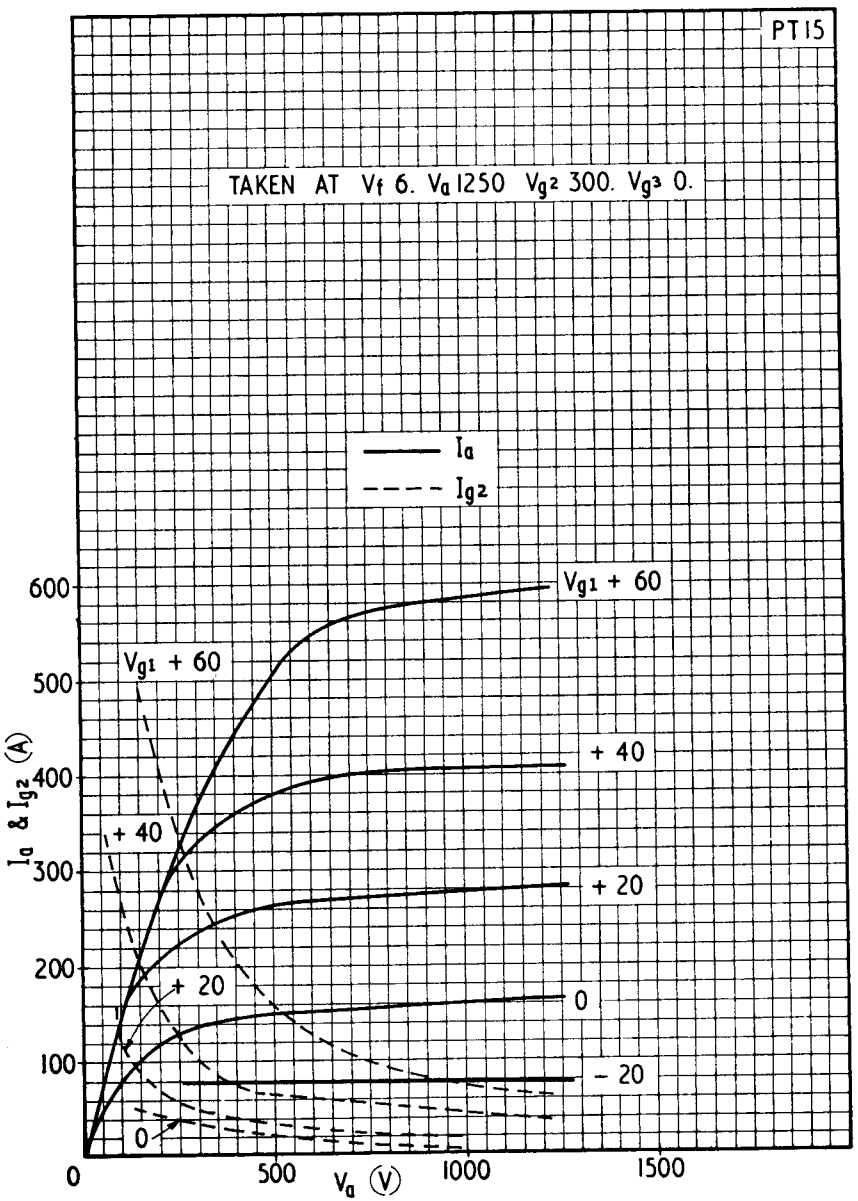
(*a*) Subject to wide variation. The figures are approximate only.

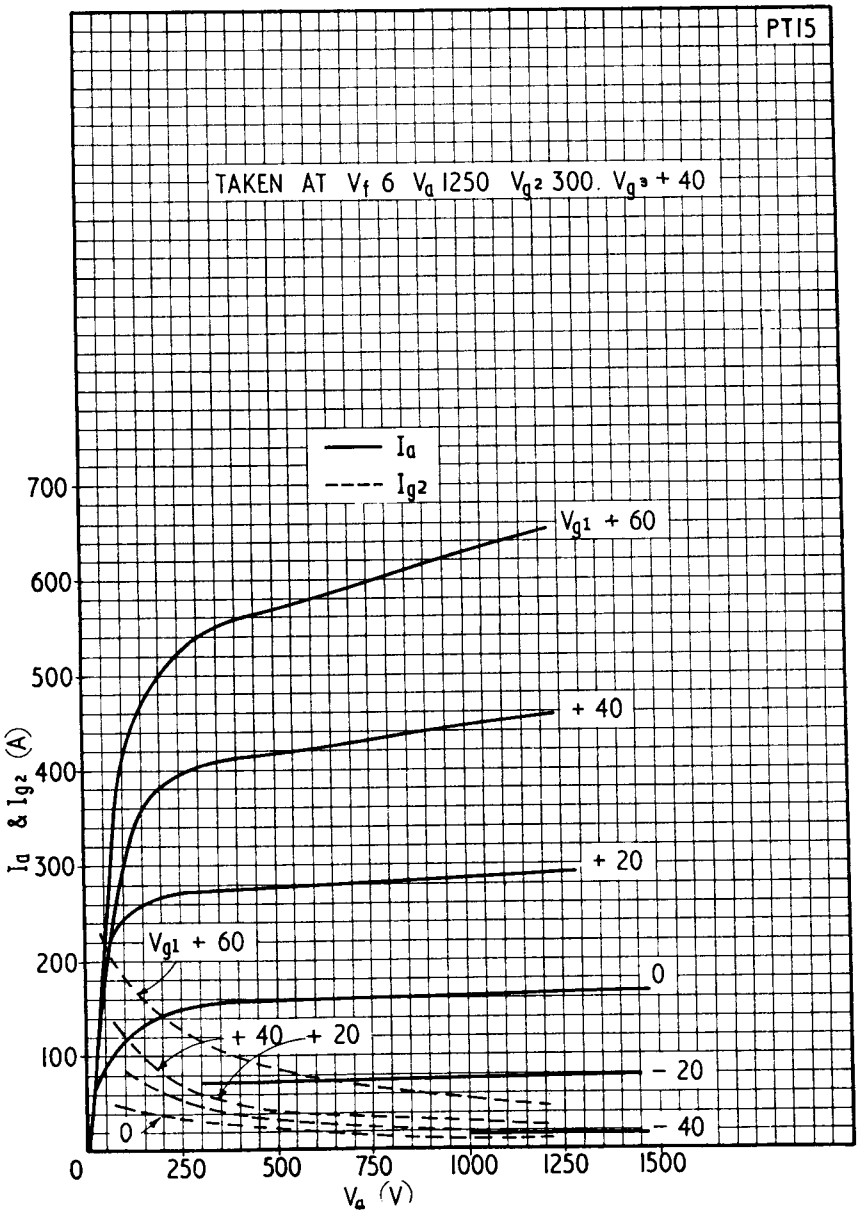
(*b*) At crest of audio cycle with 100% modulation.

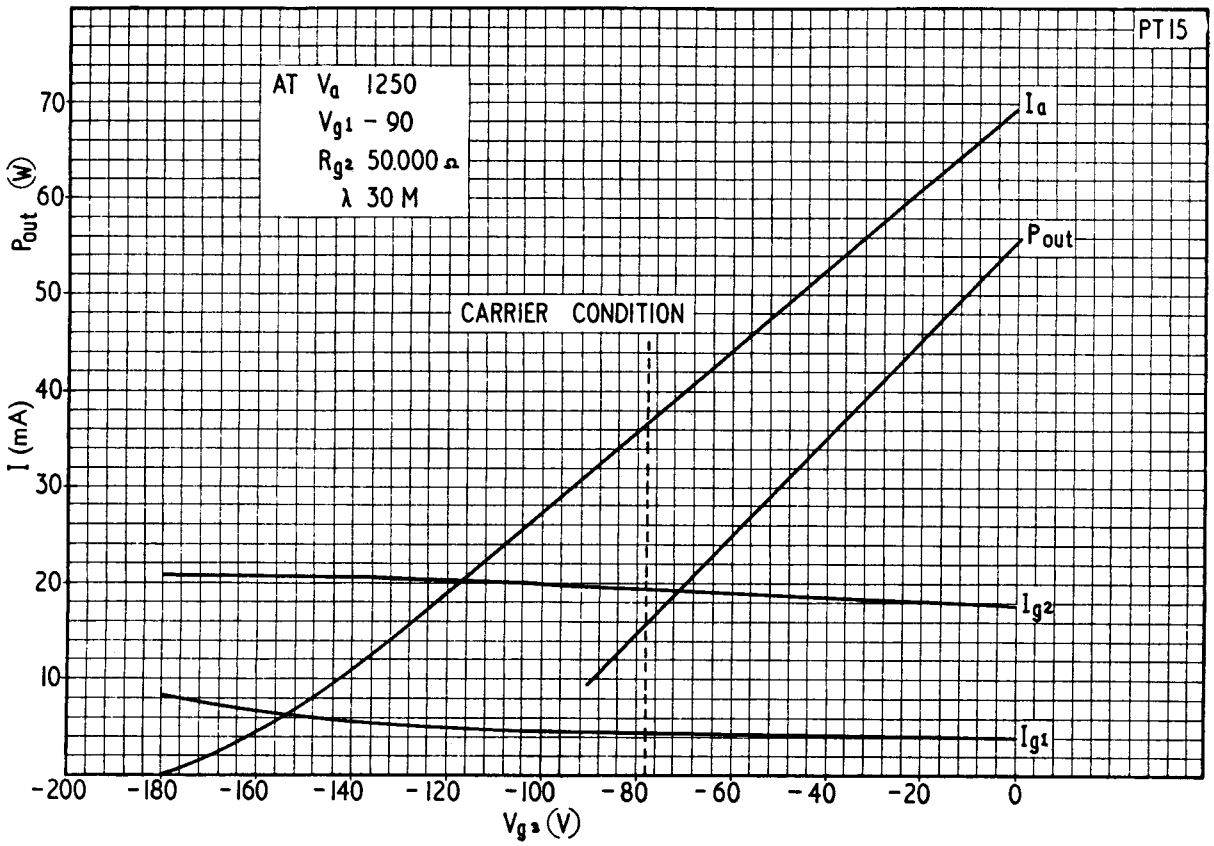
(*c*) 100% modulation.


PT15
V_{g1} + 80
+ 70
+ 60
+ 50
+ 40
+ 30
+ 20
+ 10
V_{g2} 300
V_{g3} 0
V_{g2} 300
V_{g3} + 40
I_{g1} (mA)
V_a (V)


PT15
V_{g3} + 40
V_{g3} 0
η
P_{out}
V_a
P_{out} (max)(W)
η (%)
V_a (max)(V)
λ (m)


PT15
TAKEN AT Vf 6. Va 1250 Vg2 300. Vg3 0.
Ia
Ig2
Vg1 + 60
+ 40
+ 20
0
– 20
Ia & Ig2 (A)
Va (V)
0
500
1000
1500
100
200
300
400
500
600


PT15
TAKEN AT Vf 6 Va 1250 Vg2 300. Vg3 + 40
Ia
Ig2
Vg1 + 60
+ 40
+ 20
0
– 20
– 40
Ia & Ig2 (A)
Va (V)
0
250
500
750
1000
1250
1500
100
200
300
400
500
600
700

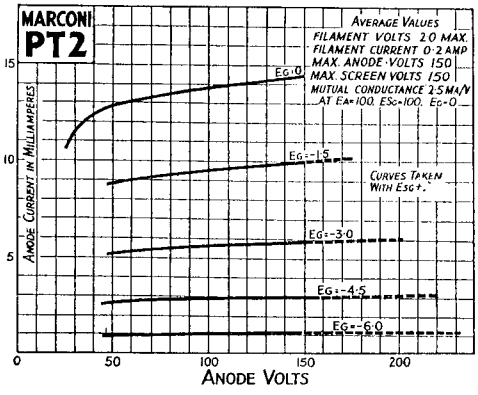

PT15
AT V_a 1250
V_{g1} - 90
R_{g2} 50.000 Ω
λ 30 M
CARRIER CONDITION
I_a
P_{out}
I_{g2}
I_{g1}
P_{out} (W)
I (mA)
V_{g2} (V)
70
60
50
40
30
20
10
-200
-180
-160
-140
-120
-100
-80
-60
-40
-20
0



PRINTED IN ENGLAND

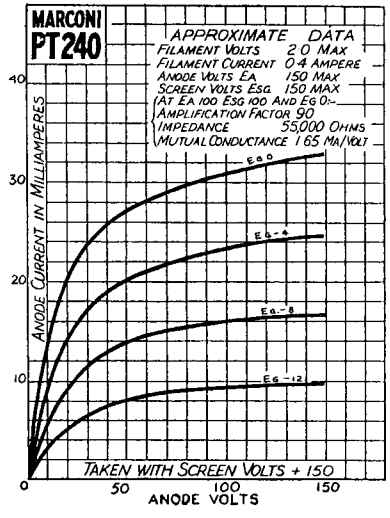
PT 2, Pentode, 20/-

PT.2 is a new pentode output valve designed particularly for use when economy in current consumption is of first importance. Output is quite adequate for the operation of moving iron speakers, while its small current requirements render PT.2 ideal for many portable and other battery operated receivers, in which its high amplification factor is a real advantage.



Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.	Anode Current.
150	150	—4.5	6.5
125	125	—3	5.8
100	100	—3	3.0

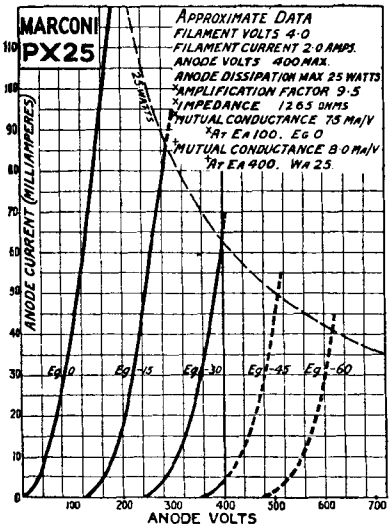


PT 240, Pentode, 20/-

PT.240 is a pentode output valve suitable, like PT.2, for receivers in which only one L.F. stage is used. Its power output is appreciably greater than PT.2 while it retains the characteristic high amplification factor of the pentode. PT.240 is thus an excellent valve for operating moving coil speakers at moderate volume.

Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.	Anode Current.
120	100	—6	9 m.a.
150	150	—9	16 m.a.



Marconi PX25

25 watt Triode

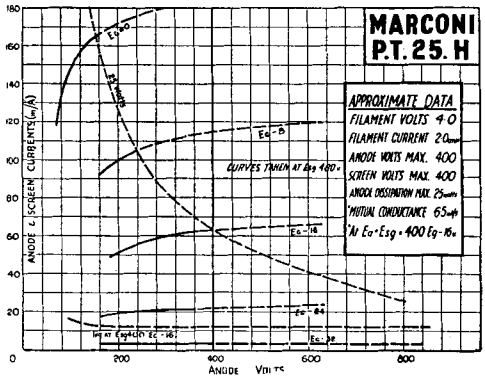
Marconi PX25 is a low impedance triode giving about 5 watts output in class A. It is useful for domestic receivers and small amplifiers because of its high slope, and is also used as a driver valve for certain larger valves.

PX25 is a popular transmitter on medium wavelengths, and is also employed as a modulator.

Normal operating conditions in class A are shown on the curve, with load 4000 ohms, bias resistance 475 ohms, grid bias 30 volts.

Price **20/-**

Dimensions : 160×66 mm. 4 pin base.



Marconi PT25H

25 watt Pentode

Marconi PT25H is a high efficiency pentode giving 10 watts per valve in class A. The screen is operated at the full line voltage, thus simplifying the maintenance of the constant potential necessary for maximum output. With a grid bias of only 16 volts, PT25H is easily loaded by microphone or pickup with only one preceding stage.

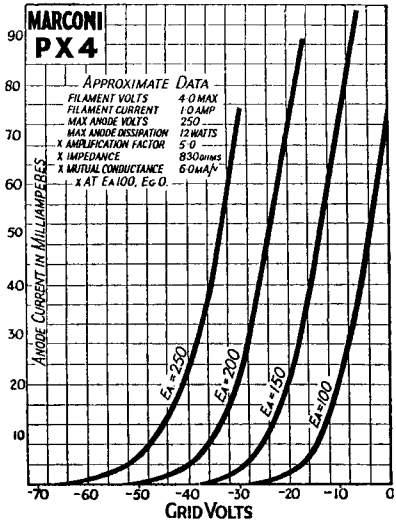
The normal load is 4000 ohms, bias resistance 240 ohms, screen current 12.5 mA.

Overall Dimensions : 160×66 mm. 5 pin base.

Price - - **45/-**

PX 4, Super-Power, 20/-

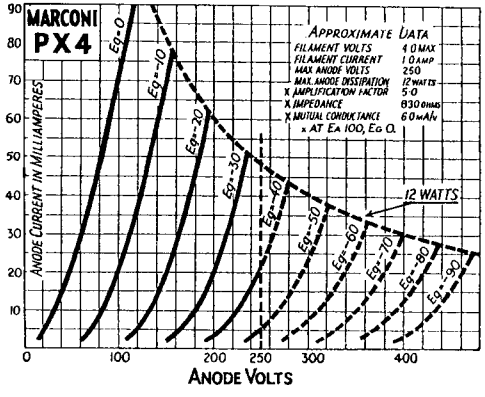
Marconi PX.4 is a super-power output valve for powerful receivers, capable of driving moving coil and large speakers at full volume for dancing, etc., at home and in small halls. When used with moving iron speakers a choke or transformer output is desirable. In many cases 200 volts will be found to provide sufficient volume, as in commercial receivers using this common H.T. potential throughout the set.



Approx. Operating Data.

Anode Volts.	Negative Grid Bias Volts.	Average Anode Current in milliamperes.
250	33	48
200	26	40
150	16	36

Anode Volts—Anode Current curve for PX 4.

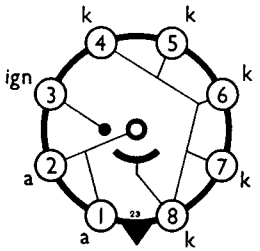


VOLTAGE STABILISERS
SINGLE GAP

QS108/45
QS150/45
NOVEMBER, 1954

QS108/45 is a commercial equivalent of CV442.
QS150/45 is a commercial equivalent of CV395.

BASE CONNECTIONS AND TUBE DIMENSIONS



View from underside of base.

Base : B8G.
Bulb : Tubular.

Overall length :	80	mm.
Seated length :	66	mm.
Max. diameter :	30	mm.

RATINGS

	QS108/45	QS150/45	
V_{ign} (a-k)	†120	††170	V
V_{stab}	‡108 ± 5	‡150 ± 5	V
V_{ign} (ign-k)	150	200	V
R_{ign}	100	100	kΩ
I_{tube}	45 max.	45 max.	mA
I_{tube}	5 min.	5 min.	mA
Regulation (I_{tube} min.-max.)	5	5	V
Stability (100 hr. period)	± 1	± 1	%
Stability (1000 hr. period)	± 2	± 2	%

† With ignition electrode connected to 150 V supply via 100 kΩ series resistor.
‡ At 25 mA.
†† With ignition electrode connected to 200 V supply via 100 kΩ series resistor.

The QS108/45 replaces the QS105/45 which is no longer available.

OPERATION

The stabilisers require an ignition voltage greater than the stabilised voltage, and the supply should be not less than one and a half times the stabilised voltage. The ignition voltage must be applied to the tube through a series resistor to absorb the excess voltage after ignition and prevent a heavy discharge current through the tube. When calculating the value of series resistor, an ignition current of approximately 10 mA should be allowed in addition to the load current.

The tubes are fitted with an ignition electrode to facilitate ignition when a heavy load is permanently shunted across the tube. The ignition electrode voltage is applied through a series resistor (R_{ign}) from a higher voltage source and suitable values are given in the above ratings. This voltage may be taken from a separate supply if desired.

QS108/45
QS150/45

OV.2736

Printed in England. C.

VOLTAGE STABILISER
SINGLE GAP

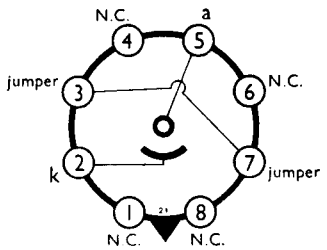
QS150/40
QS75/40

NOVEMBER, 1954

The QS150/40 is a commercial equivalent of CV216, and a direct equivalent of the American type VR150/30 (OD3).

The QS75/40 is a commercial equivalent of CV1895, and a direct equivalent of the American type VR75/30 (OA3).

BASE CONNECTIONS AND TUBE DIMENSIONS



View from underside of base.

Base : International Octal.
Bulb : Dome top pear.

Overall length :	105	mm.
Seated length :	90	mm.
Max. diameter :	39·5	mm.

RATING

	QS75/40	QS150/40	
V_{ign} (max.)	105	180	V
V_{stab} (at I_{tube} = 30 mA)	75 ± 5	$150 \pm^{10}_{5}$	V
I_{tube} (max)	40	40	mA
I_{tube} (min)	5	5	mA
Regulation (I_{tube} min.-max.)	6·5	5·5	V
Stability (100 hr. period)	± 2	± 1	%
Stability (1000 hr. period)	± 2	± 2	%

The QS75/40 which replaces the obsolete STV70/60 has a slightly higher operating voltage range (V_{stab}), *and a lower maximum tube current rating* (I_{tube}), *than the latter type. The STV70/60 is no longer available.*

OPERATION

The stabilisers require an ignition voltage greater than the stabilised voltage, and the supply should be not less than one and a half times the stabilised voltage. The ignition voltage must be applied to the tube through a series resistor to absorb the excess voltage after ignition and prevent a heavy discharge current through the tube. When calculating the value of series resistor, an ignition current of approximately 10 mA should be allowed in addition to the load current.

CONNECTION

In order to safeguard other apparatus when the stabiliser is removed from circuit with the H.T. applied, pins 3 and 7 are strapped internally, so that they may be wired in series with the H.T. supply.

QS150/40
QS75/40

OV.2735

Printed in England. C

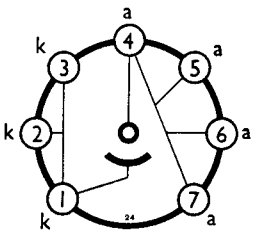
MINIATURE VOLTAGE STABILISERS SINGLE GAP

QS75/20 QS95/10 QS150/15

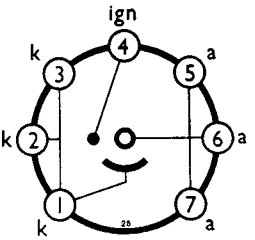
NOVEMBER, 1954

The QS75/20 is a commercial equivalent of CV284.
The QS95/10 is a commercial equivalent of CV286.
The QS150/15 is a commercial equivalent of CV287.

BASE CONNECTIONS AND TUBE DIMENSIONS



QS75/20



QS95/10 and QS150/15

View from underside of bases.

Base :	B7G	Overall length : 54	mm.
Bulb :	Tubular	Seated length : 47·6	mm.
		Max. diameter : 19	mm.

RATINGS

	QS75/20	QS95/10	QS150/15	
V_{ign} (a-k)	110	110	177	V
V_{stab}	*75 ± 5	†95 ± 5	*150 ± 5	V
V_{ign} (ign-k)	—	150	240	V
I_{tube} (max)	20	10	15	mA
I_{tube} (min)	2	2	2	mA
R_{ign}	—	0·25	0·25	MΩ
Regulation (I_{tube} min.-max.)	6	5	5	V
Stability (100 hr. period)	±2	± 3	± 1	%
Stability (1000 hr. period)	±2	± 7	± 1·5	%

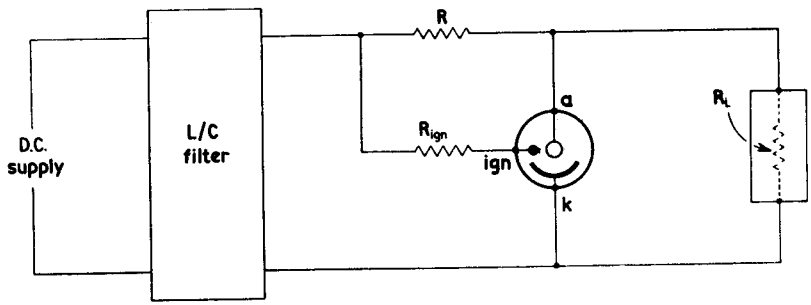
* At I_{tube} = 10 mA. † At I_{tube} = 5 mA.

OPERATION

The stabilisers require an ignition voltage greater than the stabilised voltage, and the supply should be not less than one and a half times the stabilised voltage. The ignition voltage must be applied to the tube through a series resistor to absorb the excess voltage after ignition and prevent a heavy discharge current through the tube. When calculating the value of series resistor, an ignition current of approximately 4 mA should be allowed in addition to the load current.

Types QS95/10 and QS150/15 are fitted with ignition electrodes to facilitate ignition when a heavy load is permanently shunted across the tube. The ignition electrode voltage is applied through a series resistor (R_{ign}) from a higher voltage source and suitable values are given in the above ratings. This voltage may be taken from a separate supply if desired.

QS75/20
QS95/10
QS150/15



Printed in England. C.

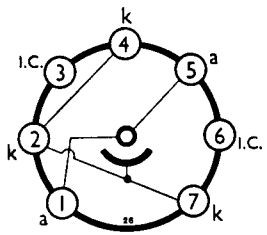
MINIATURE VOLTAGE STABILISER HIGH STABILITY · SINGLE GAP

QS83/3

APRIL, 1955

The QS83/3 is a commercial equivalent of CV449.

BASE CONNECTIONS AND TUBE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Max. Overall length : 54 mm.
Max. Seated length : 47·6 mm.
Max. diameter : 19 mm.

RATING

V_{ign}	125 max.	V
V_{stab} (at I_{tube} = 3 mA)	83 ± 2	V
I_{tube} (max)	5	mA
I_{tube} (min)	1	mA
z* (max)	150	Ω
Temp. coeff.	−2·7	mV/°C
Regulation (I_{tube} 2—4 mA)	0·3	V
Stability† (Initial 300 hrs.)	± 0·2	%
Stability† (Any subsequent 100 hrs.)	± 0·1	%
Stability† (Any 1000 hr. period)	± 0·5	%

* Half arithmetic sum of change in voltage 2—3 mA + change in voltage 3—4 mA.
† Maximum variation of voltage at constant current (preferably 3 mA).

TYPICAL OPERATION

In order to obtain maximum stability (less than 0·1% change in voltage over long periods), it is necessary to stabilise the input voltage. This is most easily achieved by connecting a suitable stabiliser in cascade with the QS83/3.

The circuits shown in Figs. 2 and 3 are recommended when a very stable voltage of approximately 83V is required ; the load should draw a constant current, which may have any value up to 3 mA.

The circuit parameters are tabulated in Tables A and B for load currents from zero to 3 mA, and the permissible changes in input voltage V_1 are also given, together with the consequent changes in output voltage, V_{stab}.

The figures are based on the average characteristics of the stabilisers, and some variation from tube to tube may be expected.

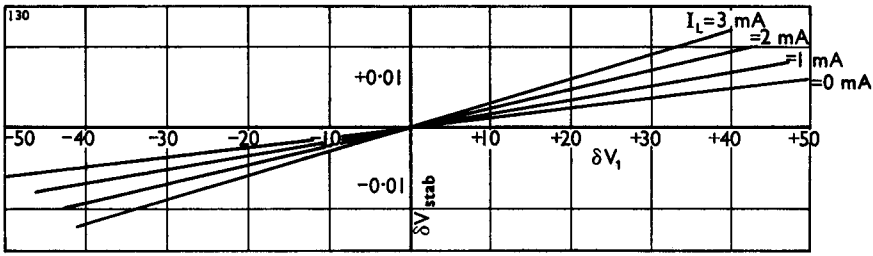


Fig. 1.

TABLE A

I_L (mA)	R_L (kΩ)	R_1 (kΩ)	R_2 (kΩ)	δ V_1 from 250V (V)	δ V_{stab} (V)
0	∞	8·35	22·3	±50	±0·006
1	83	7·7	16·7	±46	±0·008
2	41	7·15	13·4	±43	±0·01
3	27·6	6·67	11·2	±40	±0·012

The curves given above show limits of input voltage and the variation in output voltage for various loads.

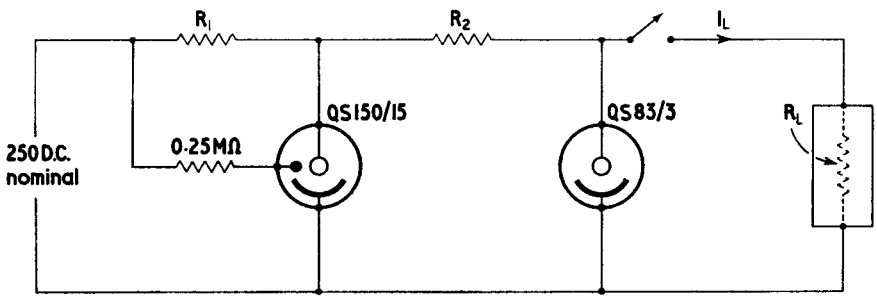


Fig. 2.

The switch in the above circuit should be of the type which closes within 2 seconds of the application of the supply voltage (i.e. 250V D.C.). If the use of this switch is undesirable the circuit arrangement shown in Fig. 3 is recommended.

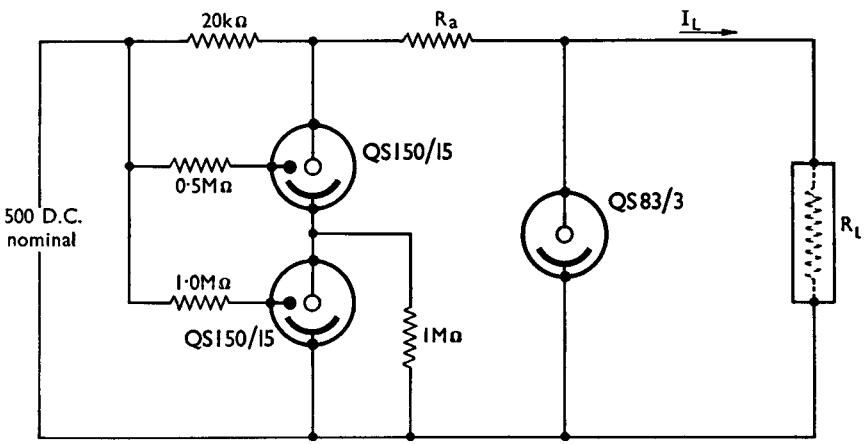


Fig. 3

TABLE B

I_L (mA)	R_L (kΩ)	R_a (kΩ)	δ V_i from 500V	δ V_{stab}
0	∞	72·3	±50	±0·0015
1	83	54	±50	±0·0021
2	41·5	43	±50	±0·0026
3	27·7	36	±50	±0·0031

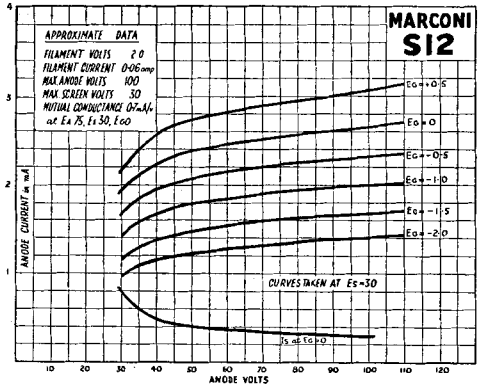
GENERAL

If a different voltage, or a current greater than 3mA is required, it is necessary to employ one of the constant voltage networks such as the series voltage stabiliser, using a QS83/3 as the voltage reference source for the network.

QS83/3

OV.2734

Printed in England. C.



Marconi S12

Midget Screen Grid

Marconi S12 is suitable for the early stages of deaf aid amplifiers where it gives high gain with low H.T. voltage.

It is not intended for H.F. work.

Nominal rating, see curve.

Inter-electrode capacities.

A—G	0.3$\mu\mu$F
G—E	5.6$\mu\mu$F
A—E	3.4$\mu\mu$F

Dimensions : 76 × 17 mm.

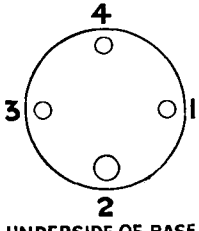
Typical Operating Data.

H.T. voltage	36	36	36	52	52	52
Anode load resistance	150,000	250,000	Choke	150,000	250,000	Choke
Screen feed resistance	1 meg.	1 meg.	1 meg.	1 meg.	1.5 meg.	1 meg.
Total cathode current	0.11	0.1	0.16	0.18	0.12	0.27 mA
Grid bias	0	0	0	0	0	0
Stage gain	24	26	57	29	32	57

Notes.

When choke coupling is used its value depends on the frequency response required. With small apparatus some compromise between size and bass response is usually necessary.

Price - - 17/6

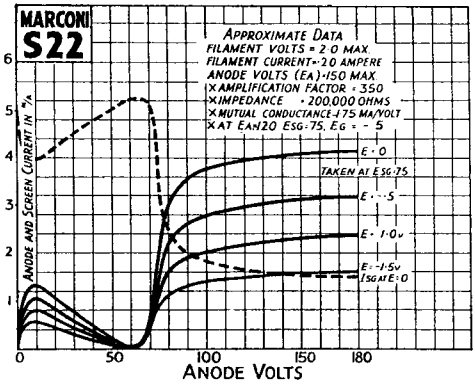


UNDERSIDE OF BASE

Base Connections.

	H12	L12	S12
1	Anode	Anode	Screen
2	Grid	Grid	Grid
3	Filament	Filament	Filament
4	Filament	Filament	Filament
Top Cap	—	—	Anode

MARCONI 2-VOLT VALVES



S 22, Screen Grid, 20/-

S.22 is a screen grid amplifier with an exceptionally high mutual conductance and very low self-capacity. It is ideal for receivers having a single H.F. stage, and also for some two H.F. sets, providing longer range, greater volume and perfect stability.

S.22 is available with a metallised bulb if desired.

Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.
120–150	75	0 to −1.5

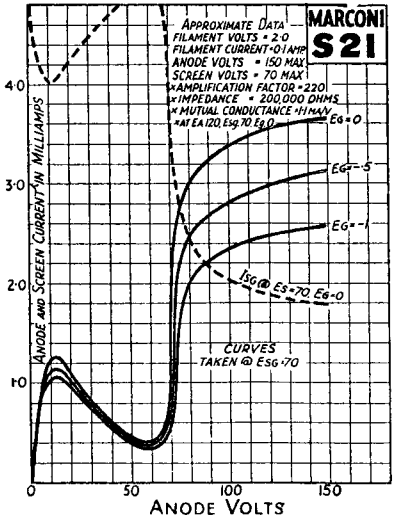
S 21, Screen Grid, 20/-

S.21 is a screen grid amplifier similar in design to Marconi S.22, but intended for multi-stage H.F. amplifiers, including 2 S.G. portables, in which a lower stage gain is preferable. An exceptionally small self-capacity ensures perfect stability, while the small current consumption is of particular value to users of large receivers.

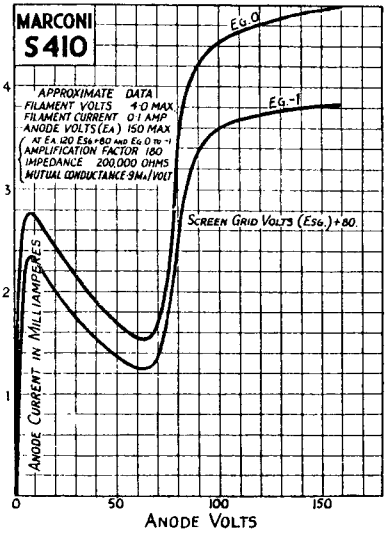
S.21 is available with a metallised bulb is desired.

Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.
120–150	70	0 to −1.5



MARCONI 4-VOLT VALVES



S410, Screen Grid, 20/-

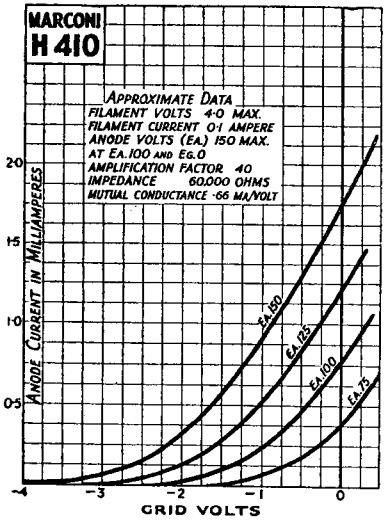
S410 is a general purpose screen grid valve of high efficiency, suitable both for single H.F. stages and multi-valve H.F. amplifiers.

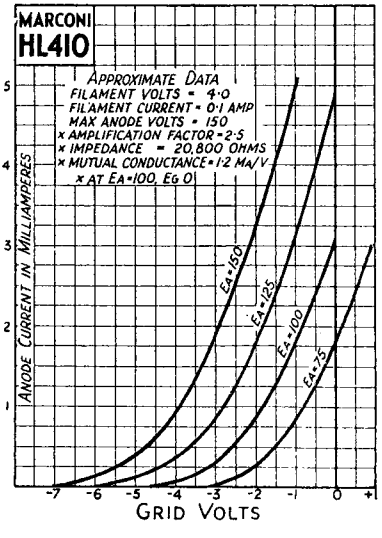
H 410, High Magnification, 8/6

H410 is a high magnification valve for the earlier stages of receivers. It is an excellent detector or initial L.F. amplifier, when followed by resistance or low ratio transformer coupling.

HL 410, Medium Magnification, 8/6

HL.410 is the general purpose valve of the 4 volt range, equally efficient as detector or H.F. or L.F. amplifier and with transformer or resistance coupling.

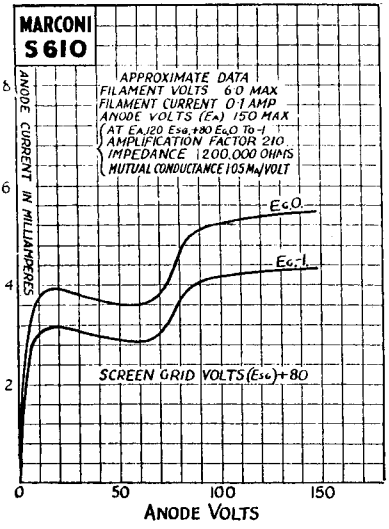




MARCONI 6-VOLT VALVES

S 610, Screen Grid, 20/-

S610 is a high efficiency screen grid amplifier equally suitable for use in single H.F. stages and in multi-valve instruments.

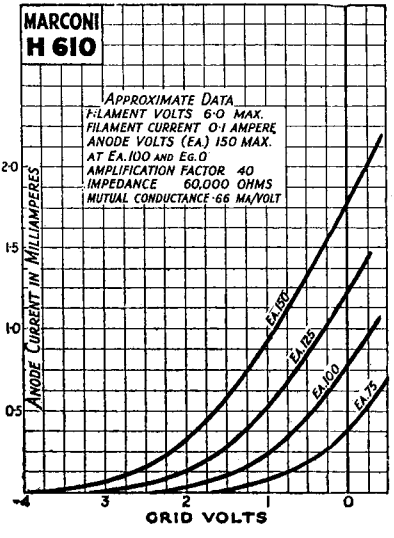


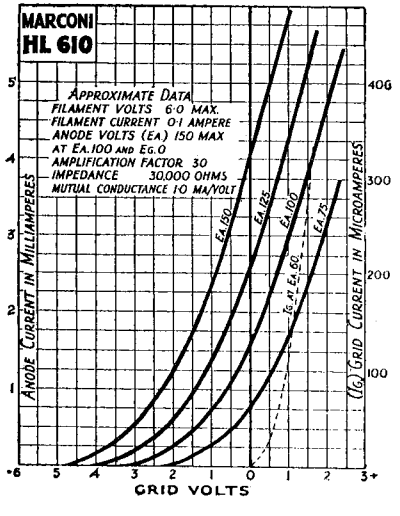
H 610, High Magnification, 8/6

H610 is a high magnification type for use as detector or initial L.F. amplifier followed by resistance or low ratio transformer coupling.

Marconi HL 610, 8/6

HL610 is the general purpose valve of the 6 volt range. It is an excellent detector and H.F. or L.F. amplifier.



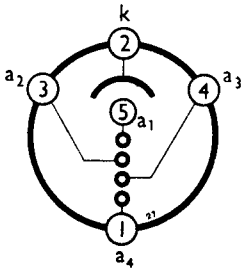


STABILOVOLTS

FOUR GAP

STV280/40
STV280/80
APRIL, 1952

BASE CONNECTIONS AND TUBE DIMENSIONS



View from underside of base.

Base : British 5 pin
Bulb : Tubular

	STV280/40	STV280/80	
Overall length :	142	142	mm.
Seated length :	127	127	mm.
Max. diameter :	41	62	mm.

RATING

	STV280/40	STV280/80	
$V_{b\ min.\ a_{4}\text{-}k}$ (approx)	420	420	V
$V_{b\ min.\ a_{3}\text{-}k}$ (approx)	320	320	V
$V_{b\ min.\ a_{2}\text{-}k}$ (approx)	210	210	V
$V_{b\ min.\ a_{1}\text{-}k}$ (approx)	110	110	V
$V_{stab\ a_{4}\text{-}k}$	280	280	V
$V_{stab\ a_{3}\text{-}k}$	210	210	V
$V_{stab\ a_{2}\text{-}k}$	140	140	V
$V_{stab\ a_{1}\text{-}k}$	70	70	V
I_{a4} (max)	35	70	mA
I_{a3} (max)	40	70	mA
I_{a2} (max)	60	90	mA
I_{a1} (max)	60	100	mA
I_{tube} (min)	5	10	mA
z (per gap)	60	40	Ω

OPERATION

The stabilisers require an ignition voltage greater than the stabilised voltage, and the supply should be not less than one and a half times the voltage developed across the gap, or gaps employed. The ignition voltage must be applied to the tube through a series resistor to absorb the excess voltage after ignition and prevent a heavy discharge current through the tube, as the D.C. resistance of the latter can be regarded as negligible. The series resistance also becomes an important factor in the ultimate stability of the supply to the load.

In addition to the series resistor it is essential that resistors of the order of 0·25 MΩ be connected between a supply line and each anode of the tube. They may be connected to either supply line, and as their effect is to apply the full available voltage to each gap in turn, the tube is ignited by a voltage much less than that required to ignite all the gaps simultaneously in series. Thus, if four gaps are used, the ignition voltage required $= 4V + v$ and not $4V + 4v$ where V is the stabilised voltage per gap, and v is the extra ignition voltage required per gap. As the ignition currents are of the order of 0·1 mA, the resistors may be of small power rating.

The extra ignition voltage is of the order of 50 volts per gap, and thus, for the STV 280/40 the ignition voltage is theoretically 280 + 50 volts. It should be noted, however, that this figure is the minimum value for the tube, and in practice it is calculated as one and a half times the overall stabilised voltage (i.e. 420V for the STV280/40). The ignition voltage will necessitate a higher value of series resistor, but this is an advantage as the variation of stabilised voltage is inversely proportional to the value of series resistance.

The following examples illustrate typical stabiliser applications and the method of calculating performance. The calculations are based on the following approximate formulae :

$$\delta V_{stab}\ (b) = \frac{\delta V_b \times z}{R}$$

$$\delta V_{stab}\ (L) = \delta I_L \times z$$

Where δV_{stab} (b) = Variation of stabilised voltage due to supply fluctuation.
δV_{stab} (L) = Variation of stabilised voltage due to load variation.
δV_b = Variation of supply voltage.
δI_L = Variation of load current through tube.
z = Tube impedance (i.e. number of gaps in use multiplied by impedance per gap).
R = Series resistance in circuit.

Example 1

To obtain a stabilised supply of 280 volts, 40 mA with no variation in load.
Consider the use of STV280/80 in the circuit of fig. 1.
Allow 20 mA ionisation current, then supply current = 60 mA.

Minimum supply voltage required = $280 + \frac{280}{2} = 420$ volts.

Voltage drop across R = $420 - 280 = 140$ volts.

$\therefore R = \frac{140}{0{\cdot}06} = 2350\ \Omega$ approx.

Consider a $\pm$ 5% supply variation (i.e. $\pm$ 21 volts).

$$\delta V_{stab}\ (b) = \frac{\delta V_s \times z}{R} = \frac{21 \times 4 \times z}{2350} = \frac{21 \times 4 \times 40}{2350} = 1{\cdot}43 \text{ volts}$$

or 0·51% approx.

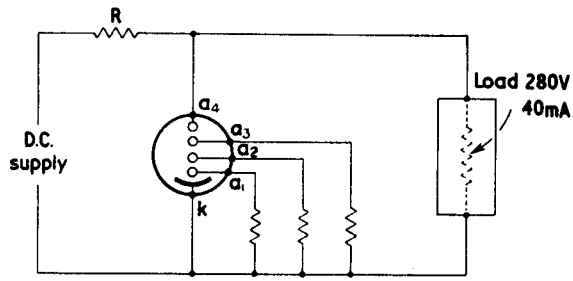


Fig. 1

Example 2

Assume that the load varies from 30 to 40 mA at 280 volts.
Then in addition to the variations due to supply fluctuation, as calculated in Example 1, there is also a voltage change in the tube due to its internal impedance.

$$\delta V_{stab}\ (L) = \frac{40-30}{1000} \times z = 0{\cdot}01 \times 4 \times 40 = 1{\cdot}6 \text{ volts or } 0{\cdot}57\% \text{ approx.}$$

Therefore the total load variation which may be anticipated under the above conditions is : $\pm$ 0·57% $\pm$ 0·51% = $\pm$ 1·08% max. approx.

When greater stability is required the value of the series resistor should be increased, or tubes operated in cascade.

Example 3

With a view to still greater reduction of output fluctuations due to supply variations, stabilisation can be applied twice in succession. The D.C. voltage from the first tube may be stabilised again by a second tube with the necessary series resistor.

The following example (see fig. 2), illustrates the cascade method of operation.

A stabilised supply of 140 volts, 40 mA is required.

Consider the use of the STV280/80.

Let $V_1 = 500$ volts, and $R_{source} + R_{filter} = 600\Omega$

Where R_{source} is the internal resistance of the power supply and R_{filter} is the resistance of the LC filter.

$I_L = 40$ mA.

allow 20 mA ionisation current per tube.

then $I_{R2} = 60$ mA.

and $I_{R1} = 80$ mA.

then $V_2 = V_1 - I_{R1}(R_{source} + R_{filter}) = 500 - \frac{(80 \times 600)}{1000} = 450$ volts approx.

and $R_1 = \frac{450 - 280}{0{\cdot}08} = 2125\Omega$ (280 volts is applied to T_1).

N.B.—The value of series resistance necessary to absorb the extra voltage after ionisation has occured, (R_x), may be calculated as $R_x = R_1 - (R_{source} + R_{filter})$.

Consider also a supply variation of $\pm 10\%$ (i.e. ± 50 volts), then output variation from $T_1 = \frac{50 \times 40 \times 40}{2125} = 3{\cdot}77$ volts.

The starting voltage applied to T_2 is 280 volts, and the final output required is 140 volts, therefore the voltage to be absorbed by R_2 is 140 volts.

It will be appreciated that the voltage obtained from T_1 must be again one and a half times the output voltage required, as $\frac{3}{2} \times 280 = 187$ volts.

The nearest gap voltage below this is 140 (the second gap) and this is used.

From the above reasoning : $R_2 = \frac{140}{0{\cdot}06} = 2340\Omega$

Output variation from $T_2 = \frac{3{\cdot}77 \times 40 \times 2}{2340} = 0{\cdot}129$ volts.

representing a percentage of 0·092%.

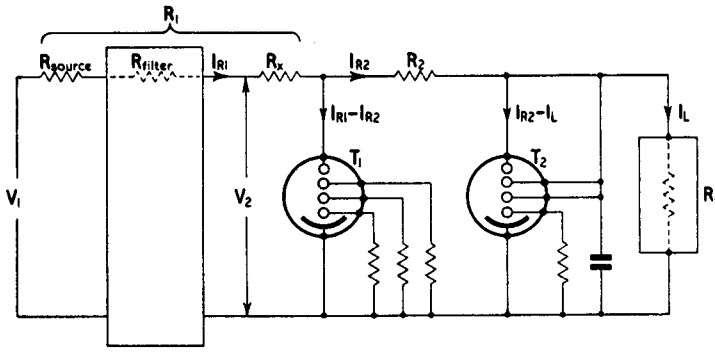


Fig. 2

SERIES OPERATION

In order to obtain stabilised voltages in excess of 280, the tubes may be operated in series.

The series connection may be considered as one tube with an increased number of gaps or tapping points, e.g. two STV280/40 tubes series-connected will provide a stabilised voltage of 560 volts, with evenly spaced intermediate voltages.

This method of connection is particularly suitable for tubes operated in cascade as described above in order to obtain stabilised voltages in excess of 140.

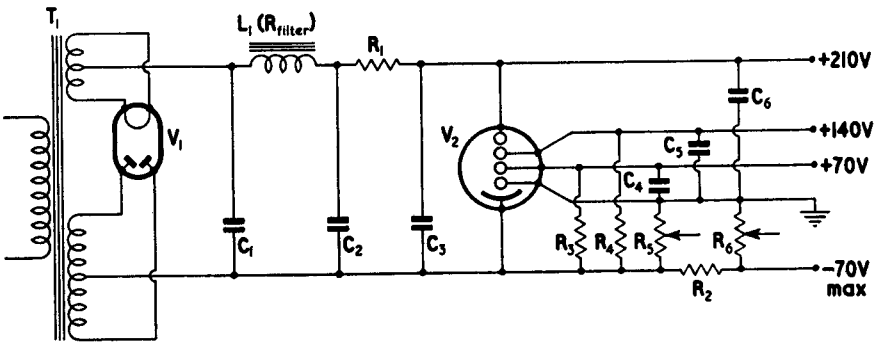


Fig. 3. A typical circuit of a stabilised supply unit for a power amplifier requiring various supply voltages.

Printed in England. C.

S-BAND
PASSIVE PROTECTION PLUG-IN CELL
WIDEBAND

TRP8
ISSUE 2

The TRP8 is a combination of three primed passive protection tubes for use in receivers where crystal protection is necessary over a large part of S-band.

RATINGS

Max. incident peak r.f. power	15	W
*Min. d.c. negative primer supply voltage	950	V
†Max. primer current to each tube	65	μA
†Min. primer current to each tube	45	μA

*Negative with respect to cell body and with a peak to peak ripple voltage not exceeding 1%.

†The primer current should be limited by series resistors of which at least 2MΩ must be connected immediately to each primer terminal in order to reduce the possibility of relaxation oscillation in the primer circuit.

CHARACTERISTICS

The frequency range 2·5 to 4·1kMc/s can be covered with one mounting using the mount shown in fig. 1. For use over a more limited band the centre frequency may be varied by changing the dimensions of the inductive matching elements used in the mounting.

***Low Power** (Fig. 3)

Max. total insertion loss:

At 2·8 to 3·8kMc/s:	1·3dB
At 2·5 to 4·1kMc/s:	4·3dB

High Power (Figs. 4, 5 and 6)

†Power limitation at 3·6kMc/s (max):	300mW
‡Recovery time to 6dB down (max):	70μs

Primer

Maximum breakdown time:	5s
Running voltage (at 60μA):	240V

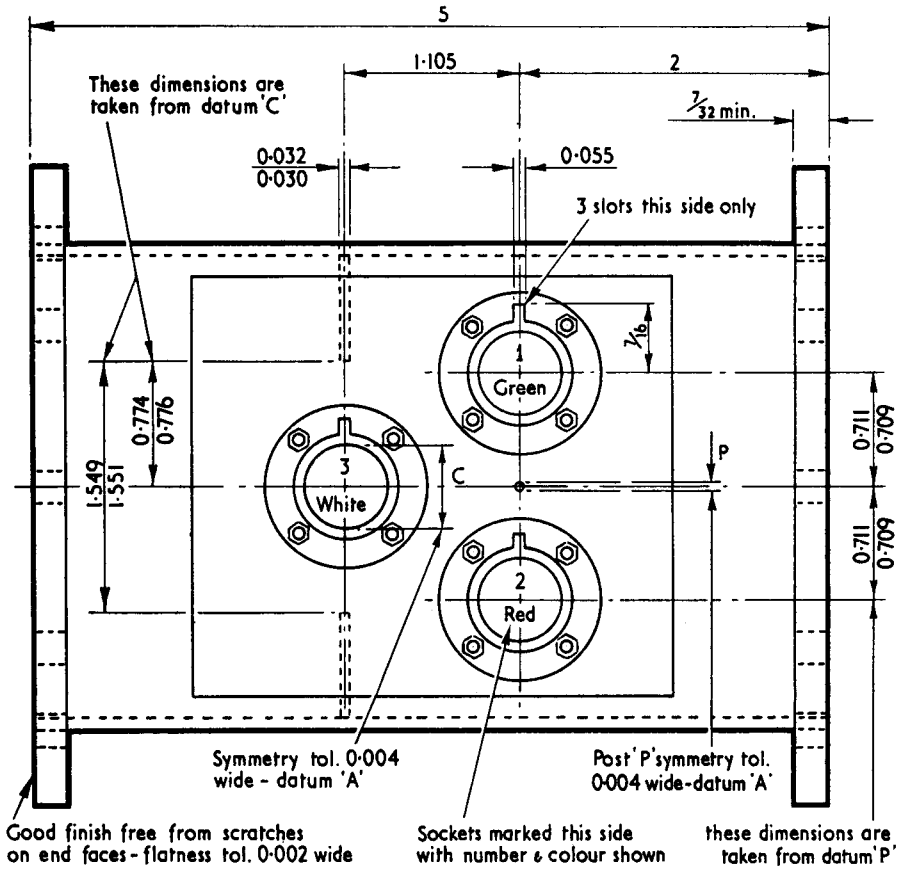
*The low power characteristics for individual tubes are as follows:

Loaded Q:	1	—
Max. insertion loss:	0·15	dB
Min. VSWR at resonance:	0·91	—

†The tube in the gap remote from the generator is dominant in determining the leakage of the combination.

‡The tubes in the gaps nearest the generator are dominant in determining the recovery time of the combination.

(395)



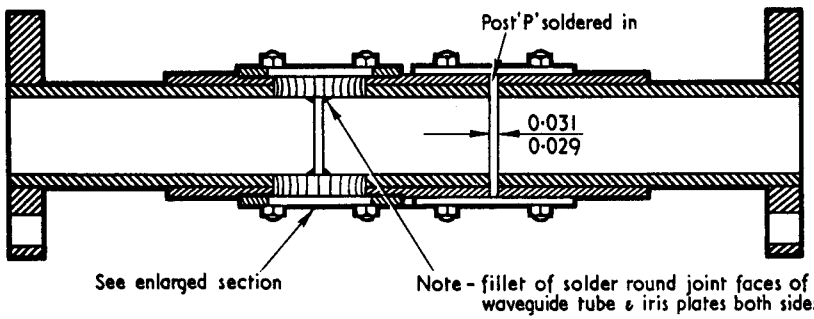
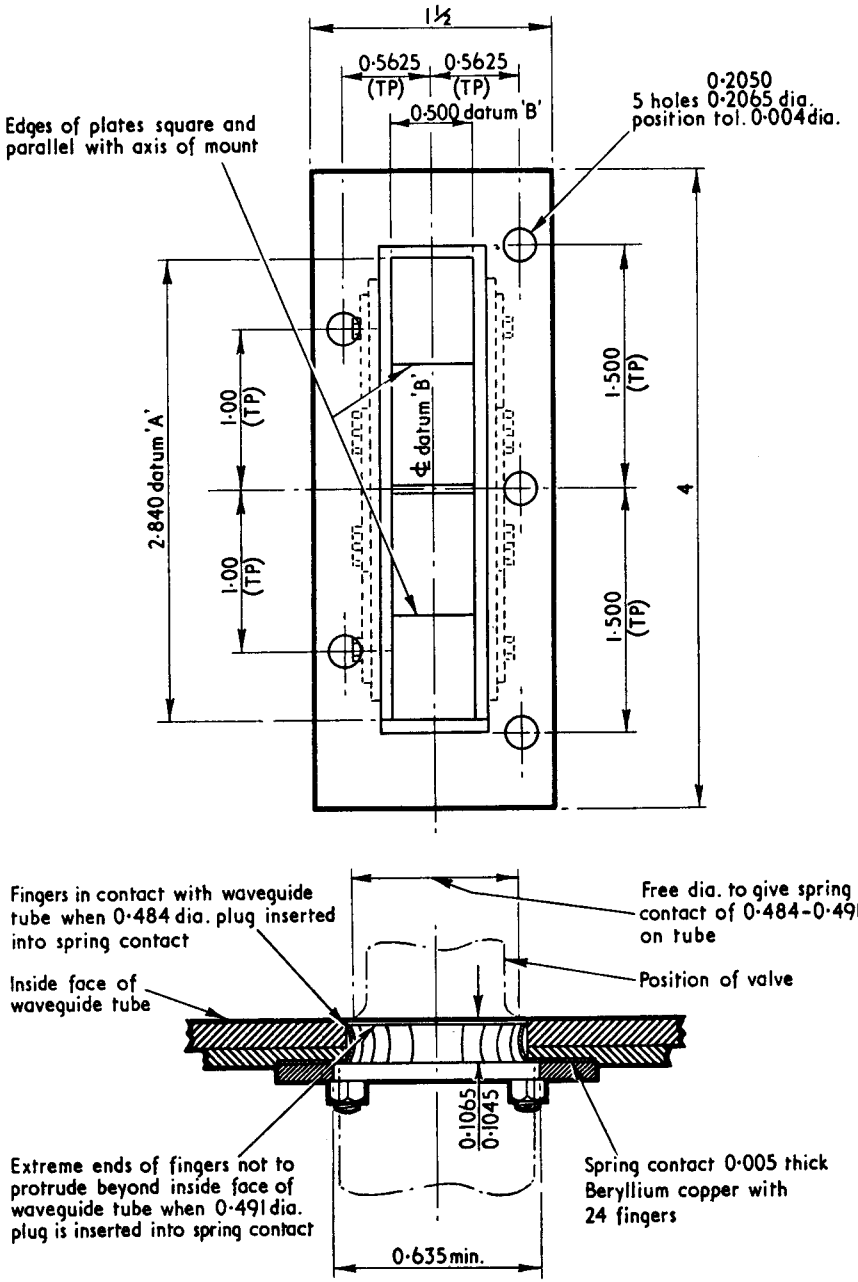


Fig. 1. (Above and opposite).

Test Mount.

Dimensions are in inches.

For explanation of dimensions, notes, symbols, etc.; please see BS308/1953.



Enlarged section showing spring contact.

Dimensions are in inches.

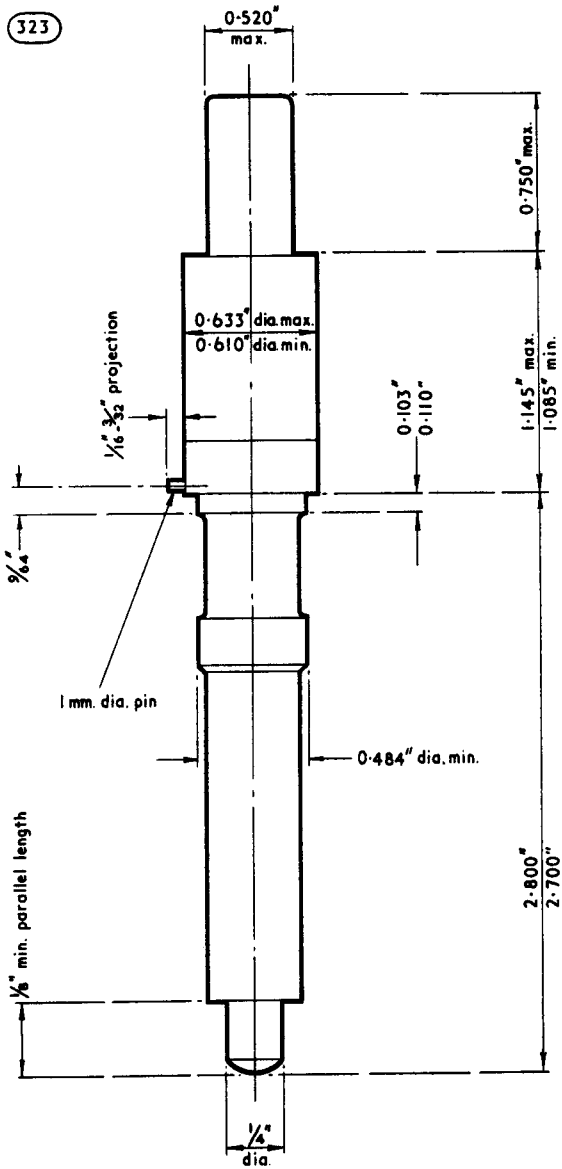


Fig. 2. Outline drawing.

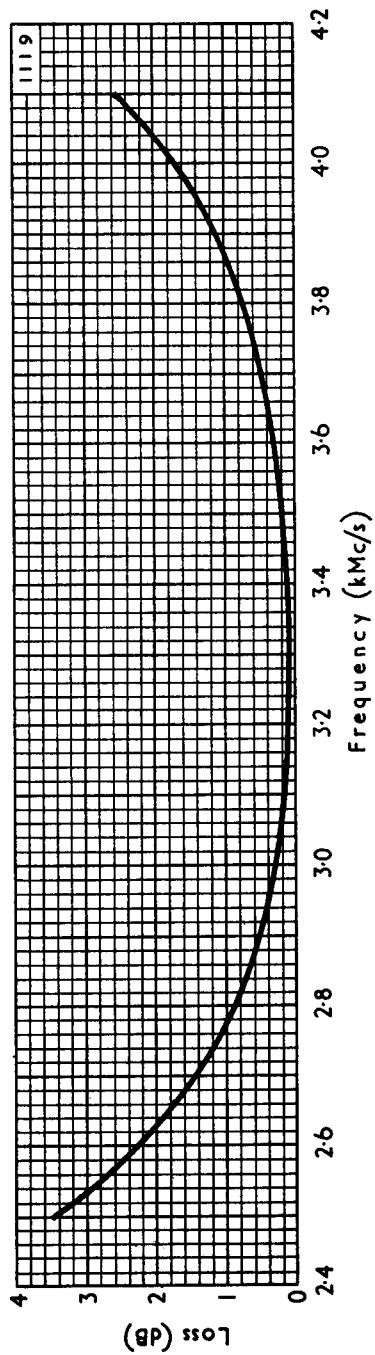


Fig. 3.

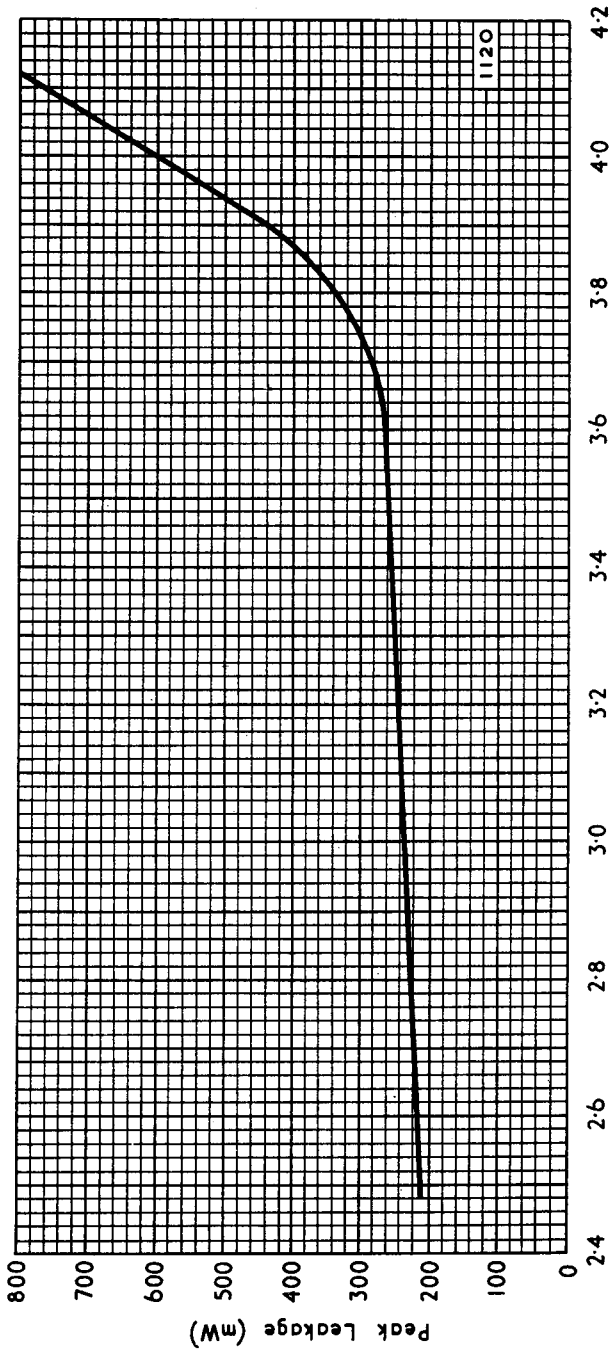

1120
Peak Leakage (mW)
800
700
600
500
400
300
200
100
0
2·4
2·6
2·8
3·0
3·2
3·4
3·6
3·8
4·0
4·2
Frequency (kMc/s)

Fig. 4.

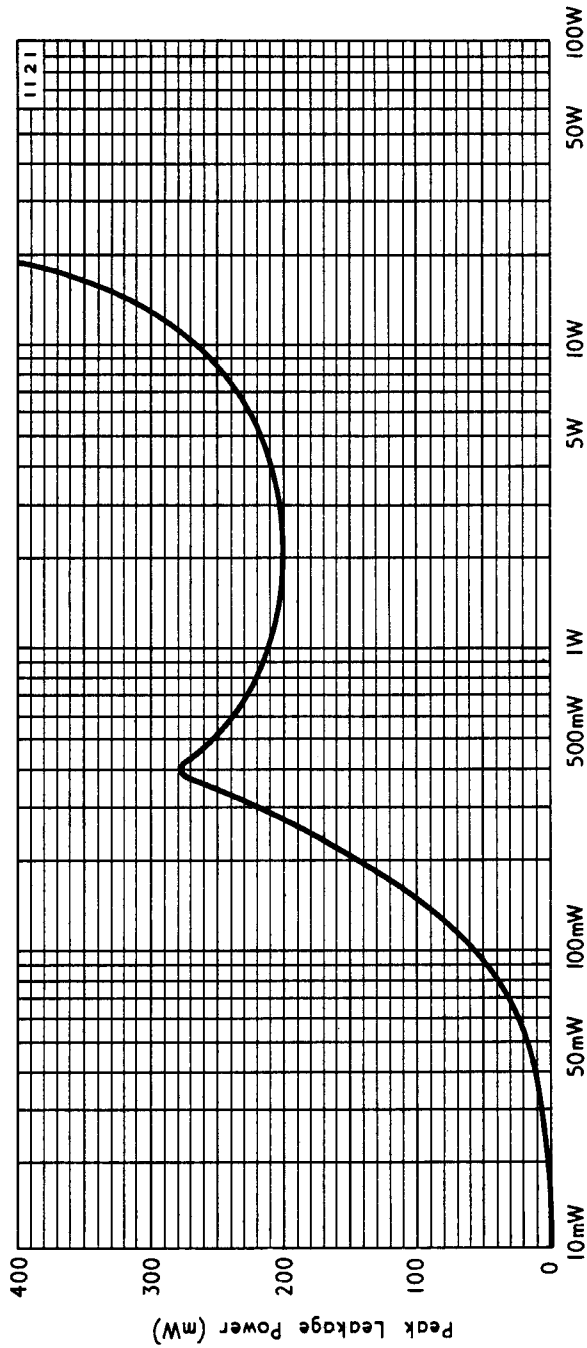

1121
400
300
200
100
0
Peak Leakage Power (mW)
10mW
50mW
100mW
500mW
1W
5W
10W
50W
100W
Peak Incident Power

Fig. 5.

TRP8

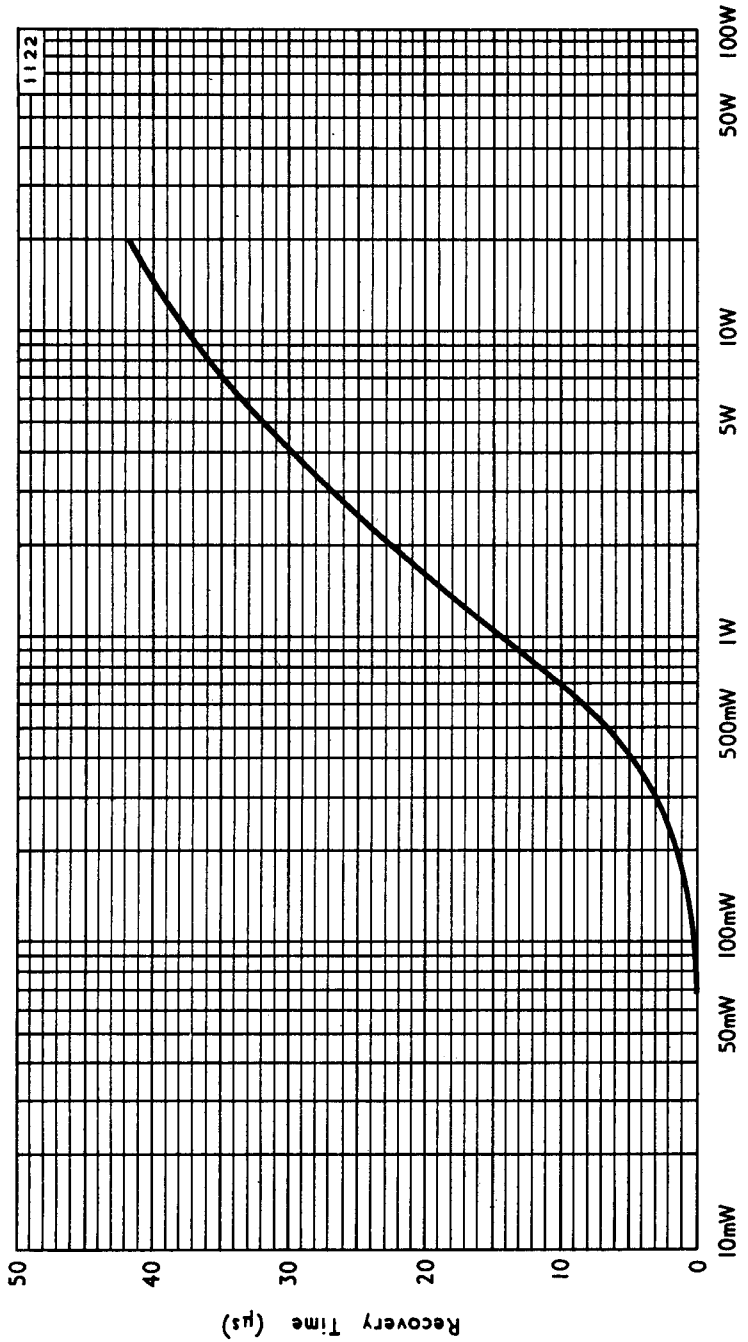


Fig. 6.

Printed in England—K-C

Tetrode *Type TT 10*

(RF AMPLIFIER)

General. A beam transmitting tetrode fitted with a thoriated filament. It has a continuous anode dissipation rating of 100 W.

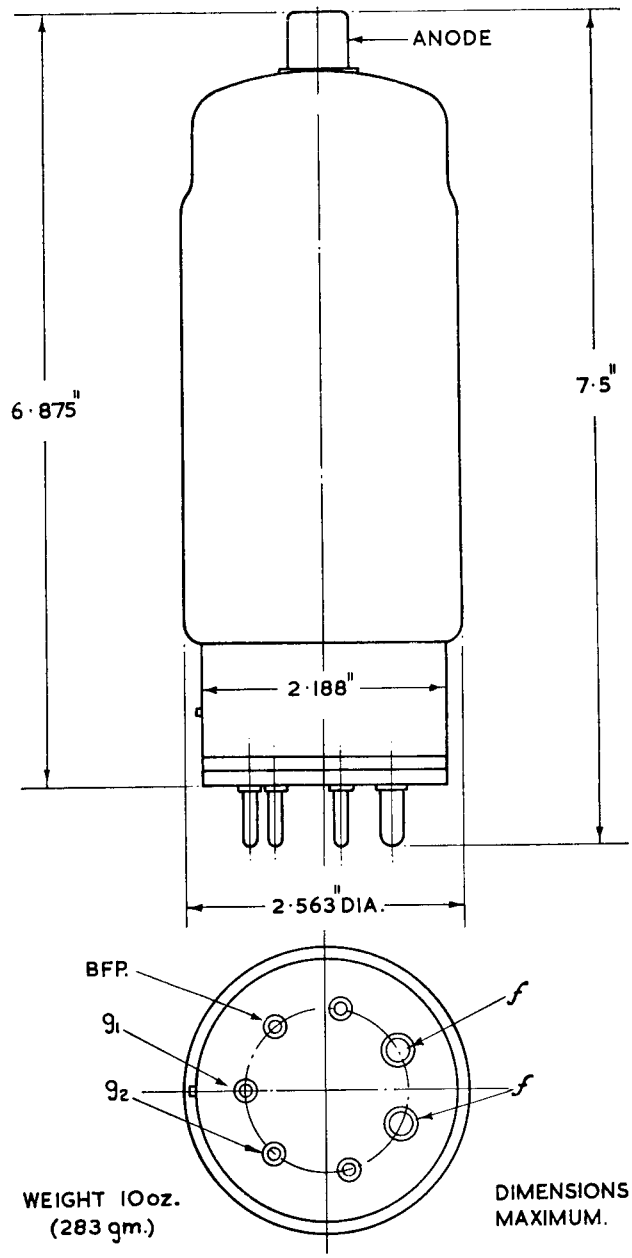
The valve employs the moulded glass dish type stem, a construction which permits very short leads with resulting low lead inductance. Neutralising is unnecessary on adequately shielded circuits.

This special construction enables the TT 10 to be operated at maximum ratings down to 10 metres. At lower wavelengths the maximum permissible anode voltage and input must be reduced to the following percentage of the quoted figures:

10 metres	100%
6·6 metres	87%
5 metres	75%

APPROXIMATE DATA

V_f		10·0	V
I_f		5·0	A
g_m	taken at V_a 2,000 V, V_{g2} 400 V, I_a 50 mA	3·75	mA/V
$c_{a\text{-}gl}$		0·2	pF
c_{in}		16·3	pF
c_{out}		14·0	pF



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

(1) HF POWER AMPLIFIER AND OSCILLATOR. CLASS C TELEGRAPHY

(Unmodulated, one valve, key down conditions.)

Maximum permissible ratings

V_a	2,000	V
I_a	180	mA
V_{g1}	–300	V
I_{g1}	25	mA
V_{g2}	400	V
P_a	360	W
p_{g2}	22	W
p_a	100	W

Typical Operation

V_a	1,250	1,500	2,000	V
I_a	180	180	180	mA
V_{g1}	–60	–70	–90	V
I_{g1}	7	6	3	mA
V_{g2}	300	300	400	V
I_{g2}	23	20	15	mA
R_{g1}	8,500	11,700	30,000	Ω
$v_{g1(pk)}$	145	150	160	V
P_{dr}	1	0·8	0·5	W
P_{out}	155	190	260	W

(2) HF POWER AMPLIFIER. CLASS C

(Grid-modulated, one valve, carrier conditions, permissible modulation 100%.)

Maximum permissible ratings

V_a	2,000	V
I_a	100	mA
V_{g1}	–200	V
V_{g2}	400	V
P_a	150	W
p_{g2}	15	W
p_a	100	W

Typical Operation

V_a	1,500	2,000	V
I_a	70	75	mA
V_{g1}	–140	–120	V
V_{g2}	400	400	V
I_{g2}	3	3	mA
$v_{g2(pk)}$	145	120	V
$v_{mod(pk)}$	60	60	V
P_{dr} (approx.) (a)	2	2	W
P_{out}	40	50	W

(3) HF POWER AMPLIFIER. CLASS C

(Anode-modulated, one valve, carrier conditions, permissible modulation 100%.)

Maximum permissible ratings

V_a	1,600	V
I_a	150	mA
V_{g1}	–300	V
I_{g1}	25	mA
V_{g2}	400	V
P_a	240	W
p_{g2}	15	W
p_a	67	W

Typical Operation

V_a	1,250	1,600	V
I_a	150	150	mA
V_{g1} (b)	–120	–130	V
I_{g1}	4	6	mA
V_{g2}	400	400	V
I_{g2}	16	20	mA
R_{g1}	30,000	21,600	Ω
$v_{g1(pk)}$	195	210	V
P_{dr}	0·7	1·2	W
P_{out}	135	175	W

(4) HF POWER AMPLIFIER. CLASS B TELEPHONY

(One valve, carrier conditions, permissible modulation 100%.)

