Mullard

Mullard TECHNICAL HANDBOOK

VOL. 1

RECEIVING VALVES - EQUIPMENT TYPES

CATHODE RAY TUBES

MISCELLANEOUS TUBES

SUBMINIATURE DIODE A.F. PENTODE

DAF70

Subminiature a.f. pentode, combined with a single diode, suitable for battery operation.

FILAMENT

V_f	1.25	V
I_f	25	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm. from the seal and any bending of the valve leads must be at least 1.5mm. from the seal.

CAPACITANCES (measured with external shield)

c_{a-g1}	0.15	pF
c_{in}	2.0	pF
c_{out}	4.3	pF
c_{ad-g}	0.1	pF

CHARACTERISTICS

V_a	67.5	V
V_{g2}	67.5	V
I_a	1.0	mA
I_{g2}	250	µA
V_{g1}	0	V
g_m	440	µA/V
r_a	400	kΩ
μ_{g1-g2}	16	

OPERATING CONDITIONS AS R.C. COUPLED A.F. AMPLIFIER

V_b	67.5	V
R_a	1.0	MΩ
R_{g2}	4.7	MΩ
$*R_{g1}$	3.3	MΩ
$\frac{V_{out}}{V_{in}}$	73	

* Grid resistor of following valve.

MAINTENANCE TYPE

Mullard

DAF70

SUBMINIATURE DIODE A.F. PENTODE

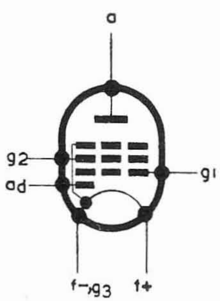
Subminiature a.f. pentode, combined with a single diode, suitable for battery operation.

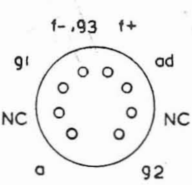
OPERATING CONDITIONS AS CLASS "A" AMPLIFIER

V_a	67.5	90	V
V_{g2}	67.5	90	V
V_{g1}	−1.8	−2.6	V
$I_{a(0)}$	400	600	μA
$I_{g2(0)}$	85	135	μA
R_a	150	150	kΩ
P_{out}	10.5	20	mW
D_{tot}	10	10	%

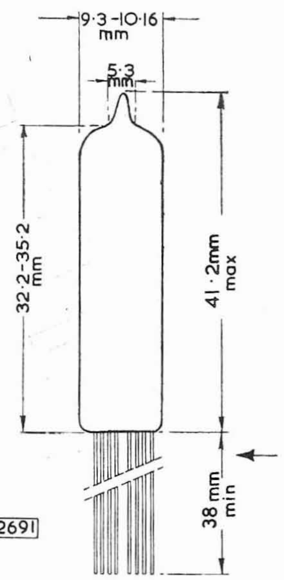
LIMITING VALUES

V_a max.	90	V
V_{g2} max.	90	V
I_k max.	1.3	mA
I_{ad} max.	250	μA





B8D/F Base



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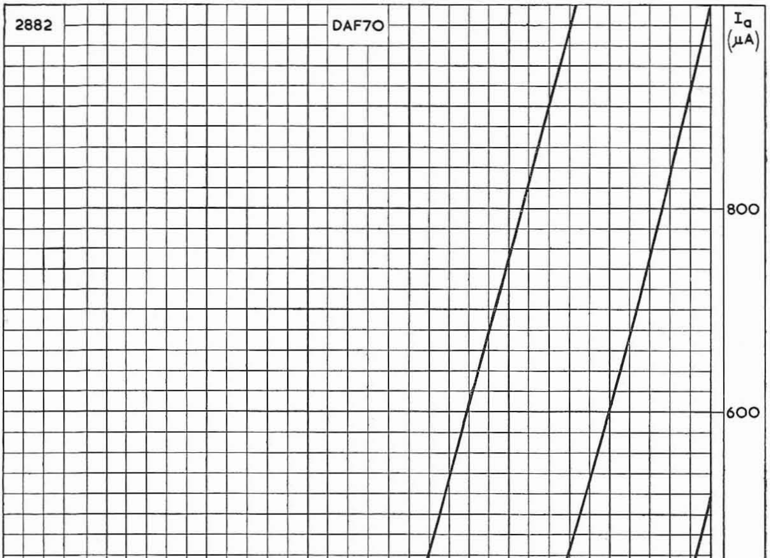
SUBMINIATURE DIODE A.F. PENTODE

DAF70

Subminiature a.f. pentode, combined with a single diode, suitable for battery operation.

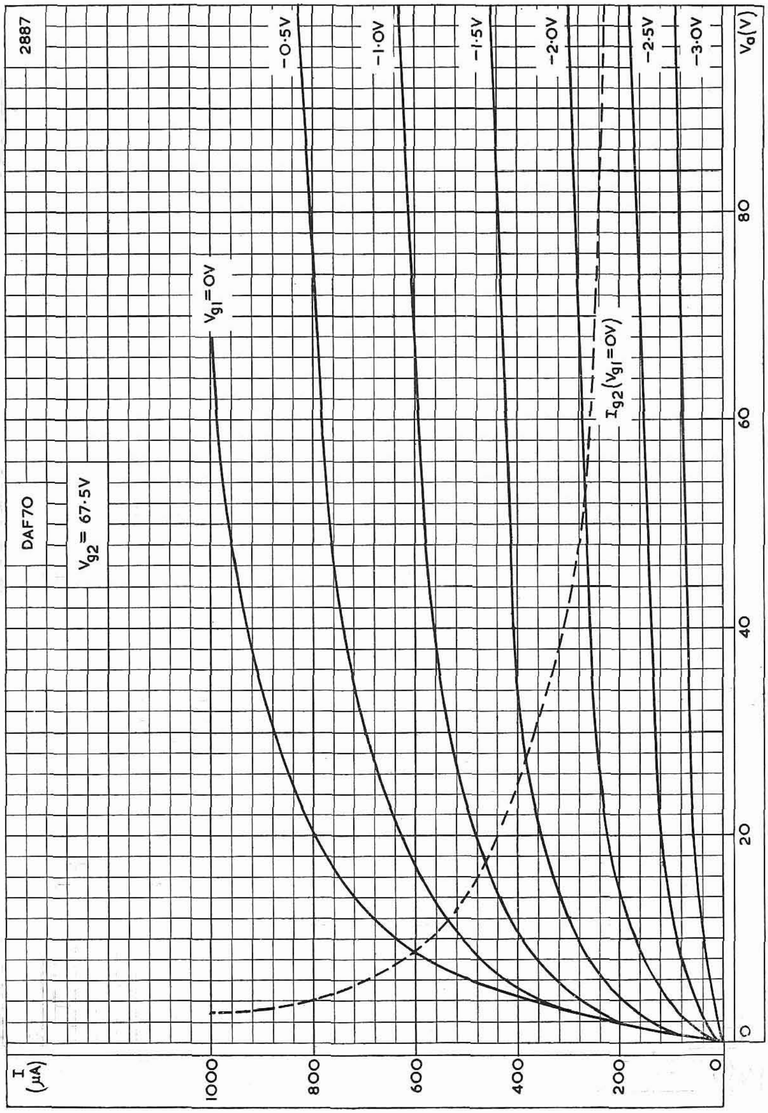


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

DAF70

SUBMINIATURE DIODE A.F. PENTODE

Subminiature a.f. pentode, combined with a single diode, suitable for battery operation.

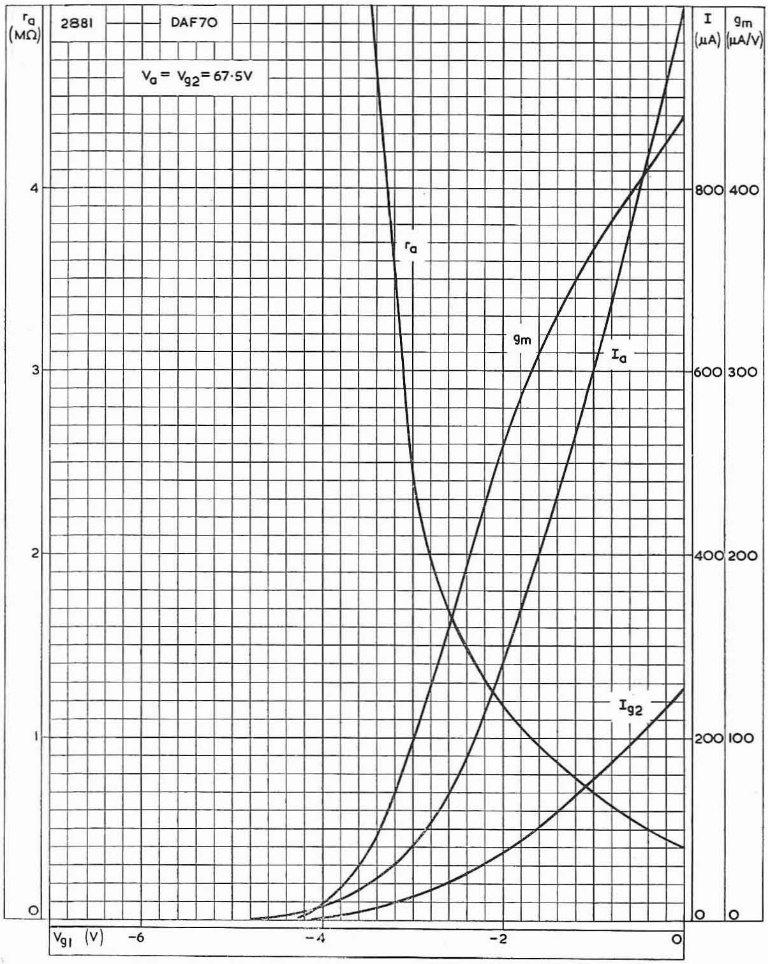


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

SUBMINIATURE DIODE A.F. PENTODE

DAF70

Subminiature a.f. pentode, combined with a single diode, suitable for battery operation.

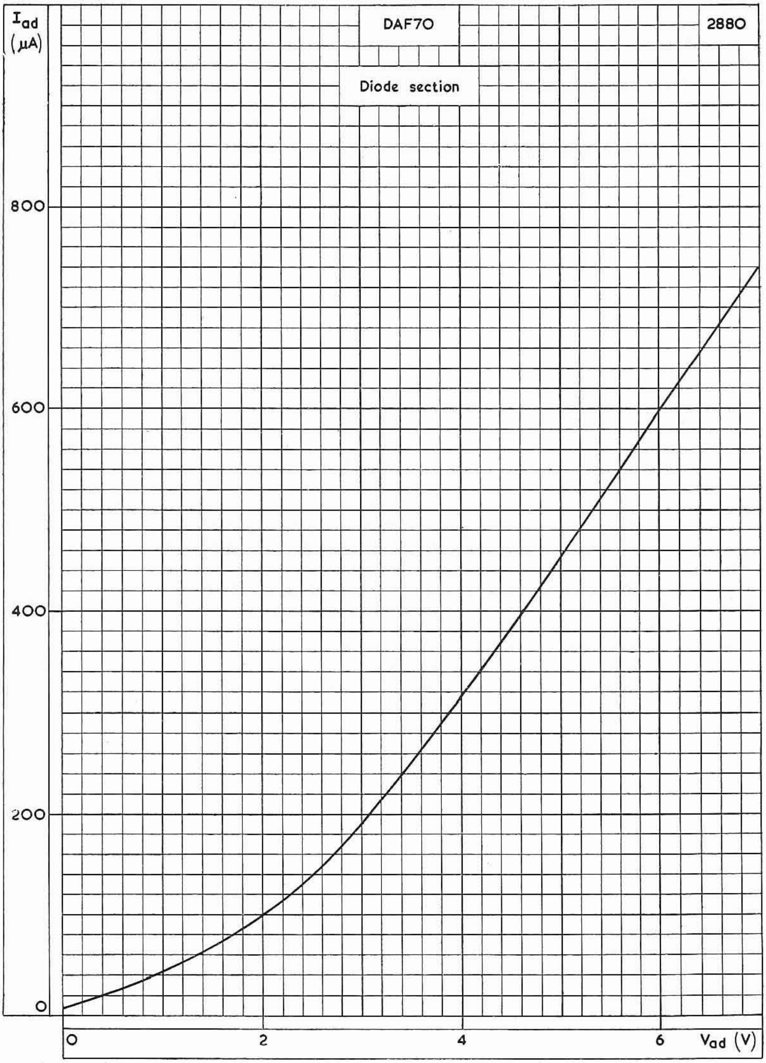


ELECTRODE CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

DAF70

SUBMINIATURE DIODE A.F. PENTODE

Subminiature a.f. pentode, combined with a single diode, suitable for battery operation.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
(DIODE SECTION)

VARIABLE-MU R.F. PENTODE

DF33

Variable-mu R.F. pentode for use as a controlled R.F. or I.F. amplifier.

FILAMENT

This valve is suitable for D.C. operation only.

V_f	1.4	V
I_f	0.05	A

CAPACITANCES

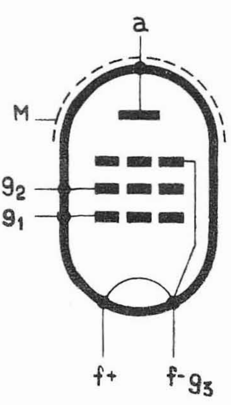
c_{a-g1}	<0.007	μμF
c_{in}	3.8	μμF
c_{out}	9.5	μμF

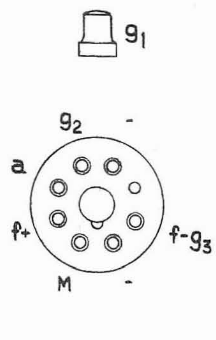
TYPICAL OPERATING CONDITIONS AS CLASS "A" AMPLIFIER

V_a	90	90	V
V_{g2}	90	90	V
V_{g1}	–4.0	0	V
I_a	—	1.2	mA
I_{g2}	—	0.3	mA
r_a	—	1.5	MΩ
g_m	5.0	750	μA/V

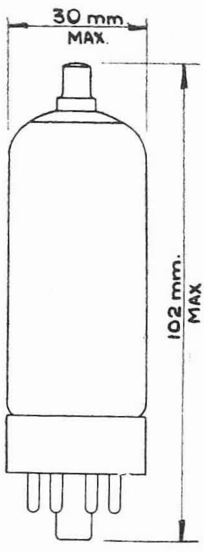
LIMITING VALUES

V_a max.	110	V
V_{g2} max.	110	V





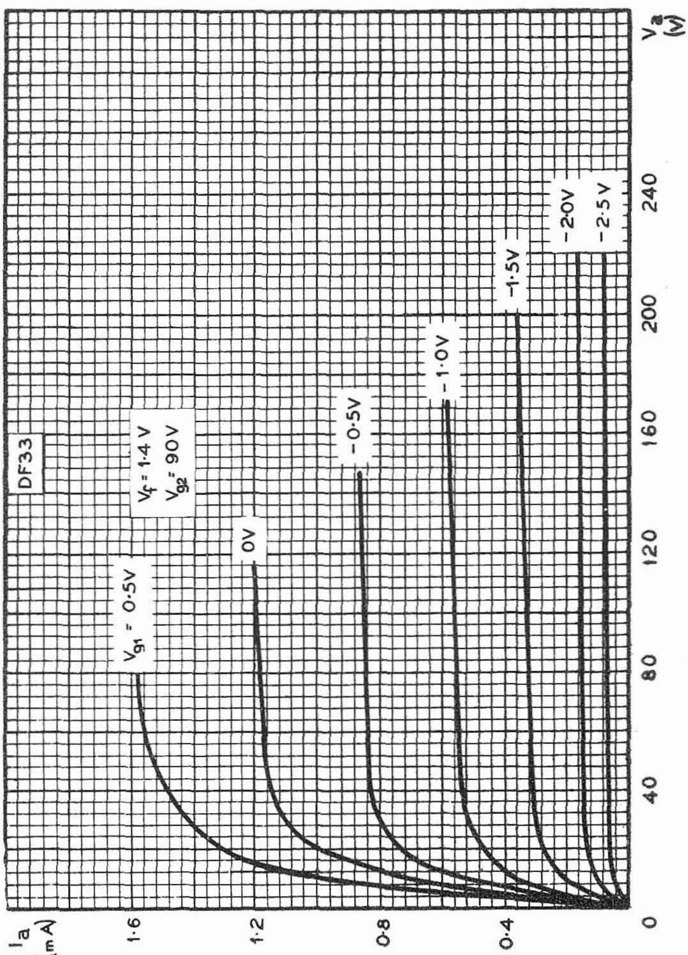
OCTAL BASE



DF33

VARIABLE-MU R.F. PENTODE

Variable-mu R.F. pentode for use as a controlled R.F. or I.F. amplifier.



SUBMINIATURE R.F. PENTODE

DF60

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

FILAMENT

Suitable for d.c. operation only.

V_f	1.25	V
I_f	50	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

CAPACITANCES

c_{a-g1}	<0.01	pF
c_{in}	3.7	pF
c_{out}	4.6	pF

CHARACTERISTICS

V_a	45	67.5	V
V_{g2}	45	67.5	V
V_{g1}	0	0	V
R_{g1}	5.0	5.0	MΩ
I_a	0.8	1.8	mA
I_{g2}	220	480	μA
g_m	0.82	1.1	mA/V
r_a	1.2	1.0	MΩ
V_{g1} (g_m=10μA/V)	−3.0	−4.0	V
R_{in} (f=50Mc/s)	–	34.5	kΩ
R_{eq}	–	8.2	kΩ

OPERATING CONDITIONS AS A FREQUENCY CHANGER

V_a	45	67.5	V
V_{g2}	45	67.5	V
R_{g1}	100	100	kΩ
I_a	0.56	1.06	mA
I_{g2}	150	300	μA
$V_{osc(r.m.s.)}$	3.0	4.0	V
I_{g1}	33	40	μA
g_c	270	320	μA/V
g_m(eff)	320	400	μA/V
r_a	1.6	1.46	MΩ

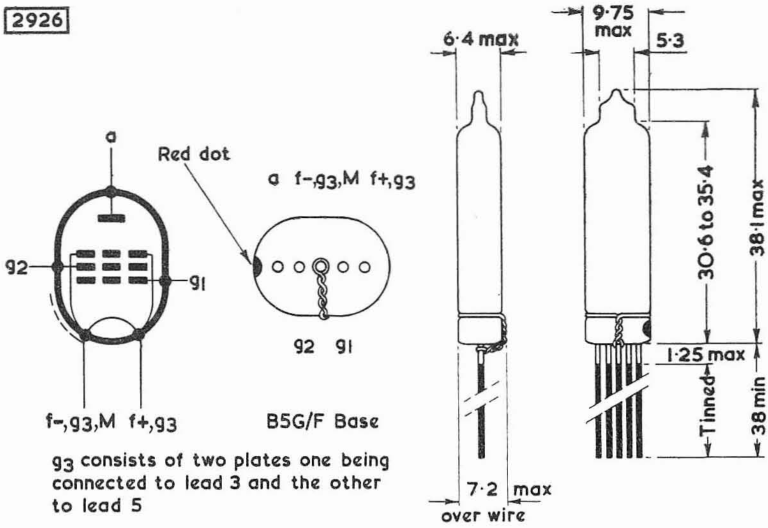
DF60

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

LIMITING VALUES

V_a max.	90	V
V_{g2} max.	67.5	V
I_k max.	4.0	mA



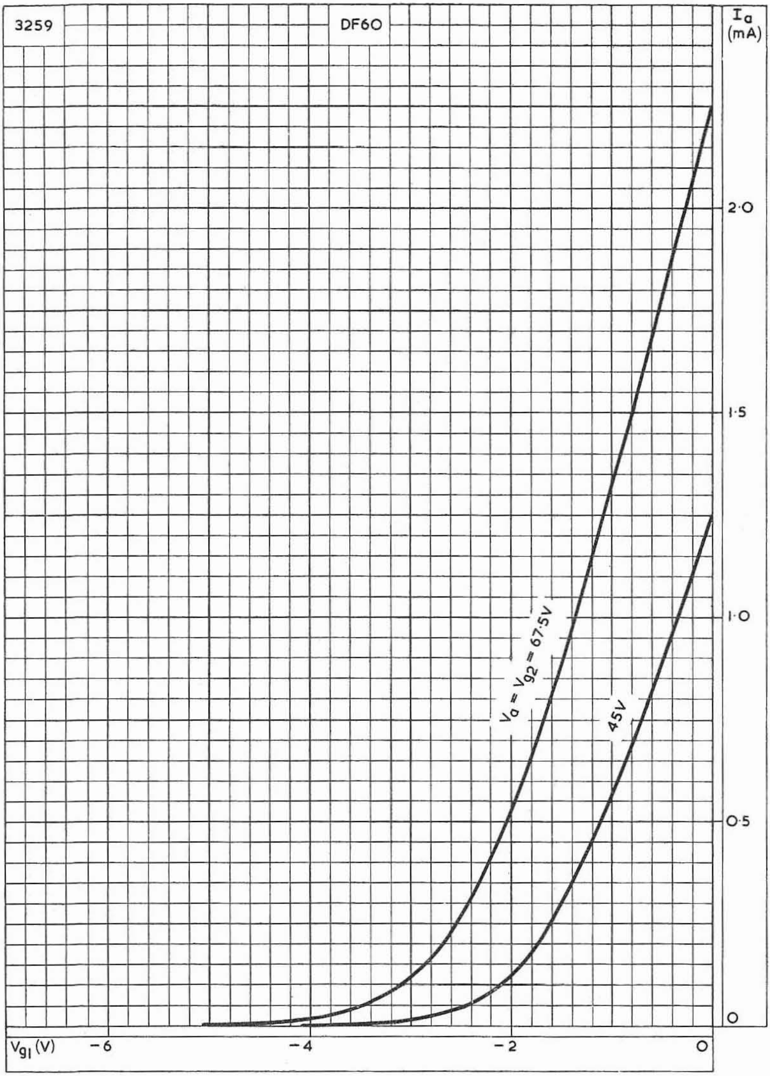
g3 consists of two plates one being connected to lead 3 and the other to lead 5

All dimensions in mm

SUBMINIATURE R.F. PENTODE

DF60

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

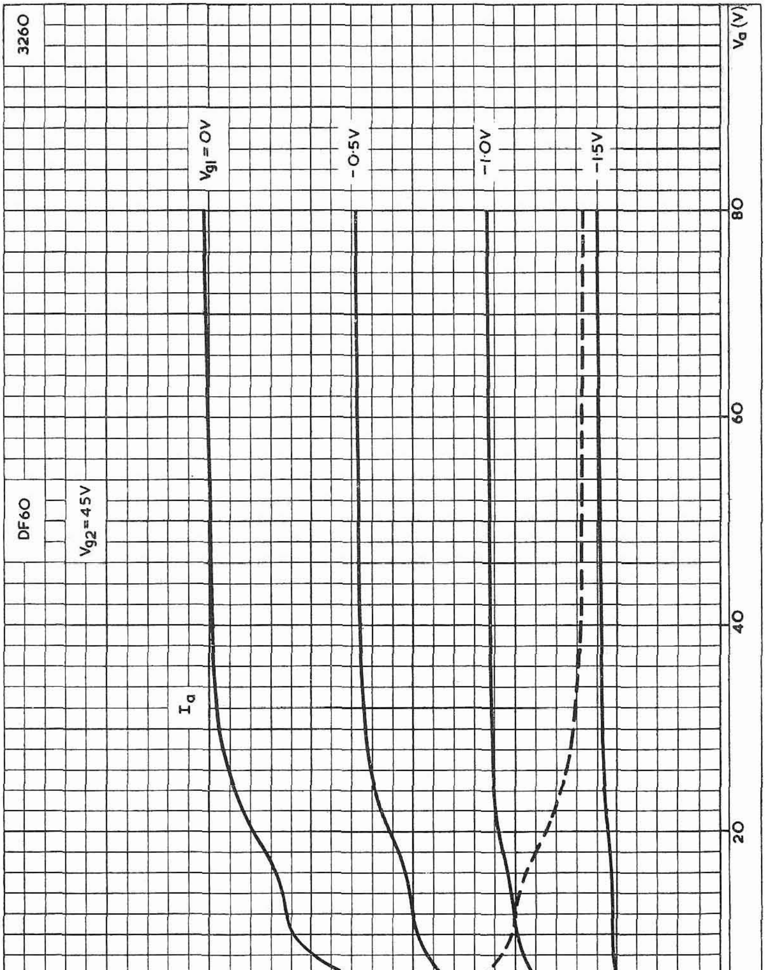


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS VALUES OF ANODE AND SCREEN-GRID VOLTAGES

DF60

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

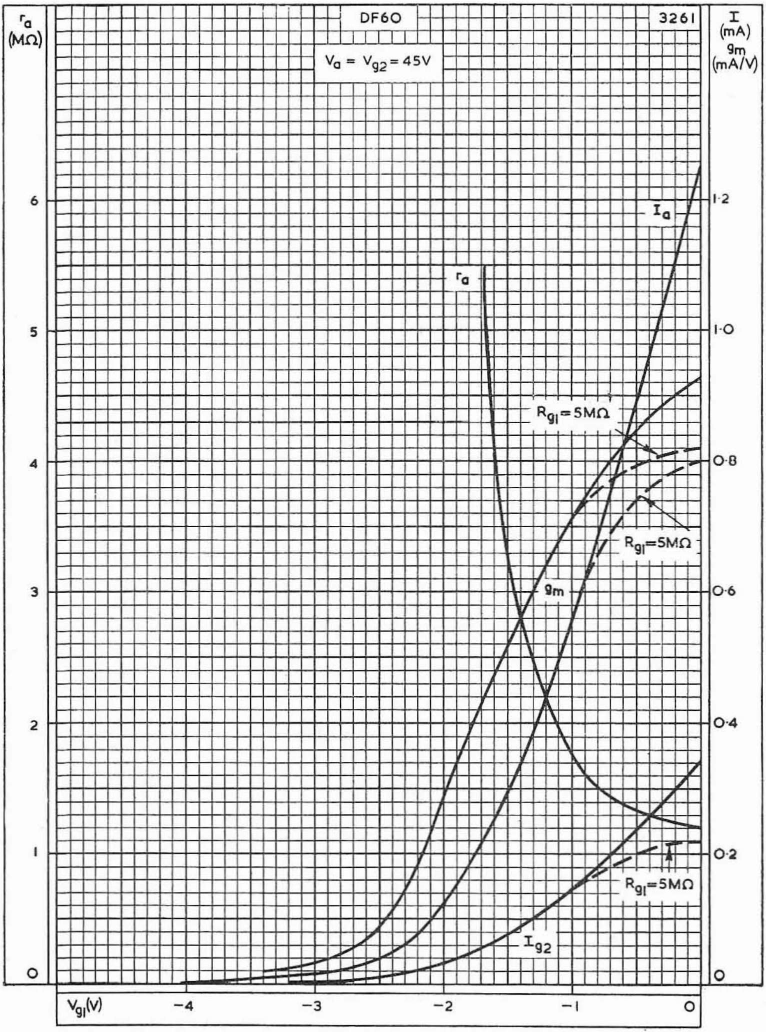


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g_2}=45V$

SUBMINIATURE R.F. PENTODE

DF60

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

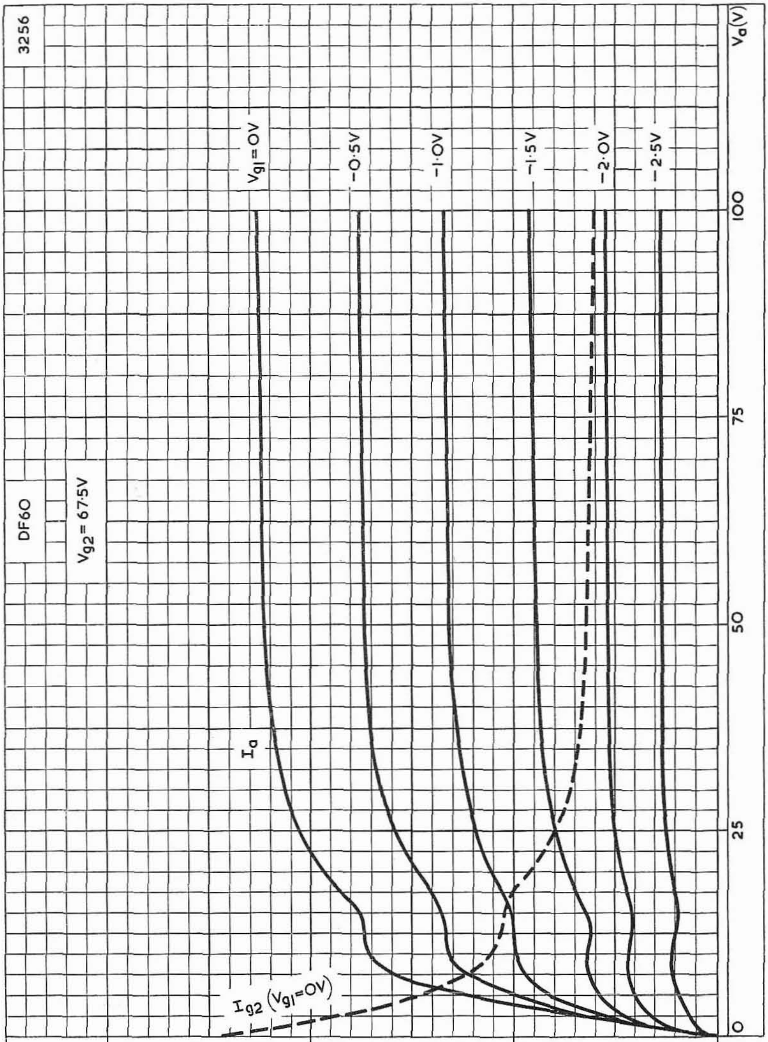


ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE $V_a = V_{g2} = 45V$

DF60

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

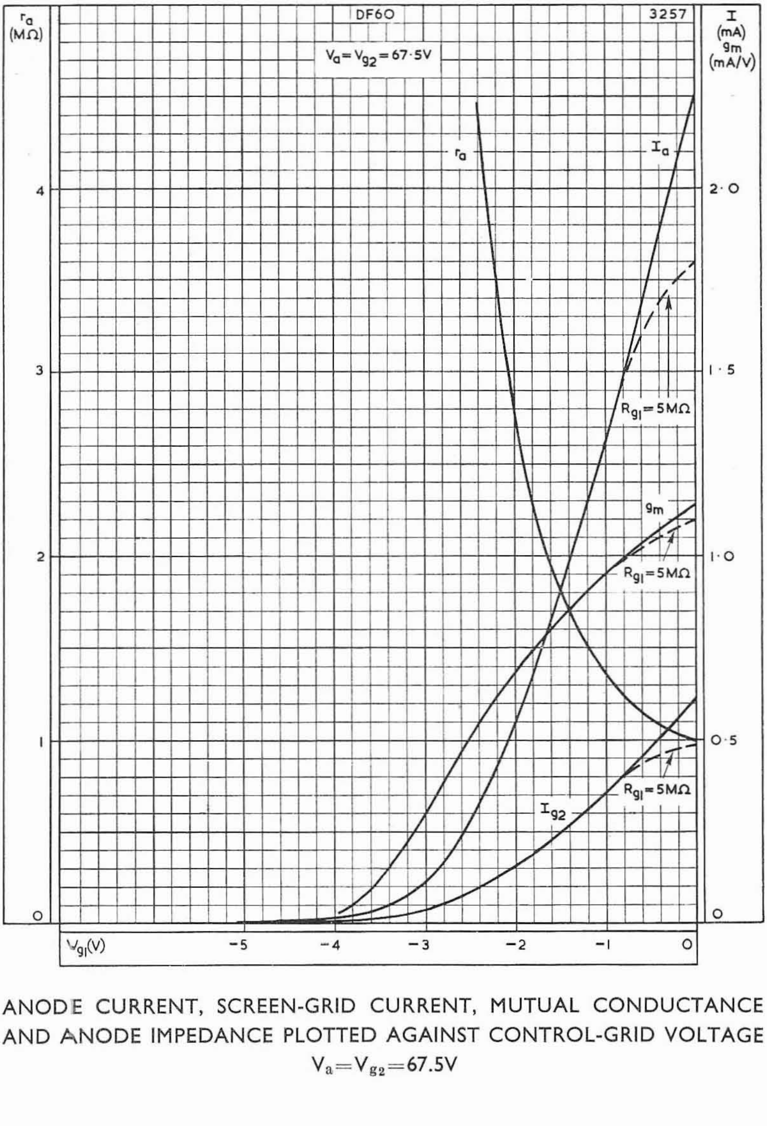


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=67.5V$

SUBMINIATURE R.F. PENTODE

DF60

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.



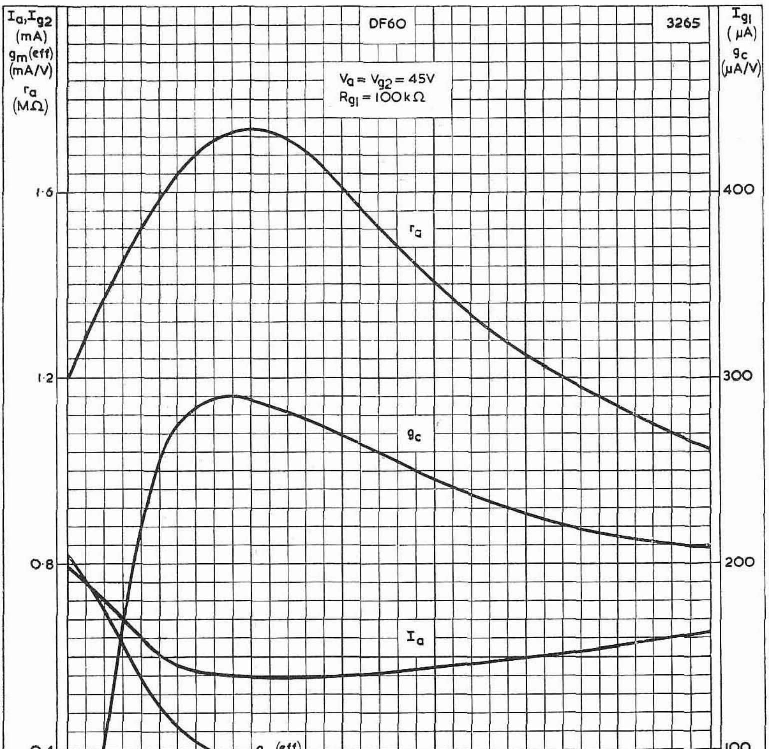
ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 67.5V$

DF60

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

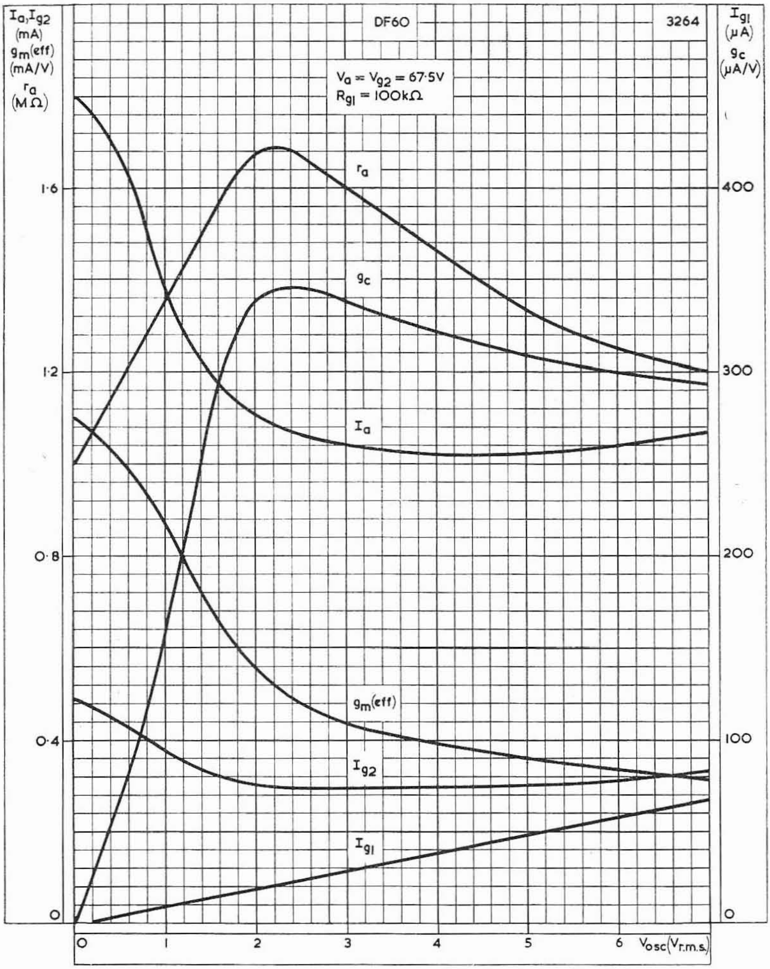


PERFORMANCE AS A FREQUENCY CHANGER. $V_a = V_{g2} = 45V$

SUBMINIATURE R.F. PENTODE

DF60

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.

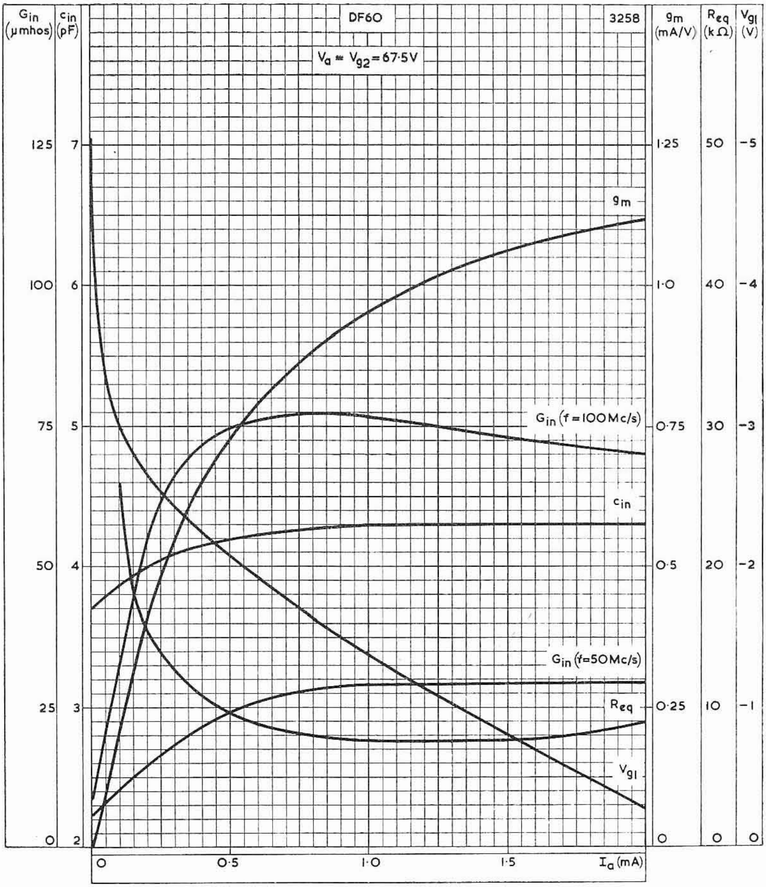


PERFORMANCE AS A FREQUENCY CHANGER. $V_a = V_{g2} = 67.5V$

DF60

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off r.f. pentode for use in battery-operated equipment.



INPUT CONDUCTANCE, EQUIVALENT NOISE RESISTANCE, INPUT CAPACITY, CONTROL-GRID VOLTAGE AND MUTUAL CONDUCTANCE PLOTTED AGAINST ANODE CURRENT

SUBMINIATURE R.F. PENTODE

DF61

R.F. Pentode for use in battery operated receivers.

FILAMENT

Suitable for d.c. operation only

V_f	1.25	V
I_f	25	mA

CAPACITANCES

c_{a-g1}	<0.01	pF
c_{in}	3.1	pF
c_{out}	3.6	pF

CHARACTERISTICS

V_a	45	67.5	V
V_{g2}	45	67.5	V
V_{g1}	0	0	V
I_a	0.8	1.7	mA
I_{g2}	200	450	μA
g_m	750	950	μA/V
r_a	1.4	1.6	MΩ
μ_{g1-g2}	21	21	
V_{g1} (for 100:1 reduction in g_m)	−2.6	−4.0	V
R_{in} (f=50Mc/s)	—	57	kΩ
R_{eq}	—	10	kΩ

OPERATING CONDITIONS AS A FREQUENCY CHANGER

V_a	45	67.5	V
V_{g2}	45	67.5	V
R_{g1-f}	100	100	kΩ
I_a	0.6	1.35	mA
I_{g2}	140	400	μA
$V_{osc(r.m.s.)}$	3.0	4.0	V
I_{g1}	30	30	μA
g_c	220	290	μA/V
g_m(eff)	300	450	μA/V
r_a	1.4	2.0	MΩ

LIMITING VALUES

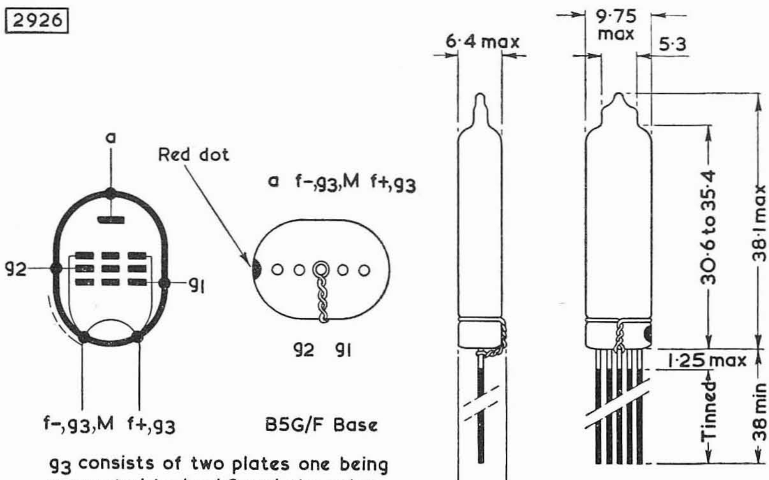
V_a max.	90	V
$V_{g2(b)}$ max.	90	V
V_{g2} max.	67.5	V
I_k max.	2.5	mA
$V_{g1}(I_{g1}=+0.3\mu A)$	>0	V

DF61

SUBMINIATURE R.F. PENTODE

R.F. Pentode for use in battery operated receivers.

2926



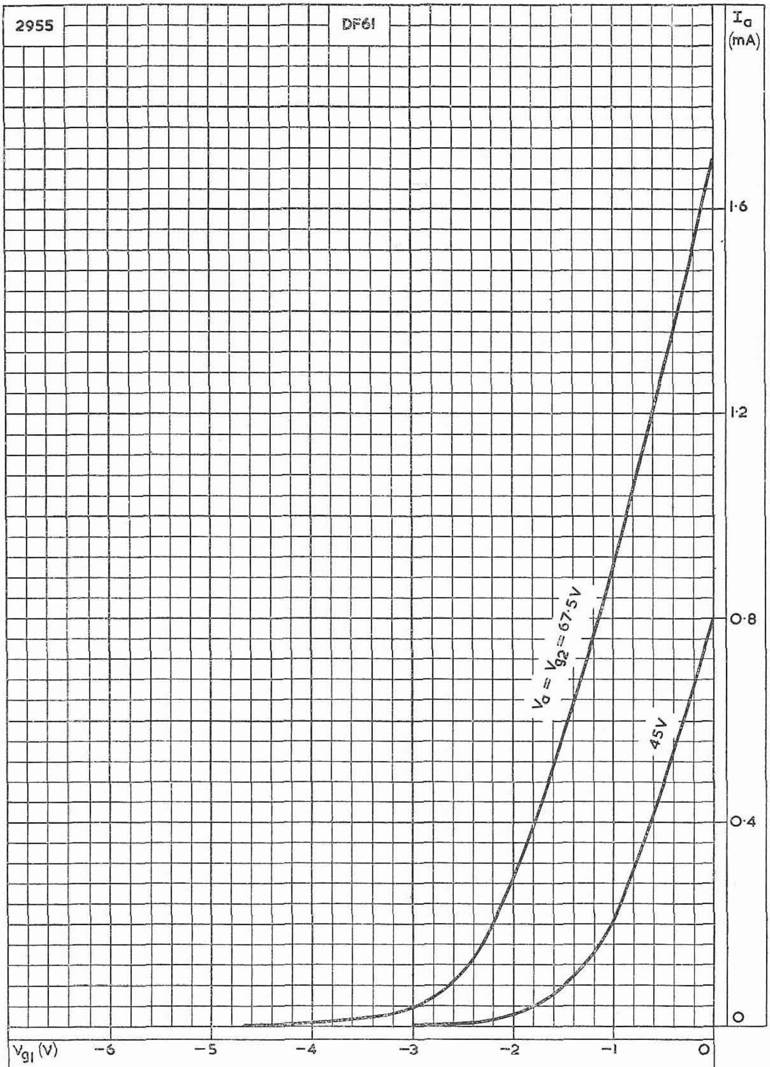
g3 consists of two plates one being connected to lead 3 and the other to lead 5

All dimensions in mm

SUBMINIATURE R.F. PENTODE

DF61

R.F. Pentode for use in battery operated receivers.

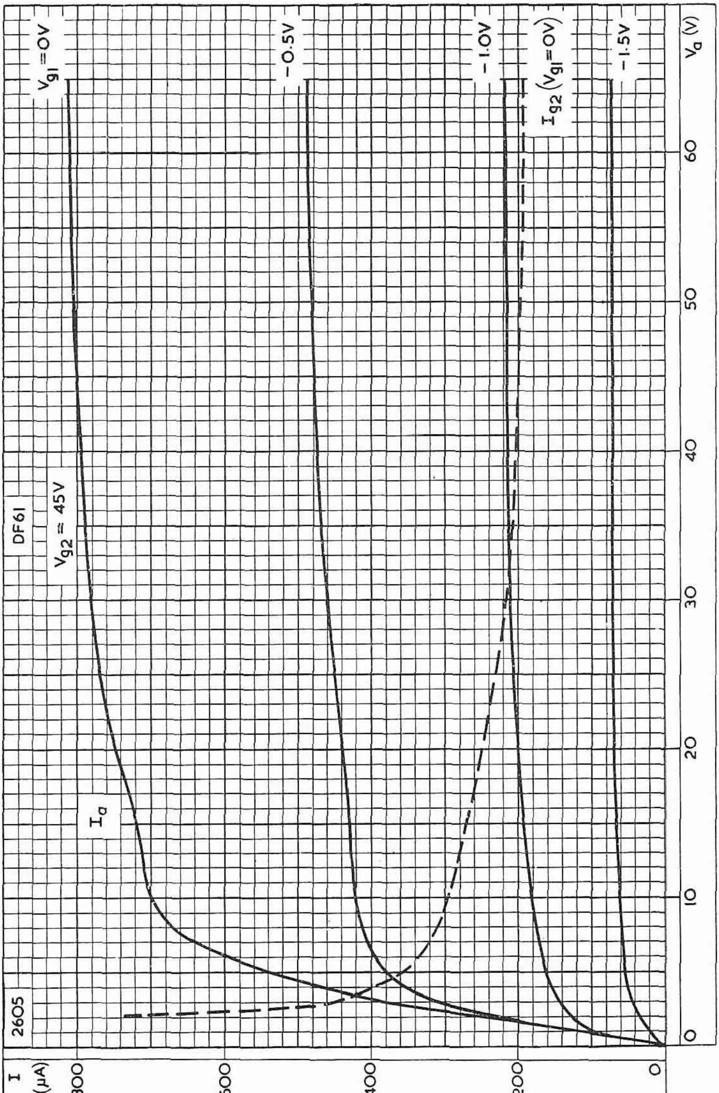


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

DF61

SUBMINIATURE R.F. PENTODE

R.F. Pentode for use in battery operated receivers.

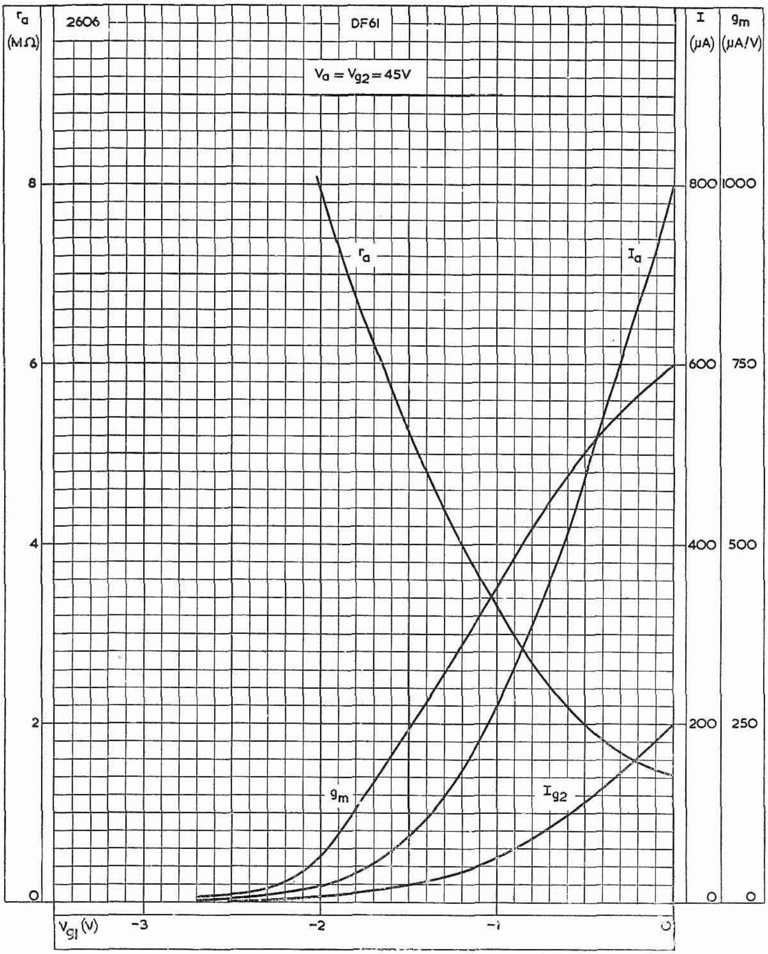


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. V_a=45V

SUBMINIATURE
R.F. PENTODE

DF61

R.F. Pentode for use in battery operated receivers.



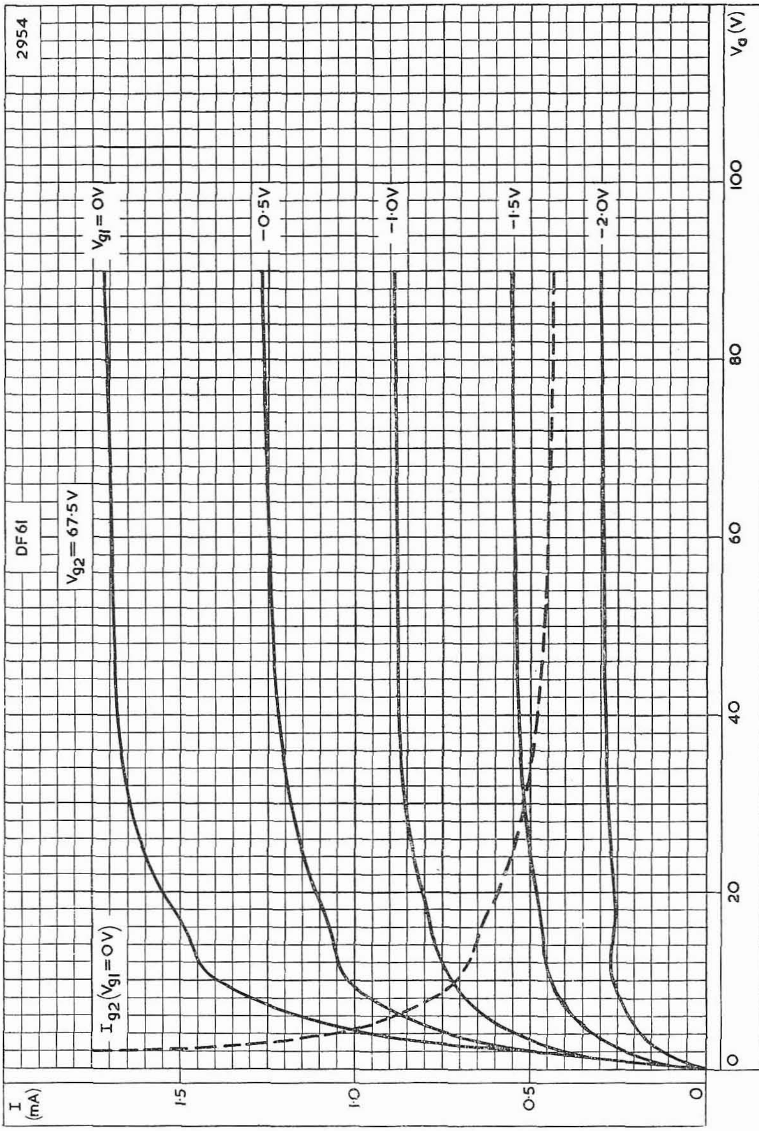
ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 45V$

DF61

SUBMINIATURE
R.F. PENTODE

R.F. Pentode for use in battery operated receivers.

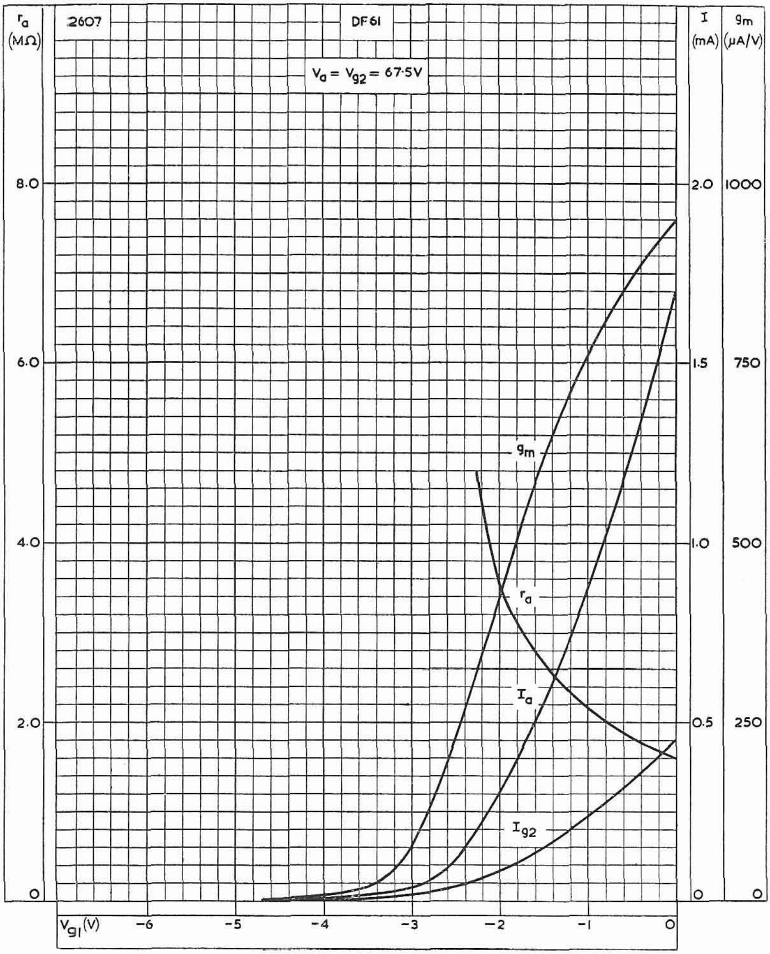


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE $V_{g2} = 67.5V$

SUBMINIATURE R.F. PENTODE

DF61

R.F. Pentode for use in battery operated receivers.



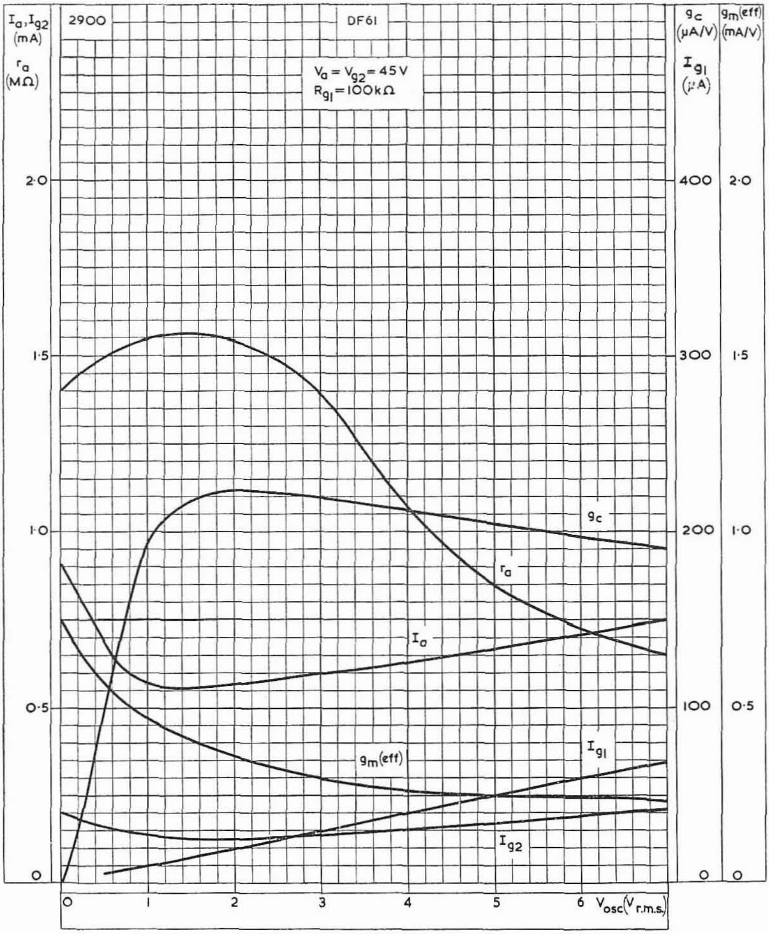
ANODE CURRENT SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 67.5V$

DF61

SUBMINIATURE R.F. PENTODE

R.F. Pentode for use in battery operated receivers.

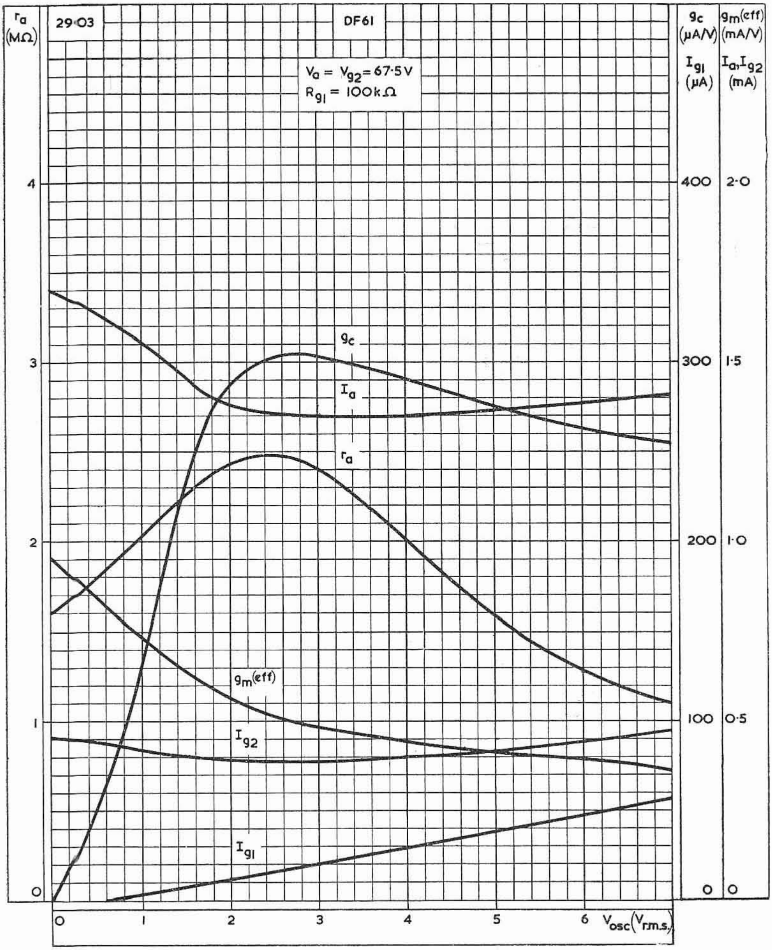


PERFORMANCE AS A FREQUENCY CHANGER. $V_a = V_{g2} = 45$V

SUBMINIATURE
R.F. PENTODE

DF61

R.F. Pentode for use in battery operated receivers.

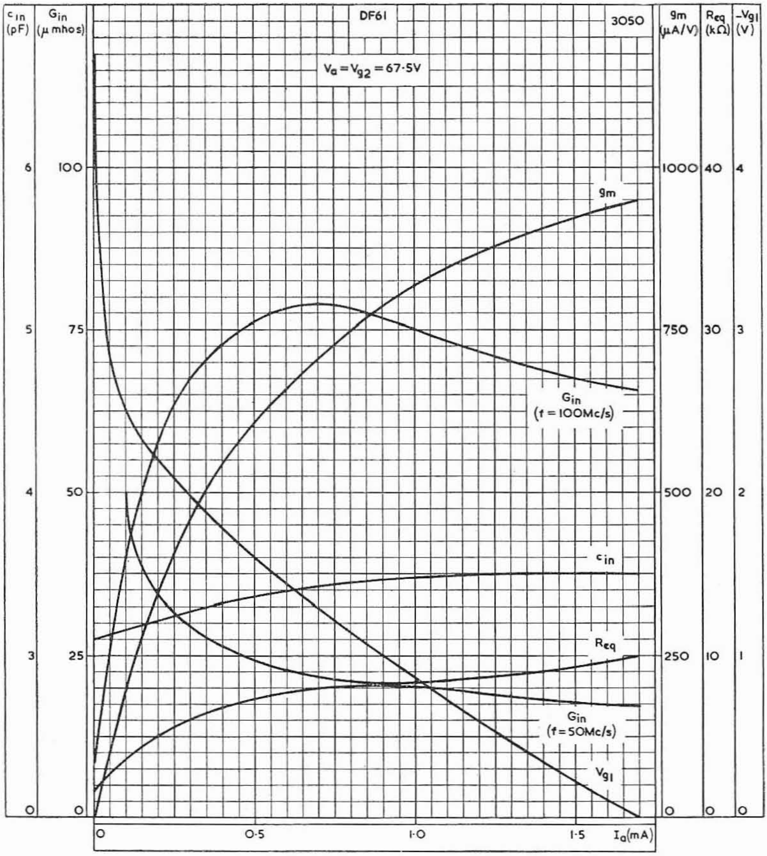


PERFORMANCE AS A FREQUENCY CHANGER. $V_a = V_{g2} = 67.5V$

DF61

SUBMINIATURE R.F. PENTODE

R.F. Pentode for use in battery operated receivers.



INPUT CONDUCTANCE, EQUIVALENT NOISE RESISTANCE, INPUT CAPACITY, CONTROL-GRID VOLTAGE AND MUTUAL CONDUCTANCE PLOTTED AGAINST ANODE CURRENT

SUBMINIATURE R.F. PENTODE

DF62

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

FILAMENT

Suitable for d.c. operation only

V_f	1.25	V
I_f	100	mA

CAPACITANCES

c_{a-g1}	<0.01	pF
c_{in}	4.0	pF
c_{out}	4.0	pF

CHARACTERISTICS

V_a	45	V
V_{g2}	45	V
V_{g1}	0	V
R_{g1}	2.0	MΩ
I_a	3.0	mA
I_{g2}	800	µA
g_m	2.0	mA/V
r_a	500	kΩ
μ_{g1-g2}	17.5	
R_{in} (f=50Mc/s)	20	kΩ
R_{eq}	5.5	kΩ

OPERATING CONDITIONS AS A FREQUENCY CHANGER

V_a	45	67.5	V
V_{g2}	45	67.5	V
R_{g1-f}	100	100	kΩ
I_a	0.8	1.4	mA
I_{g2}	250	450	µA
$V_{osc(r.m.s.)}$	3.5	4.0	V
I_{g1}	40	45	µA
g_c	490	600	µA/V
g_m(eff)	600	800	µA/V
r_a	525	450	kΩ

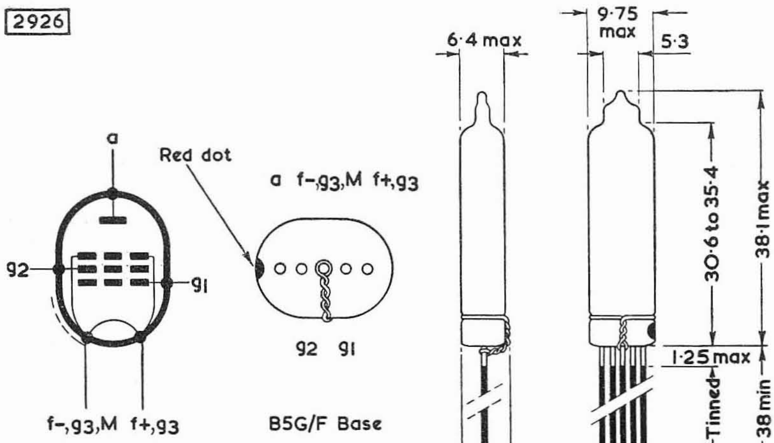
LIMITING VALUES

V_a max.	90	V
V_{g2} max.	90	V
I_k max.	6.5	mA
$V_{g1}(I_{g1}=+0.5\mu A)$	−0.5	V

DF62

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.



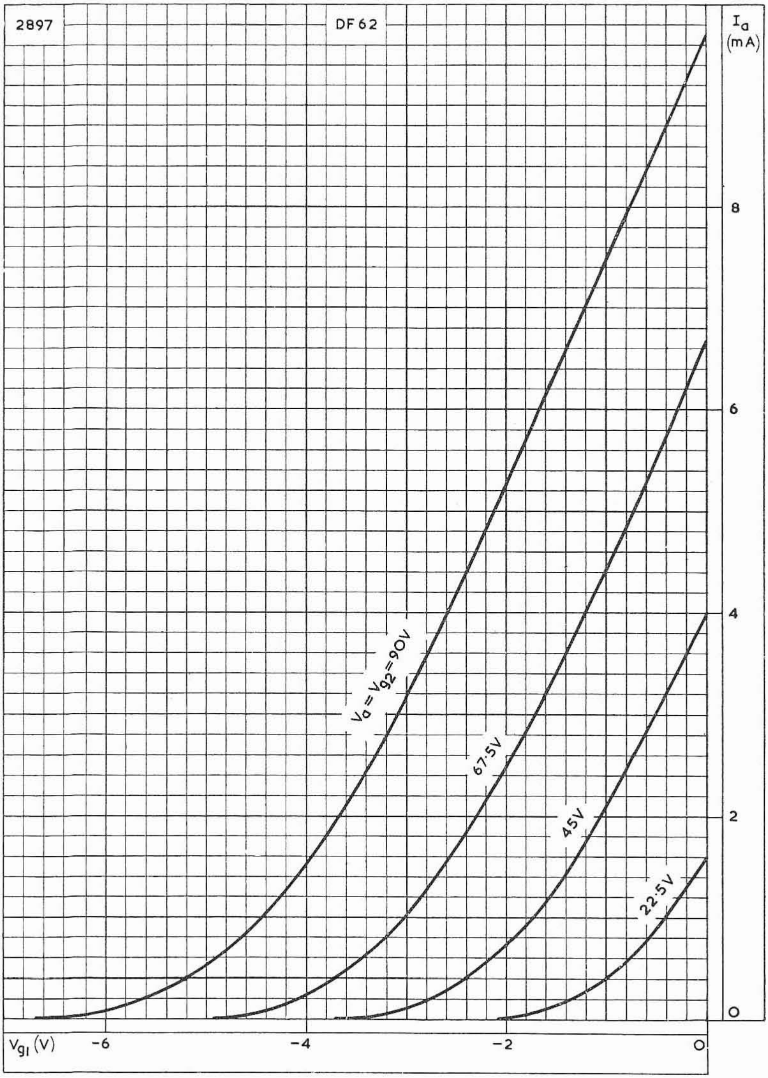
g_3 consists of two plates one being connected to lead 3 and the other to lead 5

All dimensions in mm

SUBMINIATURE R.F. PENTODE

DF62

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

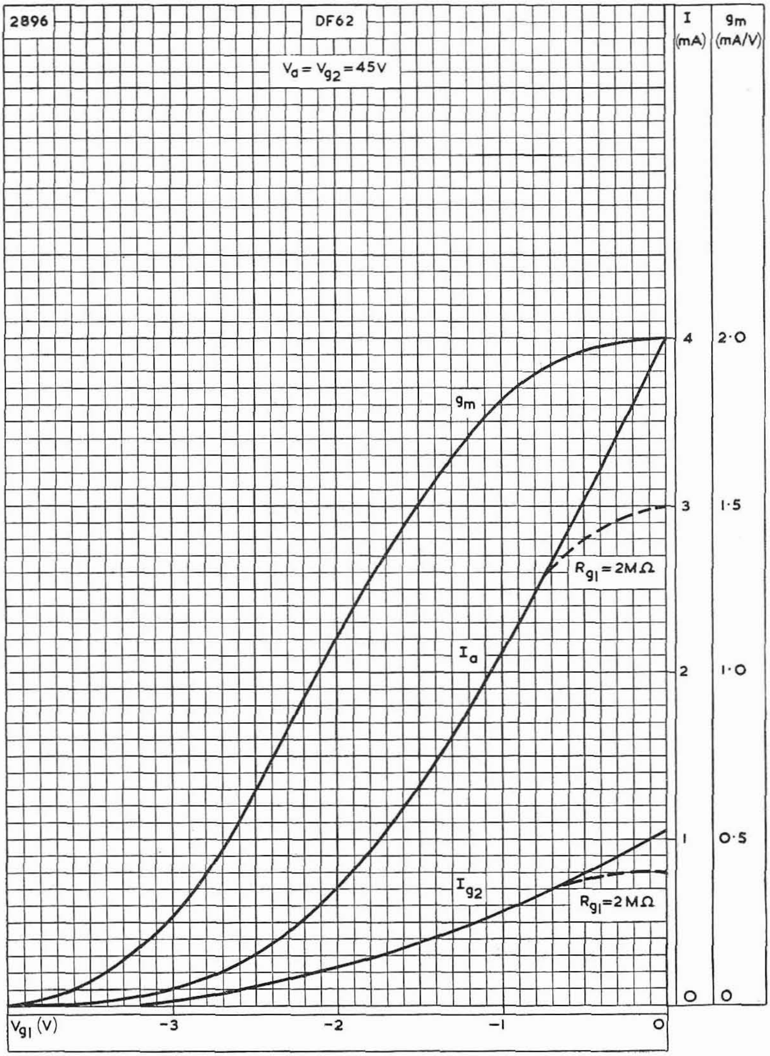


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

DF62

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.



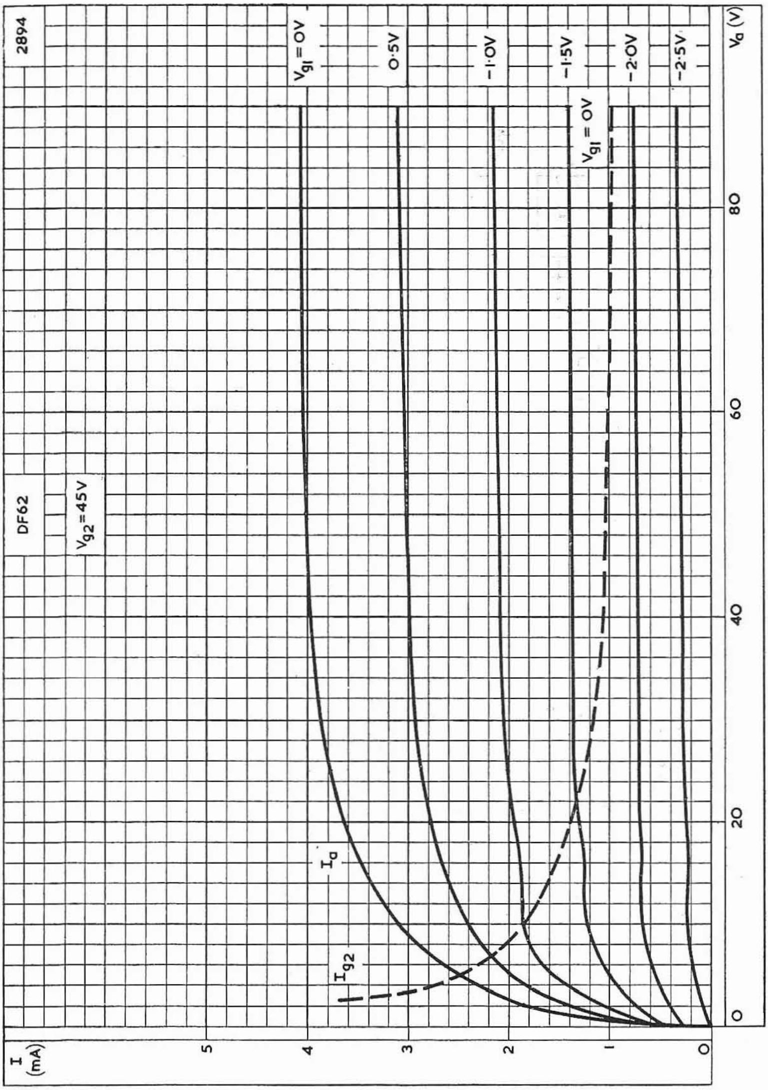
ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 45V$

SUBMINIATURE R.F. PENTODE

DF62

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

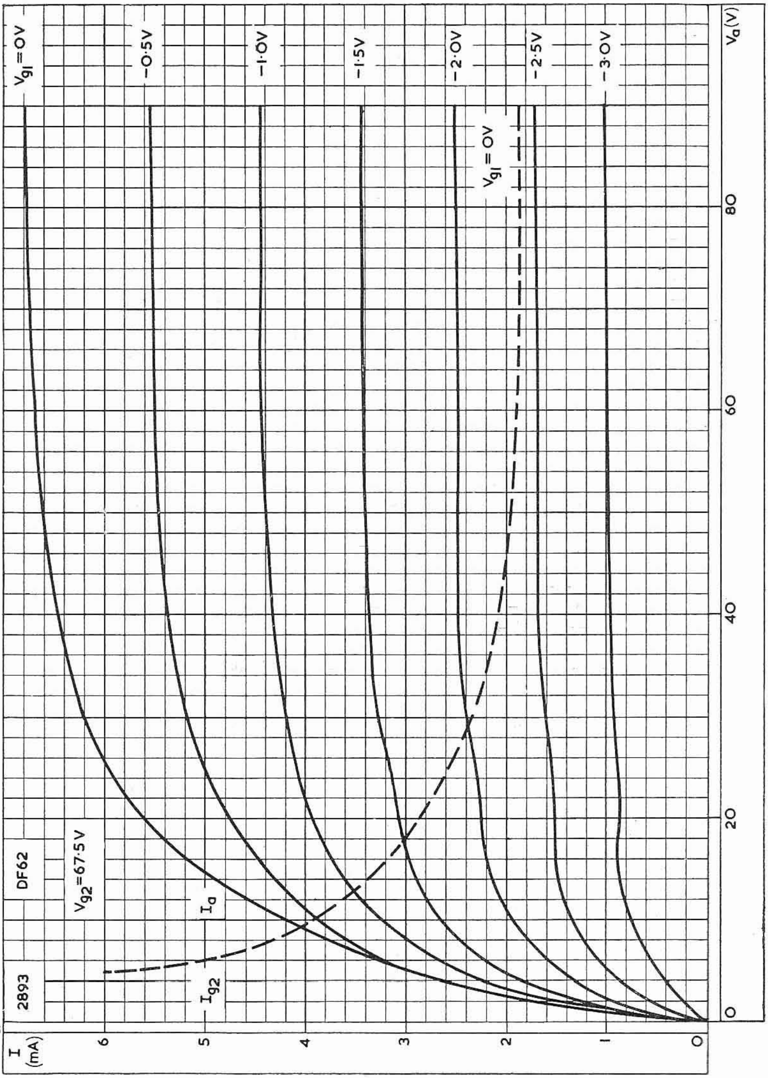


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. V_{g2}=45V

DF62

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

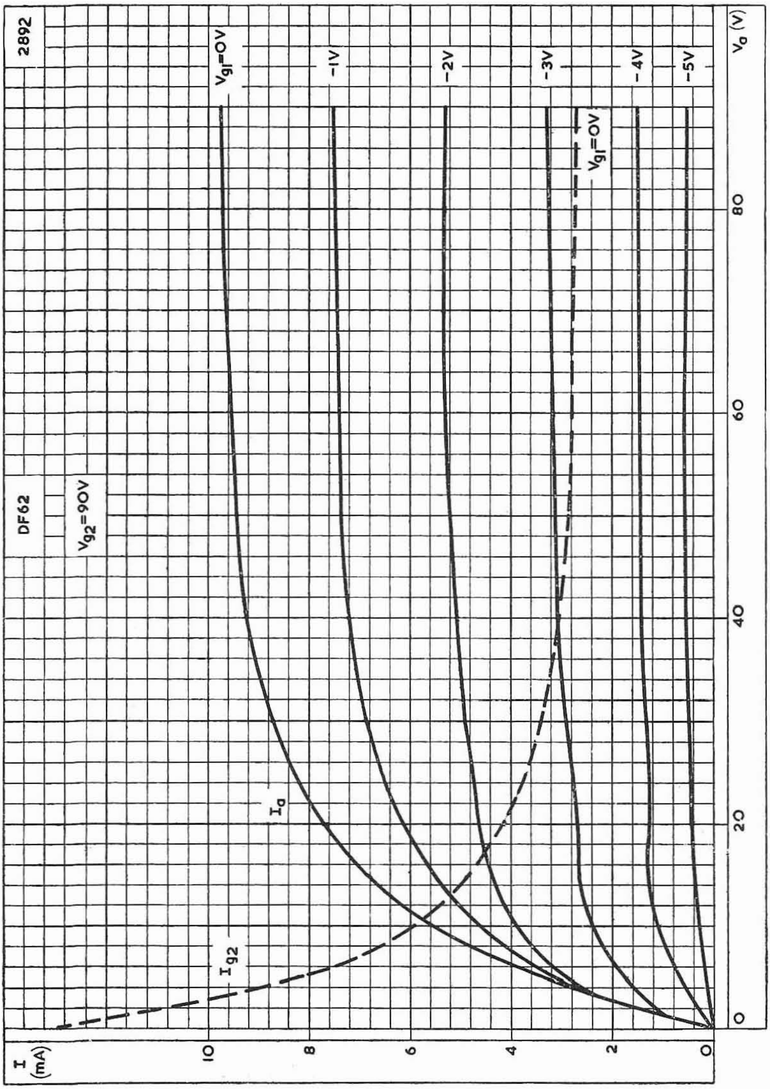


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. V_{g_2}=67.5V

SUBMINIATURE
R.F. PENTODE

DF62

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

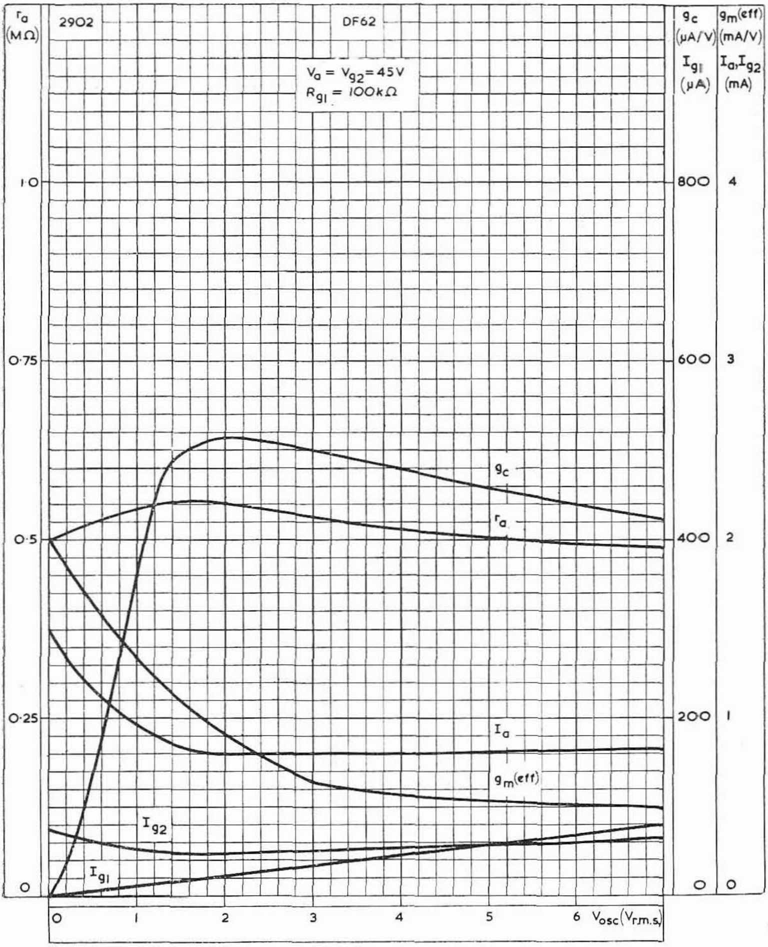


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. V_{g2}=90V

DF62

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

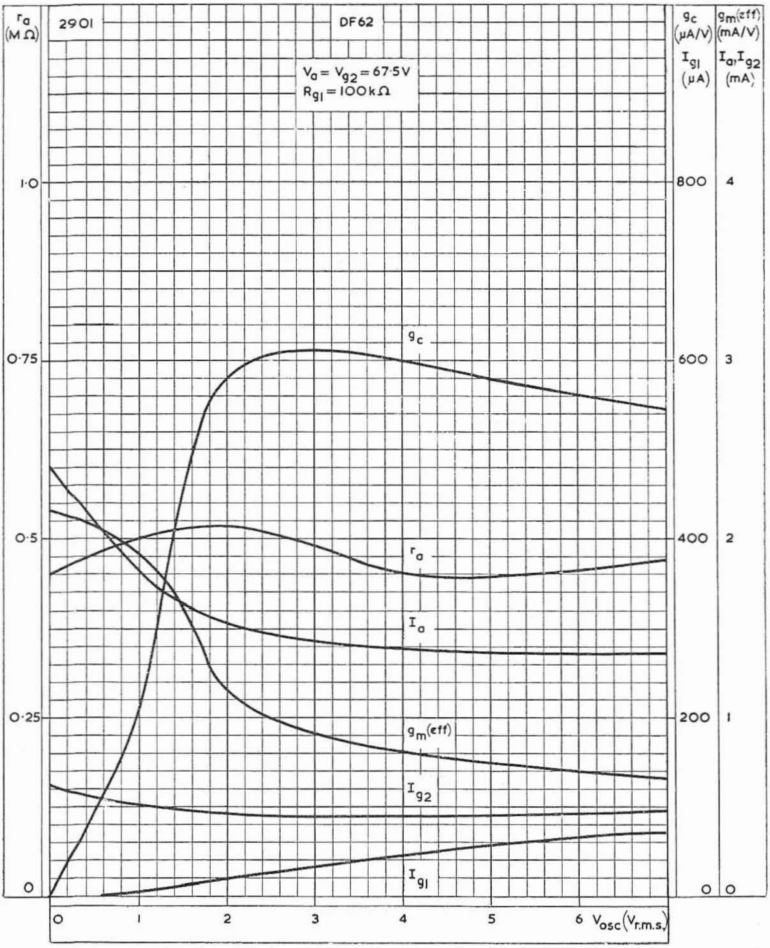


PERFORMANCE AS A FREQUENCY CHANGER. $V_a = V_{g2} = 45V$

SUBMINIATURE R.F. PENTODE

DF62

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.

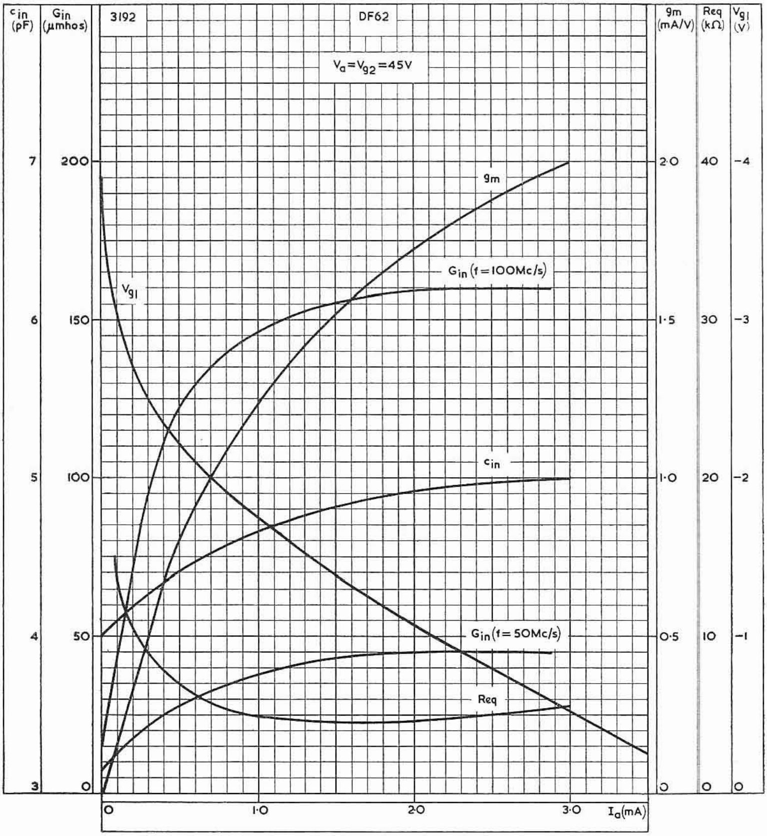


PERFORMANCE AS A FREQUENCY CHANGER. $V_a = V_{g2} = 67.5V$

DF62

SUBMINIATURE R.F. PENTODE

Subminiature sharp cut-off R.F. Pentode for use in battery operated equipment.



INPUT CONDUCTANCE, EQUIVALENT NOISE RESISTANCE, INPUT CAPACITY, CONTROL-GRID VOLTAGE AND MUTUAL CONDUCTANCE PLOTTED AGAINST ANODE CURRENT

SUBMINIATURE VARIABLE-MU R.F. PENTODE

DF63

Subminiature variable-mu r.f. pentode suitable for battery operated equipment.

FILAMENT

Suitable for d.c. operation only

V_f	1.25	V
I_f	25	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

CAPACITANCES

c_{a-g1}	<0.01	pF
c_{in}	3.0	pF
c_{out}	3.5	pF

CHARACTERISTICS

V_a	67.5	V
V_{g2}	67.5	V
V_{g1}	0	V
I_a	1.7	mA
I_{g2}	490	μA
g_m	850	μA/V
r_a	1.6	MΩ
V_{g1} (for 100 : 1 reduction in g_m)	–14	V
$+V_{g1}$ min. ($I_{g1} = +0.3\mu$A)	0	V

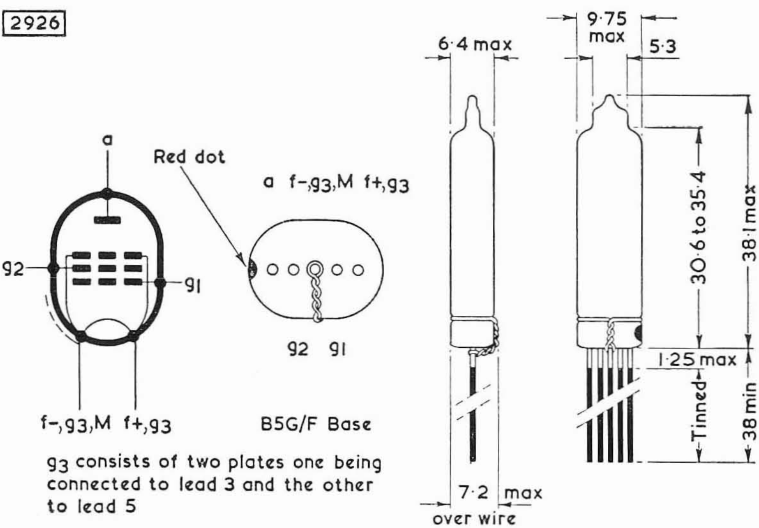
LIMITING VALUES

V_a max.	90	V
$V_{g2(b)}$ max.	90	V
V_{g2} max.	67.5	V
I_k max.	2.5	mA

DF63

SUBMINIATURE VARIABLE-MU R.F. PENTODE

Subminiature variable-mu r.f. pentode suitable for battery operated equipment.

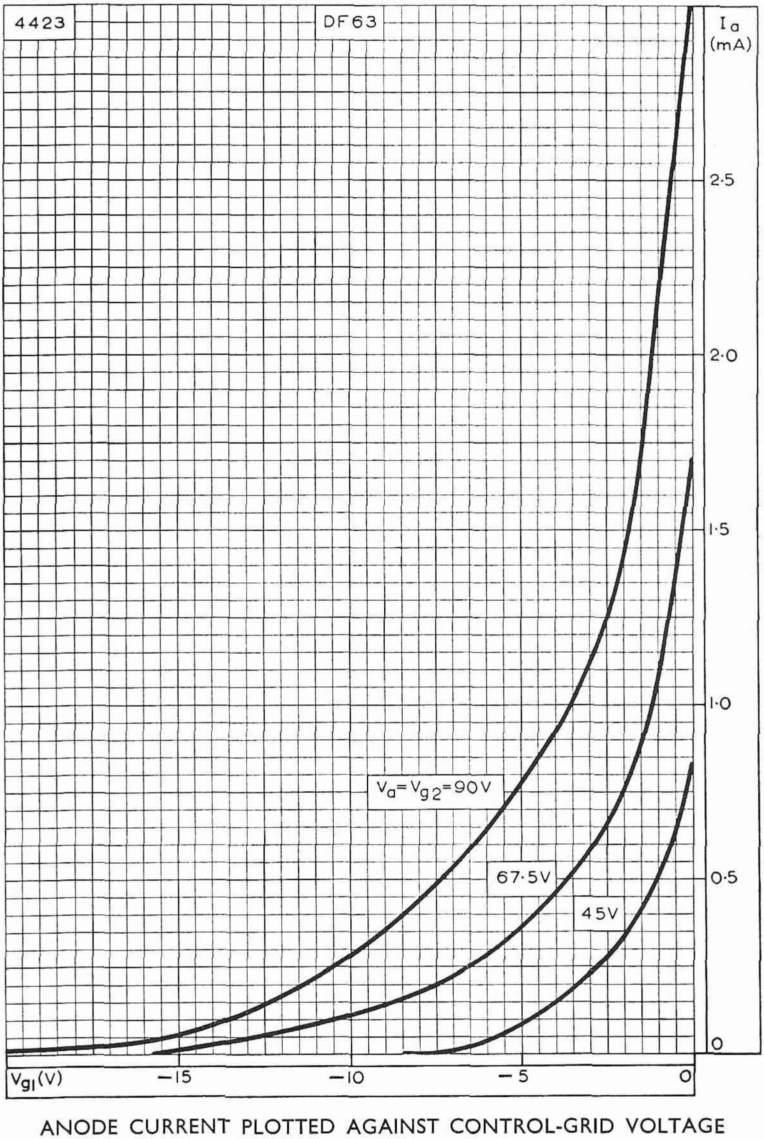


All dimensions in mm

SUBMINIATURE VARIABLE-MU R.F. PENTODE

DF63

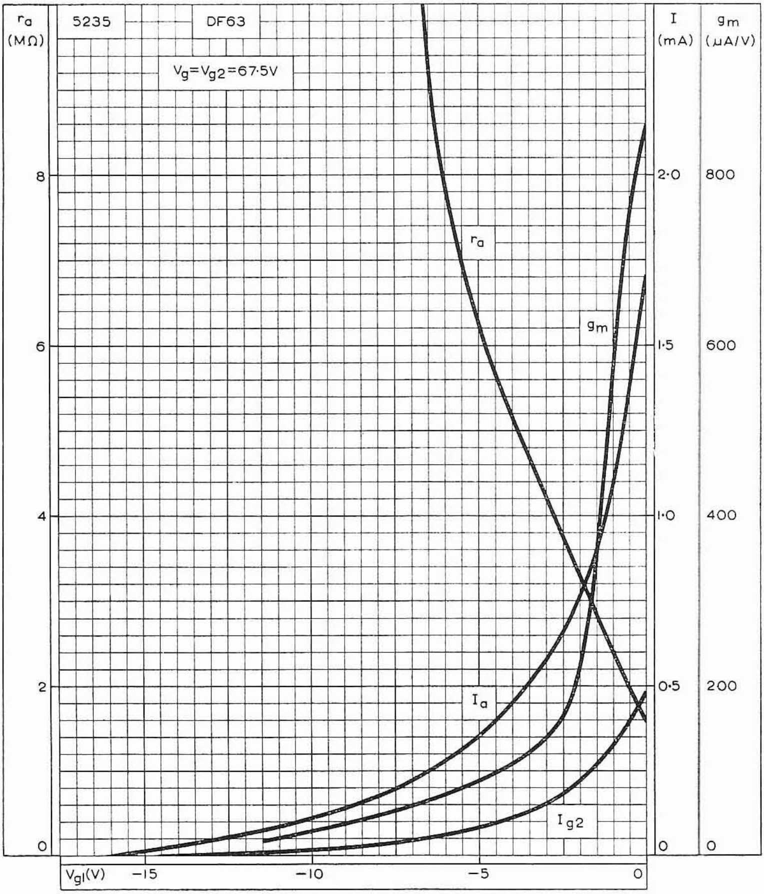
Subminiature variable-mu r.f. pentode suitable for battery operated equipment.



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE VARIABLE-MU R.F. PENTODE

Subminiature variable-mu r.f. pentode suitable for battery operated equipment.

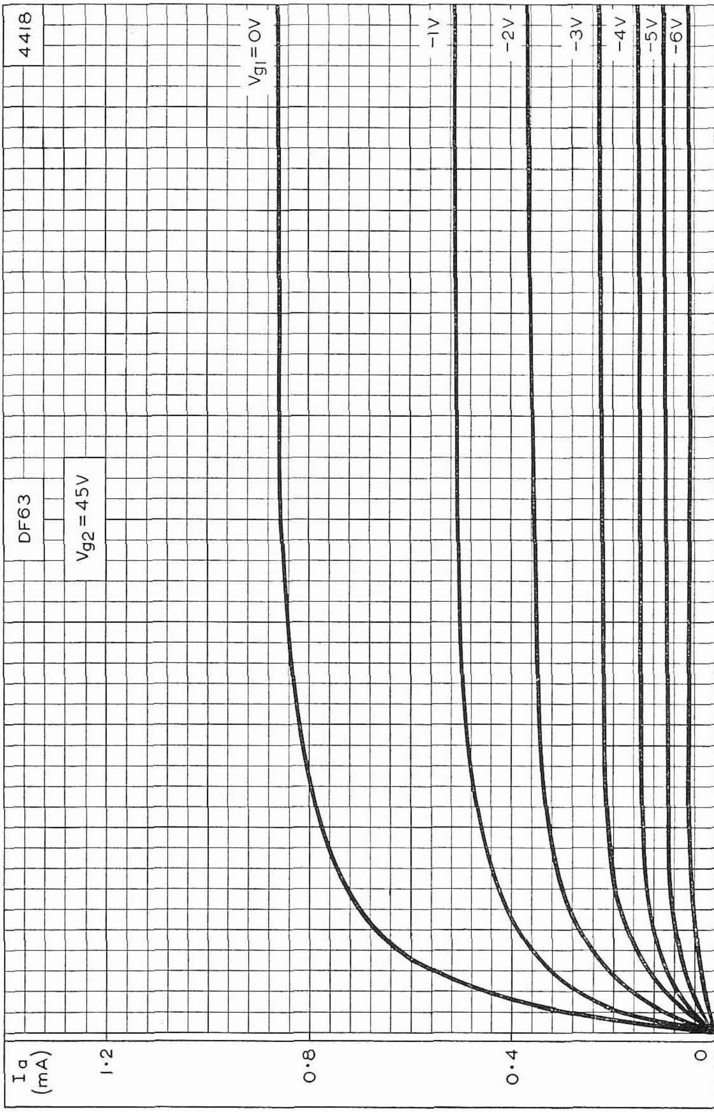


ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = V_{g2} = 67.5V$

SUBMINIATURE VARIABLE-MU R.F. PENTODE

DF63

Subminiature variable-mu r.f. pentode suitable for battery operated equipment.

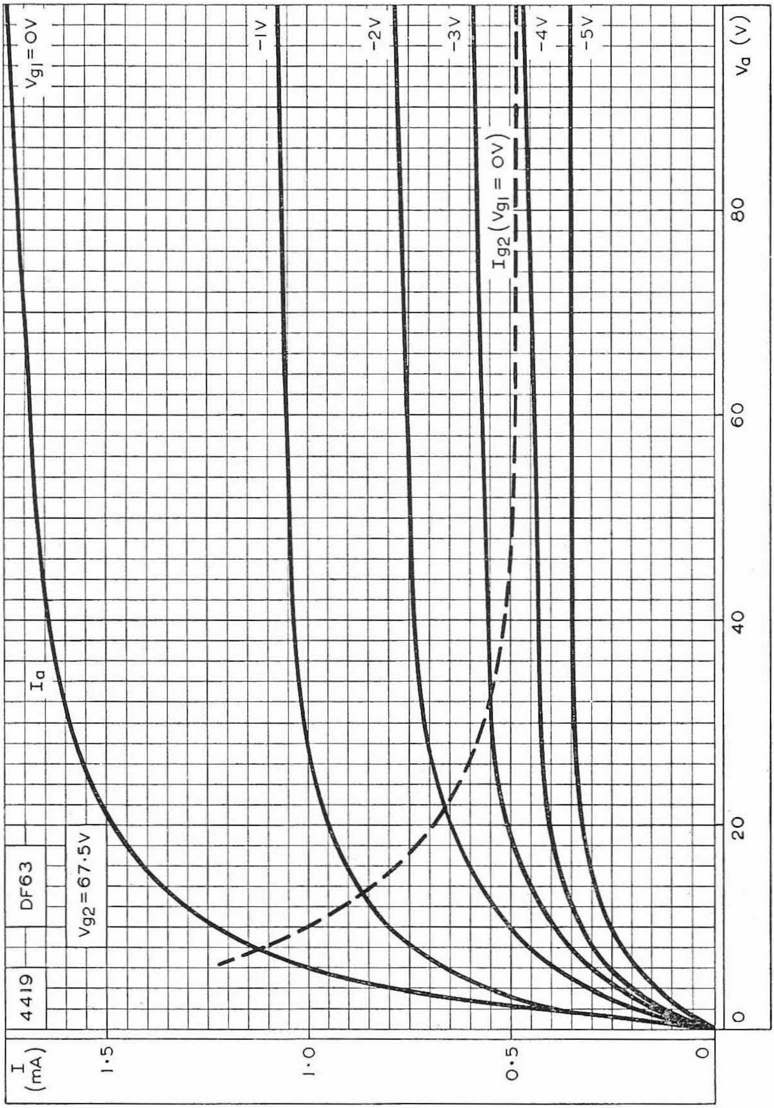


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 45V$

DF63

SUBMINIATURE VARIABLE-MU R.F. PENTODE

Subminiature variable-mu r.f. pentode suitable for battery operated equipment.

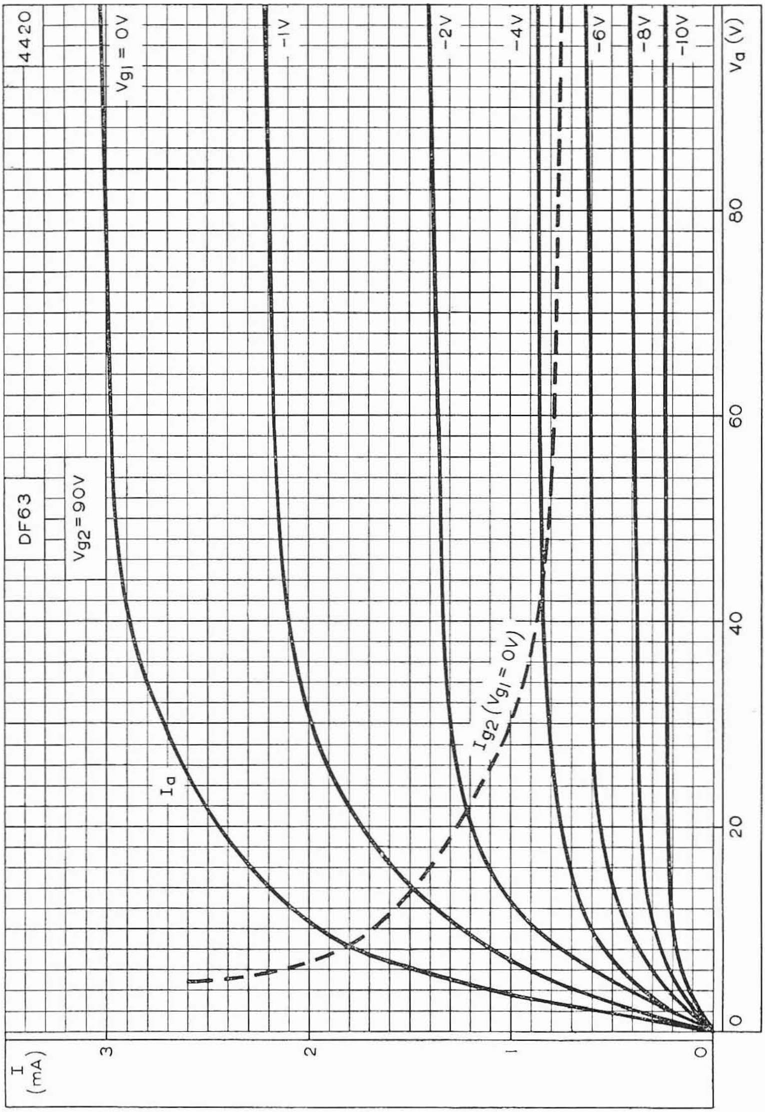


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 67.5V

SUBMINIATURE VARIABLE-MU R.F. PENTODE

DF63

Subminiature variable-mu r.f. pentode suitable for battery operated equipment.



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 90V$

SUBMINIATURE VARIABLE-MU R.F. PENTODE

DF73

Subminiature variable-mu r.f. pentode suitable for battery operation.

FILAMENT

V_f	1.25	V
I_f	25	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm. from the seal and any bending of the valve leads must be at least 1.5mm. from the seal.

CAPACITANCES (measured with external shield)

c_{a-g1}	<0.015	pF
c_{in}	2.9	pF
c_{out}	5.0	pF

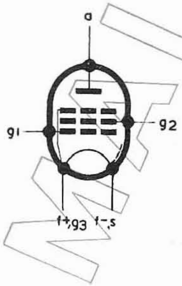
CHARACTERISTICS

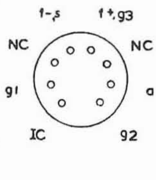
V_a	67.5	V
V_{g2}	67.5	V
I_a	1.7	mA
I_{g2}	490	μA ←
V_{g1}	0	V
g_m	850	μA/V ←
r_a	650	kΩ ←
μ_{g1-g2}	16	
$*V_{g1}$	–14	V

*For a 100:1 reduction in g_m.

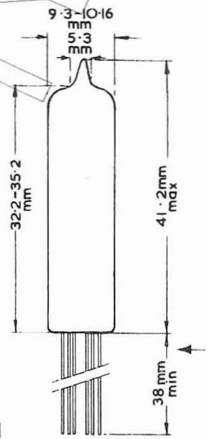
LIMITING VALUES

V_a max.	90	V
V_{g2} max.	90	V
I_k max.	2.5	mA





B8D/F Base



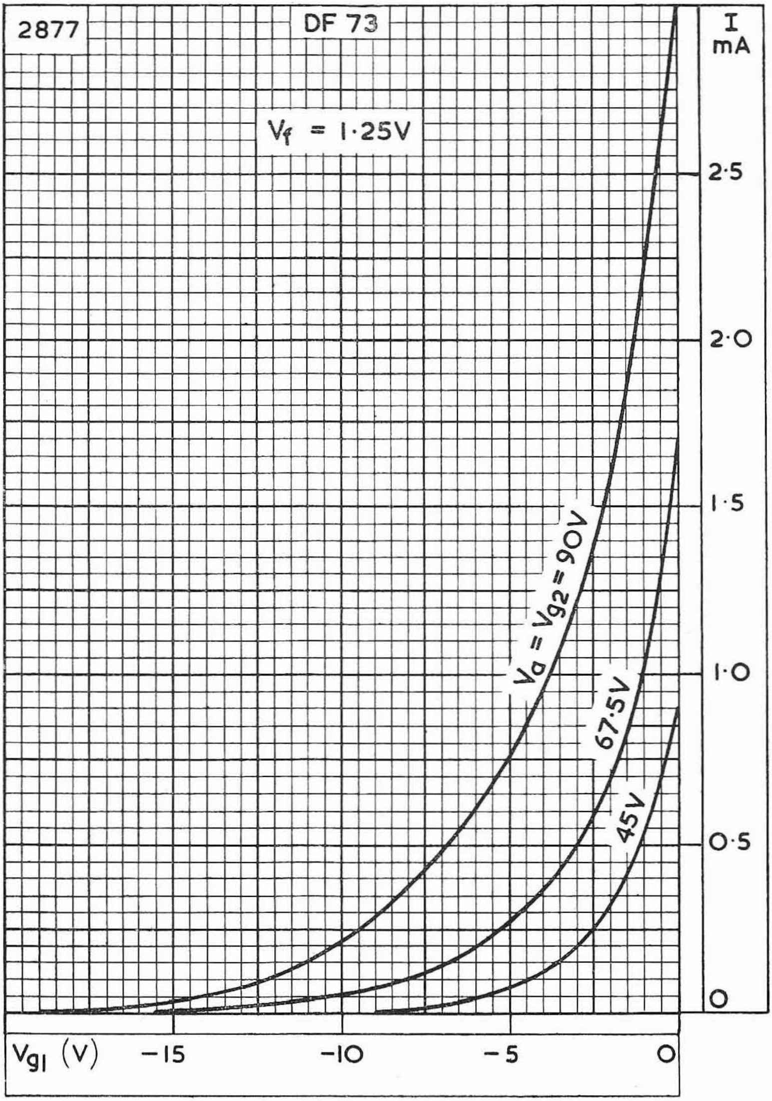
2689

Mullard

DF73

SUBMINIATURE VARIABLE-MU R.F. PENTODE

Subminiature variable-mu r.f. pentode suitable for battery operation.

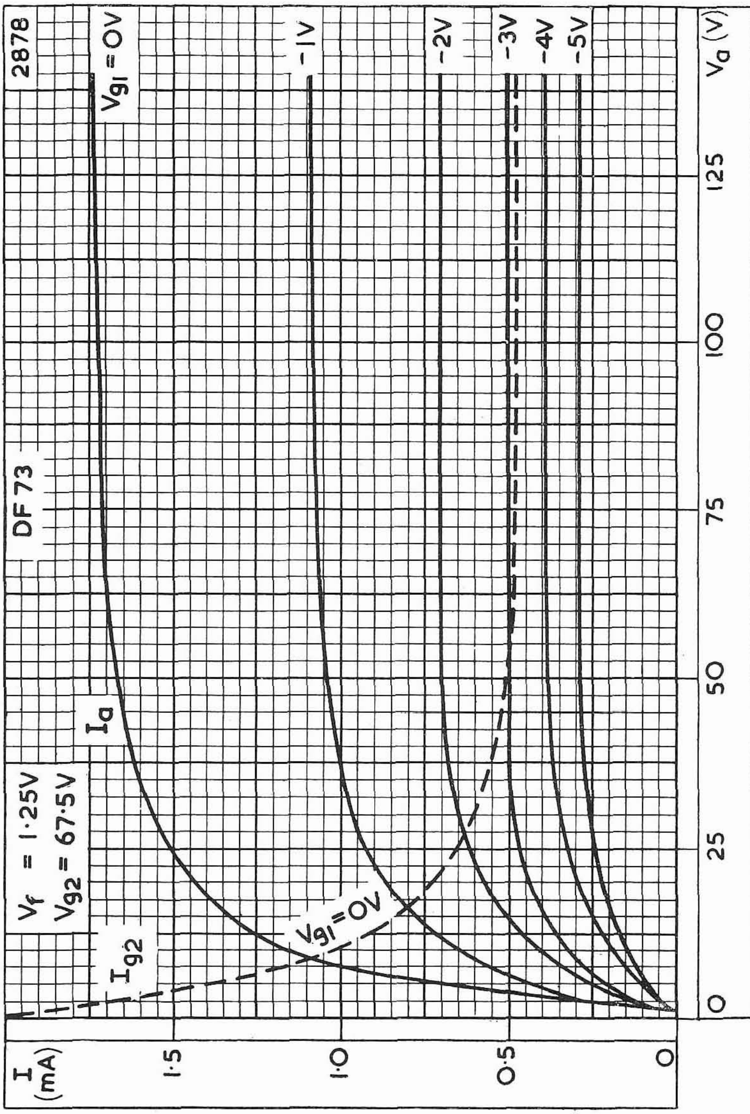


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE VARIABLE-MU R.F. PENTODE

DF73

Subminiature variable-mu r.f. pentode suitable for battery operation.

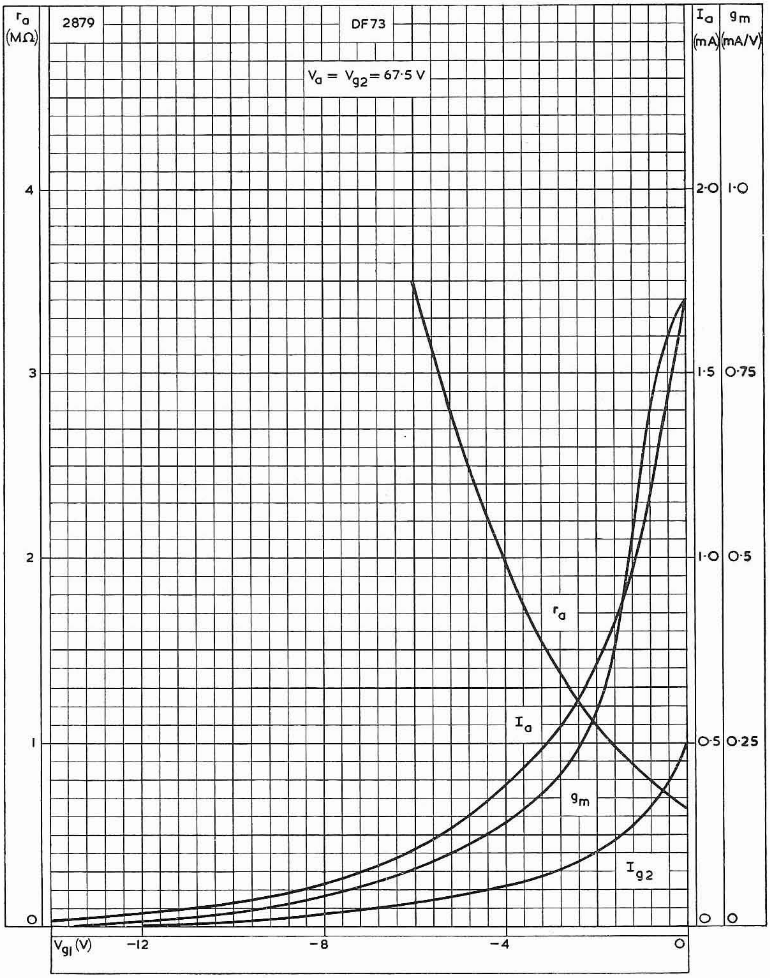


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

DF73

SUBMINIATURE VARIABLE-MU R.F. PENTODE

Subminiature variable-mu r.f. pentode suitable for battery operation.



ELECTRODE CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE OUTPUT PENTODE

DL66

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.

FILAMENT

V_f	1.25	V
I_f	15	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5 mm. from the seal and any bending of the valve leads must be at least 1.5 mm. from the seal.

CAPACITANCES

c_{a-g1}	<0.2	μμF
c_{in}	2.5	μμF
c_{out}	3.7	μμF

CHARACTERISTICS

V_a	22.5	V
V_{g2}	22.5	V
I_a	300	μA
I_{g2}	75	μA
V_{g1}	−1.4	V
g_m	350	μA/V
r_a	300	kΩ
μ_{g1-g2}	8.0	

OPERATING CONDITIONS AS SINGLE VALVE CLASS "A" AMPLIFIER

V_b	22.5	V
V_{g2}	22.5	V
V_{g1}	−1.4	V
R_a	75	kΩ
$I_{a(o)}$	300	μA
$I_{g2(o)}$	75	μA
$V_{in(r.m.s.)}$	0.85	V
P_{out}	2.7	mW
D_{tot}	10	%

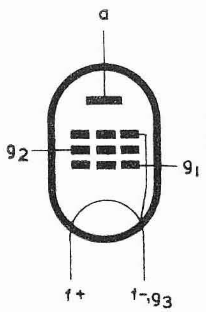
LIMITING VALUES

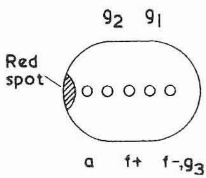
V_a max.	45	V
V_{g2} max.	45	V
I_k max.	1.0	mA

DL66

SUBMINIATURE OUTPUT PENTODE

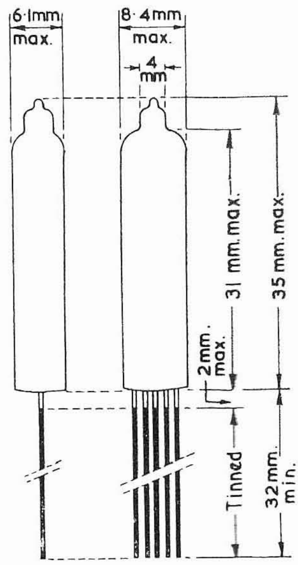
Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.





B5A BASE

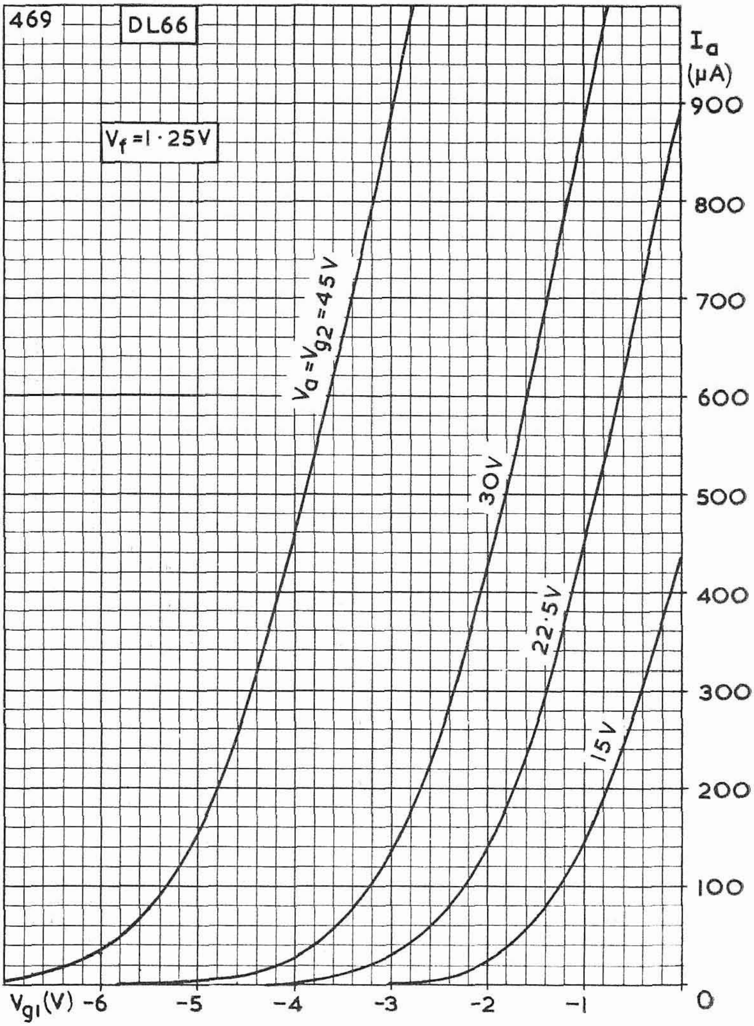
463



SUBMINIATURE OUTPUT PENTODE

DL66

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.

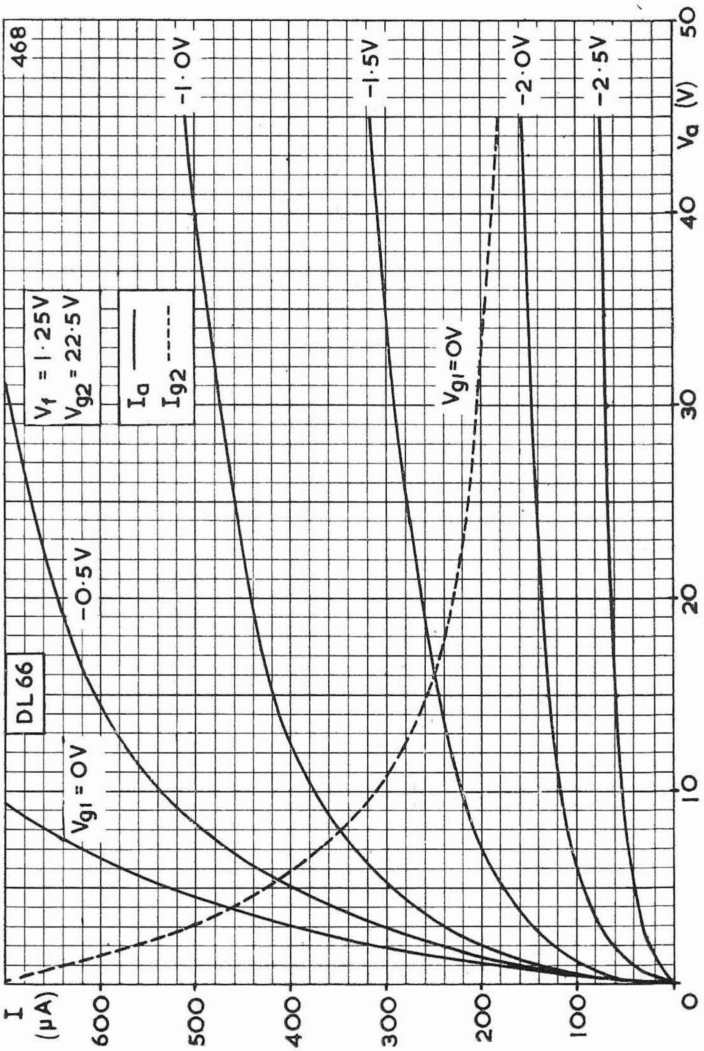


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID BIAS

DL66

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.

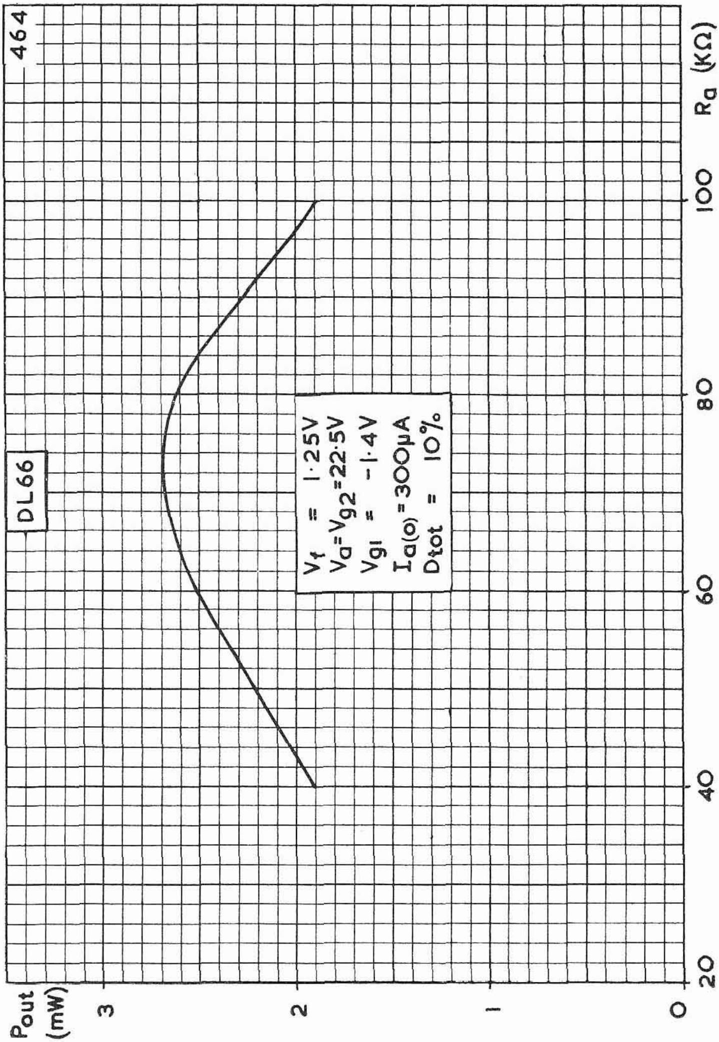


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE FOR A SCREEN-GRID VOLTAGE OF 22.5 V

SUBMINIATURE OUTPUT PENTODE

DL66

Subminiature output pentode suitable for use in hearing-aids It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.

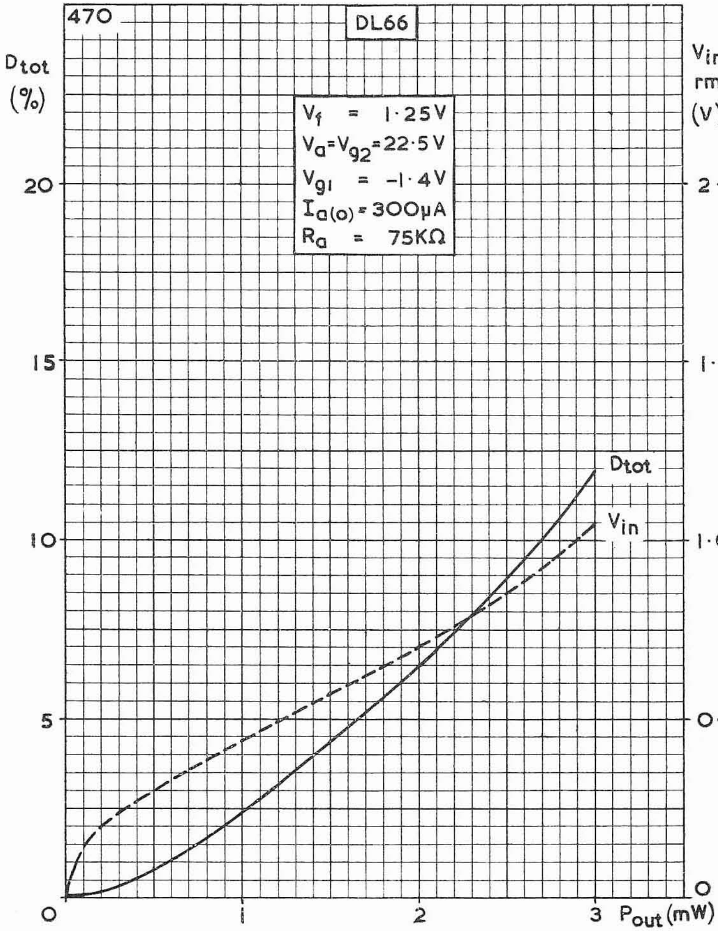


OUTPUT POWER PLOTTED AGAINST LOAD RESISTANCE FOR ANODE AND SCREEN-GRID VOLTAGE OF 22.5 V

DL66

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.

