V.H.F. POWER TRIODE

TY4-500

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

This data should be read in conjunction with "Operating Notes Part I—Power Valves" included in this volume of the Handbook.

FILAMENT Thoriated tungsten

V_f	10	V
I_f	9.9	A

MOUNTING POSITION Vertical only, base up or down.

C_{a-g}	8.0	μμF
C_{g-f}	10	μμF
C_{a-f}	0.3	μμF

CHARACTERISTICS

g_m	4.5	mA/V
μ	28	

COOLING

Max. temperature of base pins	180	°C
Max. temperature of anode seal	220	°C

In order to keep within the temperature limits it may be necessary to direct a low velocity flow of air on to the anode seal and the base of the valve when operated at maximum ratings at frequencies above 50 Mc/s. The air stream on to the base should be directed so that it also passes over the envelope. Below 50 Mc/s, radiation cooling from the envelope is sufficient but an anode terminal connector of large surface area is necessary in order to keep the anode seal cool.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)

Limiting Values

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A

Typical Operating Conditions at f ≤100 Mc/s

V_a	2.5	3.0	3.5	4.0	kV
V_g	−200	−250	−300	−350	V
I_a	535	535	535	535	mA
I_g	115	115	115	115	mA
$v_{in(pk)}$	405	460	520	580	V
P_{drive}	42	48	54	60	W
p_a	390	425	450	450	W
P_{out}	950	1175	1430	1690	W
*P_{load}	760	940	1144	1350	W
η_t	71	73.5	76	79	%

*With a circuit transfer efficiency of 80%

TY4-500

V.H.F. POWER TRIODE

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" ANODE MODULATION)

Limiting Values

V_a max.	3.0	kV
p_a max.	300	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	550	mA
$i_{k(pk)}$ max.	5.0	A

Typical Operating Conditions at f ≤100 Mc/s

V_a	3.0	kV
V_g	−375	V
I_a	450	mA
I_g	85	mA
$v_{in(pk)}$	580	V
P_{drive}	42	W
p_a	300	W
P_{out}	1050	W
*P_{load}	840	W
η	78	%
For 100% modulation		
P_{mod}	675	W

*With a circuit transfer efficiency of 80%

OPERATING CONDITIONS FOR TWO VALVES AS GROUNDED GRID R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)

Limiting Values

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A

Typical Operating Conditions at f ≤100 Mc/s

V_a	2.5	3.0	3.5	4.0	kV
V_g	−200	−250	−300	−350	V
I_a	2×535	2×535	2×535	2×535	mA
I_g	2×115	2×115	2×115	2×115	mA
$v_{in(g-g)\ pk}$	810	920	1040	1160	V
P_{drive}	2×212	2×248	2×274	2×320	W
p_a	2×390	2×425	2×450	2×450	W
*P_{out}	1900+340	2350+400	2860+440	3380+520	W
†P_{load}	1790	2200	2640	3120	W
‡η	71	73.5	76	79	%

*Includes power transferred from driving stage.

†With a circuit transfer efficiency of 80%

‡Valve efficiency.

V.H.F. POWER TRIODE

TY4-500

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

INDUSTRIAL RATINGS

Limiting Values (Absolute Ratings)

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g (p_a=450W) max.	115	mA
I_g (p_a=150W) max.	150	mA
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A

Recommended operating conditions providing reserves against such exigencies as variations of supply voltage, insertion of load material of poor power factor and *momentary* overload due to circuit flashover.

A reliable overload circuit breaker is necessary to protect the valve in case oscillation ceases for any reason.

Anode Supply	Smoothed d.c.	F.W. rectification: unsmoothed	
$V_{transformer\ (r.m.s.)}$	—	4000–0–4000	V
V_a	3.6	3.24	kV
I_a	386	348	mA
I_g	120	108	mA
I_g (at I_a=120 mA)	150	135	mA
R_{g-f}	3.0	3.0	kΩ
P_{drive}	67	67	W
P_{out}	1.06	1.06	kW
P_{load} (matched)	750	750	W
p_a	310	310	W
*P_{load} (typical)	650	650	W
p_a	450	450	W

*This condition results from setting up a dielectric heater to treat a normal load of, say, phenolic resin and substituting a similar weight of a different powder, such as paper-filled urea coloured with titanium oxide.

Operating conditions for a valve fully protected against every contingency.

