DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

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	12.6	6.3	V
I_h	150	300	mA

CAPACITANCES

$*c_{a-g}$	1.6	pF
$*c_{in}$	2.3	pF
$c_{a'-k'+h}$	0.45	pF
$c_{a''-k''+h}$	0.35	pF
$*c_{a-k}$	0.2	pF
$*c_{h-k}$	2.5	pF
$*c_{k-g+h}$	4.7	pF
$c_{a'-g'+h}$	1.9	pF
$c_{a''-g''+h}$	1.8	pF
$c_{a'-a''}$	<0.4	pF
c_{g-h}	<0.17	pF
$c_{g'-g''}$	<0.005	pF
$c_{a'-g''}$	<0.07	pF
$c_{a''-g'}$	<0.04	pF

*Each section

CHARACTERISTICS (each section)

V_a	100	170	200	250	V
I_a	3.0	8.5	11.5	10	mA
V_g	−1.0	−1.0	−1.0	−2.0	V
g_m	3.75	5.9	6.7	5.5	mA/V
μ	62	66	70	60	
r_a	16.5	11	10.5	11	kΩ
$*r_{g-k}$	21	16	14	25	kΩ

*Measured at f=50Mc/s

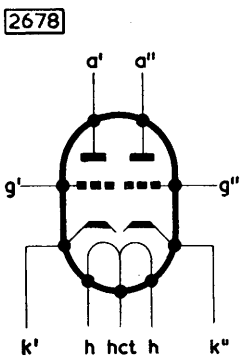
LIMITING VALUES (each section)

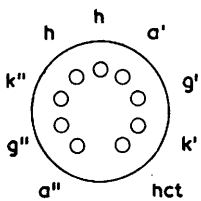
$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.5	W
I_k max.	15	mA
$-V_g$ max.	50	V
V_g (I_g=+0.3μA)	−1.3	V
R_{g-k} max. (self-bias)	1.0	MΩ
V_{h-k} max.	150	V
R_{h-k} max.	20	kΩ

ECC81

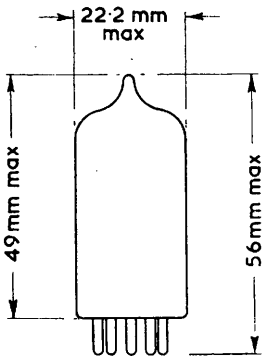
DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.





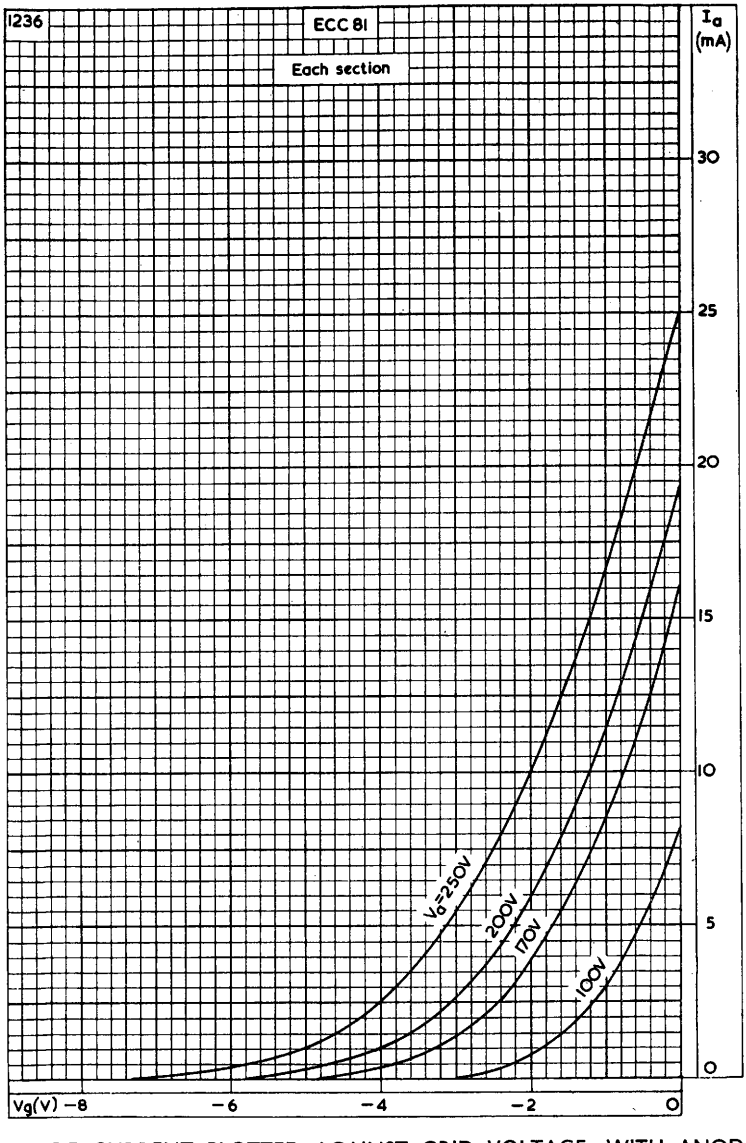
B9A Base



DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300 Mc/s.

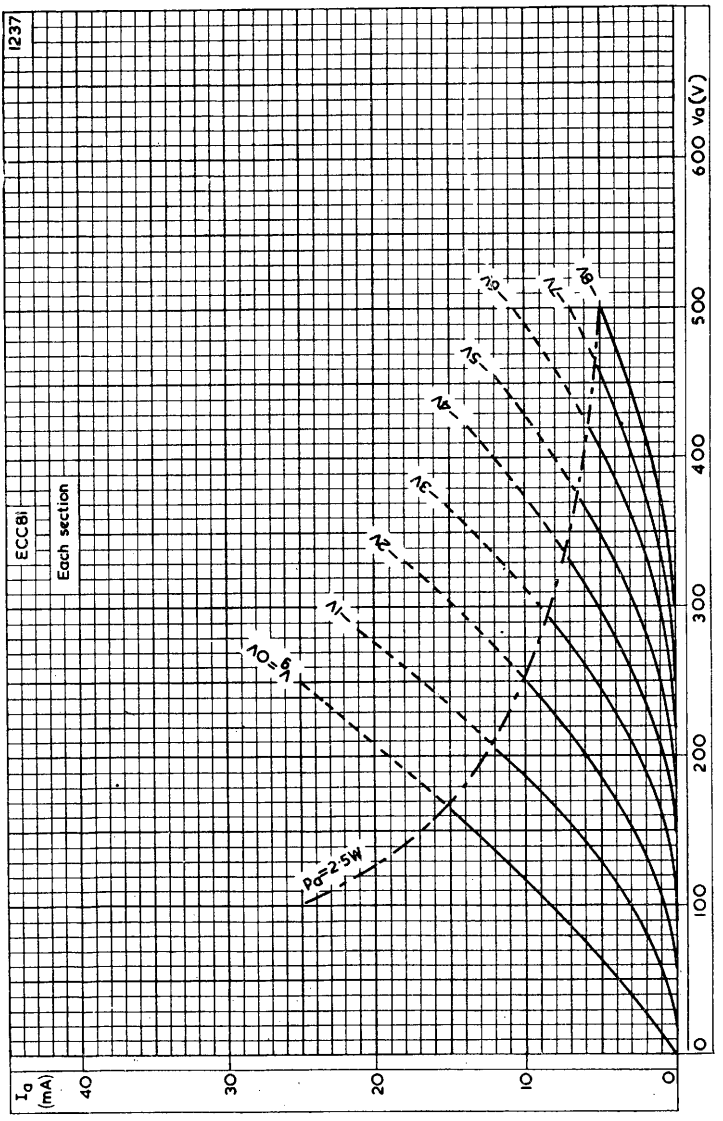


ANODE CURRENT PLOTTED AGAINST GRID VOLTAGE, WITH ANODE VOLTAGE AS PARAMETER (EACH SECTION)