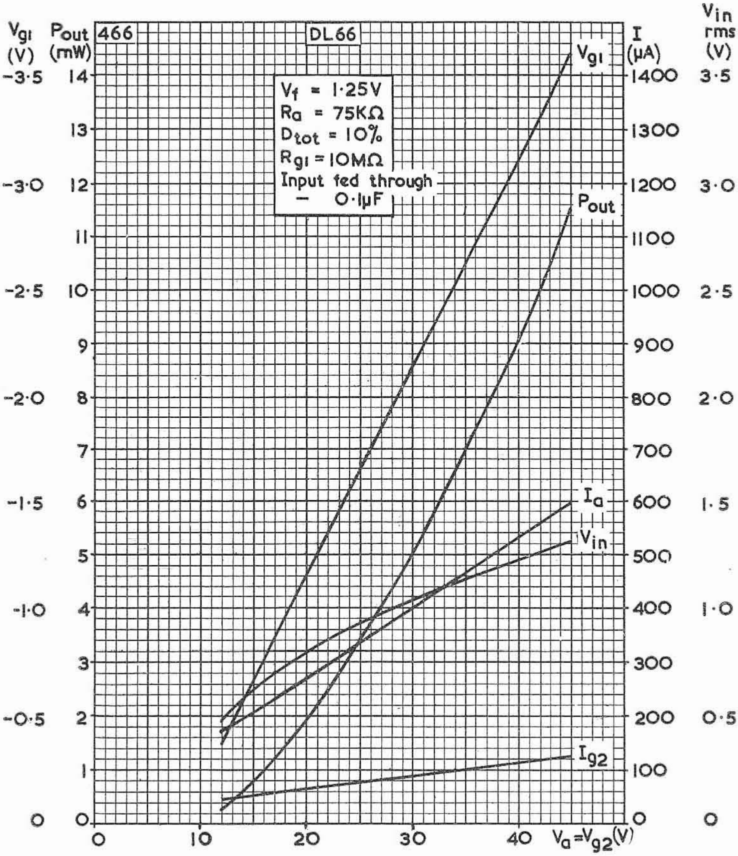


DISTORTION AND INPUT VOLTAGE PLOTTED AGAINST OUTPUT POWER AT ANODE AND SCREEN-GRID VOLTAGES OF 22.5 V, AND GRID VOLTAGE OF —1.4 V

SUBMINIATURE OUTPUT PENTODE

DL66

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.



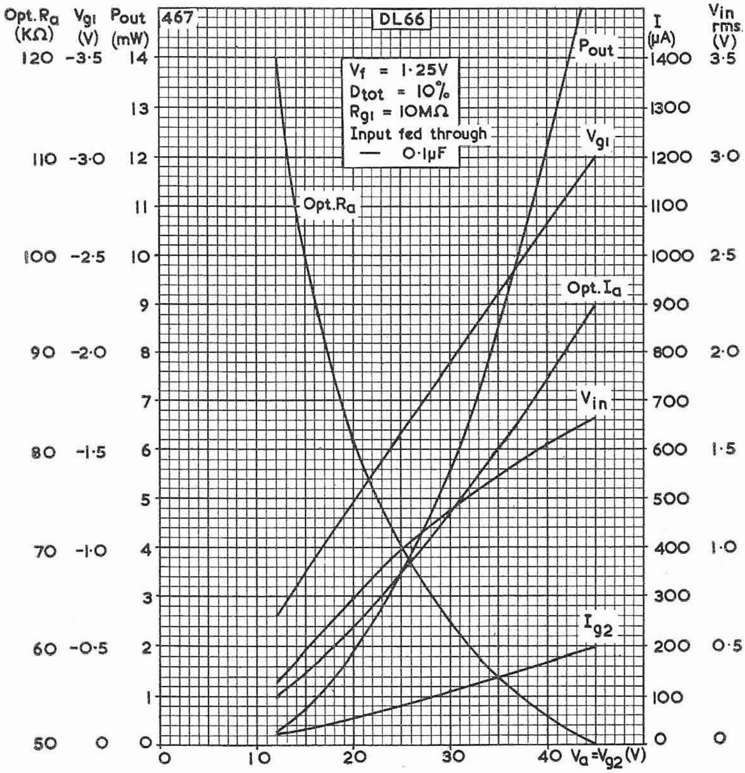
OUTPUT POWER, ANODE AND SCREEN-GRID CURRENTS, CONTROL-GRID VOLTAGE AND INPUT VOLTAGE PLOTTED AGAINST H.T. VOLTAGE, FOR THE RANGE $V_a = V_{g2}$ = 12 TO 45 V

Note.— For these curves $R_a = 75\ \mathrm{k}\,\Omega$ throughout and the anode current has been adjusted so that $\frac{V_a}{I_a} = 75\ \mathrm{k}\,\Omega$.

DL66

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.



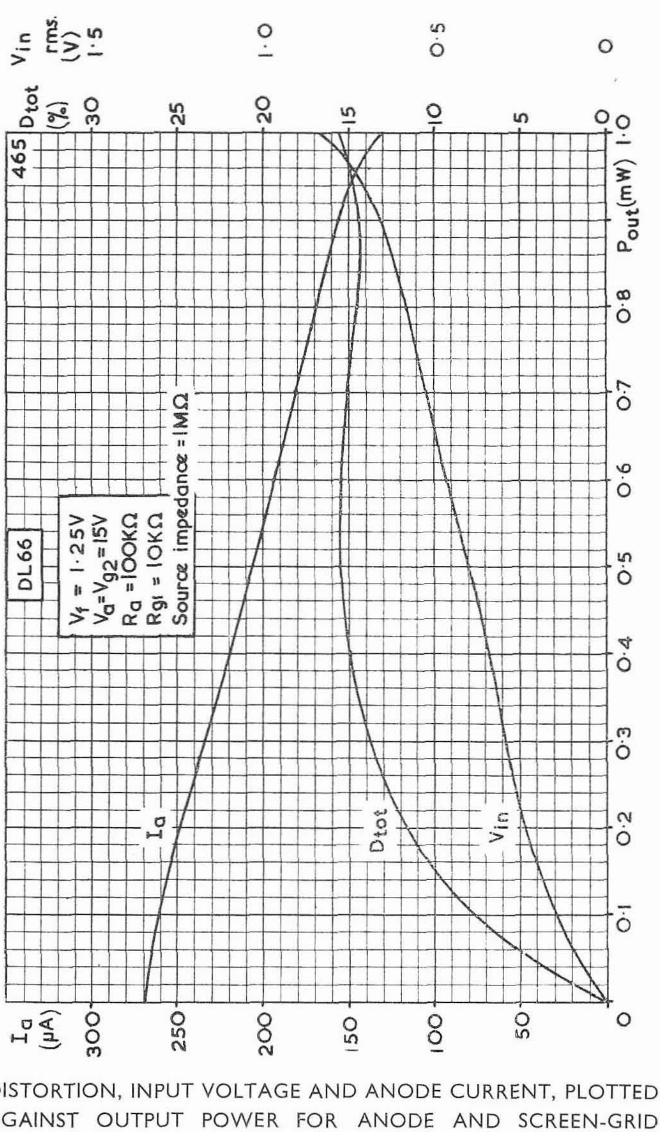
OUTPUT POWER, OPTIMUM ANODE CURRENT, SCREEN-GRID CURRENT, CONTROL-GRID VOLTAGE, INPUT VOLTAGE AND OPTIMUM LOAD RESISTANCE PLOTTED AGAINST H.T. VOLTAGE, FOR THE RANGE $V_a=V_{g2}=12$ TO 45 V

Note.— For these curves the optimum value of load resistance for each value of H.T. voltage has been used.

SUBMINIATURE OUTPUT PENTODE

DL66

Subminiature output pentode suitable for use in hearing-aids. It has a filament current of 15 mA and is primarily intended for use with an H.T. battery supply of 22.5 volts.



DISTORTION, INPUT VOLTAGE AND ANODE CURRENT, PLOTTED AGAINST OUTPUT POWER FOR ANODE AND SCREEN-GRID VOLTAGE OF 15V AND WITH GRID CURRENT BIASING

SUBMINIATURE OUTPUT PENTODE

DL69

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

FILAMENT

Suitable for d.c. operation only

V_f	1.25	V
I_f	25	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads must be at least 5mm from the seal and any bending of the leads must be at least 1.5mm from the seal.

CAPACITANCES (shielded)

←

c_{a-g1}	50	mpF
c_{in}	2.9	pF
c_{out}	3.2	pF

CHARACTERISTICS

V_a	90	V
V_{g2}	90	V
I_a	1.75	mA
I_{g2}	400	μA
V_{g1}	−2.5	V
g_m	850	μA/V
r_a	800	kΩ
μ_{g1-g2}	15	

OPERATING CONDITIONS AS SINGLE VALVE CLASS 'A' AMPLIFIER

V_a	67.5	90	V
V_{g2}	67.5	90	V
$I_{a(0)}$	0.9	1.3	mA
$I_{g2(0)}$	200	300	μA
V_{g1}	−2.0	−3.0	V
R_a	70	60	kΩ
$V_{in(r.m.s.)}$	1.2	1.6	V
P_{out}	23	50	mW
D_{tot}	10	10	%

DL69

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

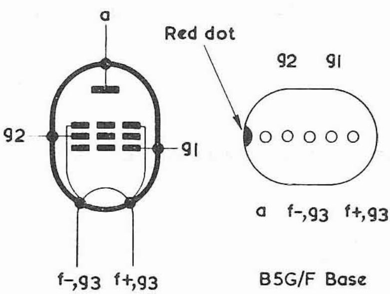
OPERATING CONDITIONS FOR TWO VALVES IN CLASS 'AB' PUSH-PULL

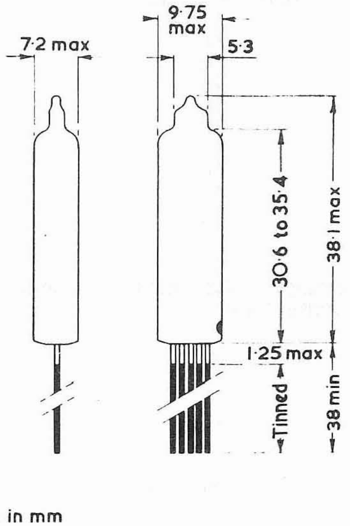
V_{a-e}	90	V
V_{g2-e}	90	V
$I_{a(o)}$	2×800	μA
I_a(max. sig.)	2×1.0	mA
$I_{g2(o)}$	2×150	μA
I_{g2}(max. sig.)	2×425	μA
R_k	1.8	kΩ
R_{a-a}	100	kΩ
$V_{in(g1-g1)r.m.s.}$	8.0	V
P_{out}	100	mW
D_{tot}	5.0	%

LIMITING VALUES

V_a max.	90	V
V_{g2} max.	90	V
I_k max.	2.5	mA

2927





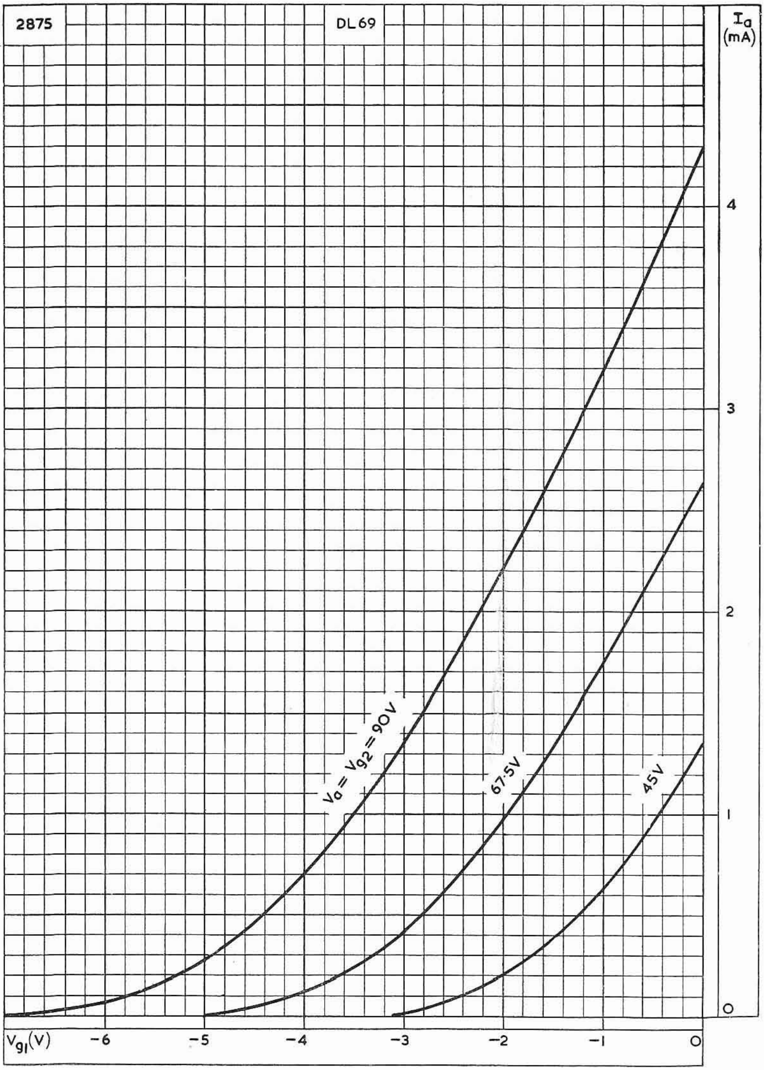
g3 consists of two plates one being connected to lead 3 and the other to lead 5

All dimensions in mm

SUBMINIATURE OUTPUT PENTODE

DL69

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

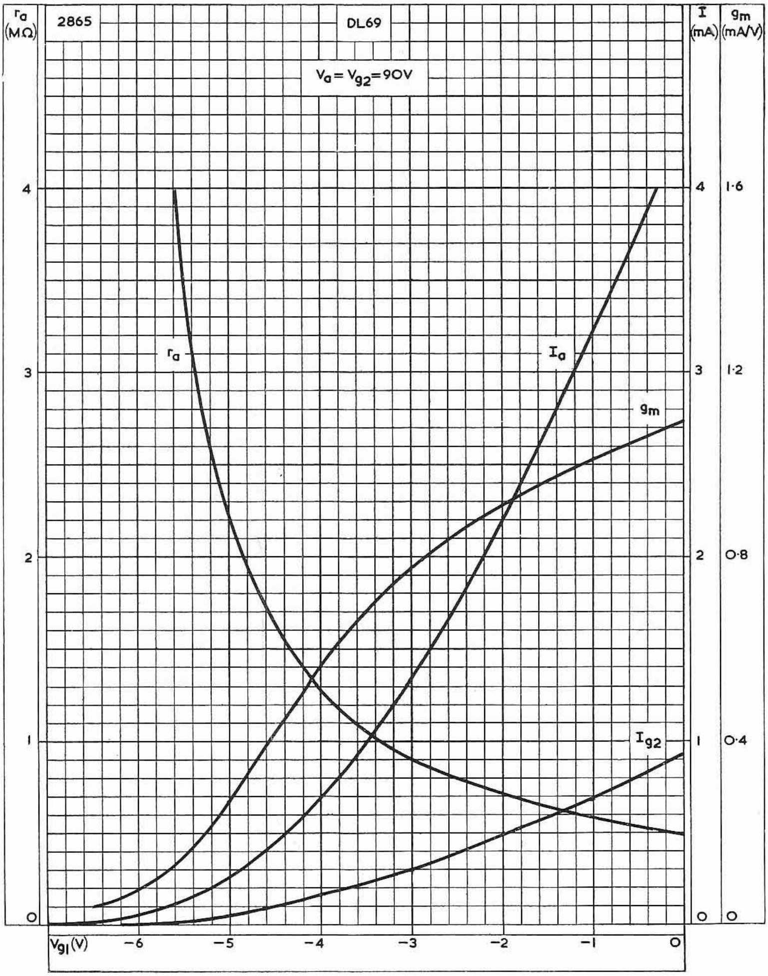


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE

DL69

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

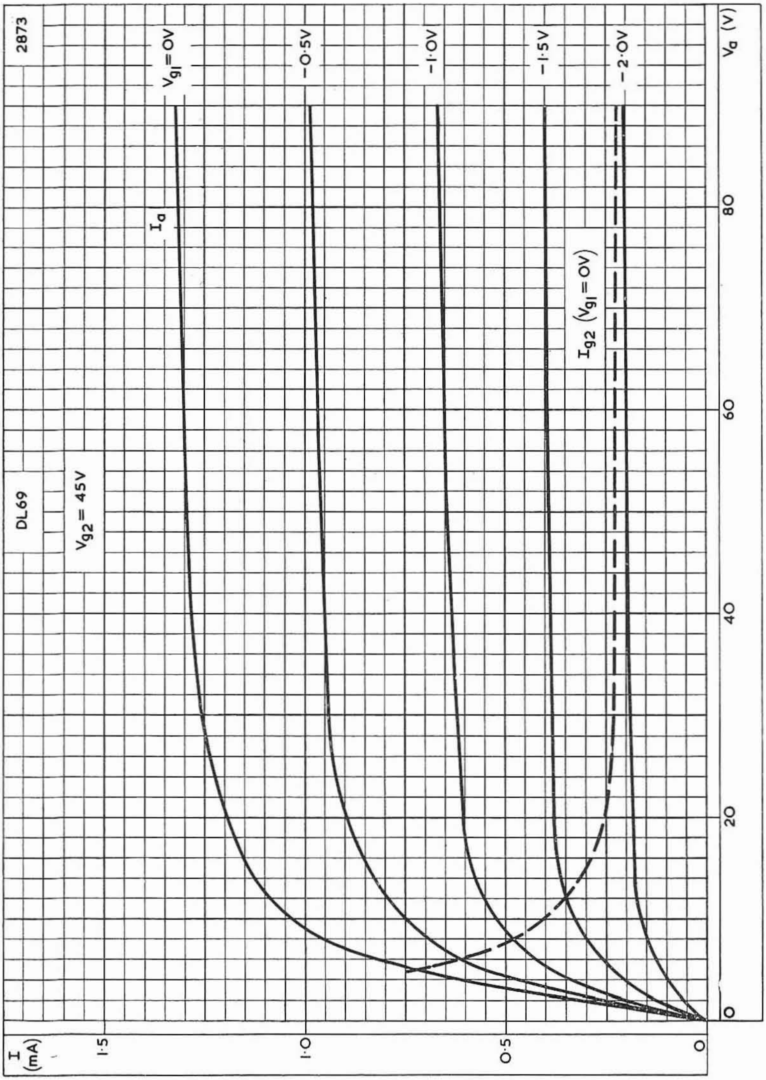


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE OUTPUT PENTODE

DL69

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

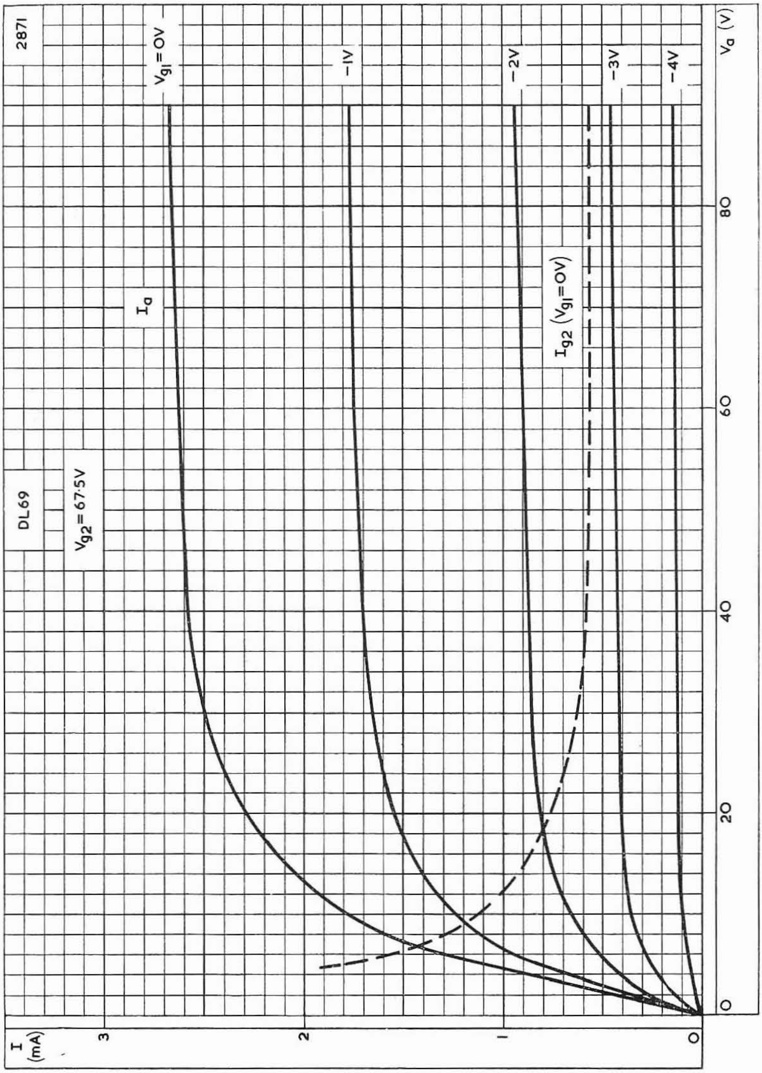


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. $V_{g2} = 45V$

DL69

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

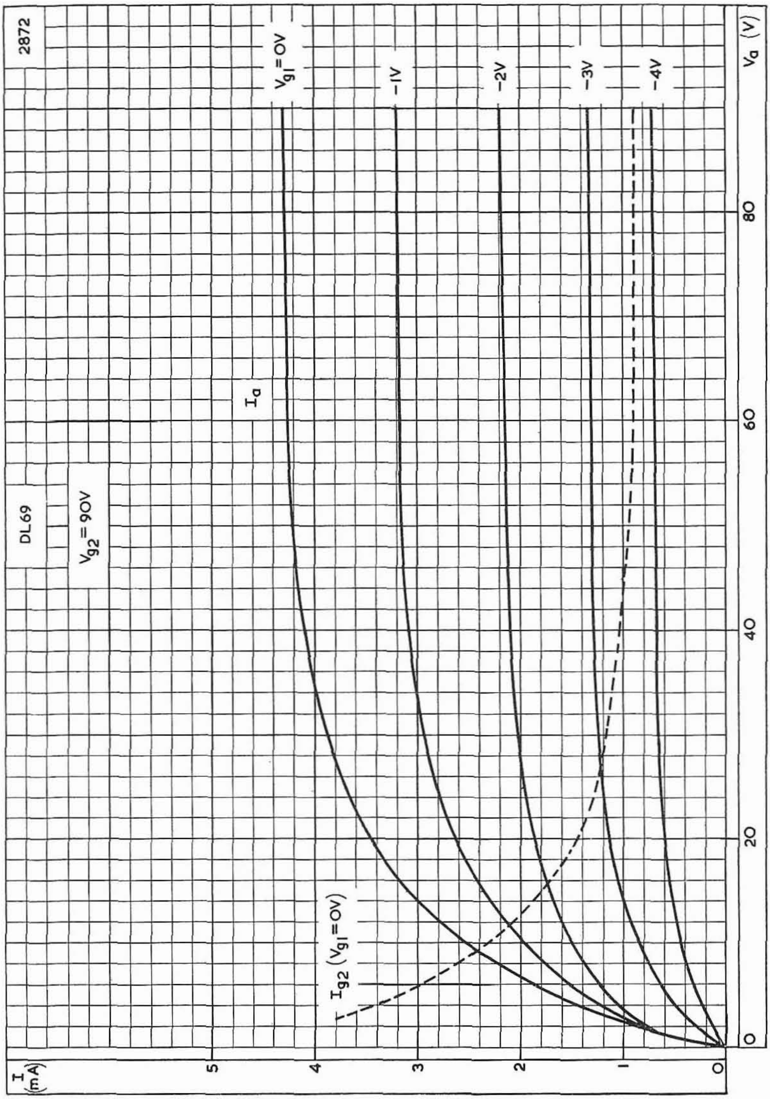


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. $V_{g2}=67.5V$

SUBMINIATURE OUTPUT PENTODE

DL69

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

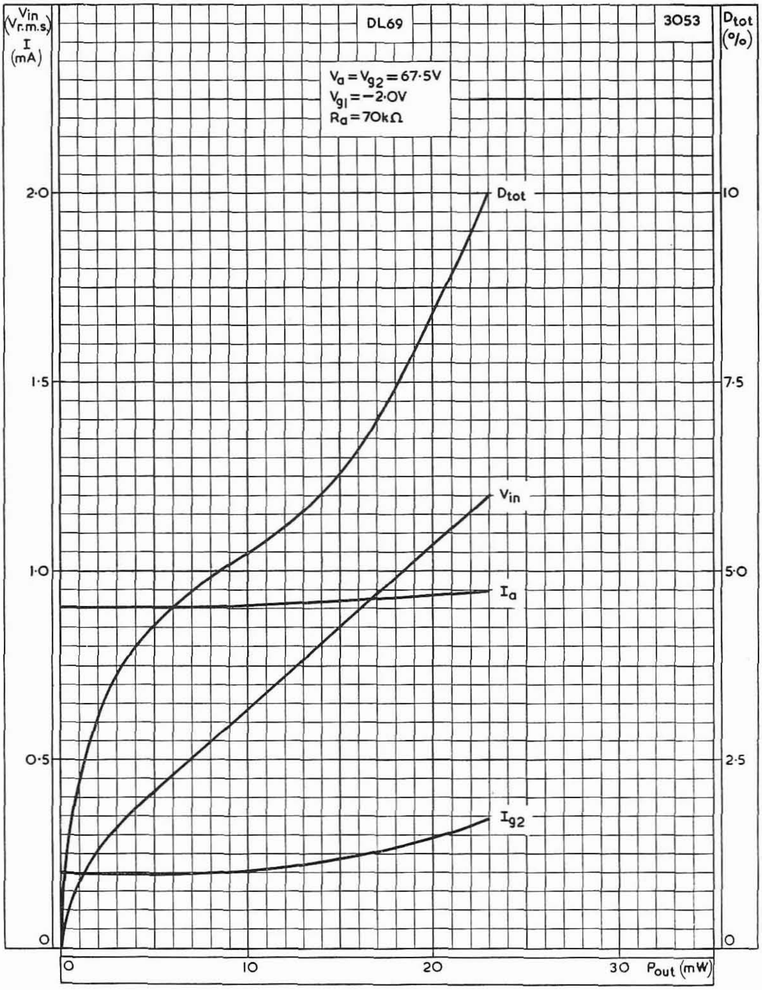


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. $V_{g2}=90V$

DL69

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

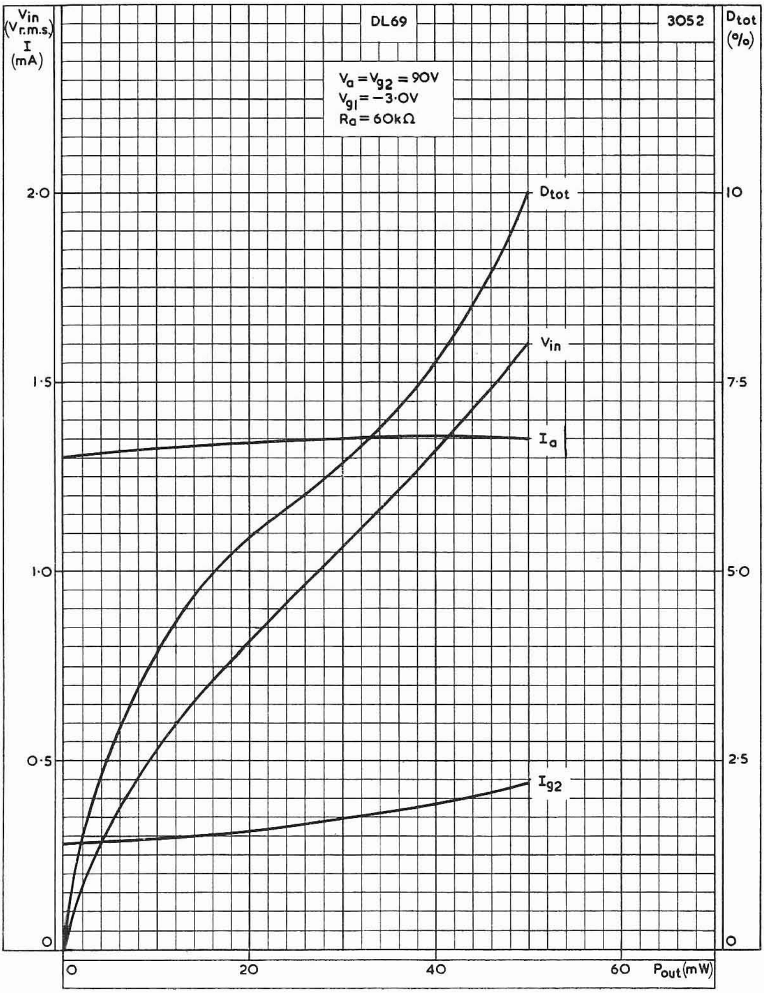


PERFORMANCE OF DL69 AS CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 67.5V$

SUBMINIATURE OUTPUT PENTODE

DL69

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

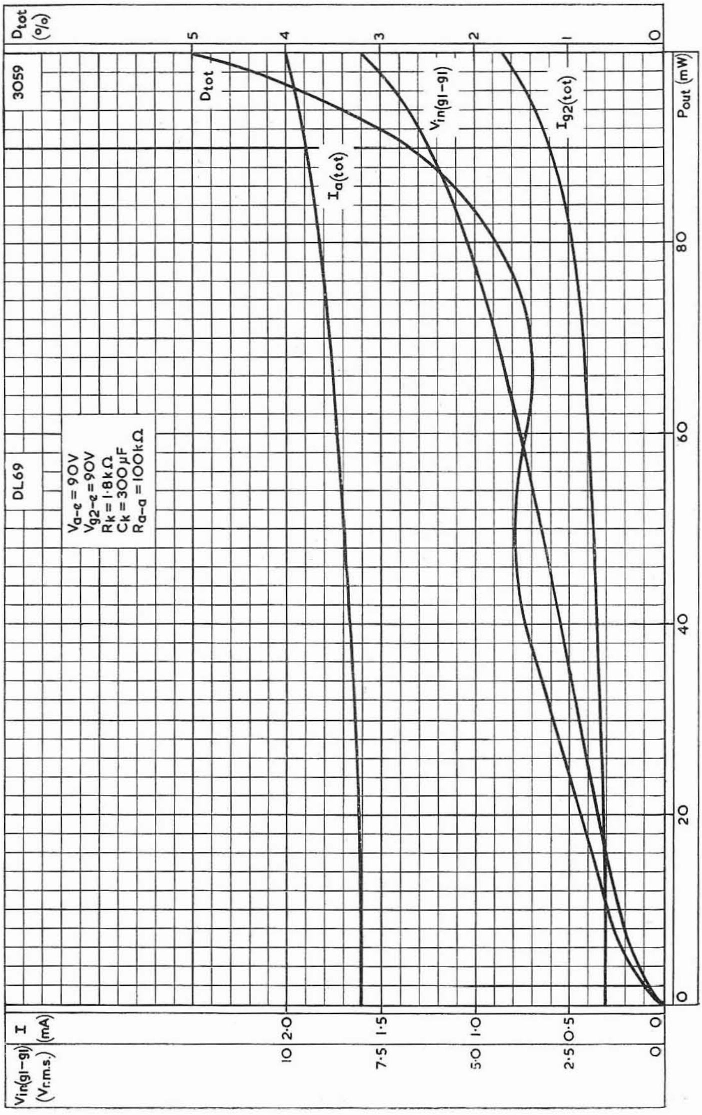


PERFORMANCE OF DL69 AS CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 90V$

DL69

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.



PERFORMANCE OF TWO DL69 IN PUSH-PULL

SUB-MINIATURE OUTPUT PENTODE — DL71

Sub-miniature output pentode with wire-in connections for use in Hearing Aids.

FILAMENT

V_f	1.25	V
I_f	25	mA

MOUNTING POSITION — Any

Note—Direct soldered connections to the leads of this valve must be at least 5 mm. from the seal and any bending of the valve leads must be at least 1.5 mm. from the seal.

CAPACITANCES (Measured without an external screen)

c_{in}	2.6	μμF
c_{out}	3.6	μμF
c_{a-g}	<0.5	μμF

CHARACTERISTICS

V_a	45	V
V_{g2}	45	V
V_{g1}	−1.25	V
I_a	600	μA
I_{g2}	150	μA
g_m	550	μA/V
r_a	0.35	MΩ
μ_{g1-g2}	15	

OPERATING CONDITIONS AS SINGLE VALVE CLASS "A" AMPLIFIER (Screen fed direct from H.T. line)

V_b	45	V
$I_{a(o)}$	590	μA
$I_{g2(o)}$	150	μA
R_k	1.5	kΩ
V_{g1}	−1.25	V
R_a	100	kΩ
$V_{in\ (r.m.s.)}$	0.88	V
P_{out}	6.3	mW
D_{tot}	10	%

Note—For the above condition the signal source impedance consisted of a 0.47 MΩ resistor in series with a capacitor of 0.1 μF, the combination being shunted by a 10 MΩ resistor.

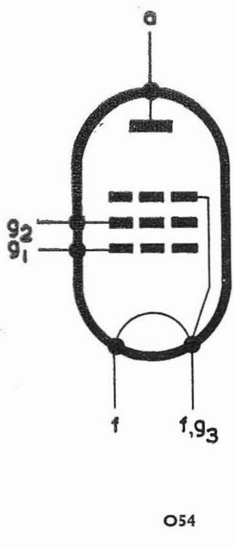
LIMITING VALUES

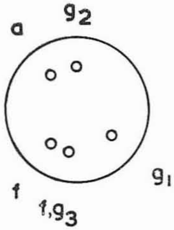
V_a max.	45	V
V_{g2} max.	45	V
I_k max.	1.7	mA

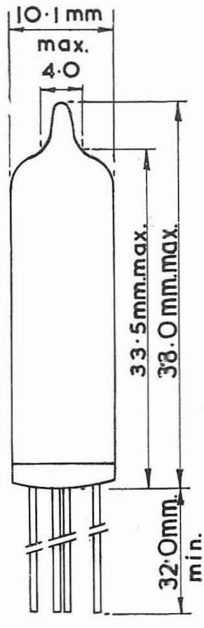
DL71

SUB-MINIATURE OUTPUT PENTODE

Sub-miniature output pentode with wire-in connections for use in Hearing Aids.



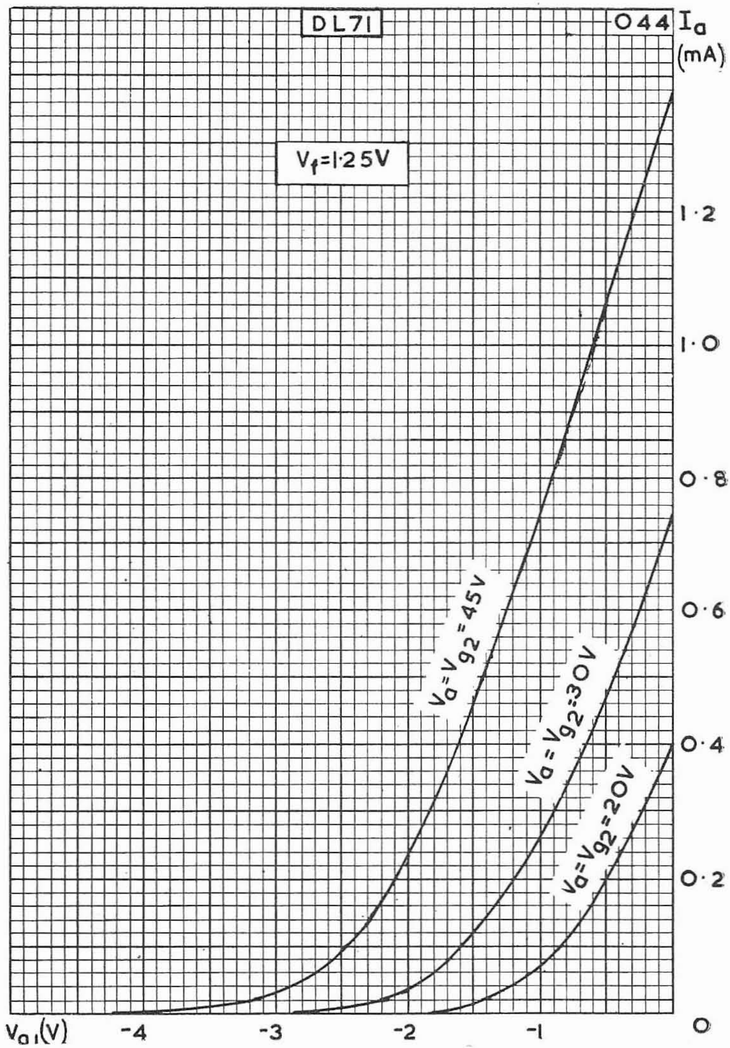




O54

A spot of red lacquer is placed on the base next to the anode lead.

Sub-miniature output pentode with wire-in connections for use in Hearing Aids.

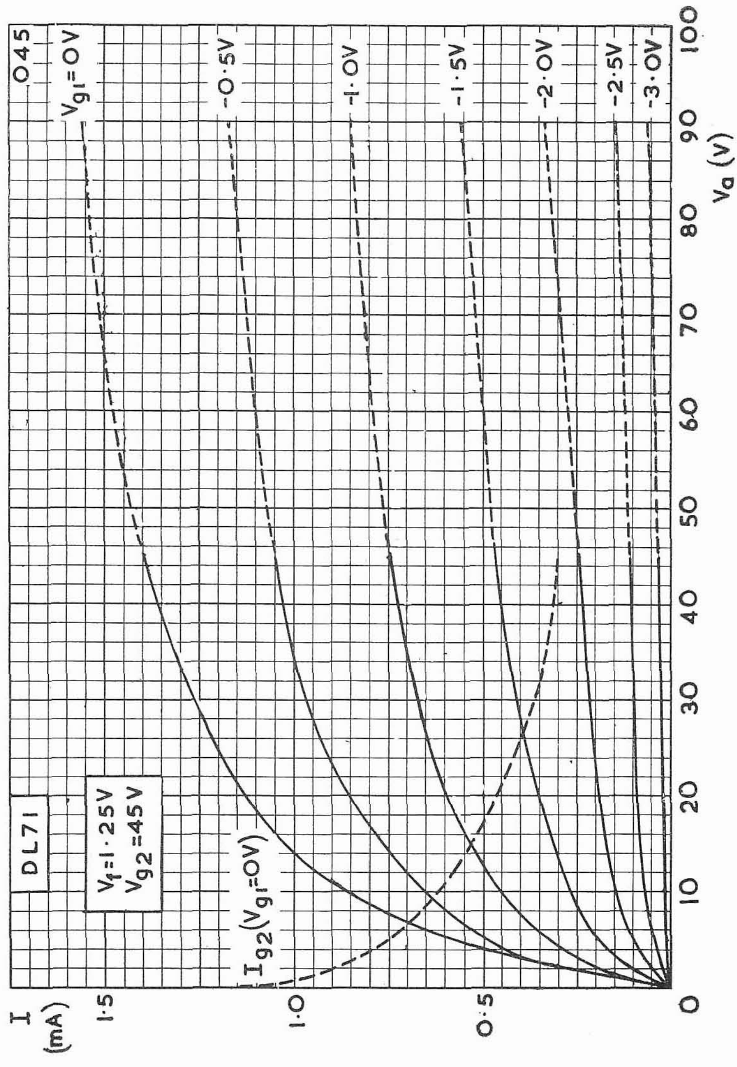


ANODE CURRENT PLOTTED AGAINST CONTROL GRID VOLTAGE

DL71

SUB-MINIATURE OUTPUT PENTODE

Sub-miniature output pentode with wire-in connections for use in Hearing Aids.

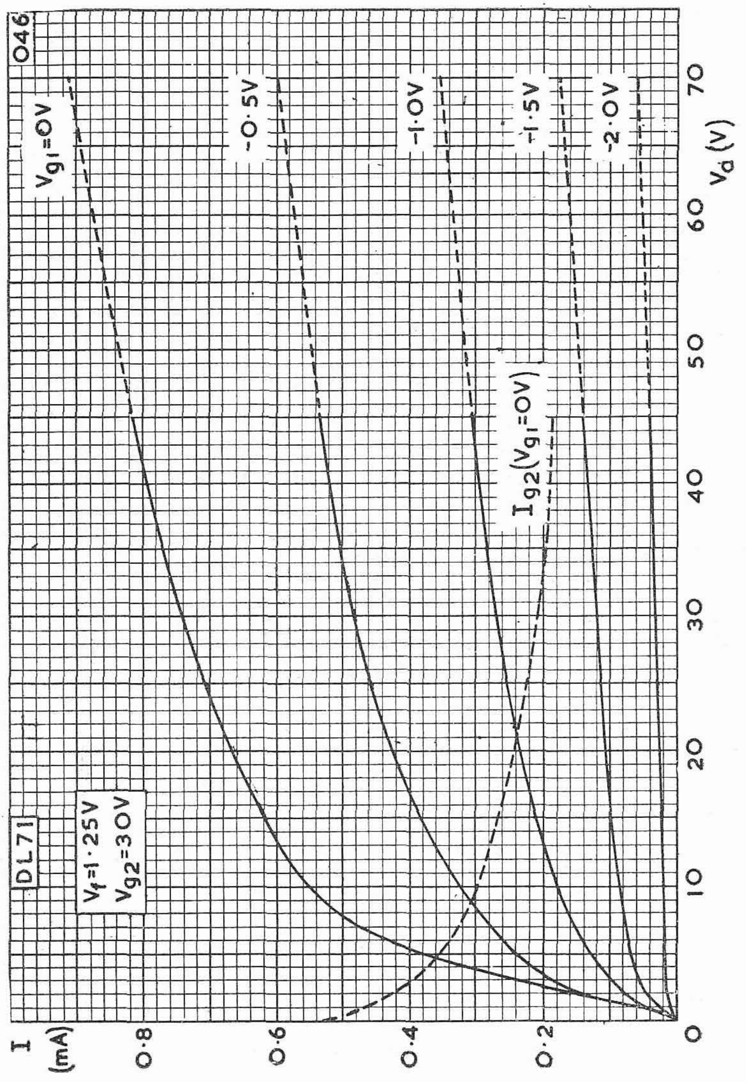


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
(SCREEN VOLTAGE = 45 V)

SUB-MINIATURE OUTPUT PENTODE

DL71

Sub-miniature output pentode with wire-in connections for use in Hearing Aids.

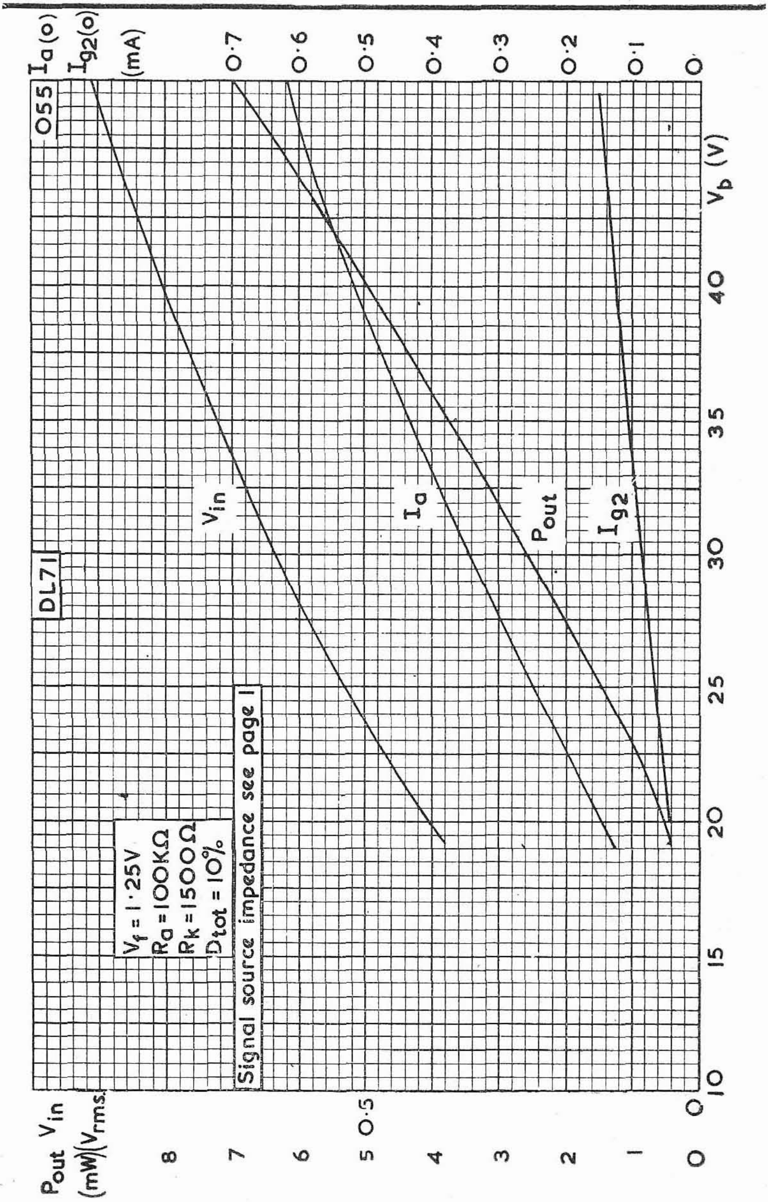


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
(SCREEN VOLTAGE = 30 V)

DL71

SUB-MINIATURE OUTPUT PENTODE

Sub-miniature output pentode with wire-in connections for use in Hearing Aids.



INPUT VOLTAGE, ANODE CURRENT, SCREEN CURRENT AND OUTPUT POWER PLOTTED AGAINST H.T. VOLTAGE

R.F. OUTPUT PENTODE

DL98

R.F. output pentode intended for use in portable equipment as a class 'C' r.f. amplifier, oscillator and frequency multiplier.

FILAMENT

	Series	Parallel	
V_f	2.5	1.25	V
I_f	165	330	mA

When the filament sections are series connected, the lower section of the filament should be shunted by a resistor to by-pass the cathode current of the upper section.

MOUNTING POSITION

Any

CAPACITANCES (measured without an external shield)

c_{a-g1}	<160	mpF
c_{in}	4.6	pF
c_{out}	7.6	pF

CHARACTERISTICS

V_a	90	135	V←
V_{g2}	90	120	V←
I_a	15	30	mA
I_{g2}	1.0	1.8	mA
g_m	1.7	2.15	mA/V←
r_a	22	22	kΩ
μ_{g1-g2}	3.2	3.45	
V_{g1}	−9.9	−10	V

OPERATING CONDITIONS

As class 'C' amplifier or oscillator

		†	
f	100	100	Mc/s
V_a	90	150	V
V_{g2}	90	135	V
V_{g1}	−18	−39	V
I_a	15	25	mA
I_{g2}	4.8	6.2	mA
I_{g1}	400	550	µA
P_{drive}	30	70	mW
P_{load}	0.45	1.25	W

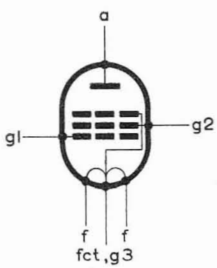
†This condition represents operation at the absolute limit of V_a, V_{g2} and I_a

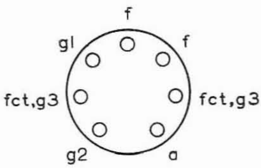
DL98

R.F. OUTPUT PENTODE

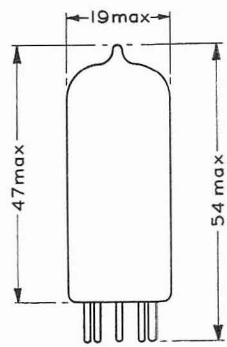
ABSOLUTE MAXIMUM RATINGS

V_a max.	150	V
p_a max.	3.0	W
V_{g2} max.	135	V
p_{g2} max.	1.1	W
$-V_{g1}$ max.	75	V
I_a max.	25	mA
I_{g1} max.	1.5	mA
R_{g1-k} max.	100	kΩ
I_k max.	32	mA



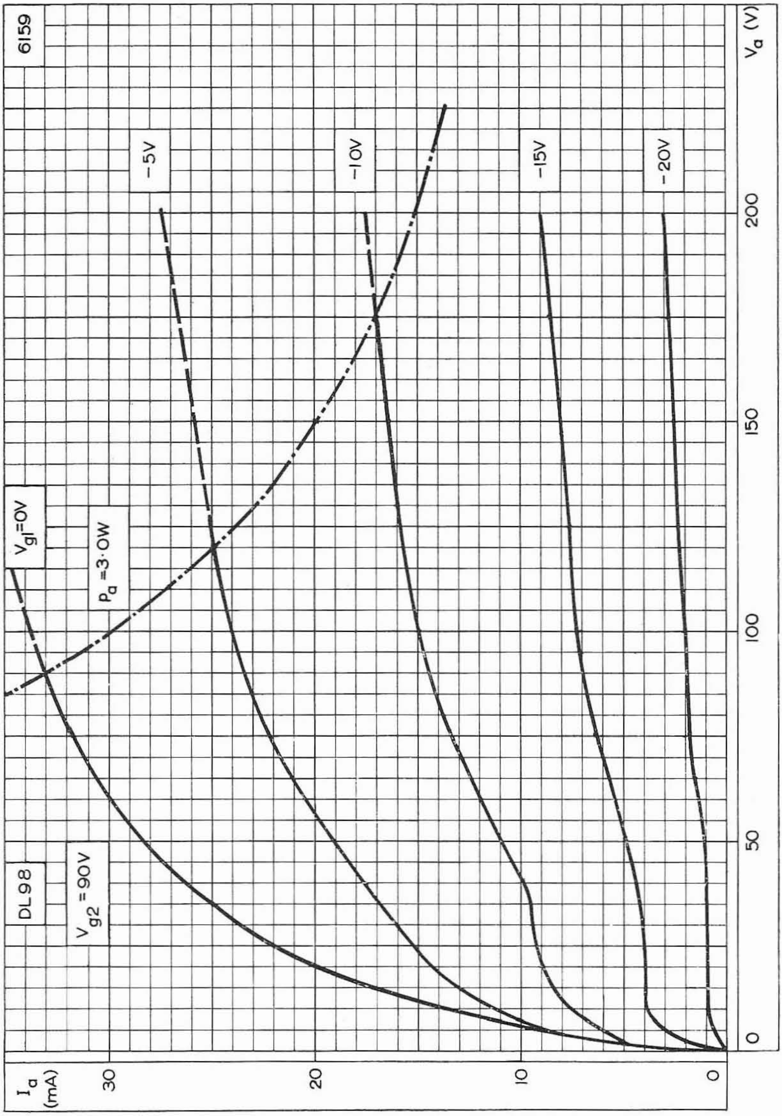


B7G Base

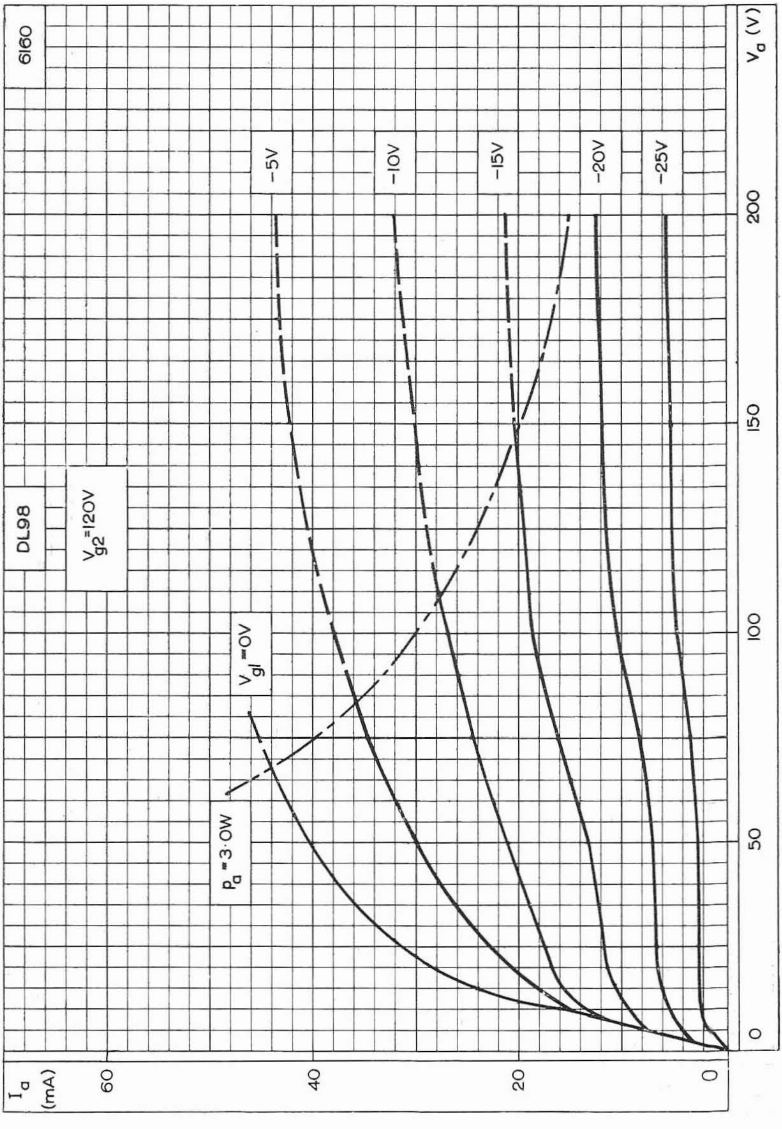


5485

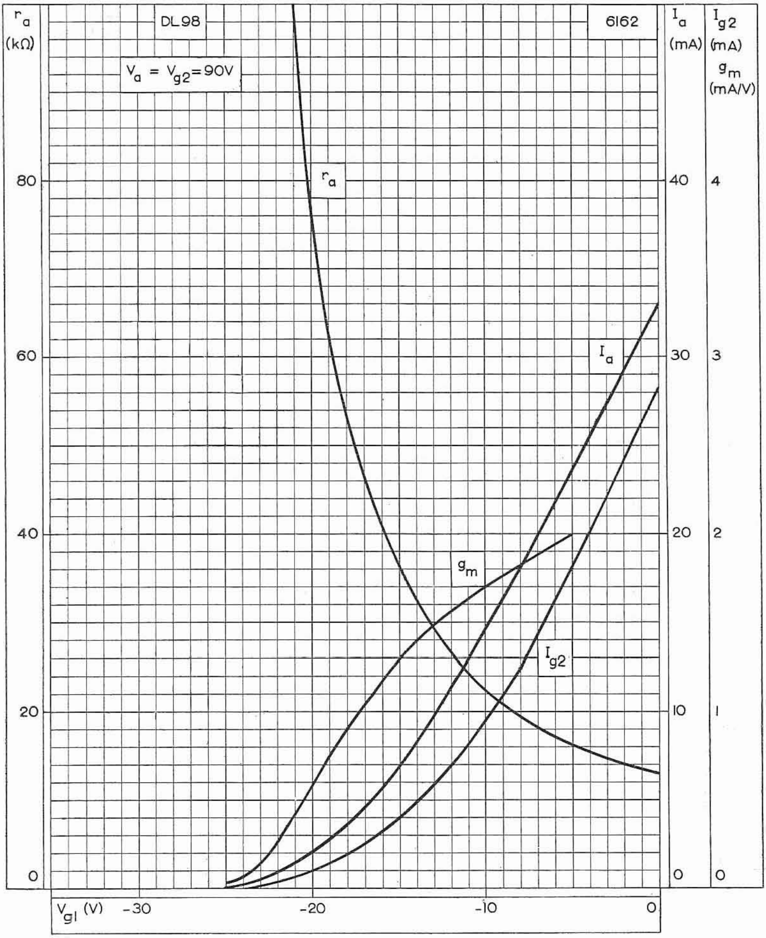
All dimensions in mm



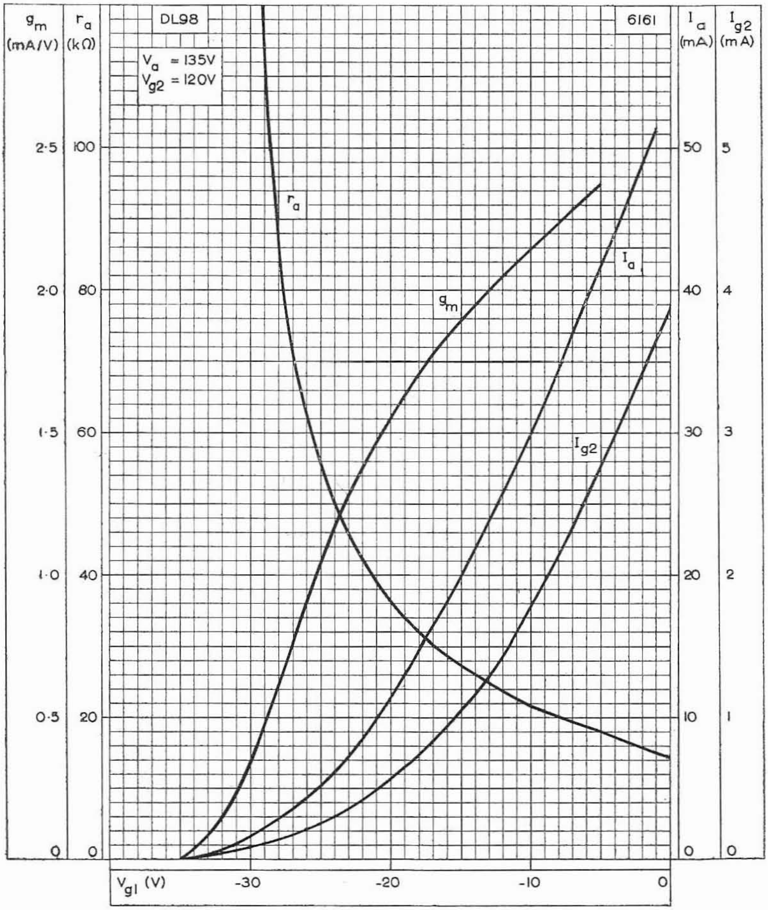
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 90V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 120V$



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. $V_a = V_{g2} = 90V$



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. $V_a = 135V$, $V_{g2} = 120V$

SUBMINIATURE OUTPUT PENTODE DL620

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

FILAMENT

Suitable for d.c. operation only.

V_f	1.25	V
I_f	50	mA

MOUNTING POSITION Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

CAPACITANCES (measured without external shield)

c_{a-g1}	<0.2	pF
c_{in}	2.8	pF
c_{out}	3.5	pF

CHARACTERISTICS

V_a	67.5	V
V_{g2}	67.5	V
I_a	3.1	mA
I_{g2}	950	µA
V_{g1}	−6.5	V
g_m	650	µA/V
r_a	110	kΩ
μ_{g1-g2}	5.0	

OPERATING CONDITIONS AS SINGLE VALVE CLASS 'A' AMPLIFIER

V_a	45	67.5	90	V
V_{g2}	45	67.5	67.5	V
$I_{a(0)}$	1.8	3.25	3.25	mA
$I_{g2(0)}$	0.6	1.0	0.9	mA
$I_{g2\ (max.sig.)}$	1.1	1.75	1.5	mA
V_{g1}	−3.8	−6.2	−6.7	V
$V_{in(r.m.s.)}$	3.4	5.0	4.8	V
R_a	20	15	25	kΩ
P_{out}	30	85	110	mW
D_{tot}	10	10	10	%

DL620

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

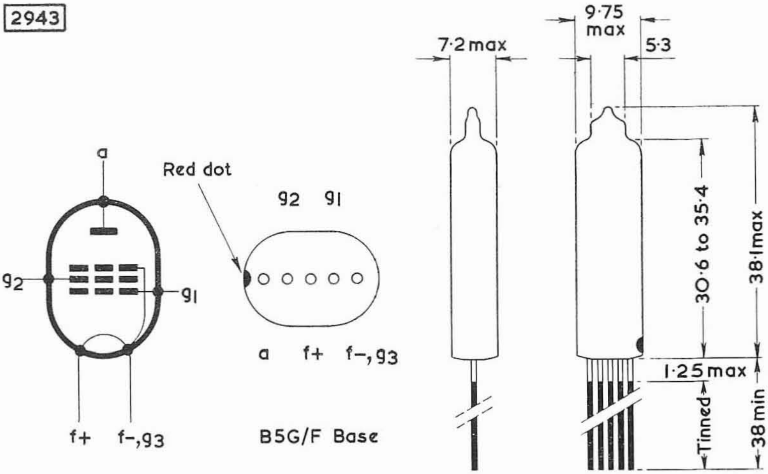
OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL CLASS 'AB'

V_{a-e}	67.5	V
V_{g2-e}	67.5	V
$I_{a(o)}$	3.3	mA
$I_{a\ (max.\ sig.)}$	3.6	mA
$I_{g2(o)}$	1.0	mA
$I_{g2\ (max.\ sig.)}$	2.25	mA
R_k	1.8	kΩ
R_{a-a}	30	kΩ
$V_{in(g1-g1)r.m.s.}$	16	V
P_{out}	100	mW
D_{tot}	3.0	%

LIMITING VALUES

V_a max.	90	V
V_{g2} max.	90	V
I_k max.	5.0	mA

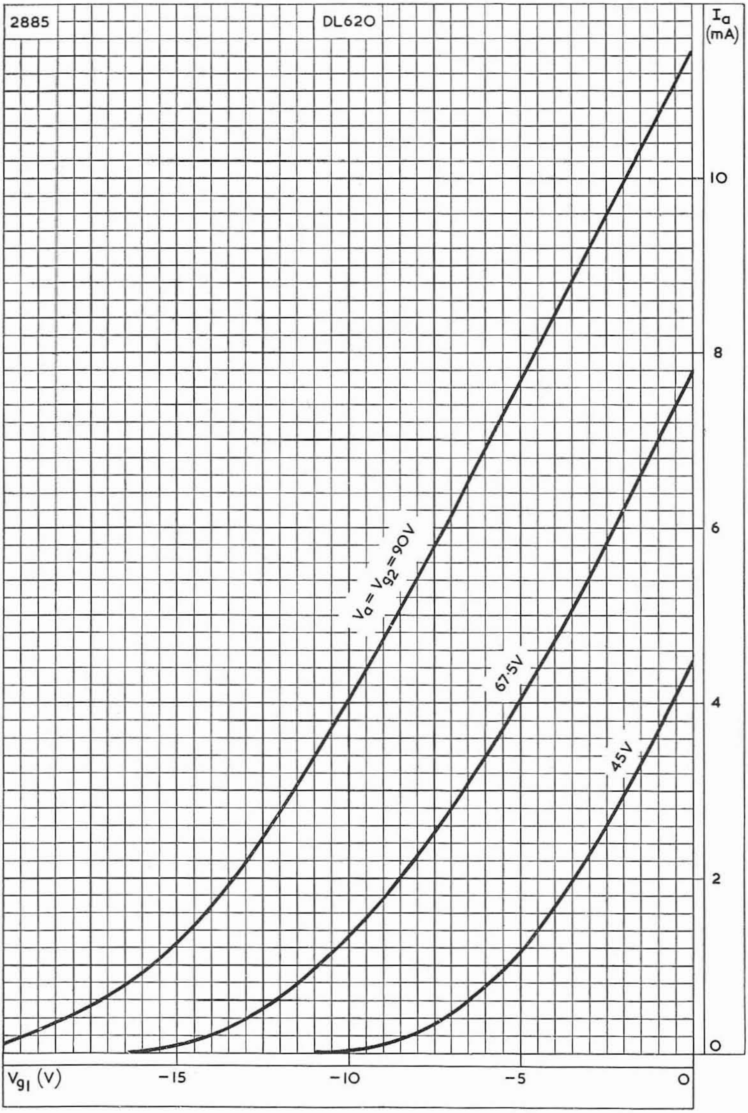
2943



All dimensions in mm

SUBMINIATURE OUTPUT PENTODE DL620

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

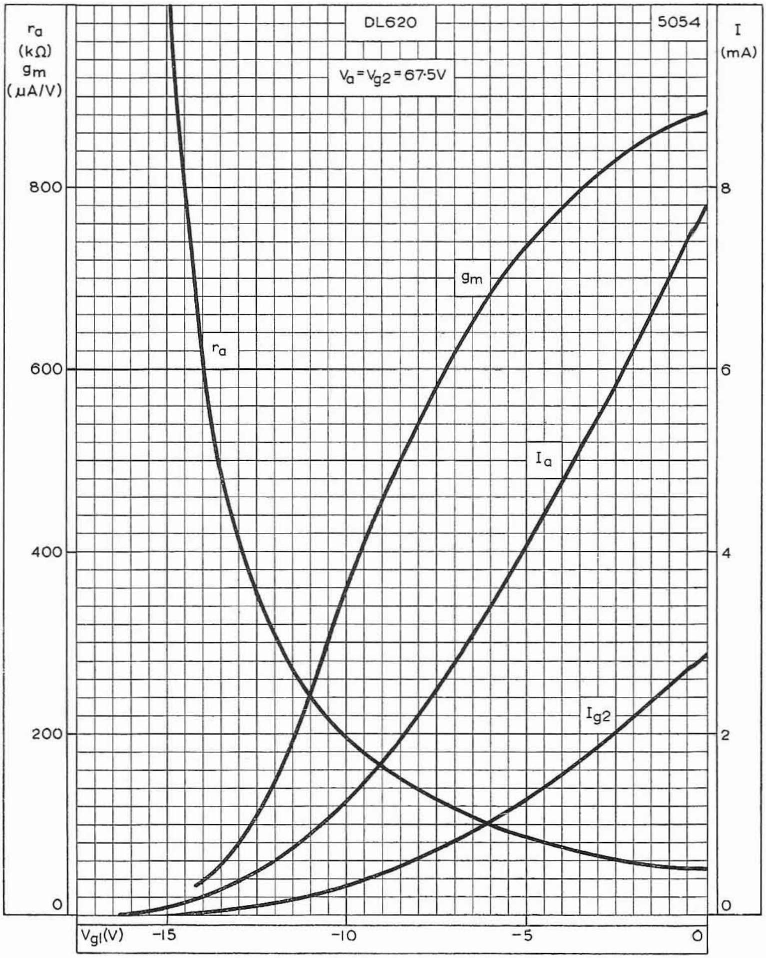


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS VALUES OF ANODE AND SCREEN-GRID VOLTAGE

DL620

SUBMINIATURE OUTPUT PENTODE

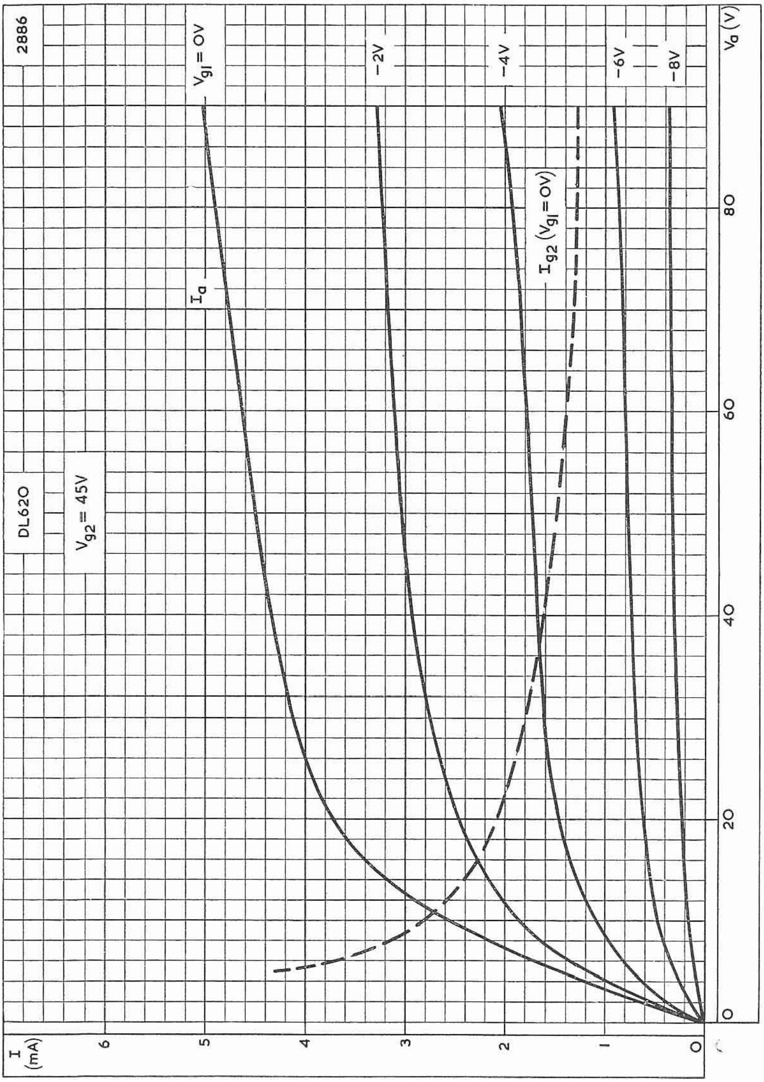
Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 67.5V$

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

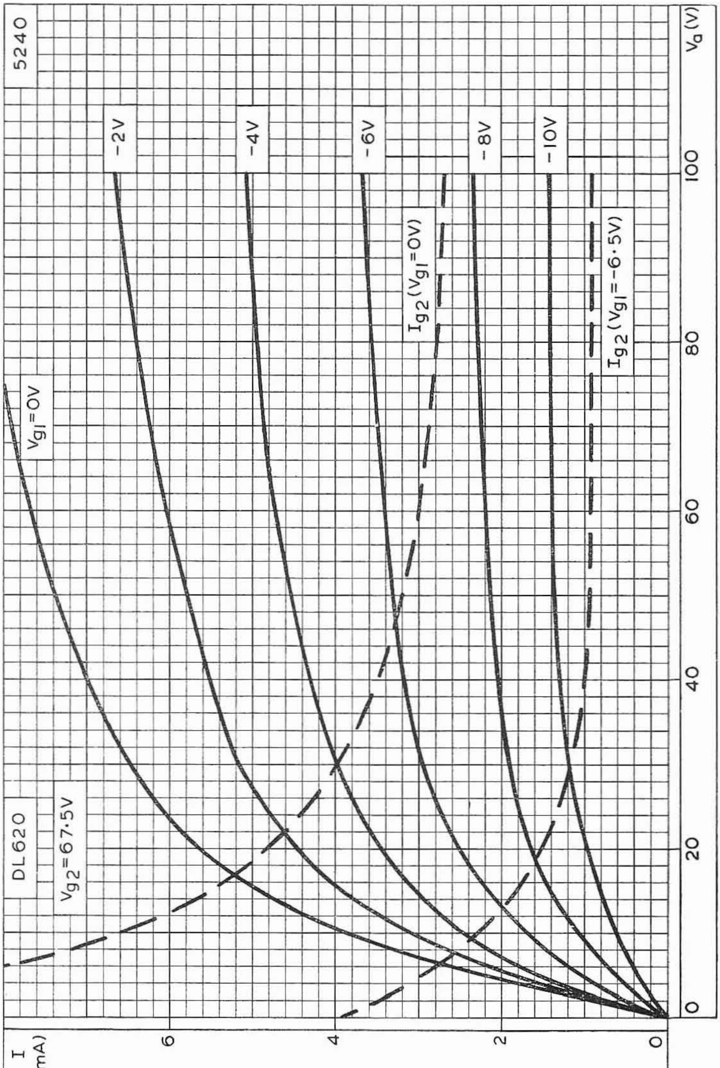


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=45V$

DL620

SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

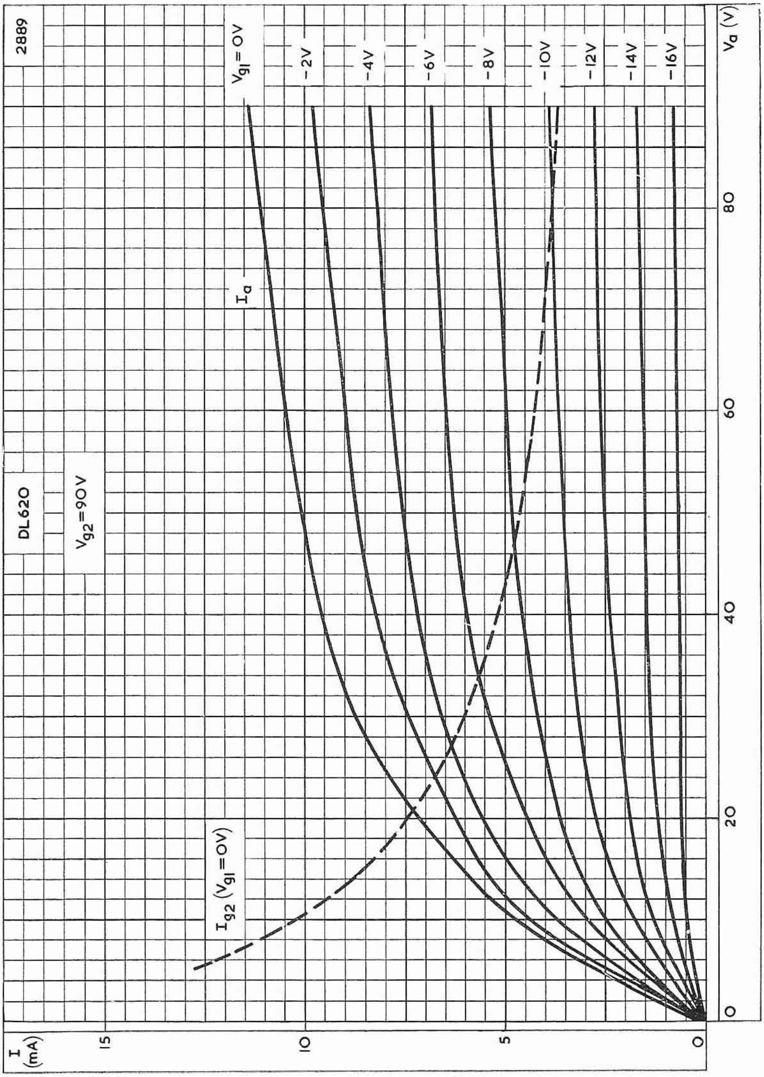


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2}=67.5V

SUBMINIATURE OUTPUT PENTODE

DL620

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

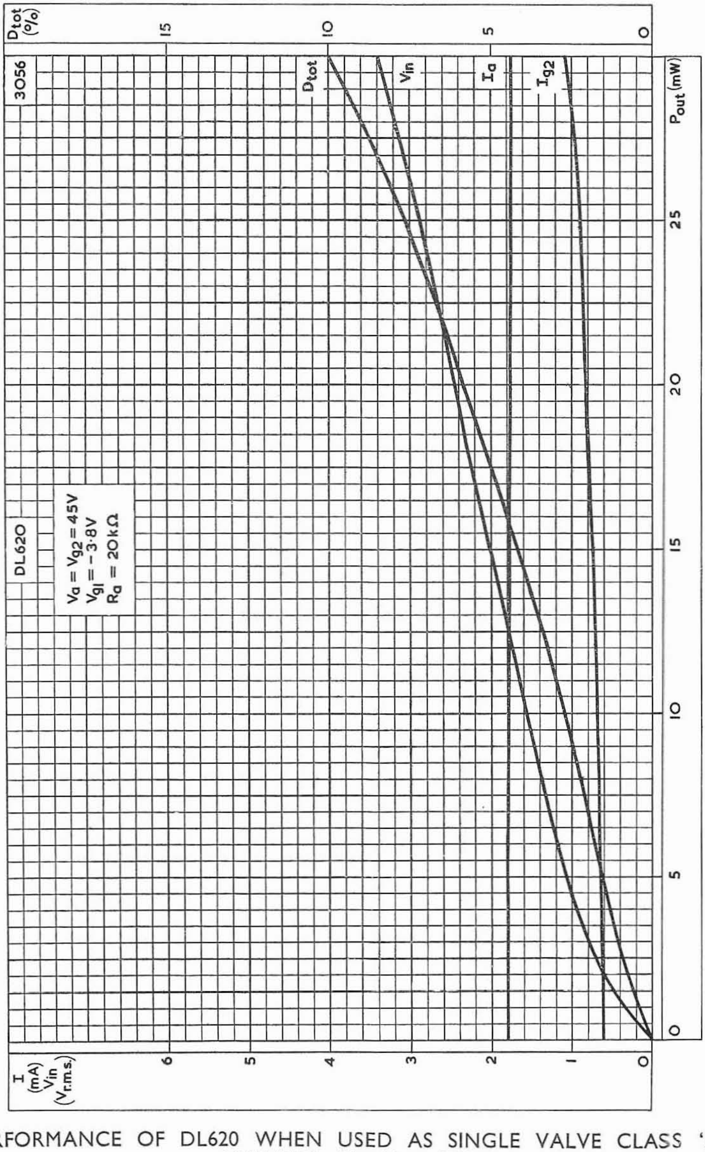


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=90V$

DL620

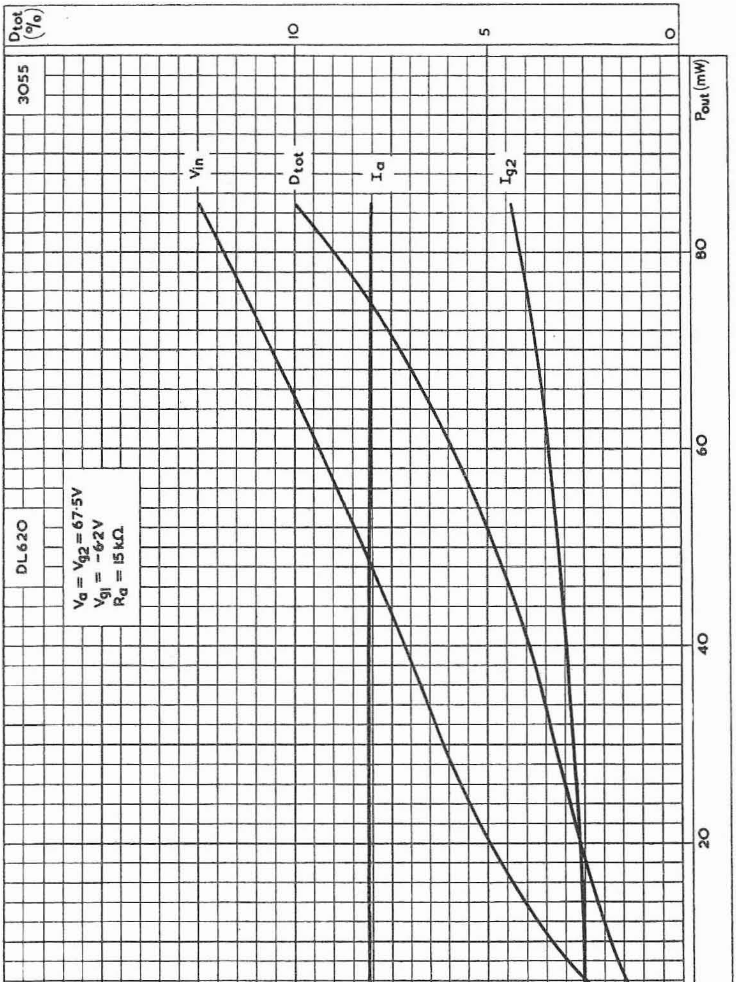
SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.



PERFORMANCE OF DL620 WHEN USED AS SINGLE VALVE CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 45V$

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.

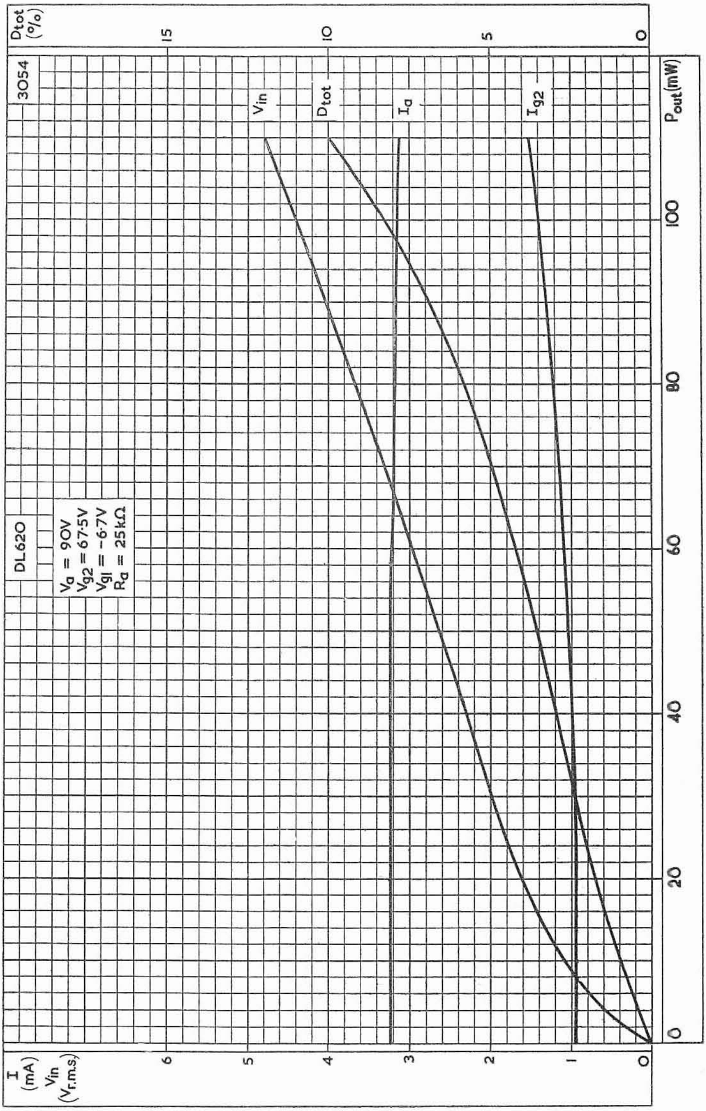


PERFORMANCE OF DL620 WHEN USED AS SINGLE VALVE CLASS 'A' AMPLIFIER. $V_a = V_{g2} = 67.5V$

DL620

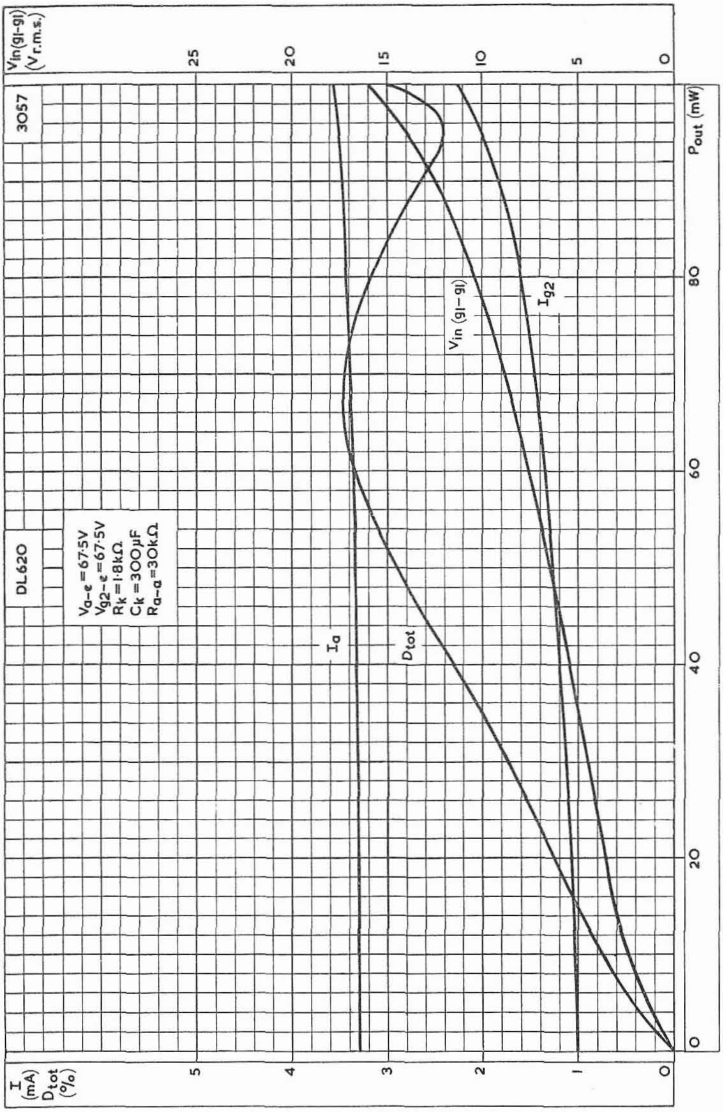
SUBMINIATURE OUTPUT PENTODE

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.



PERFORMANCE OF DL620 WHEN USED AS SINGLE VALVE CLASS 'A' AMPLIFIER. $V_a=90V$, $V_{g2}=67.5V$

Subminiature output pentode suitable for battery operation with an h.t. supply of 90V.



PERFORMANCE OF TWO DL620 IN PUSH-PULL WITH CATHODE BIAS

HALF-WAVE RECTIFIER

DY70

Subminiature high voltage half-wave rectifier with wired-in connections.

FILAMENT

V_f	1.25	V
I_f	140	mA

CAPACITANCE

c_{a-f}	1.3	pF

MOUNTING POSITION Any

The anode lead should not be soldered closer than 5mm from the ← seal and the filament leads not closer than 5mm from the seal.

Any bending of the valve leads must be at least 1.5mm from the end of the seals.

LIMITING VALUES

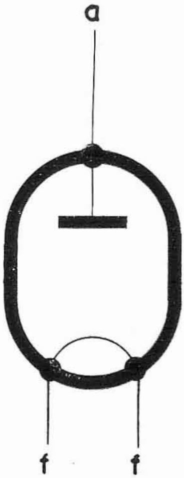
Sinusoidal input

P.I.V. max.	8.0	kV
$V_{a(r.m.s.)}$ max.	2.9	kV
$i_{a(pk)}$ max.	10	mA
I_{out} max.	1.8	mA
C max.	0.1	μF
R_{lim} min.	150	kΩ
f max.	400	kc/s

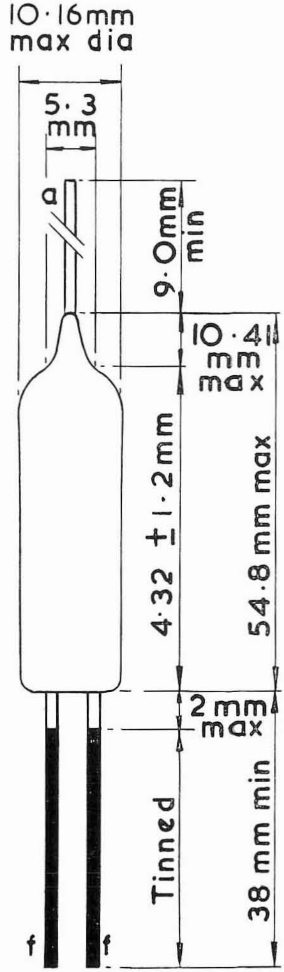
DY70

HALF-WAVE RECTIFIER

Subminiature high voltage half-wave rectifier with wired-in connections.



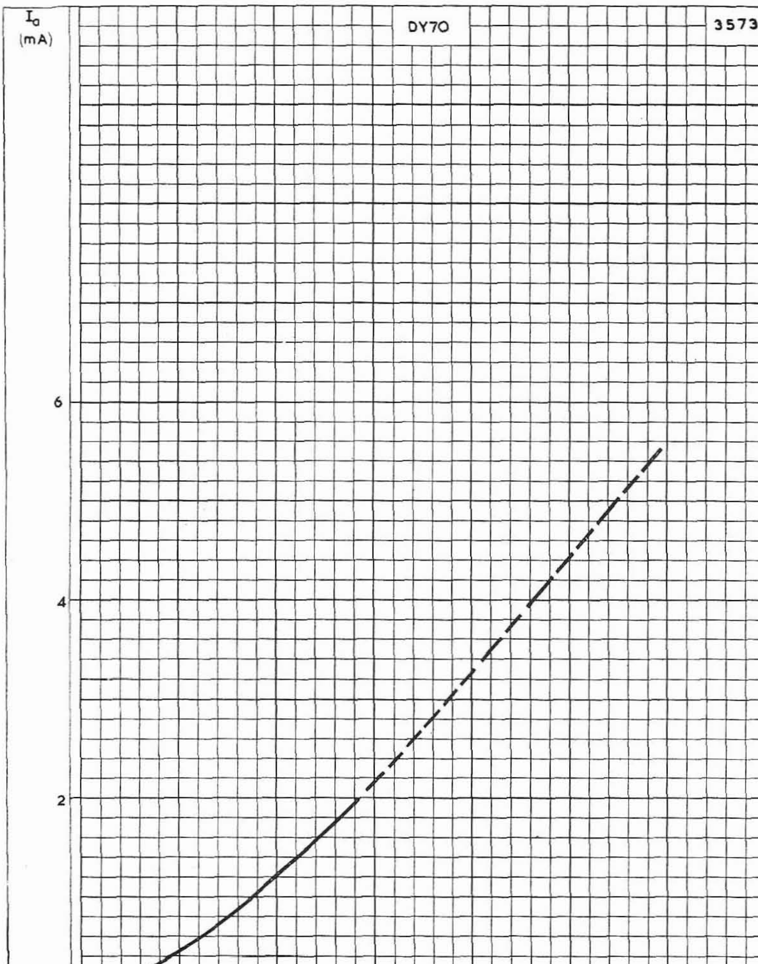
3547



HALF-WAVE RECTIFIER

DY70

Subminiature high voltage half-wave rectifier with wired-in connections.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

SUBMINIATURE SINGLE DIODE

EA76

Indirectly-heated subminiature diode with 6.3V heater.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

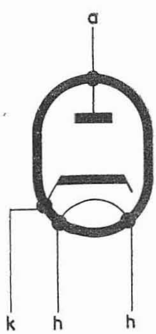
In operation this valve may become very hot and therefore, in the interests of long life, it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to the chassis.

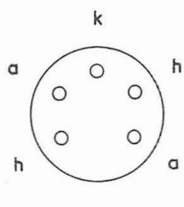
CAPACITANCES

	Shielded	Unshielded	
c_{a-k+h}	4.0	3.1	pF
c_{k-a+h}	4.5	4.55	pF
c_{a-h}	0.74	0.9	pF
c_{h-k}	1.98	2.0	pF

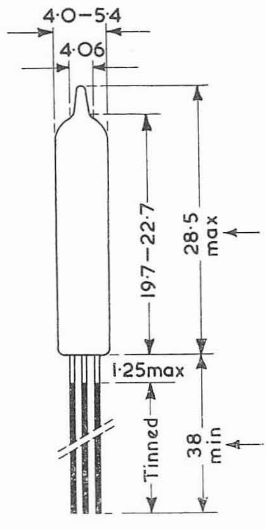
LIMITING VALUES

P.I.V. max.	420	V
V_a max.	150	V
I_a max.	9.0	mA
$i_{a(pk)}$ max.	54	mA
$v_{h-k(pk)}$ max. (cathode positive)	330	V





B5B/F Base



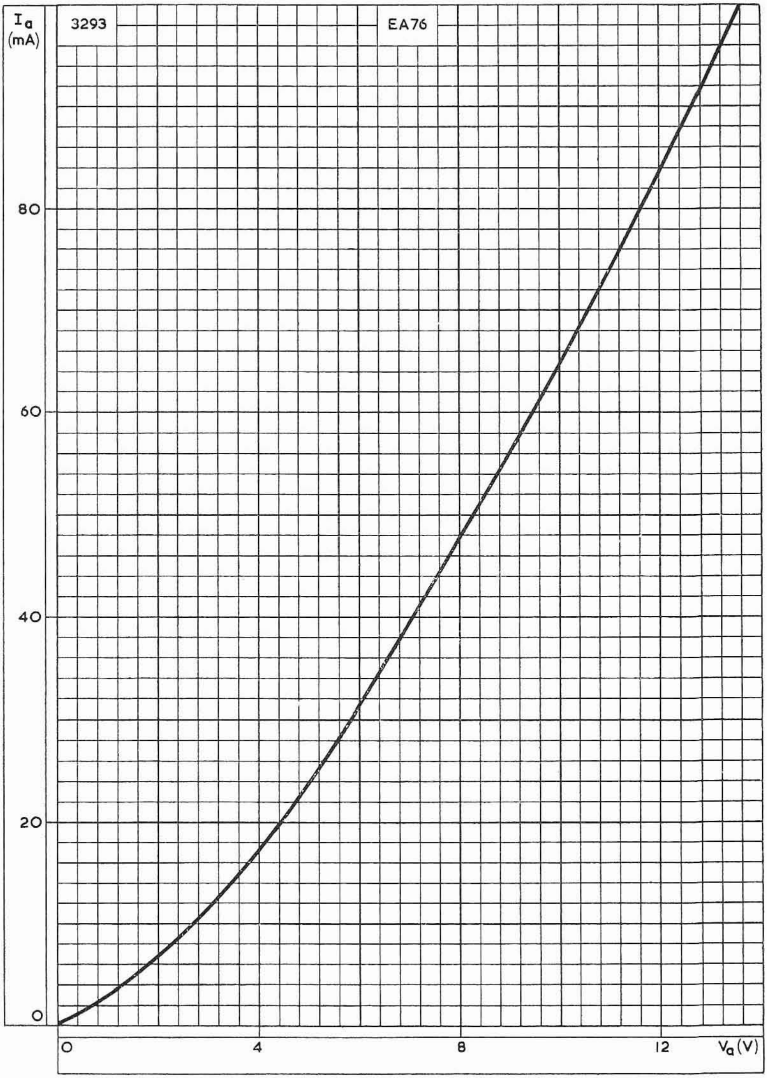
3274

All dimensions in mm

EA76

SUBMINIATURE SINGLE DIODE

Indirectly-heated subminiature diode with 6.3V heater.

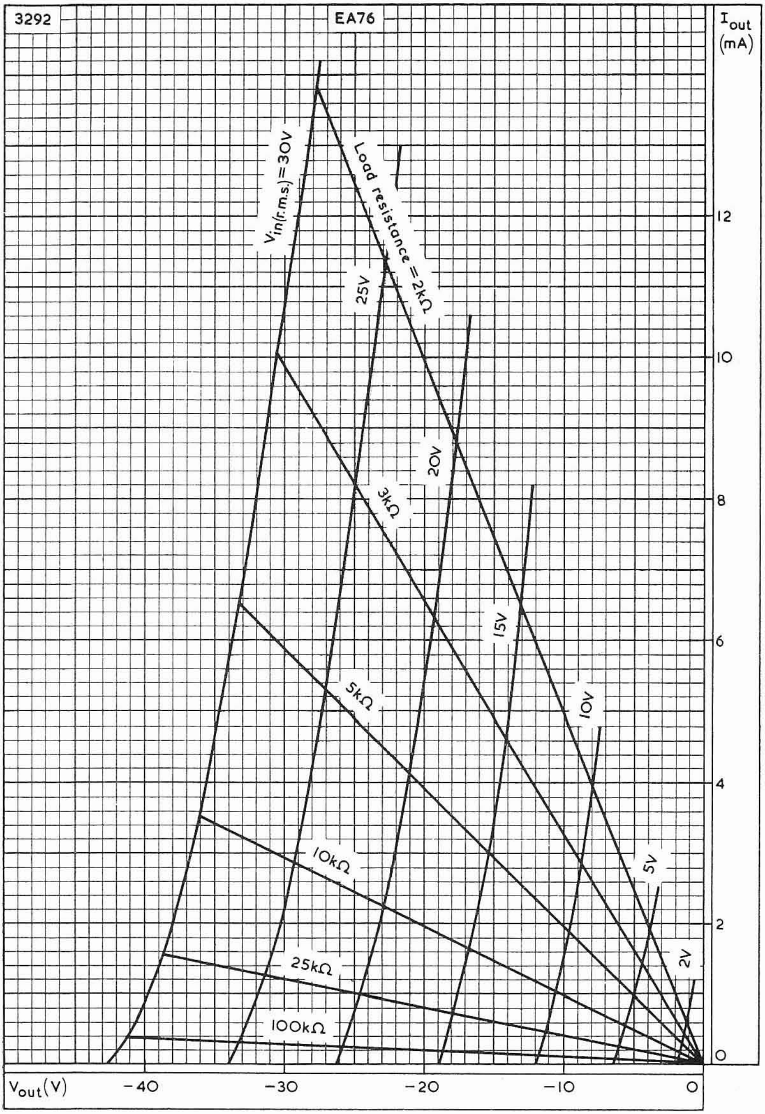


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

SUBMINIATURE SINGLE DIODE

EA76

Indirectly-heated subminiature diode with 6.3V heater.



OUTPUT CURRENT PLOTTED AGAINST OUTPUT VOLTAGE WITH INPUT VOLTAGE AS PARAMETER

DIODE TRIODE

EAC91

Low impedance diode with medium μ triode.

HEATER

V_h		6.3	V
I_h		300	mA

CAPACITANCES ←

	Shielded	Unshielded	
c_{g-ad}	20	—	mpF
c_{at-ad}	110	190	mpF
Triode section			
c_{in}	1.85	1.7	pF
c_{out}	1.25	0.4	pF
c_{a-g}	1.6	1.7	pF
Diode section			
c_{a-k}	1.8	2.0	pF
c_{a-h}	250	300	mpF

CHARACTERISTICS

Triode section ←

V_a	200	V
I_a	5.5	mA
V_g	−4.0	V
g_m	2.5	mA/V
μ	31	
r_a	12.5	kΩ

LIMITING VALUES

Triode section

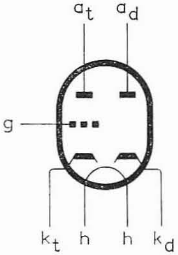
$V_{a(b)}$ max.	500	V←
V_a max.	250	V
p_a max.	2.0	W
$-V_g$ max.	50	V←
I_k max.	10	mA
V_{h-k} max.	100	V←

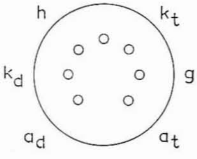
Diode section ←

P.I.V. max.	350	V
I_k max.	5.0	mA
$i_{k(pk)}$ max.	50	mA
V_{h-k} max.	100	V
T_{bulb} max.	200	°C

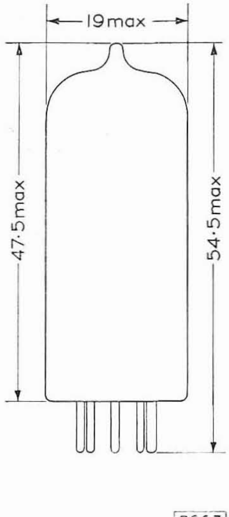
EAC91

DIODE TRIODE



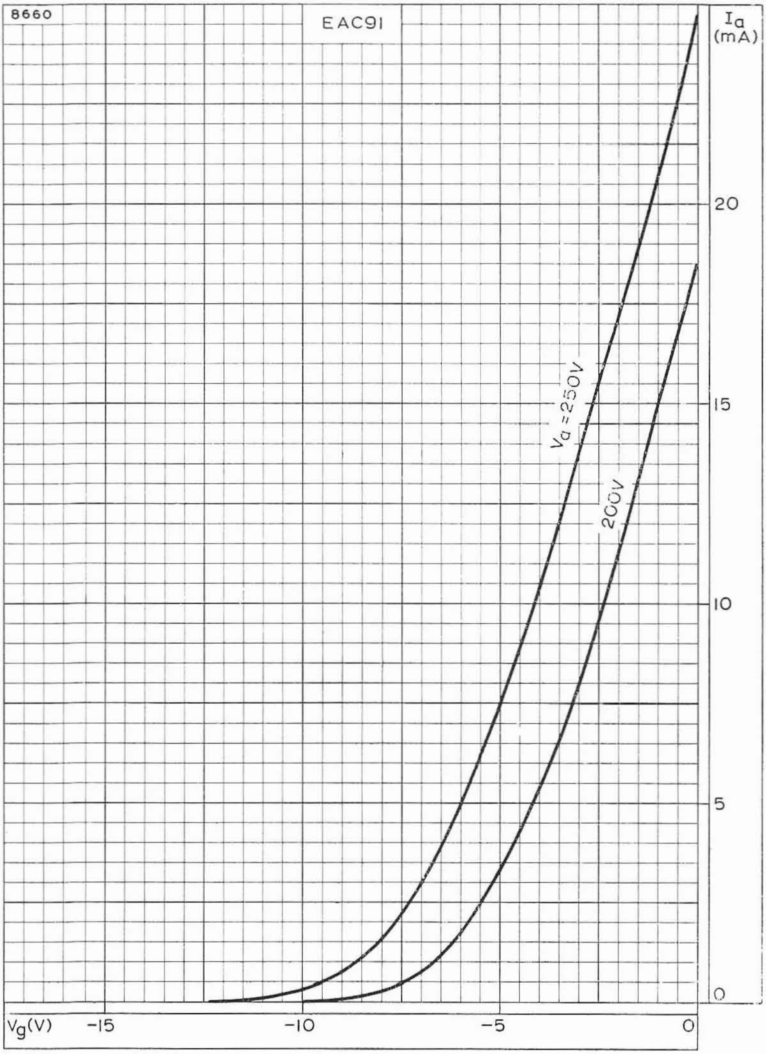


B7G Base



All dimensions in mm

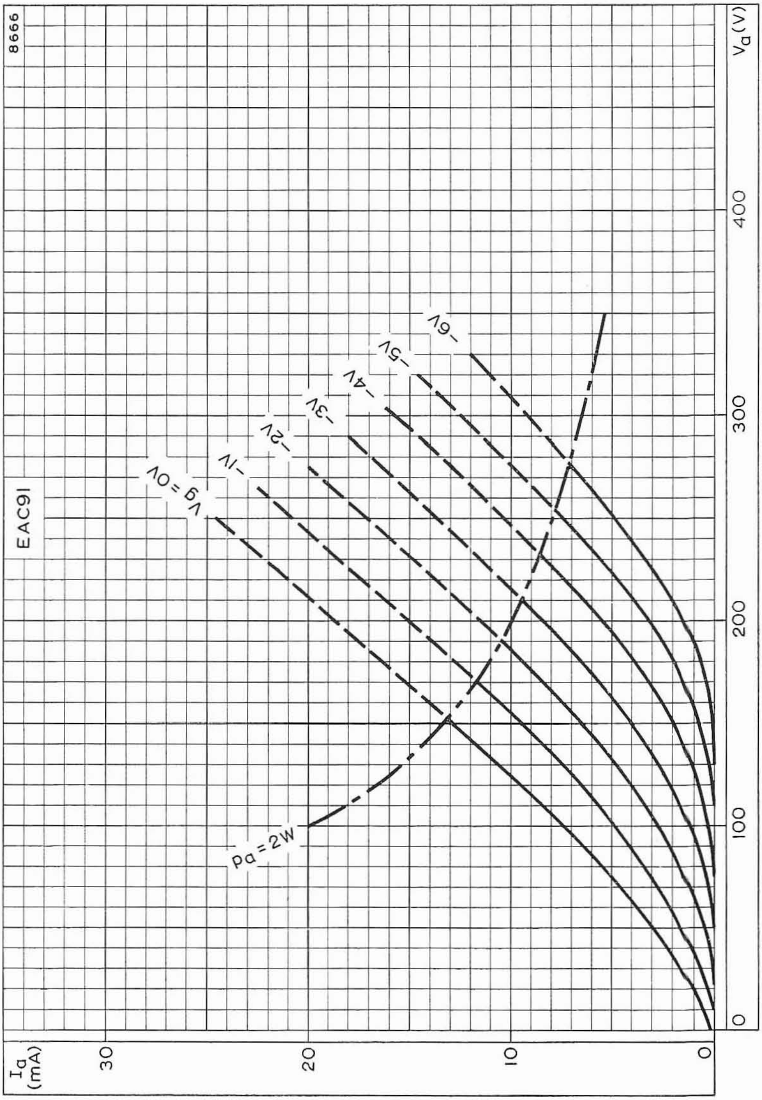
8667



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE

EAC91

DIODE TRIODE

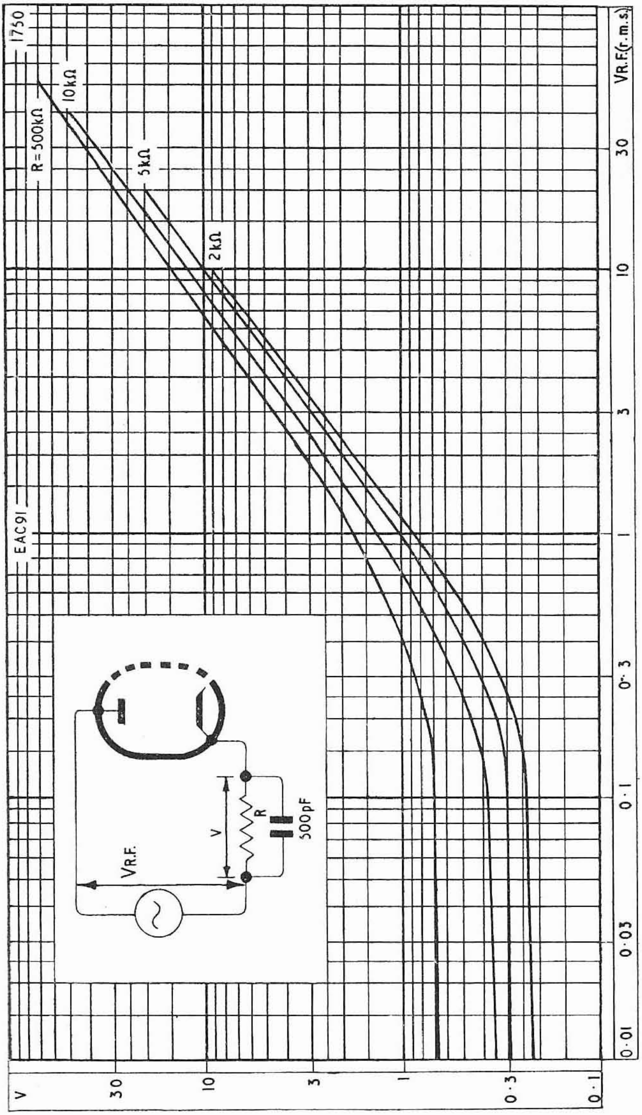


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

MINIATURE DIODE TRIODE

EAC91

Triode combined with a single diode for use as a U.H.F. frequency changer.



DIODE CHARACTERISTICS

DOUBLE DIODE OUTPUT PENTODE

EBL31

High sensitivity output pentode combined with twin diodes, for use in A.C. mains-operated equipment.

HEATER

V_h	6.3	V
I_h	1.2	A

CAPACITANCES

$c_{ad'-ad''}$	<0.35	μμF
$c_{ad'-k}$	3.0	μμF
$c_{ad''-k}$	3.6	μμF
$c_{ad'-g1}$	<0.15	μμF
$c_{ad''-g1}$	<0.15	μμF
$c_{ad'-a}$	<1.0	μμF
$c_{ad''-a}$	<0.5	μμF

OPERATING CONDITIONS AS CLASS "A" AMPLIFIER

V_a	250	V
V_{g2}	250	V
I_a	36	mA
R_k	146	Ω
V_{g1}	-6.0	V
I_{g2}	5.0	mA
g_m	9.5	mA/V
r_a	55	kΩ
R_a	7.0	kΩ
P_{out}	4.3	W
D_{tot}	10	%
$V_{in\ (r.m.s.)}$	3.6	V
$V_{in\ (r.m.s.)}$ (P_{out} = 50 mW)	0.35	V

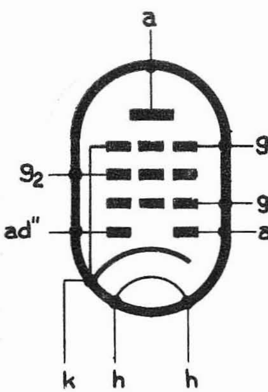
EBL31

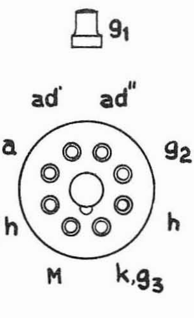
DOUBLE DIODE OUTPUT PENTODE

High sensitivity output pentode combined with twin diodes, for use in A.C. mains-operated equipment.

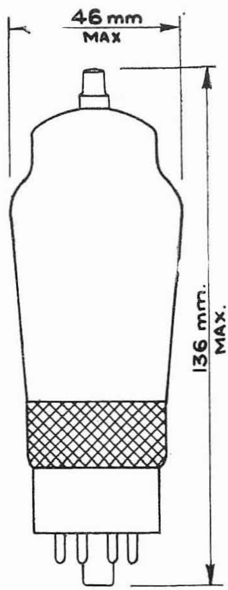
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	9	W
I_k max.	55	mA
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	1.5	W
V_{g1} max. ($I_{g1}=0.3\ \mu A$)	−1.3	V
R_{g1-k} max.	1.0	M Ω
V_{h-k} max.	50	V
R_{h-k} max.	5.0	k Ω
$V_{ad'}$ max.	200	V
$V_{ad''}$ max.	200	V
$I_{ad'}$ max.	0.8	mA
$I_{ad''}$ max.	0.8	mA
$V_{ad'}$ max. ($I_{d'}=0.3\ \mu A$)	−1.3	V
$V_{ad''}$ max. ($I_{d''}=0.3\ \mu A$)	−1.3	V





OCTAL BASE



SUBMINIATURE U.H.F. TRIODE

EC70

Triode primarily intended for use as an oscillator at frequencies of the order of 500Mc/s.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm. from the seal and any bending of the valve leads must be at least 1.5mm. from the seal.

COOLING

In operation this valve may become very hot and therefore, in the interests of satisfactory life, it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to the chassis and should result in a bulb temperature of approximately 100°C.

CAPACITANCES

	Shielded	Unshielded	
c_{a-g}	2.1	2.1	pF
c_{g-k}	1.8	1.7	pF
c_{a-k}	2.8	0.6	pF

CHARACTERISTICS

V_a	100	V
V_g	−2.0	V
I_a	13	mA
g_m	5.5	mA/V
μ	20	
r_a	3.6	kΩ

TYPICAL OPERATING CONDITIONS AS AN OSCILLATOR AT 500 Mc/s

V_a	175	V
I_a	20	mA
I_g	2.0	mA
R_{g-k}	5.6	kΩ
P_{load}	750	mW

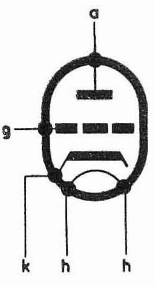
EC70

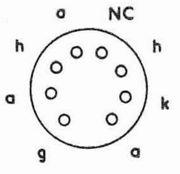
SUBMINIATURE U.H.F. TRIODE

Triode primarily intended for use as an oscillator at frequencies of the order of 500Mc/s.

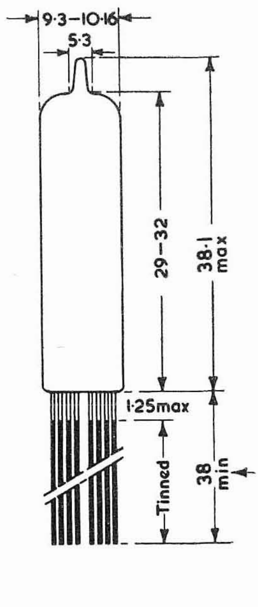
LIMITING VALUES

$V_{a(b)}$ max.	300	V
V_a max.	175	V
p_a max.	3.0	W
I_k max.	22	mA
R_{g-k} max.	500	kΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V





B8D/F Base



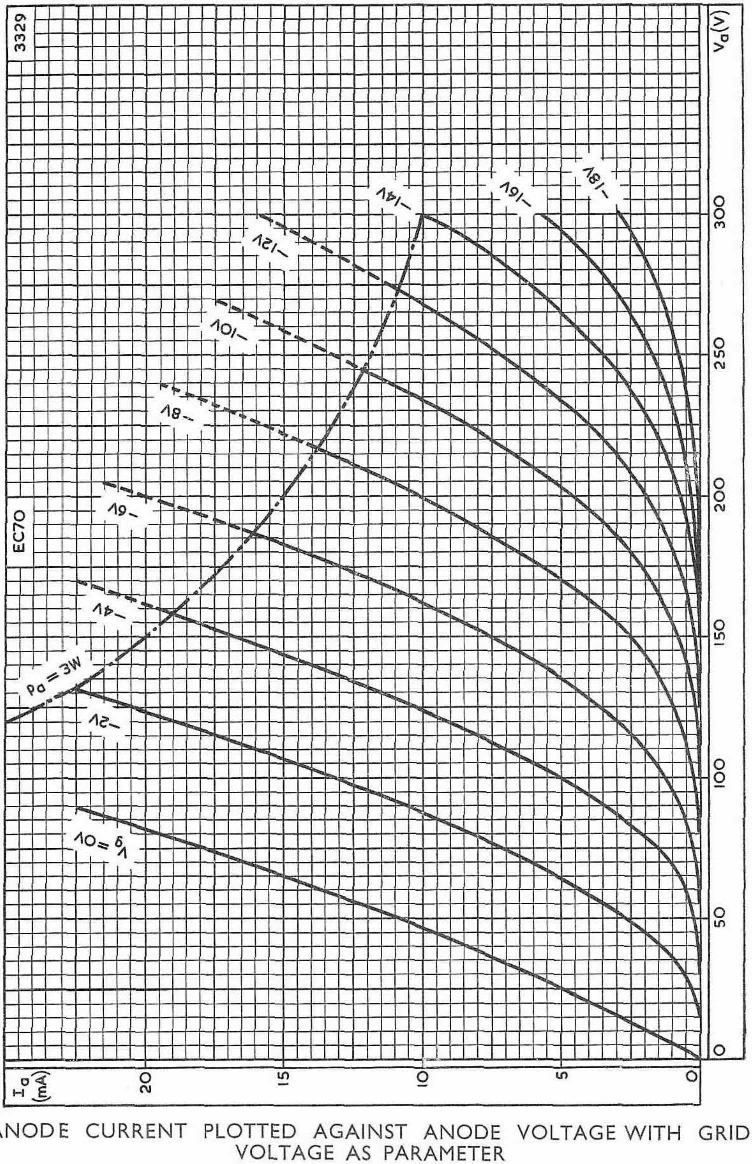
3273

All dimensions in mm

SUBMINIATURE U.H.F. TRIODE

EC70

Triode primarily intended for use as an oscillator at frequencies of the order of 500Mc/s.

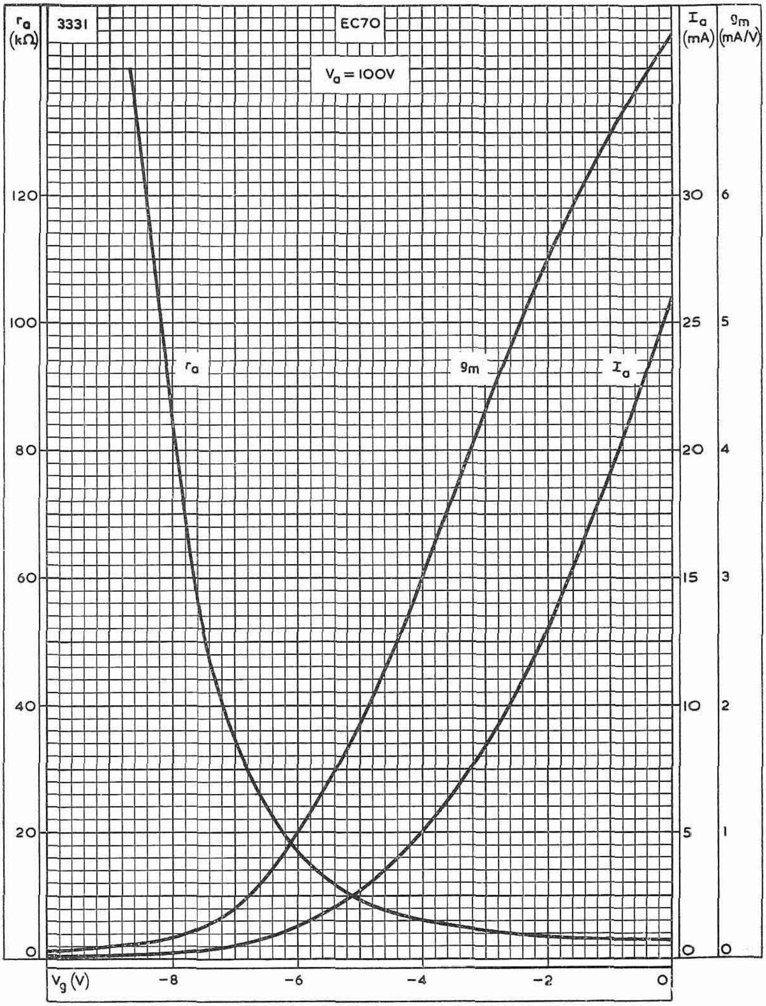


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

EC70

SUBMINIATURE U.H.F. TRIODE

Triode primarily intended for use as an oscillator at frequencies of the order of 500Mc/s.



ANODE CURRENT, MUTUAL CONDUCTANCE, AND ANODE IMPEDANCE PLOTTED AGAINST GRID VOLTAGE. V_a = 100V

SUBMINIATURE U.H.F. TRIODE

EC71

Subminiature medium-μ triode intended for use as an oscillator at frequencies up to 500Mc/s.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

	Shielded	*Unshielded*	
c_{a-g}	1.2	1.3	pF
c_{in}	2.4	2.3	pF
c_{out}	2.3	0.8	pF

CHARACTERISTICS

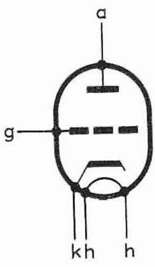
V_a	100	V
I_a	8.5	mA
g_m	5.8	mA/V
r_a	4.7	kΩ
μ	27	
V_g	−1.3	V
$V_g(I_a = 10\mu A)$	−7.0	V

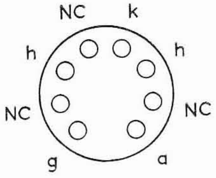
LIMITING VALUES (absolute ratings)

$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	3.3	W
$-V_g$ max.	55	V
I_k max.	22	mA
I_g max.	5.5	mA
V_{h-k} max.	200	V

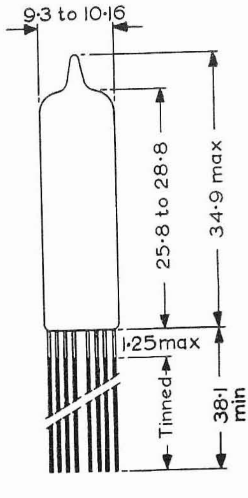
SUBMINIATURE U.H.F. TRIODE

5604

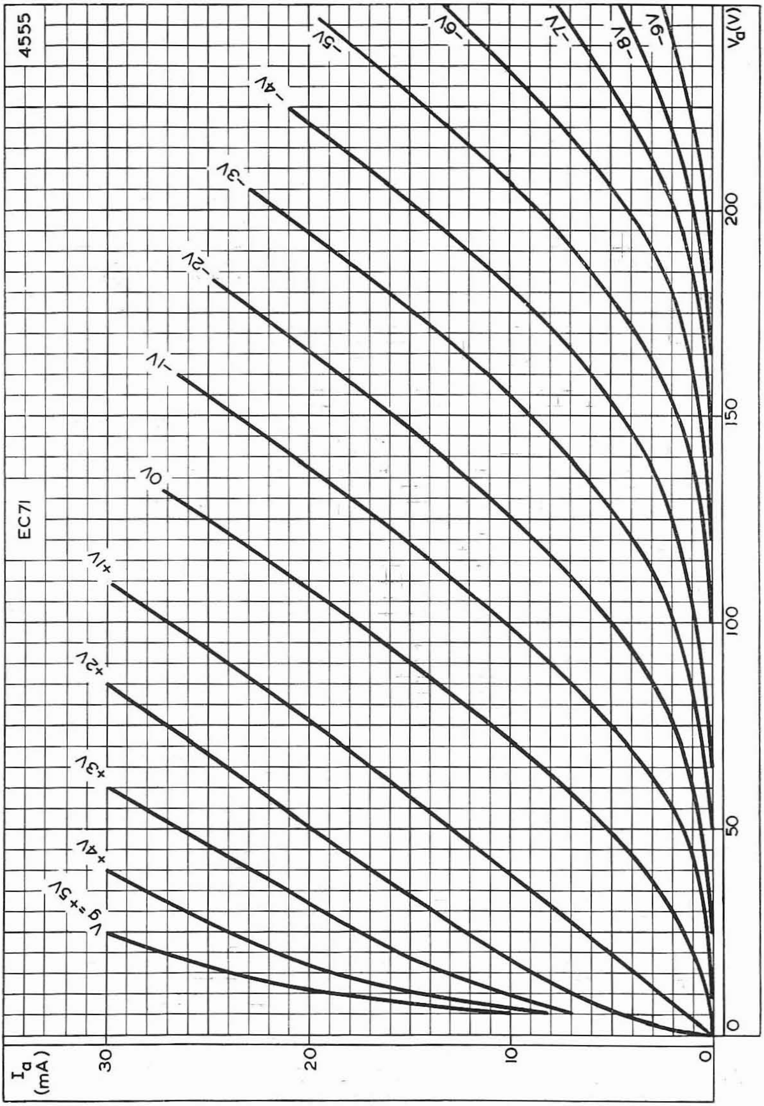




B8D/F Base



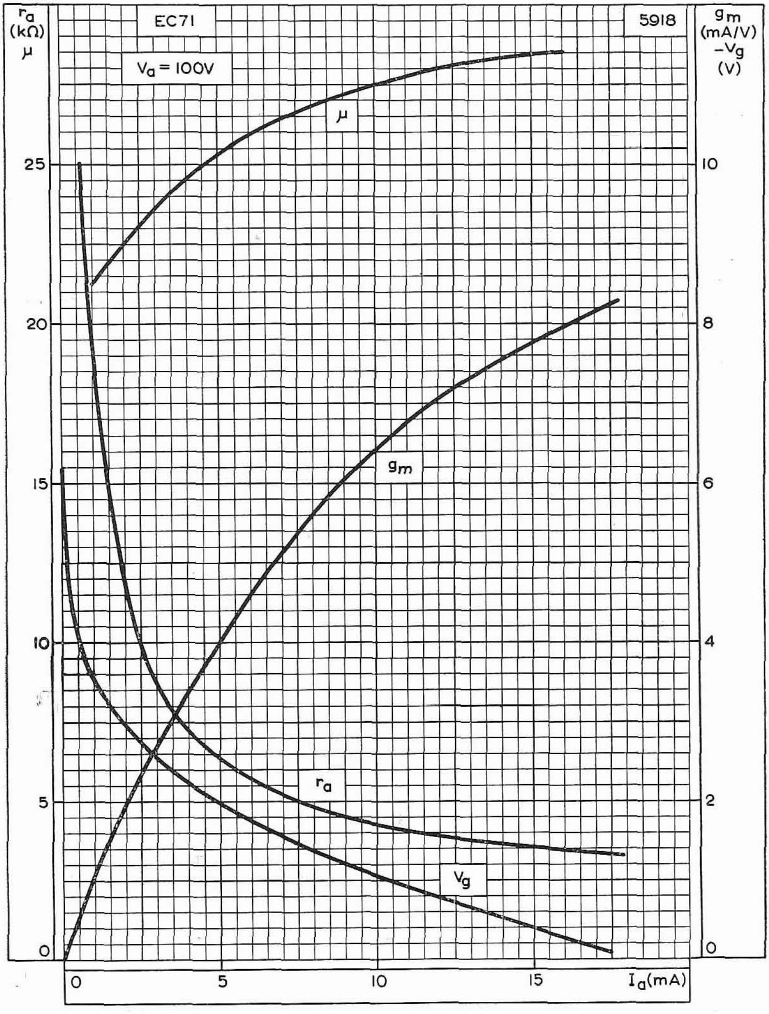
All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

EC71

SUBMINIATURE U.H.F. TRIODE



ANODE IMPEDANCE, MUTUAL CONDUCTANCE, GRID VOLTAGE AND AMPLIFICATION FACTOR PLOTTED AGAINST ANODE CURRENT

U.H.F. TRIODE

EC86

Frame-grid triode for use as grounded-grid amplifier or self-oscillating mixer in Bands IV and V.