Anode Supply	Smoothed d.c.	F.W. rectification: unsmoothed	
$V_{transformer\ (r.m.s.)}$	—	4000–0–4000	V
V_a	4.0	3.6	kV
I_a	535	482	mA
I_g	115	100	mA
I_g (at I_a=150 mA)	150	135	mA
R_{g-f}	3.0	3.0	kΩ
P_{drive}	60	60	W
P_{out}	1.69	1.69	kW
*P_{load}	1.25	1.25	kW
p_a	450	450	W

*With a transfer efficiency of 77%

TY4-500

V.H.F. POWER TRIODE

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

OPERATING CONDITIONS FOR TWO VALVES AS A.F. CLASS "B" AMPLIFIER OR MODULATOR

Limiting Values

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	140	mA
I_k max.	700	mA
$i_{k(pk)}$ max.	2.2	A

Typical Operating Conditions

V_a	2.5	3.0	3.5	4.0	kV
V_g	−75	−94	−114	−135	V
$I_{a(o)}$	2× 70	2× 70	2× 70	2× 70	mA
I_a(max. sig.)	2×555	2×500	2×442	2×368	mA
I_g	2×127	2×130	2×115	2× 93	mA
$V_{in(g-g)\ (r.m.s.)}$	378	400	402	404	V
p_a	2×375	2×380	2×330	2×329	W
R_{a-a}	5.2	7.5	10.2	14.5	kΩ
P_{out}	2.0	2.31	2.44	2.21	kW
η	72	77	78.8	77.5	%
D_{tot}	3.5	5.0	5.0	5.0	%

WEIGHT

Valve only	13.5	ozs
	380	g

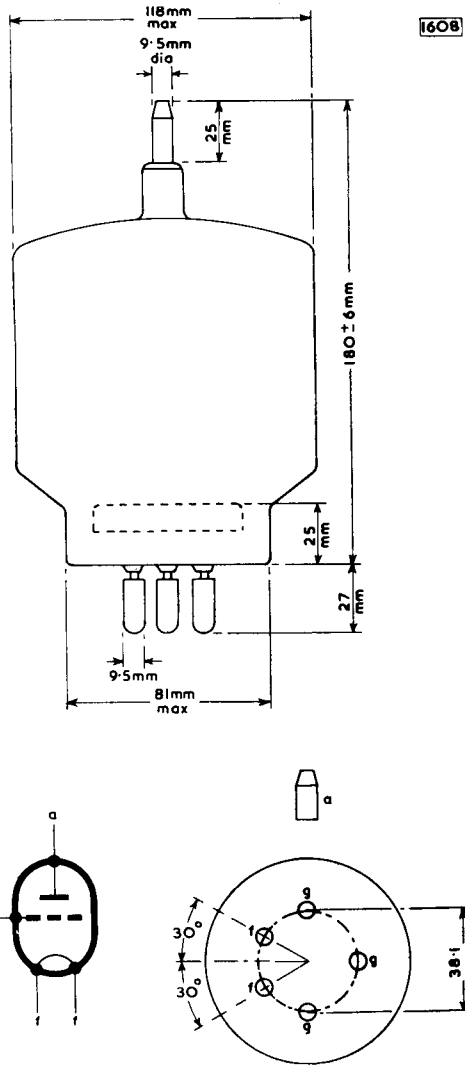
CIRCUIT NOTES

To ensure equal distribution of the currents through the seals the grid leads should be strapped together at the valve holder and the circuit connections joined to the midpoint of the strap. This should not be allowed to impair the free flotation of individual contacts.

V.H.F. POWER TRIODE

TY4-500

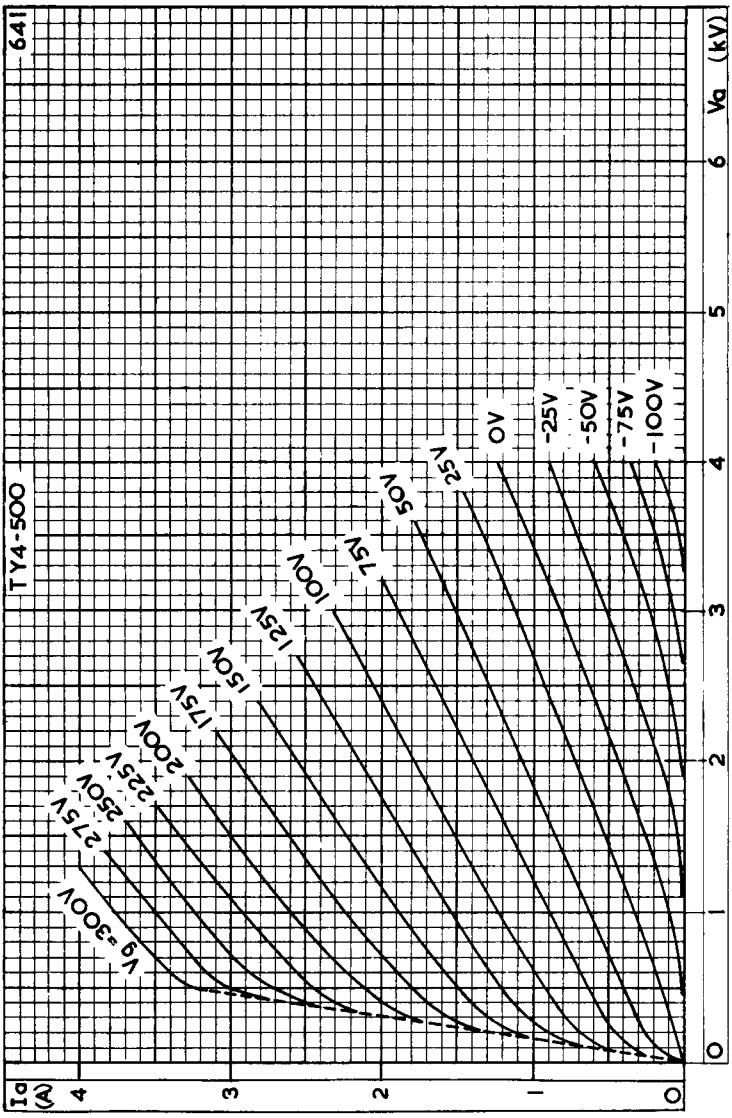
All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.