Maximum permissible ratings

V_a	2,000	V
I_a	100	mA
V_{g2}	400	V
P_a	150	W
p_{g2}	15	W
p_a	100	W

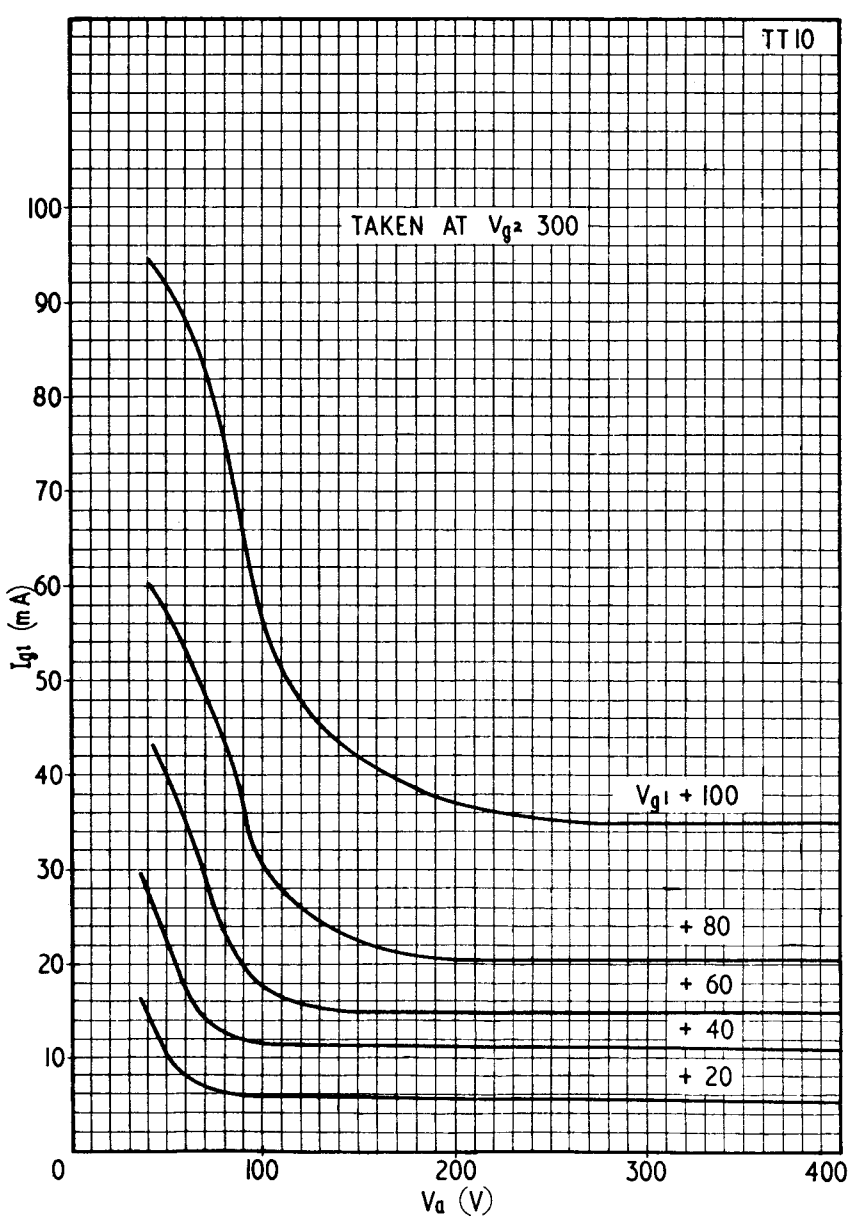
Typical Operation

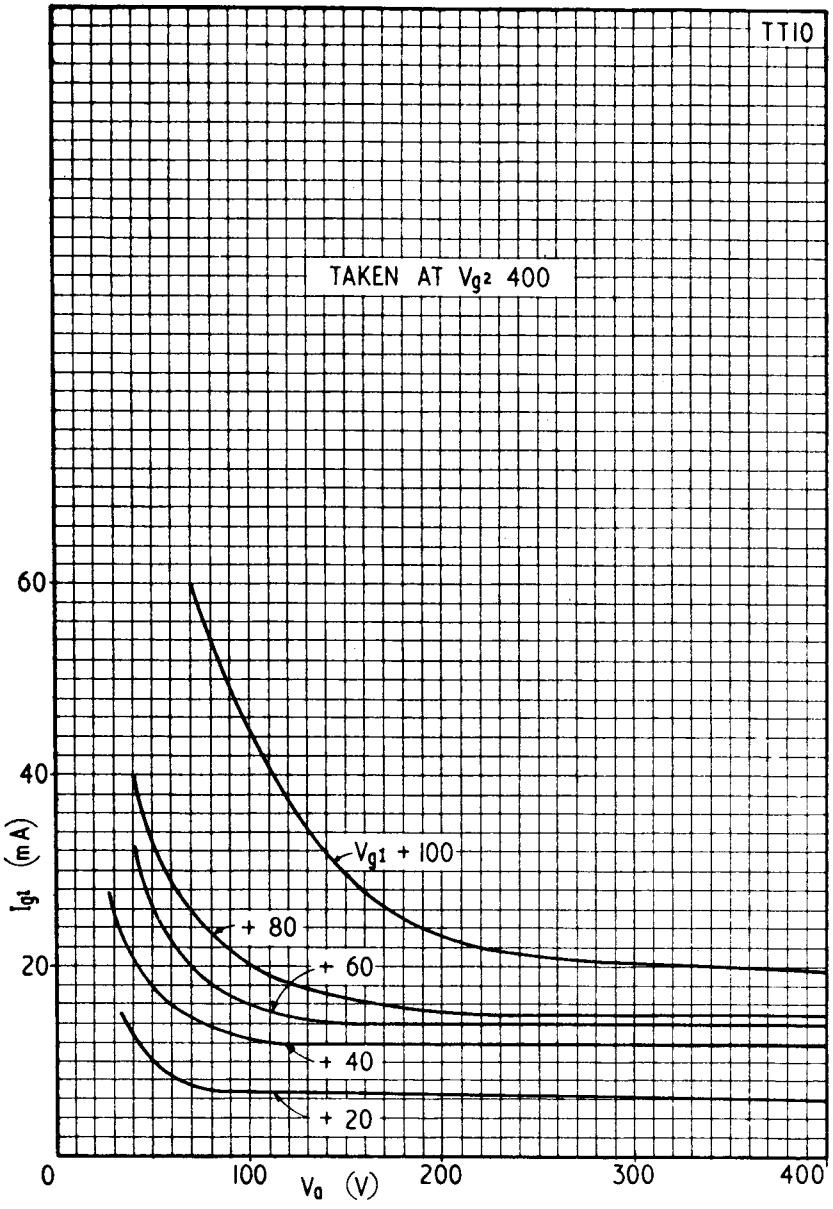
V_a	1,500	2,000	V
I_a	100	75	mA
V_{g1}	–60	–75	V
I_{g1}	Negligible	Negligible	
V_{g2}	400	400	V
I_{g2}	4	3	mA
$v_{g1(pk)}$	70	80	V
P_{dr} (approx.) (a)	2	2	W
P_{out}	50	50	W

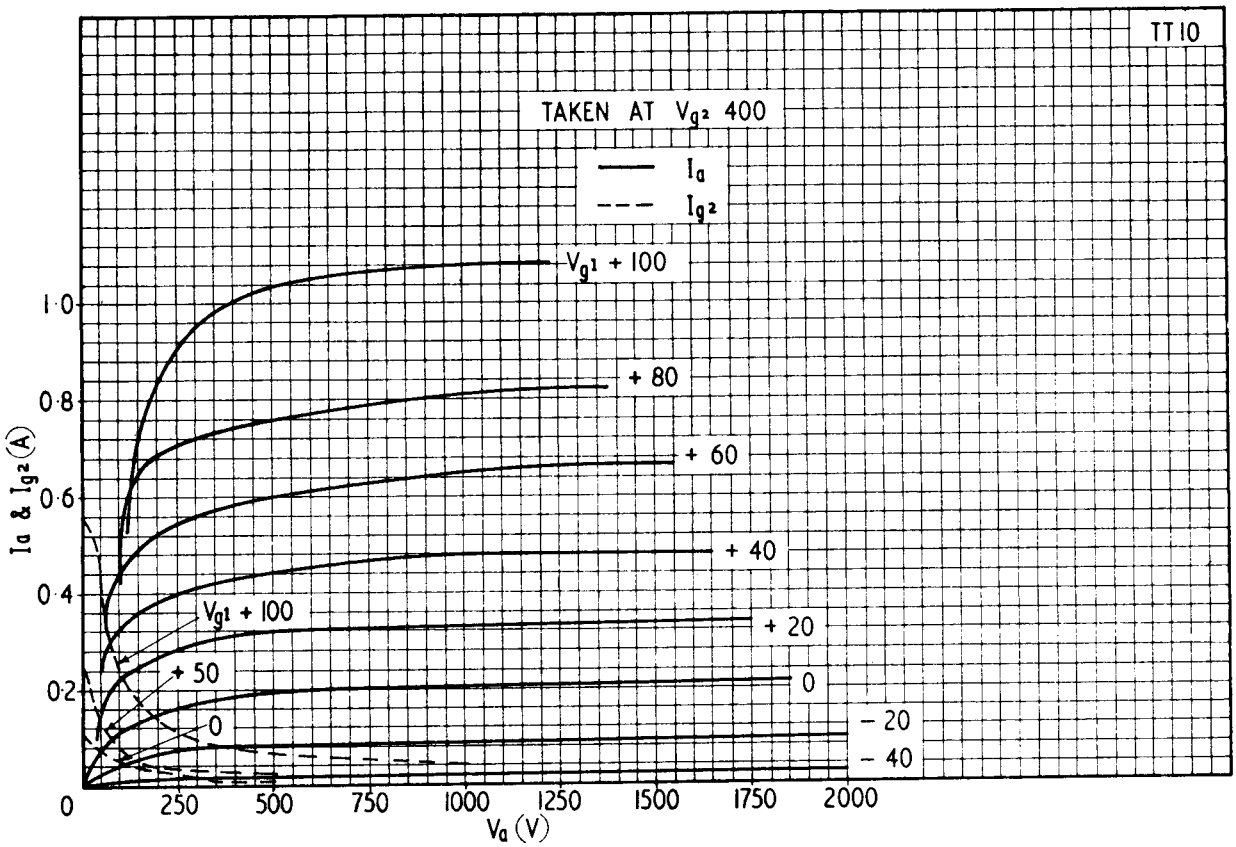
NOTES

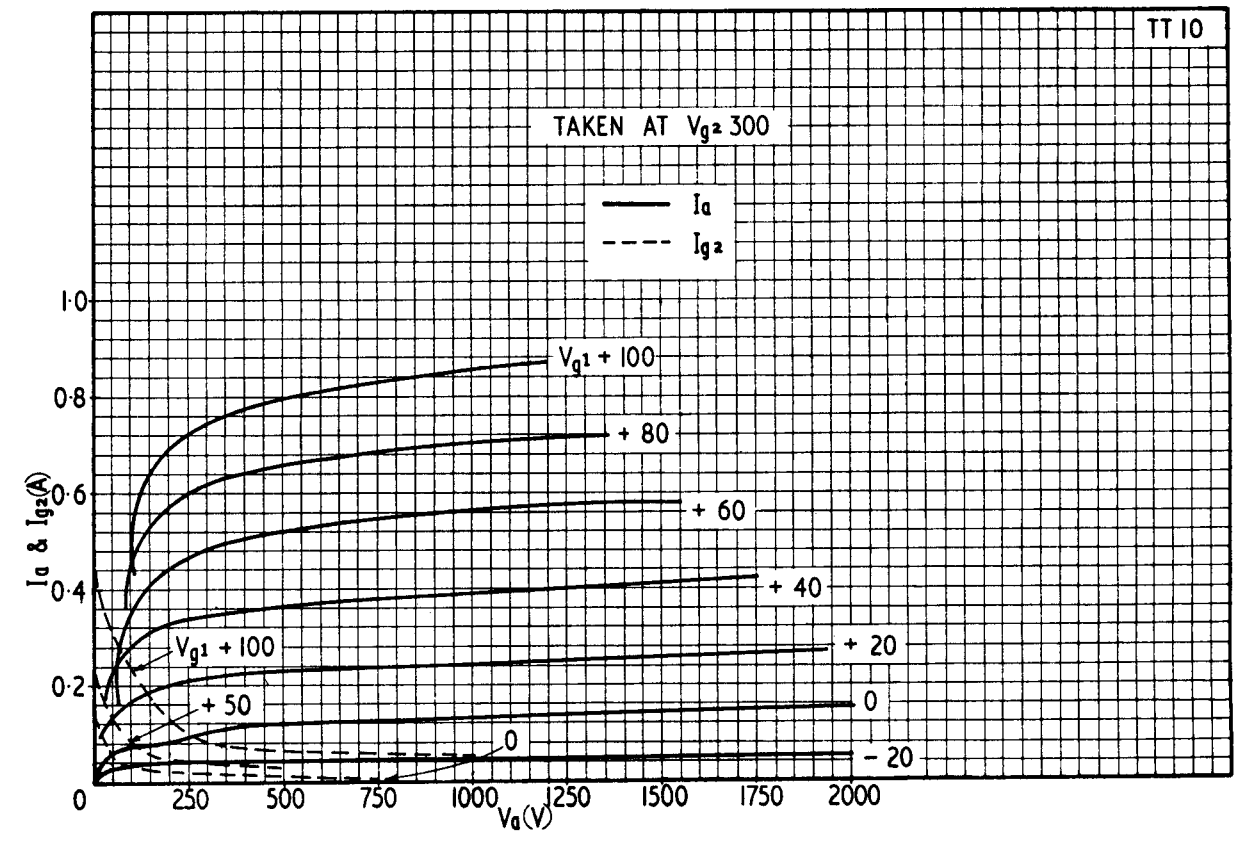
(*a*) At crest of audio cycle with 100% modulation.

(*b*) Obtained by grid resistance of value shown or by combination of grid resistance either with fixed supply or cathode resistance. Total effective grid circuit resistance should not exceed 30,000 Ω.


TT10
TAKEN AT V_{g2} 300
I_{g1} (mA)
V_a (V)
V_{g1} + 100
+ 80
+ 60
+ 40
+ 20
0
100
200
300
400
10
20
30
40
50
60
70
80
90
100


TT10
TAKEN AT V_{g2} 400
I_{g1} (mA)
V_a (V)
V_{g1} + 100
+ 80
+ 60
+ 40
+ 20
0
100
200
300
400
20
40
60


TT 10
TAKEN AT V_{g2} 400
I_a
I_{g2}
V_{g1} + 100
+ 80
+ 60
+ 40
+ 20
0
− 20
− 40
V_{g1} + 100
+ 50
0
I_a & I_{g2} (A)
1·0
0·8
0·6
0·4
0·2
0
250
500
750
1000
1250
1500
1750
2000
V_a (V)


TT 10
TAKEN AT V_{g2} 300
I_a
I_{g2}
V_{g1} + 100
+ 80
+ 60
+ 40
+ 20
0
− 20
V_{g1} + 100
+ 50
0
I_a & I_{g2} (A)
1·0
0·8
0·6
0·4
0·2
0
250
500
750
1000
1250
1500
1750
2000
V_a (V)



PRINTED IN ENGLAND

Twin Tetrode *Type TT15*

(RF AMPLIFIER)

General. The TT 15 has two beam-tetrode systems with indirectly heated oxide-coated cathodes. The valve is designed for use as a push-pull RF power amplifier for frequencies up to 160 Mc/s and, at reduced inputs, up to 250 Mc/s.

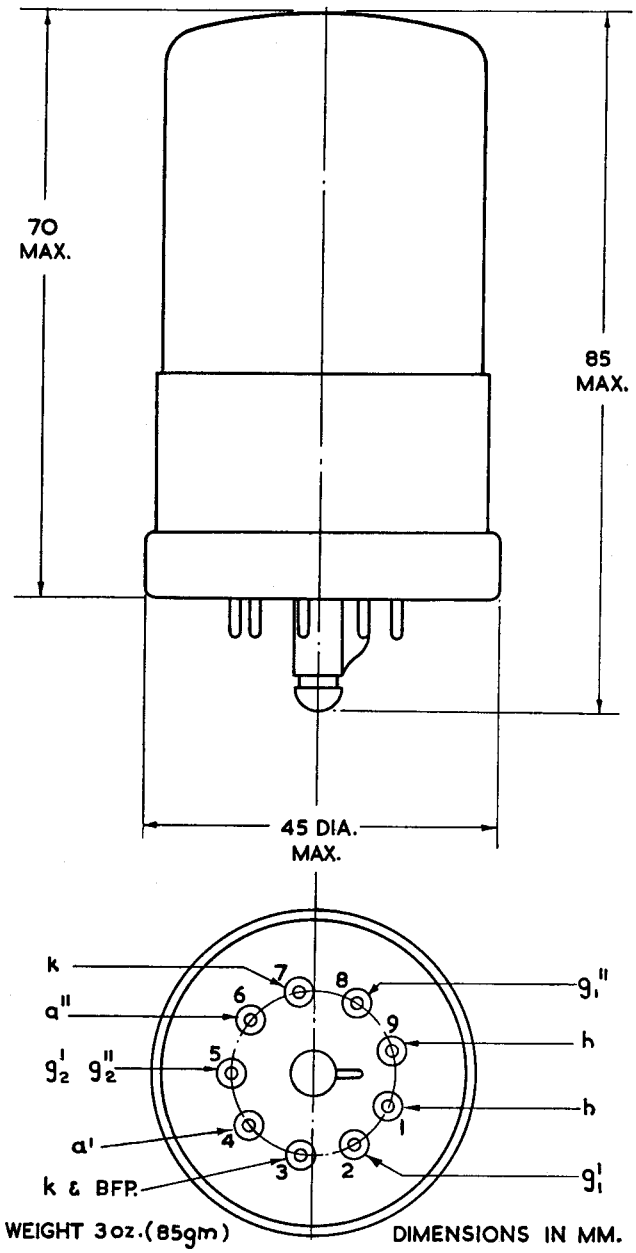
Cooling. The valve must have adequate ventilation. The temperature of the hottest part of the bulb must not exceed 250°C.

Mounting. The valve may be mounted in any position. A retaining device should always be fitted.

Screening. The metal skirt is connected to the centre spigot which should be earthed. No further screening is required.

APPROXIMATE DATA

V_h		6·3	V
I_h		1·6	A
V_a		400	V
V_{g1}		200	V
$I_{k(pk)(max)}$		2×0·4	A
$p_{a(max)}$		2×7·5	W
$p_{g2(max)}$		2×1·25	W
μ_{g1-g2}	taken at V_a 250 V,	6·5	
r_a	V_{g2} 135 V,	100	kΩ
g_m	I_a 30 mA	3·9	mA/V
c_{a-g1}	0·043 pF (mean)	0·05 pF (max.)	
c_{g1-all}	8·5 pF (mean)	9·0 pF (max.)	
c_{a-all}	9·3 pF (mean)	7·5 pF (max.)	



MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. Telegraphic Address: Expanse, Chelmsford

Typical Operation

(1) PUSH-PULL AUDIO AMPLIFIER. CLASS AB1

Values per valve (2 systems).

V_a	300	400	V
V_{g2}	175	175	V
V_{g1}	–21	–25	V
$V_{in(pk)(g'_1-g''_1)}$	41	48	V
$V_{out\ (r.m.s.)}$	324	480	V
$I_{a\ (zero\text{-}sig.)}$	50	33	mA
$I_{a\ (max\text{-}sig.)}$	100	92	mA
$I_{g2\ (zero\text{-}sig.)}$	2·6	1·4	mA
$I_{g2\ (max\text{-}sig.)}$	13·9	11·8	mA
$R_{L(a'-a'')}$	7	10	kΩ
D	2·25	4·2	%
P_{out}	16·8	22·7	W

Grid Resistor. The maximum permissible DC grid to cathode resistor for fixed bias applications is 0.1 MΩ.

These values assume that a stabilised power supply of very low impedance is used.

(2) PUSH-PULL RF POWER AMPLIFIER. CLASS C TELEGRAPHY

(*Unmodulated, key-down conditions.*)

Values per valve (2 systems).

f	20	20	Mc/s
V_a	300	400	V
V_{g2}	175	175	V
V_{g1}	–50	–50	V
$V_{in(pk)(g_1'-g_1'')}$	110	110	V
I_a	120	100	mA
I_{g2}	14	11	mA
I_{g1} (a)	2·5	2·5	mA
R_{g1}	20	20	kΩ
p_a	12	14·4	W
p_{g2}	2·5	1·9	W
P_{dr} (a)	0·3	0·3	W
P_{out}	24	25·6	W

(3) PUSH-PULL RF AMPLIFIER

(*Permissible modulation 100%, carrier conditions.*)

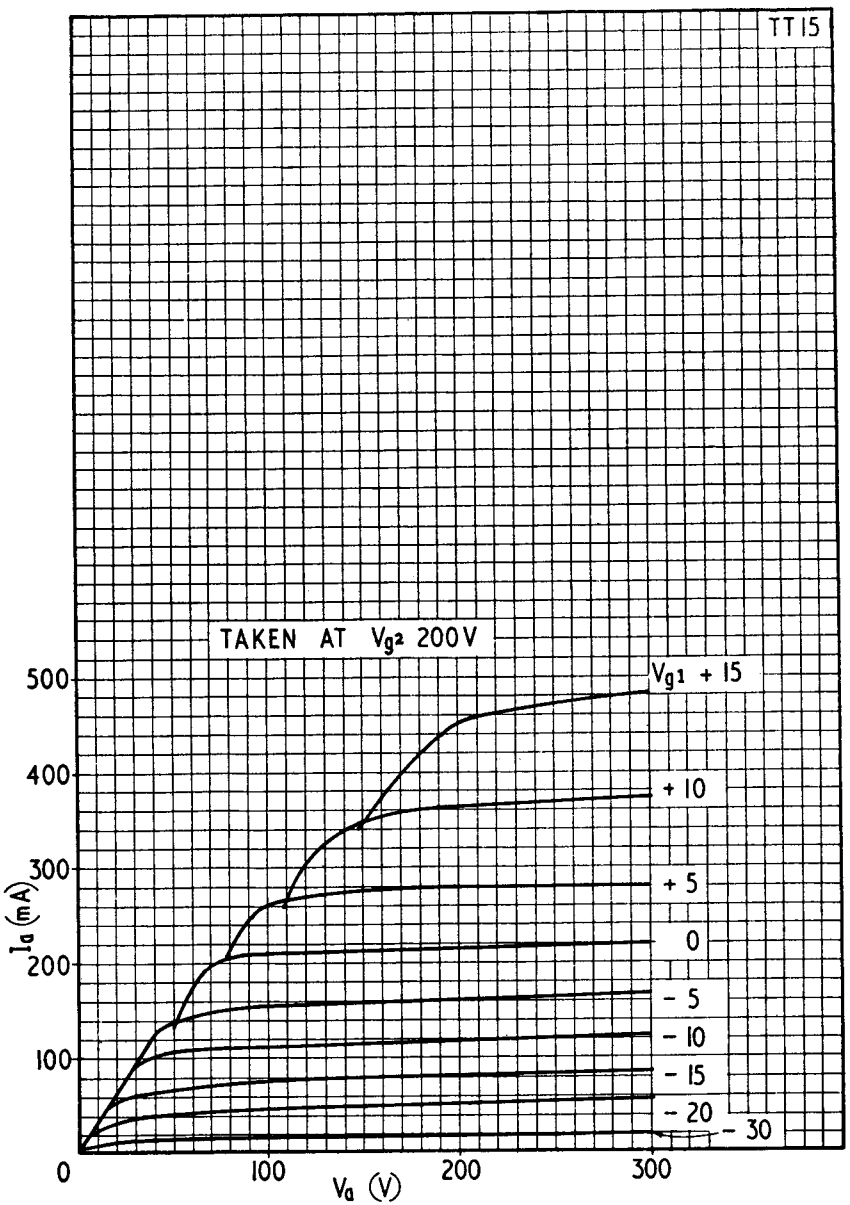
Values per valve (2 systems).

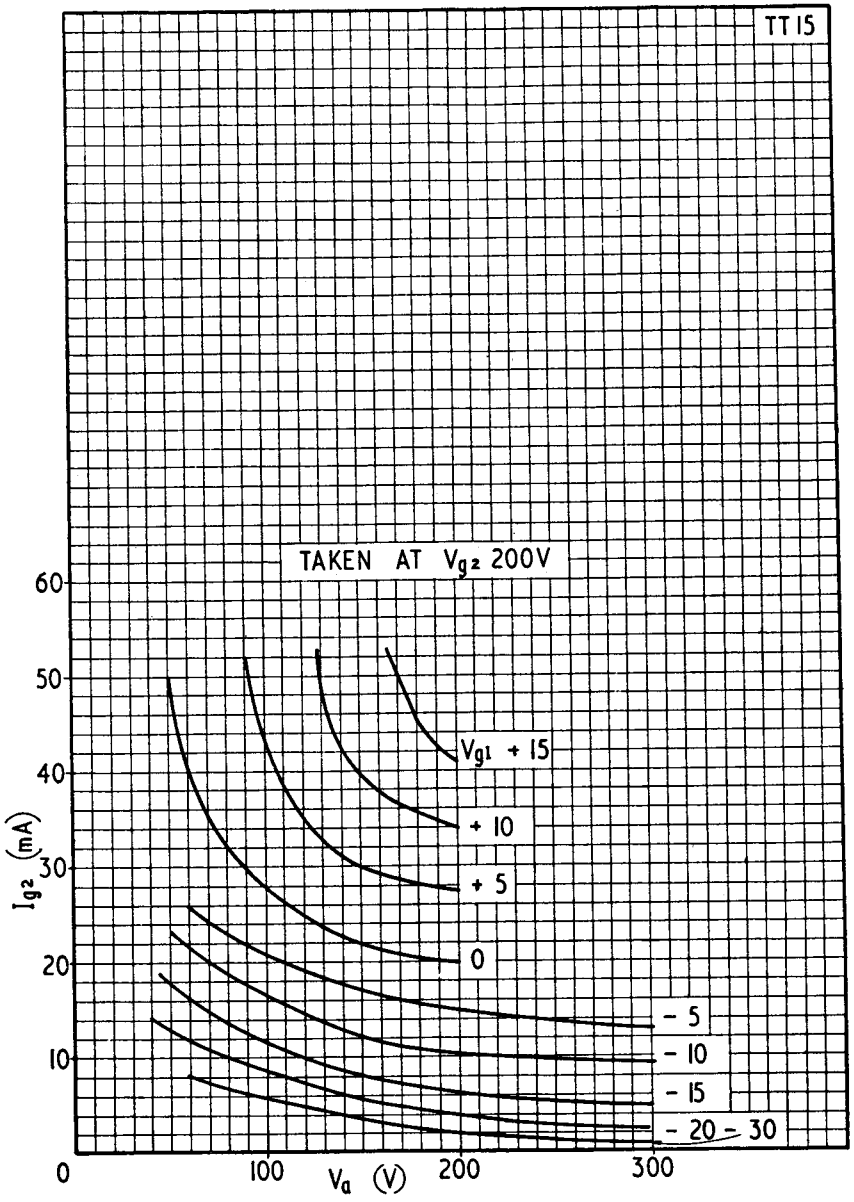
f	20	Mc/s
V_a	325	V
V_{g2}	200	V
V_{g1}	–60	V
$V_{in(pk)(g_1'-g_1'')}$	130	V
I_a	90	mA
I_{g2}	12·5	mA
I_{g1} (a)	2·5	mA
R_{g2}	10	kΩ
$Z_{to\ mod}$	3,130	Ω
p_a	10	W
p_{g2}	2·5	W
P_{dr} (a)	0·35	W
$P_{audio\ mod.}$	17	W
P_{out}	19·2	W

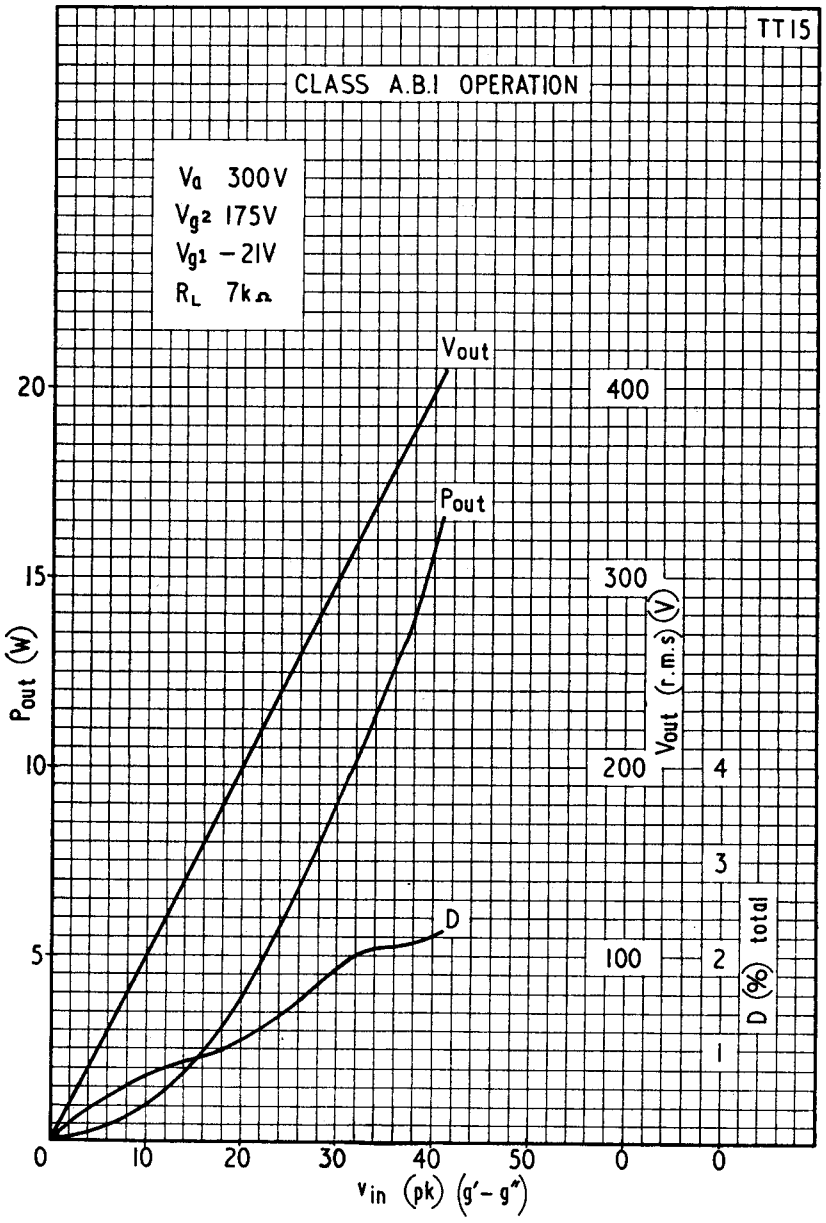
Greater anode inputs in the carrier conditions may be permissible if the mean modulation depth is very low. The anode dissipation must not exceed 15 W under modulation conditions.

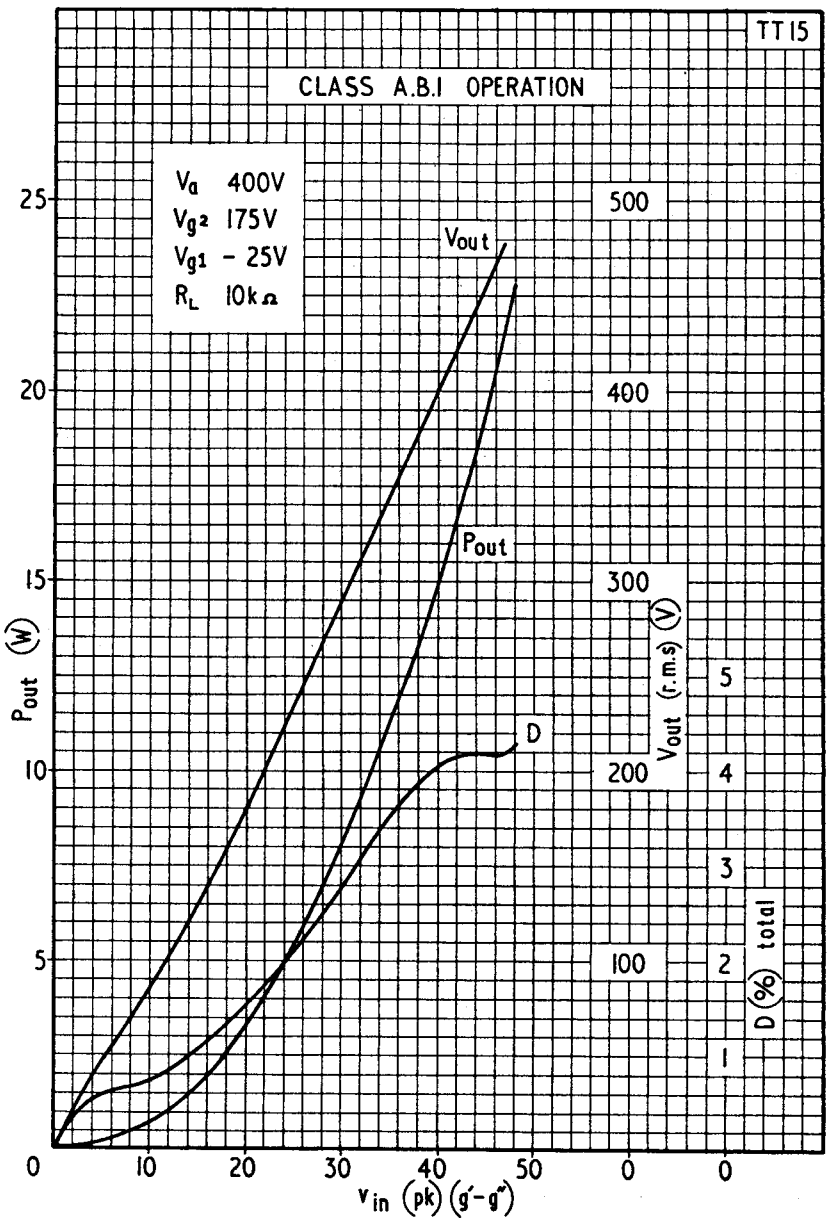
NOTE

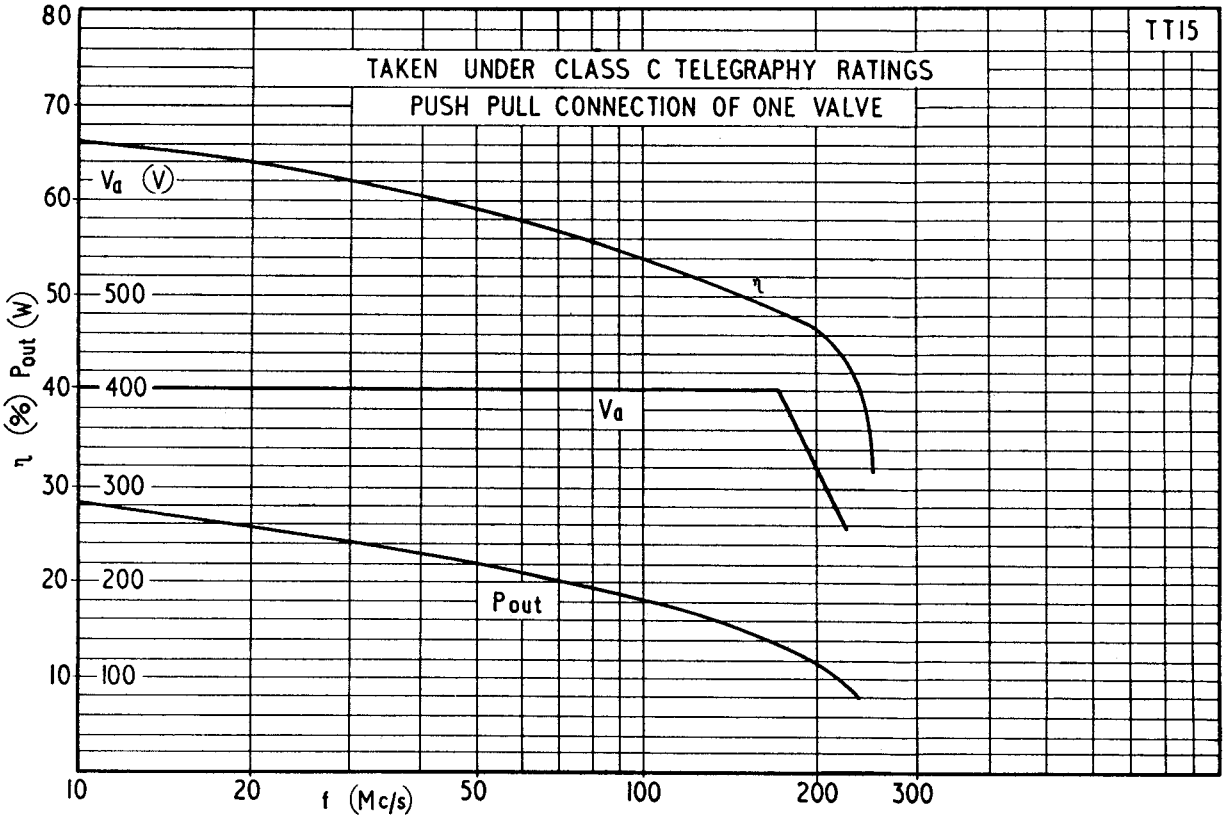
(*a*) Subject to wide variations. The figures are approximate only.

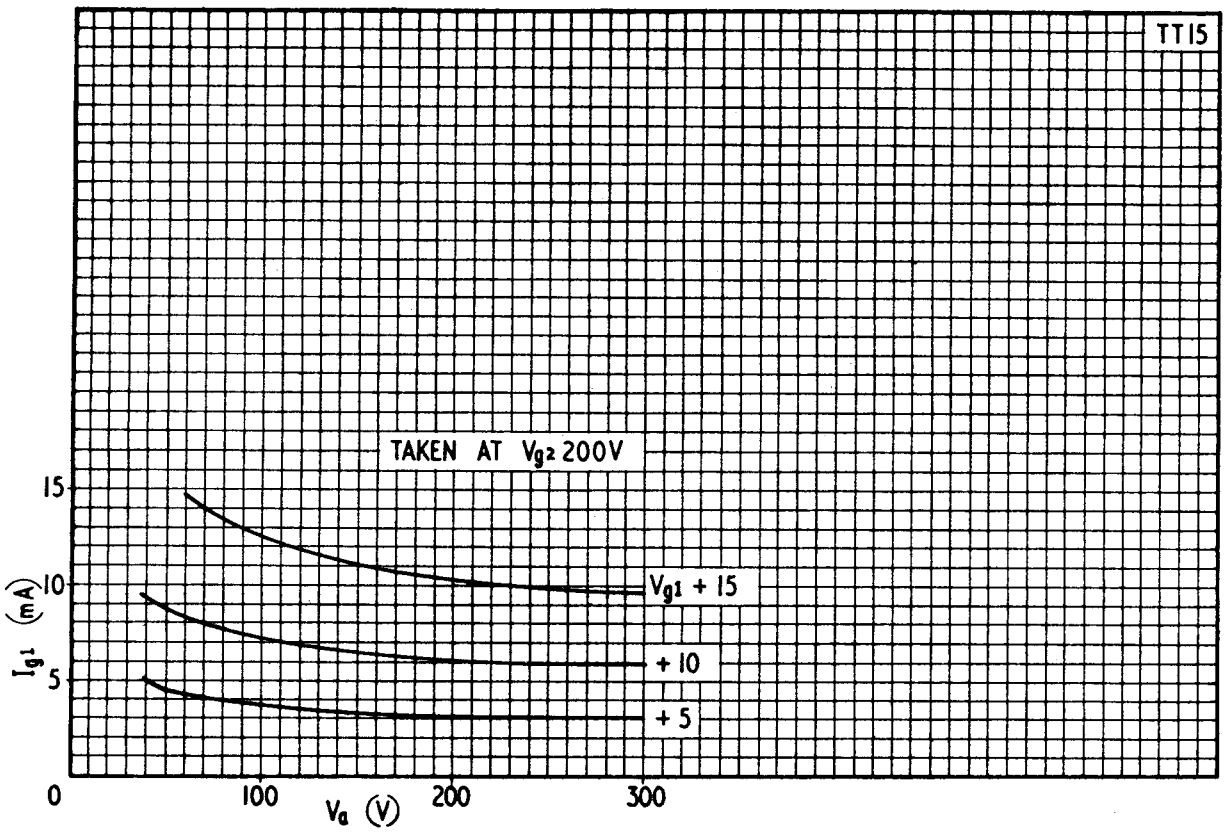

TT 15
TAKEN AT V_{g2} 200V
I_a (mA)
V_a (V)
0
100
200
300
100
200
300
400
500
V_{g1} + 15
+ 10
+ 5
0
- 5
- 10
- 15
- 20
- 30

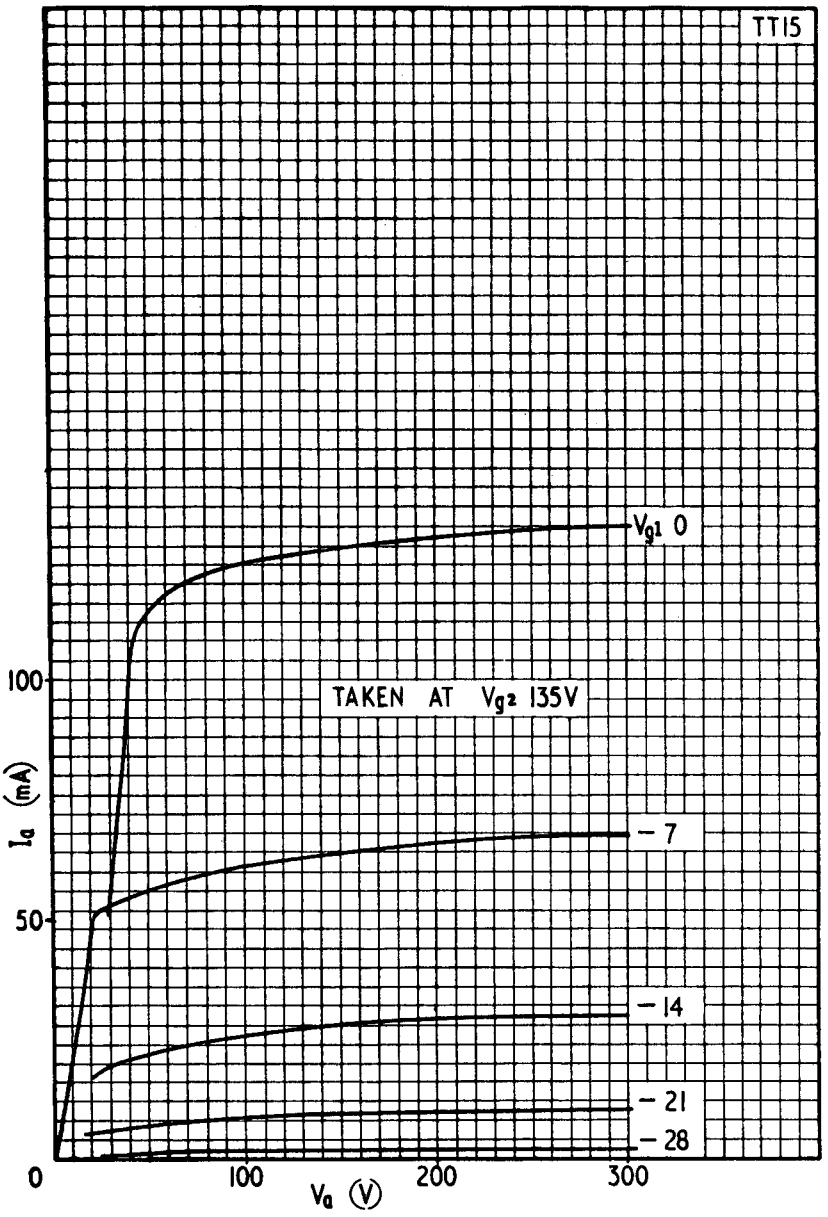

TT 15
TAKEN AT V_{g2} 200V
I_{g2} (mA)
V_a (V)
0
100
200
300
10
20
30
40
50
60
V_{g1} + 15
+ 10
+ 5
0
- 5
- 10
- 15
- 20 - 30


TT15
CLASS A.B.I OPERATION
Va 300V
Vg2 175V
Vg1 −21V
RL 7kΩ
Vout
Pout
D
Pout (W)
Vout (r.m.s) (V)
D (%) total
vin (pk) (g'-g")


TT15
CLASS A.B.I OPERATION
Va 400V
Vg2 175V
Vg1 − 25V
RL 10kΩ
Vout
Pout
D
Pout (W)
Vout (r.m.s) (V)
D (%) total
vin (pk) (g'-g")


TT15
TAKEN UNDER CLASS C TELEGRAPHY RATINGS
PUSH PULL CONNECTION OF ONE VALVE
Va (V)
500
400
300
200
100
η
Va
Pout
η (%) Pout (W)
80
70
60
50
40
30
20
10
10
20
f (Mc/s)
50
100
200
300


TT15
TAKEN AT Vg2 200V
Vg1 + 15
+ 10
+ 5
Ig1 (mA)
15
10
5
0
100
Va (V)
200
300


TT15
V_{g1} 0
TAKEN AT V_{g2} 135V
– 7
– 14
– 21
– 28
100
50
0
I_a (mA)
100
200
300
V_a (V)



PRINTED IN ENGLAND

Tetrode *Type TT 16 D*

VHF AMPLIFIER OR MODULATOR

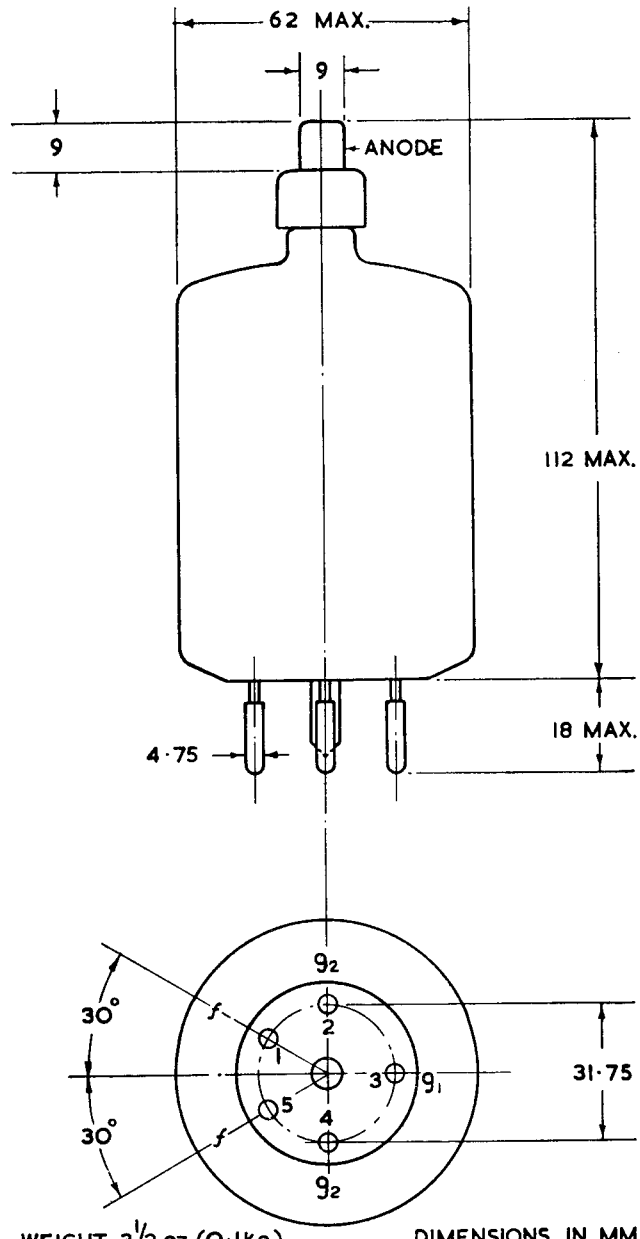
General. The TT 16D is a power tetrode fitted with a thoriated tungsten filament. The valve may be operated at full ratings at frequencies up to 120 Mc/s and, at reduced ratings, up to 200 Mc/s.

Cooling. The temperature of the anode seal must not exceed 220°C and that of the base pins must not exceed 180°C. It may be necessary to direct an air flow on to the anode seal and on to the base of the valve, when operating at frequencies above 50 Mc/s in order to keep within these temperature limits. The air stream on to the base should be so directed that it also passes over the valve envelope. At frequencies below 50 Mc/s radiation cooling from the envelope should be sufficient, but an anode connector of large surface area will be required to cool the anode seal.

Mounting. The valve should be mounted vertically. The base may be either at the top or the bottom.

APPROXIMATE DATA

V_f		5	V
I_f		6·5	A
$V_{a(max)}$		3	kV
$V_{g2(max)}$		600	V
$p_{a(max)}$ (*a*)		125	W
→ $p_{g2(max)}$		20	W
$I_{k(max)}$		270	mA
→ $I_{k(pk)(max)}$		1·6	A
g_m	taken at V_a 2·5 kV,	2·2	mA/V
u_{g1-g2}	V_{g2} 350 V, I_a 40 mA	6·2	
→ c_{in}		10·8	pF
→ c_{out}		3·1	pF
c_{a-g1}		0·05	pF



WEIGHT 3½ oz. (0·1kg.)

DIMENSIONS IN MM.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Typical Operation

(1) RF POWER AMPLIFIER CLASS C TELEGRAPHY OR FM TELEPHONY. SINGLE VALVE

Maximum ratings

V_a		3·0	kV
p_a	(*a*)	125	W
I_k		300	mA
$i_{k(pk)}$		1·6	A
V_{g2}		400	V
p_{g2}		20	W
p_{g1}		5·0	W
V_{g1}		−500	V
I_{g1}		15	mA

Typical Operating Conditions at f ≦120 Mc/s

V_a	2·0	2·5	3·0	kV
V_{g2}	350	350	350	V
V_{g1}	−100	−150	−150	V
I_a	200	200	167	mA
I_{g2}	50	40	30	mA
I_{g1}	9·0	9·0	6·5	mA
$V_{in(pk)}$	260	330	300	V
P_{dr}	2·4	3·0	2·0	W
p_a	125	125	125	W
p_{g2}	17·5	14	10·5	W
P_{out}	275	375	375	W
P_{load} (*b*)	220	300	300	W
η	69	75	75	%

(2) RF POWER AMPLIFIER CLASS B TELEPHONY. SINGLE VALVE

Maximum ratings

V_a		3·0	kV
p_a	(*a*)	125	W
I_k		120	mA
$i_{k(pk)}$		350	mA
V_{g2}		400	V
p_{g2}		14	W

Typical Operating Conditions f ≦120 Mc/s

V_a	2·0	2·5	3·0	kV
V_{g2}	350	350	350	V
V_{g1}	−50	−50	−50	V
I_a	83	70	60	mA
I_{g2}	1·5	1·0	1·0	mA
$V_{in(pk)}$	65	55	50	V
p_a	112	120	122	W
p_{g2}	0·52	0·35	0·35	W
P_{out}	54	55	58	W
P_{load} (*b*)	43	45	46	W
η for 100% mod.	32·5	31·5	32	%
I_{g1}	4·0	4·0	4·5	mA
P_{dr}	0·52	0·44	0·45	W

(3) RF POWER AMPLIFIER CLASS C TELEPHONY, ANODE AND SCREEN GRID MODULATION. SINGLE VALVE

Maximum ratings

V_a		2·5	kV
p_a		83	W
I_k		200	mA
$i_{k(pk)}$		2·0	A
V_{g2}		400	V
p_{g2}		20	W
V_{g1}		−500	V
I_{g1}		15	mA

Typical Operating Conditions at f ≦120 Mc/s

V_a	2·0	2·5	kV
V_{g2}	350	350	V
V_{g1}	−220	−210	V
I_a	150	152	mA
I_{g2}	33	30	mA
I_{g1}	5·0	4·5	mA
P_{dr}	2·0	1·7	W
$V_{in(pk)}$	390	380	V
p_a	75	80	W
p_{g2}	11·5	10·5	W
P_{out}	225	300	W
P_{load} (*b*)	180	240	W
η for 100% mod.	75	79	%
P_{mod}	150	190	W
$V_{g2(pk)mod.}$	300	300	V

(4) AF POWER AMPLIFIER OR MODULATOR CLASS B. TWO VALVES IN PUSH-PULL

Maximum ratings

V_a		3·0	kV
p_a	(*a*)	125	W

I_k	320	mA
$i_{k(pk)}$	1·0	A
V_{g2} (Ig1 = 0)	600	V
V_{g2} (Ig1 > 0)	400	V
p_{g2}	20	W
V_{g1}	−500	V
R_{g1-k}	150	kΩ

Typical Operating Conditions. Class B1

V_a	1·5	2·0	2·5	kV
V_{g2}	600	600	600	V
V_{g1}	−94	−96	−97	V
$I_{a\ (zero\text{-}sig)}$	2×30	2×30	2×30	mA
$I_{a\ (max\text{-}sig)}$	2×109	2×111	2×108	mA
$I_{g2\ (max\text{-}sig)}$	2×13·5	2×12	2×13	mA
$V_{in\ (g1-g1)\ (r.m.s.)}$	130	132	134	V
p_a	2×78	2×92	2×95	W
P_{out}	170	260	345	W
R_{a-a}	12	17·6	25	kΩ
η	52	58·5	64	%
D_{tot}	3·5	3·6	4·0	%

Typical Operating Conditions. Class B2

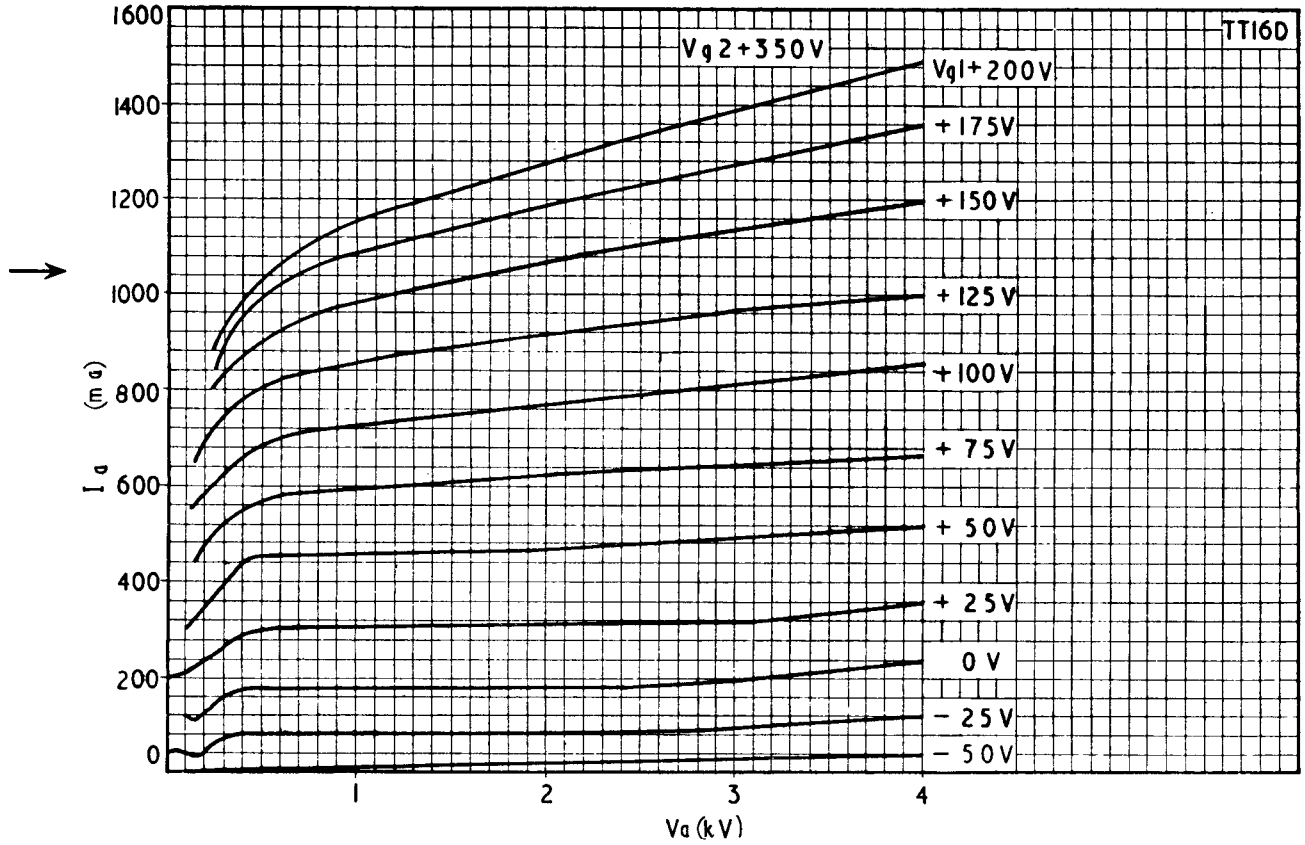
V_a	1·5	2·0	2·5	kV
V_{g2}	350	350	350	V
V_{g1}	−48	−50	−51	V
$I_{a\ (zero\text{-}sig)}$	2×30	2×30	2×30	mA
$I_{a\ (max\text{-}sig)}$	2×225	2×197	2×151	mA
$I_{g2\ (max\text{-}sig)}$	2×42	2×32	2×18	mA
I_{g1}	2×16	2×12	2×8·5	mA
$V_{in\ (g1-g1)\ (r.m.s.)}$	234	210	170	V
P_{dr}	2×2·4	2×1·6	2×0·9	W
p_a	2×114	2×120	2×103	W
P_{out}	455	550	550	W
R_{a-a}	7·2	12	20	kΩ
η	66·5	69·5	72·5	%
D_{tot}	5·0	5·0	5·0	%

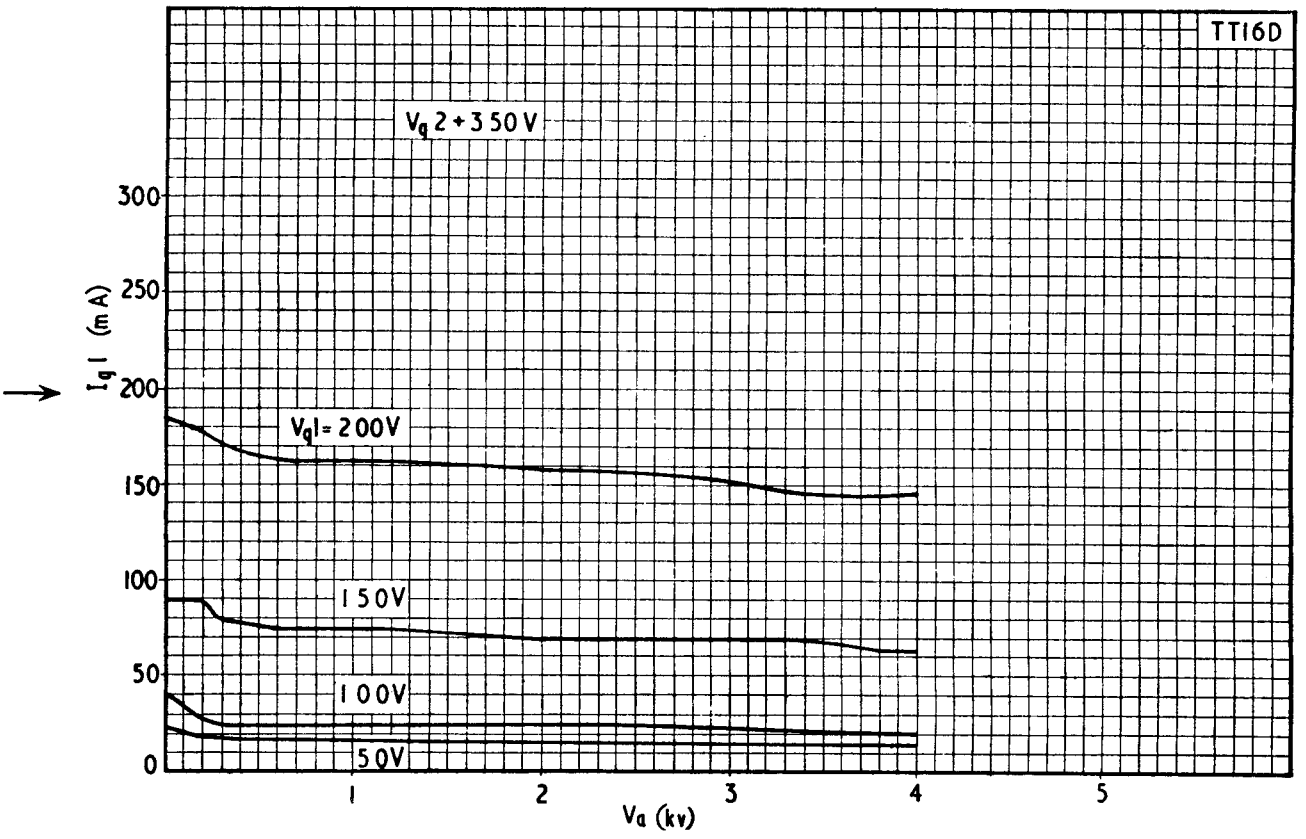
NOTES

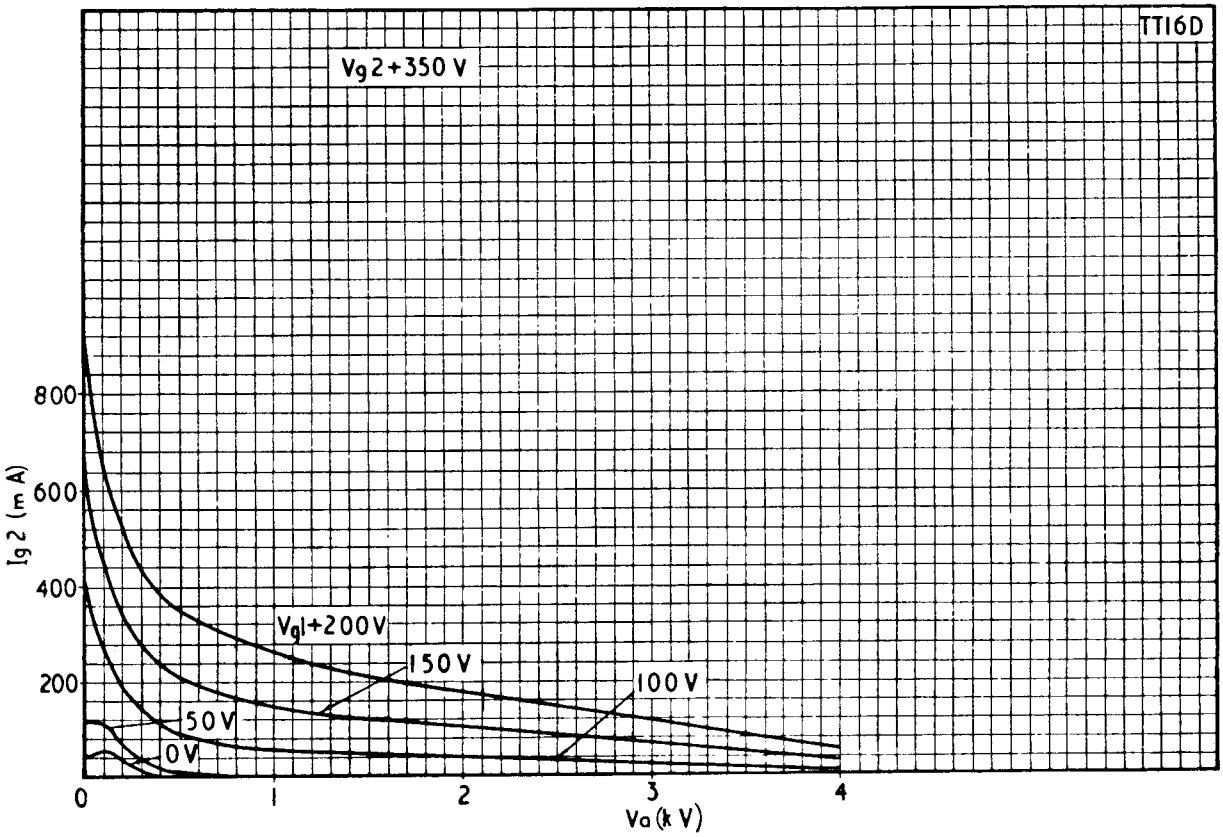
1. The RF circuit returns must be brought to the filament connection on Pin No. 1.
2. To ensure equal distribution of the currents through the seals, the screen-grid leads should be strapped together at the valve holder and the circuit connections joined to the mid-point of the strap. This should not be allowed to impair the free flotation of individual contacts.

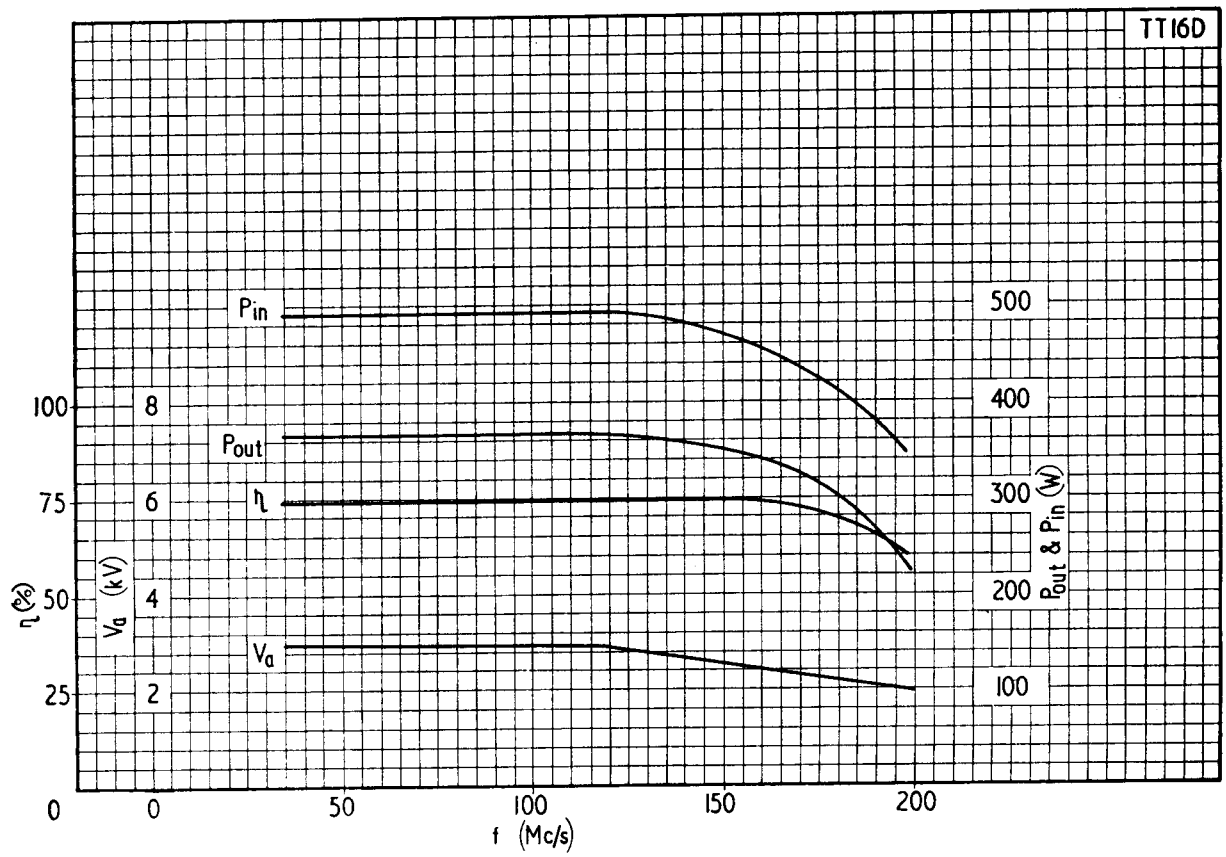
(*a*) Corresponding to anode temperature of 850°C, i.e. red heat.

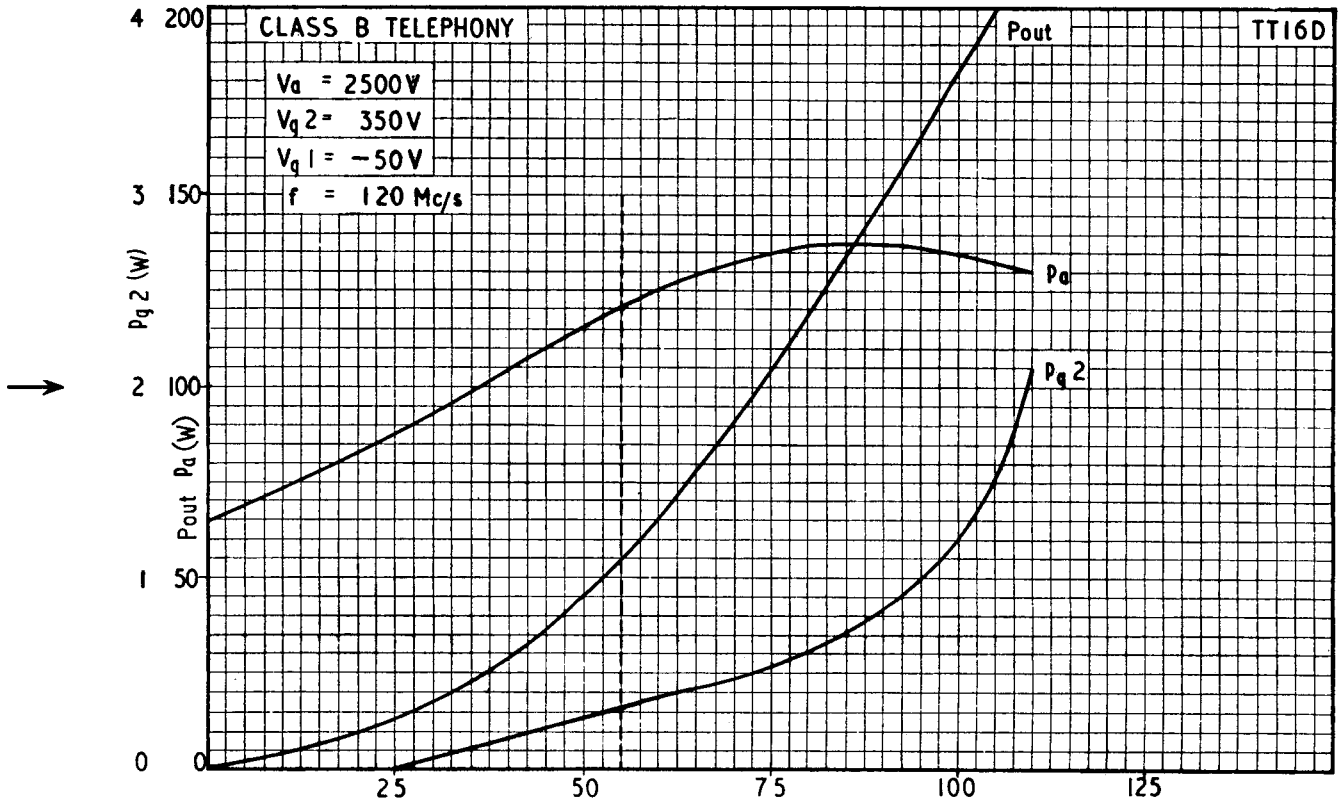
(*b*) With a circuit transfer efficiency of 80%.