HEATER

V_h	6.3	V
I_h	200	mA ←

CAPACITANCES ←

Unshielded

c_{a-g}	2.2	pF
c_{a-k}	240	mpF
c_{a-k+h}	350	mpF
c_{a-g+h}	2.3	pF
c_{g-k}	3.5	pF
c_{g-k} (I_a = 12mA)	5.6	pF
c_{g-k+h}	3.8	pF
c_{g-h}	270	mpF
c_{k-g+h}	6.3	pF

Shielded

$c_{h+k-g+s}$	4.1	pF
c_{a-g+s}	3.3	pF
c_{a-k+h}	300	mpF

CHARACTERISTICS

V_a	175	V
V_g	-1.5	V
I_a	12	mA
g_m	14	mA/V
r_a	4.85	kΩ
μ	68	
R_{eq}	230	Ω

OPERATING CONDITIONS

As grounded-grid amplifier

V_a	175	V
I_a	12	mA
R_k	125	Ω
g_m	14	mA/V

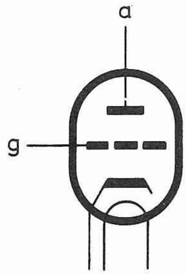
As self-oscillating mixer

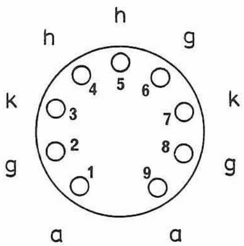
$V_{a\ (b)}$	220	V
R_a	5.6	kΩ
R_g	47	kΩ
I_a	12	mA
I_g	50	μA
v_{osc} (r.m.s.)	2.5	V
g_c	5.5	mA/V

DESIGN CENTRE RATINGS

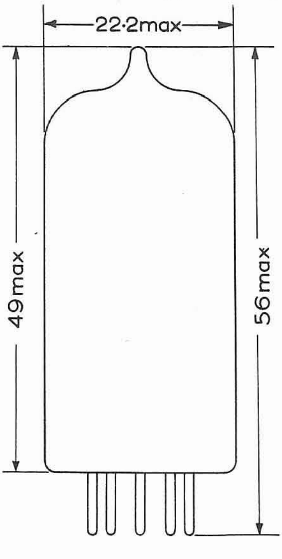
$V_{a\ (b)}$ max.	550	V
V_a max.	220	V
p_a max.	2.2	W
I_k max.	20	mA
$-V_g$ max.	50	V
R_{g-k} max.	1.0	MΩ
V_{h-k} max. (cathode positive)	100	V
V_{h-k} max. (cathode negative)	50	V

B4187





B9A Base



All dimensions in mm

R.F. POWER TRIODE

EC90

Triode for use as r.f. power amplifier or oscillator.

HEATER

V_h	6.3	V
I_h	150	mA

CAPACITANCES ←

	Shielded	Unshielded	
c_{a-g}	1.3	1.4	pF
c_{in}	1.7	1.5	pF
c_{out}	2.6	1.2	pF

CHARACTERISTICS

V_a	100	250	V
V_g	0	−8.5	V
I_a	11.8	10.5	mA
g_m	3.25	2.2	mA/V ←
μ	21.5	17	←
r_a	6.6	7.7	kΩ ←

OPERATING CONDITIONS AS R.F. AMPLIFIER OR OSCILLATOR ←
(Class "C" Telegraphy or F.M.)

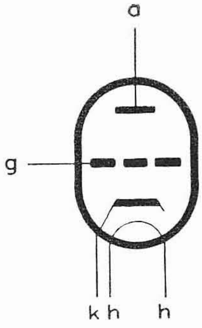
f	50	100	Mc/s
V_a	300	300	V
V_g	−27	−27	V
I_a	16.2	17.1	mA
I_g	3.8	2.9	mA
P_{out}	3.6	3.3	W
η	67	55	%

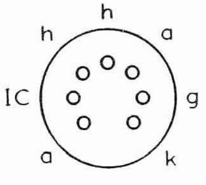
LIMITING VALUES ←

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	3.5	W
I_k max. (as r.f. oscillator or amplifier)	30	mA
I_k max. (as r.f. doubler or trebler)	20	mA
$-V_g$ max.	100	V
I_g max.	5.0	mA
R_{g-k} max.	250	kΩ
V_{h-k} max.	150	V
T_{bulb} max.	180	°C
f max.	150	Mc/s

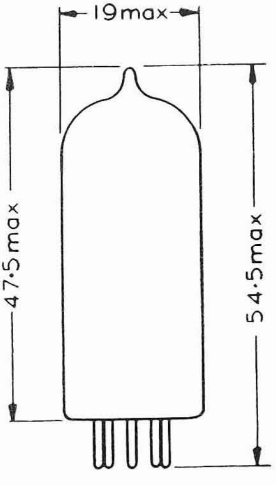
EC90

R.F. POWER TRIODE



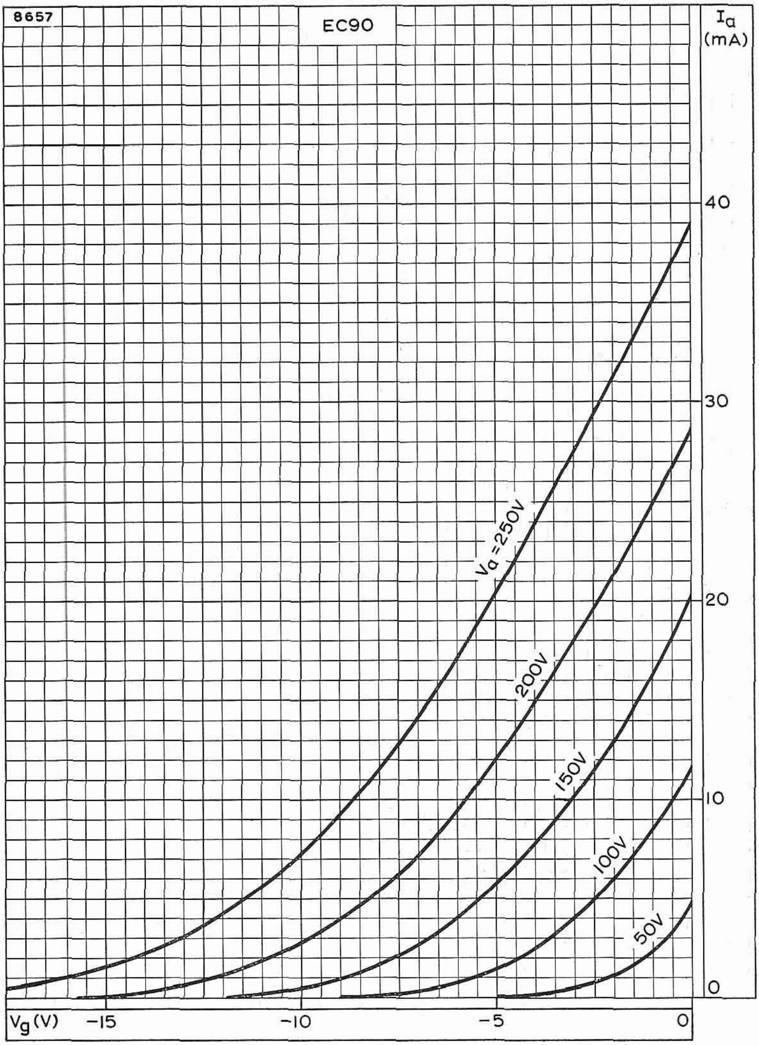


B7G Base



6403

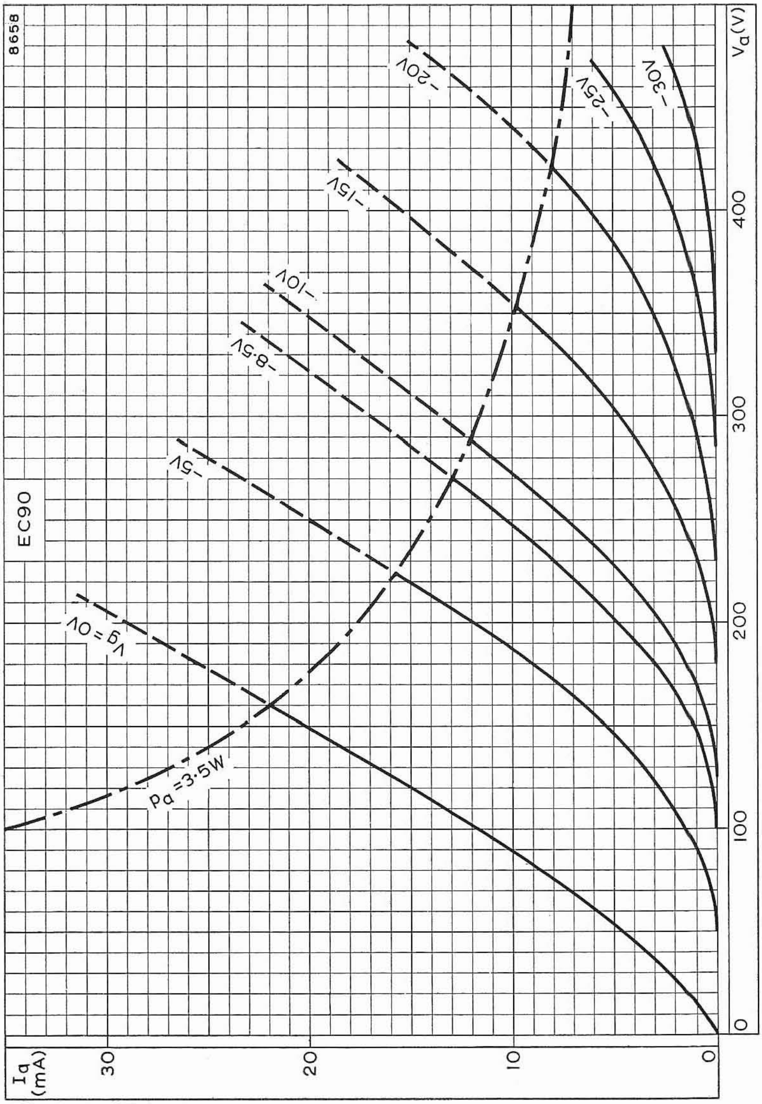
All dimensions in mm



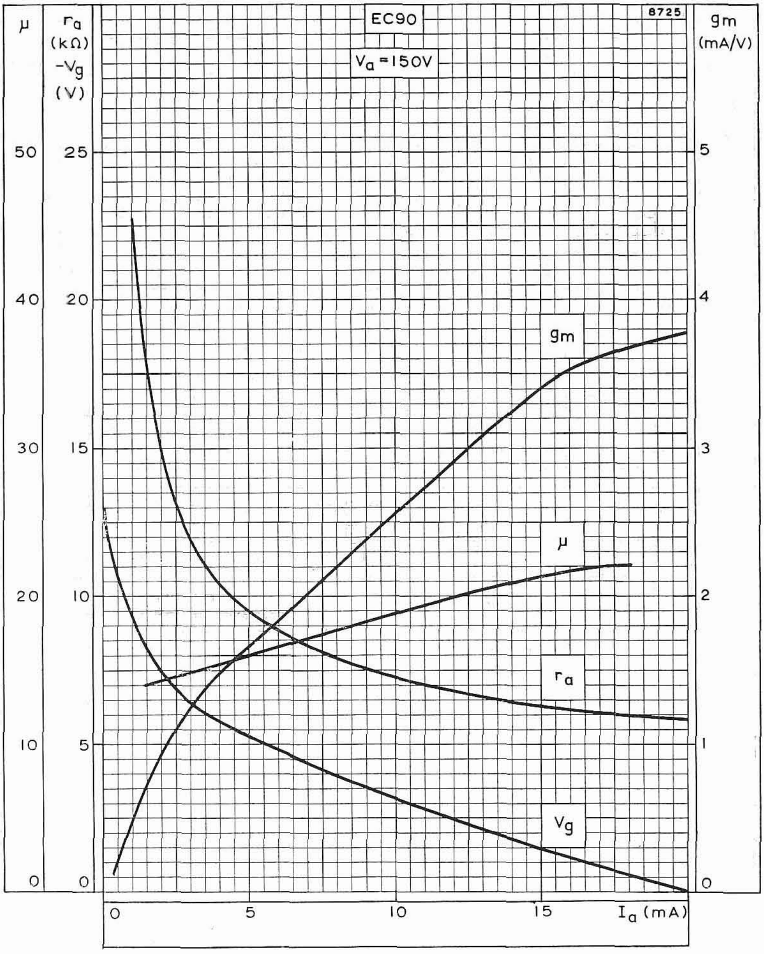
ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER

EC90

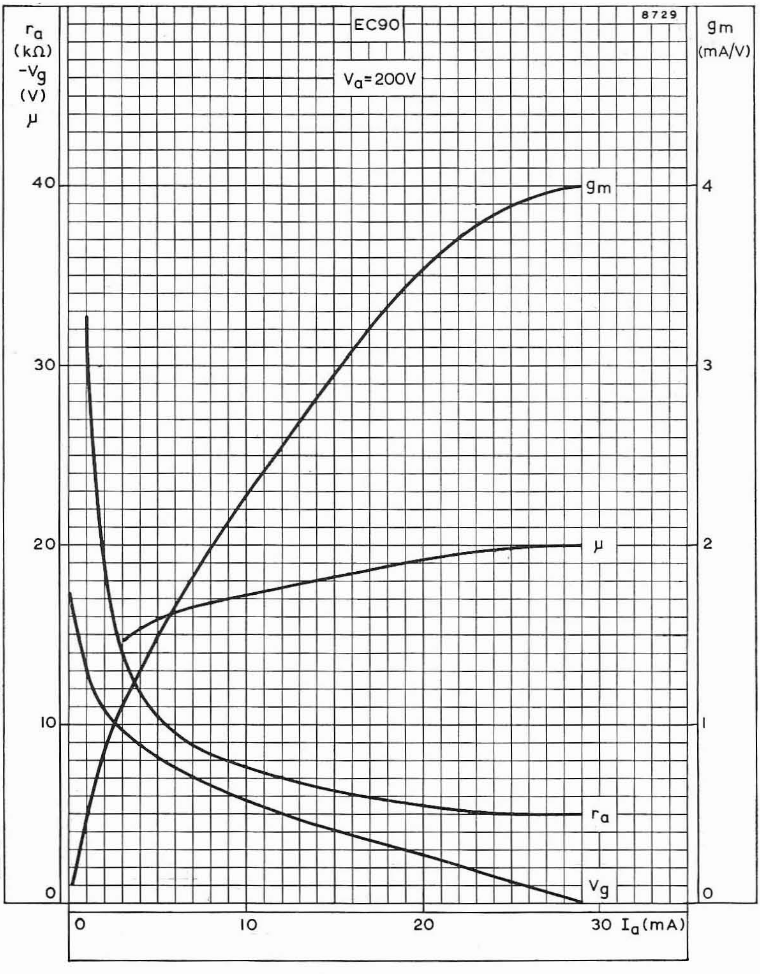
R.F. POWER TRIODE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR, ANODE IMPEDANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. $V_a = 150V$



MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR, ANODE IMPEDANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. $V_a = 200V$

GROUNDED GRID TRIODE

EC91

Grounded grid triode for use as an amplifier up to 250Mc/s.

HEATER

V_h	6.3	V
I_h	300	mA

CAPACITANCES ←

	Shielded*	Unshielded	
c_{a-g}	3.4	2.6	pF
c_{a-k+h}	120	150	mpF
c_{g-k+h}	5.0	4.5	pF
c_{k-g+h}	7.5	7.0	pF

*External shield connected to grid.

CHARACTERISTICS

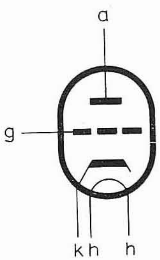
V_a	250	V
I_a	10	mA
V_g	−1.5	V
g_m	8.5	mA/V
μ	90	←
r_a	10.5	kΩ←
R_{eq}	400	Ω

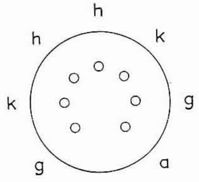
LIMITING VALUES

$V_{a(b)}$ max.	500	V←
V_a max.	250	V
p_a max.	2.5	W
$-V_g$ max.	100	V
I_k max.	15	mA
V_{h-k} max.	150	V
T_{bulb} max.	200	°C←

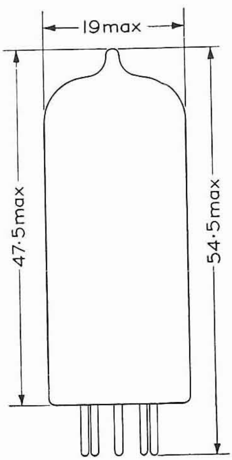
EC91

GROUNDED GRID TRIODE



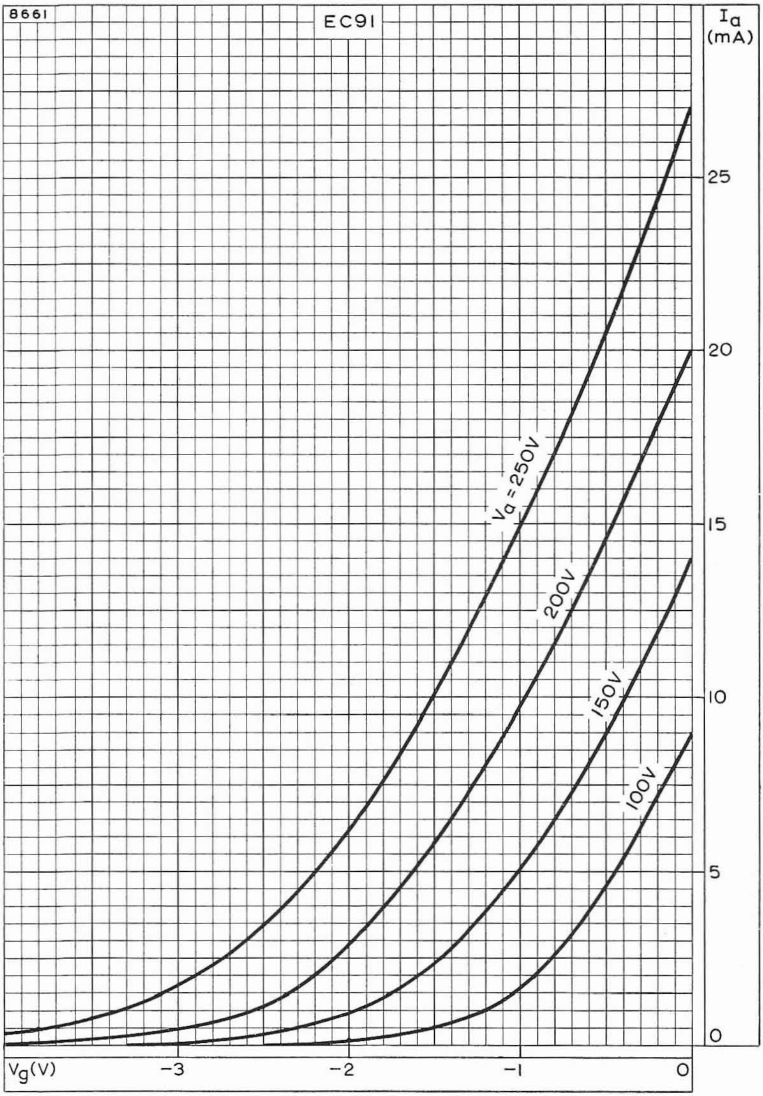


B7G Base

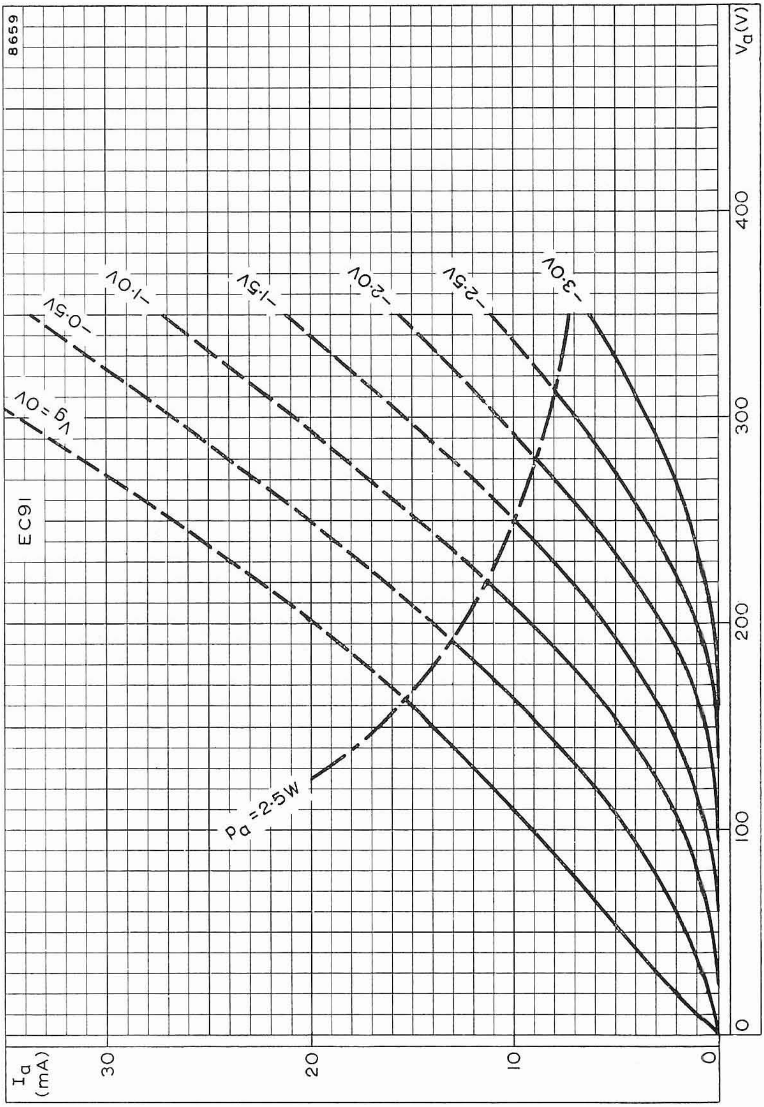


All dimensions in mm

8665



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER

U.H.F. TRIODE

EC98

Triode intended for use as a grounded-grid amplifier in U.H.F. receivers.

HEATER

V_h	6.3	V
I_h	400	mA

CAPACITANCES (measured with external shield)

c_{a-g}	2.8	pF
c_{a-k}	80	mpF
c_{h-k}	3.8	pF
$c_{k-g+h+S}$	8.8	pF
$c_{a-g+h+S}$	4.0	pF

CHARACTERISTICS

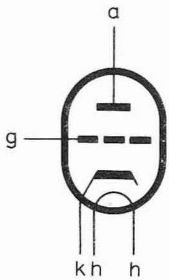
V_a	150	V
I_a	13.5	mA
V_g	−1.35	V
g_m	13.5	mA/V
μ	50	
r_a	3.7	kΩ
R_k	0	Ω
V_g ($I_a \leqslant 60\mu A$)	−15	V

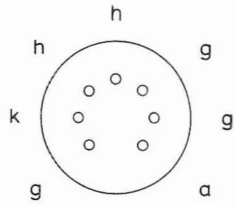
DESIGN CENTRE RATINGS

$V_{a(b)}$ max.	300	V
V_a max.	150	V
p_a max.	2.2	W
$-V_g$ max.	50	V
$+V_g$ max.	0	V
I_k max.	18	mA
I_g max.	3.2	mA
R_{g-k} max.	250	kΩ
V_{h-k} max.	90	V

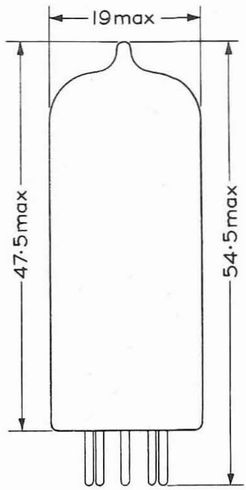
EC98

U.H.F. TRIODE



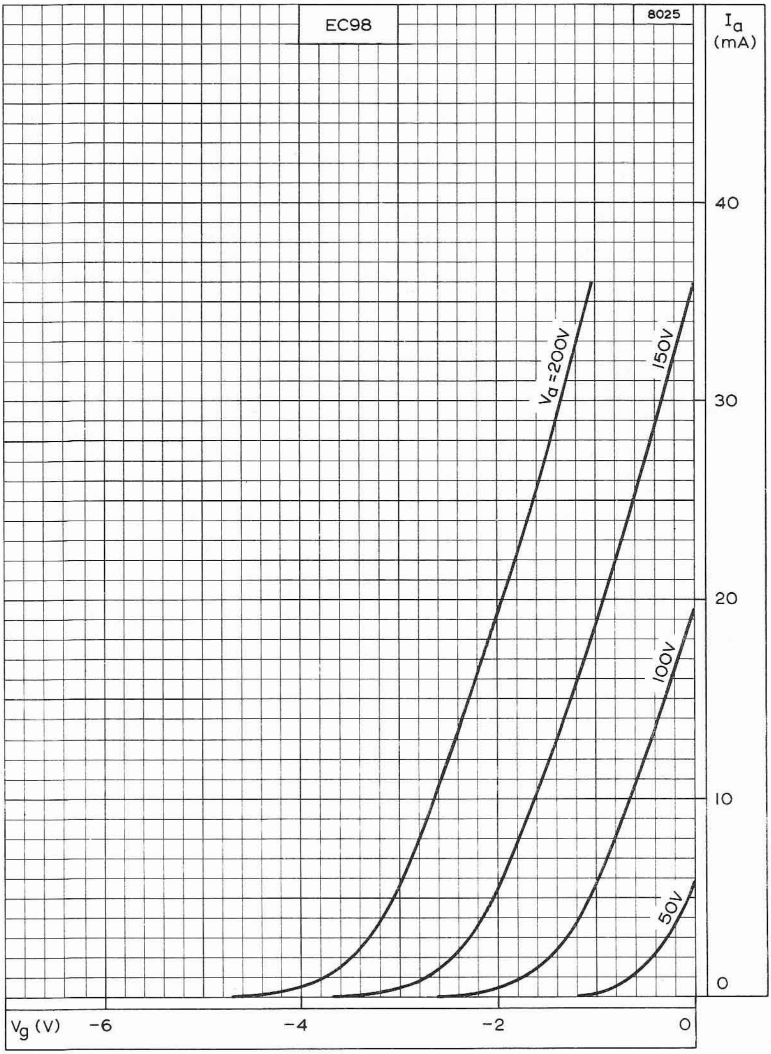


B7G Base

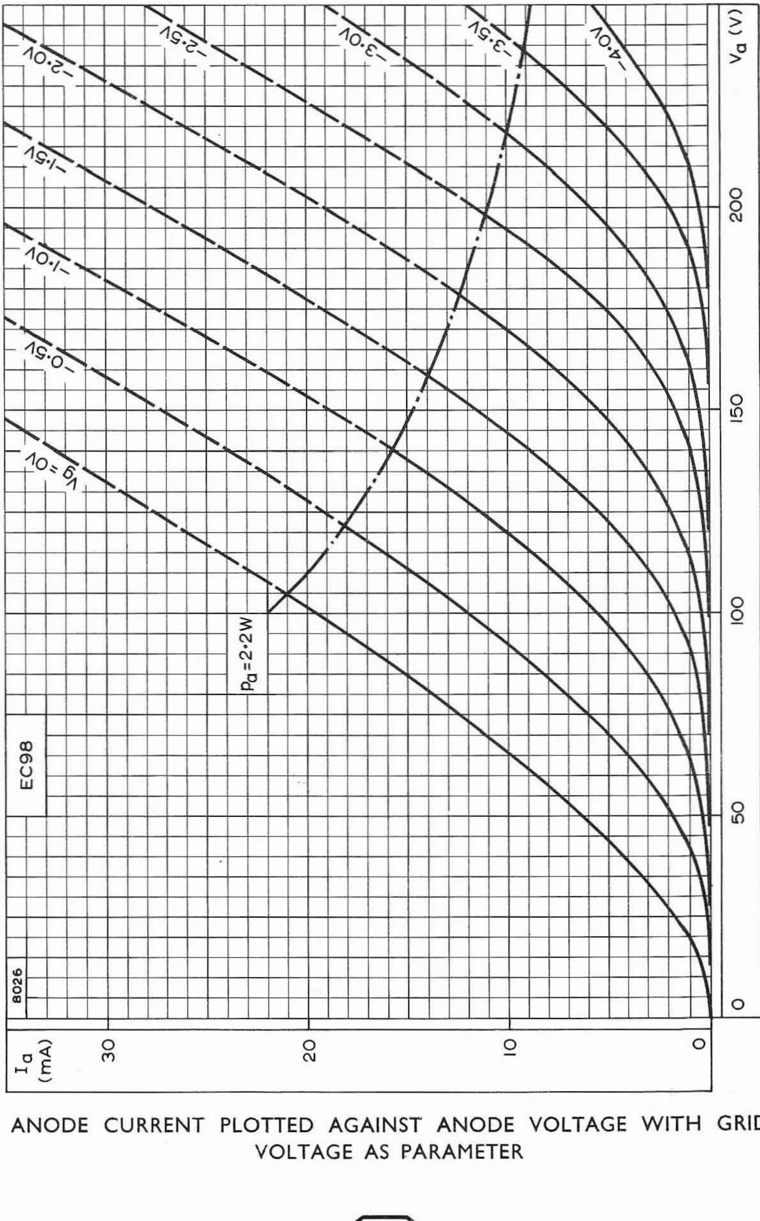


All dimensions in mm

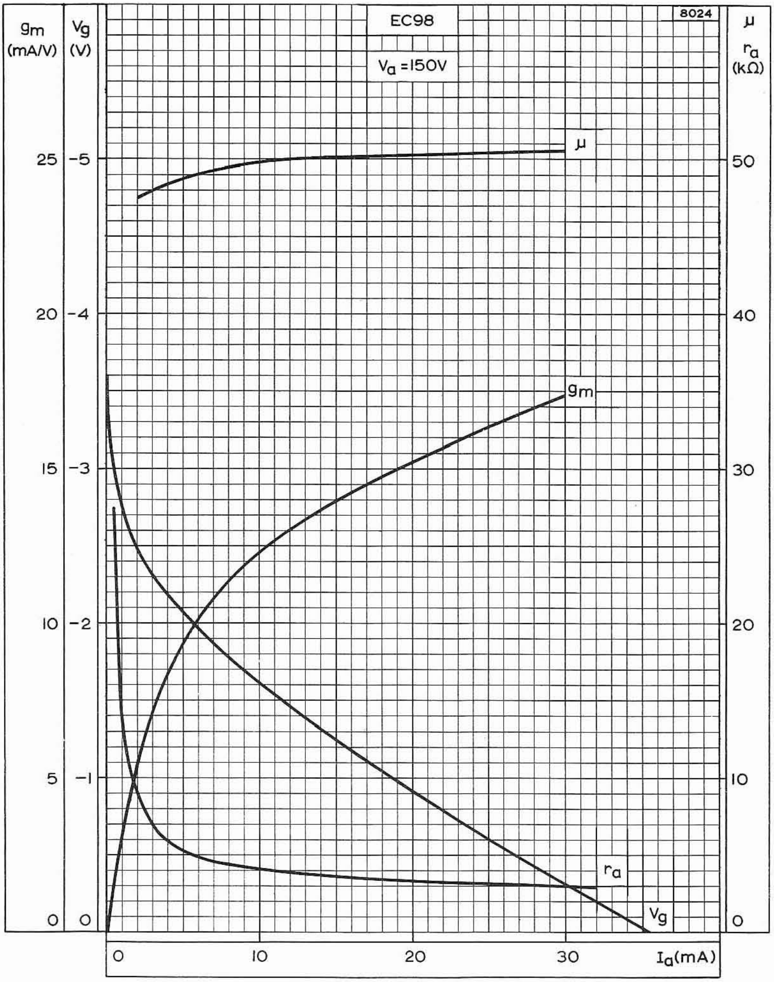
7824



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



MUTUAL CONDUCTANCE, ANODE IMPEDANCE, AMPLIFICATION FACTOR AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT

SUBMINIATURE DOUBLE TRIODE

ECC70

Subminiature medium-μ double triode intended for use at v.h.f.

HEATER

V_h	6.3	V
I_h	300	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

	Shielded	*Unshielded*	
$c_{a'-a''}$	<0.33	<0.52	pF
c_{a-g} (each section)	1.4	1.6	pF
$c_{g'-g''}$	<0.011	<0.015	pF
c_{in} (each section)	—	2.4	pF
$c_{out'}$	1.2	0.3	pF
$c_{out''}$	1.3	0.35	pF

CHARACTERISTICS (each section)

V_a	100	V
V_g	–1.0	V
I_a	6.5	mA
g_m	5.4	mA/V
r_a	6.5	kΩ
μ	35	
V_g ($I_a = 10\mu A$)	–6.5	V

LIMITING VALUES (absolute ratings) each section

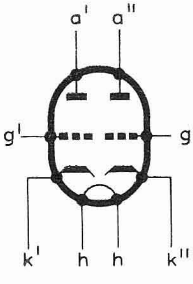
$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	1.1	W
I_a max.	22	mA
$-V_g$ max.	55	V
I_g max.	5.5	mA
V_{h-k} max.	200	V

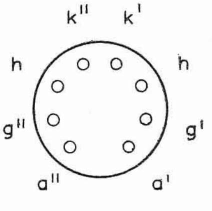
ECC70

SUBMINIATURE DOUBLE TRIODE

Subminiature medium-μ double triode intended for use at v.h.f.

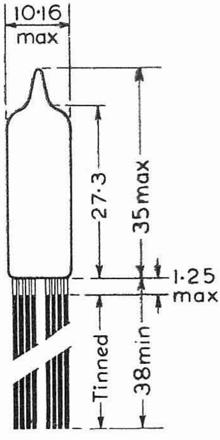
5262

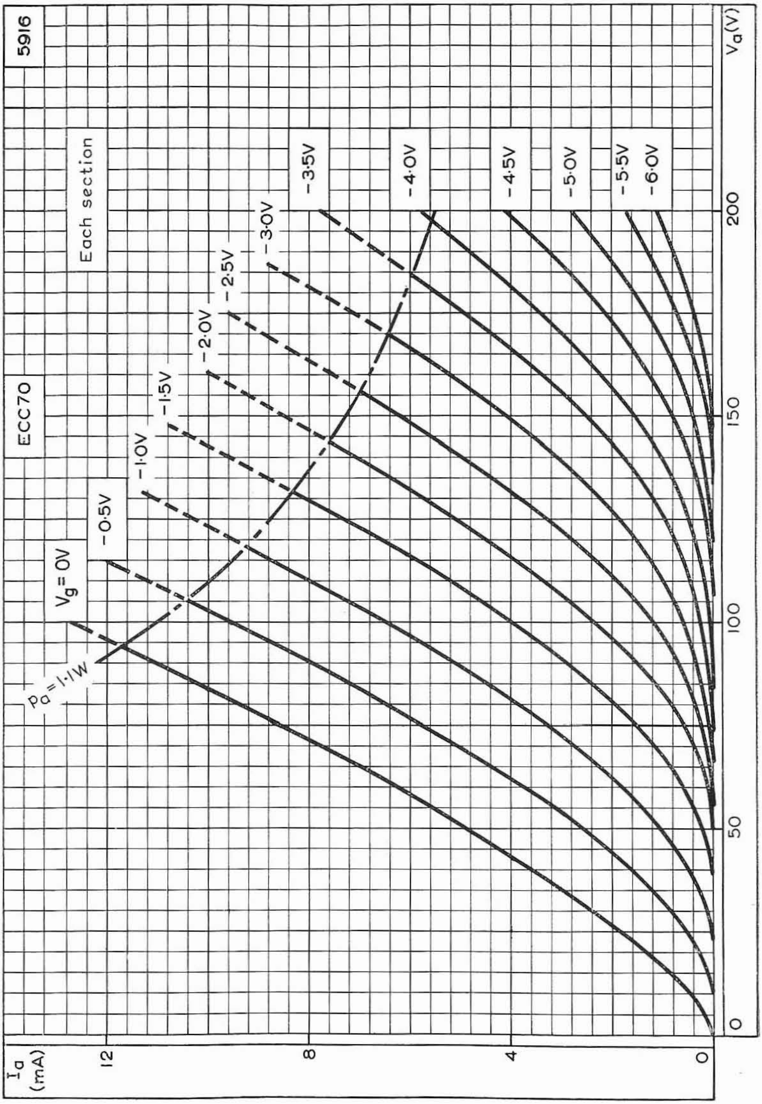




B8D/F Base

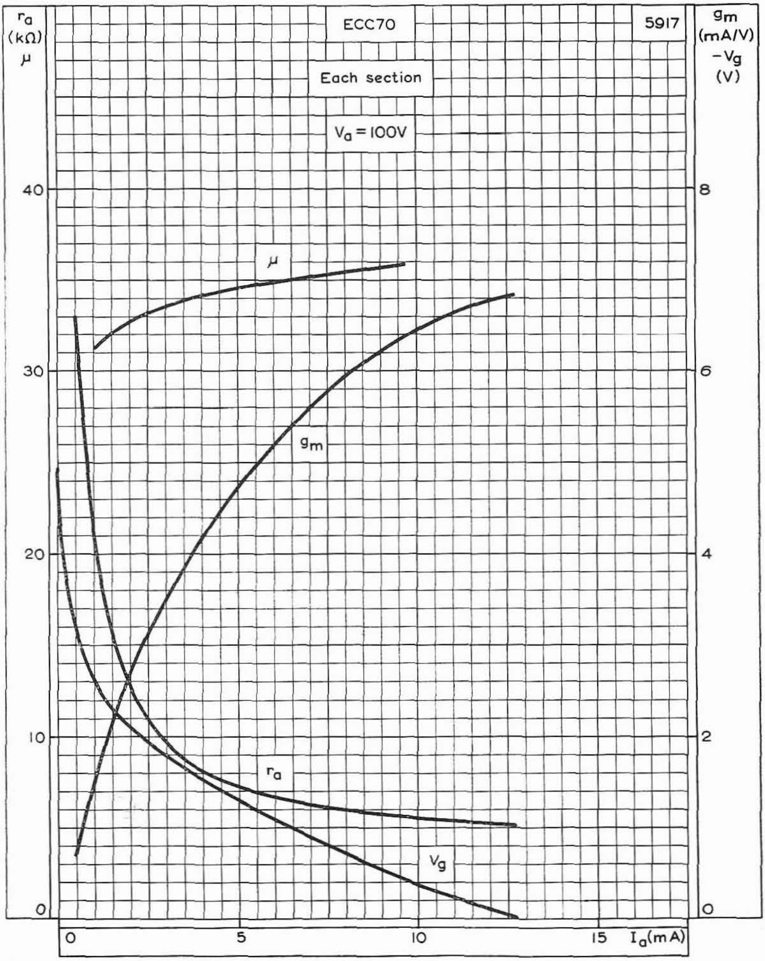
All dimensions in mm





ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER FOR EACH SECTION

SUBMINIATURE DOUBLE TRIODE



ANODE IMPEDANCE, MUTUAL CONDUCTANCE, GRID VOLTAGE AND AMPLIFICATION FACTOR PLOTTED AGAINST ANODE CURRENT FOR EACH SECTION

A.F. VOLTAGE AMPLIFYING PENTODE

EF36

EF37A

High gain pentode for use in a.f. amplifiers.

The EF37A has an anti-microphonic construction and its heater is designed to reduce hum. Except for these differences, the valve is identical to the EF36.

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h	6.3	V
I_h	200	mA

In order to reduce the hum to a minimum the centre tap of the transformer winding which feeds the heaters should be connected to the chassis. The impedance between cathode and chassis should be as small as possible ($<40\Omega$).

CAPACITANCES

c_{a-g1}	<0.02	pF
c_{in}	5.5	pF
c_{out}	8.5	pF

CHARACTERISTICS

V_a	250	V
V_{g2}	100	V
V_{g3}	0	V
I_a	3.0	mA
V_{g1}	−2.0	V
I_{g2}	800	µA
g_m	1.8	mA/V
r_a	2.5	MΩ
μ_{g1-g2}	28	

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER, CONNECTED AS A PENTODE

V_b (V)	R_a (kΩ)	I_k (mA)	R_{g2} (kΩ)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	R_{g1}** (kΩ)
400	100	3.4	330	1.2	115	80	330
350	100	2.9	330	1.2	112	69	330
300	100	2.5	330	1.2	108	59	330
250	100	2.1	330	1.2	103	49	330
200	100	1.7	330	1.2	98	39	330
400	220	1.8	680	2.2	180	81	680
350	220	1.6	680	2.2	176	69	680
300	220	1.3	680	2.2	170	58	680
250	220	1.1	680	2.2	163	48	680
200	220	0.9	680	2.2	152	37	680

* $D_{tot} = 5\%$.

** R_{g1} is the grid resistance of the following valve.

EF36

EF37A

A.F. VOLTAGE AMPLIFYING PENTODE

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER, CONNECTED AS A TRIODE

With g_2 connected to a, g_3 connected to k.

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	D_{tot}* (%)	R_{g1}** (kΩ)
400	47	4.6	1.2	18.4	67	4.5	150
350	47	4.0	1.2	18.2	57	4.4	150
300	47	3.4	1.2	18.0	48	4.3	150
250	47	2.8	1.2	17.7	38	4.2	150
200	47	2.3	1.2	17.5	29	4.0	150
400	100	2.4	2.2	20.1	66	3.9	330
350	100	2.1	2.2	20.0	57	3.9	330
300	100	1.8	2.2	19.9	48	3.8	330
250	100	1.5	2.2	19.7	38	3.7	330
200	100	1.2	2.2	19.5	28	3.5	330
400	220	1.2	3.9	20.6	61	3.4	680
350	220	1.0	3.9	20.4	52	3.3	680
300	220	0.9	3.9	20.3	44	3.3	680
250	220	0.8	3.9	20.2	35	3.2	680
200	220	0.6	3.9	20.0	26	3.0	680

* Output voltage and distortion at the start of positive grid current. At lower output voltages the distortion is approximately proportional to the voltage.

** R_{g1} is the grid resistance of the following valve.

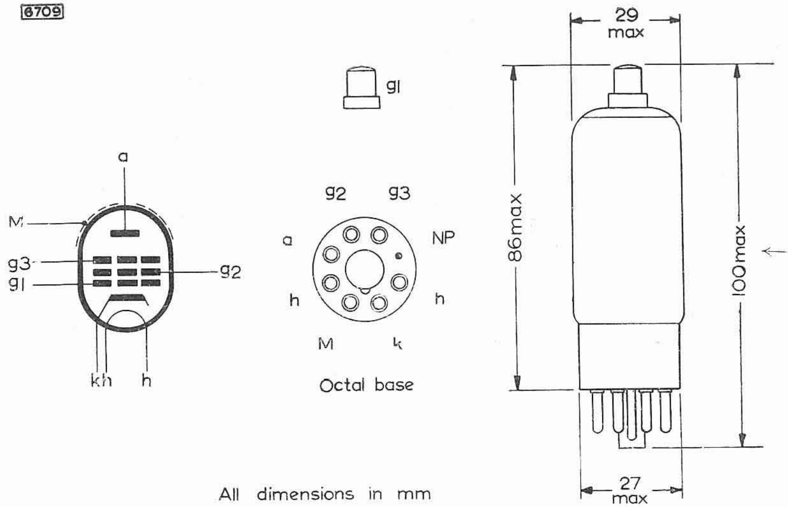
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	200	V
p_{g2} max.	300	mW
I_k max.	6.0	mA
V_{g1} max. ($I_{g1}=+0.3$ μA)	−0.6	V
I_{g2} max.	1.4	mA
R_{g1-k} max. (self bias)	3.0	MΩ
R_{g1-k} max. (fixed bias)	1.0	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

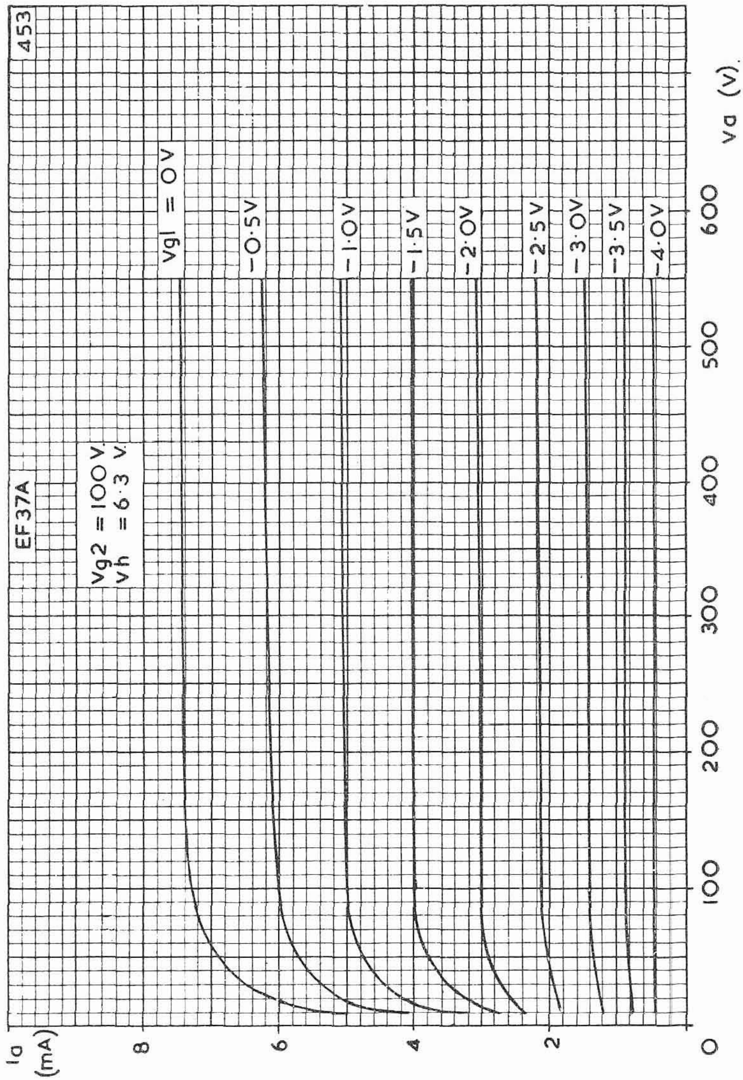
A.F. VOLTAGE AMPLIFYING PENTODE

EF36
EF37A

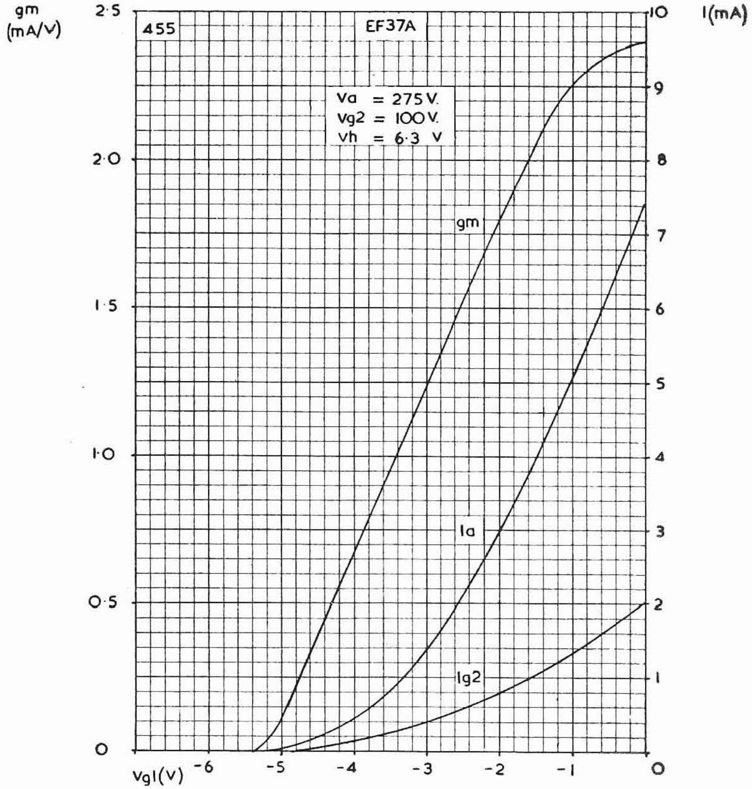
6709



All dimensions in mm

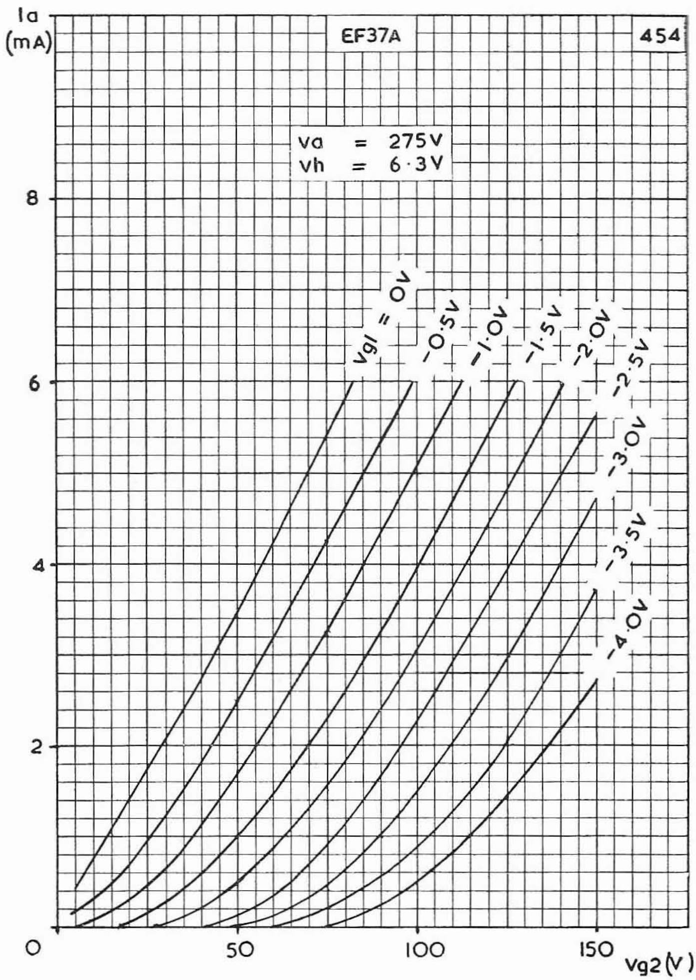


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE.
$V_{g2} = 100V$.

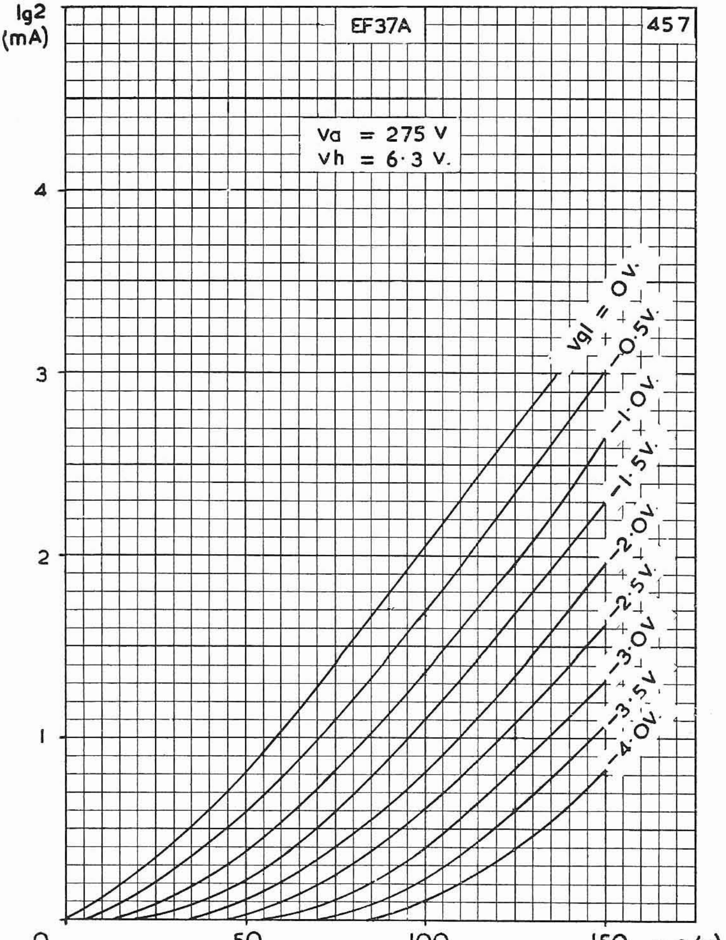


ANODE AND SCREEN-GRID CURRENTS AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. $V_a = 275V$, $V_{g2} = 100V$

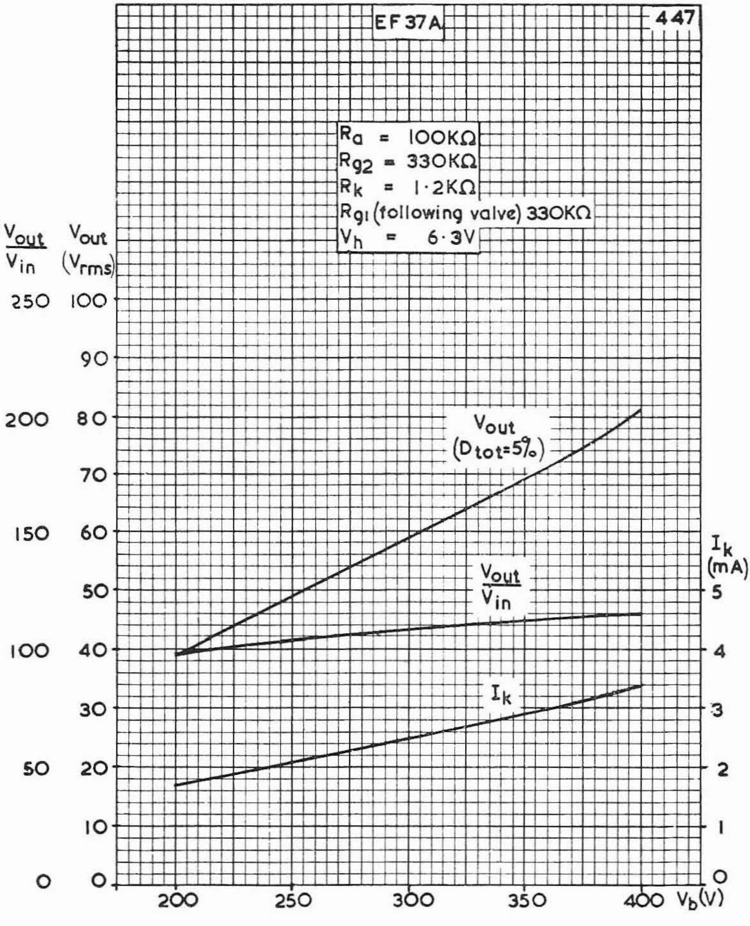
A.F. VOLTAGE AMPLIFYING PENTODE



ANODE CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE.
V_a = 275V



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE. $V_a = 275V$



OUTPUT VOLTAGE, GAIN AND CATHODE CURRENT PLOTTED AGAINST LINE VOLTAGE AS A RESISTANCE COUPLED A.F. AMPLIFIER (PENTODE CONNECTION)

$R_a = 100k\Omega$ $R_{g2} = 330k\Omega$

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

EF37A

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.

HEATER

This valve is suitable for d.c./a.c. operation.

V_h	6.3	V
I_h	0.2	A

In order to reduce the hum to a minimum the centre tap of the transformer winding which feeds the heaters should be connected to the chassis. The impedance between cathode and chassis should be as small as possible ($<40\ \Omega$).

CAPACITANCES

c_{a-g1}	<0.02	μμF
c_{in}	5.5	μμF
c_{out}	8.5	μμF

CHARACTERISTICS

V_a	250	V
V_{g2}	100	V
V_{g3}	0	V
I_a	3.0	mA
V_{g1}	—2.0	V
I_{g2}	0.8	mA
g_m	1.8	mA/V
r_a	2.5	M Ω
μ_{g1-g2}	28	

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER, CONNECTED AS A PENTODE

V_b (V)	R_a (k Ω)	I_k (mA)	R_{g2} (k Ω)	R_k (k Ω)	$\frac{V_{out}}{V_{in}}$	V_{out}* (V (r.m.s.))	R_{g1}** (k Ω)
400	100	3.4	330	1.2	115	80	330
350	100	2.9	330	1.2	112	69	330
300	100	2.5	330	1.2	108	59	330
250	100	2.1	330	1.2	103	49	330
200	100	1.7	330	1.2	98	39	330
400	220	1.8	680	2.2	180	81	680
350	220	1.6	680	2.2	176	69	680
300	220	1.3	680	2.2	170	58	680
250	220	1.1	680	2.2	163	48	680
200	220	0.9	680	2.2	152	37	680

* $D_{tot} = 5\%$.

** R_{g1} is the grid resistance of the following valve.

EF37A

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER, CONNECTED AS A TRIODE

With g_2 connected to a, g_3 connected to k.

V_b (V)	R_a (k Ω)	I_a (mA)	R_k (k Ω)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{(r.m.s.)}$)	D_{tot}* (%)	R_{g1}** (k Ω)
400	47	4.6	1.2	18.4	67	4.5	150
350	47	4.0	1.2	18.2	57	4.4	150
300	47	3.4	1.2	18.0	48	4.3	150
250	47	2.8	1.2	17.7	38	4.2	150
200	47	2.3	1.2	17.5	29	4.0	150
400	100	2.4	2.2	20.1	66	3.9	330
350	100	2.1	2.2	20.0	57	3.9	330
300	100	1.8	2.2	19.9	48	3.8	330
250	100	1.5	2.2	19.7	38	3.7	330
200	100	1.2	2.2	19.5	28	3.5	330
400	220	1.2	3.9	20.6	61	3.4	680
350	220	1.0	3.9	20.4	52	3.3	680
300	220	0.9	3.9	20.3	44	3.3	680
250	220	0.8	3.9	20.2	35	3.2	680
200	220	0.6	3.9	20.0	26	3.0	680

* Output voltage and distortion at the start of positive grid current. At lower output voltages the distortion is approximately proportional to the voltage.

** R_{g1} is the grid resistance of the following valve.

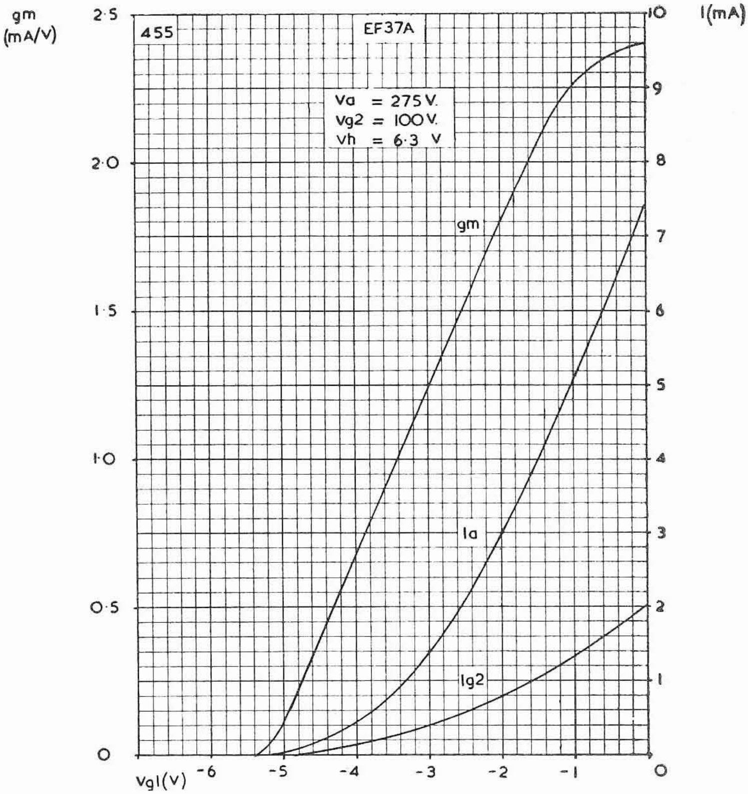
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	200	V
p_{g2} max.	0.3	W
I_k max.	6.0	mA
V_{g1} max. ($I_{g1} = +0.3\ \mu A$)	−0.6	V
I_{g2} max.	1.4	mA
R_{g1-k} max. (self bias)	3.0	MΩ
R_{g1-k} max. (fixed bias)	1.0	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

EF37A

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.

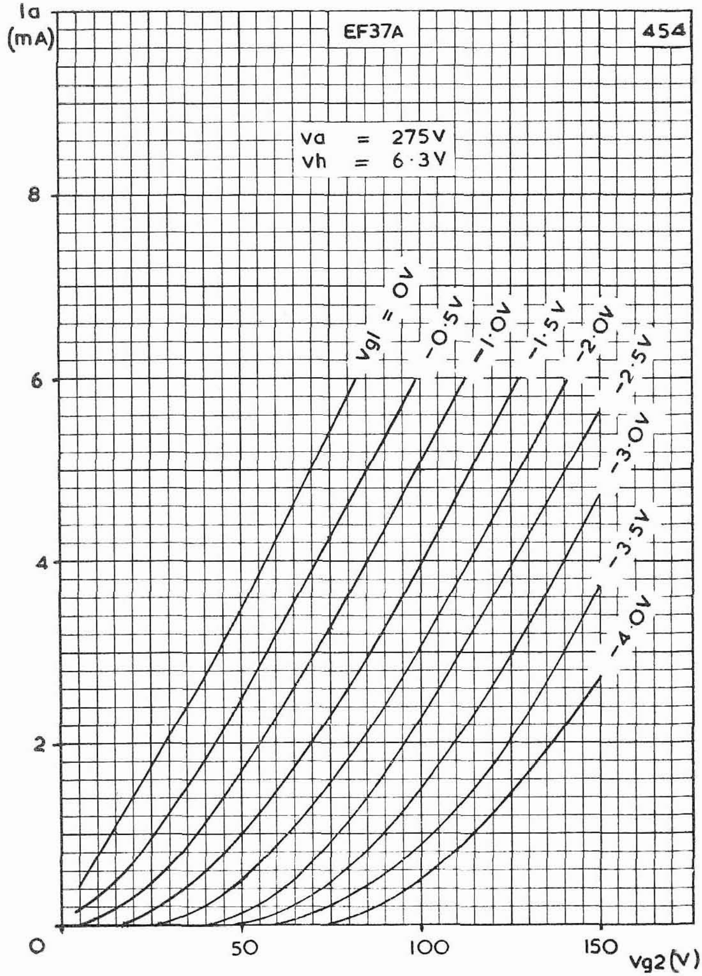


ANODE AND SCREEN-GRID CURRENTS AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE VOLTAGE OF 275 V AND SCREEN-GRID VOLTAGE OF 100 V

EF37A

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.

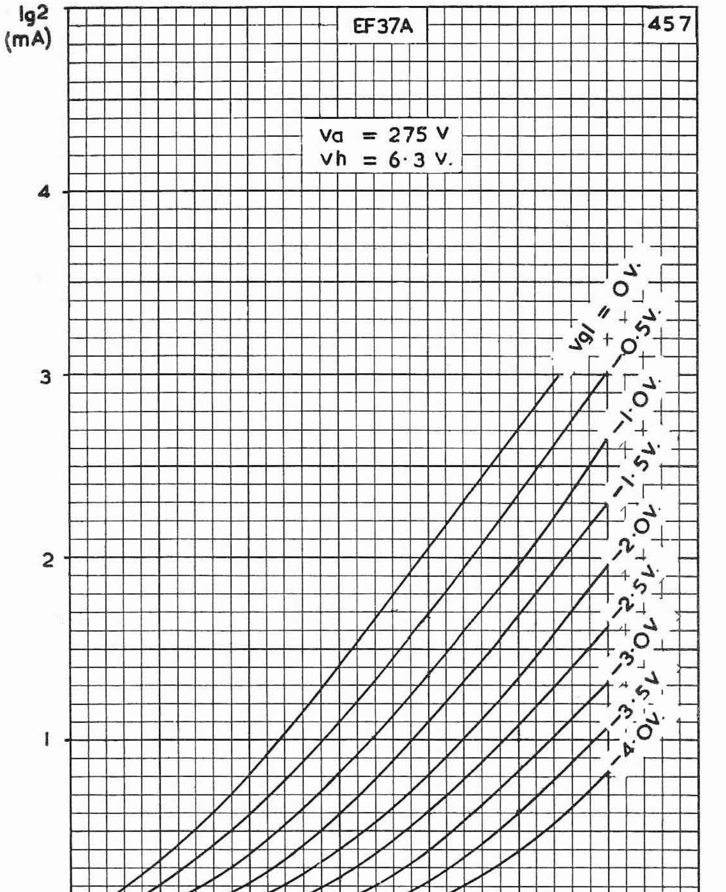


ANODE CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE FOR ANODE VOLTAGE OF 275 V

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

EF37A

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.

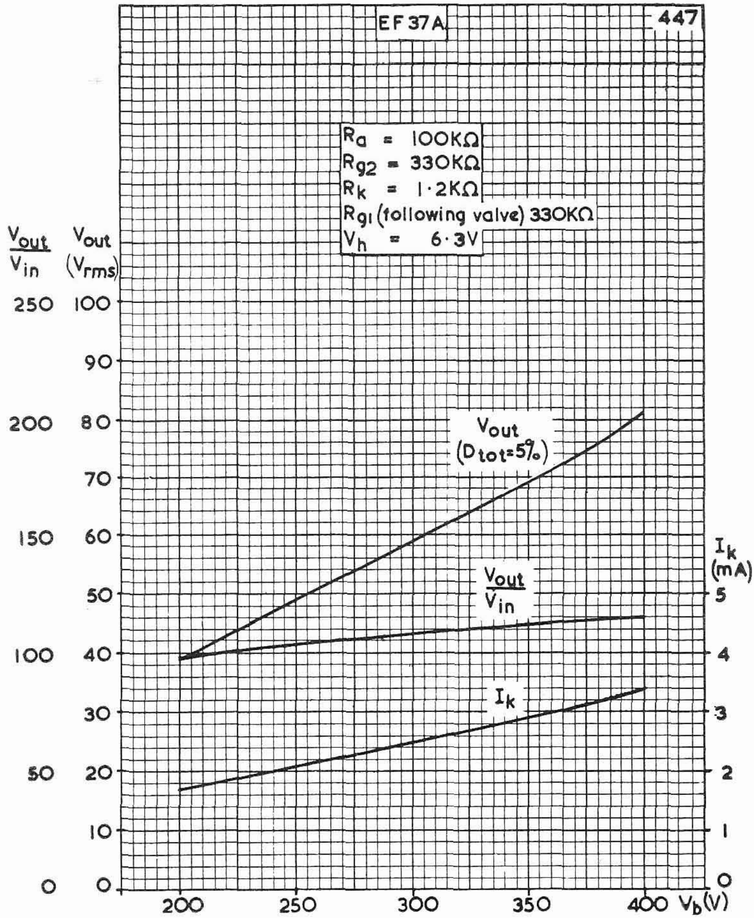


SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE FOR ANODE VOLTAGE OF 275 V

EF37A

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.



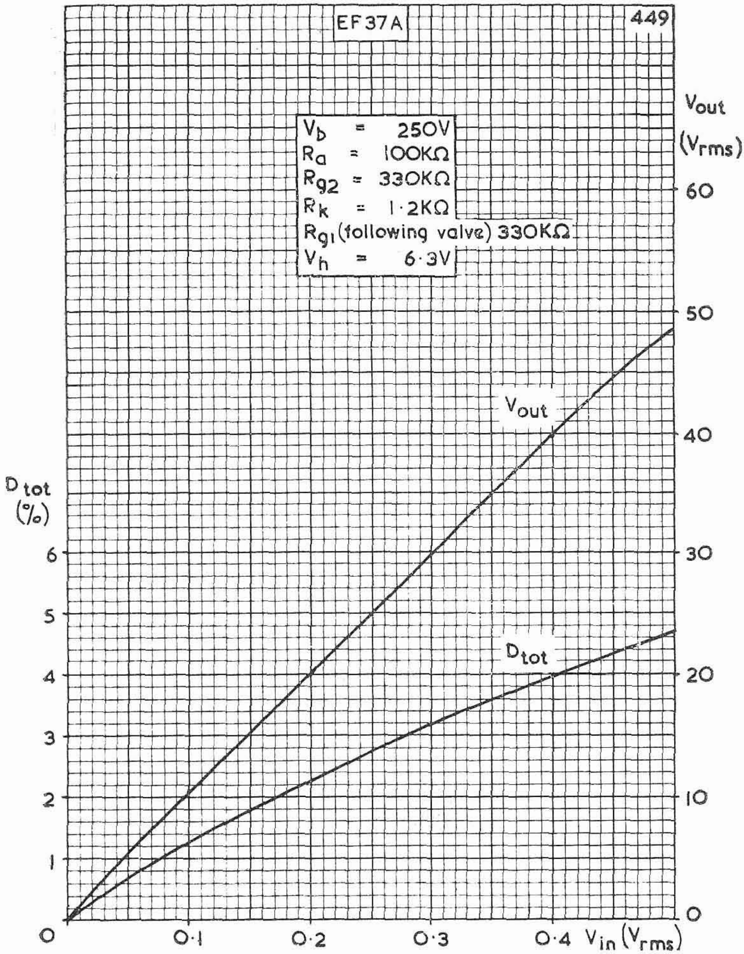
OUTPUT VOLTAGE, GAIN AND CATHODE CURRENT PLOTTED AGAINST LINE VOLTAGE AS A RESISTANCE COUPLED A.F. AMPLIFIER (PENTODE CONNECTION)

$R_a = 100\ k\Omega \qquad R_{g2} = 330\ k\Omega$

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

EF37A

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.



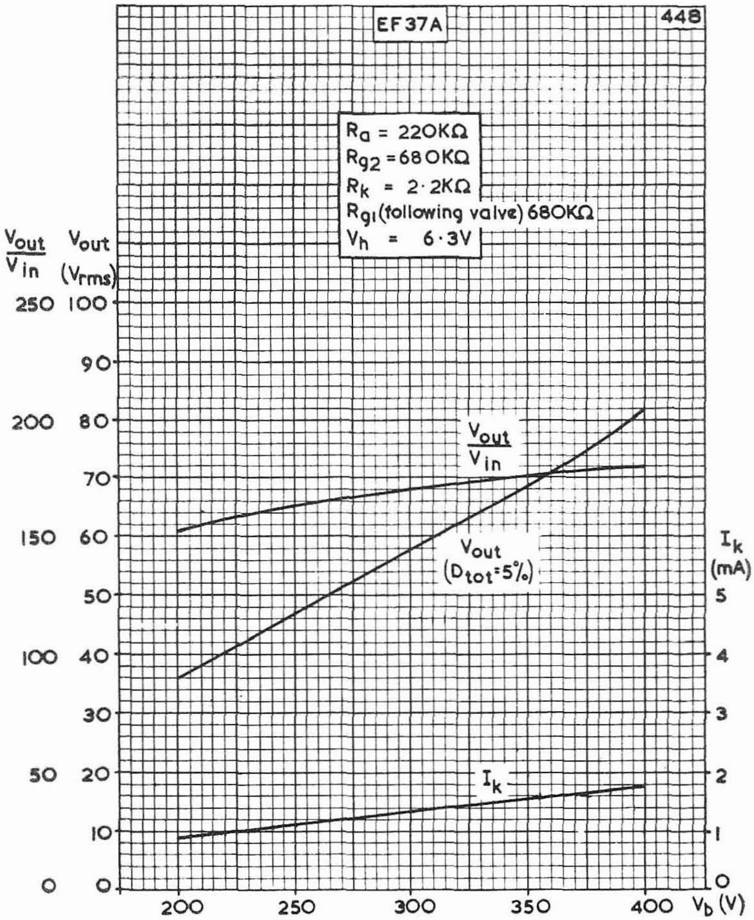
OUTPUT VOLTAGE AND DISTORTION PLOTTED AGAINST INPUT VOLTAGE AS A RESISTANCE COUPLED A.F. AMPLIFIER (PENTODE CONNECTION)

$R_a = 100\ k\Omega \qquad R_{g2} = 330\ k\Omega$

EF37A

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.



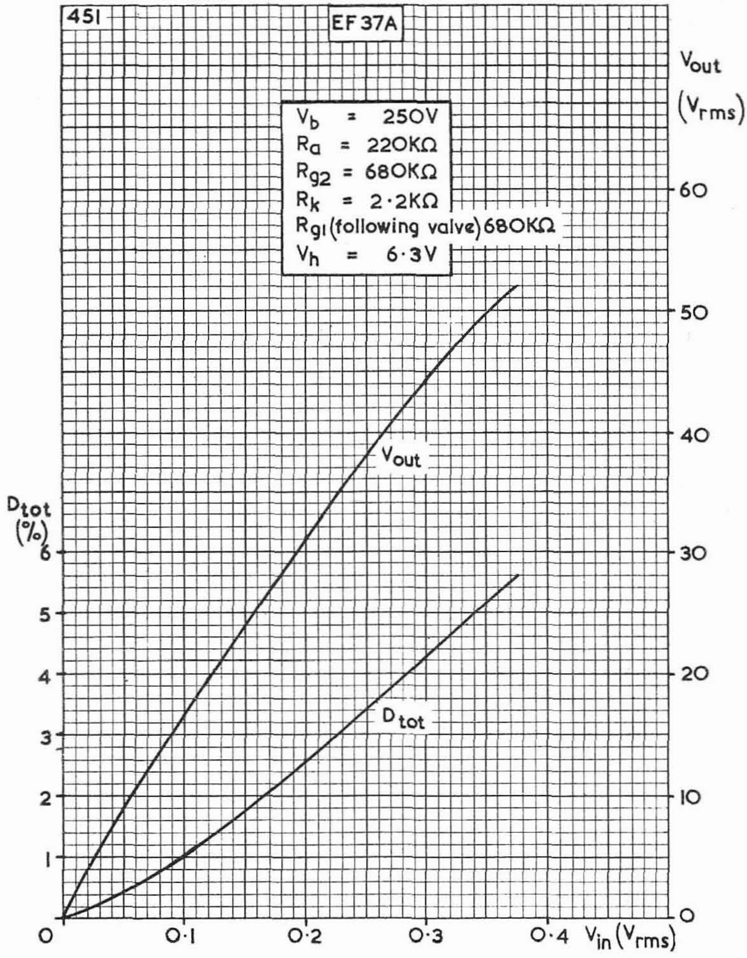
OUTPUT VOLTAGE, GAIN AND CATHODE CURRENT PLOTTED AGAINST LINE VOLTAGE AS A RESISTANCE COUPLED A.F. AMPLIFIER (PENTODE CONNECTION)

R_a = 220 k Ω $\qquad$ R_{g2} = 680 k Ω

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

EF37A

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.



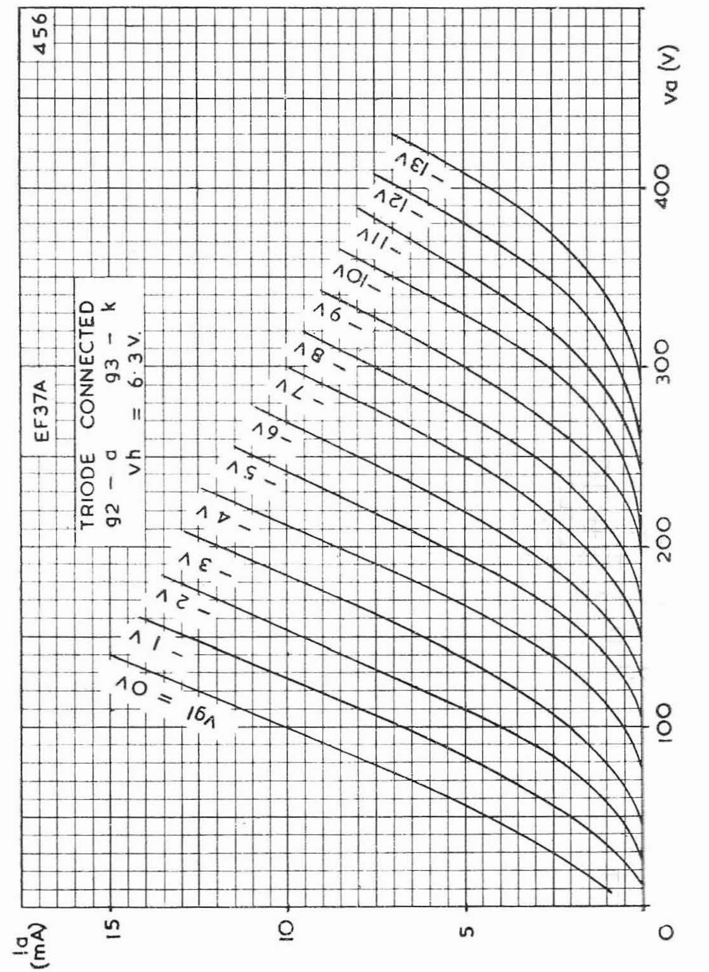
OUTPUT VOLTAGE AND DISTORTION PLOTTED AGAINST INPUT VOLTAGE AS A RESISTANCE COUPLED A.F. AMPLIFIER (PENTODE CONNECTION)

R_a = 220 k Ω R_{g2} = 680 k Ω

EF37A

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.

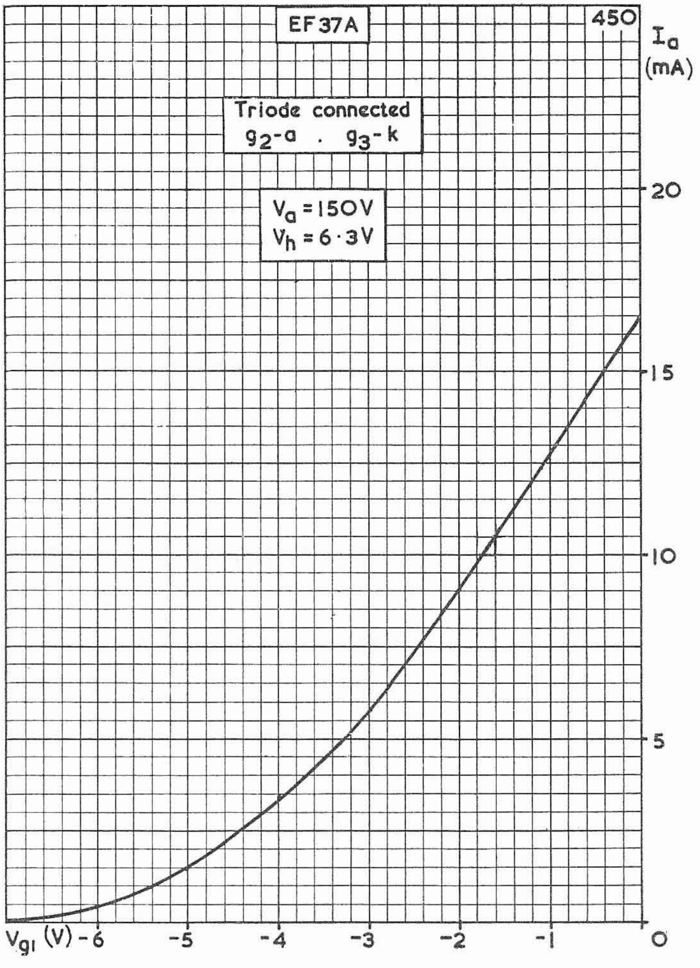


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WHEN CONNECTED AS A TRIODE (SCREEN-GRID CONNECTED TO ANODE, SUP.PRESSOR-GRID TO CATHODE)

LOW MICROPHONY, LOW HUM A.F. VOLTAGE AMPLIFYING PENTODE

EF37A

High gain pentode primarily intended for use in A.F. pre-amplifier stages. It has an anti-microphonic construction and its heater is designed to reduce hum.



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE VOLTAGE OF 150 V WHEN CONNECTED AS A TRIODE (SCREEN-GRID CONNECTED TO ANODE, SUPPRESSOR-GRID TO CATHODE)

R.F. PENTODE

EF50

Single-ended r.f. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h	6.3	V
I_h	300	mA

CAPACITANCES

	Min.	Av.	Max.	
c_{a-g1}	—	—	0.007	pF
c_{g1-g2}	—	2.4	—	pF
c_{in}	7.1	8.3	9.5	pF
c_{out}	4.8	5.2	5.6	pF

OPERATING CONDITIONS

V_a	250	250	250	250	V
V_{g2}	250	250	250	250	V
V_{g1-c}	−2	−1.55*	**	††	V
V_{g3}	0*	0	−30*	−20*	V
I_a	10	10	10	10	mA
I_{g2}	3.0	3.0	5.5	4.0	mA
g_m	6.5	6.5	5.2	6.0	mA/V
r_a	1.0	1.0	0.1	0.2	MΩ
μ_{g1-g2}	75	—	—	—	
R_{eq}	1.4	—	—	—	kΩ
Input damping (f=50Mc/s)	4.0	—	—	—	kΩ
Output damping (f=50Mc/s)	50	—	—	—	kΩ
R_k	0	32	0	32	Ω
C_k	0	50	0	50	pF
V_{g1} (for 10 : 1 reduction in g_m)	—	−4.5	**	††	V
V_{g3} (for 10 : 1 reduction in g_m)	−53	—	−55.5	−51.5	V

* Valve not controlled by a.g.c.

** V_{g1} is obtained from V_{g3} by means of a potentiometer of 50kΩ and 3kΩ.

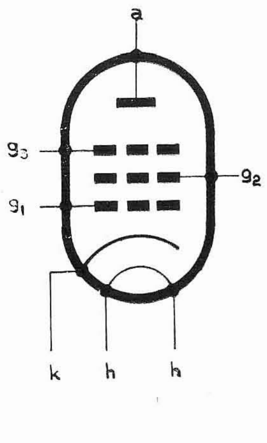
†† V_{g1} is obtained from V_{g3} by means of a potentiometer of 50kΩ and 4kΩ.

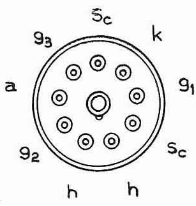
EF50

R.F. PENTODE

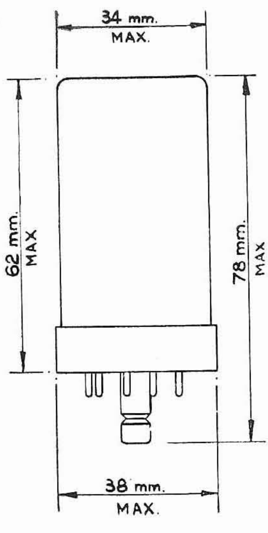
LIMITING VALUES

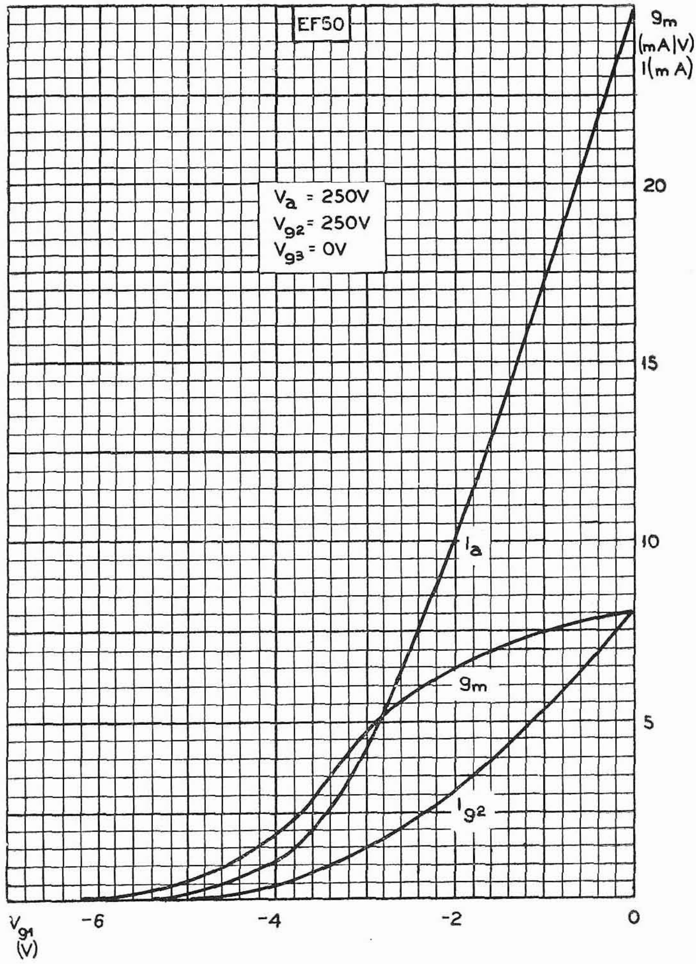
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	3	W
I_k max.	15	mA
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
p_{g2} max.	1.7	W
V_{g1} max. ($I_{g1} = +0.3\mu A$)	−1.3	V
V_{g3} max. ($I_{g3} = +0.3\mu A$)	−1.3	V
R_{g1} max.	3	MΩ
R_{g3} max.	3	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ



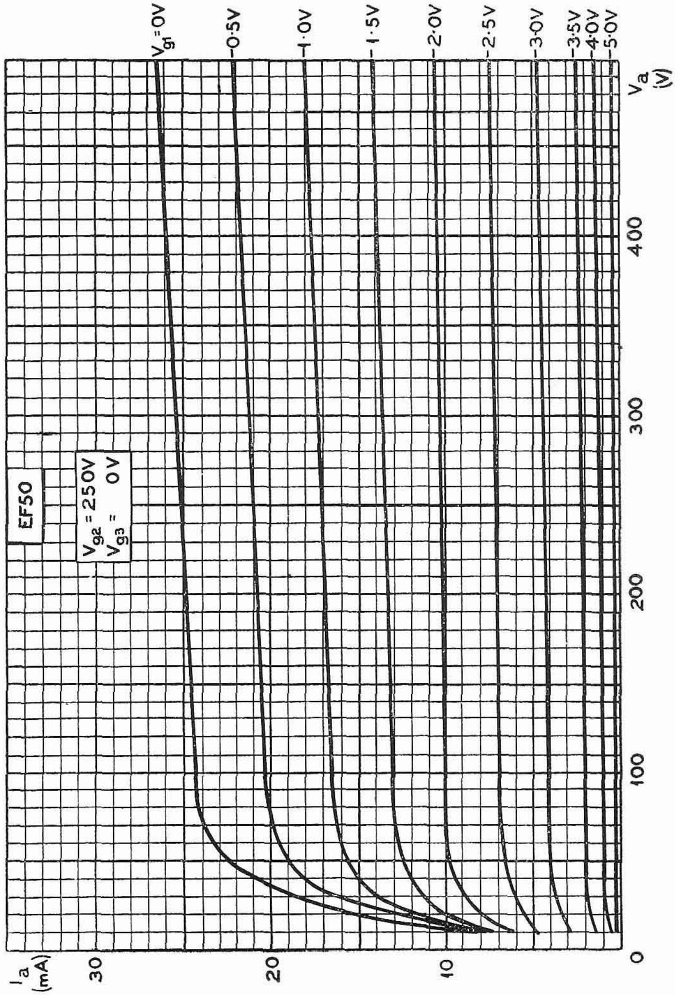


B9G BASE





ANODE AND SCREEN-GRID CURRENTS AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

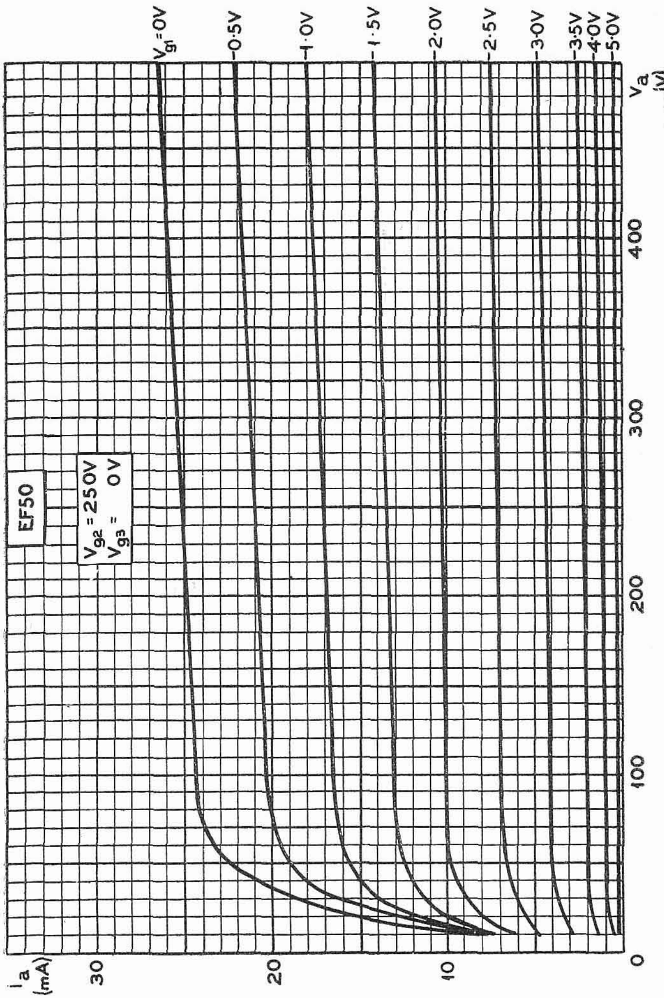


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

R.F. PENTODE

EF50

Single-ended R.F. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.

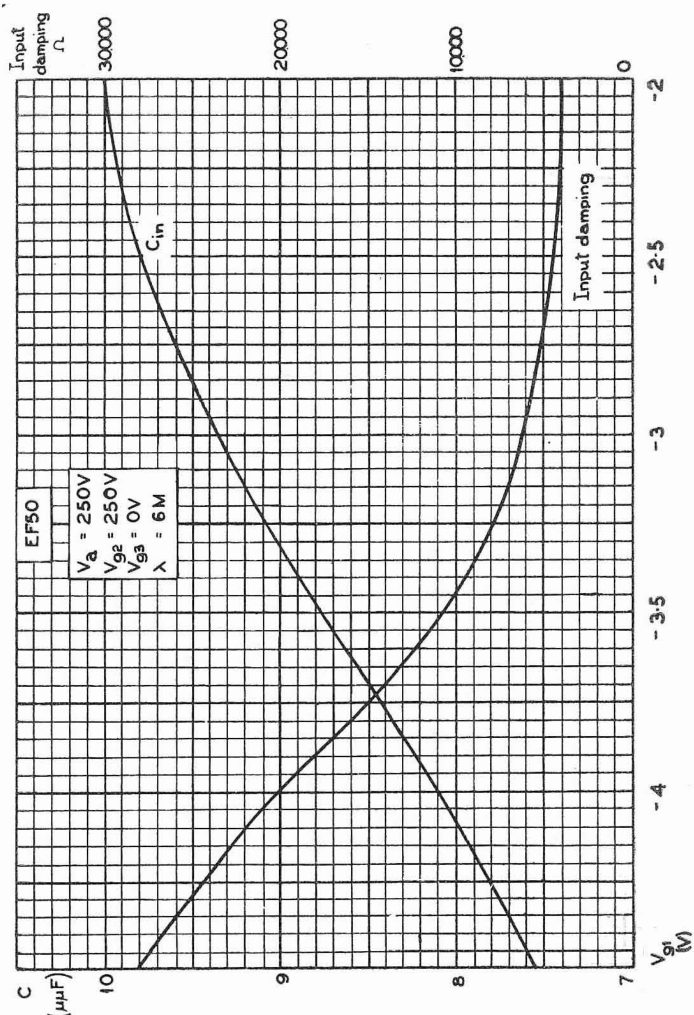


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

EF50

R.F. PENTODE

Single-ended R.F. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.

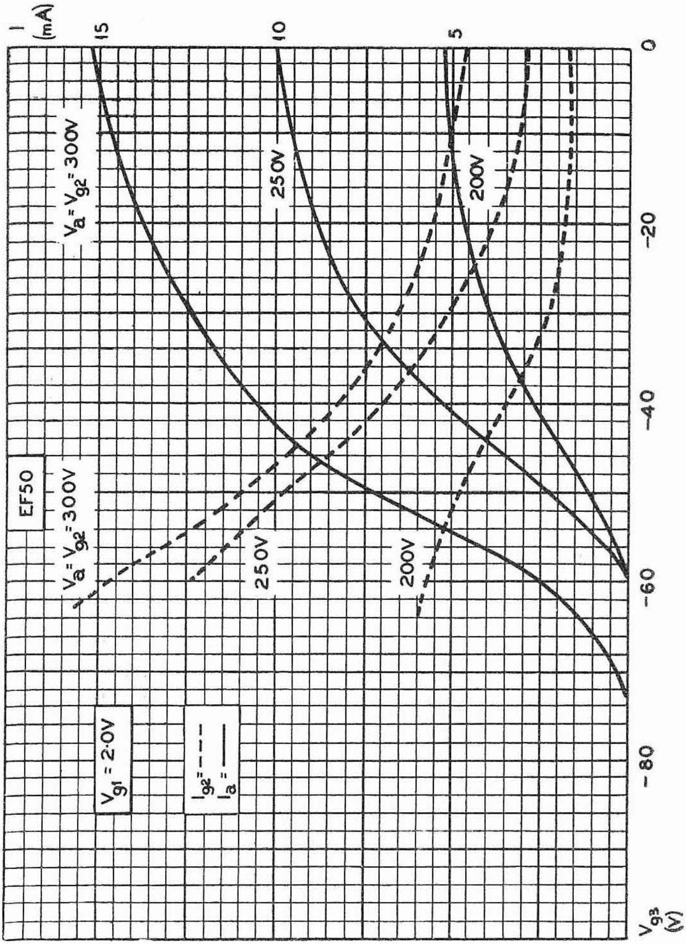


INPUT DAMPING AND INPUT CAPACITANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE AT50 MC/S

R.F. PENTODE

EF50

Single-ended R.F. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.

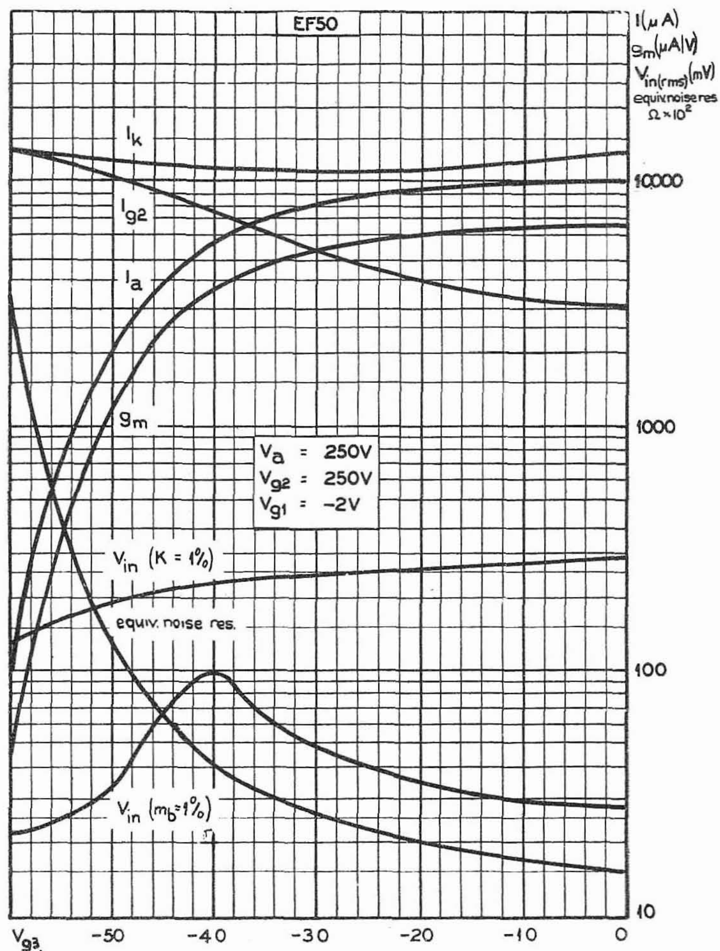


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE

EF50

R.F. PENTODE

Single-ended R.F. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.

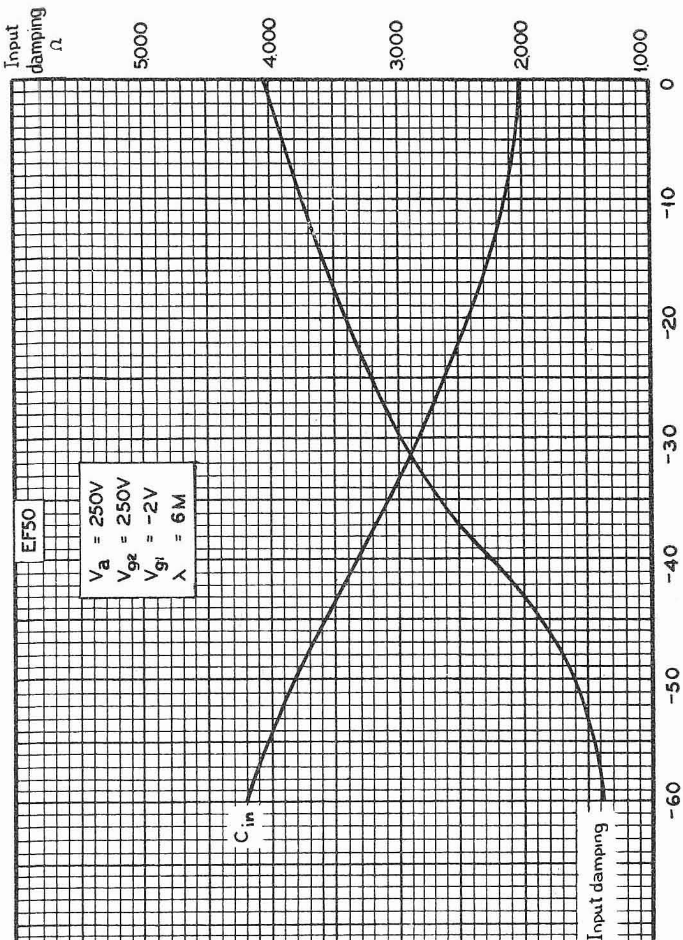


CONTROL CHARACTERISTICS WHEN CONTROLLED BY SUPPRESSOR-GRID VOLTAGE

R.F. PENTODE

EF50

Single-ended R.F. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.

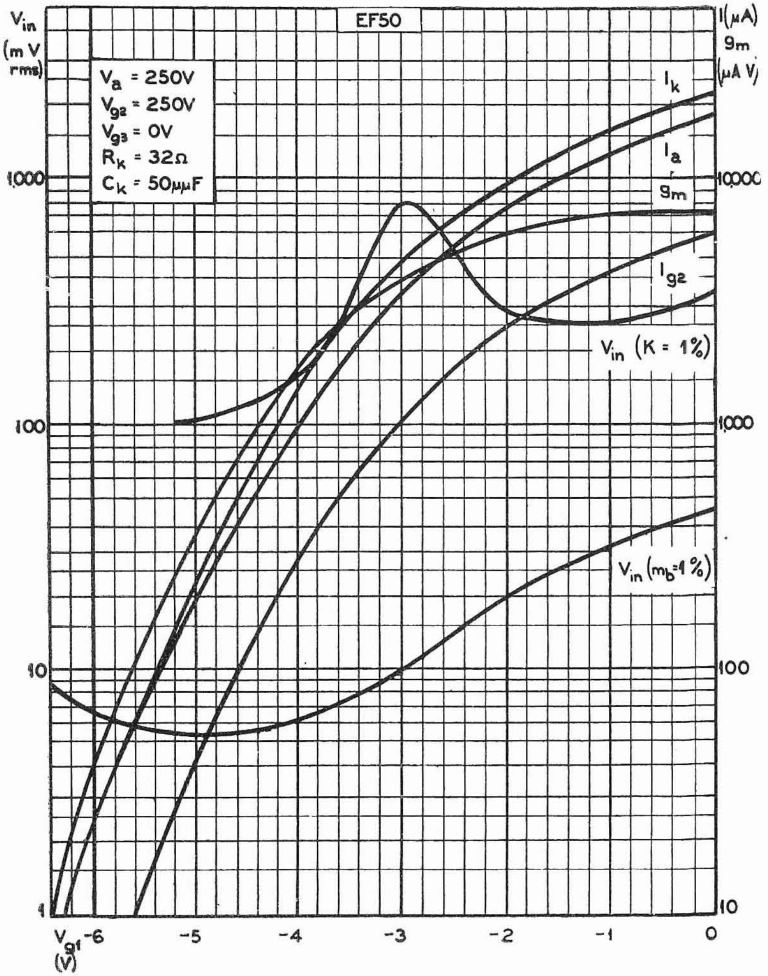


INPUT DAMPING AND INPUT CAPITANCE PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE AT 50 MC/S

EF50

R.F. PENTODE

Single-ended R.F. pentode, fully controlled by voltages of 0 to —6V or 0 to —55V according to the circuit used.



CONTROL CHARACTERISTICS WHEN CONTROLLED BY CONTROL-GRID VOLTAGE

SUBMINIATURE R.F. PENTODE

EF70

Subminiature high slope r.f. pentode with a short suppressor grid base. A diode is connected internally to the suppressor grid to prevent this grid locking at a positive voltage.

HEATER

V_h	6.3	V
I_h	200	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and, therefore, in the interests of satisfactory life, it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to the chassis and should result in a bulb temperature of 100°C.

CAPACITANCES (measured with external shield)

c_{a-g1}	<0.025	pF ←
c_{in}	4.5	pF
c_{out}	4.7	pF

CHARACTERISTICS

V_a	100	V
V_{g2}	100	V
V_{g3}	0	V
I_a	3.0	mA
I_{g2}	2.25	mA ←
V_{g1}	−2.0	V
g_m	2.5	mA/V
r_a	100	kΩ
μ_{g1-g2}	38	
$V_{g3}(I_a=100\mu A)$	−8.0	V ←

EF70

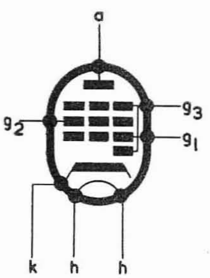
SUBMINIATURE R.F. PENTODE

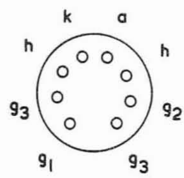
Subminiature high slope r.f. pentode with a short suppressor grid base. A diode is connected internally to the suppressor grid to prevent this grid locking at a positive voltage.

LIMITING VALUES

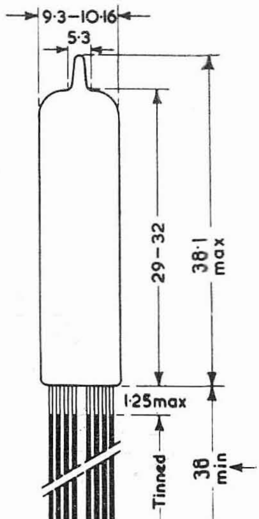
$V_{a(b)}$ max.	300	V
V_a max.	175	V
p_a max.	750	mW
$V_{g2(b)}$ max.	300	V
V_{g2} max.	175	V
p_{g2} max.	400	mW
I_k max.	10	mA
R_{g1-k} max.	500	kΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V

Note – A diode is connected internally to g_3 in order to prevent this grid locking at a positive voltage.





B8D/F Base



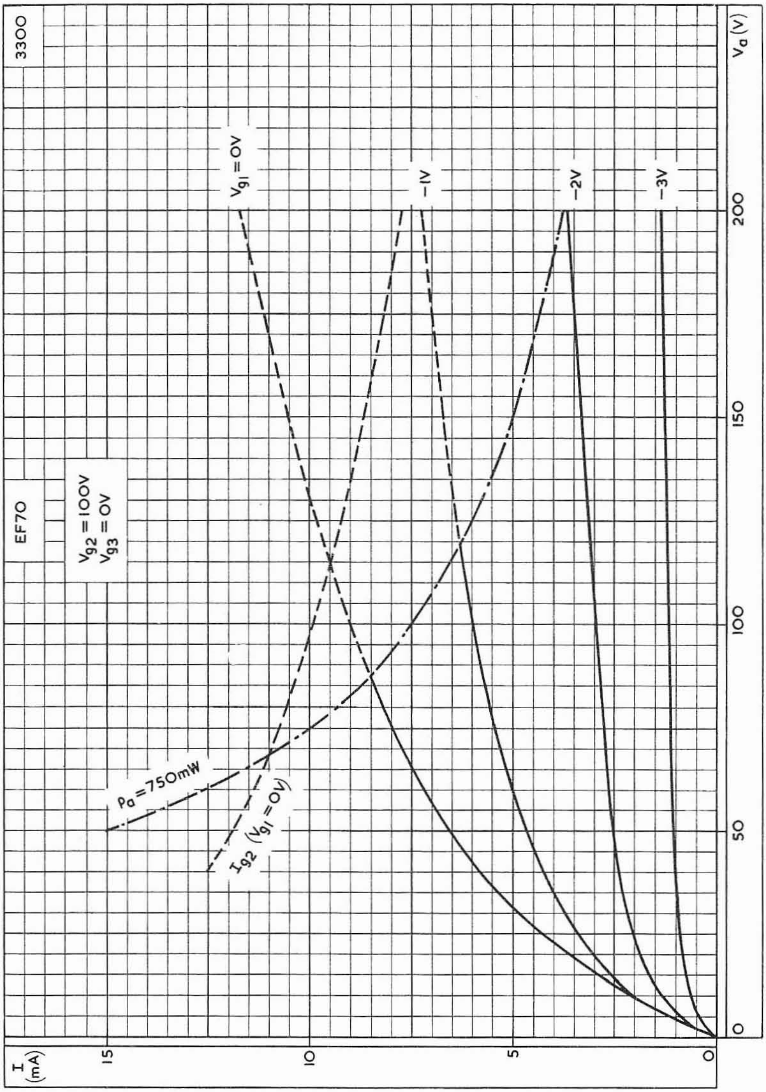
3270

All dimensions in mm

SUBMINIATURE R.F. PENTODE

EF70

Subminiature high slope r.f. pentode with a short suppressor grid base. A diode is connected internally to the suppressor grid to prevent this grid locking at a positive voltage.

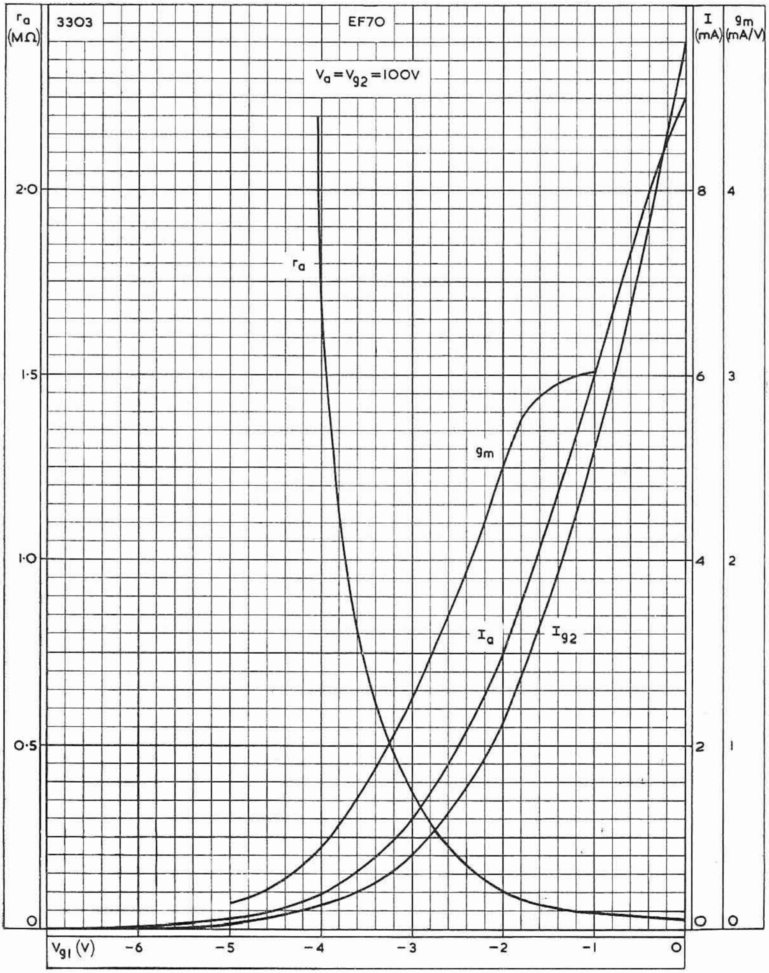


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE

EF70

SUBMINIATURE R.F. PENTODE

Subminiature high slope r.f. pentode with a short suppressor grid base. A diode is connected internally to the suppressor grid to prevent this grid locking at a positive voltage.

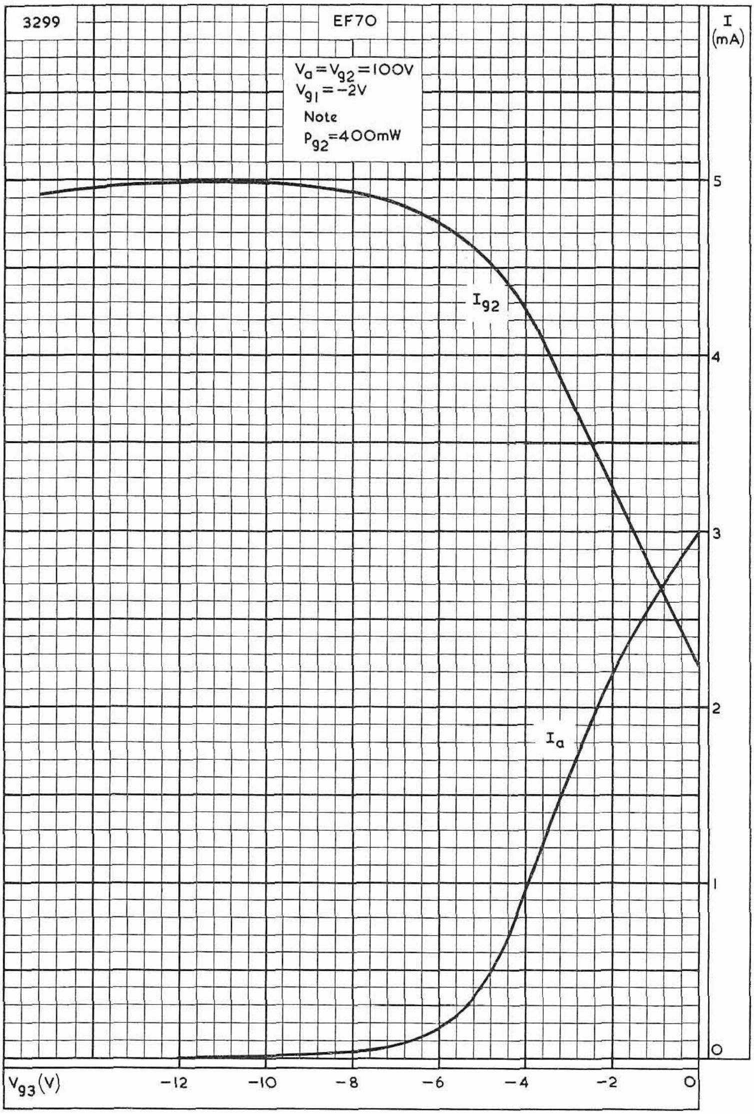


ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE R.F. PENTODE

EF70

Subminiature high slope r.f. pentode with a short suppressor grid base. A diode is connected internally to the suppressor grid to prevent this grid locking at a positive voltage.



ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE

SUBMINIATURE VARIABLE-MU R.F. PENTODE

EF71

Variable-mu pentode suitable for use in controlled r.f. amplifiers.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

CAPACITANCES

	Shielded	Unshielded	
c_{in}	4.5	4.0	pF
c_{out}	3.4	1.9	pF
c_{a-g1}	<0.015	<0.035	pF

CHARACTERISTICS

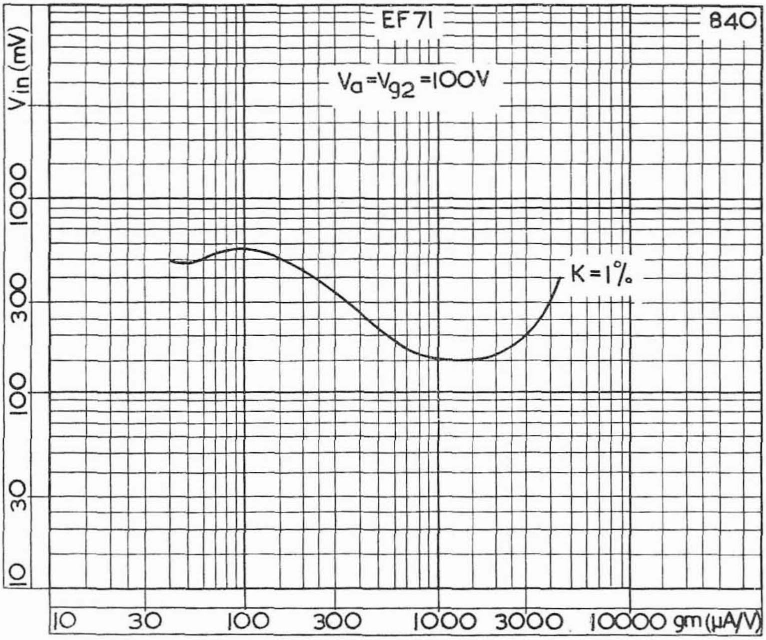
V_a	100	V
V_{g2}	100	V
R_k	120	Ω
I_a	7.2	mA
I_{g2}	2.2	mA
g_m	4.5	mA/V
r_a	260	kΩ
V_{g1} ($g_m = 25\mu A/V$)	–14	V

LIMITING VALUES

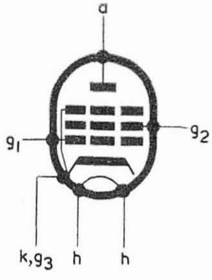
$V_{a(b)}$ max.	300	V
V_a max.	175	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	300	V
V_{g2} max.	175	V
p_{g2} max.	500	mW
I_k max.	10	mA
R_{g1-k} max.	500	kΩ
V_{h-k} max.	100	V

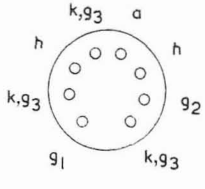
EF71

SUBMINIATURE VARIABLE-MU R.F. PENTODE

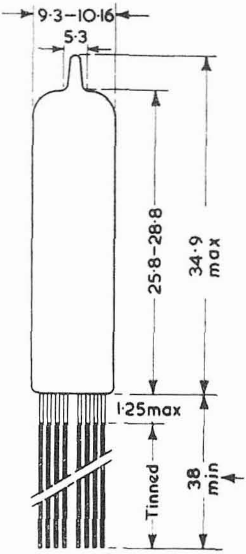


CROSS-MODULATION CURVE



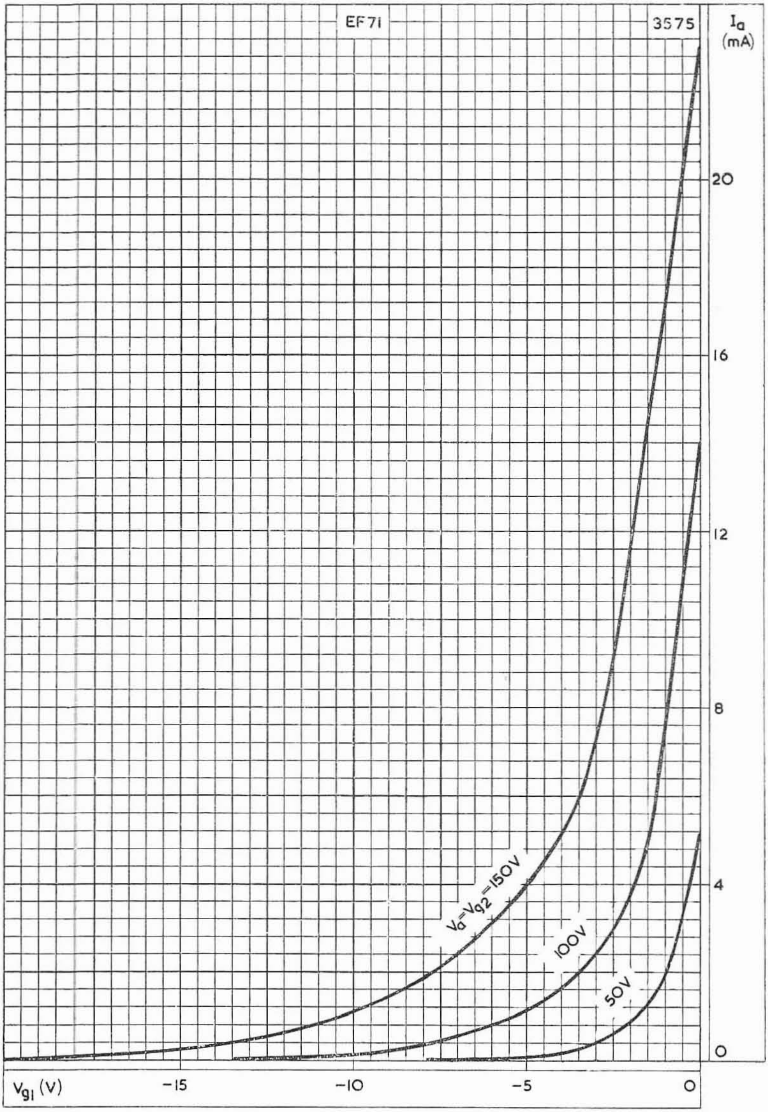


B8D/F Base

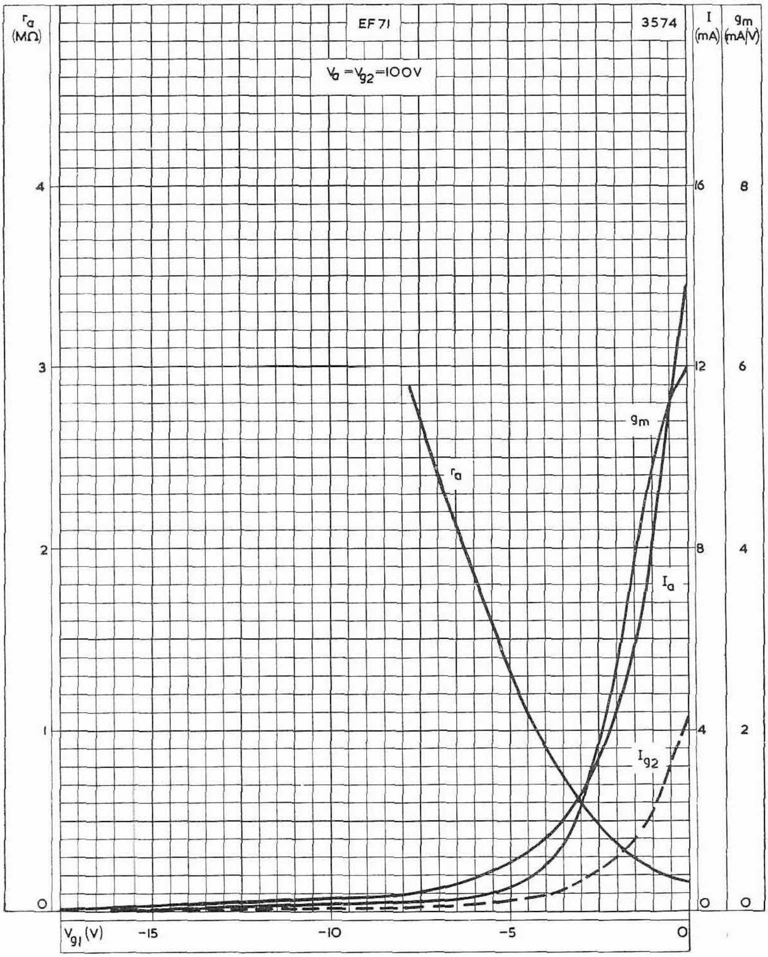


3267

All dimensions in mm



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE R.F. PENTODE

EF72

High slope r.f. pentode

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and therefore, in the interests of long life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to the chassis and should result in a bulb temperature of approximately 100°C.