TY4-500

V.H.F. POWER TRIODE

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

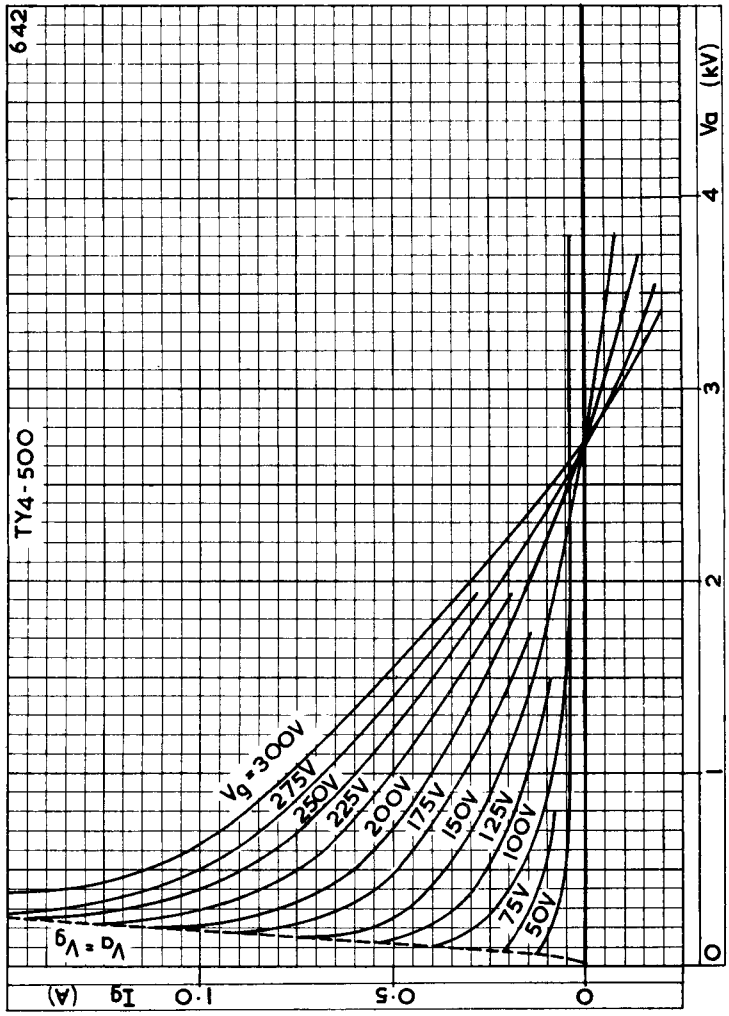


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

V.H.F. POWER TRIODE

TY4-500

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

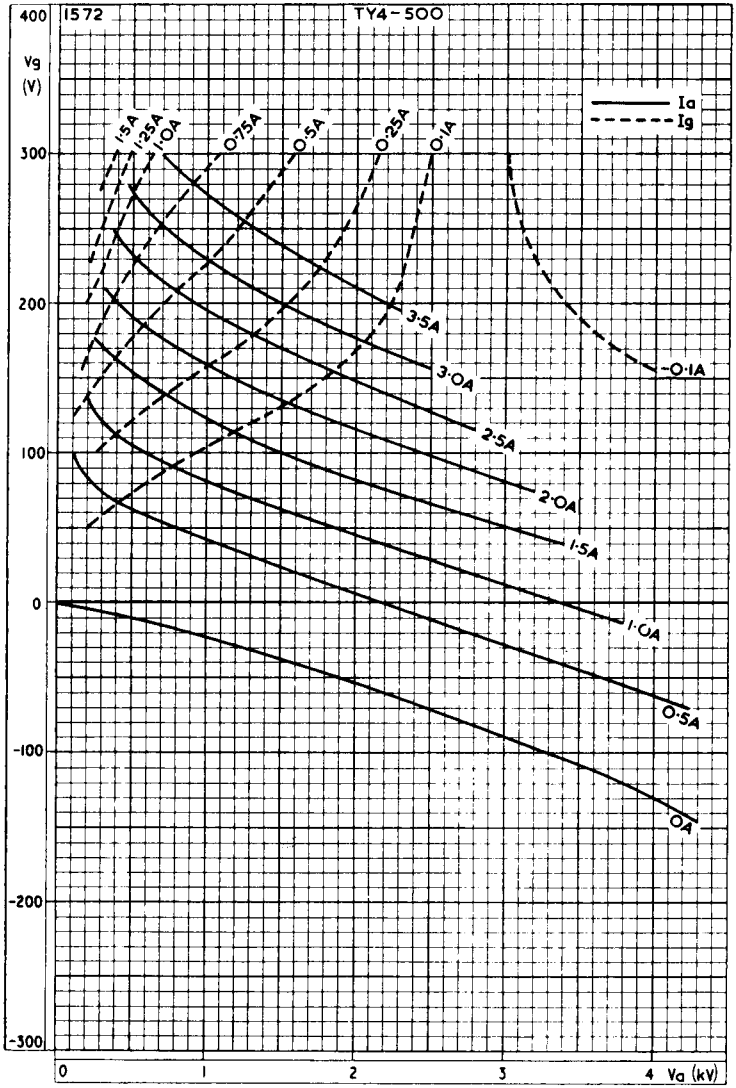


GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE

TY4-500

V.H.F. POWER TRIODE

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

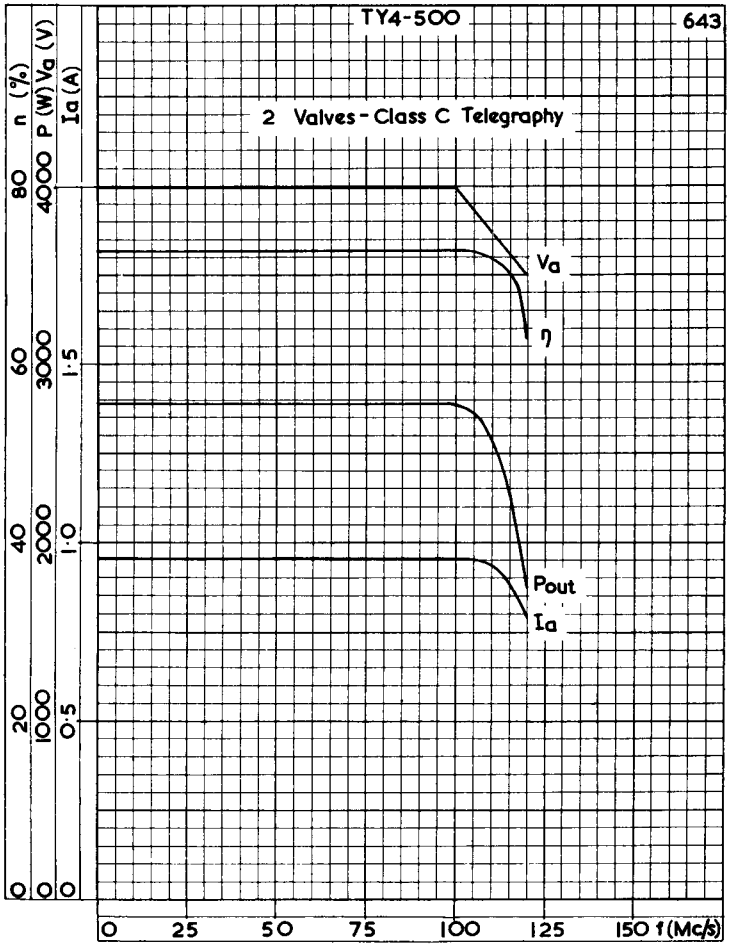


CONSTANT CURRENT CURVES

V.H.F. POWER TRIODE

TY4-500

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

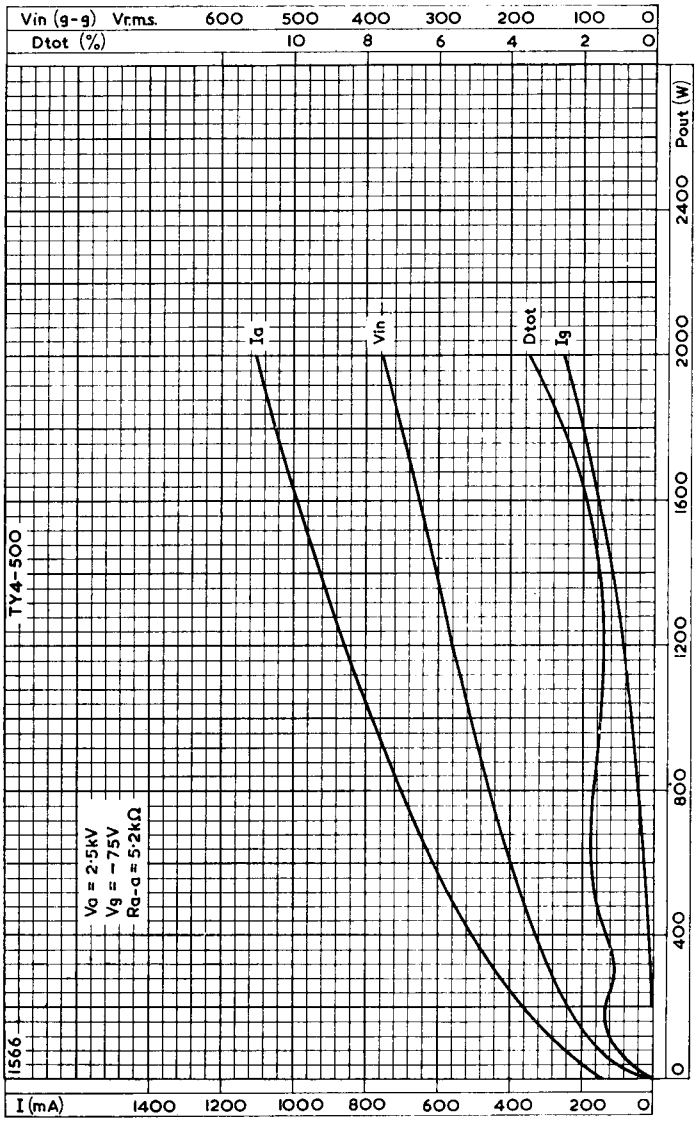