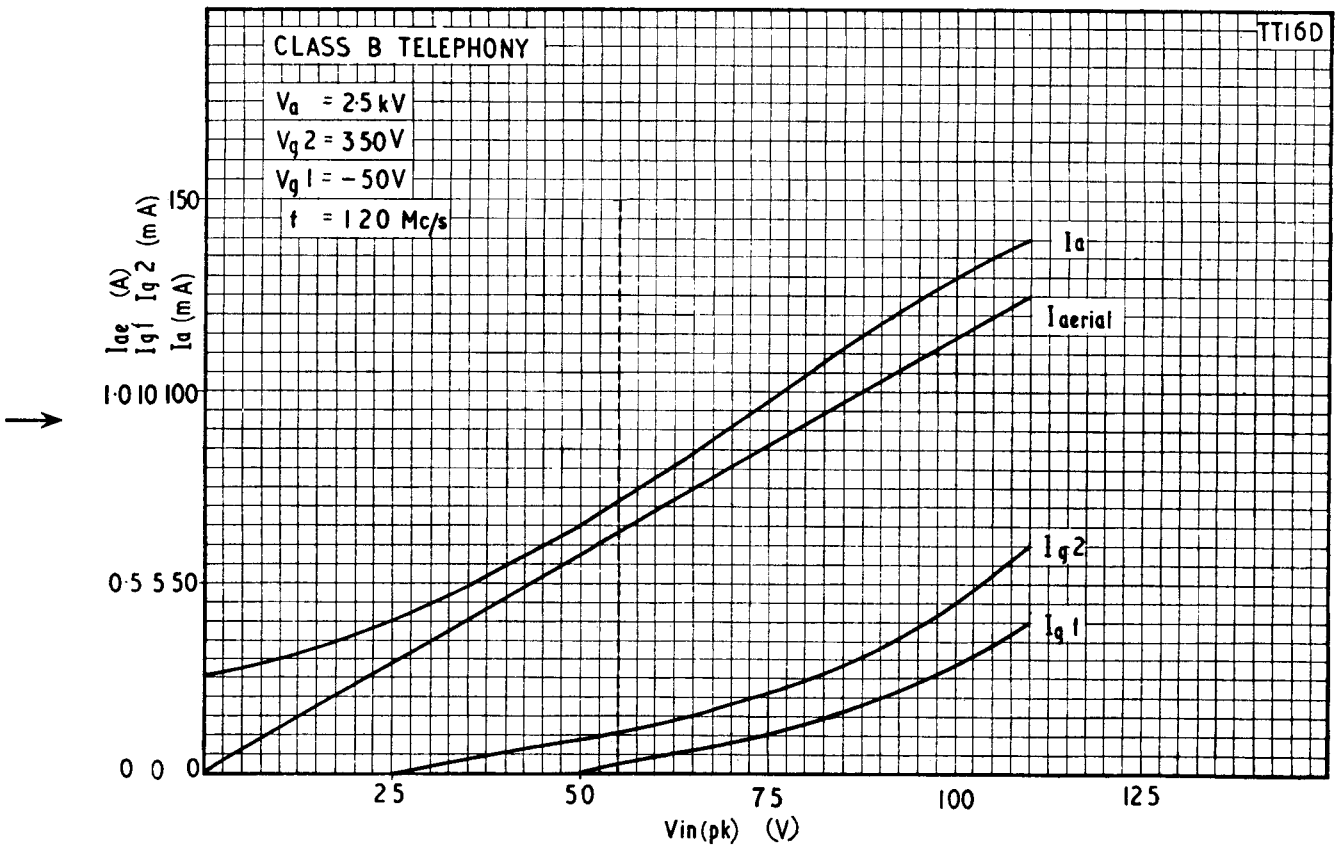

TT16D
Vg2 +350V
Vg1 +200V
+175V
+150V
+125V
+100V
+75V
+50V
+25V
0V
−25V
−50V
Ia (mA)
Va (kV)

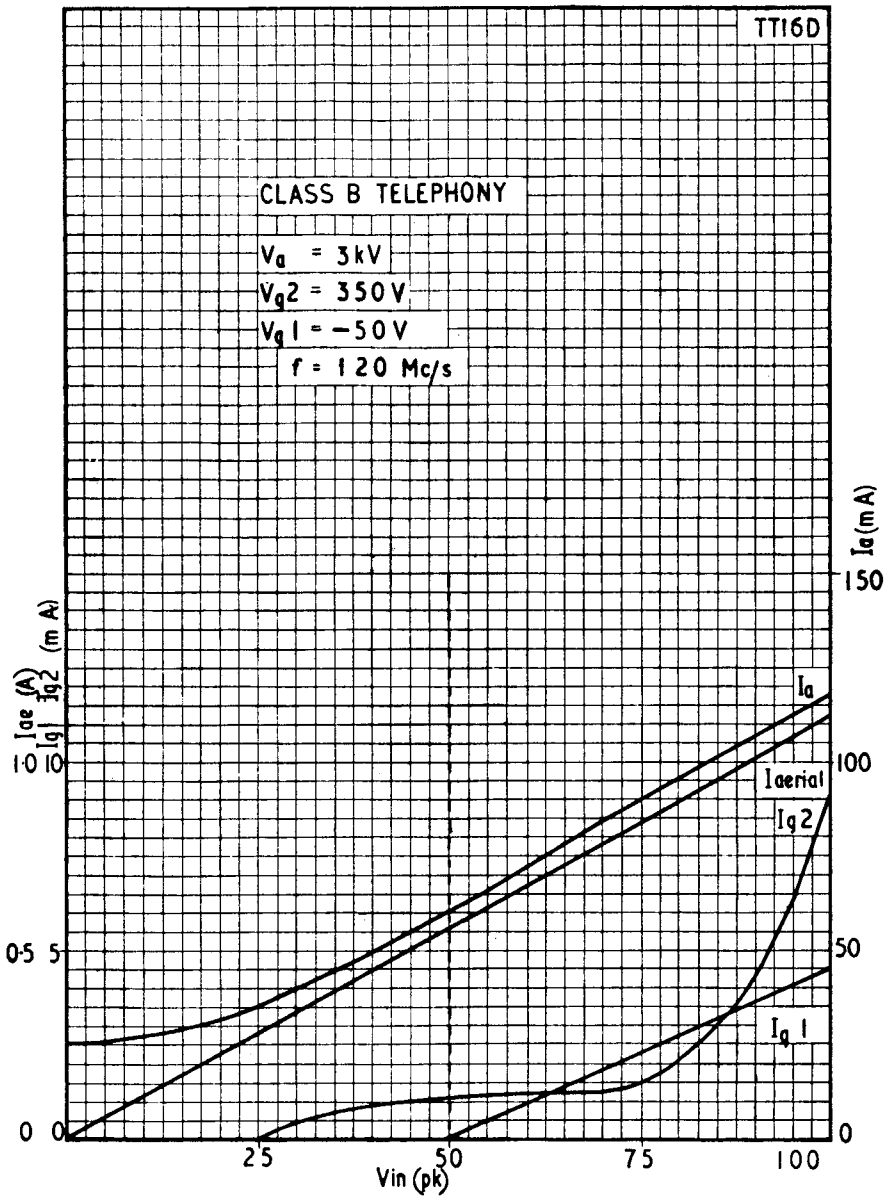

TT16D
Vg2 +350V
Vg1 = 200V
150V
100V
50V
Ig1 (mA)
Va (kv)

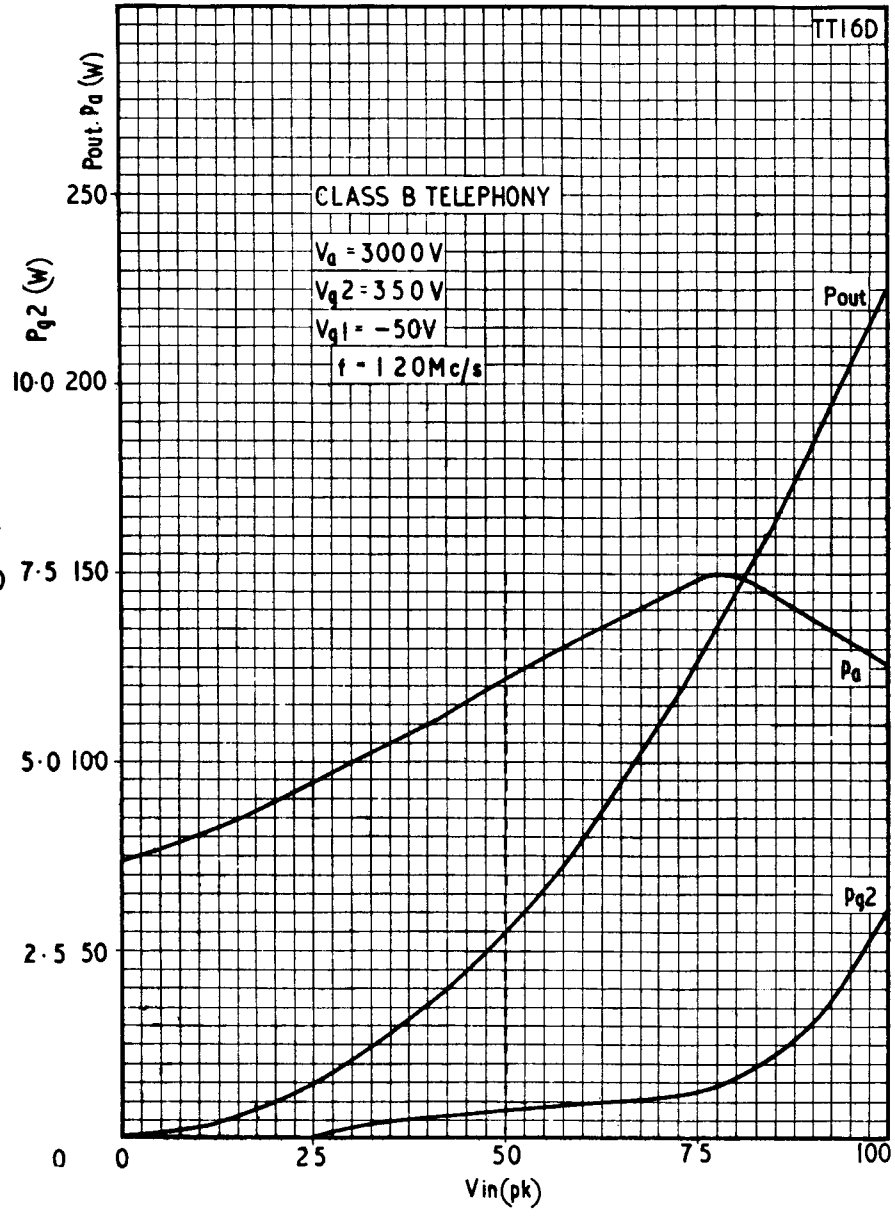

TT16D
Vg2+350 V
Ig2 (mA)
800
600
400
200
Vg1+200V
150 V
100 V
50 V
0 V
0
1
2
3
4
Va (k V)

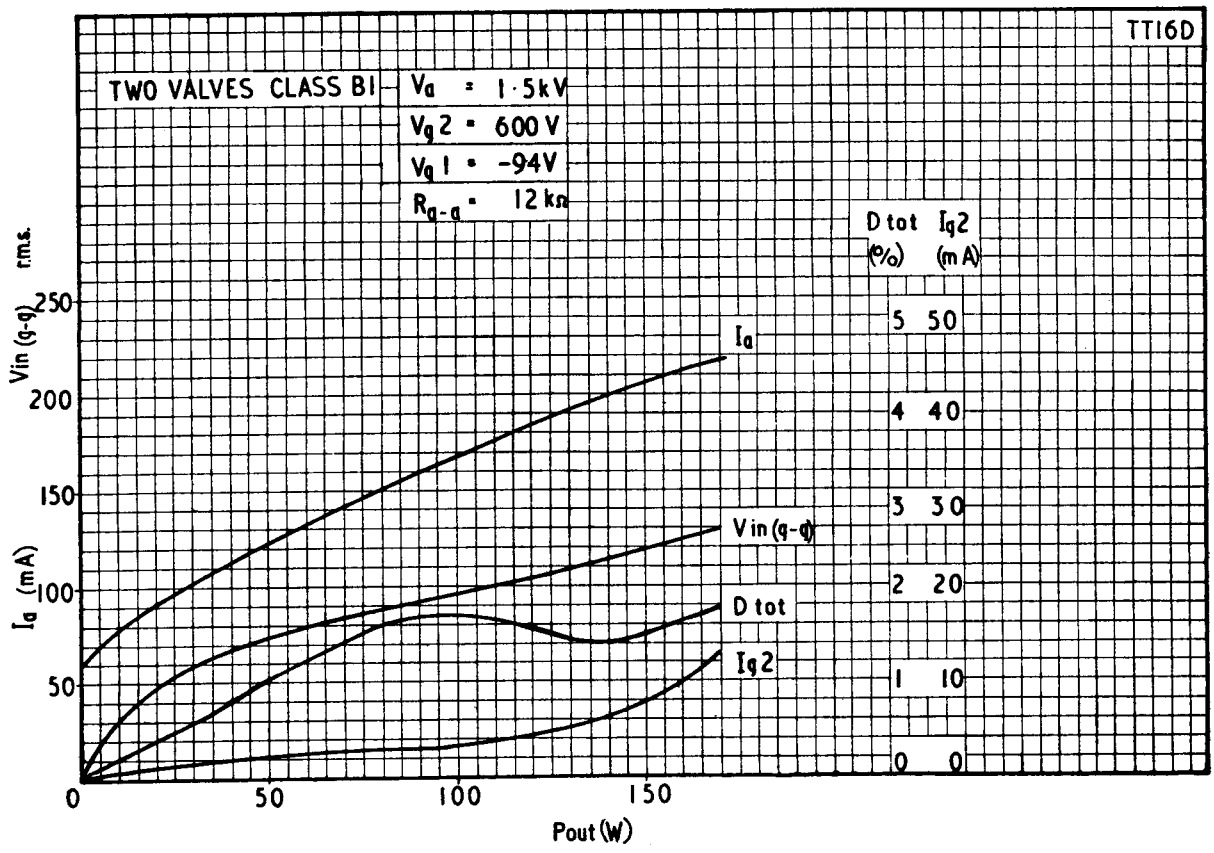

TT16D
Pin
Pout
η
Va
100
75
50
25
η (%)
8
6
4
2
Va (kV)
500
400
300
200
100
Pout & Pin (W)
0
0
50
100
150
200
f (Mc/s)

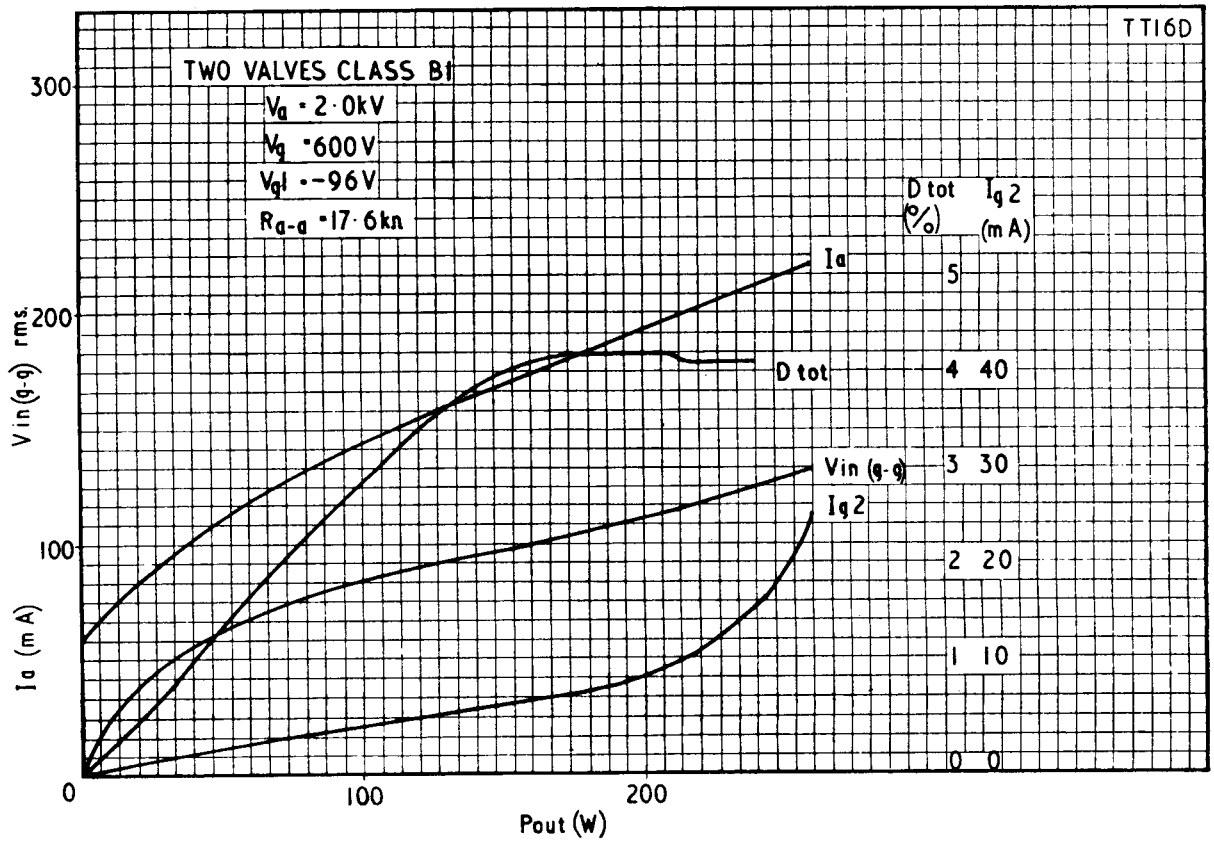

CLASS B TELEPHONY
TT16D
Va = 2500V
Vg2 = 350V
Vg1 = −50V
f = 120 Mc/s
Pout
Pa
Pg2
Pg2 (W)
Pout Pa (W)
4 200
3 150
2 100
1 50
0 0
25
50
75
100
125

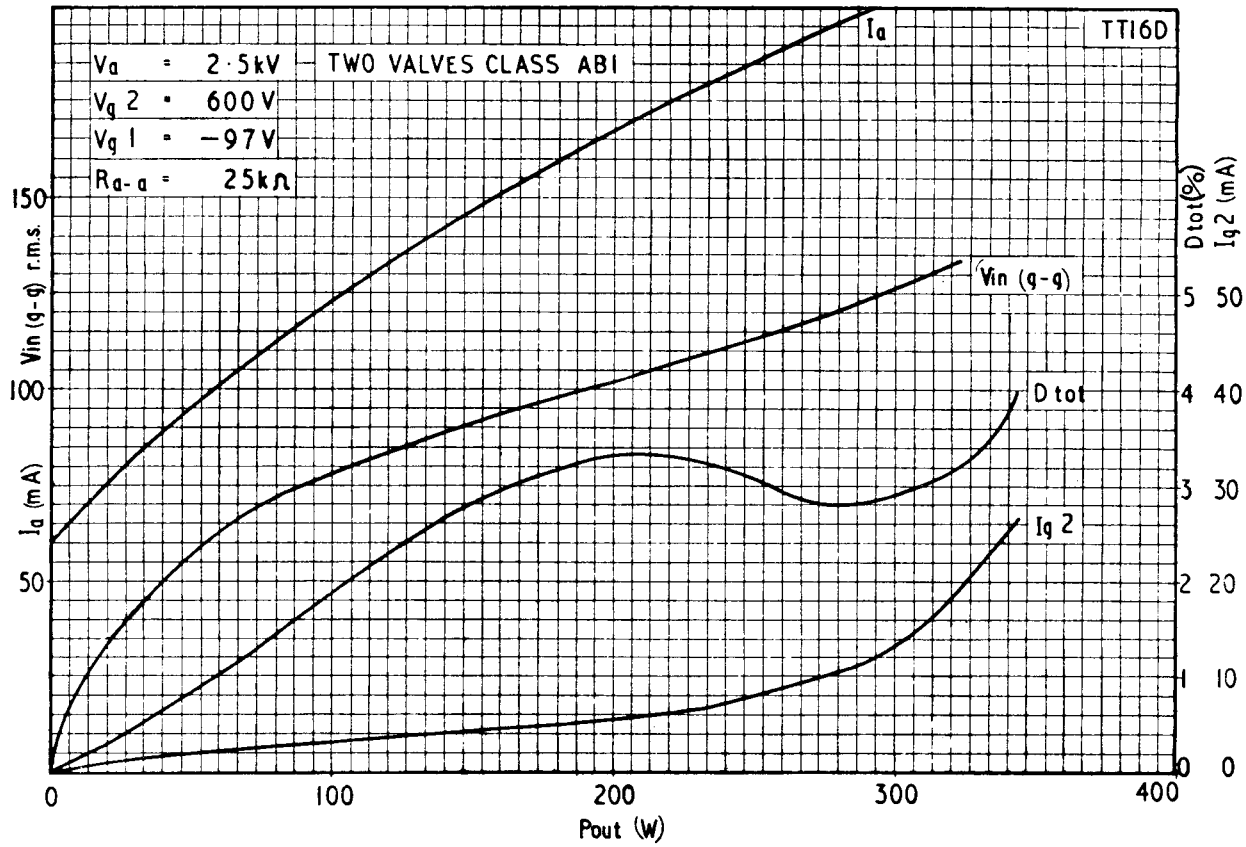

CLASS B TELEPHONY
TT16D
Va = 2·5 kV
Vg2 = 350V
Vg1 = −50V
f = 120 Mc/s
Ia
Iaerial
Ig2
Ig1
Iae (A)
Ig1 Ig2 (mA)
Ia (mA)
1·0 10 100
0·5 5 50
0 0 0
25
50
75
100
125
Vin(pk) (V)

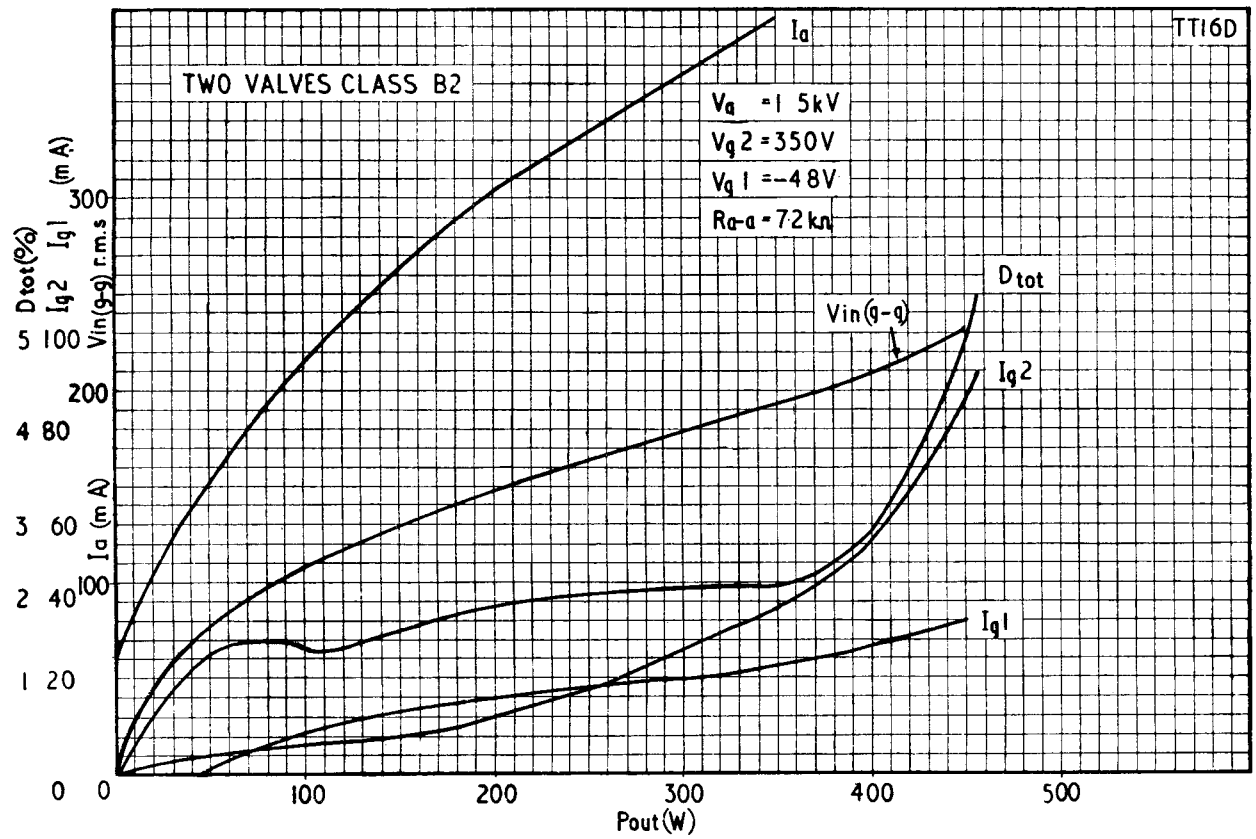

TT16D
CLASS B TELEPHONY
Va = 3kV
Vg2 = 350V
Vg1 = −50V
f = 120 Mc/s
Iae (A)
Ig1 Ig2 (mA)
Ia (mA)
Ia
Iaerial
Ig2
Ig1
Vin (pk)
0
25
50
75
100
0·5
1·0
5
10
50
100
150

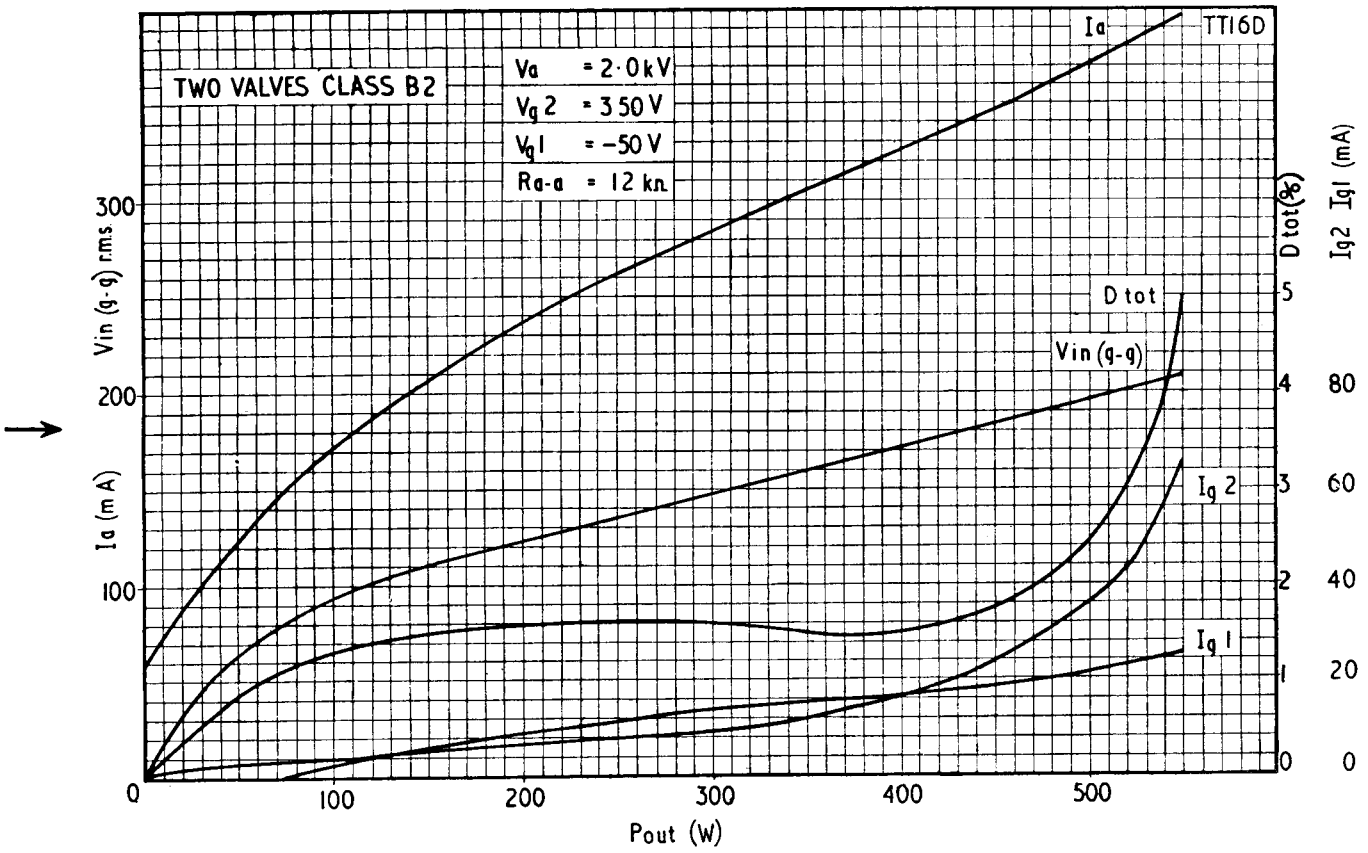

TT16D
CLASS B TELEPHONY
Va = 3000V
Vg2 = 350V
Vg1 = −50V
f = 120Mc/s
Pout. Pa (W)
Pg2 (W)
Pout
Pa
Pg2
Vin (pk)
0
25
50
75
100
2·5
5·0
7·5
10·0
50
100
150
200
250

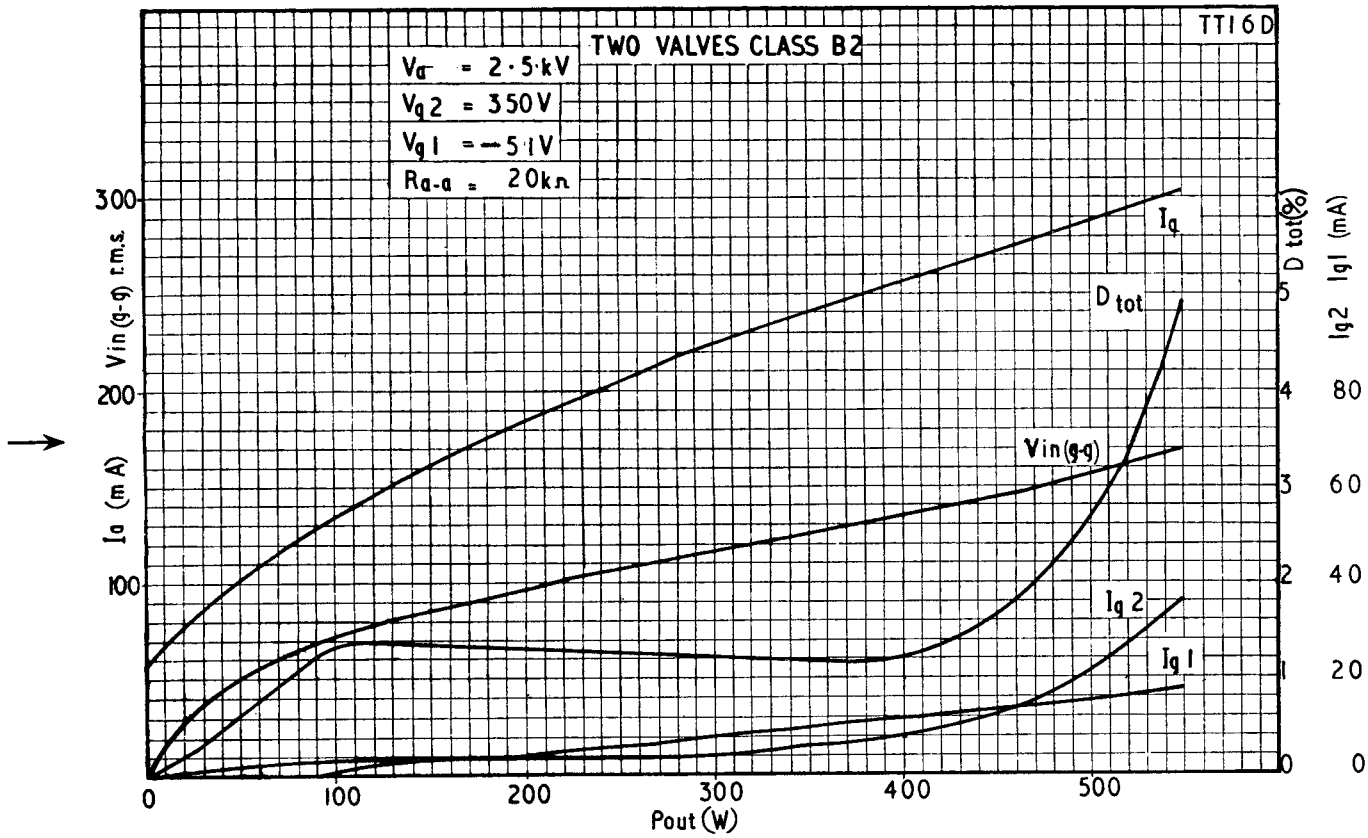

TT16D
TWO VALVES CLASS BI
Va = 1·5kV
Vg2 = 600V
Vg1 = -94V
Ra-a = 12kΩ
D tot (%)
Ig2 (mA)
5 50
4 40
3 30
2 20
1 10
0 0
Ia
Vin (g-g)
D tot
Ig2
Vin (g-g) rms.
Ia (mA)
250
200
150
100
50
0
50
100
150
Pout (W)

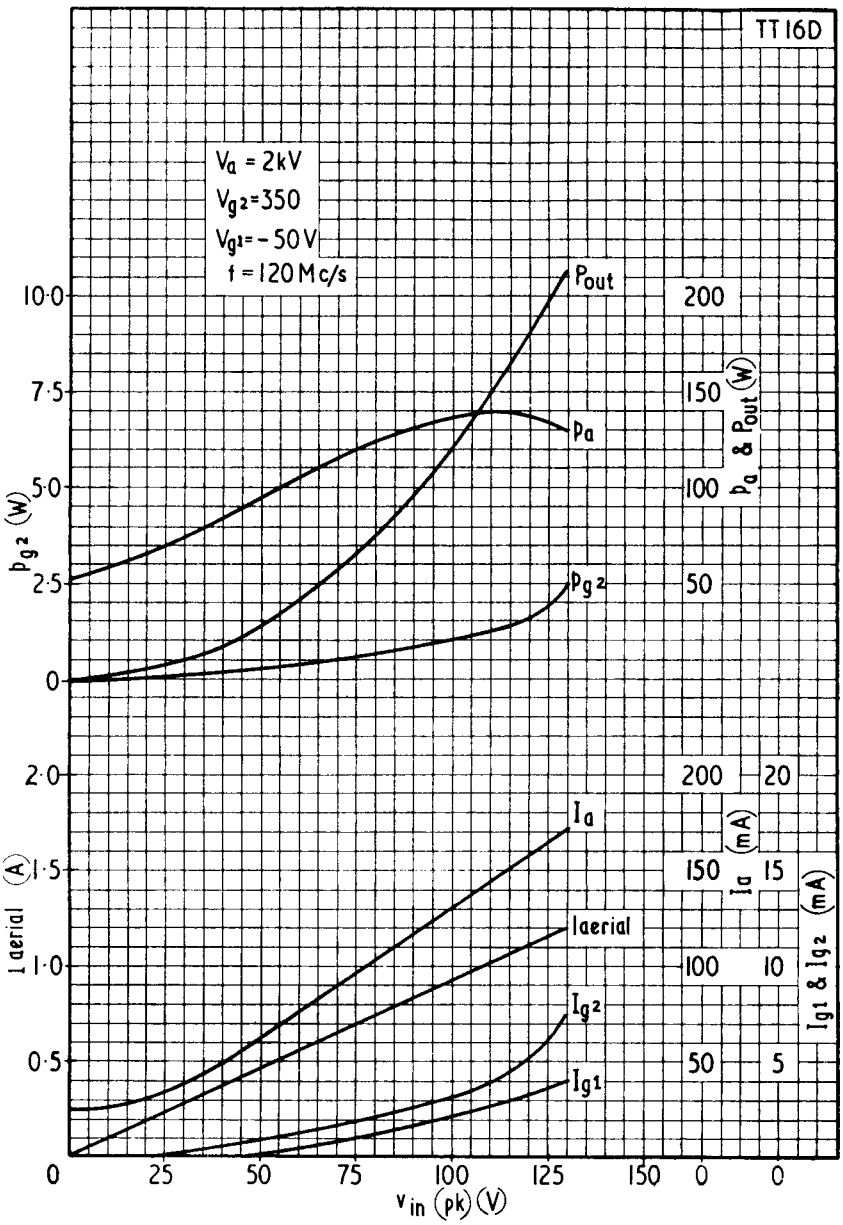

TT16D
TWO VALVES CLASS BI
Va = 2·0kV
Vg = 600V
Vg1 = -96V
Ra-a = 17·6kΩ
D tot (%)
Ig2 (mA)
5
4 40
3 30
2 20
1 10
0 0
Ia
D tot
Vin (g-g)
Ig2
Vin (g-g) rms.
Ia (mA)
300
200
100
0
100
200
Pout (W)


TT16D
Va = 2·5kV
Vg 2 = 600V
Vg 1 = −97V
Ra-a = 25kΩ
TWO VALVES CLASS AB1
Ia
Vin (g-g)
D tot
Ig 2
Ia (mA)
Vin (g-g) r.m.s.
Dtot(%)
Ig2 (mA)
Pout (W)


TT16D
TWO VALVES CLASS B2
Va = 1·5kV
Vg 2 = 350V
Vg 1 = −48V
Ra-a = 7·2kΩ
Ia
Dtot
Vin(g-g)
Ig2
Ig1
Dtot(%)
Ig2
Ig1 (mA)
Vin(g-g) r.m.s
Ia (mA)
Pout (W)


TWO VALVES CLASS B2
Va = 2·0 kV
Vg2 = 350 V
Vg1 = −50 V
Ra-a = 12 kΩ
Ia
TT16D
D tot
Vin (g-g)
Ig 2
Ig 1
Vin (g-g) r.m.s.
Ia (mA)
D tot(%)
Ig2 Ig1 (mA)
Pout (W)
0
100
200
300
400
500
20
40
60
80


TWO VALVES CLASS B2
Va = 2·5 kV
Vg2 = 350 V
Vg1 = −51 V
Ra-a = 20kΩ
TT16D
Ia
D tot
Vin(g-g)
Ig 2
Ig 1
Vin (g-g) r.m.s.
Ia (mA)
D tot(%)
Ig2 Ig1 (mA)
Pout (W)
0
100
200
300
400
500
20
40
60
80


TT16D
V_a = 2kV
V_{g2}=350
V_{g1}= - 50V
f = 120 Mc/s
P_{out}
p_a
p_{g2}
I_a
I_{aerial}
I_{g2}
I_{g1}
p_{g2} (W)
I_{aerial} (A)
p_a & P_{out} (W)
I_a (mA)
I_{g1} & I_{g2} (mA)
V_{in} (pk) (V)
10·0
7·5
5·0
2·5
0
2·0
1·5
1·0
0·5
0
25
50
75
100
125
150
0
0
200
150
100
50
200
150
100
50
20
15
10
5



PRINTED IN ENGLAND

Tetrode *Type TT20*

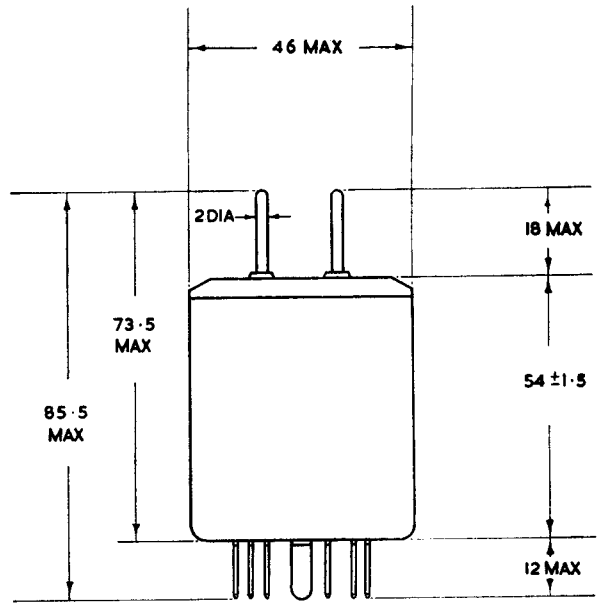
UHF AMPLIFIER

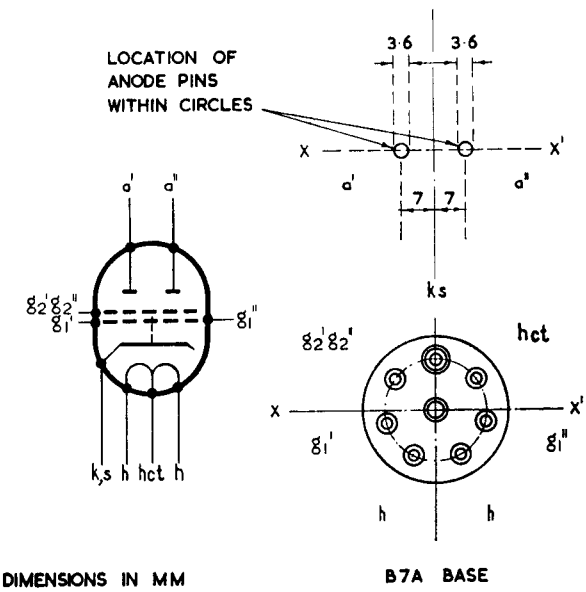
General. The TT20 is a double tetrode suitable for use as an amplifier at frequencies up to 600 Mc/s. The two tetrode systems are mounted round a common indirectly-heated oxide-coated cathode.

Frequency. At frequencies above 150 Mc/s, with only natural cooling by ventilation, it is necessary to reduce the anode voltage: e.g. V_a=500 V at f=200 Mc/s and V_a=300 V at f=430 Mc/s. When the frequency exceeds 430 Mc/s, it is normally necessary to provide an air flow at any anode voltage.

Cooling. Suitable anode connectors having a high thermal capacity to transfer heat by radiation and/or conduction should be used. When the operating conditions (V_a/f) exceed those stated above or at high ambient temperatures, it may be necessary to provide an air flow (approximately 0·5 cu. ft. per min.) sufficient to keep the seal temperature within the specified limit. The temperature of the pins must not exceed 180°C.

Mounting. This tube may be mounted in any position.





DIMENSIONS IN MM

B7A BASE

APPROXIMATE DATA

Heater			
V_h	6·3	12·6	V
I_h	1·3	0·65	A
Maximum Ratings (*per system*)			
V_a		600	V
V_{g2}		250	V
V_{g1}		−200	V
p_a		10	W
p_{g2}		1·5	W
p_{g1}		0·5	W
$i_{k\ (pk)}$		400	mA
$V_{h\text{-}k}$		100	V

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Marconi House, Chelmsford. Telephone: Chelmsford 3221. Telex: 1953. Telegrams: Expanse Chelmsford Telex

Characteristics (*per system*)

I_a	20	mA
g_m	2·5	mA/V
$\mu_{g1\text{-}g2}$	8	

Capacitances

Each system

$C_{a\text{-}g1}$	Internally neutralised	
$C_{g1\text{-}all}$	7·5	pF
$C_{a\text{-}all}$	2·6	pF

Systems in push-pull

C_{out}	1·6	pF
C_{in}	4·4	pF

Weight: 2 oz. (53 g).

Operating Data

(1) RF POWER AMPLIFIER – CLASS C TELEGRAPHY AND FM TELEPHONY

Maximum Ratings

V_a	600	V
p_a	2×10	W
V_{g2}	250	V
p_{g2}	2×1·5	W
V_{g1}	−75	V
p_{g1}	2×0·5	W
I_k	2×55	mA
$i_{k\ (pk)}$	2×260	mA
$R_{g1\text{-}k\ (fixed\ bias)}$	50	kΩ
$R_{g1\text{-}k\ (auto\ bias)}$	100	kΩ

Typical Operation

f	200	400	600	Mc/s
V_a	600	400	400	V
I_a	2×50	2×50	2×50	mA
V_{g2}	250	250	250	V
I_{g2}	2×4	2×2·5	2×2·5	mA
V_{g1}	−60	−50	−50	V
$I_{g1\ (a)}$	2×0·7	2×0·7	2×0·7	mA
P_{drive}	1·5	2·0	—	W
P_a	2×6	2×8	2×10	W
P_{out}	48	25	20	W
P_{load}	39	19	15	W

(2) RF POWER AMPLIFIER – CLASS C ANODE AND SCREEN-GRID MODULATED

Maximum Ratings

V_a	500	V
p_a	2×10	W
V_{g2}	250	V
p_{g2}	2×1·5	W
V_{g1}	−100	V
p_{g1}	2×0·5	W
I_k	2×50	mA
$i_{k\ (pk)}$	2×400	mA

Typical Operation

Unmodulated carrier conditions

f	200	200	400	Mc/s
V_a	500	300	300	V
I_a	2×40	2×40	2×40	mA
V_{g2}	250	250	250	V
I_{g2}	2×4	2×4	2×3	mA
V_{g1}	−80	−50	−50	V
$I_{g1\ (a)}$	2×1	2×1	2×1	mA
P_{drive}	3	1·5	—	W
p_a	2×4	2×3	2×5·5	W
P_{out}	31	17	13	W
P_{load}	24	14	10	W
for 100% Modulation				
$V_{g2\ (pk)\ mod}$	185	185	185	V
P_{mod}	20	12	12	W

(3) FREQUENCY TREBLER

Maximum Ratings

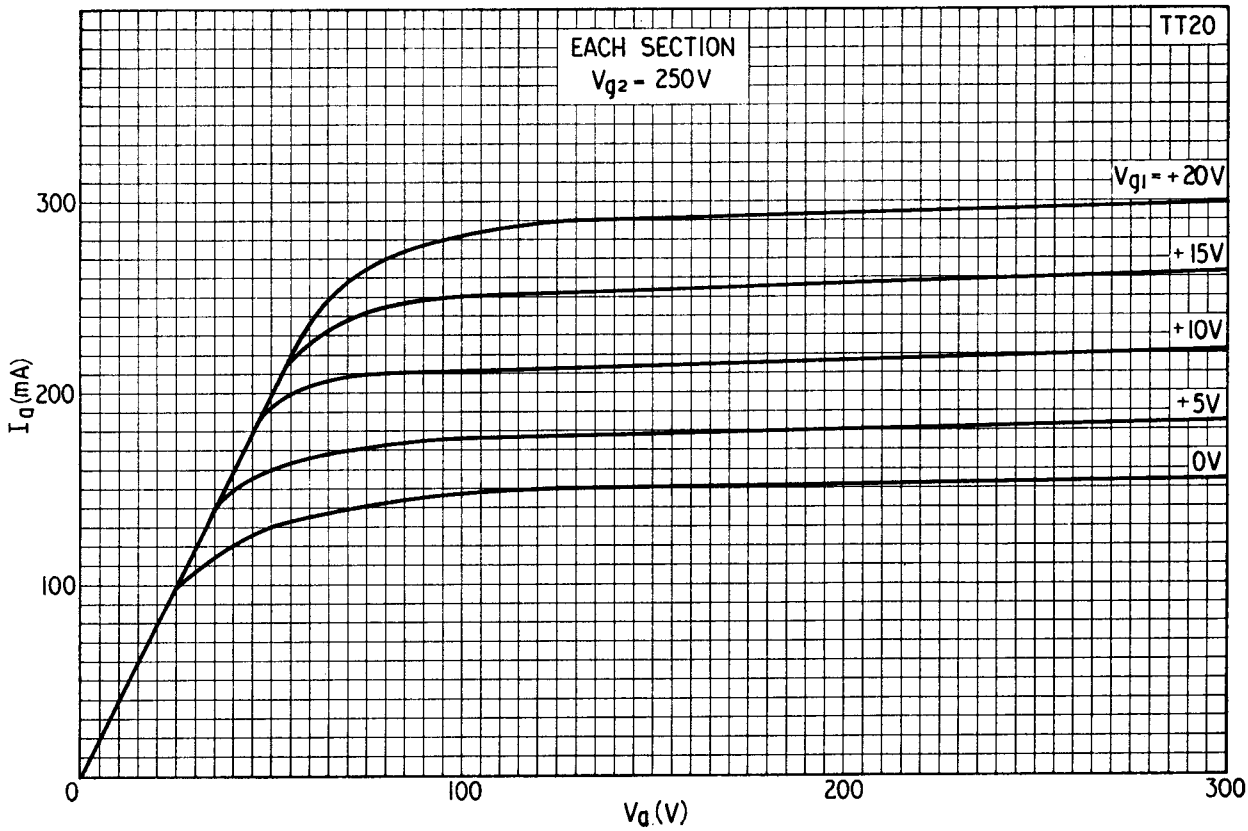
V_a	600	V
p_a	2×10	W
V_{g2}	250	V
p_{g2}	2×1·5	W
V_{g1}	−200	V
p_{g1}	2×0·5	W
I_k	2×50	mA
$i_{k\ (pk)}$	2×275	mA
$R_{g1\text{-}k\ (fixed\ bias)}$	50	kΩ
$R_{g1\text{-}k\ (auto\ bias)}$	100	kΩ

Typical Operation

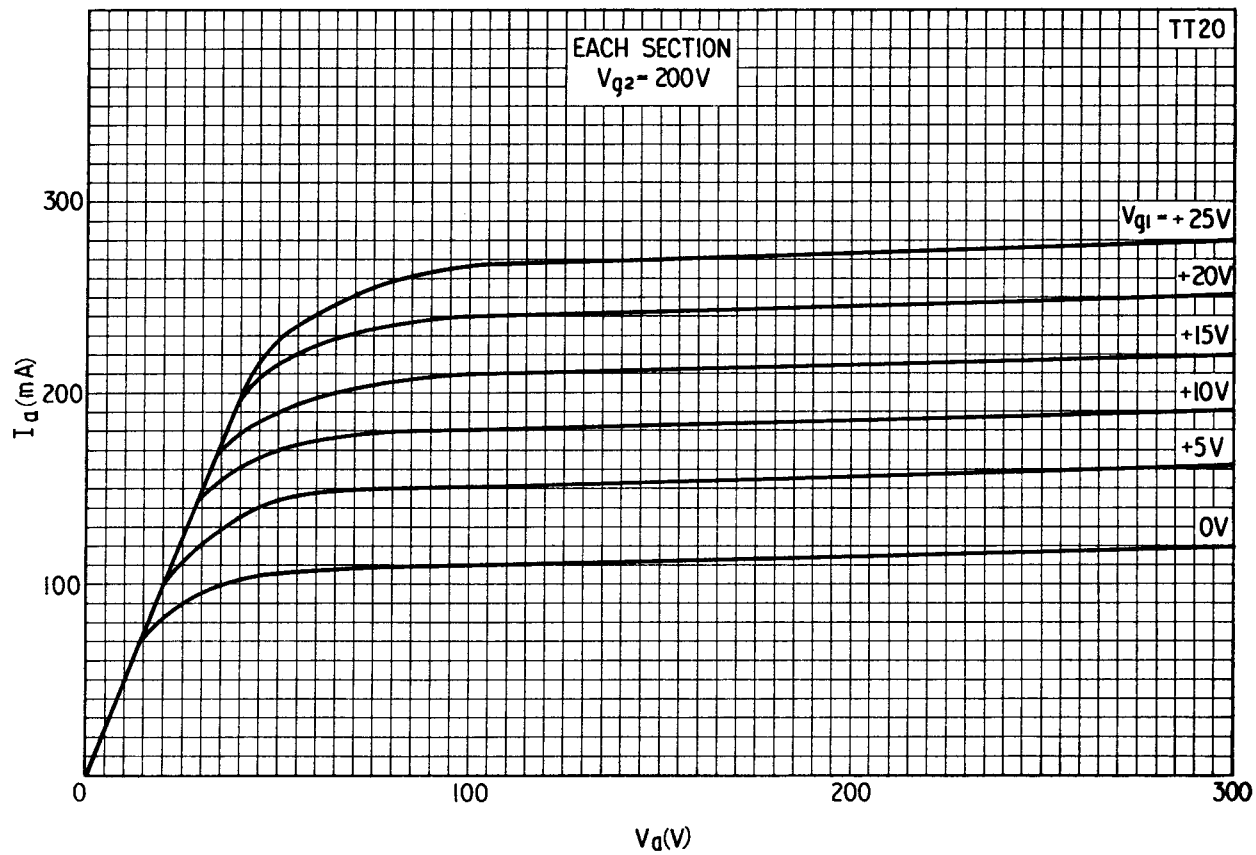
f_{out}	200	400	Mc/s
V_a	300	300	V
I_a	2×45	2×45	mA
V_{g2}	250	250	V
I_{g2}	2×3	2×2·8	mA
V_{g1}	−175	−175	V
I_{g1}	2×1·5	2×1·2	mA
P_{drive}	4	5	W
p_a	2×8	2×9·5	W
P_{out}	10	8	W
p_{load}	8	6	W

NOTES

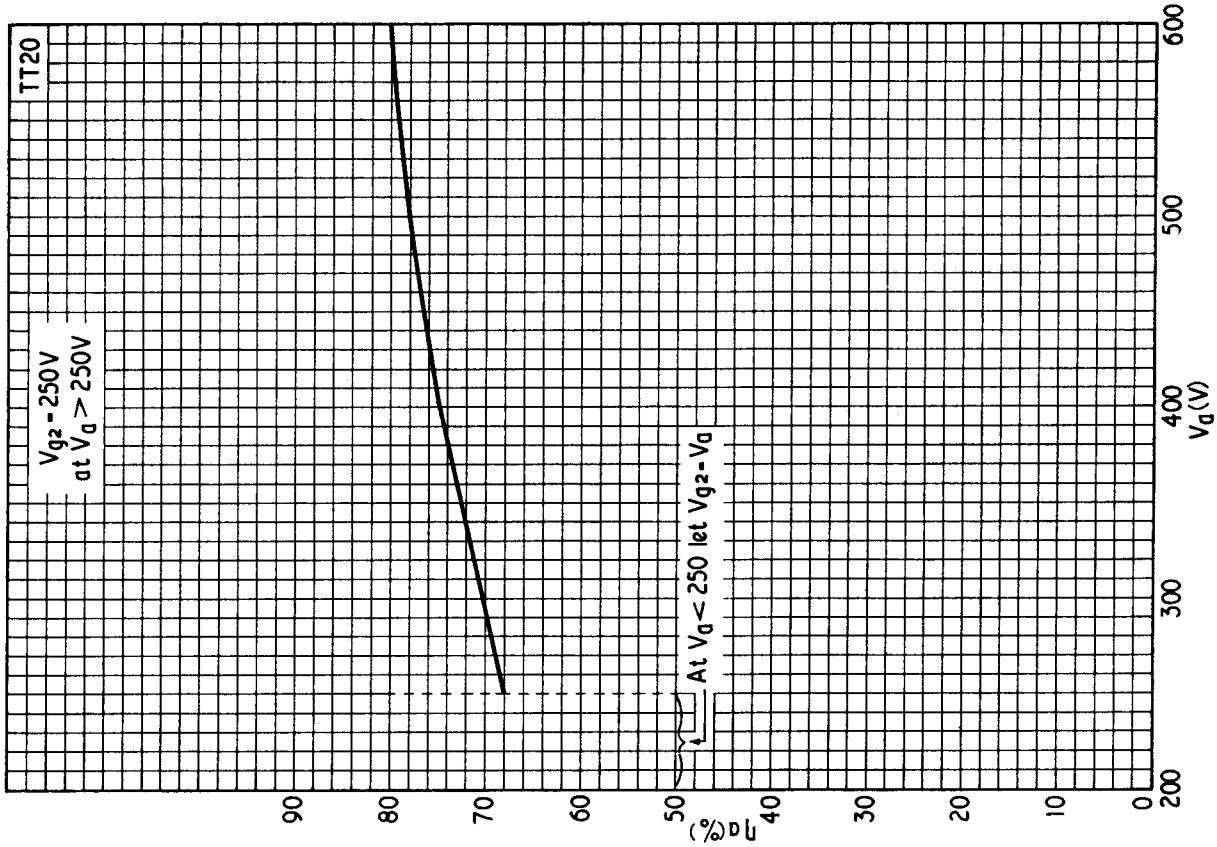
(a) will vary between tubes.



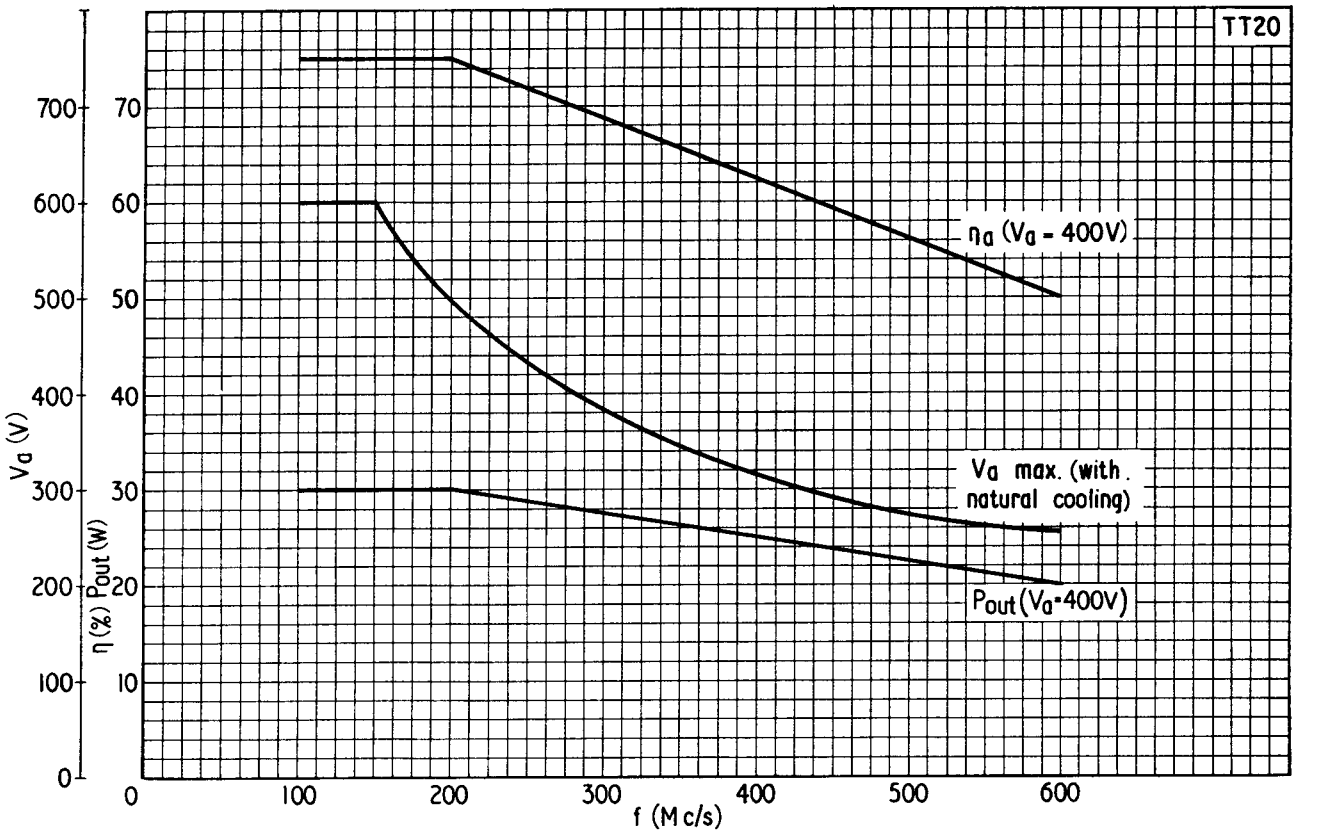
Anode current for each section plotted against anode voltage for screen-grid voltage of 250v.



Anode current for each section plotted against anode voltage with screen-grid voltage of 200v.



Anode efficiency plotted against anode voltage for Class "C" push-pull telegraphy.



Frequency characteristic for "Class C" push-pull telegraphy showing anode efficiency and output power with V_a=400v. The maximum anode voltage at which natural cooling is sufficient is also shown.

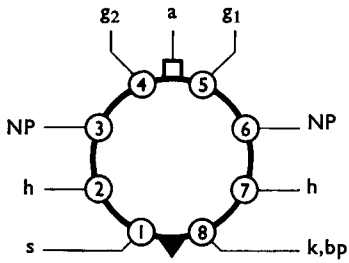
BEAM TETRODES

TT21
TT22

ISSUE 1

Beam tetrodes with oxide coated cathodes, the TT21 and TT22 are identical except for their heater ratings. They are designed for use as r.f. power amplifiers with full ratings at frequencies up to 30Mc/s and are also useful as audio output valves and pulse modulators.

BASE CONNECTIONS AND VALVE DIMENSIONS



Base: Octal
Bulb: Dome top tubular
Top cap: CT2
Max. overall length: 131mm
Max. seated length: 116mm
Max. diameter: 52mm

HEATER	TT21	TT22	
V_h	6·3	12·6	V
I_h	1·6 (approx)	0·8 (approx)	A

MAXIMUM RATINGS (Absolute)

	*C.C.S.	†I.C.A.S.	
V_a	1·25	1·25	kV
V_a (I_a=0)	3·5	3·5	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
p_a	37·5	45	W
p_{g2}	6	6	W
p_{g1}	2	2	W
I_k	230	230	mA
$i_{k(pk)}$ (r.f.)	2	2	A
$i_{a(pk)}$ (pulse)	7·5	7·5	A
V_{h-k}	150	150	V
R_{g1-k} (fixed bias)	100	100	kΩ
R_{g1-k} (cathode bias)	220	220	kΩ
T_{bulb}	250	250	°C

*Continuous Commercial Service is defined as that type of service in which long life and reliability of performance under continuous operating conditions are the prime considerations.

†Intermittent Commercial and Amateur Service is defined as that type of service where minimum size, light weight and maximum power output are more important than long life.

Intermittent operation implies that no 'on' period exceeds 5 minutes and an 'on' period is followed by an 'off' period of the same or longer duration.

CAPACITANCES

C_{a-g1}: 0·25pF; $C_{g1-\text{all less a}}$: 17pF; $C_{a-\text{all less g1}}$: 13·5pF

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Chelmsford, Essex, England · Telephone: Chelmsford 3221 · Telex: 1953 · Telegrams: Expanse Chelmsford Telex

OCTOBER 1961

CHARACTERISTICS

V_a	250	V
V_{g2}	250	V
I_a	140	mA
g_m	11	mA/V
r_a	12	kΩ
μ_{g1-g2}	8	—

OPERATING DATA

A.F. POWER AMPLIFIER

The TT21 may be used as an alternative to the KT88 in any existing audio designs.

A.F. POWER AMPLIFIER—CLASS AB1—CATHODE BIAS

Push-Pull Ultra-Linear Connection with 43% Taps

Maximum Permissible Conditions—C.C.S.

$V_{a,g2}$	600	V
p_a	37·5	W
p_{g2}	6	W

Typical Operation

$V_{a(b)}$	500	V
$V_{a,g2}$	425	V
$I_{a+g2(o)}$	2×87	mA
$I_{a+g2(max)}$	2×100	mA
*R_k	2×525±5%	Ω
$V_{in(g1-g1)(pk)}$	90	V
$R_{L(a-a)}$	6	kΩ
P_{out}	50	W
D_{tot}	1	%

*Separate bias resistors essential.

A.F. POWER AMPLIFIER—CLASS AB1—FIXED BIAS

Push-Pull Ultra-Linear Connection with 43% Taps

Maximum Permissible Conditions—C.C.S.

$V_{a,g2}$	600	V
p_a	37·5	W
p_{g2}	6	W

Typical Operation

$V_{a(b)}$	560	V
$V_{a,g2}$	550	V
$I_{a+g2(o)}$	2×50	mA
$I_{a+g2(max)}$	2×150	mA
*$-V_{g1}$	80 (approx)	V
$V_{in(g1-g1)(pk)}$	120	V
$R_{L(a-a)}$	4·5	kΩ
P_{out}	100	W
D_{tot}	5	%

*Must be separately adjusted on each valve. Bias supply should have an adjustment range of ±25%.

When it is inconvenient to use either the TT21 or the KT88 in the ultra-linear connection, conditions similar to those given above may be used for tetrode connection. However, there is no advantage in setting the fixed screen voltage supply in excess of about 300V.

A.F. POWER AMPLIFIER—CLASS AB1—FIXED BIAS

Push-Pull Tetrode Connection—Intermittent Operation only

Maximum Permissible Conditions—I.C.A.S.

V_a	1·25	kV
V_{g2}	600	V
p_a	45	W
p_{g2}	6	W

Typical Operation

$V_{a(b)}$	1·25	kV
V_{g2}	300	V
$I_{a(o)}$	2×28	mA
$I_{a(max)}$	2×130	mA
$I_{g2(o)}$	<2×1	mA
$I_{g2(max)}$	2×13	mA
$R_{L(a-a)}$	15	kΩ
*$-V_{g1}$	45 (approx)	V
$V_{in(g1-g1)(pk)}$	71	V
P_{out}	200	W
D_{tot}	7	%

*Must be separately adjusted on each valve. Bias should have an adjustment range of ±25%.

R.F. POWER AMPLIFIER—CLASS C TELEGRAPHY

Maximum Permissible Conditions

	C.C.S.	I.C.A.S.	
V_a	1·25	1·25	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
I_a	200	200	mA
p_a	37·5	45	W
P_{in}	200	220	W
p_{g2}	6	6	W
p_{g1}	2	2	W

Typical Operation—C.C.S.

V_a	500	800	1000	1250	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	115	115	115	115	V
I_a	192	182	175	160	mA
I_{g2}	20	20	20	20	mA
I_{g1}	8·5	7	5·5	4·5	mA
p_a	37·5	37·5	37·5	37·5	W
p_{g2}	6	6	6	6	W
P_{out}	58·5	108·5	137·5	162·5	W
Efficiency	61	75	78	81	%
*P_L	52	95	115	132	W
P_{out} (driver)	2·1	1·9	1·8	1·6	W

*Measured at 30Mc/s.

Typical Operation—I.C.A.S.

			*	*		
V_a	500	800	1000	1000	1250	V
V_{g2}	300	300	300	300	300	V
$-V_{g1}$	115	115	115	60	115	V
I_a	200	200	190	175	175	mA
I_{g2}	20	20	20	20	20	mA
I_{g1}	9	9	7·5	4	6	mA
p_a	40	43	45	45	45	W
p_{g2}	6	6	6	6	6	W
P_{out}	60	117	145	130	174	W
Efficiency	59	74	76·5	74·5	79·5	%
†P_L	52	103	126	106	146	W
P_{out} (driver)	2·1	2·1	2	0·65	1·9	W

*These operating conditions demonstrate the effect of reduced bias and driving power on power output.
†Measured at 30Mc/s.

R.F. POWER AMPLIFIER—CLASS C—ANODE MODULATED (Carrier Conditions)
Maximum Permissible Conditions

	C.C.S.	I.C.A.S.	
V_a	1	1	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
I_a	160	180	mA
p_a	25	30	W
P_{in}	130	150	W
p_{g2}	6	6	W
p_{g1}	2	2	W
Modulation	100	100	%

Typical Operation—C.C.S.

V_a	550	700	850	1000	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	115	115	115	115	V
I_a	160	150	140	130	mA
I_{g2}	20	20	20	20	mA
I_{g1}	5	3·5	3	2·5	mA
p_a	25	25	25	25	W
p_{g2}	6	6	6	6	W
P_{out}	63·5	80	95	105	W
Efficiency	72	76	80	81	%
*P_L	54	70	82	87	W
P_{out} (driver)	1·5	1·4	1·2	1·1	W
P_{mod}	50	60	68	75	W

*Measured at 30Mc/s.

Typical Operation—I.C.A.S.

V_a	550	700	850	1000	V
V_{g2}	300	300	300	300	V
$-V_{g1}$	115	115	115	115	V
I_a	180	175	165	150	mA
I_{g2}	20	20	20	20	mA
I_{g1}	6·5	5·5	5	3·5	mA
p_a	30	30	30	30	W
p_{g2}	6	6	6	6	W
P_{out}	69	92	110	123	W
Efficiency	70	75·5	78·5	82	%
*P_L	61	82	94	101	W
P_{out} (driver)	1·8	1·7	1·5	1·2	W
P_{mod}	55	68	80	85	W

*Measured at 30Mc/s.

R.F. POWER AMPLIFIER—CLASS AB1—S.S.B.
Maximum Permissible Conditions

	C.C.S.	I.C.A.S.	
V_a	1·25	1·25	kV
V_{g2}	600	600	V
$-V_{g1}$	200	200	V
p_a	37·5	45	W
p_{g2}	6	6	W
p_{g1}	2	2	W

Typical Operation

V_a	800	1000	V
V_{g2}	300	300	V
*$-V_{g1}$	38	40	V
$v_{g1(pk)}$	38	40	V
$I_{a(o)}$	40	35	mA
$I_{a(max)}$	122	116	mA
$I_{g2(o)}$	0	0	mA
$I_{g2(max)}$	11	8·5	mA
$I_{g1(max)}$	0	0	mA
$p_{a(o)}$	32	35	W
$p_{a(max)}$	31	34·5	W
$p_{g2(o)}$	0	0	W
$p_{g2(max)}$	3·3	2·55	W
†P_{out}	67	80	W
Z_a	2·8	3·6	kΩ
Efficiency	63	69	%
‡P_L	55	65	W

*Adjust to obtain specified value of $I_{a(o)}$.
†Peak envelope power output or single tone power output.
‡Measured at 30Mc/s.

PULSE MODULATOR SERVICE

Maximum Permissible Conditions

V_a	3·5	kV
V_{g2}	600	V
$-V_{g1}$	200	V
p_a	37·5	W
p_{g2}	6	W
p_{g1}	2	W
$i_{a(pk)}$	7·5	A

Typical Operation

V_a	3·5	kV
V_{g2}	600	V
$-V_{g1}$	150	V
$v_{g1(pk)}$	380	V
$i_{a(pk)}$	6	A
$i_{g2(pk)}$	2·1	A
$i_{g1(pk)}$	2·3	A
R_a	460	Ω
t_p	2	μs
PRF	1500	p/s

INSTALLATION

The valve may be mounted either vertically or horizontally.

When a pair of valves is mounted vertically it is recommended that the centres of the valve sockets are not less than 4in. apart and that pins 4 and 8 of each valve are in line.

When a pair of valves is mounted horizontally it is recommended that the centres of the valve sockets are not less than 4in. apart and that pins 4 and 8 of each valve are in the same vertical line.

Free air circulation around the valve is desirable.

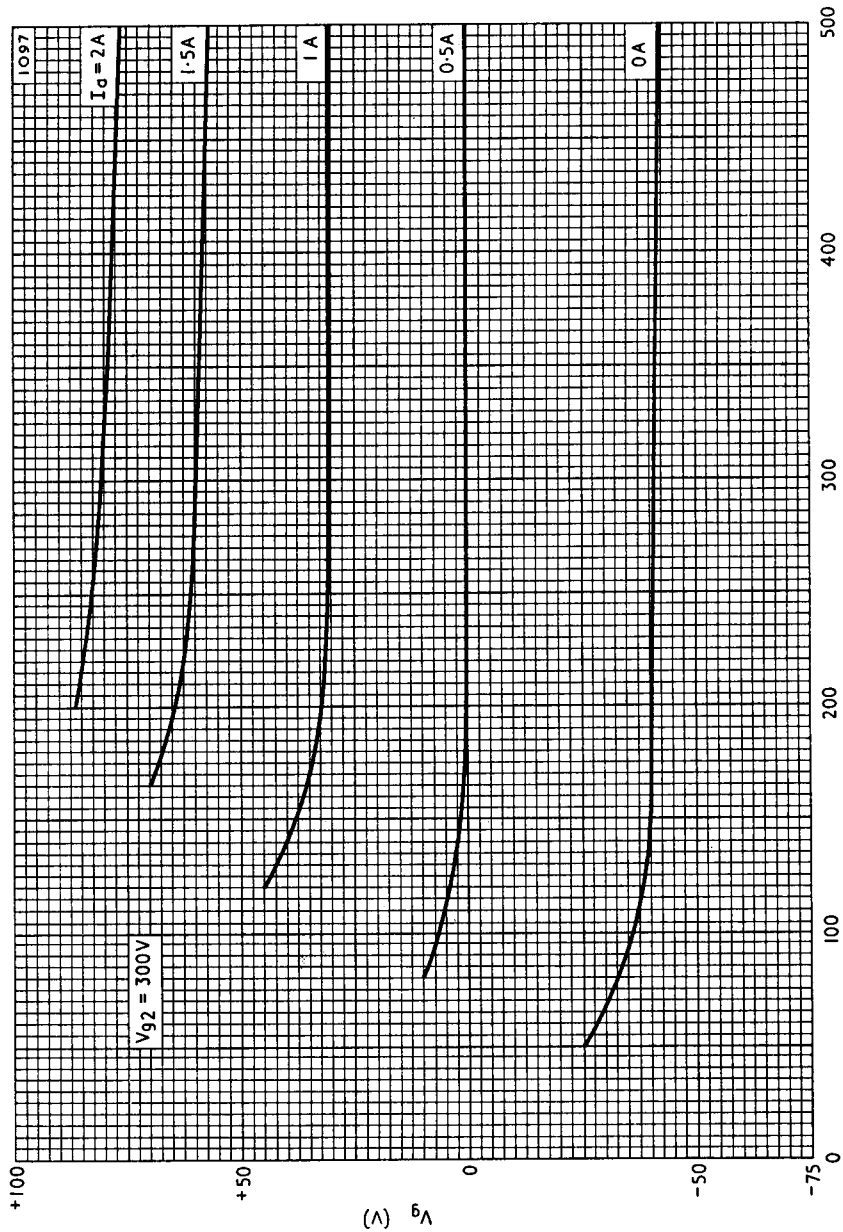


Fig. 1. Constant anode current curves at V_{g2} = 300V.

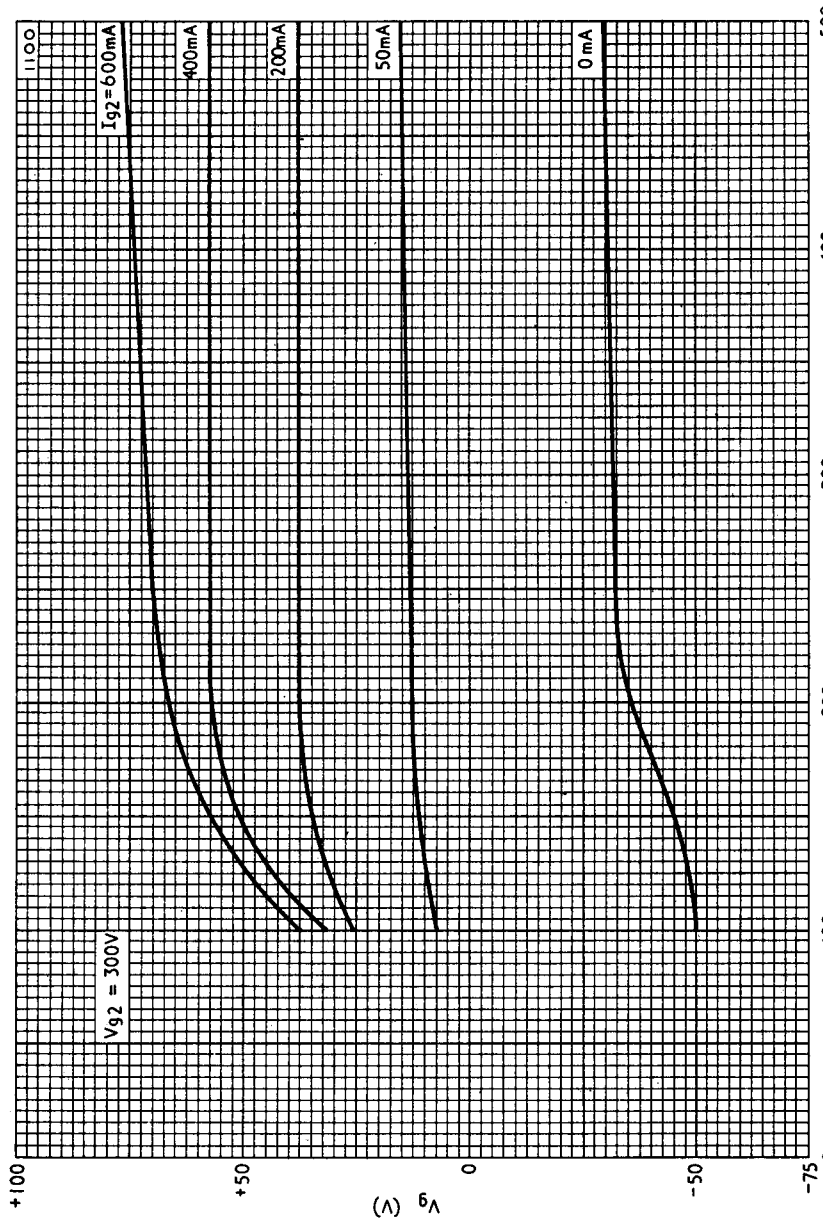


Fig. 2. Constant screen current curves at $V_{g2}=300V$.

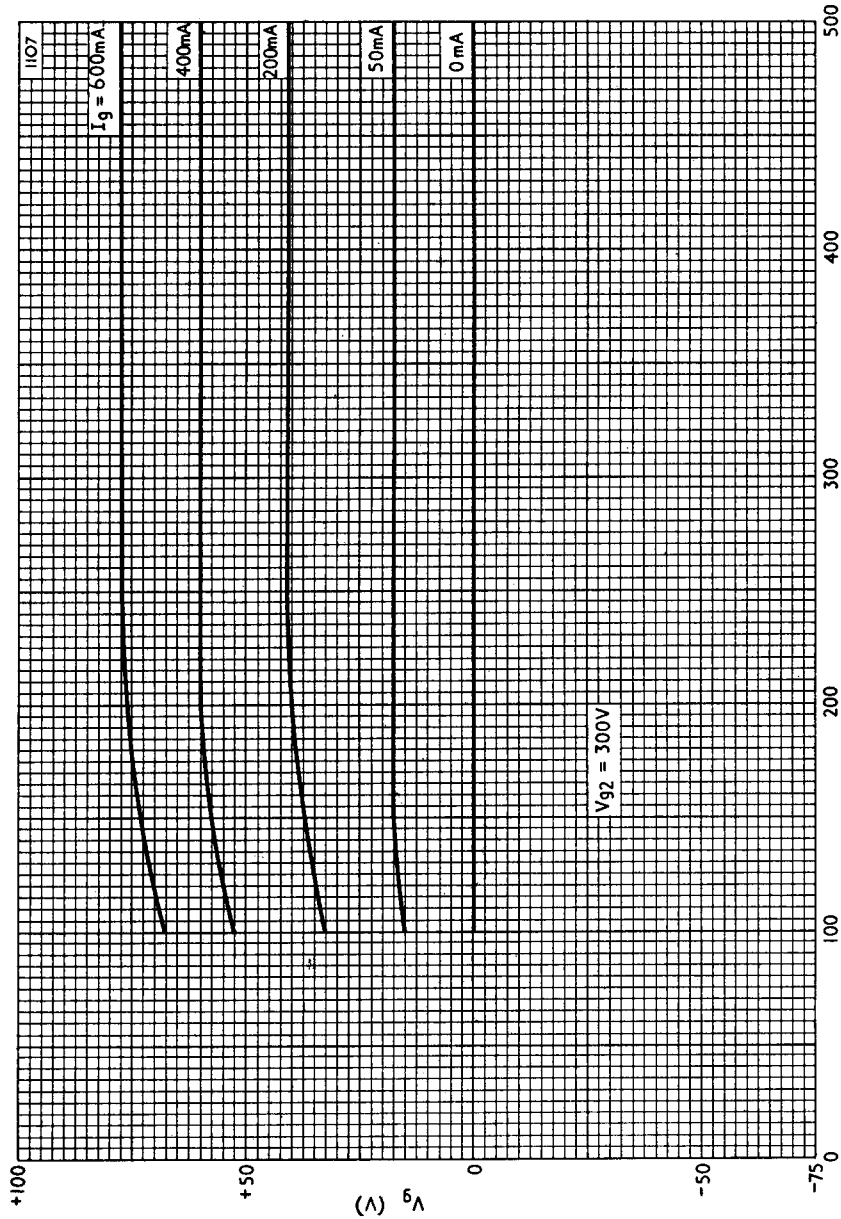


Fig. 3. Constant grid current curves at $V_{g2}=300V$.

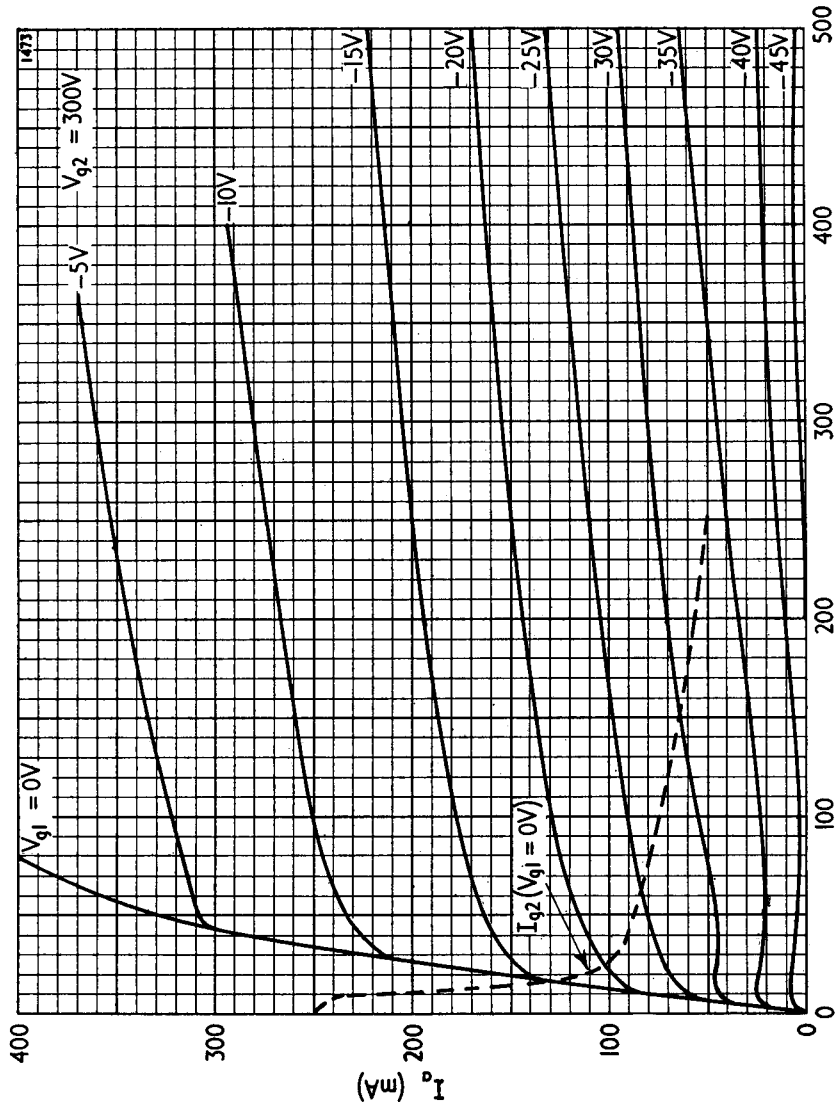


Fig. 4. Anode current curves at V_{g2} = 300V and V_{g1} negative.