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

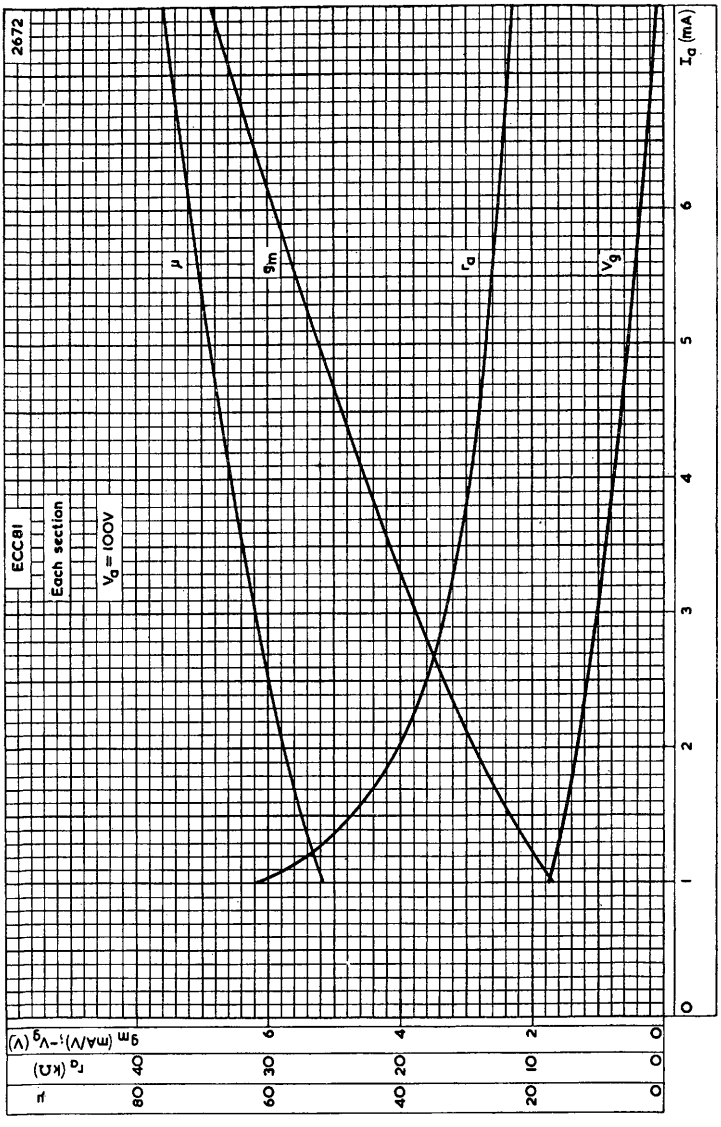


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE, WITH GRID VOLTAGE AS PARAMETER (EACH SECTION)

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

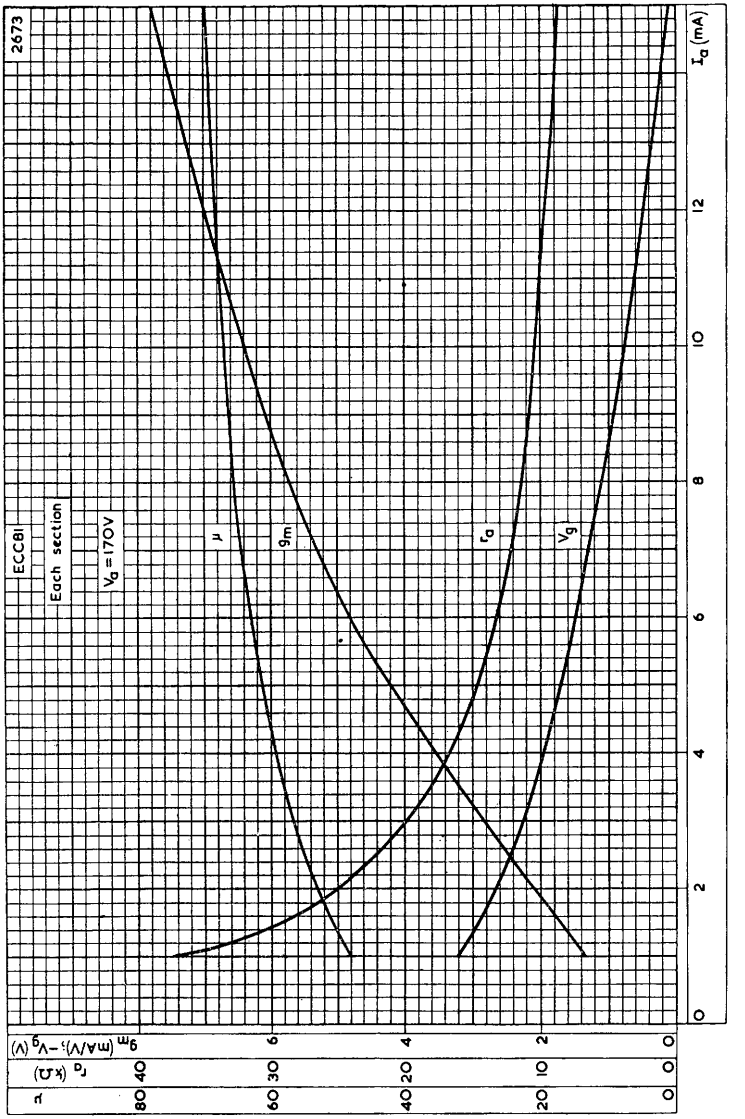


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 100V (EACH SECTION)

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f amplifier at frequencies up to 300Mc/s.

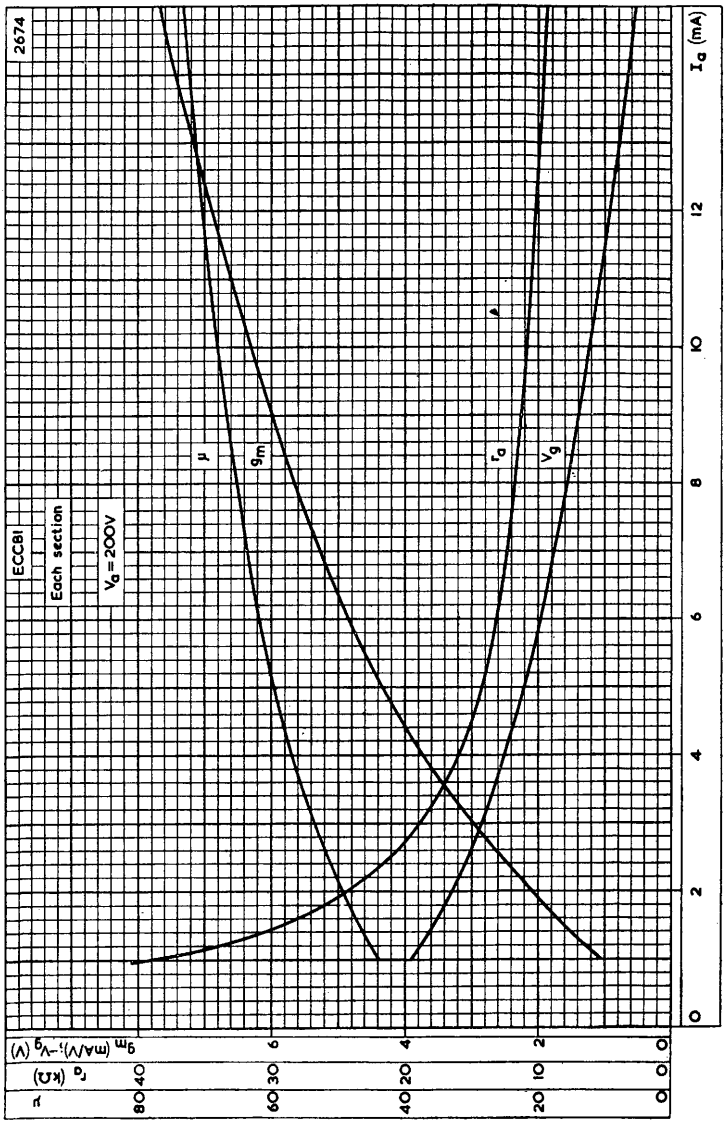


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR, AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 170V (EACH SECTION)