FREQUENCY CHARACTERISTICS

TY4-500

V.H.F. POWER TRIODE

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

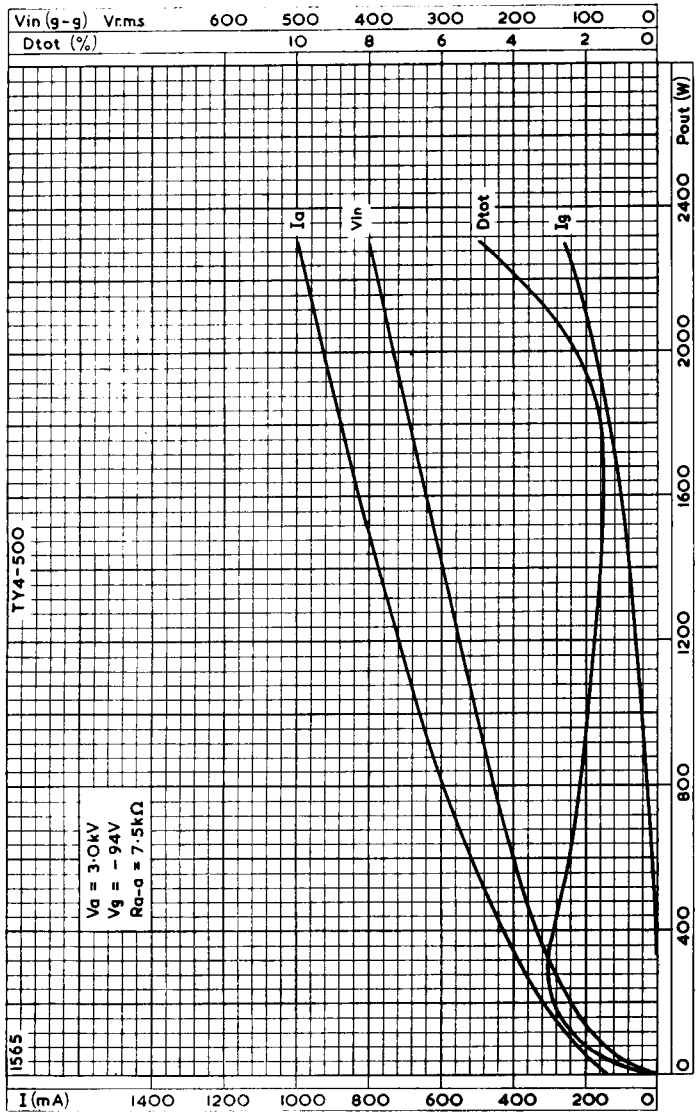


TWO VALVES AS CLASS "B" A.F. AMPLIFIER. $V_a = 2.5$ kV

V.H.F. POWER TRIODE

TY4-500

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

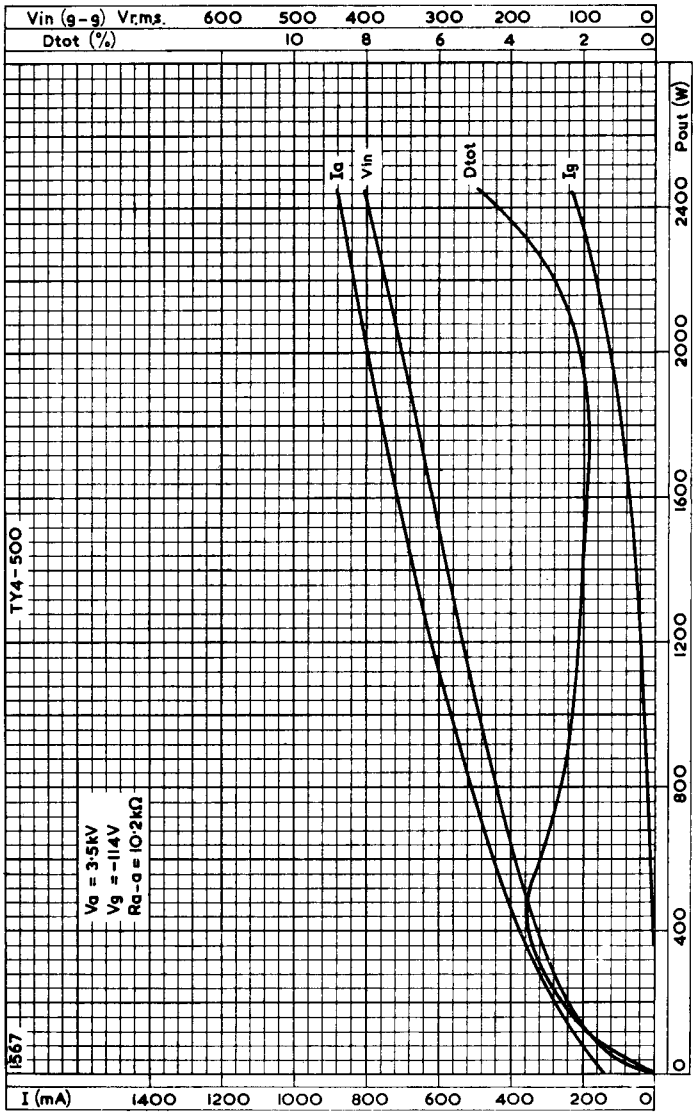


TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=3.0 kV

TY4-500

V.H.F. POWER TRIODE

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s.

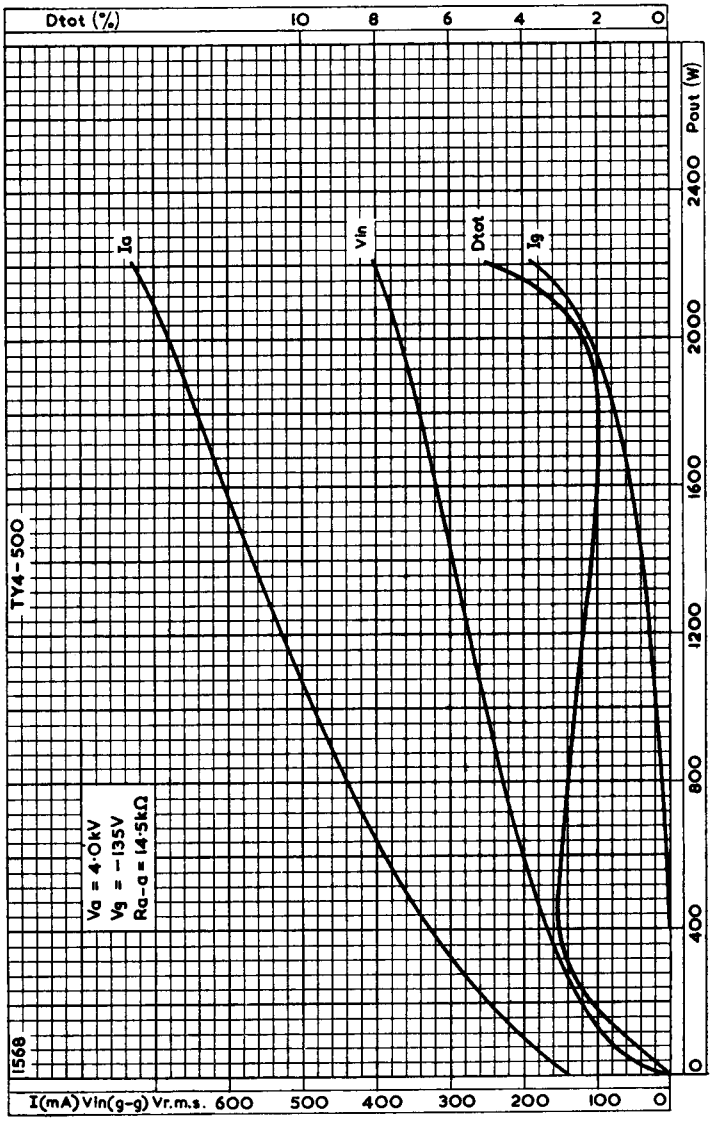


TWO VALVES AS CLASS "B" A.F. AMPLIFIER. $V_a = 3.5$ kV

V.H.F. POWER TRIODE

TY4-500