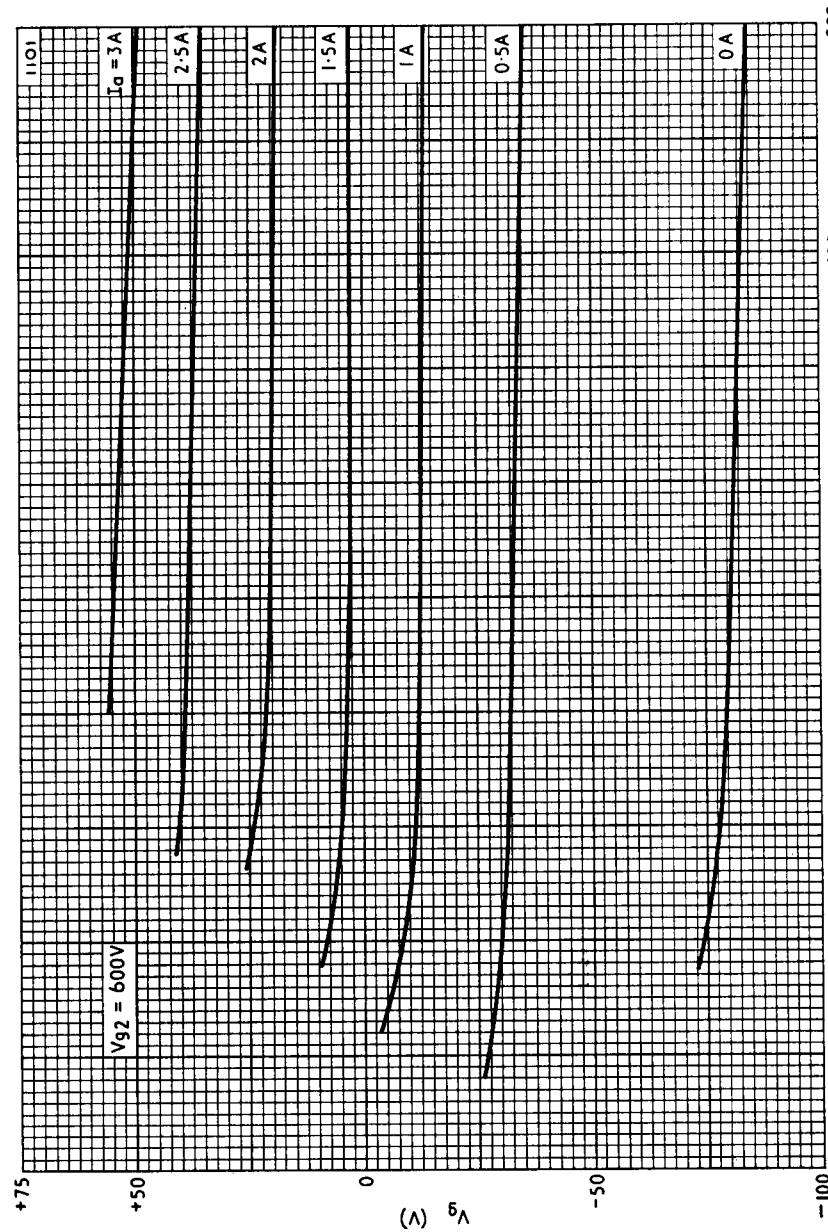


Fig. 5. Constant anode current curves at V_{g2}=600V.



Fig. 6. Constant screen current curves at V_{g2}=600V.

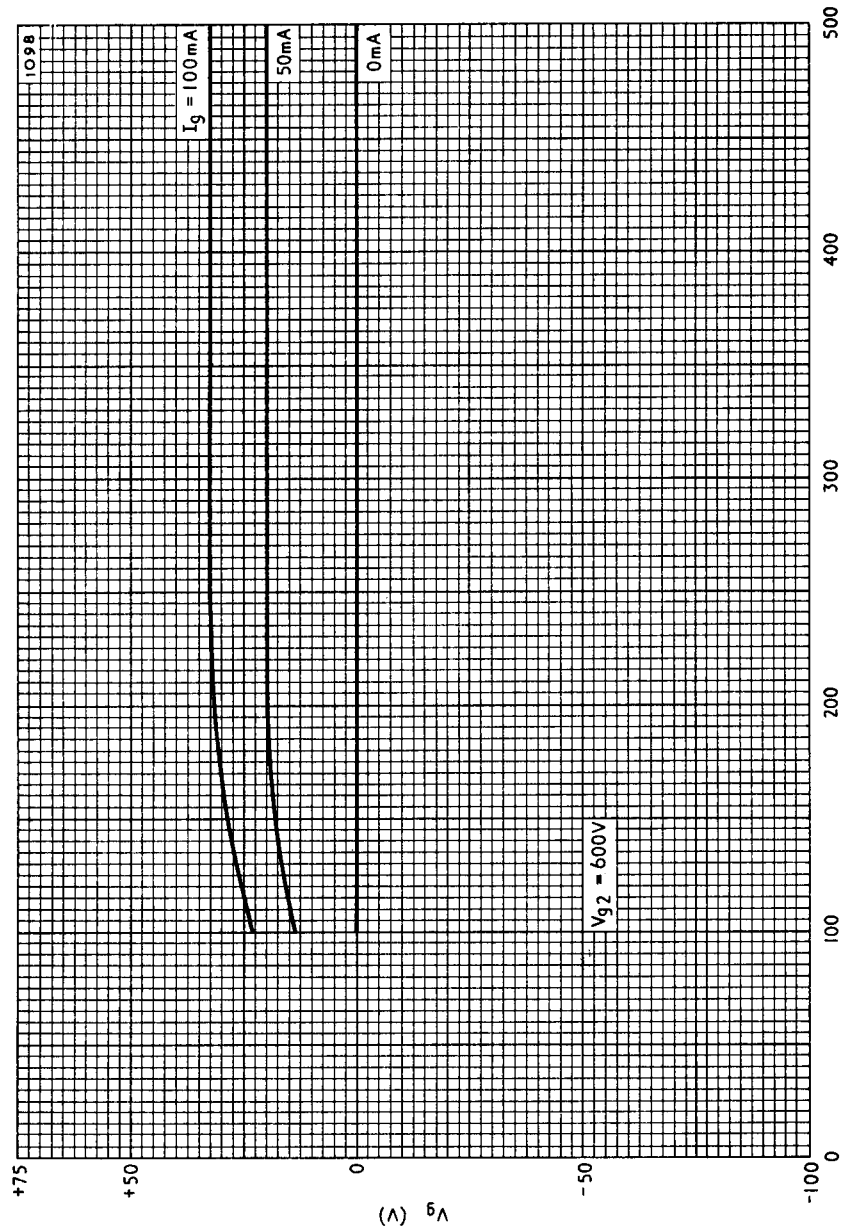


Fig. 7. Constant grid current curves at V_{g2}=600V.

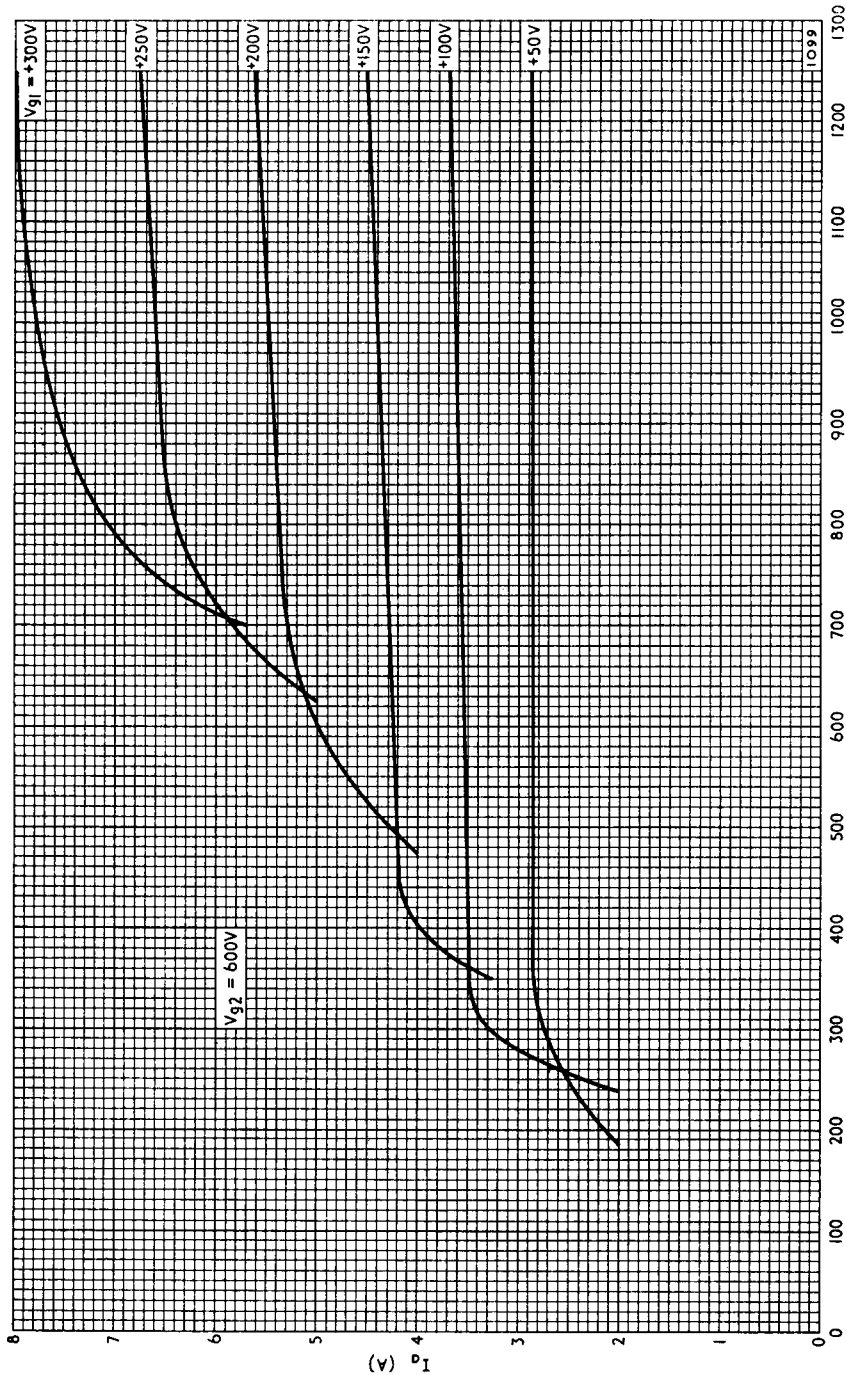


Fig. 8. Anode current curves for pulse modulator applications.

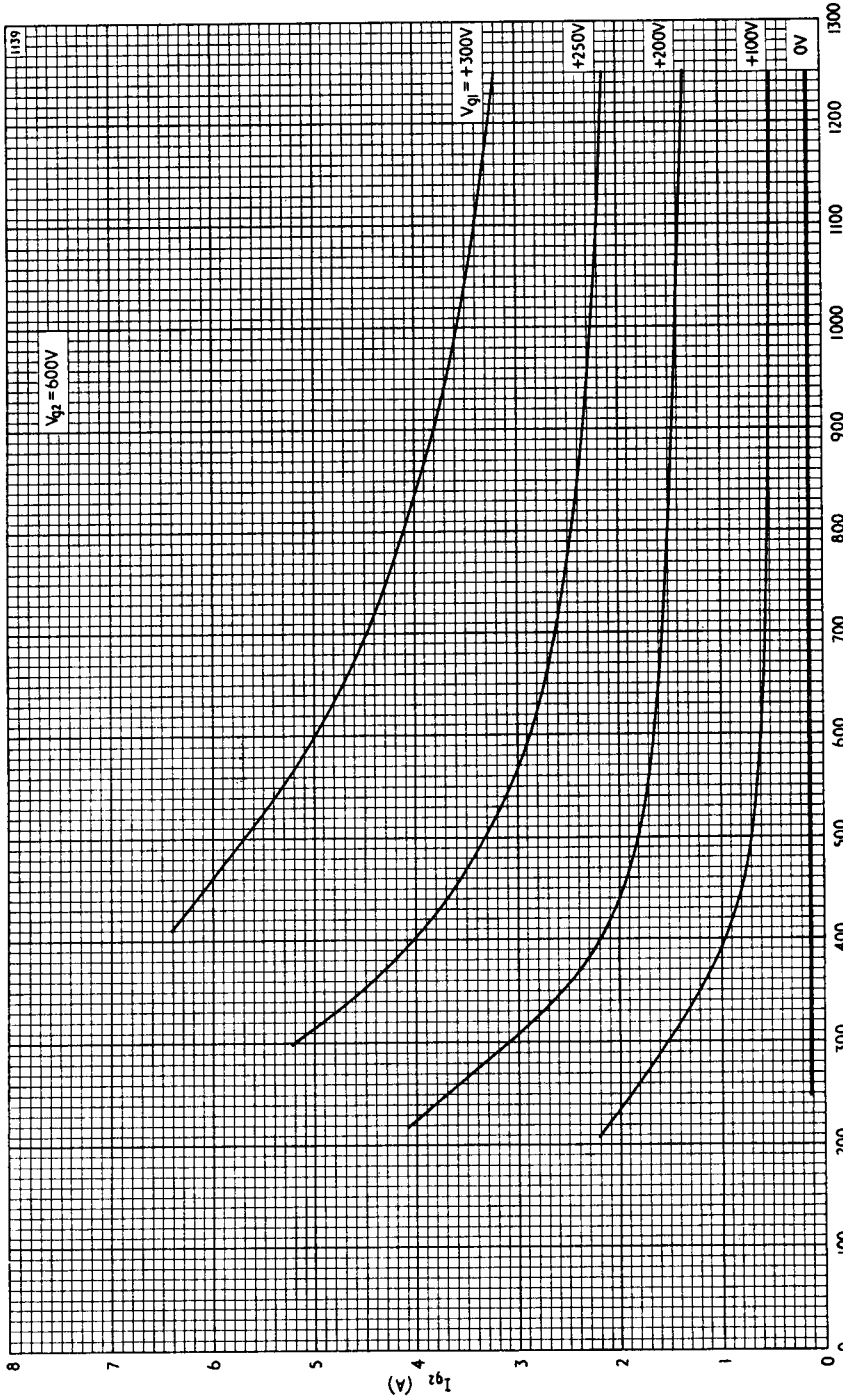


Fig. 9. Screen current curves for pulse modulator applications.

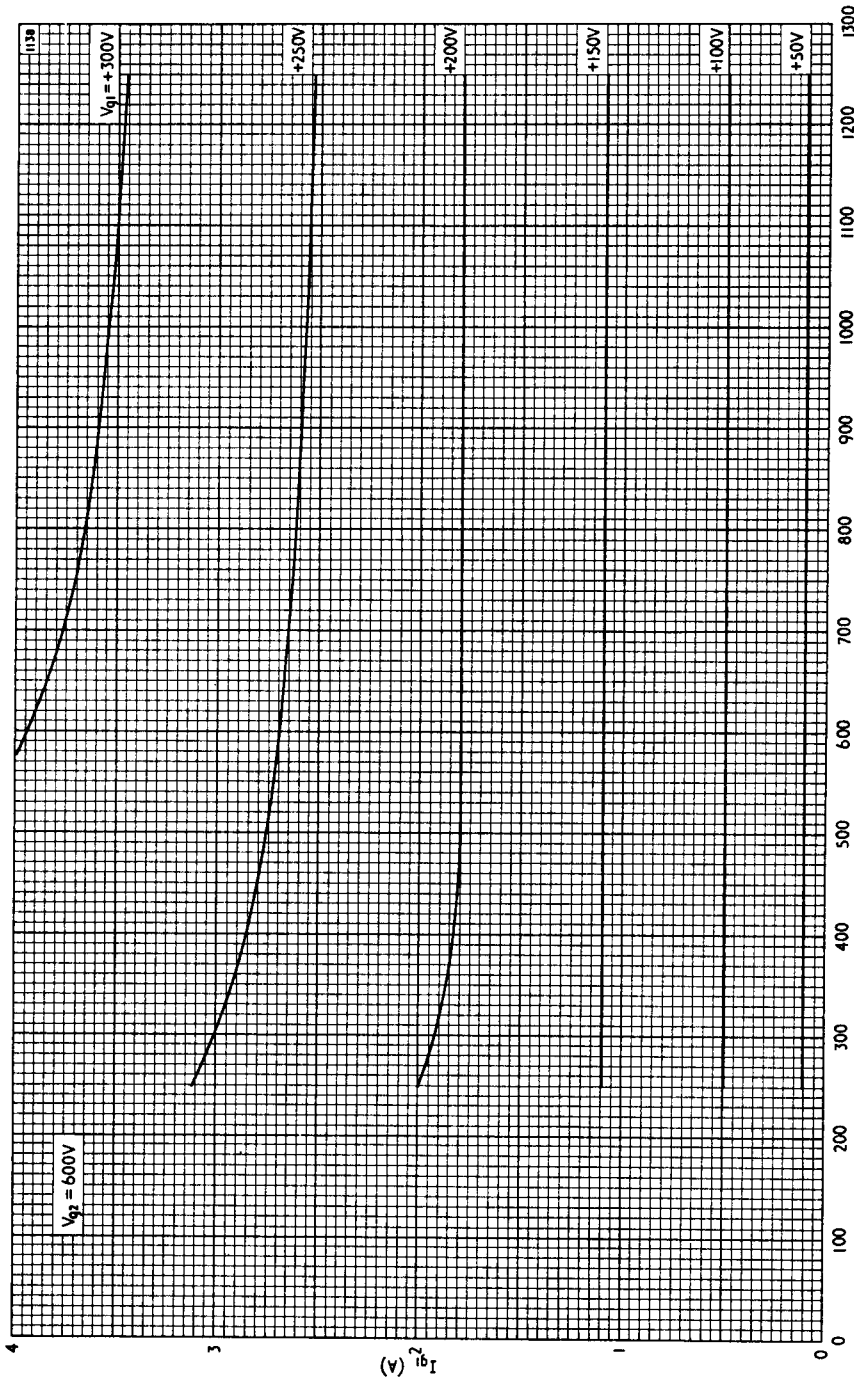


Fig. 10. Grid current curves for pulse modulator applications.

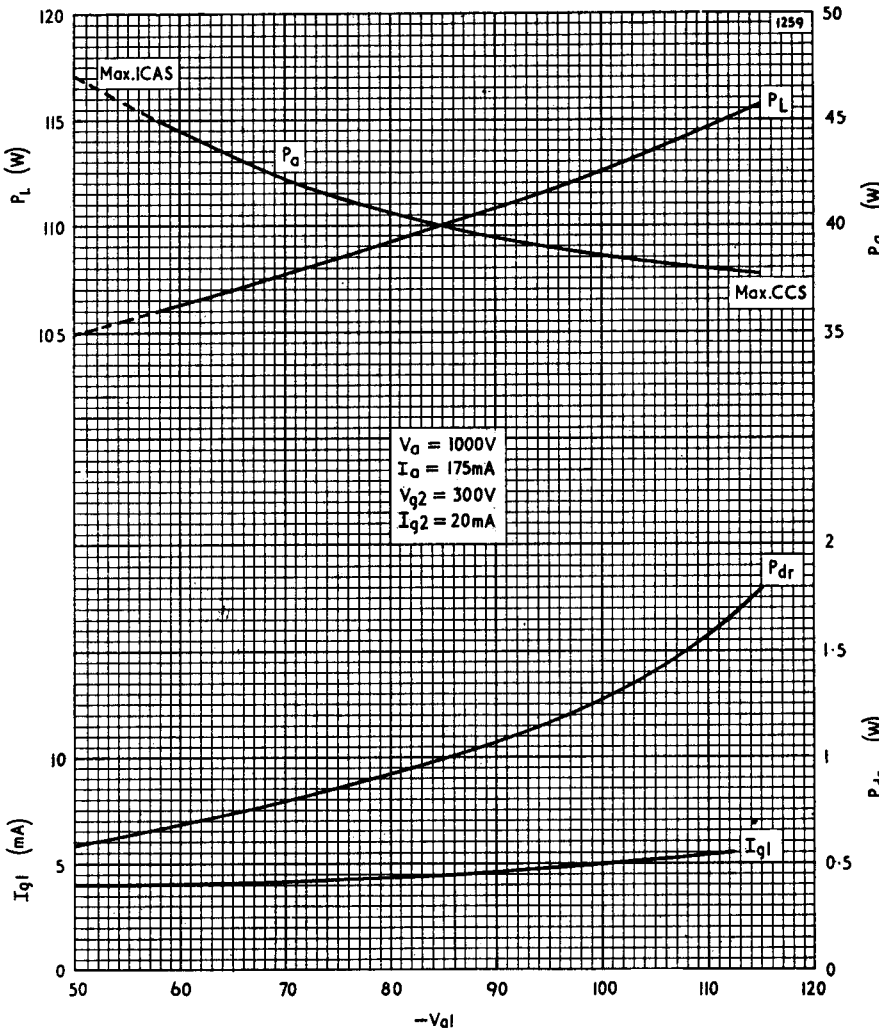


Fig. 11. Class C telegraphy. Bias variation curves.

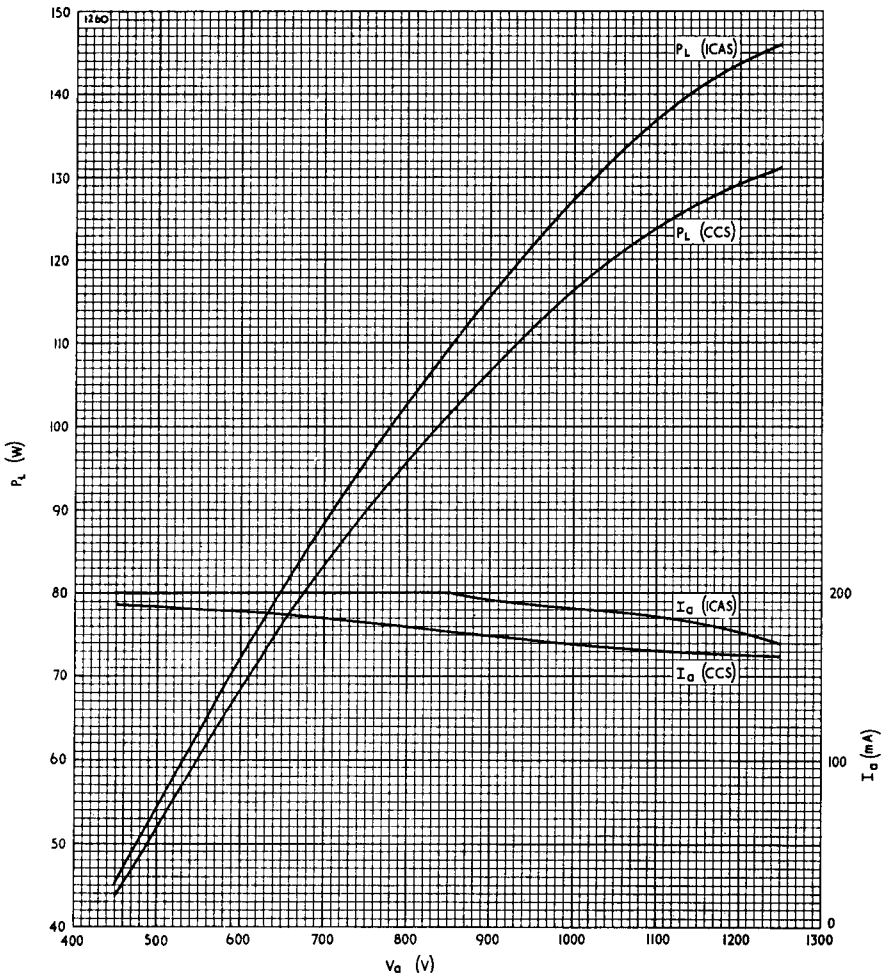


Fig. 12. Class C telegraphy. Power output/anode voltage curves.

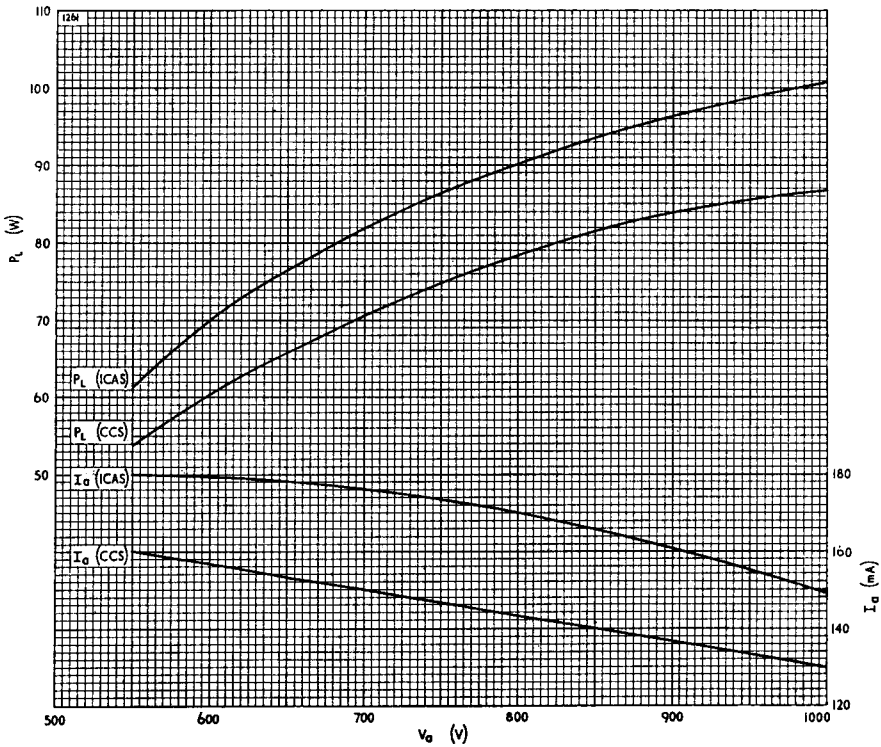


Fig. 13. Anode modulated class C telephony.
Power output/anode voltage curves.

TT21
TT22

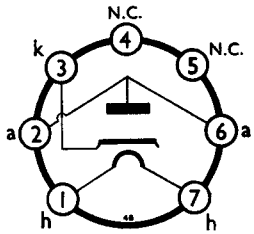
R645

Printed in England—KC

MINIATURE
HALF WAVE RECTIFIER
0·1A INDIRECTLY HEATED

U107
OCTOBER, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	64—70	mm.
Seated length :	58—64	mm.
Max. diameter :	19	mm.

RATING

I_h	0·1		A
V_h	40		V
$V_{h\text{-}k}$	350	max.	V
$v_{h\text{-}k}$ (pk)	700	max.	V
PIV	700	max.	V
V_a (r.m.s.)	250	max.	V
I_{out}	90	max.	mA
i_a (pk)	540	max.	mA
i_a (sur)	1·8	max.	A

TYPICAL OPERATION

Single phase half wave. Capacitor input

V_a (r.m.s.)	250	V
V_{out}	240	V
PIV	700	V
I_{out}	90	mA
i_a (pk)	540	mA
i_a (sur)	1·8	A
I_{ph} (r.m.s.)	190	mA
R_{source}	75	Ω
C	16	μF
R_{ripple}	10	%

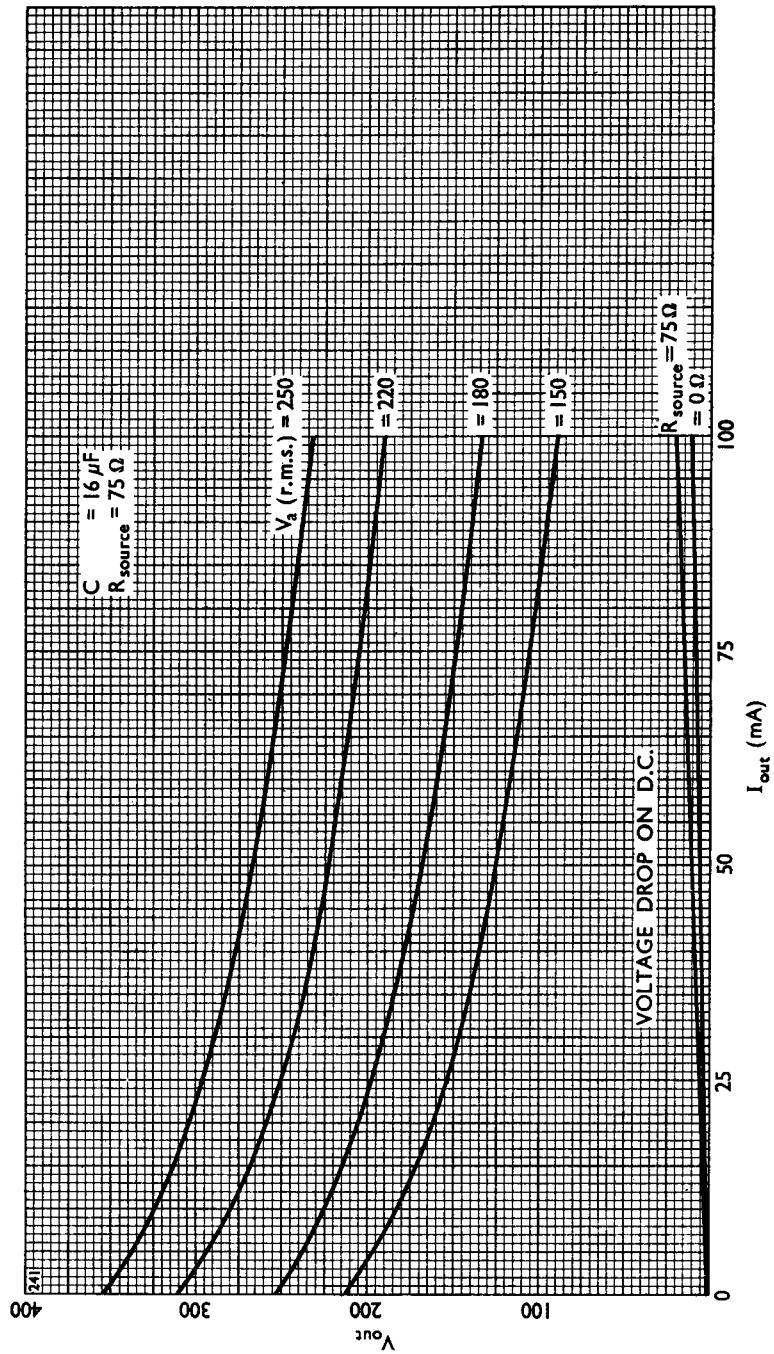
MOUNTING

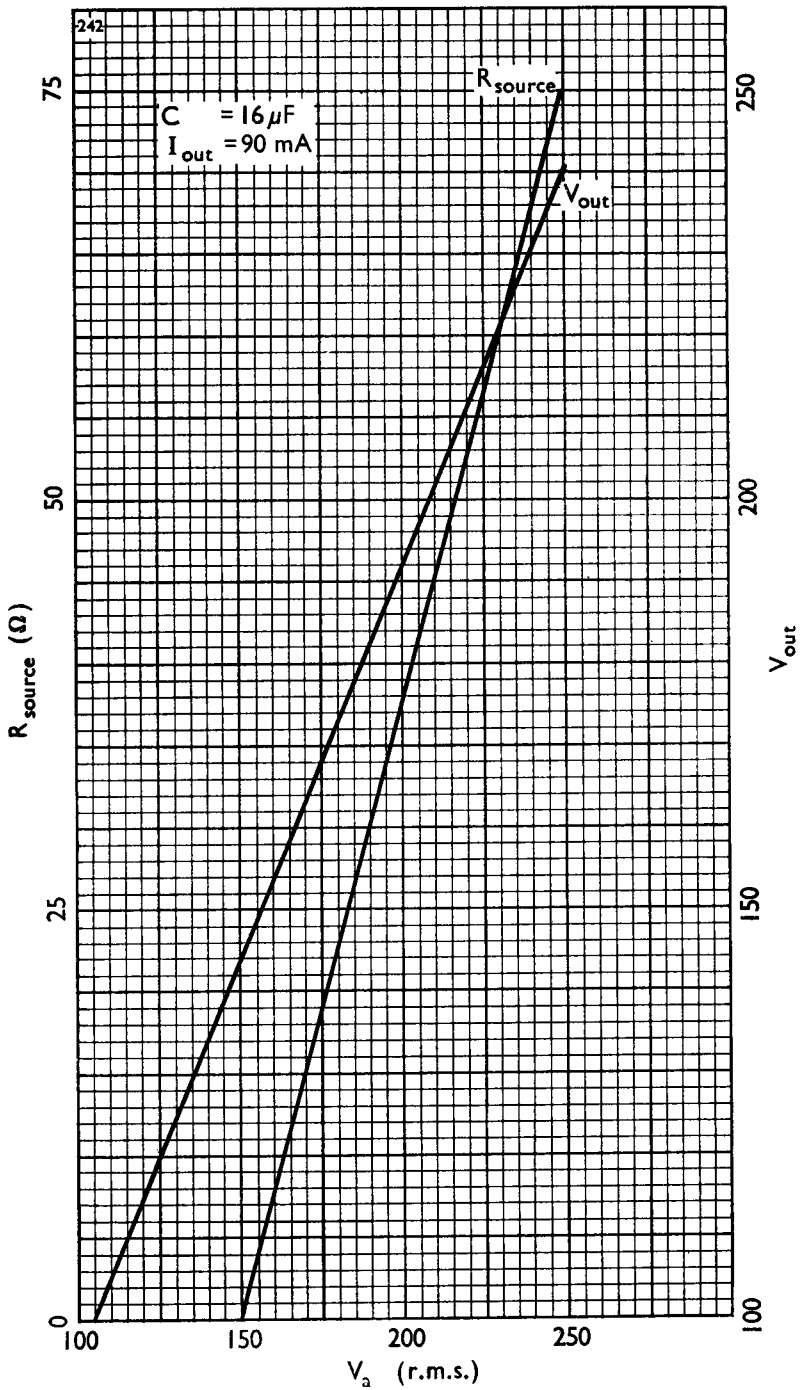
Any position.

VENTILATION AND RETAINING

Free air circulation is preferable. If a retaining device in the form of a metal canister is used, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

U107


C = 16 μF
R source = 75 Ω
V_a (r.m.s.) = 250
= 220
= 180
= 150
R source = 75 Ω
= 0 Ω
VOLTAGE DROP ON D.C.
241
400
300
200
100
V_out
0
25
50
75
100
I_out (mA)

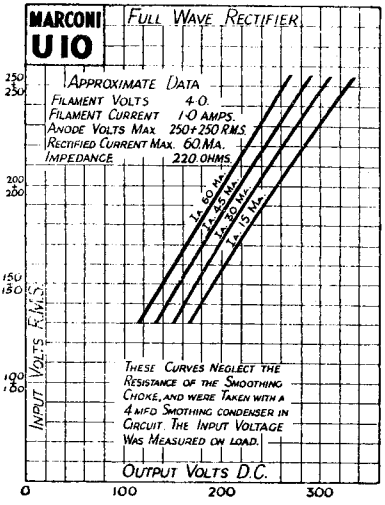

242
C = 16 μF
I out = 90 mA
R source
V out
R source (Ω)
V out
0
25
50
75
100
150
200
250
100
150
200
250
Va (r.m.s.)

U107

OV.1745

Printed in England. C.

MARCONI RECTIFIERS

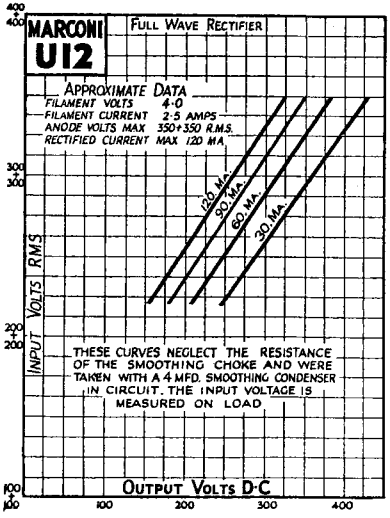


U 10 - 15/-

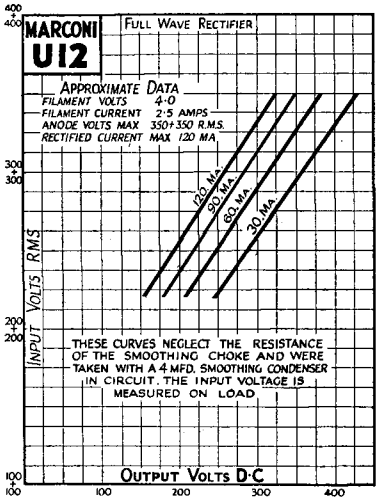
Marconi U.10 is the most popular rectifier, providing up to 60 milliamperes at 250 volts and thus catering for the great majority of three and four valve receivers. It is also useful for supplying rectified current to the field windings of moving coil speakers taking up to 15 watts.

U 12 - 17/6

Marconi U.12 is a new general purpose rectifier delivering up to 120 milliamperes at 350 volts. It is thus suitable for multi-valve receivers having large output valves of the PX.4 type, which operate on a moderate H.T. voltage. U.12 is often used as a combined source of high tension and field current for a moving coil speaker, thus dispensing with the need for a second rectifier.



Marconi Rectifiers & Barretters



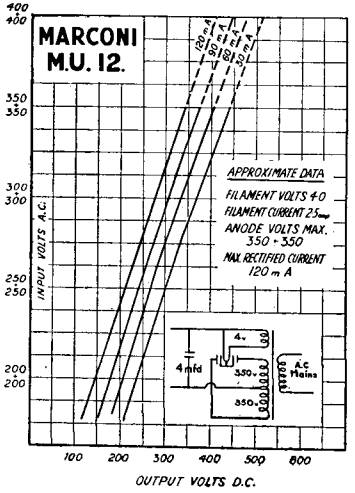
Marconi U12

Full Wave Rectifier

Marconi U12 is a full wave rectifier most widely used in modern receivers, giving an output of 325 volts at 120 mA for an input of 350 volts R.M.S.

Price **9/-**

Overall Dimensions : 119×41 mm.



Marconi MU12

Full Wave Rectifier

Marconi MU12, which has been re-designed for this year, is the indirectly heated counterpart of the U12, giving a slightly greater output. The slower heating time assists in preventing the setting up of high peak voltages when the receiver is switched on.

Price **9/-**

Overall Dimensions : 125×50 mm.

MARCONI U10

Full Wave Rectifier

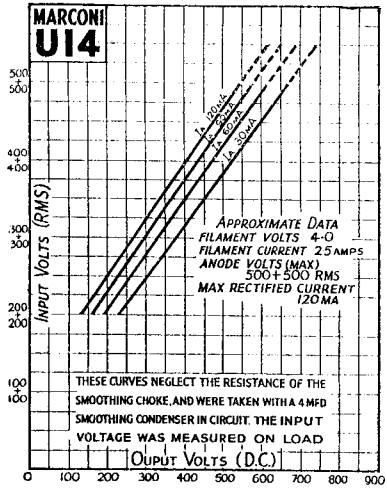
The maximum output of this rectifier is 60 mA at 250 volts. The filament rating is 4v. 1 amp.

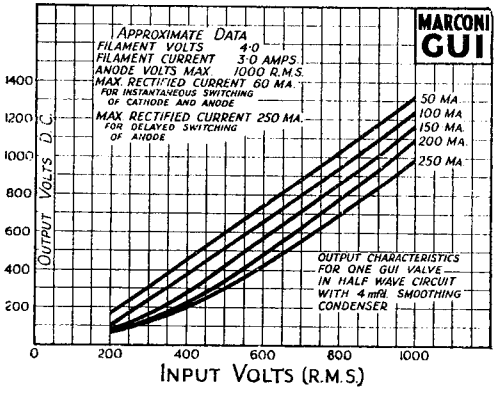
Price **9/-**

MARCONI RECTIFIERS

U 14 - 22/6

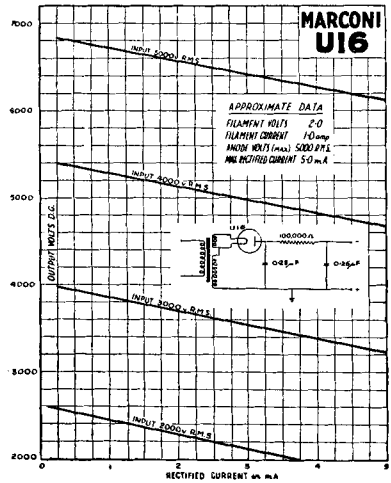
Marconi U.14 is a high voltage rectifier delivering up to 120 m.a. at 500 volts, for valves of the high power class such as LS.5a, LS.6a, etc. It is in effect an improved equivalent to the famous Marconi U8, with a 4 volt filament. The high voltage provides ample margin for high tension and automatic grid bias.





GU I - 25/-

Marconi GU.I is a half-wave mercury rectifier delivering up to 250 m.a. at 1,000 volts. It is used for supplying valves such as Marconi DA.60 or banks of smaller valves; also for H.T. accumulator charging and loudspeaker field supply



Marconi U16

Half Wave Rectifier

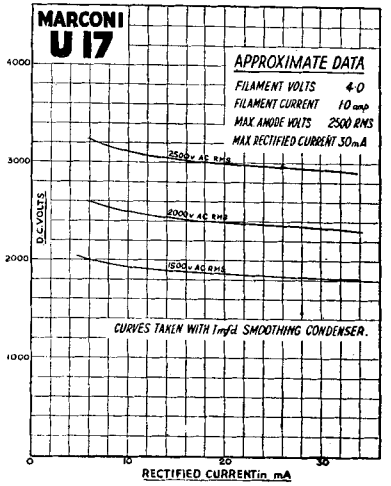
Marconi U16 is designed for Television and general Cathode Ray tube use where a high voltage is required at low values of current.

A maximum input of 5000 volts R.M.S. is permissible with a rectified current of 5.0 mA.

The anode is taken to the top cap.

Price 12/6

Overall Dimensions : 128 × 51mm.



Marconi U17

Half Wave Rectifier

Where a high voltage supply is required for time bases as well as for the Cathode Ray tube, Marconi U17 should be used.

30 mA rectified current can be drawn and the input may be up to 2500 volts R.M.S.

A top cap anode connection is employed.

Price 12/6

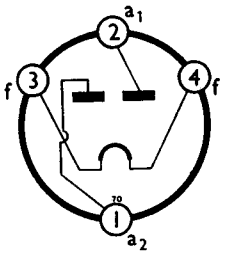
Overall Dimensions : 140 × 51 mm.

BI-PHASE
HALF WAVE RECTIFIER
4V DIRECTLY HEATED

U18/20

NOVEMBER, 1955

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : British 4 pin.
Bulb : Dome top tubular.

Max. overall length : 135 mm.
Max. seated length : 120 mm.
Max. diameter : 56·5 mm.

FILAMENT

V_f	4·0	V
I_f	2·8	A

MAXIMUM RATING

PIV	2·4	kV
$V_{in\ (rms)}$	850	V
I_{out}	275	mA
$i_{a\ (pk)}$	750	mA
$i_{a\ (sur)}$	2·75	A

TYPICAL OPERATION

Single valve. Bi-phase half wave. Capacitor Input.

$V_{a\ (rms)}$	500	850	V
PIV	1·4	2·4	kV
V_{out}	520	1060	V
I_{out}	250	125	mA
$i_{a\ (pk)}$	750	400	mA
$i_{a\ (sur)}$	2·5	1·25	A
$I_{ph\ (rms)}$	265	132	mA
C	16	8	μF
R_{source}	180	180	Ω
V_{ripple}	10	10	%

Single valve. Bi-phase half wave. Choke Input.

$V_{a\ (rms)}$	550	850	V
PIV	1·4	2·4	kV
V_{out}	405	690	V
I_{out}	275	150	mA
$i_{a\ (pk)}$	750	400	mA
$I_{ph\ (rms)}$	290	160	—
L	10	10	H
R_{source}	180	180	Ω
V_{ripple} (before choke)	≏50	≏50	%

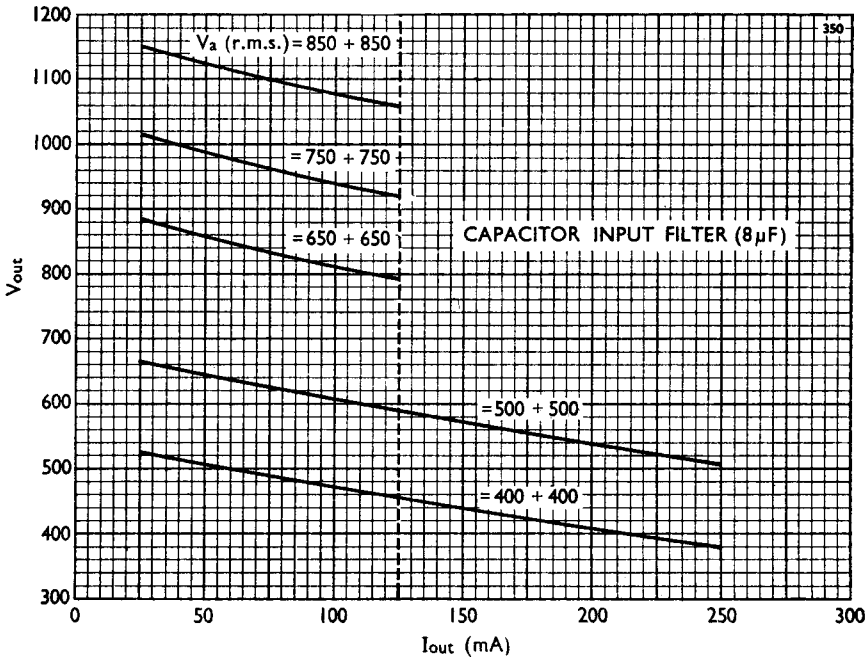
MOUNTING

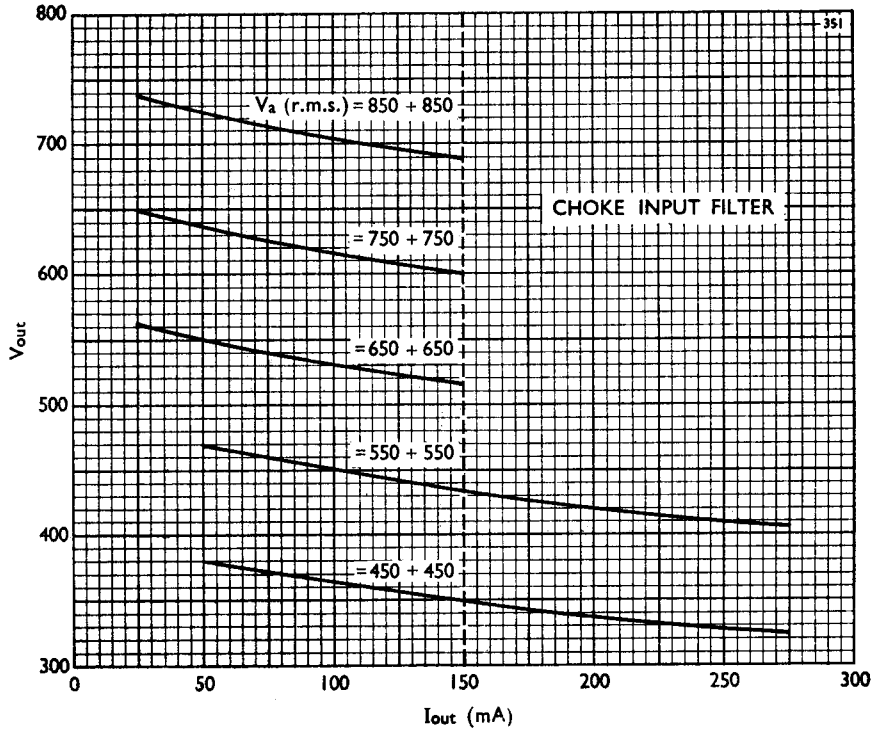
Any position.

VENTILATION

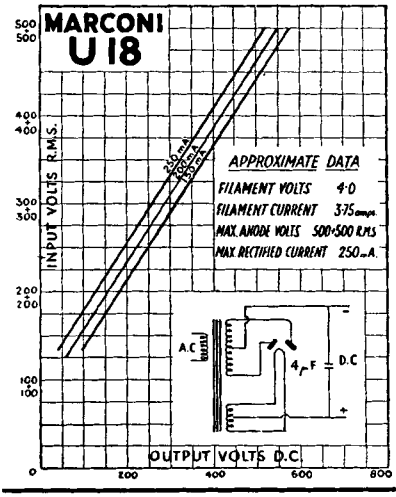
Ample free air circulation should be allowed.

U18/20





Printed in England. C.



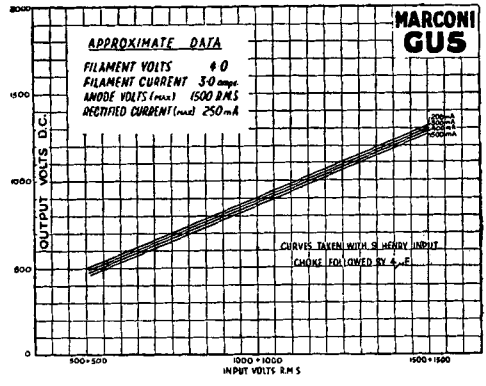
Marconi U18

Full Wave Rectifier

U18 is a directly heated rectifier of sturdy construction giving an output of 250 mA at over 500 volts. This valve enables the users of big gear to avoid the disadvantages of rectifiers in parallel or the delayed switching of mercury vapour types.

Price 15/-

Overall Dimensions: 135 × 57 mm.



Marconi GU5 and GU1

Half Wave Mercury Vapour Rectifiers

GU5 and GU1 are half wave hot cathode mercury vapour rectifiers, recommended when heavy currents are required at voltages in excess of 500. The valves are in general similar but GU5 has its anode connection taken to a top cap so that its rating is 1500v. R.M.S. The maximum rectified current is 250 mA in each case. Delayed switching of the H.T. must be employed. These rectifiers give high efficiency owing to the very low voltage drop, about 15 volts, and excellent regulation is obtainable by virtue of the very low effective internal resistance. To avoid damage to the valve from unduly high peak current a choke should precede the first smoothing condenser, with 4 mfd. the minimum valve is 1 Henry. Larger values will often be used to give the necessary regulation when fluctuating loads such as class 'B' amplifiers are being supplied.

Overall Dimensions:
GU5 145 × 51 mm.
GU1 110 × 45 mm.

Price 25/- each.

Rectifying Valve *Type U19*

General. A directly heated half-wave rectifier with an oxide-coated cathode.

The valve is fitted with a 4-pin British base, the anode being connected to the top cap.

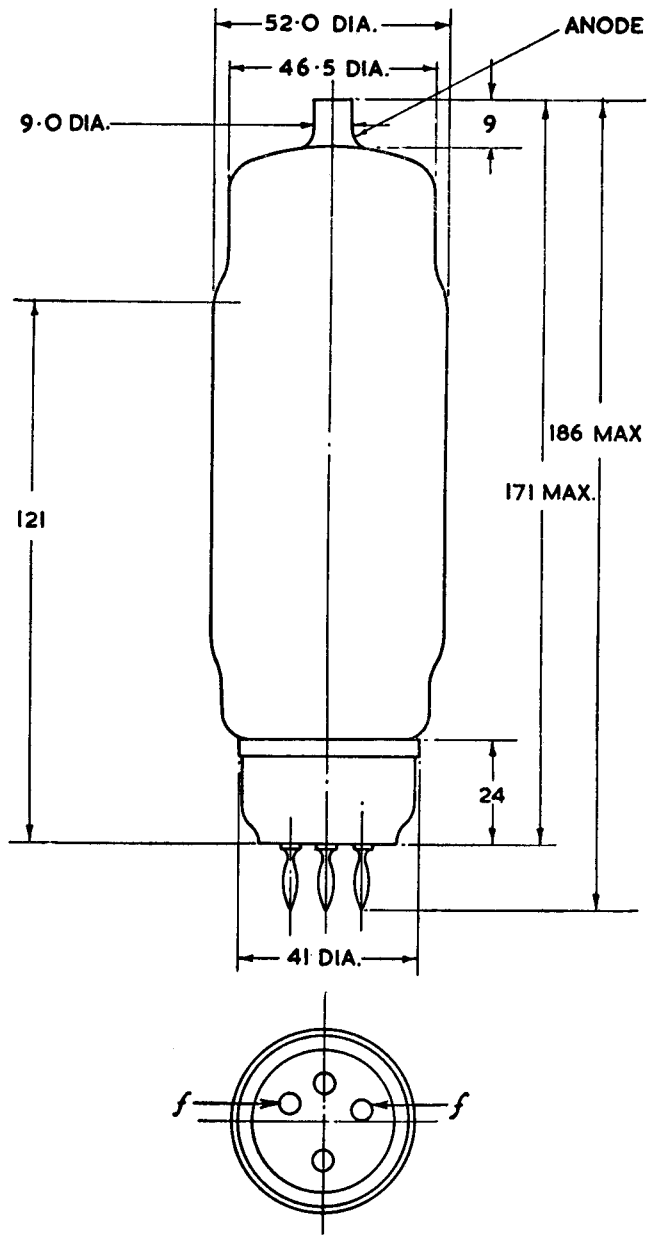
Mounting. The valves should be mounted in such a manner that they are not subjected to any undue mechanical shock or vibration. Vertical mounting is preferred, but if mounted horizontally the major axis of the valve filament should be vertical.

Precautions. (*a*) If the peak inverse voltage exceeds 5 kV the filament should be switched on for at least 20 secs. before the anode voltage is applied.

(*b*) Since valves of this type are often used in circuits having a low DC resistance, definite precautions must be taken to avoid accidental short circuiting of the load. A breakdown or flashover even of very short duration may cause destruction of the rectifier valves.

APPROXIMATE DATA

V_f	4·0	V
I_f	3·3	A
$PIV_{(max)}$	7·1	kV
$V_{a(r.m.s.)\ (max)}$	2·5	kV
$I_{a(pk)\ (max)}$	1·5	A
$I_{a(r.m.s.)\ (max)}$	250	mA
$R_{source\ (min)}$	500	Ω
C (condenser filter)	4·0	μF
$L_{(min)}$ (choke filter)	10	H



DIMENSIONS IN MM.

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford, England. Telephone: Chelmsford 3221. *Telegraphic Address: Expanse, Chelmsford*

Typical Operation

(1) BI-PHASE HALF-WAVE CIRCUIT

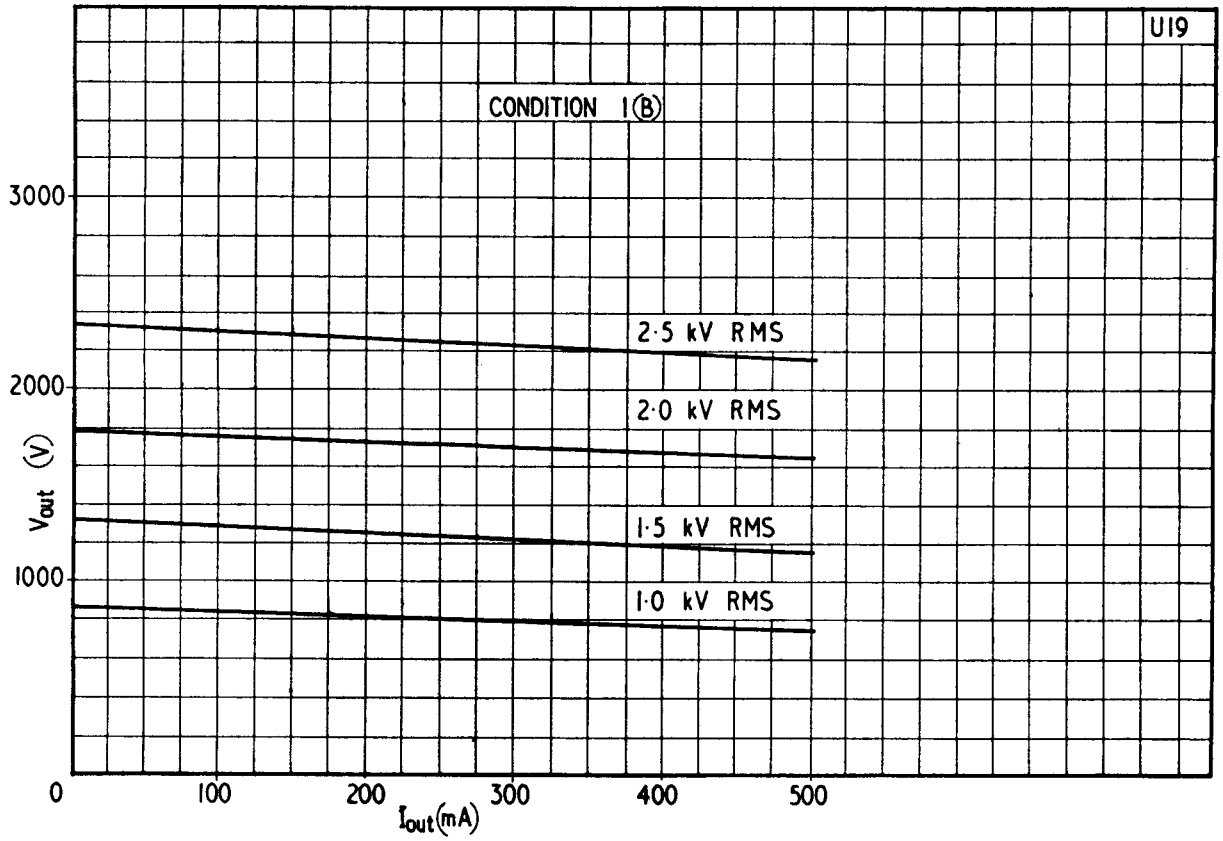
(2 valves).

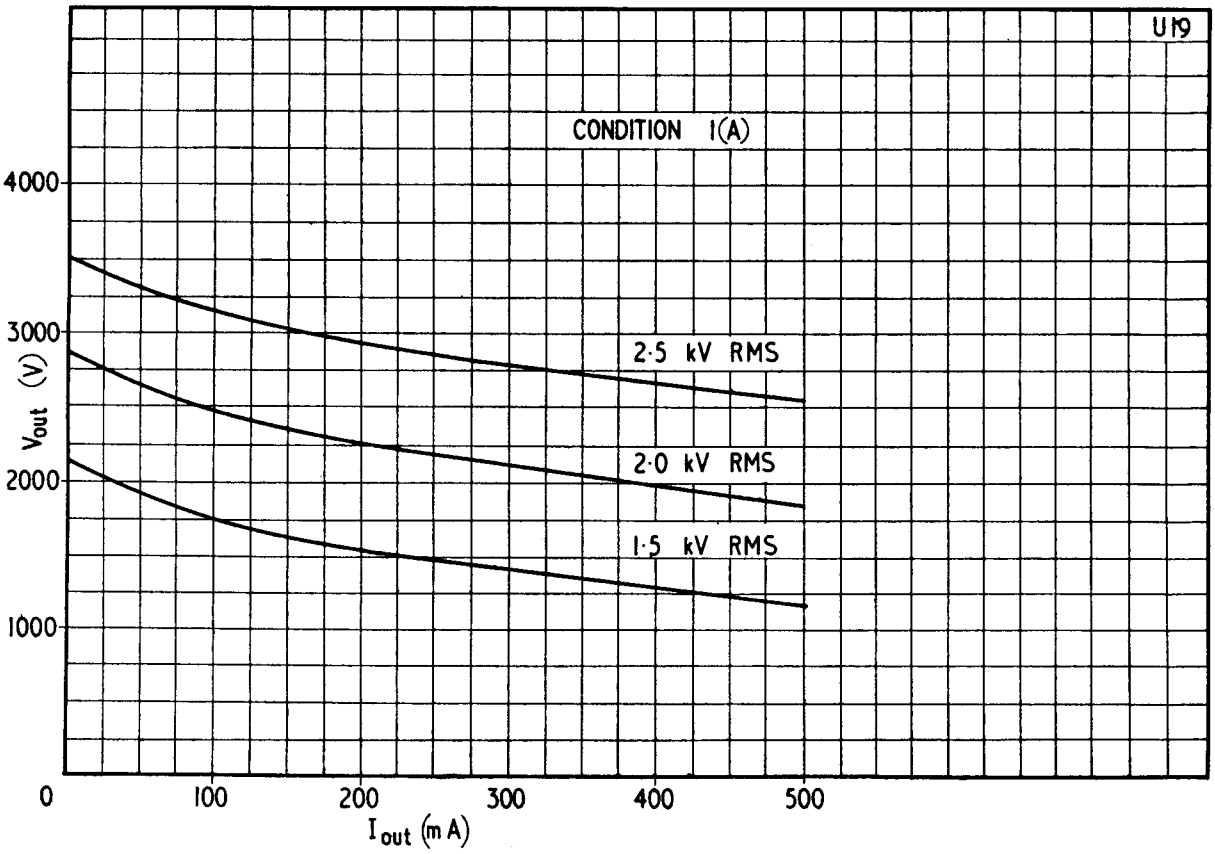
(A) Condenser Input to Filter			(B) Choke Input to Filter		
V_f	4·0	V	V_f	4·0	V
$V_{in(r.m.s.)}$	2·5+2·5	kV	$V_{in(r.m.s.)}$	2·5+2·5	kV
PIV	7·1	kV	PIV	7·1	kV
$V_{a(out)}$	2·5	kV	$V_{a(out)}$	2·1	kV
$I_{a(out)}$	500	mA	$I_{a(out)}$	500	mA
$I_{a(pk)}$	1·5	A	$I_{a(pk)}$	1·25	A
$I_{a(sur.)(max)}$	4·5	A	$I_{a(r.m.s.)}$	515	mA
$I_{a(r.m.s.)}$	525	mA	$L_{(min)}$	4·25	H
C	4·0	μF	$R_{source(min)}$	700	Ω
$R_{source(min)}$	700	Ω	Ripple (before choke)	50	%
Ripple	10	%			

(2) SINGLE-PHASE FULL-WAVE CIRCUIT

(4 valves).

(A) Condenser Input to Filter			(B) Choke Input to Filter		
V_f	4·0	V	V_f	4·0	V
$V_{in(r.m.s.)}$	5·0	kV	$V_{in(r.m.s.)}$	5·0	kV
PIV	7·1	kV	PIV	7·1	kV
$V_{a(out)}$	5·0	kV	$V_{a(out)}$	4·2	kV
$I_{a(out)}$	500	mA	$I_{a(out)}$	500	mA
$I_{a(pk)}$	1·5	A	$I_{a(pk)}$	1·25	A
$I_{a(sur)(max)}$	4·5	A	$I_{a(r.m.s.)}$	515	mA
$I_{a(r.m.s.)}$	525	mA	$L_{(min)}$	8·0	H
C	4·0	μF	$R_{source(min)}$	600	Ω
$R_{source(min)}$	1,000	Ω	Ripple (before choke)	50	%
Ripple	10	%			


U19
CONDITION 1(B)
3000
2000
1000
0
V_{out} (V)
2·5 kV RMS
2·0 kV RMS
1·5 kV RMS
1·0 kV RMS
100
200
300
400
500
I_{out}(mA)


U19
CONDITION 1(A)
4000
3000
2000
1000
0
V_{out} (V)
2·5 kV RMS
2·0 kV RMS
1·5 kV RMS
100
200
300
400
500
I_{out} (mA)

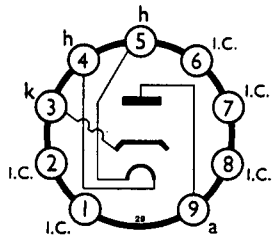


PRINTED IN ENGLAND

BOOSTER DIODE
0·3A INDIRECTLY HEATED

U309
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	72—78	mm.
Seated length :	66—72	mm.
Max. diameter :	22	mm.

RATING

I_h	0·3		A
V_h	20	approx.	V
$V_{h\text{-}k}$	350	max.	V
$v_{h\text{-}k}$ (pk)	700	max.	V
PIV (pulse)*	4	max.	kV
I_{out}	170	max.	mA
i_a (pk)	1	max.	A

* Maximum pulse duration of 15% of one cycle with a maximum of 15 μs.

CAPACITANCE

$C_{a\text{-}all}$	8	pF

OPERATION

When operating the valve as a booster diode, care must be taken to ensure that the valve socket insulation will withstand the maximum peak inverse voltage. The central cylindrical shield in the valve socket should be removed and it is also advisable to remove contacts 1, 6 and 7. In addition, it may be necessary to mount certain types of socket on a plate of insulating material.

MOUNTING

Any position.

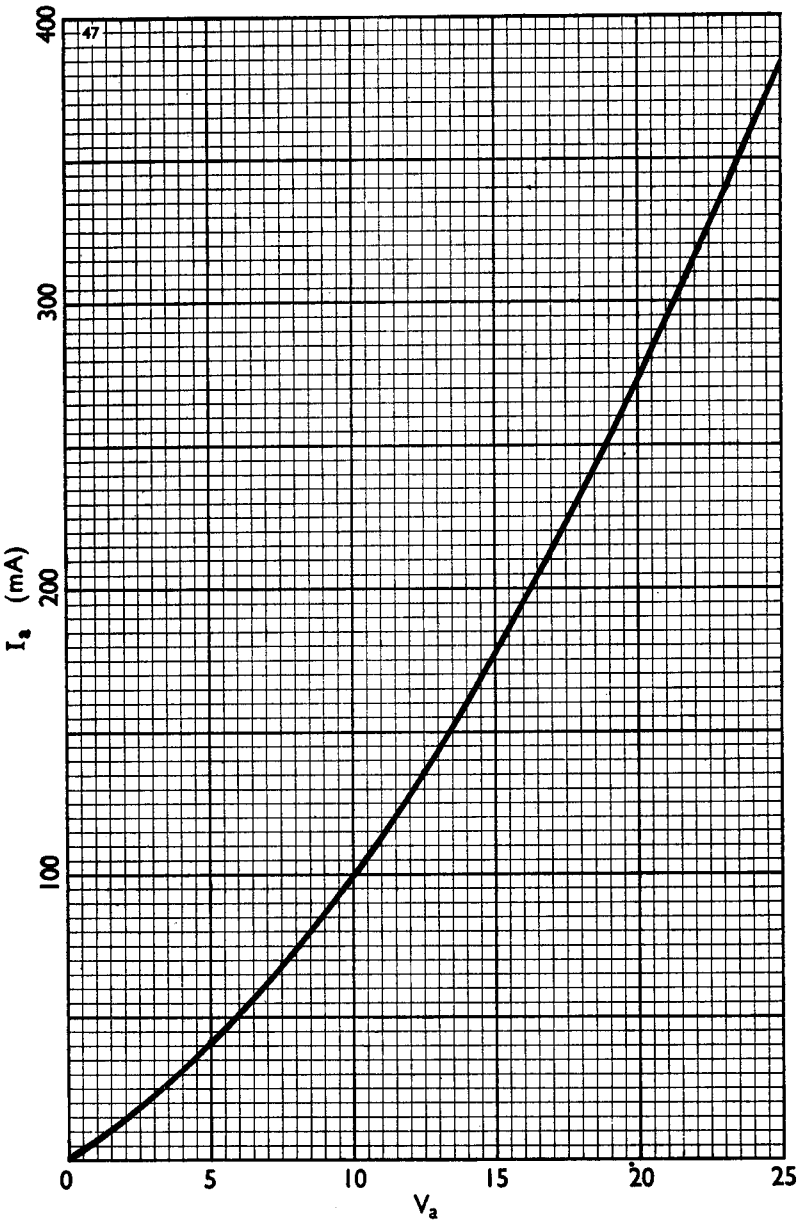
RETAINING

A retaining device should be used.

VENTILATION

Free air circulation is preferable. If the retaining device is in the form of a canister, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 225°C.

U309

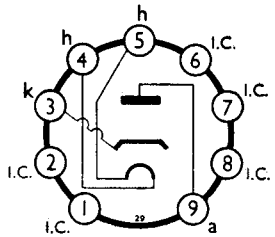


Printed in England. C.

HALF WAVE RECTIFIER
0·3A INDIRECTLY HEATED

U319
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	72—78	mm.
Seated length :	66—72	mm.
Max. diameter :	22	mm.

RATING

I_h	0·3		A
V_h	20	approx.	V
$V_{h\text{-}k}$	350	max.	V
$v_{h\text{-}k}$ (pk)	700	max.	V
P.I.V.	700	max.	V
I_{out}	170	max.	mA
V_{in} (rms)	250	max.	V
i_a (pk)	1	max.	A
i_a (sur)	3·4	max.	A

CAPACITANCE

$C_{a\ all}$	8	pF

TYPICAL OPERATION

Single Phase Half wave

Capacitor input.

V_{in} (rms)	250	V
P.I.V.	700	V
V_{out}	235	V
I_{out}	170	mA
i_a (pk)	1	A
i_a (sur)	3·4	A
I_{ph} (rms)	360	mA
R_{source}	55	Ω
C	12	μF
Ripple	15	%

MOUNTING

Any position.

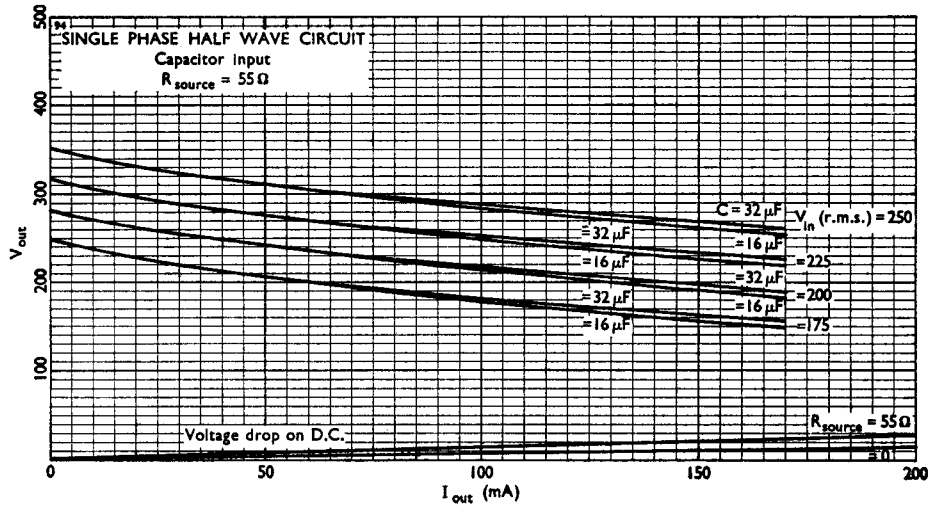
RETAINING

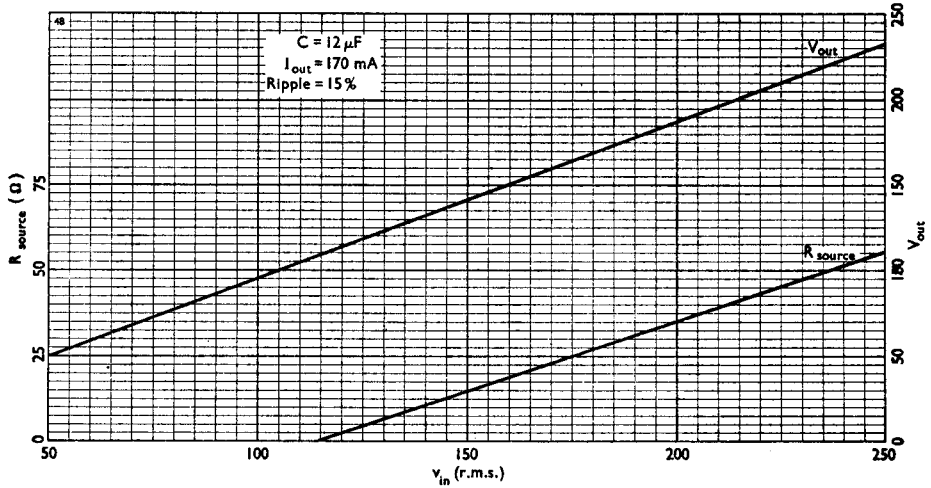
A retaining device should be used.

VENTILATION

Free air circulation is preferable. If the retaining device is in the form of a canister, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 225°C.

U319





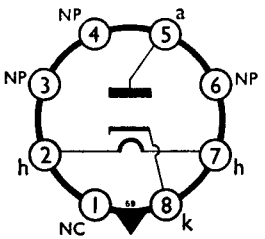
Printed in England. C.

HALF WAVE RECTIFIER
0·3A INDIRECTLY HEATED

U31

JUNE, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International octal.
Bulb : Dome top pear.

Overall length :	112—122	mm.
Seated length :	98—108	mm.
Max. diameter :	45	mm.

RATING

V_f	26	approx.	V
I_f	0·3		A
$V_{h\text{-}k}$ D.C.	350	max.	V
$v_{h\text{-}k}$ (pk)	700	max.	V
PIV	710	max.	V
V_{in} (rms)	250	max.	V
I_{out}	120	max.	mA
i_a (pk)	720	max.	mA
i_a (sur)	2·4	max.	A

It is recommended that a resistor of 100 Ω min. is connected in series with the anode lead to the valve.

TYPICAL OPERATION

	Single phase half-wave.	Voltage doubler (two valves).	
V_{in} (rms)	250	250	V
V_{out}	250	500	V
I_{out}	120	120	mA
I_{ph} (rms)	250	360	mA
R_{source}	100	100	Ω
C	16	32+32	μF
Ripple	15	10	%

MOUNTING

Any position.

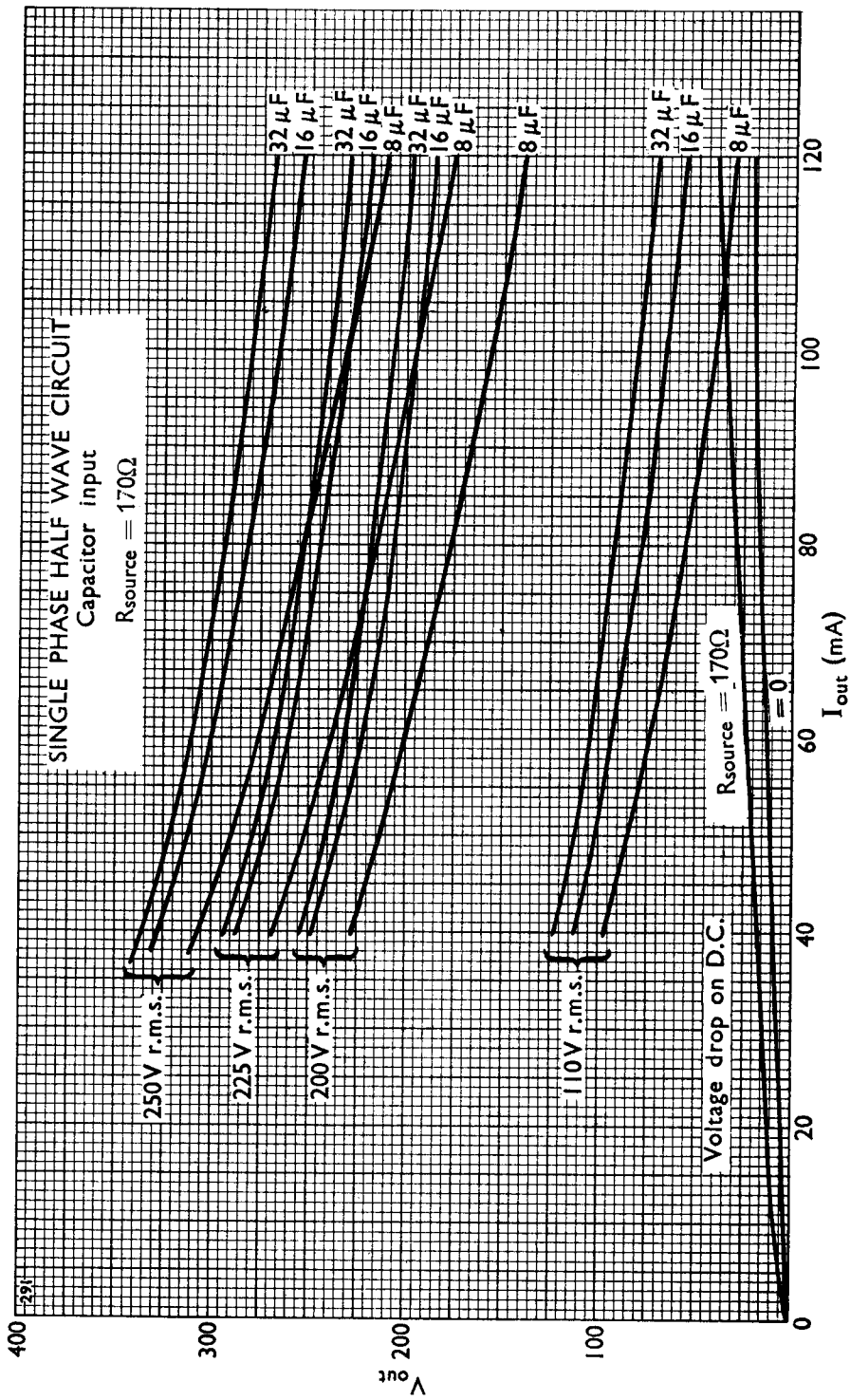
RETAINING

Not normally necessary.