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

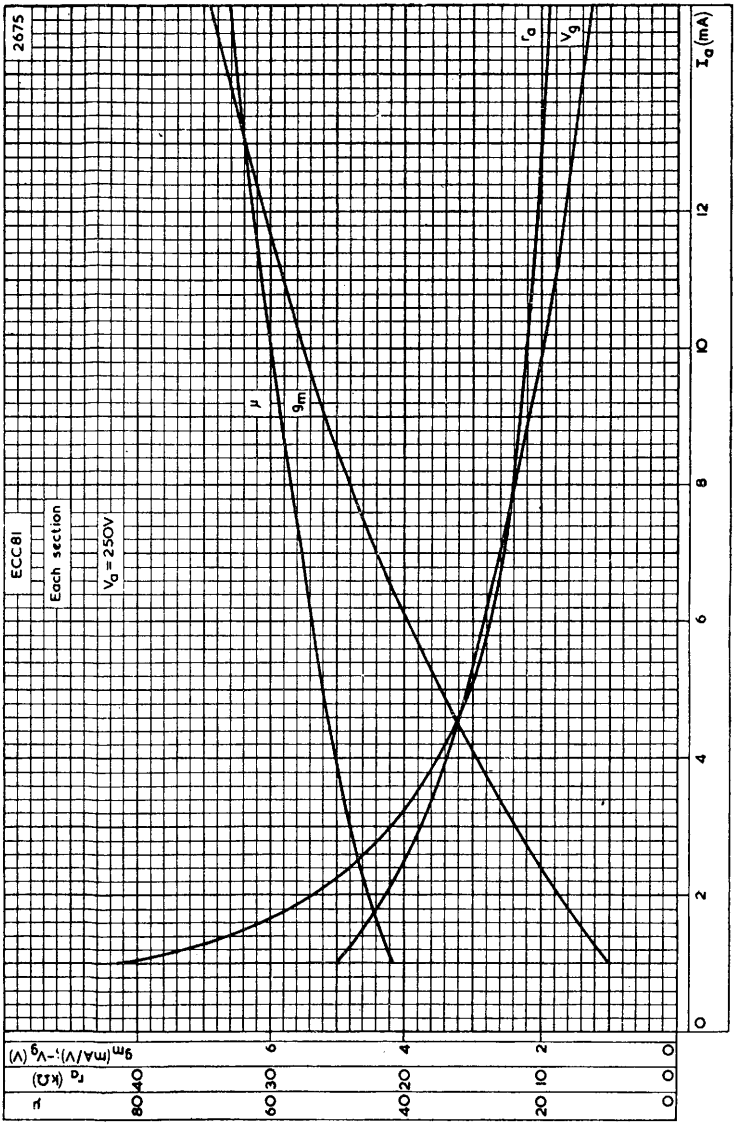


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 200V (EACH SECTION)

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

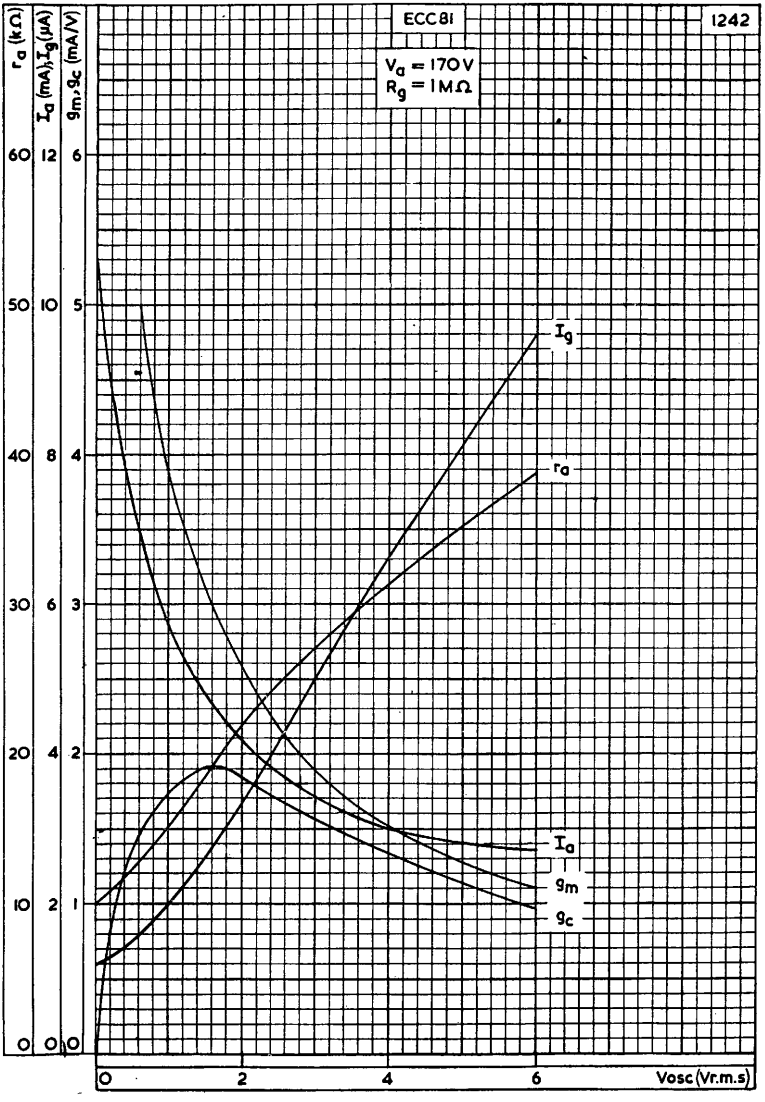


GRID VOLTAGE, MUTUAL CONDUCTANCE, AMPLIFICATION FACTOR AND INTERNAL RESISTANCE PLOTTED AGAINST ANODE CURRENT, FOR ANODE VOLTAGE OF 250V (EACH SECTION)

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

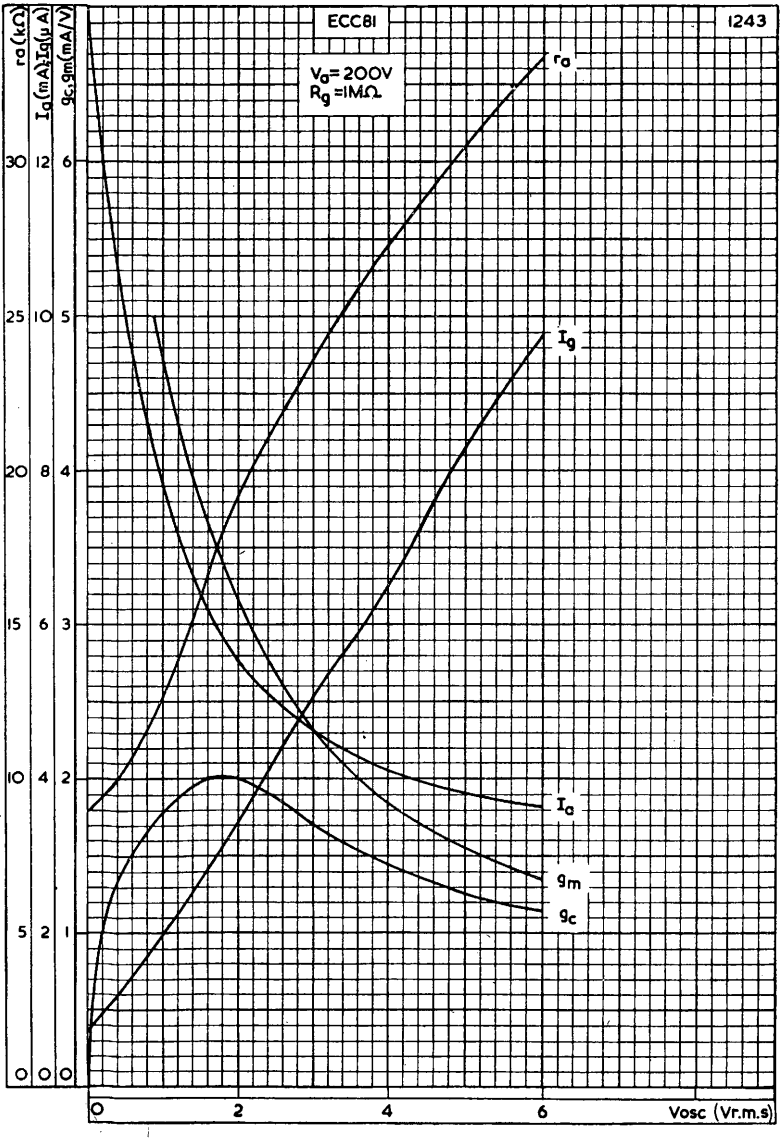


PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 170V

ECC81

DOUBLE TRIODE

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.