All-glass triode rated for a maximum anode dissipation of 450 W and suitable for use at frequencies up to 120 Mc/s



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=4.0 kV

TY4-500

QUICK REFERENCE DATA

Radiation cooled triode intended for use as r.f. amplifier or oscillator or a.f. amplifier.

	Class 'C' telegraphy	Class 'C' industrial oscillator	Class 'B' A.F.	
f max.	120	100	—	Mc/s
V_a max.	4.0	4.0	4.0	kV
p_a max.	450	450	450	W
Performance				
f	100	100	—	Mc/s
P_{out}	1.69	1.14	2.44	kW

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES which precede this section of the handbook.

FILAMENT Thoriated tungsten

V_f	10	V
I_f	9.9	A

MOUNTING POSITION Vertical only, base up or down

CAPACITANCES

C_{a-g}	7.0	pF
C_{g-f}	8.0	pF
C_{a-f}	170	mpF

CHARACTERISTICS

g_m (I_a=125mA)	4.5	mA/V
μ	28	

COOLING

Max. temperature of base pins	180	°C
Max. temperature of anode seal	220	°C

In order to keep within the temperature limits it may be necessary to direct a low velocity flow of air on to the anode seal and the base of the valve when operated at maximum ratings at frequencies above 50Mc/s. The air stream on to the base should be directed so that it also passes over the envelope. Below 50Mc/s, radiation cooling from the envelope is sufficient but an anode terminal connector of large surface area is necessary in order to keep the anode seal cool.