VENTILATION

Ample free air circulation around the bulb should be permitted.

U31



Printed in England. C.

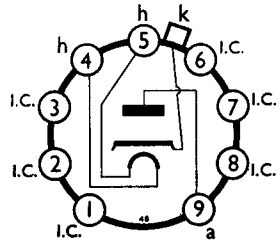
BOOSTER DIODE

0·3A INDIRECTLY HEATED

U329

NOVEMBER, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	83 mm. (max.)
Seated length :	76 mm. (max.)
Max. diameter :	22·2 mm.
Top cap :	CT1

RATING

I_h	0·3		A
V_h	25	approx.	V
$V_{h\text{-}k}$ (heater-ve)	2		kV
$v_{h\text{-}k}$ (pk) (pulse)*	7·5	max.	kV
PIV† (pulse)*	7	max.	kV
I_{out}	120	max.	mA
i_a (pk)	720	max.	mA
i_a (sur)	2·4	max.	A

* Maximum pulse duration of 15% of one cycle with a maximum of 15μs.

† It is desirable to provide some HT delay after application of heater voltage. This is essential, however, above 6kV PIV.

CAPACITANCES

$c_{a\text{-all}}$ 6·1 pF $c_{h\text{-}k}$ 3·2 pF

MOUNTING

Any position. It is recommended that the valve pins are aligned in a pin-straightener of accredited design before inserting the valve in a socket. When operating the valve as a booster diode, care must be taken to ensure that the valve holder has adequate insulation to withstand the maximum peak inverse voltage. The cylindrical centre shield of the valve holder should be removed, and it is also advisable to remove contacts 1, 6 and 7. In addition it may be necessary to mount certain types of holder on a plate of insulating material.

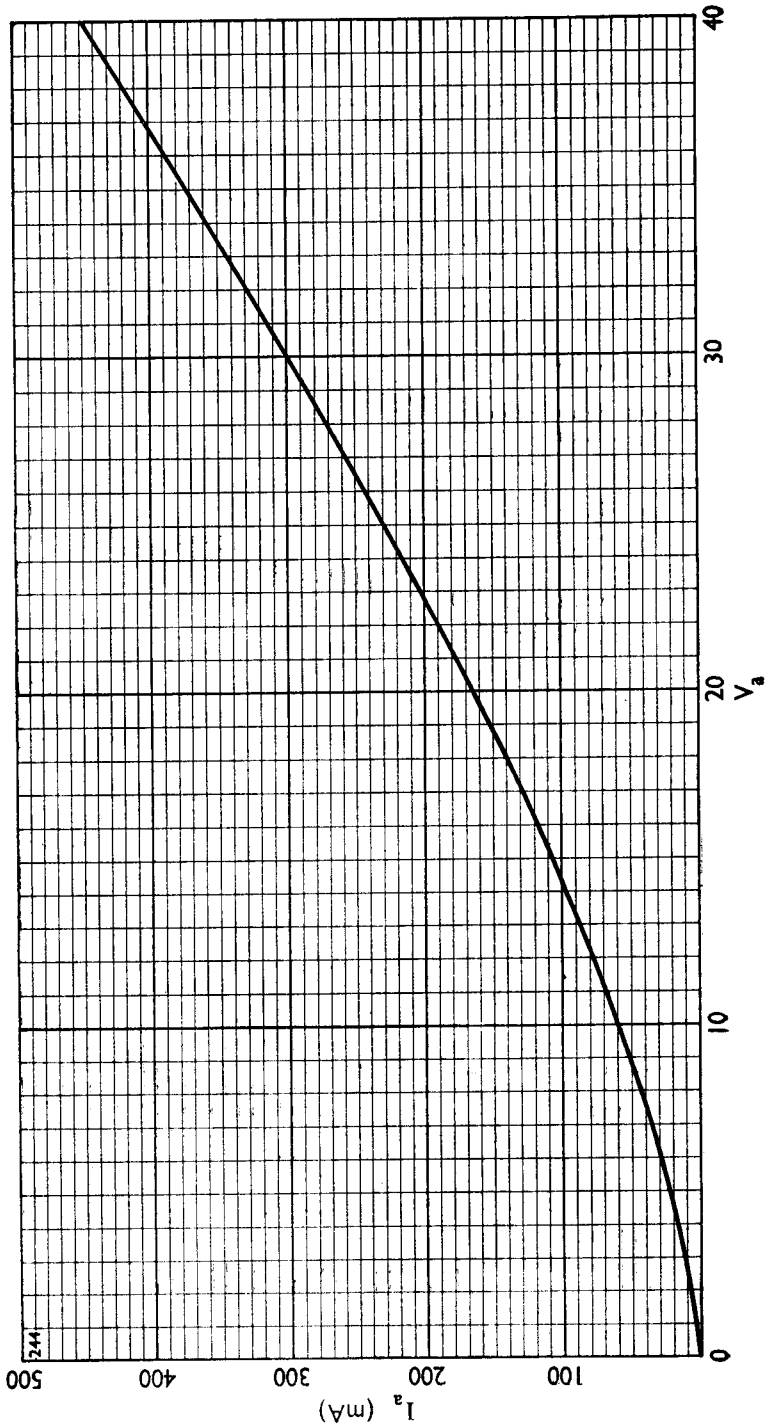
VENTILATION

Free air circulation is preferable. If a retaining device in the form of a metal canister is employed, the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 225°C.

RETAINING

In equipment subject to vibration or shock a retainer is required.

U329



CIRCUIT SUPPLEMENT

U329

NOVEMBER, 1954

The ratings and characteristics of the valves mentioned in this Supplement are given in the Technical Data Sheet.

The U329 is a low impedance diode for use principally in voltage booster circuits in television receivers. It is capable of withstanding a peak voltage of 7·5 kV between the heater and cathode. This high voltage is possible due to the special heater and cathode design used. The ceramic insulation used at low voltage is omitted and a special vacuum insulation technique employed.

A typical circuit suitable for use with the U329 is shown overleaf.

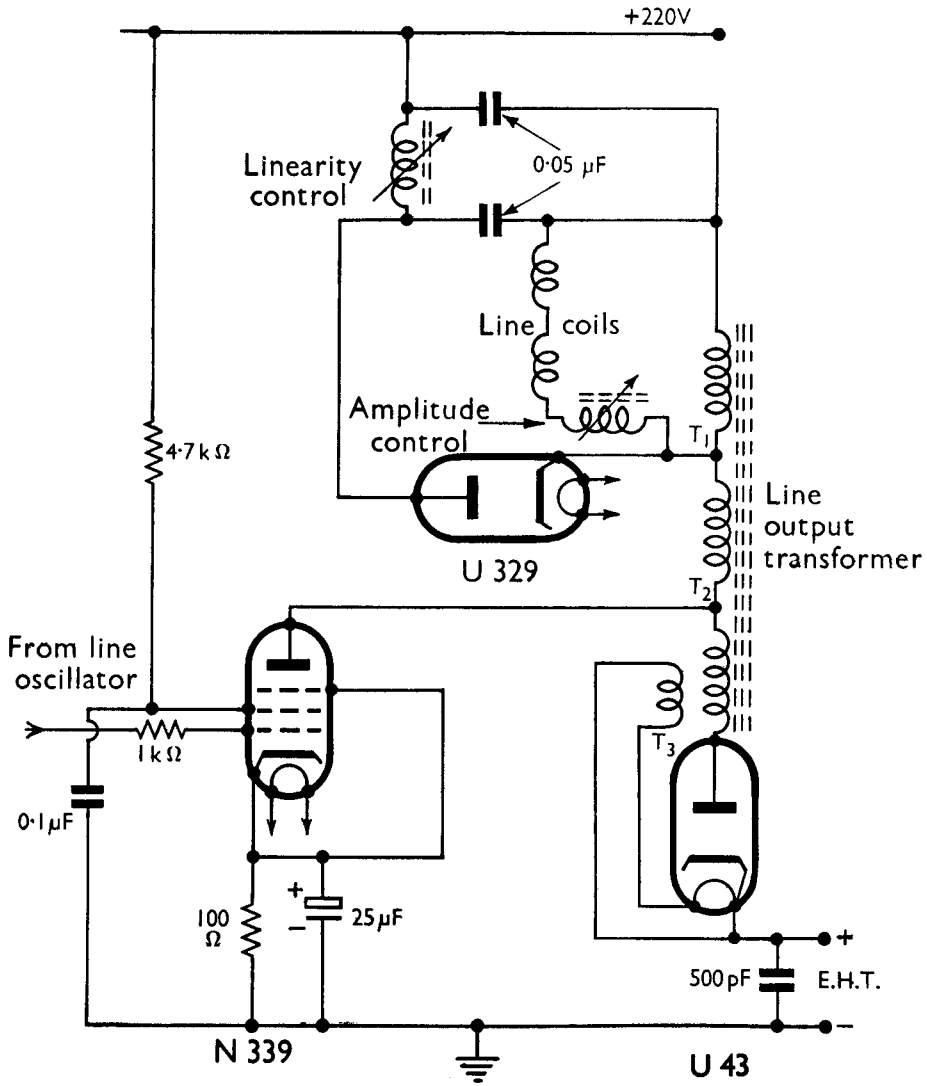
During the flyback period a positive voltage pulse appears at the U329 cathode ; the amplitude of this pulse will depend on the impedance of the line coils and consequently on the position of the tapping point on the line transformer. The limiting case is reached when the line coils and diode are connected direct to the line output valve anode at point T_2 and the transformer has then an effective 1 : 1 ratio and maximum peak voltage is reached.

The proportion of the winding between T_2 and T_3 is the overwind for the EHT supply to the picture tube. The pulse produced during the flyback period is rectified by the U43 and appears as a DC voltage across the EHT capacitor.

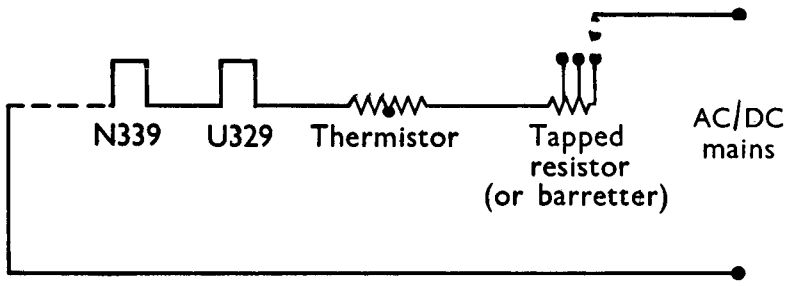
MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford

U329 CIRCUIT SUPPLEMENT



Typical circuit : line time base output stage.



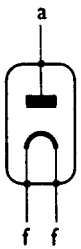
Heater connections.

Printed in England. C.

MINIATURE
HALF WAVE RECTIFIER
1·4V DIRECTLY HEATED

U37
APRIL, 1952

CONNECTIONS AND VALVE DIMENSIONS



Base : Wire leads
Bulb : Tubular.

Overall length :	43—48	mm.
Max. diameter :	13	mm.
Nom. length of all leads :	30	mm.

RATING

V_f	1·4	V
I_f	140	mA
PIV	15* max.	kV
I_{out}	2 max.	mA
i_a (pk)	12 max.	mA
i_a (sur)	40 max.	mA

* For conditions where the anode voltage rises at approximately the same rate as the filament voltage, e.g. in fly-back and R.F. oscillator EHT systems.

For applications where the full A.C. anode voltage is applied on switching, the PIV is limited to 10 kV.

CAPACITANCE

$c_{a\text{-}f}$	0·65	pF

TYPICAL OPERATION

Fly-back EHT Source

I_f (rms)	140	mA
PIV	7·5	kV
V_{out}	7	kV
I_{out}	100	μA
C	0·001	μF

R.F. Oscillator EHT Source

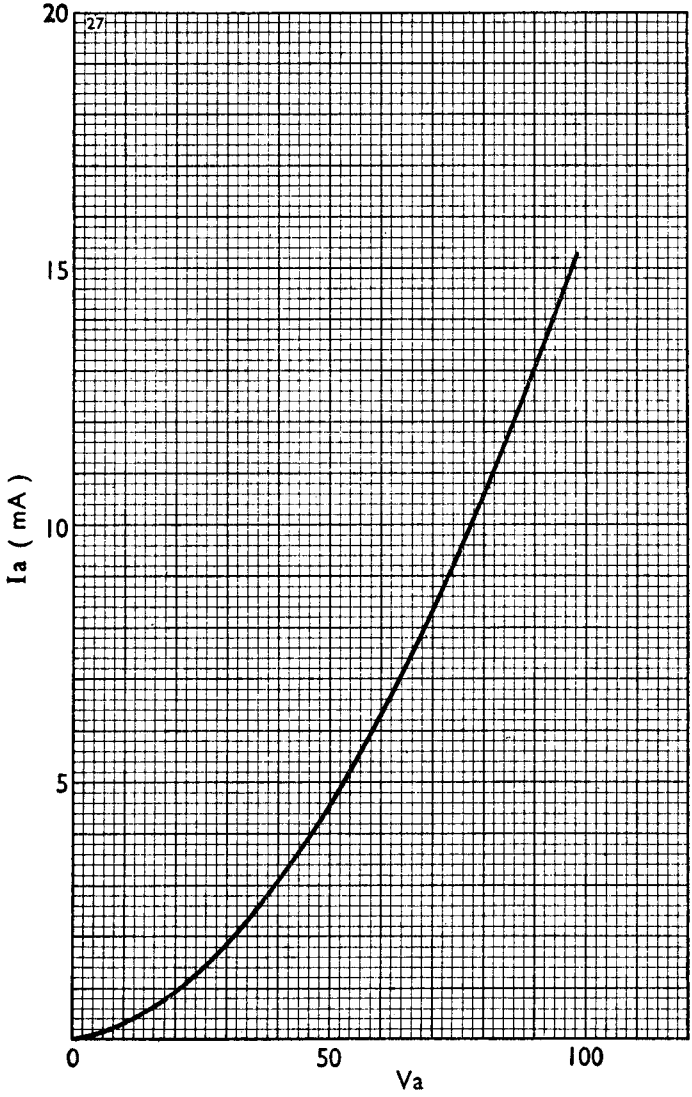
I_f (rms)	140	mA
PIV	15	kV
V_a (rms)	5·3	kV
V_{out}	7·5	kV
I_{out}	100	μA

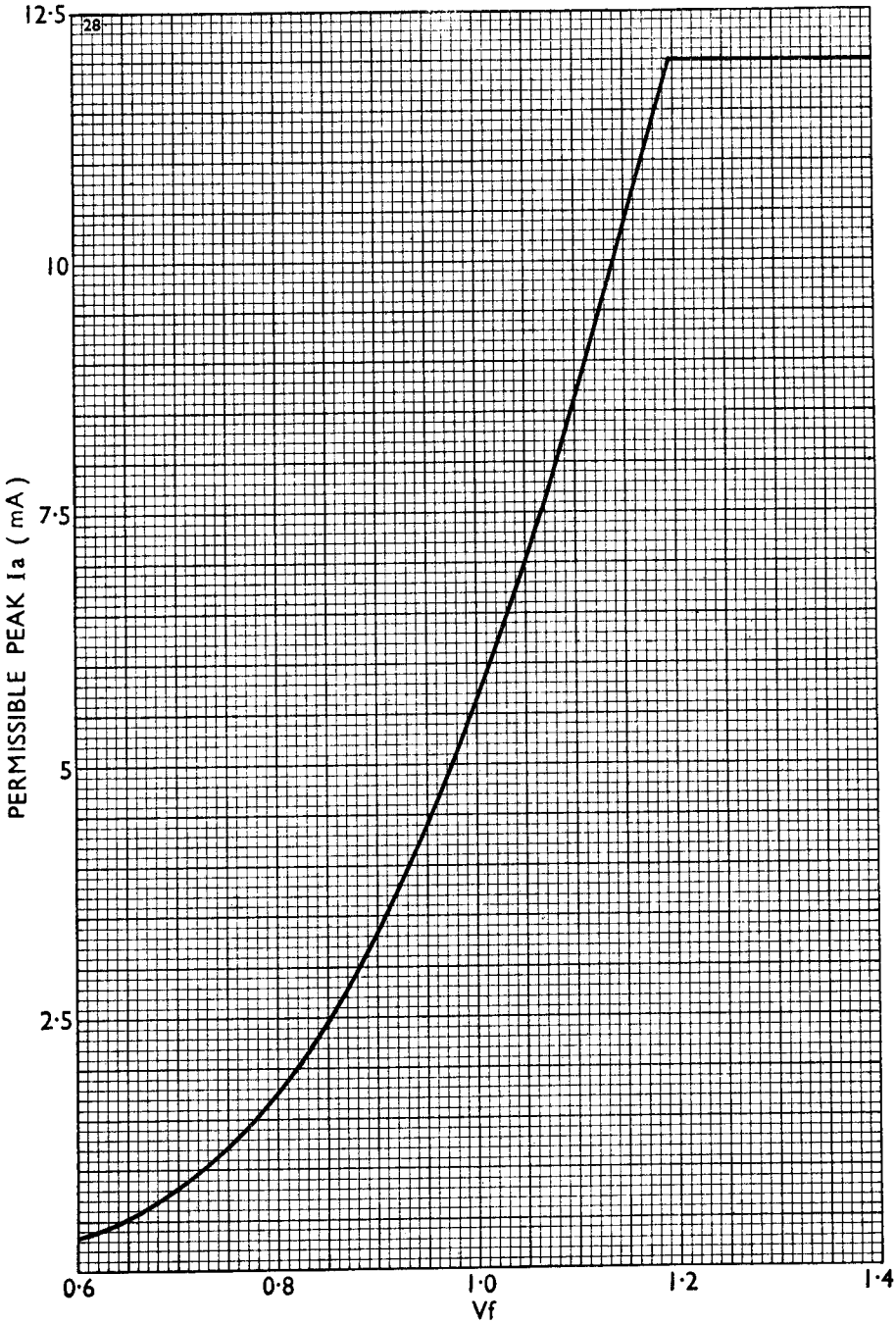
The filament should be operated at the same temperature as it would attain if operated at 1·4V D.C.

MOUNTING

Any position.

U37




12·5
10
7·5
5
2·5
PERMISSIBLE PEAK Ia (mA)
0·6
0·8
1·0
1·2
1·4
Vf

OV.1675

Printed in England. C.

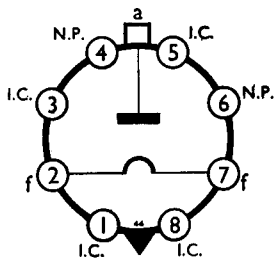
HALF WAVE RECTIFIER

1·25V DIRECTLY HEATED

U41

OCTOBER, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International Octal
Bulb : Tubular

Overall length :	93—103	mm.
Seated length :	79—89	mm.
Max. diameter :	34	mm.
Top cap :	CT2	

RATING

V_f	1·25		V
I_f	0·2		A
PIV	35	max.	kV
I_{out}	2	max.	mA
i_a (pk)	17	max.	mA
i_a (sur)	40	max.	mA
f	350	max.	kc/s

CAPACITANCE

c_{a-f}	1·5	pF

TYPICAL OPERATION

Single Phase ; Half Wave. Capacitor Input

V_a (rms)	12·5		kV
PIV	35		kV
V_{out}	15		kV
I_{out}	2		mA
i_a (pk)	12		mA
I_{ph} (rms)	4·2		mA
R_{source}	300	min.	kΩ
C	0·01		μF
R_{ipple}	15		%

U41

VOLTAGE DOUBLER. 2 VALVES

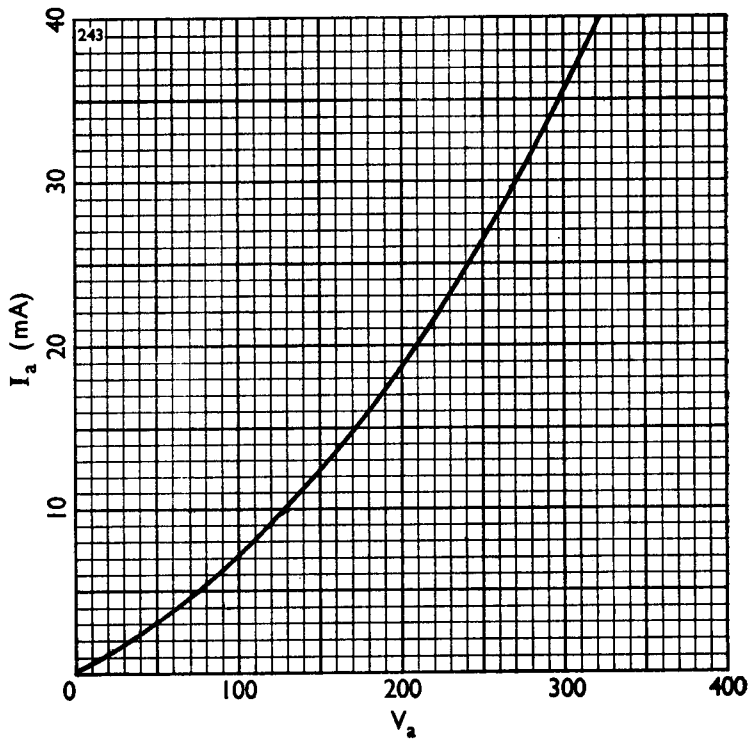
V_a (rms)	12·5	kV
PIV	35	kV
V_{out}	30	kV
I_{out}	2	mA
i_a (pk)	12	mA
I_{ph} (rms)	4·2	mA
R_{source}	300 min.	kΩ
C	0·02	μF
R_{ipple}	10	%

MOUNTING

Any position.

SWITCHING

Direct.



Printed in England. C.

MINIATURE
HALF WAVE RECTIFIER
6·3V INDIRECTLY HEATED

U43
MARCH, 1954

A High Voltage Vacuum Rectifier suitable for providing HT power for cathode ray tubes from an RF source or by rectification of the fly-back voltage.

CONNECTIONS AND VALVE DIMENSIONS



Bulb
Max. overall length: 48 mm.
Max. diameter: 10 mm.
Leads (Nominal)
Diameter: 45 mm.
Length: 32 mm.

RATINGS (Maximum)

	50 c/s Input	Sinusoidal Input (10—500 kc/s)	Pulsed Input*	
V_h	6·3			V
I_h	0·09			A
V_{in}(rms)	5	—	—	kV
PIV	—	17	17	kV
I_{out}	3·0	0·5	0·35	mA
I_k(pk)	18	4	80	mA
C	0·1	0·01	0·05	μF
R_{source}	0·1	—	—	MΩ

* Max. pulse duration 0·5% of the time between 2 pulses with a maximum of 5μ secs.

CAPACITANCE

$c_{a\text{-}k}$ 0·8 pF

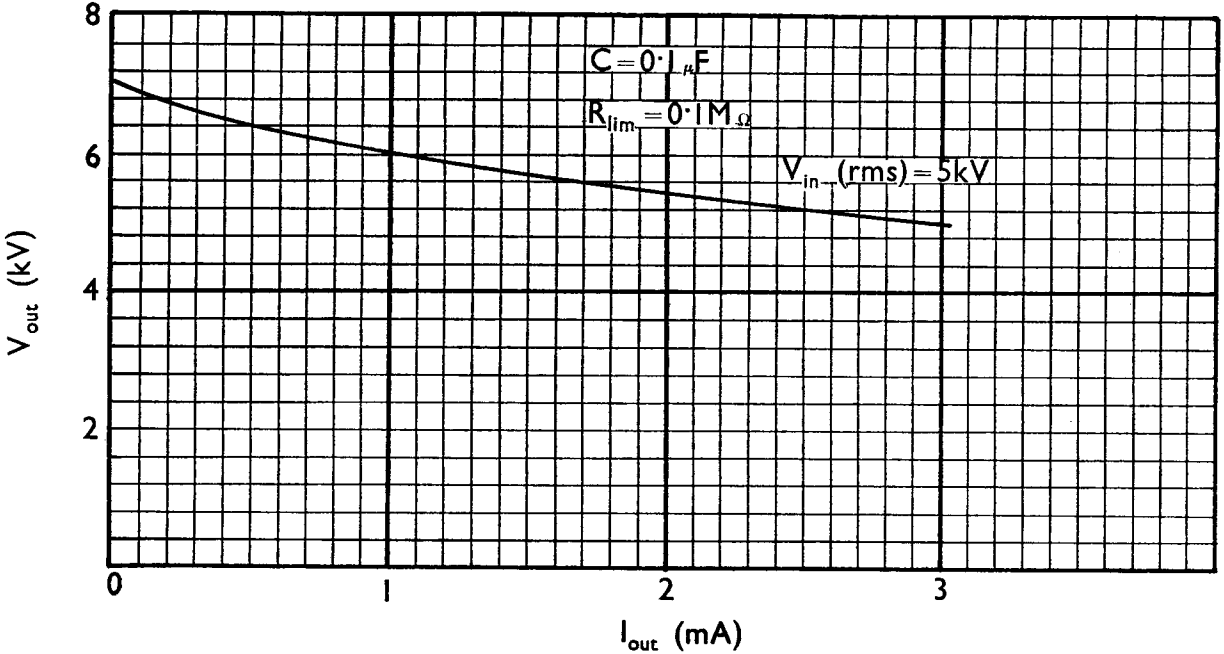
SWITCHING

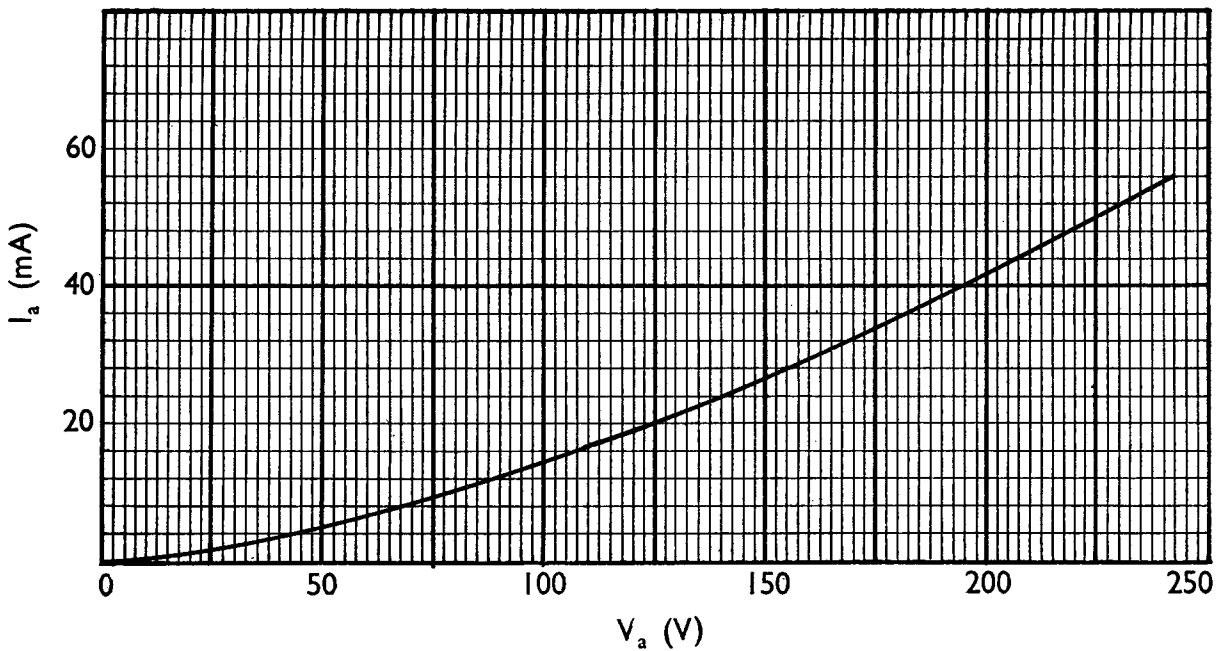
Direct.

MOUNTING

Any position.

Leads should not be soldered closer than 5 mm. to the glass and they should not be bent nearer than 1·5 mm. from the glass.


8
6
4
2
0
1
2
3
C = 0·1 μF
R lim = 0·1 MΩ
V in (rms) = 5kV
V out (kV)
I out (mA)


60
40
20
I_a (mA)
0
50
100
150
200
250
V_a (V)

Printed in England

HIGH VOLTAGE

HALF-WAVE RECTIFIER

6·3V INDIRECTLY HEATED

ISSUE 1

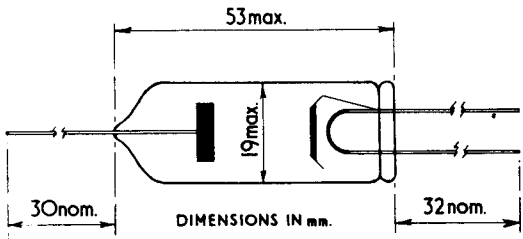
PROVISIONAL

U45

AUGUST 1955

A high voltage vacuum rectifier with an indirectly heated cathode. It is suitable for providing HT power for cathode ray tubes from an RF source or by rectification of the flyback voltage.

BASE CONNECTIONS AND VALVE DIMENSIONS



Nominal diameter of leads:

Anode: 0·35mm
Heater: 0·45mm

HEATER

V_h	6·3	V
I_h	0·12	A

RATINGS

	50c/s input	Sinusoidal input (10–500kc/s)	Pulsed * input	
V_{in} (rms)	5 max.	-	-	kV
PIV	-	18 max.	18 max.	kV
†PIV	-	20 max.	20 max.	kV
I_{out}	3 max.	0·5 max.	0·35max.	mA
I_k (pk)	18 max.	4 max.	80 max.	mA
C	0·1 max.	0·01max.	0·005max.	µF
R_s	100 min.	-	-	kΩ

* Max. pulse duration 0·5% of the time between two pulses with a maximum of 5µs.

† Immersed in oil.

CAPACITANCE

C_{a-k} 0·8pF

SWITCHING

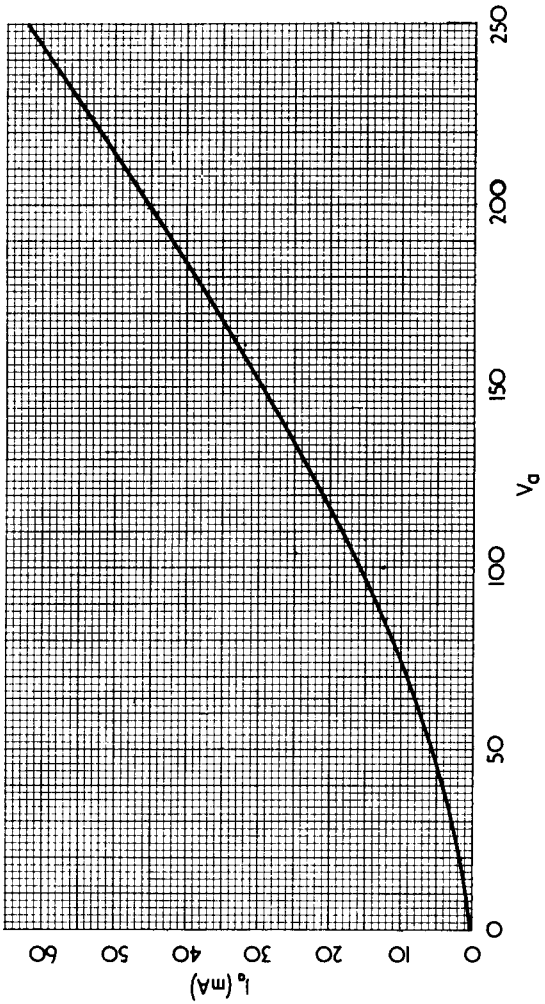
Direct.

MOUNTING

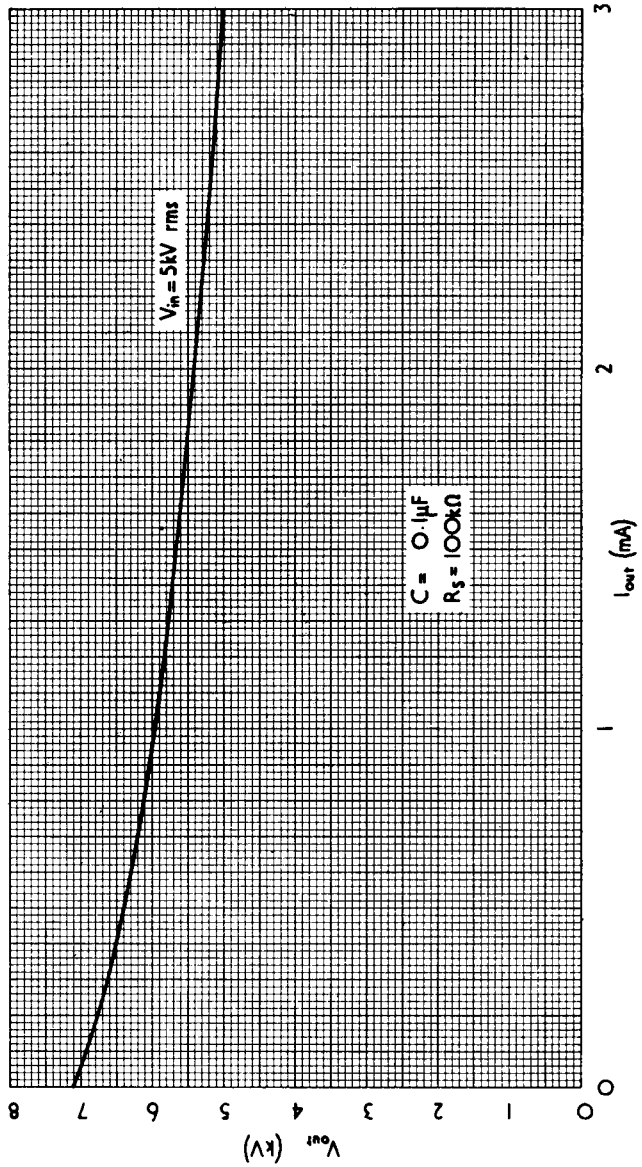
Any position.

Leads should not be soldered closer than 5mm from the glass and they should not be bent nearer than 1·5mm from the glass.

U45



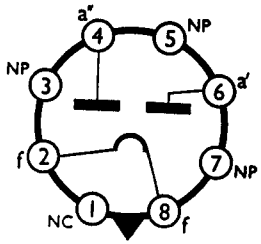
U45



BI-PHASE HALF WAVE RECTIFIER
DIRECTLY HEATED

U52
MARCH, 1956

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : International octal
Bulb : Dome top

Max. overall length :	135	mm.
Max. seated length :	121	mm.
Max. diameter :	51	mm.

FILAMENT

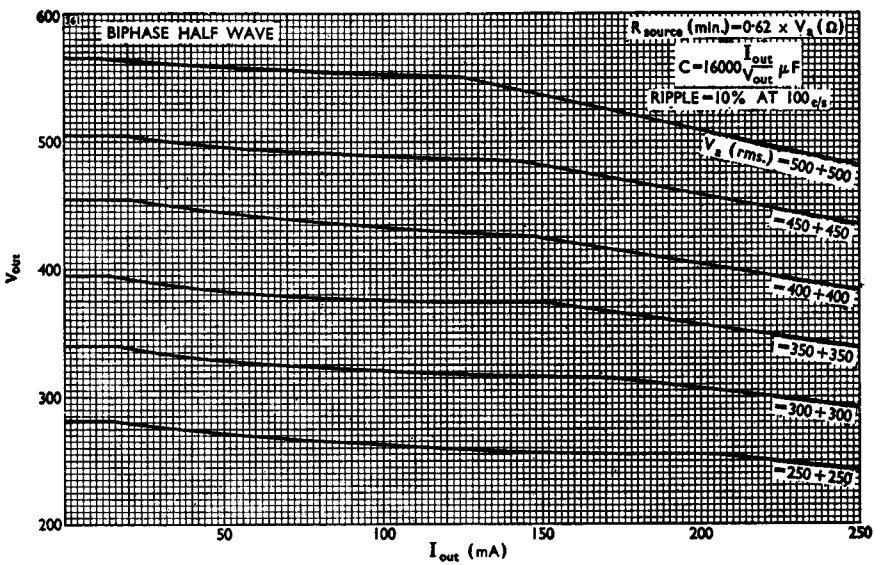
V_f	5	V
I_f	2·25	A

MAXIMUM RATINGS

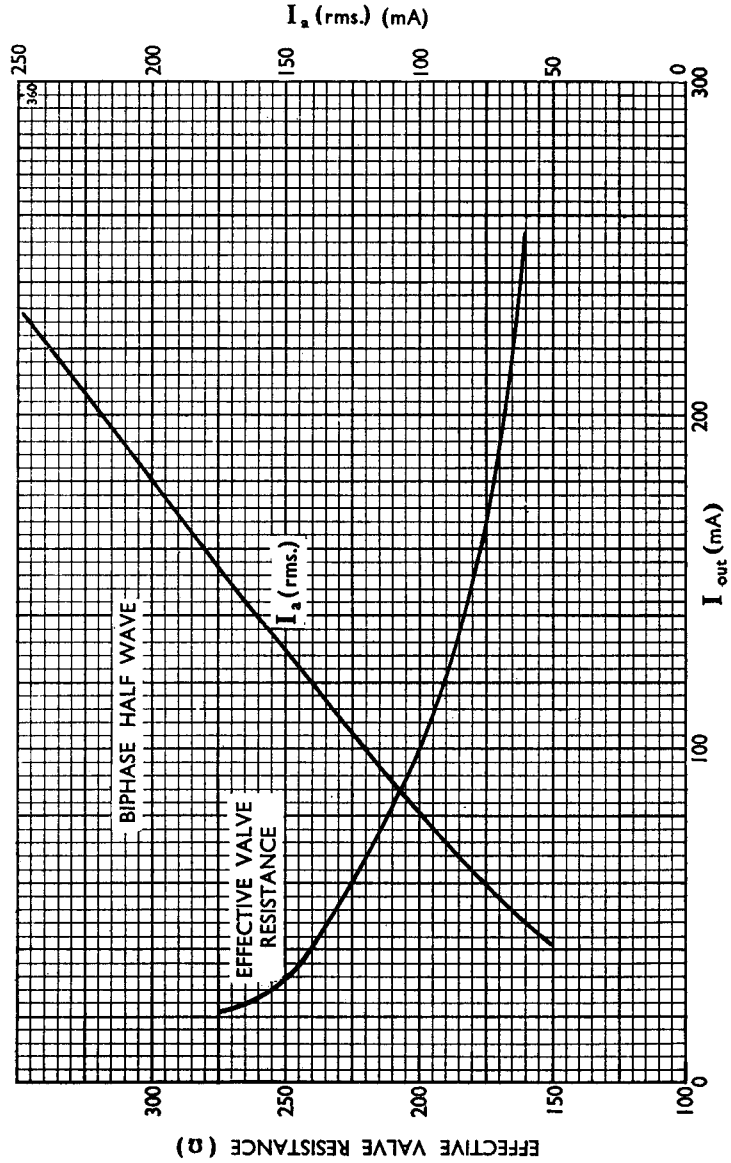
PIV	1·43	kV
PIV (sur)	2·96	kV
V_a (rms)	500	V
i_a (pk)	770	mA
i_a (sur)	2·5	A
I_{out}	250	mA

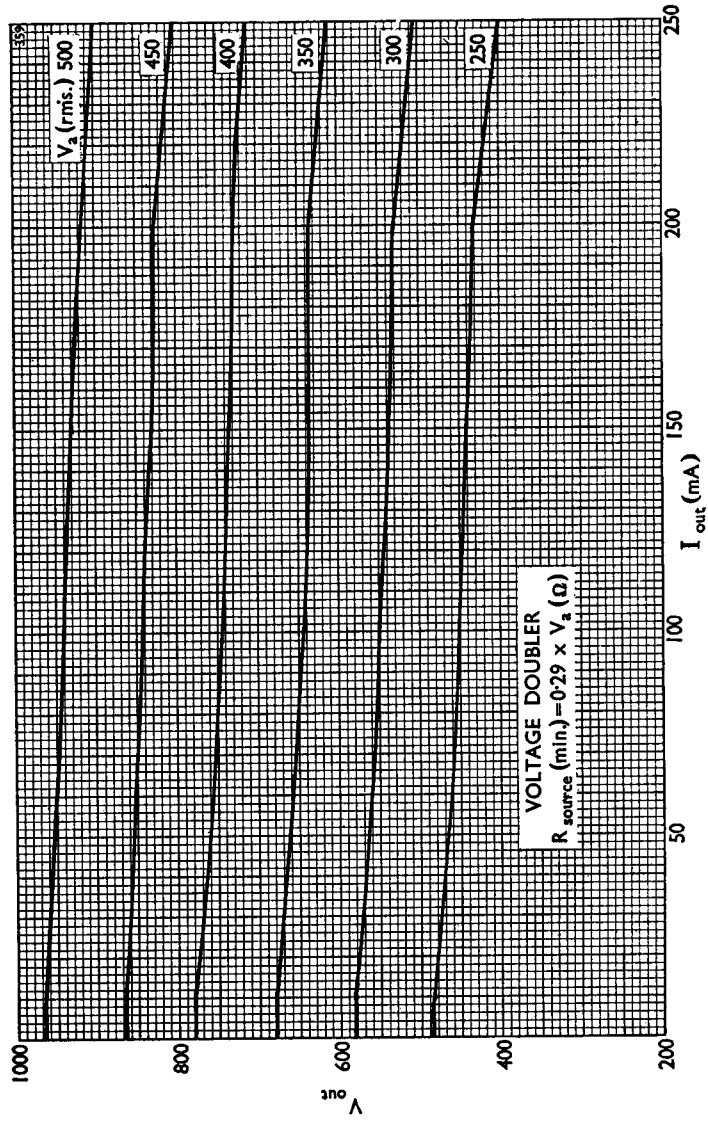
SWITCHING Direct.

MOUNTING Vertical. Horizontal operation is permitted if pins 1 and 4 are in a vertical plane.

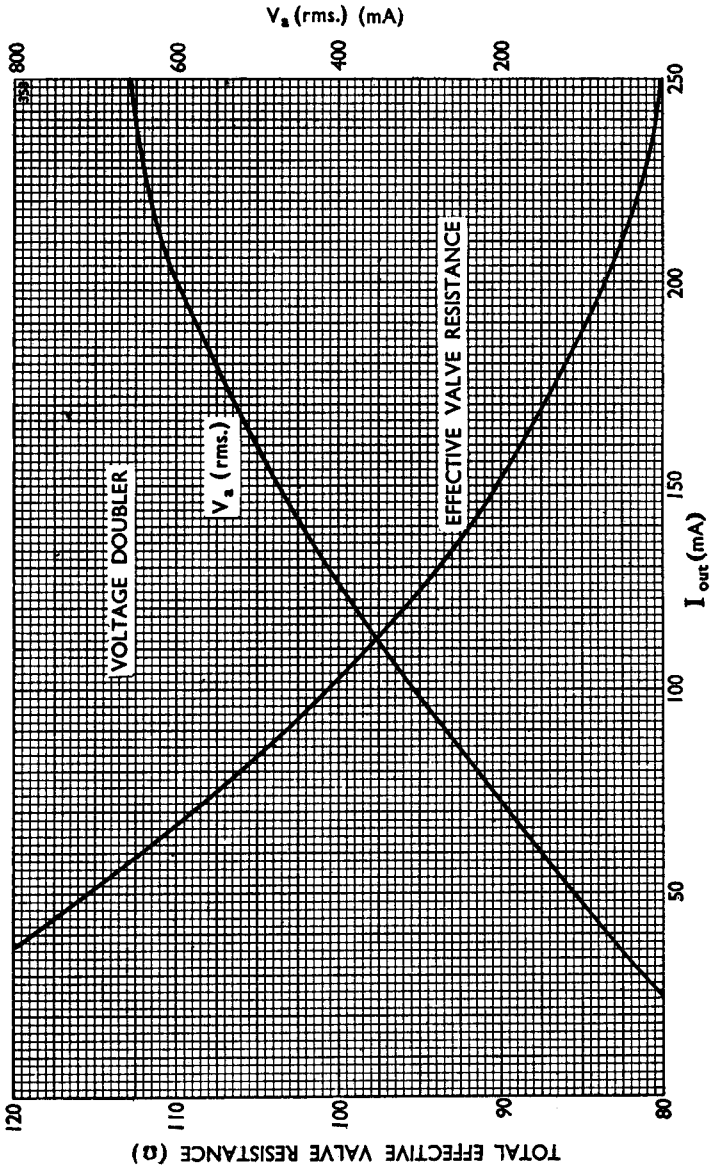


U52


I_a (rms.) (mA)
250
200
150
100
50
0
300
200
100
0
I_{out} (mA)
BIPHASE HALF WAVE
I_a (rms.)
EFFECTIVE VALVE RESISTANCE
300
250
200
150
100
EFFECTIVE VALVE RESISTANCE (Ω)


1359
V_a (rms.) 500
450
400
350
300
250
VOLTAGE DOUBLER
R_{source} (min.) = 0·29 x V_a (Ω)
V_{out}
1000
800
600
400
200
50
100
150
200
250
I_{out} (mA)

U52



Printed in England. C.

BI-PHASE HALF-WAVE RECTIFIER

5V INDIRECTLY HEATED

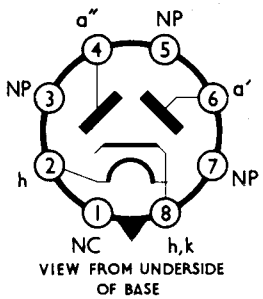
ISSUE 1

PROVISIONAL

U54

AUGUST 1955

BASE CONNECTIONS AND VALVE DIMENSIONS



VIEW FROM UNDERSIDE OF BASE

Base: International octal
Bulb: Dome top tubular

Max. overall length: 135mm
Max. seated length: 120mm
Max. diameter: 51mm

HEATER

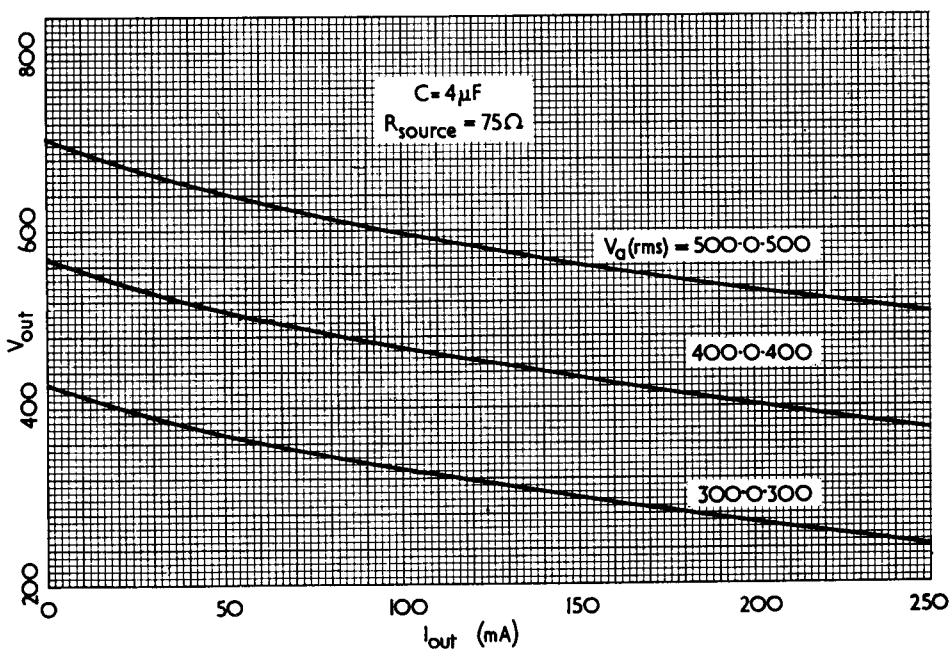
V_h	5	V
I_h	2·8approx.	A

RATINGS (Capacitor Input)

PIV	I_{out} = 0	1·6 max	kV
	I_{out} = max.	1·25max	kV
i_a (pk)		1·5 max	A
I_{out}		250 max	mA

TYPICAL OPERATION (Capacitor input)

V_a (rms)	500	V
V_{out}	500 approx	V
I_{out}	250	mA
C	4	µF
R_{source}	75 min	Ω

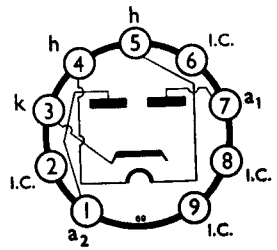


MINIATURE
BI-PHASE HALF WAVE RECTIFIER
6·3V INDIRECTLY HEATED

U709

OCTOBER, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	67·5 max.	mm.
Seated length :	60·5 max.	mm.
Max. diameter :	22·2 max.	mm.

RATING

V_h	6·3	V
I_h	0·95	A
V_{h-k}	450 max.	V
PIV	1 max.	kV
V_a (rms)	350 max.	V
I_{out}	150 max.	mA
i_a (pk)	450 max.	mA
i_a (sur)	1·5 max.	A

TYPICAL OPERATION

Single valve, Bi-phase half-wave. Capacitor input

V_a (rms)	350	V
PIV	1000	V
V_{out}	340	V
I_{out}	150	mA
i_a (pk)	450	mA
i_a (sur)	1·5	A
I_{ph} (rms)	157	mA
C	8	µF
R_{source}	270	Ω
V_{ripple}	10	%

SWITCHING

Direct

MOUNTING

Any position.

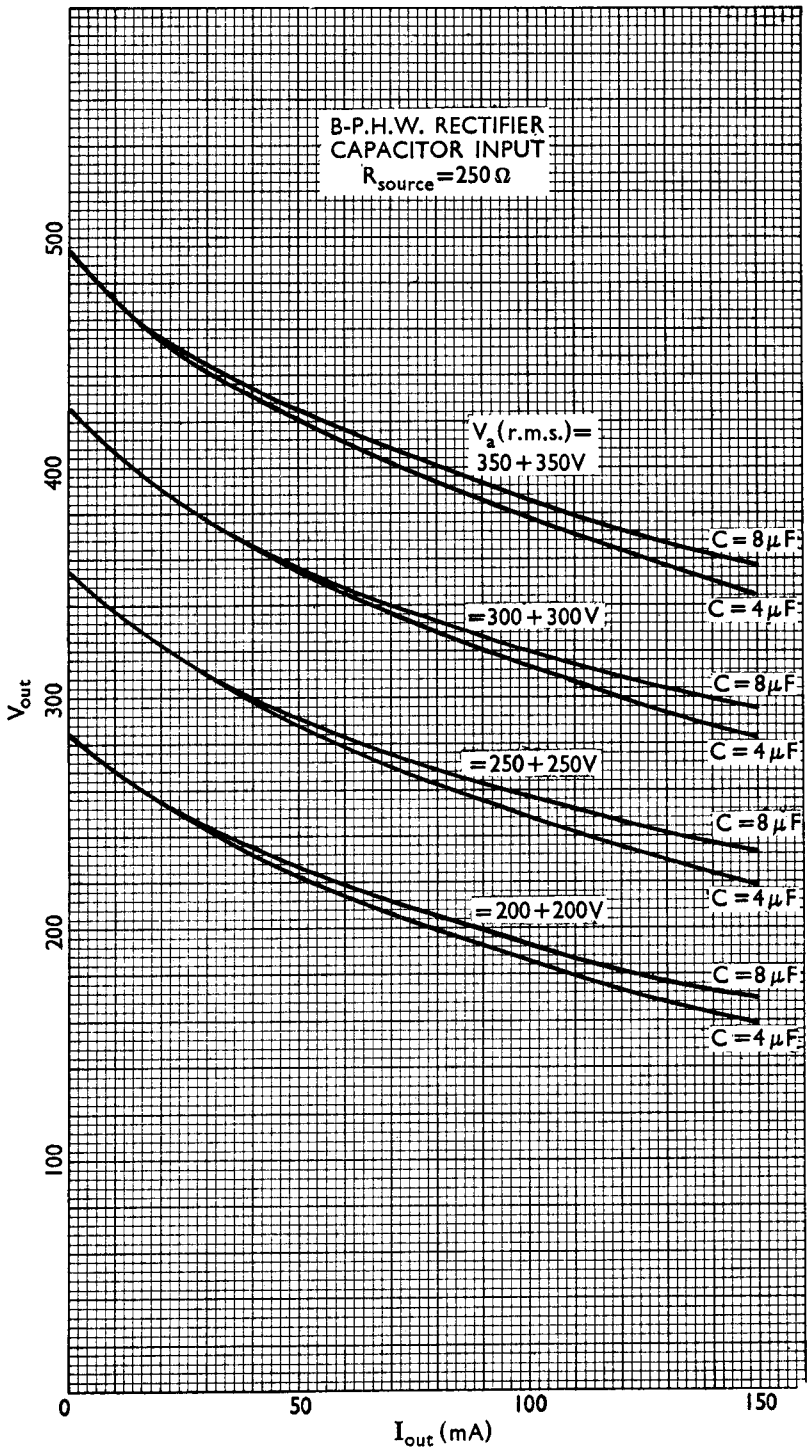
RETAINING

A retaining device should be used.

VENTILATION

Free air circulation is preferable. The temperature of the hottest part of the bulb must not exceed 220°C.

U709

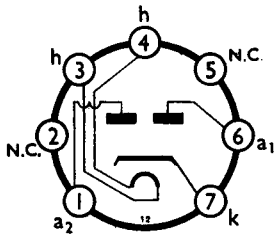


Printed in England. C.

MINIATURE
BI-PHASE HALF WAVE RECTIFIER
6·3V INDIRECTLY HEATED

U78
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	44—70	mm.
Seated length :	58—64	mm.
Max. diameter :	19	mm.

RATING

V_h	6·3		V
I_h	0·6		A
V_{h-k}	450	max.	V
PIV	1·25	max.	kV
V_a (rms)	325	max.	V
I_{out}	70	max.	mA
i_a (pk)	210	max.	mA
i_a (sur)	700	max.	mA

TYPICAL OPERATION

Single Valve, Bi-phase Half Wave. Capacitor Input

V_a (rms)	325	V
PIV	920	V
V_{out}	300	V
I_{out}	70	mA
i_a (pk) (per anode)	210	mA
i_a (sur) (per anode)	700	mA
I_{ph} (rms)	73·5	mA
C	16	μF
R_{source}	435	Ω
V_{ripple}	3	%

MOUNTING

Any position.

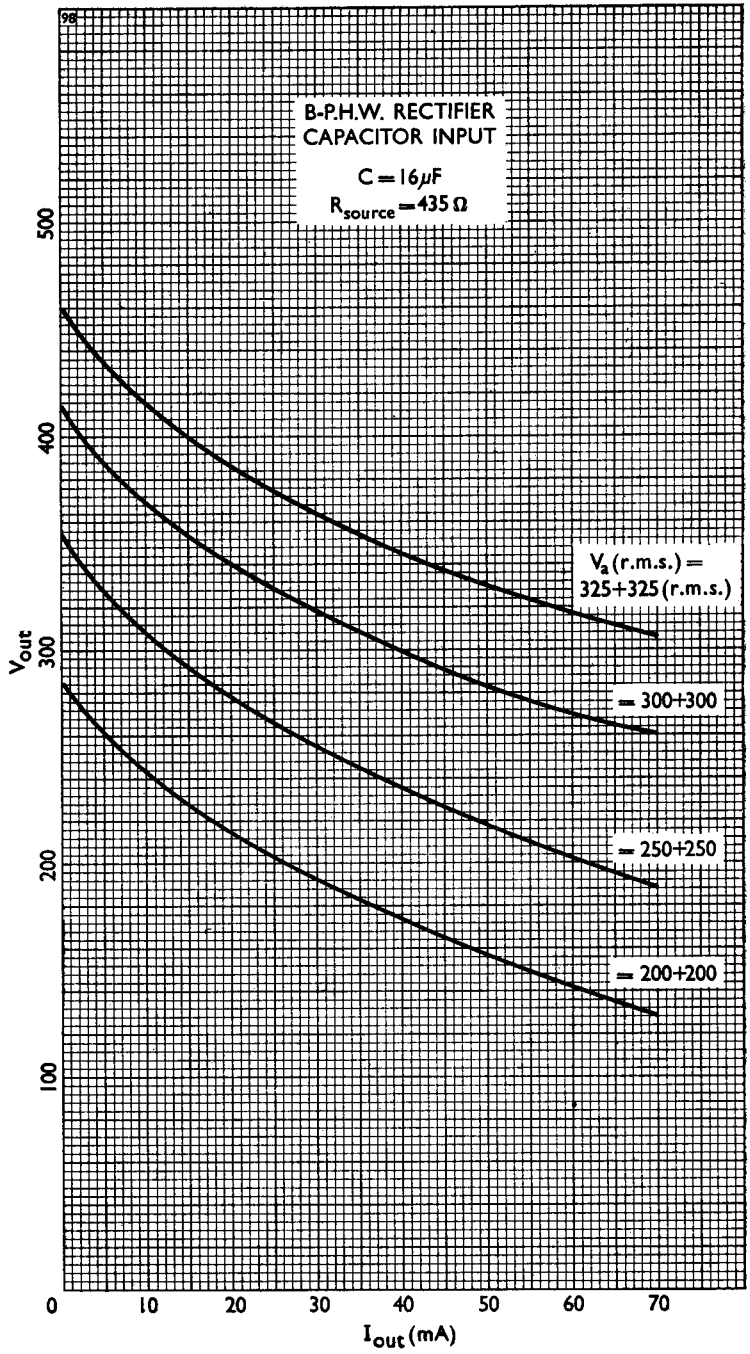
RETAINING

A retaining device should be used.

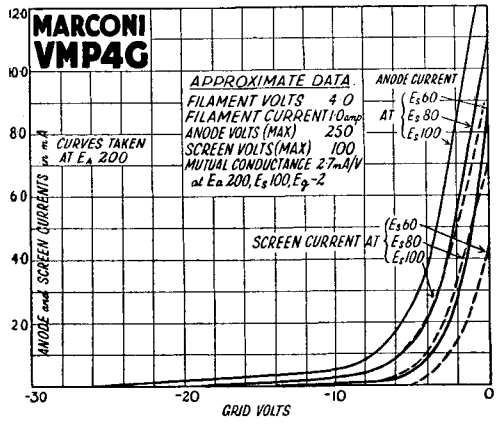
VENTILATION

Free air circulation is preferable. The hottest part of the bulb must not exceed 250°C.

U78



Printed in England. C.



Marconi VMP4G

Variable Mu H.F. Pentode

Marconi VMP4G has a low leakage capacity combined with high slope and is suitable for H.F. and I.F. amplification.

Nominal rating, see curve.

Inter-electrode capacities
(metallised valve).

A—G	0.0026$\mu\mu$F
A—E	8.7$\mu\mu$F
G—E	14.0$\mu\mu$F

Dimensions : 140 × 44.5 mm. 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

Anode voltage	250	250	250	200	200	200
Screen voltage	100	80	60	100	80	60
Bias resistance	150	250	400	150	250	450
Screen potentiometer, upper element	9,000	12,000	20,000	6,000	9,000	15,000
Screen potentiometer, lower element	10,000	10,000	10,000	10,000	10,000	10,000
Series screen feed	20,000	35,000	70,000	12,000	22,000	45,000

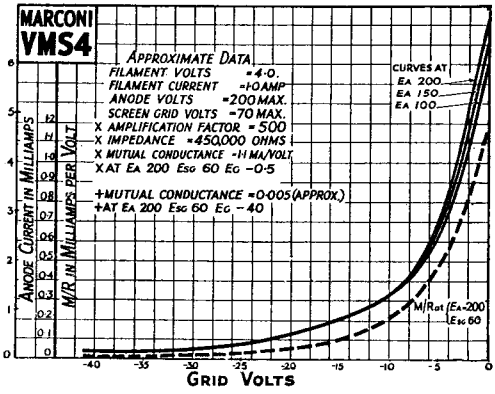
Notes.

If manual control is used the potentiometer should have a value of 5,000 ohms. The grid base is normally 25 volts but it can be extended by using a series feed to the screen as shown in the above table. This device is of value when VMP4G is used for feeding a diode at high level.

Price - - 10/6

VMS 4, Variable Mu. Screen Grid, 22/6

Marconi VMS.4 is a screen grid valve incorporating an entirely new principle of construction which renders it suitable for use as a volume control stage in powerful receivers. The curve falls very gradually from the normal working point at approximately 1½ volts bias, and does not become horizontal until some 40 volts bias is applied. Since the slope of the curve is related to the amplification, it is easily seen that smooth variation of volume is



obtained with none of the disadvantages attached to the more usual methods of volume control. VMS.4 is also helpful in reducing "cross-modulation" troubles, and is thus a most valuable contribution to modern radio practice.

VMS.4 is available with metallised bulb if desired.

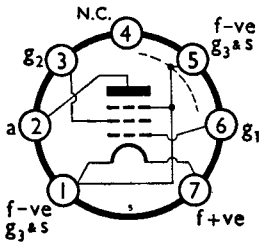
Approximate Operating Data.

Anode Volts.	Screen Volts.	Grid Bias.
200	60–80	−1½ to −40

MINIATURE
VARIABLE-MU R.F. PENTODE
1·4V DIRECTLY HEATED

W17
OCTOBER, 1951

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

V_f	1·4	V
I_f	0·05 approx.	A
V_a	90 max.	V
V_{g2}	67·5 max.	V
I_k	5·5 max.	mA
r_a at $V_a=90$, $V_{g2}=67·5$, $V_{g1}=0$	0·5	MΩ
g_m at $V_a=90$, $V_{g2}=67·5$, $V_{g1}=0$	0·9	mA/V

CAPACITANCES

$c_{g1—all}$ 3·6 pF $c_{a—all}$ 7·5 pF $c_{a—g1}$ 0·01 pF

TYPICAL OPERATION

V_a	45	67·5	90	90	V
I_a	1·7	3·4	1·8	3·5	mA
V_{g2}	45	67·5	45	67·5	V
I_{g2}	0·7	1·5	0·65	1·4	mA
V_{g1}	0	0	0	0	V
*V_{g1}	−10	−16	−10	−16	V

*For $g_m=10$ μA/V.

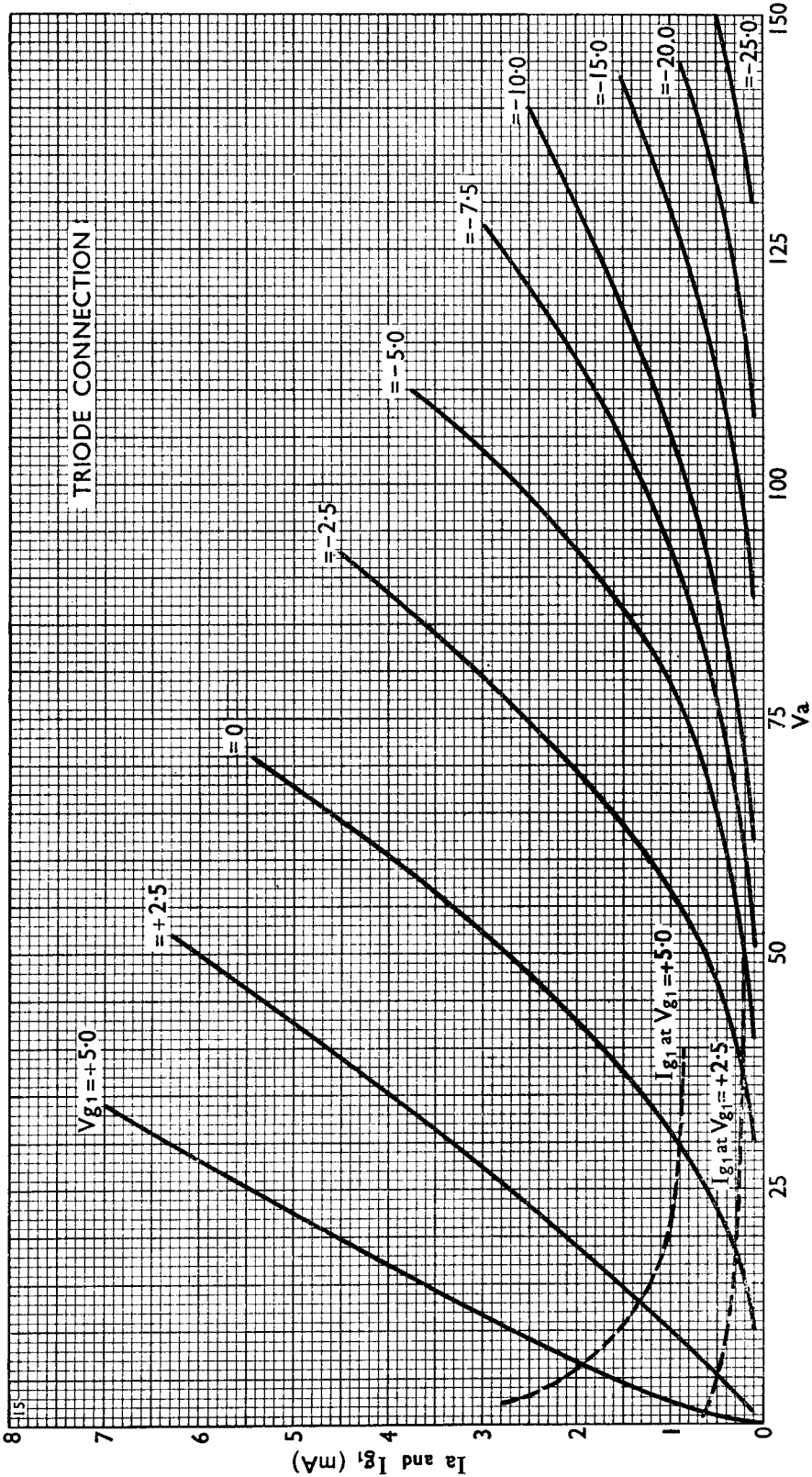
The screen grid may be supplied from a 90 volt source via a series resistor but the screen grid voltage must not exceed 67·5 at zero control grid voltage.

FILAMENT OPERATION

When operating the filament from a mains supply, the voltage should be adjusted to 1·3 or the current to 47·5 mA mean. Under certain conditions, a suitable shunt resistor will be required.

SCREENING

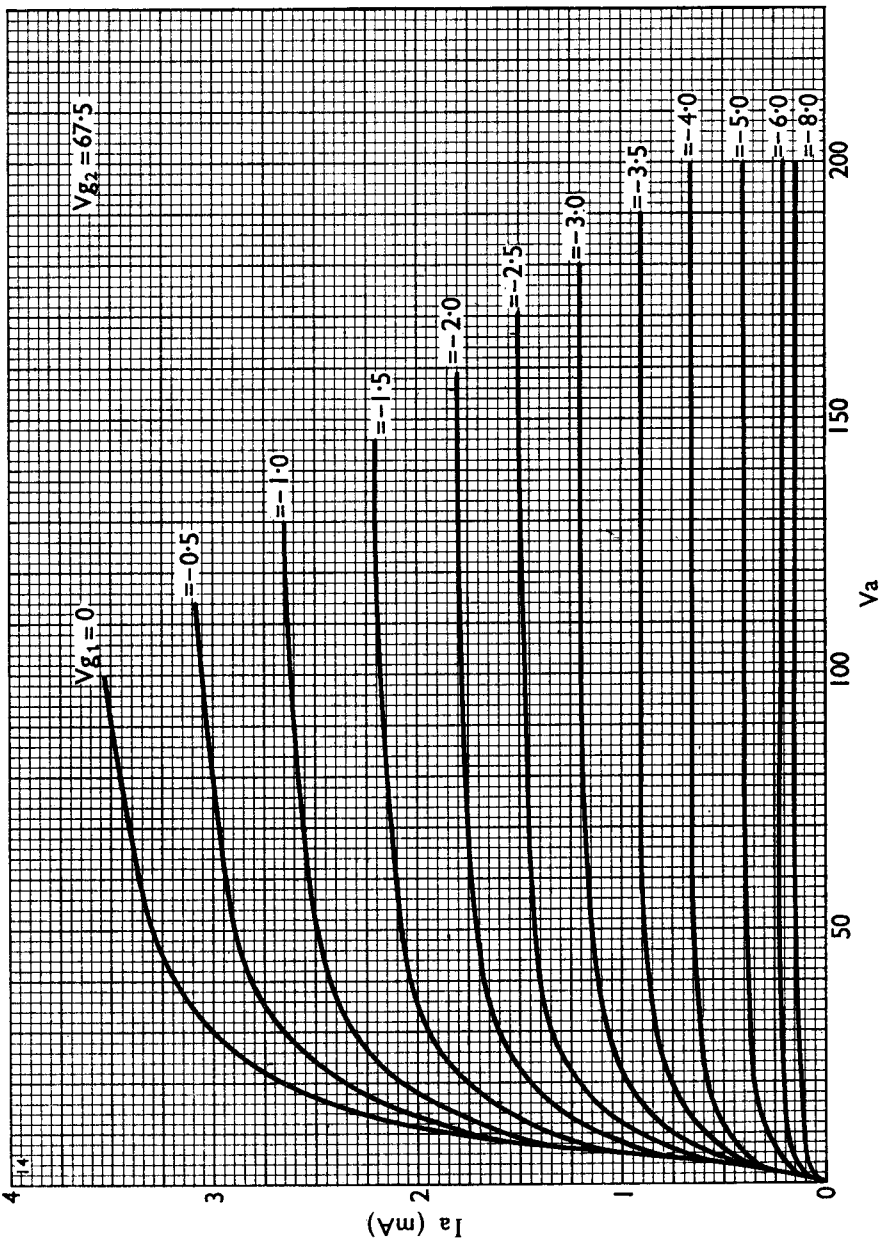
An internal screen is fitted and is connected to pins 1 and 5.


TRIODE CONNECTION
Vg1=+5·0
=+2·5
=0
=-2·5
=-5·0
=-7·5
=-10·0
=-15·0
=-20·0
=-25·0
Ig1 at Vg1=+5·0
Ig1 at Vg1=+2·5
Ia and Ig1 (mA)
Va
0
1
2
3
4
5
6
7
8
25
50
75
100
125
150

Ia (mA)
gm (mA/V)
10
1·0
0·1
0·01
Va = 90
Vg2 = 67·5
Ia
gm
-4
-8
-12
-16
Vg1
16

STAGE GAIN AND ACCEPTANCE – g1 BIAS
FOR TYPICAL I F AMPLIFIER CIRCUIT
FEEDING DIODE DETECTOR.
CARRIER MODULATED 80%
1% DISTORTION OF L F OUTPUT
Va = 90
Vg2 = 67·5
ACCEPTANCE VOLTAGE (RMS.)
STAGE GAIN
100
10
1·0
0·1
0
-2
-4
-6
-8
-10
-12
Vg1
ACCEPTANCE
STAGE GAIN
17

W17


$V_{g_2} = 67.5$
$V_{g_1} = 0$
$= -0.5$
$= -1.0$
$= -1.5$
$= -2.0$
$= -2.5$
$= -3.0$
$= -3.5$
$= -4.0$
$= -5.0$
$= -6.0$
$= -8.0$
I_a (mA)
V_a
0
1
2
3
4
50
100
150
200

Marconi W21

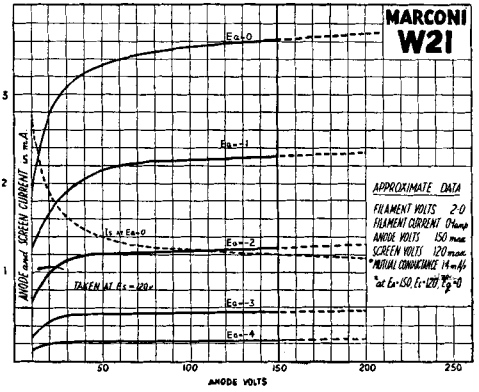
2 volt Variable Mu H.F. Pentode

Marconi W21 is suitable for the H.F. and I.F. stages of all battery receivers. It gives high gain with economical operation.

Nominal Rating, see curve

Inter-electrode capacities
(*metallised valve*).

A—G	.006$\mu\mu$F
A—E	6.8$\mu\mu$F
G—E	10.5$\mu\mu$F



Dimensions : 125×41 mm. 4 or 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

Anode voltage	150	150	120
Screen voltage	150	150 through 25,000 ohms	120
Grid bias	−1.5	−1.5	−1.0
Anode current	3.0 mA	3.0 mA	2.3 mA
Screen current	0.9 mA	0.7 mA	0.7 mA

Notes.

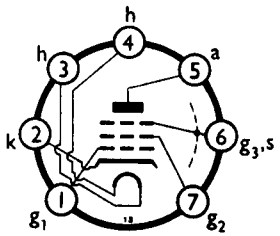
Full control of gain is given by 9-12 volts bias. The total effective resistance between grid and filament should not exceed 2.0 megohms. W21 may be used as a grid leak detector with an anode load of 75,000 ohms and screen feed of 200,000 ohms, but the Z21 is in general more suitable for this purpose.

Price - - 9/-

MINIATURE
VARIABLE-MU R.F. PENTODE
6·3V INDIRECTLY HEATED

W77
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	49—55	mm
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

V_h		6·3	V
I_h		0·2	A
V_a		250 max.	V
V_{g2}		250 max.	V
p_a		2·5 max.	W
p_{g2}		0·5 max.	W
r_a	at $V_a = V_{g2} = 200$, $V_{g1} = -2·5$	0·5 approx.	MΩ
g_m		2·5	mA/V

CAPACITANCES

$c_{a\text{-all}}$	7	pF	$c_{g1\text{-all}}$	4·2	pF	$c_{a\text{-}g1}$	0·006	pF

TYPICAL OPERATION

V_a	200	V
V_{g2}	200	V
V_{g3}	0	V
V_{g1}	−2·5	V
I_a	8	mA
I_{g2}	2	mA
R_k	250	Ω

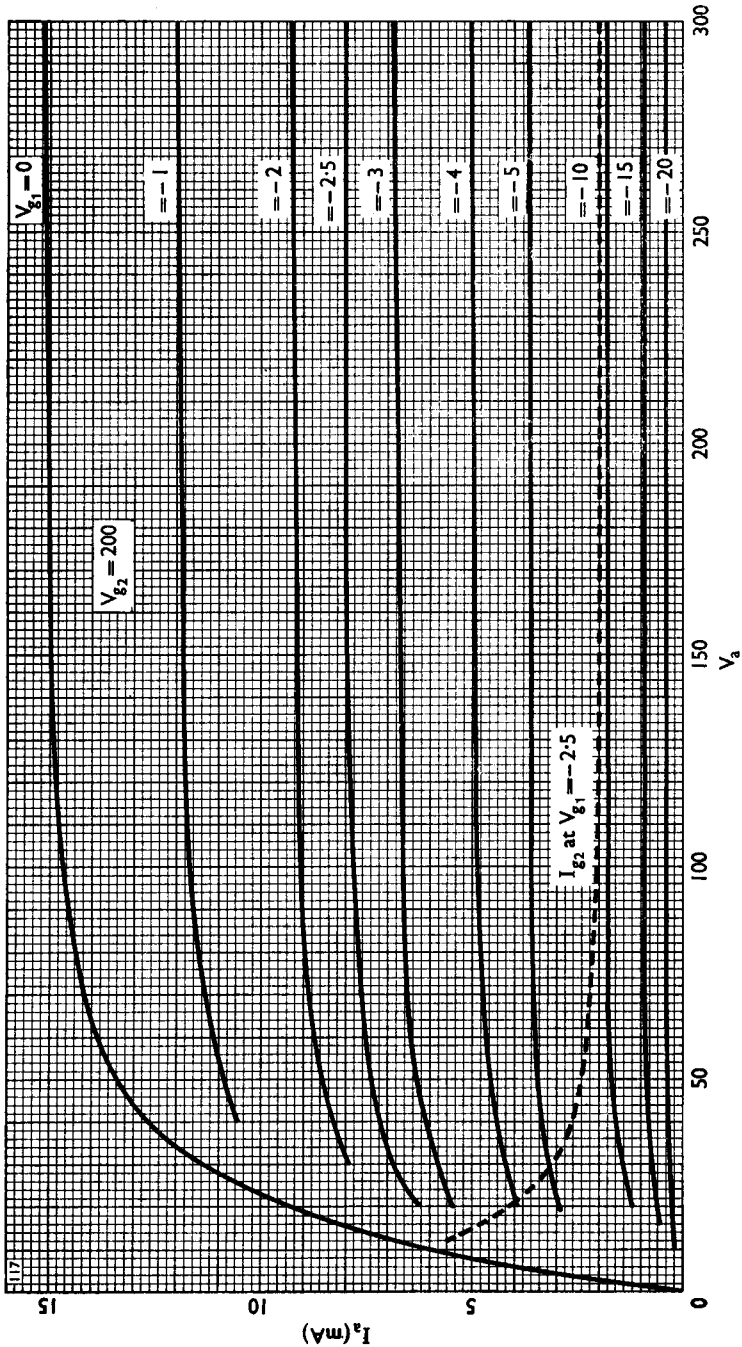
The maximum D.C. resistance between control grid and cathode must not exceed 4 MΩ.