CAPACITANCES ←

Pentode connected

	Shielded	Unshielded	
c_{a-g1}	<0.015	<0.02	pF
c_{in}	4.1	4.0	pF
c_{out}	2.5	2.0	pF

Triode connected

c_{a-g1}	1.65	pF
c_{in}	2.8	pF
c_{out}	4.2	pF

CHARACTERISTICS

Pentode connected

V_a	100	V
V_{g2}	100	V
V_{g1}	−1.4	V
I_a	7.0	mA
I_{g2}	2.2	mA
g_m	5.0	mA/V
r_a	250	kΩ
μ_{g1-g2}	36	
R_{eq}	1.6	kΩ
R_{in} (f = 50Mc/s)	25	kΩ

Triode connected ←

V_a	100	V
V_{g1}	−1.4	V
I_a	9.2	mA
g_m	6.8	mA/V
r_a	5.3	kΩ
μ	36	

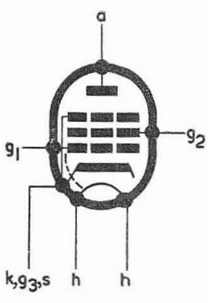
EF72

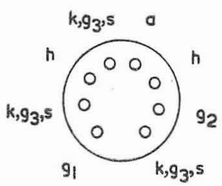
SUBMINIATURE R.F. PENTODE

High slope r.f. pentode

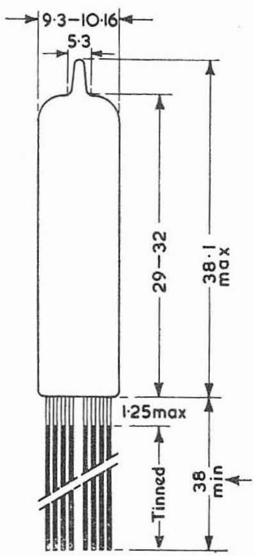
LIMITING VALUES

$V_{a(b)}$ max.	300	V
V_a max.	175	V
$V_{g2(b)}$ max.	300	V
V_{g2} max.	175	V
p_a max.	800	mW
p_{g2} max.	300	mW
p_{a+g2} max.	1.0	W
I_k max.	12	mA
V_{g1} max. ($I_{g1}=+0.3\mu A$)	−1.3	V
R_{g1-k} max.	500	kΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ





B8D/F Base



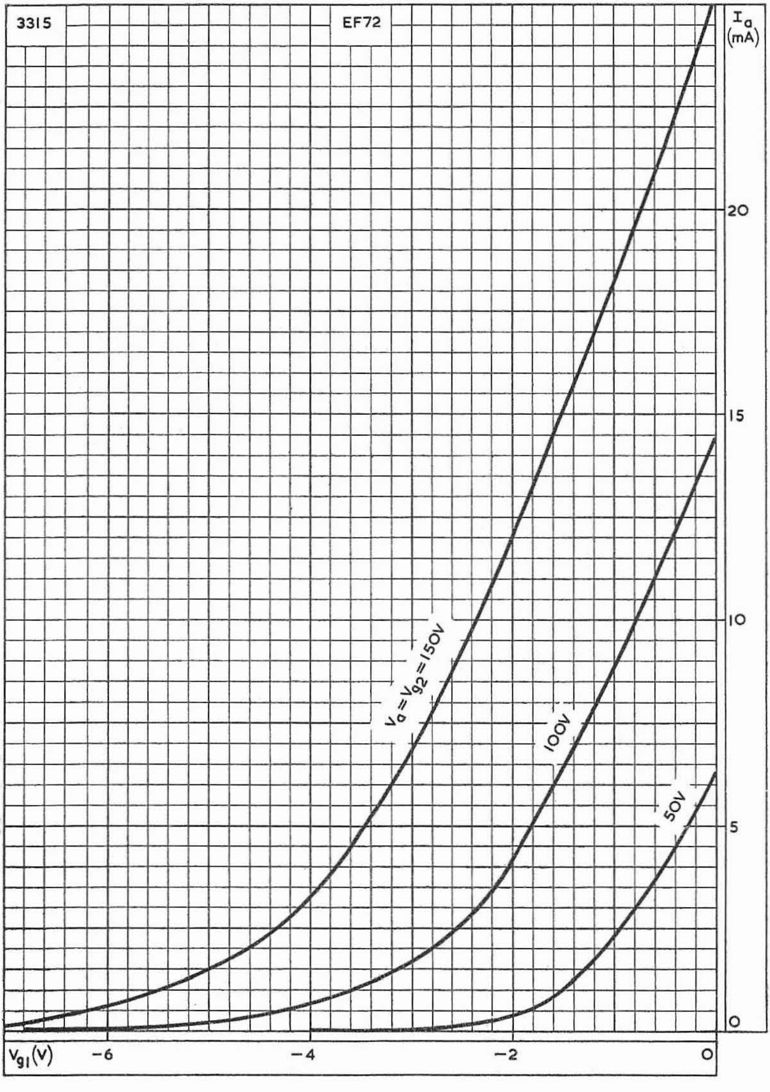
3271

All dimensions in mm

SUBMINIATURE R.F. PENTODE

EF72

High slope r.f. pentode

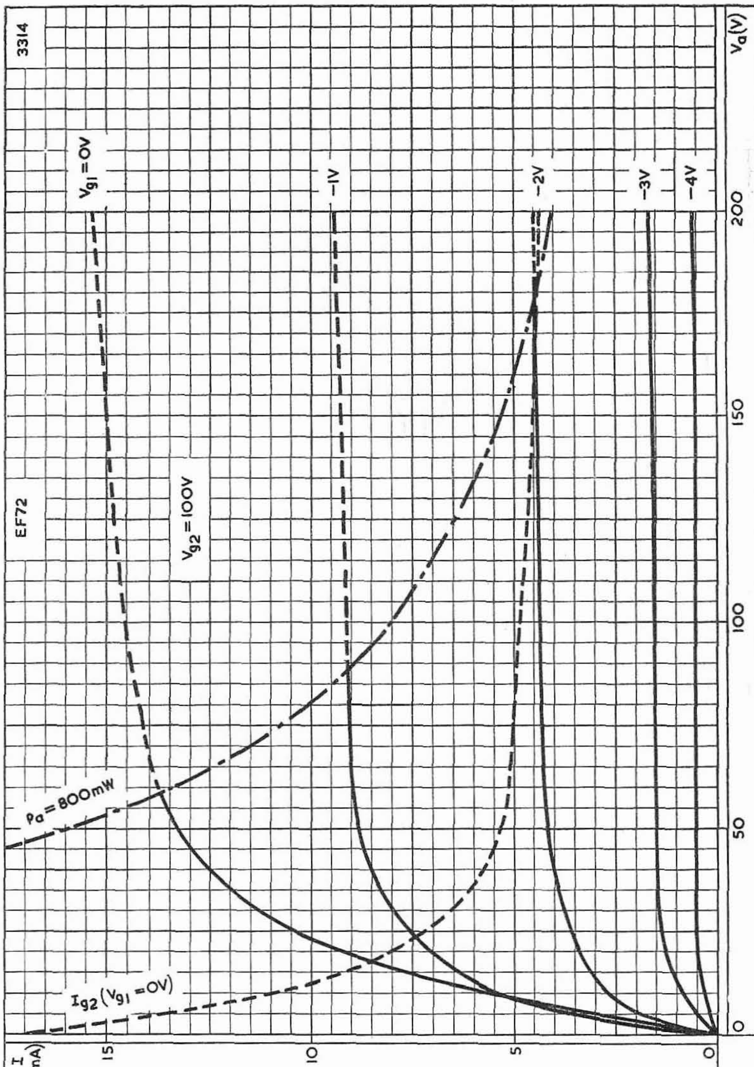


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS VALUES OF ANODE AND SCREEN-GRID VOLTAGES

EF72

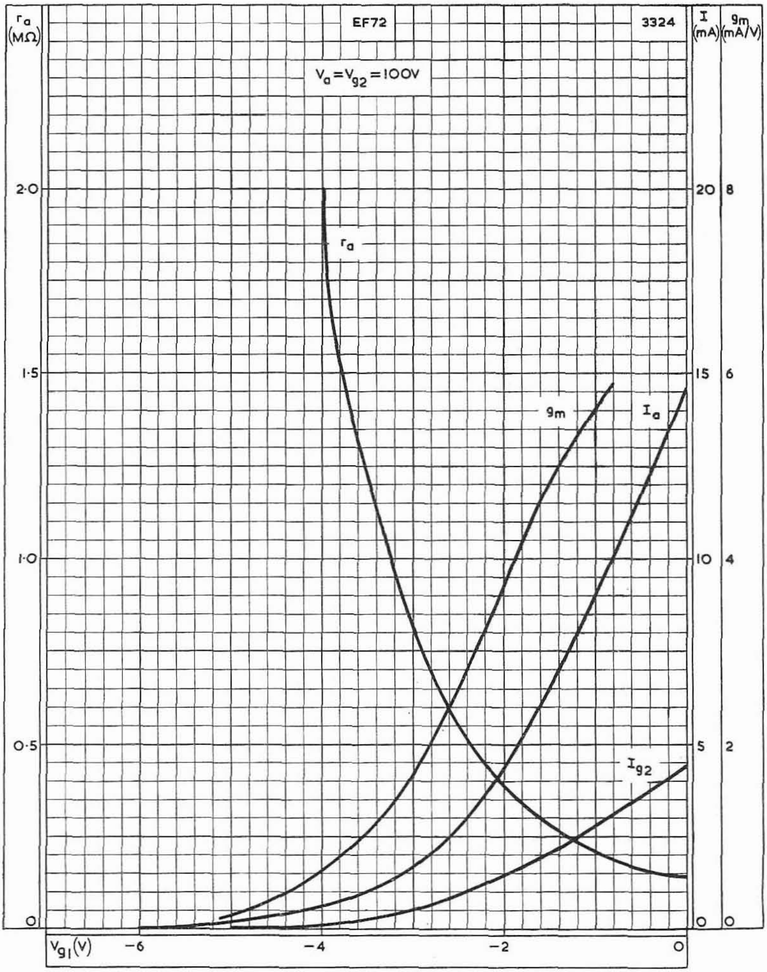
SUBMINIATURE R.F. PENTODE

High slope r.f. pentode



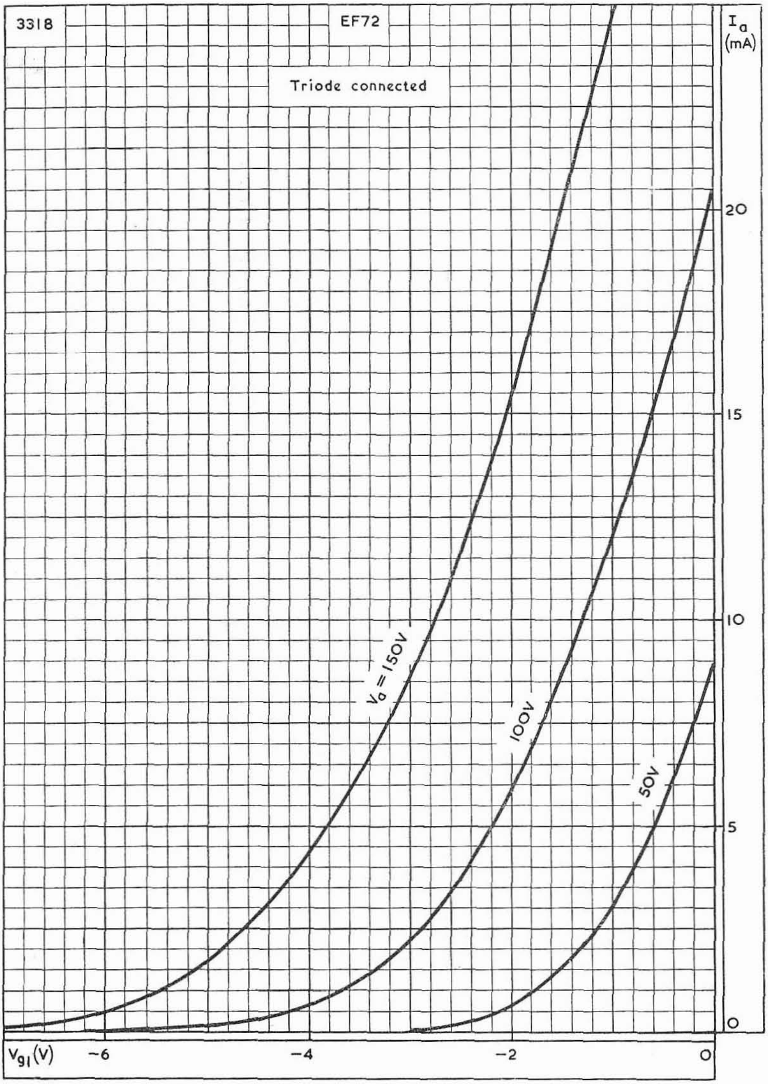
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=100V$

High slope r.f. pentode



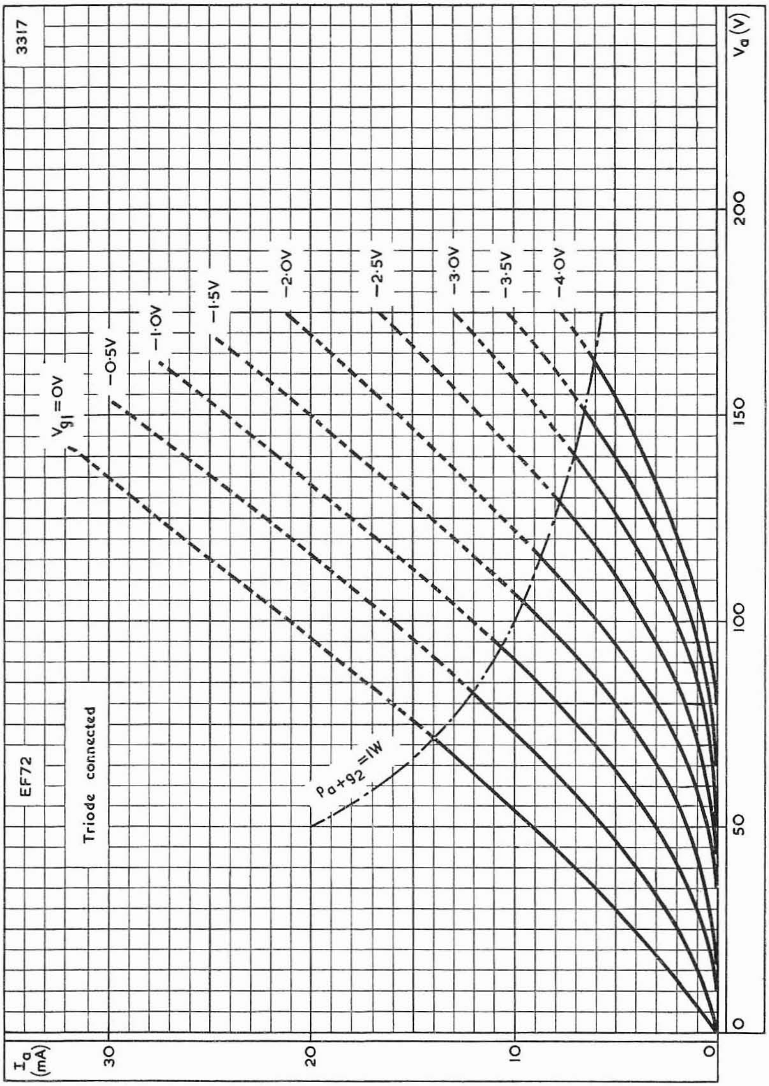
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 100V$



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS VALUES OF ANODE VOLTAGE, WHEN CONNECTED AS A TRIODE

High slope r.f. pentode

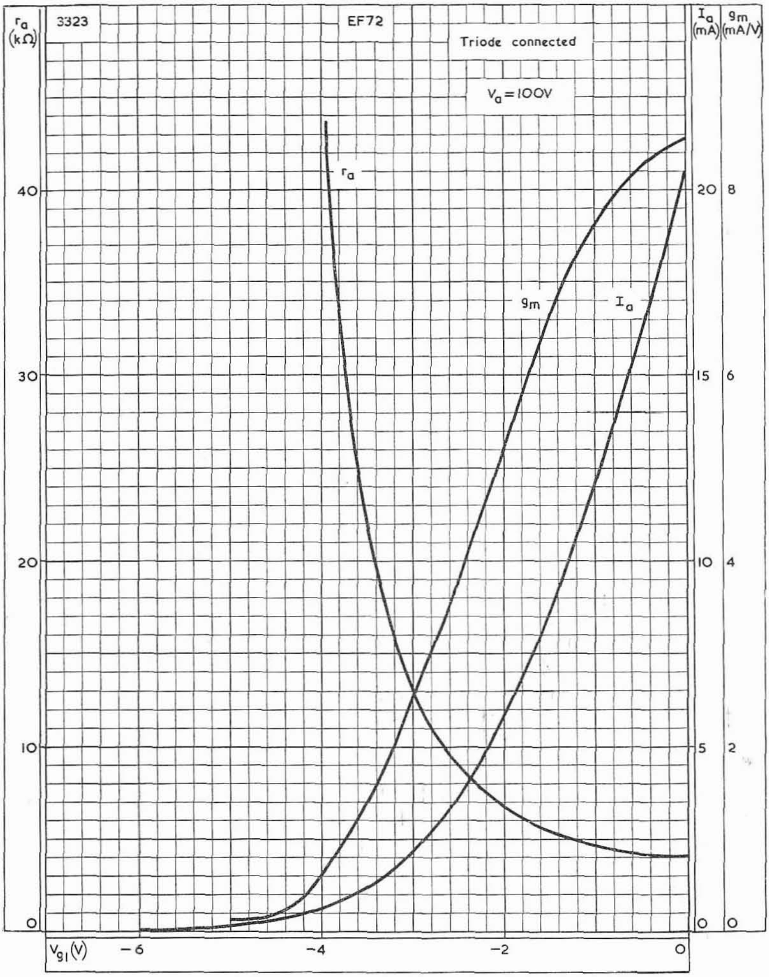


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER, WHEN CONNECTED AS A TRIODE

EF72

SUBMINIATURE R.F. PENTODE

High slope r.f. pentode



ANODE CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE, WHEN CONNECTED AS A TRIODE $V_a = 100V$

SUBMINIATURE HIGH SLOPE PENTODE

EF73

High slope pentode primarily intended for industrial applications.

HEATER

V_h	6.3	V
I_h	200	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and, therefore, in the interests of satisfactory life, it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to the chassis and should result in a bulb temperature of 100°C.

CAPACITANCES

	Shielded	Unshielded	
c_{a-g1}	<0.15	<0.2	pF
c_{in}	4.5	5.0	pF
c_{out}	5.0	3.0	pF

CHARACTERISTICS

V_a	100	V
V_{g3}	0	V
V_{g2}	100	V
I_a	7.5	mA
I_{g2}	2.5	mA
V_{g1}	−2.0	V
g_m	5.5	mA/V
r_a	250	kΩ
μ_{g1-g2}	28	
V_{g3}max. (for $I_a=100\mu A$)	−60	V

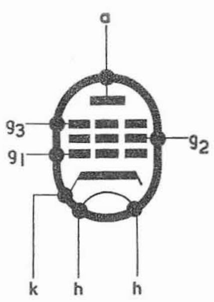
EF73

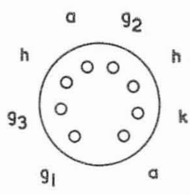
SUBMINIATURE HIGH SLOPE PENTODE

High slope pentode primarily intended for industrial applications.

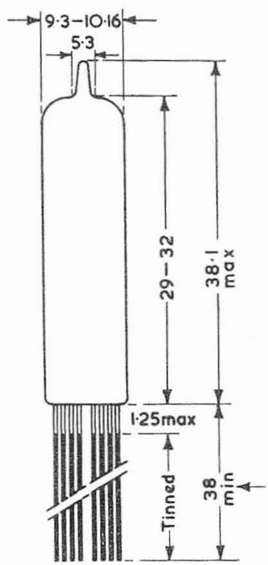
LIMITING VALUES

$V_{a(b)}$ max.	300	V
V_{a} max.	175	V
$V_{g2(b)}$ max.	300	V
V_{g2} max.	175	V
I_{k} max.	14	mA
p_{a} max.	1.5	W
p_{g2} max.	1.0	W
p_{a+g2} max.	2.0	W
V_{g1} max. ($I_{g1}=+0.3\mu A$)	−1.3	V
R_{g1-k} max.	500	kΩ
R_{h-k} max.	20	kΩ
V_{h-k} max.	100	V





B8D/F Base



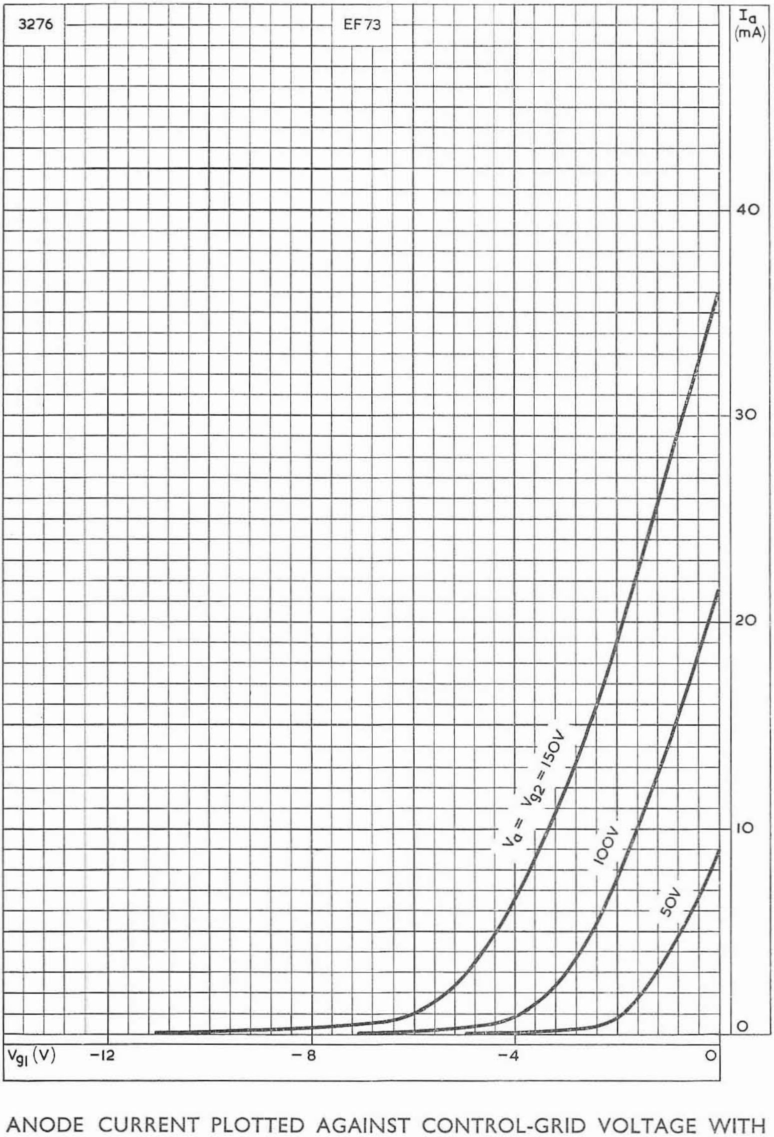
3272

All dimensions in mm

SUBMINIATURE HIGH SLOPE PENTODE

EF73

High slope pentode primarily intended for industrial applications.

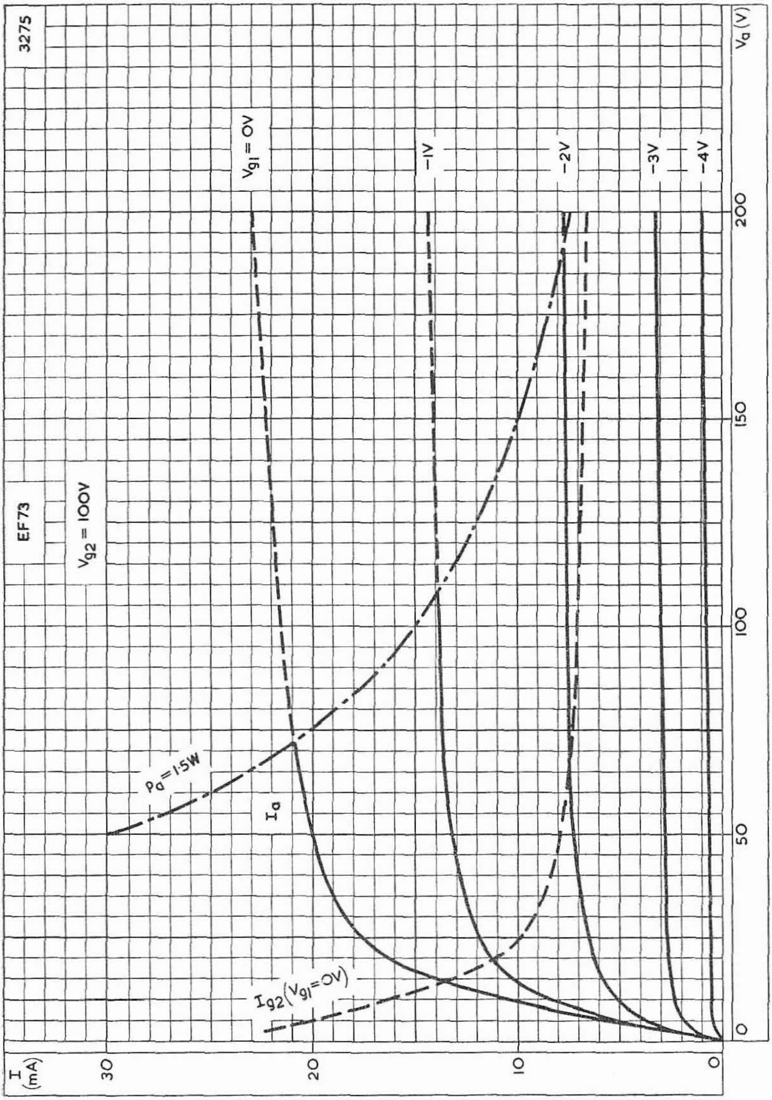


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGE AS PARAMETER

EF73

SUBMINIATURE HIGH SLOPE PENTODE

High slope pentode primarily intended for industrial applications.

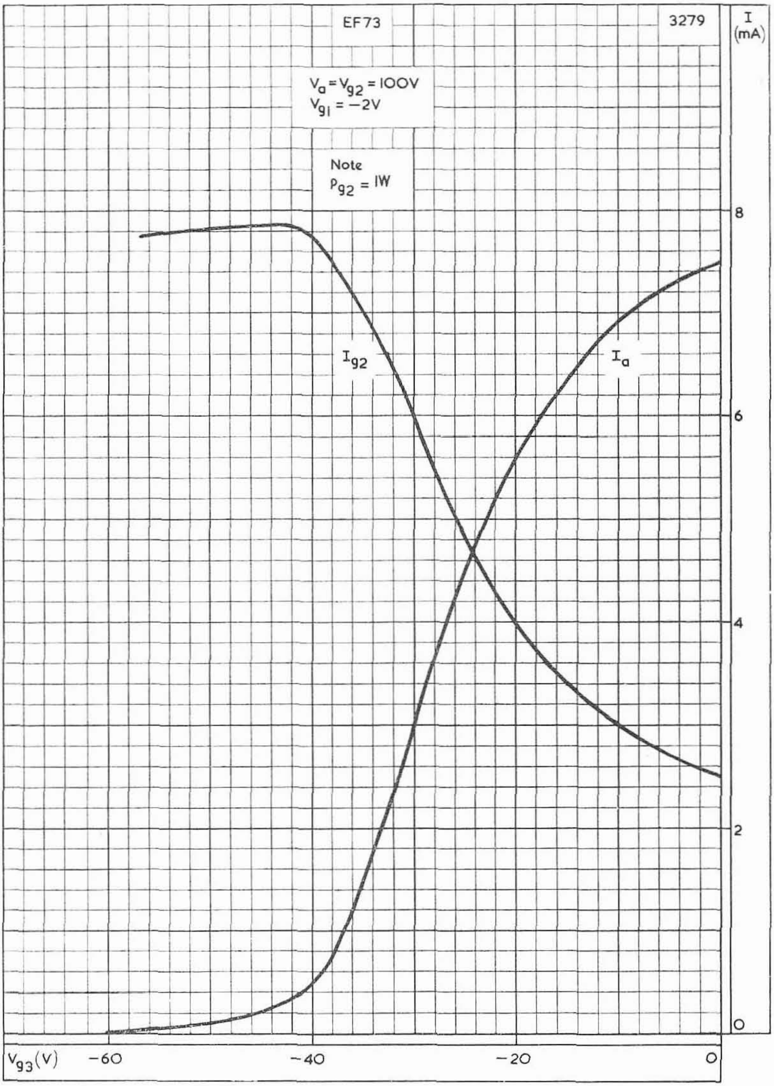


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

SUBMINIATURE HIGH SLOPE PENTODE

EF73

High slope pentode primarily intended for industrial applications.

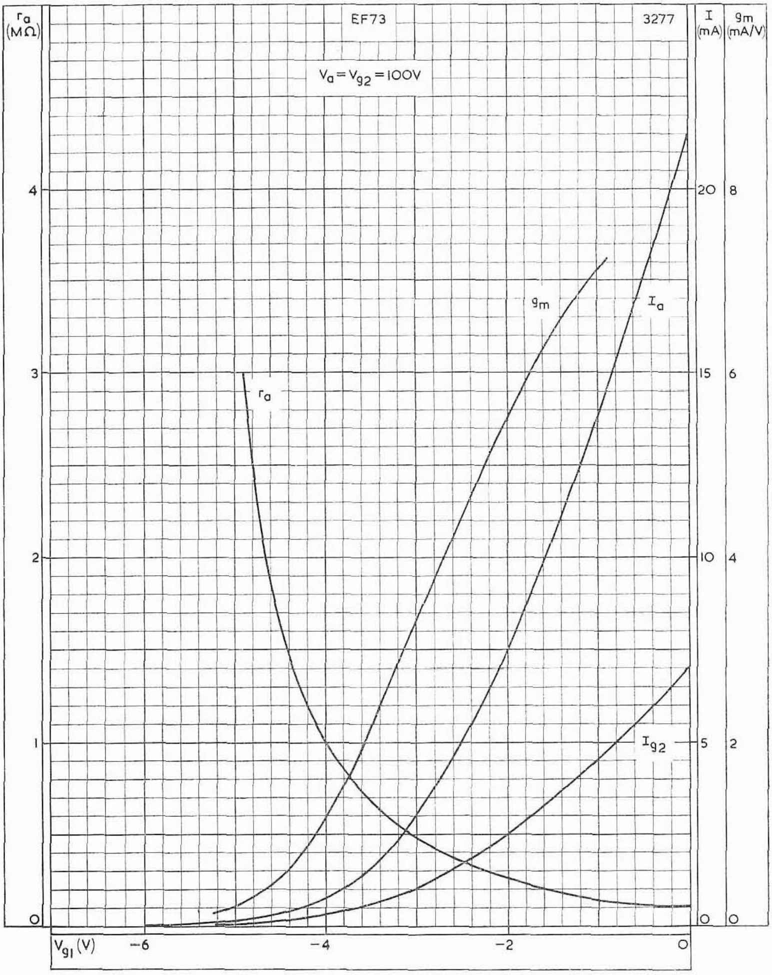


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE

EF73

SUBMINIATURE HIGH SLOPE PENTODE

High slope pentode primarily intended for industrial applications.

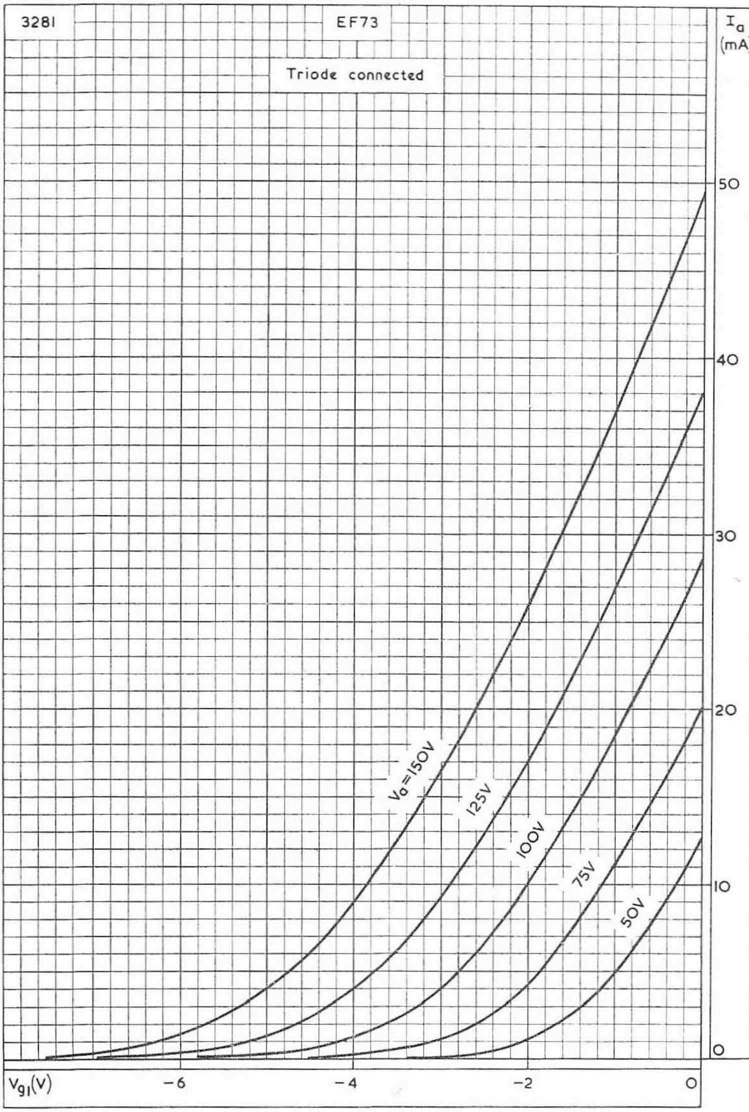


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE HIGH SLOPE PENTODE

EF73

High slope pentode primarily intended for industrial applications.

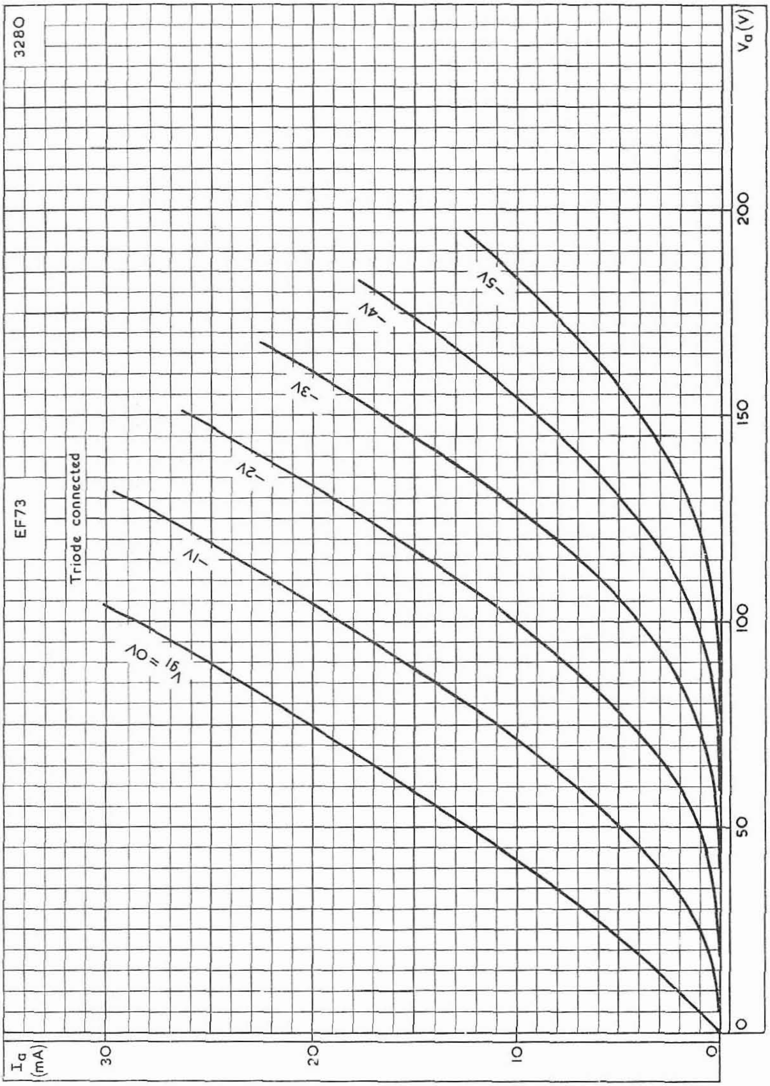


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER, WHEN CONNECTED AS A TRIODE

EF73

SUBMINIATURE HIGH SLOPE PENTODE

High slope pentode primarily intended for industrial applications.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER, WHEN CONNECTED AS A TRIODE

SUBMINIATURE LOW MICROPHONY PENTODE

EF74

Voltage amplifying pentode primarily designed for low microphony applications.

HEATER

V_h	6.3	V
I_h	200	mA

To reduce the possibility of hum the heater should be operated from d.c.

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and therefore, in the interest of long life, it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to the chassis.

CAPACITANCES (measured with external shield) ←

c_{a-g1}	<0.3	pF
c_{in}	3.6	pF
c_{out}	4.2	pF

CHARACTERISTICS

V_a	100	V
V_{g3}	0	V
V_{g2}	100	V
I_a	7.0	mA
I_{g2}	2.4	mA ←
V_{g1}	−1.4	V
g_m	3.1	mA/V ←
r_a	200	kΩ ←
μ_{g1-g2}	28	

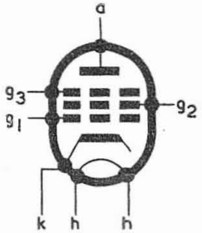
EF74

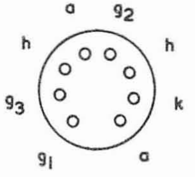
SUBMINIATURE LOW MICROPHONY PENTODE

Voltage amplifying pentode primarily designed for low microphony applications.

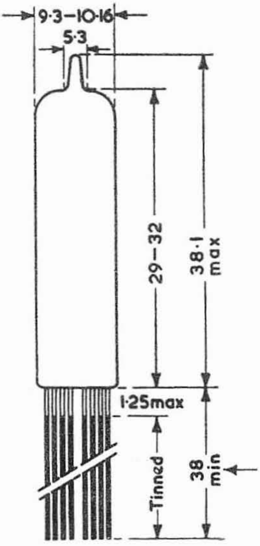
LIMITING VALUES

$V_{a(b)}$ max.	300	V
V_a max.	175	V
$V_{g2(b)}$ max.	300	V
V_{g2} max.	175	V
p_a max.	900	mW←
p_{g2} max.	350	mW←
I_k max.	10	mA
R_{g1-k} max. (cathode bias)	3.0	MΩ
R_{g1-k} max. (fixed bias)	1.0	MΩ
V_{h-k} max.	100	V





B8D/F Base



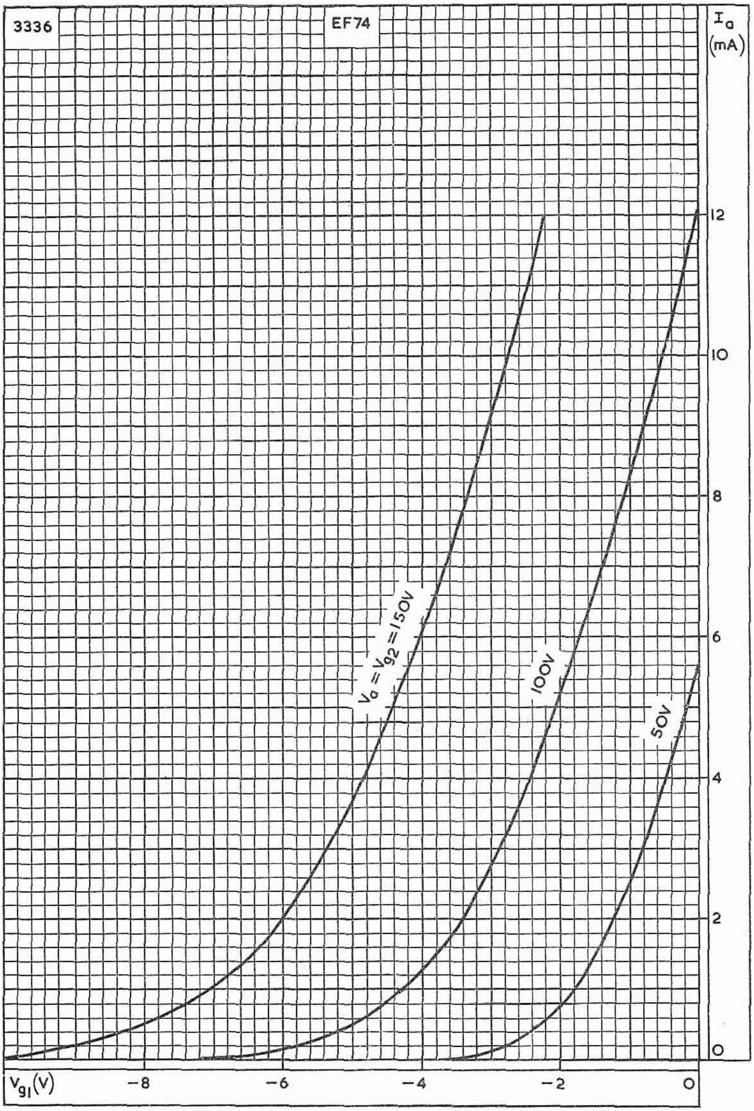
3326

All dimensions in mm

SUBMINIATURE LOW MICROPHONY PENTODE

EF74

Voltage amplifying pentode primarily designed for low microphony applications.

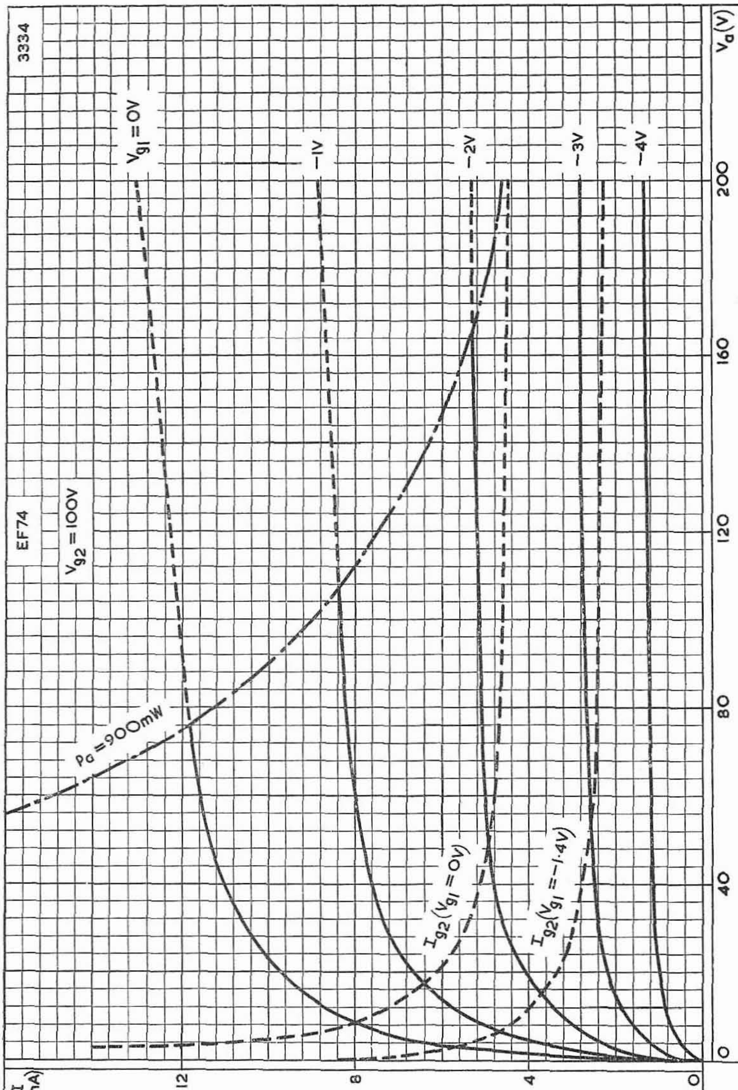


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGE AS PARAMETER

EF74

SUBMINIATURE LOW MICROPHONY PENTODE

Voltage amplifying pentode primarily designed for low microphony applications.

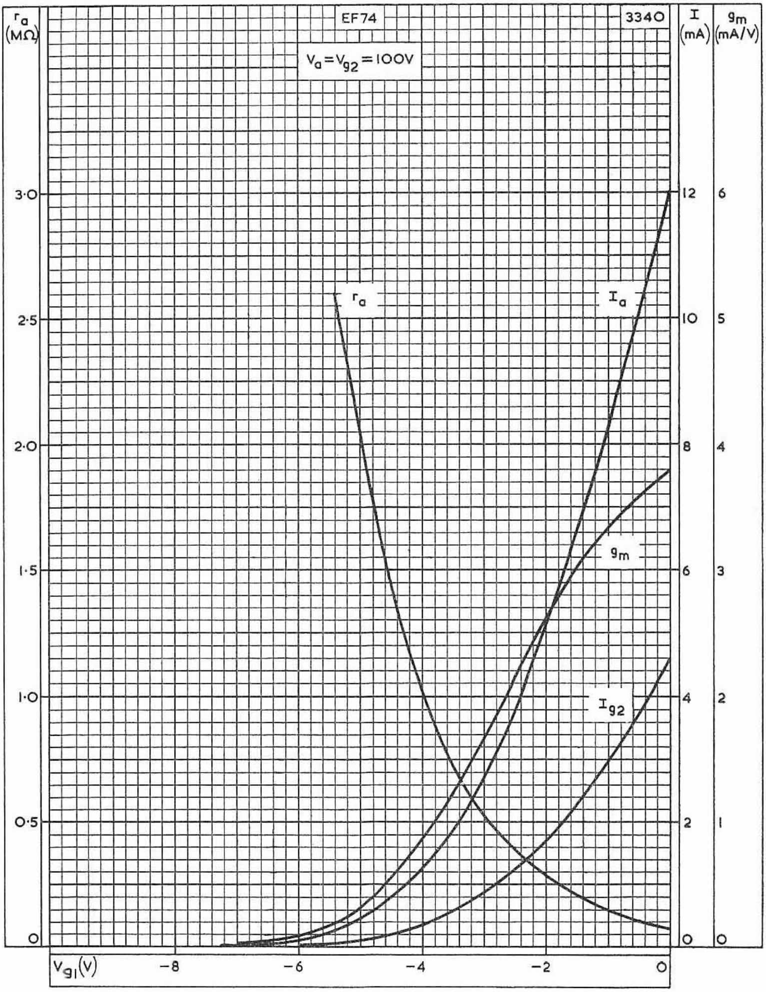


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

SUBMINIATURE LOW MICROPHONY PENTODE

EF74

Voltage amplifying pentode primarily designed for low microphony applications.



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

VARIABLE-MU A.F. PENTODE

EF83

Variable-mu a.f. pentode for use as a controlled-gain audio amplifier.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h	6.3	V
I_h	200	mA

MOUNTING POSITION

Any

CAPACITANCES (measured without external shield)

c_{in}	4.0	pF
c_{out}	5.0	pF
c_{a-g1}	<50	mpF
c_{g1-h}	<2.5	mpF

CHARACTERISTICS

V_a	250	V
V_{g3}	0	V
V_{g2}	50	V
V_{g1}	−1.6	V
I_a	4.0	mA
I_{g2}	1.15	mA
g_m	1.6	mA/V
r_a	1.25	MΩ
μ_{g1-g2}	10	
V_{g1} max. ($I_{g1} = +0.3\mu A$)	−1.3	V

OPERATING CONDITIONS

V_b	250		V
R_a	100		kΩ
V_{g3}	0		V
R_{g2}	390		kΩ
R_{g1}	3.0		MΩ
*R_{g1}	1.0		MΩ
R_{source}	≤ 200		kΩ
$V_{out(r.m.s.)}$	8.0		V
V_{g1}	−1.0	−20	V
I_a	1.8	1.65	mA
I_{g2}	550	250	μA
V_{out}/V_{in}	105	16	
D_{tot}	1.5	2.3	%

*Grid resistor of the following valve.

Under these operating conditions, the following total distortion figures apply.

$V_{out(r.m.s.)}$	3.0	5.0	8.0	15	V
D_{tot} ($-V_{g1}$ = 1 to 3V)	0.8	1.0	1.5	2.5	%
D_{tot} ($-V_{g1}$ = 3 to 20V)	1.0	1.5	2.3	3.5	%

EF83

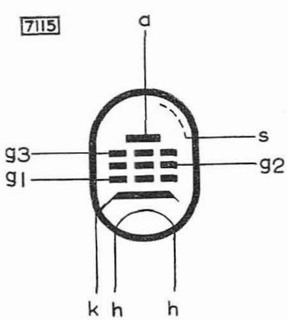
VARIABLE-MU A.F. PENTODE

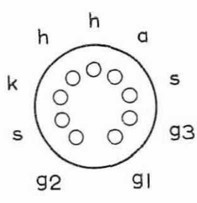
LIMITING VALUES

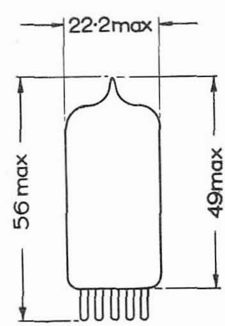
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
p_{g2} max.	200	mW
I_k max.	6.0	mA
R_{g3-k} max.	10	kΩ
R_{g1-k} max.	3.0	MΩ
V_{h-k} max. (cathode positive)	100	V
V_{h-k} max. (cathode negative)	50	V
R_{h-k} max.	20	kΩ

MICROPHONY AND HUM

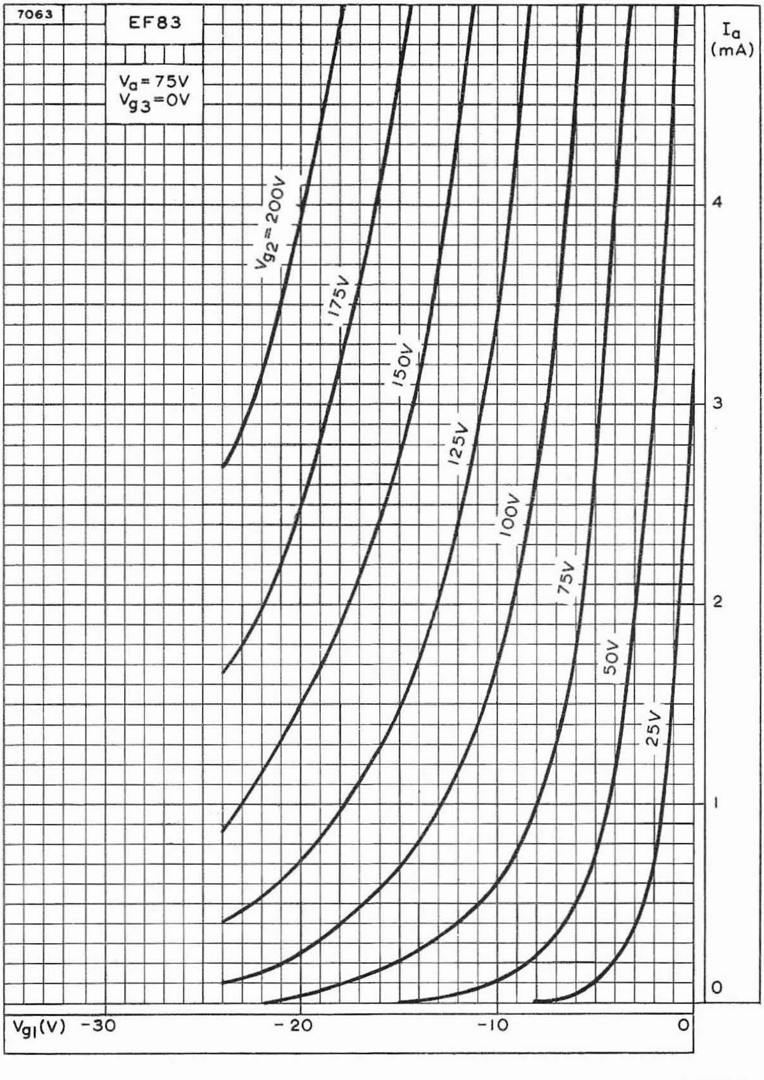
This valve can be used without special precautions against microphony and hum in circuits in which the input voltage is $\geqq$2mV at f = 1kc/s and $-V_{g1} \leqq 1$V for an output of 50mW from the output stage.



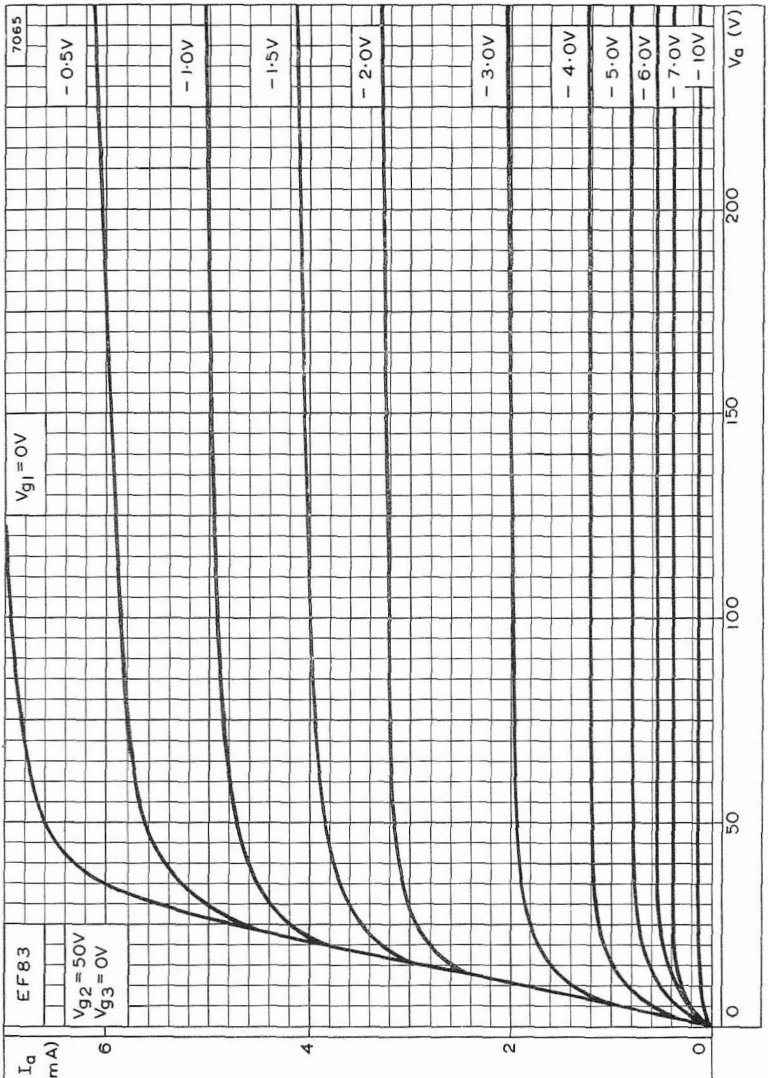




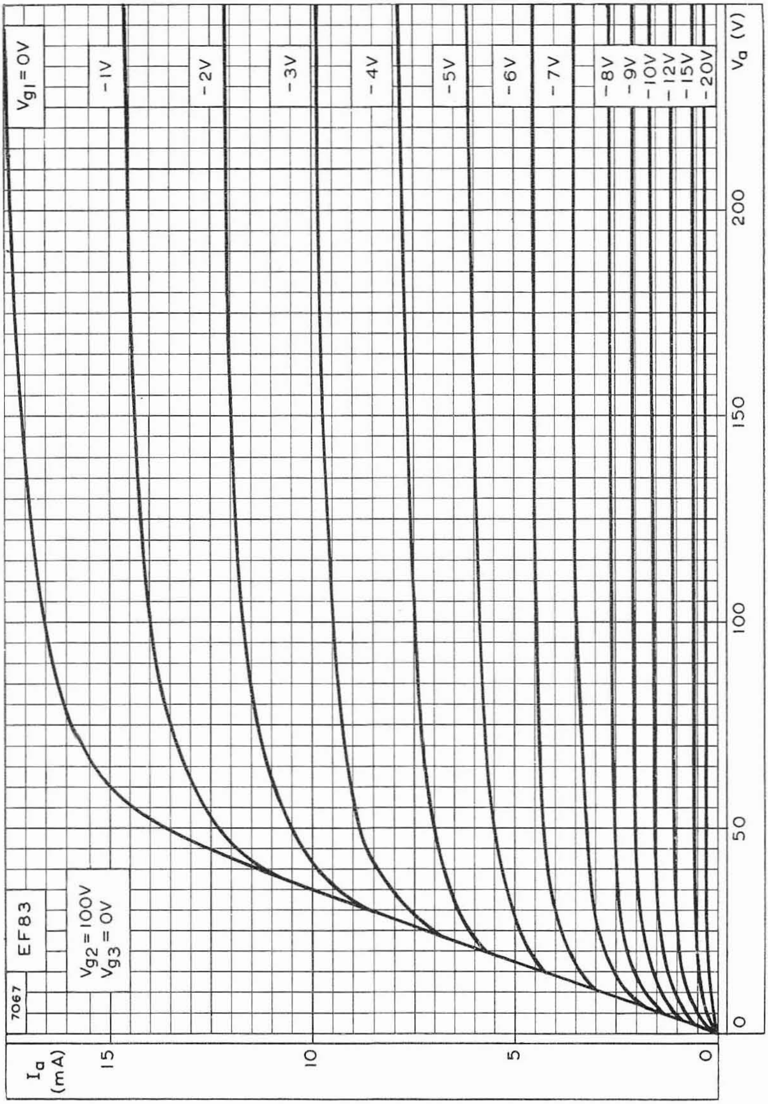
B9A Base
All dimensions in mm



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



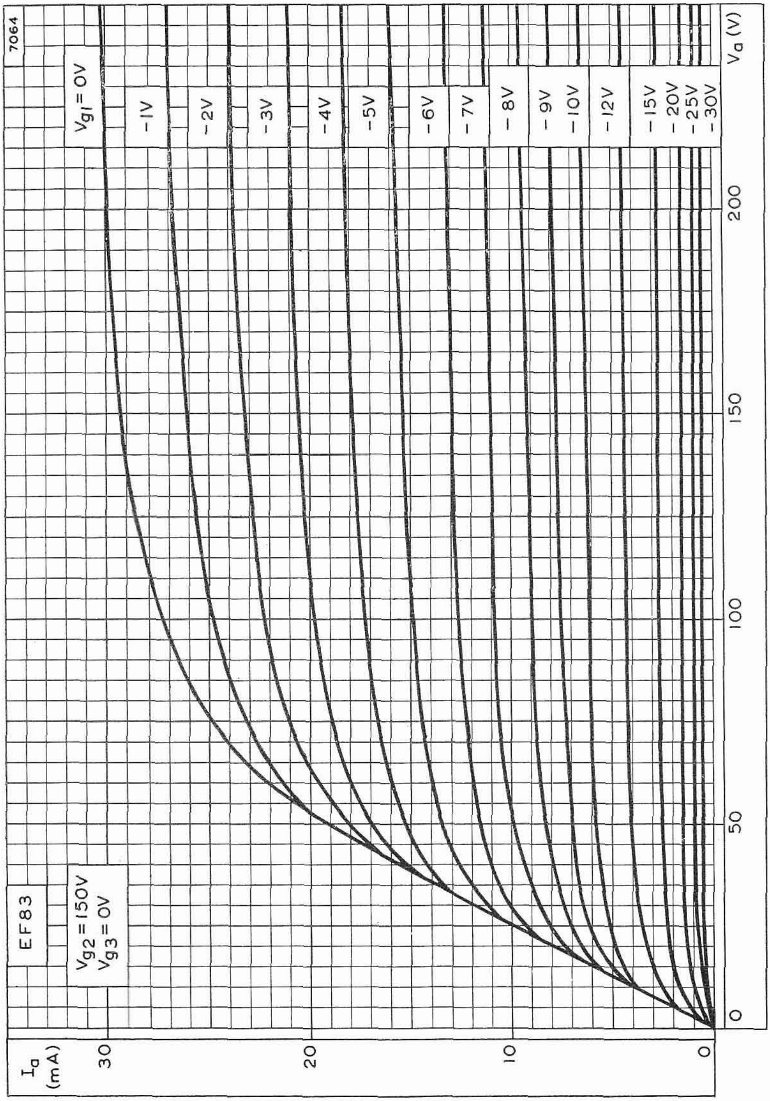
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 50V$



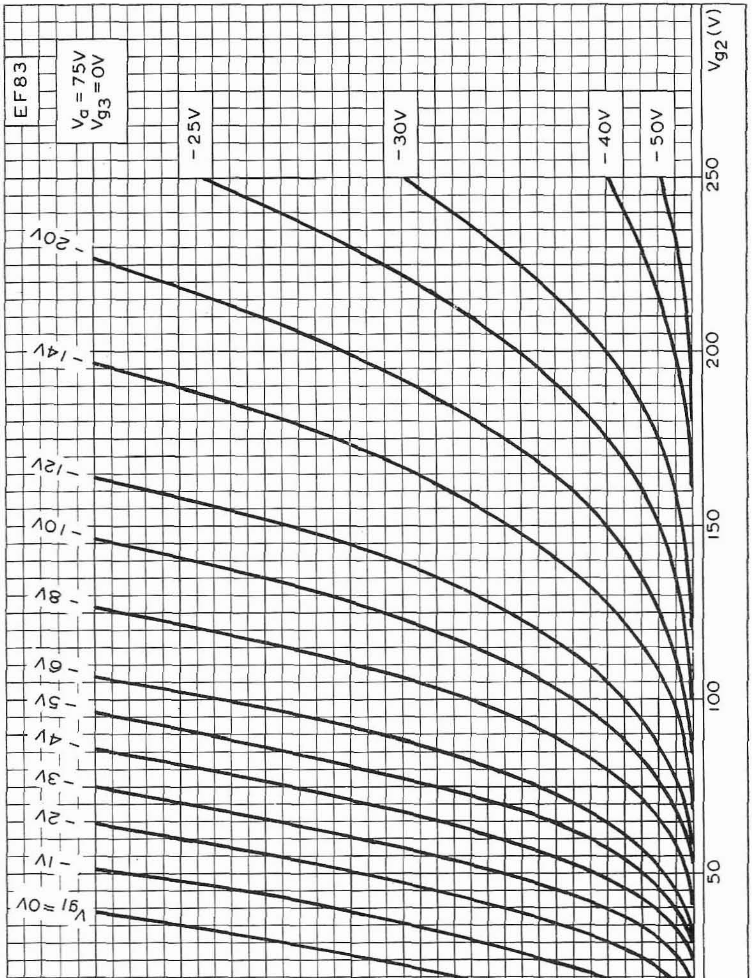
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 100V$

EF83

VARIABLE-MU A.F. PENTODE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 150V$



SCREEN-GRID CURRENT PLOTTED AGAINST SCREEN-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

R.F. PENTODE

EF97

Pentode with variable mutual conductance for use as r.f. amplifier, i.f. amplifier and mixer in equipment operating directly from a 6V, 12V or 24V battery, on or off charge.

HEATER

V_h	6.3	V
I_h	300	mA

CAPACITANCES

c_{out}	4.0	pF
c_{in}	6.5	pF
c_{a-g1}	15	mpF
c_{g1-g2}	3.0	pF

CHARACTERISTICS

V_a	6.3	6.3	12.6	12.6	25	V
V_{g3}	0	0	0	0	0	V
V_{g2}	1.6	3.2	3.2	6.3	6.3	V
V_{g1}	†	†	†	†	†	V
I_a	0.4	1.0	1.0	3.0	3.3	mA
I_{g2}	0.15	0.4	0.35	1.1	0.95	mA
g_m	0.5	1.0	1.1	1.9	2.1	mA/V
r_a	200	70	200	150	50	kΩ
$*V_{g1}$	−2.5	−2.5	−2.5	−3.5	−3.5	V
$**V_{g1}$	−3.5	−4.0	−4.0	−5.0	−5.0	V
R_{eq}	15	8.0	7.0	5.5	5.0	kΩ

†Obtained by grid current biasing, $R_{g1} = 10M\Omega$
*For 10 : 1 reduction in g_m
**For 20 : 1 reduction in g_m

OPERATING CONDITIONS AS R.F. MIXER (r.f. voltage on g_1, oscillator voltage on g_3)

V_b	6.3	12.6	25	V
R_{g2}	4.7	3.9	12	kΩ
R_{g3}	100	100	100	kΩ
$V_{osc(r.m.s.)}$	5.0	10	10	V
V_{g1}	†	†	†	V
I_a	0.42	1.1	1.5	mA
I_{g2}	0.6	1.6	1.5	mA
I_{g3}	27	62.5	50	µA
g_c	300	550	655	µA/V
r_a	49	47	47	kΩ
R_{eq}	55	40	40	kΩ
$*V_{g1}$	−2.5	−3.5	−3.0	V
$**V_{g1}$	−3.5	−5.0	−4.0	V

†Obtained by grid current biasing, $R_{g1} = 10M\Omega$
*For 10 : 1 reduction in g_m
**For 20 : 1 reduction in g_m

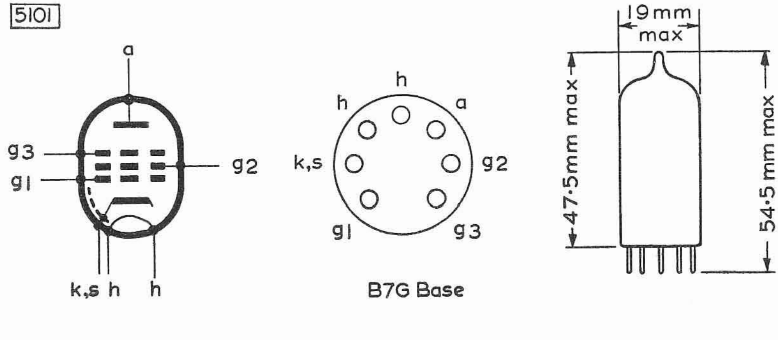
EF97

R.F. PENTODE

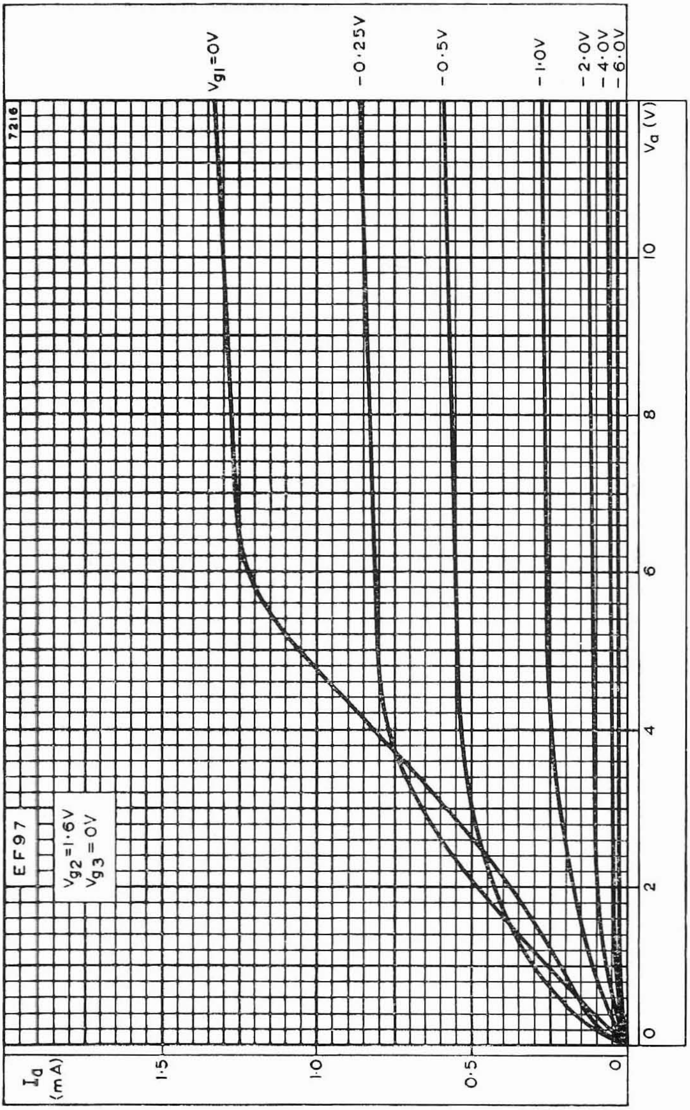
LIMITING VALUES

V_a max.	50	V
P_a max.	500	mW
V_{g3} max.	50	V
V_{g2} max.	50	V
P_{g2} max.	500	mW
I_k max.	15	mA
R_{g1} max.	22	MΩ
R_{g3} max.	5.0	MΩ
V_{h-k} max.	50	V

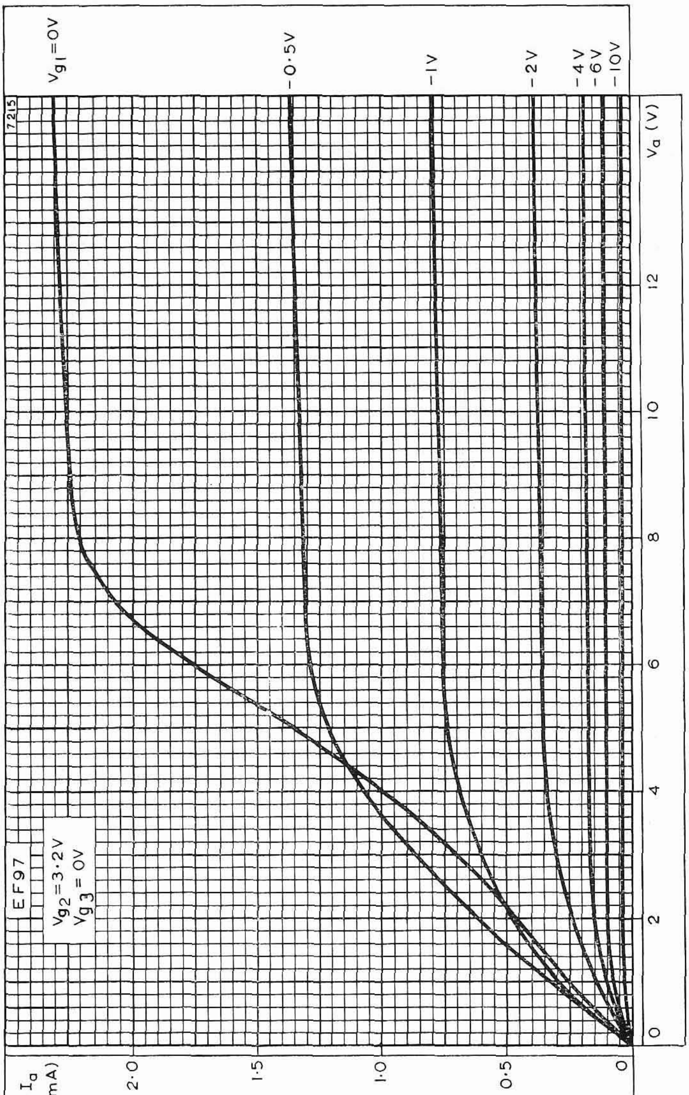
5101



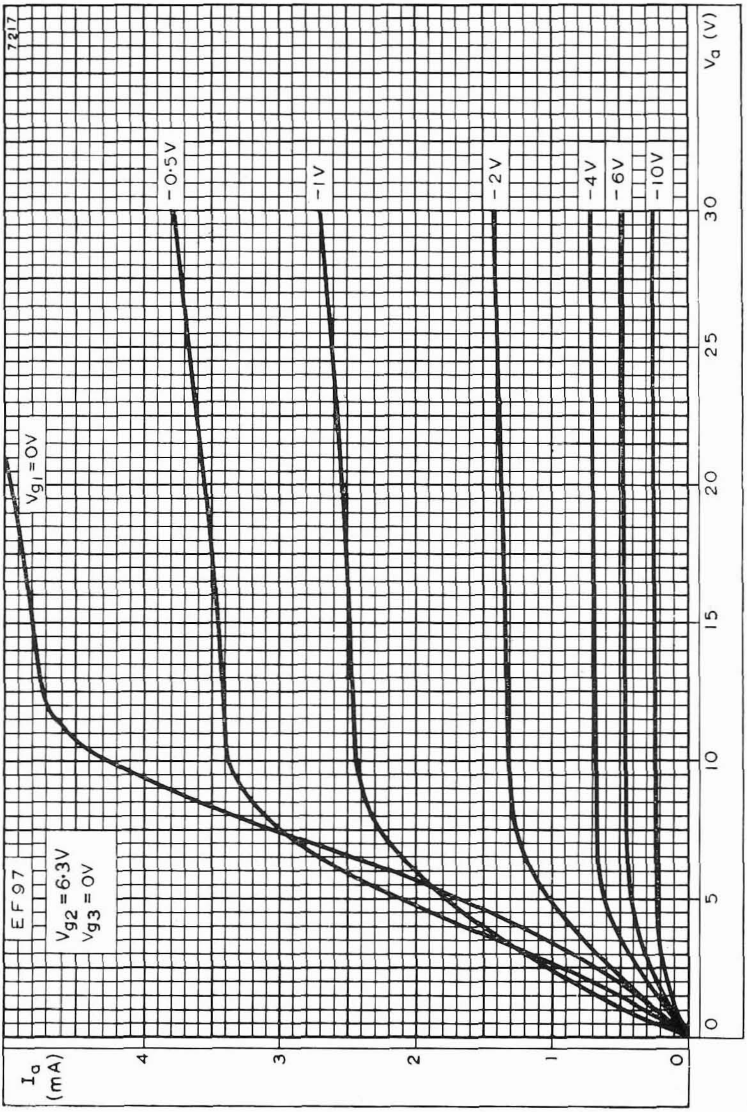
B7G Base



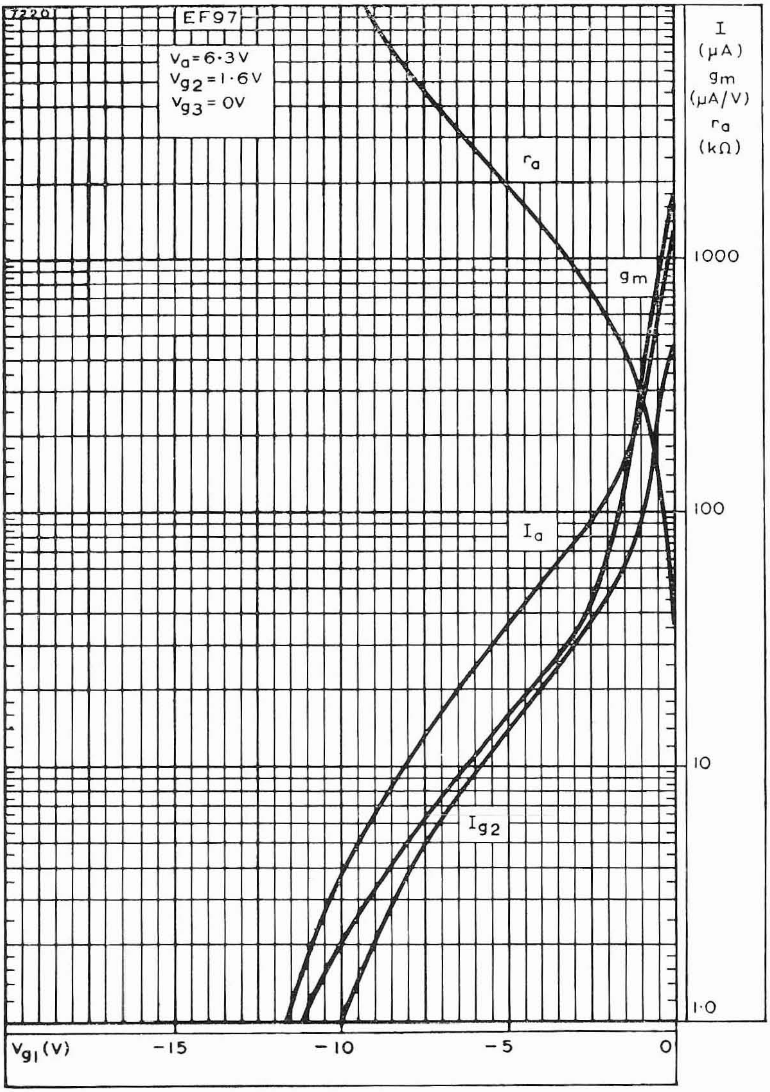
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 1.6V$



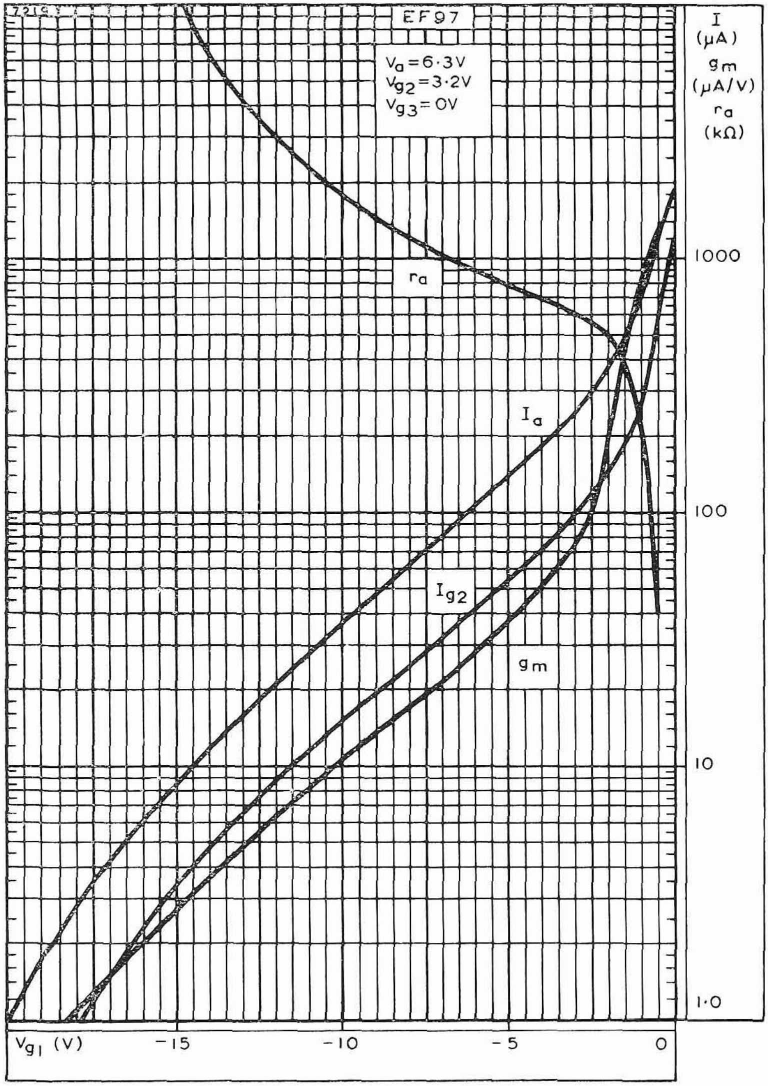
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 3.2V$



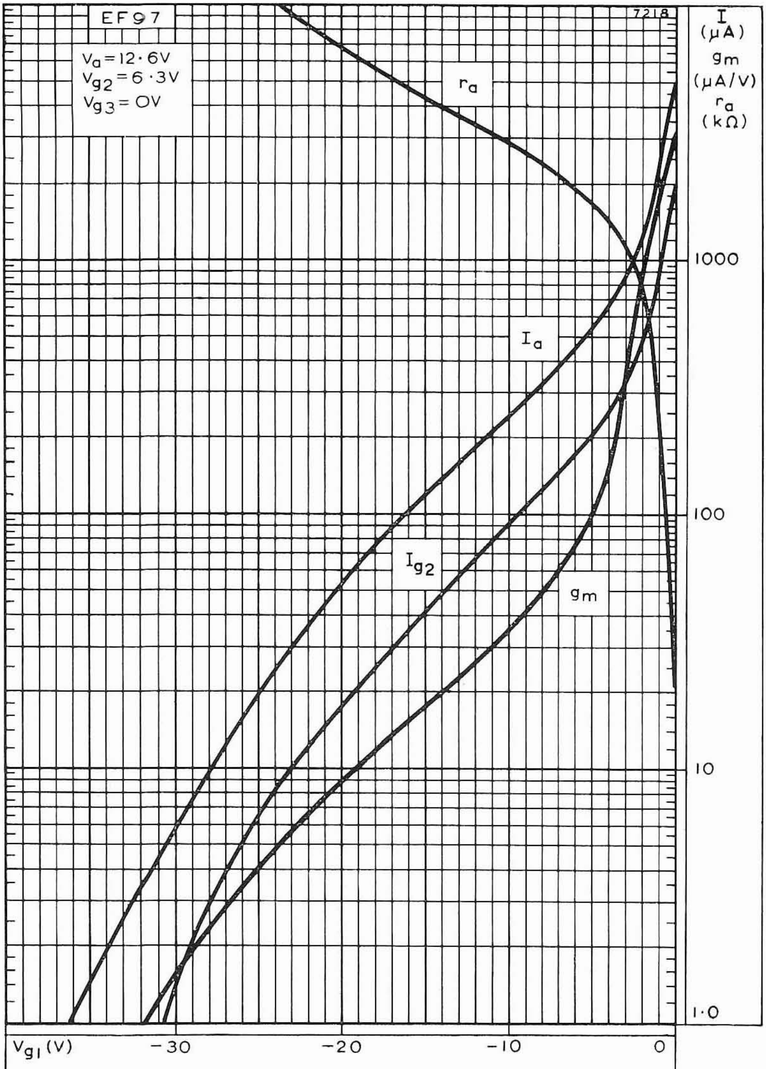
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 6.3V$



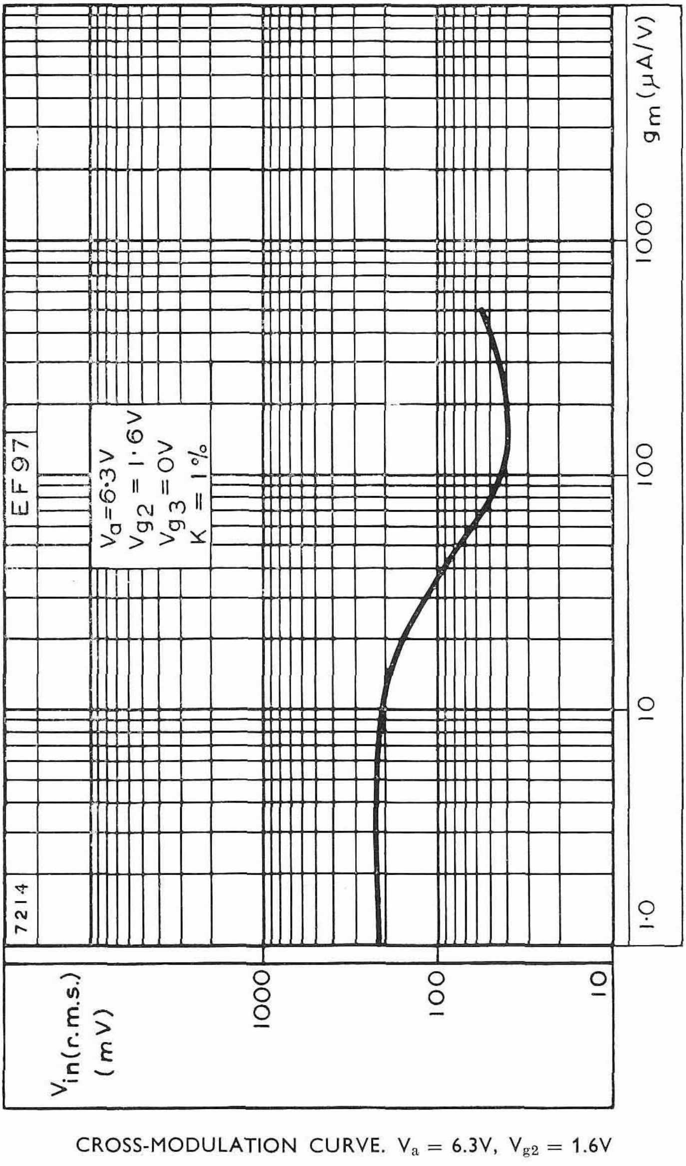
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. $V_a = 6.3V$, $V_{g2} = 1.6V$



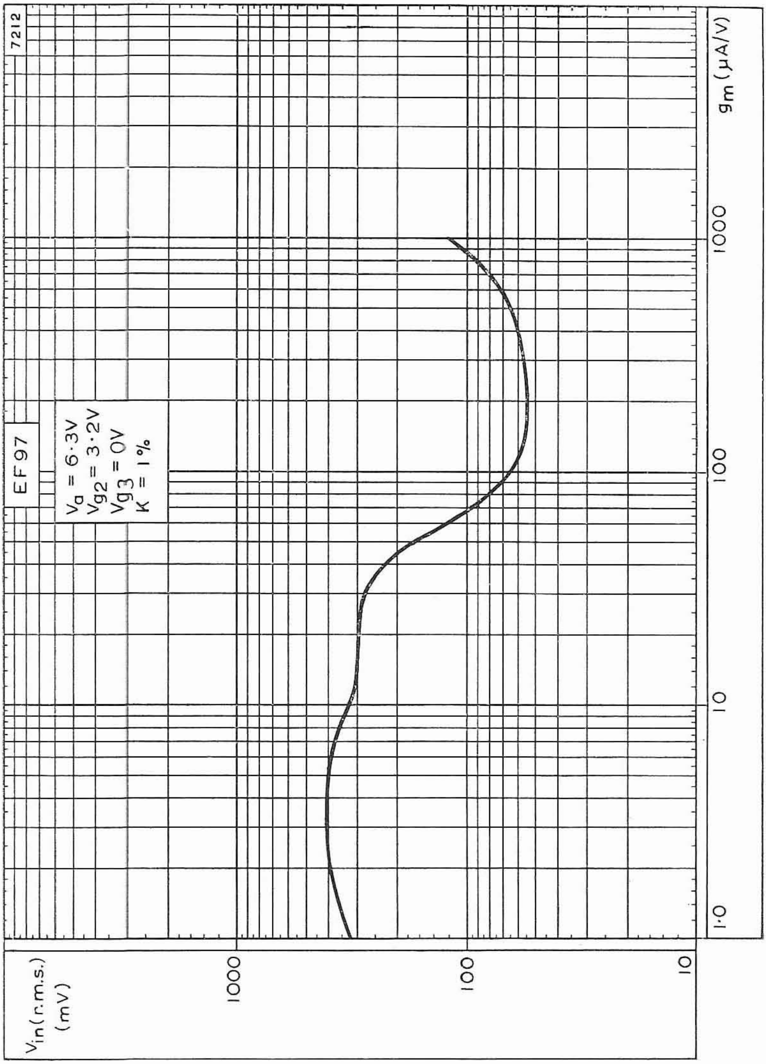
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = 6.3V$, $V_{g2} = 3.2V$



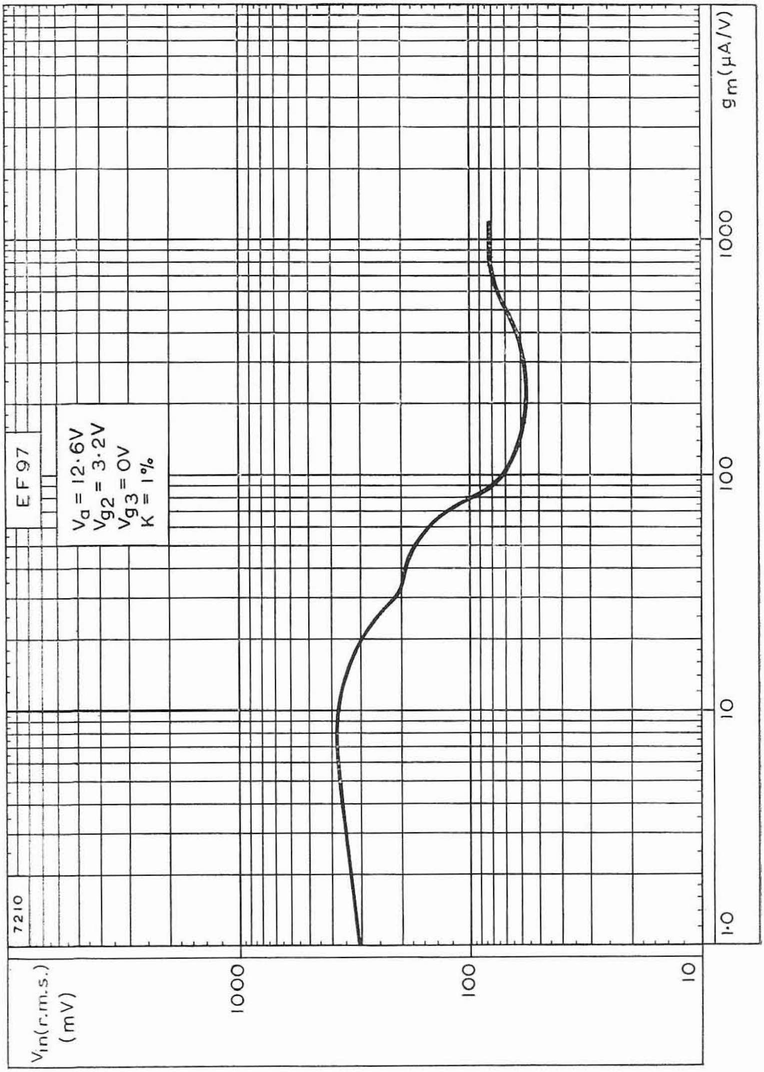
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = 12.6V$, $V_{g2} = 6.3V$



CROSS-MODULATION CURVE. $V_a = 6.3V$, $V_{g2} = 1.6V$



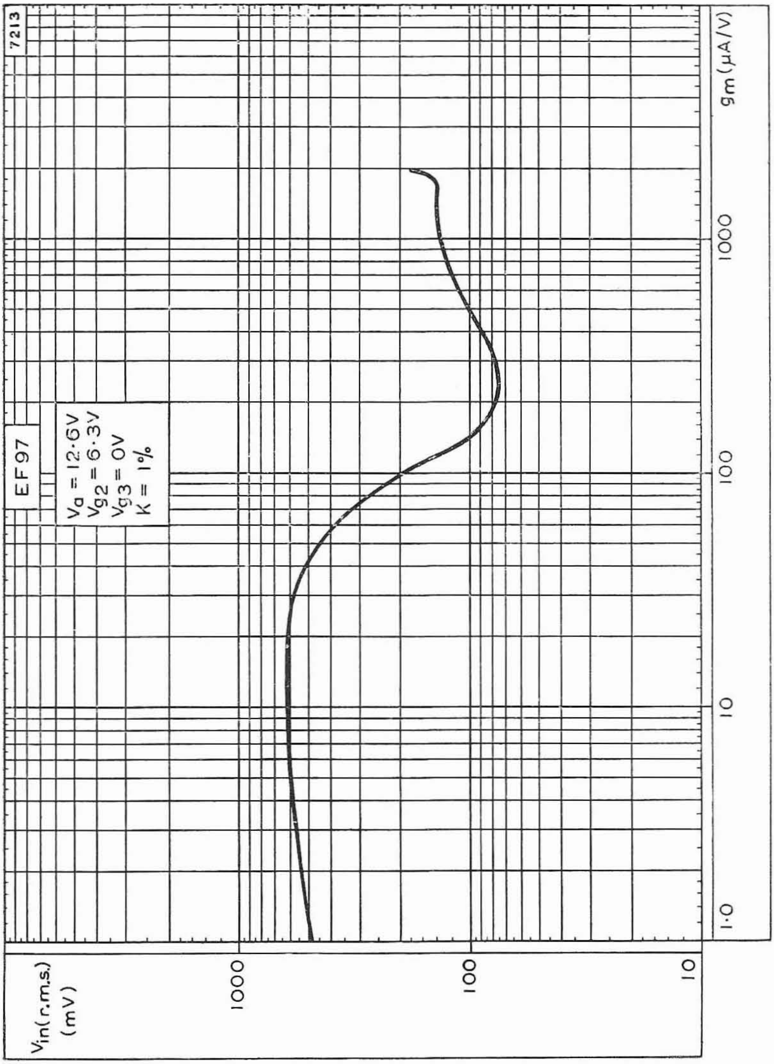
CROSS-MODULATION CURVE. $V_a = 6.3V$, $V_{g2} = 3.2V$



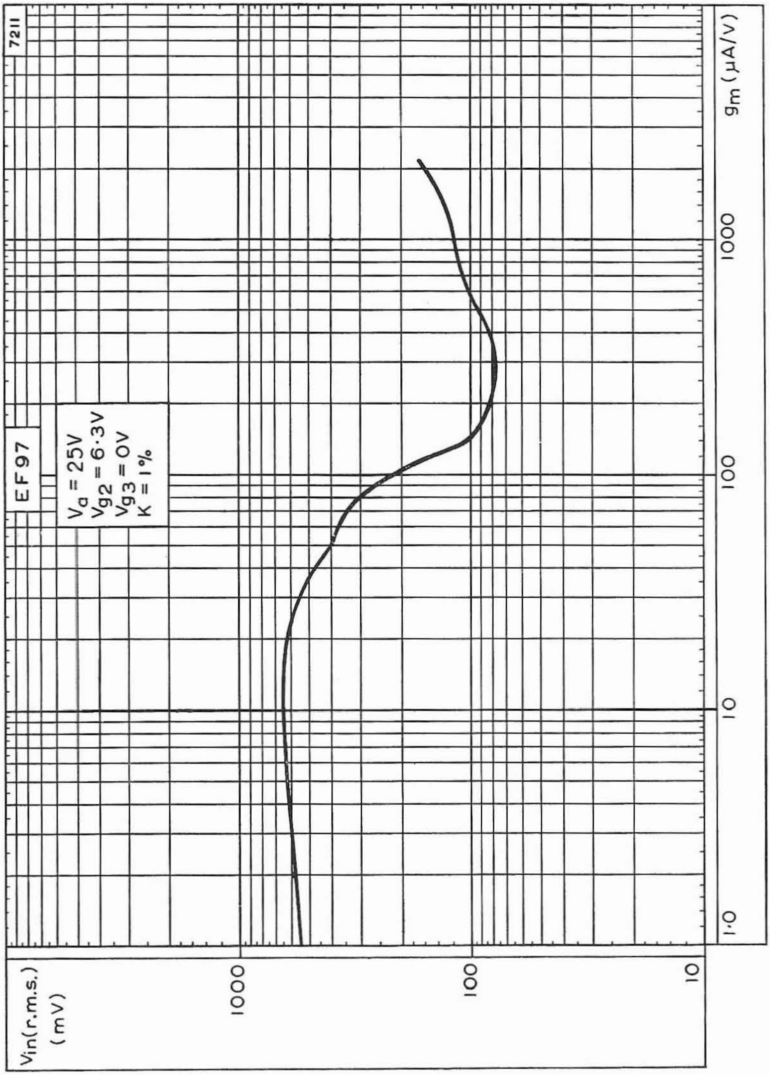
CROSS-MODULATION CURVE. $V_a = 12.6V$, $V_{g2} = 3.2V$

EF97

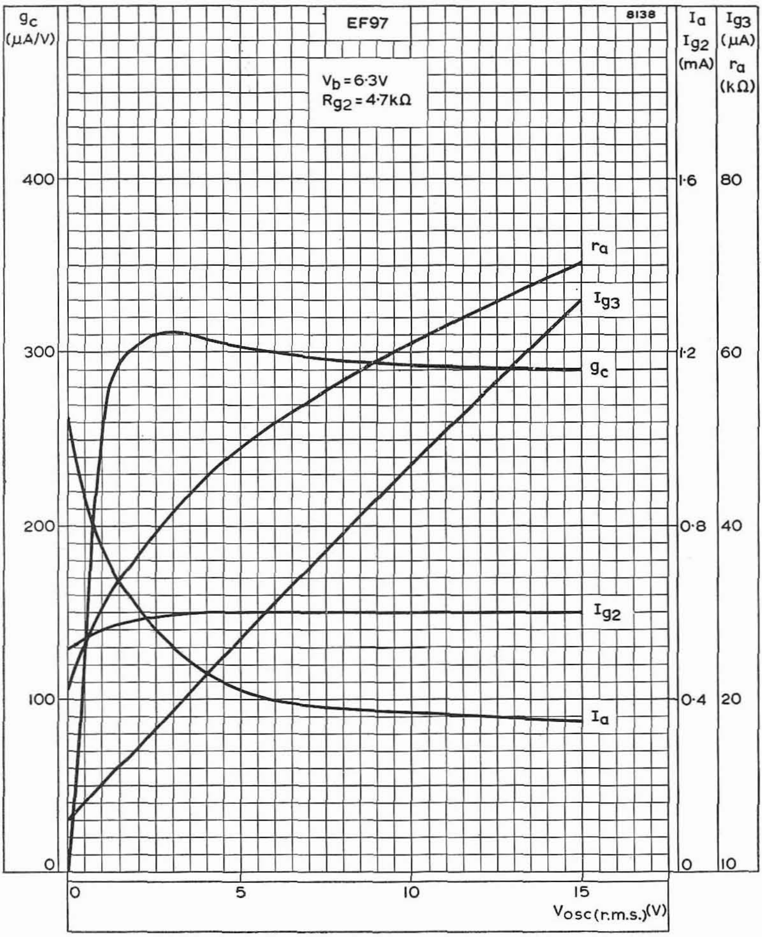
R.F. PENTODE



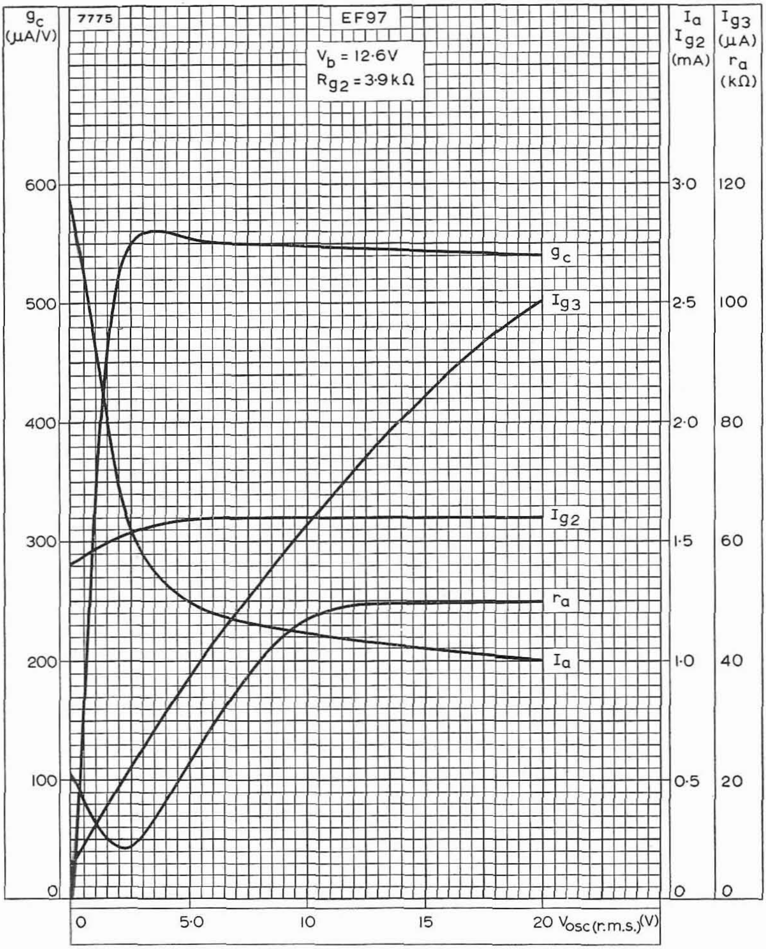
CROSS-MODULATION CURVE. $V_a = 12.6V$, $V_{g2} = 6.3V$



CROSS-MODULATION CURVE. $V_a = 25V$, $V_{g2} = 6.3V$



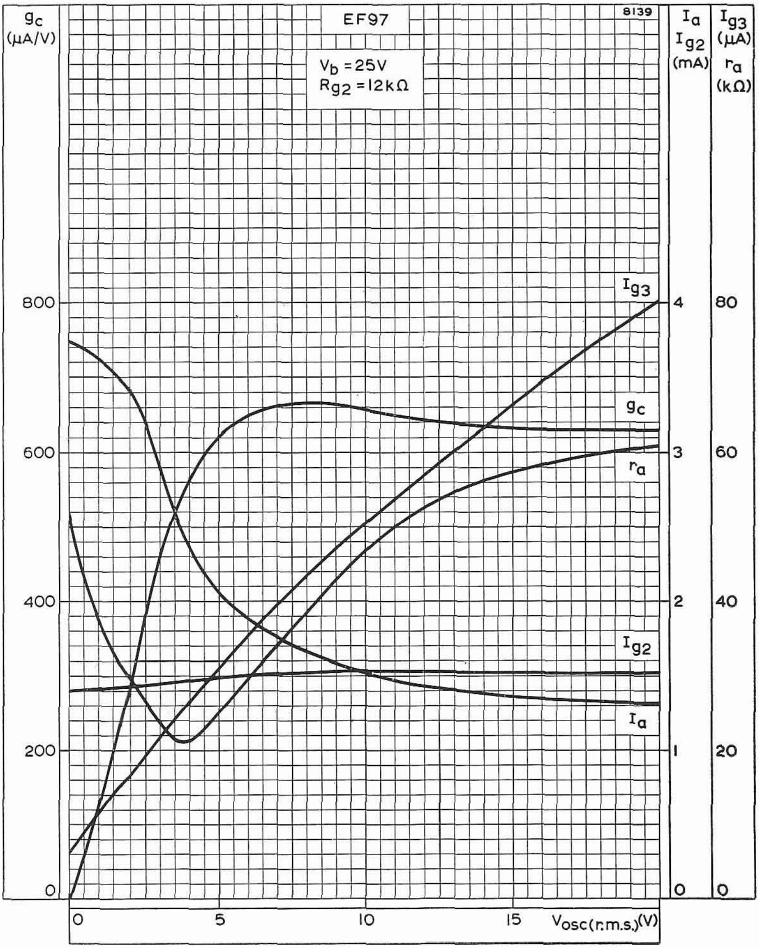
PERFORMANCE CURVES AS R.F. MIXER.
$V_b = 6.3V$, $R_{g2} = 4.7k\Omega$



PERFORMANCE CURVES AS R.F. MIXER.
$V_b = 12.6V$, $R_{g2} = 3.9k\Omega$

EF97

R.F. PENTODE



PERFORMANCE CURVES AS R.F. MIXER.
$V_b = 25V$, $R_{g2} = 12k\Omega$

SUBMINIATURE R.F. PENTODE

EF730

R.F. pentode with short suppressor-grid base.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

	Shielded	*Unshielded*	
c_{a-g1}	<0.02	<0.034	pF
c_{a-g3}	<1.1	<1.1	pF
c_{g1-g3}	<0.15	<0.17	pF
$c_{in(g1)}$	4.0	4.0	pF
$c_{in(g3)}$	3.7	3.7	pF
c_{out}	3.4	2.1	pF

CHARACTERISTICS

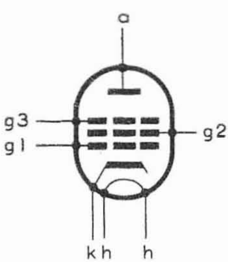
V_a	100	V
V_{g3}	0	V
V_{g2}	100	V
V_{g1}	–1.4	V
I_a	5.3	mA
I_{g2}	4.1	mA
$g_{m(g1-a)}$	3.2	mA/V
$g_{m(g3-a)}$	500	μA/V
r_a	110	kΩ
V_{g1} ($I_a = 10\mu A$)	–7.5	V
V_{g3} ($I_a = 10\mu A$)	–8.0	V

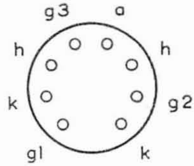
LIMITING VALUES (absolute ratings)

$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	1.1	W
$+V_{g3}$ max.	30	V
$V_{g2(b)}$ max.	310	V
V_{g2} max.	155	V
$-V_{g1}$ max.	55	V
p_{g2} max.	700	mW
I_a max.	11	mA
I_{g2} max.	7.0	mA
V_{h-k} max.	200	V

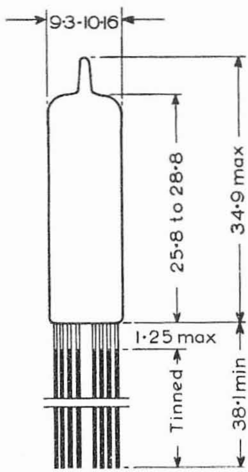
EF730

SUBMINIATURE R.F. PENTODE



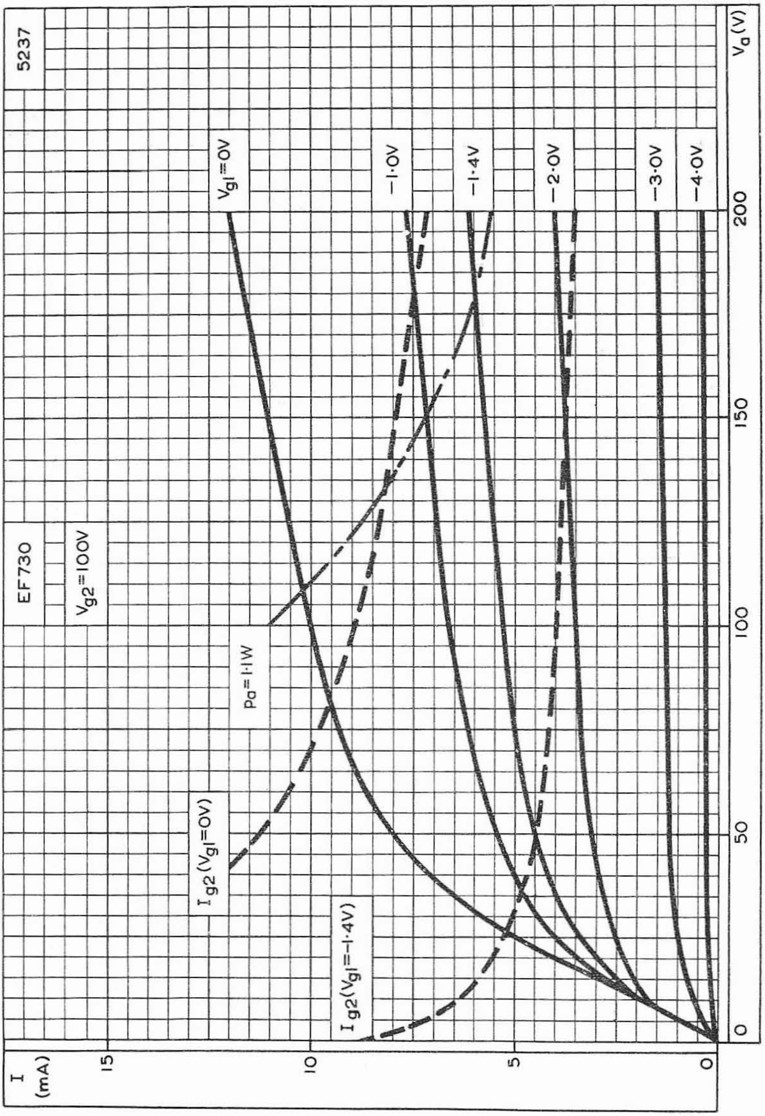


B8D/F Base

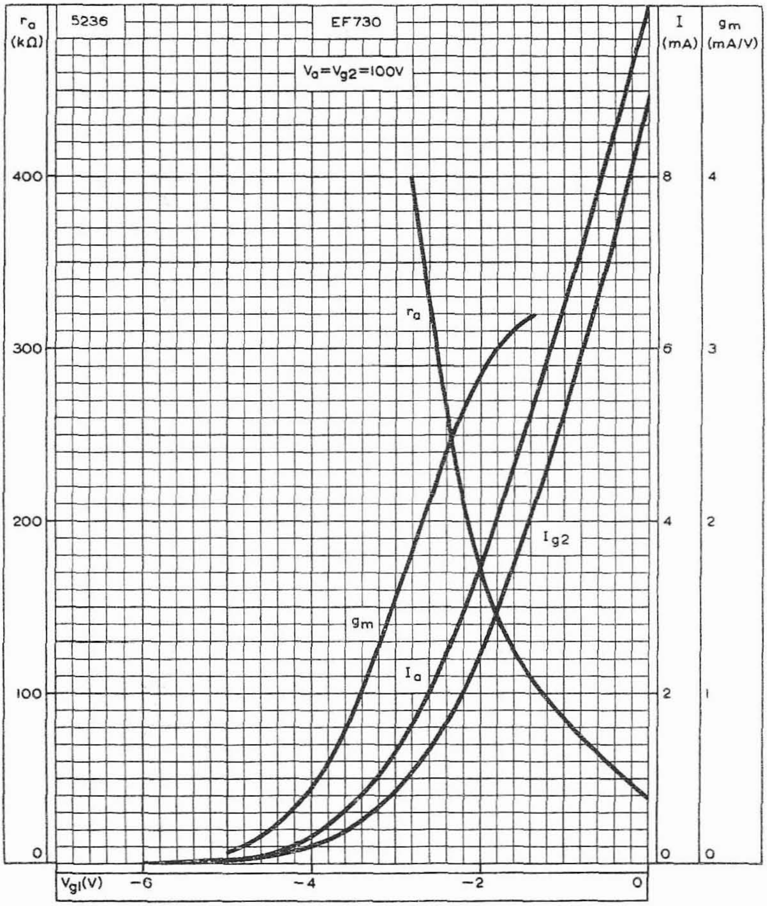


5325

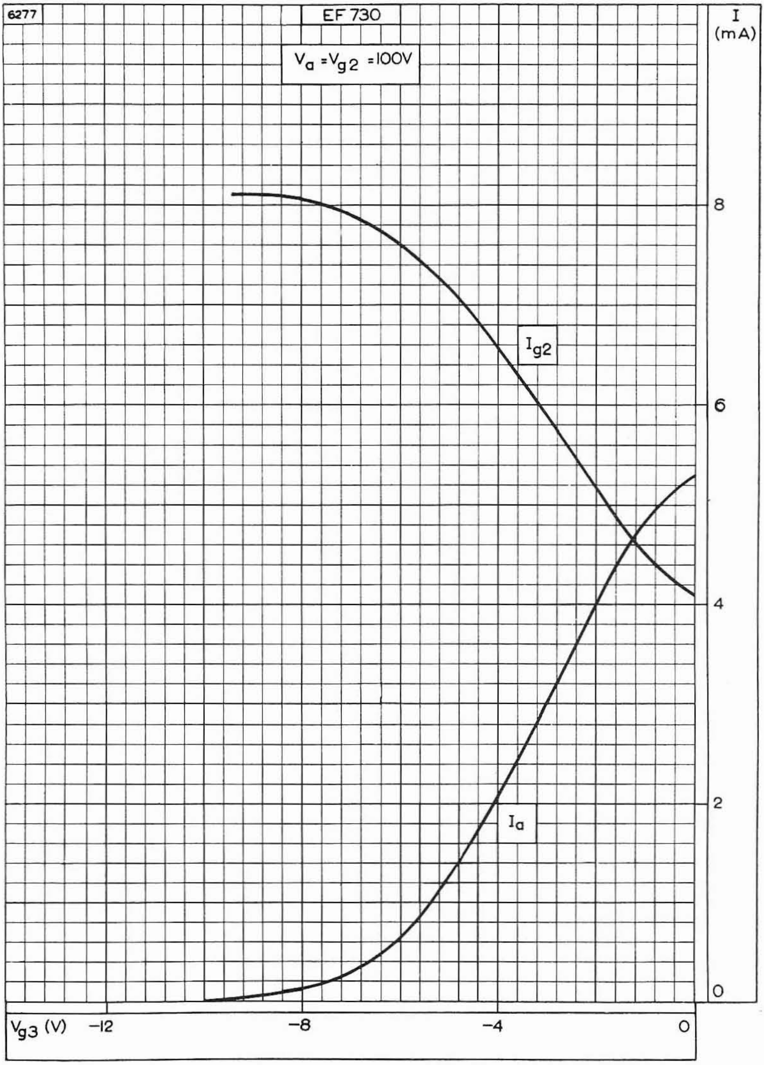
All dimensions in mm



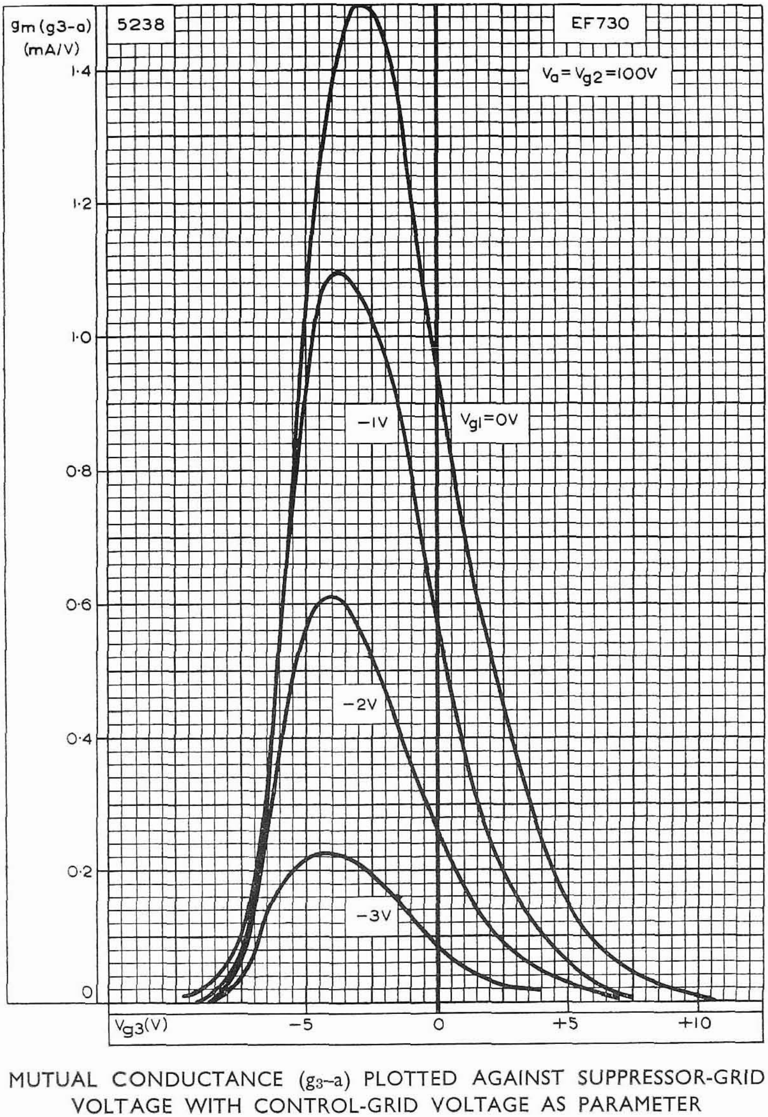
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE



MUTUAL CONDUCTANCE (g_3–a) PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

SUBMINIATURE VARIABLE-MU R.F. PENTODE

EF731

Subminiature variable-mu r.f. pentode for use as a controlled r.f. amplifier.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

	Shielded	*Unshielded*	
c_{a-g1}	<0.015	<0.03	pF
c_{in}	4.3	4.0	pF
c_{out}	3.4	1.9	pF

CHARACTERISTICS

V_a	100	V
V_{g2}	100	V
V_{g1}	−1.1	V
I_a	7.2	mA
I_{g2}	2.2	mA
g_m	4.5	mA/V
r_a	260	kΩ
g_m ($V_{g1} = -14$V)	25	µA/V

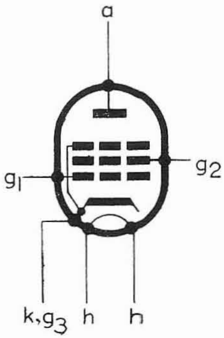
LIMITING VALUES (absolute ratings)

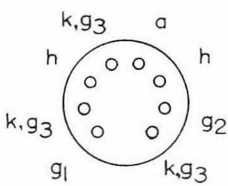
$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	1.1	W
$V_{g2(b)}$ max.	310	V
V_{g2} max.	155	V
p_{g2} max.	550	mW
$-V_{g1}$ max.	55	V
I_k max.	16.5	mA
V_{h-k} max.	200	V

EF731

SUBMINIATURE VARIABLE-MU R.F. PENTODE

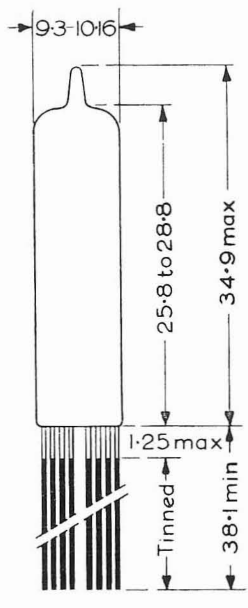
5494





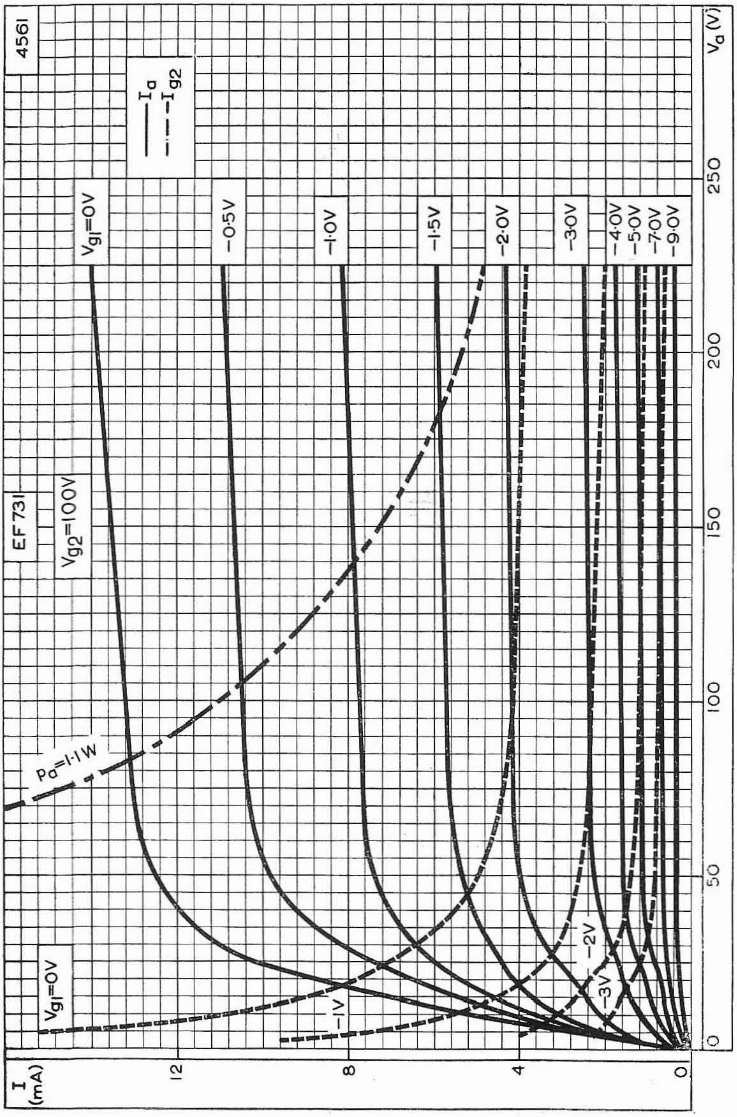
B8D/F Base

All dimensions in mm



SUBMINIATURE VARIABLE-MU R.F. PENTODE

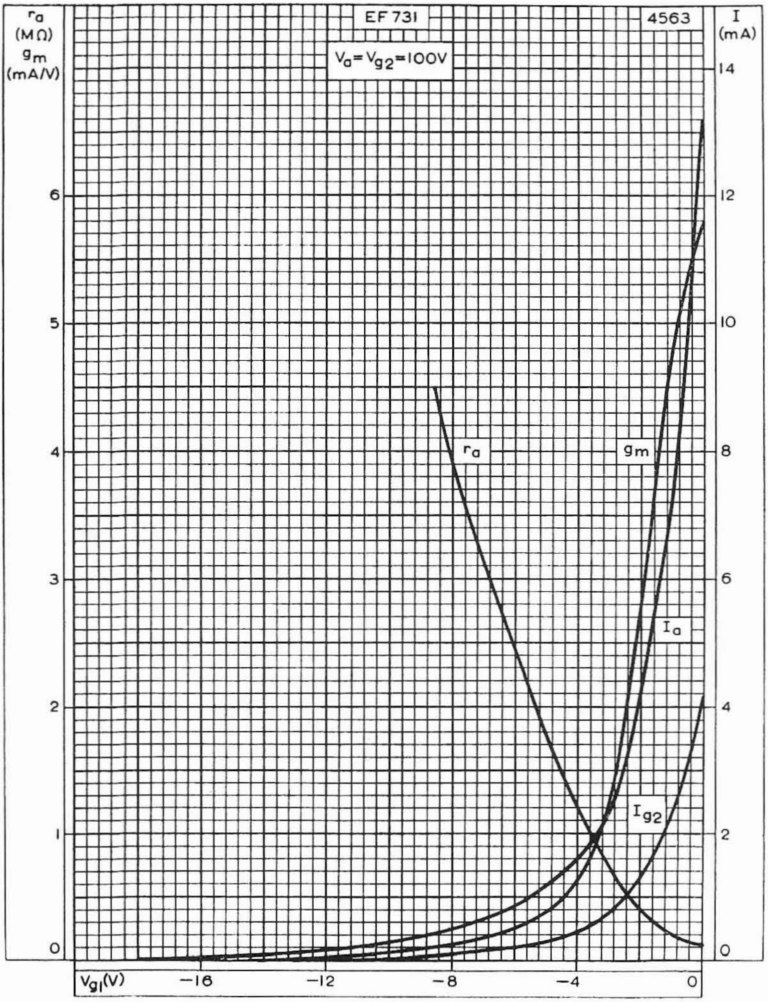
EF731



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

EF731

SUBMINIATURE VARIABLE-MU R.F. PENTODE



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE R.F. PENTODE

EF732

High slope r.f. pentode.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

	shielded	*unshielded*	
c_{a-g1}	<0.015	<0.03	pF
c_{in}	4.2	4.0	pF
c_{out}	3.4	1.9	pF

CHARACTERISTICS

V_a	100	V
V_{g2}	100	V
V_{g1}	−1.5	V
I_a	7.5	mA
I_{g2}	2.4	mA
g_m	5.0	mA/V
r_a	260	kΩ
V_{g1} ($I_a = 10\mu A$)	−9.0	V

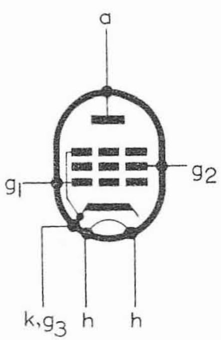
LIMITING VALUES (absolute ratings)

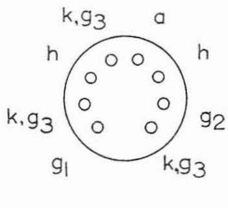
$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	1.1	W
$V_{g2(b)}$ max.	310	V
V_{g2} max.	155	V
p_{g2} max.	550	mW
$-V_{g1}$ max.	55	V
I_k max.	16.5	mA
V_{h-k} max.	200	V

EF732

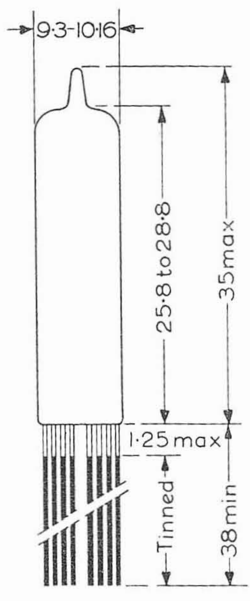
SUBMINIATURE R.F. PENTODE

High slope r.f. pentode.