TY4-500

V.H.F. POWER TRIODE

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Absolute maximum ratings

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A

Typical operating conditions, grounded cathode

f	100	100	100	100	Mc/s
V_a	2.5	3.0	3.5	4.0	kV
V_g	−200	−250	−300	−350	V
I_a	535	535	535	535	mA
I_g	115	115	115	115	mA
$v_{in(pk)}$	405	460	520	580	V
P_{drive}	42	48	54	60	W
p_a	390	425	450	450	W
P_{out}	950	1175	1430	1690	W
P_{load}	760	940	1144	1350	W
η_a	71	73.5	76	79	%

Typical operating conditions, grounded grid (two valves)

f	100	100	100	100	Mc/s
V_a	2.5	3.0	3.5	4.0	kV
V_g	−200	−250	−300	−350	V
I_a	2 × 535	2 × 535	2 × 535	2 × 535	mA
I_g	2 × 115	2 × 115	2 × 115	2 × 115	mA
$v_{in(g-g)\ pk}$	810	920	1040	1160	V
P_{drive}	2 × 212	2 × 248	2 × 274	2 × 320	W
p_a	2 × 390	2 × 425	2 × 450	2 × 450	W
*P_{out}	1900 + 340	2350 + 400	2860 + 440	3380 + 520	W
P_{load}	1.79	2.2	2.64	3.12	kW
η_a	71	73.5	76	79	%

*Includes power transferred from driver stage.

CLASS 'C' ANODE MODULATION

Absolute maximum ratings (carrier condition for a modulation factor of 1)

V_a max.	3.0	kV
p_a max.	300	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	550	mA
$i_{k(pk)}$ max.	5.0	A

Typical operating conditions at f ⩽ 100Mc/s

V_a	3.0	kV
V_g	−375	V
I_a	450	mA
I_g	85	mA
$v_{in(pk)}$	580	V
P_{drive}	42	W
p_a	300	W
P_{out}	1.05	kW
P_{load}	840	W
η_a	78	%
For 100% modulation		
P_{mod}	675	W

CONTINUOUS INDUSTRIAL OPERATION AS CLASS 'C' OSCILLATOR

Absolute maximum ratings

f max.	100	Mc/s
V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A
I_g (loaded) max.	115	mA
I_g (unloaded) max.	150	mA

Typical operating conditions

Supply	F.W. rectification unsmoothed	
f	100	Mc/s
$V_{tr(r.m.s.)}$	3.5-0-3.5	kV
V_a	3.15	kV
I_a	415	mA
I_g	120	mA
R_{g-f}	3.0	kΩ
R_a	1.4	kΩ
Feedback ratio $\frac{v_{in(pk)}}{v_{a(pk)}}$	0.2	
P_{drive}	60	W
p_a	420	W
P_{out} (less P_{drive})	1.14	kW
η_a	74	%
P_{load}	950	W

TY4-500

V.H.F. POWER TRIODE

INTERMITTENT OPERATION FOR DIELECTRIC WELDING ←

Absolute maximum ratings

f max.	100	Mc/s
Duty factor max.	0.5	
Averaging time max.	10	s
V_a max.	4.0	kV
p_a max.	700	W
p_g max.	72	W
I_g (loaded) max.	160	mA
I_k max.	900	mA
$i_{k(pk)}$ max.	5.0	A

Typical operating conditions

Supply	Smoothed d.c.	F.W. rectification unsmoothed	
f	100	100	Mc/s
Duty factor	0.5	0.5	
Averaging time	10	10	s
$V_{tr(r.m.s.)}$	—	3.5-0-3.5	kV
V_a	3.5	3.15	kV
I_a	750	675	mA
I_g (loaded)	140	125	mA
R_{g-f}	2.2	2.2	kΩ
R_a	2.2	2.2	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.2	0.2	
P_{drive}	75	75	W
P_{out} (less P_{drive})	1.86	1.86	kW
p_a	690	690	W
η_a	74	74	%
P_{load}	1.5	1.5	kW

CLASS 'B' A.F.