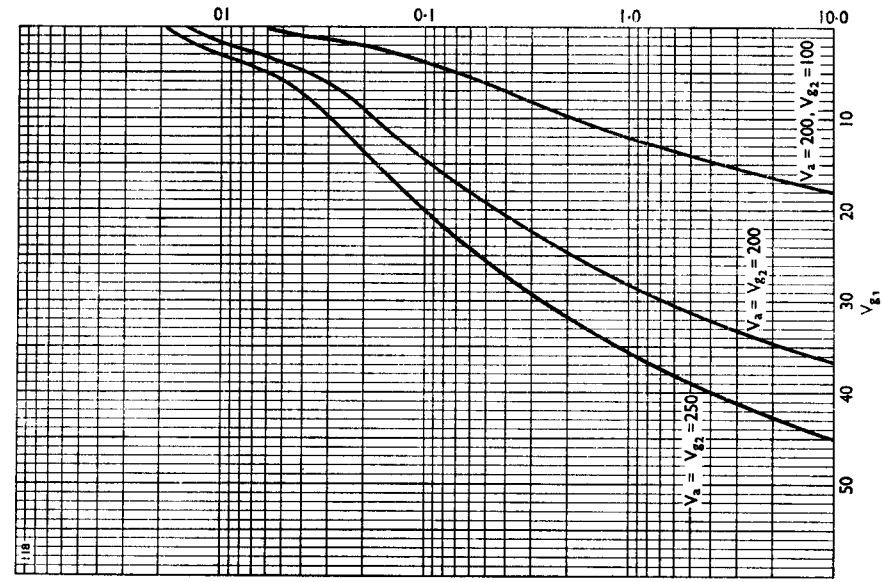
SCREENING

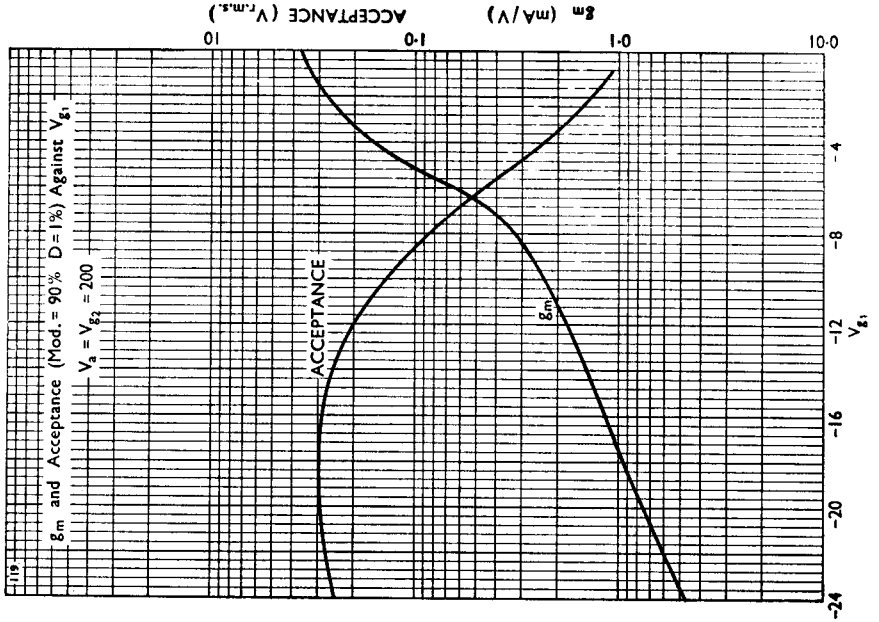
An internal screen is fitted, and is connected to pin 6.

MOUNTING

Any position.


$V_{g_1}=0$
$=-1$
$=-2$
$=-2{\cdot}5$
$=-3$
$=-4$
$=-5$
$=-10$
$=-15$
$=-20$
$V_{g_2}=200$
I_{g_2} at $V_{g_1}=-2{\cdot}5$
I_a (mA)
V_a
0
5
10
15
50
100
150
200
250
300
1177


I_a (mA)
10
1·0
0·1
10·0
$V_a = V_{g_2} = 250$
$V_a = V_{g_2} = 200$
$V_a = 200, V_{g_2} = 100$
V_{g_1}
10
20
30
40
50
811
118


g_m (mA/V)
ACCEPTANCE ($V_{r.m.s.}$)
10
1·0
0·1
10·0
g_m and Acceptance (Mod. = 90% D = 1%) Against V_{g_1}
$V_a = V_{g_2} = 200$
ACCEPTANCE
g_m
V_{g_1}
-4
-8
-12
-16
-20
-24
119

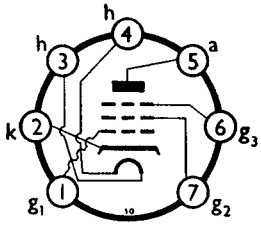
OV.1683

Printed in England. C.

MINIATURE
VARIABLE-MU R.F. PENTODE
0·1A INDIRECTLY HEATED

W107
OCTOBER, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

		Pentode connection	Triode connection	
I_h		0·1	0·1	A
V_h		12·6 approx.	12·6 approx.	V
I_k		12 max.	12 max.	mA
V_a		250 max.	250† max.	V
V_{g2}		250 max.	—	V
p_a		2·5 max.	3† max.	W
p_{g2}		0·5 max.	—	W
μ	at $V_a = V_{g2} = 200$, $V_{g1} = -2·5$	—	30	
r_a		500	10	kΩ
g_m		2·5	3	mA/V

† combined anode and screen grid rating.

CAPACITANCES (of unscreened valve)

$c_{a\text{-all}}$	7	pF	$c_{g1\text{-all}}$	4·2	pF	$c_{a\text{-}g1}$	0·006	pF

TYPICAL OPERATION

Class A Amplifier. Pentode Connection

V_a	200	V
V_{g2}	200	V
V_{g3}	0	V
V_{g1}	−2·6	V
I_a	8	mA
I_{g2}	2	mA
R_k	270	Ω

The effective external grid to cathode resistance should not exceed 4 MΩ.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

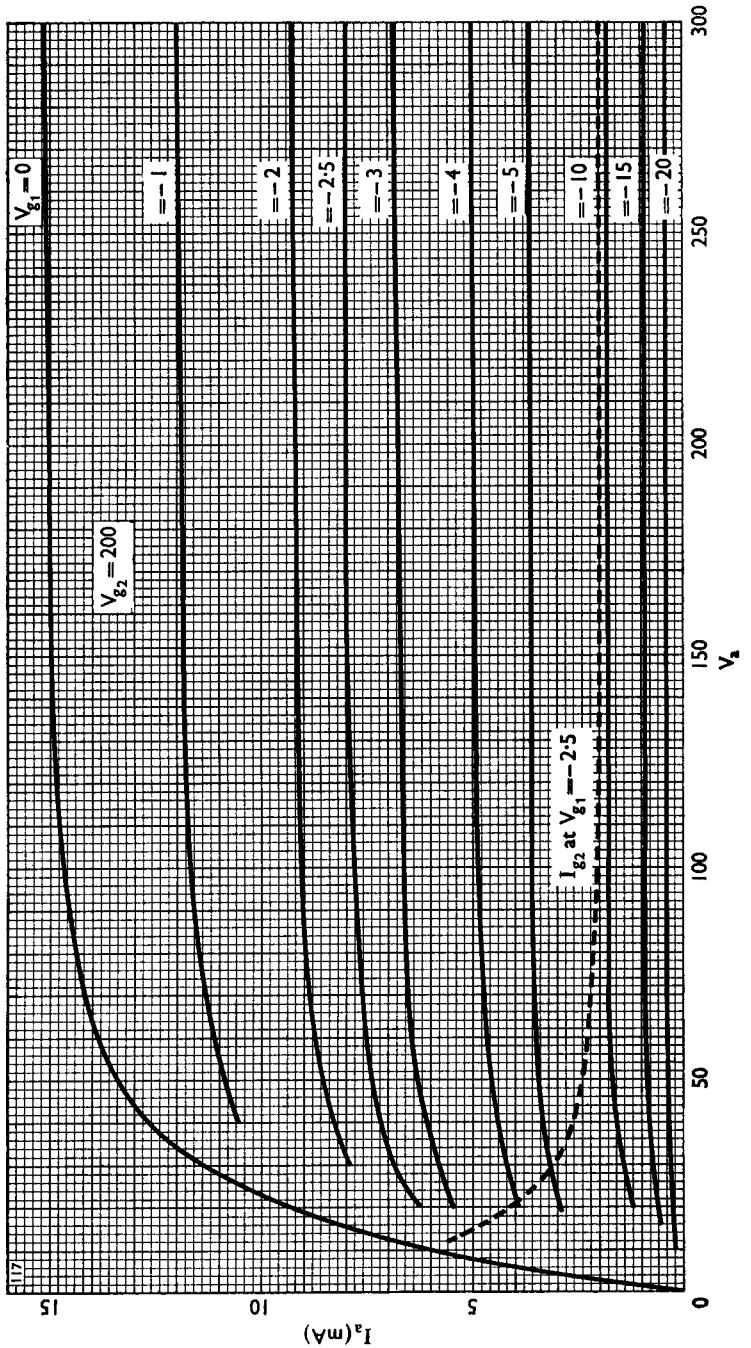
MICROPHONY

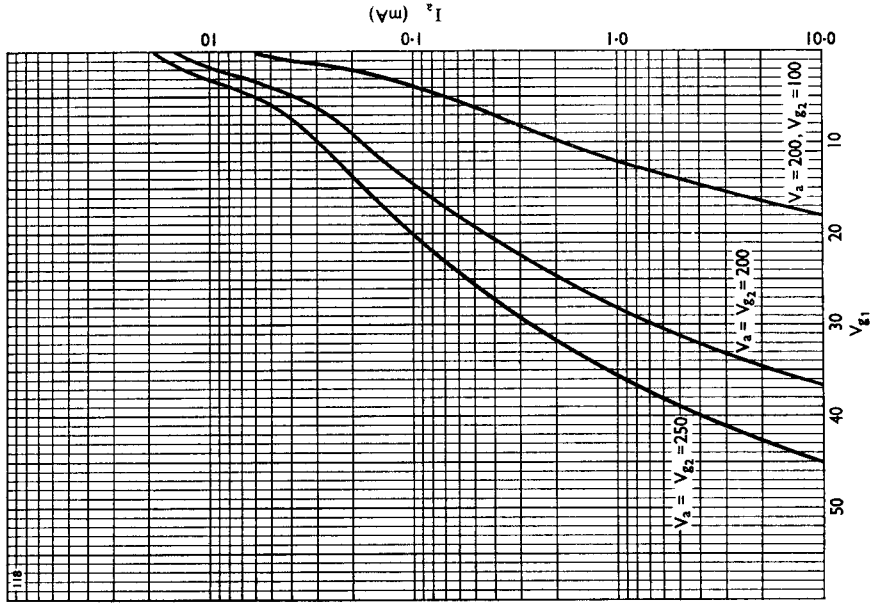
Although this is of a very low order, equipment should be designed to minimise microphony.

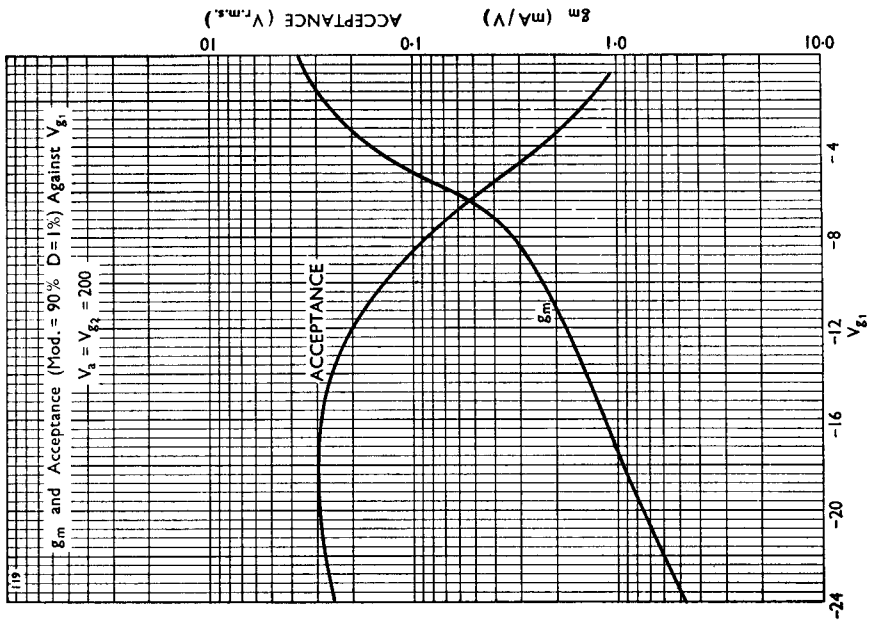
VENTILATION

No special precautions.

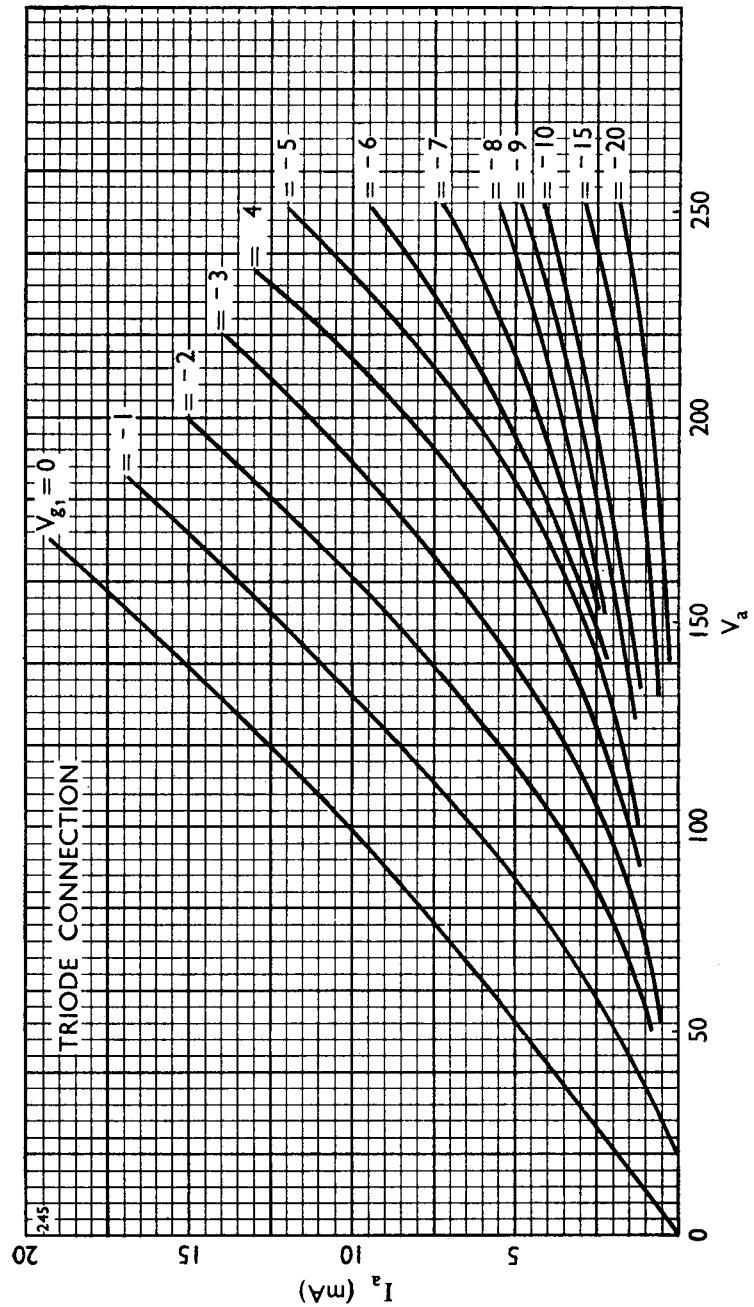
W107


$V_{g_1}=0$
$=-1$
$=-2$
$=-2{\cdot}5$
$=-3$
$=-4$
$=-5$
$=-10$
$=-15$
$=-20$
$V_{g_2}=200$
I_{g_2} at $V_{g_1}=-2{\cdot}5$
I_a(mA)
V_a
0
50
100
150
200
250
300
5
10
15
117


I_a (mA)
10
1·0
0·1
10·0
$V_a = 200, V_{g2} = 100$
$V_a = V_{g2} = 200$
$V_a = V_{g2} = 250$
V_{g1}
10
20
30
40
50
118


g_m (mA/V)
ACCEPTANCE ($V_{r.m.s.}$)
10
1·0
0·1
10·0
g_m and Acceptance (Mod. = 90% D = 1%) Against V_{g1}
$V_a = V_{g2} = 200$
ACCEPTANCE
g_m
V_{g1}
-4
-8
-12
-16
-20
-24
119

W107



Printed in England. C.

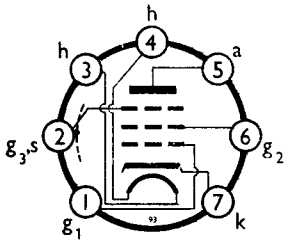
R.F. REMOTE CUT-OFF PENTODE 6·3V INDIRECTLY HEATED

W727/6BA6

NOVEMBER, 1954

The W727/6BA6 is a commercial equivalent of CV.454

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	54·5 max.	mm
Seated length :	47·5 max.	mm.
Diameter :	19 max.	mm.

HEATER

V_h	6·3	V
I_h	0·3	A

MAXIMUM RATINGS (design centre)

V_a	300	V
V_{g2}	125	V
V_{h-k}	150	V
p_a	3	W
p_{g2}	0·6	W

CHARACTERISTICS

V_a	250	100	V
V_{g2}	100	100	V
I_a	11·0	10·8	mA
I_{g2}	4·2	4·4	mA
V_{g1}	−1·0	−1·0	V
V_{g1} (for g_m=40 μA/V)	−20	−20	V
*V_{g3}	0		V
g_m	4·4	4·3	mA/V
r_a	1·5	0·25	MΩ

* Connected to cathode externally

CAPACITANCES (of cold unscreened valve)

c_{in} 5·5 pF c_{out} 5·0 pF $c_{a\text{-}g1}$ 0·0035 pF

MOUNTING

Any position.

SCREENING

An internal screen is fitted.

RETAINING

It is recommended that a retaining device is used.

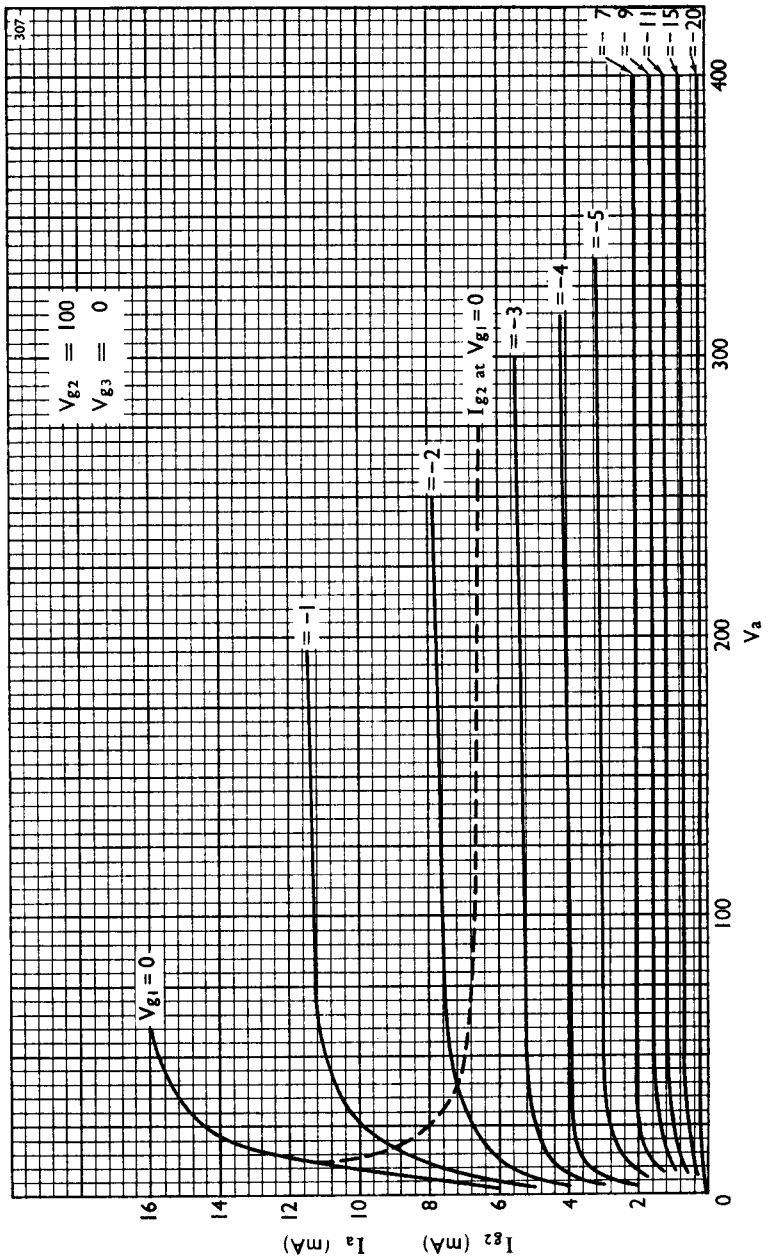
VENTILATION

No special precautions.

MICROPHONY

The valve is free from microphony in normal receiver applications.

W727/6BA6



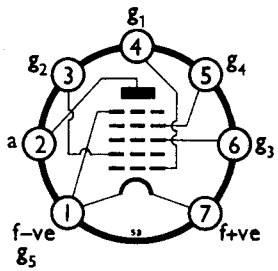
Printed in England. C.

MINIATURE
HEPTODE FREQUENCY CHANGER
1·4V DIRECTLY HEATED

X18
MARCH, 1954

For use as a frequency changer in battery operated receivers where economy of current consumption is important. The valve will oscillate satisfactorily at reduced battery voltages at frequencies up to 26 Mc/s.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Diameter :	19 max.	mm.

FILAMENT

V_f	1·4	V
I_f	0·05	A

MAXIMUM RATINGS (design centre)

V_a	90	max.	V
V_{g4}	67·5	max.	V
V_{g2}	67·5	max.	V
I_k	5·5	max.	mA

CHARACTERISTICS

V_a	67·5	67·5	90	90	V
V_{g2}	67·5	67·5	67·5	67·5	V
V_{g4}	45	45	45	45	V
I_a	1·1	0·01	1·15	0·01	mA
I_{g2}	2·85	3·8	2·85	3·8	mA
I_{g4}	0·35	0·01	0·35	0·01	mA
V_{g1} (pk)	15	15	15	15	V
V_{g3}	0	−9	0	−9	V
g_c	296	6	320	6	μA/V
r_a	0·6	>4	0·6	>4	MΩ

CAPACITANCES (of cold unscreened valve)

$c_{g3\text{-all}}$	7·0 pF	$c_{a\text{-}g3}$	0·4 pF	$c_{g2\text{-}g3}$	1·6 pF
$c_{a\text{-all}}$	7·0 pF	$c_{g1\text{-}g2}$	0·2 pF		
$c_{g1\text{-all}}$	3·8 pF	$c_{a\text{-}g1}$	0·1 pF		

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford

TYPICAL OPERATION (Circuit: page 6)

V_a (b)	90		V
V_a	82	approx.	V
V_{g2}	67·5	approx.	V
V_{g1} (pk)	10		V
R_{g2}	5·6		kΩ
V_{g4}	55	approx.	V
R_{g4}	150		kΩ
I_a	0·86		mA
I_{g2}	3·0		mA
I_{g4}	0·23		mA
Conversion gain	30		

Satisfactory operation can be obtained with reduced battery voltages of 1·1V L.T and 60V H.T. (the run down battery condition) using the circuit shown. The minimum conversion gain in these conditions will be 6 at frequencies up to 26 Mc/s.

MOUNTING

Any position.

SCREENING

No internal or external screening is fitted. A separate screening canister should be used.

RETAINING

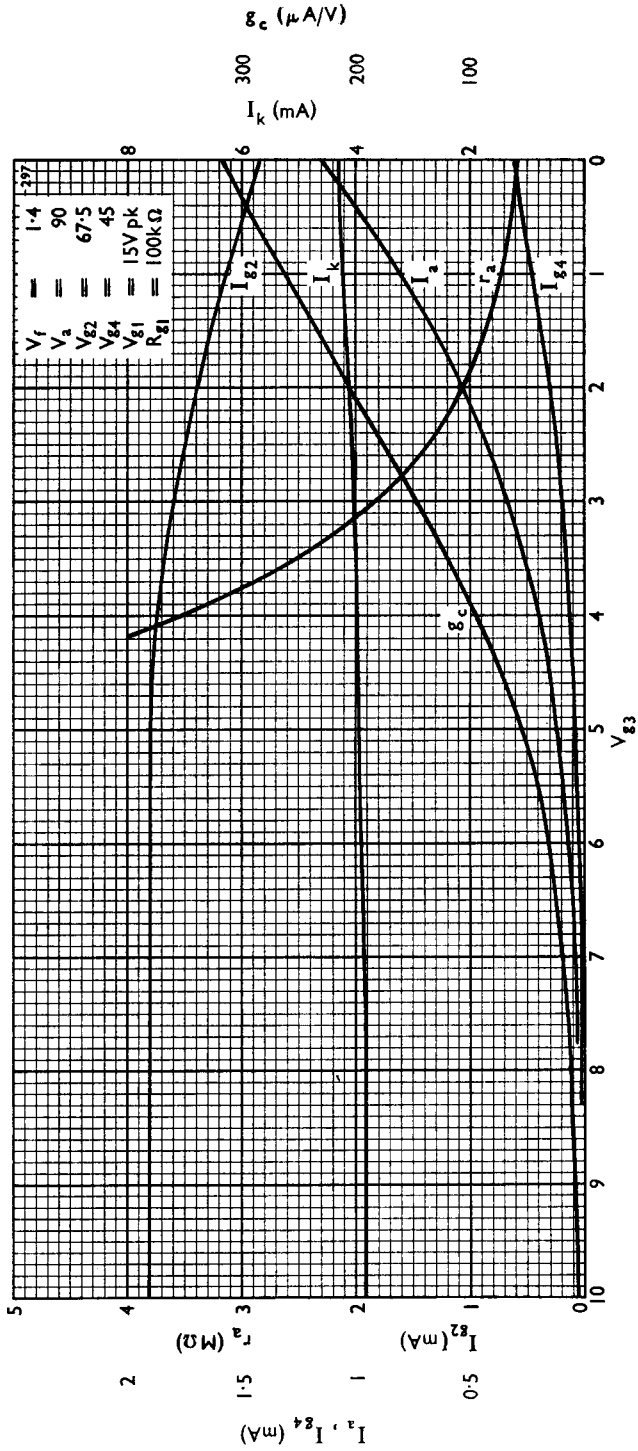
The use of a retaining device is recommended.

VENTILATION

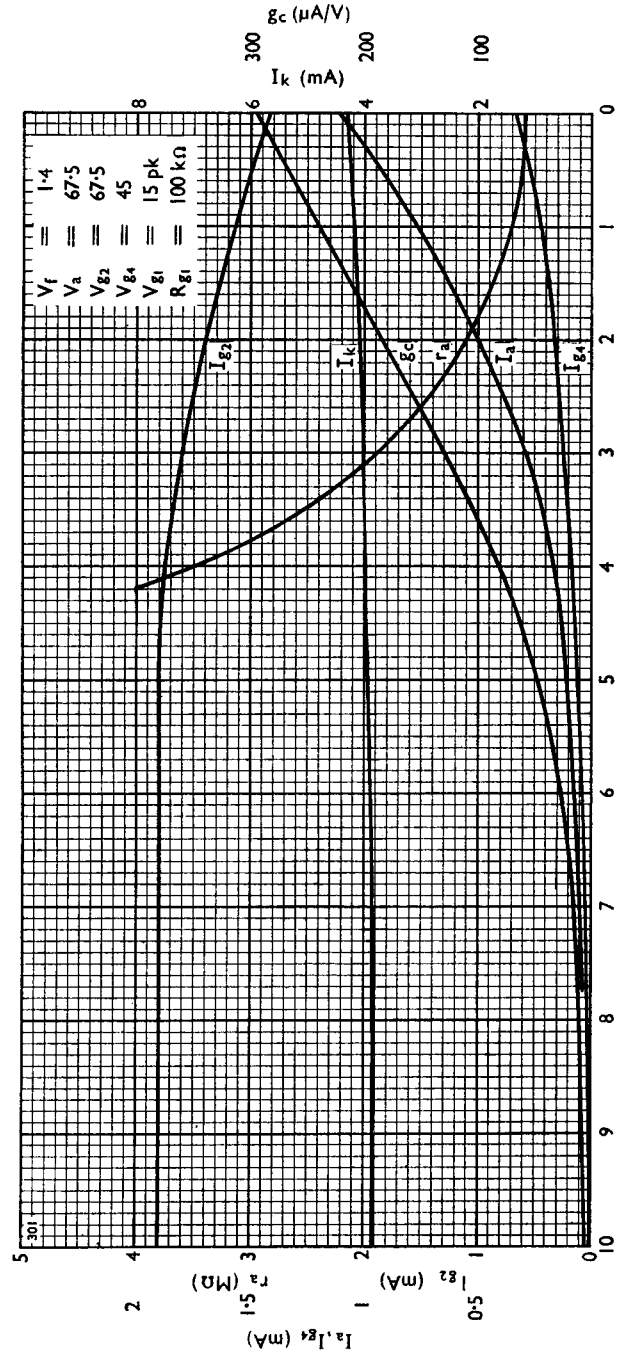
No special precautions.

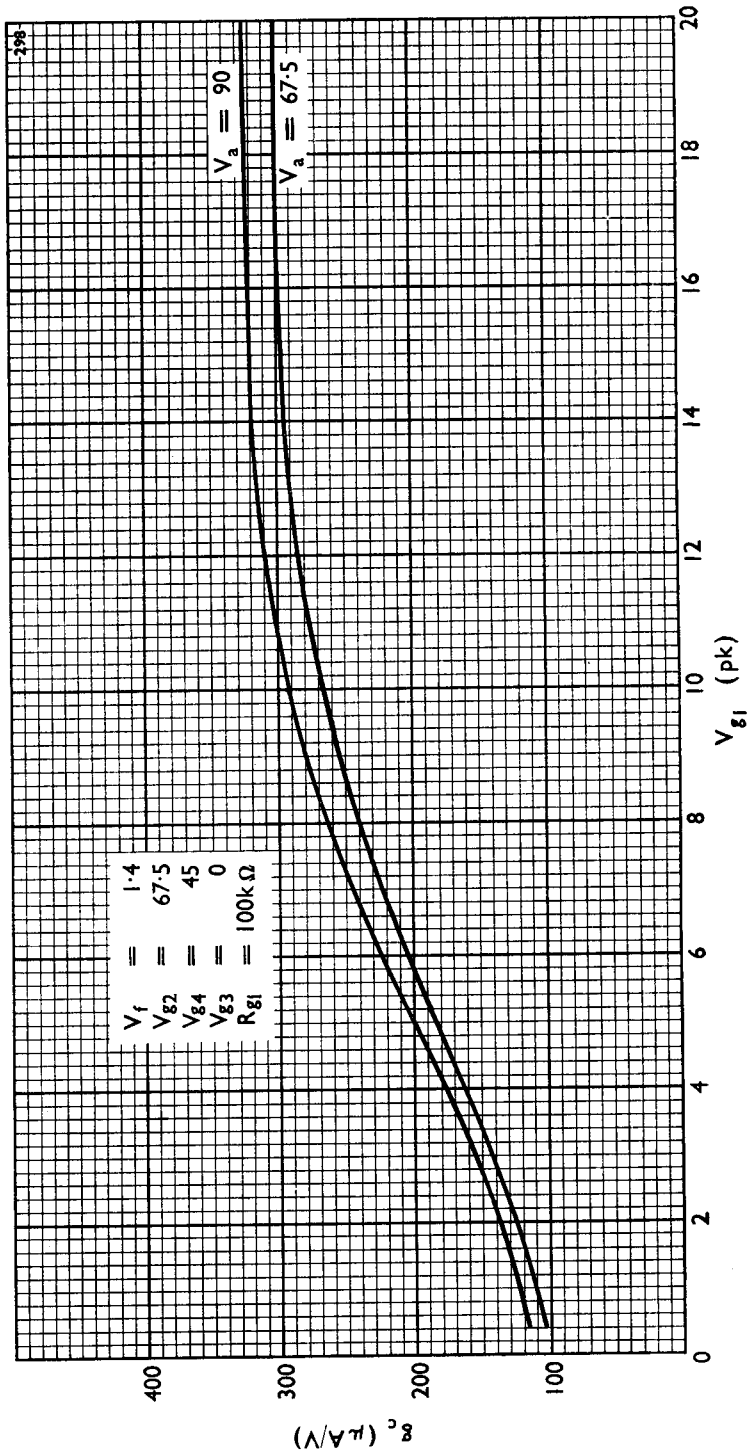
MICROPHONY

This valve is free from microphony in normal receiver applications.

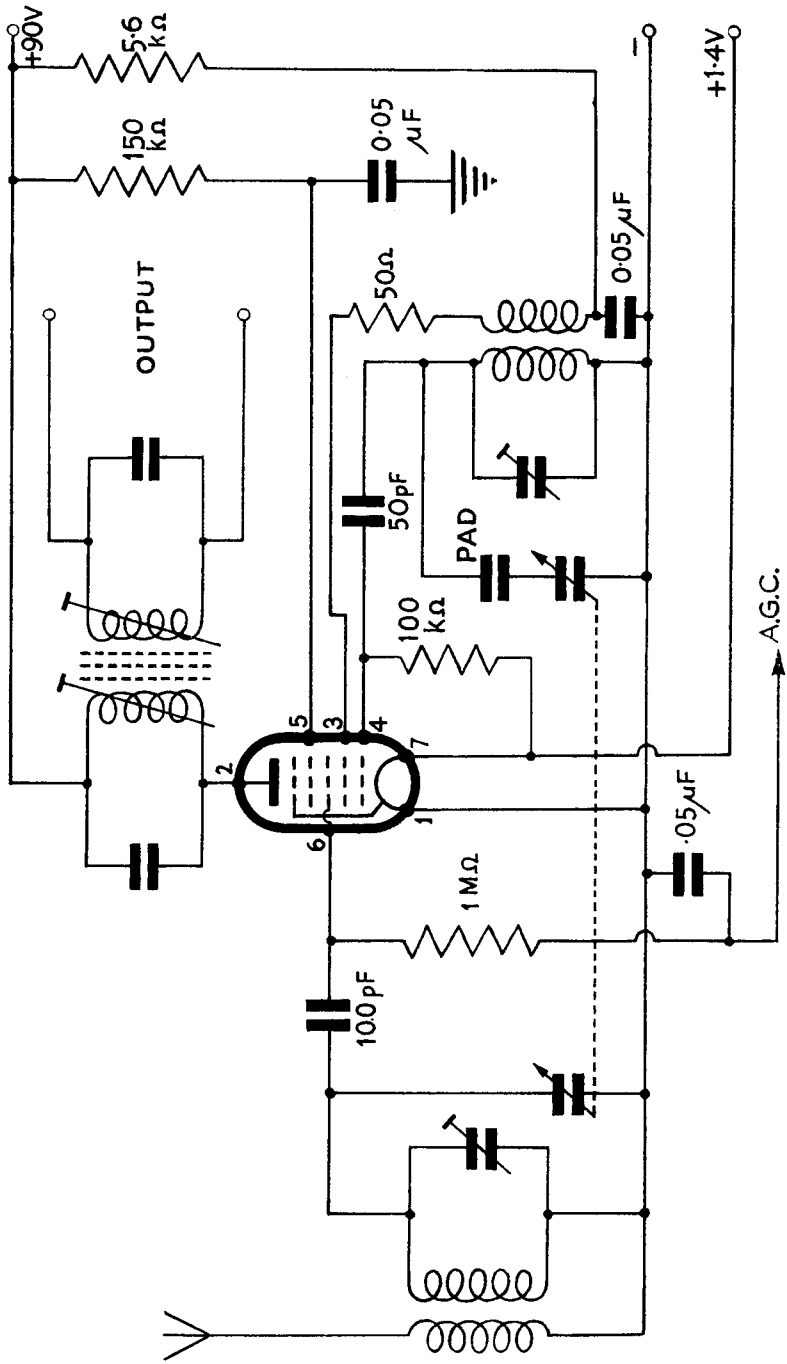

g_c (μA/V)
300
200
100
I_k (mA)
8
6
4
2
0
-3·97
1·4
90
67·5
45
15V pk
100kΩ
V_f
V_a
V_{g2}
V_{g4}
V_{g1}
R_{g1}
I_{g2}
I_k
I_a
r_a
I_{g4}
g_c
V_{g3}
I_a , I_{g4} (mA)
2
1
0·5
r_a (MΩ)
5·1
I_{g2} (mA)
5
4
3
2
1
0
10
9
8
7
6
5
4
3
2
1
0

X18


g_c (μA/V)
300
200
100
I_k (mA)
8
6
4
2
0
V_f = 1·4
V_a = 67·5
V_{g2} = 67·5
V_{g4} = 45
V_{g1} = 15 pk
R_{g1} = 100 kΩ
I_{g2}
I_k
g_c
r_a
I_a
I_{g4}
V_{g3}
I_a, I_{g4} (mA)
r_a (MΩ)
I_{g2} (mA)
2
1·5
1
0·5
0
5
4
3
2
1
0
10
9
8
7
6
5
4
3
2
1
0
301


298
V_a = 90
V_a = 67·5
V_f = 1·4
V_{g2} = 67·5
V_{g4} = 45
V_{g3} = 0
R_{g1} = 100kΩ
g_c (μA/V)
400
300
200
100
0
2
4
6
8
10
12
14
16
18
20
V_{g1} (pk)

X18


+90V
5·6 kΩ
150 kΩ
0·05 µF
OUTPUT
50Ω
0·05µF
50pF
PAD
100 kΩ
A.G.C.
1 MΩ
10·0 pF
·05µF
+1·4V
–

OV.2312 Printed in England. C.

Marconi 2-volt Battery Valves

Marconi X22

2 volt Heptode

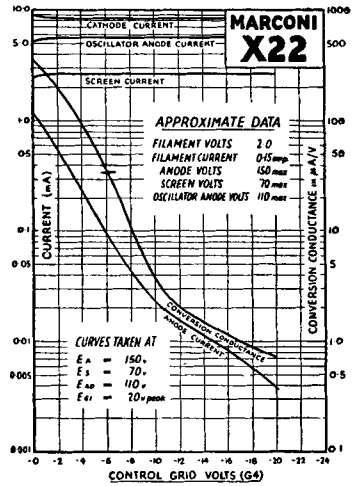
Marconi X22 is a heptode frequency changer for battery receivers. It operates satisfactorily down to 12 metres.

Nominal Rating, see curve.

Inter-electrode capacities.

(metallised valve).

G_4-A	0.61$\mu\mu$F	G_4-E	12.7$\mu\mu$F
G_4-G_1	0.22$\mu\mu$F	G_1-G_2	1.6$\mu\mu$F
A $-$E	23.7$\mu\mu$F	G_1-E	8.5$\mu\mu$F



Dimensions : 130×45 mm. 7 pin base ; for connections see pages 4-5.

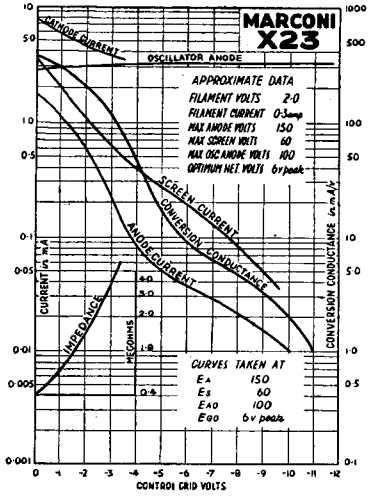
Typical Operating Data.

Anode voltage	150	100
Oscillator anode voltage	110	80
Screen voltage	70	55
Total cathode current	8.5 mA	5.0 mA
Heterodyne voltage L.W. operation ...	20 peak	
Heterodyne voltage S.W. operation ...	6-10 peak	

Notes.

A standard tuned grid circuit should be used. With 150v. H.T. the screen may be fed through a series resistance of 30,000 ohms, and the oscillator anode through 50,000—100,000 for L.W. operation and 10,000 ohms. for S.W.

Price - - 10/6



Marconi X23

2 volt Triode Hexode

Marconi X23 is a triode hexode frequency changer particularly suitable for all-wave receivers.

Its design ensures easy oscillation and lack of "pulling" at the highest frequencies.

Nominal Rating, see curve.

Inter-electrode capacities
(metallised valve).

G_1-A	0.05$\mu\mu$F	A_o-E	9.8$\mu\mu$F
G_1-E	6.3$\mu\mu$F	G_o-E	21.5$\mu\mu$F
G_1-G_o	0.5$\mu\mu$F	G_o-A_o	4.1$\mu\mu$F
A $-$E	17.5$\mu\mu$F		

Dimensions : 120 × 42 mm. 7 pin base ; for connections see pages 4-5

Typical Operating Data.

Anode voltage	150
Screen voltage	60
Oscillator anode voltage	150 through 20,000 ohms
Grid bias	−1.5
Heterodyne voltage	6 peak
Anode current	0.7 mA
Screen current	1.7 mA
Oscillator anode current	2.1 mA

Notes.

A tuned grid circuit is normally recommended. Comparatively loose coupling can be used between grid and anode circuits since the triode has adequate slope. If the screen is fed through a series resistance from maximum H.T. instead of from a tap on the battery, the grid base is greatly extended. A method which retains a reasonably short grid base is to feed the screen through 20,000 ohms from the oscillator anode this being fed from maximum H.T. through a further 20,000 ohms.

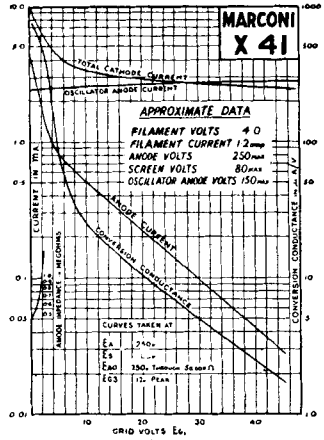
Price - - 10/6

Marconi 4v. A.C. Mains Valves

Marconi X41

Triode Hexode

Marconi X41 is a frequency changer suitable for all wavelengths including the Television band.



Nominal rating, see curve.

Inter-electrode capacities
(metallised valve.).

G_1—A	0.046$\mu\mu$F	A_o—E	8.5$\mu\mu$F
G_1—E	7.0$\mu\mu$F	G_o—E	17.0$\mu\mu$F
A—E	21.5$\mu\mu$F	G_o—G_1	0.26$\mu\mu$F
A_o—G_o	3.56$\mu\mu$F		

Dimensions : 135×44.5 mm. 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

Anode voltage	250
Screen voltage	70
Oscillator anode voltage	100
Heterodyne voltage, L.W. operation	12 volts peak
Heterodyne voltage, S.W. operation	6 volts peak
Grid bias	—1.5
Bias resistance	200 ohms
Conversion impedance	1.25 megohm
Total cathode current	5.4 mA

Notes.

A tuned anode circuit is recommended for minimum pulling but tuned grid can be used with highly satisfactory results. The screen should be fed from a low resistance potentiometer and the oscillator anode from full H.T. through a series resistance of 50,000—100,000 ohms. The effective resistance between grid and cathode should not exceed 4.0 megohms.

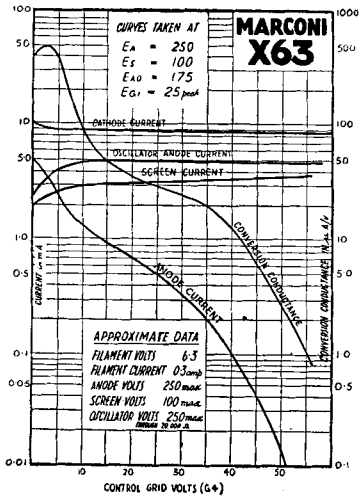
Price - - 11/6

Marconi X41c

Marconi X41c is identical with X41 in characteristics but it has a ceramic base to eliminate the last traces of frequency drift in television receivers.

Price 12/6

Marconi International Range Valves



Marconi X63

Heptode

Marconi X63 is a frequency changer which will operate satisfactorily on all wavelengths down to 15 metres.

Nominal Rating, see curve.

Inter-electrode capacities
(with screening can)

A — G_4	0.3$\mu\mu$F	G_4 — E	8.6$\mu\mu$F
G_4 — G_2	0.21$\mu\mu$F	G_2 — E	6.2$\mu\mu$F
G_4 — G_1	0.22$\mu\mu$F	G_1 — E	8.2$\mu\mu$F
G_1 — G_2	1.20$\mu\mu$F	A — E	12.9$\mu\mu$F

Dimensions : 114 × 40 mm. Octal base ; for connections see pages 4-5.

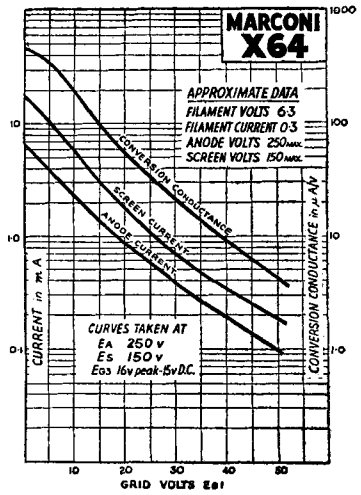
Typical Operating Data.

Anode voltage	250
Screen voltage	100
Oscillator anode voltage	250 through 20,000 ohms min.
Heterodyne voltage	25 peak
Grid bias	−3
Total cathode current	12 mA max.

Notes.

The screen should be fed from a potentiometer of good regulation. The heterodyne voltage is not very critical and can vary from the optimum between 5 and 35 volts peak without serious effect in gain. A small capacity of 1 — 2$\mu\mu$F introduced between G_1 and G_4 improves the gain on the higher frequencies. It is not advisable to apply A.V.C. to this valve below 50 metres.

Price - - 11/6



Marconi X64

Mixing Heptode

Marconi X64 is a mixing valve requiring a separate oscillator (KTZ63 or L63 are suitable) to form a complete frequency changing stage.

Nominal Rating, see curve.

Inter-electrode capacities
(with screening can)

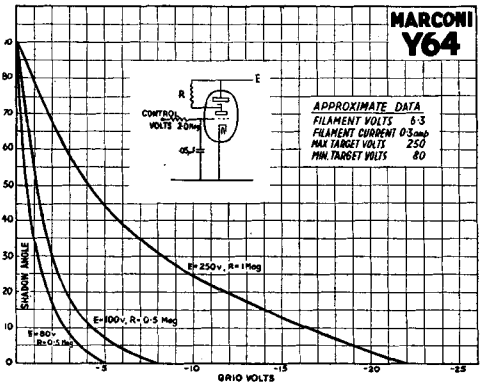
G_1-A	0.14$\mu\mu$F	A $-$E	10.9$\mu\mu$F
A $-G_3$	0.72$\mu\mu$F	G_1-E	6.0$\mu\mu$F
G_1-G_3	0.15$\mu\mu$F	G_3-E	11.9$\mu\mu$F

Typical Operating Data.

Anode Voltage ...	250	250
Screen voltage ...	100	150
Grid bias	−3	−6
Peak heterodyne voltage ...	12	18
Anode current ...	2.4	3.25 mA
Screen current ...	6.5	8.75 mA
Conversion Conductance	290	310μA/V.

Dimensions : 114×40 mm. Octal base ; for connections see pages 4-5.

Price - - 10/6



Marconi Y63 and Y64

Tuning Indicators.

These indicators consist of a fluorescent screen and a variable mu triode amplifier. A shadow sector is varied in angle by the control voltage. Y63 is for A.C. receivers, Y64 for A.C./D.C. receivers where the H.T. voltage is usually too low to give a satisfactory glow with the Y63.

Dimensions : 108×40 mm. Octal base ; for connections see pages 4 & 5.

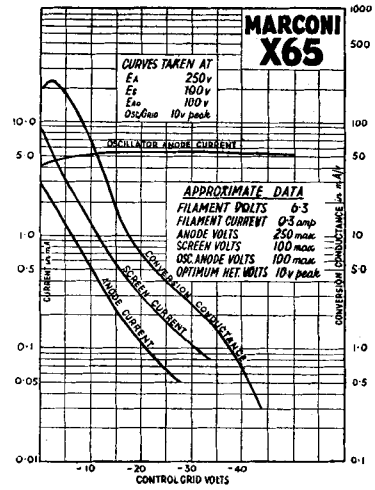
MARCONI 6G5 is Y63 capped with a small 6 pin base.

Price - - 8/6 each

Marconi X65

Triode Hexode

Marconi X65 is a frequency changer particularly suitable for all-wave receivers on account of its excellent short wave performance. Its input impedance remains high and pulling is negligible even at the highest frequencies.



Nominal Rating, see curve.

Inter-electrode capacities

(with screening can)

A — G_1	0.16$\mu\mu$F	G_3 — A_0	2.0$\mu\mu$F
A — E	10.2$\mu\mu$F	A_0 — E	6.6$\mu\mu$F
G_1 — E	4.0$\mu\mu$F	G_3 — E	10.2$\mu\mu$F
		G_3 — G_1	0.11$\mu\mu$F

Dimensions : 114×40 mm. Octal base ; for connections see pages 4-5.

Typical Operating Data.

Anode voltage	250
Screen voltage	100
Grid bias	−3
Oscillator anode voltage	250 through 30,000 min.
Heterodyne voltage	10 peak
Impedance	2.5 megohms
Total cathode current	11.0 mA

Notes.

A tuned grid circuit is recommended but tuned anode can also be used. The heterodyne voltage is not critical, the change in gain between 5 and 20 volts being less than 3db. In A.C. receivers one side of the heater should be taken to earth and the other side earthed through 0.001μF.

Price - - 11/6

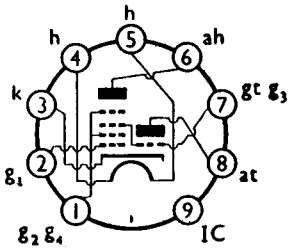
MINIATURE
TRIODE-HEXODE
6·3v INDIRECTLY HEATED

X79

OCTOBER, 1951

A frequency changer for operation up to 100 Mc/s.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	22	mm.

RATING

V_h	6·3		V
I_h	0·3	approx.	A
V_{ah}	250	max.	V
$V_{g2, g4}$	100	max.	V
V_{at}	100	max.	V
I_k	20	max.	mA
v_{gt} (pk)	10	opt.	V

TRIODE SECTION ONLY

At $V_a = 100$, $V_g = 0$

I_a	10	mA
μ	22	
g_m	2·8	mA/V

CAPACITANCES (of unscreened valve)

$c_{g1—ah}$	0·11	pF	$c_{g1—all}$	4·1	pF
$c_{g1—at}$	0·08	pF	$c_{at—all}$ (g_t earthed)	1·5	pF
$c_{g1—gt}$	0·22	pF	$c_{gt—all}$ (a_t earthed)	5·47	pF
$c_{gt—at}$	1·48	pF	$c_{ah—all}$	4·34	pF

TYPICAL OPERATION

V_a	250		V
$V_{g2, g4}$	75		V
V_{at}	100		V
v_{gt} (pk)	10		V
V_{g1}	0		V
I_a	4·5		mA
$I_{g2, g4}$	3·4		mA
I_{at}	4·5		mA
g_c	780 at $V_{g1} = 0$	v_{gt} (pk) = 0	μA/V
g_c	7·8 at $V_{g1} = -21$	v_{gt} (pk) = 0	μA/V
Z_c	0·7 at $V_{g1} = 0$	v_{gt} (pk) = 0	MΩ
$R_{gt—k}$	0·05		MΩ
*$r_{g1—k}$	3500		Ω
*$c_{g1—k}$	6		pF
†$r_{g1—k}$	150		kΩ

* at : $V_{ah} = 175$, $V_{g2, g4} = 75$, $V_{g1h} = 0$, $f = 45$ Mc/s.
† at : $V_{ah} = 175$, $V_{g2, g4} = 75$, $V_{g1h} = 0$, $v_{gt, g3}$ (pk) = 10

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

SCREENING

No internal or external screening is fitted to the valve. A separate screening can should be used.

MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

RETAINING

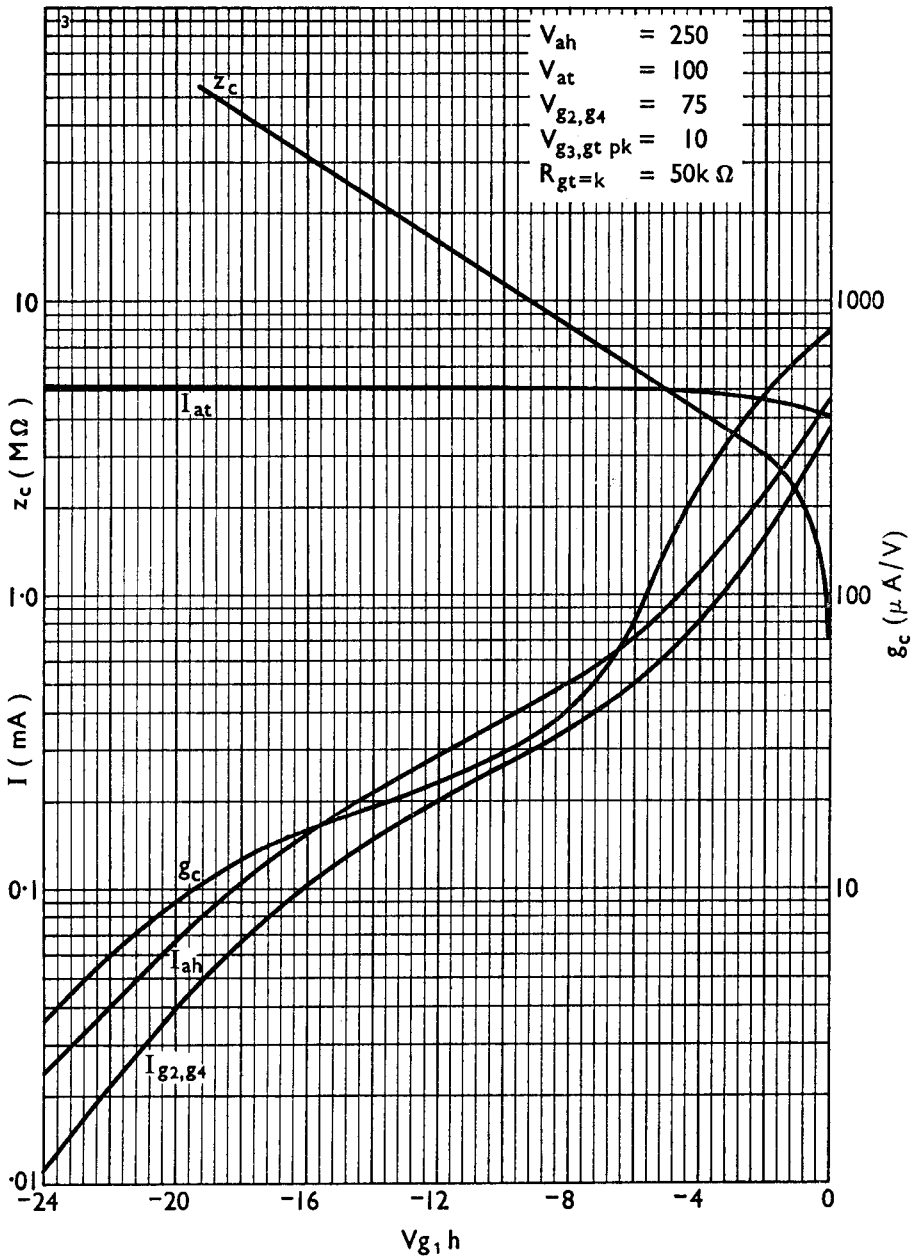
A retaining device should be used.

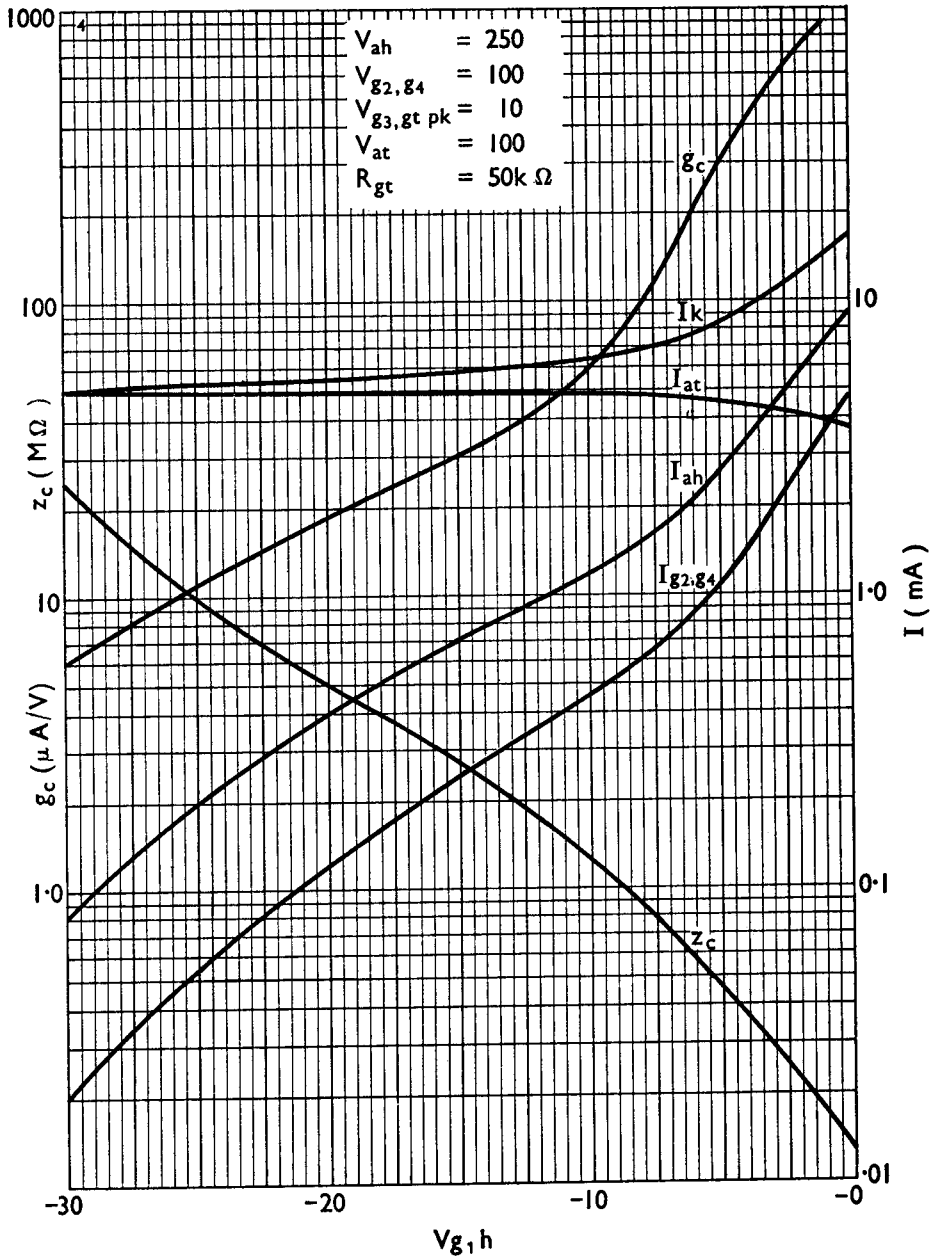
VENTILATION

No special precautions.

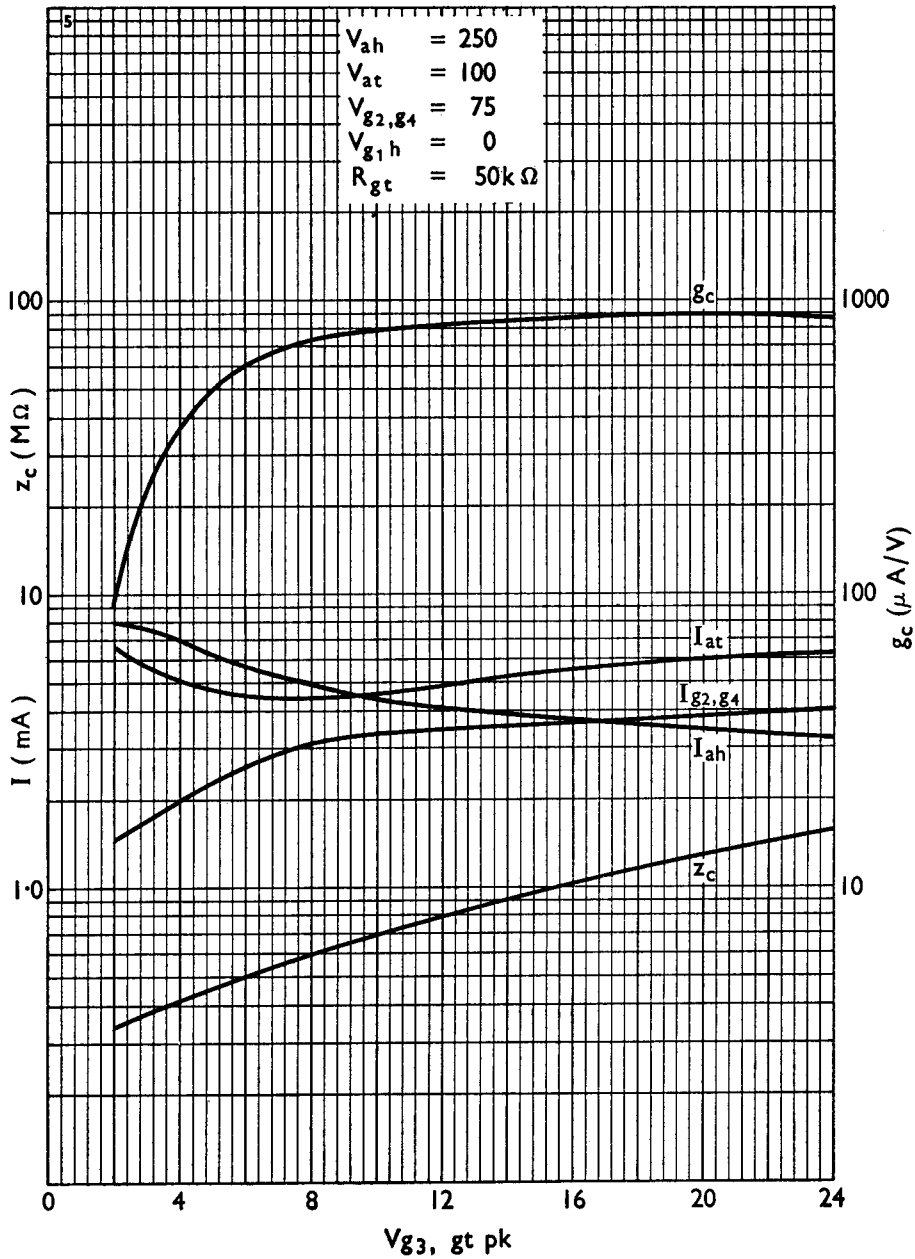
MOUNTING

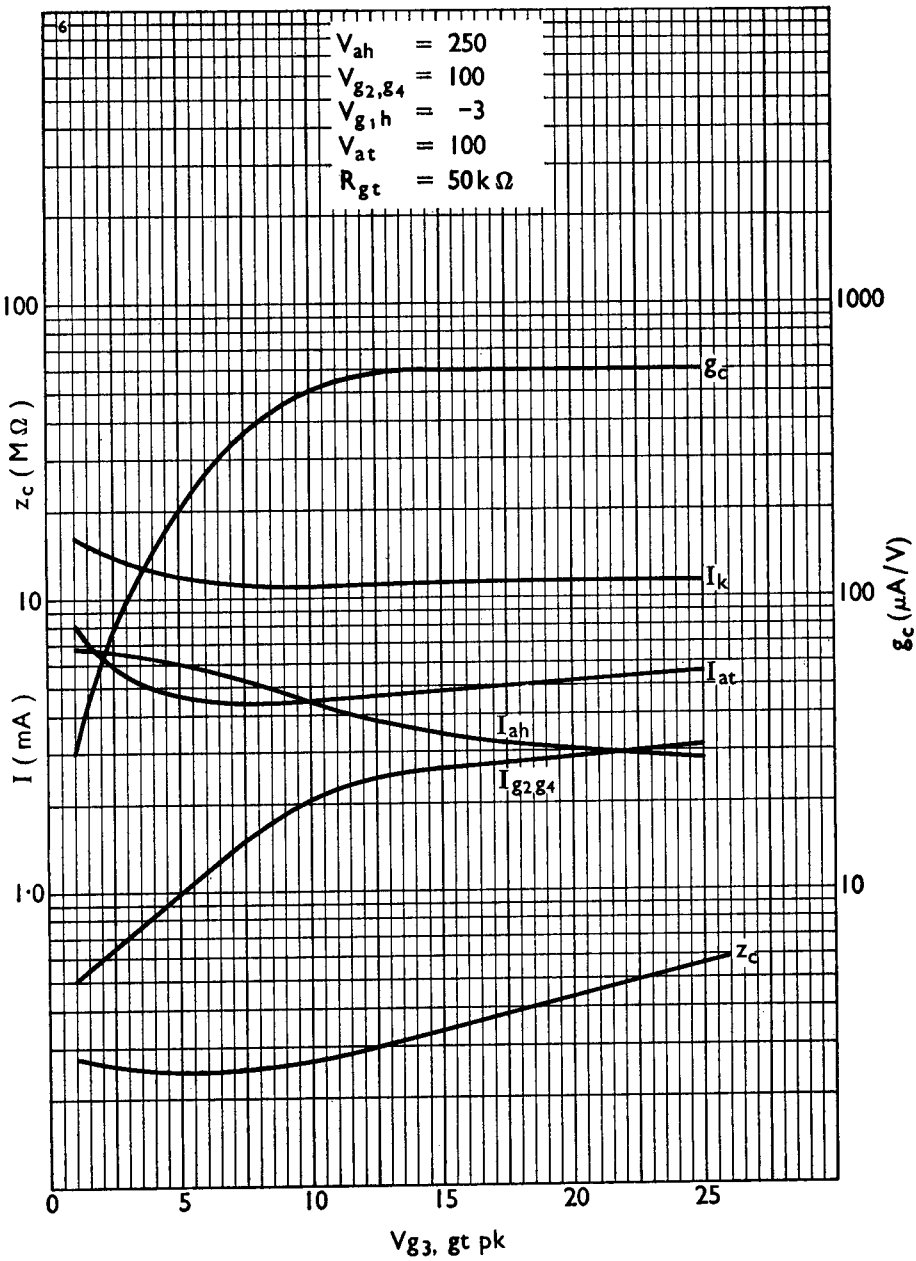
Any position.



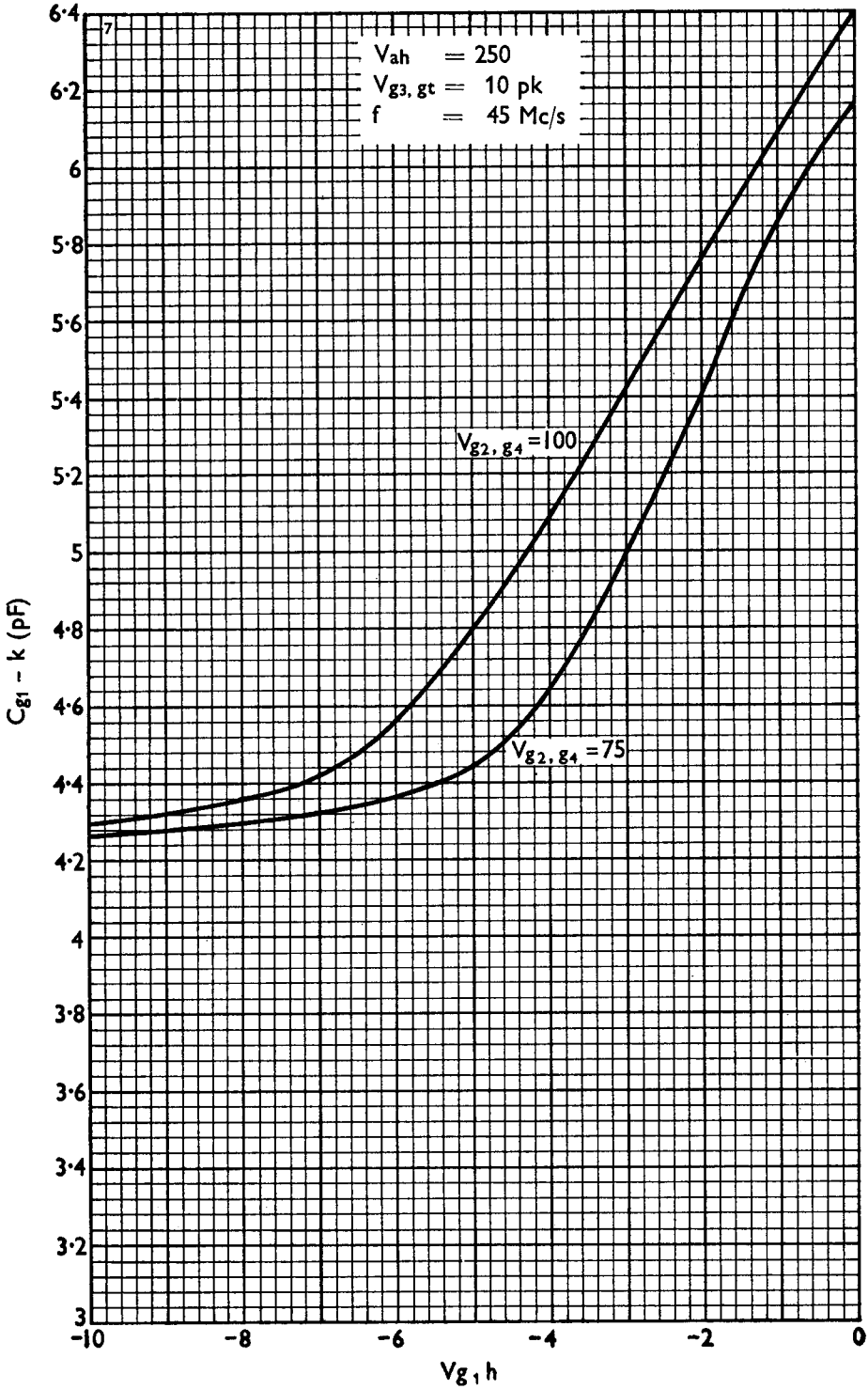

V_{ah} = 250
$V_{g2,g4}$ = 100
$V_{g3,gt\ pk}$ = 10
V_{at} = 100
R_{gt} = 50k Ω
g_c
I_k
I_{at}
I_{ah}
$I_{g2,g4}$
z_c
1000
100
10
1·0
·01
10
1·0
0·1
·01
z_c (MΩ)
g_c (μA/V)
I (mA)
-30
-20
-10
-0
Vg_1h

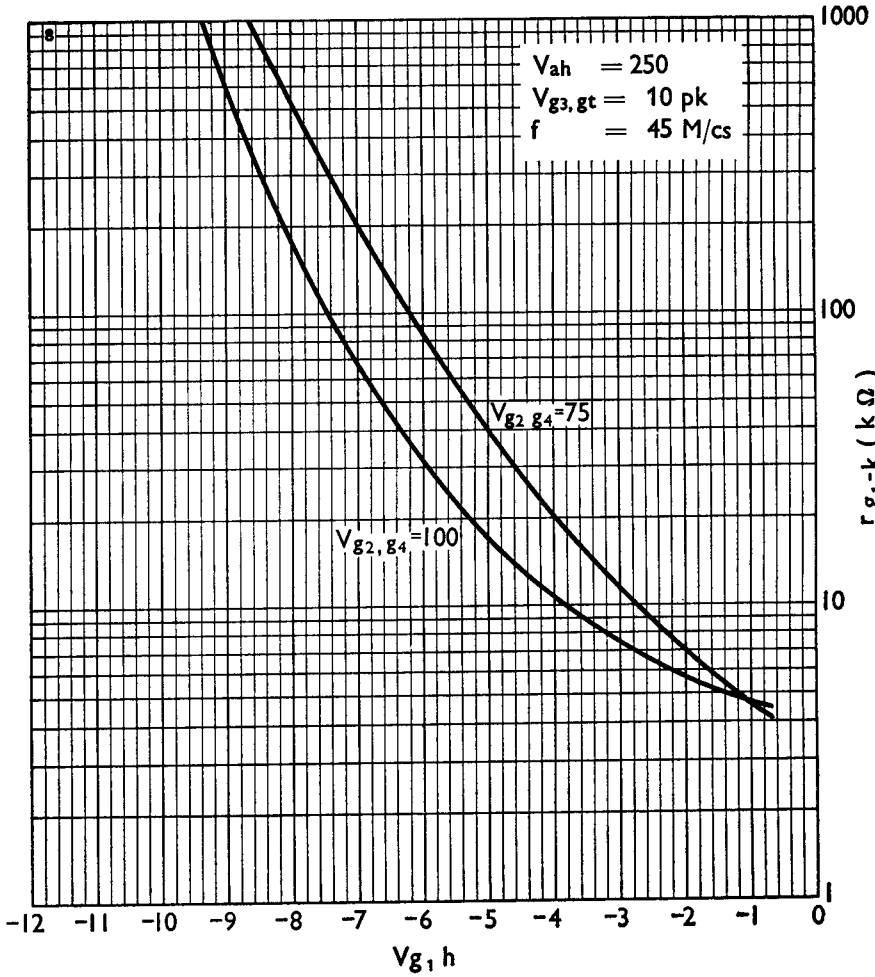
X79


5
V_{ah} = 250
V_{at} = 100
$V_{g2,g4}$ = 75
$V_{g1}h$ = 0
R_{gt} = 50k Ω
100
10
1·0
z_c (MΩ)
I (mA)
g_c
1000
100
10
g_c (μA/V)
I_{at}
$I_{g2,g4}$
I_{ah}
z_c
0
4
8
12
16
20
24
Vg_3, gt pk

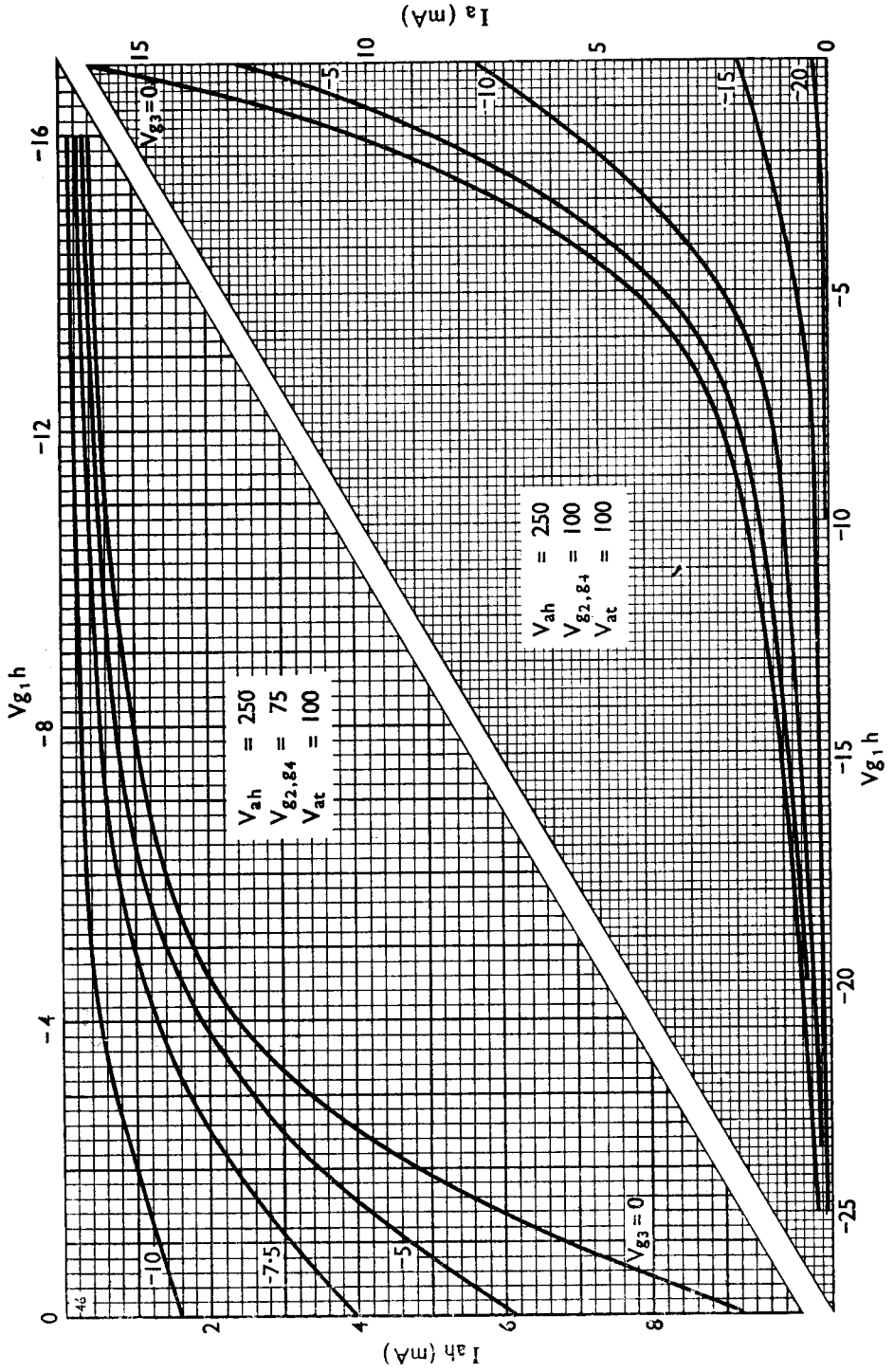

V_{ah} = 250
V_{g_2,g_4} = 100
V_{g_1h} = −3
V_{at} = 100
R_{gt} = 50 kΩ
100
10
1·0
z_c (MΩ)
I (mA)
1000
100
10
g_c (μA/V)
g_c
I_k
I_{at}
I_{ah}
I_{g_2,g_4}
z_c
0
5
10
15
20
25
V_{g_3}, gt pk

X79


V_{ah} = 250
$V_{g3,\,gt}$ = 10 pk
f = 45 Mc/s
$V_{g2,\,g4}$ = 100
$V_{g2,\,g4}$ = 75
C_{g1} – k (pF)
V_{g1} h
6·4
6·2
6
5·8
5·6
5·4
5·2
5
4·8
4·6
4·4
4·2
4
3·8
3·6
3·4
3·2
3
−10
−8
−6
−4
−2
0


V_{ah} = 250
$V_{g3,gt}$ = 10 pk
f = 45 M/cs
$V_{g2,g4}$=75
$V_{g2,g4}$=100
1000
100
10
1
r_{g_1}-k (kΩ)
-12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0
V_{g_1} h

X79


Ia (mA)
Vg1,h
Vg3 = 0
-5
-10
-15
-20
Vah = 250
Vg2,g4 = 100
Vat = 100
Iah (mA)
Vg1,h
Vg3 = 0
-10
-7·5
-5
Vah = 250
Vg2,g4 = 75
Vat = 100

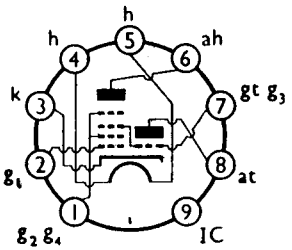
MINIATURE
TRIODE-HEXODE
0·1A INDIRECTLY HEATED

X109

OCTOBER, 1952

A frequency changer for operation up to 100 Mc/s.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	22	mm.