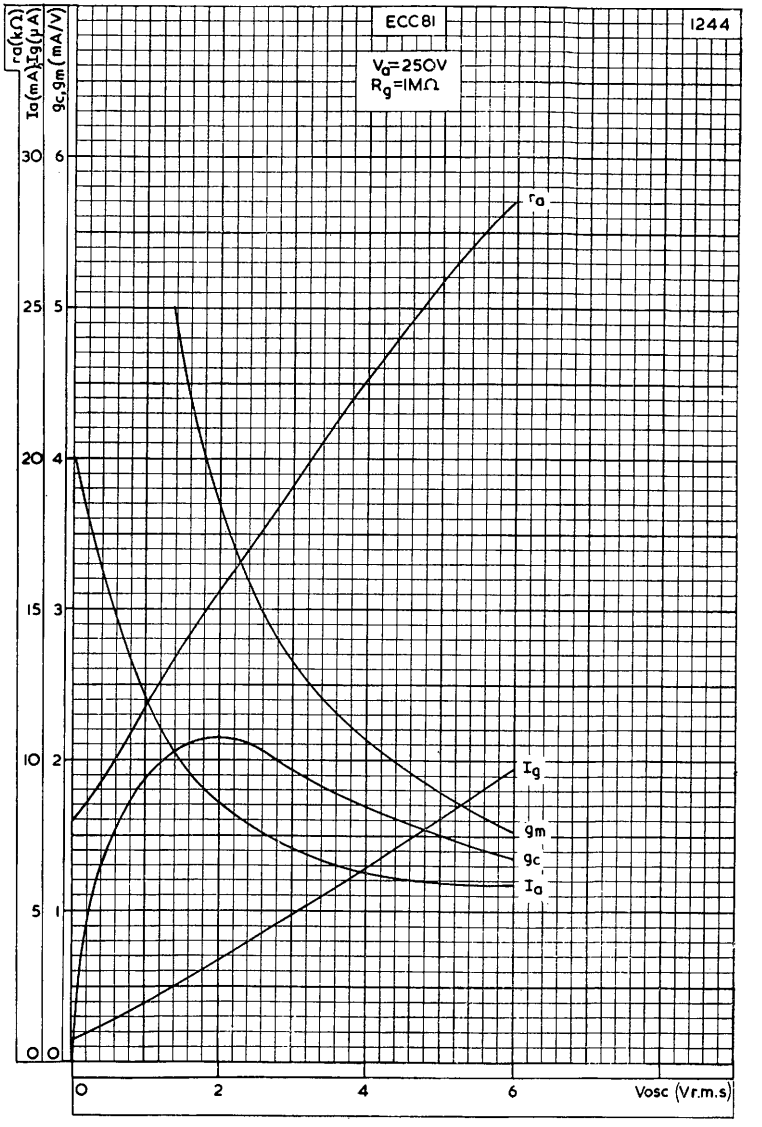


PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 200V

DOUBLE TRIODE

ECC81

Double triode primarily intended for use as a frequency changer or r.f. amplifier at frequencies up to 300Mc/s.



PERFORMANCE CURVES AS FREQUENCY CHANGER AT ANODE VOLTAGE OF 250V

DOUBLE TRIODE

ECC82

Low μ double triode having separate cathodes, primarily intended for use as an amplifier or oscillator.

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	12.6	6.3	V
I_h	150	300	mA

CAPACITANCES (measured without an external shield) ←

*C_{a-g}	1.5	pF
*C_{in}	1.8	pF
$C_{out'}$	370	mpF
$C_{out''}$	250	mpF
*C_{g-h}	<135	mpF
$C_{a'-a''}$	<1.1	pF
$C_{a''-g'}$	<60	mpF
$C_{a'-g''}$	<110	mpF
$C_{g'-g''}$	<10	mpF

*Each section

CHARACTERISTICS (each section)

V_a	100	250	V
I_a	11.8	10.5	mA ←
V_g	0	−8.5	V
g_m	3.1	2.2	mA/V
μ	19.5	17	←
r_a	6.25	7.7	kΩ ←
V_g max. (I_g = +0.3μA)		−1.3	V ←

OPERATING CONDITIONS (each section)

As an a.f. amplifier

V_b (V)	R_a (kΩ)	I_k (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	V_{out}* ($V_{r.m.s.}$)	D_{tot}* (%)	R_g† (kΩ)
400	47	5.0	1.2	13.5	59	6.7	150
350	47	4.3	1.2	13.5	51	6.6	150
300	47	3.7	1.2	13.5	43	6.5	150
250	47	3.0	1.2	13.5	34	6.4	150
200	47	2.4	1.2	13.5	26	6.3	150
150	47	1.8	1.2	13.5	18	6.1	150
100	47	1.2	1.2	13.5	11	5.6	150
400	100	2.6	2.2	14	57	6.2	330
350	100	2.3	2.2	14	49	6.1	330
300	100	2.0	2.2	14	41	6.0	330
250	100	1.6	2.2	14	32	5.9	330
200	100	1.3	2.2	14	25	5.8	330
150	100	1.0	2.2	14	17	5.6	330
100	100	0.7	2.2	14	10	4.8	330
400	220	1.3	3.9	14.5	50	5.1	680
350	220	1.2	3.9	14.5	43	5.0	680
300	220	1.0	3.9	14.5	36	4.9	680
250	220	0.8	3.9	14.5	28	4.8	680
200	220	0.7	3.9	14.5	22	4.7	680
150	220	0.5	3.9	14.5	15	4.4	680
100	220	0.3	3.9	14.5	8.0	4.0	680

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

†R_g = grid resistor of following valve.

LIMITING VALUES (each section)

$V_{a(b)}$ max.	550	V
V_a max.	300	V
p_a max.	2.75	W
I_k max.	20	mA
*$i_{k(pk)}$ max.	150	mA ←
$-V_g$ max.	100	V ←
$-v_{g(pk)}$ max.	250	V ←
R_{g-k} max. (fixed bias)	1.5	MΩ
V_{h-k} max.	180	V
†R_{h-k} max.	20	kΩ

†When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 150kΩ.

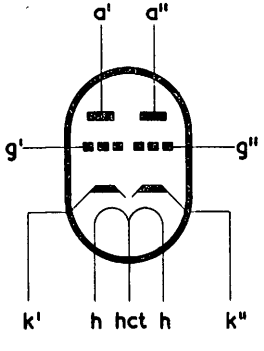
*Maximum pulse duration = 200μs.

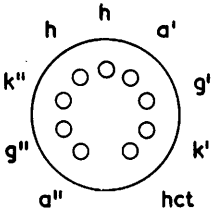
OPERATING NOTES

This valve can be used without special precautions against microphony in equipment where the input voltage is not less than 10mV for an output of 50mW (or 100mV for 5W output).

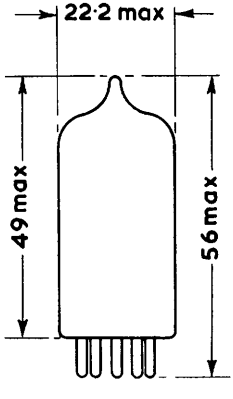
With V_h applied between pin 9 and pins 4 and 5 connected together, and with the centre tap of the heater transformer earthed, the section connected to pins 6, 7 and 8 is the most favourable with regard to hum.