B8D/F Base



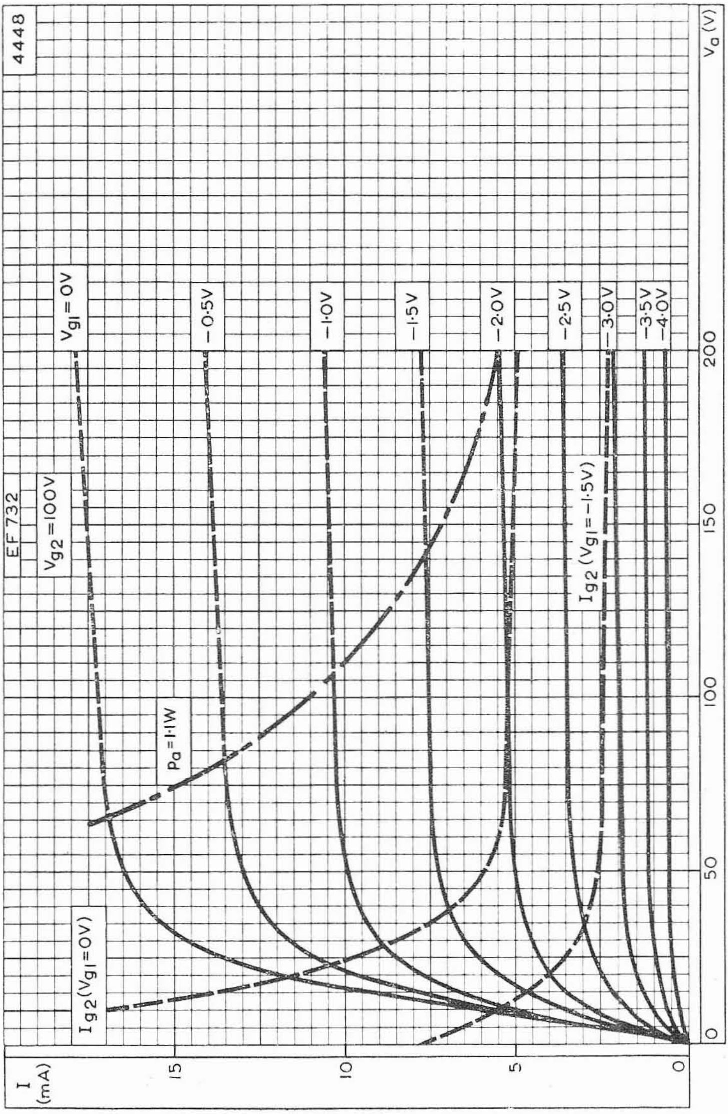
4071

All dimensions in mm

SUBMINIATURE R.F. PENTODE

EF732

High slope r.f. pentode.

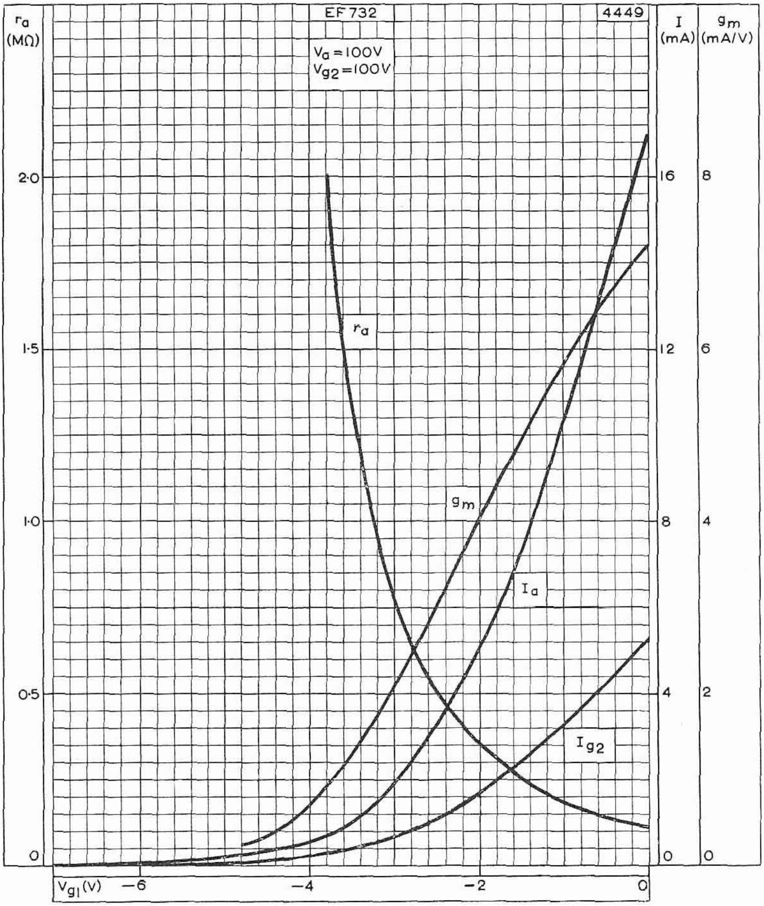


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

EF732

SUBMINIATURE R.F. PENTODE

High slope r.f. pentode.



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

SUBMINIATURE R.F. PENTODE

EF734

High slope r.f. pentode.

HEATER

V_h	6.3	V
I_h	150	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

	shielded	*unshielded*	
c_{a-g1}	<0.015	<0.03	pF
c_{in}	4.2	4.0	pF
c_{out}	3.4	1.9	pF

CHARACTERISTICS

V_a	100	V
*V_{g3}	0	V
V_{g2}	100	V
V_{g1}	−1.5	V
I_a	7.5	mA
I_{g2}	2.4	mA
g_m	5.0	mA/V
r_a	260	kΩ
V_{g1} ($I_a = 10\mu A$)	−9.0	V

*The suppressor grid should not be used for control or gating purposes.

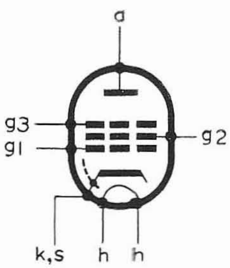
LIMITING VALUES (absolute ratings)

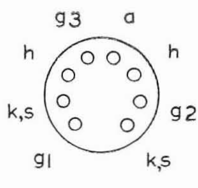
$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	1.1	W
$V_{g2(b)}$ max.	310	V
V_{g2} max.	155	V
p_{g2} max.	550	mW
$-V_{g1}$ max.	55	V
I_k max.	16.5	mA
V_{h-k} max.	200	V

EF734

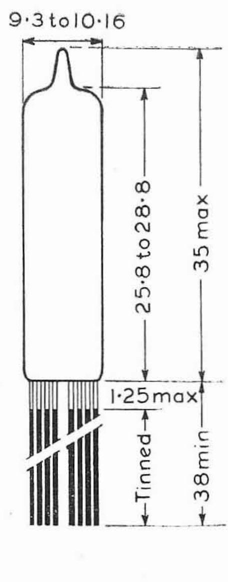
SUBMINIATURE R.F. PENTODE

High slope r.f. pentode.





B8D/F Base



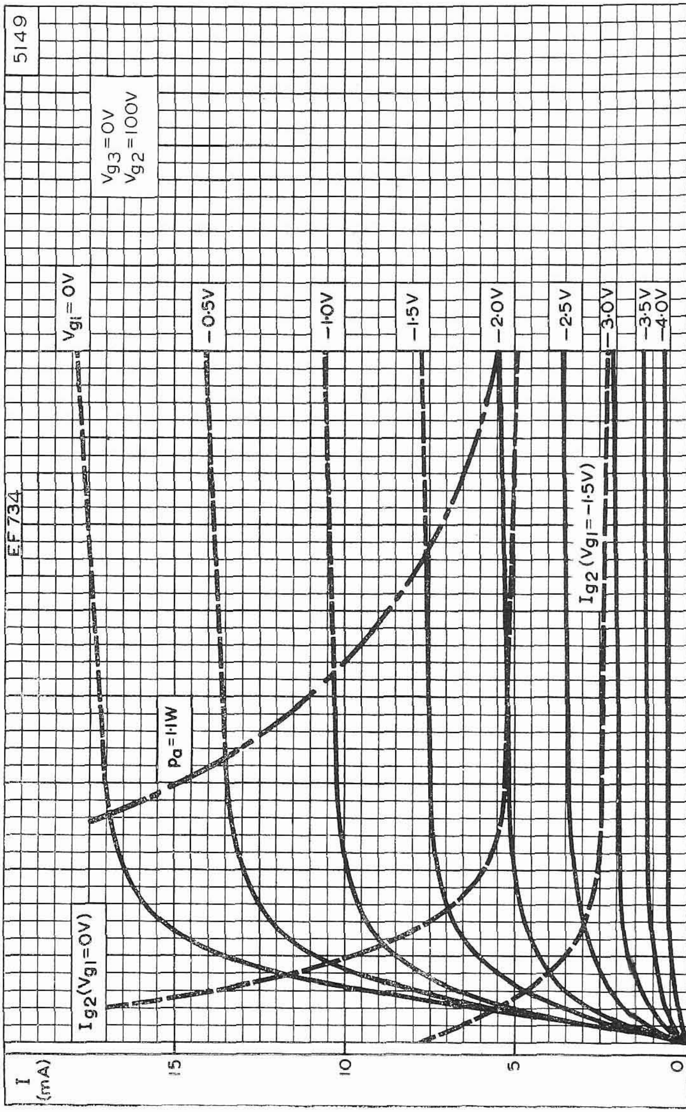
5164

All dimensions in mm

SUBMINIATURE R.F. PENTODE

High slope r.f. pentode.

EF734

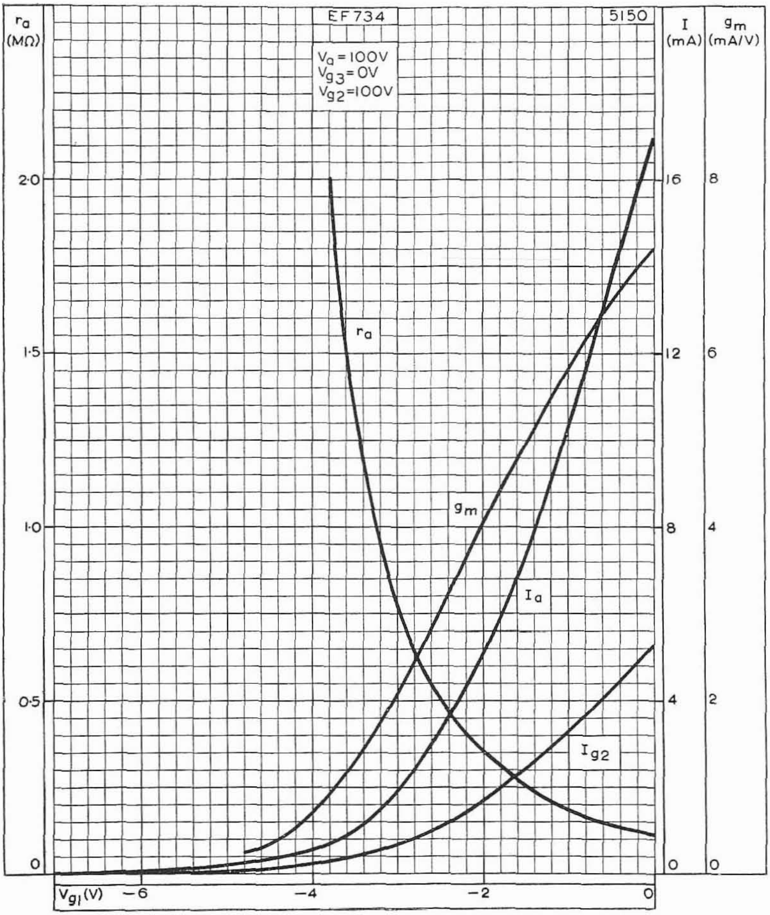


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

EF734

SUBMINIATURE R.F. PENTODE

High slope r.f. pentode.



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

OCTODE FREQUENCY CHANGER EK2

HEATER

This valve is suitable for d.c./a.c. operation.

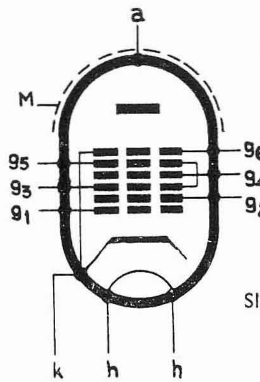
V_h	6.3	V
I_h	0.2	A

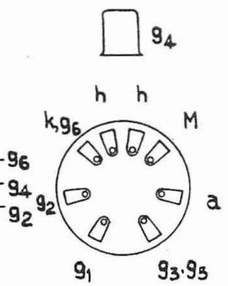
CAPACITANCES

c_{a-g4}	<0.07	μμF
c_{a-k}	10	μμF
c_{g1-k}	6.0	μμF
c_{g1-g4}	1.1	μμF
c_{g2-k}	4.5	μμF
c_{g2-g4}	<0.25	μμF
c_{g4-k}	8.8	μμF

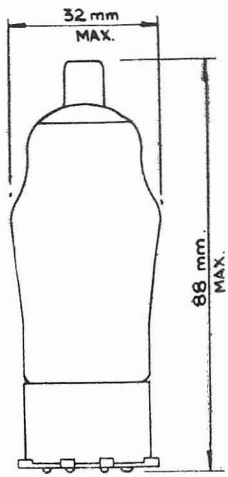
OPERATING CONDITIONS

For characteristics, curves and operating data, see Type EK32. Except for base and capacitances, EK2 and EK32 are identical.





SIDE-CONTACT BASE



OCTODE FREQUENCY CHANGER EK32

HEATER

This valve is suitable for AC/DC operation

V_h	6.3	V
I_h	0.2	A

CAPACITANCES

c_{in}	9.0	μμF
c_{out}	10.5	μμF
c_{g1-g4}	<1.0	μμF
c_{g2-g4}	<0.25	μμF
c_{a-g4}	<0.1	μμF
c_{g1-all}	6.0	μμF
c_{g2-all}	5.0	μμF

OPERATING CONDITIONS

Medium and Long wavelengths

V_a	250	V
V_{g2}	200	V
V_{g3+5}	50	V
R_{g1}	50	kΩ
$V_{g1\ (r.m.s.)}$	15	V
I_{g1}	300	μA
I_a (V_{g4}=−2V)	1	mA
I_a (V_{g4}=−25V)	<0.015	mA
I_{g2} (I_a=1mA)	2.5	mA
I_{g3+5} (I_a=1mA)	0.8	mA
g_c (I_a=1mA)	0.55	mA/V
g_c (V_{g4}=−25V)	<0.002	mA/V
r_a (I_a=1mA)	2	MΩ
r_a (V_{g4}=−25V)	>10	MΩ

Short wavelengths

V_a	250	250	V
V_{g2}	200	200	V
V_{g3+5}	80	80	V
R_{g1}	16	50	kΩ
$V_{g1\ (r.m.s.)}$	5	9	V
I_{g1}	275	200	μA
V_{g4}	−4	−4	V
I_a	2.3	1.7	mA
I_{g2}	5.3	4.0	mA
I_{g3+5}	1.9	1.3	mA
g_c	0.65	0.5	mA/V
r_a	0.9	1.4	MΩ

LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.0	W
$V_{g3+5(b)}$ max.	550	V
V_{g3+5} max.	125	V

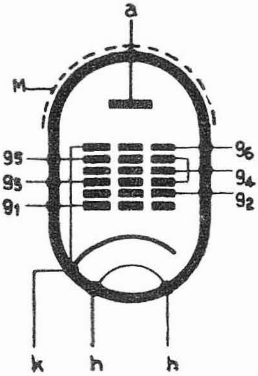
EK32

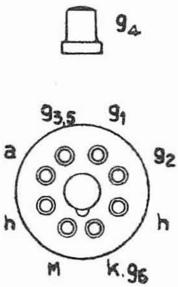
OCTODE FREQUENCY CHANGER

LIMITING VALUES *(cont.)*

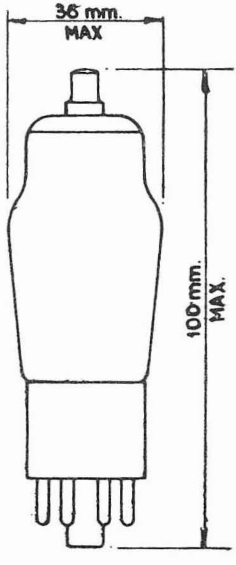
*	I_{g2} min.	2.0	mA
*	I_{g2} max.	3.0	mA
*	I_{g3+5} min.	0.6	mA
*	I_{g3+5} max.	1.0	mA
†	I_{g2} min.	4.2	mA
†	I_{g2} max.	6.4	mA
†	I_{g3+5} min.	1.5	mA
†	I_{g3+5} max.	2.3	mA
‡	I_{g2} min.	3.2	mA
‡	I_{g2} max.	4.8	mA
‡	I_{g3+5} min.	1.0	mA
‡	I_{g3+5} max.	1.6	mA
	p_{g3+5} max.	0.3	W
	R_{g4} max.	2.5	MΩ
	V_{g4} max ($I_{g4}=0.3\mu A$)	−1.3	V
	$V_{g2(b)}$	550	V
	p_{g2} max.	1.3	W
	R_{g1} max.	100	kΩ
	I_k max.	12	mA
	R_{h-k} max.	5·0	kΩ
	V_{h-k} max.	50	V
	V_{g2} max.	225	V

* Medium and long wave operation ($V_{g1}=15V_{(r.m.s.)}$)
† Short wave operation ($V_{g1}=5V_{(r.m.s.)}$)
‡ Short wave operation ($V_{g1}=9V_{(r.m.s.)}$)





OCTAL BASE



OUTPUT PENTODE

EL2

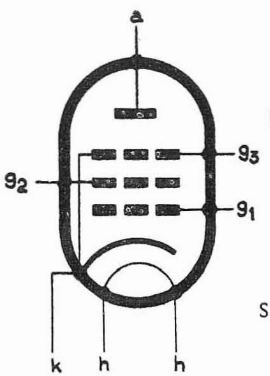
HEATER

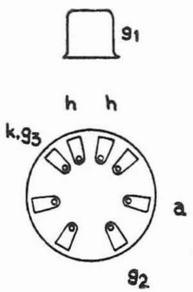
This valve is suitable for D.C./A.C. operation.

V_h	6.3	V
I_h	0.2	A

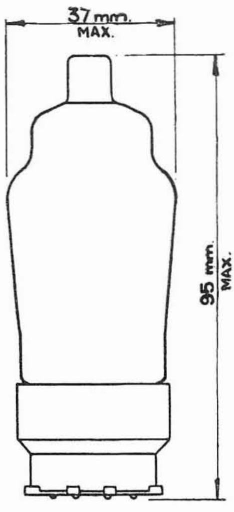
OPERATING CONDITIONS

For characteristics, curves and operating data, see Type EL32. Except for base, EL2 and EL32 are identical.





SIDE-CONTACT BASE



OUTPUT PENTODE

EL31

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

HEATER

V_h	6.3	V
I_h	1.4	A

CAPACITANCE

c_{a-g1}	1.2	μμF

CHARACTERISTICS

V_a	275	600	V
V_{g2}	275	400	V
V_{g1}	−9.0	−22	V
I_a	91	42	mA
I_{g2}	11	5.0	mA
g_m	14	7.0	mA/V
r_a	20	43	kΩ
μ_{g1-g2}	16.5	—	

OPERATING CONDITIONS—TWO VALVES IN PUSH PULL
(Self Bias)

V_a	350	375	400	V
V_{g2}	350	375	400	V
R_k	100	122	145	Ω
$I_{a(0)}$	2×71	2×67	2×63	mA
I_a (max. sig.)	2×83	2×75	2×69	mA
$I_{g2(0)}$	2×8.8	2×8.8	2×8.3	mA
I_{g2} (max. sig.)	2×23.5	2×24.5	2×24	mA
R_{a-a}	5.0	6.0	7.0	kΩ
$V_{in\ (g-g)}$ r.m.s.	2×14.7	2×15	2×15·5	V
*P_{out}	38	37.5	37	W
D_{tot}	4.2	5.0	5.0	%

OPERATING CONDITIONS—TWO VALVES IN PUSH PULL
(Fixed bias)

V_a	400	600	800	V
V_{g2}	400	400	400	V
V_{g1}	−23	−25.2	−26	V
$I_{a(0)}$	2×40	2×30	2×30	mA
I_a (max. sig.)	2×110	2×103	2×107	mA
$I_{g2(0)}$	2×5.2	2×3.4	2×3.1	mA
I_{g2} (max. sig.)	2×26.8	2×28.5	2×28.5	mA
R_{a-a}	4.0	7.5	10	kΩ
$V_{in\ (g-g)}$ r.m.s.	2×15.7	2×17.3	2×18	V
*P_{out}	55	84	120	W
D_{tot}	3.2	5.0	5.0	%

*Measured at start of I_{g1} or 5% distortion.

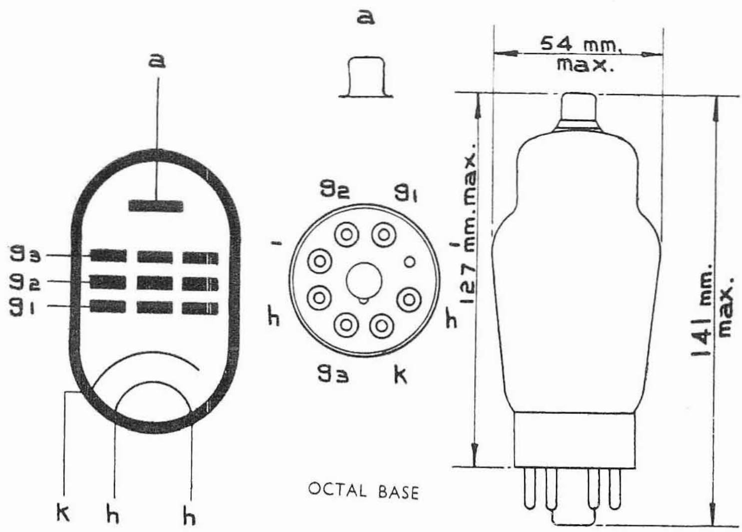
EL31

OUTPUT PENTODE

Output pentode rated for a continuous dissipation of 25 W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100 W in class AB amplifiers.

LIMITING VALUES

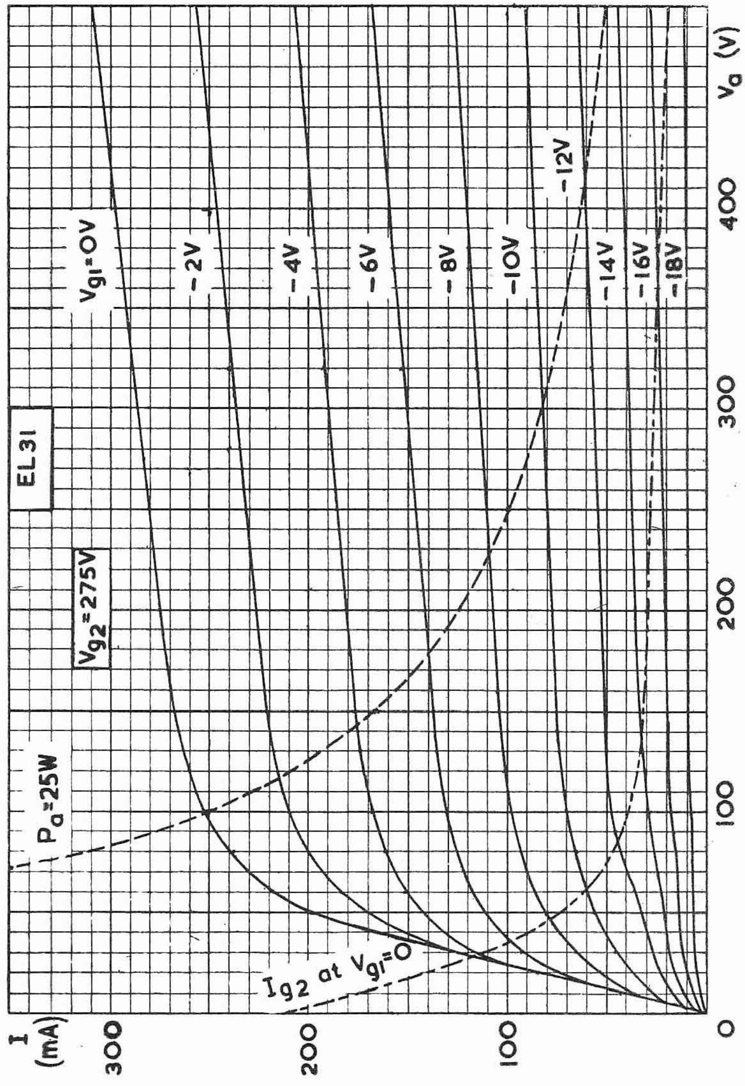
$V_{a(b)}$ max.	1.2	kV
V_a max.	800	V
$V_{g2(b)}$ max.	800	V
V_{g2} max.	400	V
p_a max.	25	W
p_{g2} max.	8	W
I_k max.	200	mA
V_{g1} ($I_{g1}=+0.3\ \mu A$) max.	−1.3	V
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ
R_{g1-k} max. (self bias)	500	kΩ
R_{g1-k} max. (fixed bias)	100	kΩ



OUTPUT PENTODE

EL31

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

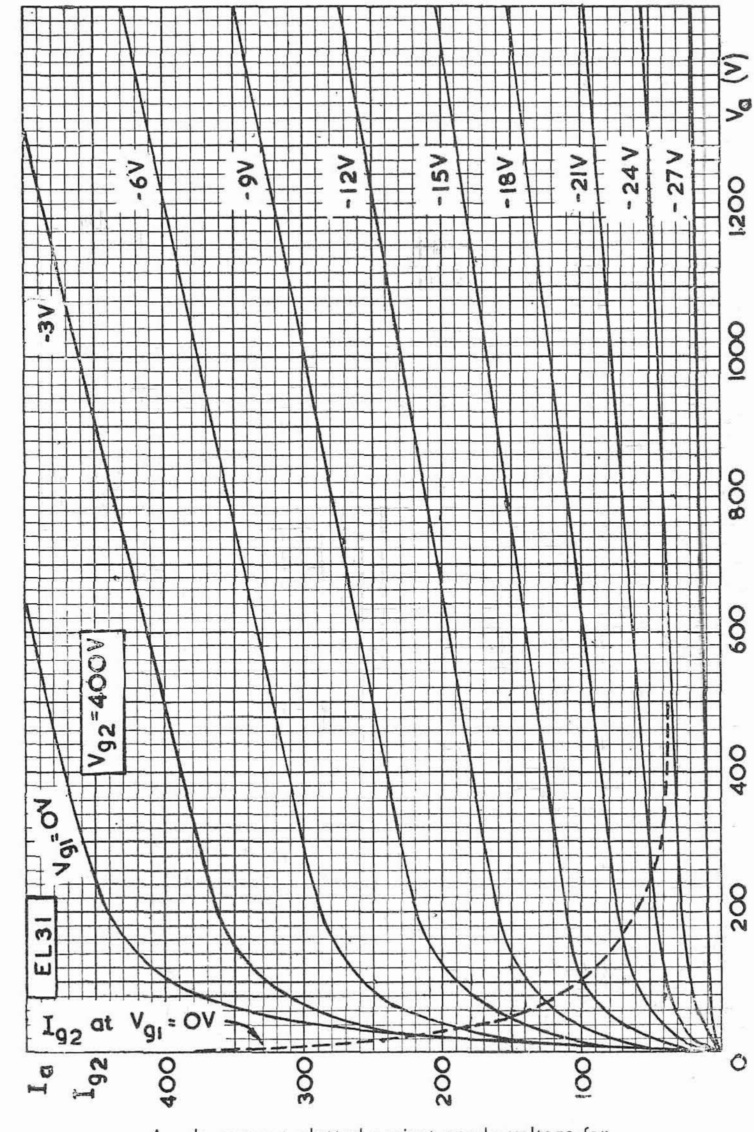


Anode current plotted against anode voltage for a screen voltage of 275V

EL31

OUTPUT PENTODE

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

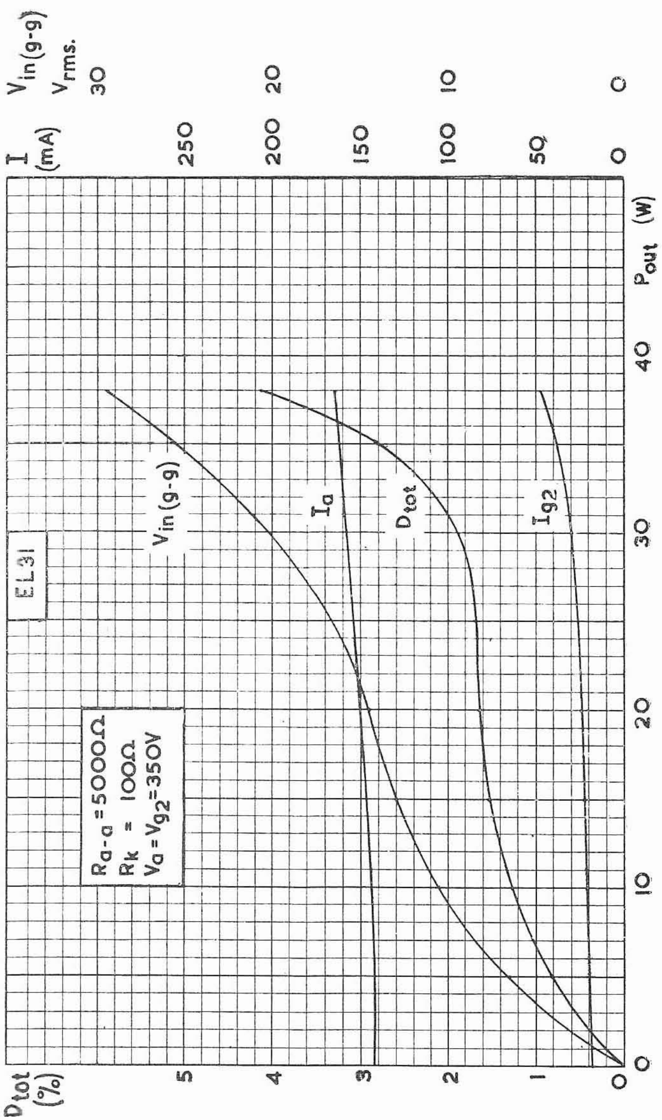


Anode current plotted against anode voltage for a screen voltage of 400V

OUTPUT PENTODE

EL31

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

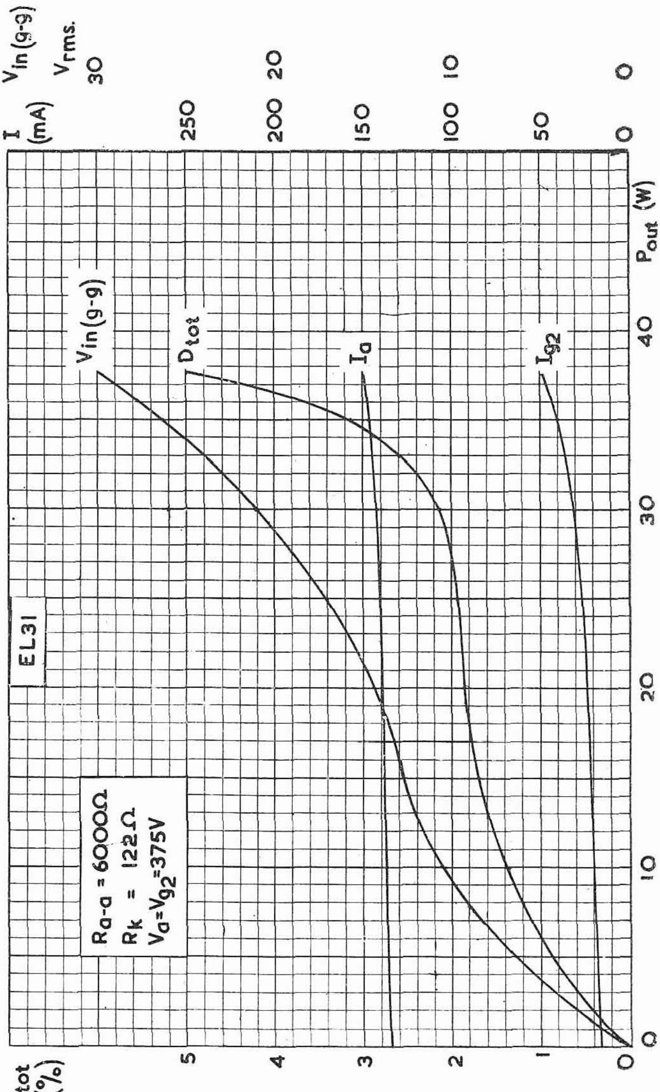


Distortion and input voltage plotted against output power for push–pull operation with self bias

EL31

OUTPUT PENTODE

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

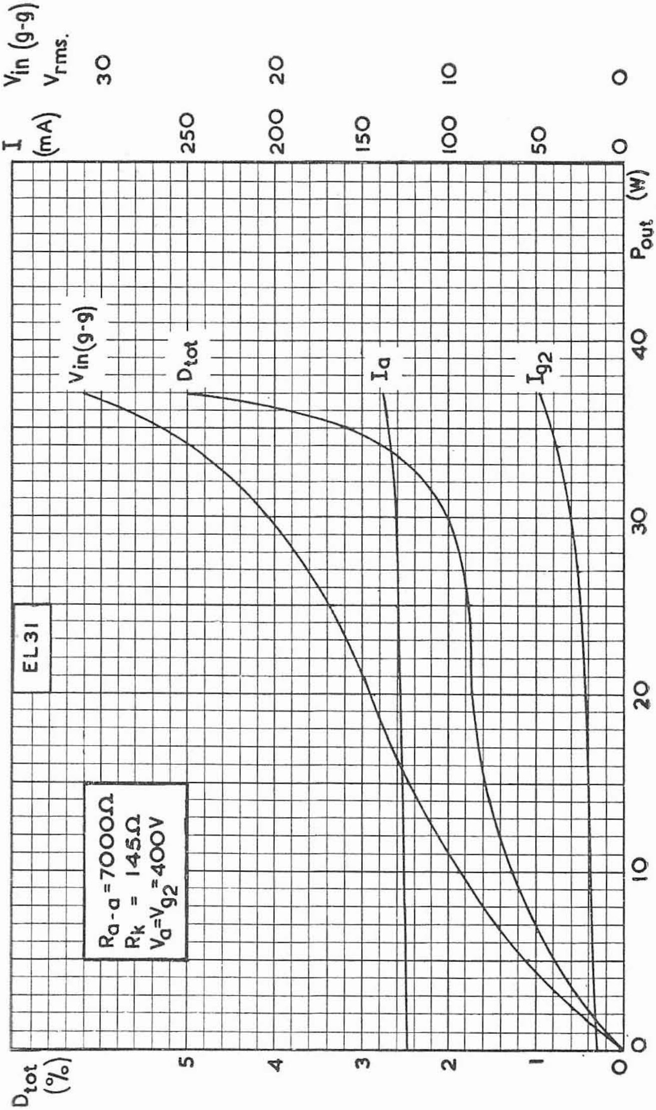


Distortion and input voltage plotted against output power for push-pull operation with self bias

OUTPUT PENTODE

EL31

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.



Distortion and input voltage plotted against output power for push–pull operation with self bias

EL31

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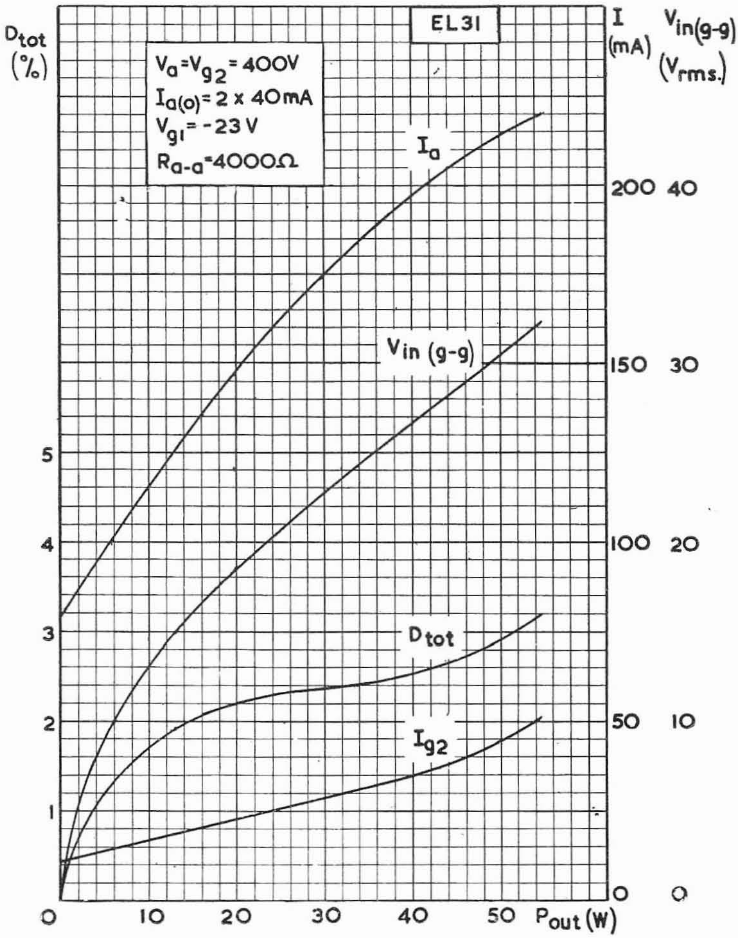
Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

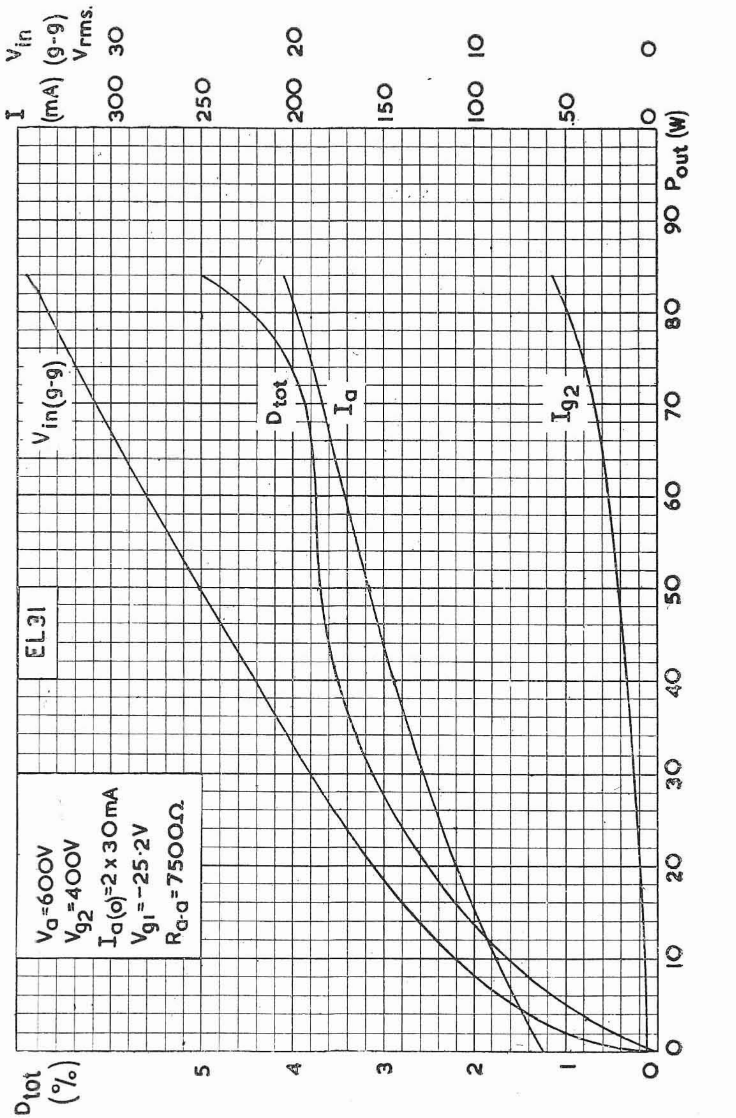


Distortion and input voltage plotted against output power for push–pull operation with fixed bias

OUTPUT PENTODE

EL31

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.

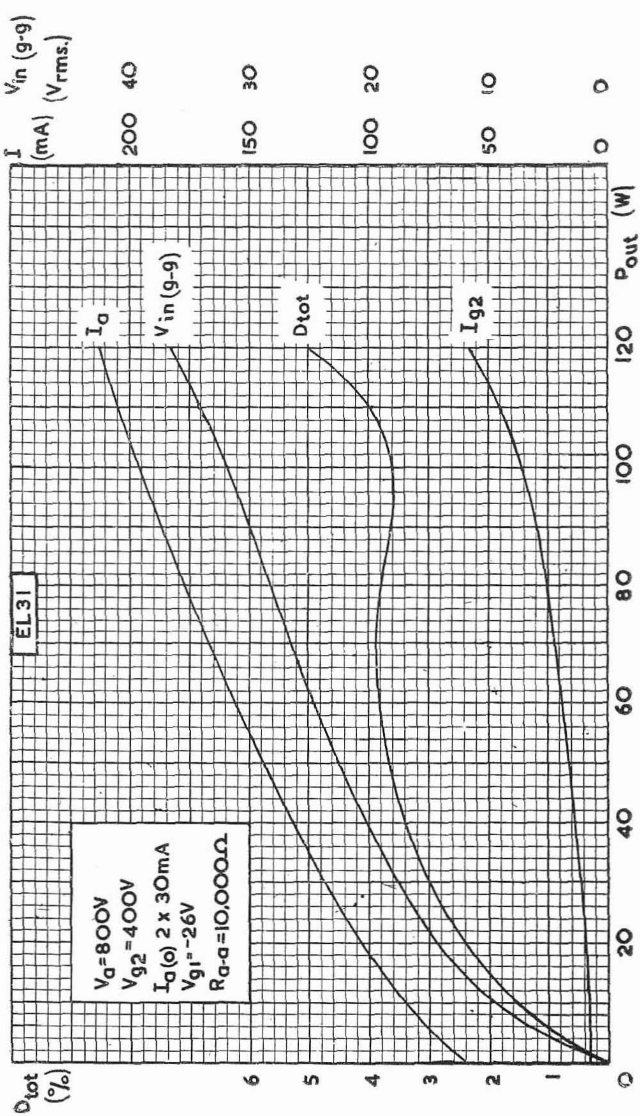


Distortion and input voltage plotted against output power
for push-pull operation with fixed bias

EL31

OUTPUT PENTODE

Output pentode rated for a continuous dissipation of 25W at the anode and suitable for use in push-pull combination for effective outputs of the order of 100W in class AB amplifiers.



Distortion and input voltage plotted against output power for push-pull operation with fixed bias

SUBMINIATURE OUTPUT PENTODE

EL71

Audio output pentode.

HEATER

V_h	6.3	V
I_h	450	mA

MOUNTING POSITION

Any

Note – Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

COOLING

In operation this valve may become very hot and to obtain satisfactory life it should be adequately cooled. A suitable method is to mount the valve in a metal clip which conducts the heat away to a suitable heat sink.

CAPACITANCES

c_{a-g1}	<0.2	pF
c_{in}	6.5	pF
c_{out}	7.5	pF

CHARACTERISTICS

V_a	100	V
V_{g2}	100	V
I_a	30	mA
I_{g2}	1.2	mA
g_m	4.2	mA/V
r_a	15	kΩ
V_{g1}	−8.3	V
V_{g1} ($I_a = 10\mu A$)	−40	V

TYPICAL OPERATING CONDITIONS

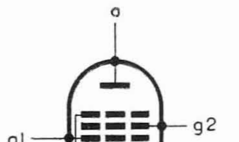
V_{a-e}	110	V
V_{g2-e}	110	V
I_a	30	mA
I_{g2}	1.2	mA
R_k	270	Ω
R_a	3.0	kΩ
$V_{in(r.m.s.)}$	6.4	V
P_{out}	1.0	W
D_{tot}	10	%

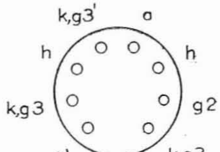
LIMITING VALUES (absolute ratings)

$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	4.0	W
$V_{g2(b)}$ max.	310	V
V_{g2} max.	155	V
p_{g2} max.	1.0	W
$-V_{g1}$ max.	55	V
I_k max.	50	mA
V_{h-k} max.	200	V

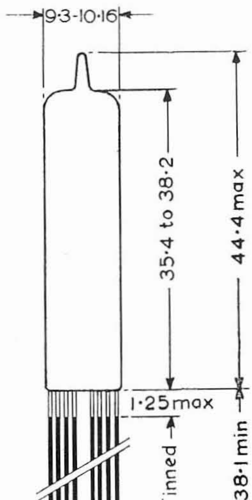
EL71

SUBMINIATURE OUTPUT PENTODE





B8D/F Base



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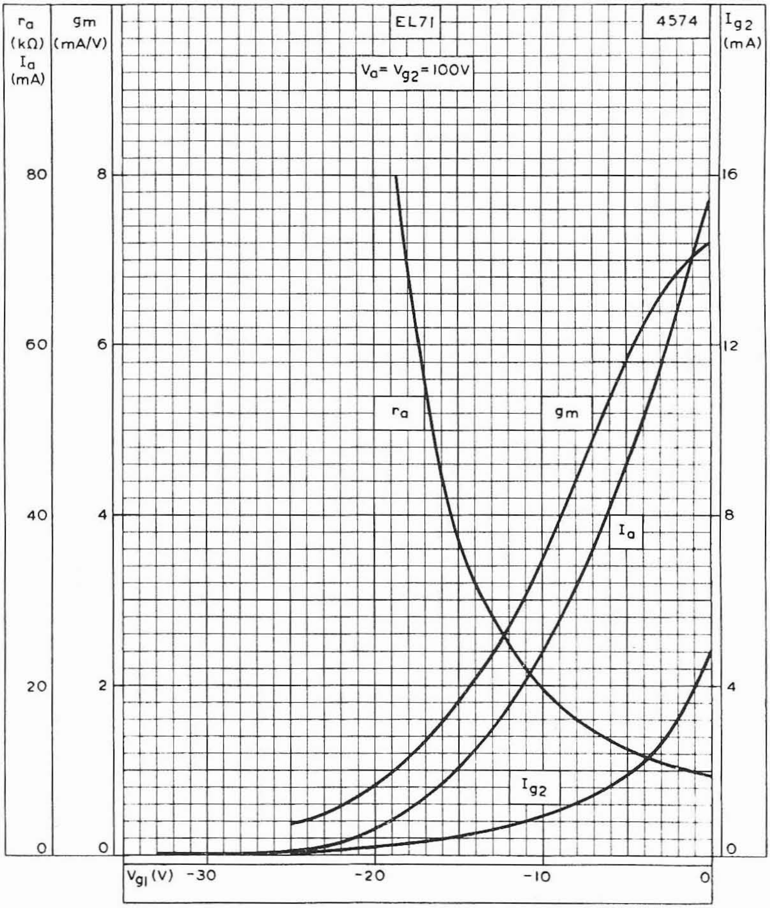
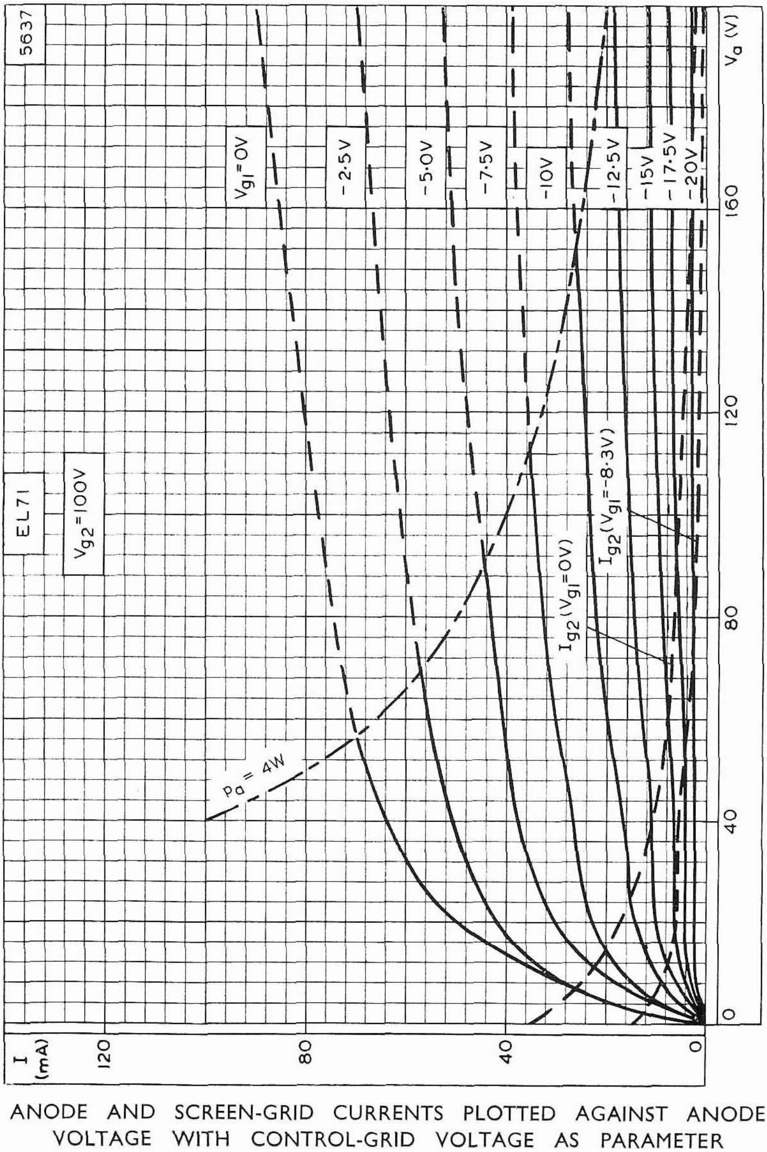
All dimensions in mm



ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

SPECIAL QUALITY OUTPUT PENTODE

E80L

Special quality output pentode designed for use in industrial equipment where stability of characteristics and long life are required.

This data should be read in conjunction with GENERAL NOTES—SPECIAL QUALITY VALVES which precede this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h[1]	6.3	V
I_h	700	mA

The maximum variation of heater current at $V_h = 6.3V$ is $\pm 35mA$. In order to achieve a useful valve life with the heater in a series connected chain, the absolute maximum variation of heater current due to voltage fluctuations and component tolerances should be $< \pm 1.5\%$.

MOUNTING POSITION

Any

CAPACITANCES[2]

	Minimum	Average	Maximum	←
c_{a-g1}	—	—	150	mpF
c_{in}	9.2	10	10.8	pF
c_{out}	6.3	6.8	7.3	pF
c_{g1-h}	—	—	250	mpF
c_{h-k}	—	7.0	—	pF

CHARACTERISTICS[3]

V_a	200	V
V_{g3}	0	V
V_{g2}	200	V
V_{g1}	−4.4	V
I_a	30	mA
I_{g2}	4.1	mA
g_m	9.0	mA/V
r_a	52	kΩ←
μ_{g1-g2}	21.5	
R_k	0	Ω

E80L SPECIAL QUALITY OUTPUT PENTODE

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

	Average	Initial range	End of life*	
Anode current				
at $V_{a-e} = V_{g2-e} = 204.5V$, $V_{g3-k} = 0V$, $R_k = 130\Omega$	30	26.5 to 33.5	21	mA
at $V_{a-k} = V_{g2-k} = 200V$, $V_{g3-k} = 0V$, $V_{g1} = -14V$	—	< 200	—	μA
Screen-grid current				
at $V_{a-e} = V_{g2-e} = 204.5V$, $V_{g3-k} = 0V$, $R_k = 130\Omega$	4.1	2.7 to 5.5	2.0	mA
Control-grid current				
at $V_{a-e} = V_{g2-e} = 204.5V$, $V_{g3-k} = 0V$, $R_k = 130\Omega$	—	< 0.5	1.0	μA
Mutual conductance				
at $V_{a-e} = V_{g2-e} = 204.5V$, $V_{g3-k} = 0V$, $R_k = 130\Omega$	9.0	7.4 to 10.6	6.0	mA/V
Power output				
at $V_{a-k} = V_{g2-k} = 200V$, $V_{g3-k} = 0V$, $I_a = 30mA$	—	> 2.0	—	W

*To allow for valve deterioration during life, circuits should be designed to function with a valve whose characteristics have changed to the values stated.

OPERATING CONDITIONS AS SINGLE VALVE CLASS 'A' AMPLIFIER

V_{a-k}	200	250	V
V_{g3-k}	0	0	V
$V_{g2(b)}$	—	250	V
V_{g2-k}	200	—	V
R_k	130	270	Ω
R_a	7.0	10	kΩ
R_{g2}	—	1.0	kΩ
I_a	30	24	mA
I_{g2}	4.1	3.3	mA
$V_{in(r.m.s.)}$ ($P_{out} = 50mW$)	330	—	mV
$V_{in(r.m.s.)}$	3.0	3.0	V
P_{out}	2.7	2.8	W
D_{tot}	10	10	%

SPECIAL QUALITY OUTPUT PENTODE **E80L**

OPERATING CONDITIONS FOR TWO VALVES IN CLASS 'AB' PUSH-PULL

V_{a-k}	200	250	V
V_{g3-k}	0	0	V
V_{g2-k}	200	250	V
R_k (per valve)	130	270	Ω
R_{a-a}	9	9	kΩ
$I_{a(o)}$	2×20.6	2×23.5	mA
$I_{g2(o)}$	2×2.8	2×3.2	mA
$V_{in(g1-g1)r.m.s.}$	10.4	15.6	V
P_{out}	5.7	9.0	W
D_{tot}	3.0	4.5	%
$I_{a\ (max.\ sig.)}$	2×24.6	2×29.5	mA
$I_{g2\ (max.\ sig.)}$	2×4.9	2×6.6	mA

INSULATION

	Initial Range	*End of life**	
Between heater and cathode Measured at $V_{h-k} = 120$V (cathode positive) $R_{lim} = 1.0$MΩ Leakage current	<15	20	μA
Between any two arbitrary electrodes Measured at 300V (cathode positive)	>50	10	MΩ

*To allow for valve deterioration during life, circuits should be designed to function with a valve whose characteristics have changed to the values stated.

ABSOLUTE MAXIMUM RATINGS

$V_{a(b)}$ max.	600	V
V_a max.	300	V
p_a max.	8.0	W
$V_{g2(b)}$ max.	600	V
V_{g2} max.	300	V
p_{g2} max.	2.6	W
$-V_{g1}$ max.	100	V
$-V_{g3}$ max.	100	V
I_k max.	50	mA
R_{g1-k} max. (self bias)	1.0	MΩ
V_{h-k} max.	120	V
R_{h-k} max.	20	kΩ
T_{bulb} max.	225	°C

SHOCK AND VIBRATION

The E80L can withstand vibrations of 2.5g and 50c/s for 96 hours and is proof against impact accelerations of approximately 500g.

E80L SPECIAL QUALITY OUTPUT PENTODE

OPERATING NOTES

The hum voltage referred to g_1 has a maximum value of 250μV and is measured with the centre tap of the heater winding earthed, at a supply frequency of 50c/s and with a linear band-pass filter under the following conditions:

V_{a-k}	200	V
V_{g2-k}	200	V
R_a	1.0	kΩ
R_k	130	Ω

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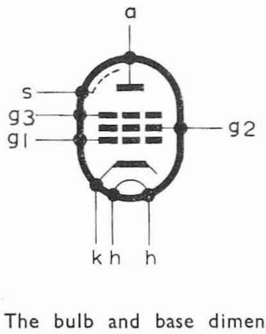
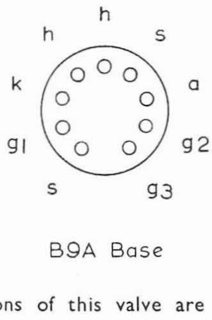
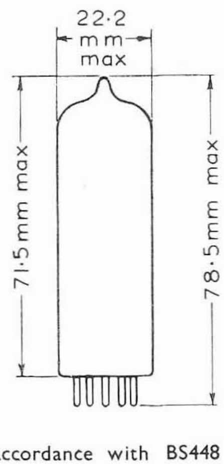
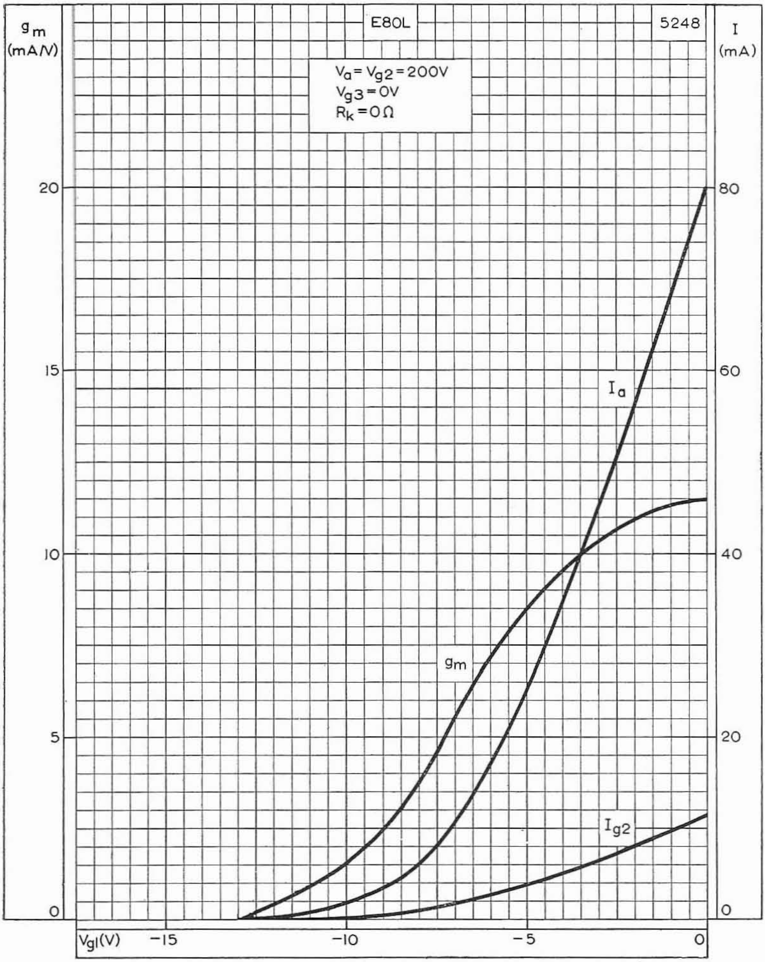




B9A Base

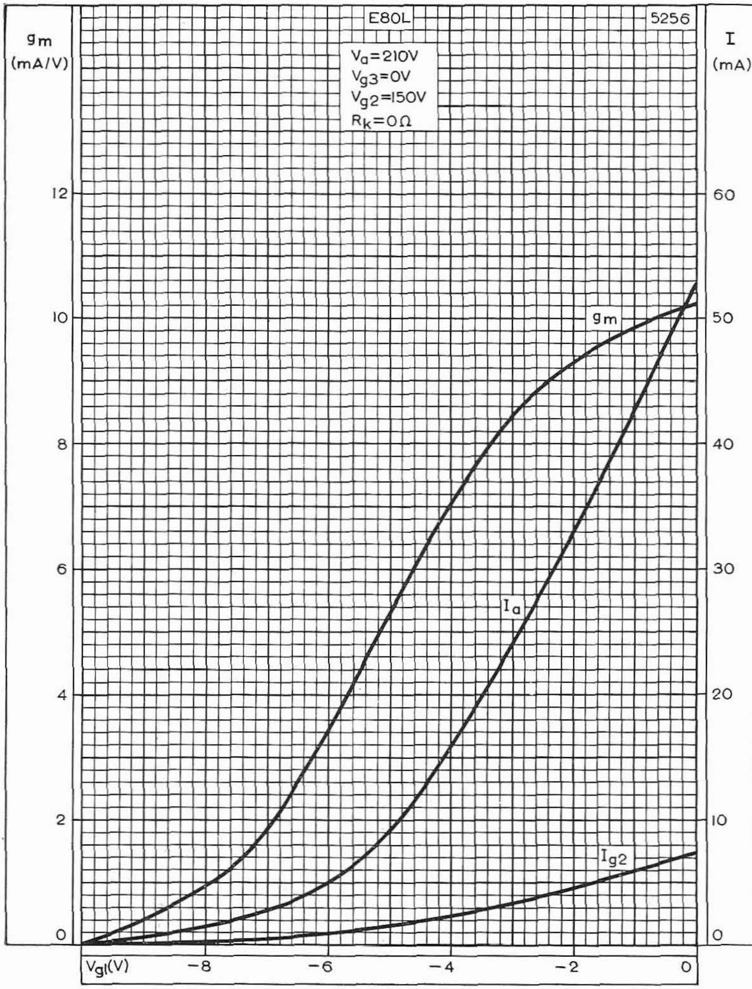


The bulb and base dimensions of this valve are in accordance with BS448 Section B9A

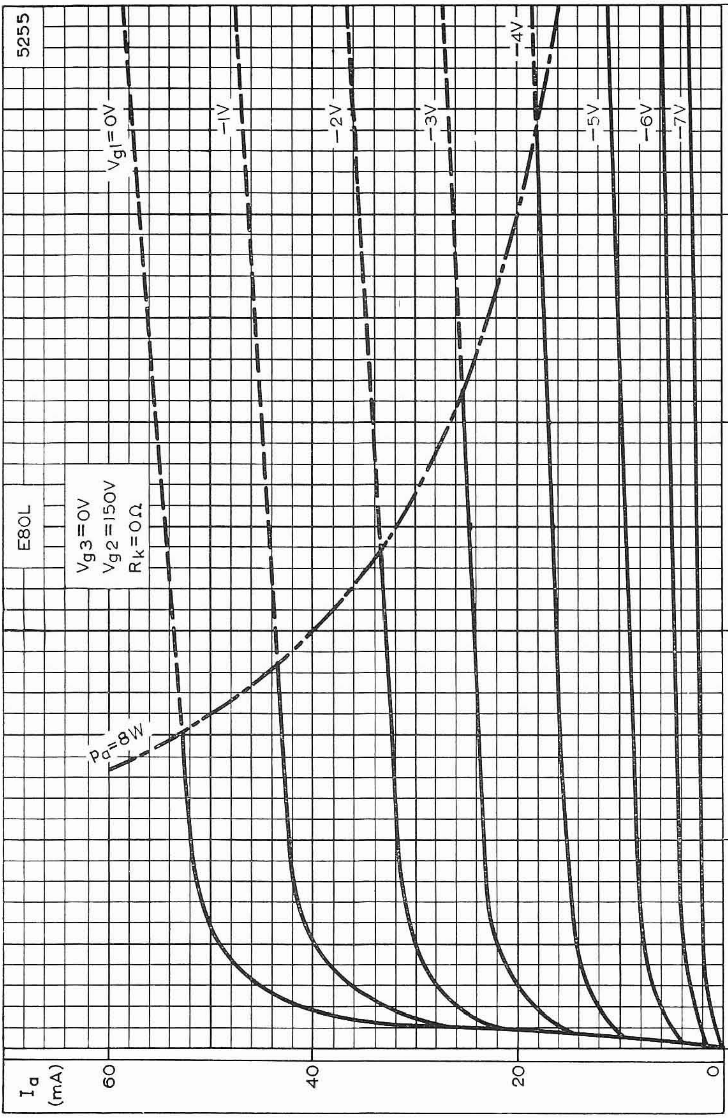


ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
$V_a = V_{g2} = 200V$

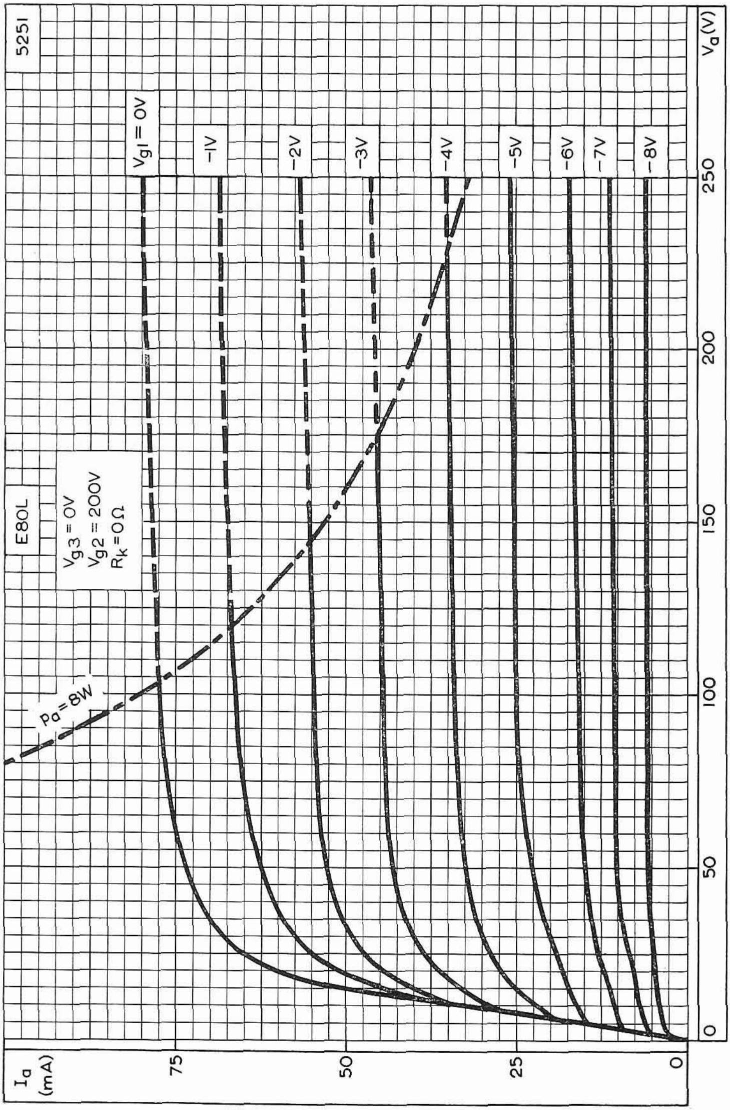
E80L SPECIAL QUALITY OUTPUT PENTODE



ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
$V_a = 210V, \quad V_{g2} = 150V$

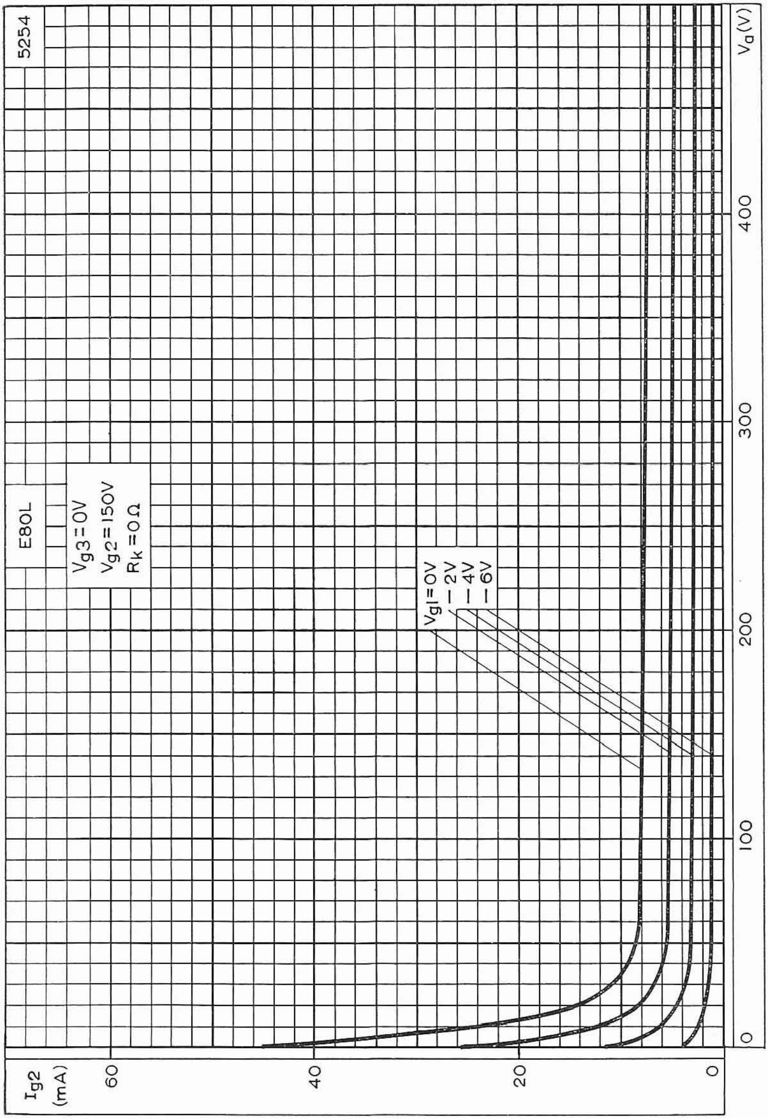


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER
$V_{g2} = 150V$

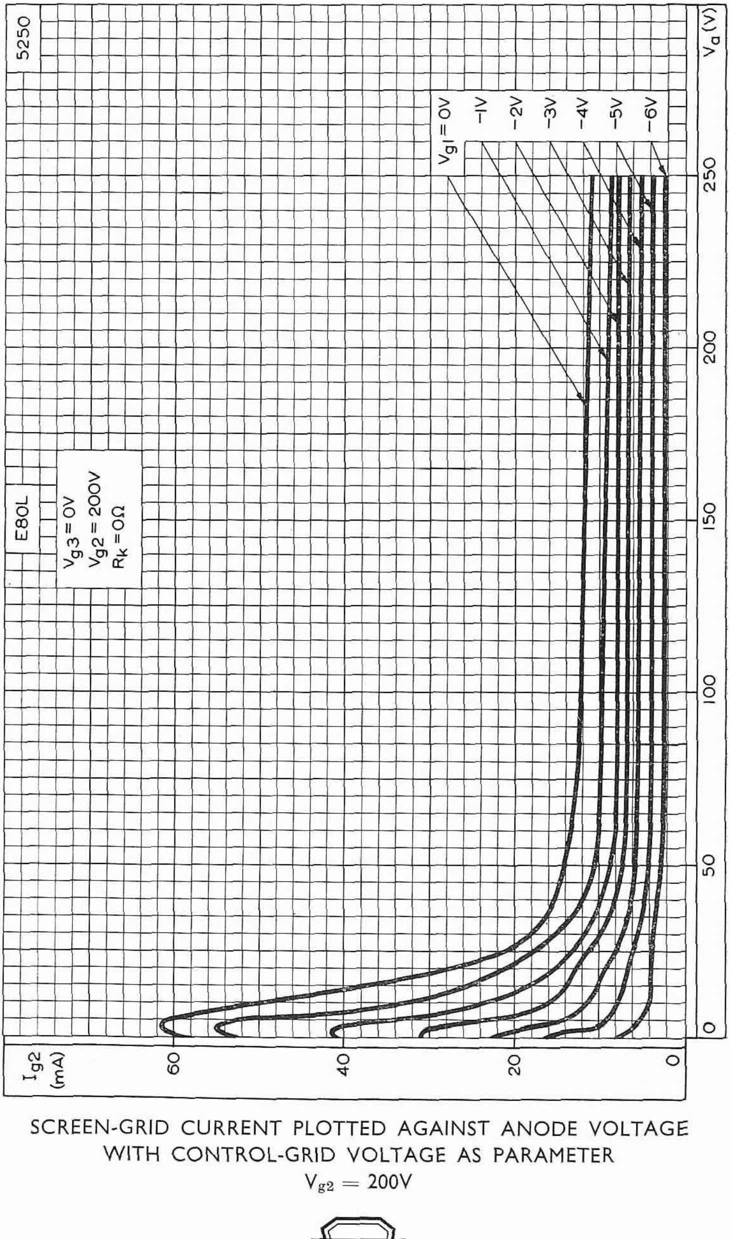


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

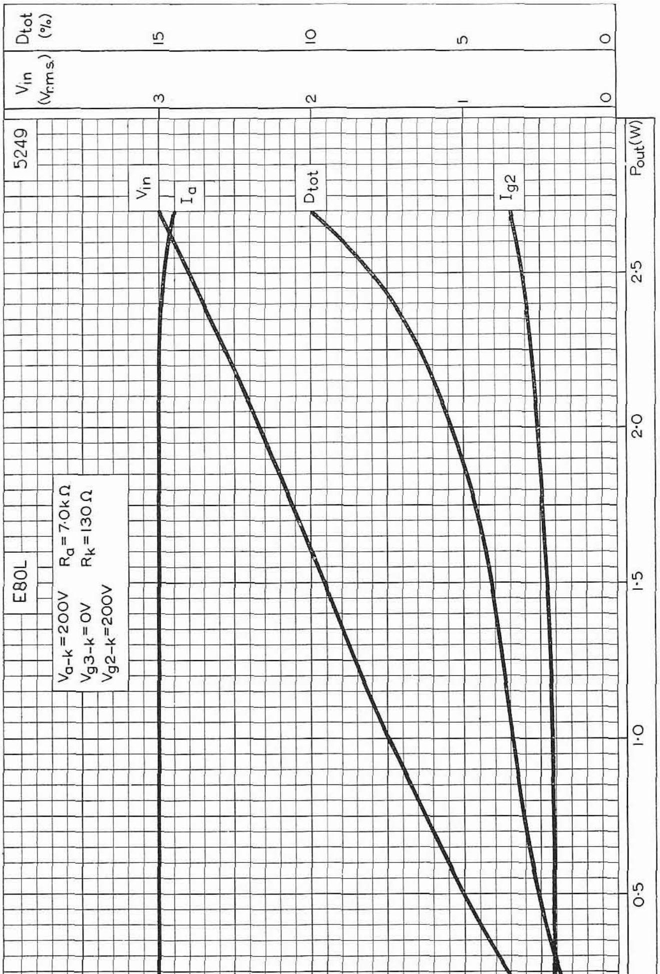
$V_{g2} = 200V$



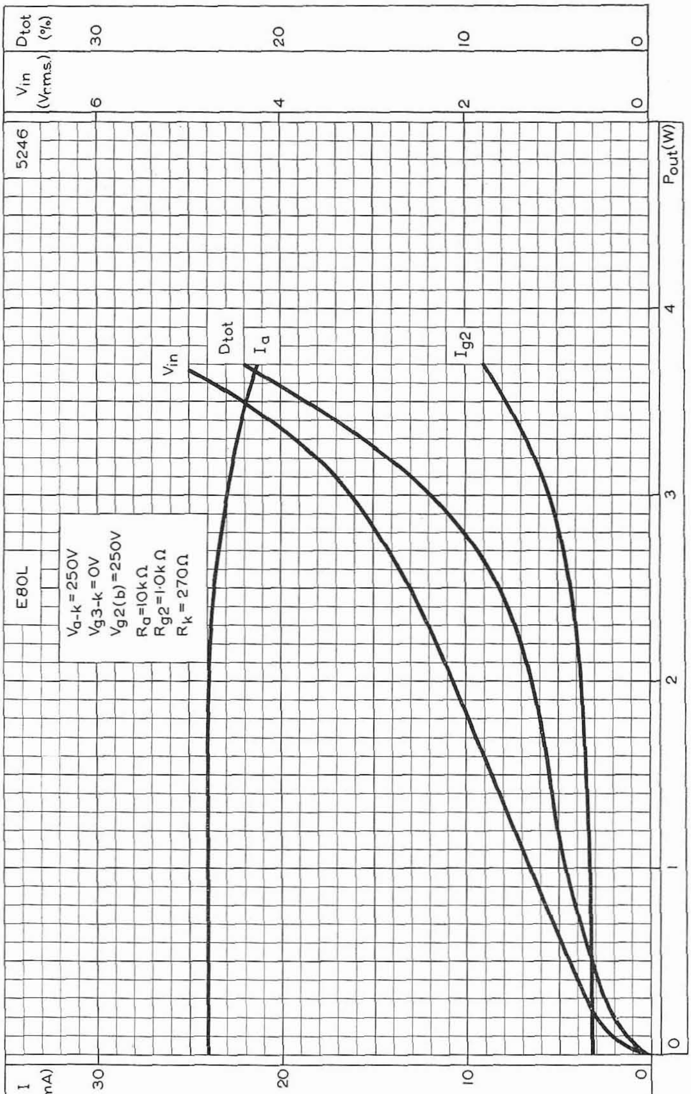
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER
$V_{g2} = 150V$



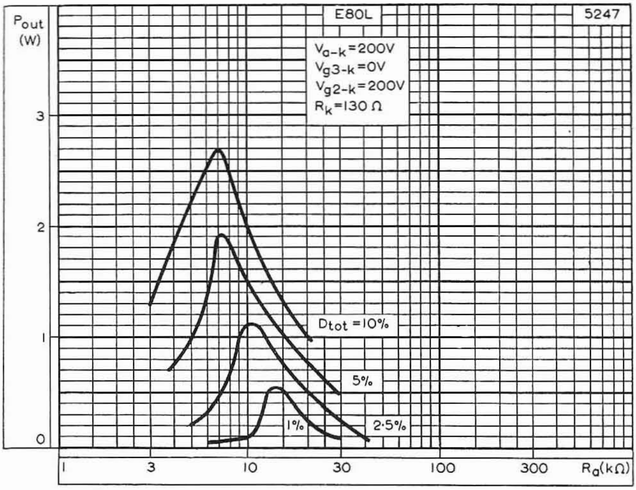
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER
$V_{g2} = 200V$



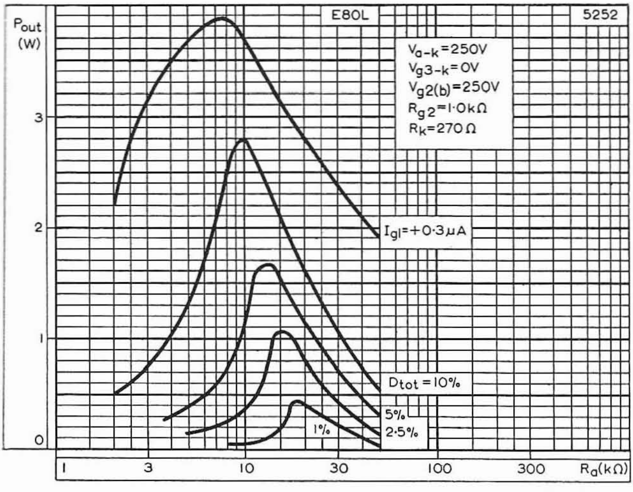
PERFORMANCE OF E80L AS CLASS 'A' AMPLIFIER. $R_a = 7.0k\Omega$



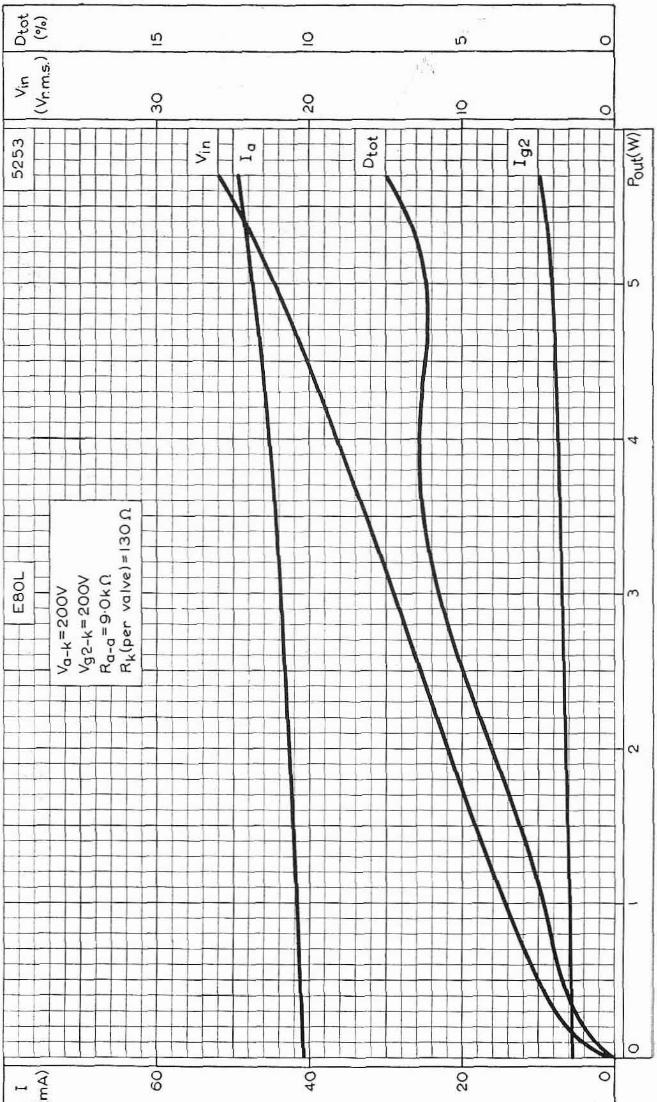
PERFORMANCE OF E80L AS CLASS 'A' AMPLIFIER. $R_a = 10k\Omega$



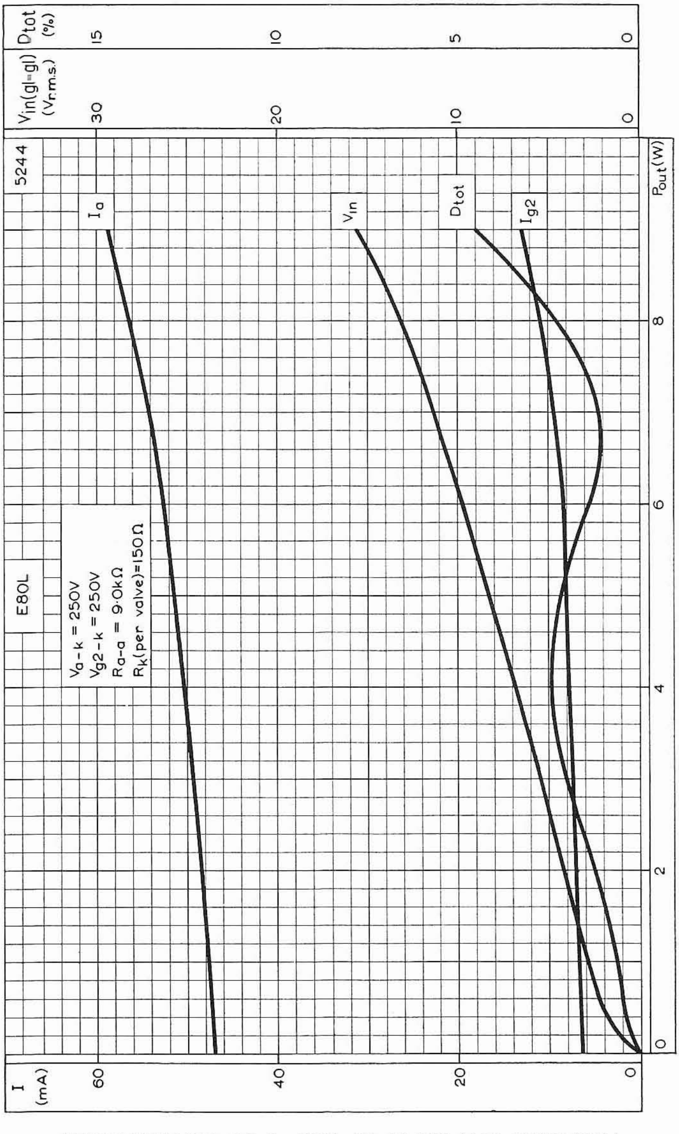
POWER OUTPUT PLOTTED AGAINST ANODE LOAD. $V_a = 200V$



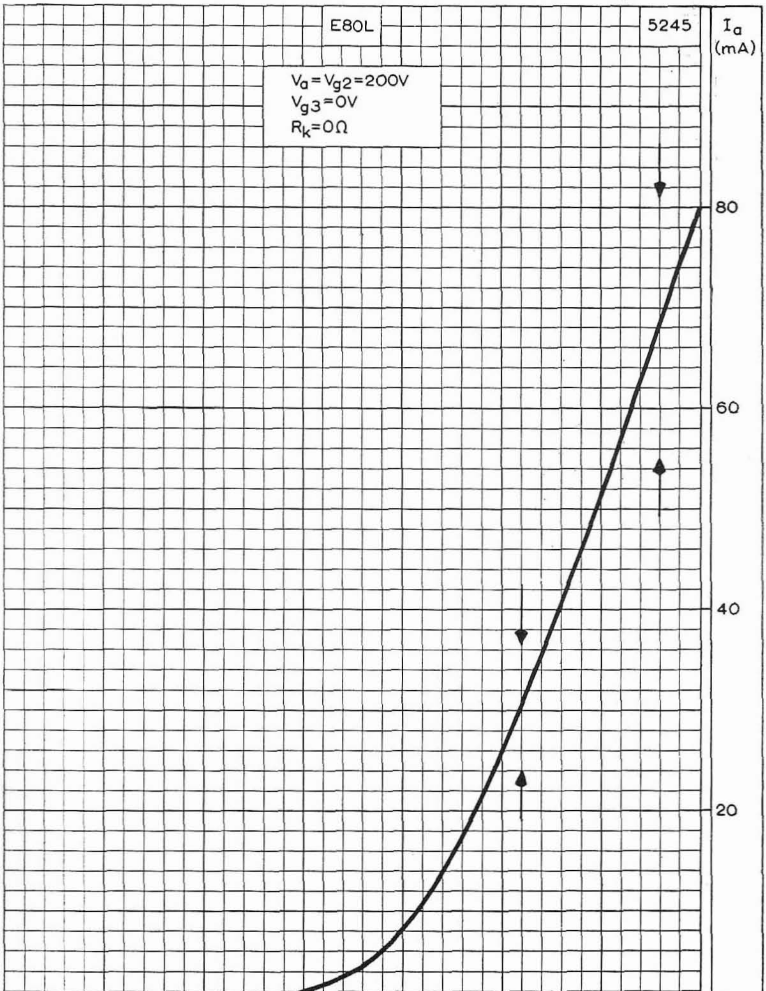
POWER OUTPUT PLOTTED AGAINST ANODE LOAD. $V_a = 250V$



PERFORMANCE OF 2 × E80L IN CLASS 'AB' PUSH-PULL
$V_{a-k} = V_{g2-k} = 200V$



PERFORMANCE OF 2×E80L IN CLASS 'AB' PUSH-PULL
$V_{a-k} = V_{g2-k} = 250V$



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH INDICATION OF INITIAL SPREADS

SPECIAL QUALITY OUTPUT PENTODE

E81L

Special quality output pentode designed for use in telephone equipment.

This data should be read in conjunction with GENERAL NOTES – SPECIAL QUALITY VALVES which precede this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for series or parallel operation a.c. or d.c.

V_h[1]	6.3	V
I_h	375	mA

The maximum variation of heater current at $V_h = 6.3V$ is $\pm 20mA$. In order to achieve a useful valve life with the heater in a series connected chain, the absolute maximum variation of heater current due to voltage fluctuations and component tolerances should be $< \pm 1.5\%$.

CAPACITANCES[2]

c_{a-g1}	<0.02	pF
c_{in}	11.5 ± 0.8	pF
c_{out}	6.5 ± 0.6	pF
c_{g1-h}	<0.2	pF
c_{h-k}	4.2	pF
c_{in} ($I_k = 25mA$)	14.3	pF

CHARACTERISTICS[3]

V_{a-k}	210	V
V_{g3-k}	0	V
V_{g2-k}	210	V
R_k	120	Ω
*I_a	20 ± 3.0	mA
*I_{g2}	5.3 ± 1.2	mA
*g_m	11 ± 1.5	mA/V
r_a	300	kΩ
r_a min.	200	kΩ
μ_{g1-g2}	36	
R_{eq} (r.f.)	1.2	kΩ
*$-I_{g1}$ max.	0.5	μA
V_{g1} ($I_{g1} = +0.3\mu A$)	<-1.1	V

*To allow for valve deterioration during life, circuits should be designed to function with a valve in which one or more of these characteristics have changed to the following values:

I_a	≤ 13.5	mA
I_{g2}	≤ 3.1	mA
g_m	≤ 7.8	mA/V
$-I_{g1}$ ($R_{g1} = 100k\Omega$)	≥ 1.0	μA

E81L

SPECIAL QUALITY OUTPUT PENTODE

OPERATING CONDITIONS

As a pre-amplifier

V_{a-k}	210	V
V_{g3-k}	0	V
V_{g2-k}	210	V
R_k	180	Ω
R_a	20	kΩ
I_a	15	mA
I_{g2}	4.0	mA
V_{out}/V_{in}	172	

As an output valve

V_{a-k}	210	V
V_{g3-k}	0	V
V_{g2-k}	210	V
R_k	120	Ω
R_a	15	kΩ
I_a	20	mA
I_{g2}	5.3	mA
P_{out} ($D_{tot} = 5\%$)	1.0	W
$V_{in(r.m.s.)}$	0.9	V

INSULATION

Between heater and cathode		
V_h	6.3	V
V_{h-k}	120	V
Series resistor	1.0	MΩ
Leakage current	<24 $<$[redacted]	μA
Between any two arbitrary electrodes	>30	MΩ

LIMITING VALUES[4] (design centre ratings)

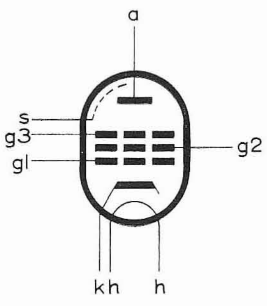
$V_{a(b)}$ max.	550	V
V_a max.	210	V
p_a max.	4.5	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	210	V
p_{g2} max.	1.2	W
I_k max.	30	mA
R_{g1-k} max. (cathode bias)	500	kΩ
R_{g1-k} max. (fixed bias)	250	kΩ
V_{h-k} max.	120	V
R_{h-k} max.	20	kΩ
T_{bulb} max.	170	°C

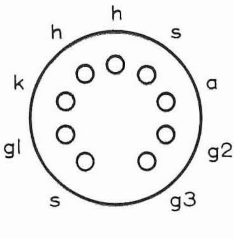
OPERATING NOTES

The hum voltage referred to g_1 has a maximum value of 200μV r.m.s. at 50c/s with a grid leak of 1.0MΩ.

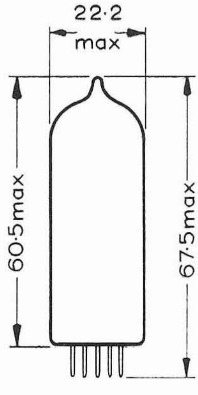
SPECIAL QUALITY OUTPUT PENTODE

E81L





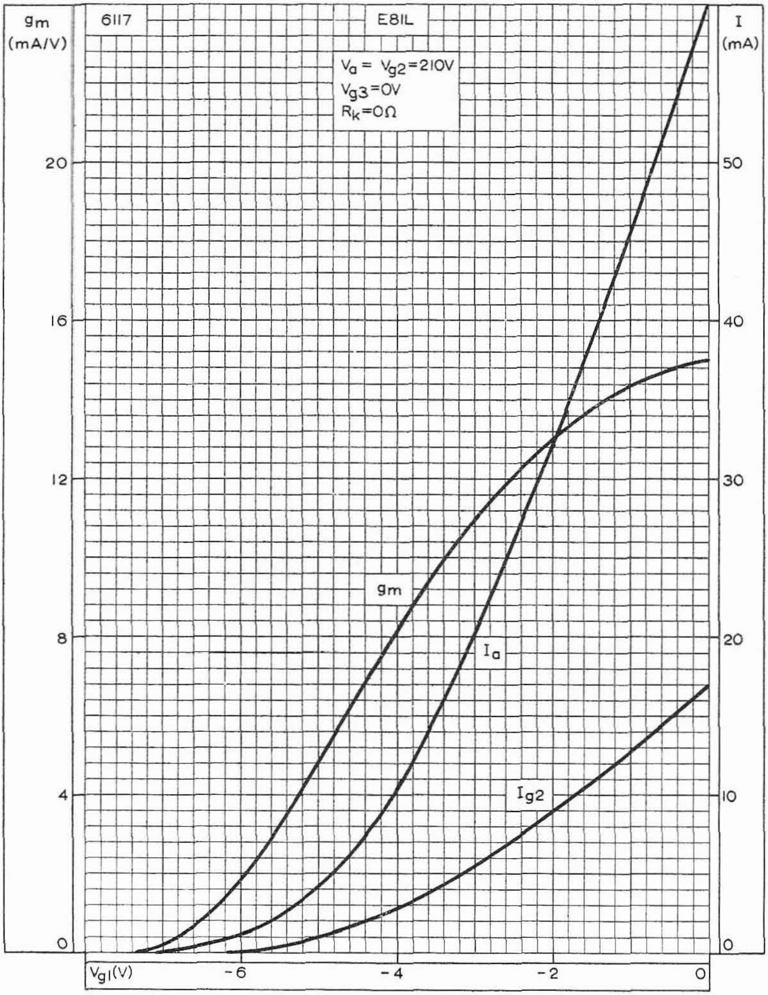
B9A Base



5112

All dimensions in mm

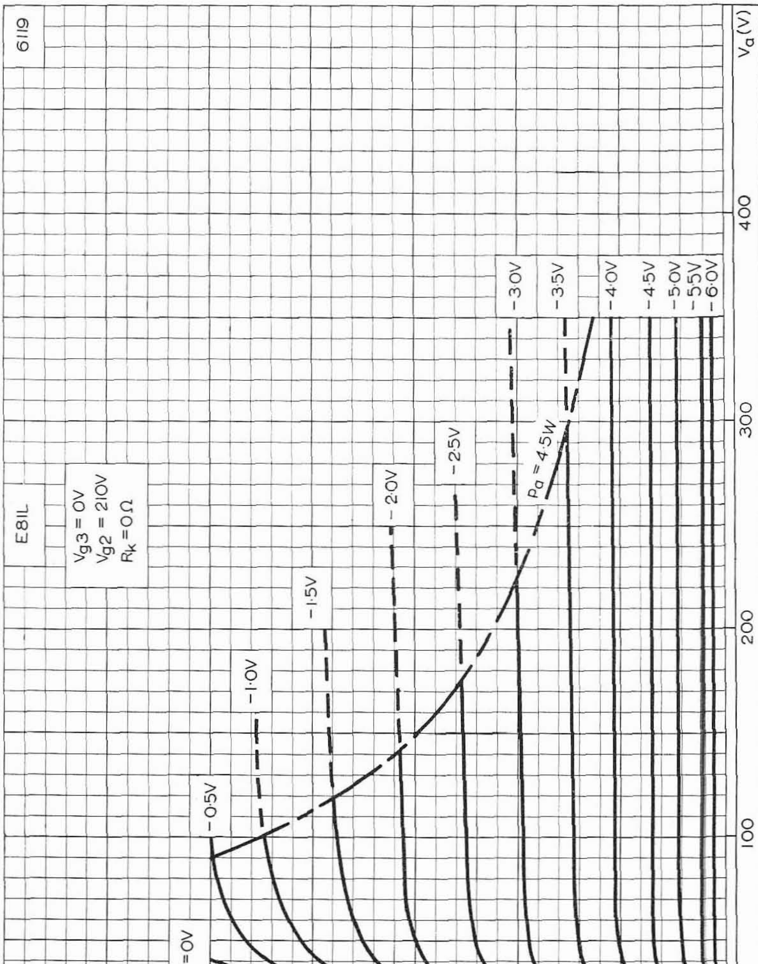
The bulb and base dimensions of this valve are in accordance with BS448, Section B9A



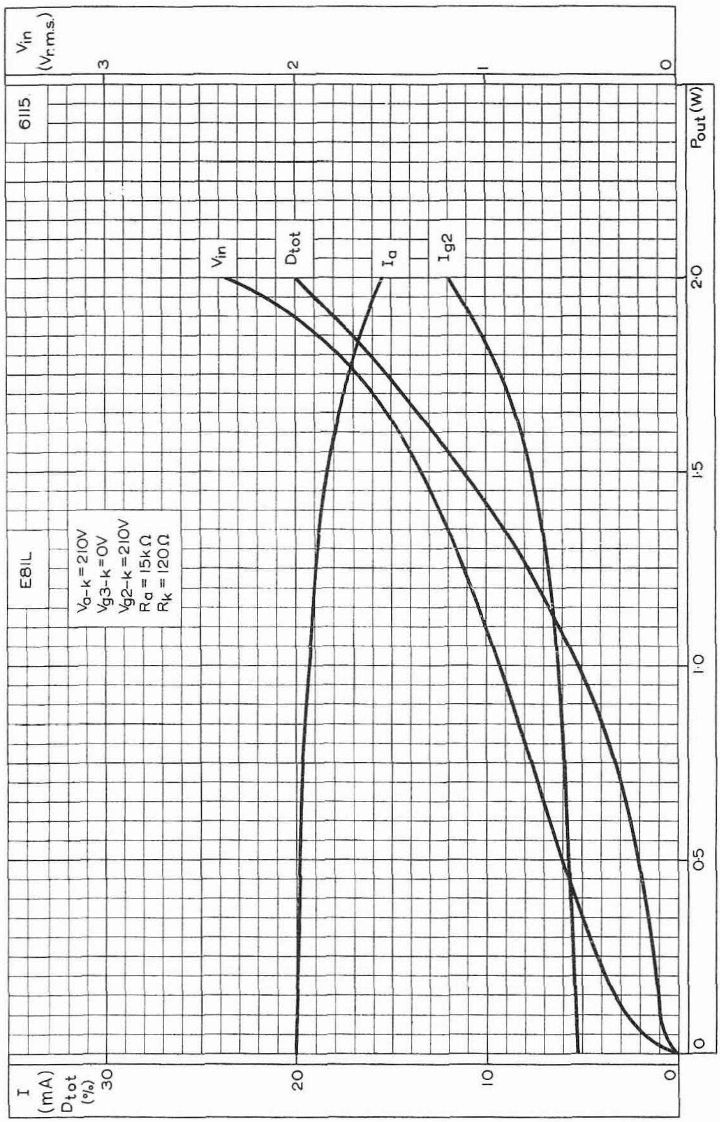
ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

E81L

SPECIAL QUALITY OUTPUT PENTODE



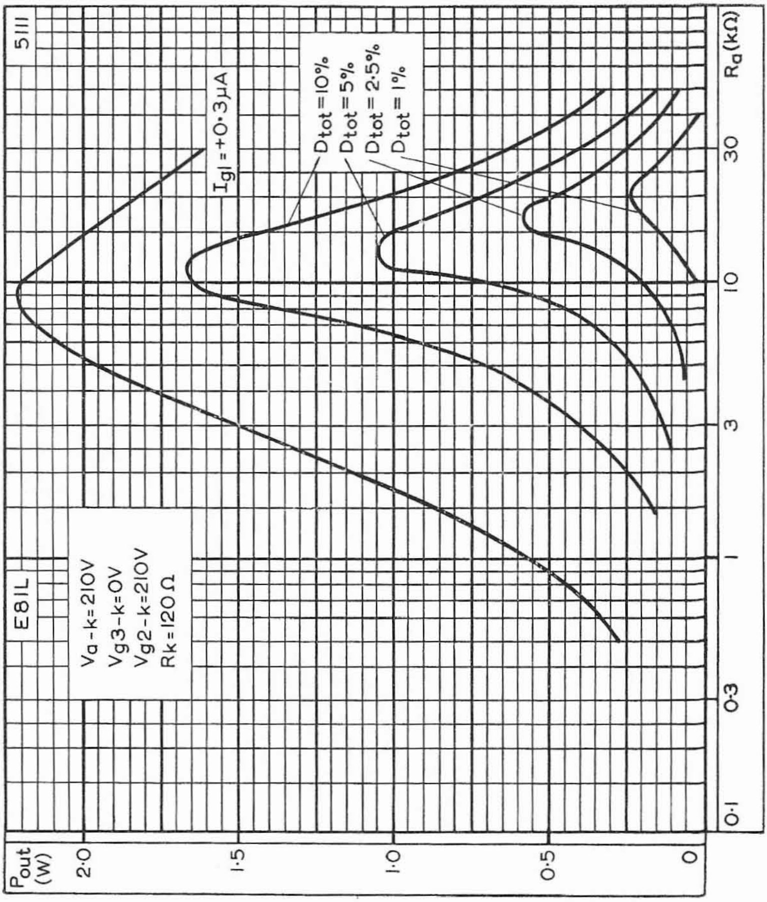
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



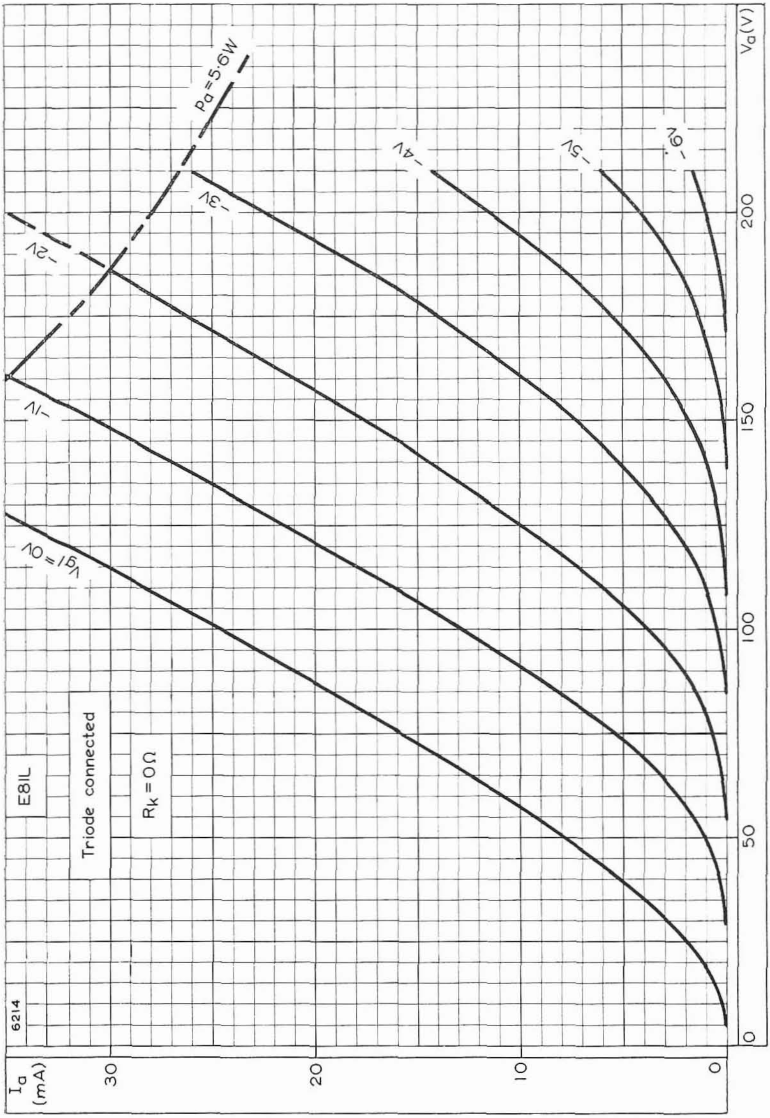
PERFORMANCE OF E81L AS CLASS 'A' AMPLIFIER

E81L

SPECIAL QUALITY OUTPUT PENTODE

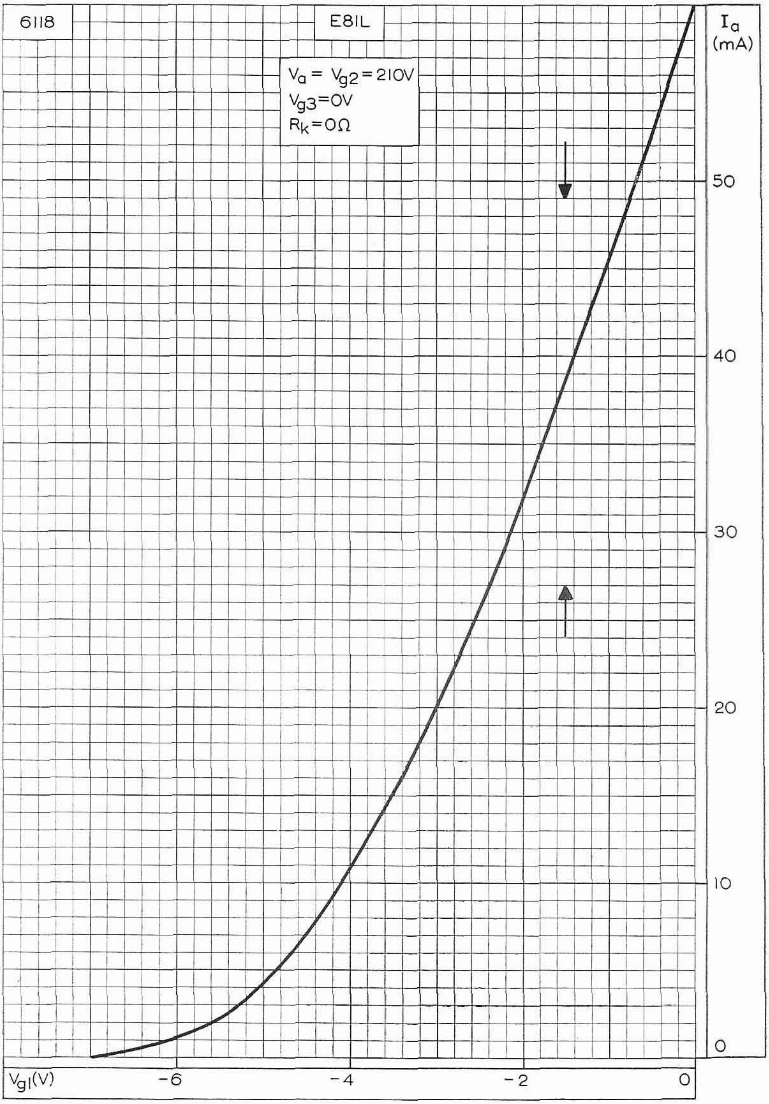


POWER OUTPUT PLOTTED AGAINST ANODE LOAD



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED

SPECIAL QUALITY OUTPUT PENTODE



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH INDICATION OF INITIAL SPREAD

SPECIAL QUALITY HIGH SLOPE PENTODE

E83F

Special quality high slope pentode for use in general industrial applications where stability of characteristics and long life are required.

This data should be read in conjunction with GENERAL NOTES—SPECIAL QUALITY VALVES, which precede this section of the handbook and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

V_h[1]	6.3	V
I_h	300	mA

The maximum variation of heater current at Vh=6.3V is ±15mA.
In order to achieve a useful valve life with the heater in a series connected chain the absolute maximum variation of heater current due to voltage fluctuations and component tolerances should be <±1.5%.

MOUNTING POSITION — Any

CAPACITANCES[2] (measured without an external shield)

c_{in} av.	8.0	pF
c_{in} max.	8.7	pF
c_{out} av.	3.6	pF
c_{out} max.	4.2	pF
c_{a-g1}	<0.015	pF
c_{g1-h}	<0.15	pF
c_{h-k}	4.0	pF
c_{in} (I_k=12.1mA)	10.8	pF
*$c_{g1-shield}$	<0.025	pF
*$c_{a-shield}$	<0.025	pF

*Capacitance of the electrode to a surrounding shield with an inner diameter of 52mm and a height of 98mm, all other electrodes being earthed.

CHARACTERISTICS[3]

V_{a-k}	210	V
V_{g3-k}	0	V
V_{g2-k}	120	V
R_k	165	Ω
*I_a	10±1.3	mA
*I_{g2}	2.1±0.4	mA
*g_m	9.0±1.2	mA/V
r_a	500	kΩ
r_a min.	300	kΩ
μ_{g1-g2}	34	
R_{eq} (r.f.)	750	Ω
R_{eq} max. (r.f.)	1.0	kΩ
R_{eq} max. (f=0 to 10kc/s)	36	kΩ
−*I_{g1} max. (R_{g1}=100kΩ)	0.5	μA
V_{g1-k} max. (I_a=500μA)	−5.25	V

*To allow for valve deterioration during life, circuits should be designed to function with a valve in which one or more of these characteristics have changed to the following values:-

I_a	7.0	mA
I_{g2}	1.25	mA
g_m	6.4	mA/V
$-I_{g1}$ (R_{g1}=100kΩ)	1.0	μA

E83F

SPECIAL QUALITY HIGH SLOPE PENTODE

OPERATING CONDITIONS AS CLASS "A" AMPLIFIER

V_{a-k}	120	210	V
V_{g3-k}	0	0	V
$V_{g2(b)}$	120	120	V
R_k	180	180	Ω
R_a	10	20	kΩ
R_{g2}	5.6	5.6	kΩ
I_a	8.3	8.3	mA
I_{g2}	1.7	1.7	mA
g_m	8.2	8.2	mA/V
r_a	420	440	kΩ
$V_{in\ (r.m.s.)}$	1.1	1.1	V
$V_{in\ (r.m.s.)}$ (P_{out}=50mW)	350	250	mV
P_{out}	340	660	mW
*P_{out}(I_{g1}=+0.3μA)	400	870	mW
D_{tot}	10	10	%

*Measured with R_{g1}=330kΩ

INSULATION

Between heater and cathode

V_h	6.3	V
V_{h-k}	100	V
Series resistor	1.0	MΩ
Leakage current	<15	μA
Between any two arbitrary electrodes	>100	MΩ

LIMITING VALUES (design centre ratings)

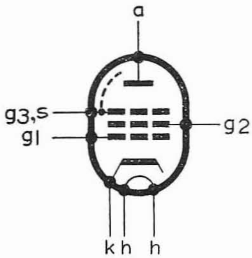
$V_{a(b)}$ max.	550	V
V_a max.	210	V
p_a max.	2.1	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	210	V
p_{g2} max.	350	mW
I_k max.	16	mA
*$i_{k(pk)}$ max.	80	mA
V_{g1} max. (I_{g1}=+0.3μA)	−1.1	V
−V_{g1} max.	100	V
−*$v_{g1(pk)}$ max.	200	V
p_{g1} max.	50	mW
R_{g1-k} max. (cathode bias)	1.0	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ
T_{bulb} max. (absolute rating)	170	°C

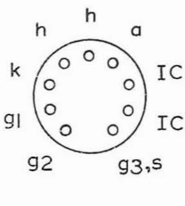
*Max. duty cycle=10%, max. pulse duration=200μs

OPERATING NOTES

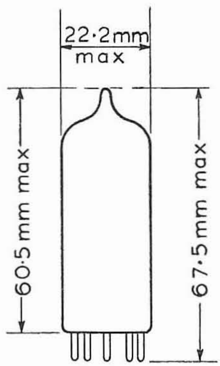
The hum voltage referred to g_1 has a maximum value of 500μV(r.m.s.) with a grid leak of 500kΩ.

5167

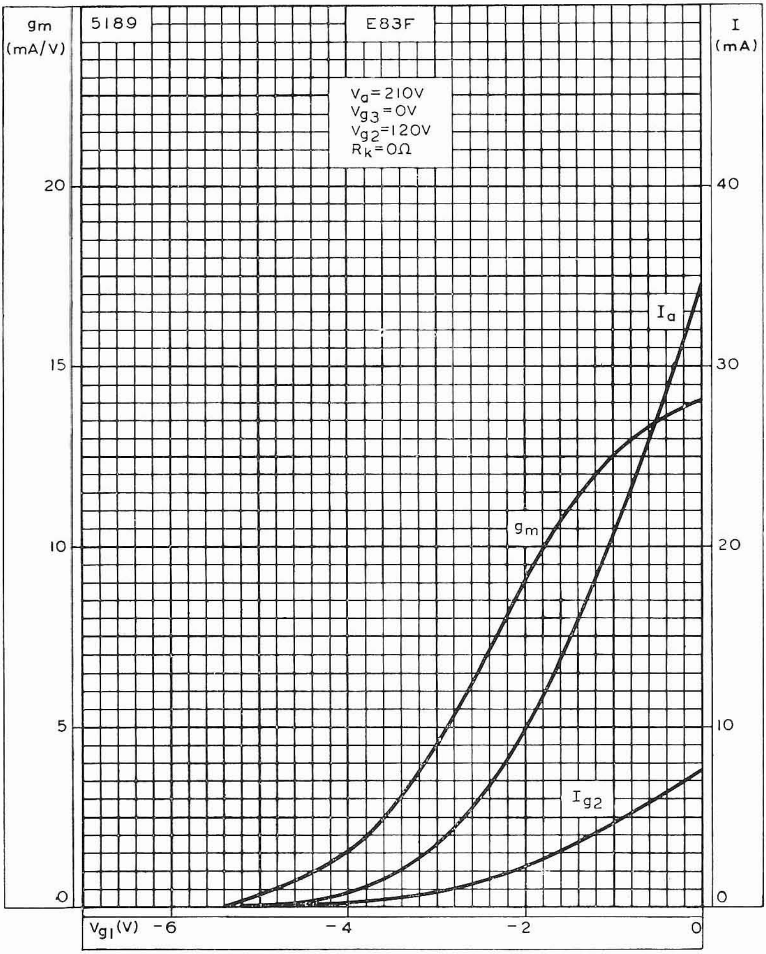




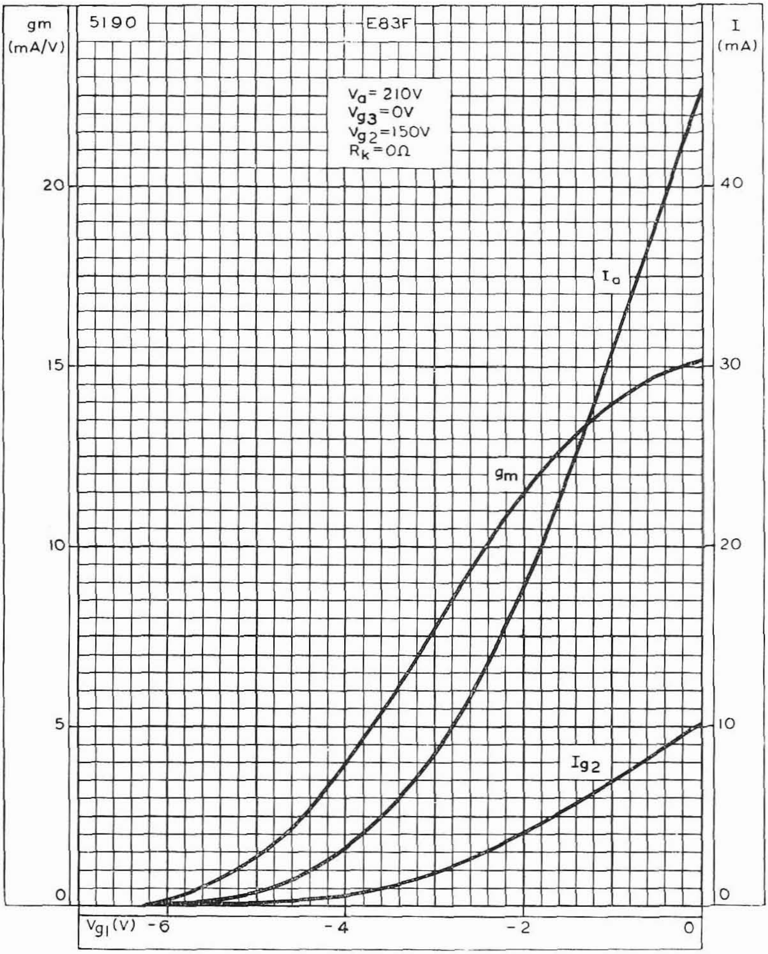
B9A Base



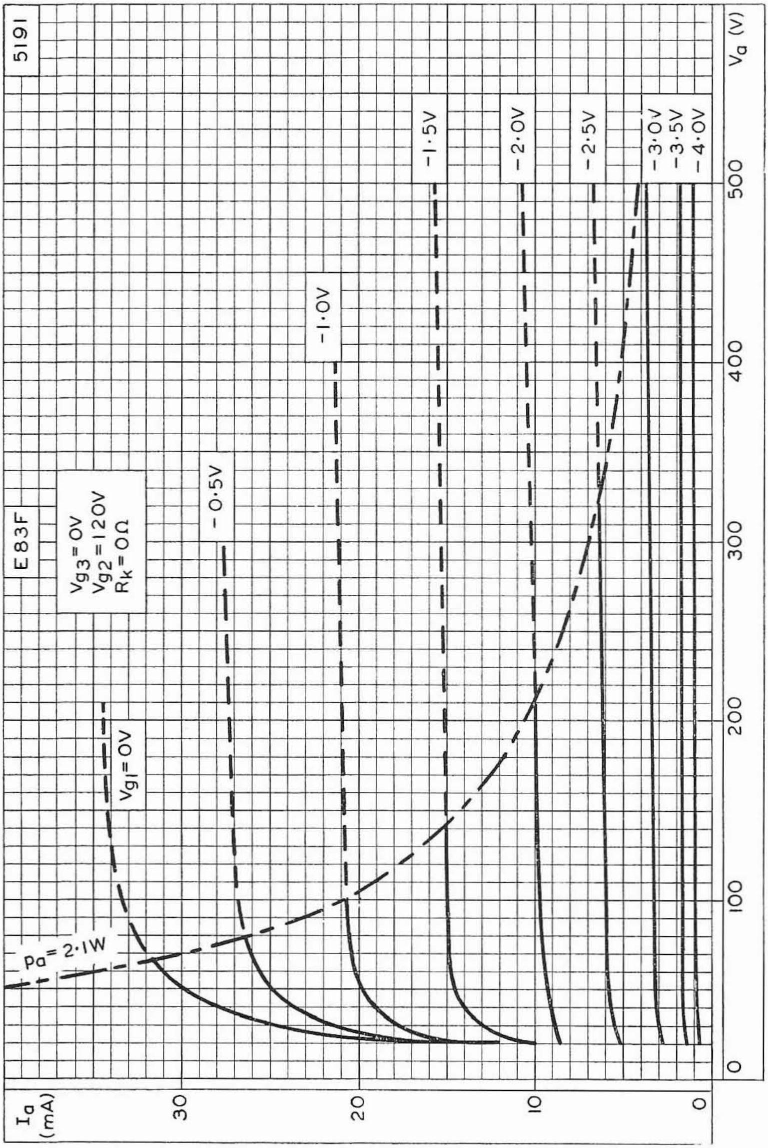
The bulb and base dimensions of this valve are in accordance with BS448, Section B9A



ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE AT V_a=210V, V_{g2}=120V.



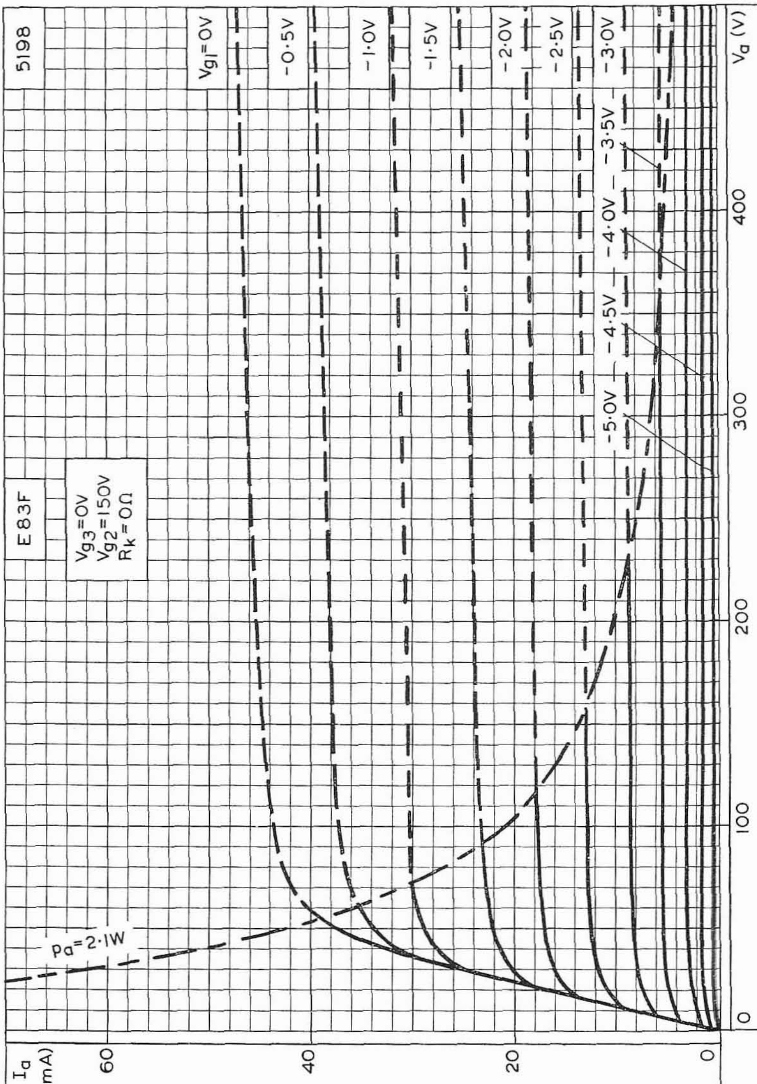
ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE AT V_a=210V, V_{g2}=150V.