RATING

I_h	0·1		A
V_h	19	approx.	V
V_{ah}	250	max.	V
$V_{g2,\ g4}$	100	max.	V
V_{at}	100	max.	V
v_{gt} (pk)	10	opt.	V
I_k	20	max.	mA

TRIODE SECTION ONLY

At $V_a = 100$, $V_g = 0$

I_a	10	mA
μ	22	
g_m	2·8	mA/V

CAPACITANCES (of unscreened valve)

$c_{g1—ah}$	0·11	pF	$c_{g1—all}$	4·1	pF
$c_{g1—at}$	0·08	pF	$c_{at—all}$ (g_t earthed)	1·5	pF
$c_{g1—gt}$	0·22	pF	$c_{gt—all}$ (a_t earthed)	5·47	pF
$c_{gt—at}$	1·48	pF	$c_{ah—all}$	4·34	pF

TYPICAL OPERATION

V_a	175		V
$V_{g2,\ g4}$	75		V
V_{at}	100		V
v_{gt} (pk)	10		V
V_{g1}	0		V
I_a	4·3		mA
$I_{g2,\ g4}$	3·6		mA
I_{at}	4·5		mA
g_c	710 at $V_{g1} = 0$	v_{gt} (pk) = 0	μA/V
g_c	7·1 at $V_{g1} = -20·5$	v_{gt} (pk) = 0	μA/V
Z_c	0·25 at $V_{g1} = 0$	v_{gt} (pk) = 0	MΩ
$R_{gt—k}$	0·05		MΩ
$r_{g1—k}$*	3·6		kΩ
$c_{g1—k}$*	6		pF
r_{eq} noise ref g_1†	150		kΩ

* at : $V_{ah} = 175$, $V_{g2,\ g4} = 75$, $V_{g1h} = 0$, $f = 45$ Mc/s.
† at : $V_{ah} = 175$, $V_{g2,\ g4} = 75$, $V_{g1h} = 0$, $v_{gt,\ g3}$ (pk) = 10

X109

SCREENING

No internal or external screening is fitted to the valve. A separate screening can should be used.

MICROPHONY

Although this is of a very low order, equipment should be designed to minimise microphony.

RETAINING

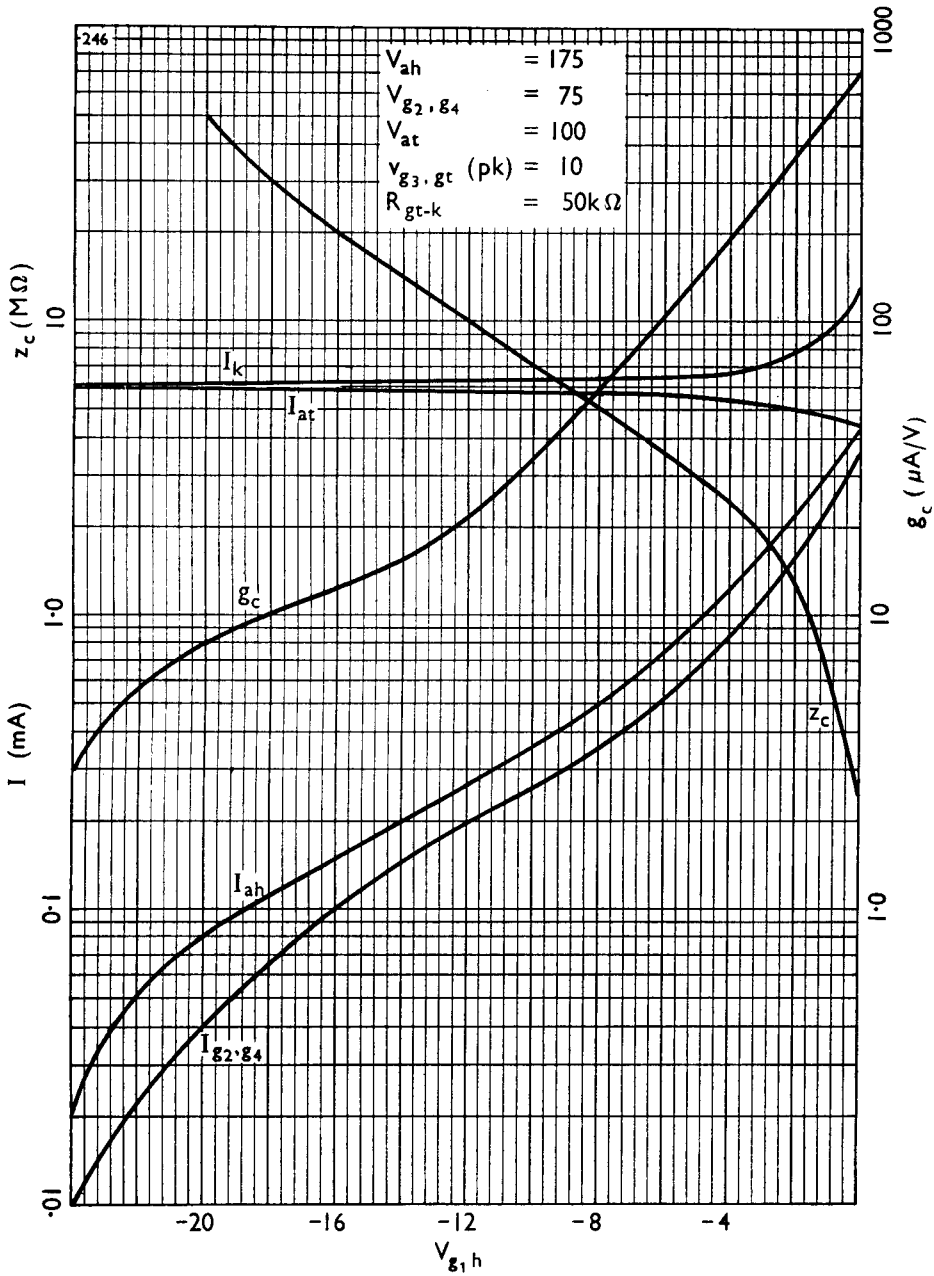
A retaining device should be used.

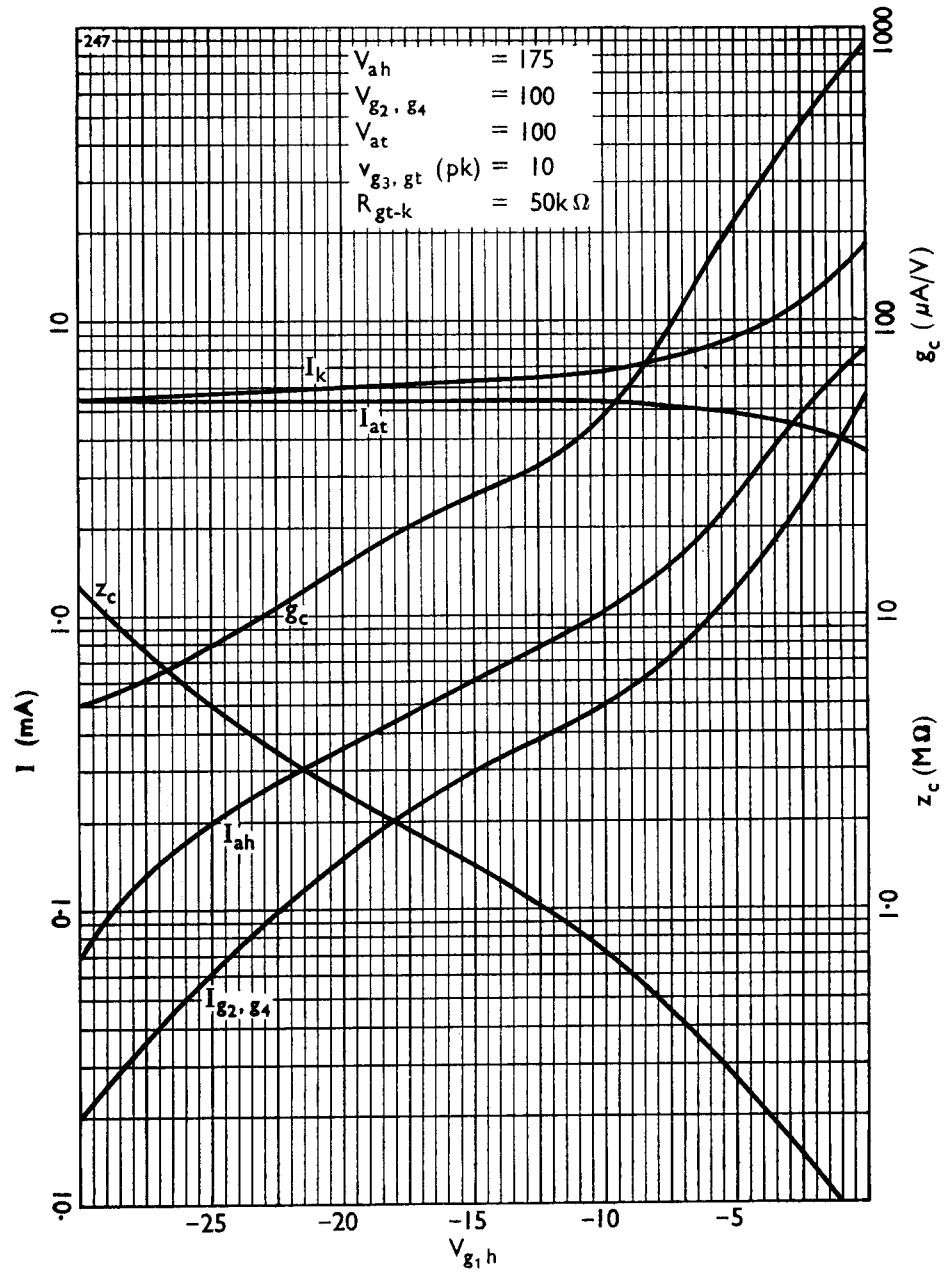
VENTILATION

No special precautions.

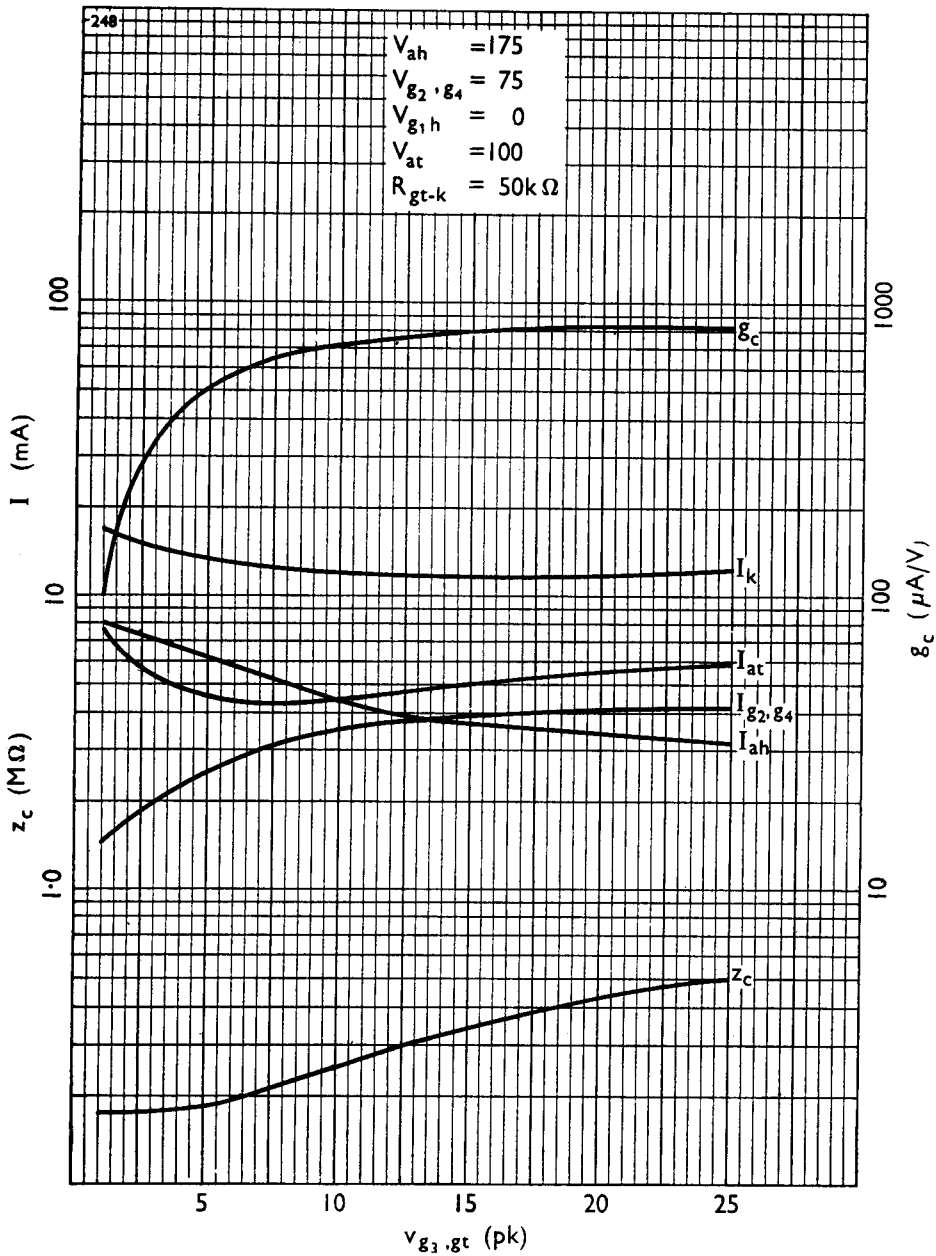
MOUNTING

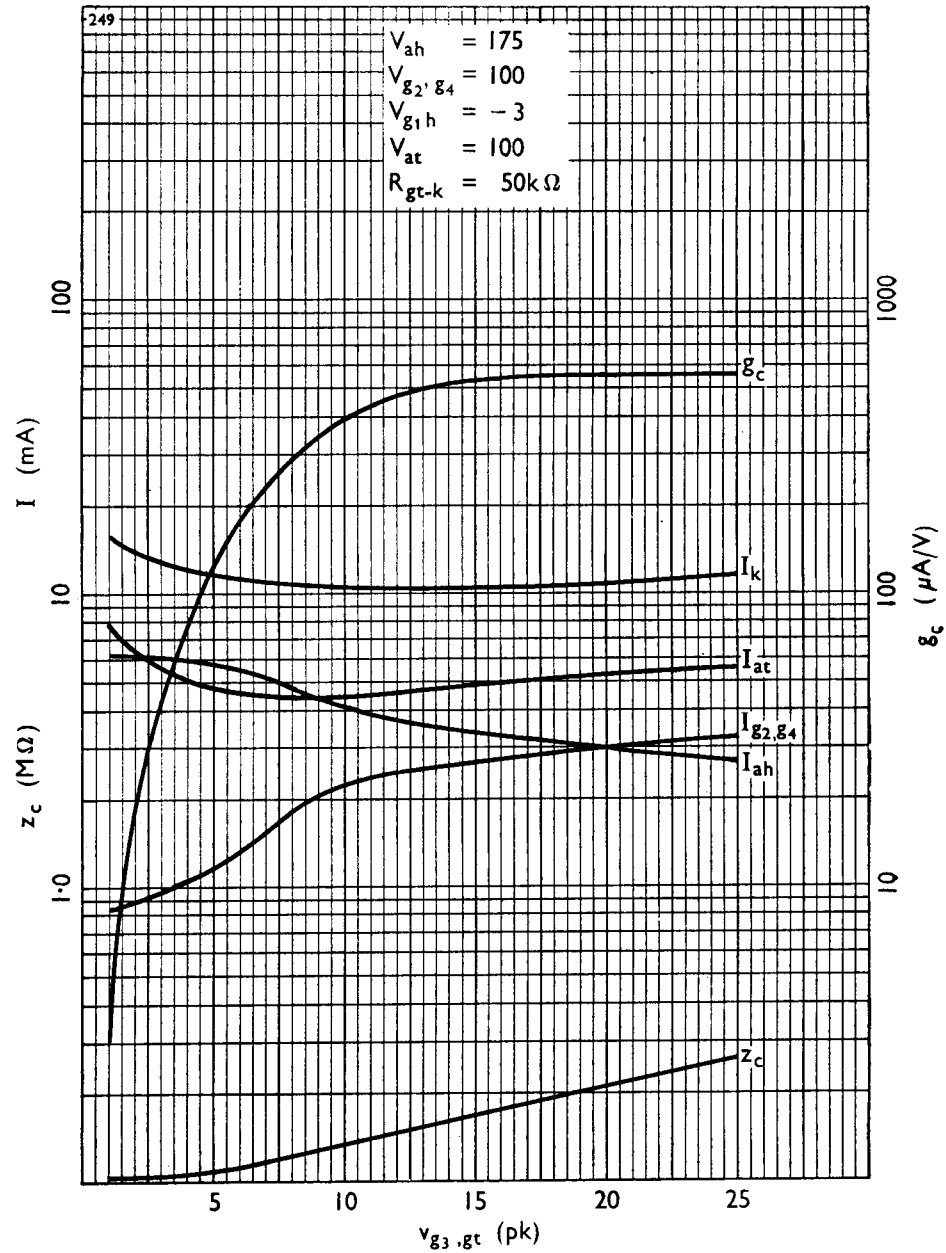
Any position.



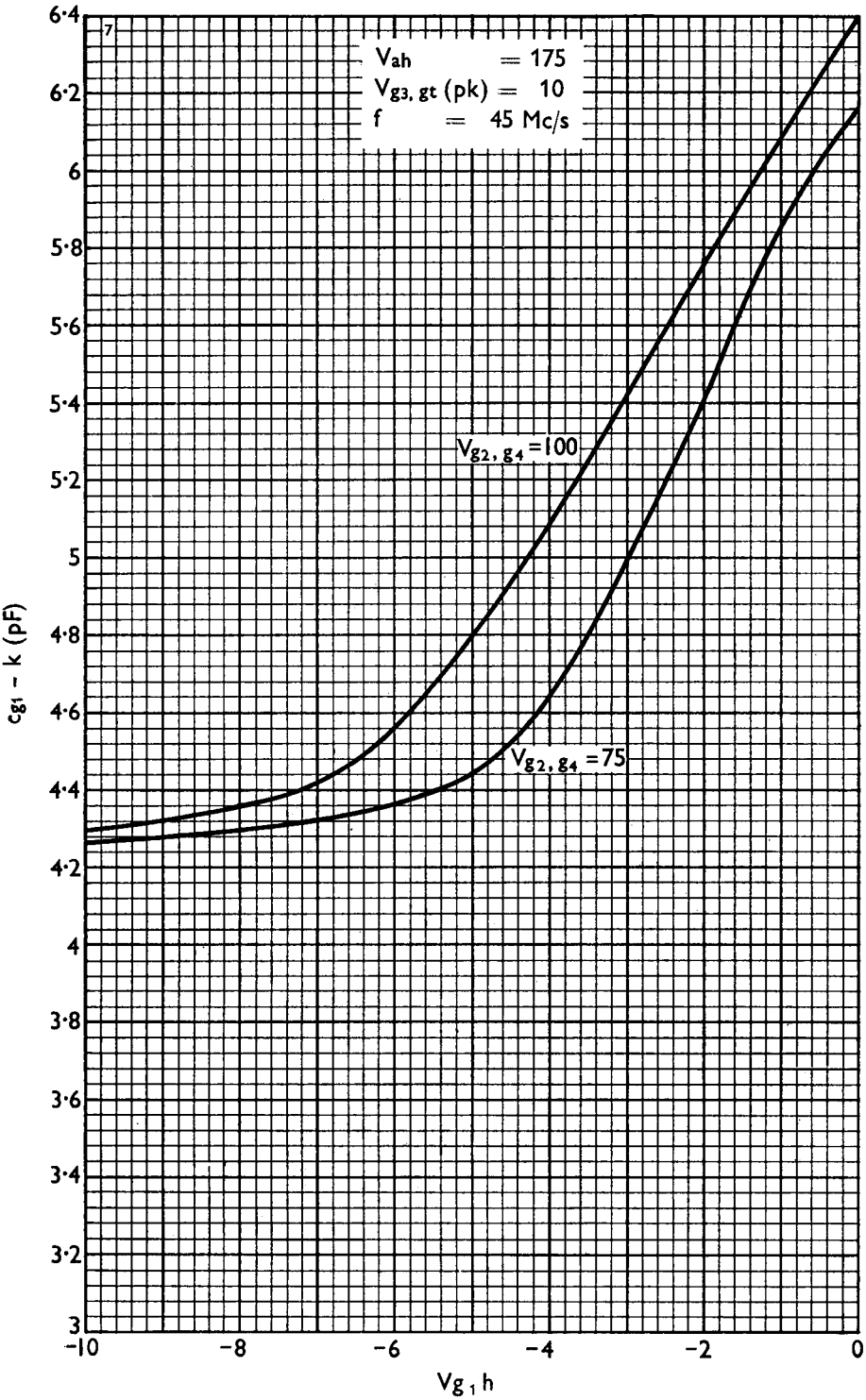

247
V_{ah} = 175
V_{g_2, g_4} = 100
V_{at} = 100
$v_{g_3, gt}$ (pk) = 10
R_{gt-k} = 50k Ω
I_k
I_{at}
z_c
g_c
I_{ah}
I_{g_2, g_4}
I (mA)
10
1·0
0·1
·01
g_c (μA/V)
1000
100
10
z_c (MΩ)
1·0
−25
−20
−15
−10
−5
$V_{g_1 h}$

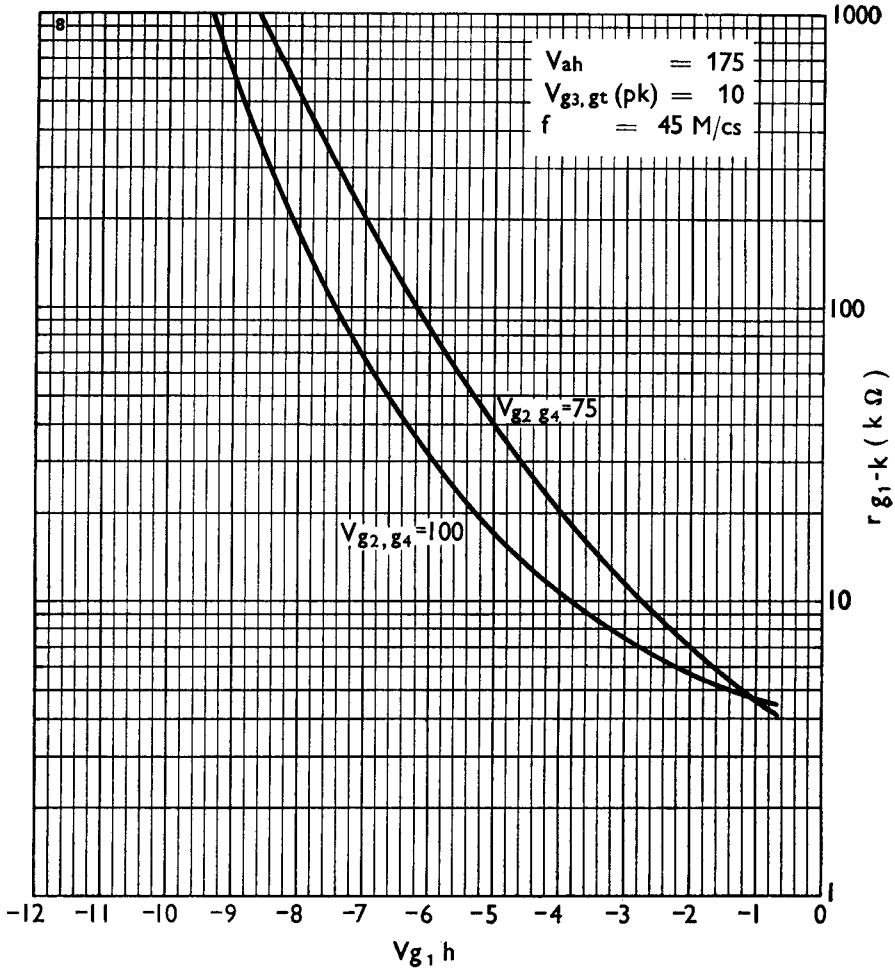
X109


248
V_{ah} =175
V_{g_2,g_4} = 75
V_{g_1h} = 0
V_{at} =100
R_{gt-k} = 50kΩ
100
10
1·0
I (mA)
z_c (MΩ)
1000
100
10
g_c (μA/V)
g_c
I_k
I_{at}
I_{g_2,g_4}
I_{ah}
z_c
5
10
15
20
25
$V_{g_3,gt}$ (pk)

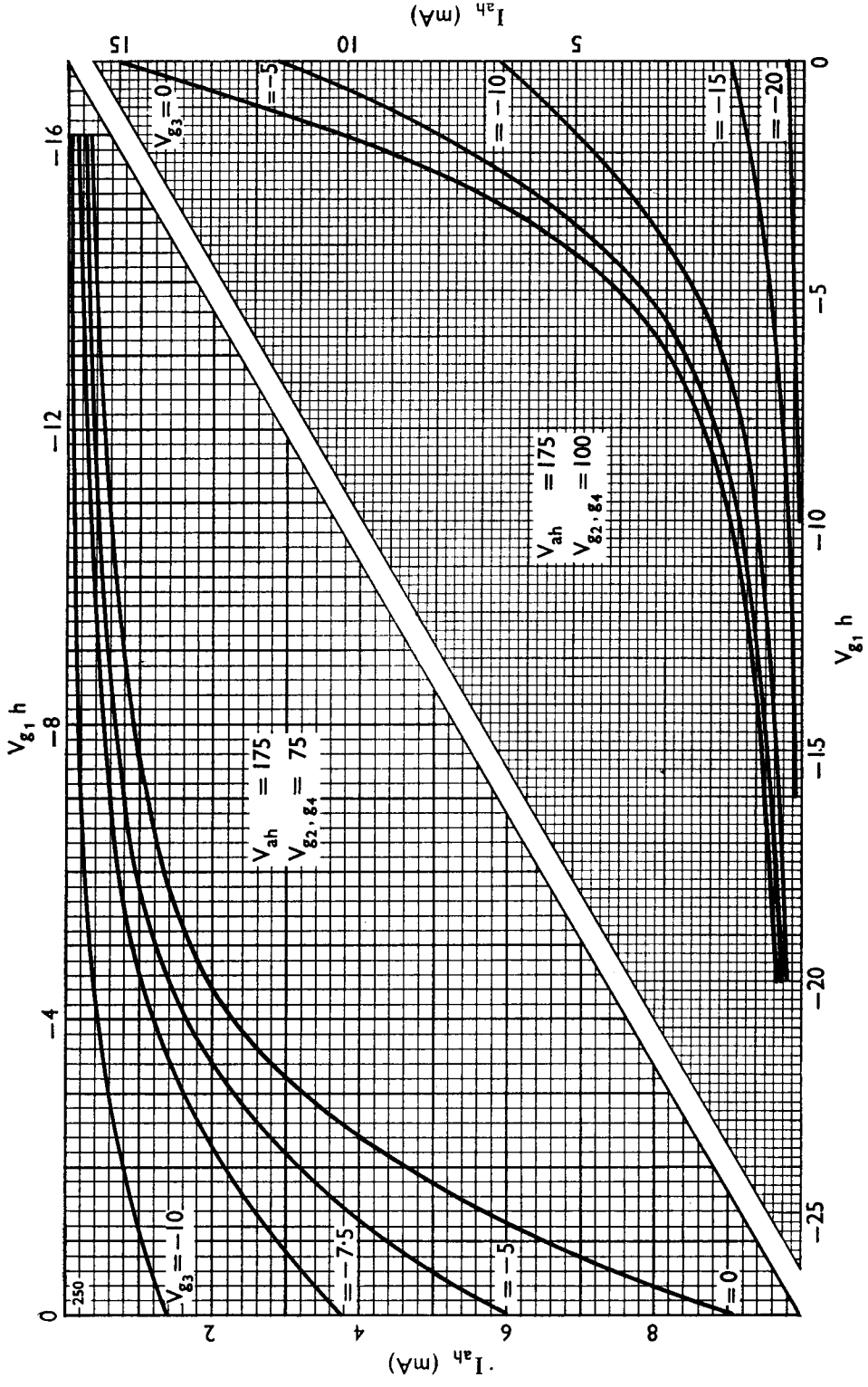

249
V_{ah} = 175
V_{g_2, g_4} = 100
$V_{g1\,h}$ = −3
V_{at} = 100
$R_{gt\text{-}k}$ = 50kΩ
I (mA)
100
10
1·0
z_c (MΩ)
1000
100
10
g_c (μA/V)
g_c
I_k
I_{at}
I_{g_2,g_4}
I_{ah}
z_c
5
10
15
20
25
$v_{g_3, gt}$ (pk)

X109


V_{ah} = 175
$V_{g3, gt}$ (pk) = 10
f = 45 Mc/s
$V_{g2, g4}$ = 100
$V_{g2, g4}$ = 75
c_{g1} - k (pF)
V_{g1} h
6·4
6·2
6
5·8
5·6
5·4
5·2
5
4·8
4·6
4·4
4·2
4
3·8
3·6
3·4
3·2
3
−10
−8
−6
−4
−2
0


8
V_{ah} = 175
$V_{g3,gt}$ (pk) = 10
f = 45 M/cs
$V_{g2\ g4}$=75
$V_{g2,g4}$=100
1000
100
10
1
r_{g_1}-k (kΩ)
-12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0
V_{g_1} h

X109



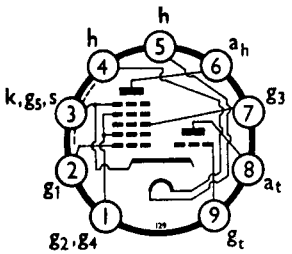
Printed in England C.

TRIODE-HEPTODE
6·3V INDIRECTLY HEATED

X719/ ECH81
ISSUE 1
JANUARY, 1958

Primarily designed for use as a frequency changer.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base

Base : B9A
Bulb : Tubular
Max. overall length : 67 mm.
Max. seated length : 60 mm.
Max. diameter : 22·2 mm.

HEATER

V_h	6·3	V
I_h	0·3	A

MAXIMUM RATINGS

Heptode Section

V_a	300	V
$V_{g2, g4}$ (I_a<1mA)	300	V
$V_{g2, g4}$	125	V
V_{g3} (I_{g3}=+0·3μA)	−1·3	V
V_{g1} (I_{g1}=+0·3μA)	−1·3	V
p_a	1·7	W
p_{g2+g4}	1	W
I_k	12·5	mA
V_{h-k}	100	V
R_{g1-k}	3	MΩ
*R_{g3-k}	3	MΩ
R_{h-k}	20	kΩ

*If the two sections of the valve are switched during operation so that there is no direct connection between g_3 and g_t, as may occur in f.m./a.m. receivers, then R_{g3-k}= 20kΩ.

Triode Section

V_a	250	V
p_a	0·8	W
I_k	6·5	mA
V_g (I_g=+0·3μA)	−1·3	V
V_{h-k}	100	V
R_{g-k}	3	MΩ
R_{h-k}	20	kΩ

CAPACITANCES

c_{ah-at} : 0·20 pF	c_{ah-gt} : <0·09 pF	$c_{ah-(g3, gt)}$: <0·35 pF
c_{g1-at} : <0·06 pF	c_{g1-gt} : <0·17 pF	$c_{g1-(g3, gt)}$: <0·45 pF

Heptode Section

$c_{in(g1)}$: 4·8 pF	$c_{in(g3)}$: 5·8 pF		c_{out} : 7·9 pF
c_{a-g1} : <0·01 pF	c_{g1-g3} : <0·3 pF	c_{g1-h} : <0·02 pF	c_{g3-h} : <0·06 pF

Triode Section

C_{in} : 2·6 pF	c_{out} : 2·1 pF	c_{a-g} : 1·0 pF	c_{g-h} : <0·02 pF

CHARACTERISTICS

Triode Section

V_a	100	V
I_a	13·5	mA
V_g	0	V
g_m	3·7	mA/V
μ	22	

TYPICAL OPERATION

Heptode Section as r.f. or i.f. Amplifier

$V_a = V_b$	250	250	V
$V_{g2,\,g4}$	100	103	V
V_{g3}	0	0	V
V_{g1}	−2·0	−2·1	V
V_{g1} (for $g_m/100$)	−42	−42	V
I_a	6·5	6·5	mA
I_{g2+g4}	3·8	4·1	mA
$R_{g2,\,g4}$	39	22*	kΩ
R_{eq}	8·5	8·5	kΩ
r_{in} (at 100 Mc/s)	2·0	—	kΩ
g_m	2·4	2·4	mA/V
r_a	700	700	kΩ
$\mu_{g1-(g2,\,g4)}$	20	20	

*Common screen resistor for X719/ECH81 and W719/EF85. The current through this resistor is 6·7 mA.

Heptode Section as a.m. Frequency Changer

$V_a = V_b$	250	250	250	V
$V_{g2,g4}$	103	97	92	V
V_{g1}	−2	−1·9	−2	V
V_{g1} (for $g_c/100$)	−28·5	−28·5	−28·5	V
I_a	3·25	3	2·5	mA
I_{g2+g4}	6·7	6·1	5·5	mA
I_{g3+gt}	200	200	200	μA
$R_{g2,\,g4}$	22	18*	22†	kΩ
R_{eq}	70	70	66	kΩ
g_c	775	750	700	μA/V
r_a	1	1	1	MΩ

*Common screen resistor for X719/ECH81 and W719/EF85. The current through this resistor is 8·5 mA.

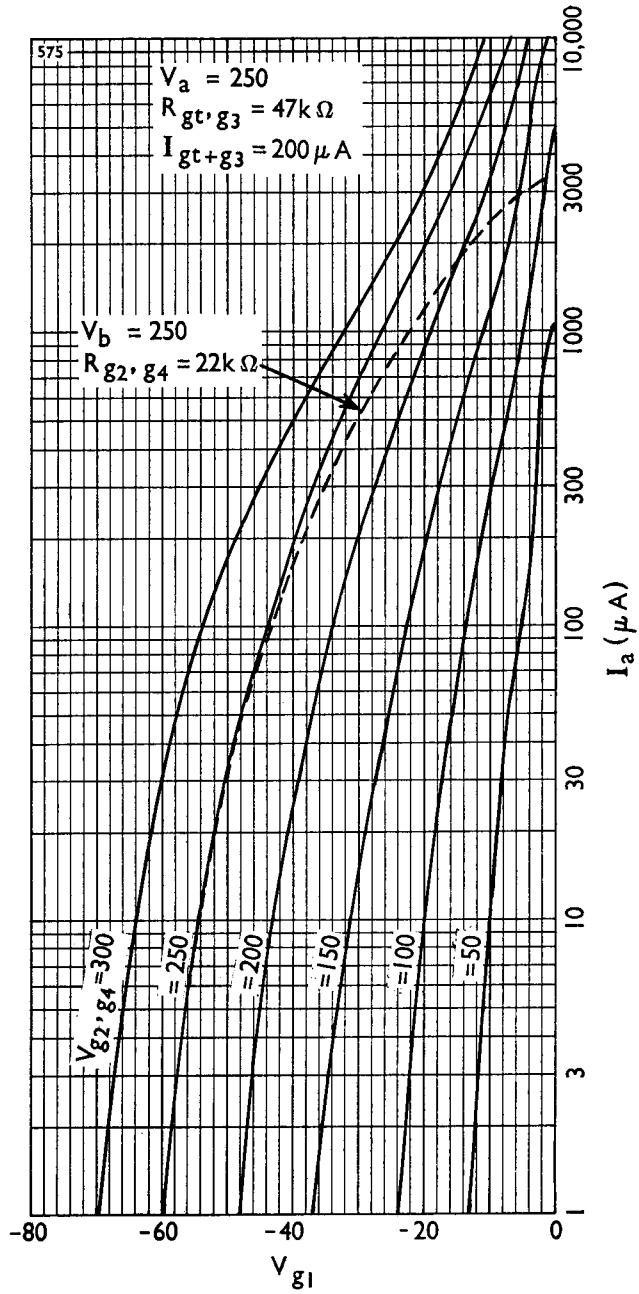
†Common screen resistor for X719/ECH81 and WD709/EBF80. The current through this resistor is 7·2 mA.

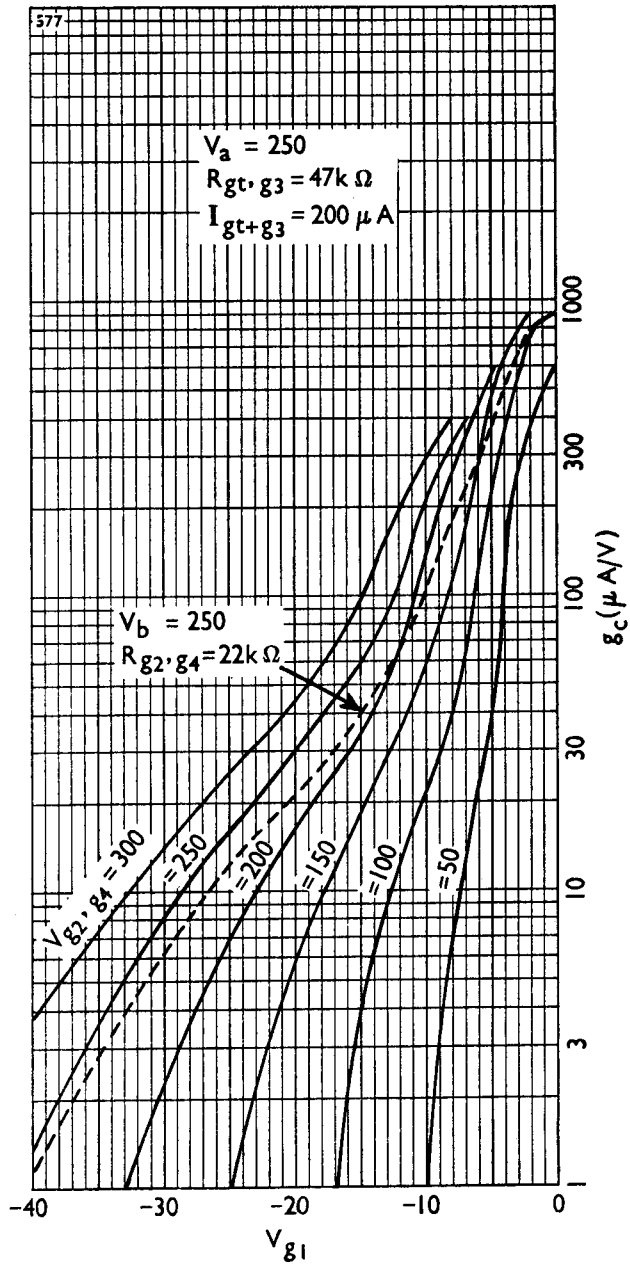
Triode Section as r.f. Oscillator

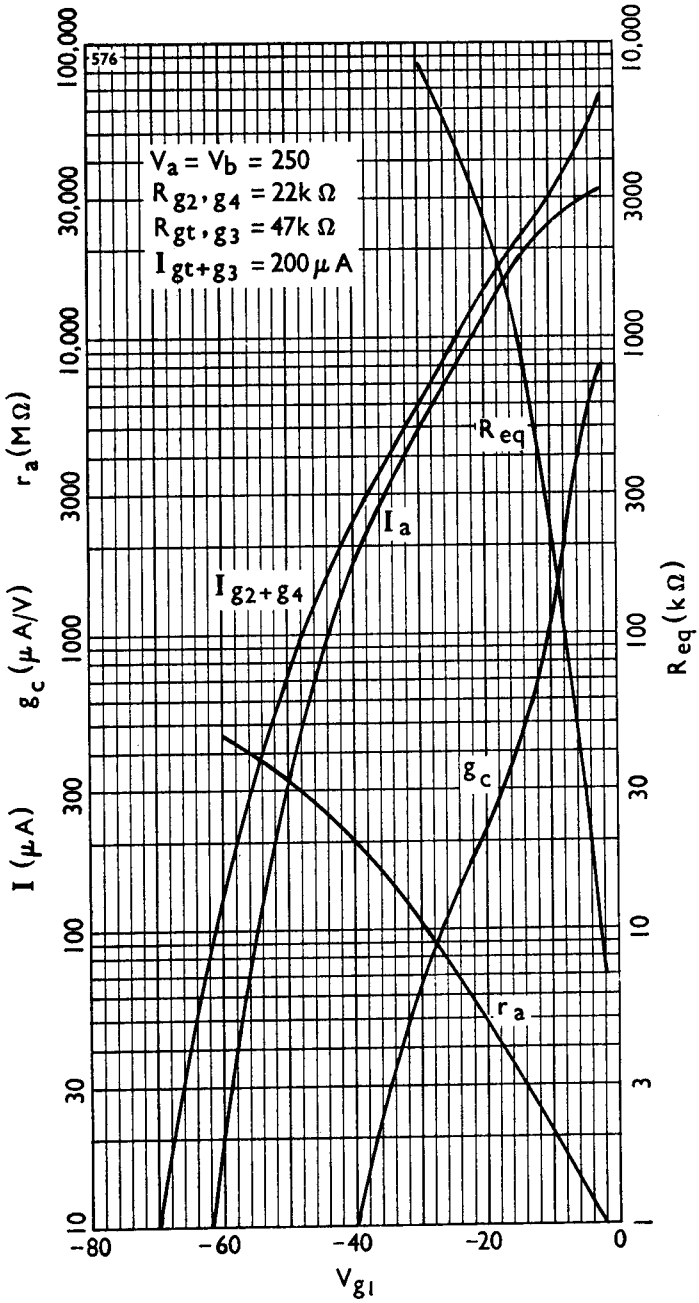
V_b	250	V
R_{at}	33	kΩ
I_{at}	4·5	mA
$R_{g3,\,gt}$	47	kΩ
I_{g3+gt}	200	μA
g_m (effective)	650	μA/V

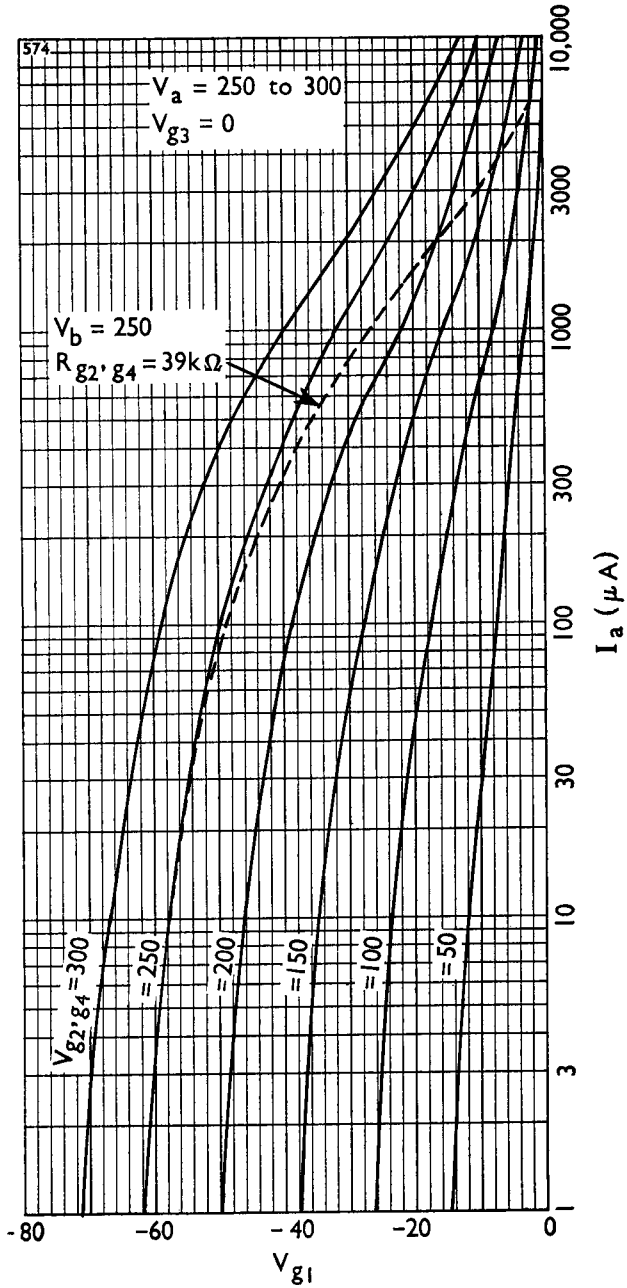
MOUNTING

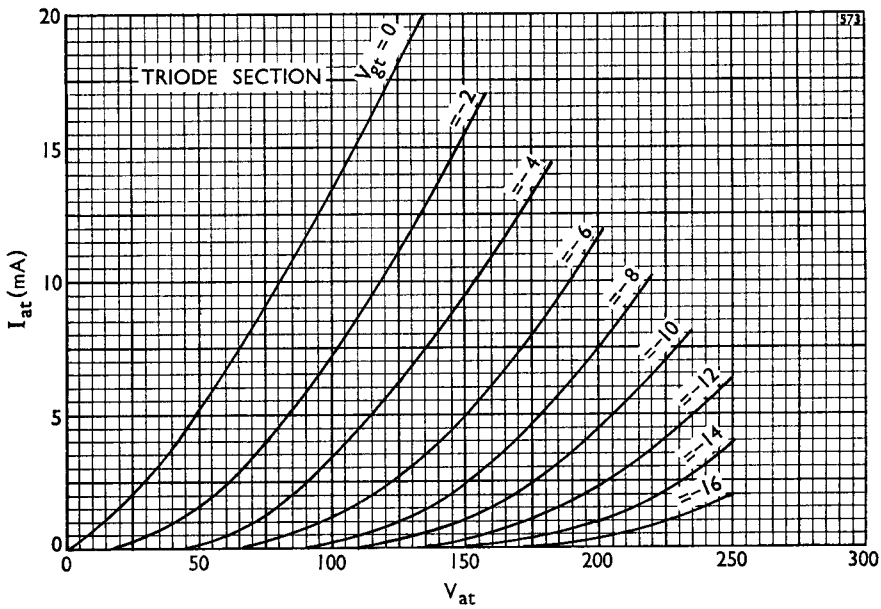
Any position.


575
V_a = 250
$R_{gt, g3}$ = 47k Ω
I_{gt+g3} = 200 μA
V_b = 250
$R_{g2, g4}$ = 22k Ω
$V_{g2, g4}$ = 300
= 250
= 200
= 150
= 100
= 50
10,000
3000
1000
300
100
30
10
3
1
I_a (μA)
-80
-60
-40
-20
0
V_{g1}


577
V_a = 250
R_{gt}, g_3 = 47k Ω
I_{gt+g_3} = 200 μA
V_b = 250
R_{g2}, g_4 = 22k Ω
V_{g2}, g_4 = 300
=250
=200
=150
=100
=50
g_c (μA/V)
1000
300
100
30
10
3
1
−40
−30
−20
−10
0
V_{g1}


576
$V_a = V_b = 250$
$R_{g2,g4} = 22k\,\Omega$
$R_{gt,g3} = 47k\,\Omega$
$I_{gt+g3} = 200\,\mu A$
I_a
I_{g2+g4}
R_{eq}
g_c
r_a
$I\ (\mu A)$
$g_c\ (\mu A/V)$
$r_a\ (M\Omega)$
$R_{eq}\ (k\Omega)$
100,000
30,000
10,000
3000
1000
300
100
30
10
10,000
3000
1000
300
100
30
10
3
1
-80
-60
-40
-20
0
V_{g1}

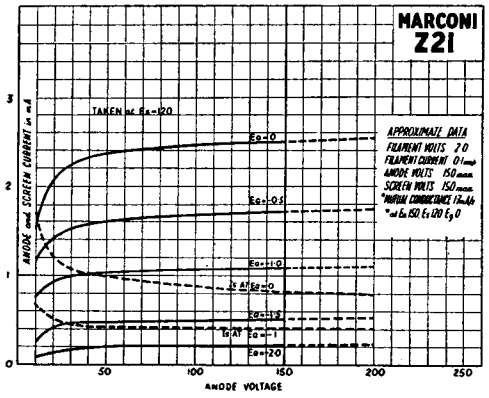

574
V_a = 250 to 300
V_{g3} = 0
V_b = 250
$R_{g2, g4}$ = 39kΩ
$V_{g2, g4}$ = 300
= 250
= 200
= 150
= 100
= 50
10,000
3000
1000
300
100
30
10
3
1
I_a (μA)
-80
-60
-40
-20
0
V_{g1}


TRIODE SECTION
$V_{gt} = 0$
$= -2$
$= -4$
$= -6$
$= -8$
$= -10$
$= -12$
$= -14$
$= -16$
I_{at} (mA)
V_{at}
0
5
10
15
20
50
100
150
200
250
300

X719/ECH81

OV.4170

Printed in England. C.



Marconi Z21

2 volt H.F. Pentode

Marconi Z21 is a screened pentode for use where a variable mu characteristic is not required. In particular it makes a sensitive grid detector

Nominal Rating, see curve.

Inter-electrode capacities
(*metallised valve*).

A—G	0.005$\mu\mu$F
A—E	6.5$\mu\mu$F
G—E	10.0$\mu\mu$F

Dimensions : 125 × 41 mm. 4 or 7 pin base ; for connections see pages 4-5.

Typical Operating Data.

As leaky grid detector.

H.T. voltage ...	120	120	150	150
Anode load ...	50,000 ohms	0.25 megohm	50,000 ohms	0.25 megohm
Screen resistance	50,000 ohms	1.0 megohm	100,000 ohms	1.0 megohm
Anode current ...	1.5 mA	0.3 mA	1.7 mA	0.4 mA
Screen current ...	0.6 mA	0.1 mA	0.6 mA	0.12 mA
Anode voltage ...	45	45	65	50
Screen voltage ...	90	20	90	30

Notes.

When used as a detector the grid leak should be returned to filament positive and the screen should be decoupled with 0.5μF.

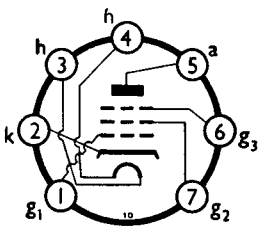
Other uses for the valve are as L.F. amplifier, as oscillator and as H.F. amplifier. In the last mentioned use bias control of gain may be obtained if the screen is fed through a series resistance of 50,000 ohms from maximum H.T.

Price - - 9/-

MINIATURE
R.F. PENTODE
6·3V INDIRECTLY HEATED

Z77
APRIL, 1952

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

Pentode Connection

V_h	6·3	V
I_h	0·3	A
v_{h-k} (pk)	150 max.	V
V_a	250	V
V_{g2}	250	V
p_a	2·5 max.	W
p_{g2}	0·8 max.	W
r_a at $V_a = V_{g2} = 250$, $I_a = 10$ mA	0·3	MΩ
g_m at $V_a = V_{g2} = 250$, $I_a = 10$ mA	7·5	mA/V

Triode Connection

I_k	30 max.	mA
$V_{a,\,g2}$	250 max.	V
$p_{a,\,g2}$	3·3 max.	W
μ at $V_{a,\,g2} = 250$, $V_{g1} = -2$	75	
r_a at $V_{a,\,g2} = 250$, $V_{g1} = -2$	10	kΩ
g_m at $V_{a,\,g2} = 250$, $V_{g1} = -2$	7·5	mA/V

CAPACITANCES (of cold unscreened valve)

$c_{g1\text{-all}}$	7·4	pF	$c_{a\text{-all}}$	3·1	pF	$C_{a\text{-}g1}$	0·009	pF

TYPICAL OPERATION

Class A Amplifier. Pentode Connection

V_a	250	V
V_{g2}	250	V
V_{g3}	0	V
I_a	10	mA
I_{g2}	2·5	mA
V_{g1}	−2 approx.	V
R_k	160	Ω

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Head Office: Marconi House, Chelmsford . Telephone: Chelmsford 3221 . Telegraphic Address: Expanse, Chelmsford

Mixer. Pentode Connection

Series injection to g_1.

V_a	250	V
V_{g2}	250	V
V_{g3}	0	V
I_a	4·5	mA
I_{g2}	1·5	mA
R_k	680	Ω
g_c	2·7	mA/V
v_{osc} (pk)	4·5	V

Class A. Amplifier. Triode Connection

$V_{a, g2}$	250	V
V_{g1}	−2 approx.	V
$I_{a, g2}$	12·5	mA
R_k	160	Ω
μ	75	
g_m	7·5	mA/V
r_a	10	k

Class A Amplifier. Pentode Connection

$V_{a, g3}$	28	V
V_{g2}	8	V
I_a	0·75	mA
I_{g2}	0·15	mA
R_L	22	kΩ
R_k	2·2	kΩ
Gain	30	db

Whenever possible, a potentiometer supply should be used for V_{g2}.

GENERAL

At $V_a = V_{g2} = 250$, $V_{g3} = 0$, $I_a = 10$ mA.

$c_{g1\text{-}k}$	10	pF
$c_{a\text{-}k}$	3	pF
$c_{h\text{-}k}$	4	pF
$r_{g1\text{-}k}$ (at 45 Mc/s)	9	kΩ
$r_{eq\ noise\ ref\ g1}$	1·0	kΩ

Under conditions of maximum anode and screen dissipation, the D.C. resistance between control grid and cathode must not exceed 0·5 MΩ with auto-bias, or 0·1 MΩ with fixed bias.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

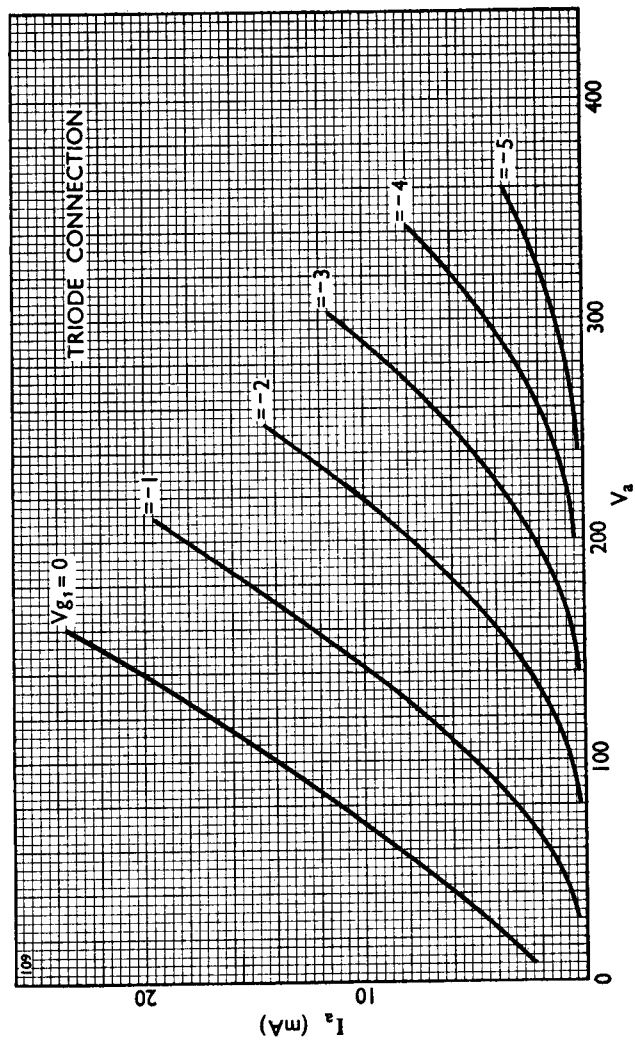
A retaining device should be used.

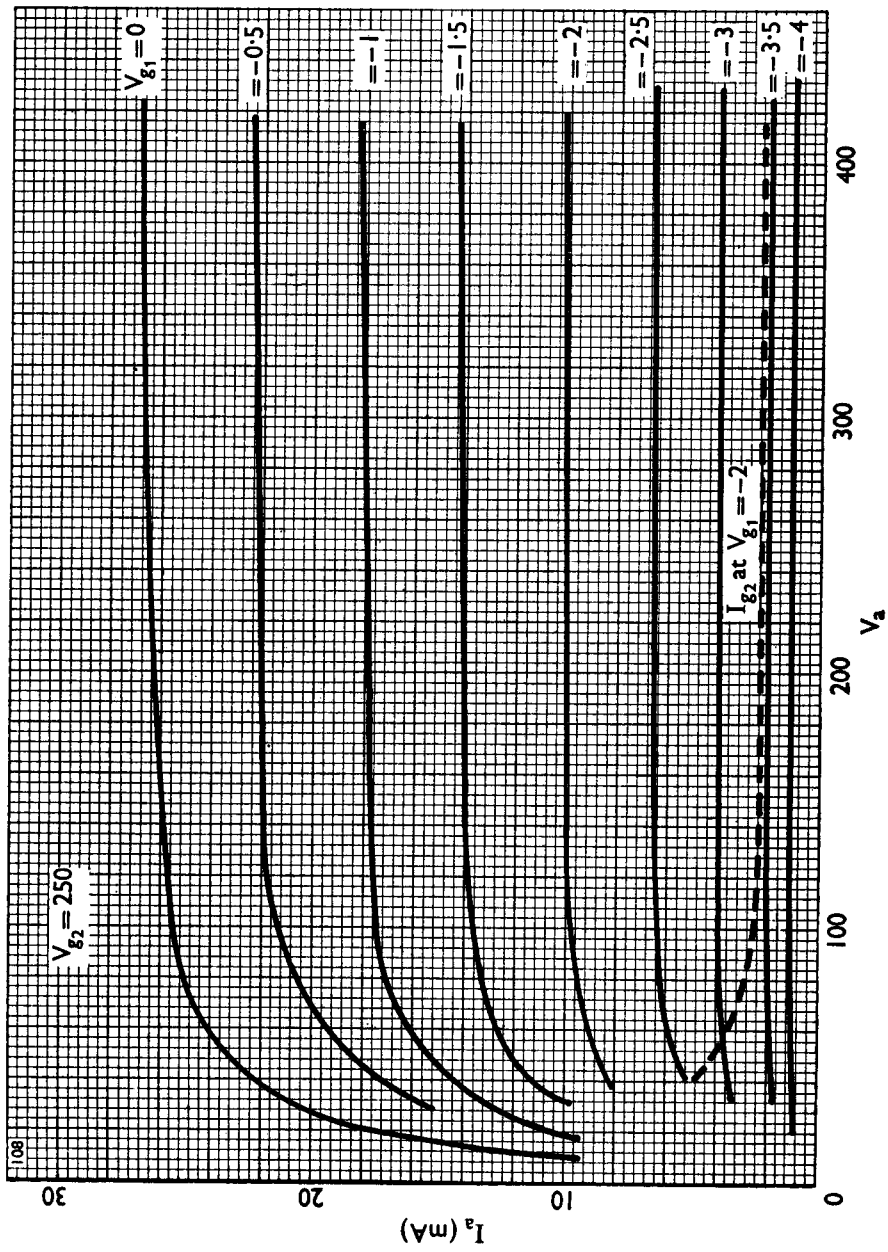
VENTILATION

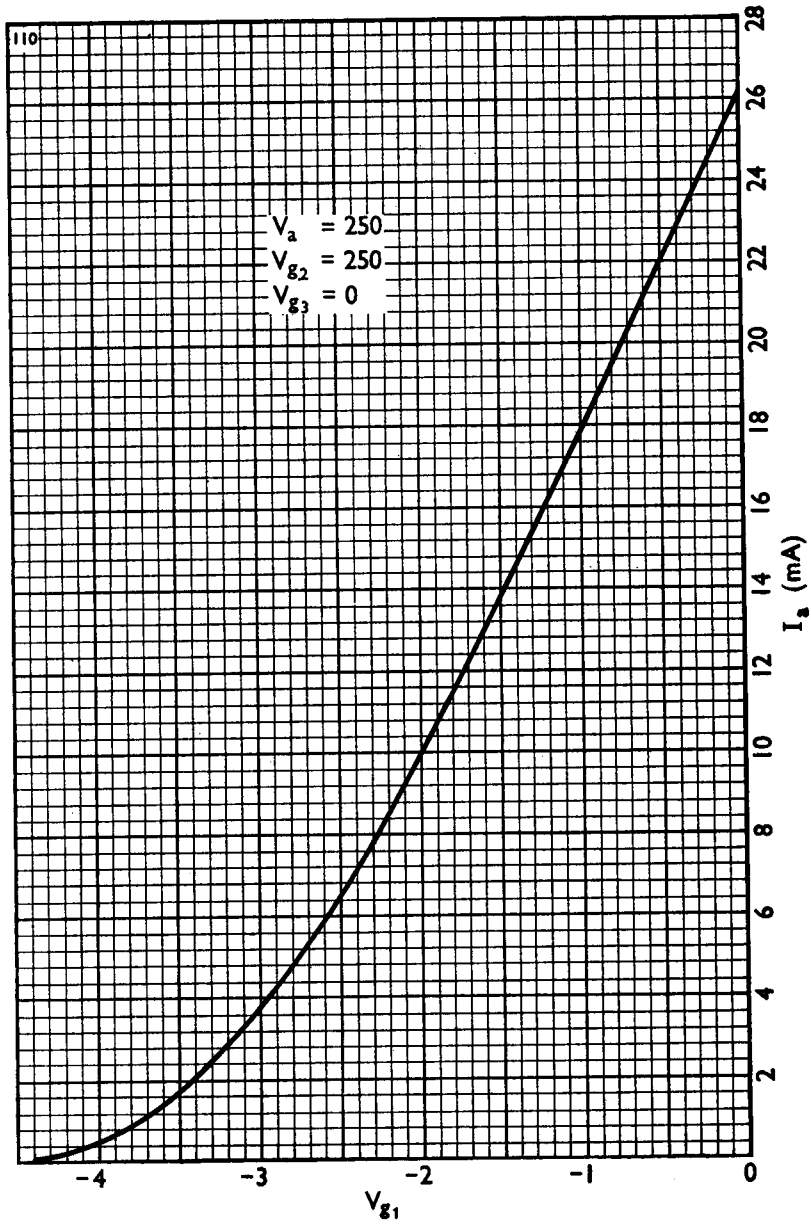
The valve and screening canister should be mounted to provide as much free air circulation as possible.

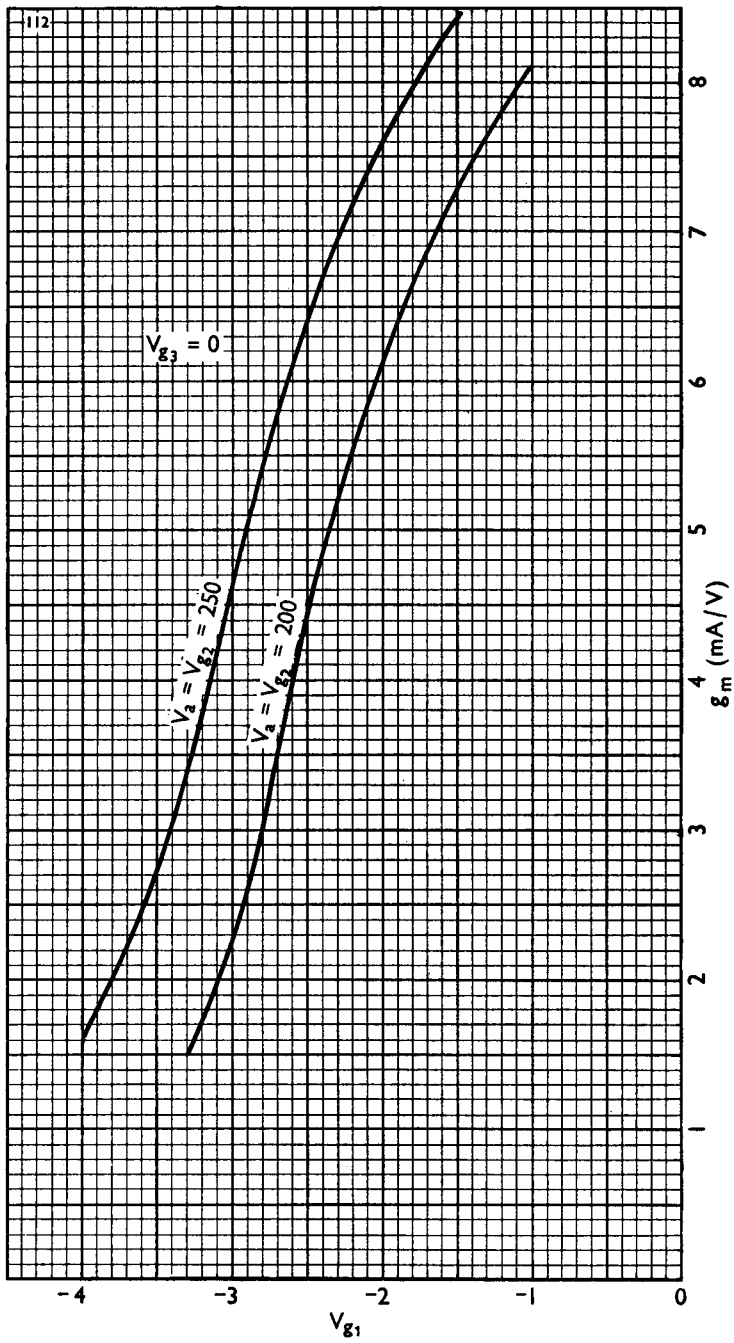
MICROPHONY

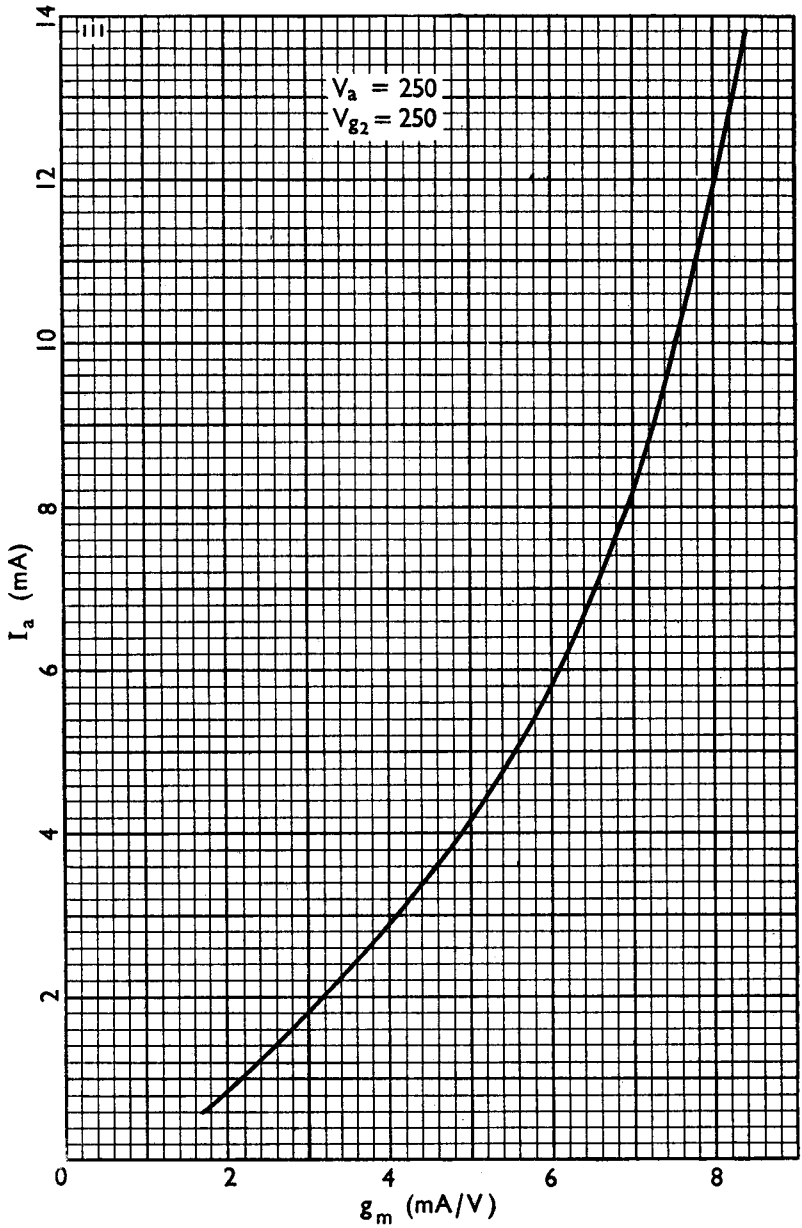
Although this is of a very low order, equipment should be designed to minimise microphony.