6922



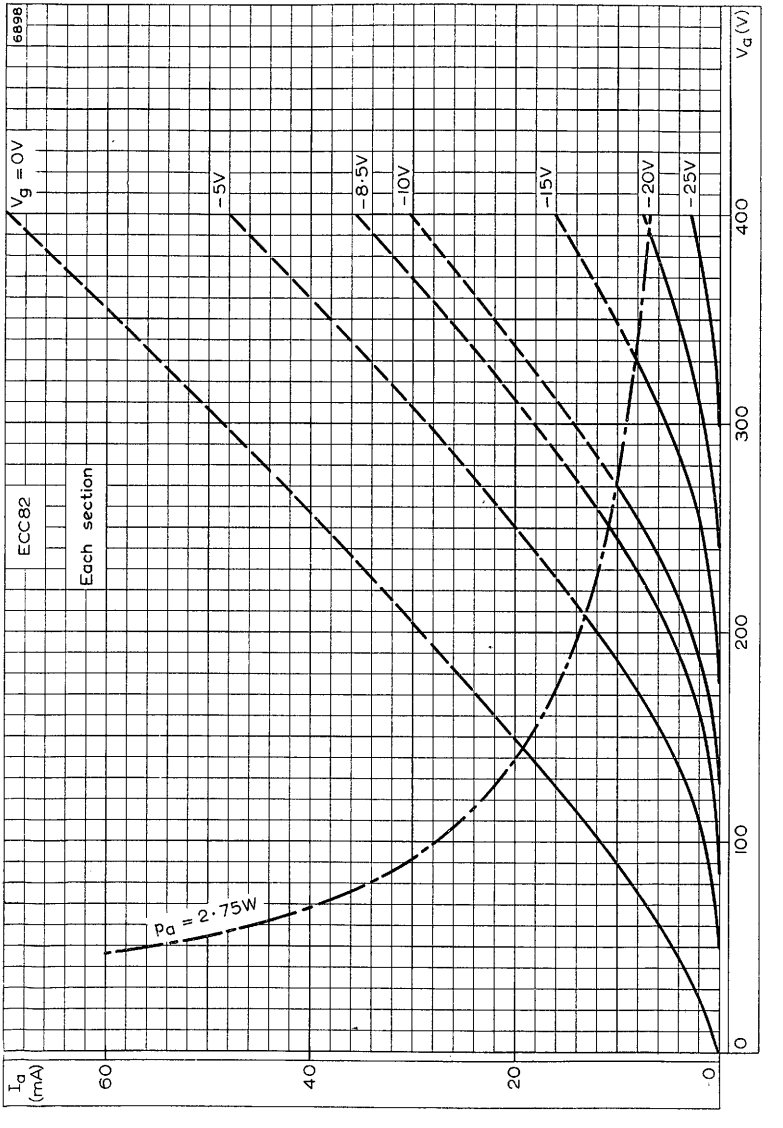


B9A Base

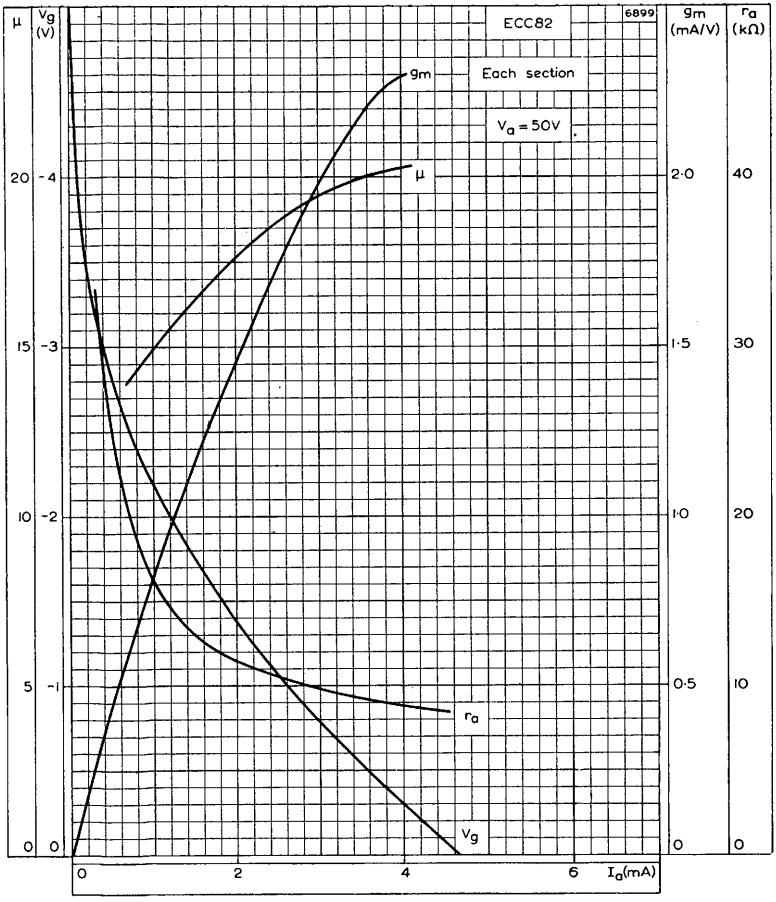


All dimensions in mm

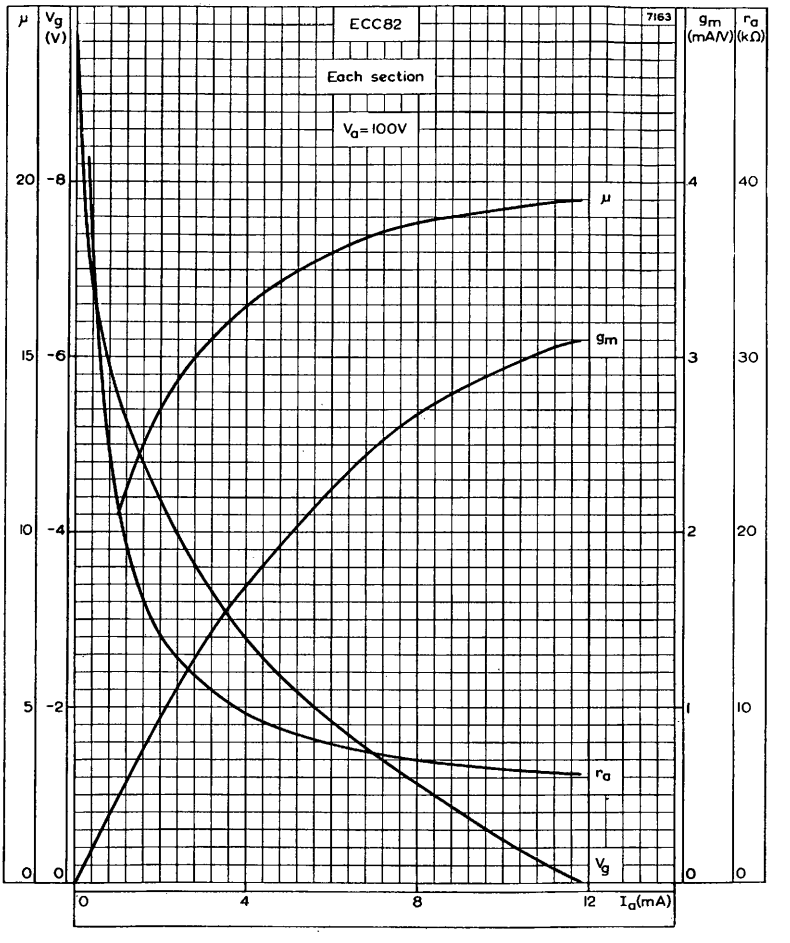
ECC82



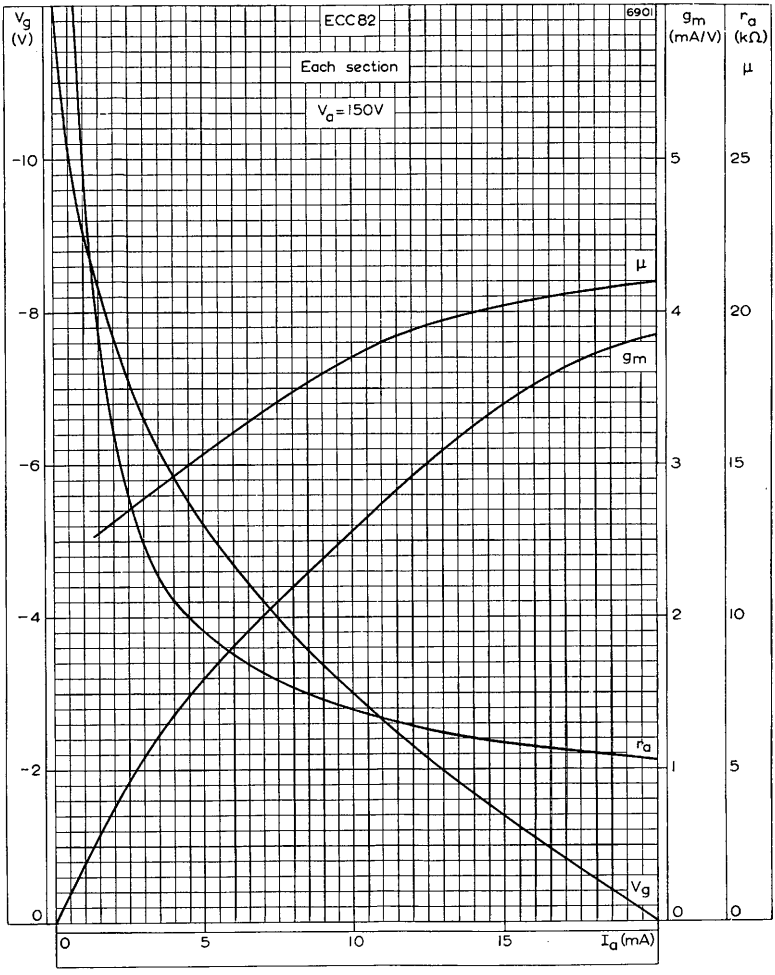
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER