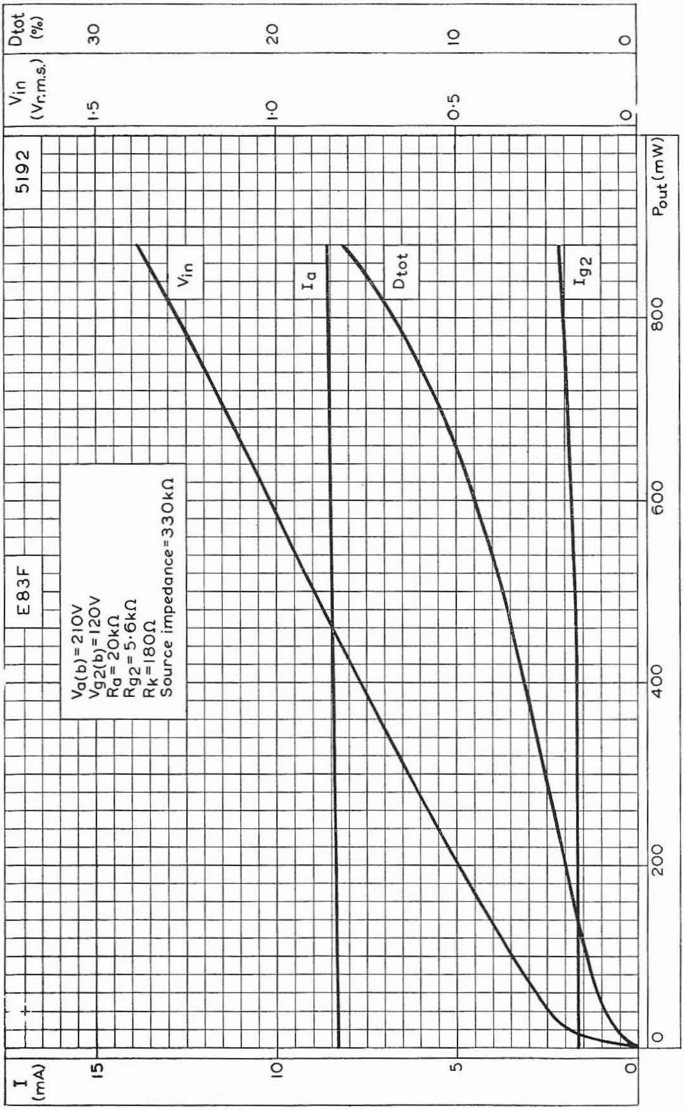
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 120V

E83F

SPECIAL QUALITY HIGH SLOPE PENTODE



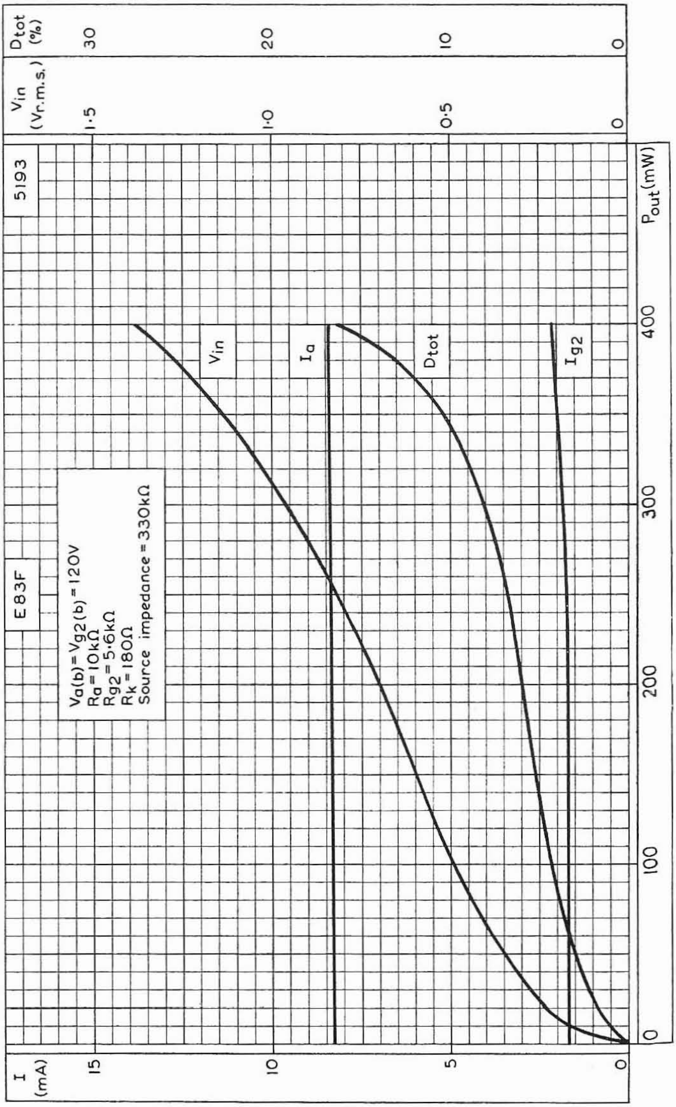
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=150V$



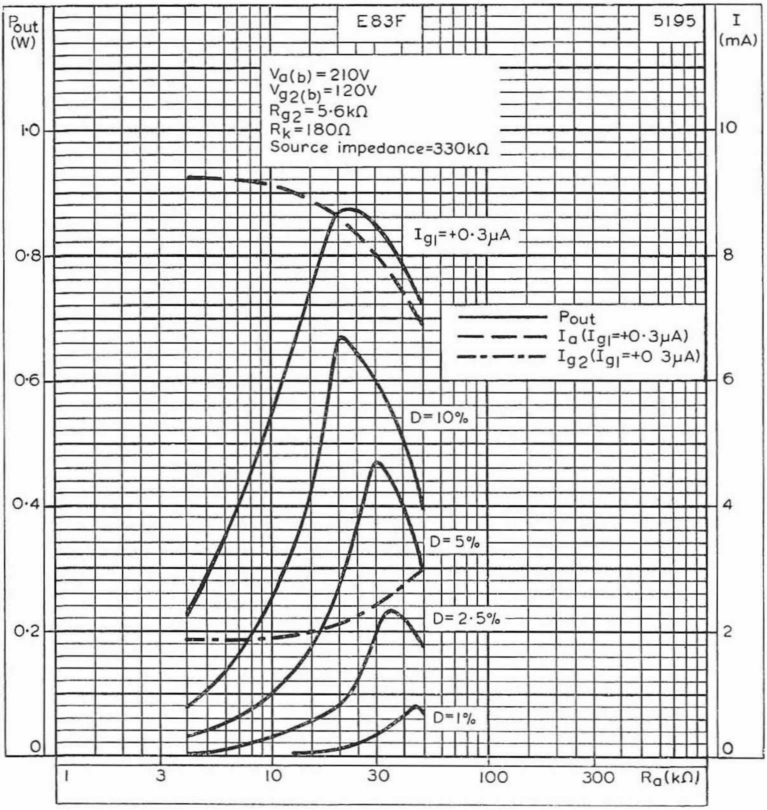
PERFORMANCE OF E83F AS A SINGLE VALVE CLASS "A" AMPLIFIER WITH $V_{a(b)}=210V$, $V_{g2(b)}=120V$

E83F

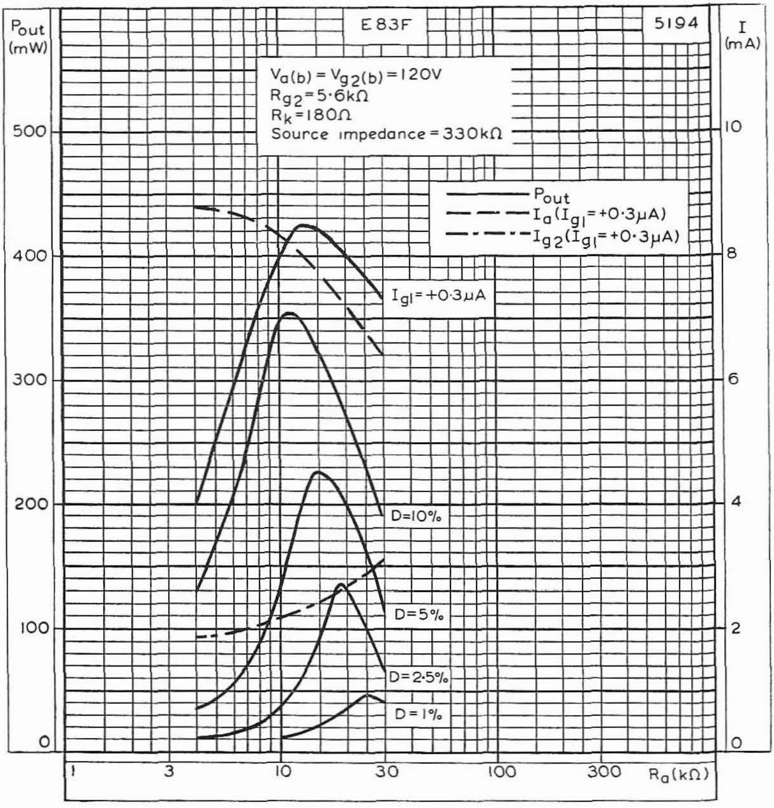
SPECIAL QUALITY
HIGH SLOPE PENTODE



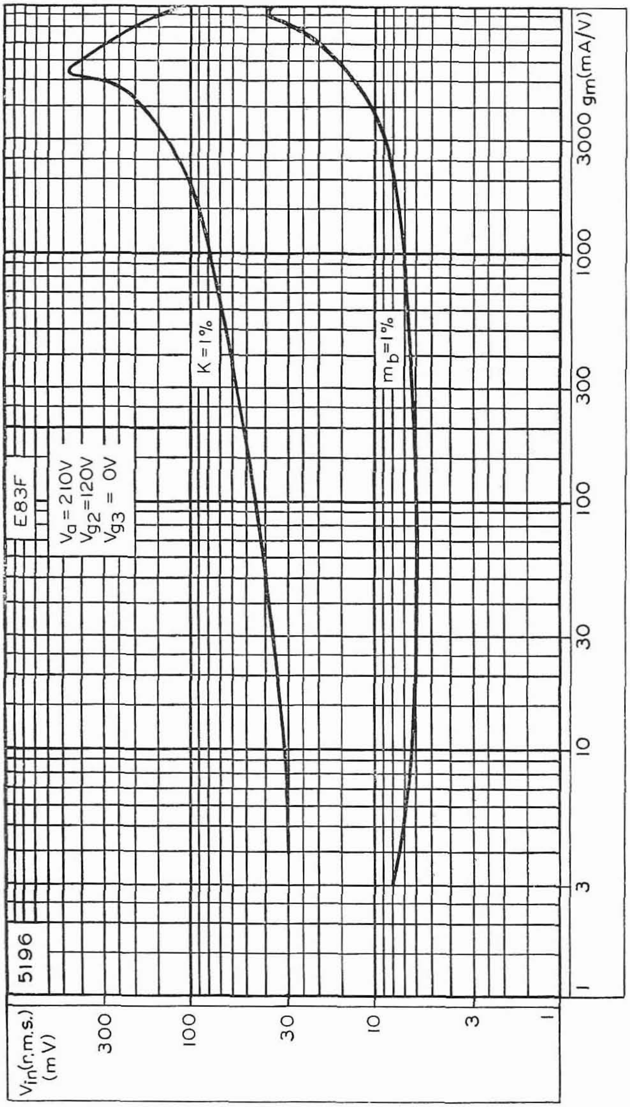
PERFORMANCE OF E83F AS A SINGLE VALVE CLASS "A" AMPLIFIER WITH $V_{a(b)} = V_{g2(b)} = 120V$



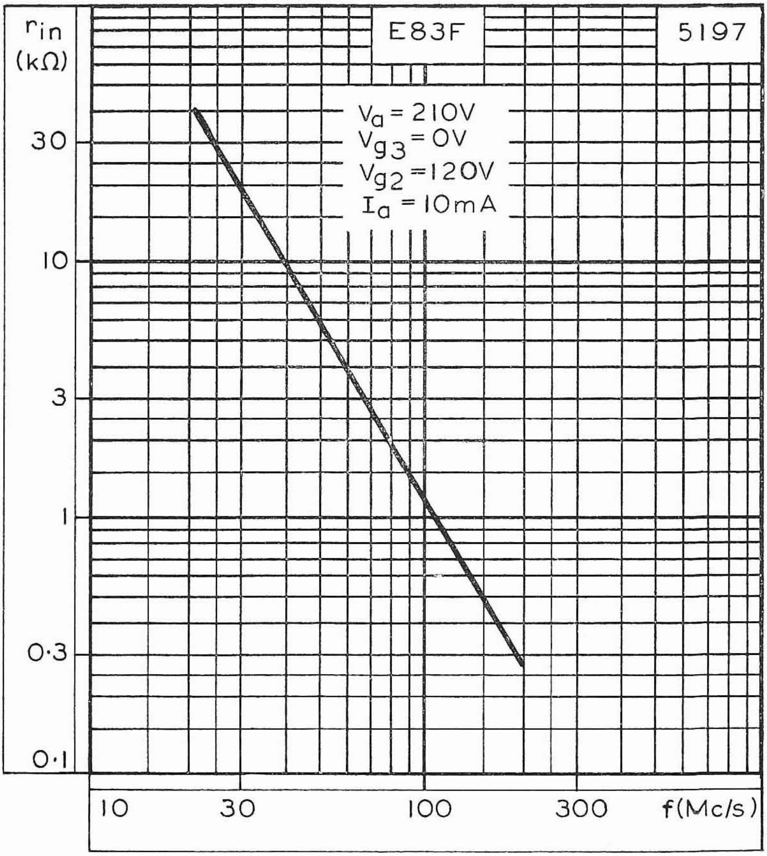
POWER OUTPUT, ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE LOAD RESISTANCE AT $V_{a(b)}=210V$, $V_{g2(b)}=120V$



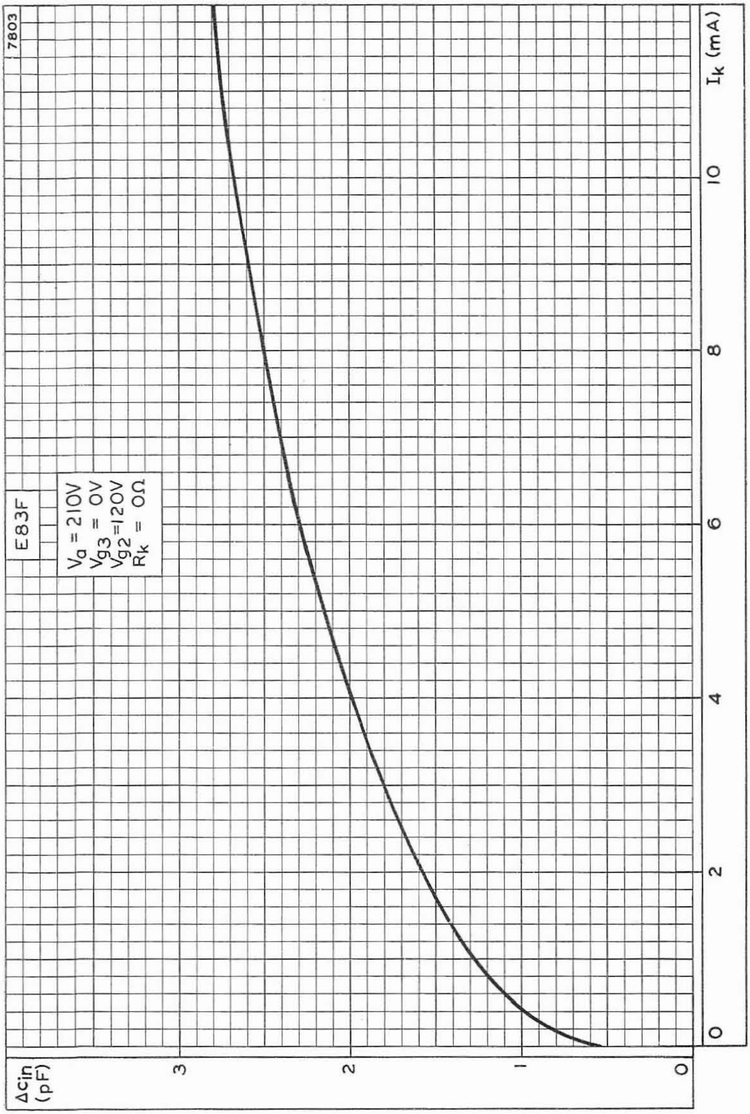
POWER OUTPUT, ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE LOAD RESISTANCE AT $V_{a(b)} = V_{g2(b)} = 120V$



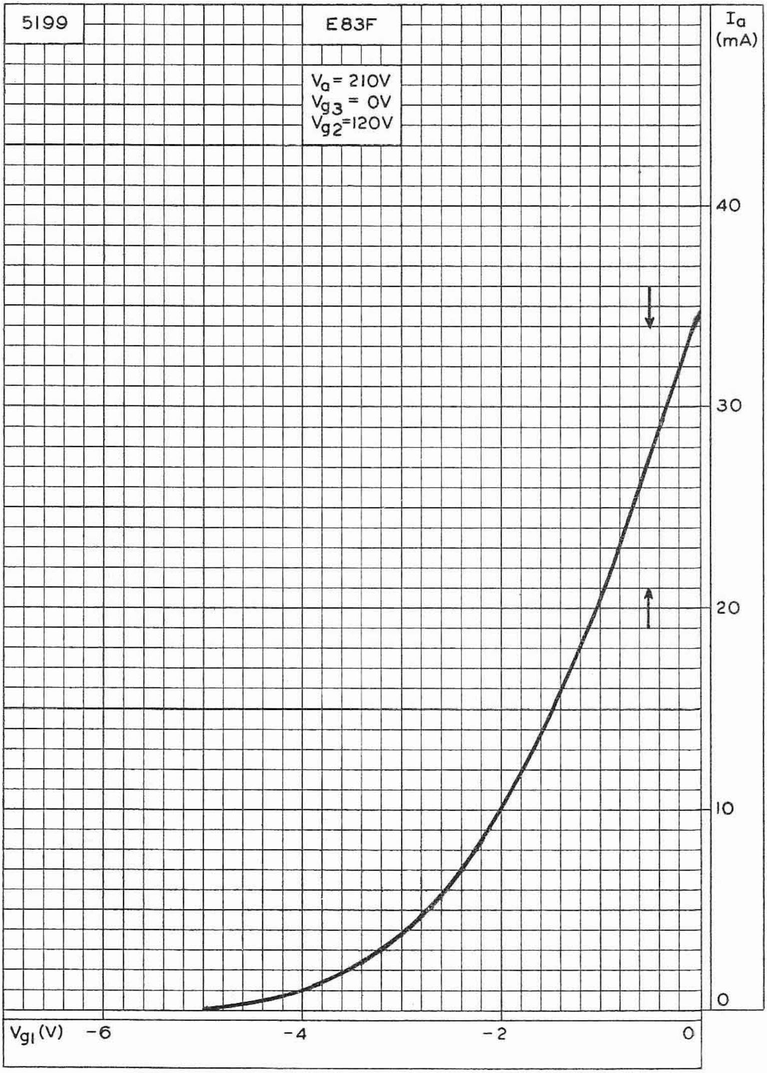
CROSS MODULATION AND MODULATION HUM CURVES



INPUT RESISTANCE PLOTTED AGAINST FREQUENCY AT $V_a = 210V$, $V_{g2} = 120V$



INCREMENTAL INPUT CAPACITANCE PLOTTED AGAINST CATHODE CURRENT AT $V_a = 210V$, $V_{g2} = 120V$



SPREAD OF ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE AT $V_a = 210V$, $V_{g2} = 120V$

SPECIAL QUALITY DUAL CONTROL HEPTODE

E91H

Special quality dual control heptode for use as a gating valve in computer circuits where stability of characteristics and long life are required.

This data should be read in conjunction with GENERAL NOTES—SPECIAL QUALITY VALVES which precede this section of the handbook and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for parallel operation, a.c. or d.c.

V_h[1]	6.3	V
I_h	270	mA

The maximum variation of heater current at $V_h = 6.3V$ is $\pm 14mA$.

MOUNTING POSITION — Any

CAPACITANCES[2] (measured without an external shield)

c_{a-g1}	<0.08	pF
c_{a-g3}	<0.45	pF
c_{g1-g3}	<0.2	pF
c_{g1-all}	5.4	pF
c_{g3-all}	7.0	pF←
c_{a-all}	7.9	pF←

CHARACTERISTICS[3] (see fig. 1)

$V_{a(b)}$	150	150	150	150	V
$V_{g2+g4(b)}$	75	75	75	75	V
$V_{g1(b)}$	0	0	−10	0	V
$V_{g3(b)}$	0	−10	0	+55	V
R_a	20	20	20	—	kΩ
R_{g2+g4}	470	470	470	—	Ω
R_{g1}	47	47	47	—	kΩ
R_{g3}	47	47	47	—	kΩ
I_a	>5.5 <7.0	<0.2	<0.2	—	mA←
I_{g3}	—	—	—	>0	mA

2551

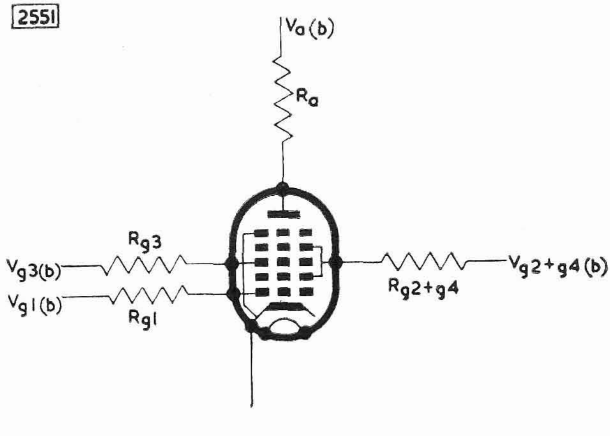


Fig. 1

Inverse grid current (g_1 and g_3)

$V_{a(b)}$	150	V
$V_{g2+g4(b)}$	75	V
$V_{g1(b)}$	−1.5	V
$V_{g3(b)}$	−1.5	V
R_a	20	kΩ
R_{g2+g4}	470	Ω
R_{g1}	47	kΩ
R_{g3}	47	kΩ
$-I_{g1}$	<0.2	µA
$-I_{g3}$	<0.5	µA ←

INSULATION

Between heater and cathode.

V_h	6.3	V
V_{h-k}	120	V
Leakage current	<15	µA

TYPICAL OPERATING CONDITIONS

As a frequency changer

V_a	250	V
V_{g2+g4}	100	V
V_{g3}	−5.0	V
I_a	3.3	mA
I_{g2+g4}	6.5	mA
$V_{g1(r.m.s.)}$	10	V
I_{g1}	530	µA
R_{g1}	20	kΩ
g_c	450	µA/V
r_a	850	kΩ

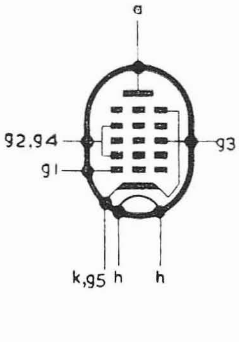
SPECIAL QUALITY DUAL CONTROL HEPTODE

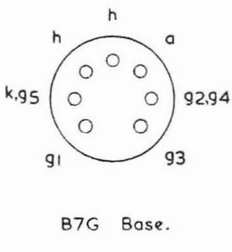
E91H

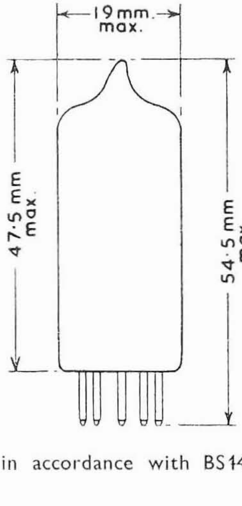
LIMITING VALUES[4] (absolute ratings)

$V_{a(b)}$ max.	500	V
V_a max.	250	V
p_a max.	1.0	W
$V_{g2+g4(b)}$ max.	500	V
V_{g2+g4} max.	100	V
p_{g2+g4} max.	1.0	W
$+V_{g1}$ max.	0	V
$-V_{g1}$ max.	100	V
$-v_{g1(pk)}$ max.	200	V
p_{g1} max.	500	mW
$+V_{g3}$ max.	0	V
$-V_{g3}$ max.	100	V
$+v_{g3(pk)}$ max.	90	V
$-v_{g3(pk)}$ max.	200	V
p_{g3} max.	500	mW
I_k max.	20	mA
$i_{k(pk)}$ max.	70	mA
R_{g1-k} max. (cathode bias)	1.0	MΩ
R_{g1-k} max. (fixed bias)	500	kΩ
R_{g3-k} max. (cathode bias)	1.0	MΩ
R_{g3-k} max. (fixed bias)	500	kΩ
V_{h-k} max.	120	V

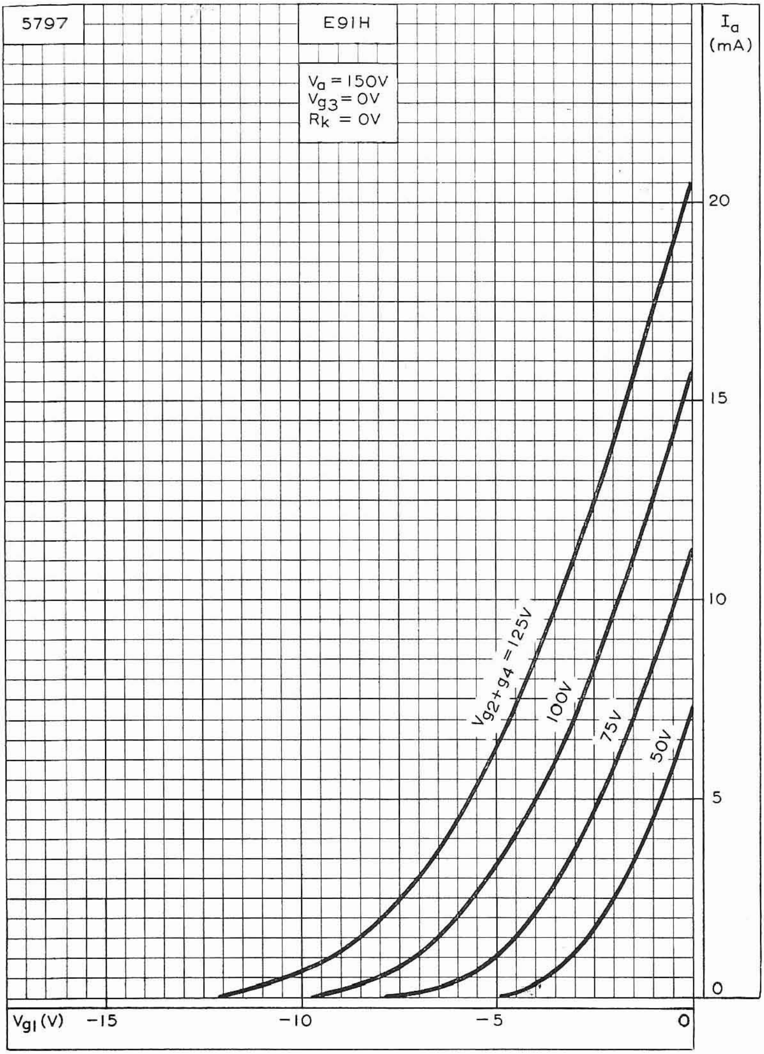
1507



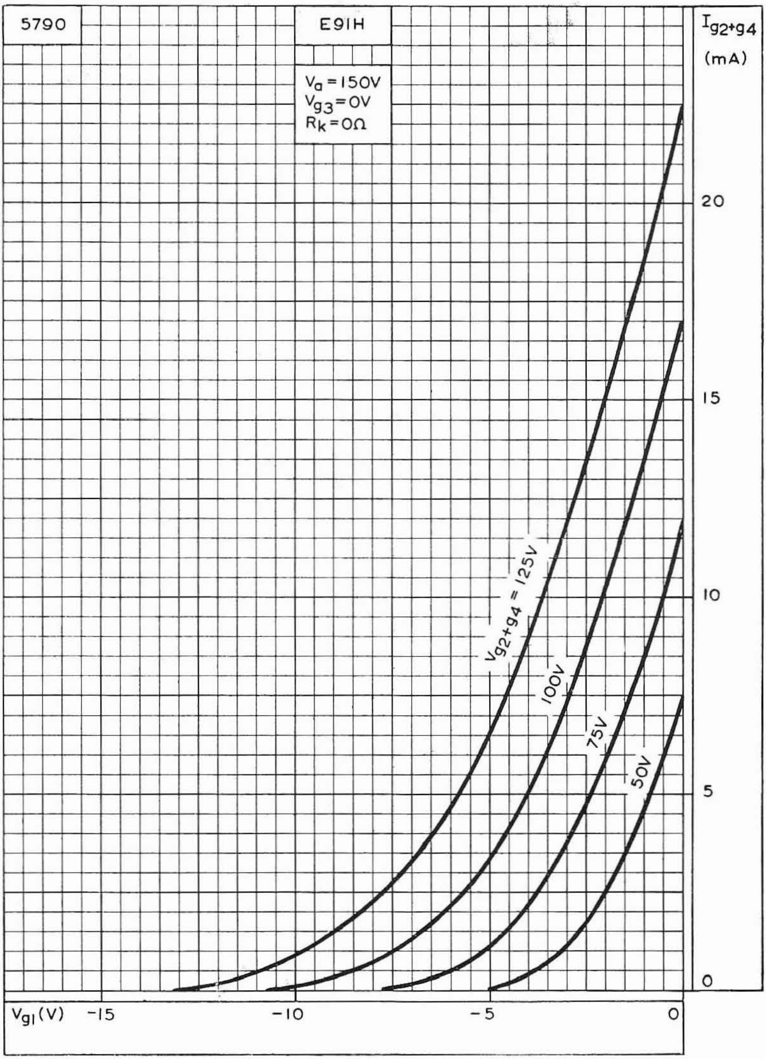




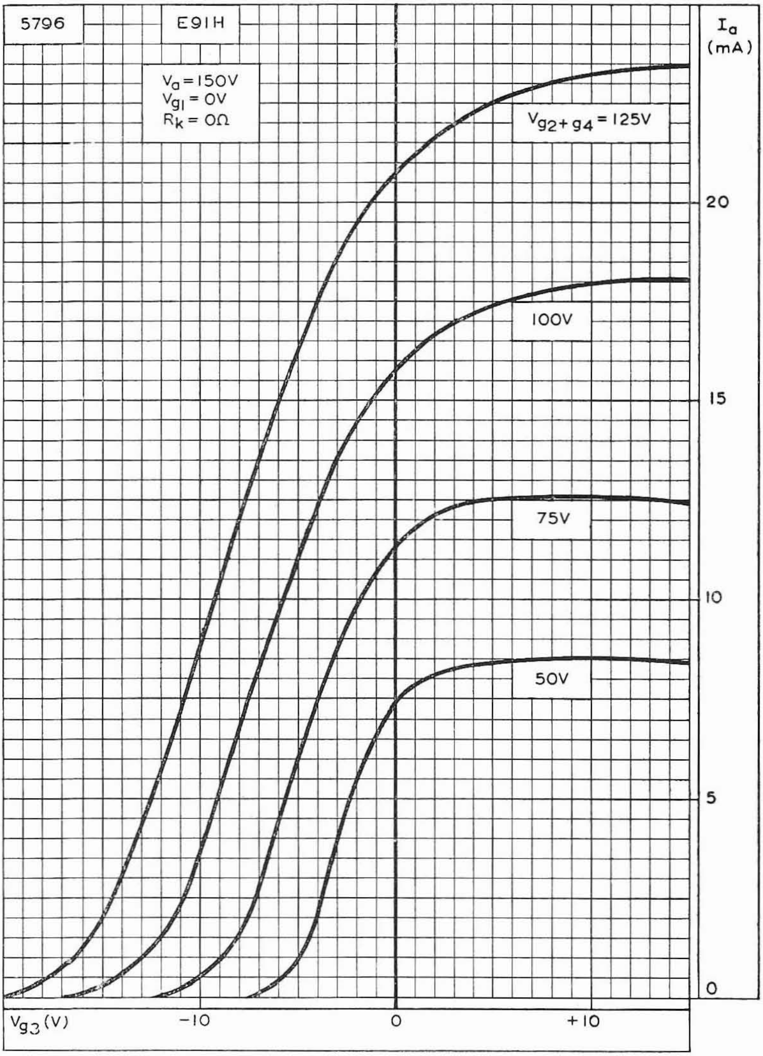
The bulb and base dimensions of this valve are in accordance with BS148, Section B7G.



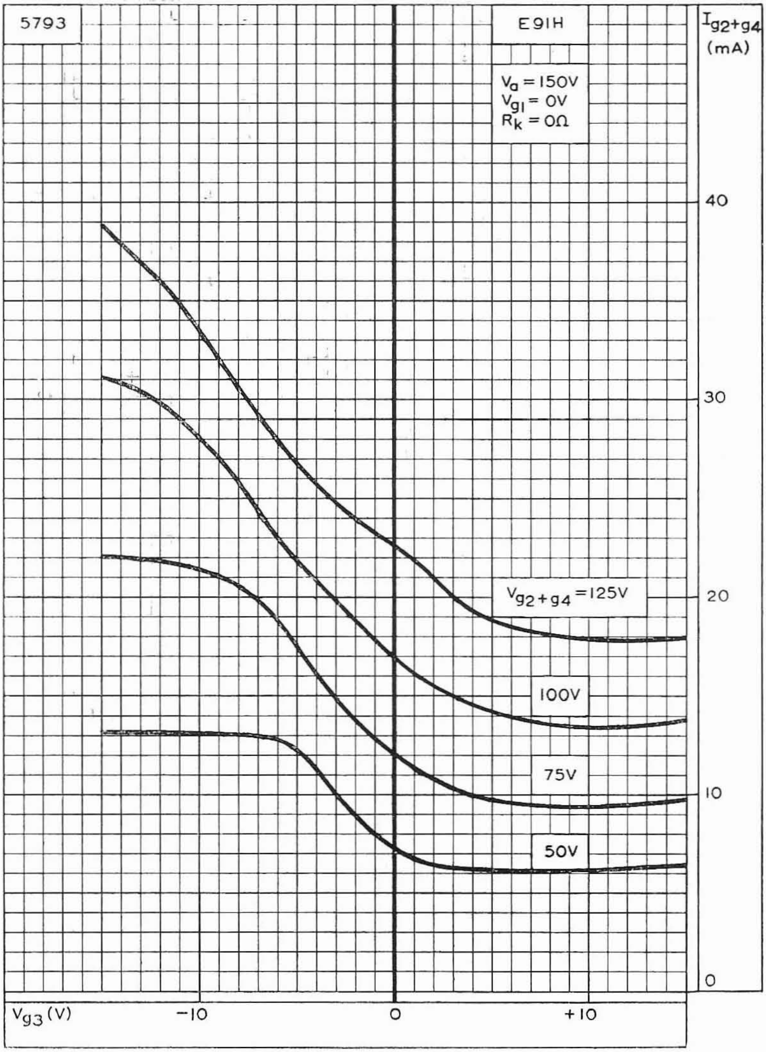
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID (g1) VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



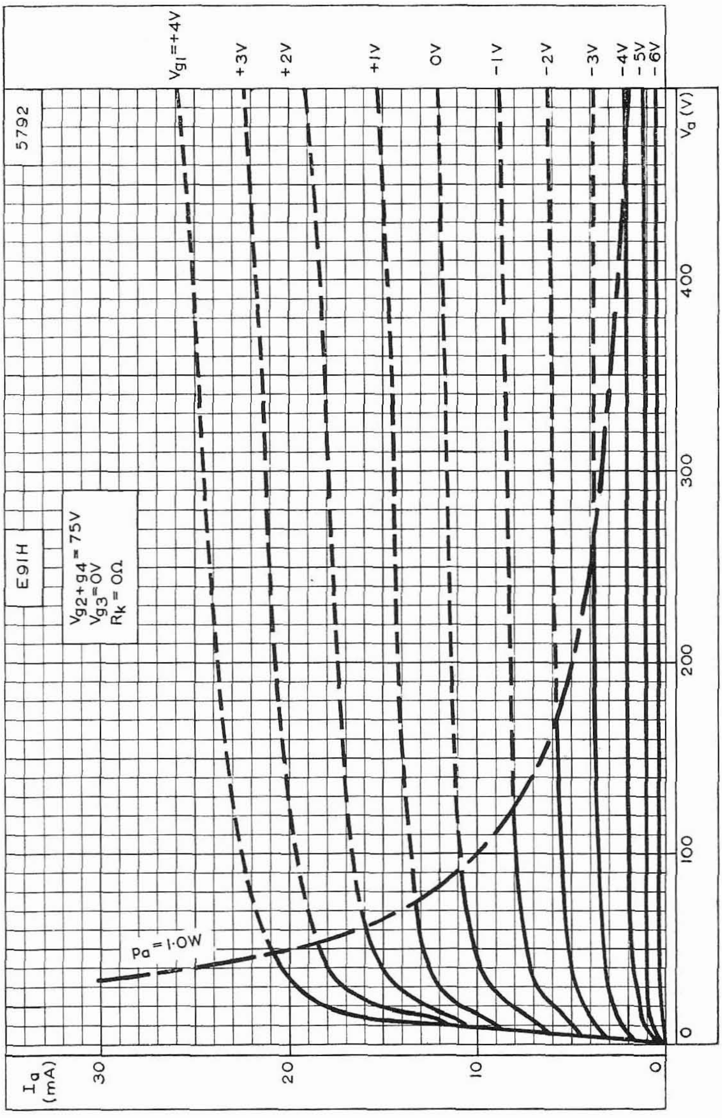
SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID (g1) VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



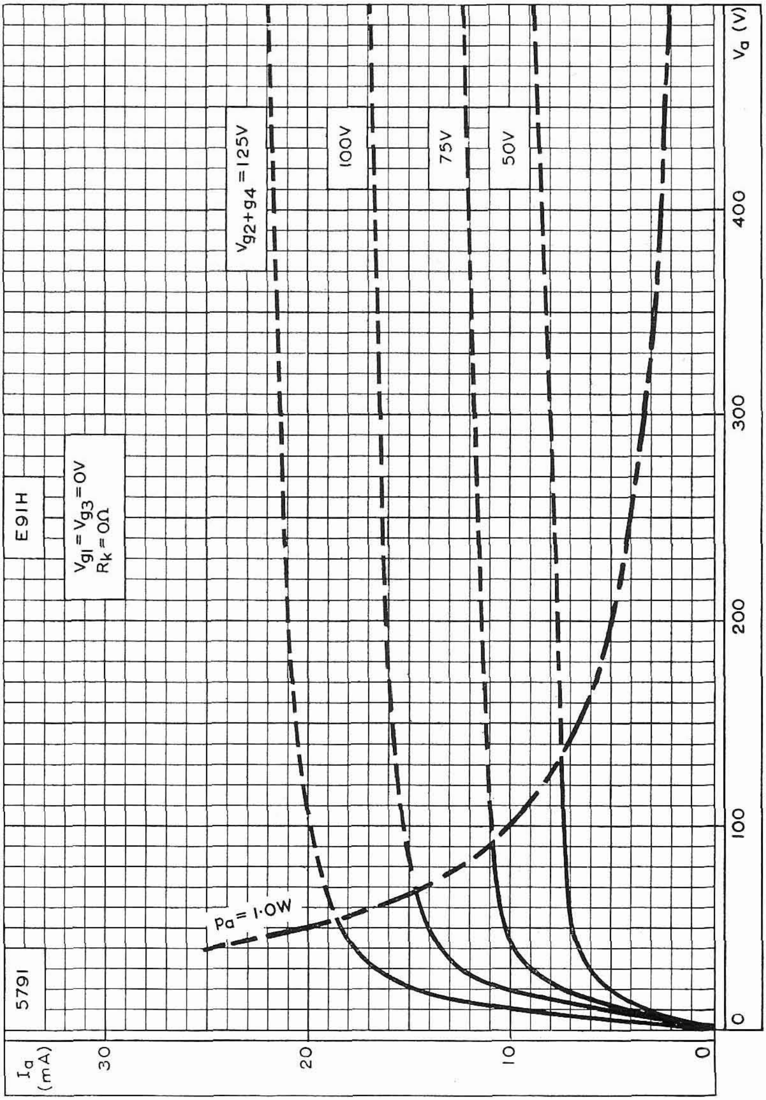
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID (g3) VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL-GRID (g3) VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

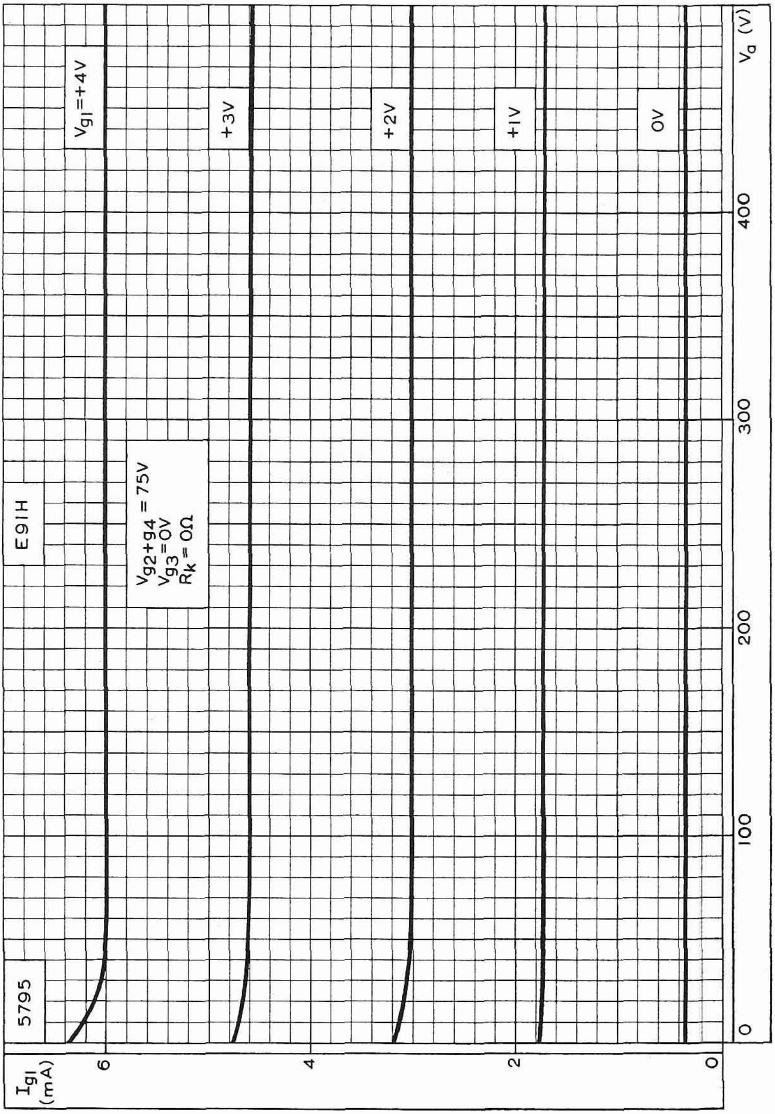


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID (g1) VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER

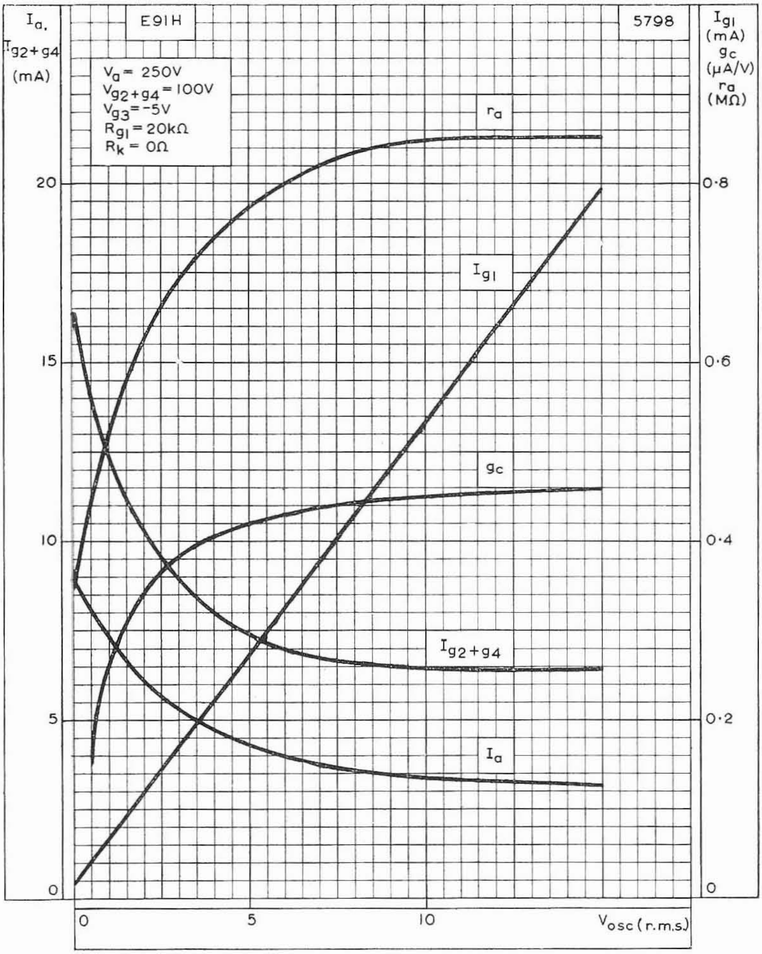
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID (g1) VOLTAGE AS PARAMETER



CONTROL-GRID (g1) CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID (g1) VOLTAGE AS PARAMETER

SPECIAL QUALITY DUAL CONTROL HEPTODE

E91H



PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER

TUNING INDICATOR

EM80

Electron beam tube for use as tuning indicator in f.m. or a.m. receivers.

HEATER

V_h	6.3	V
I_h	300	mA

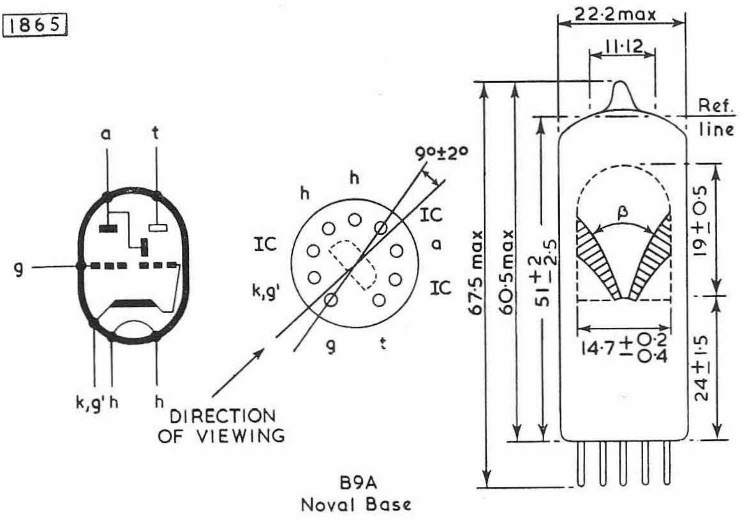
TYPICAL OPERATING CONDITIONS

V_b		250		V
V_t		250		V
R_a		500		kΩ
R_{g-k}		3.0		MΩ
V_g	−1.0		−14	V
β	5		50	deg
I_a	370		10	μA
I_t	2.0		2.3	mA

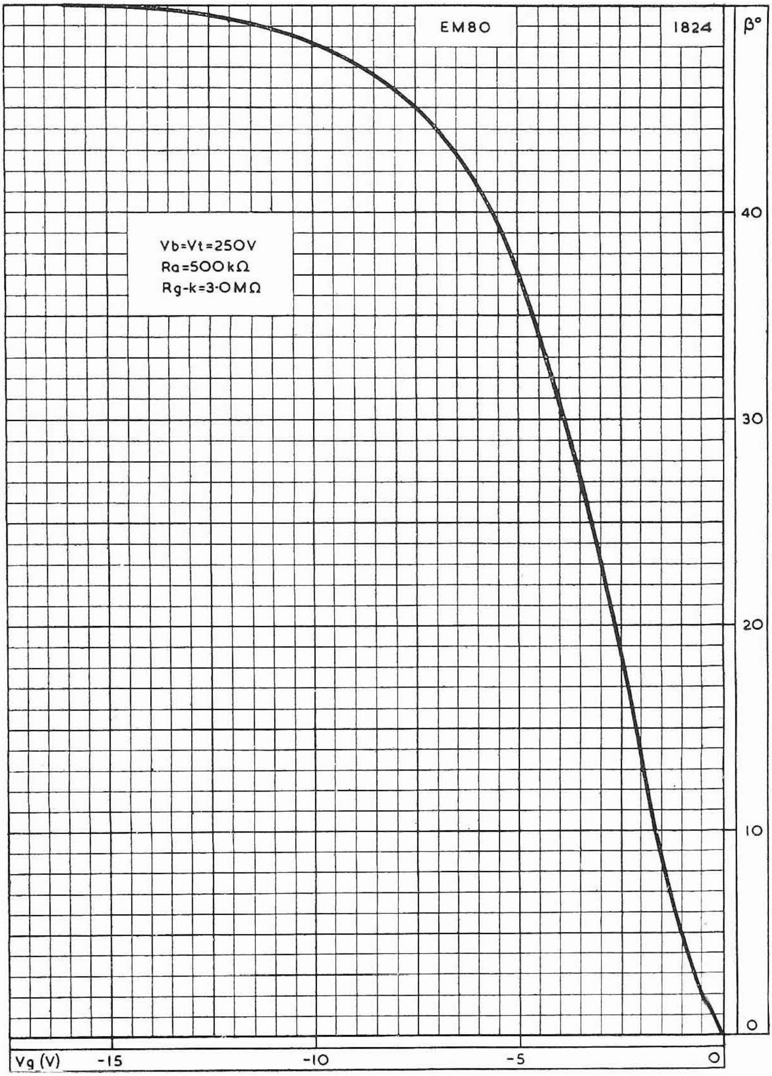
LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	200	mW
$V_{t(b)}$ max.	500	V
V_t max.	300	V
V_t min	165	V
I_k max.	3.0	mA
R_{g-k} max.	3.0	MΩ
V_{h-k} max.	100	V

1865



All dimensions in mm

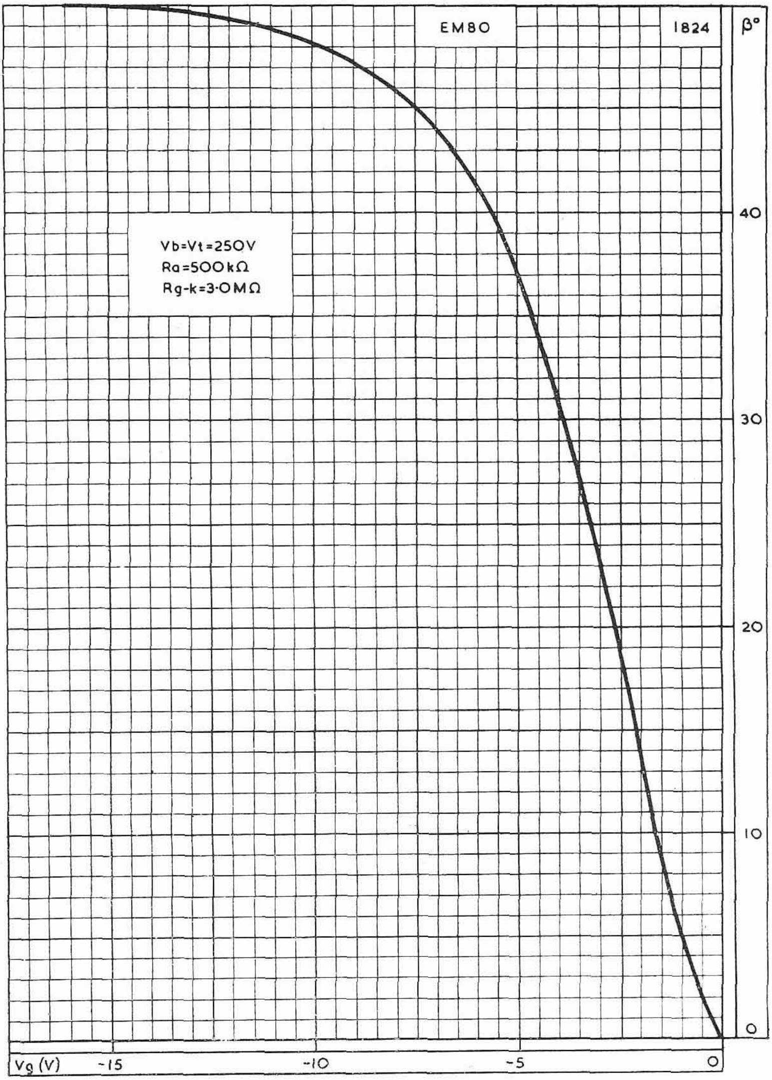


LIGHT ANGLE PLOTTED AGAINST CONTROL-GRID VOLTAGE

TUNING INDICATOR

EM80

Electron beam tube for use as tuning indicator in F.M. or A.M. receivers.



LIGHT ANGLE PLOTTED AGAINST CONTROL-GRID VOLTAGE

OCTODE FREQUENCY CHANGER

FC2

Octode frequency changer for use in battery superheterodyne receivers.

FILAMENT

V_f	2.0	V
I_f	0.1	A

CAPACITANCES

c_{a-g4}	0.057	$\mu\mu$F
c_{out}	14.5	$\mu\mu$F
c_{in}	9.9	$\mu\mu$F
c_{g1-g4}	0.11	$\mu\mu$F

CHARACTERISTICS

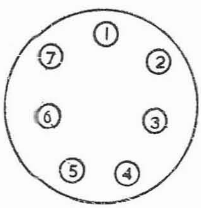
V_a	135	V
V_{g2}	135	V
V_{g3+g5}	70	V
I_a	0.95	mA
$I_{g2+g3+g5}$	3.75	mA
g_c	200	μA/V

LIMITING VALUES

V_a max.	150	V
V_{g2} max.	150	V
V_{g3+g5} max.	70	V
R_{g4-k} max.	2.5	MΩ

CONNECTIONS

Brit. 7-Pin Base



Viewed from free end of pins

Pin No. 1 Oscillator Anode (g_2)
,, 2 Oscillator Grid (g_1)
,, 3 Screen Grids ($g_3 + g_5$)
,, 4 Filament
,, 5 Filament
,, 6 Metallising
,, 7 Anode
Top Cap—Control Grid (g_4)

DIMENSIONS

Overall length	132mm.
Overall diameter	46mm.

OCTODE FREQUENCY CHANGER

FC2A

Octode frequency changer for use in battery superheterodyne receivers. This valve has been specially designed for frequencies up to 19 M/cs.

FILAMENT

V_f	2.0	V
I_f	0.13	A

Bulb finish—Metallised

CAPACITANCES

c_{g1-1}	6.6	μμF
c_{in}	9.1	μμF
c_{out}	13.6	μμF
c_{g2-1}	8.5	μμF
c_{g1-g4}	<0.12	μμF
c_{g2-g4}	<0.35	μμF
c_{a-g4}	<0.07	μμF

OPERATING CONDITIONS

Normal Operation

V_a	90	135	V
V_{g2}	90	135	V
V_{g3+g5}	45	45	V
I_a	0.7	0.7	mA
V_{g4}	−0.5	−0.5	V
I_{g2}	1.3	2.1	mA
I_{g3+g5}	0.6	0.7	mA
$V_{osc\ (r.m.s.)}$	8.5	8.5	V
g_c	0.27	0.27	mA/V
r_a	2.0	2.5	MΩ
r_a	>10	>10	MΩ
V_{g4} (for 100 : 1 reduction in g_c)	−12	−12	V

Short Wave Operation

V_a	135	V
V_{g2}	135	V
V_{g3+g5}	60	V
I_a	1.0	mA
V_{g4}	−1.5	V
I_{g2}	2.3	mA
I_{g3+g5}	1.0	mA
$V_{osc\ (r.m.s.)}$	4.0	V
g_c	67	μA/V
r_a	1.7	MΩ

FC2A

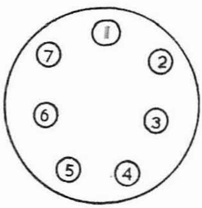
OCTODE FREQUENCY CHANGER

Octode frequency changer for use in battery superheterodyne receivers. This valve has been specially designed for frequencies up to 19 Mc/s.

LIMITING VALUES

V_a max.	150	V
p_a max.	0.5	W
V_{g2} max.	150	V
p_{g2} max.	0.6	W
V_{g3+g5} max.	100	V
p_{g3+g5} max.	0.4	W
I_k max.	11	mA
R_{g4-k} max.	2.5	M Ω
R_{g1-k} max.	100	k Ω

CONNECTIONS



Viewed from free end of pins

Brit. 7-Pin Base

Pin No. 1 Oscillator Anode (g_2)
,, 2 Oscillator Grid (g_1)
,, 3 Screen Grids (g_3 & g_5)
,, 4 Filament
,, 5 Filament
,, 6 Metallising and (g_6)
,, 7 Anode

Top Cap—Control Grid (g_4)

DIMENSIONS

Overall length	135 mm.
Overall diameter	46 mm.

OCTODE FREQUENCY CHANGER

FC4

Octode frequency changer for use in a.c. mains super heterodyne receivers.

FC13 & FC13C OVERLEAF

HEATER

V_h	4.0	V
I_h	650	mA

CAPACITANCES

c_{a-g4}	0.06	pF
c_{in}	9.0	pF
c_{out}	12.5	pF
c_{g1-h}	9.4	pF
c_{g2-h}	6.1	pF
c_{g1-g4}	<0.35	pF
c_{g2-g4}	<0.25	pF

OPERATING CHARACTERISTICS

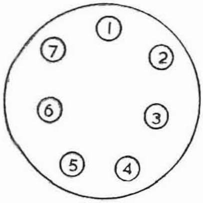
V_a	250	V
V_{g2}	90	V
V_{g3+g5}	70	V
I_a	1.6	mA
I_{g2}	2.0	mA
I_{g3+g5}	3.8	mA
V_{g4}	−1.5	V
g_c	600	µA/V
R_k	250	Ω

At $V_a=200V$, $V_{g2}=V_{g3+g5}=70V$ and $V_{osc(pk)}=12V$, the grid current (I_{g4}) reaches a value of 1.0µA for $V_{g4}=-0.1$ to $-0.95V$.

LIMITING VALUES

V_a max.	250	V
V_{g2} max.	90	V
V_{g3+g5} max.	70	V
R_{g4-k} max.	2.5	MΩ

CONNECTIONS



Viewed from free end of pins

Brit. 7-Pin Base

Pin No. 1 Oscillator anode (g_2)
,, 2 Oscillator grid (g_1)
,, 3 Screen grids (g_3+g_5)
,, 4 Heater
,, 5 Heater
,, 6 Cathode, metallising and suppressor grid
,, 7 Anode
Top cap Control grid (g_4)

DIMENSIONS

Overall length	135	mm
Overall diameter	47	mm

FC13

FC13C

OCTODE FREQUENCY CHANGER

Octode frequency changer for use in d.c./a.c. mains superheterodyne receivers.

Except for basing and dimensions the FC13 and FC13C are identical.

HEATER

I_h	200	mA
V_h	13	V

CAPACITANCES

c_{a-g4}	<0.1	pF
c_{in}	9.0	pF
c_{out}	12.5	pF
c_{g1-k}	9.4	pF
c_{g2-k}	6.1	pF
c_{g1-g4}	<0.35	pF
c_{g2-g4}	<0.25	pF

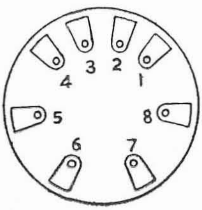
CHARACTERISTICS

V_a	200	V
V_{g2}	90	V
V_{g3+g5}	70	V
I_a	1.6	mA
I_{g2}	2.0	mA
I_{g3+g5}	3.8	mA
V_{g4}	−1.5	V
g_c	600	µA/V
R_k	250	Ω
$v_{osc(pk)}$	12	V

LIMITING VALUES

V_a max.	200	V
V_{g2} max.	90	V
V_{g3+g5} max.	90	V
R_{g4-k} max.	2	MΩ

CONNECTIONS—FC13



Viewed from underside of valve base

Contact No.	1	Metallising
,,	2	Heater
,,	3	Heater
,,	4	Cathode and suppressor grid (g_6)
,,	5	Oscillator anode (g_2)
,,	6	Oscillator grid (g_1)
,,	7	Screen grid (g_{3+5})
,,	8	Anode
Top cap		Control grid (g_4)

DIMENSIONS—FC13

Overall length	118	mm
Overall diameter	47	mm

The basing and connections of the FC13C are identical to the FC4

FULL WAVE RECTIFIER

Directly-heated power rectifier for output currents up to 250mA.

FW4-500

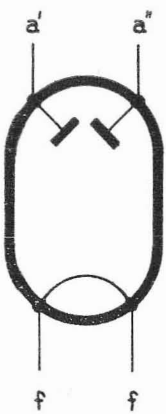
HEATER

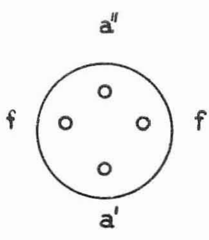
V_f	4.0	V
I_f	3.0	A

LIMITING VALUES

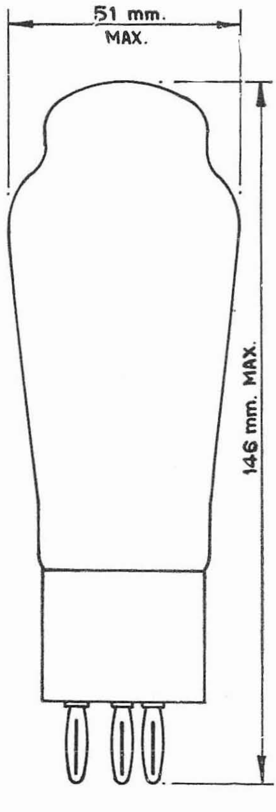
P.I.V.	1,600	V
$V_{a(r.m.s.)}$ max.	2×500	V
I_{out} max.	250	mA

$V_{a(r.m.s.)}$ (V)	C (μF)	R_{lim} min. (per anode) (Ω)
2×500	16	200
2×350	32	150





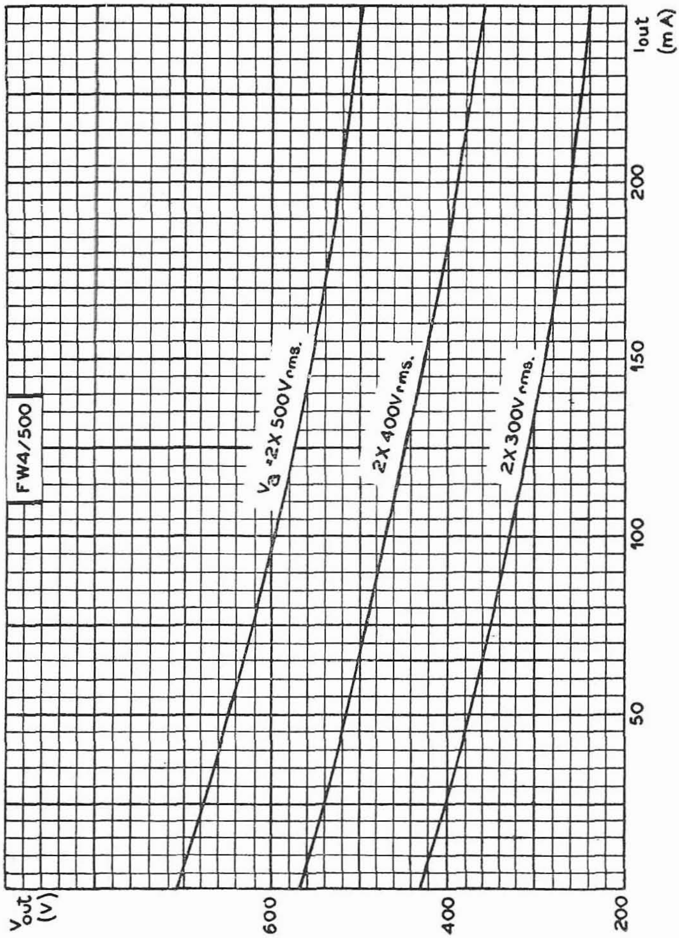
4-PIN BASE



FW4-500

FULL WAVE RECTIFIER

Directly-heated power rectifier for output currents up to 250mA.



OUTPUT VOLTAGE PLOTTED AGAINST OUTPUT CURRENT
WITH ANODE VOLTAGES AS PARAMETER

FULL WAVE RECTIFIER

FW4-800

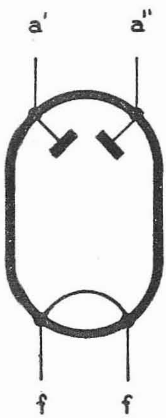
Directly-heated power rectifier for outputs up to 800V or 125mA.

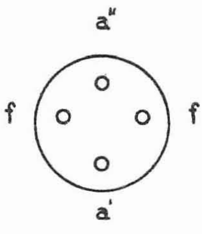
FILAMENT

V_f	4.0	V
I_f	3.0	A

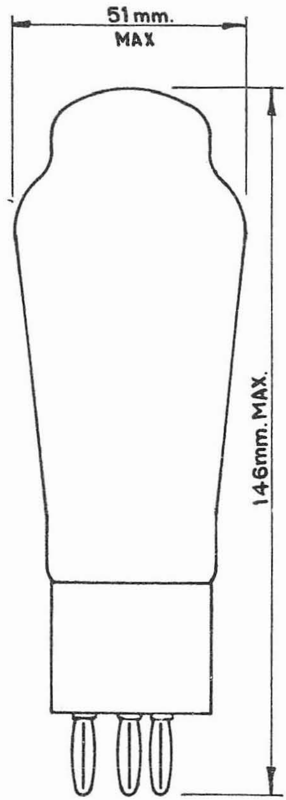
LIMITING VALUES

$V_{a(r.m.s.)}$ max.	2×850	V
I_{out} max.	125	mA
C max.	4.0	μF
R_{lim} min. (per anode)	150	Ω





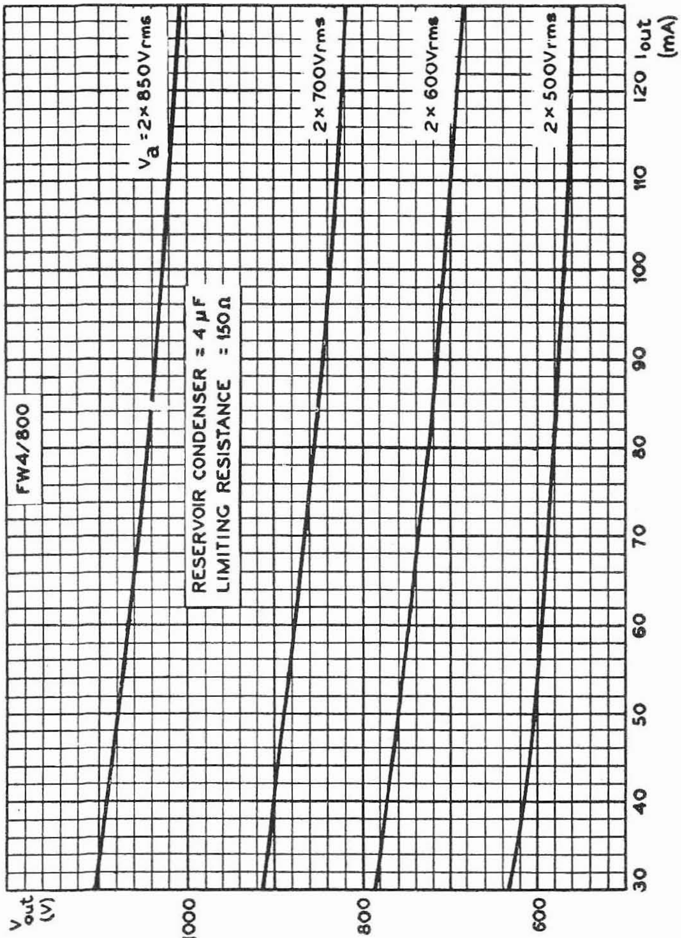
BRITISH 4-PIN BASE



FW4-800

FULL WAVE RECTIFIER

Directly-heated power rectifier for outputs up to 800V or 125mA.



OUTPUT VOLTAGE PLOTTED AGAINST OUTPUT CURRENT WITH ANODE VOLTAGES AS PARAMETER

MEDIUM IMPEDANCE TRIODE

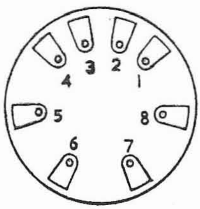
HL13

Indirectly heated medium impedance Triode for use in D.C./A.C. mains receivers.

OPERATING DATA

For heater characteristics and operating data, see Type HL13C. Except for dimensions and base connections, Types HL13 and HL13C are identical.

CONNECTIONS



Viewed from underside of Valve base

Contact No.	1	Metallising
,,	2	Heater
,,	3	Heater
,,	4	Cathode
,,	5	N.C.
,,	6	N.C.
,,	7	N.C.
,,	8	Anode

Top Cap—Control Grid

DIMENSIONS

Overall length	101 mm.
Overall diameter	44 mm.

MEDIUM IMPEDANCE TRIODE

HL13C

Medium impedance triode for use as detector or L.F. amplifier in D.C./A.C. mains receivers.

HEATER

I_h	0.2	A
V_h	13	V

CAPACITANCES

c_{a-g}	3.1	μμF
c_{g-k}	3.9	μμF
c_{a-k}	4.6	μμF

CHARACTERISTICS

V_a	200	V
I_a	5.0	mA
V_g	−3.7	V
g_m	3.3	mA/V
μ	40	
r_a	12	kΩ
R_k	740	Ω

OPERATING CONDITIONS AS R.C. AMPLIFIER

V_b	200	V
I_a	0.65	mA
V_g	−2.6	V
R_a	160	kΩ
R_k	4.0	kΩ
V_{out}/V_{in}	30	
V_{out}	36	V
D_{tot}	5.0	%

LIMITING VALUES

V_a max.	200	V
p_a max.	2.0	W
I_k max.	10	mA
R_{g-k} max.	1.5	MΩ
V_{h-k} max.	125	V
R_{h-k} max.	20	kΩ

HL13C

MEDIUM IMPEDANCE TRIODE

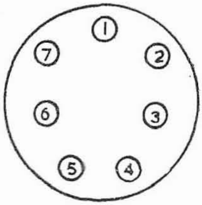
Medium impedance triode for use as detector or L.F. amplifier in D.C./A.C. mains receivers.

DIMENSIONS

Overall Length	120	mm.
Overall Diameter	43	mm.
Bulb Finish—Metallised		

CONNECTIONS

Brit. 7-pin Base



Viewed from free end of pins.

Pin No.	1	Metallising
,, ,,	2	N.C.
,, ,,	3	N.C.
,, ,,	4	Heater
,, ,,	5	Heater
,, ,,	6	Cathode
,, ,,	7	Anode
Top Cap—Control Grid		

FULL WAVE RECTIFIER

IW4-350

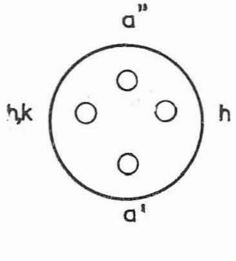
Indirectly-heated power rectifier for outputs up to 350V at 120mA.

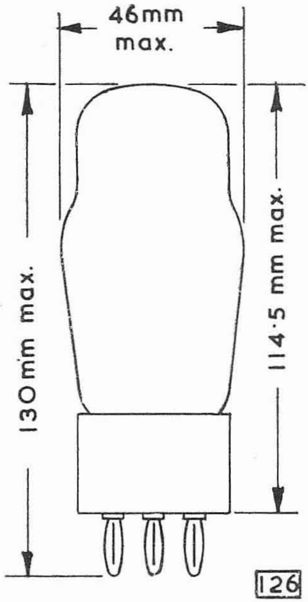
HEATER

V_h	4.0	V
I_h	2.0	A
Heating time	35	sec.

LIMITING VALUES

$V_{a(r.m.s.)}$ max.	2×350	V
I_{out} max.	120	mA
C max.	12	μF





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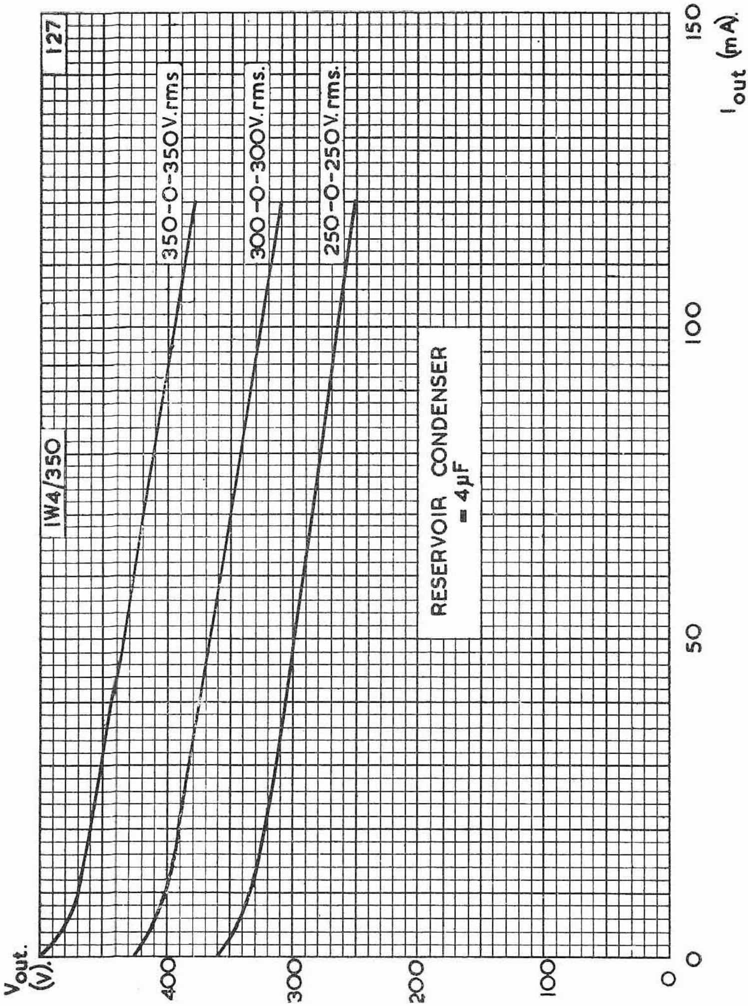
IW4-350

FULL WAVE RECTIFIER

Indirectly-heated power rectifier for outputs up to 350V at 120mA.



FULL WAVE RECTIFIER

IW4-500

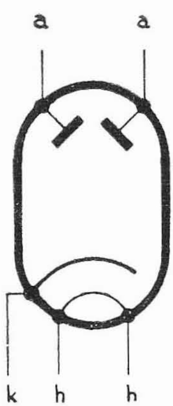
Indirectly-heated power rectifier for outputs up to 500V at 120 mA.

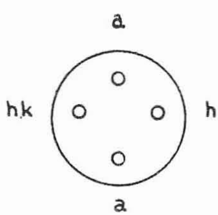
HEATER

V_h	4.0	V
I_h	2.5	A

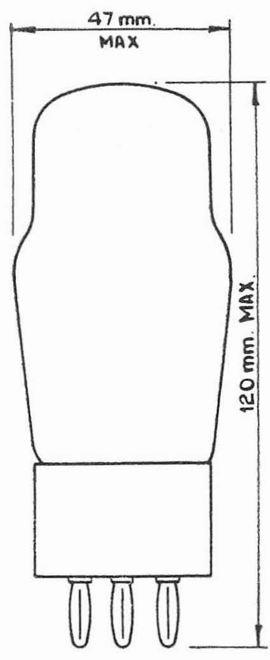
LIMITING VALUES

$V_{a(r.m.s.)}$ max.	2×500	V
I_{out} max.	120	mA
C (max.)	16	μF
R_{lim} min. (per anode)	150	Ω





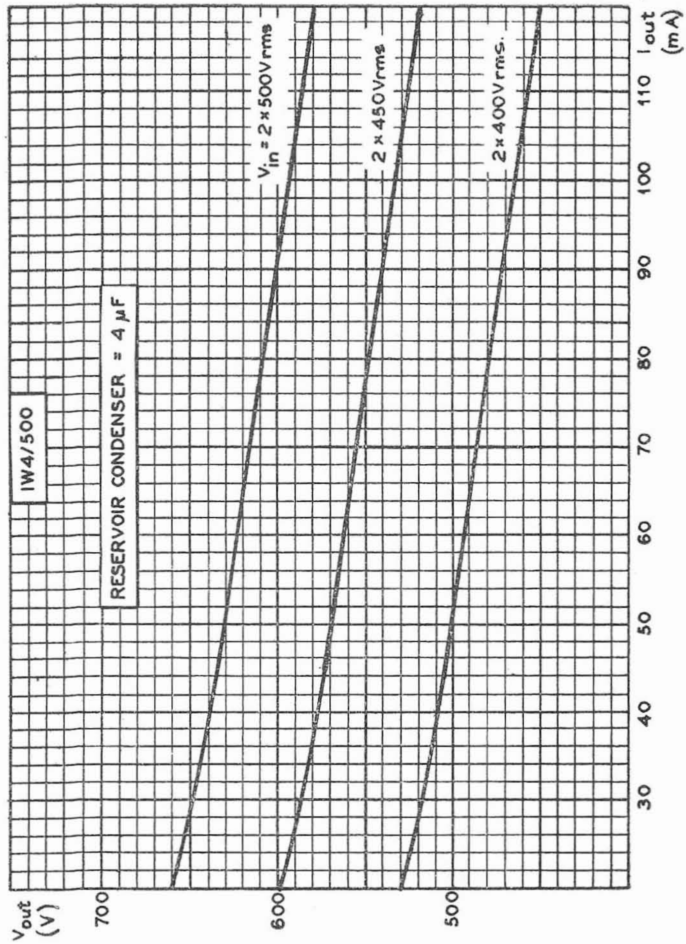
4-PIN BASE



IW4-500

FULL WAVE RECTIFIER

Indirectly-heated power rectifier for outputs up to 500V at 120 mA.



DOUBLE DIODE TRIODE

KBC32

Double diode triode for use as combined detector, A.V.C. rectifier, and A.F. amplifier in battery-operated equipment.

FILAMENT

V_f	2.0	V
I_f	0.05	A

CAPACITANCES

c_{out}	7.0	μμF
c_{in}	1.9	μμF
c_{a-g}	3.1	μμF
$c_{ad'-all}$	2.5	μμF
$c_{ad''-all}$	2.5	μμF
$c_{ad'-ad''}$	<0.5	μμF
$c_{ad'-g}$	<0.05	μμF
$c_{ad''-g}$	<0.05	μμF
$c_{ad'-at}$	<0.6	μμF
$c_{ad''-at}$	<0.3	μμF

CHARACTERISTICS

V_a	100	V
V_g	0	V
I_a	2.4	mA
g_m	1.2	mA/V
μ	25	
r_a	21	kΩ

TYPICAL OPERATING CONDITIONS AS RESISTANCE-CAPACITY-COUPLED AMPLIFIER

$V_{a(b)}$	120	120	V
R_a	50	100	kΩ
V_g	−1.5	−0.9	V
I_a	0.6	0.5	mA

LIMITING VALUE

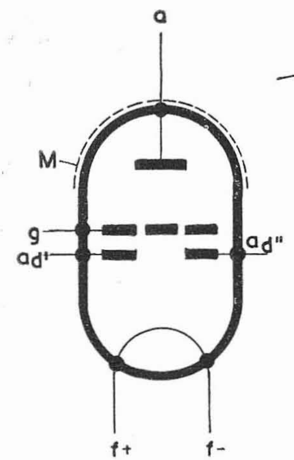
V_a max.	150	V

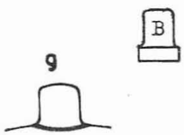
NOTE—Owing to the supply position a certain number of KBC32 valves will be fitted with the "Standard Plug" Cap (A) in place of the "Octal" or "Skirted Miniature" Cap (B).

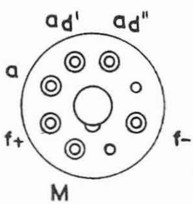
KBC32

DOUBLE DIODE TRIODE

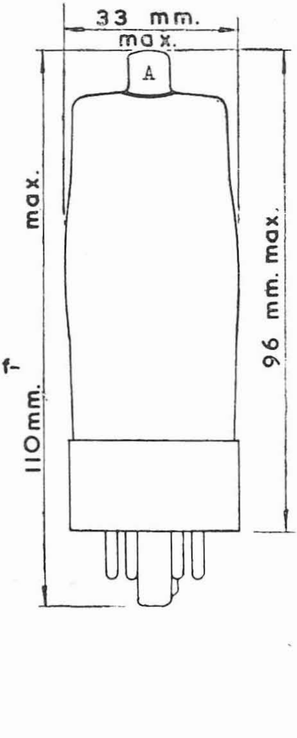
Double diode triode for use as combined detector, A.V.C. rectifier, and A.F. amplifier in battery-operated receivers.







OCTAL BASE



H.F. PENTODE

KF35

Variable-mu H.F. pentode for use as R.F. or I.F. amplifier in battery-operated equipment.

FILAMENT

V_f	2.0	V
I_f	0.05	A

CAPACITANCES

c_{a-g1}	<0.01	μμF
c_{in}	8.0	μμF
c_{out}	10.0	μμF

CHARACTERISTICS

V_a	120	V
V_{g2}	60	V
V_{g1}	0	V
g_m	1,300	μA/V

OPERATING CONDITIONS

V_a		120		V
V_{g2}		60		V
V_{g1}	−1.5	−2.0	−9.5	V
g_m	1,080	800	10	μA/V
I_a	1.45	1.0	—	mA
I_{g2}	0.5	0.35	—	mA

LIMITING VALUES

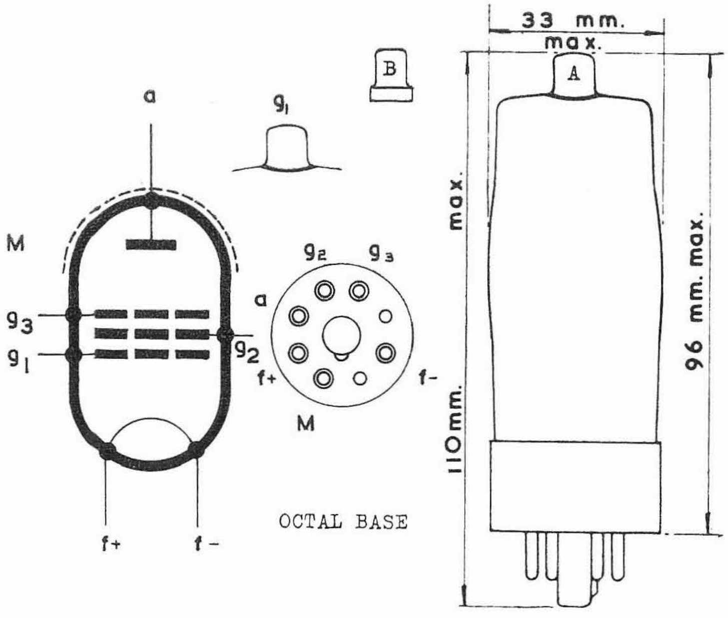
V_a max.	150	V
V_{g2} max.	150	V

KF35

H.F. PENTODE

Variable-mu H.F. pentode for use as R.F. or I.F. amplifier in battery-operated equipment.

Note.—Owing to the supply position a certain number of KF35 valves will be fitted with the " Standard Plug " Cap (A) in place of the " Octal " or " Skirted Miniature " Cap (B).



OCTODE FREQUENCY CHANGER

KK32

Octode frequency changer with 2-volt filament for use in battery-operated receivers.

FILAMENT

V_f	2.0	V
I_f	0.13	A

CAPACITANCES

c_{g1-all}	6.3	µµF
c_{g2-all}	8.5	µµF
c_{g4-all}	9.0	µµF
c_{out}	11.0	µµF
c_{g2-g4}	<0.4	µµF
c_{a-g4}	<0.07	µµF
c_{g1-g4}	<0.2	µµF

OPERATING CONDITIONS—MEDIUM AND LONG WAVE WORKING

V_a	90	135	V
V_{g2}	90	135	V
V_{g3+g5}	45	45	V
$V_{osc\ (r.m.s.)}$ (approx.)	8.5	8.5	V
I_a (V_{g4}=−0.5 V)	0.7	0.7	mA
I_a (V_{g4}=−12 V)	<0.015	0.015	mA
I_{g2}	1.3	2.1	mA
I_{g3+g5}	0.6	0.7	mA
g_c (V_{g4}=−0.5 V)	270	270	µA/V
g_c (V_{g4}=−12 V)	<2.0	2.0	µA/V
r_a (V_{g4}=−0.5 V)	2.0	2.5	MΩ
r_a (V_{g4}=−12 V)	>10	10	MΩ

OPERATING CONDITIONS—SHORT WAVE WORKING

V_a	135	V
V_{g2}	135	V
V_{g3+g5}	60	V
$V_{osc\ (r.m.s.)}$	6.0	V
I_a (V_{g4}=−1.5 V)	1.0	mA
I_{g2}	2.3	mA
I_{g3+g5}	1.0	mA
g_c (V_{g4}=−1.5 V)	67	µA/V
r_a (V_{g4}=−1.5 V)	1.7	MΩ

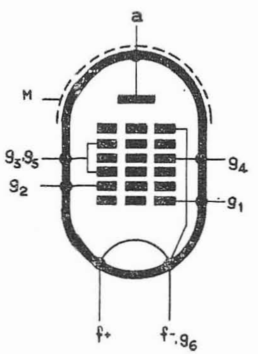
KK32

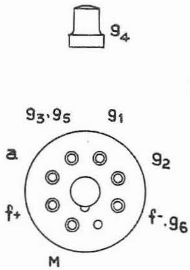
OCTODE FREQUENCY CHANGER

Octode frequency changer with 2-volt filament for use in battery-operated receivers.

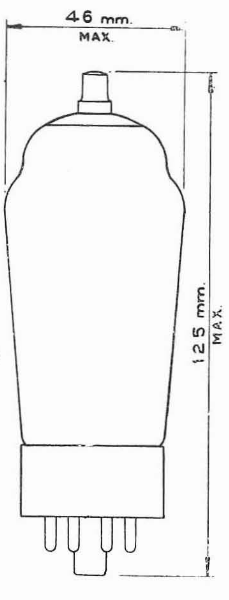
LIMITING VALUES

V_a max.	150	V
p_a max.	0.5	W
V_{g2} max.	150	V
p_{g2} max.	0.6	W
V_{g3+g5} max.	100	V
p_{g3+g5} max.	0.4	W
I_k max.	11	mA
R_{g4-k} max.	2.5	MΩ
R_{g1-k} max.	100	kΩ





OCTAL BASE



OUTPUT PENTODE

KL35

Output pentode with 2-volt filament for use in battery-operated receivers.

FILAMENT

V_f	2.0	V
i	0.15	A

CHARACTERISTICS

V_a	135	V
V_{g2}	135	V
I_a	5.6	mA
g_m	2.2	mA/V
r_a	150	k Ω

OPERATING CONDITIONS AS SINGLE VALVE CLASS A AMPLIFIER

	Fixed Bias	Self Bias	
V_a	135	135	V
V_{g2}	135	135	V
V_{g1}	−4.5	−4.8	V
I_a	5.6	5.0	mA
R_a	19	20	k Ω
$V_{in\ (r.m.s.)}$	3.0	2.9	V
P_{out}	340	310	mW
D_{tot}	10	10	%

LIMITING VALUES

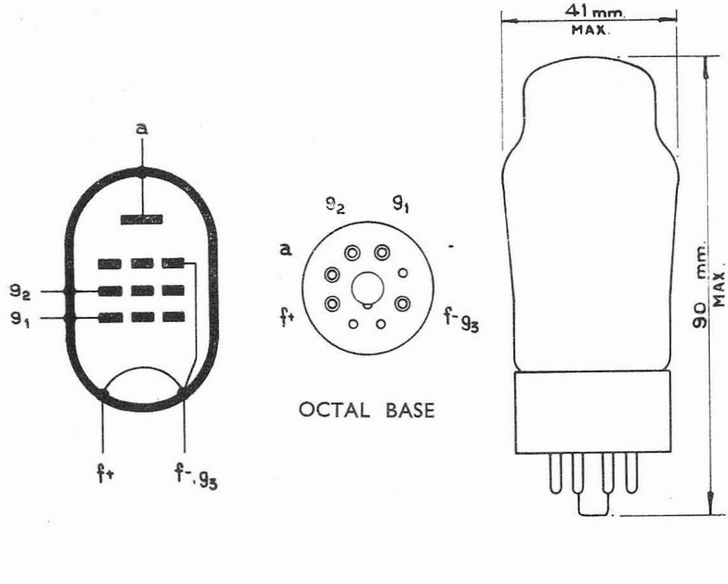
V_a max.	150	V
p_a max.	1.0	W
V_{g2} max.	150	V
I_k max.	10	mA
R_{g1-f} max. (fixed bias)	1.0	M Ω
R_{g1-f} max. (self bias)	1.5	M Ω
V_{g1} ($I_{g1}=+1\mu A$)	+0.3 to +0.8*	V

*At $V_a = V_{g2} = 135V$

KL35

OUTPUT PENTODE

Output pentode with 2-volt filament for use in battery-operated receivers.



OCTAL BASE

DOUBLE OUTPUT PENTODE

KLL32

Double output pentode for use in battery-operated Q.P.P. circuits.

FILAMENT

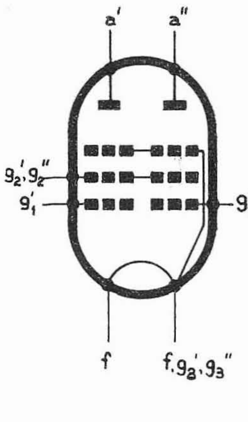
V_f	2.0	V
I_f	0.3	A

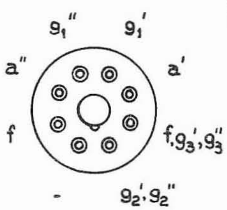
CHARACTERISTICS

V_a	100	V
V_{g2}	100	V
V_{g1}	0	V
g_m	2.6	mA/V

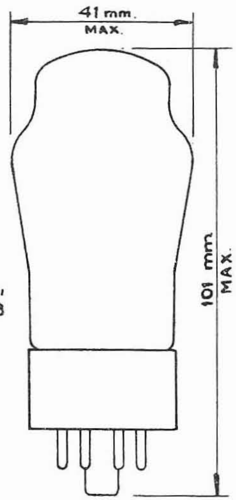
TYPICAL OPERATING CONDITIONS

V_a	90	120	135	V
V_{g2}	90	120	135	V
$I_{a(o)}$	2.8	3.3	3.8	mA
I_a (max. sig.)	9.8	14.4	16.9	mA
V_{g1}	−7.4	−10.2	−11.3	V
I_{g2} (max. sig.)	2.8	4.6	5.7	mA
$V_{in\ (r.m.s.)}$	5.2	7.3	8.4	V
P_{out}	0.45	0.94	1.2	W
D_{tot}	1.8	2.5	2.8	%
R_{a-a}	16	16	16	k Ω





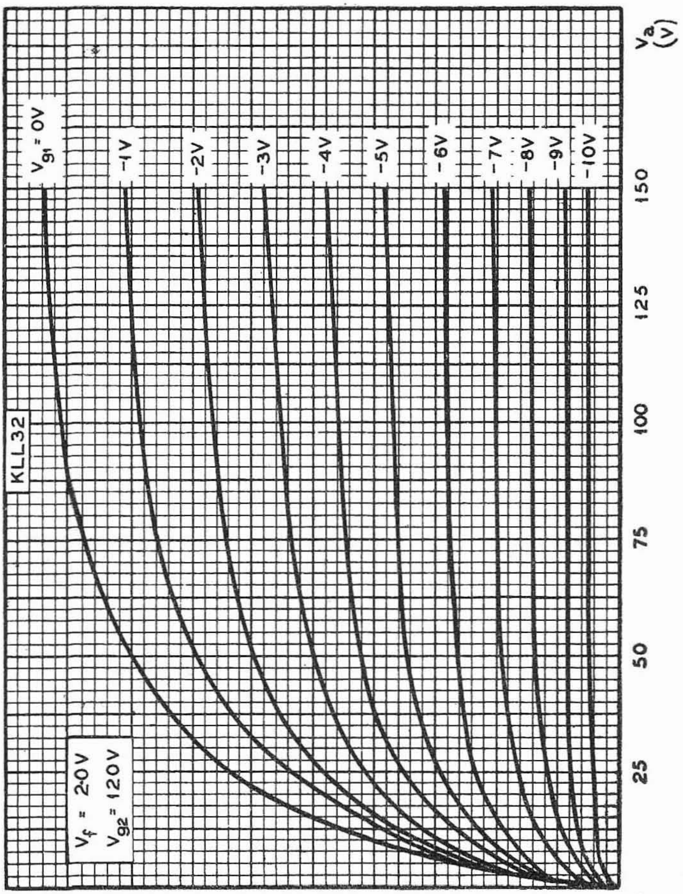
OCTAL BASE



KLL32

DOUBLE OUTPUT PENTODE

Double output pentode for use in battery-operated Q.P.P. circuits.



SPECIAL QUALITY U.H.F. TRIODE

M8248

Special quality triode for use as a grounded grid amplifier in equipment where mechanical vibration and shocks are unavoidable and where statistically controlled major electrical characteristics are required.

This data should be read in conjunction with the GENERAL NOTES—SPECIAL QUALITY VALVES which precede this section of the handbook and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for parallel operation a.c. or d.c.

V_h[1]	6.3	V
I_h	400	mA

CAPACITANCES[2] (measured with external shield)

c_{a-k}	80	mpF
c_{a-k} max.	150	mpF
c_{h-k}	3.8	pF
c_{a-g}	2.8	pF
$c_{k-g+h+sh}$	8.8	pF
$c_{a-g+h+sh}$	4.0	pF

CHARACTERISTICS[3]

V_a	150	V
I_a	13.5	mA
V_g	−1.35	V
g_m	13.5	mA/V
r_a	3.7	kΩ
μ	50	
R_k	0	Ω
V_g ($I_a \leqslant 60\mu A$)	−15	V

ABSOLUTE MAXIMUM RATINGS[4]

V_h max.	6.6	V
V_h min.	6.0	V
$V_{a(b)}$ max.	330	V
V_a max.	165	V
p_a max.	2.7	W
$+V_g$ max.	0	V
$-V_g$ max.	55	V
I_k max.	20	mA
I_g max.	3.5	mA
R_{g-k} max.	250	kΩ
V_{h-k} max.	90	V
Maximum acceleration (continuous operation)	50	g
Maximum shock (short duration)	500	g
T_{bulb} max.	120	°C

TEST CONDITIONS (unless otherwise specified)

V_h (V)	V_{a-e} (V)	V_{g1-e} (V)	R_k (Ω)	C_k (μF)
6.3	150	0	100	1000

TESTS	*A.Q.L.*[5] (%)	*Individuals*[6] *Bogey*[9]	*Individuals Min.*	*Individuals Max.*	*Lot average*[7] *Min.*	*Lot average Max.*	*Lot standard deviation*[8] *Max.*	
GROUP A								
Heater current	0.65	400	375	425	—	—	—	mA
Heater-cathode leakage current $V_{h-k} \pm 100$V	0.65	—	—	10	—	—	—	μA
Reverse grid current V_{a-e} 175V, R_k 150Ω, R_{g1} 250kΩ	0.65	—	—	0.5	—	—	—	μA
Anode current	0.65	13.5	9.0	18.0	—	—	—	mA
	—	—	—	—	11.8	15.2	1.35	mA
Anode current $V_g = -15$V, $R_k = 0\Omega$	0.65	—	—	60	—	—	—	μA
Mutual conductance	0.65	13.5	11.0	16.0	—	—	—	mA/V
	—	—	—	—	12.6	14.4	0.73	mA/V
Sub-group quality level[10]	1.0	—	—	—	—	—	—	
Inoperatives[16]	0.4	—	—	—	—	—	—	

GROUP B

Insulation								
a-rest measured at –300V	2.5	—	200	—	—	—	—	MΩ
g-rest measured at –100V		—	200	—	—	—	—	MΩ
Change in mutual conductance. $V_h = 5.7V$	2.5	—	—	15	—	—	—	%
Amplification factor	6.5	—	40	65	—	—	—	
Capacitances[2] (shielded). No applied voltages	6.5							
c_{a-k} shield to earth		—	—	150	—	—	—	mpF
c_{h-k} shield to earth		—	2.5	5.0	—	—	—	pF
c_{a-g} shield to earth		—	2.3	3.3	—	—	—	pF
c_{k-g+h} shield to grid		—	8.0	11.0	—	—	—	pF
c_{a-g+h} shield to grid		—	—	5.0	—	—	—	pF
Low pressure voltage breakdown pressure 55 ± 5mm Hg, voltage 500V o.c. No other applied voltages	6.5	—	—	—	—	—	—	
Microphone noise at the anode at 50c/s, 2.0g minimum peak acceleration, $R_a = 2000\Omega$	6.5	—	—	200	—	—	—	mV (r.m.s.)

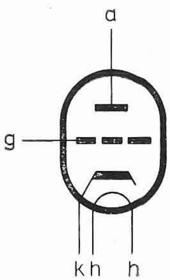
TESTS	A.Q.L.[5] (%)	Individuals[6] Bogey[9]	Individuals[6] Min.	Individuals[6] Max.	Lot average[7] Min.	Lot average[7] Max.	Lot standard deviation[8] Max.	
GROUP C								
Fatigue[14]								
V_h = 6.3V. No other voltages applied. 2.5g minimum peak acceleration, fixed frequency. f = 25c/s min., 60c/s max. for 32 hours in each of 3 mutually perpendicular planes.								
Post Fatigue Tests								
Heater to cathode leakage current $V_{h-k} \pm 100V$	6.5	—	—	20	—	—	—	µA
Change in mutual conductance	6.5	—	—	20	—	—	—	%
Reverse grid current	6.5	—	—	1.0	—	—	—	µA
Microphonic noise as in Group B	6.5	—	—	300	—	—	—	mV (r.m.s.)
Shock[15]								
V_{h-k} = 100V (cathode negative) V_g = −1.5V d.c. R_g = 100kΩ, 500g.								
Post Shock Tests								
Heater-cathode leakage current $V_{h-k} \pm 100V$	20	—	—	20	—	—	—	µA
Change in mutual conductance	20	—	—	20	—	—	—	%
Reverse grid current	20	—	—	1.0	—	—	—	µA
Microphonic noise as in Group B	20	—	—	300	—	—	—	mV (r.m.s.)
Base strain[12]. No applied voltages	—	—	—	—	—	—	—	
Glass strain[11A]. No applied voltages	2.5	—	—	—	—	—	—	

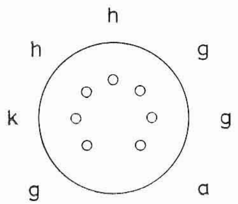
GROUP D

Heater cycling life test
V_h = 7.0V. V_{h-k} + 100V d.c.
1 minute on 4 minutes off. No other voltages.

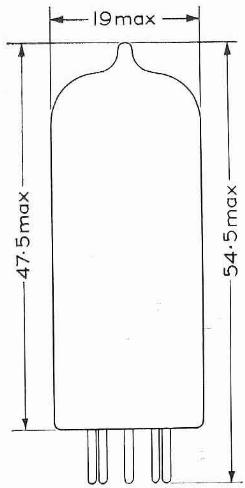
Heater cycling life end points								
Heater to cathode leakage								
V_{h-k} ±100V d.c.	1.0	—	—	20	—	—	—	µA
Insulation as in Group B	2.5	—	30	—	—	—	—	MΩ
Stability life test[14]								
Running conditions, V_{h-k} +100V d.c. R_g = 250 kΩ								
$T_{ambient}$ = Room temperature.								
Stability life end point								
Change in mutual conductance after 1 hour	1.0	—	—	10	—	—	—	%
Survival rate life test[14]								
Running conditions. V_{h-k} +100V d.c. R_g = 250kΩ								
$T_{ambient}$ = room temperature								
Survival rate end points (100 hours)								
Inoperatives[16]	0.65	—	—	—	—	—	—	
Mutual conductance	1.0	—	10	—	—	—	—	mA/V
Intermittent life test								
Running conditions								
V_{h-k} +100V d.c. R_g = 250kΩ								
T_{bulb} min. = 120°C								
Intermittent life test end points (500 hours)								
Inoperatives[16]	2.5							
Heater current	2.5	—	370	460	—	—	—	mA
Reverse *grid current*	2.5	—	—	2.0	—	—	—	µA
Change in mutual conductance. V_h = 5.7V	4.0	—	—	15	—	—	—	%
Change in mutual conductance (individuals)	2.5	—	—	20	—	—	—	%
Heater to cathode leakage								
V_{h-k} = ±100V d.c.	2.5	—	—	20	—	—	—	µA
Insulation as in Group B	2.5	—	100	—	—	—	—	MΩ
Average change in mutual conductance	—	—	—	10	—	—	—	%
Sub-group quality level[10]	10.0							

M8248 SPECIAL QUALITY U.H.F. TRIODE



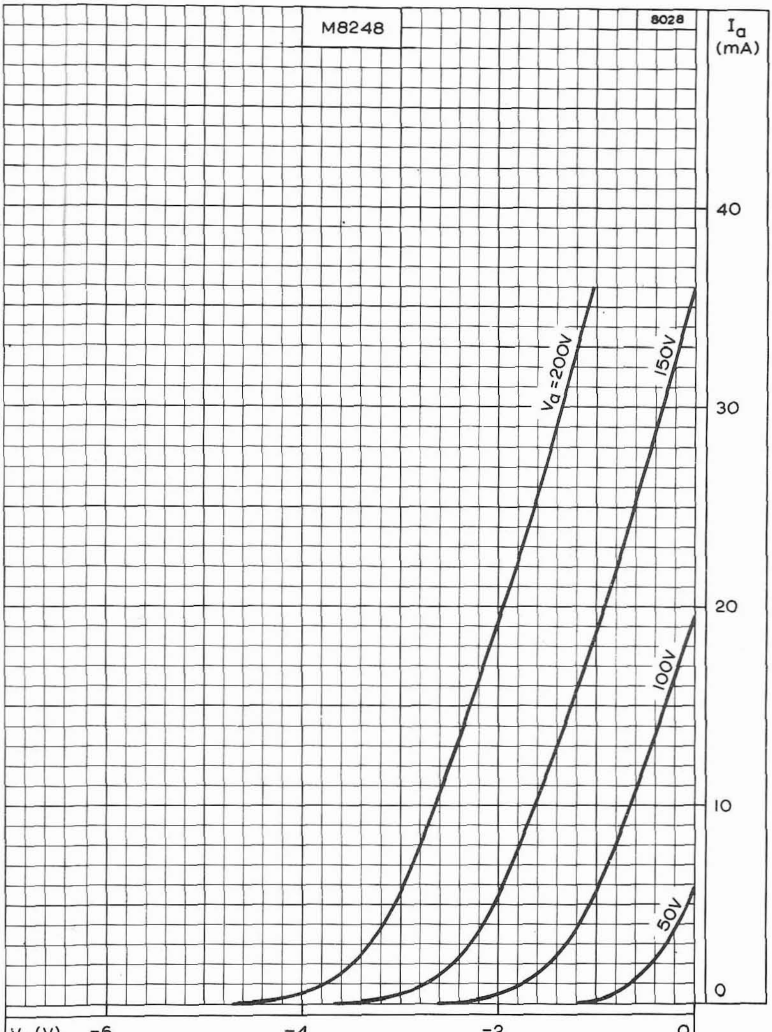


B7G Base

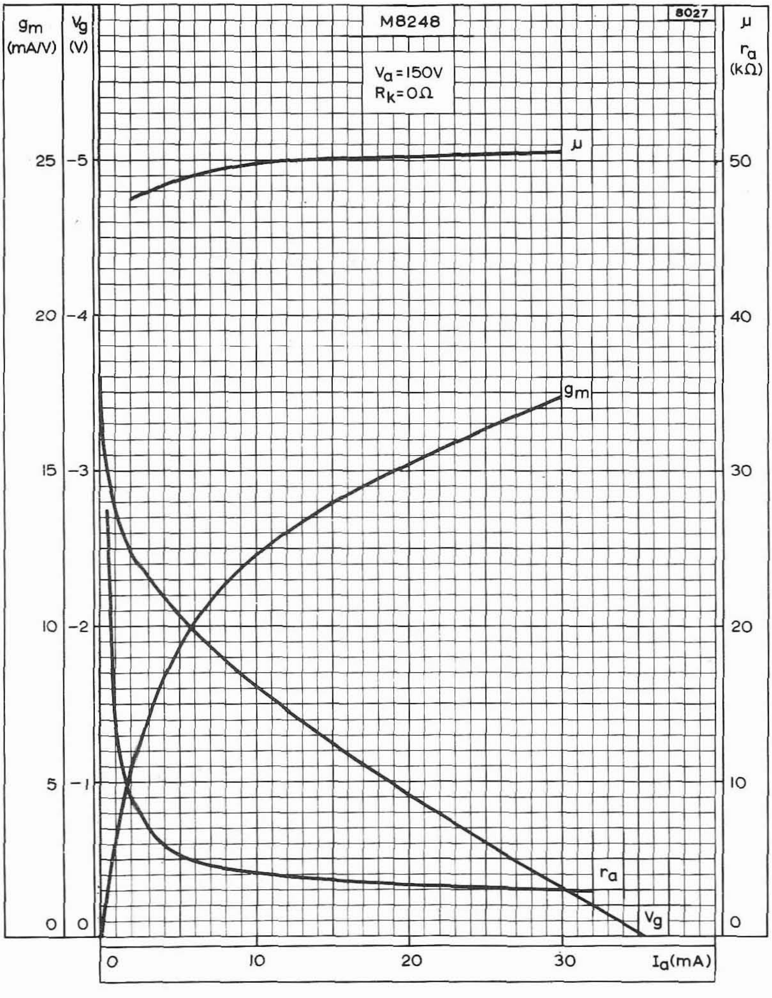


All dimensions in mm

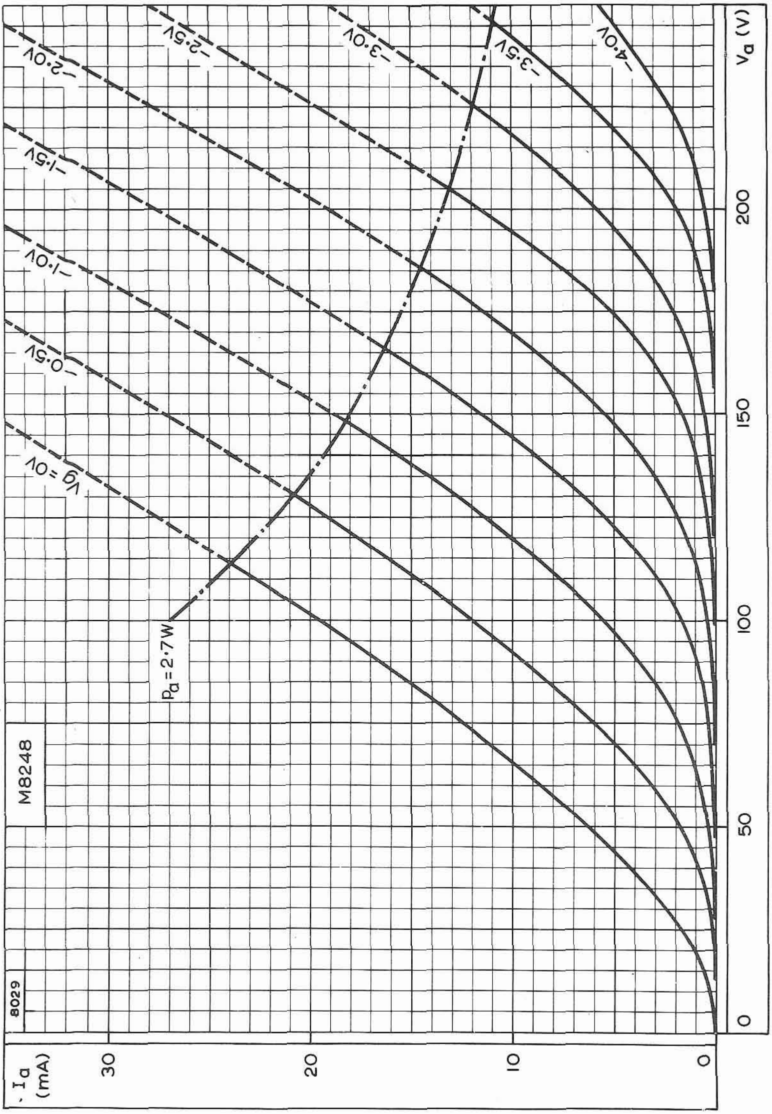
7824



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



ANODE IMPEDANCE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND CONTROL-GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

DOUBLE TRIODE

PCC84

Double triode primarily intended for use as a cascode r.f. amplifier at frequencies up to 220Mc/s in television receivers with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	7.0	V

CAPACITANCES (measured without external shield)

$c_{a'-k'+h+g''}$	1.2	pF
$c_{a'-a''}$	<0.035	pF
$c_{g'-a''}$	<0.006	pF

Grounded cathode section

$c_{a'-g'}$	1.2	pF←
$c_{in'}$	2.1	pF←
$c_{out'}$	0.45	pF
$c_{g'-h}$	<0.25	pF

Grounded grid section

$c_{a''-g''}$	2.3	pF
$c_{a''-k''}$	0.16	pF
$c_{k''-g''+h}$	4.7	pF
$c_{a''-g''+h}$	2.5	pF
$c_{h-k''}$	2.7	pF

CHARACTERISTICS (each section)

V_a	90	V
I_a	12	mA
V_g	−1.5	V
g_m	6.0	mA/V
μ	24	
*R_{in}	2.0	kΩ

*Measured at $f = 200$Mc/s with cathode connections pins 7 and 8 strapped.

PCC84

DOUBLE TRIODE

Double triode primarily intended for use as a cascode r.f. amplifier at frequencies up to 220Mc/s in television receivers with series-connected heaters.

TYPICAL OPERATING CONDITIONS

V_b	180	V
I_a	12	mA
V_g	–1.5	V

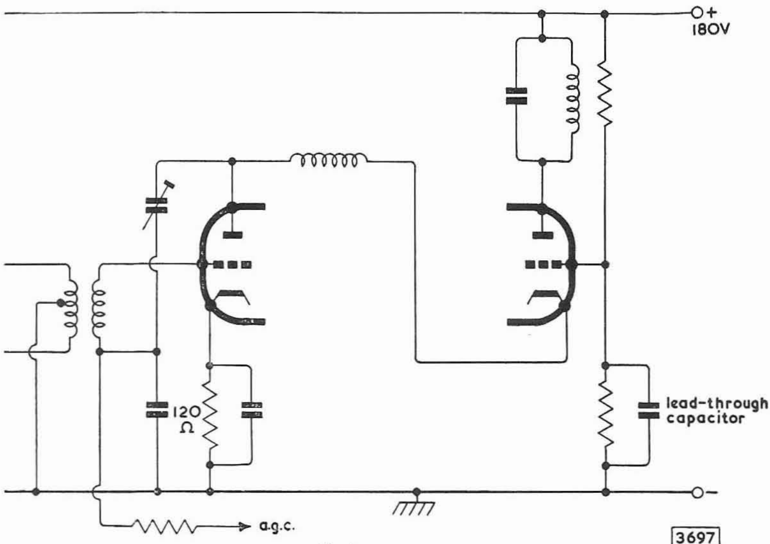


Fig.1

Noise figure (bandwidth of input circuit 7 to 8Mc/s) 6.5

DOUBLE TRIODE

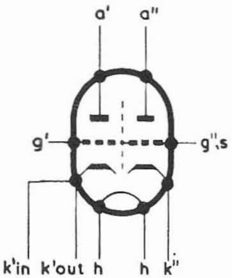
PCC84

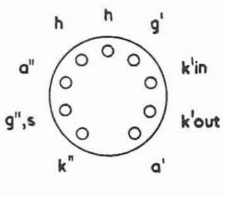
Double triode primarily intended for use as a cascode r.f. amplifier at frequencies up to 220Mc/s in television receivers with series-connected heaters.

LIMITING VALUES (each section unless otherwise specified)

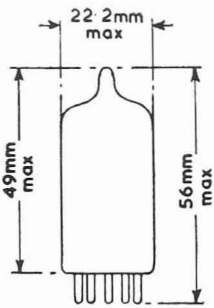
$V_{a(b)}$ max.	550	V
V_a max.	180	V
p_a max.	2.0	W
I_k max.	18	mA
$-V_g$ max.	50	V
$R_{g'-k'}$ max.	1.0	MΩ←
$R_{g''-k''}$ max.	500	kΩ←
*$v_{h-k''\,(pk)}$ max. (cathode positive)	250	V
$V_{h-k''}$ max. (cathode negative)	90	V
$V_{h-k'}$ max.	90	V
R_{h-k} max.	20	kΩ

*Max. d.c. component = 180V.





B9A Base



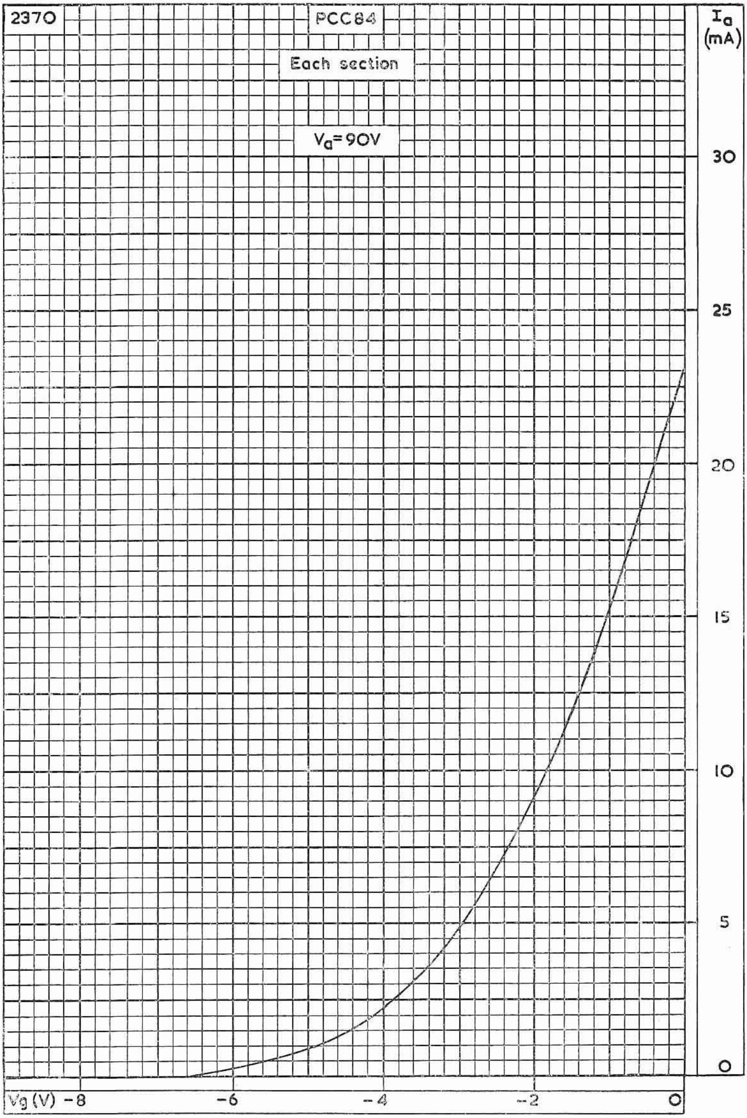
1390

The triode on pins 6, 7, 8, 9 should have grounded-cathode connection and that on pins 1, 2, 3 should have grounded-grid connection.

PCC84

DOUBLE TRIODE

Double triode primarily intended for use as a cascode r.f. amplifier at frequencies up to 220Mc/s in television receivers with series-connected heaters.

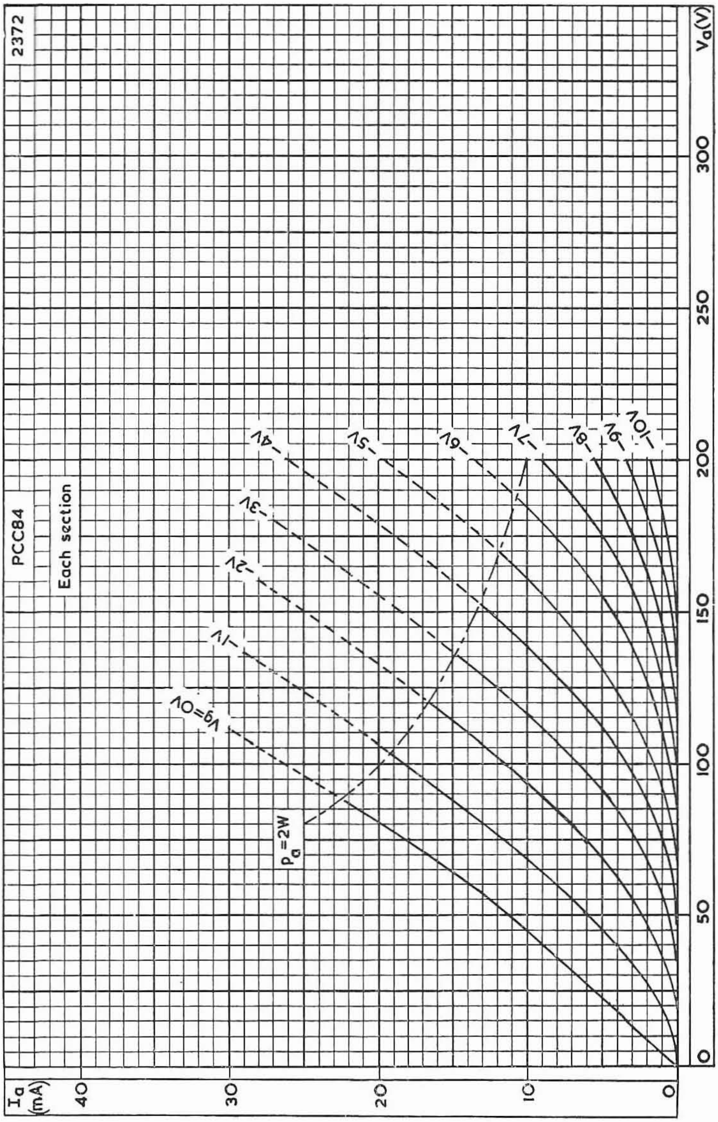


ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE

DOUBLE TRIODE

PCC84

Double triode primarily intended for use as a cascode r.f. amplifier at frequencies up to 220Mc/s in television receivers with series-connected heaters.

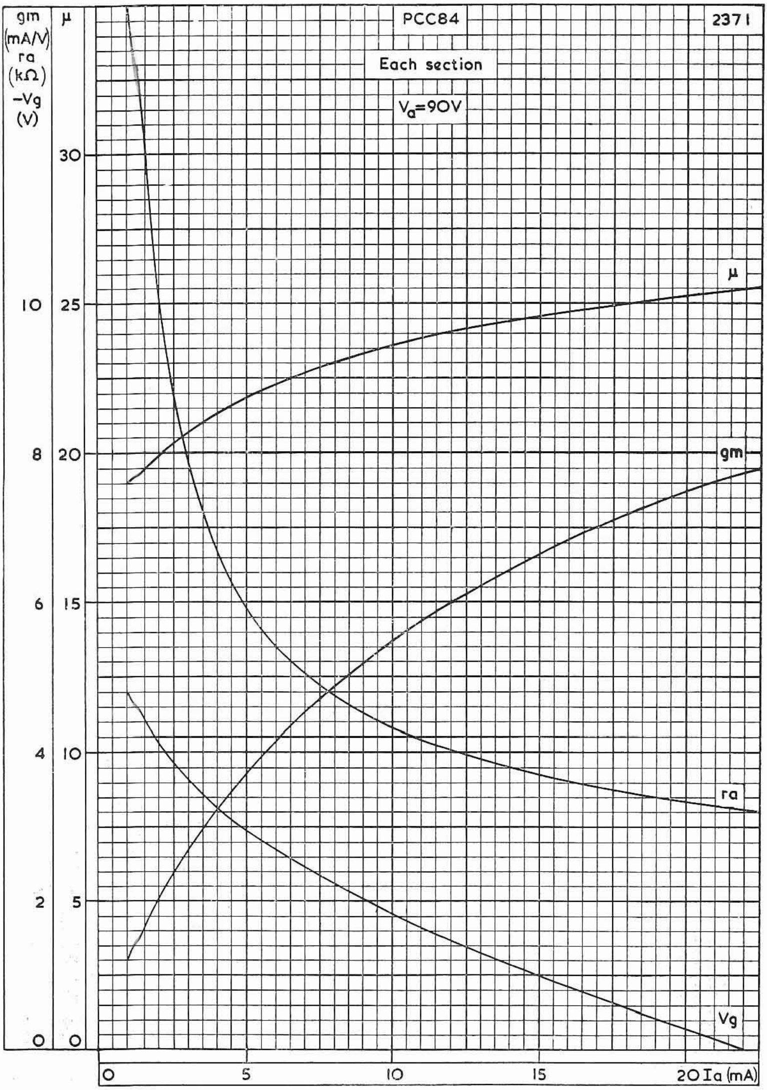


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

PCC84

DOUBLE TRIODE

Double triode primarily intended for use as a cascode r.f. amplifier at frequencies up to 220Mc/s in television receivers with series-connected heaters.



AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE, ANODE IMPEDANCE AND GRID BIAS PLOTTED AGAINST ANODE CURRENT

TRIODE PENTODE

PCL83

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

HEATER

Suitable for series operation a.c. or d.c.

I_h	300	mA
V_h	12.6	V

MOUNTING POSITION

Any

CAPACITANCES (measured without an external shield)

c_{at-gp}	<0.1	pF
c_{at-ap}	<1.6	pF
c_{gt-gp}	<0.03	pF
c_{gt-ap}	<0.05	pF

Pentode Section

c_{a-g1}	<0.2	pF
c_{in}	5.7	pF
c_{out}	4.7	pF
c_{g1-h}	0.4	pF

Triode Section

c_{a-g}	1.6	pF
c_{a-k+h}	0.35	pF
c_{g-k+h}	2.0	pF
c_{g-h}	0.1	pF

CHARACTERISTICS

Pentode Section

V_a	170	V
V_{g2}	170	V
I_a	30	mA
I_{g2}	5.0	mA
V_{g1}	−9.5	V
g_m	5.5	mA/V
r_a	53	kΩ
μ_{g1-g2}	10	

Triode Section

V_a	250	V
I_a	10.5	mA
V_g	−8.5	V
g_m	2.2	mA/V
r_a	7.7	kΩ
μ	17	

PCL83

TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

PENTODE SECTION AS FRAME OUTPUT VALVE

Circuit design

To allow for valve spread and deterioration during life the frame output circuit should be designed around the following values.

V_a	70	70	V
V_{g2}	170	200	V
$i_{a(pk)}$	54	64	mA

For an average new valve the following figures will apply.

V_a	70	70	V
V_{g2}	170	200	V
$i_{a(pk)}$	81	96	mA

PENTODE SECTION AS AUDIO OUTPUT VALVE

Single Valve Class 'A'

V_a	170	200	V
V_{g2}	170	200	V
V_{g1}	−9.5	−13	V
$I_{a(o)}$	30	27	mA
$I_{g2(o)}$	4.8	4.4	mA
R_a	5.5	7.5	kΩ
$V_{in(r.m.s.)}$	5.0	5.2	V
P_{out}	2.2	2.5	W
D_{tot}	10	10.5	%

Two Valves in Class 'AB' Push-Pull

V_a	170	200	V
V_{g2}	170	200	V
R_k	180	220	Ω
$I_{a(o)}$	2×24	2×25	mA
I_a (max. sig.)	2×27.5	2×29	mA
$I_{g2(o)}$	2×3.8	2×3.9	mA
I_{g2} (max. sig.)	2×6.25	2×8.5	mA
R_{a-a}	6.5	7.5	kΩ
$V_{in(g1-g1)\ r.m.s.}$	17	23.5	V
P_{out}	5.0	7.2	W
D_{tot}	3.6	4.2	%

TRIODE SECTION AS A.F. VOLTAGE AMPLFIER

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out} ($V_{r.m.s.}$)	R_{g1}* (kΩ)
170	100	1.07	2.7	14	21	330
200	100	1.17	3.3	13.5	26.5	330

$\frac{V_{out}}{V_{in}}$ measured with an input voltage of 100mV

V_{out} measured for a total harmonic distortion of 5%

*Grid resistor of following valve.