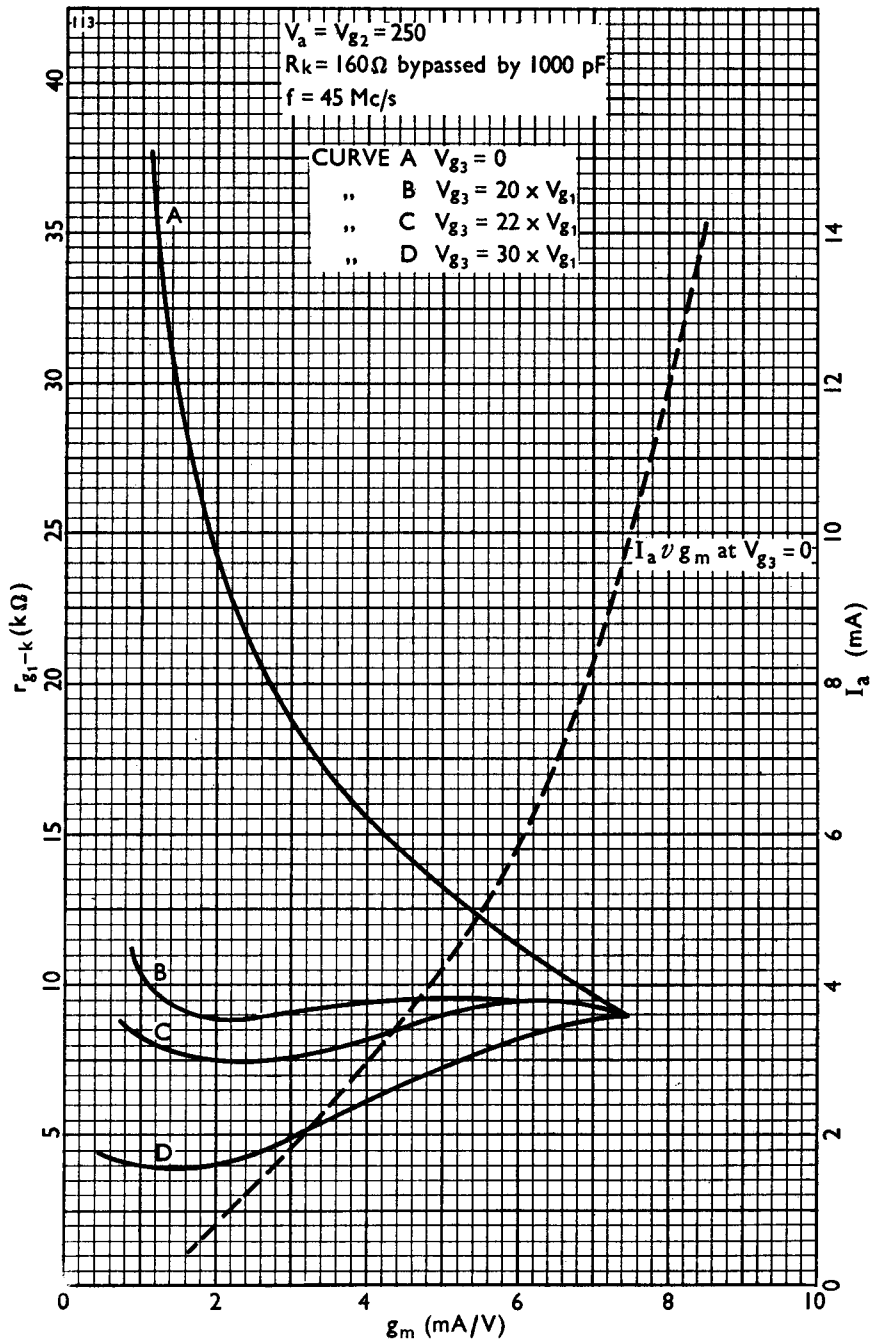


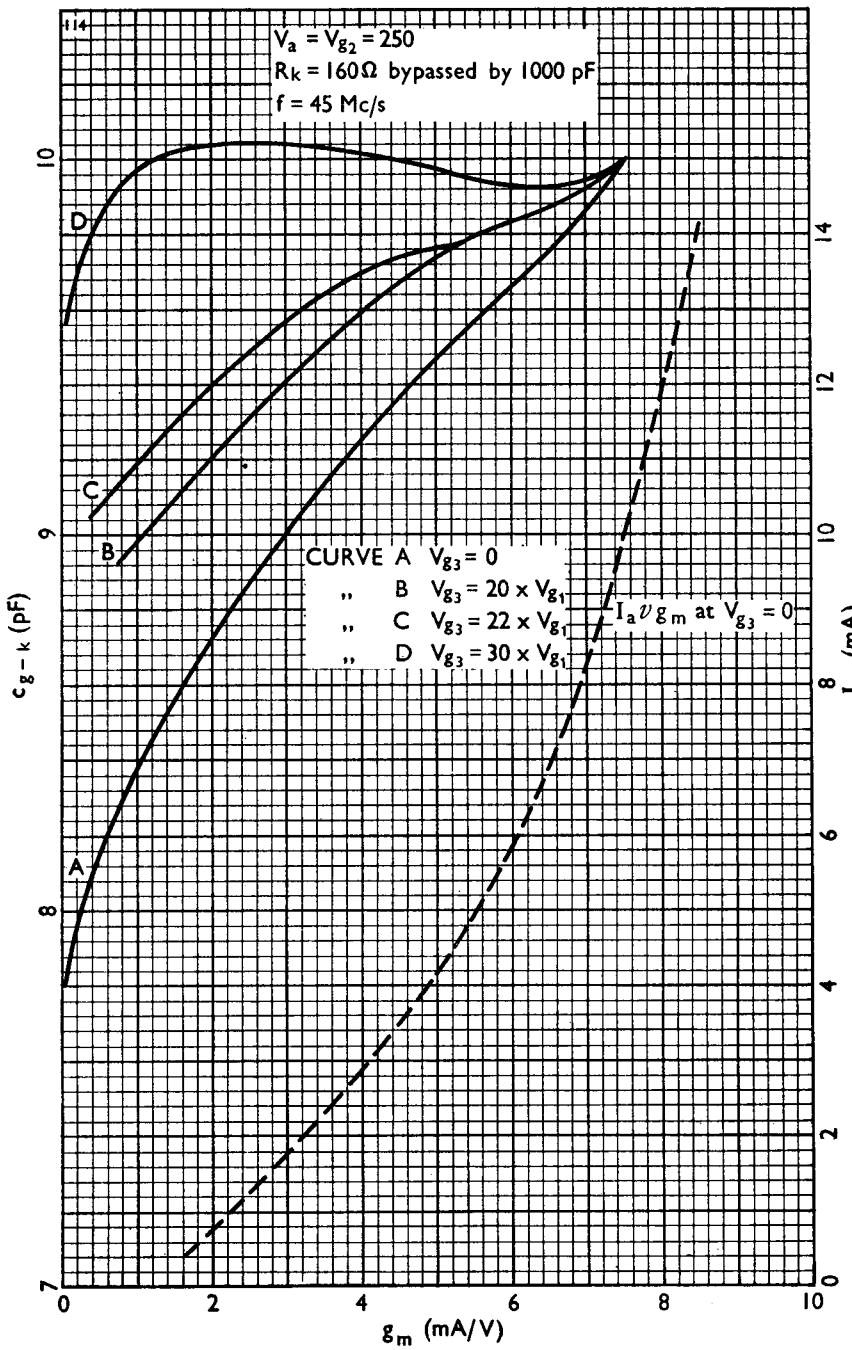

$V_{g_1}=0$
$=-0{\cdot}5$
$=-1$
$=-1{\cdot}5$
$=-2$
$=-2{\cdot}5$
$=-3$
$=-3{\cdot}5$
$=-4$
$V_{g_2}=250$
I_{g_2} at $V_{g_1}=-2$
I_a (mA)
V_a
0
10
20
30
100
200
300
400
108

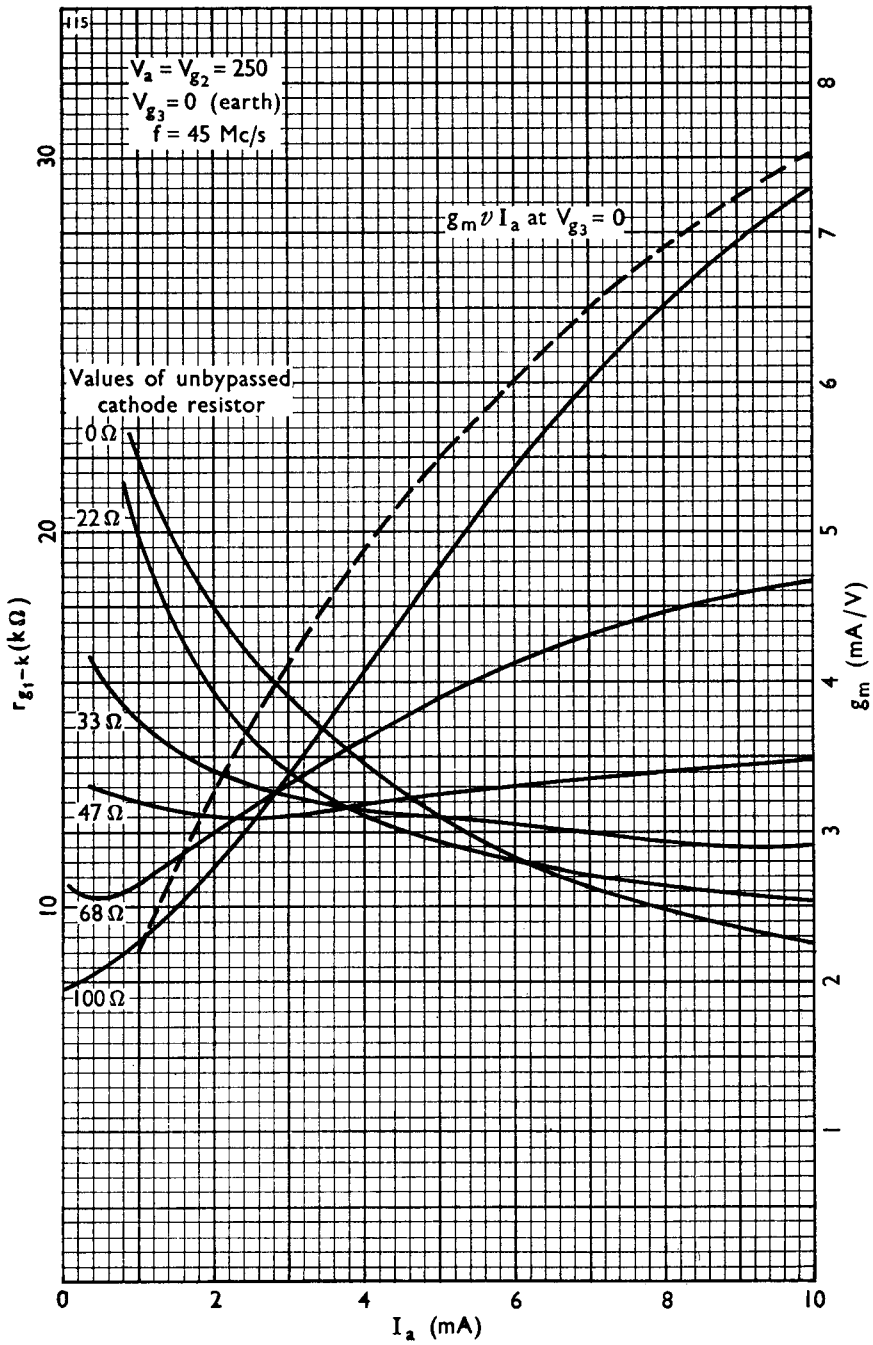

110
V_a = 250
V_{g_2} = 250
V_{g_3} = 0
28
26
24
22
20
18
16
14
12
10
8
6
4
2
I_a (mA)
-4
-3
-2
-1
0
V_{g_1}

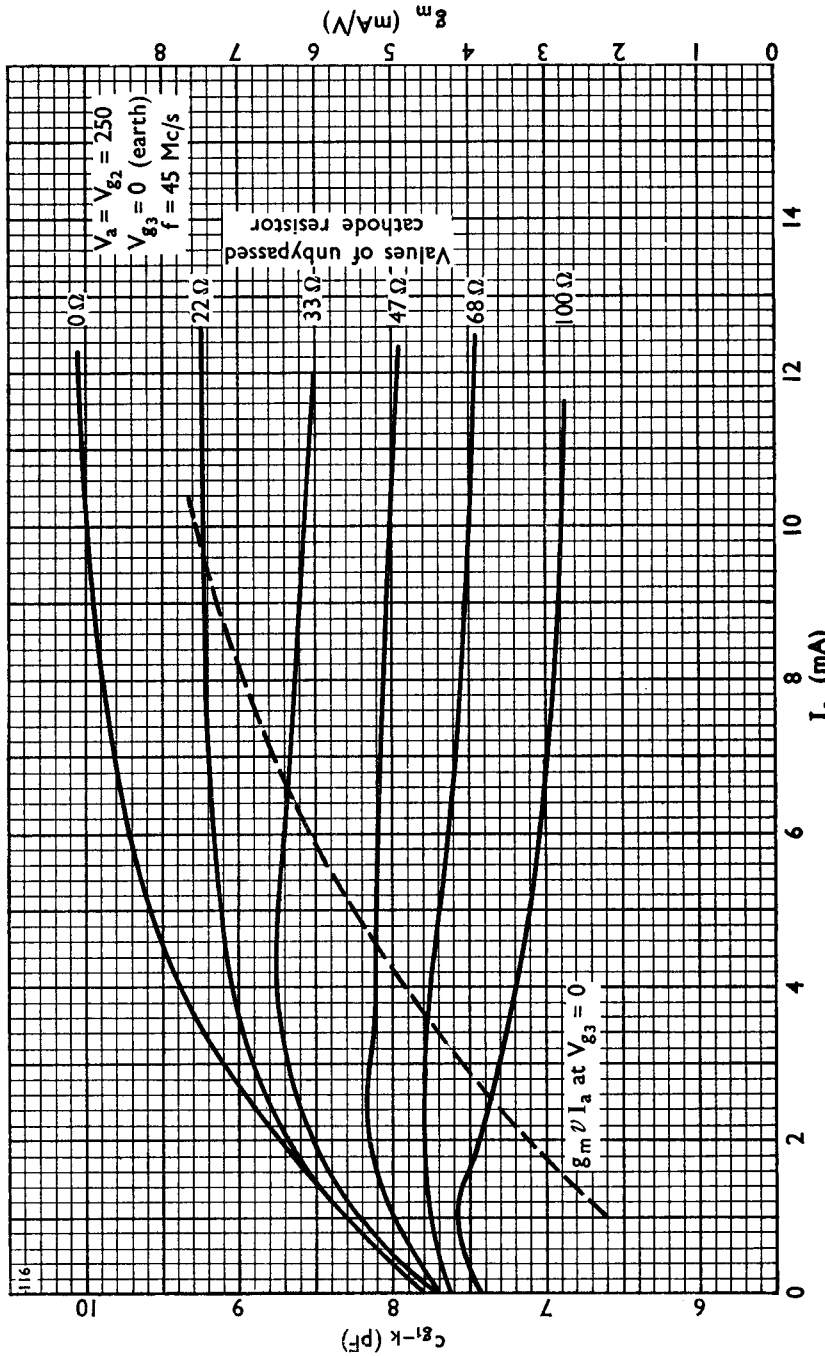

112
$V_{g_3} = 0$
$V_a = V_{g_2} = 250$
$V_a = V_{g_2} = 200$
g_m (mA/V)
1
2
3
4
5
6
7
8
-4
-3
-2
-1
0
V_{g_1}


V_a = 250
V_{g_2} = 250
I_a (mA)
g_m (mA/V)
0
2
4
6
8
2
4
6
8
10
12
14


113
$V_a = V_{g_2} = 250$
$R_k = 160\Omega$ bypassed by 1000 pF
f = 45 Mc/s
CURVE A $V_{g_3} = 0$
" B $V_{g_3} = 20 \times V_{g_1}$
" C $V_{g_3} = 22 \times V_{g_1}$
" D $V_{g_3} = 30 \times V_{g_1}$
A
B
C
D
I_a v g_m at $V_{g_3} = 0$
r_{g_1-k} (kΩ)
I_a (mA)
g_m (mA/V)
0
2
4
6
8
10
5
10
15
20
25
30
35
40
0
2
4
6
8
10
12
14


114
$V_a = V_{g_2} = 250$
$R_k = 160\Omega$ bypassed by 1000 pF
f = 45 Mc/s
CURVE A $V_{g_3} = 0$
" B $V_{g_3} = 20 \times V_{g_1}$
" C $V_{g_3} = 22 \times V_{g_1}$
" D $V_{g_3} = 30 \times V_{g_1}$
$I_a v g_m$ at $V_{g_3} = 0$
A
B
C
D
c_{g-k} (pF)
I_a (mA)
g_m (mA/V)
0
2
4
6
8
10
7
8
9
10
0
2
4
6
8
10
12
14


415
$V_a = V_{g_2} = 250$
$V_{g_3} = 0$ (earth)
f = 45 Mc/s
g_m v I_a at $V_{g_3} = 0$
Values of unbypassed cathode resistor
0 Ω
22 Ω
33 Ω
47 Ω
68 Ω
100 Ω
r_{g_1-k} (kΩ)
g_m (mA/V)
I_a (mA)
0
2
4
6
8
10
10
20
30
1
2
3
4
5
6
7
8


g_m (mA/V)
0
1
2
3
4
5
6
7
8
$V_a = V_{g2} = 250$
$V_{g3} = 0$ (earth)
f = 45 Mc/s
Values of unbypassed cathode resistor
0 Ω
22 Ω
33 Ω
47 Ω
68 Ω
100 Ω
g_m at I_a at $V_{g3} = 0$
I_a (mA)
0
2
4
6
8
10
12
14
C_{g1-k} (pF)
6
7
8
9
10
116

OV.1681

Printed in England. C.

SECONDARY EMITTER PENTODE
6·3 INDIRECTLY HEATED

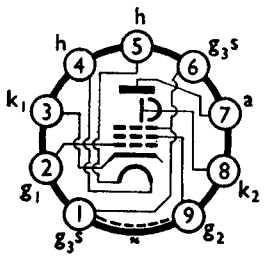
Z319

NOVEMBER, 1954

A high slope pentode for use as a wide-band R.F. amplifier, incorporating a single stage secondary emitter.

The Z319 is a commercial equivalent of CV2276.

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	56·0 max.	mm.
Seated length :	49·0 max.	mm.
Diameter :	22·2 max.	mm.

HEATER

V_h	6·3	V
I_h	0·3	A

RATINGS

V_a	400 max.	V
V_{k2}	250 max.	V
V_{g2}	250 max.	V
$V_{h\text{-}k1}$	150 max.	V
p_a	2·5 max.	W
p_{k2}	2·0 max.	W
p_{g2}	0·8 max.	W

CHARACTERISTICS

V_a	350	V
V_{k2}	250	V
V_{g2}	250	V
I_a	15	mA
g_m	19	mA/V
r_a	50	kΩ
$\mu_{g1\text{-}g2}$	100	

CAPACITANCES (of cold externally screened valve)

$c_{g1\text{-}a}$ 0·003 pF c_{in} 8·0 pF c_{out} 3·0 pF

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office: Marconi House, Chelmsford · Telephone: Chelmsford 3221 · Telegraphic Address: Expanse, Chelmsford

TYPICAL OPERATION

Class A. R.F. Amplifier.

V_a	350	V
V_{k2}	250	V
V_{g2}	250	V
I_a	15·5	mA
I_{k2}	−10·4	mA
I_{g2}	1·2	mA
I_{k1}	6·3	mA
R_{k1}	270	Ω
$r_{eq.\ noise}$ (ref. to g1)	5	kΩ
r_{in} at 45 Mc/s	6	kΩ
c_{in} at 45 Mc/s	11·4	pF

PRECAUTIONS

As the secondary cathode current is negative it is important, in order to prevent circuit instability, to ensure that the total current taken from the power supply is positive. This may be done by means of a suitable resistance load, or by utilising the screen grid or other positive currents in the circuit.

Careful consideration must be given to valve and circuit screening, and also to chassis layout as failure to do this may result in instability due to the high mutual conductance of the valve.

MOUNTING

Any position.

SCREENING

A separate external screening canister should be used. The internal and external surfaces of the canister should be blackened.

RETAINING

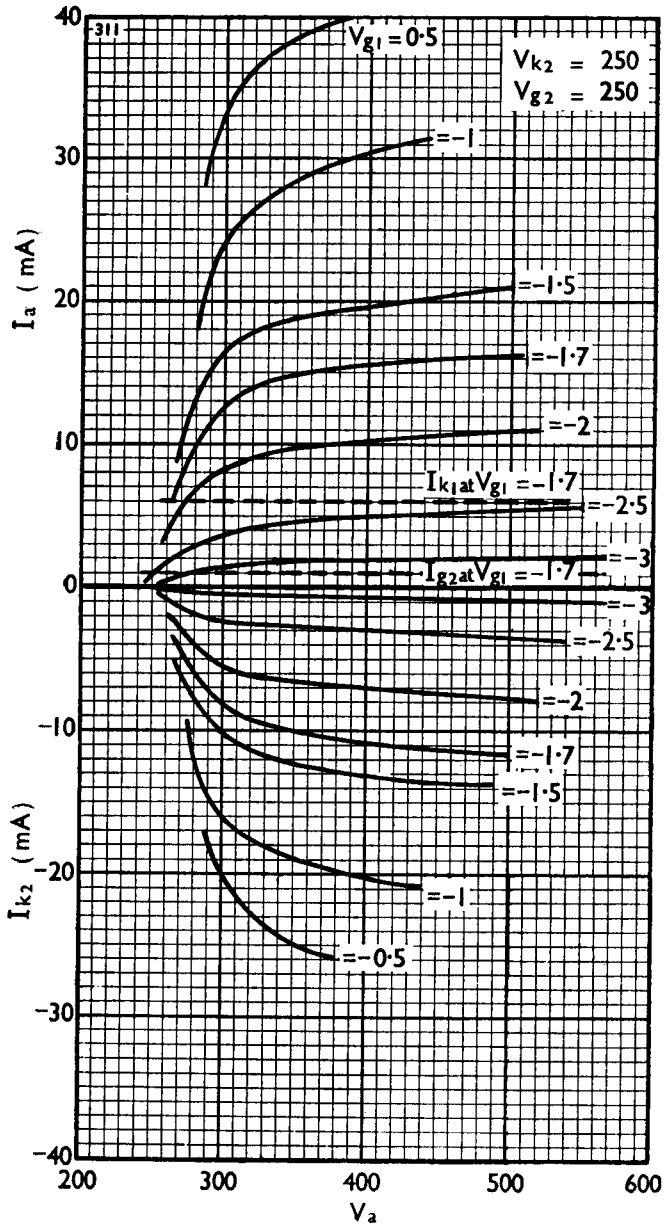
The use of a retaining device is recommended.

VENTILATION

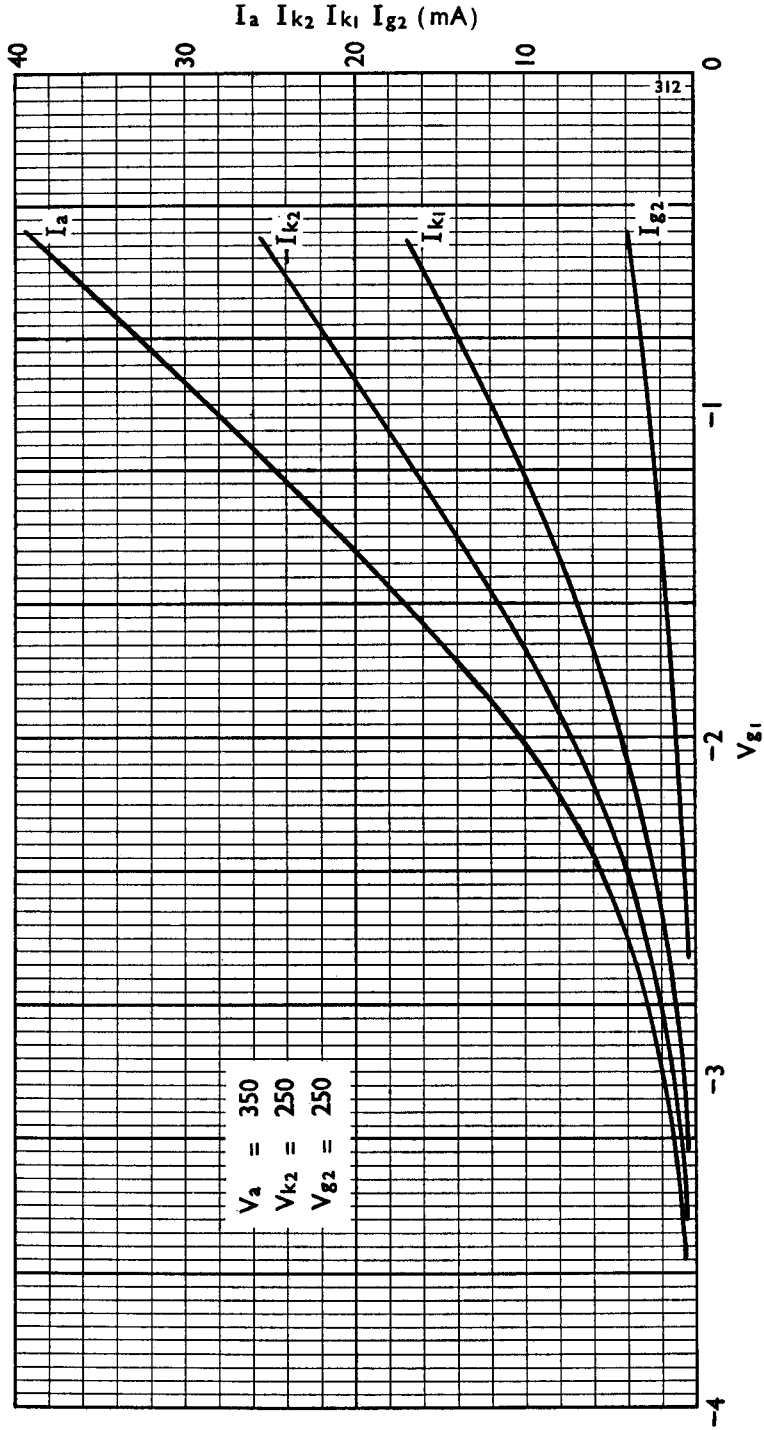
Free air circulation around the bulb is preferable. The temperature of the hottest part of the bulb must not exceed 220°C.

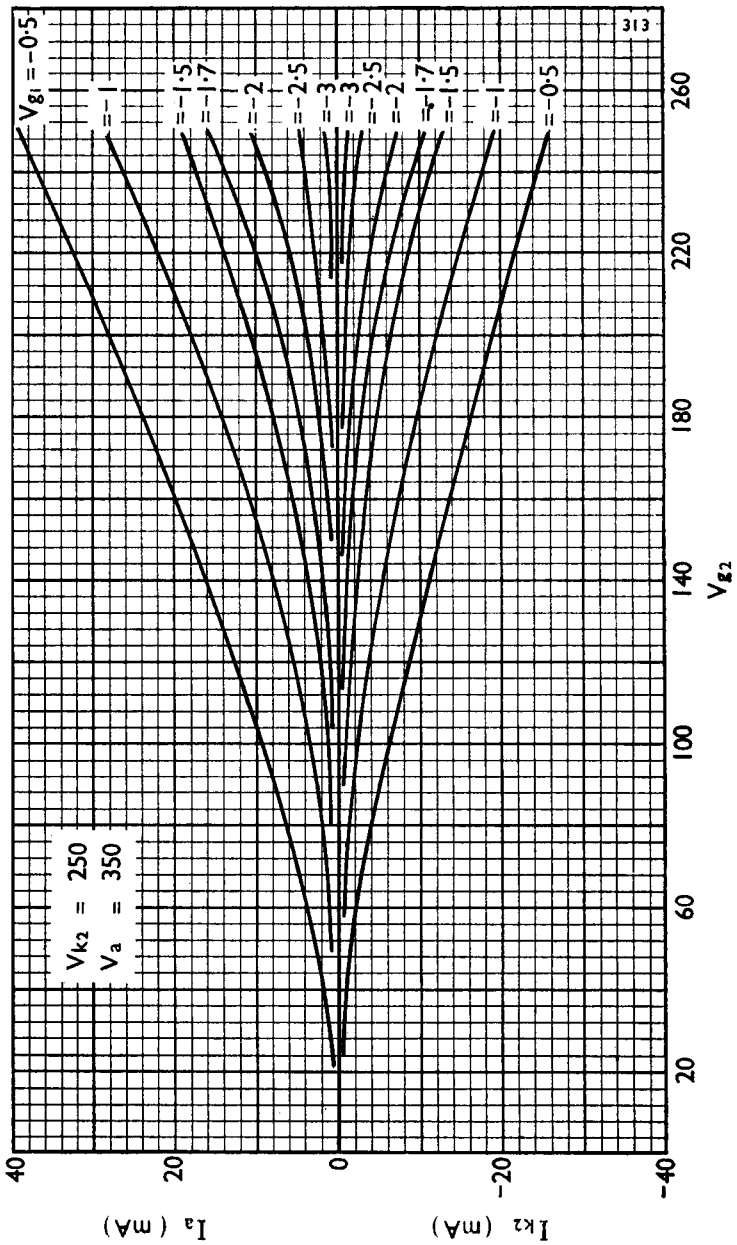
MICROPHONY

This type is free from microphony in normal receiver applications, but checks should be made under maximum gain conditions of the equipment.


311
V_{g1} = 0·5
V_{k2} = 250
V_{g2} = 250
=-1
=-1·5
=-1·7
=-2
I_{k1} at V_{g1} = -1·7
=-2·5
=-3
I_{g2} at V_{g1} = -1·7
=-3
=-2·5
=-2
=-1·7
=-1·5
=-1
=-0·5
I_a (mA)
I_{k2} (mA)
40
30
20
10
0
-10
-20
-30
-40
200
300
400
500
600
V_a

Z319


I_a I_{k2} I_{k1} I_{g2} (mA)
40
30
20
10
0
312
I_a
I_{k2}
I_{k1}
I_{g2}
V_a = 350
V_{k2} = 250
V_{g2} = 250
-1
-2
-3
-4
V_{g1}


313
$V_{g1} = -0·5$
$= -1$
$= -1·5$
$= -1·7$
$= -2$
$= -2·5$
$= -3$
$= -3$
$= -2·5$
$= -2$
$= -1·7$
$= -1·5$
$= -1$
$= -0·5$
V_{k2} = 250
V_a = 350
40
20
0
-20
-40
20
60
100
140
180
220
260
V_{g2}
I_a (mA)
I_{k2} (mA)

OV.2545

Printed in England. C.

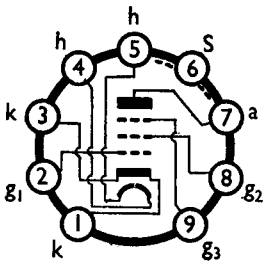
MINIATURE
R. F. PENTODE
6.3V INDIRECTLY HEATED

Z719
MARCH, 1954

A High Slope RF Pentode with High Input Impedance at radio frequencies.

BASE CONNECTIONS AND VALVE DIMENSIONS

Base: B9A
Bulb: Tubular



View from underside of base.

Max. overall length: 67·5 mm.
Max. seated length: 60·5 mm.
Max. diameter: 22·2 mm.

RATING

V_h	6·3		V
I_h	0·3	approx.	A
$V_{a(b)}$*	550	max.	V
V_a	300	max.	V
$V_{g2(b)}$*	550	max.	V
V_{g2}	300	max.	V
v_{h-k}	150	max.	V
p_a	2·5	max.	W
p_{g2}	0·7	max.	W
g_m at $V_a = V_{g2} = 170$, $I_a = 10$mA	7·4		mA/V
r_a at $V_a = V_{g2} = 170$, $I_a = 10$mA	0·4		MΩ
μ_{g1-g2} at $V_a = V_{g2} = 170$, $I_a = 10$mA	50		
$R_{eq.\ noise}$	1000		Ω
R_{in}†	14		kΩ
c_{g1-k}†	11·2		pF

* With $I_a = 0$, $I_{g2} = 0$.

† Taken at f = 45 Mc/s with both cathode tags strapped as in Fig. 1. A small variation in cathode wiring can alter the value of R_{in}.

CAPACITANCES (of an unscreened valve)

$c_{g\text{-all}}$ 7·5 pF $c_{a\text{-all}}$ 3·3 pF $c_{a\text{-}g1}$ 0·006 pF

MOUNTING

Any position.

SCREENING

A separate external screening canister should be used. The internal and external surfaces of the canister should be blackened.

RETAINING

It is recommended that a retaining device is used.

VENTILATION

The temperature of the hottest part of the bulb must not exceed 250°C.

MICROPHONY

This type is free from microphony in normal receiver application.

NOTE.— To obtain the values of R_{in} quoted, the above circuit must be used. The following points being important.

(1) Cathode pins 1 & 3 must be connected by a straight wire.
(2) All input circuit returns to be taken direct to one of these pins.
(3) All output circuit returns to be taken direct to the other pin.

Fixed bias is not important, and the values of C used must be large enough to give satisfactory de-coupling at the frequencies involved.

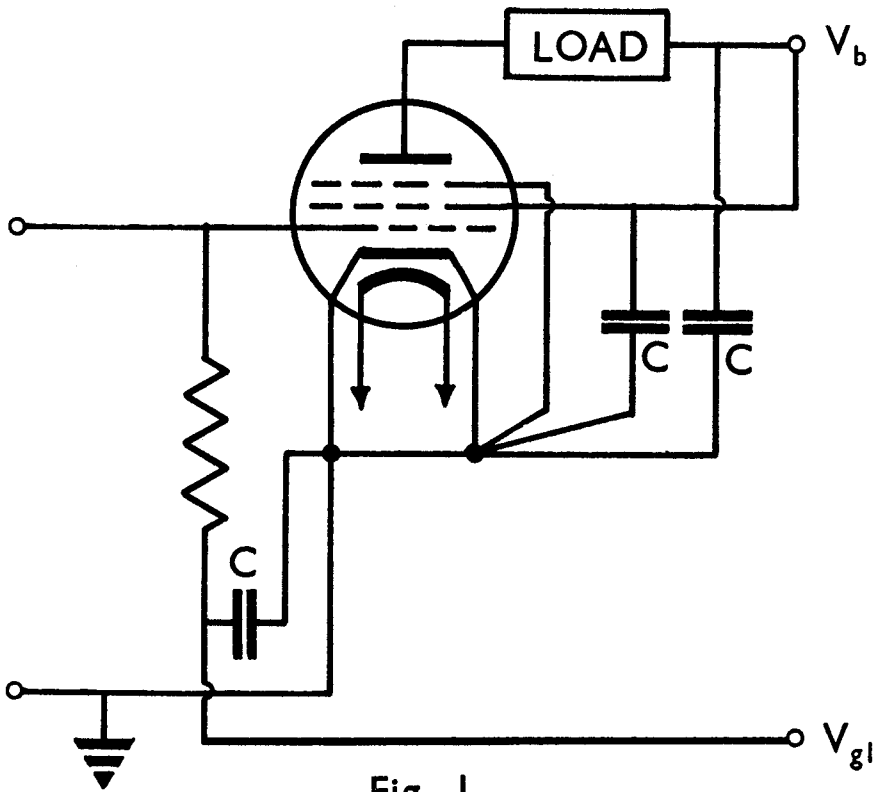
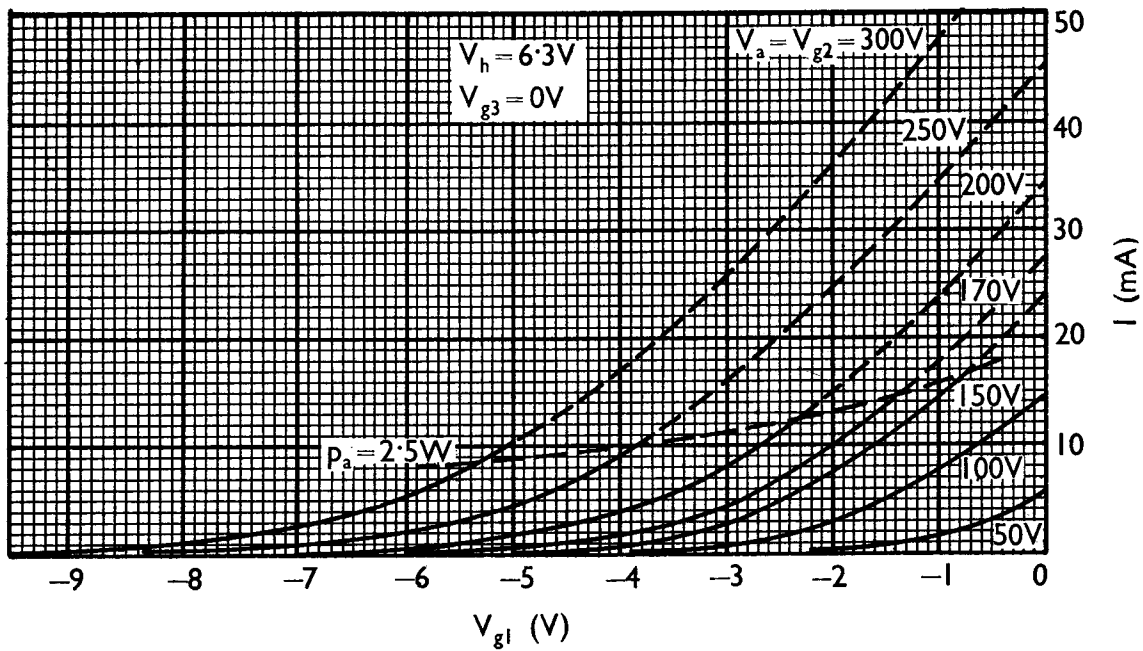
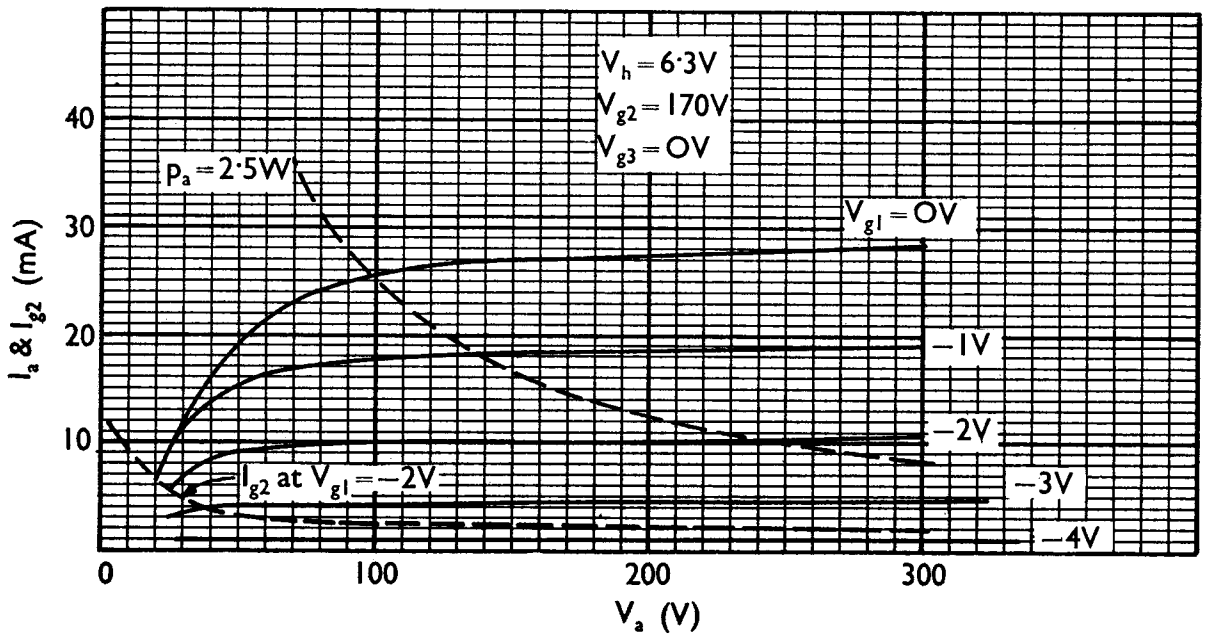
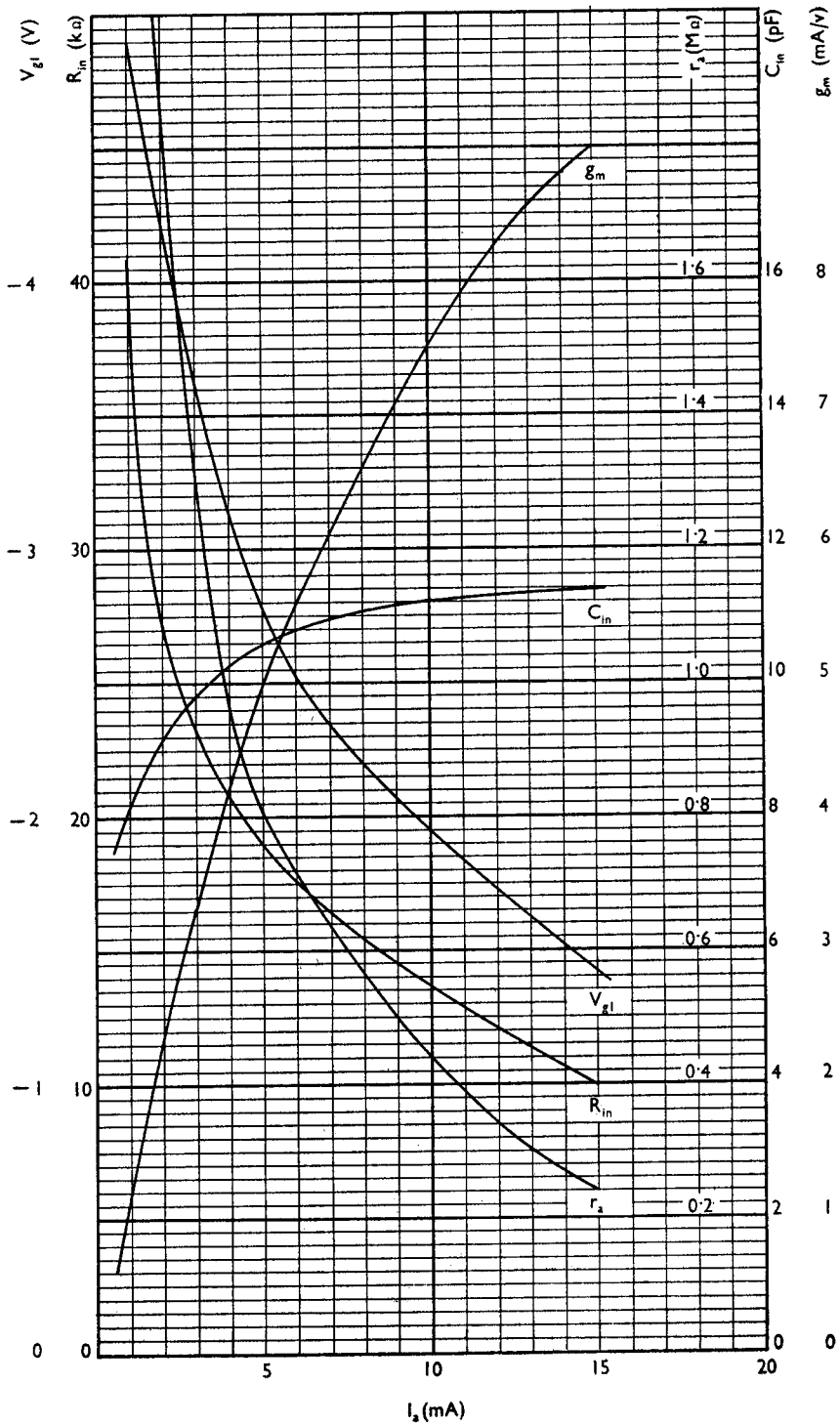


Fig. 1.


$V_h = 6{\cdot}3V$
$V_{g3} = 0V$
$V_a = V_{g2} = 300V$
250V
200V
170V
150V
100V
50V
$P_a = 2{\cdot}5W$
50
40
30
20
10
I (mA)
−9
−8
−7
−6
−5
−4
−3
−2
−1
0
V_{g1} (V)


$V_h = 6{\cdot}3V$
$V_{g2} = 170V$
$V_{g3} = 0V$
$P_a = 2{\cdot}5W$
$V_{g1} = 0V$
$-1V$
$-2V$
$-3V$
$-4V$
I_{g2} at $V_{g1} = -2V$
40
30
20
10
0
100
200
300
I_a & I_{g2} (mA)
V_a (V)



V_h = 6·3V V_a = 170V V_{g2} = 170V f = 45Mc/s

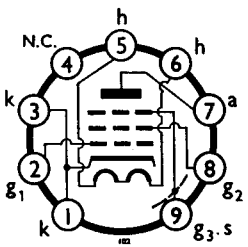
Printed in England

R.F. SHORT BASE PENTODES
INDIRECTLY HEATED

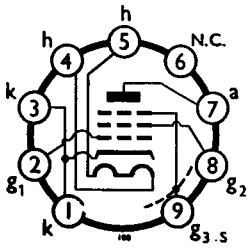
Z759
Z359
AUGUST, 1955

A high slope valve primarily designed for use as a video amplifier and for wide-band amplifiers.

BASE CONNECTIONS AND VALVE DIMENSIONS



Z759



Z359

View from underside of base.

Base : B9A
Bulb : Tubular

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Diameter :	22 max.	mm.

HEATERS

	Z759	Z359	
V_h	6·3	12·6	V
I_h	0·6	0·3	A

MAXIMUM RATING (design centre)

V_a	300	V
V_{g2}	250	V
$V_{h\text{-}k\ pk}$	150	V
p_a	5	W
p_{g2}	1·5	W

CHARACTERISTICS

V_a	250	V
V_{g2}	250	V
I_a	20	mA
I_{g2}	5·25	mA
V_{g1}	—2	V
g_m	15	mA/V
r_a	0·5	MΩ

CAPACITANCES (of cold screened valve)

$c_{g1\text{-}a}$ 0·007 pF c_{in} 13 pF c_{out} 2·5 pF

MOUNTING

Any position.

SCREENING

A separate external screening canister should be used.

RETAINING

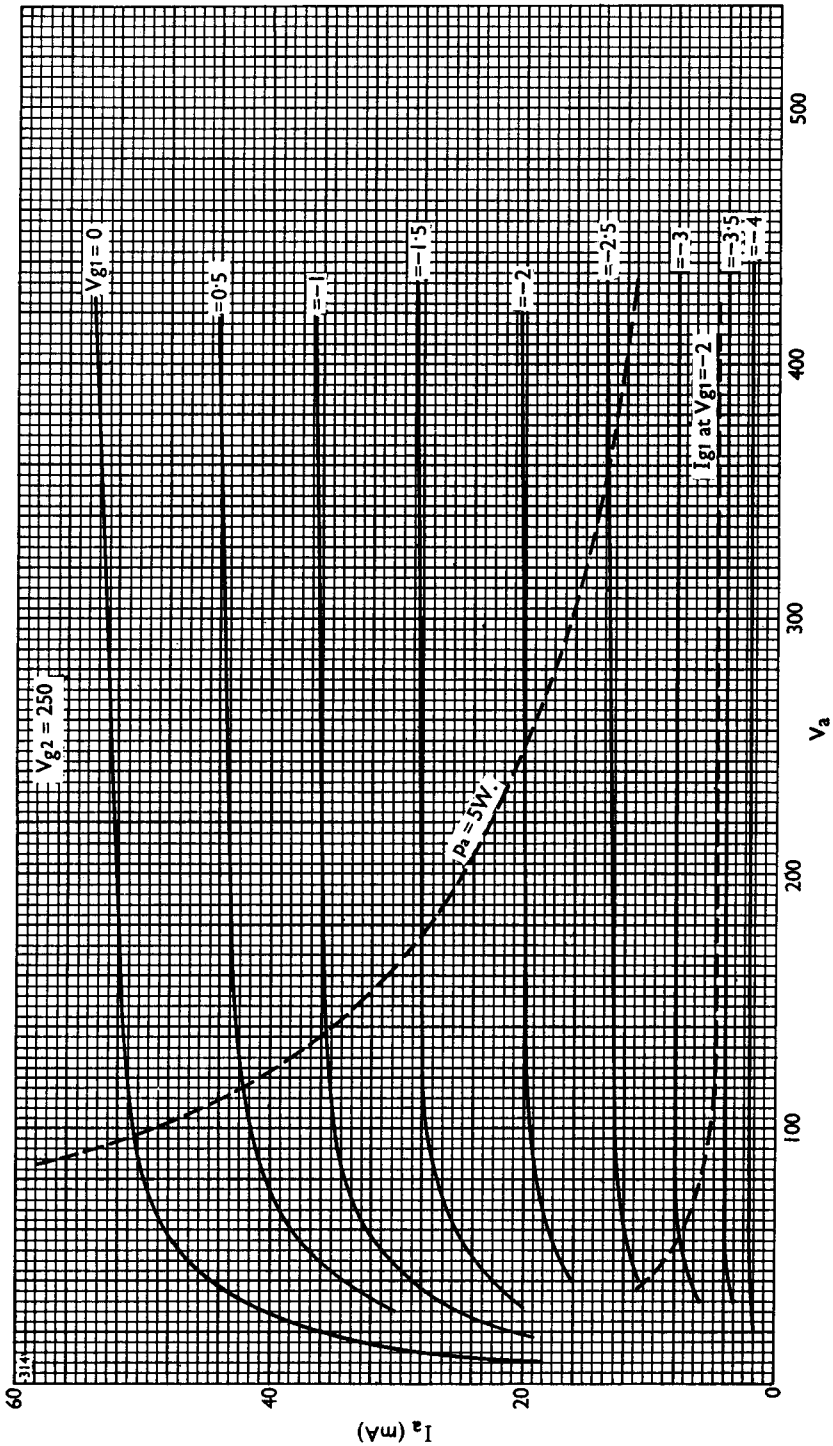
The use of a retaining device is recommended.

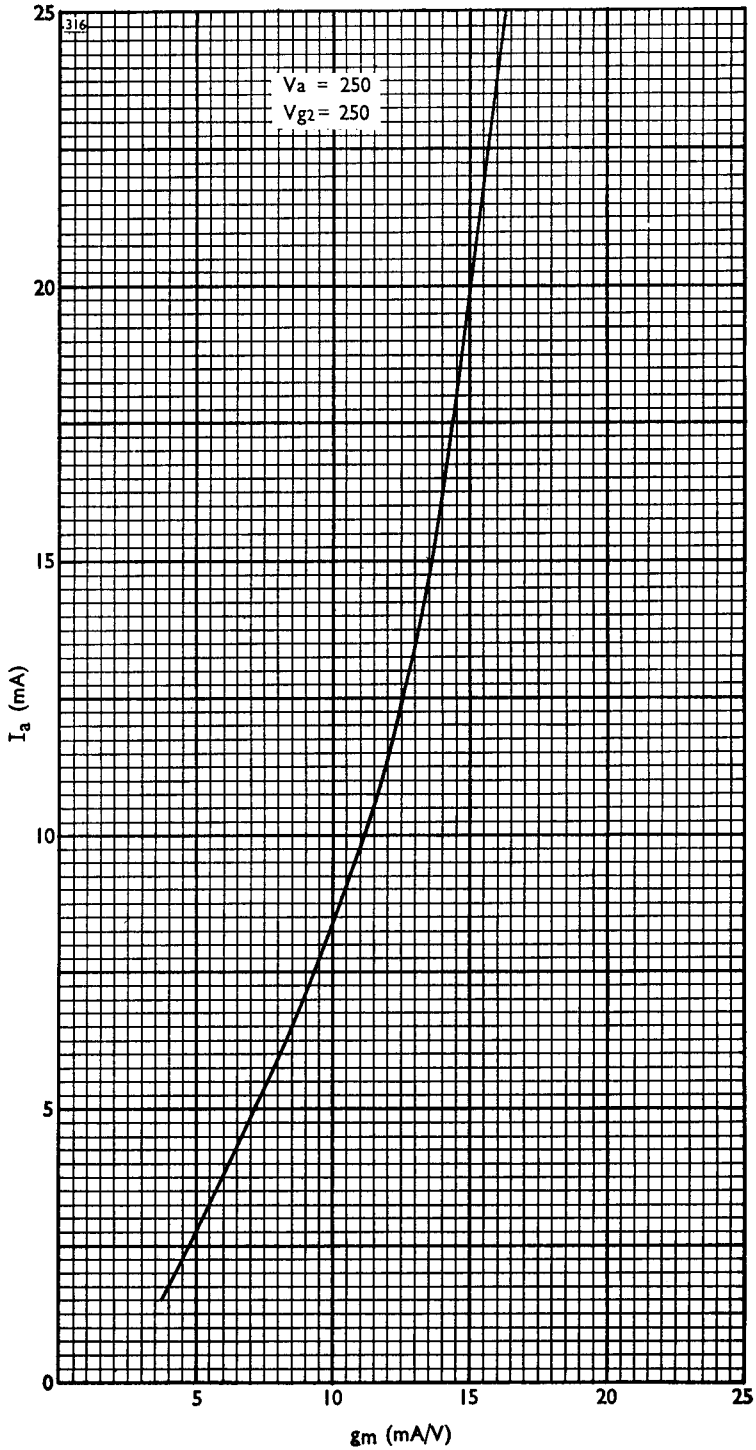
VENTILATION

Free air circulation around the bulb is preferable. If a retaining device in the form of a canister is used the surfaces should be blackened. The temperature of the hottest part of the bulb must not exceed 250°C.

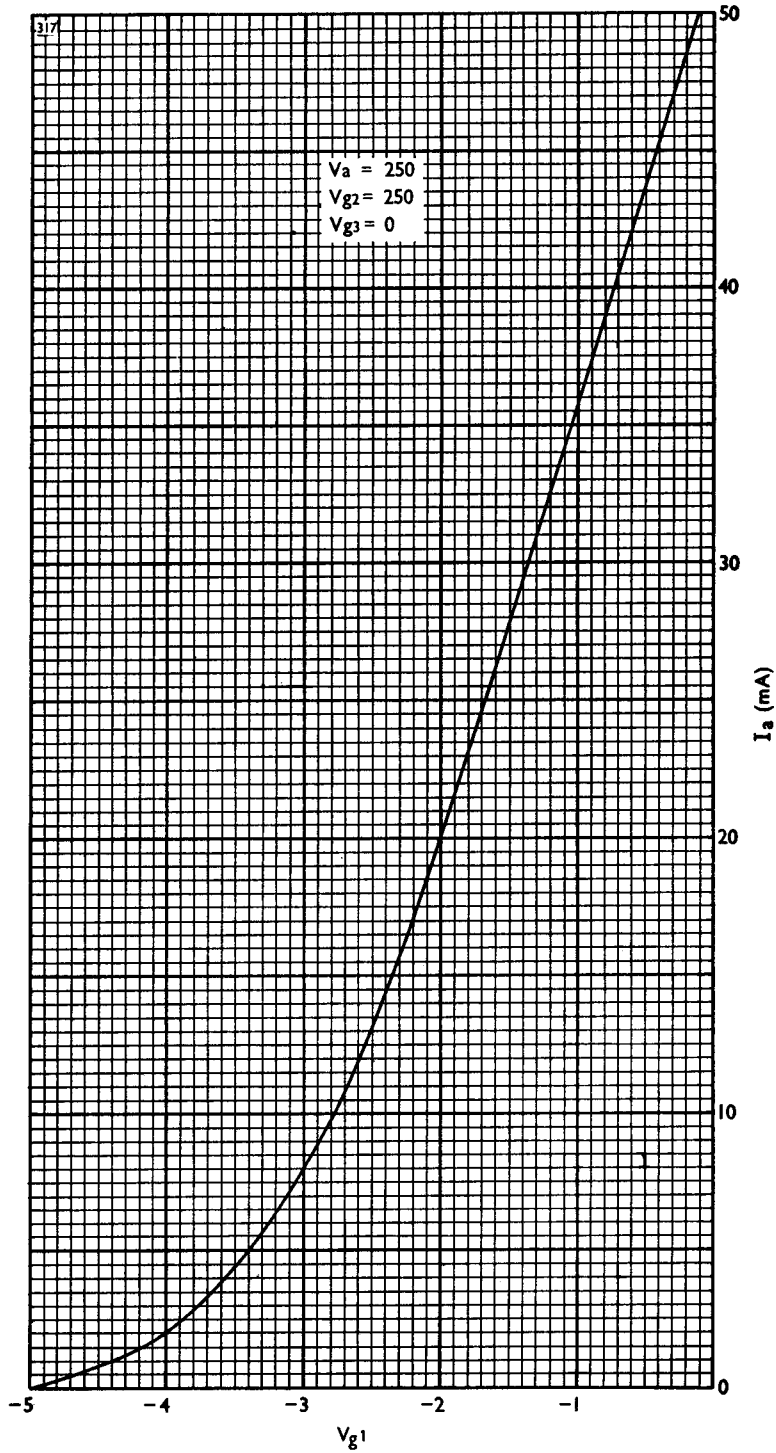
MICROPHONY

This type is free from microphony in most applications, but checks should be made under maximum gain conditions of the equipment.

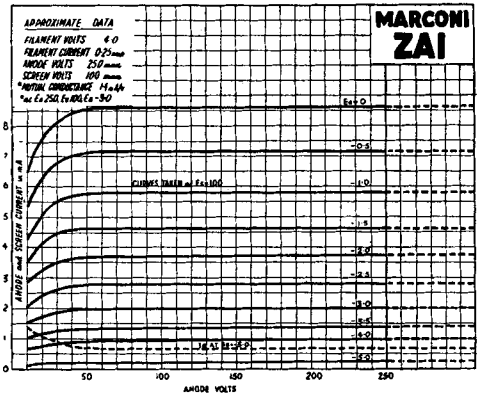

$V_{g1} = 0$
$= 0{\cdot}5$
$= -1$
$= -1{\cdot}5$
$= -2$
$= -2{\cdot}5$
$= -3$
$= -3{\cdot}5$
$= -4$
$V_{g2} = 250$
$P_a = 5W$
I_{g1} at $V_{g1} = -2$
I_a (mA)
V_a
0
20
40
60
100
200
300
400
500
3144


316
Va = 250
Vg2 = 250
25
20
15
10
5
0
Ia (mA)
5
10
15
20
25
gm (mA/V)

Z759 Z359



Printed in England. C.



Marconi ZA1

Acorn Pentode

Marconi ZA1 enables H.F. gain to be attained at frequencies above 50Mc where the ordinary type of valve ceases to amplify.

Nominal rating, see curve.

Inter-electrode capacities.

G—A	0.007$\mu\mu$F
A—E	3.0$\mu\mu$F
G—E	3.0$\mu\mu$F

Typical Operating Data.

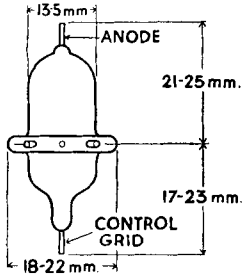
As H.F. amplifier.

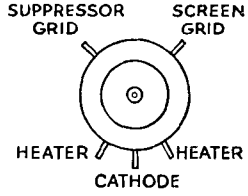
Anode volts	250
Screen volts	100
Grid volts	—3
Bias resistance	1500 ohms

Notes.

The acorn pentode can also be used as a frequency changer in conjunction with an acorn triode, suppressor grid injection being employed. As a valve voltmeter ZA1 can be mounted at the end of a test prod, thus keeping the live lead very short indeed.

Soldered connections must not be made to the valve prongs.





VIEW FROM TOP

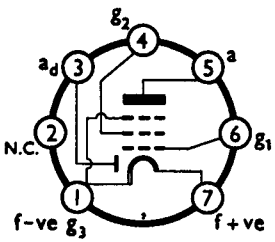
Price - - 60/-

MINIATURE
DIODE-PENTODE
1·4V DIRECTLY HEATED

ZD17

MAY, 1953

BASE CONNECTIONS AND VALVE DIMENSIONS



View from underside of base.

Base : B7G
Bulb : Tubular.

Overall length :	49—55	mm.
Seated length :	43—49	mm.
Max. diameter :	19	mm.

RATING

Pentode connection :

V_f	1·4		V
I_f	50	approx.	mA
V_a	90	max.	V
V_{g2}	90	max.	V
I_k	3	max.	mA
r_a at $V_a = V_{2g} = 67·5$, $V_{g1} = 0$	0·6		MΩ
g_m at $V_a = V_{2g} = 67·5$, $V_{g1} = 0$	0·63		mA/V

Triode connection :

V_a, g_2	90	max.	V
I_k	3	max.	mA
μ at $V_a = g_2 = 67·5$, $V_{g1} = 0$	14		
r_a at $V_a = g_2 = 67·5$, $V_{g1} = 0$	17·5		kΩ
g_m at $V_a = g_2 = 67·5$, $V_{g1} = 0$	0·8		mA/V

TYPICAL OPERATION

Pentode connection :

V_{ab}	45	67·5	90	V
V_{g2b}	45	67·5	90	V
V_{g1}	0	0	0	V
R_a	0·5—1	0·5—1	0·5—1	MΩ
$R_{b—g2}$	$R_a \times 5$	$R_a \times 5$	$R_a \times 5$	MΩ
$R_{g1—k}$	10	10	10	MΩ
V_{gain}	30	40	50	

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED

Head Office : Marconi House, Chelmsford · Telephone : Chelmsford 3221 · Telegraphic Address : Expanse, Chelmsford

CAPACITANCES (of cold unscreened valve)

$C_{gl—all}$	2·2	pF	$C_{a—all}$	2·4	pF	$C_{gl—a}$	0·2	pF
$C_{d—gl}$	0·5	pF	$C_{d—a}$	0·45	pF	$C_{d—f}$	1·4	pF

FILAMENT OPERATION

When operating the filament from a mains supply, the voltage should be adjusted to 1·3 or the current to 47·5 mA mean. Under certain conditions, a suitable shunt resistor will be required.

SCREENING

No internal or external screening is fitted to the valve.

MOUNTING

Any position.

RETAINING

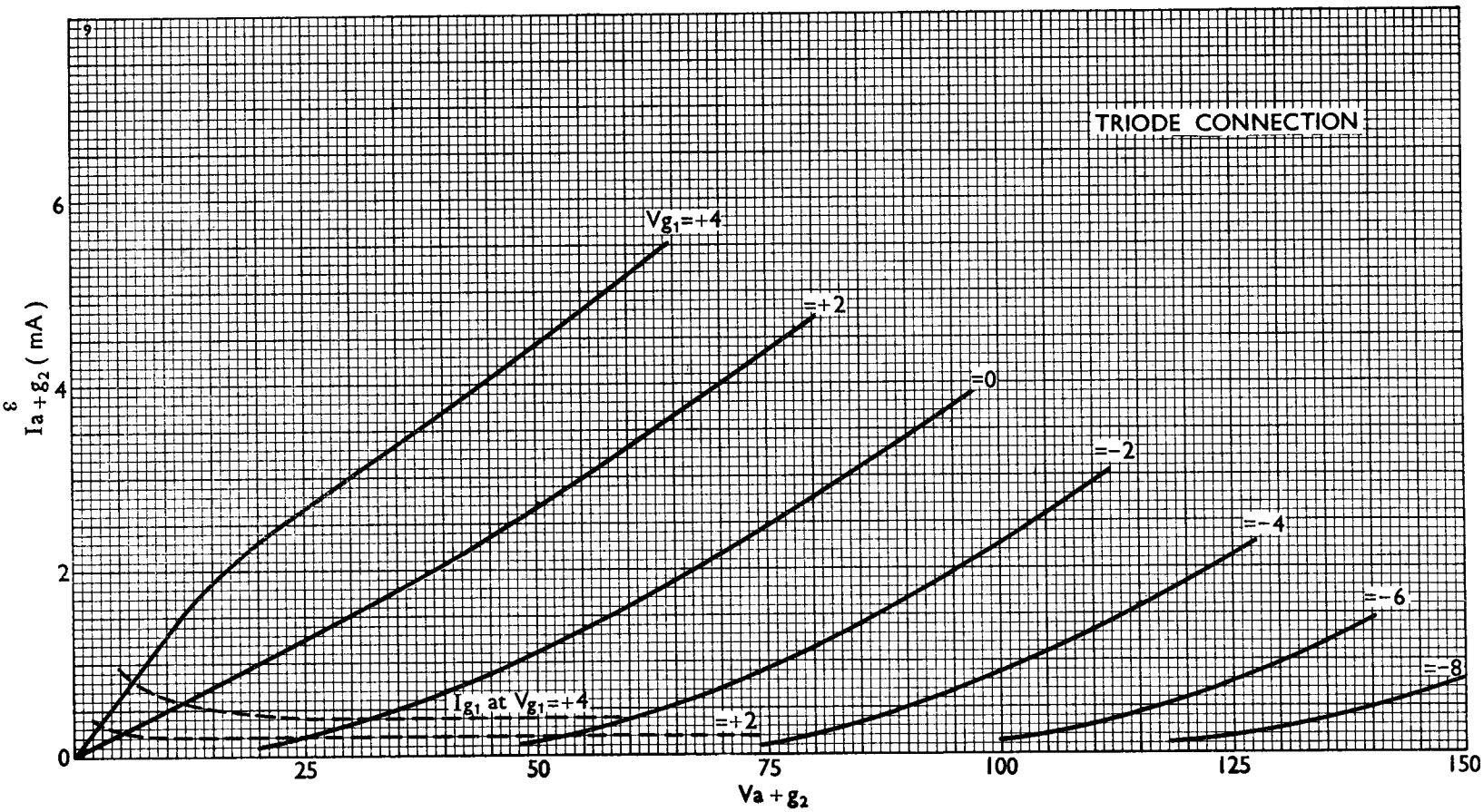
A retaining device should be used.

VENTILATION

No special precautions are necessary.

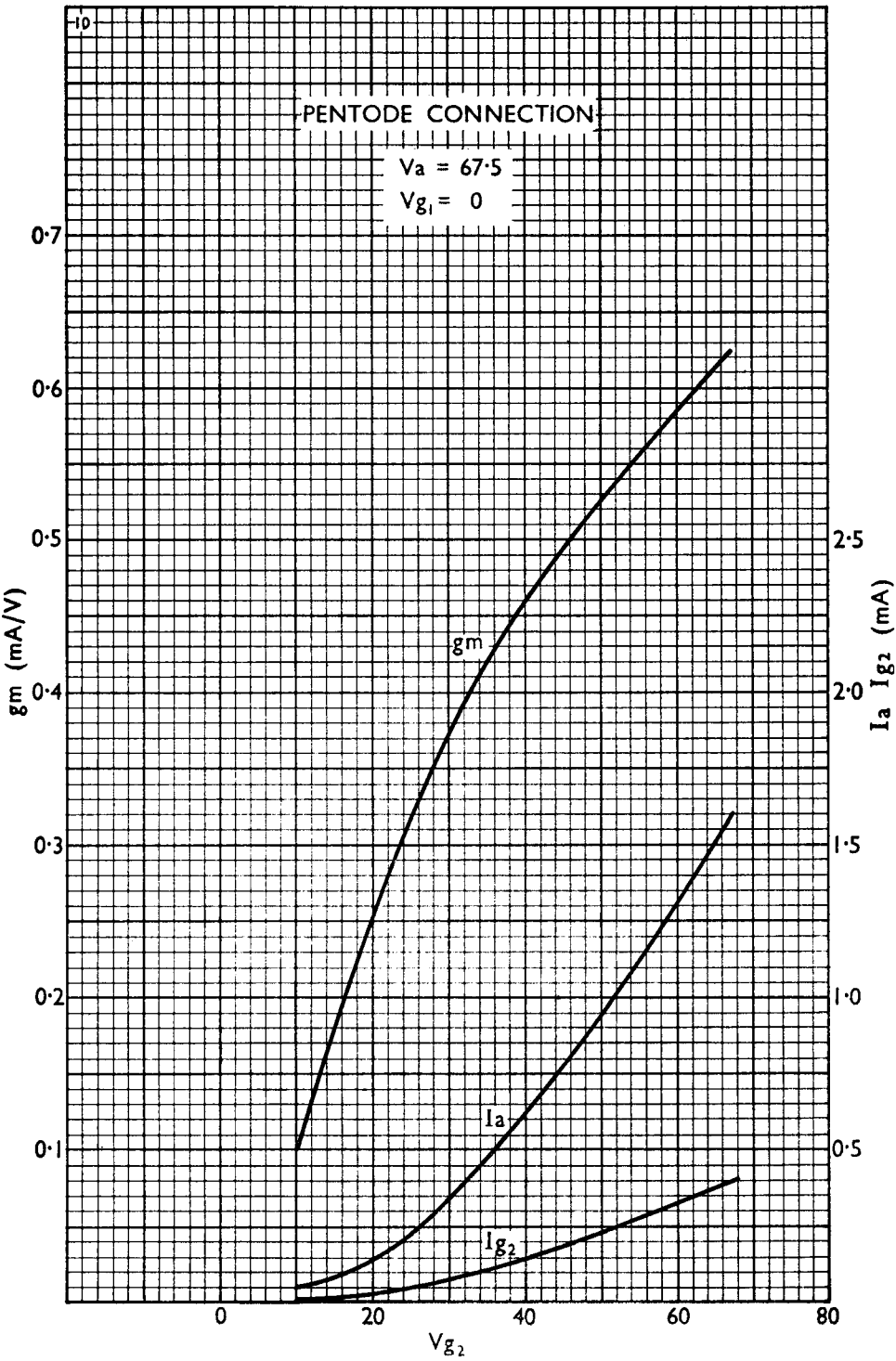
MICROPHONY

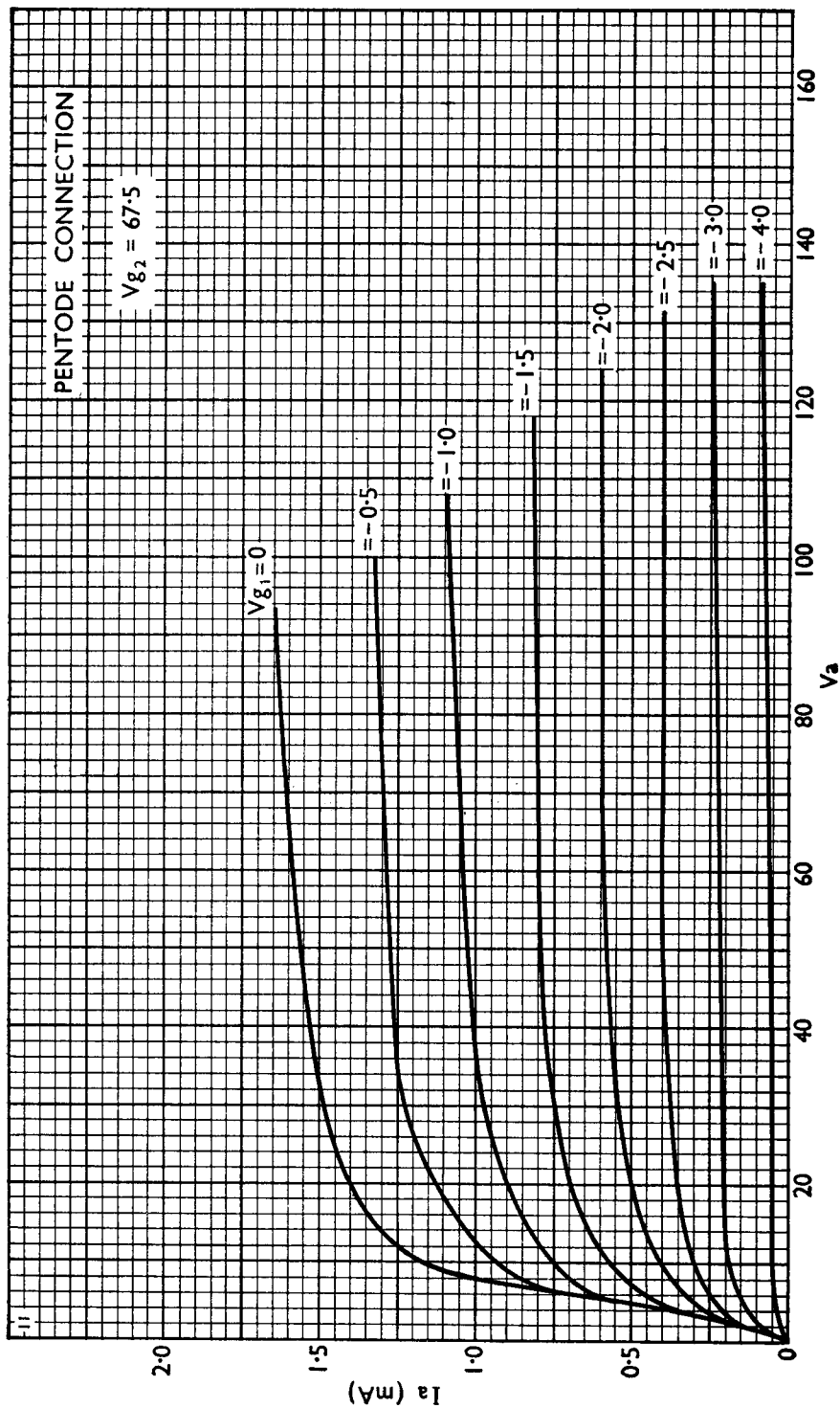
Although this is of a very low order, equipment should be designed to minimise microphony.


TRIODE CONNECTION
V_{g_1}=+4
=+2
=0
=−2
=−4
=−6
=−8
I_{g_1} at V_{g_1}=+4
=+2
ε
$I_a + g_2$ (mA)
$V_a + g_2$
0
2
4
6
25
50
75
100
125
150

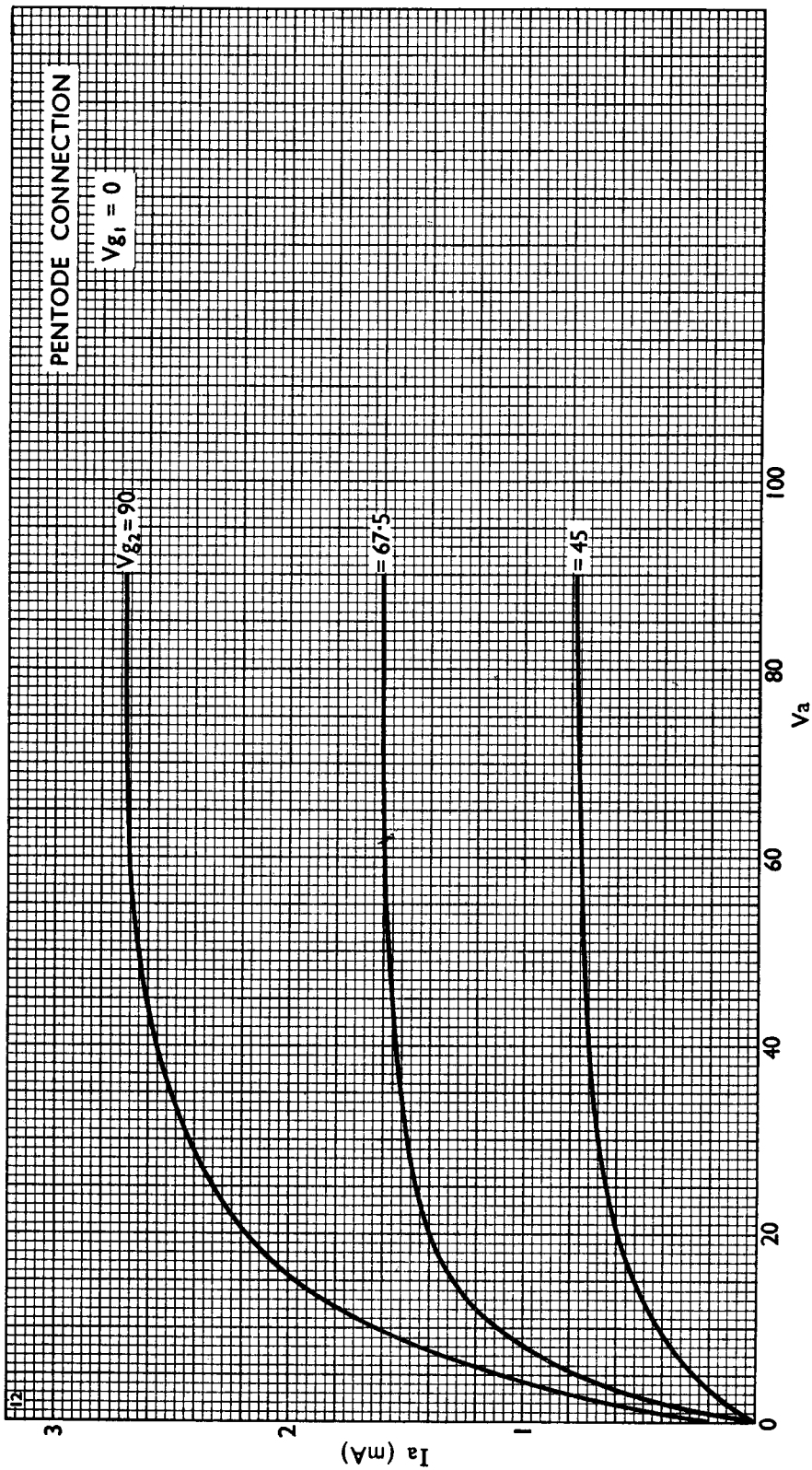
ZD17

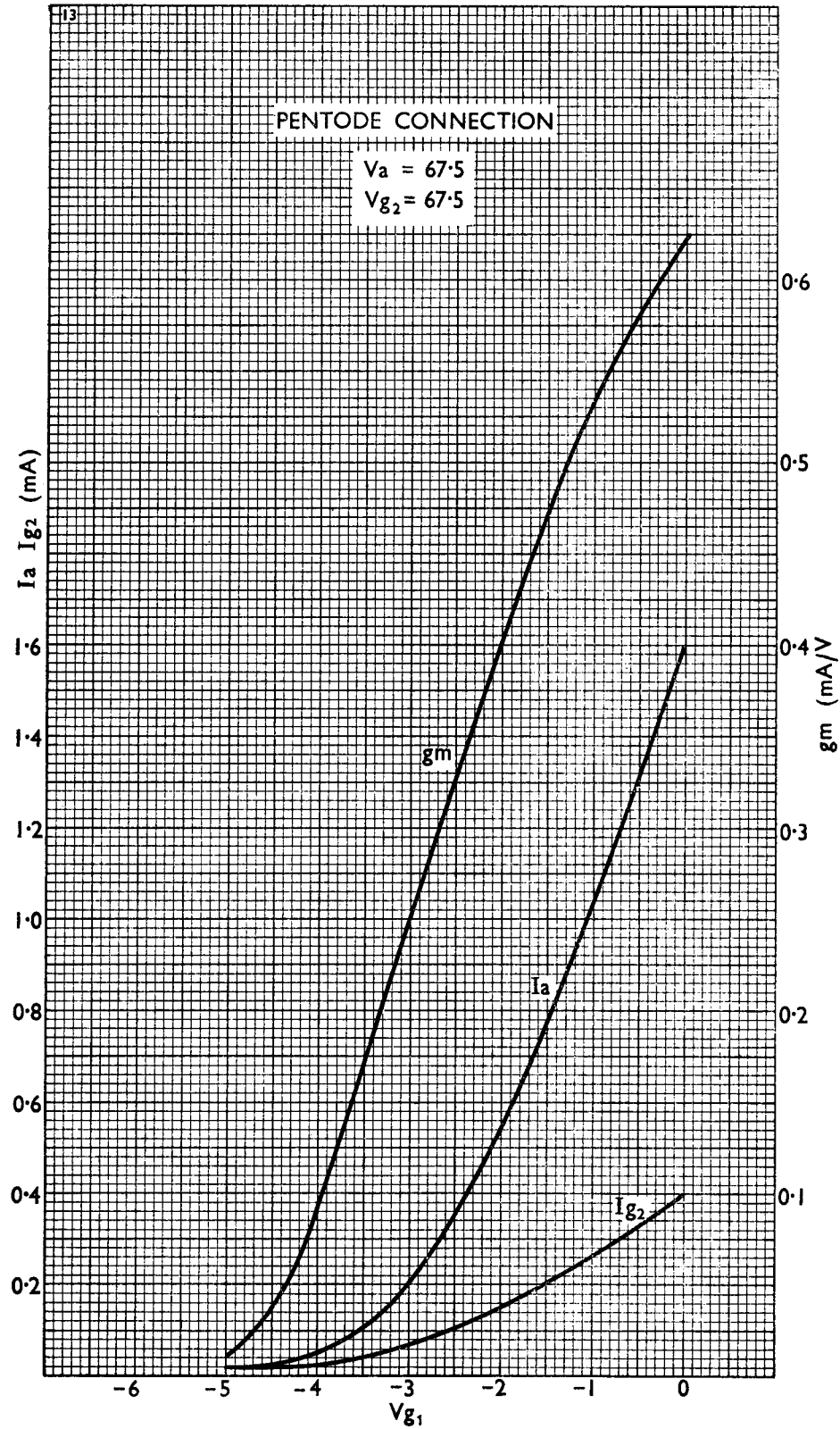
ZD17


10
PENTODE CONNECTION
Va = 67·5
Vg1 = 0
0·7
0·6
0·5
0·4
0·3
0·2
0·1
gm (mA/V)
gm
Ia
Ig2
2·5
2·0
1·5
1·0
0·5
Ia Ig2 (mA)
0
20
40
60
80
Vg2


PENTODE CONNECTION
V_{g_2} = 67·5
V_{g_1} = 0
= − 0·5
= − 1·0
= − 1·5
= − 2·0
= − 2·5
= − 3·0
= − 4·0
Ia (mA)
0
0·5
1·0
1·5
2·0
Va
20
40
60
80
100
120
140
160

ZD17


PENTODE CONNECTION
$V_{g_1} = 0$
$V_{g_2} = 90$
= 67·5
= 45
I_a (mA)
V_a
0
20
40
60
80
100
1
2
3


13
PENTODE CONNECTION
Va = 67·5
Vg2 = 67·5
Ia Ig2 (mA)
gm (mA/V
gm
Ia
Ig2
Vg1
1·6
1·4
1·2
1·0
0·8
0·6
0·4
0·2
0·6
0·5
0·4
0·3
0·2
0·1
−6
−5
−4
−3
−2
−1
0

ZD17

OV.1557 Printed in England. C. May, 1953