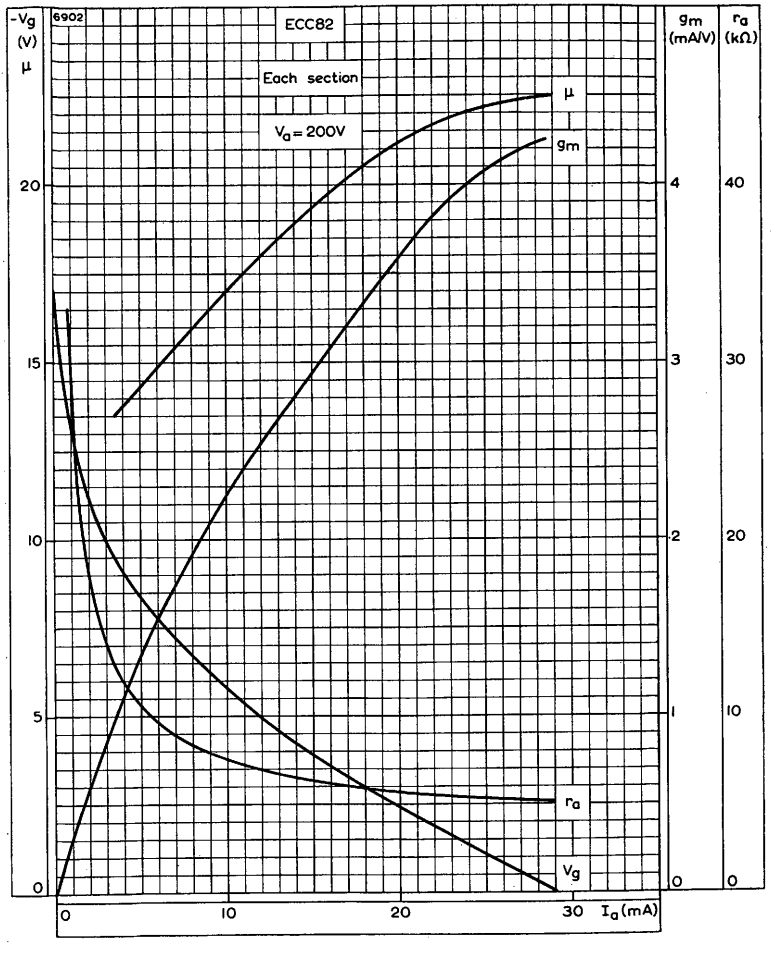
ANODE IMPEDANCE, AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. $V_a = 50V$



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



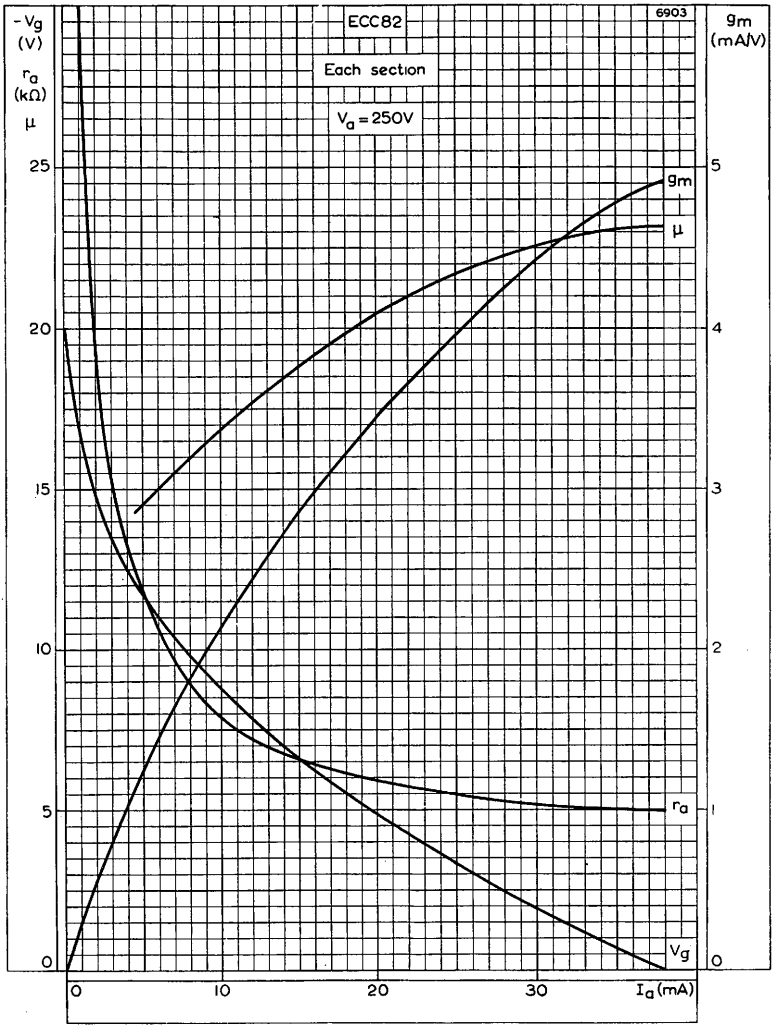
ANODE IMPEDANCE, AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. V_a = 150V