TRIODE PENTODE

PCL83

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

LIMITING VALUES

Pentode Section

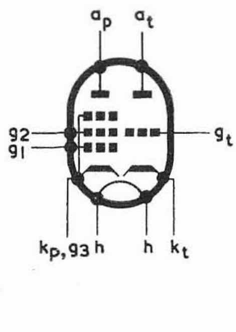
$V_{a(b)}$ max.	550	V
V_a max.	250	V
$+v_{a(pk)}$ max.	2.0	kV
$-v_{a(pk)}$ max.	500	V
p_a max.	5.4	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	1.2	W
p_{g2} max. (speech and music)	2.4	W
I_k max.	45	mA
R_{g1-k} max. (self bias)	500	kΩ
R_{g1-k} max. (fixed bias)	250	kΩ
R_{g1-k} max. (timebase operation)	2.2	MΩ
V_{h-k} max. (d.c. heater negative with respect to cathode or a.c.$_{r.m.s.}$)	250	V
V_{h-k} max. (d.c. heater positive with respect to cathode)	150	V

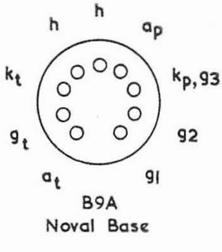
Triode Section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	3.5	W
I_k max.	20	mA
*$i_{k(pk)}$ max.	250	mA
$-v_{g1(pk)}$ max.	350	V
R_{g1-k} max.	1.0	MΩ
V_{h-k} max. (d.c. heater negative with respect to cathode or a.c.$_{r.m.s.}$)	250	V
V_{h-k} max. (d.c. heater positive with respect to cathode)	150	V

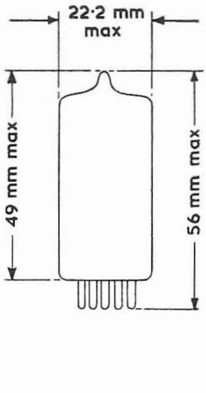
*Max. pulse duration 400μsec.

2224





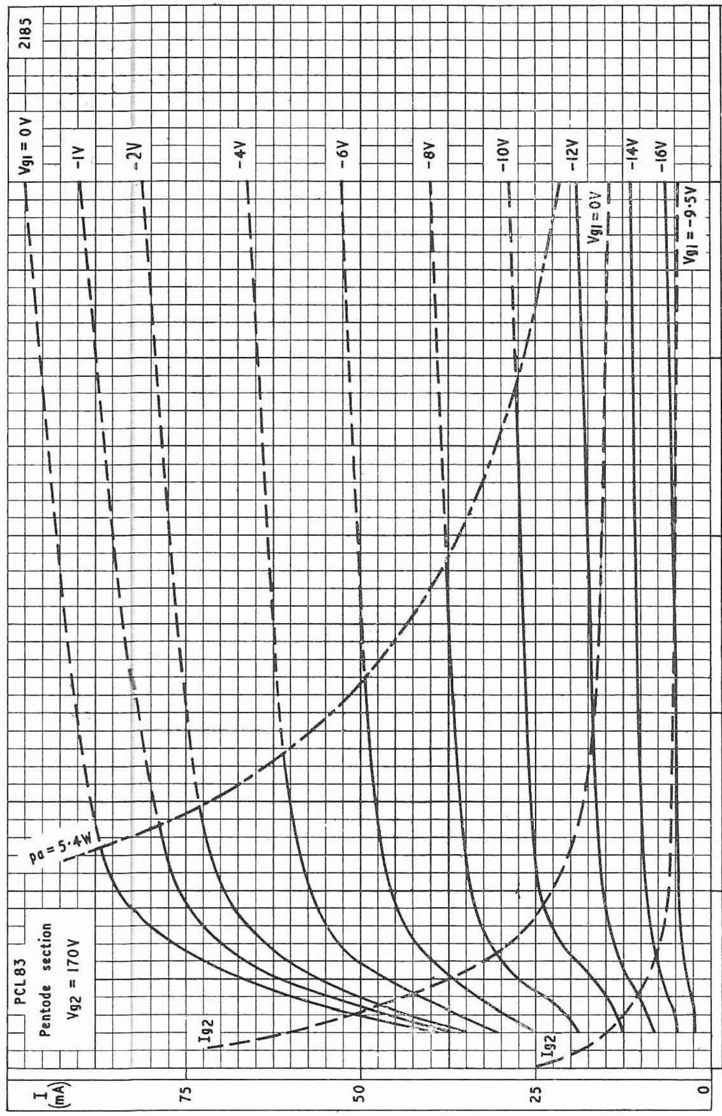
B9A
Noval Base



PCL83

TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

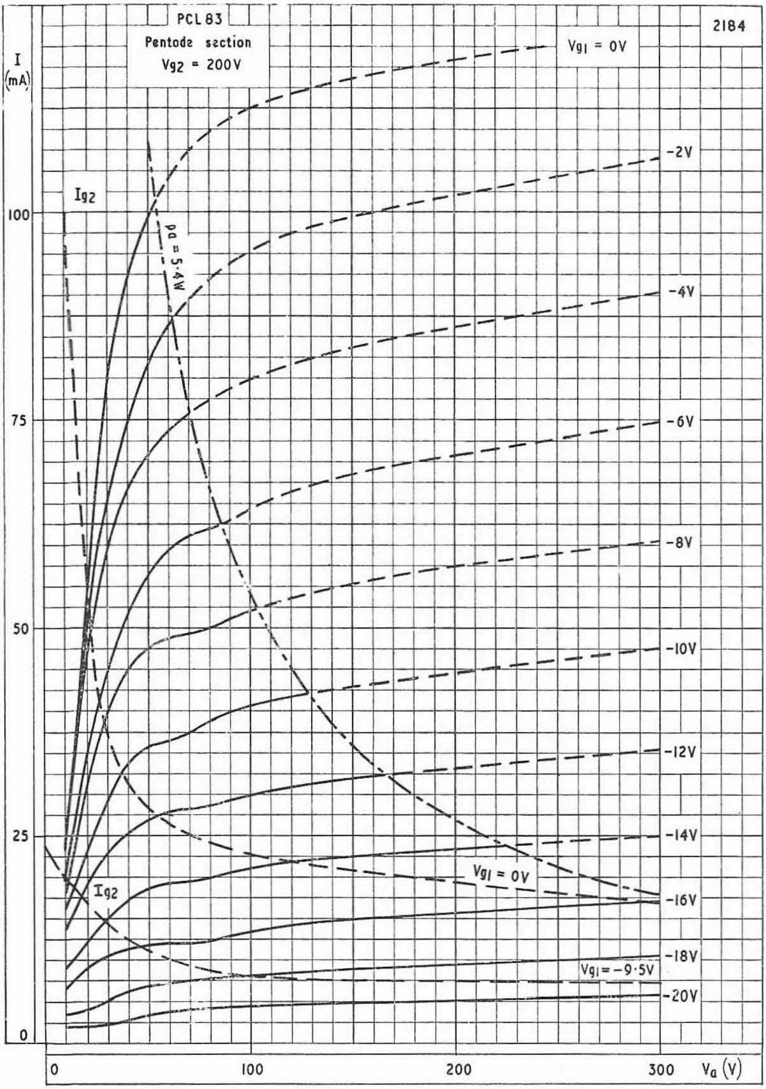


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2}=170V

TRIODE PENTODE

PCL83

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

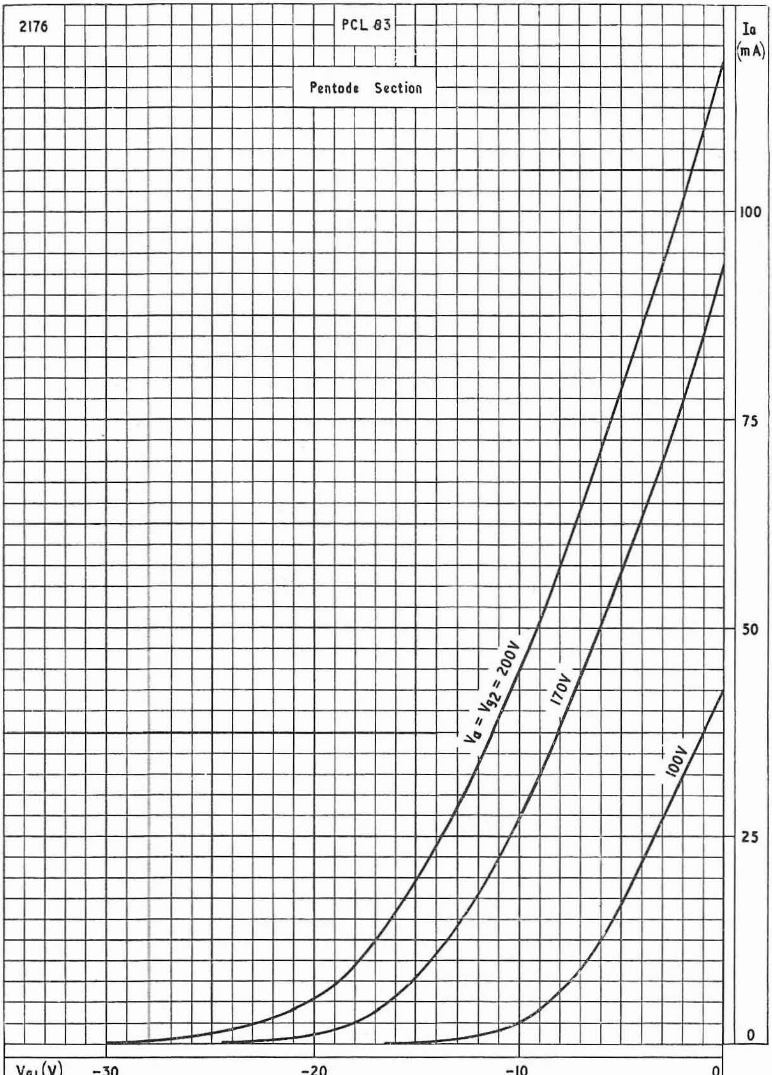


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2}=200V$

PCL83

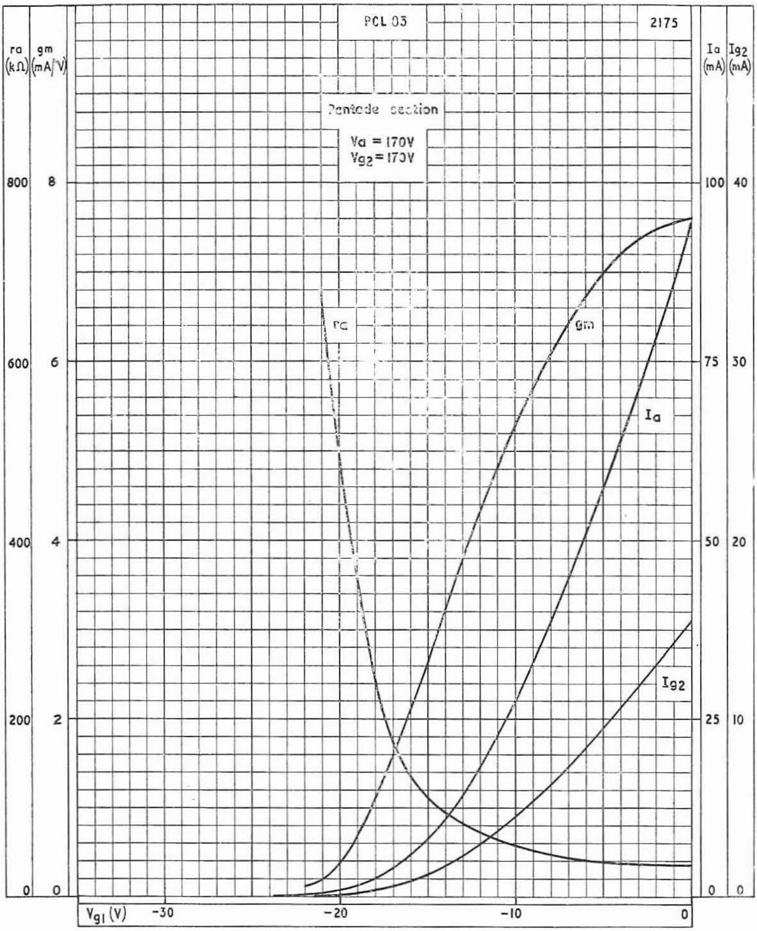
TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR VARIOUS ANODE AND SCREEN-GRID VOLTAGES

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

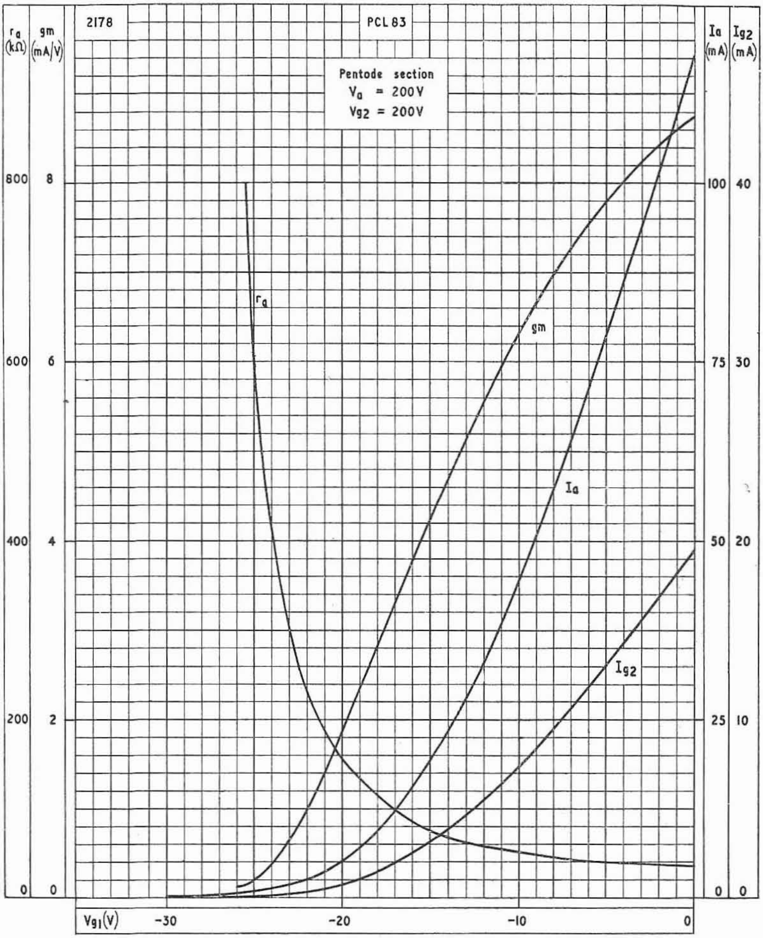


ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
$V_a = V_{g2} = 170V$

PCL83

TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.



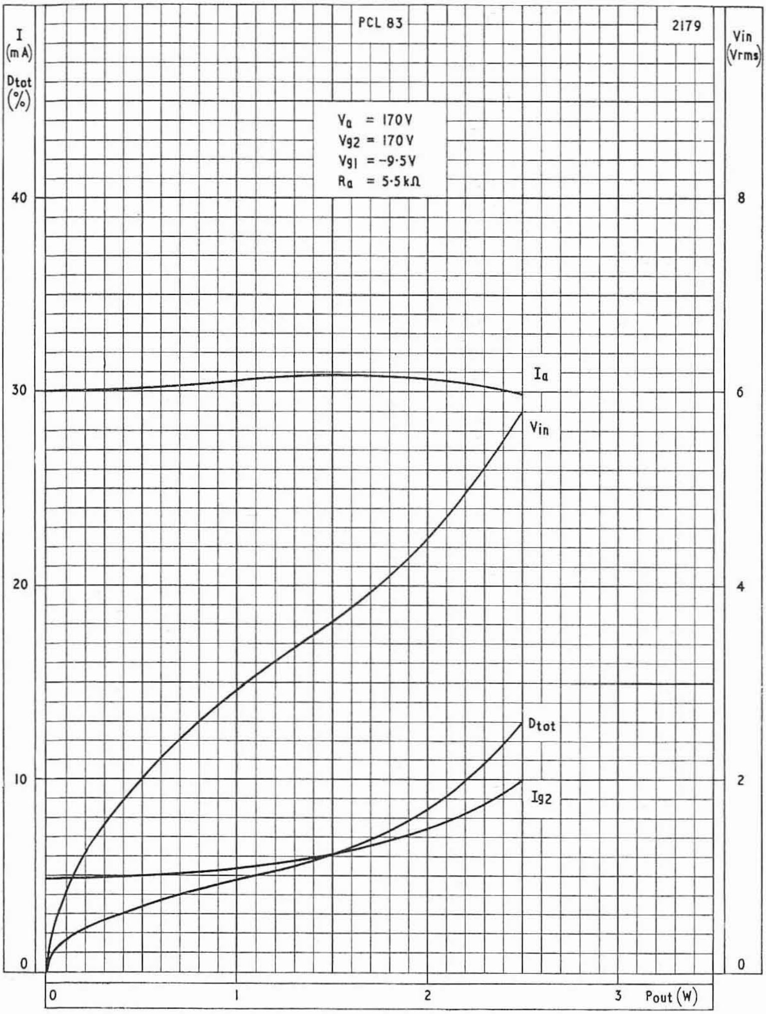
ANODE CURRENT, SCREEN-GRID CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

$V_a = V_{g2} = 200V$

TRIODE PENTODE

PCL83

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

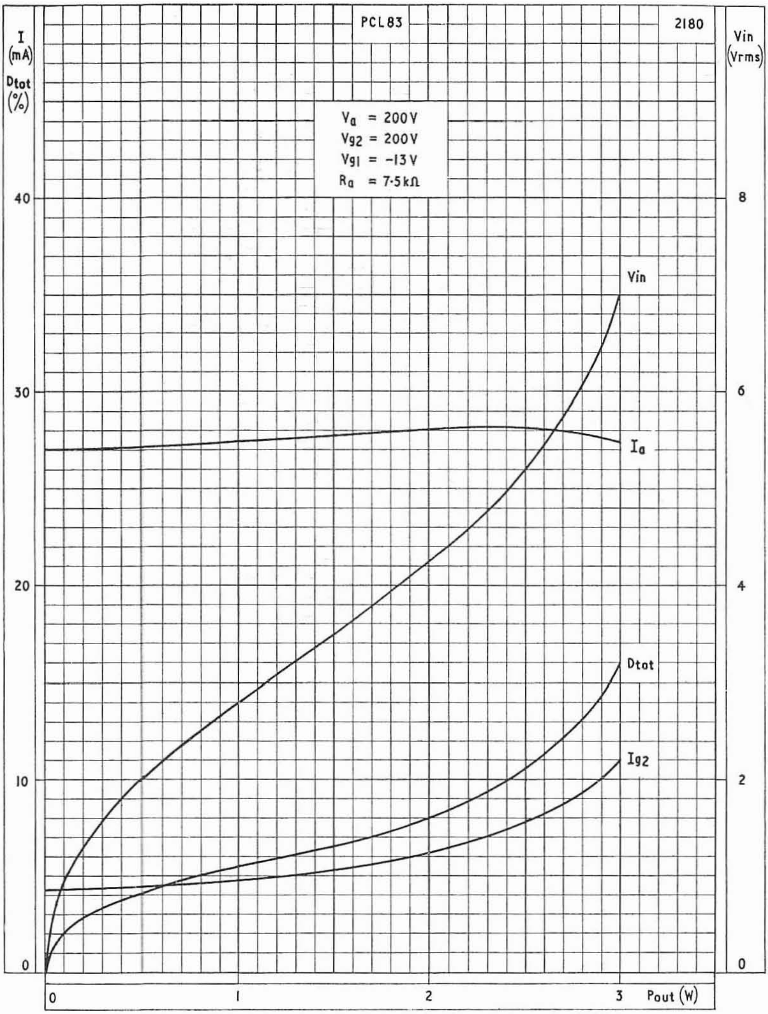


PERFORMANCE OF PENTODE SECTION AS CLASS 'A' AMPLIFIER WITH FIXED BIAS. $V_a = 170V$

PCL83

TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

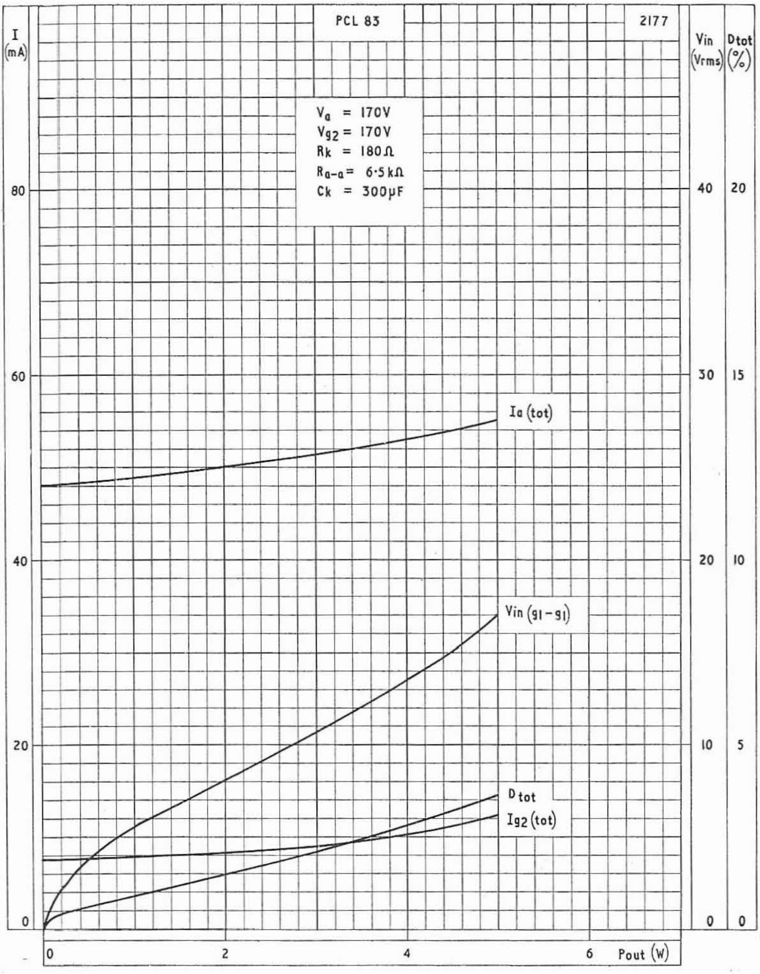


PERFORMANCE OF PENTODE SECTION AS CLASS 'A' AMPLIFIER WITH FIXED BIAS. $V_a = 200V$

TRIODE PENTODE

PCL83

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

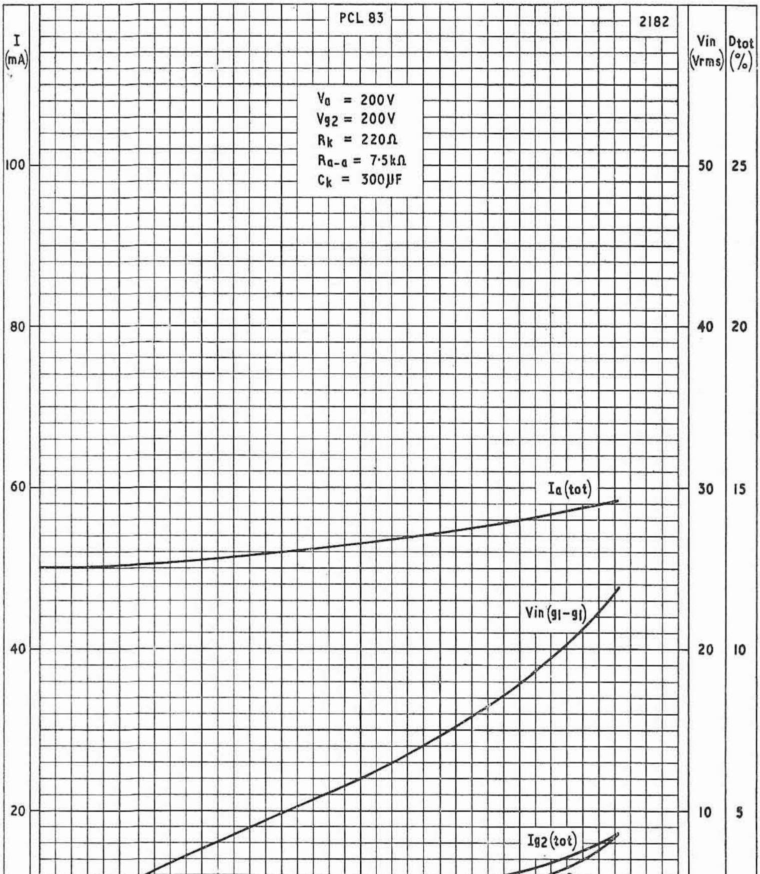


PERFORMANCE OF PCL83 IN PUSH-PULL. $V_a = 170V$

PCL83

TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

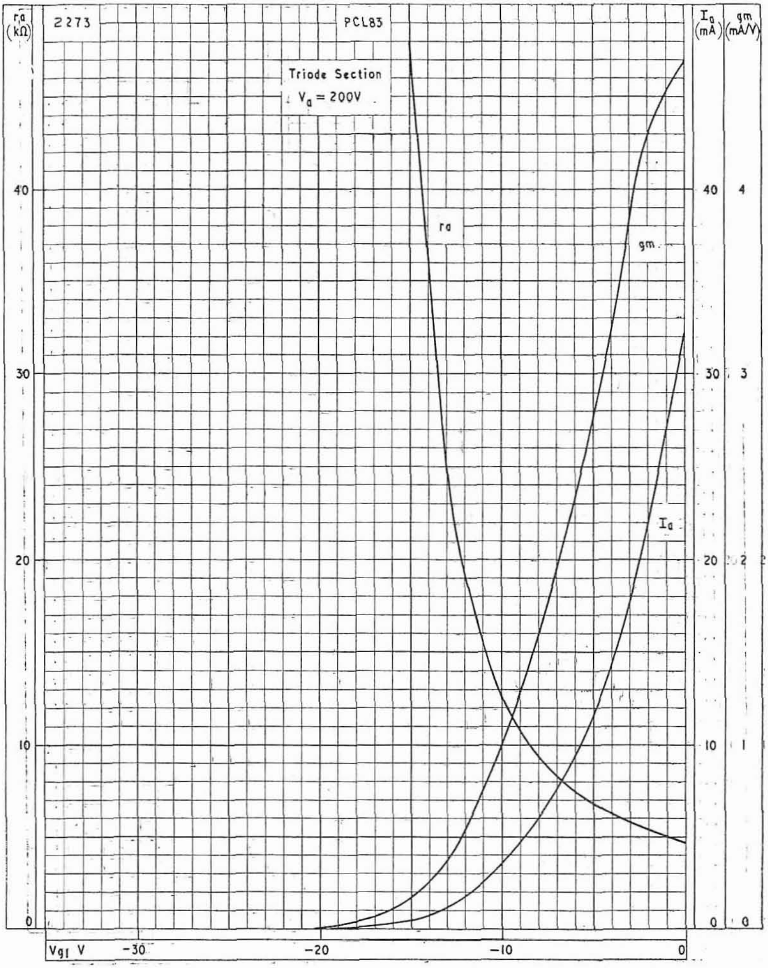


PERFORMANCE OF PCL83 IN PUSH-PULL. $V_a = 200V$

TRIODE PENTODE

PCL83

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.

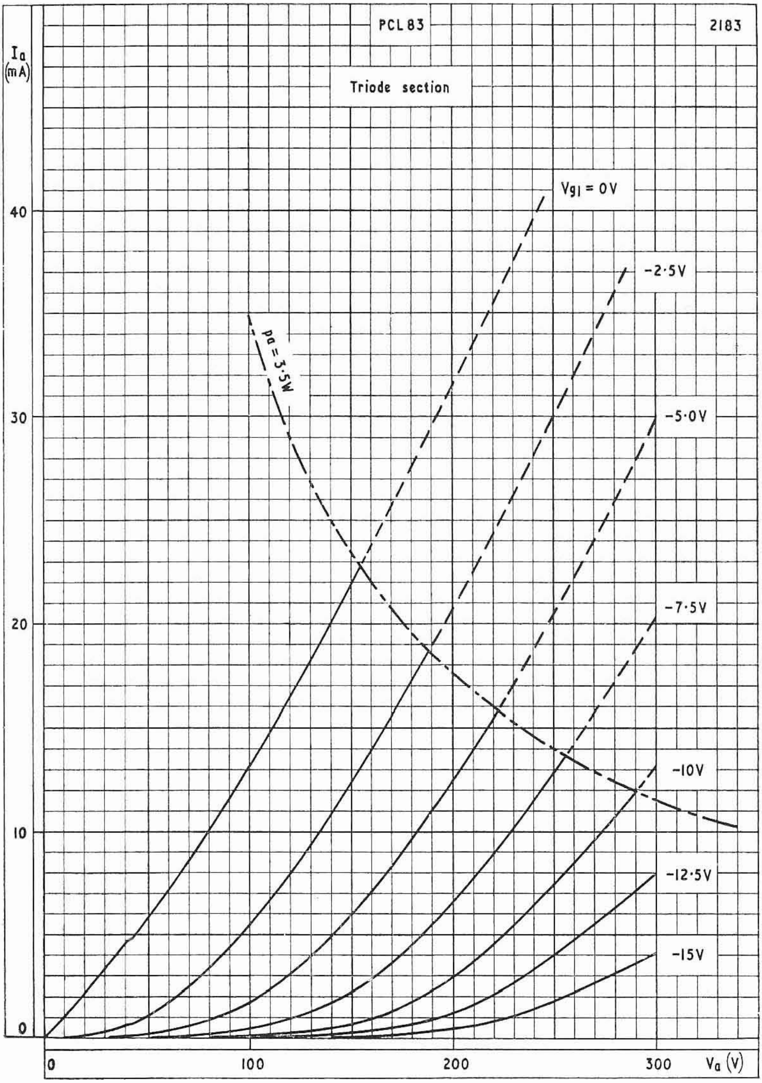


ANODE CURRENT, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST GRID VOLTAGE

PCL83

TRIODE PENTODE

Combined triode and output pentode with separate cathodes for use in television receivers with the triode as a frame blocking oscillator and the pentode as a frame output valve.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

OUTPUT PENTODE

PENA4

PENB4
OVERLEAF

HEATER

V_h	4.0	V
I_h	1.95	A

CAPACITANCES

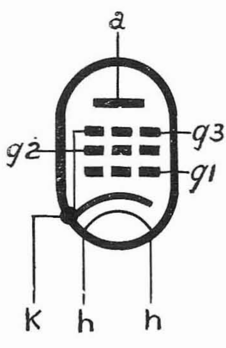
c_{a-g1}	2.0	pF
c_{out}	7.0	pF
c_{in}	14	pF

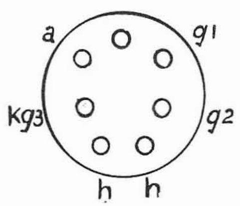
OPERATING CONDITIONS

V_a	250	V
V_{g2}	250	V
I_a	36	mA
I_{g2}	5.0	mA
g_m	9.5	mA/V
r_a	50	kΩ
P_{out}	3.8	W
R_a	8.0	kΩ
R_k	145	Ω

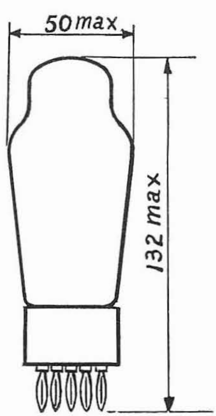
LIMITING VALUES

V_a max.	250	V
p_a max.	9.0	W
V_{g2} max.	250	W
R_{g1-k} max.	1.0	MΩ





BRIT. 7-PIN BASE



PEN B4

OUTPUT PENTODE

HEATER

V_h	4.0	V
I_h	2.1	A

CAPACITANCES

c_{out}	11	pF
c_{in}	14	pF
c_{a-g}	<1.0	pF

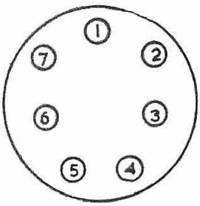
OPERATING CONDITIONS

V_a	250	V
V_{g2}	275	V
I_a	72	mA
I_{g2}	7.0	mA
g_m	8.5	mA/V
r_a	22	kΩ
R_a	3.5	kΩ
P_{out}	8.8	W
$V_{in\ (r.m.s.)}$	8.2	V
R_k	175	Ω

LIMITING VALUES

V_a max.	250	V
p_a max.	18	W
V_{g2} max.	275	V
p_{g2} max.	3.0	W
I_k max.	90	mA
R_{g1-k} max.	300	kΩ
V_{h-k} max.	50	V
R_{h-k} max.	5.0	kΩ

CONNECTIONS



Viewed from free end of pins

Brit. 7-Pin Base

Pin No. 1 NC
,, 2 Control grid (g_1)
,, 3 Screen grid (g_2)
,, 4 Heater
,, 5 Heater
,, 6 Cathode
,, 7 Anode

DIMENSIONS

Overall length	138	mm
Overall diameter	51	mm

DOUBLE DIODE OUTPUT PENTODE

PEN4DD

HEATER

V_h	4.0	V
I_h	2.25	A

CAPACITANCES

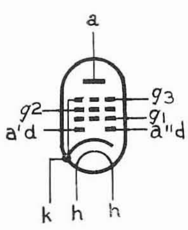
$c_{a'd-a''d}$	<0.2	μμF
$c_{a'd-k}$	3	μμF
$c_{a''d-k}$	3	μμF
$c_{a'd-a}$	0.5	μμF
$c_{a''d-a}$	0.2	μμF
$c_{a'd-g1}$	0.05	μμF
$c_{a''d-g1}$	0.05	μμF
c_{a-g1}	<0.5	μμF
c_{out}	9.5	μμF
c_{in}	13	μμF

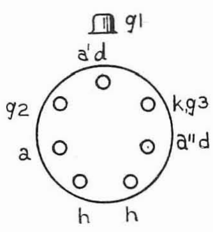
OPERATING CONDITIONS

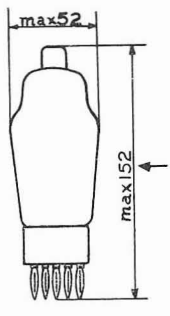
V_a	250	V
V_{g2}	250	V
I_a	36	mA
V_{g1}	−6	V
I_{g2}	5	mA
g_m	9.5	mA/V
r_a	50	kΩ
R_a	7	kΩ
$V_{in\ (r.m.s.)}$	3.6	V
P_{out}	4.3	W
D_{tot}	10	%

LIMITING VALUES

V_a max.	250	V
p_a max.	9	W
I_k max.	55	mA
V_{g2} max.	250	V
p_{g2} max.	1.5	W
R_{g1-k} max.	1	MΩ
V_{h-k} max.	50	V
R_{h-k} max.	5	kΩ
$v_{ad\ (pk)}$	200	V
$i_{ad\ (pk)}$	0.8	mA
V_{g1} max. ($I_{g1}=+1$ μA)	−0.8	V







OUTPUT PENTODE

PEN428

Indirectly heated output pentode designed primarily for use in power amplifying equipment where an output of 20 to 30 watts is required. It is particularly suitable for class AB push-pull operation.

HEATER

V_h	4.0	V
I_h	2.1	A

OPERATING CONDITIONS—SINGLE VALVE IN CLASS "A"

V_a	250	V
V_{g2}	250	V
R_k	150	Ω
I_a	72	mA
R_a	3.2	kΩ
P_{out}	8.0	W
D_{tot}	10	%

OPERATING CONDITIONS—TWO VALVES IN CLASS "AB" PUSH-PULL

V_a	250	375	V
V_{g2}	275	275	V
$I_{a(0)}$	2×52	2×48	mA
$I_{g2(0)}$	2×4.0	2×5.0	mA
I_a (max. sig.)	2×66	2×62	mA
I_{g2} (max. sig.)	—	2×9.0	mA
R_k	120	165	Ω
R_{a-a}	4.5	6.5	kΩ
P_{out}	19	28	W
D_{tot}	6.0	3.0	%

OPERATING NOTES

In Class AB output stages the type of input coupling to the Pen428 should not introduce too much resistance in the grid circuit, and for all normal amplifier circuits transformer coupling should be used.
The voltages specified above refer only to Class AB operation with two valves, and are the maximum voltage conditions which must not be exceeded.

LIMITING VALUES

*V_a max.	250	V
*V_{g2} max.	250	V
p_a max.	18	W
p_{g2} max.	3.0	W
R_{g1-k} max.	700	kΩ
V_{h-k} max.	50	V
R_{h-k} max.	5.0	kΩ

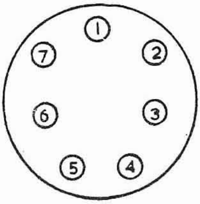
*In Class "AB" push-pull operation V_a max. = 375 V, V_{g2} max. = 275 V

PEN428

OUTPUT PENTODE

Indirectly heated output pentode designed primarily for use in power amplifying equipment where an output of 20 to 30 watts is required. It is particularly suitable for class AB push-pull operation.

CONNECTIONS



Viewed from free end of pins

Brit. 7-Pin Base

Pin No. 1	NC
,, 2	Control Grid (g_1)
,, 3	Screen Grid (g_2)
,, 4	Heater
,, 5	Heater
,, 6	Cathode
,, 7	Anode

OUTPUT PENTODE

PENA4

HEATER

V_h	4.0	V
I_h	1.95	A

CAPACITANCES

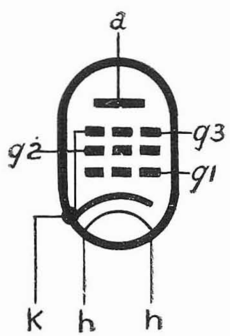
c_{a-g1}	2.0	μμF
c_{out}	7.0	μμF
c_{in}	14	μμF

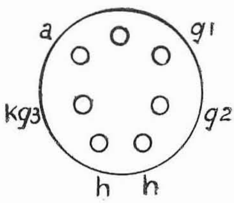
OPERATING CONDITIONS

V_a	250	V
V_{g2}	250	V
I_a	36	mA
V_{g1}	−5.8	V
I_{g2}	5.0	mA
g_m	9.5	mA/V
R_a	50	kΩ
P_{out}	3.8	W
R_a	8.0	kΩ
R_k	145	Ω

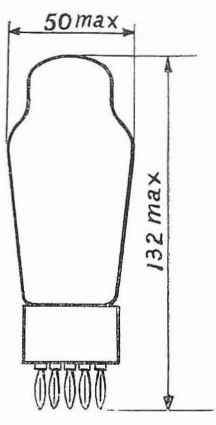
LIMITING VALUES

V_a max.	250	V
p_a max.	9.0	W
V_{g2} max.	250	W
R_{g1-k} max.	1.0	MΩ





BRIT. 7-PIN BASE



OUTPUT PENTODE

PENB4

Indirectly heated high-sensitivity Pentode capable of giving a large output in A.C. mains receivers.

HEATER

	V_h	4.0	V
	I_h	2.1	A
Heating Time		20	secs.

CAPACITANCES

c_{out}	11	$\mu\mu$F
c_{in}	14	$\mu\mu$F
c_{a-g}	<1.0	$\mu\mu$F

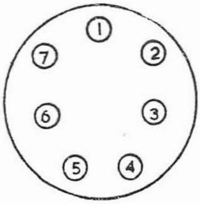
OPERATING CONDITIONS

V_a	250	V
V_{g2}	275	V
I_a	72	mA
I_{g2}	7.0	mA
g_m	8.5	mA/V
r_a	22	k Ω
R_a	3.5	k Ω
P_{out}	8.8	W
$V_{in\ (r.m.s.)}$	8.2	V
R_k	175	Ω

LIMITING VALUES

V_a max.	250	V
p_a max.	18	W
V_{g2} max.	275	V
p_{g2} max.	3.0	W
I_k max.	90	mA
R_{g1-k} max.	300	k Ω
V_{h-k} max.	50	V
R_{h-k} max.	5.0	k Ω

CONNECTIONS



Viewed from free end of pins

Brit. 7–Pin Base

Pin No. 1 N.C.
,, 2 Control Grid (g_1)
,, 3 Screen Grid (g_2)
,, 4 Heater
,, 5 Heater
,, 6 Cathode
,, 7 Anode

DIMENSIONS

Overall length	138	mm.
Overall diameter	51	mm.

OUTPUT PENTODE

PL38
PL38M

Output pentode primarily intended for use as line time base output valve in television receivers with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	30	V

CAPACITANCES

	PL38M	PL38	
c_{in}	18	18	pF
c_{out}	9.5	6.5	pF
c_{a-g1}	<1.0	<1.2	pF

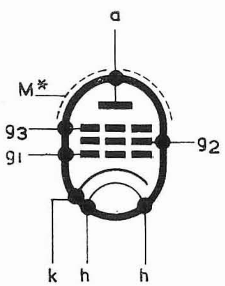
CHARACTERISTICS

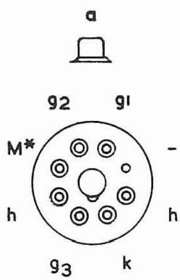
V_a	200	V
V_{g2}	200	V
V_{g1}	−5.5	V
I_a	75	mA
I_{g2}	9.0	mA
g_m	13.5	mA/V
r_a	20	kΩ
μ_{g1-g2}	16.5	

LIMITING VALUES

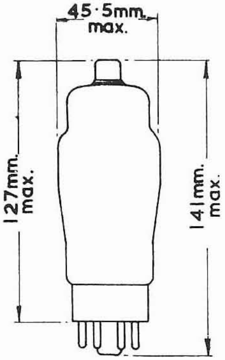
$V_{a(b)}$ max.	1.2	kV
V_a max.	800	V
$v_{a(pk)}$ max.	8.0	kV
$V_{g2(b)}$ max.	800	V
V_{g2} max.	400	V
p_a max.	25	W
p_{g2} max.	8.0	W
I_k max.	200	mA
V_{g1} max. ($I_{g1} = +0.3\mu A$)	−1.3	V
*R_{g1-k} max. ($p_a < 25W$)	500	kΩ
*R_{g1-k} max. ($p_a < 9W$)	800	kΩ
V_{h-k} max.	200	V
R_{h-k} max.	20	kΩ

*For self bias operation.





OCTAL BASE

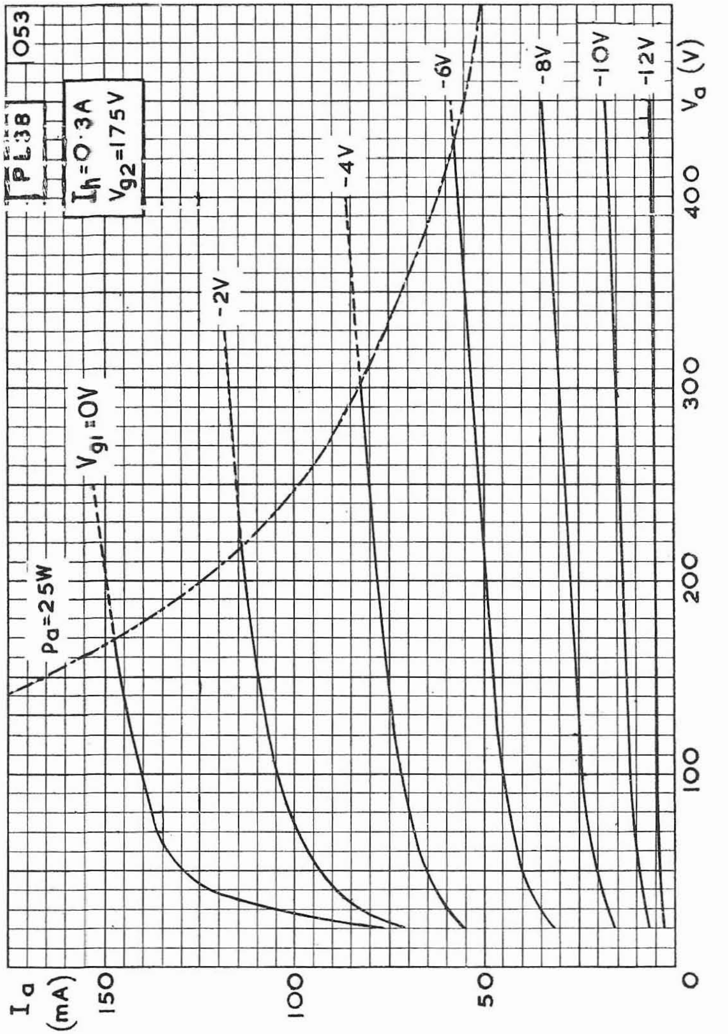


732

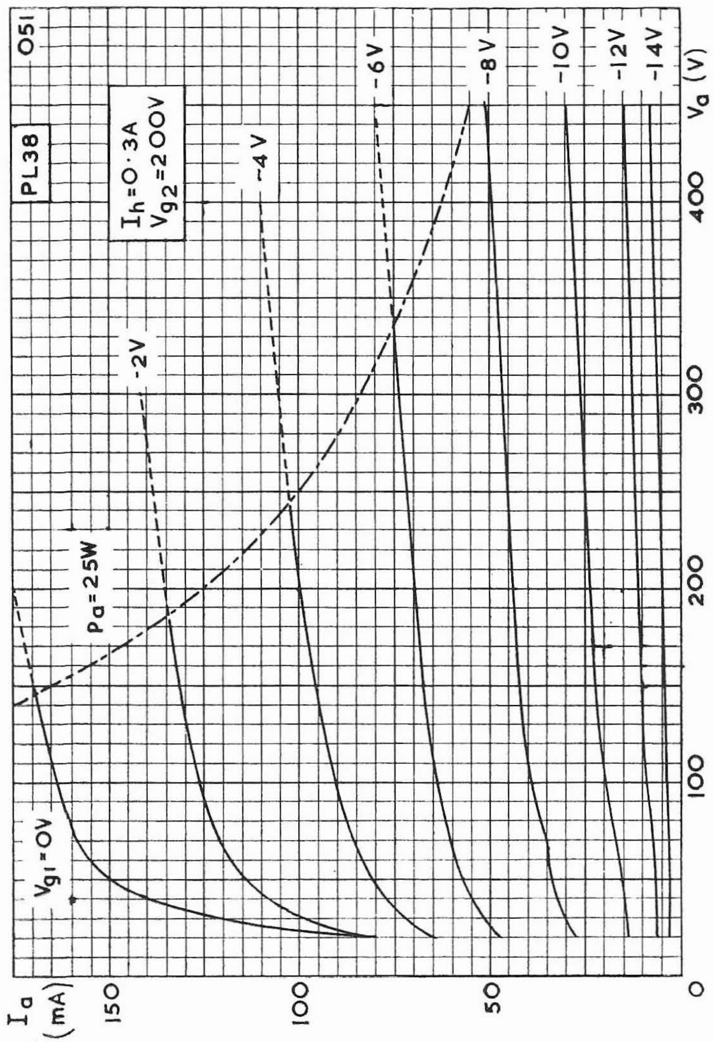
* External metallising on type PL38M only.

PL38
PL38M

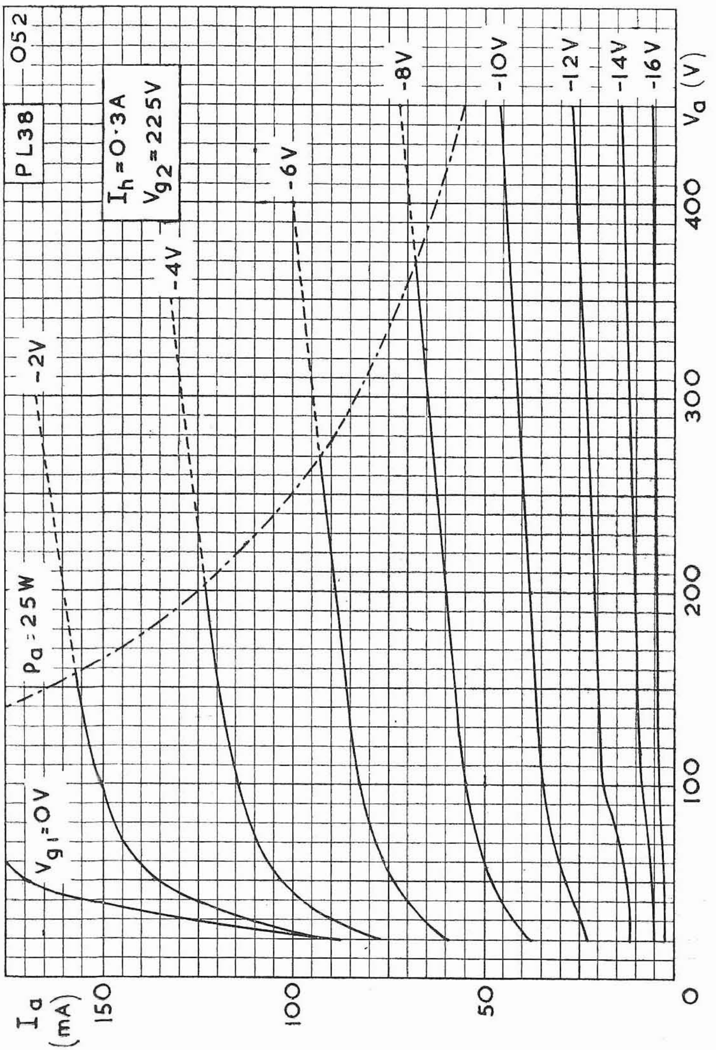
OUTPUT PENTODE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER AT V_{g2} = 175V



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER AT V_{g2} = 200V



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER AT V_{g2} = 225V

LINE OUTPUT PENTODE

PL81

Output pentode primarily intended for use in the line timebase of television receivers.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	21.5	V

CAPACITANCES

c_{in}	14.7	pF
c_{out}	6.4	pF
c_{a-g1}	<800	mpF
c_{g1-h}	<200	mpF
c_{a-k}	<100	mpF

CHARACTERISTICS

V_a	170	V
V_{g3}	0	V
V_{g2}	170	V
V_{g1}	–24	V
I_a	45	mA
I_{g2}	3.0	mA
g_m	6.5	mA/V
r_a	15	kΩ
μ_{g1-g2}	5.5	
V_{g1} max. ($I_g = +0.3\mu A$)	–1.3	V

OPERATION AS LINE OUTPUT PENTODE

Circuit Design

In calculating the peak anode current for circuit design purposes the knee is taken as the reference point. Operation so that the anode potential of the output valve at the end of scan is above the knee of the anode characteristic is not recommended, unless an effective feedback stabilising circuit is employed.

For operation below the knee of the characteristic the nomogram on page C1 should be used.

LIMITING VALUES

$V_{a(b)}$ max.	650	V
V_a max.	250	V
p_a max.	8.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
**p_{g2} max.	4.5	W
$p_a + p_{g2}$ max.	8.5	W
I_k max.	180	mA
R_{g1-k} max.	500	kΩ
V_{h-k} max.	200	V
R_{h-k} max.	20	kΩ
T_{bulb} max.	240	°C

PL81

LINE OUTPUT PENTODE

Line output applications

*$+v_{a(pk)}$ max.	6.0	kV
p_a max.	7.0	W
**p_{g2} max.	4.5	W
p_a+p_{g2} max.	8.5	W
*$+v_{g1(pk)}$ max.	3.0	V
*$-v_{g1(pk)}$ max.	1.0	kV
R_{g1-k} max.	3.3	MΩ
Min. drive at $v_{a(pk)} = 4kV$	80	V
Min. drive at $v_{a(pk)} = 6kV$	95	V

*Max. pulse duration 22% of one cycle, with a maximum of 18μs.

**Max. average p_{g2} is 6W during the period between the commencement of I_{g2} and the instant when I_a attains one half of its normal operating value.

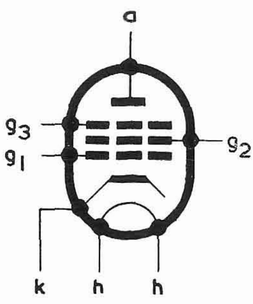
PEAK ANODE CURRENT NOMOGRAM

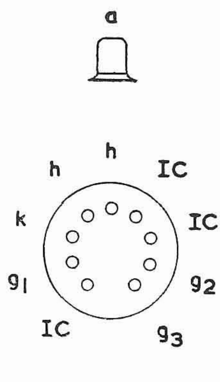
The nomogram shown on the following pages gives directly the recommended peak values of anode current, i_a(design), for a wide range of h.t. line potentials and screen-grid resistors.

It assumes 'below the knee' operation (which is recommended for all cases except when a stabilising circuit is used), undecoupled screen-grid resistor (excluding capacitors of a few hundred picofarad), and control-grid potential of +1V. The last condition is normally fulfilled by driven time bases having the control-grid resistor returned to chassis.

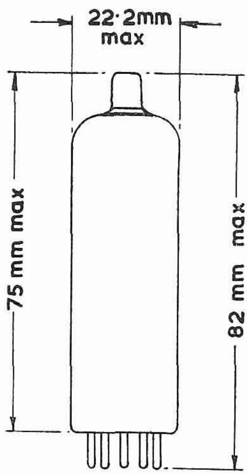
The use of the nomogram does not exempt the designer from checking that the valve is operating within its limiting values. During measurements of the operating conditions in a line timebase a valve whose characteristic is close to that of a nominal valve and a nominal screen-grid resistor should be used.

In receivers designed for a range of declared values of mains voltages, measurements should be made at the nominal declared value of mains voltage producing the lowest nominal h.t. voltage. The timebase should be synchronised and the raster adjusted to nominal scan. The beam current drawn from the e.h.t. supply should be adjusted to 300μA. ←

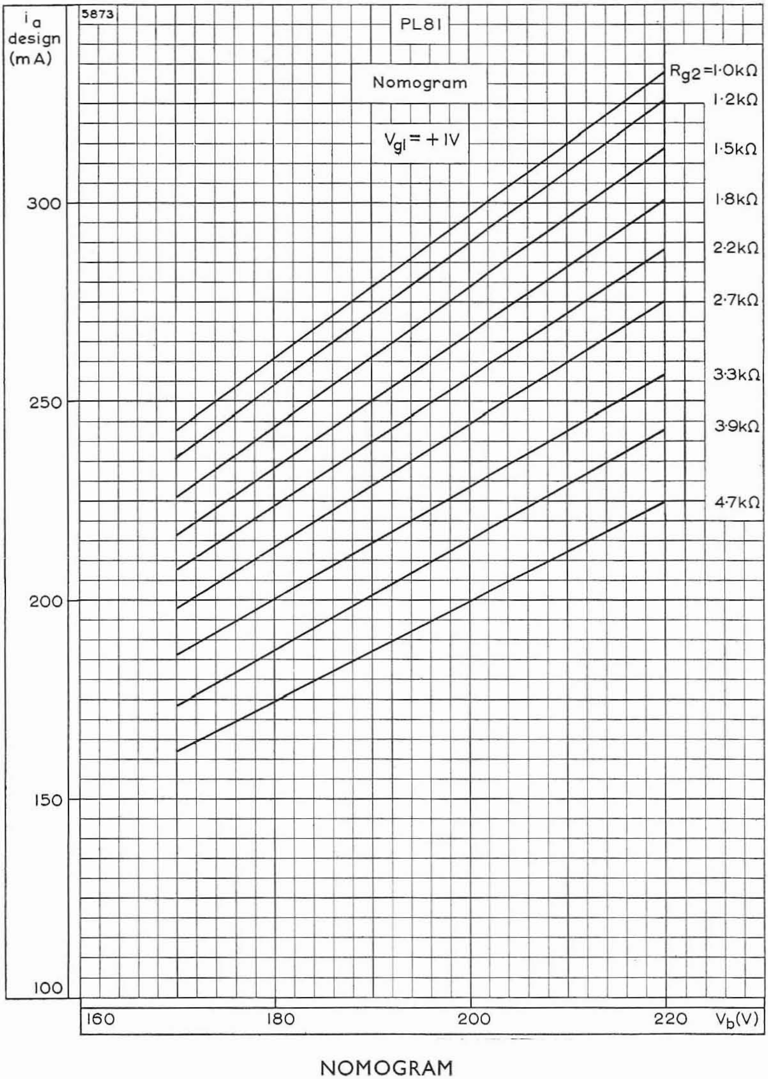




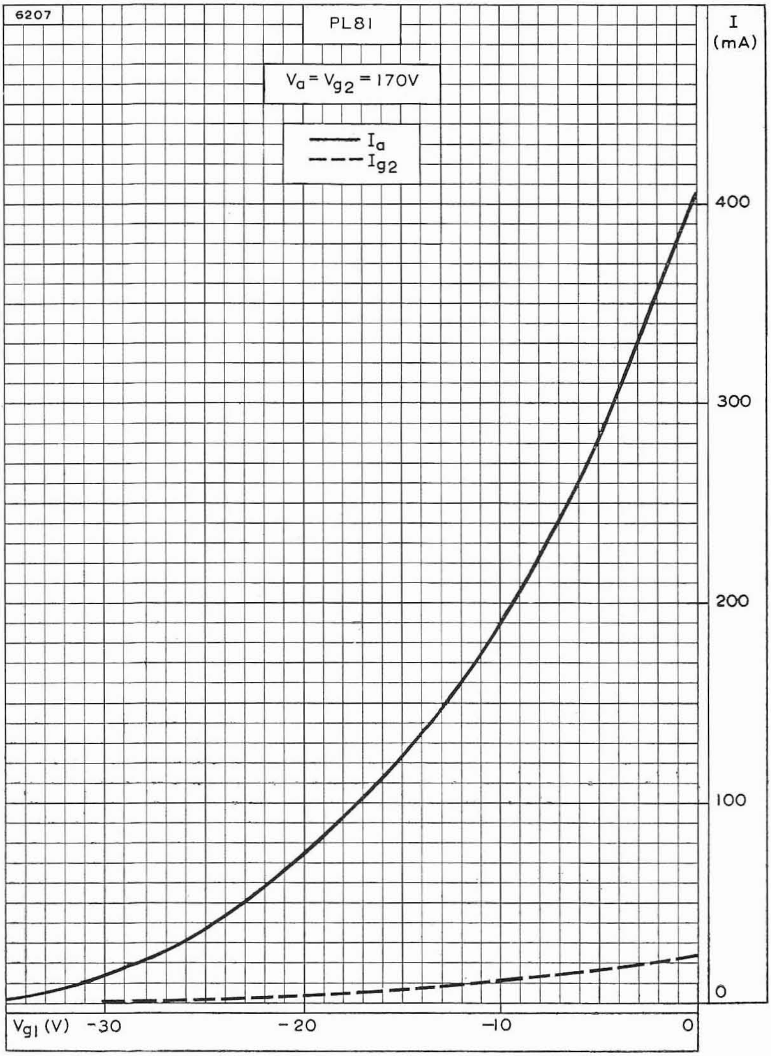
B9A Base



2710

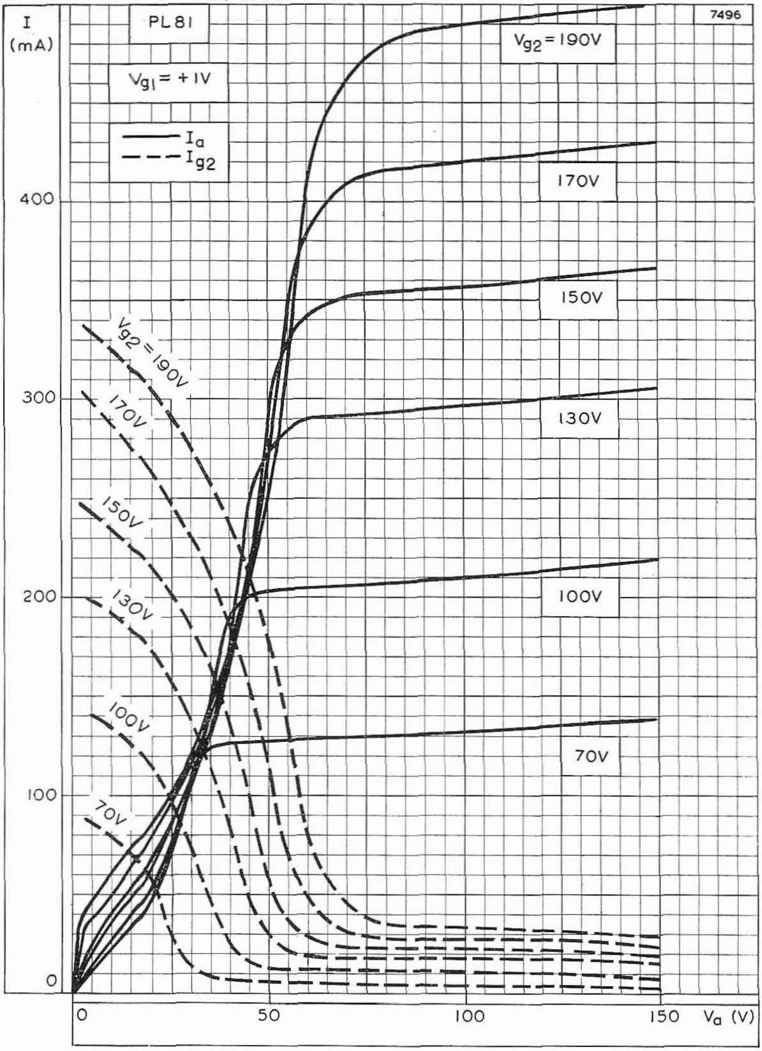

5873
PL81
Nomogram
$V_{g1} = +1V$
i_a design (mA)
300
250
200
150
100
160
180
200
220
V_b(V)
R_{g2}=1·0kΩ
1·2kΩ
1·5kΩ
1·8kΩ
2·2kΩ
2·7kΩ
3·3kΩ
3·9kΩ
4·7kΩ

NOMOGRAM

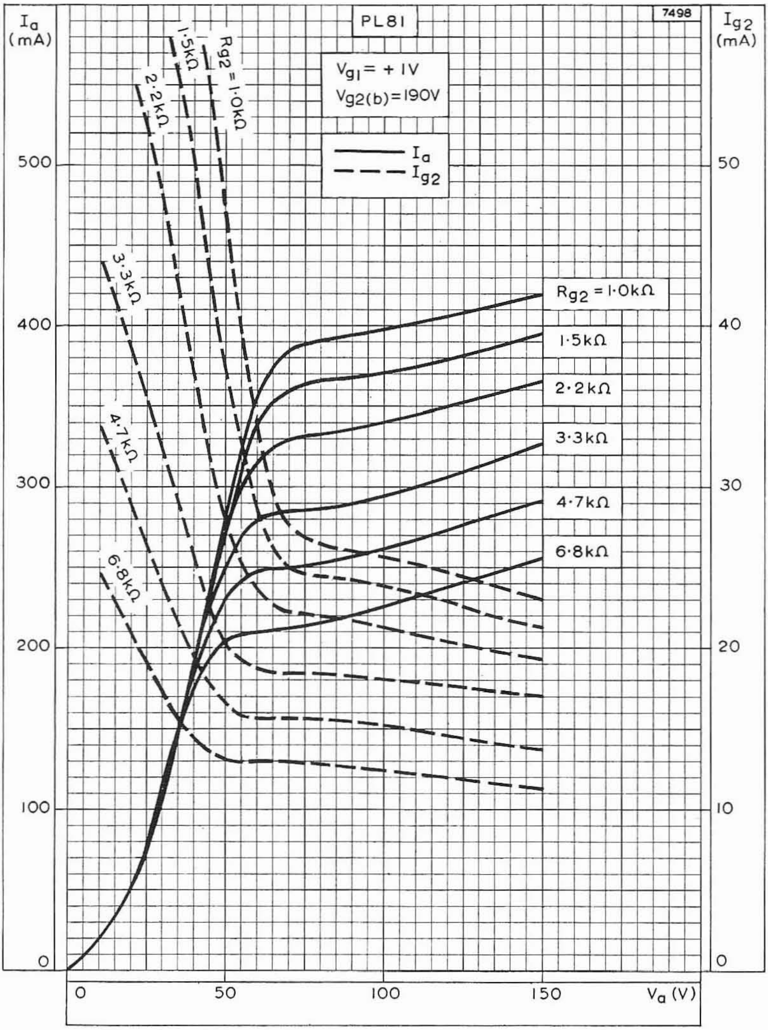


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE

ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID VOLTAGE AS PARAMETER



ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH SCREEN-GRID RESISTOR AS PARAMETER

OUTPUT PENTODE

PL82

Output pentode with a maximum anode dissipation of 9W suitable for use as frame timebase or audio output valve.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	16.5	V

CAPACITANCES

c_{in}	11	pF
c_{out}	6.2	pF←
c_{a-g1}	<1.0	pF
c_{g1-h}	<0.15	pF

CHARACTERISTICS

V_a	170	200	V
V_{g2}	170	200	V
I_a	53	45	mA
I_{g2}	10	8.5	mA
V_{g1}	−10.4	-14.2	V
g_m	9	7.6	mA/V←
r_a	20	24	kΩ
μ_{g1-g2}	10	10	

OPERATING CONDITIONS AS AUDIO OUTPUT VALVE ←

V_a	170	200	V
V_{g2}	170	200	V
V_{g1}	−10.4	−13.9	V
R_a	3	4	kΩ
$I_{a(0)}$	53	45	mA
$I_{g2(0)}$	10	8.5	mA
$V_{in\ (r.m.s.)}$ (P_{out}=50 mW)	0.5	0.55	V
$V_{in\ (r.m.s.)}$ (D_{tot}=10%)	6.0	7.0	V
P_{out} (D_{tot}=10%)	4.0	4.2	W

PL82

OUTPUT PENTODE

Output pentode with a maximum anode dissipation of 9W suitable for use as frame timebase or audio output valve.

OPERATION AS FRAME OUTPUT VALVE

To allow for valve spread and for deterioration during life, the frame output stage should be designed around the following values:—

V_a	50	60	V
V_{g2}	170	200	V
I_a	90	120	mA

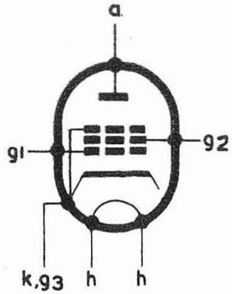
For an average new valve the following figures will apply:—

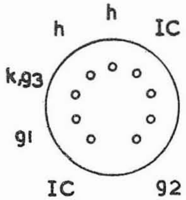
V_a	50	60	V
V_{g2}	170	200	V
V_{g1}	−1	−1	V
I_a	140	175	mA

LIMITING VALUES

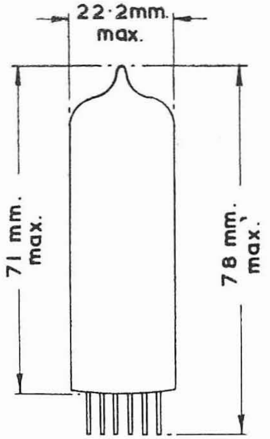
$V_{a(b)}$ max.	550	V
V_a max.	250	V
* $+v_{a\ (pk)}$ max.	2.5	kV
$-v_{a\ (pk)}$ max.	500	V
p_a max.	9	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_{g2} max.	2.5	W
I_k max.	75	mA
V_{g1} max. ($I_{g1} = +0.3\ \mu A$)	−1.3	V
R_{g1-k} max. (audio output valve)	1.0	MΩ
R_{g1-k} max. (frame output valve)	2.2	MΩ
V_{h-k} max.	200	V ←
R_{h-k} max.	20	kΩ

*Max. pulse duration 10% of one cycle, with a maximum of 2 msec.





B9A
Noval Base

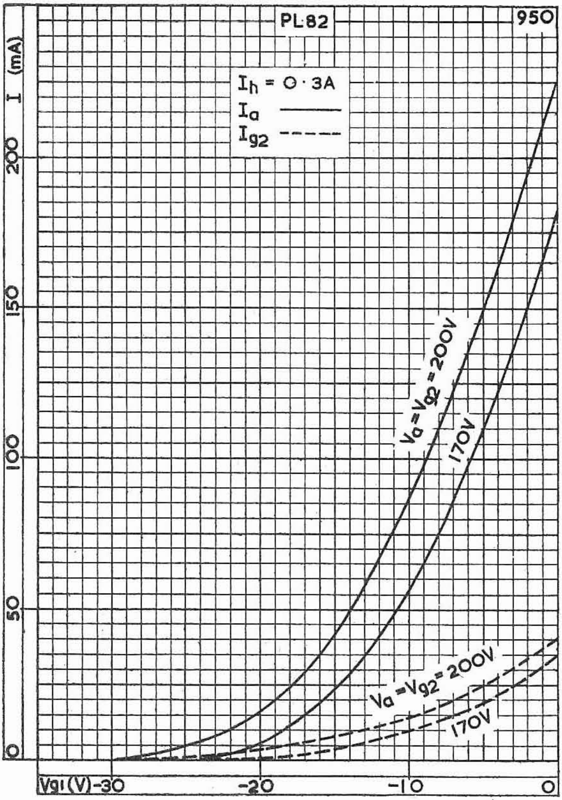


558

OUTPUT PENTODE

PL82

Output pentode with a maximum anode dissipation of 9W suitable for use as frame timebase or audio output valve.

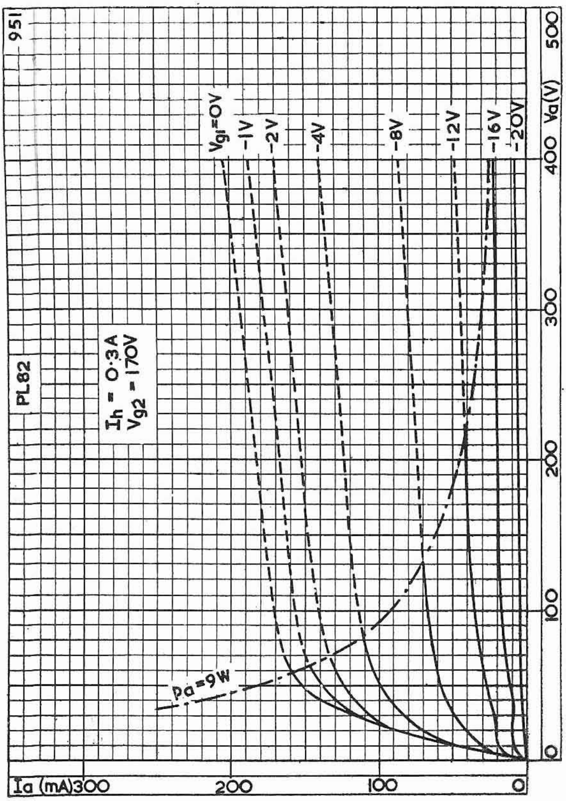


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST CONTROL GRID VOLTAGE

PL82

OUTPUT PENTODE

Output pentode with a maximum anode dissipation of 9W suitable for use as frame timebase or audio output valve.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH SCREEN-GRID VOLTAGE AT 170V

R. F. TETRODE

PM12M

FILAMENT

V_f	2.0	V
I_f	0.18	A

BULB FINISH

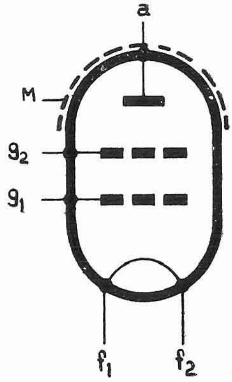
Metallised or clear.

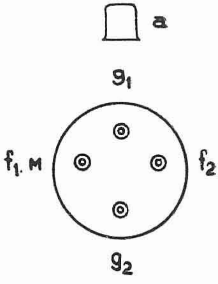
OPERATING CHARACTERISTICS AS R.F. AMPLIFIER

V_a	150	V
V_{g2}	90	V
V_{g1}	0	V
I_a	2.5	mA
I_{g2}	0.5	mA
g_m	1.4	mA/V
V_{g1} (for 100 : 1 reduction in g_m)	–7	V

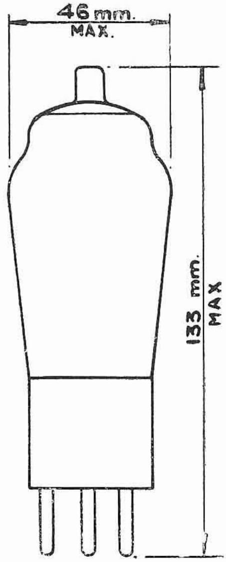
LIMITING VALUES

V_a max.	150	V
V_{g2} max.	90	V





BRITISH 4–PIN BASE



OUTPUT PENTODE

PM22A

FILAMENT

V_f	2.0	V
I_f	0.15	A

CAPACITANCES

c_{in}	8.5	μμF
c_{out}	13.0	μμF
c_{a-g1}	<1.0	μμF

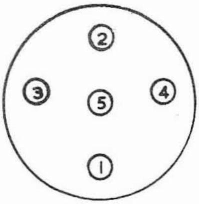
OPERATING CONDITIONS

V_a	135	V
V_{g2}	135	V
V_{g1}	—4.5	V
I_a	5.6	mA
R_a	19	kΩ
$V_{in\ (r.m.s.)}$	3.0	V
P_{out}	340	mW
g_m	2.2	mA/V
r_a	150	kΩ

LIMITING VALUES

V_a max.	150	V
p_a max.	1.0	W
V_{g2} max.	150	V
I_k max.	10	mA
R_{g1-f} max.	1.0	MΩ

CONNECTIONS



Viewed from free end of pins

Brit. 5-Pin Base

Pin No. 1 Anode
,, 2 Control Grid (g_1)
,, 3 Filament
,, 4 Filament
,, 5 Screen Grid (g_2)

DIMENSIONS

Overall length	117	mm.
Overall diameter	41	mm.

OUTPUT PENTODE

PM22D

FILAMENT

V_f	2.0	V
I_f	0.3	A

CAPACITANCES

c_{a-g1}	1.15	$\mu\mu$F
c_{in}	11.0	$\mu\mu$F
c_{out}	11.0	$\mu\mu$F

OPERATING CONDITIONS

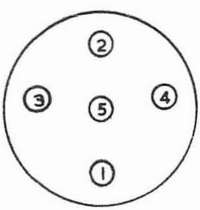
V_a	135	V
V_{g2}	135	V
V_{g1}	–2.4	V
I_a	5.0	mA
I_{g2}	0.8	mA
g_m	3.0	mA/V
R_a	24	kΩ
$V_{in\ (r.m.s.)}$	1.75	V
P_{out}	300	mW

LIMITING VALUES

V_a max.	150	V
V_{g2} max.	150	V

CONNECTIONS

Brit. 5-Pin Base



Viewed from free end of pins

Pin No. 1	Anode
,, 2	Control Grid (g_1)
,, 3	Filament
,, 4	Filament
,, 5	Screen Grid (g_2)

DIMENSIONS

Overall length	120mm.
Bulb diameter	47mm.

OUTPUT PENTODE

PM24M

Directly heated Output Pentode for use in A.C. mains receivers.

FILAMENT

V_f	4.0	V
I_f	1.1	A

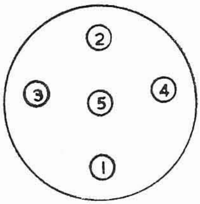
OPERATING CONDITIONS

V_a	250	V
V_{g2}	250	V
I_a	30	mA
I_{g2}	5.6	mA
V_{g1}	−17.0	V
g_m	3.0	mA/V
r_a	43	kΩ
P_{out}	2.8	W
R_a	7	kΩ
$V_{in\ (r.m.s.)}$	9.0	V

LIMITING VALUES

V_a max.	250	V
V_{g2} max.	250	V
I_k max.	50	mA
p_a max.	7.5	W
p_{g2} max.	2.0	W
R_{g1-h} max.	0.8	MΩ

CONNECTIONS



Viewed from free end of pins

Brit. 5–Pin Base

Pin No. 1 Anode
,, 2 Control Grid (g_1)
,, 3 Filament
,, 4 Filament
,, 5 Screen Grid (g_2)

DIMENSIONS

Overall length	135	mm.
Overall diameter	50	mm.

HALF WAVE RECTIFIER

PY31

Indirectly heated half wave rectifier with 300mA heater for DC/AC operation.

HEATER

I_h	0.3	A
V_h	17	V

MOUNTING POSITION

Any

OPERATING CONDITIONS

$V_{a(r.m.s.)}$ (V)	C max. (μF)	R_{lim} min. (Ω)
250	60	175
250	32	125
250	16	75
250	8.0	0
170	60	100
170	32	75
170	16	30
127	60	0

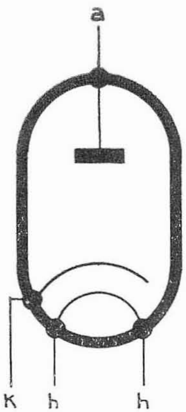
LIMITING VALUES

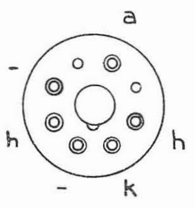
P.I.V. max.	1.0	kV
$V_{a(r.m.s.)}$ max.	250	V
I_a max.	125	mA
$v_{h-k(pk.)}$ max.	300	V
C max.	60	μF

PY31

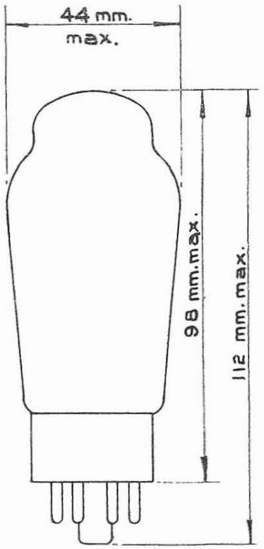
HALF WAVE RECTIFIER

Indirectly heated half wave rectifier with 300mA heater for DC/AC operation.





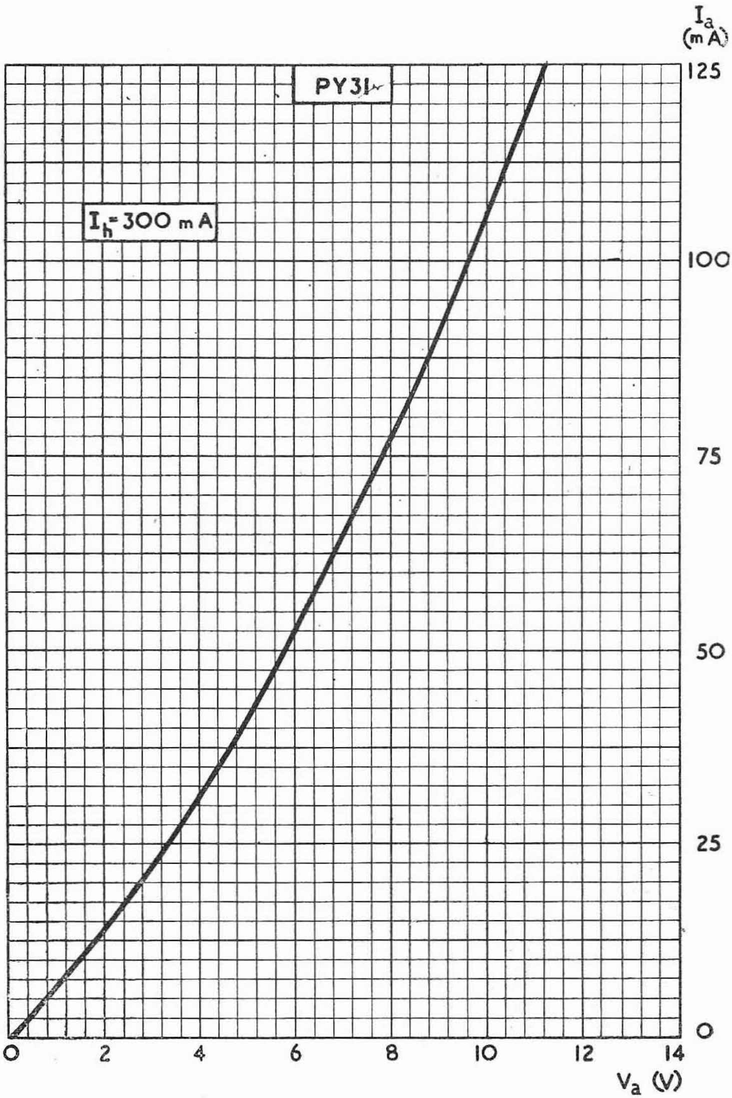
OCTAL BASE



HALF WAVE RECTIFIER

PY31

Indirectly heated half wave rectifier with 300mA heater for DC/AC operation.

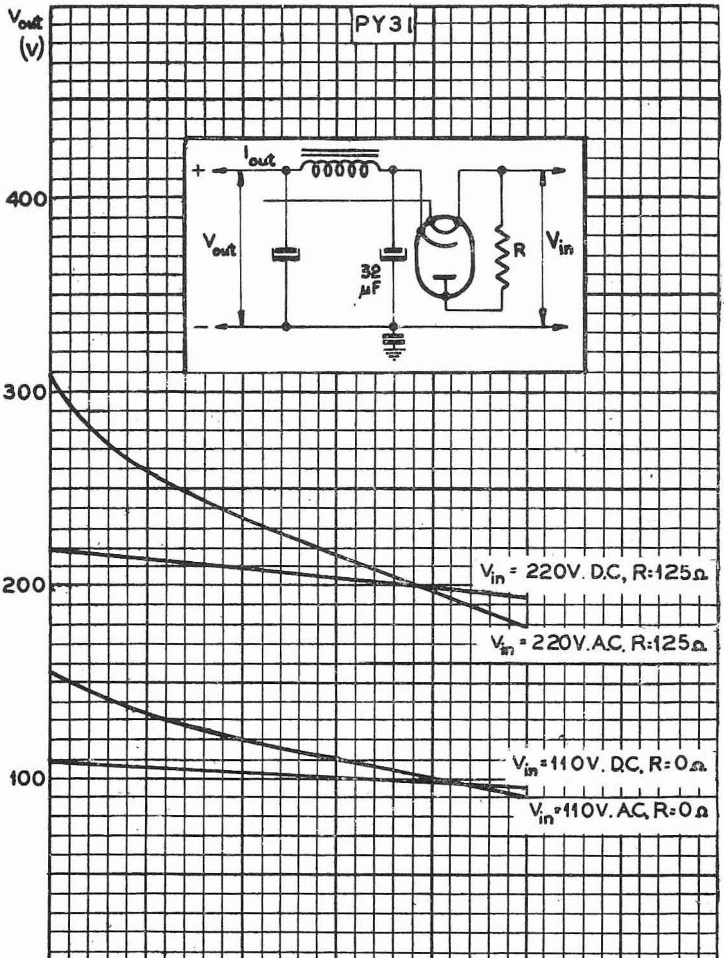


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

PY31

HALF WAVE RECTIFIER

Indirectly heated half wave rectifier with 300mA heater for DC/AC operation.



REGULATION CURVE

HALF-WAVE RECTIFIER

PY33

Indirectly-heated half-wave rectifier with 300mA heater for use in television receivers with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	29	V

DESIGN CENTRE RATINGS

P.I.V. max.	700	V
$V_{a(r.m.s.)}$ max.	250	V
I_{out} max.	325	mA
$i_{a(pk)}$ max.	2.6	A
$i_{a(surge)}$ max.	9.5	A
C max.	200	μF
*$v_{h-k(pk)}$ max. (cathode positive)	625	V

*Max. d.c. component = 275V. Max. a.c. component = 250$V_{r.m.s.}$

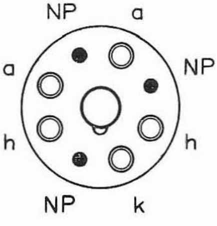
OPERATING CONDITIONS*

$V_{in(r.m.s.)}$	200	210	220	230	240	250	V
I_{out}	325	325	295	270	240	220	mA
C	200	200	200	200	200	200	μF
R_{lim} min.	15	17	19	21	23	25	Ω
V_{out}	209	219	234	249	264	280	V

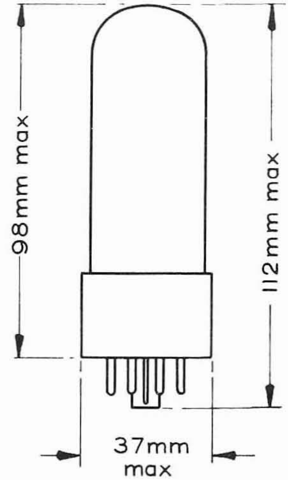
*For television receivers, where a constant output voltage is required for different input voltages, the values of limiting resistor required can be obtained from the curves on pages C3 and C4.

PY33

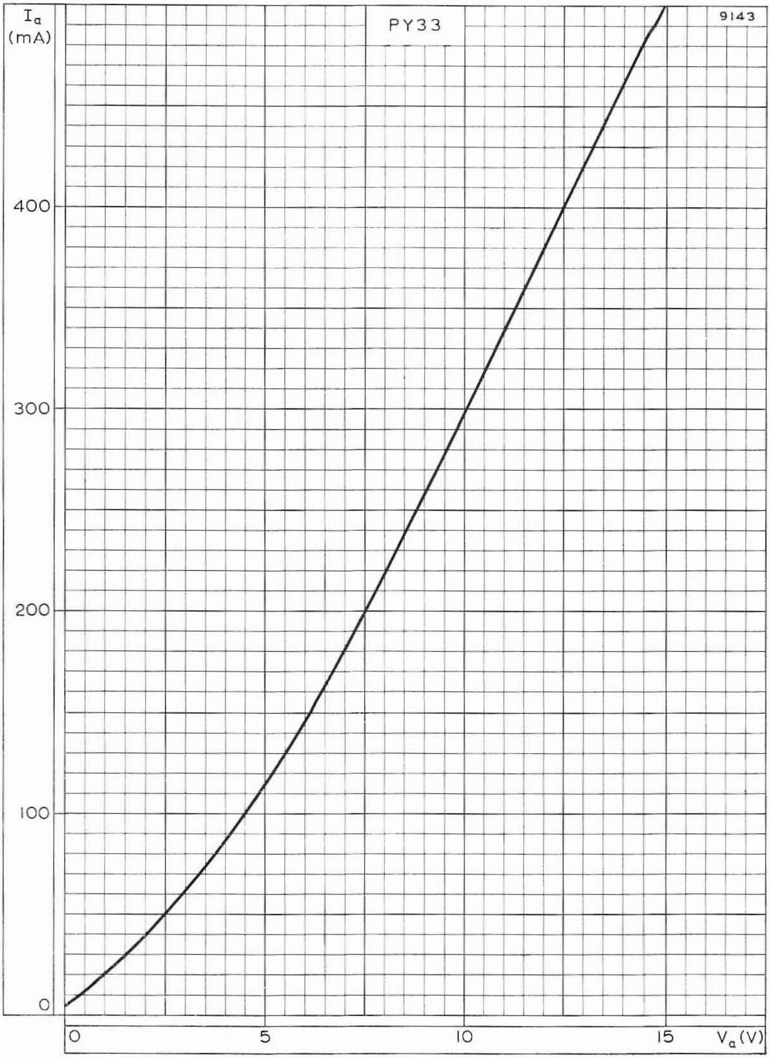
HALF-WAVE RECTIFIER



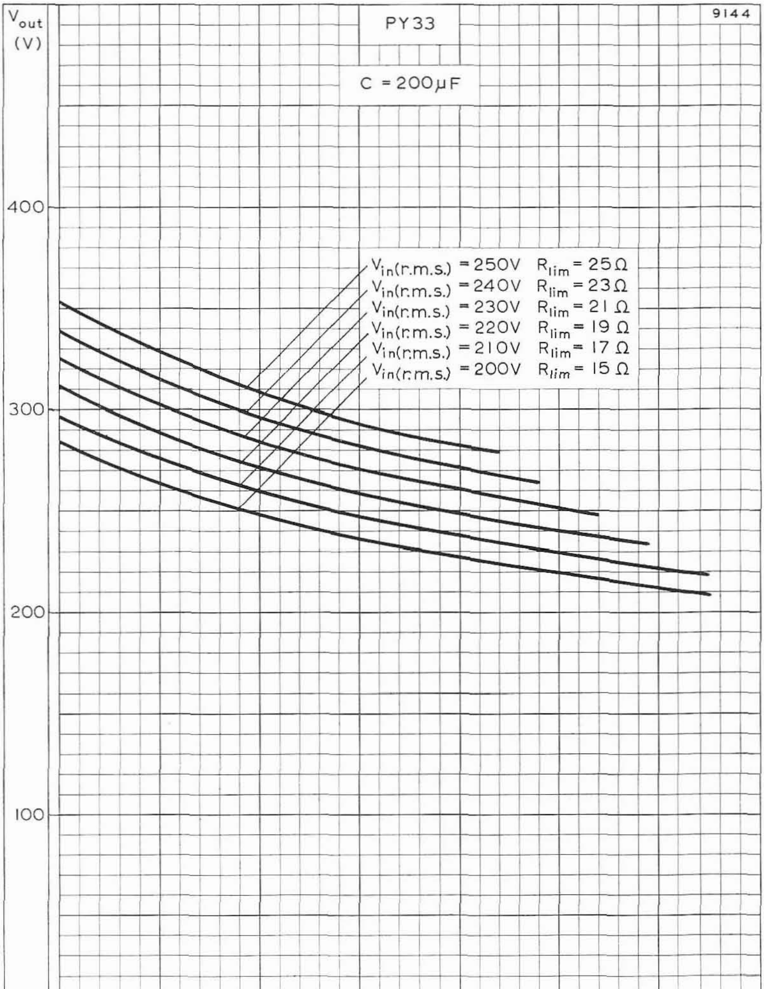
Octal Base



7575



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE



REGULATION CURVES

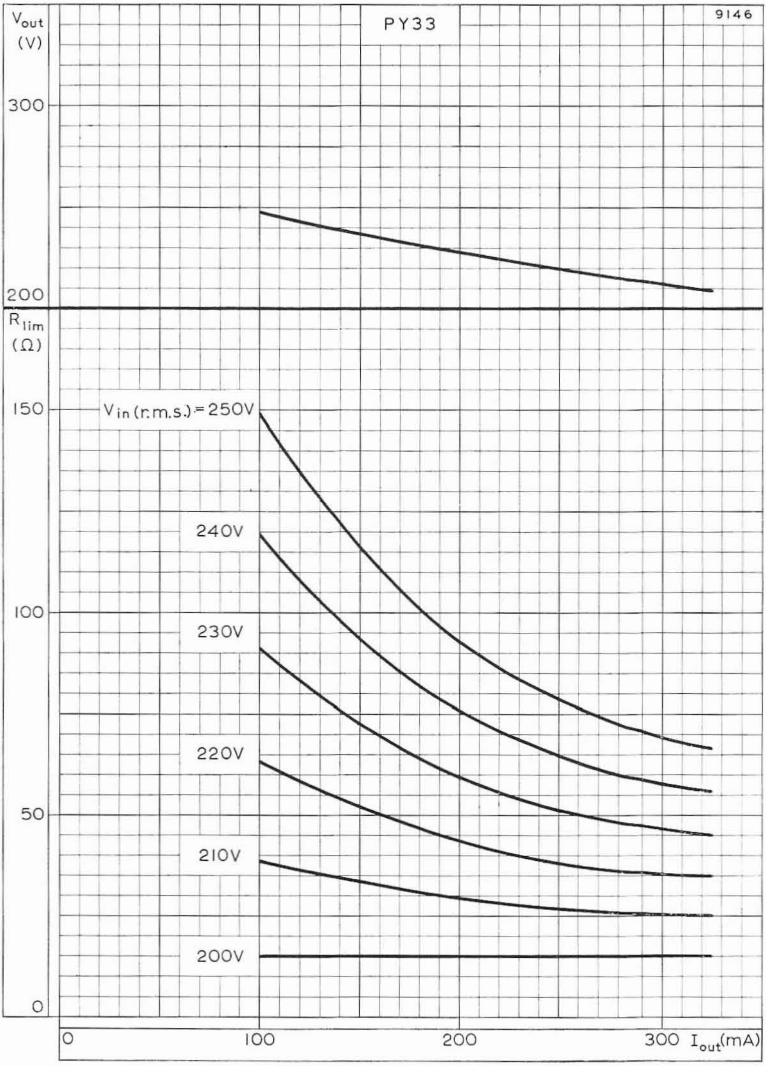


CHART FOR DETERMINING THE VALUE OF LIMITING RESISTOR REQUIRED TO GIVE CONSTANT OUTPUT VOLTAGE WITH VARIOUS INPUT VOLTAGES

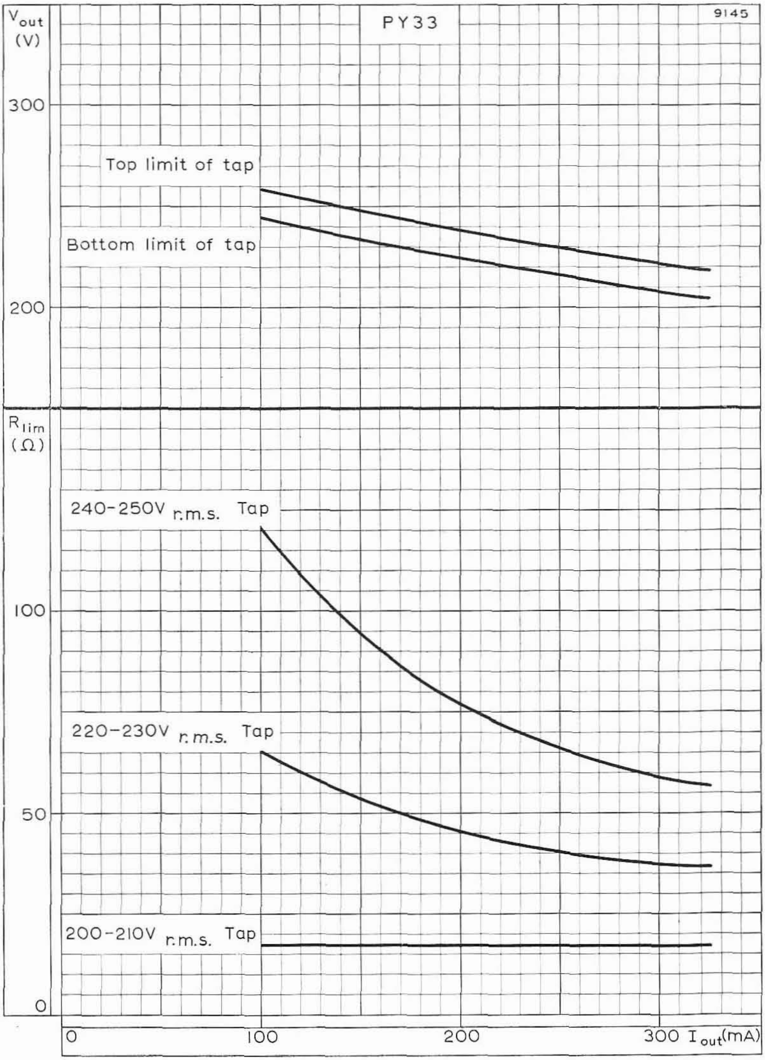


CHART FOR DETERMINING THE VALUE OF LIMITING RESISTOR REQUIRED FOR A RECEIVER USING THREE MAINS TAPS, AND RESULTANT SPREAD IN OUTPUT VOLTAGE

HALF-WAVE RECTIFIER

PY82

Half-wave rectifier with 300mA heater for use in television receivers with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	300	mA
V_h	19	V

LIMITING VALUES

P.I.V. max.	700	V
$V_{a(r.m.s.)}$ max.	250	V
I_{out} max.	180	mA
$i_{a(pk)}$ max.	1.12	A ←
$i_{a(surge)}$ max.	5.0	A ←
C max. (single valve)	60	μF
C max. (two valves in parallel)	100	μF
*$v_{h-k(pk)}$ max. (cathode positive)	550	V

*Maximum d.c. component = 250V. Maximum a.c. component = 220V r.m.s.

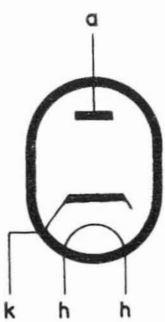
OPERATING CONDITIONS FOR TWO PY82 IN PARALLEL* ←

$V_{in(r.m.s.)}$	200	210	220	230	240	250	V
R_{lim} min. (per anode)	30	33	36	39	42	45	Ω
C	100	100	100	100	100	100	μF
I_{out}	350	328	306	284	262	240	mA
V_{out}	198	212	226	242	256	270	V

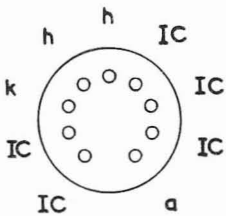
*For television receivers, where a constant output voltage is required for different input voltages, the values of limiting resistors required can be obtained from the curves on pages C4 and C5.

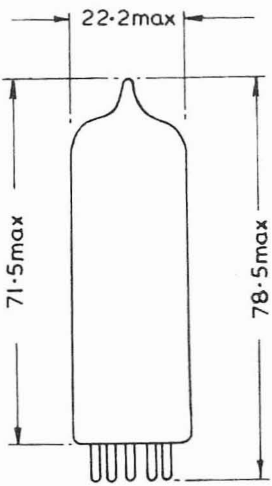
PY82

HALF-WAVE RECTIFIER

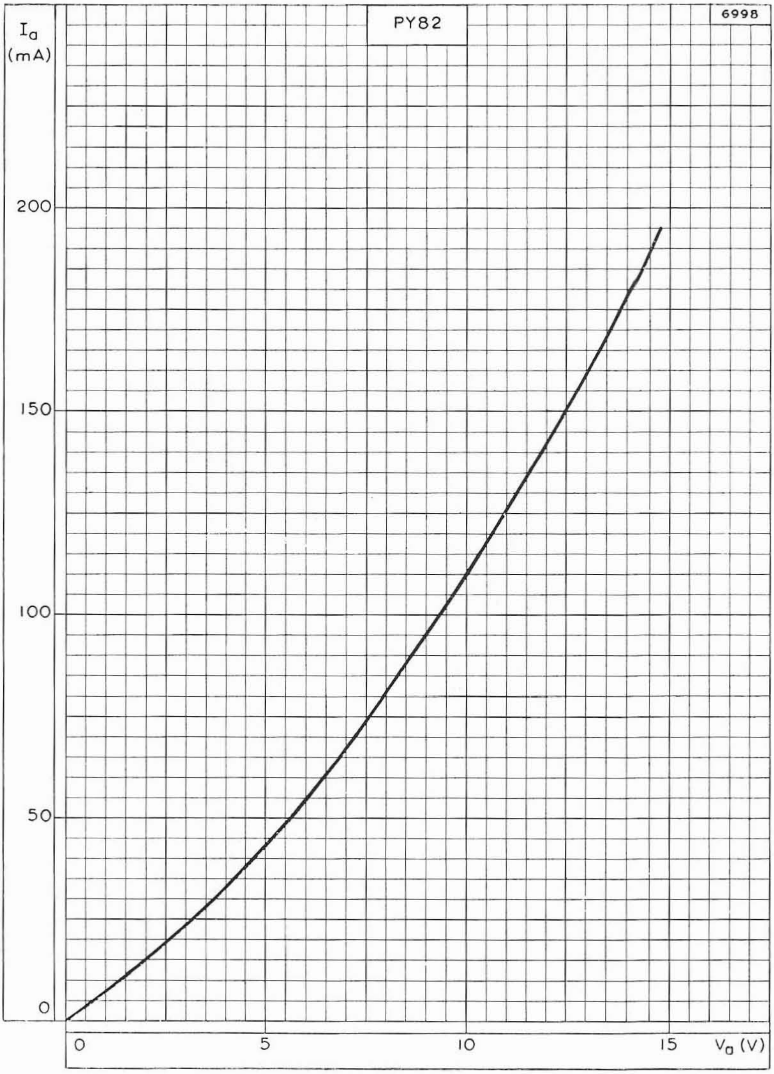


7102

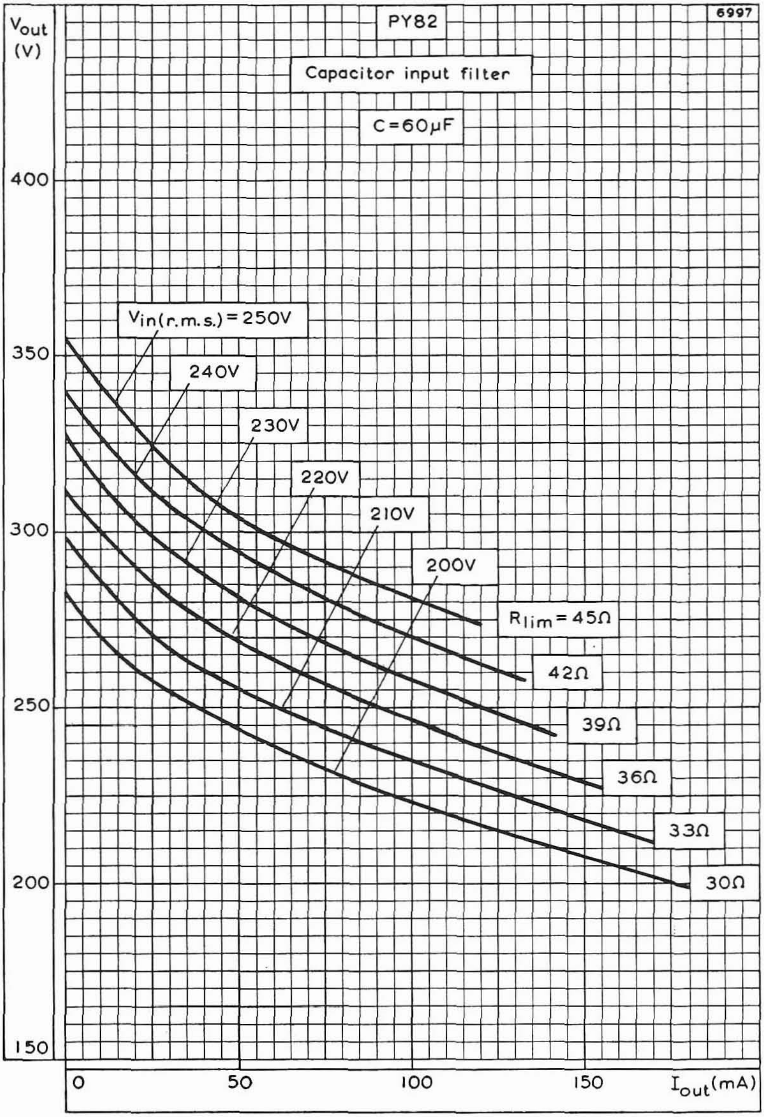




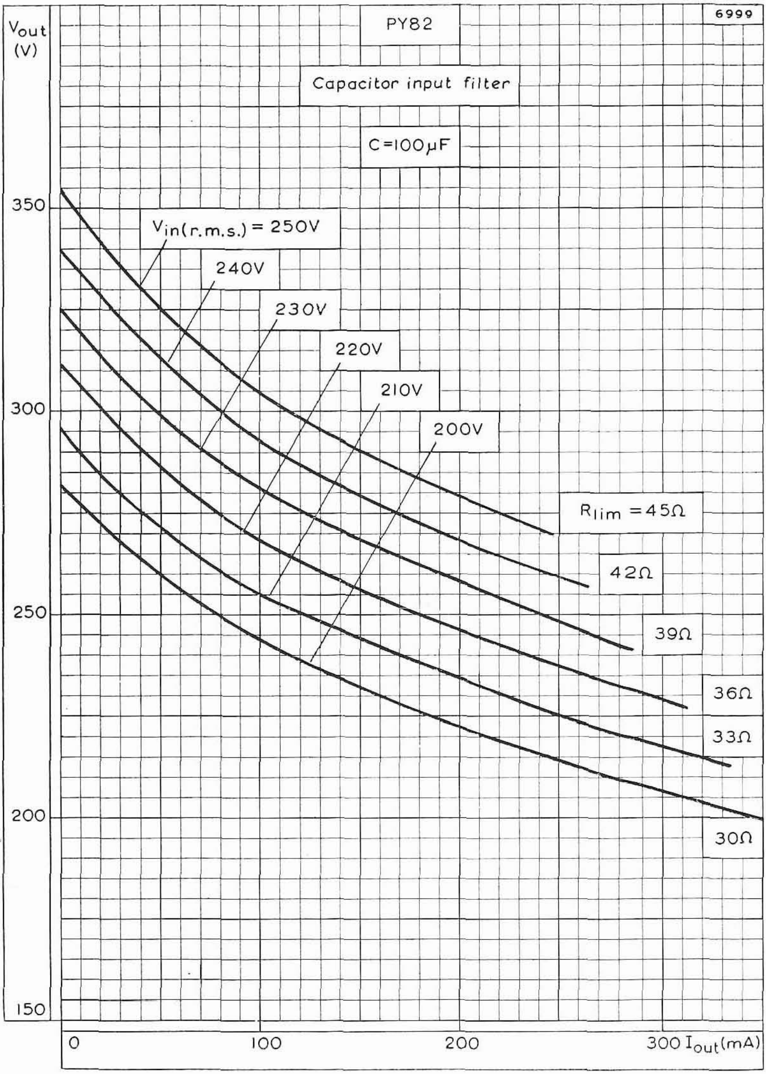
B9A Base
All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE



CAPACITOR INPUT FILTER REGULATION CURVES.
(SINGLE VALVE OPERATION)



CAPACITOR INPUT FILTER REGULATION CURVES.
(TWO VALVES IN PARALLEL)

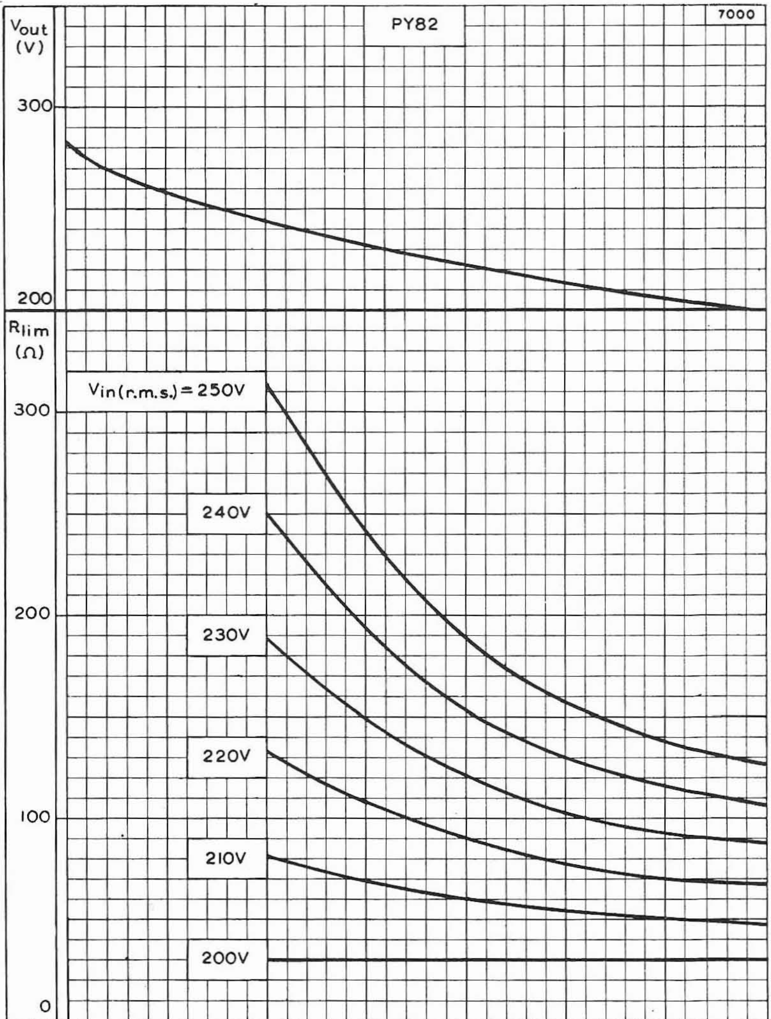


CHART FOR DETERMINING THE VALUE OF LIMITING RESISTOR REQUIRED TO GIVE CONSTANT OUTPUT VOLTAGE WITH VARIOUS INPUT VOLTAGES (TWO VALVES IN PARALLEL)

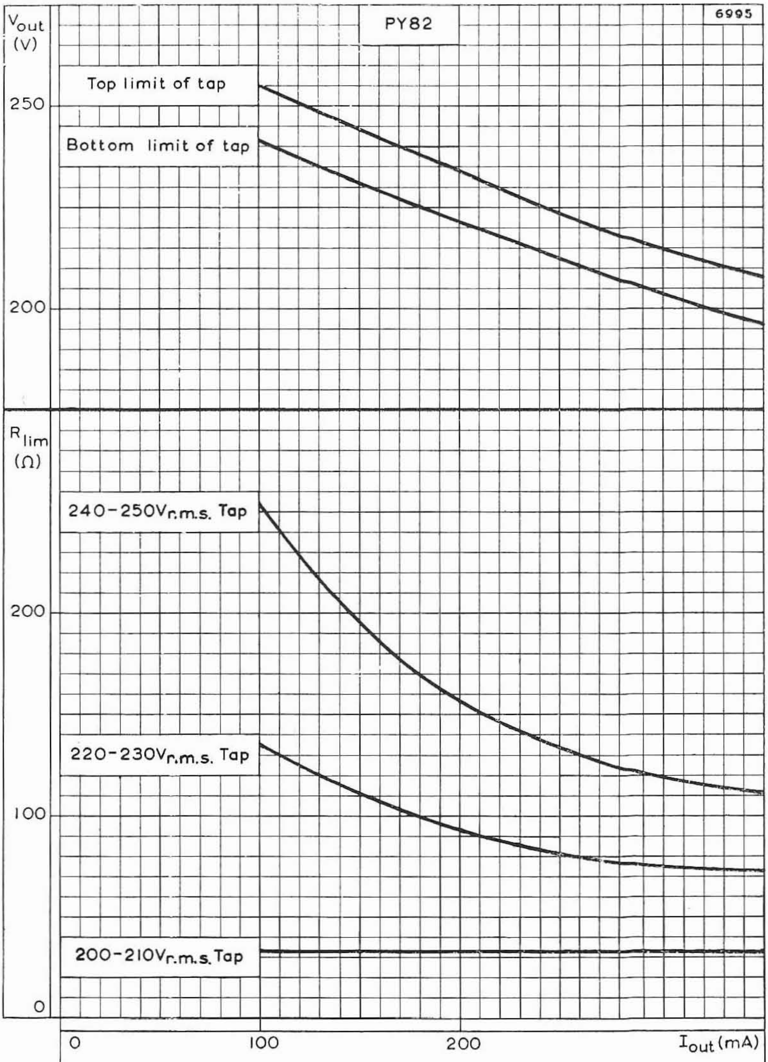


CHART FOR DETERMINING THE VALUE OF LIMITING RESISTOR REQUIRED FOR A RECEIVER USING THREE MAINS TAPS, AND THE RESULTANT SPREAD IN OUTPUT VOLTAGE
(TWO VALVES IN PARALLEL)

DOUBLE OUTPUT PENTODE

QP22B

FILAMENT

V_f	2.0	V
I_f	0.3	A

CAPACITANCES

c_{out} (each section)	14.6	μμF
c_{in} (each section)	8.3	μμF
c_{a-g1} (each section)	0.9	μμF
$c_{a'-a''}$	3.4	μμF
$c_{g'1-g''1}$	0.9	μμF

OPERATING CONDITIONS

V_a	120	135	V
V_{g2}	120	135	V
V_{g1}	−10.7	−11.7	V
$I_{a(o)}$	3.3	3.8	mA
I_{g2}	0.45	0.5	mA
*g_m	3.1	—	mA/V
R_a	15.5	14.7	kΩ
P_{out}	1.0	1.33	W

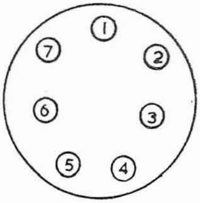
* At $V_a = V_{g2} = 100$ V, $V_{g1} = 0$V

APPLICATION NOTES

The valve can be operated with automatic bias obtained from a resistor in the common H.T. negative lead, which should be by-passed by a capacitor of 50 μF or more. The total anode current (for both anodes) should then not fall below 3.0mA with $V_{g2}=120$V, in order to minimise distortion.

A normal type of QPP transformer may be used, the usual precautions being taken against parasitic oscillation.

CONNECTIONS



Viewed from free end of pins

Brit. 7-Pin Base

Pin No. 1	Control Grid (g''_1)
,, 2	Control Grid (g'_1)
,, 3	Anode (a′)
,, 4	Filament
,, 5	Filament
,, 6	Screen Grids (g'_2, g''_2)
,, 7	Anode (a″)

Suppressor Grids—Connected to Centre of Filament

DIMENSIONS

Overall length	117 mm.
Overall diameter	41 mm.

H.F. PENTODE

SP4

Indirectly heated H.F. Pentode for use as speech detector, or R.F. amplifier, in A.C. mains receivers.

HEATER

V_h	4.0	V
I_h	1.0	A
Heating Time	35	secs.

CHARACTERISTICS

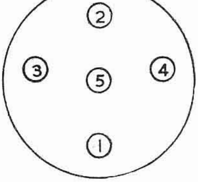
V_a	200	V
V_{g2}	100	V
I_a	3.0	mA
V_{g1}	–2.0	V
I_{g2}	1.1	mA
g_m	2.3	mA/V
r_a	2.2	M Ω

LIMITING VALUES

V_a max.	200	V
p_a max.	1.0	W
V_{g2} max.	100	V
p_{g2} max.	0.3	W
I_k max.	10	mA
R_{g1-k} max.	1.5	M Ω
V_{h-k} max.	50	V
R_{h-k} max.	20	k Ω
V_{g1} max. ($I_{g1}=+0.3\ \mu A$)	–1.4	V

CONNECTIONS

For Valves capped with 5-pin base



Pin No. 1	Screen Grid (g_2)
,, 2	Control Grid (g_1)
,, 3	Heater
,, 4	Heater
,, 5	Cathode
Top Cap	Anode

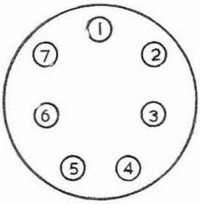
Viewed from free end of pins

SP4

H.F. PENTODE

Indirectly heated H.F. Pentode for use as speech detector, or R.F. amplifier, in A.C. mains receivers.

For Valves capped with 7-pin base



Viewed from free end of pins

Pin No. 1	Metallising
,, 2	Control Grid (g_1)
,, 3	Suppressor Grid (g_3)
,, 4	Heater
,, 5	Heater
,, 6	Cathode
,, 7	Screen Grid (g_2)
Top Cap	Anode

DIMENSIONS

Overall length	140	mm.
Overall diameter	51	mm.
Bulb Finish—Clear or Metallised		

H.F. PENTODE

SP4B

HEATER

V_h	4.0	V
I_h	0.65	A
Heating time	15	secs.

CAPACITANCES

c_{a-g1}	<0.003	μμF
c_{in}	6.9	μμF
c_{out}	8.1	μμF

OPERATING CONDITIONS—As R.F. or I.F. Amplifier

V_a	250	V
V_{g2}	250	V
I_a	4.0	mA
V_{g1}	—2.4	V
I_{g2}	1.5	mA
g_m	3.4	mA/V
r_a	2.0	M Ω

OPERATING CONDITIONS—As a Detector

V_b	250	V
R_{g2}	500	k Ω
R_a	100	k Ω
C_{g1}	100	μμF
R_{g1}	0.5 to 1.0	M Ω

OPERATING CONDITIONS—As A.F. Amplifier

V_b	250	V
R_{g2}	500	k Ω
R_a	100	k Ω
R_k	1.5	k Ω

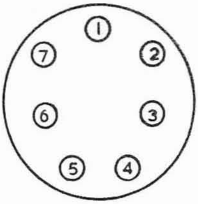
LIMITING VALUES

V_a max.	250	V
p_a max.	1.5	W
I_k max.	8.0	mA
V_{g2} max.	250	V
p_{g2} max.	0.5	W
I_{g2} max.	2.0	mA
R_{g1-k} max.	1.5	M Ω
V_{h-k} max.	50	V
R_{h-k} max.	20	k Ω

SP4B

H.F. PENTODE

CONNECTIONS



Brit. 7–Pin Base

Pin No. 1 Metallising
,, 2 Anode
,, 3 Suppressor Grid (g_3)
,, 4 Heater
,, 5 Heater
,, 6 Cathode
,, 7 Screen Grid (g_2)
Top Cap—Control Grid (g_1)

DIMENSIONS

Overall length	125 mm.
Overall diameter	43 mm.

H.F. PENTODE

SP13

Indirectly heated straight H.F. Pentode for use in D.C./A.C. receivers, and for car radio, as an R.F. amplifier, detector or L.F. amplifier.

HEATER

I_h	0.2	A
V_h	13	V
Heating time	60	secs.

CAPACITANCES

c_{a-g1}	<0.003	μμF
c_{in}	7.1	μμF
c_{out}	7.7	μμF

OPERATING CONDITIONS

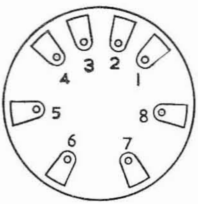
As R.F. Amplifier

V_a	200	V
V_{g2}	100	V
I_a	3.3	mA
I_{g2}	1.2	mA
V_{g1}	—2.0	V
r_a	1.3	MΩ
μ	3,000	
g_m	2.2	mA/V
R_k	400	Ω

LIMITING VALUES

V_a max.	200	V
p_a max.	1.0	W
I_k max.	6.0	mA
V_{g2} max.	100	V
R_{g1-k}	1.5	MΩ
V_{h-k}	125	V
R_{h-k}	20	kΩ

CONNECTIONS



Viewed from under side of base

Contact No. 1 Metallising
,, 2 Heater
,, 3 Heater
,, 4 Cathode
,, 5 Suppressor Grid (g_3)
,, 6 N.C.
,, 7 Screen Grid (g_2)
,, 8 Anode
Top Cap—Control Grid g_1

DIMENSIONS

Overall length	109mm.
Overall diameter	42mm.
Bulb finish	Metallised

H.F. PENTODE

SP13C

Indirectly heated straight H.F. Pentode for use in D.C./A.C. receivers, and for car radio.

HEATER

V_h	13	V
I_h	0.2	A

CAPACITANCES

c_{a-g1}	$<$0.003	μμF
c_{in}	6.9	μμF
c_{out}	8.1	μμF

CHARACTERISTICS

V_a	200	V
V_{g2}	200	V
I_a	2.5	mA
V_{g1}	−2.2	V
I_{g2}	0.9	mA
g_m	2.8	mA/V
r_a	2.5	M Ω

OPERATING CONDITIONS AS DETECTOR

V_b	200	V
R_{g2}	500	k Ω
R_a	100	k Ω
C_{g1}	100	μμF
R_{g1}	0.5—1.0	M Ω

LIMITING VALUES

V_a max.	200	V
p_a max.	1.0	W
I_k max.	6.0	mA
V_{g2} max.	200	V
p_{g2} max.	0.3	W
I_{g2} max.	1.2	mA
R_{g1-k} max.	1.5	M Ω
V_{h-k} max.	125	V
R_{h-k} max.	20	k Ω

SP13C

H.F. PENTODE

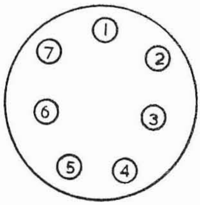
Indirectly heated straight H.F. Pentode for use in D.C./A.C. receivers, and for car radio.

DIMENSIONS

Overall Length	125	mm
Overall Diameter	43	mm
Bulb Finish—Metallised		

CONNECTIONS

Brit. 7-pin Base



Viewed from free end of pins.

Pin No.	1 Metallising
,, ,,	2 Anode
,, ,,	3 Suppressor Grid (g_3)
,, ,,	4 Heater
,, ,,	5 Heater
,, ,,	6 Cathode
,, ,,	7 Screen Grid (g_2)

Top Cap—Control Grid (g_1)

DOUBLE DIODE TRIODE

TDD2A

Double-diode triode valve for battery operation. It consists of two separate diodes and a medium impedance triode using a common filament.

FILAMENT

V_f	2.0	V
I_f	0.12	A

CAPACITANCES

c_{a-g}	3.7	$\mu\mu$F
c_{g-f}	2.5	$\mu\mu$F
c_{a-f}	7.6	$\mu\mu$F
c_{ad-gt}	$<$0.002	$\mu\mu$F

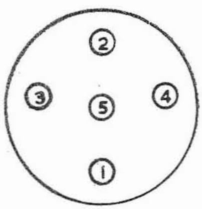
OPERATING CHARACTERISTICS

V_a	90	135	V
V_g	−1.5	−1.5	V
I_a	0.65	1.95	mA
g_m	0.7	1.2	mA/V
μ	30	30	
r_a	43	25	kΩ

LIMITING VALUES

V_a max.	150	V
p_a max.	0.6	W
I_k max.	5.0	mA
R_{g-f}	1.0	MΩ
$v_{ad(pk)}$ max.	125	V
I_{ad} max.	0.2	mA

CONNECTIONS



Viewed from free end of pins

Pin No. 1 Anode
" 2 A.V.C. Diode (a'_d)
" 3 Filament (negative)
" 4 Filament (positive)
" 5 Speech Diode (a''_d)
Top Cap–Control Grid

DIMENSIONS

Overall Length	125	mm.
Overall Diameter	46	mm.
Bulb Finish–Metallised		

DOUBLE DIODE TRIODE

TDD4

Indirectly heated double-diode-triode for use as combined detector and L.F. amplifier and for the application of A.V.C. in A.C. mains receivers.

HEATER

V_h	4.0	V
I_h	0.65	A

CAPACITANCES

c_{g-k}	3.5	μμF
c_{at-k}	2.9	μμF
$c_{a'd-k}$	2.5	μμF
$c_{a''d-k}$	3.25	μμF
$c_{a'd-a''d}$	0.3	μμF
$c_{a'd-g}$	$<$0.0015	μμF
$c_{a''d-g}$	$<$0.0015	μμF

CHARACTERISTICS

V_a	250	V
I_a	4.0	mA
V_g	−7.0	V
g_m	2.0	mA/V
r_a	13.5	kΩ
μ	27	
R_k	1.5	kΩ

OPERATING CONDITIONS AS R.C. COUPLED AMPLIFIER

V_b	250	V
R_a	60	kΩ
V_g	−4.0	V
I_a	2.0	mA
R_k	2.0	kΩ
V_{out}/V_{in}	25	
$V_{out(r.m.s.)}$	50	V
D_{tot}	5	%

LIMITING VALUES

Triode Section

V_a max.	250	V
p_a max.	1.5	W
I_k max.	10	mA
V_g max ($I_g = +1\mu A$)	−0.8	V
R_{g-k} max.	1.5	MΩ
V_{h-k} max.	50	V
R_{h-k} max.	20	kΩ

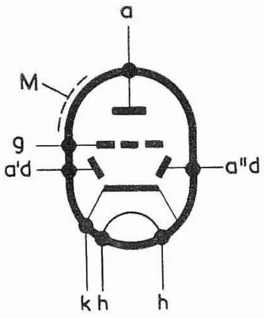
Diode Sections

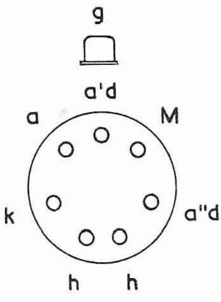
$v_{ad(pk)}$ max.	200	V
I_{ad} max.	0.8	mA

TDD4

DOUBLE DIODE TRIODE

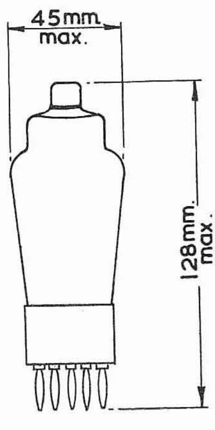
Indirectly heated double-diode-triode for use as combined detector and L.F. amplifier and for the application of A.V.C. in A.C. mains receivers.