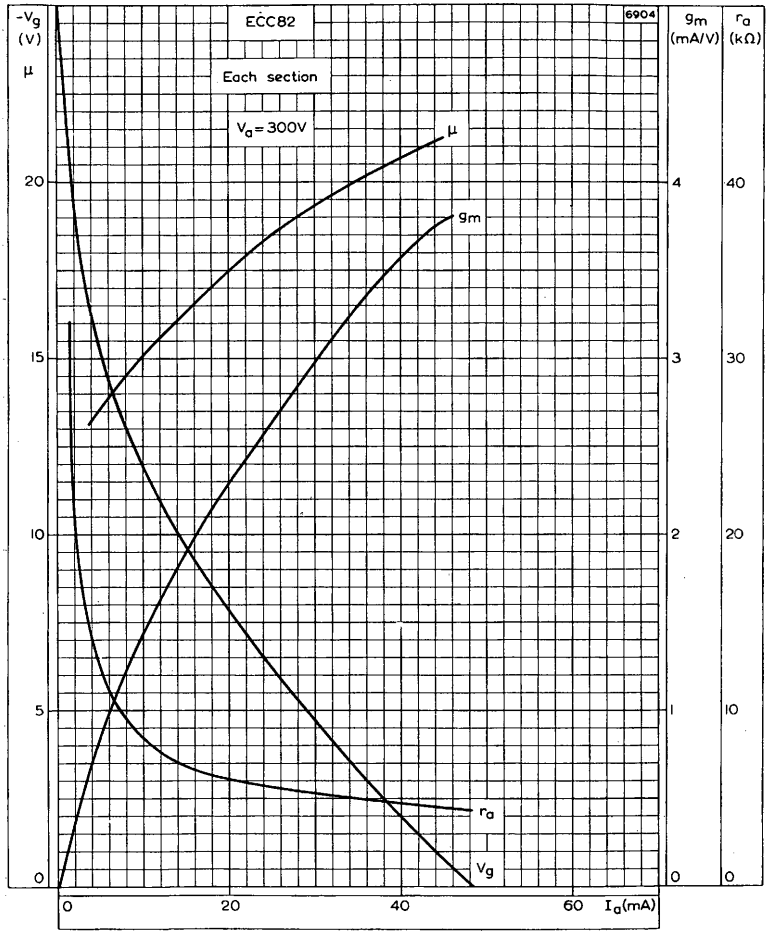
ANODE IMPEDANCE, AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. V_a = 200V

ECC82

DOUBLE TRIODE



ANODE IMPEDANCE, AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. $V_a = 250V$



ANODE IMPEDANCE, AMPLIFICATION FACTOR, MUTUAL CONDUCTANCE AND GRID VOLTAGE PLOTTED AGAINST ANODE CURRENT. V_a = 300V

DOUBLE TRIODE

ECC83

High μ double triode, having separate cathodes, primarily intended for use as a resistance-coupled amplifier or phase inverter.

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	12.6	6.3	V
I_h	150	300	mA

CAPACITANCES

$c_{out'}$	330	mpF
$c_{out''}$	230	mpF
*c_{in}	1.6	pF
*c_{a-g}	1.6	pF
$c_{a'-a''}$	<1.2	pF
$c_{a''-g'}$	<100	mpF
$c_{a'-g''}$	<110	mpF
$c_{g'-g''}$	<10	mpF
*c_{g-h}	<150	mpF

*Each section

CHARACTERISTICS (each section)

V_a	100	250	V
I_a	0.5	1.2	mA
V_g	−1.0	−2.0	V
g_m	1.25	1.6	mA/V
μ	100	100	
r_a	80	62.5	kΩ
V_g max. ($I_g = +0.3\mu A$)		−0.9	V

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER with grid current bias (R_g = 10MΩ)

				Z_s = 0kΩ		Z_s = 220kΩ	
V_b (V)	R_a (kΩ)	R_g'** (kΩ)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	$V_{out(r.m.s.)}$* (V)	$\frac{V_{out}}{V_{in}}$	$V_{out(r.m.s.)}$† (V)
400	47	150	3.4	47	43	38	46
350	47	150	2.8	46	36	37	38
300	47	150	2.2	44	29	36	30
250	47	150	1.7	42	22	34	24
200	47	150	1.2	39	15	32	17
400	100	330	2.1	61	59	49	62
350	100	330	1.75	60	49	48	52
300	100	330	1.4	58	39	47	42
250	100	330	1.1	56	30	46	33
200	100	330	0.8	54	21	43	23
400	220	680	1.2	73	71	58	75
350	220	680	1.0	72	59	57	63
300	220	680	0.8	70	47	56	52
250	220	680	0.6	68	36	54	40
200	220	680	0.45	65	25	52	29

*Output voltage measured at D_{tot} = 5%.

$\frac{V_{out}}{V_{in}}$ measured with $V_{in(r.m.s.)}$ = 100mV

**Grid resistor of following valve.

†When operating this valve with grid current bias and a high source impedance, the second harmonic distortion rises to a peak at quite low levels of output (about $10V_{r.m.s.}$) and then falls with increasing drive. The third harmonic then begins to rise, and D_{tot} finally reaches 5% at a much higher output level than with zero source impedance. The maximum value of this distortion peak varies inversely with the anode load, being about 5.5% with R_a = 47kΩ, 4.5% with R_a = 100kΩ and 4% with R_a = 220kΩ.

OPERATING CONDITIONS AS RESISTANCE COUPLED A.F. AMPLIFIER with cathode bias

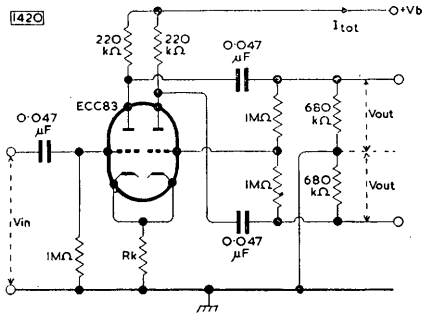
V_b (V)	R_a (kΩ)	I_a (mA)	R_k (kΩ)	$\frac{V_{out}}{V_{in}}$	$V_{out(r.m.s.)}$* (V)	D_{tot}* (%)	R_g'† (kΩ)
400	47	2.2	1.0	43	40.5	5.0	150
350	47	1.7	1.2	42	31	5.0	150
300	47	1.3	1.5	40	22	5.0	150
250	47	0.9	2.2	36	12.5	5.0	150
400	100	1.4	1.5	59	59	5.0	330
350	100	1.1	1.8	57	45	5.0	330
300	100	0.88	2.2	55	32.5	5.0	330
250	100	0.6	3.3	50	18.5	5.0	330
400	220	0.88	2.2	71	63	3.7	680
350	220	0.7	2.7	69	60	5.0	680
300	220	0.5	3.9	65	38.5	5.0	680
250	220	0.38	4.7	62	27	5.0	680

*Output voltage measured at $D_{tot} = 5\%$ or at start of positive grid current. At lower output voltages the distortion is approximately proportional to the output voltage.

†Grid resistor of following valve.

At lower values of V_b, grid current bias should be used.

OPERATING CONDITIONS AS A PHASE INVERTER



V_b (V)	I_{tot} (mA)	R_k (kΩ)	$V_{out(r.m.s.)}$* (V)	$\frac{V_{out}}{V_{in}}$
350	1.3	1.5	44	65
250	0.8	2.2	23	60

*Output voltage measured at $D_{tot}=5\%$.

LIMITING VALUES (each section)

V_a max.	300	V
p_a max.	1.0	W
I_k max.	8.0	mA
$-V_g$ max.	50	V
R_{g-k} max. (fixed bias)	1.0	MΩ
V_{h-k} max.	180	V
†R_{h-k} max.	20	kΩ

†When used as a phase inverter immediately preceding the output stage, R_{h-k} max. may be 150kΩ.

OPERATING NOTES

1. **Microphony**

   This valve may be used without special precautions against microphony in equipment where the input voltage is not less than 5mV for an output of 50mW (or 50mV for 5W output).

2. **Hum**

   With V_h applied between pin 9 and pins 4 and 5 connected together and the centre tap of the heater transformer earthed, the section connected to pins 6, 7 and 8 is the most favourable with regard to hum, and should be used for the input section when the two sections are used in cascade.

   When used as a normal voltage amplifier with $V_b = 250V$, $R_a = 100k\Omega$, $R_g = 330k\Omega$, $R_k = 1.5k\Omega$ (suitably decoupled), the maximum hum level of the input triode is $10\mu V$, the average value being $6\mu V$. If one side of the heater is earthed, rather than the centre tap, it is preferable to earth pins 4 and 5. The average value of hum under these conditions may be $50\mu V$.

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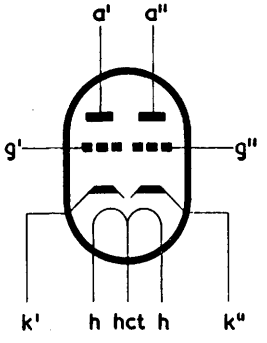
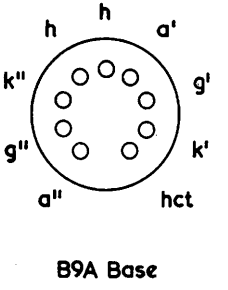
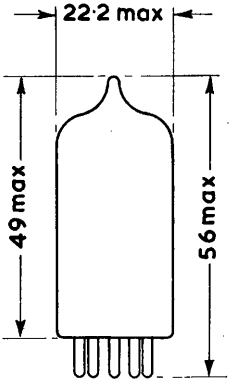
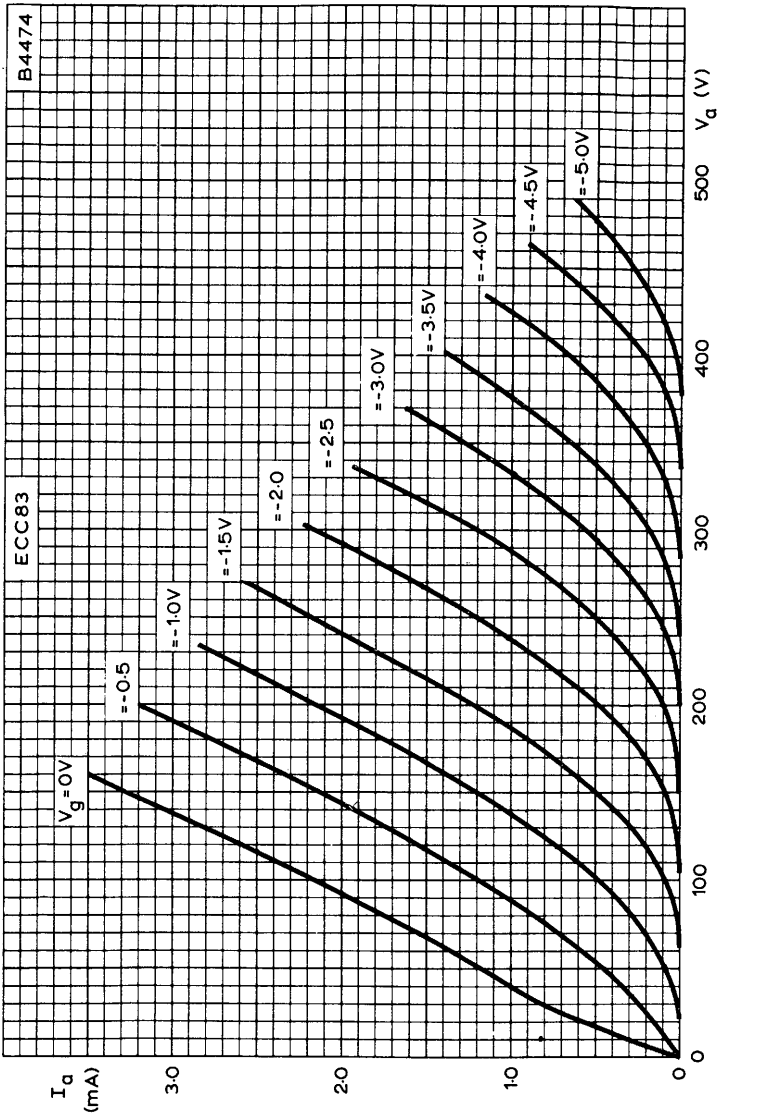




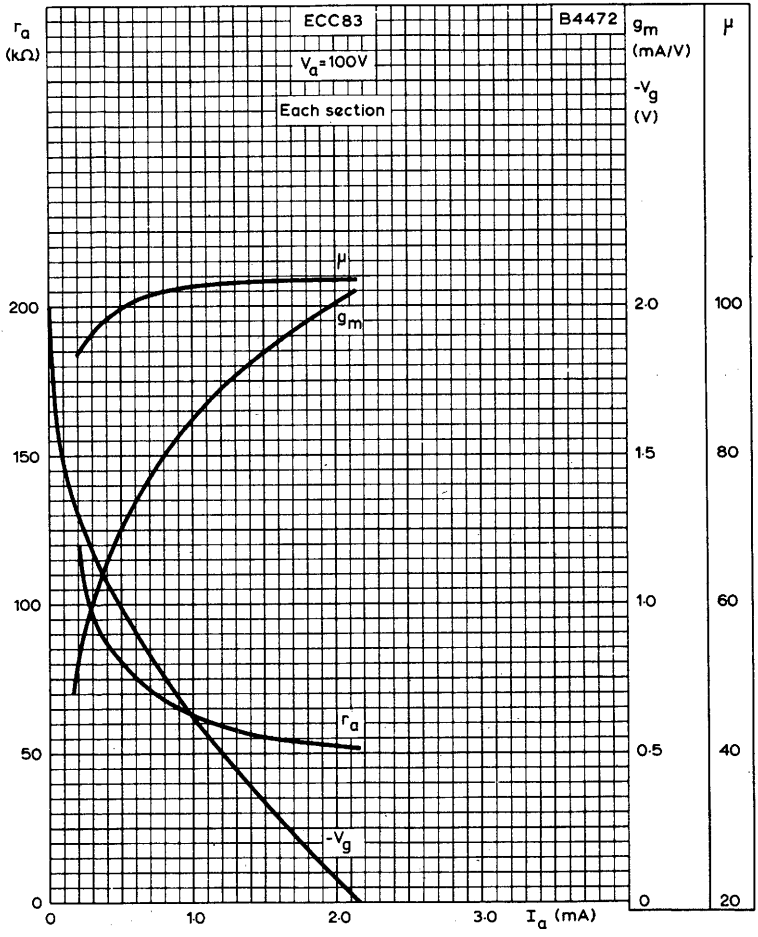
B9A Base



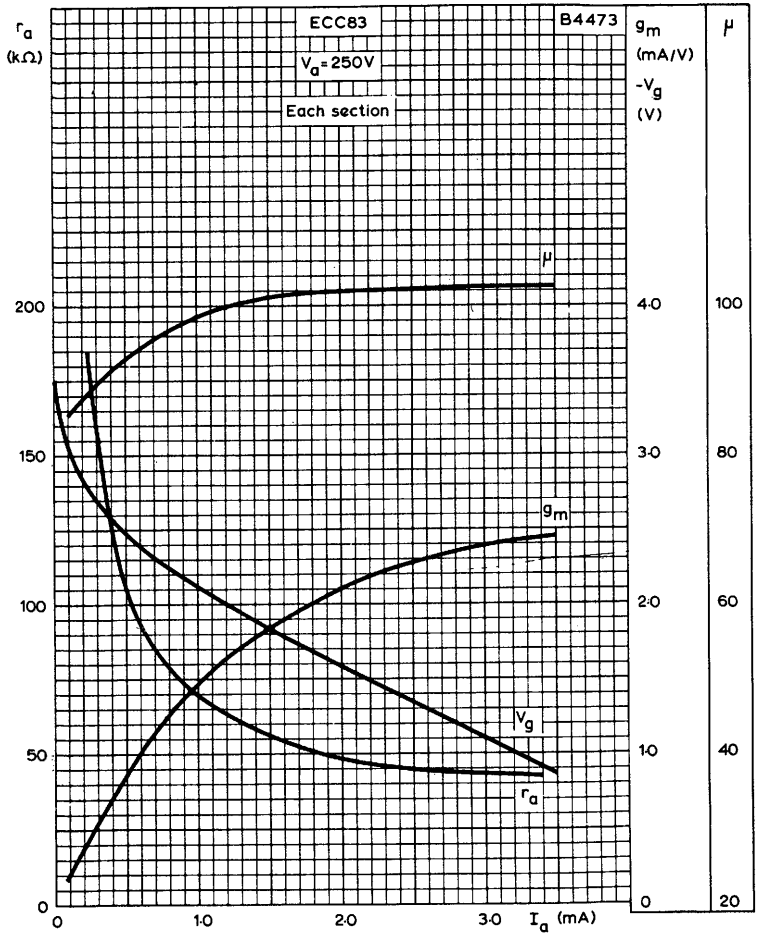
All dimensions in mm



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER (each section)



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



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

V_a = 250V