BRITISH 7-PIN BASE

909



Mullard

DOUBLE DIODE TRIODE

UBC81

High gain triode for use as a.f voltage amplifier, combined with twin diodes, for use in equipment with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	100	mA
V_h	14	V

MOUNTING POSITION

Any

CAPACITANCES

$c_{a'd-g}$	<0.007	pF
$c_{a''d-g}$	<0.007	pF
$c_{a'd-at}$	<0.005	pF
$c_{a''d-at}$	<0.01	pF

Triode section

c_{g-k}	2.3	pF
c_{a-k}	2.3	pF
c_{a-g}	1.2	pF
c_{g-h}	<0.05	pF

Diode sections

$c_{a'd-k}$	0.9	pF
$c_{a''d-k}$	0.9	pF
$c_{a'd-a''d}$	<0.2	pF
$c_{a'd-h}$	<0.25	pF
$c_{a''d-h}$	<0.25	pF

CHARACTERISTICS

V_a	100	170	V
V_g	−1.0	−1.6	V
I_a	0.8	1.5	mA
g_m	1.4	1.65	mA/V
μ	70	70	
r_a	50	42	kΩ

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER (with cathode bias)

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out} ($V_{r.m.s.}$) (D_{tot}=5%)	V_{out} ($V_{r.m.s.}$) (D_{tot}=10%)	R_{g1}† (kΩ)
350	100	1.18	2.2	43	30.5	54	330
300	100	1.0	2.2	42.5	25.5	46	330
250	100	0.85	2.2	42	21	38	330
200	100	0.7	2.2	41	16	28.5	330
150	100	0.5	2.2	40	12	19.5	330
100	100	0.28	3.3	33.5	6.0	10.5	330
350	220	0.67	3.9	47.5	34.5	64	680
300	220	0.56	3.9	47	27	54	680
250	220	0.48	3.9	46.5	24.5	44.5	680
200	220	0.4	3.9	46	19	34	680
150	220	0.32	3.9	44	16.5	24	680
100	220	0.18	5.6	38	8.0	13.5	680

UBC81

DOUBLE DIODE TRIODE

High gain triode for use as a.f. voltage amplifier, combined with twin diodes, for use in equipment with series connected heaters.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER* (with grid current bias)

V_b (V)	R_a (kΩ)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	V_{out} ($V_{r.m.s.}$) (D_{tot}=2.5%)	V_{out} ($V_{r.m.s.}$) (D_{tot}=5%)	R_{g1}† (kΩ)
350	100	2.0	55	27	43	330
300	100	1.95	53.5	22	35	330
250	100	1.3	51	17	27	330
200	100	0.95	48.5	12	19	330
150	100	0.6	44	7.0	11	330
100	100	0.3	35.5	3.0	5.0	330
350	220	1.1	61.5	29	47	680
300	220	0.9	59.5	23	38	680
250	220	0.7	57	17	29.5	680
200	220	0.5	54	12.5	21	680
150	220	0.33	49	8.0	14	680
100	220	0.18	40	4.0	7.0	680

*Measured with grid resistor of 20MΩ and signal source impedance $Z_s = 0$. The distortion figures quoted hold good for values of Z_s not exceeding 200kΩ. At this value of Z_s the gain will be reduced by 10%.

†R_{g1} = Grid resistor of following valve.

LIMITING VALUES

Triode section

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	500	mW
I_k max.	5.0	mA
V_g max. ($I_g = +0.3\mu A$)	−1.3	V
R_{g-k} max. (cathode bias)	3.0	MΩ
R_{g-k} max. (grid current biasing)	22	MΩ
V_{h-k} max.	100	V
R_{h-k} max.	20	kΩ

Diode sections (each section)

$v_{ad(pk)}$ max.	200	V
I_{ad} max.	800	μA
$i_{ad(pk)}$ max.	5.0	mA

MICROPHONY

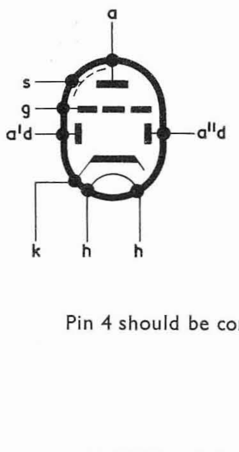
This valve can be used without special precautions against microphony in circuits in which the input voltage is >10mV (r.m.s.) for an output of 50mW from the output valve.

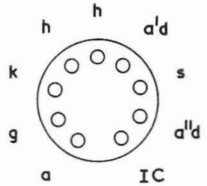
DOUBLE DIODE TRIODE

UBC81

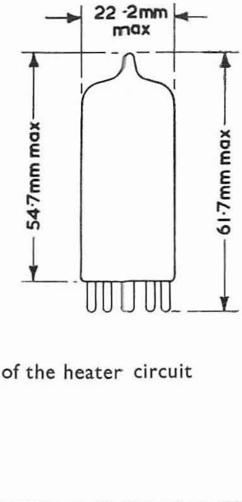
High gain triode for use as a.f. voltage amplifier, combined with twin diodes, for use in equipment with series connected heaters.

3684





B9A Base

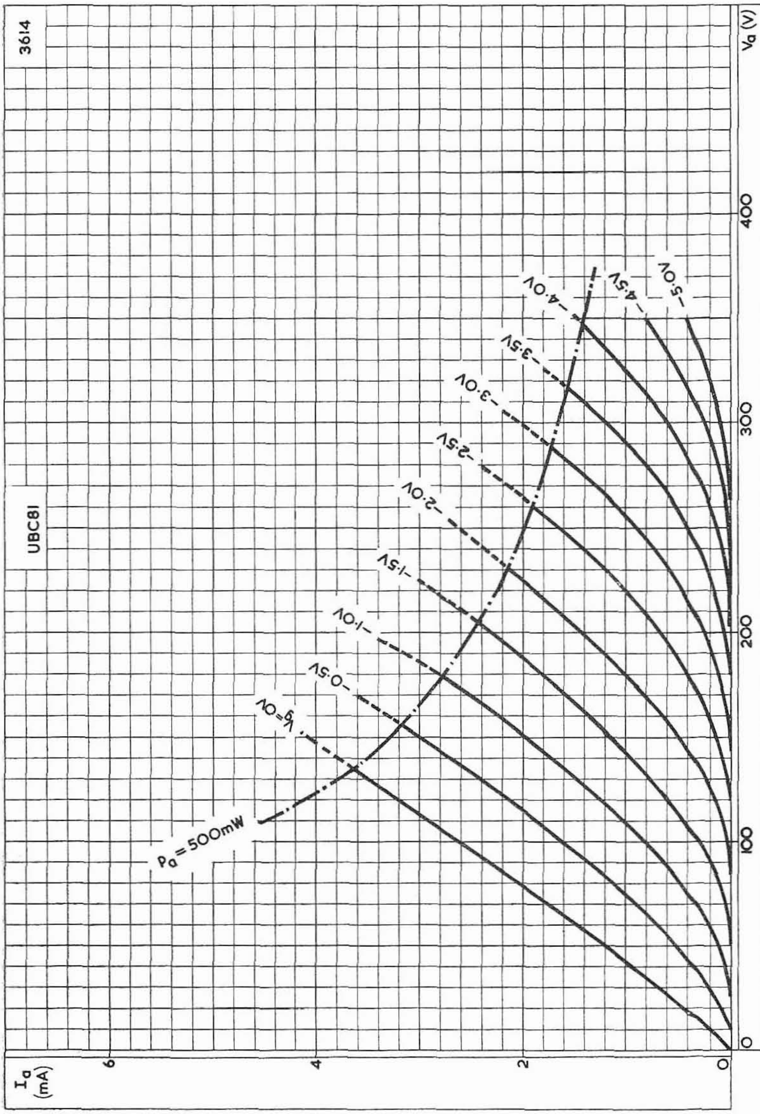


Pin 4 should be connected to the earthed side of the heater circuit

UBC81

DOUBLE DIODE TRIODE

High gain triode for use as a.f. voltage amplifier, combined with twin diodes, for use in equipment with series connected heaters.

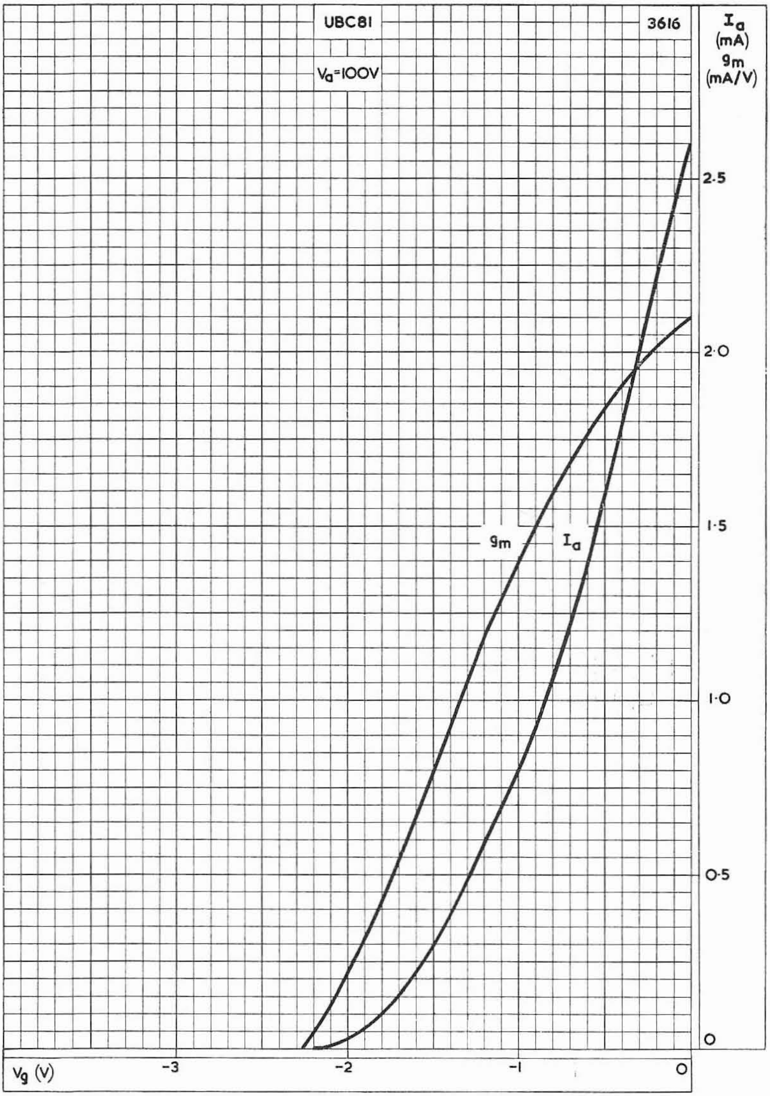


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

DOUBLE DIODE TRIODE

UBC81

High gain triode for use as a.f. voltage amplifier, combined with twin diodes, for use in equipment with series connected heaters.

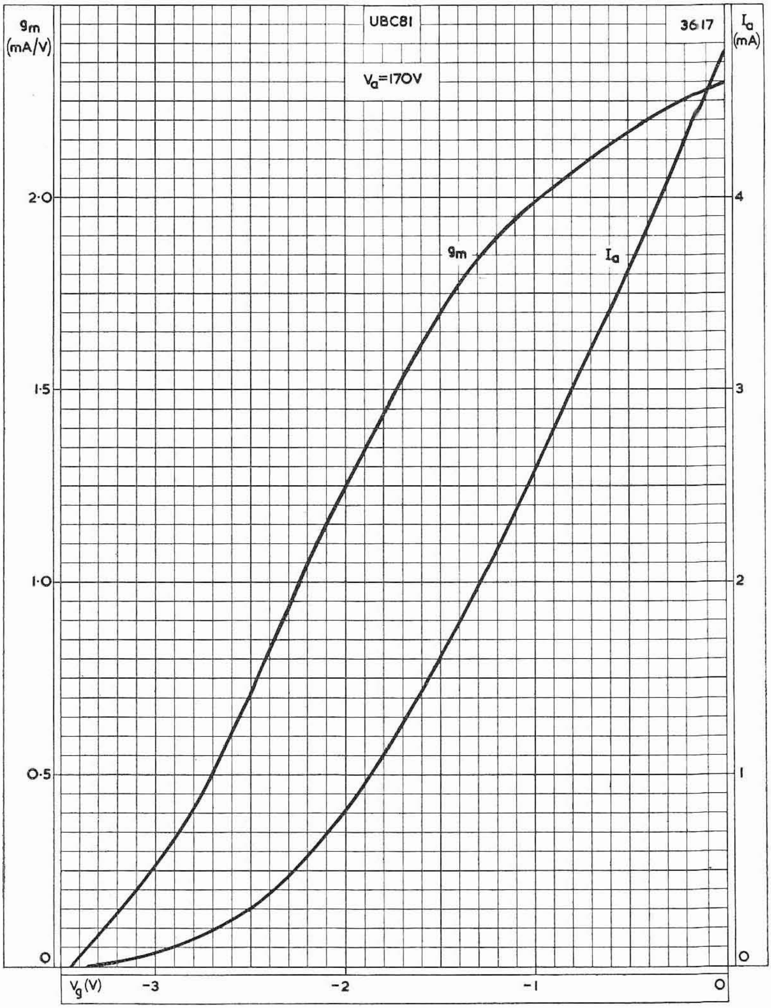


ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE. $V_a = 100V$

UBC81

DOUBLE DIODE TRIODE

High gain triode for use as a.f. voltage amplifier, combined with twin diodes, for use in equipment with series connected heaters.



ANODE CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST GRID VOLTAGE. $V_a = 170V$

TRIODE HEXODE FREQUENCY CHANGER

UCH42

Triode hexode primarily intended for use as frequency changer in D.C./A.C. mains-operated receivers. The hexode section is designed for A.V.C. operation. The valve may also be employed as a phase inverter.

HEATER

I_h	0.1	A
V_h	14	V

MOUNTING POSITION

Any

CAPACITANCES

c_{gt-gl}	<0.35	μμF
c_{gt-ah}	<0.2	μμF

Hexode Section

$c_{gl-h+k+g2+g4+skirt}$	3.8	μμF
$c_{a-h+k+g2+g4+skirt}$	9.2	μμF
c_{a-gl}	<0.1	μμF
c_{gl-h}	<0.15	μμF

Triode Section

$c_{gt-h+k+g2+g4+skirt}$	5.5	μμF
$c_{at-h+k+g2+g4+skirt}$	2.3	μμF
c_{at-gt}	1.2	μμF

OPERATING CONDITIONS AS FREQUENCY CHANGER

With screen grid fed from a potentiometer (see fig. 1)

Hexode Section

$V_a = V_b$	100	170	200	V
R_1	18	18	18	KΩ
R_2	27	27	27	KΩ
R_k	180	180	180	Ω
R_{g3+gt}	47	47	47	KΩ
I_{g3+gt}	100	200	200	μA
V_{gl}	−1.0	−1.85	−2.0	V
V_{g2+g4}	43	70	85	V
I_a	1.2	2.1	3.0	mA
I_{g2+g4}	1.5	2.6	3.0	mA
g_c	530	670	750	μA/V
r_a	>1.0	>1.0	>1.0	MΩ
R_{eq}	60	65	75	KΩ
V_{gl} (for 100:1 reduction in g_c)	−13.5	−25	−27.5	V

Triode Section

V_b	100	170	200	V
R_a	10	10	22	KΩ
R_{gt+g3}	47	47	47	KΩ
I_{gt+g3}	100	200	200	μA
I_a	3.1	5.7	5.2	mA
g_m (approx.)	0.6	0.65	0.55	mA/V

UCH42

TRIODE HEXODE FREQUENCY CHANGER

Triode hexode primarily intended for use as frequency changer in D.C./A.C. mains-operated receivers. The hexode section is designed for A.V.C. operation. The valve may also be employed as a phase inverter.

CHARACTERISTICS

Triode Section

V_a	100	V
V_g	0	V
I_a	10	mA
g_m	2.8	mA/V
μ	22	

TYPICAL OPERATING CONDITIONS AS PHASE INVERTER

(See Fig. 2)

V_b (V)	I_b (mA)	V_{g-g}* ($V_{r.m.s.}$)	$\frac{V_{g-g}}{V_{in}}$	D_{tot}* (%)
200	2.6	33.2	25.2	2.6
300	4.0	56.7	25.7	2.8
400	5.3	78.6	26.1	3.0

*Output voltage and distortion at the start of positive grid current. At lower output voltage the distortion is approximately proportional to the voltage.

LIMITING VALUES

Hexode Section

$V_{a\,(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.5	W
$V_{g2+g4(b)}$ max.	550	V
V_{g2+g4} max. (I_a=3mA)	125	V
V_{g2+g4} max. (I_a<1mA)	250	V
p_{g2+g4} max.	0.3	W
V_{g1} max. ($I_{g1}=+0.3\mu A$)	–1.3	V
I_k max.	7	mA
R_{g1-k} max.	3	MΩ
R_{g3-k} max.	3	MΩ
R_{h-k} max.	20	KΩ
V_{h-k} max.	150	V

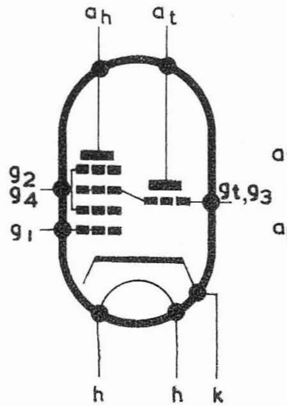
Triode Section

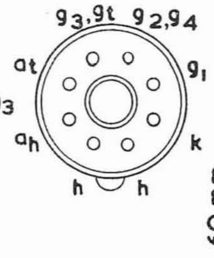
$V_{a(b)}$ max.	550	V
V_a max.	175	V
p_a max.	0.8	W
V_g max. ($I_g=+0.3\mu A$)	–1.3	V
I_k max.	6	mA
R_{gt-k} max.	3	MΩ
R_{h-k} max.	20	KΩ
V_{h-k} max.	150	V

TRIODE HEXODE FREQUENCY CHANGER

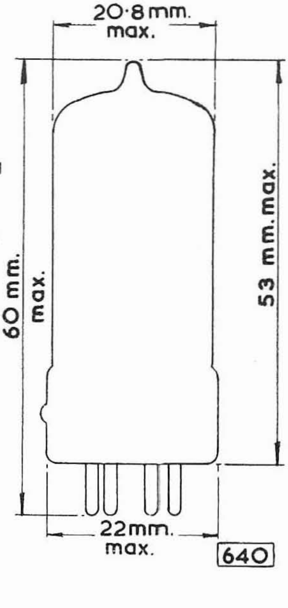
UCH42

Triode hexode primarily intended for use as frequency changer in d.c./a.c. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.





B8A BASE



UCH42

TRIODE HEXODE FREQUENCY CHANGER

Triode hexode primarily intended for use sa frequency changer in d.c./a.c. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.

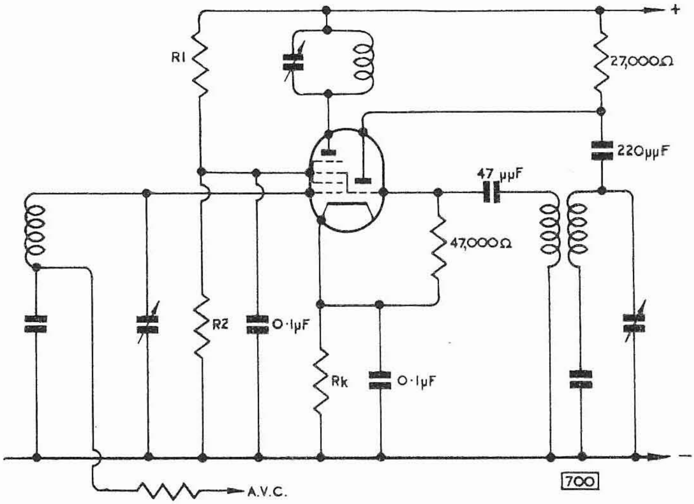


FIG. 1. UCH42 AS FREQUENCY CHANGER

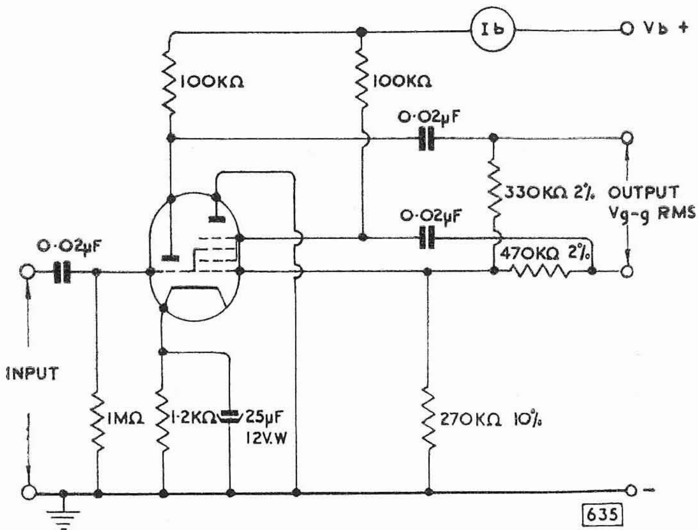
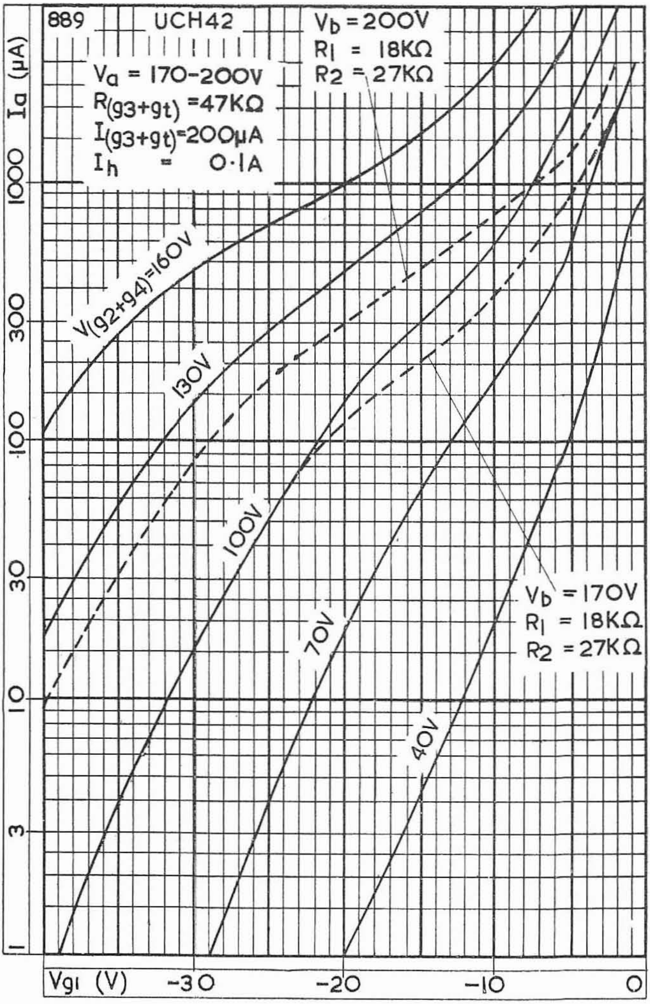


FIG. 2. UCH42 AS PHASE INVERTER

TRIODE HEXODE FREQUENCY CHANGER

UCH42

Triode hexode primarily intended for use as frequency changer in d.c./a.c. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.

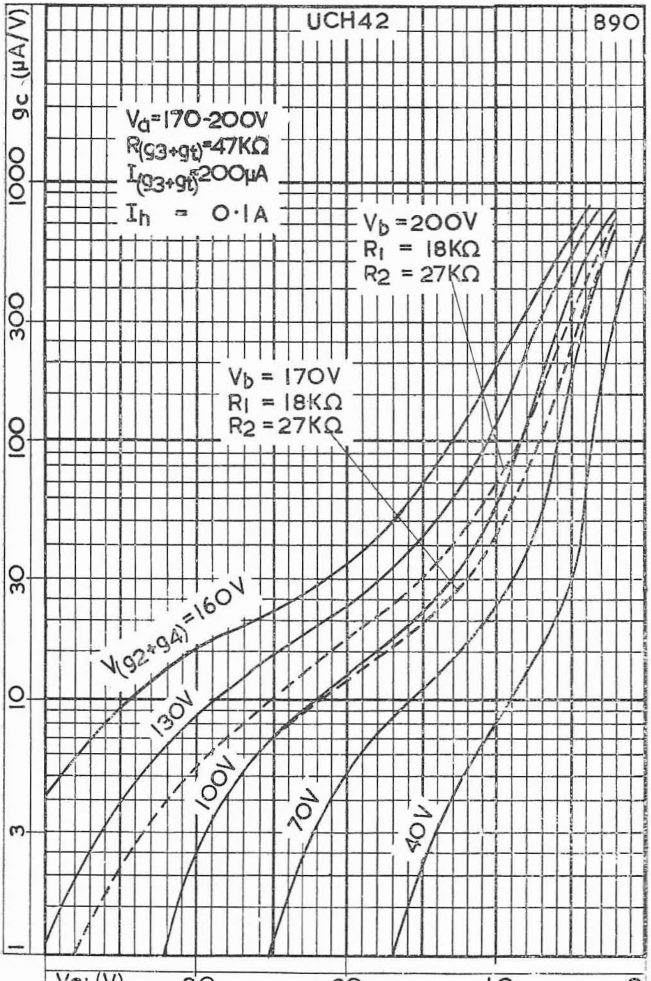


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE VOLTAGE OF 170V TO 200V

UCH42

TRIODE HEXODE FREQUENCY CHANGER

Triode hexode primarily intended for use as frequency changer in d.c./a.c. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.

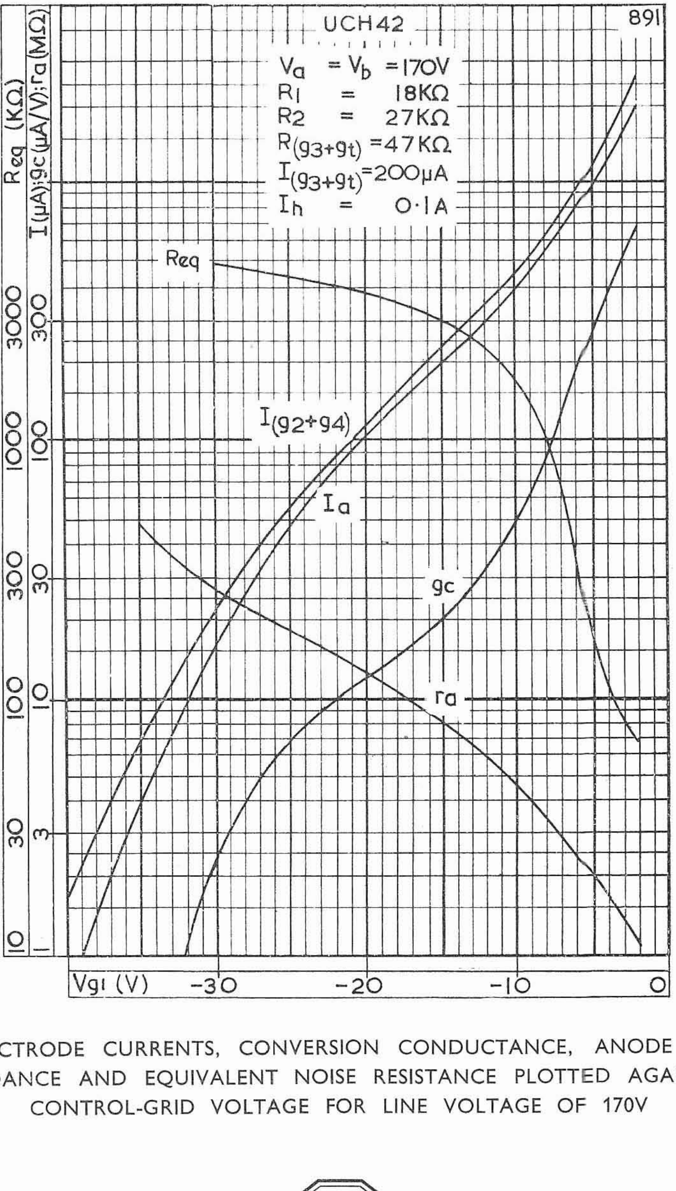


CONVERSION CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR ANODE VOLTAGE OF 170V TO 200V

TRIODE HEXODE FREQUENCY CHANGER

UCH42

Triode hexode primarily intended for use as frequency changer in D.C./A.C. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.

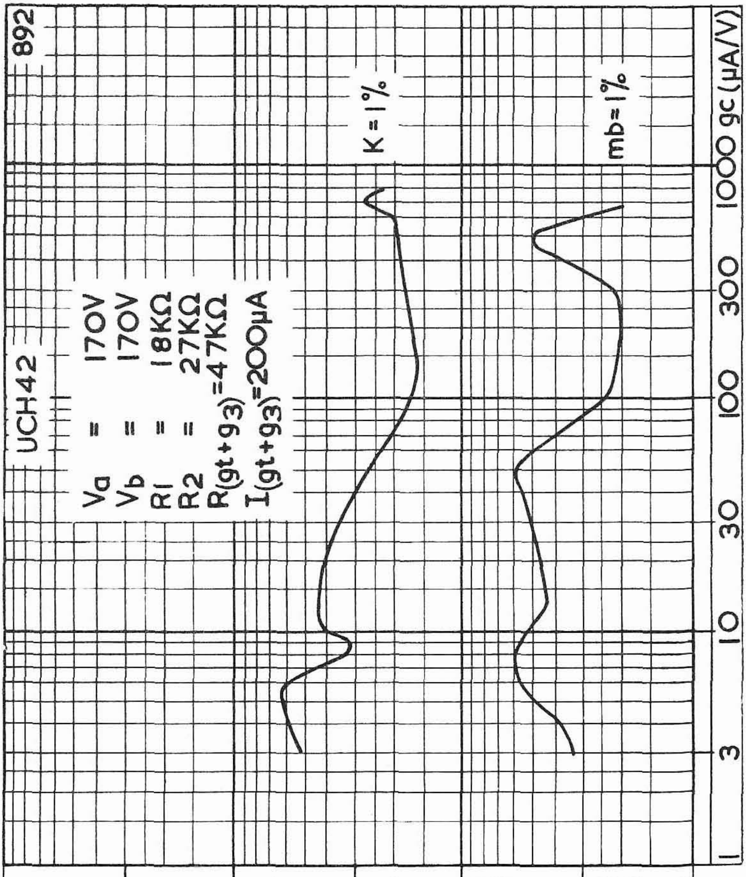


ELECTRODE CURRENTS, CONVERSION CONDUCTANCE, ANODE IMPEDANCE AND EQUIVALENT NOISE RESISTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE FOR LINE VOLTAGE OF 170V

UCH42

TRIODE HEXODE FREQUENCY CHANGER

Triode hexode primarily intended for use as frequency changer in D.C./A.C. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.

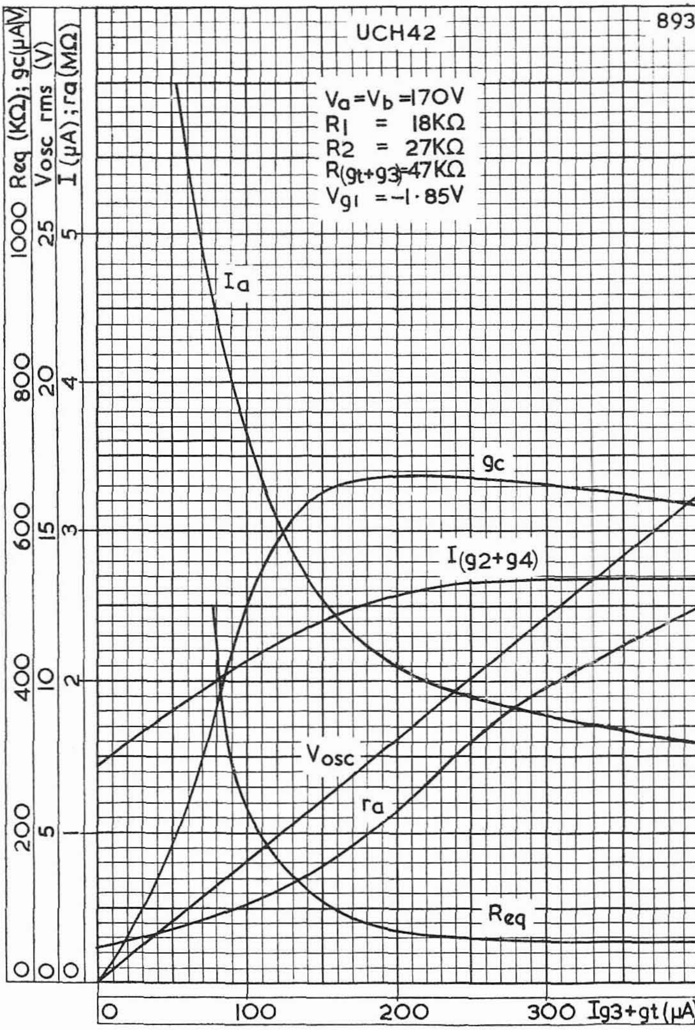


CROSS MODULATION CURVE FOR ANODE VOLTAGE OF 170V

TRIODE HEXODE FREQUENCY CHANGER

UCH42

Triode hexode primarily intended for use as frequency changer in D.C./A.C. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.

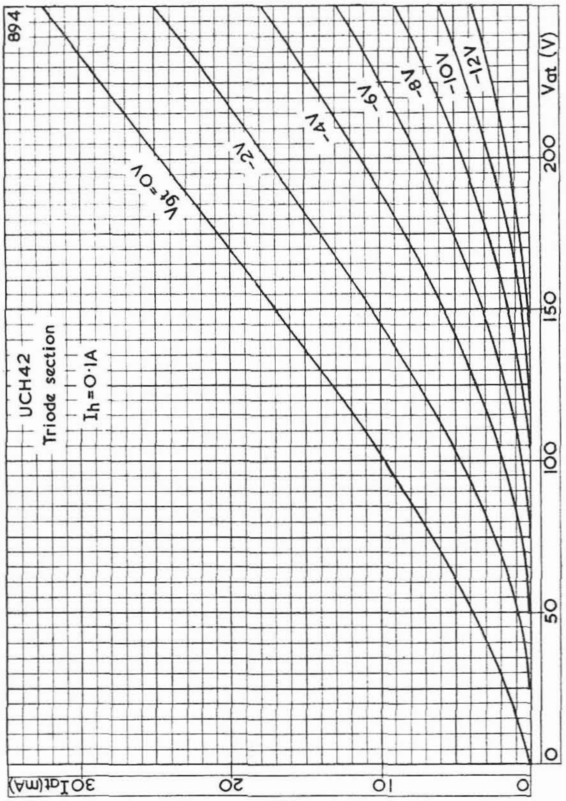


ELECTRODE CURRENTS, CONVERSION CONDUCTANCE, ANODE IMPEDANCE, EQUIVALENT NOISE RESISTANCE, OSCILLATOR-VOLTAGE PLOTTED AGAINST OSCILLATOR-GRID CURRENT FOR LINE VOLTAGE OF 170V

UCH42

TRIODE HEXODE FREQUENCY CHANGER

Triode hexode primarily intended for use as frequency changer in D.C./A.C. mains-operated receivers. The hexode section is designed for a.g.c. operation. The valve may also be employed as a phase inverter.



TRIODE-ANODE CURRENT PLOTTED AGAINST TRIODE-ANODE VOLTAGE

VOLTAGE AMPLIFYING PENTODE

UF86

Low-noise pentode intended for use as r.c. coupled a.f. voltage amplifier, particularly in the early stages of high-gain audio amplifiers and microphone preamplifiers with series connected heaters.

HEATER

Suitable for series operation, a.c. or d.c.

I_h	100	mA
V_h	12.6	V

CAPACITANCES (measured without an external screen) ←

c_{out}	5.3	pF
c_{in}	3.8	pF
c_{a-g1}	<50	mpF
c_{g1-h}	<2.5	mpF

CHARACTERISTICS

V_a	200	V
V_{g3}	0	V
V_{g2}	140	V
I_a	3.0	mA
I_{g2}	600	μA
V_{g1}	−2.0	V
g_m	2.0	mA/V ←
r_a	2.5	MΩ
μ_{g1-g2}	38	
V_{g1} max. ($I_{g1} = +0.3\mu A$)	−1.3	V

OPERATING CONDITIONS AS R.C. COUPLED A.F. AMPLIFIER ←

Pentode connection

V_b (V)	R_a (kΩ)	R_{g2} (MΩ)	R_k (kΩ)	I_a (mA)	I_{g2} (μA)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	R_{g1}** (kΩ)
200	100	0.39	1.0	1.35	280	115	38	330
150	100	0.47	1.5	0.8	180	104	26	330
100	100	0.47	1.8	0.5	100	90	12	330
200	220	1.0	2.2	0.7	120	188	37	680
150	220	1.0	2.7	0.5	100	165	26	680
100	220	1.0	3.3	0.3	80	130	15	680

$\frac{V_{out}}{V_{in}}$ measured with an input voltage of 100mV.

*Output voltage at $D_{tot} = 5\%$.

**Grid resistor of following valve.

UF86 VOLTAGE AMPLIFYING PENTODE

Triode connection (g_2 connected to a, g_3 to k)

V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	D_{tot}* (%)	R_{g1}† (kΩ)
200	47	1.8	1.2	25.8	26.5	3.9	150
150	47	1.2	1.5	24	22	5.8	150
100	47	0.67	2.2	22	15	8.8	150
200	100	1.0	2.2	30	31	4.0	330
150	100	0.7	2.7	28	25	5.5	330
100	100	0.4	3.3	26	16.5	6.5	330
200	220	0.55	3.9	32	31	3.7	680
150	220	0.4	3.9	31	24	4.1	680
100	220	0.25	4.7	30	13	3.8	680

$\frac{V_{out}}{V_{in}}$ measured with an input voltage of 100mV.

*Output voltage and distortion at the start of positive grid current. At lower output voltages the distortion is approximately proportional to the voltage.

†Grid resistor of following valve.

LIMITING VALUES

$V_{a(b)}$ max.	550	V
V_a max.	250	V
p_a max.	1.0	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	200	V
p_{g2} max.	200	mW
I_k max.	6.0	mA
R_{g1-k} max. ($p_a > 200$mW)	3.0	MΩ
R_{g1-k} max. ($p_a < 200$mW)	10	MΩ
V_{h-k} max. (cathode positive)	150	V
V_{h-k} max. (cathode negative)	100	V
*R_{h-k} max.	20	kΩ

*When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 120kΩ.

OPERATING NOTES

1. Hum

When used as a normal voltage amplifier with a line voltage of 200V, an anode load of 100kΩ and a grid resistor of 470kΩ the maximum hum level of the valve alone is 12μV, the average value being about 8μV when operated with one side of the heater earthed. The low level of hum attained with this valve can be completely masked by that due to an unsuitable valveholder, in which excessive leakage and capacitive coupling between pins will introduce considerable hum. The hum will be increased if the valve is not operated at the bottom of the chain.

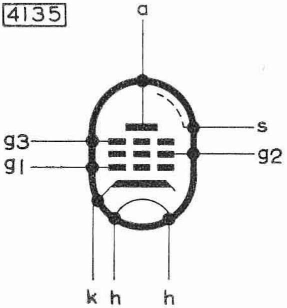
2. Noise

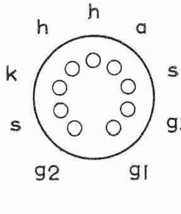
The low-frequency noise generated by a valve is most conveniently specified as an equivalent voltage on the control grid for a specific bandwidth. For the UF86 under normal conditions, i.e. line voltage of 200V and an anode load of 100kΩ, the equivalent noise voltage is approximately 2μV for a frequency range 25 to 10,000c/s.

3. Microphony

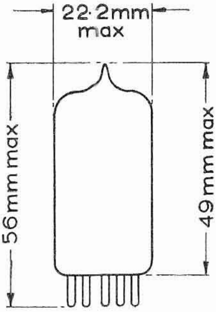
Care in the design of the valve, to ensure that the electrode structure and its mounting are as rigid as possible, has reduced the microphony of the UF86 to a very low level. There are no appreciable internal resonances at frequencies below 1000c/s. At higher frequencies the effect of vibration is usually negligible on account of the damping provided by the chassis and the valveholder. In high-gain applications, such as tape recording, care should be taken in siting the valve, particularly when a loudspeaker is present in the same cabinet or when a motor is mounted on the same chassis. In such cases a flexible mounting for the valveholder or a separate weighted sub-chassis is advisable.

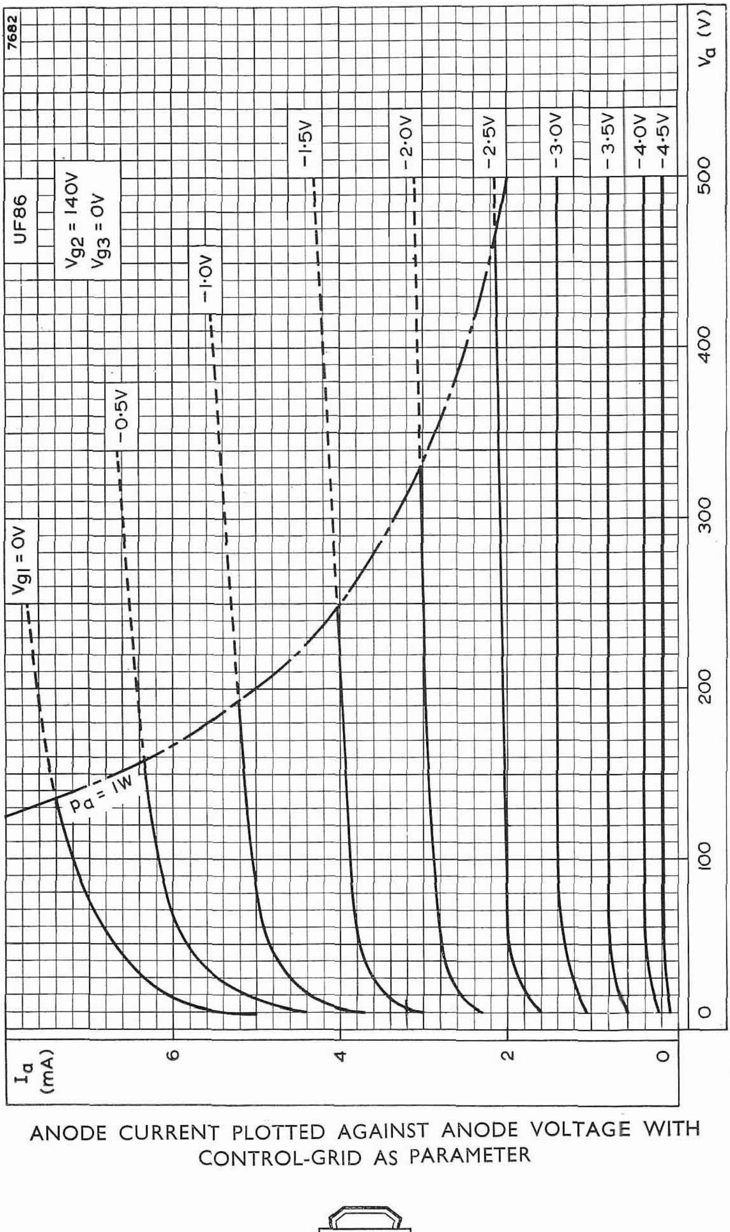
4135





B9A Base

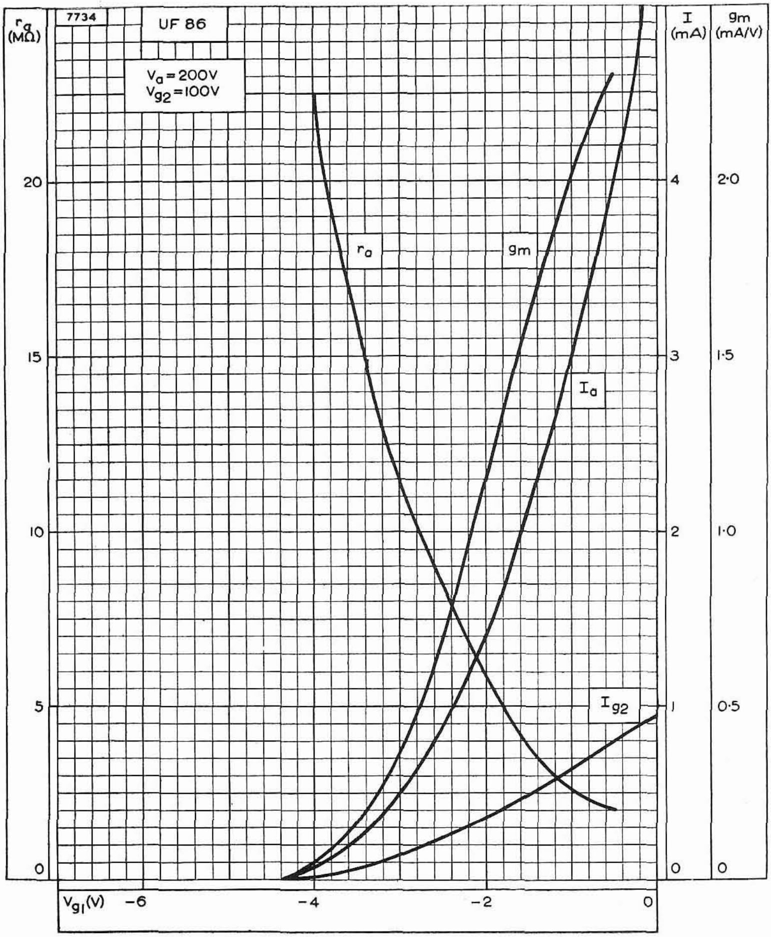




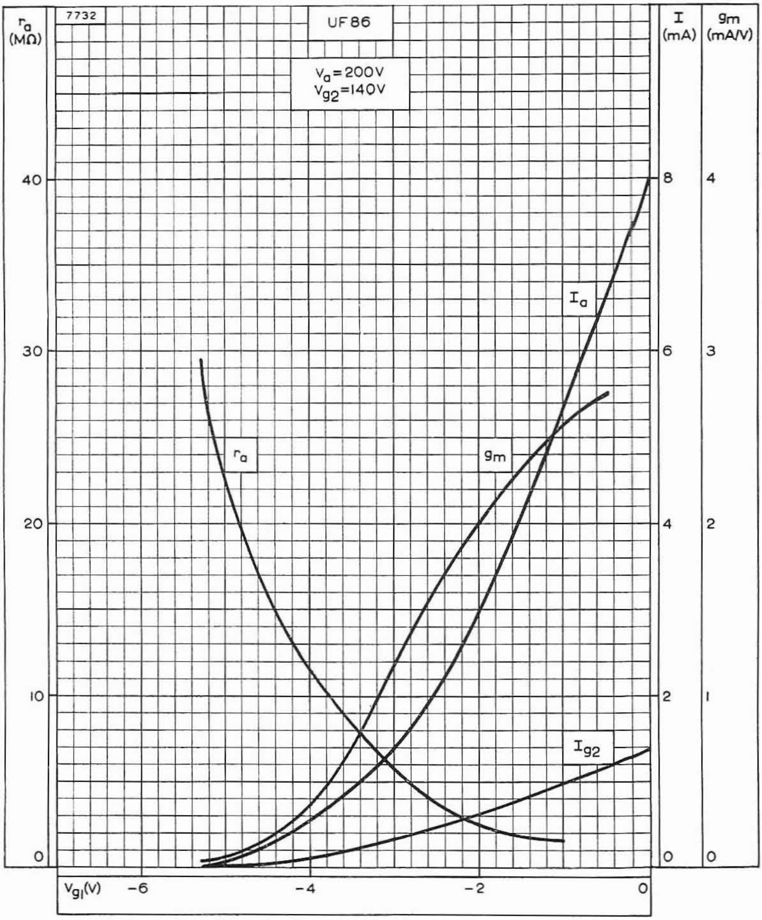
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID AS PARAMETER

UF86

VOLTAGE AMPLIFYING PENTODE

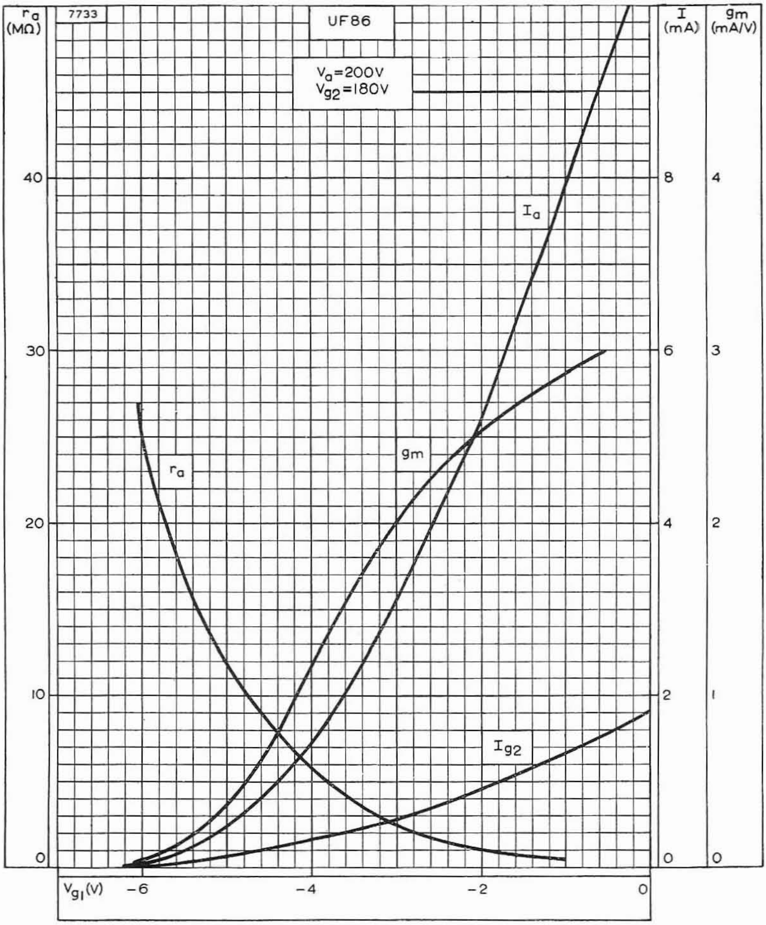


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = 200V$, $V_{g2} = 100V$

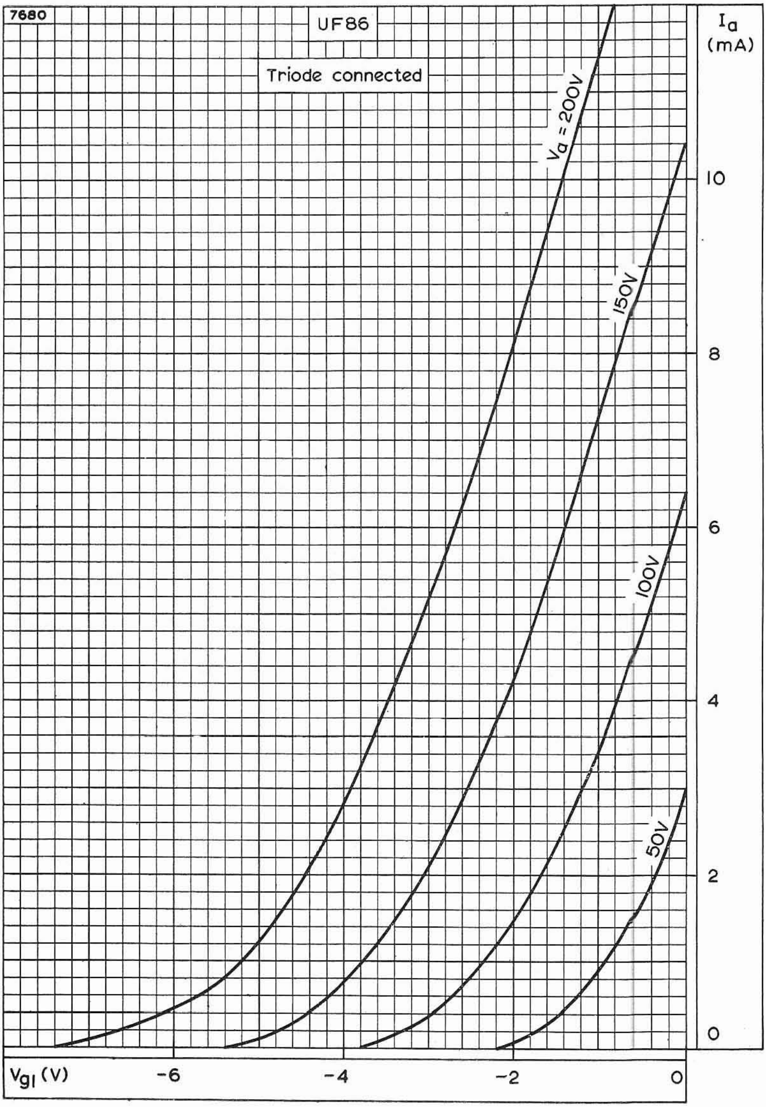


ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE. $V_a = 200V$, $V_{g2} = 140V$

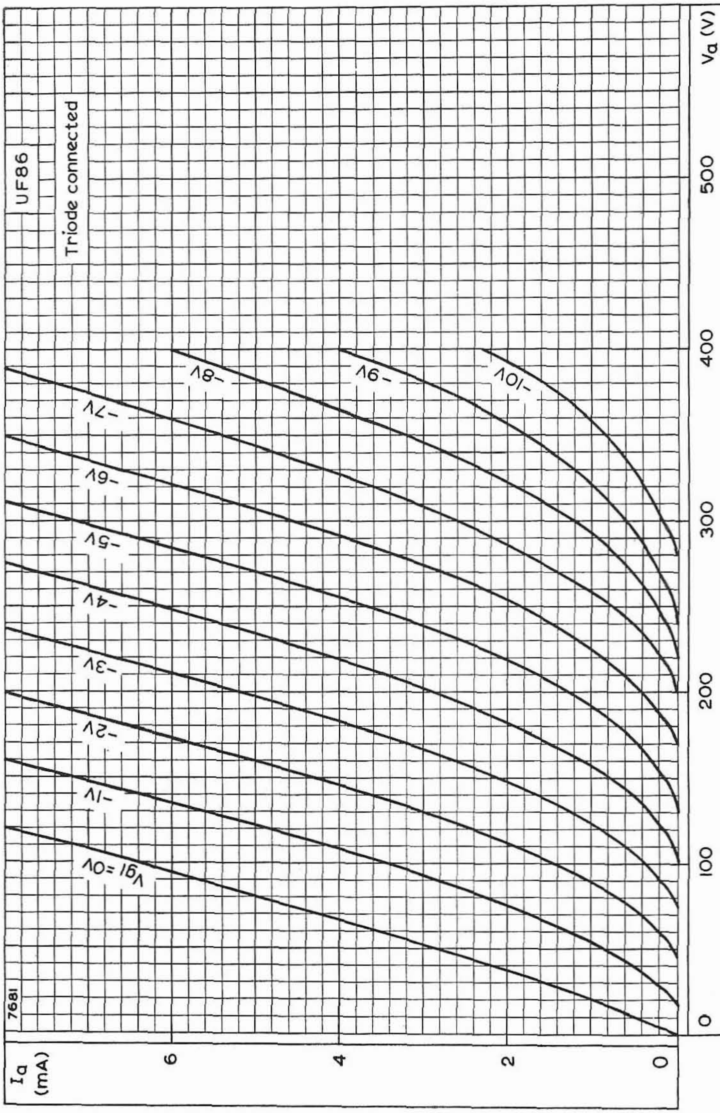
VOLTAGE AMPLIFYING PENTODE



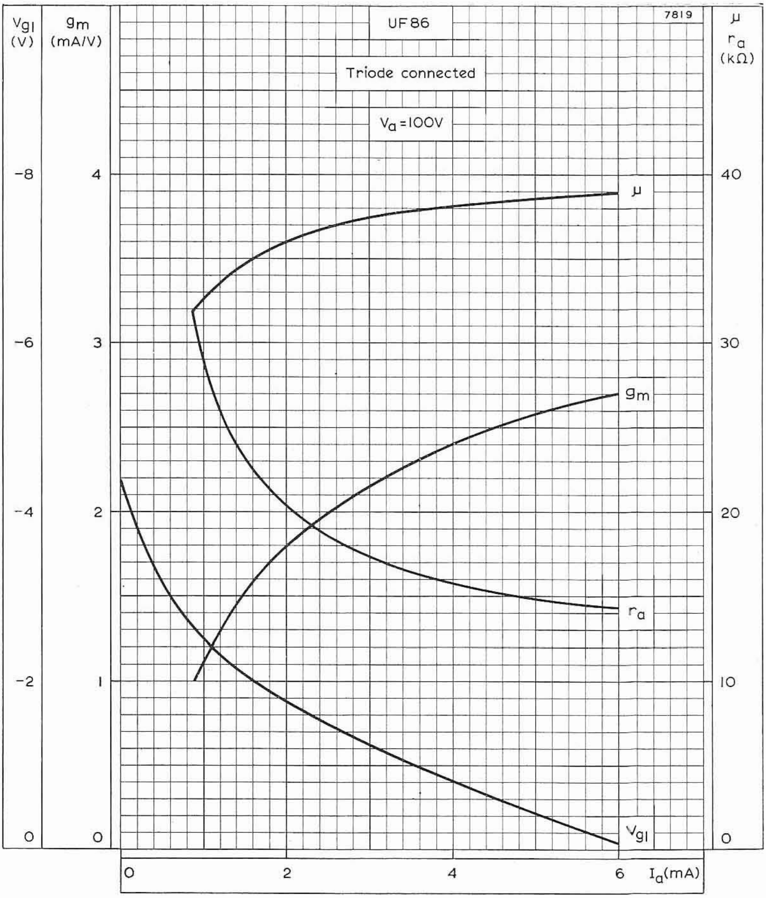
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
$V_a = 200V, \quad V_{g2} = 180V$



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER WHEN CONNECTED AS A TRIODE



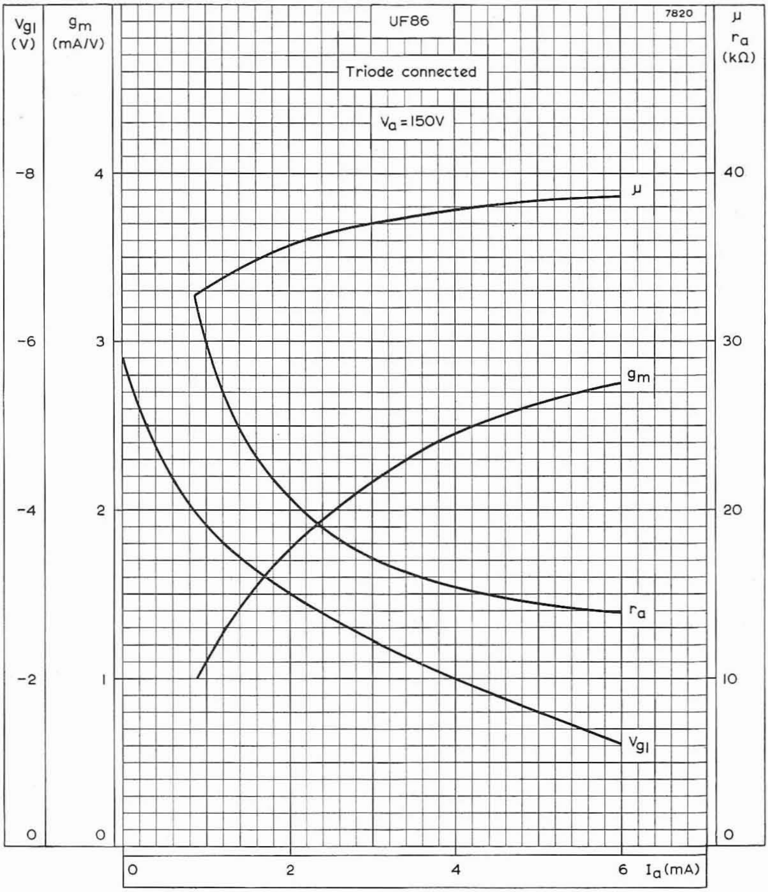
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN CONNECTED AS A TRIODE



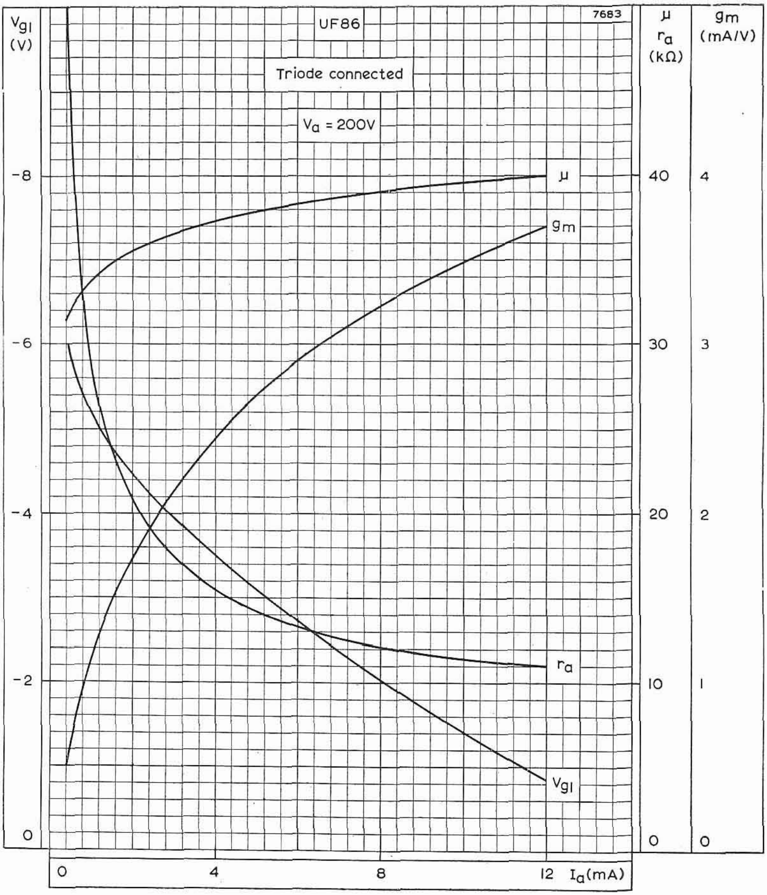
CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT WHEN TRIODE CONNECTED. $V_a = 100V$

UF86

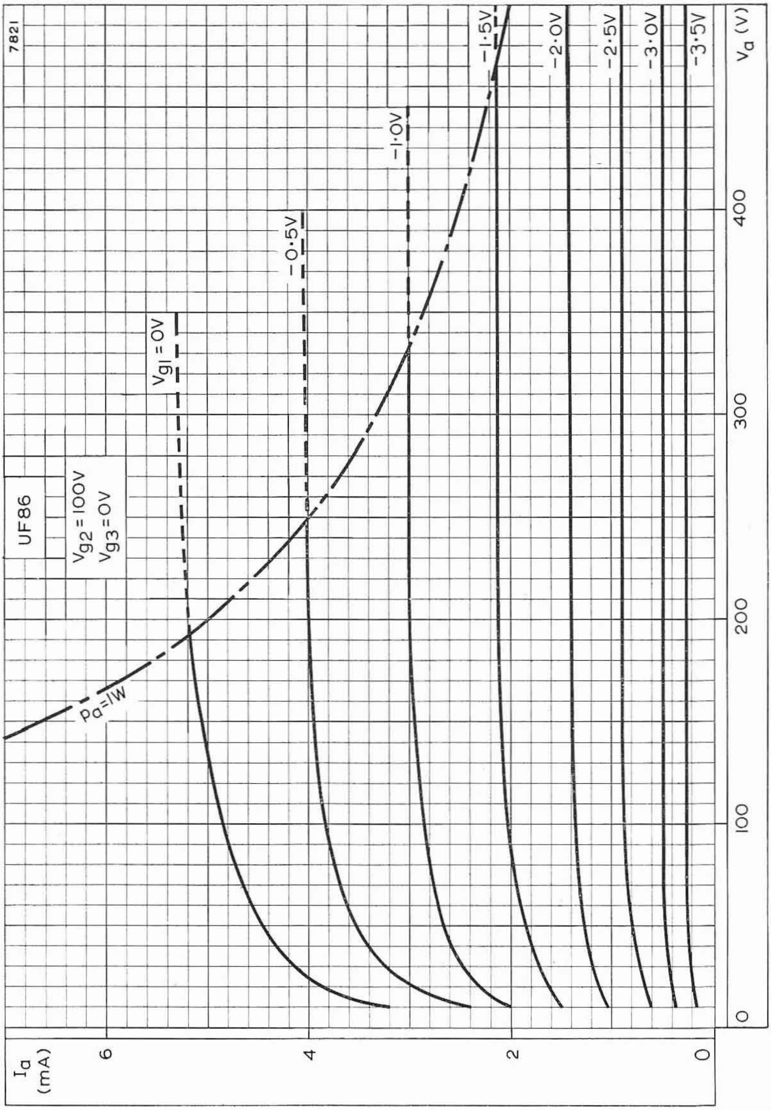
VOLTAGE AMPLIFYING PENTODE



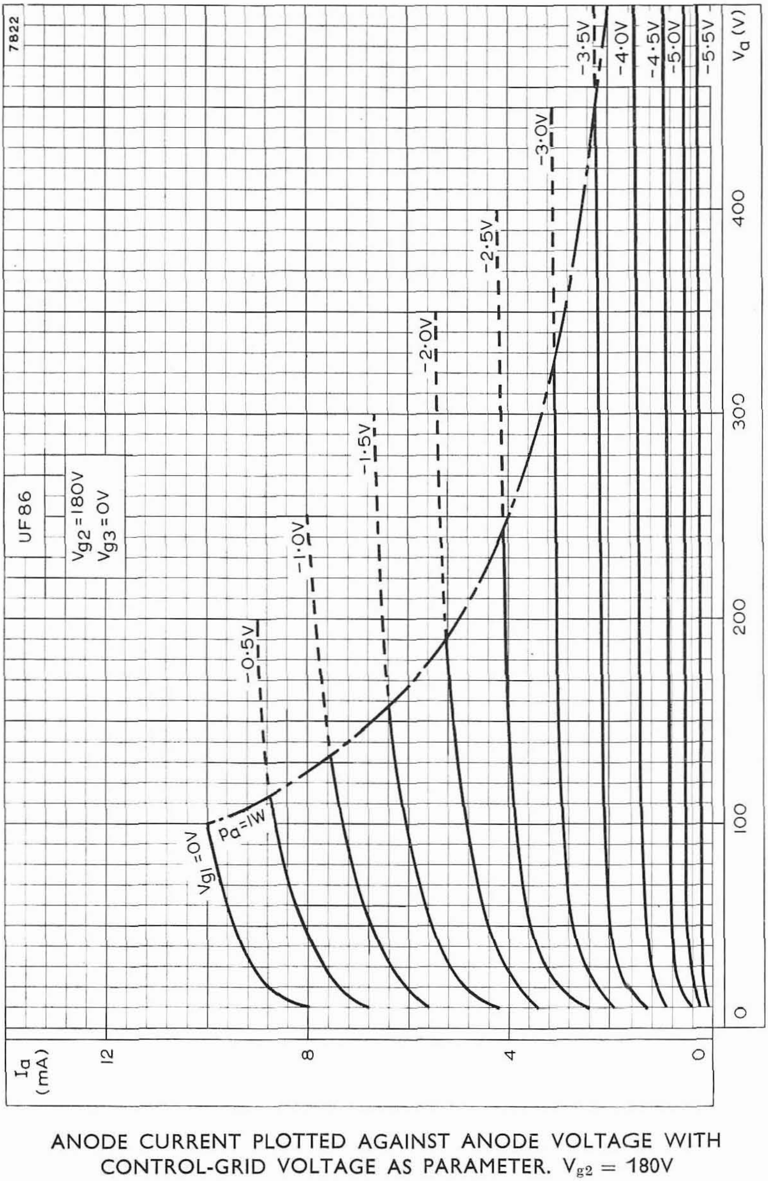
CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT WHEN TRIODE CONNECTED. $V_a = 150V$



CONTROL-GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT WHEN TRIODE CONNECTED. $V_a = 200V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 100V$



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 180V$

HALF-WAVE RECTIFIER

UY89

Indirectly heated half-wave rectifier with 100mA heater for use in receivers which operate from 110V to 250V mains supply.

PRELIMINARY DATA

HEATER

I_h	100	mA
V_h	31	V

LIMITING VALUES

P.I.V. max.	700	V
$i_{a(pk)}$ max.	600	mA
I_{out} max.	100	mA
$v_{h-k(pk)}$ max. (cathode positive)	550	V

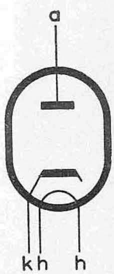
OPERATING CONDITIONS

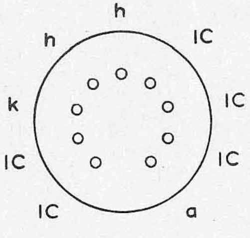
Capacitor input

$V_{in(r.m.s.)}$	R_{lim} min.	C	I_{out}	V_{out}
(V)	(Ω)	(μF)	(mA)	(V)
110	0	50	100	113
127	0	50	100	135
220	160	50	100	188
250	210	50	100	205

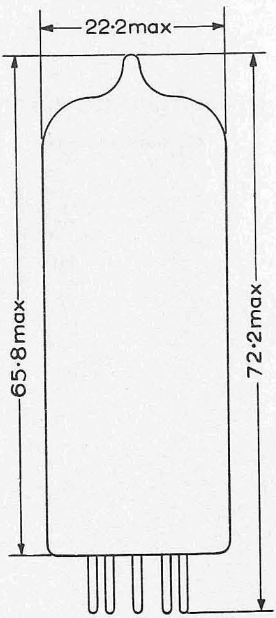
UY89

HALF-WAVE RECTIFIER



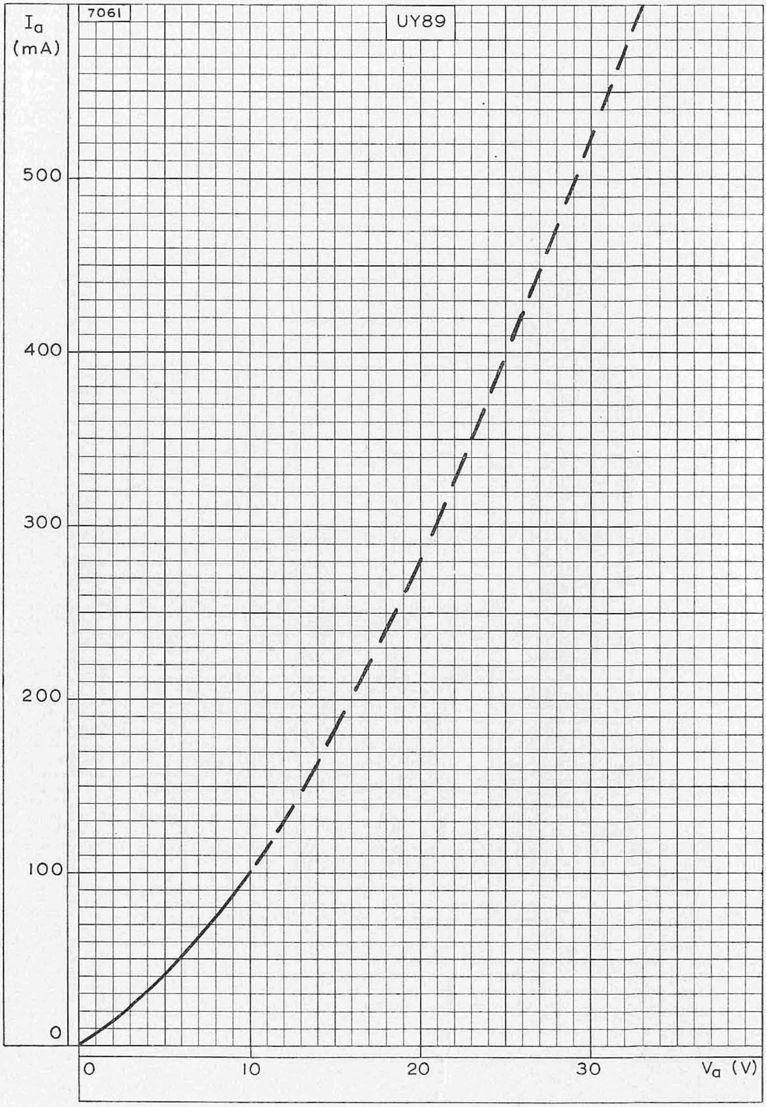


B9A Base

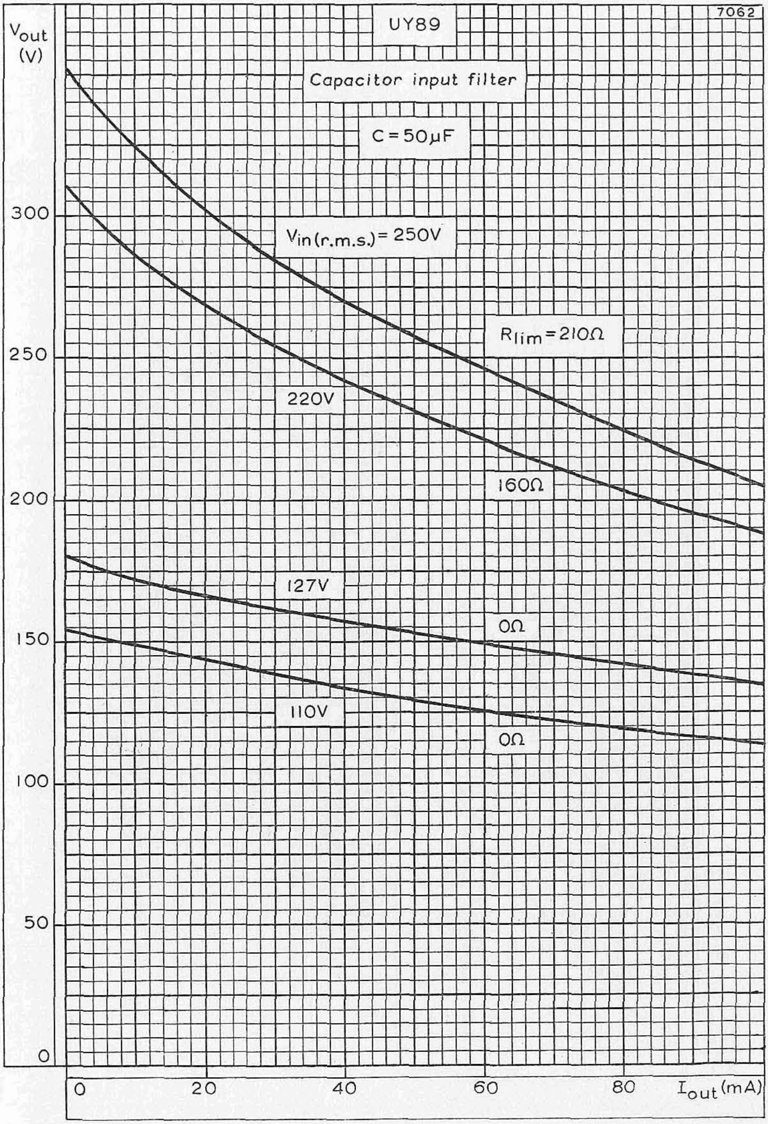


7015

All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE



CAPACITOR INPUT FILTER REGULATION CURVES

VARIABLE-MU R.F. PENTODE

VP4B

Variable-mu H.F. Pentode for use in A.C. mains-operated receivers.

HEATER

V_h	4.0	V
I_h	0.65	A
Heating time	15	secs.

CAPACITANCES

c_{a-g1}	0.002	μμF
c_{out}	8.0	μμF
c_{in}	5.35	μμF

CHARACTERISTICS

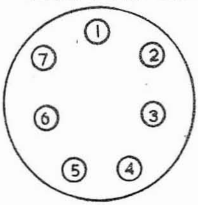
V_a	250	V
V_{g2}	250	V
I_a	11.5	mA
I_{g2}	4.25	mA
V_{g1}	−3	V
g_m	2.0	mA/V
R_k	160	Ω

LIMITING VALUES

V_a max.	250	V
V_{g2} max.	250	V
R_{g1-k} max.	2.5	M Ω

CONNECTIONS

Brit. 7–Pin Base



Viewed from free end of pins

Pin No. 1 Metallising
,, 2 Anode
,, 3 Suppressor Grid (g_3)
,, 4 Heater
,, 5 Heater
,, 6 Cathode
,, 7 Screen Grid (g_2)
Top Cap–Control Grid (g_1)

DIMENSIONS

Overall length	124 mm.
Overall diameter	43 mm.
Bulb Finish	Metallised

R.F. PENTODE

6CB6

High slope pentode primarily intended for use as r.f. or i.f. amplifier.

HEATER

Suitable for series or parallel operation

V_h	6.3	V
I_h	300	mA

MOUNTING POSITION

Any

CAPACITANCES

	Shielded	*Unshielded*	
c_{in}	6.5	6.5	pF
c_{out}	3.0	1.9	pF
c_{a-g1}	<0.01	<0.02	pF

CHARACTERISTICS

V_a	200	V
V_{g3}	0	V
V_{g2}	150	V
V_{g1}	−2.2	V
I_a	9.5	mA
I_{g2}	2.8	mA
r_a	600	kΩ
g_m	8.0	mA/V ←
$V_{g1}(I_a = 10\mu A)$	−8.0	V

LIMITING VALUES

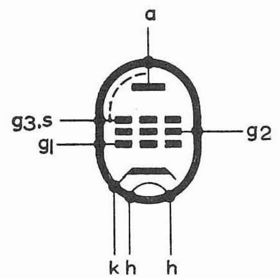
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.0	W
$V_{g2(b)}$ max.	300	V
V_{g2} max.	150	V
p_{g2} max.	500	mW
V_{h-k} max.	100	V
$v_{h-k(pk)}$ max.	200	V

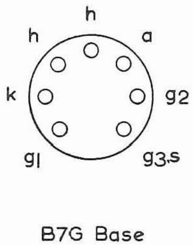
6CB6

R.F. PENTODE

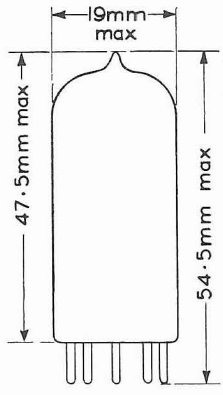
High slope pentode primarily intended for use as r.f. or i.f. amplifier.

4694





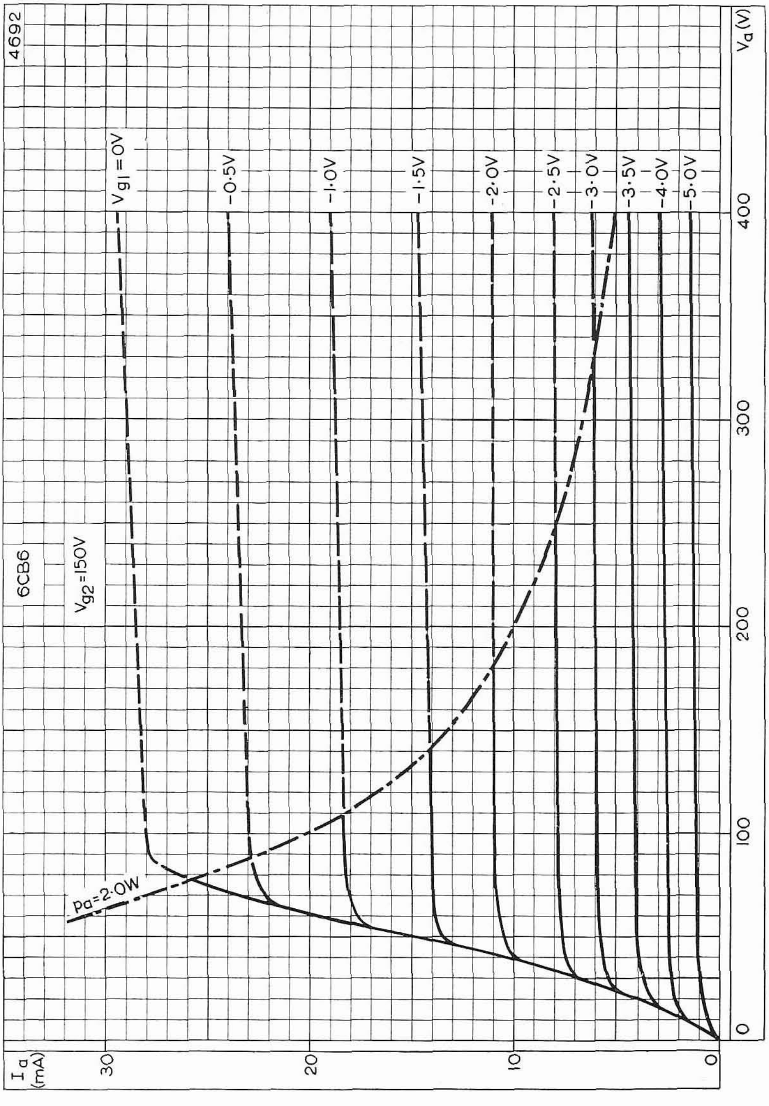
B7G Base



R.F. PENTODE

6CB6

High slope pentode primarily intended for use as r.f. or i.f. amplifier.

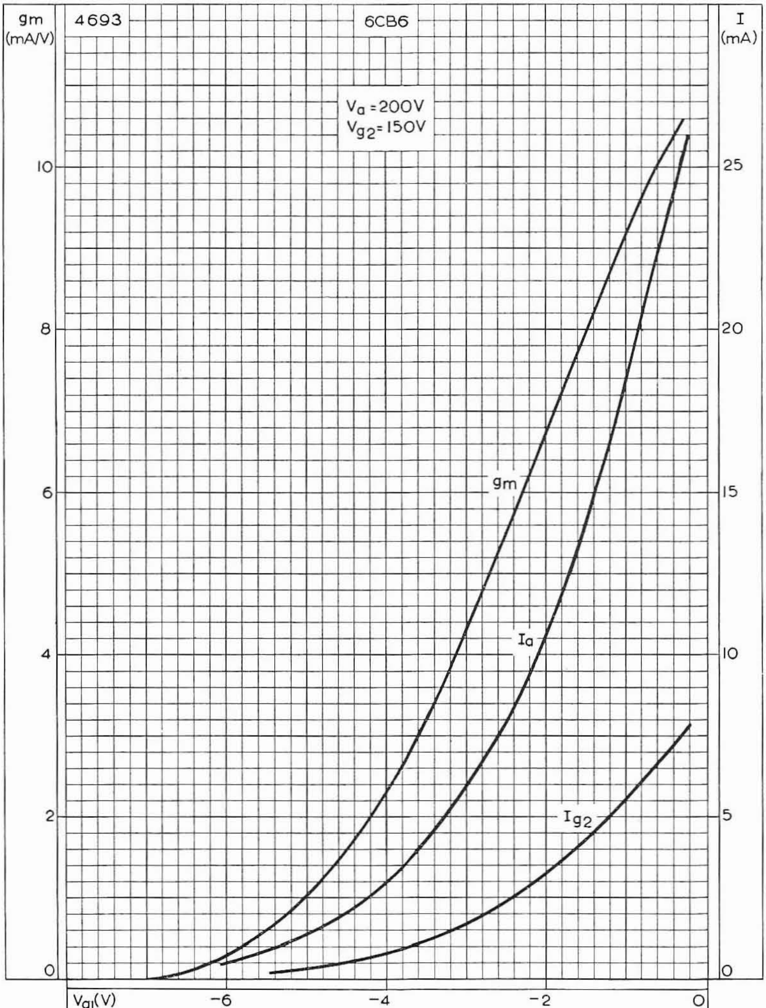


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

6CB6

R.F. PENTODE

High slope pentode primarily intended for use as r.f. or i.f. amplifier.



ANODE CURRENT, SCREEN-GRID CURRENT AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE

TRIODE PENTODE

6U8

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

HEATER

V_h	6.3	V
I_h	450	mA

MOUNTING POSITION

Any

CAPACITANCES

	Shielded	Unshielded	
c_{ap-at}	0.018	0.07	pF
c_{ap-gt}	0.0035	0.008	pF
c_{gp-at}	0.1	0.11	pF
c_{gp-gt}	0.0025	0.003	pF
Pentode section			
c_{a-g1}	<0.006	<0.01	pF
c_{in}	5.0	5.0	pF
c_{out}	3.5	2.6	pF
c_{kp-h}	3.0	3.0	pF
Triode section			
c_{a-k+h}	1.0	0.4	pF
c_{g-k+h}	2.5	2.5	pF
c_{a-g}	1.8	1.8	pF
c_{kt-h}	3.0	3.0	pF

CHARACTERISTICS

Pentode section

V_a	250	V
V_{g2}	110	V
I_a	10	mA
I_{g2}	3.5	mA
V_{g1}	−0.9	V
g_m	5.2	mA/V
r_a	400	kΩ
μ_{g1-g2}	35	
V_{g1} ($I_a = 10\mu A$)	−10	V

Triode section

V_a	150	V
I_a	18	mA
V_g	−1.0	V
g_m	8.5	mA/V
μ	40	
r_a	5.0	kΩ

6U8

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

TYPICAL OPERATING CONDITIONS

As a frequency changer

V_a	170	200	250	V
R_{g2}	30	45	70	kΩ
R_{g1}	1.0	1.0	1.0	MΩ
V_{g1}	0	0	0	V
I_a	4.7	4.9	5.2	mA
I_{g2}	2.0	1.9	1.9	mA
$V_{osc(r.m.s.)}$	3.0	3.0	3.0	V
I_{g1}	3.7	3.7	3.7	μA
g_c	1.65	1.8	1.9	mA/V

Triode section as an oscillator

V_b	170	200	250	V
R_a	20	20	20	kΩ
R_{g-k}	20	20	20	kΩ
I_a	3.3	4.1	5.7	mA
I_g	160	160	160	μA
$V_{osc(r.m.s.)}$	3.0	3.0	3.0	V
g_m (eff.)	2.8	3.2	4.0	mA/V

LIMITING VALUES

Pentode section

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.8	W
$V_{g2(b)}$ max.	550	V
V_{g2} max.	300	V
p_{g2} max.	500	mW
I_k max.	20	mA
R_{g1-k} max.	1.0	MΩ
V_{g1} ($I_{g1} = +0.3\mu A$)	−1.3	V
V_{h-k} max. (cathode negative)	90	V
V_{h-k} max. (cathode positive)	90	V

Triode section

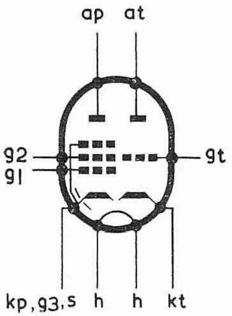
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.7	W
I_k max.	20	mA
R_{g-k} max.	1.0	MΩ
V_{h-k} max. (cathode negative)	90	V
V_{h-k} max. (cathode positive)	90	V
R_{h-k} max.	20	kΩ

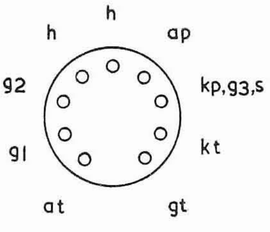
TRIODE PENTODE

6U8

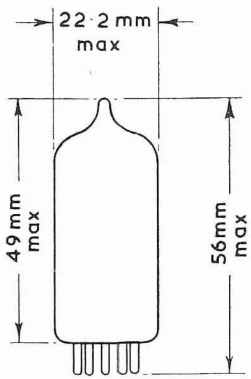
Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

3222





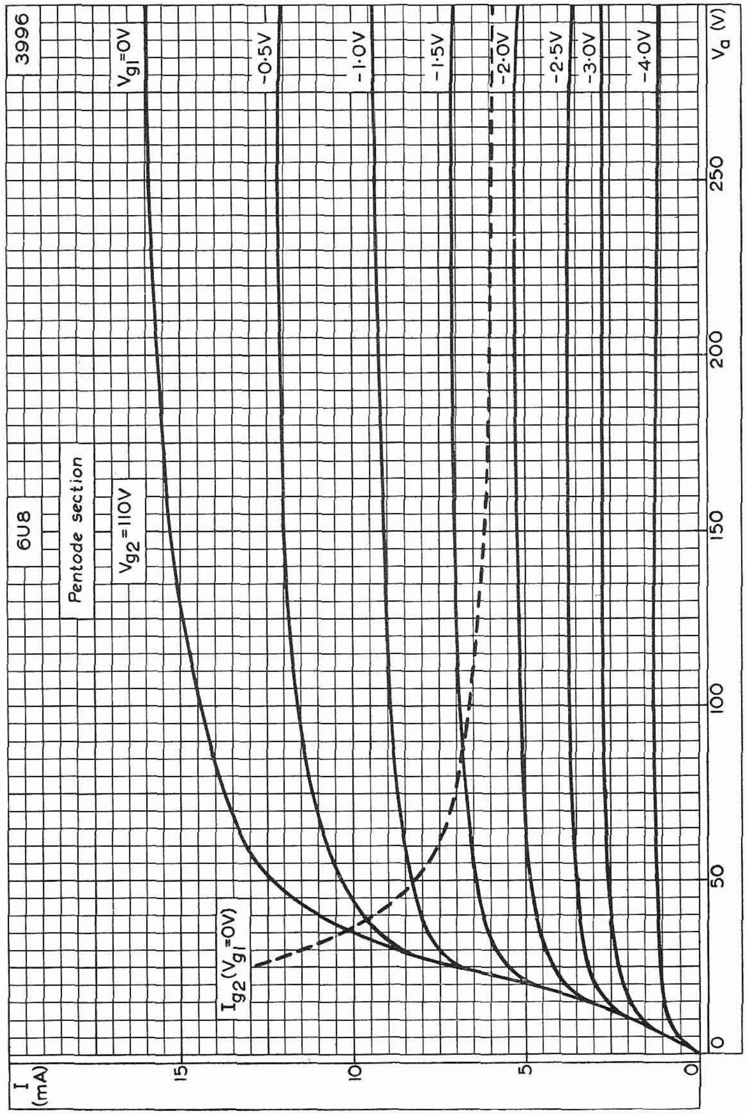
B9A Base



6U8

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

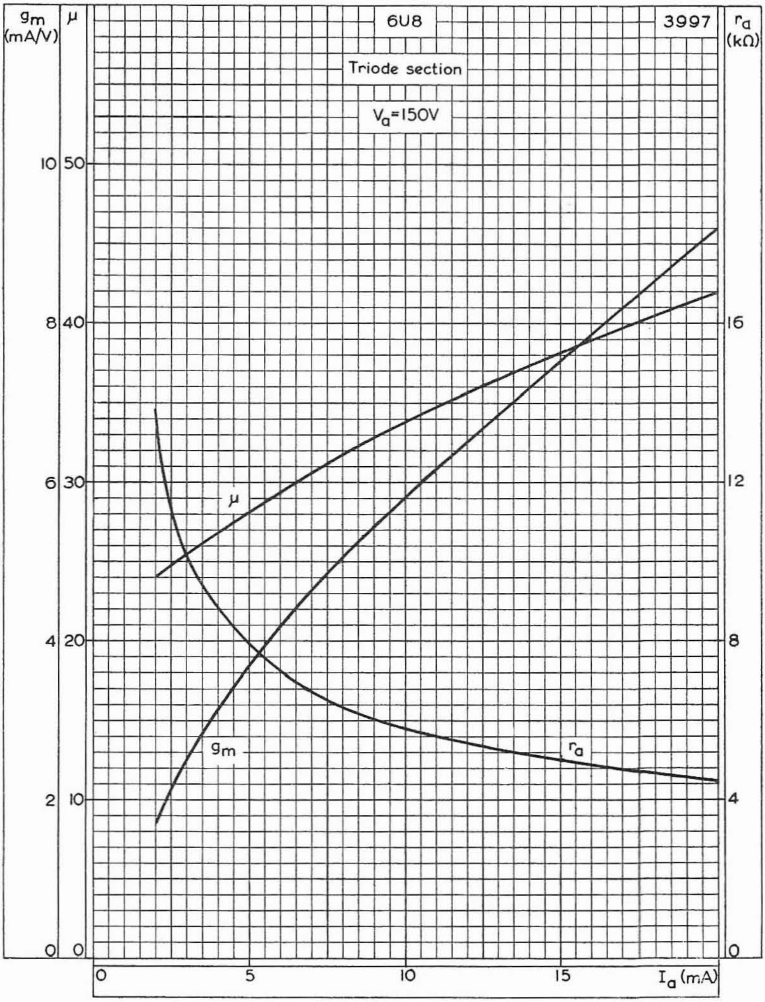


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE FOR PENTODE SECTION WITH CONTROL-GRID VOLTAGE AS PARAMETER

TRIODE PENTODE

6U8

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

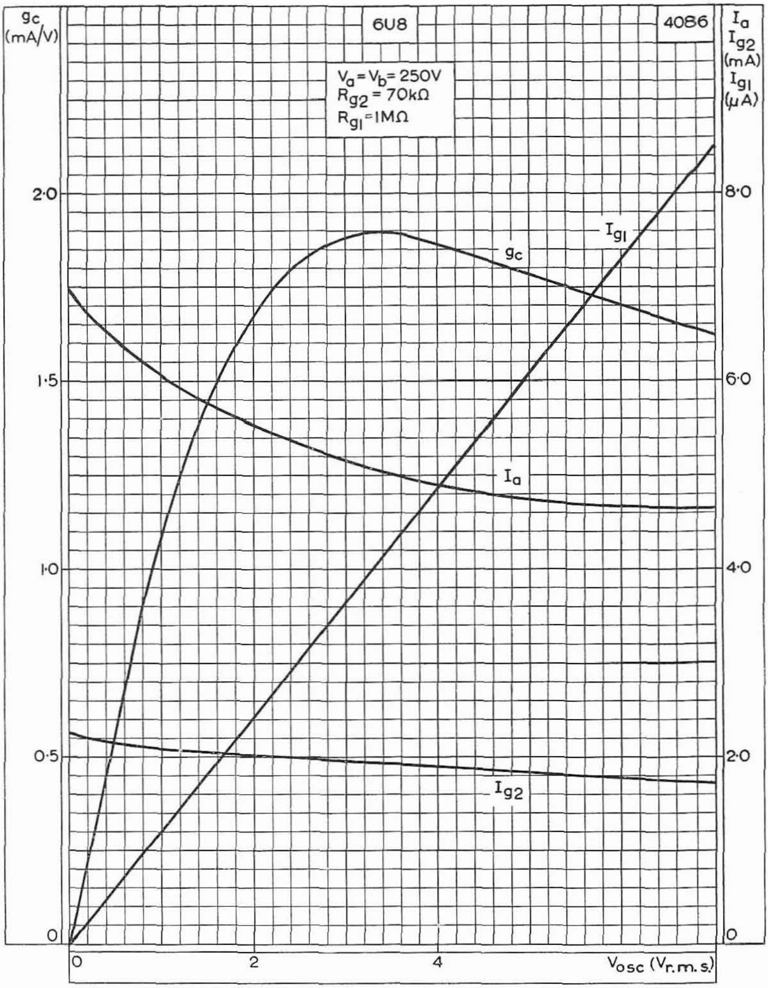


MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND ANODE IMPEDANCE PLOTTED AGAINST ANODE CURRENT FOR TRIODE SECTION

6U8

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.



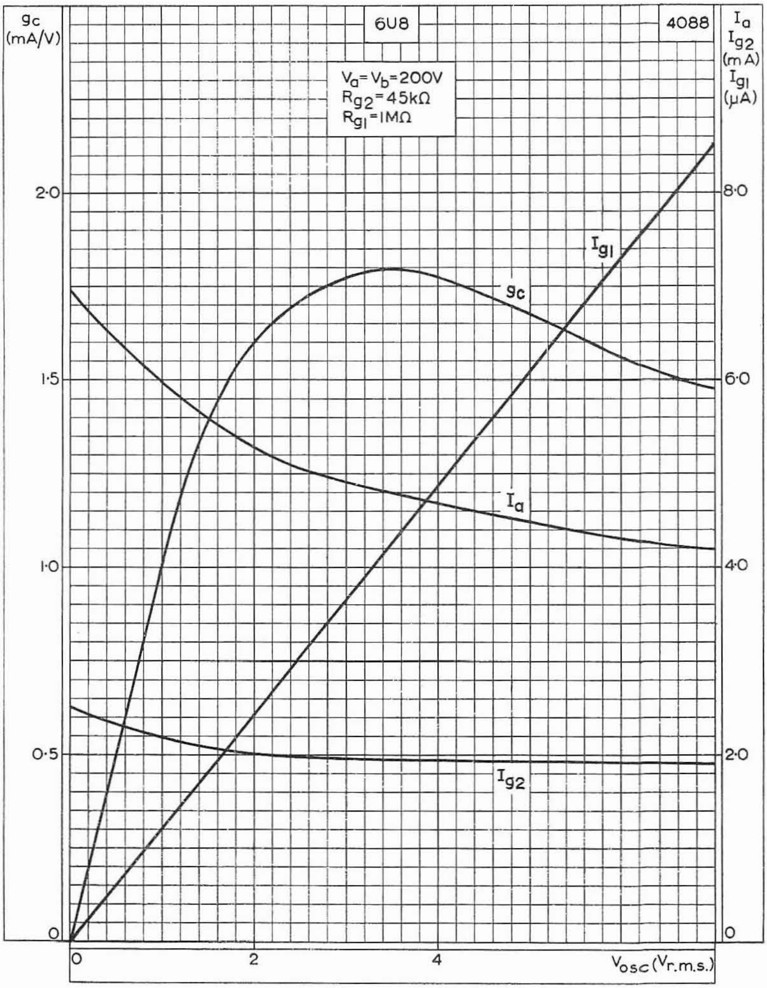
PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER

$V_a = V_b = 250V$

TRIODE PENTODE

6U8

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.

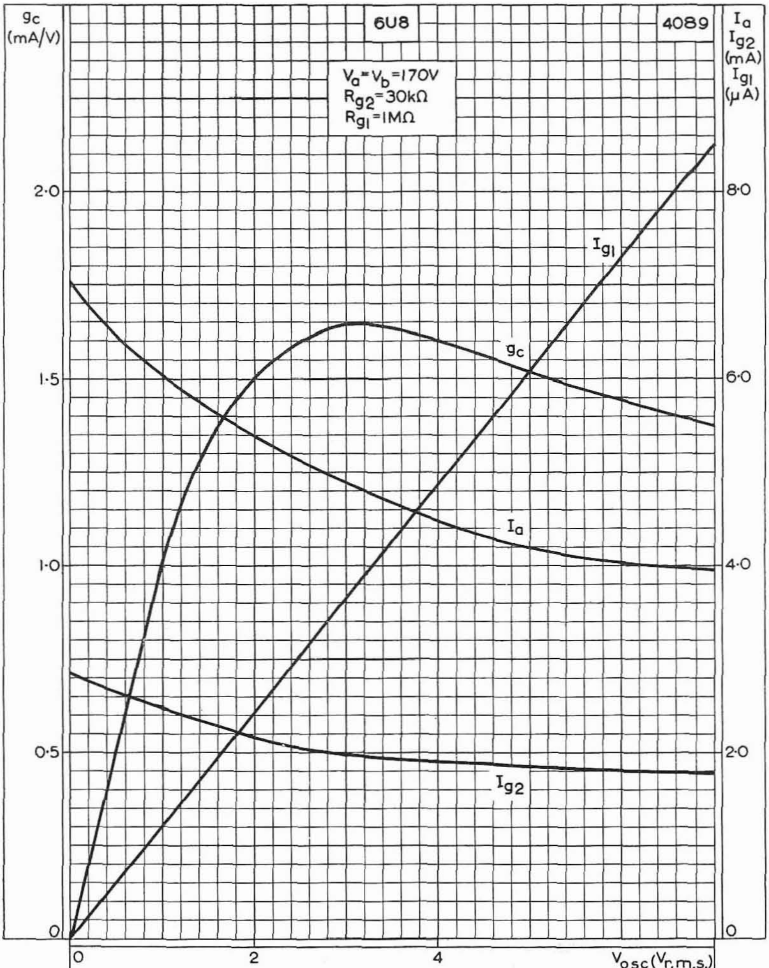


PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER
$V_a = V_b = 200V$

6U8

TRIODE PENTODE

Combined triode and high slope r.f. pentode with separate cathodes. Primarily intended for use as a frequency changer at frequencies up to 220Mc/s.



PERFORMANCE CURVES FOR USE AS A FREQUENCY CHANGER
$V_a = V_b = 170V$

SPECIAL QUALITY DOUBLE TRIODE

6211

Special quality double triode, with separate cathodes designed for use in industrial equipment where stability of characteristics and long life are required. This valve will maintain its emission capabilities after long periods of operation under cut-off conditions.

This data should be read in conjunction with GENERAL NOTES – SPECIAL QUALITY VALVES which precede this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for series or parallel operation, a.c. or d.c.

The heater is centre-tapped and the two sections may be operated in series or in parallel with one another.

Series	V_h applied between pins 4 and 5
Parallel	V_h applied between pin 9 and pins 4 and 5 connected together

	Series	*Parallel*	
V_h[1]	12.6	6.3	V
I_h	150	300	mA

The maximum variation of heater current at $V_h = 6.3V$ is $\pm 15mA$.

In order to achieve a useful valve life with the heater in a series connected chain, the absolute maximum variation of heater current due to voltage fluctuations and tolerances should be $< \pm 1.5\%$.

CAPACITANCES[2] (measured without an external shield)

	Min.	*Av.*	*Max.*	
*c_{a-g}	2.0	2.5	3.0	pF
*c_{in}	2.1	2.6	3.1	pF
$c_{out'}$	250	400	550	mpF
$c_{out''}$	230	350	470	mpF
$c_{a'-a''}$	—	0.9	1.1	pF
$c_{g'-g''}$	—	—	60	mpF
*c_{h-k}	—	2.8	—	pF

*Each section

CHARACTERISTICS[3] (each section)

V_{a-k}	100	V
R_k	470	Ω
I_a	4.6	mA
g_m	3.6	mA/V
r_a	7.8	kΩ
μ	28	

SPECIAL QUALITY DOUBLE TRIODE

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

	Average	*Initial range*	*End of life**	
Anode Current				
at $V_{a-k} = 100V$, $R_k = 470\Omega$	4.6	3.6 to 5.6	—	mA
at $V_a = 150V$, $V_g = -10V$	—	<100	100	μA
at $V_a = 85V$, $V_{g(b)} = 85V$ $R_g = 425k\Omega$	16	12 to 20	7.2	mA
Grid current at $V_a = 100V$, $V_g = -2V$, $R_g = 100k\Omega$	—	<0.2	1.0	μA
Mutual conductance at $V_{a-e} = 100V$, $R_k = 470\Omega$	3.6	2.7 to 4.5	1.6	mA/V

INSULATION

	Initial range	*End of life**	
Between heater and cathode measured at $V_{h-k} = 180V$ (cathode positive) $R_{lim} = 1.0M\Omega$			
Leakage current	<15	30	μA
Between any two electrodes measured at 300V	>100	20	MΩ

*To allow for valve deterioration during life, circuits should be designed to function with a valve in which one or more of the characteristics have changed to the values stated.

LIMITING VALUES[4] (absolute ratings) each section

$V_{a(b)}$ max.	600	V
V_a max.	200	V
p_a max.	1.5	W
$+V_g$ max.	1.0	V
$-V_g$ max.	100	V
†$-v_{g(pk)}$ max.	200	V
I_g max.	2.0	mA
†$i_{g(pk)}$ max.	50	mA
I_k max.	14	mA
†$i_{k(pk)}$ max.	75	mA
R_{g-k} max. (fixed bias)	200	kΩ
V_{h-k} max. (cathode positive)	180	V
V_{h-k} max. (cathode negative)	90	V
$v_{h-k(pk)}$ max. (cathode negative)	180	V
T_{bulb} max.	120	°C

†Maximum duration = 10μs. Duty cycle = 1%.

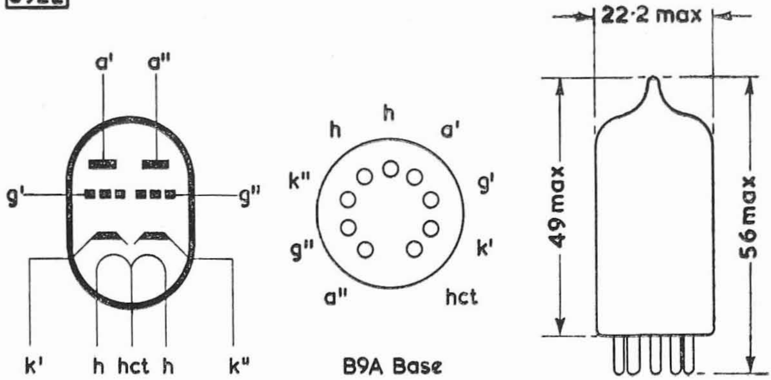
SHOCK AND VIBRATION

The 6211 can withstand vibrations of 2.5g and 50c/s for 96 hours and is proof against impact accelerations of approximately 300g.

OPERATING NOTE

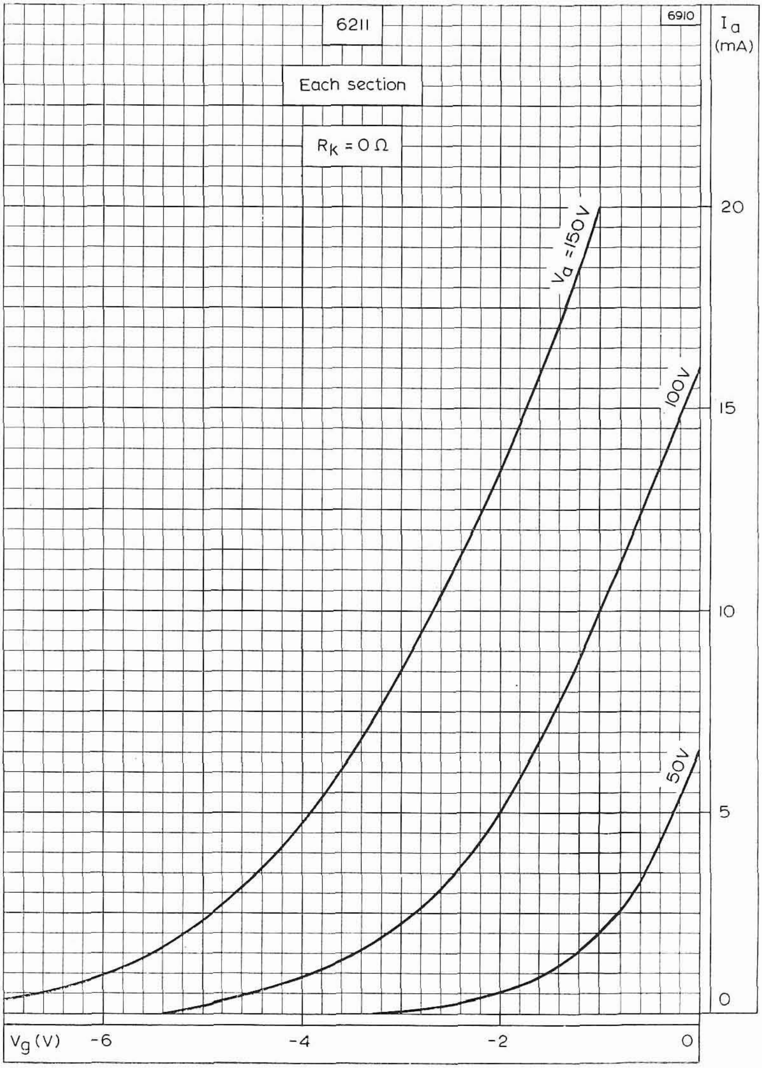
The 6211 will maintain its emission capabilities after long periods of operation under cut-off conditions but it is not intended to be used in circuits critical with regard to hum, microphony or noise.

6922



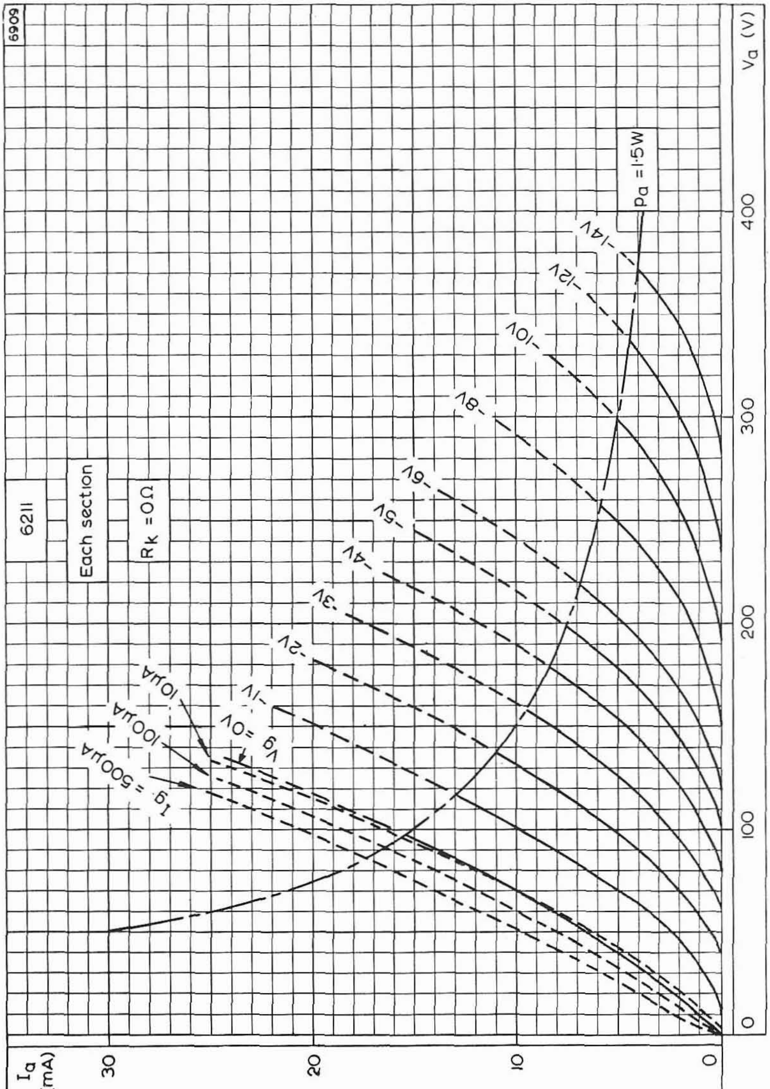
All dimensions in mm

The bulb and base dimensions of this valve are in accordance with BS448, Section B9A.



ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER

6211 SPECIAL QUALITY DOUBLE TRIODE



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

SPECIAL QUALITY DOUBLE TRIODE

6463

Special quality double triode with separate cathodes designed for use in industrial equipment where stability of characteristics and long life are required. This valve will maintain its emission capabilities after long periods of operation under cut-off conditions.

This data should be read in conjunction with GENERAL NOTES – SPECIAL QUALITY VALVES which precede this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

Suitable for parallel operation only, a.c. or d.c.
The heater is centre-tapped and the two sections may be operated in series or parallel with one another.

Series	V_h applied between pins 4 and 5
Parallel	V_h applied between pin 9 and pins 4 and 5 connected together.

	Series	*Parallel*	
V_h[1]	12.6	6.3	V
I_h	300	600	mA

The maximum variation of heater current at $V_h = 6.3$V is $\pm$30mA

CAPACITANCES[2] (measured without an external shield)

	Min.	*Av.*	*Max.*	
$c_{a'-g'}$	4.6	5.2	5.8	pF
$*c_{in}$	2.9	3.4	3.9	pF
c_{out}	400	600	800	mpF
$*c_{h-k}$	—	3.5	—	pF
$c_{a''-g''}$	4.8	5.4	6.0	pF
$c_{out''}$	350	500	650	mpF
$c_{g'-g''}$	—	—	25	mpF
$c_{a'-a''}$	—	0.9	1.2	pF

*Each section

CHARACTERISTICS[3]

V_{a-e}	250	V
R_k	620	Ω
I_a	14.5	mA
g_m	5.2	mA/V
r_a	3.85	kΩ
μ	20	

6463 SPECIAL QUALITY DOUBLE TRIODE

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

	Average	*Initial range*	*End of life**	
Anode current				
at $V_a = 100V$, $I_g = 200\mu A$	29	>24	17	mA
at $V_a = 120V$, $V_g = -2V$	21	14 to 28	10	mA
at $V_a = 200V$, $V_g = -15V$	—	<1.0	1.0	mA
Grid current				
at $V_a = 120V$, $V_g = -2V$, $R_g = 100k\Omega$	—	<0.2	1.0	μA
Mutual conductance				
at $V_{a-e} = 250V$, $R_k = 620\Omega$	5.2	3.9 to 6.5	—	mA/V

INSULATION

	Initial range	*End of life**	
Between heater and cathode measured at $V_{h-k} = 200V$ (cathode positive) $R_{lim} = 1.0M\Omega$			
Leakage current	<15	20	μA
Between any two electrodes measured at 300V	>100	20	$M\Omega$

*To allow for valve deterioration during life, circuits should be designed to function with a valve in which one or more of the characteristics have changed to the values stated.

LIMITING VALUES[4] (absolute ratings) each section

$V_{a(b)}$ max.	660	V
$v_{a(pk)}$ max.	660	V
V_a max.	330	V
p_a max.	4.4	W
$p_{a'}+p_{a''}$ max.	7.7	W
$+V_g$ max.	1.5	V
†$+v_{g(pk)}$ max.	25	V
$-V_g$ max.	85	V
†$-v_{g(pk)}$ max.	350	V
I_g max.	5.5	mA
†$i_{g(pk)}$ max.	110	mA
I_k max.	31	mA
$i_{k(pk)}$ max.	350	mA
R_{g-k} max. (fixed bias)	500	$k\Omega$
V_{h-k} max. (cathode positive)	200	V
V_{h-k} max. (cathode negative)	100	V
$v_{h-k(pk)}$ max. (cathode negative)	200	V
T_{bulb} max.	180	°C

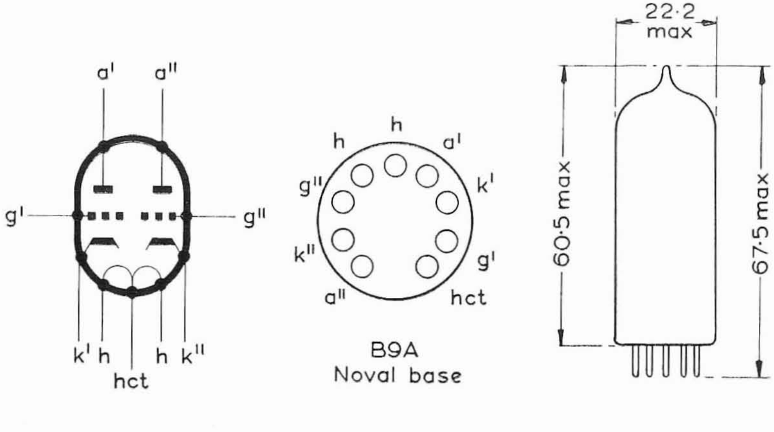
†Maximum duration = $10\mu s$. Duty cycle = 1%

SHOCK AND VIBRATION

The 6463 can withstand vibrations of 2.5g and 25c/s for 96 hours and is proof against impact accelerations of approximately 500g.

OPERATING NOTE

The 6463 will maintain its emission capabilities after long periods of operation under cut-off conditions but is not intended to be used in circuits critical with regard to hum, microphony or noise.



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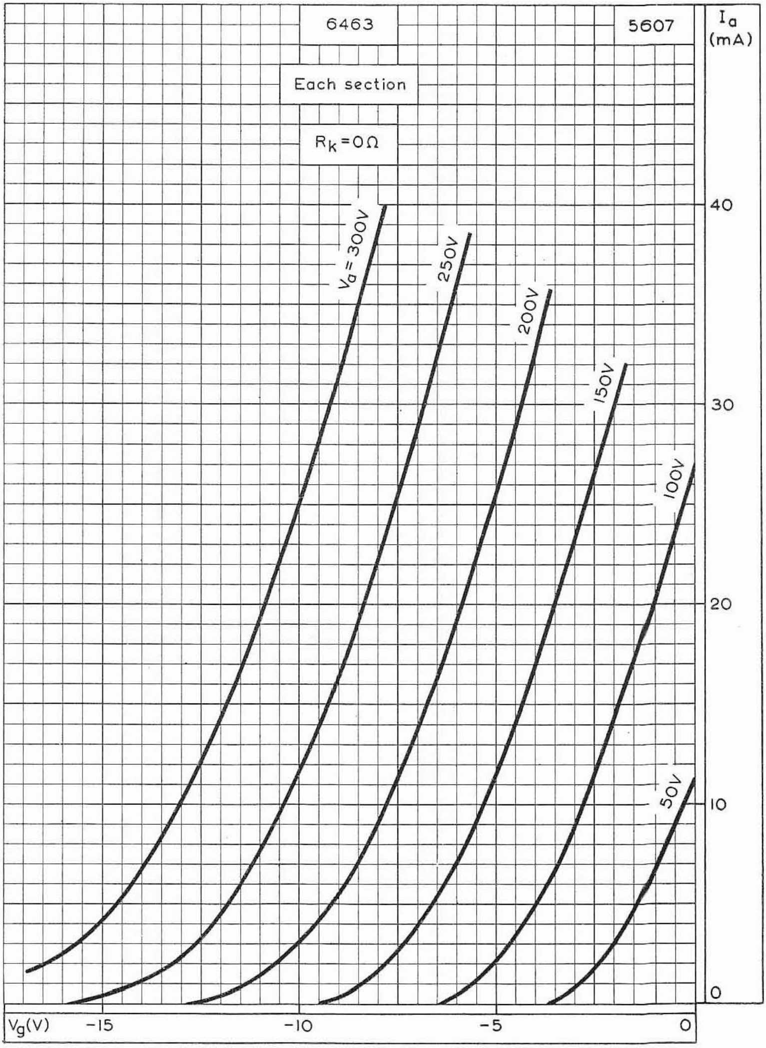
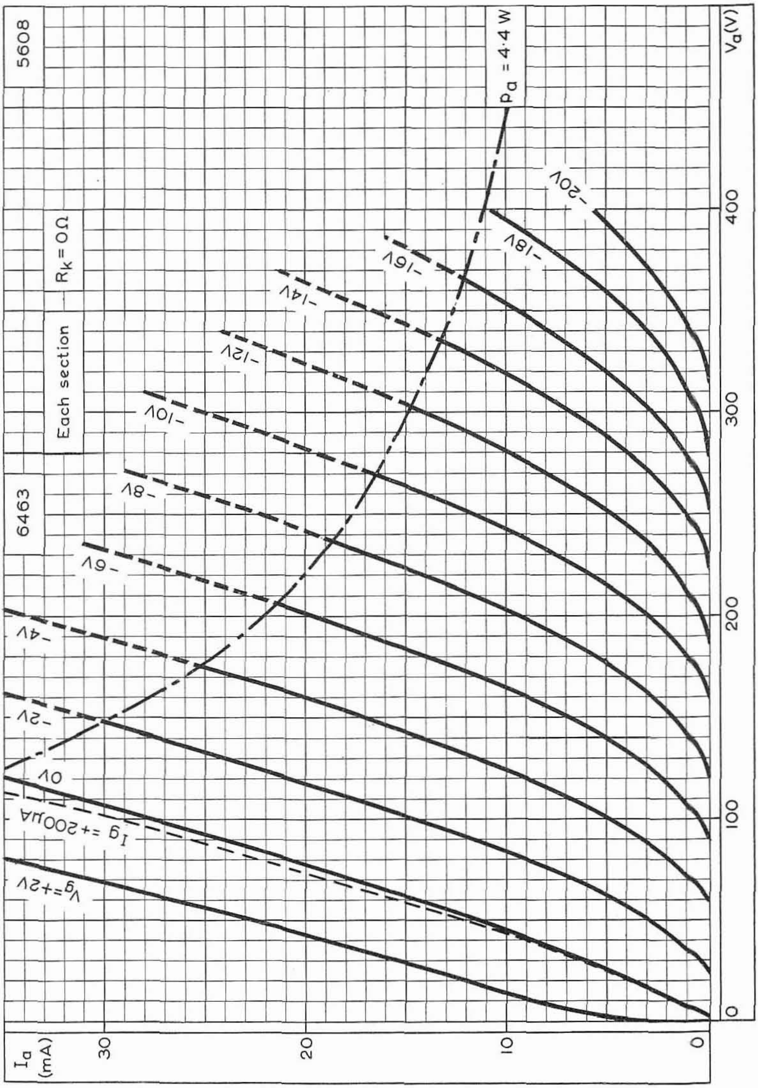
All dimensions in mm

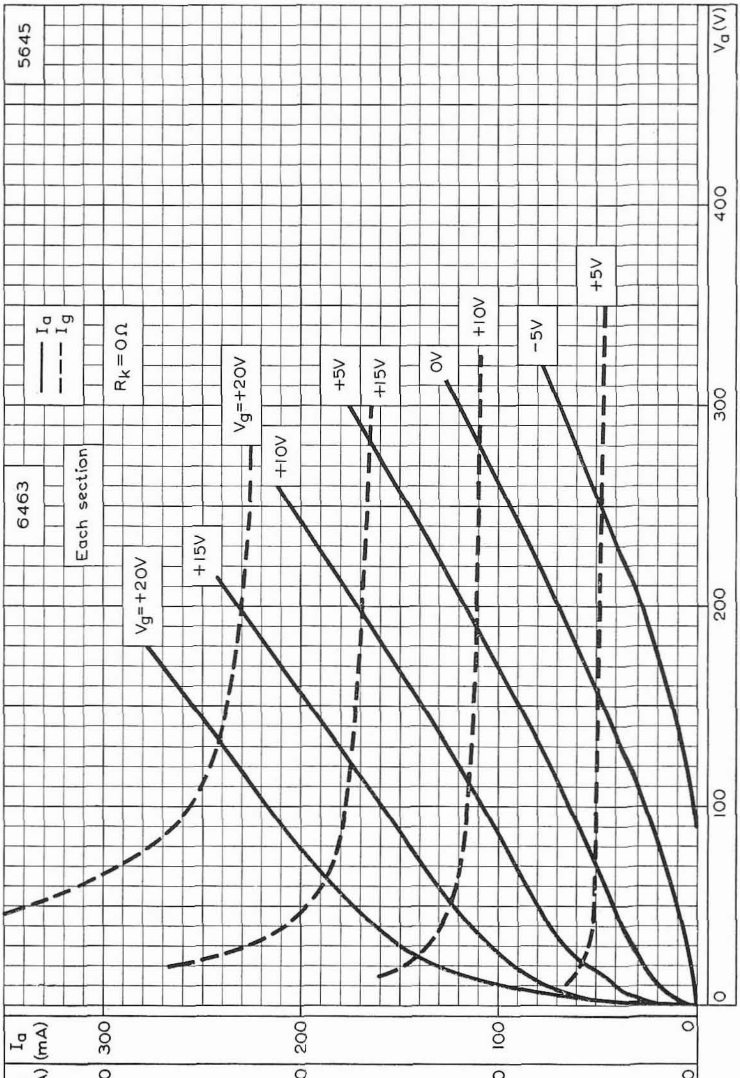
The bulb and base dimensions of this valve are in accordance with BS448, Section B9A.



ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



ANODE CURRENT AND GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

Mullard

Mu

TECH

HAN

V

RECEIVING VALVE

CATHODE

MISCELLAN