Limiting values

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	140	mA
I_k max.	700	mA
$i_{k(pk)}$ max.	2.2	A

Typical operating conditions

V_a	2.5	3.0	3.5	4.0	kV
V_g	−75	−94	−114	−135	V
$I_{a(o)}$	2 × 70	2 × 70	2 × 70	2 × 70	mA
I_a (max. sig.)	2 × 555	2 × 500	2 × 442	2 × 368	mA
I_g	2 × 127	2 × 130	2 × 115	2 × 93	mA
$V_{in(g-g)\ (r.m.s.)}$	378	400	402	404	V
p_a	2 × 375	2 × 380	2 × 330	2 × 329	W
R_{a-a}	5.2	7.5	10.2	14.5	kΩ
P_{out}	2.0	2.31	2.44	2.21	kW
η_a	72	77	78.8	77.5	%
D_{tot}	3.5	5.0	5.0	5.0	%

TY4-500

WEIGHT

Valve only	14.8	oz
	420	g
Valve plus carton	3.1	lb
	1.4	kg

CIRCUIT NOTES

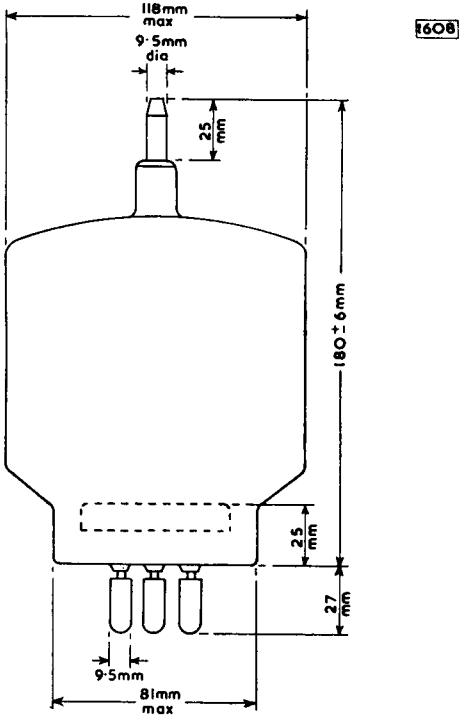
To ensure equal distribution of the currents through the seals the grid leads should be strapped together at the valve holder and the circuit connections joined to the midpoint of the strap. This should not be allowed to impair the free flotation of individual contacts.

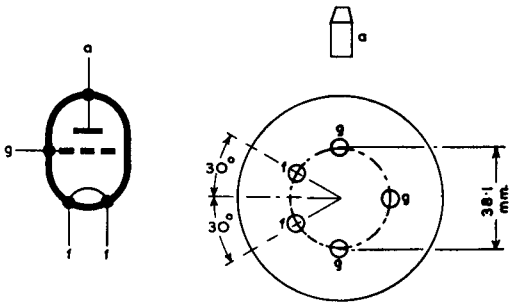
ACCESSORIES

Socket	40216
Anode clip	40626

TY4-500

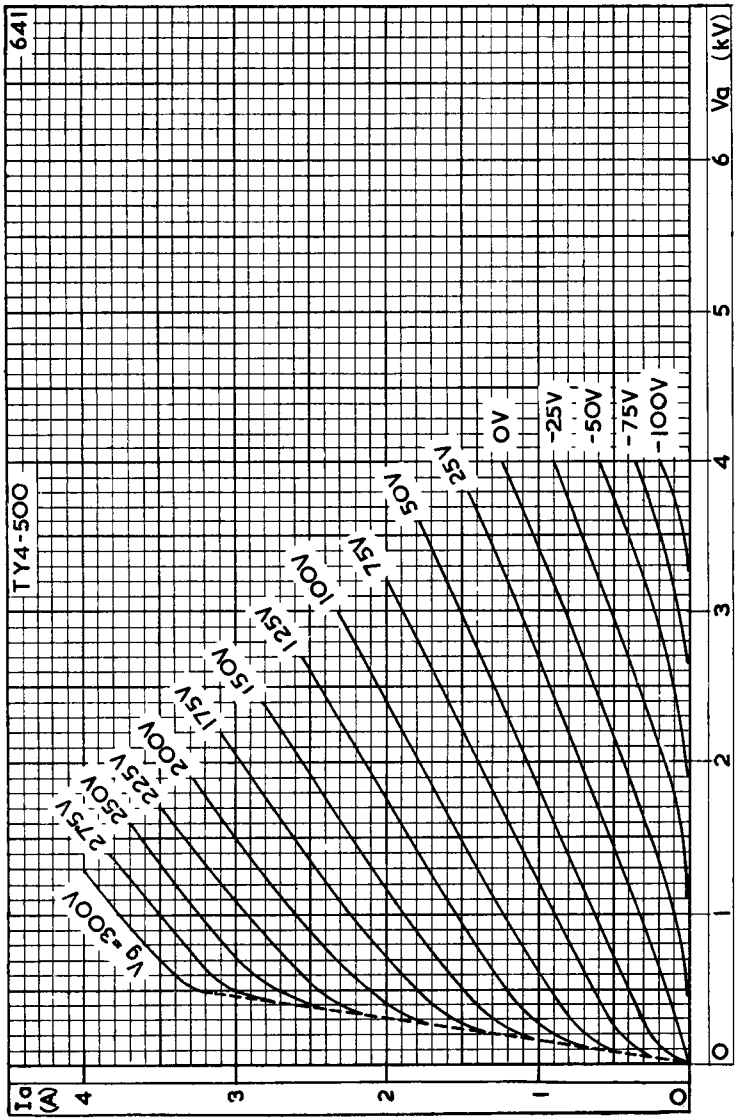
V.H.F. POWER TRIODE



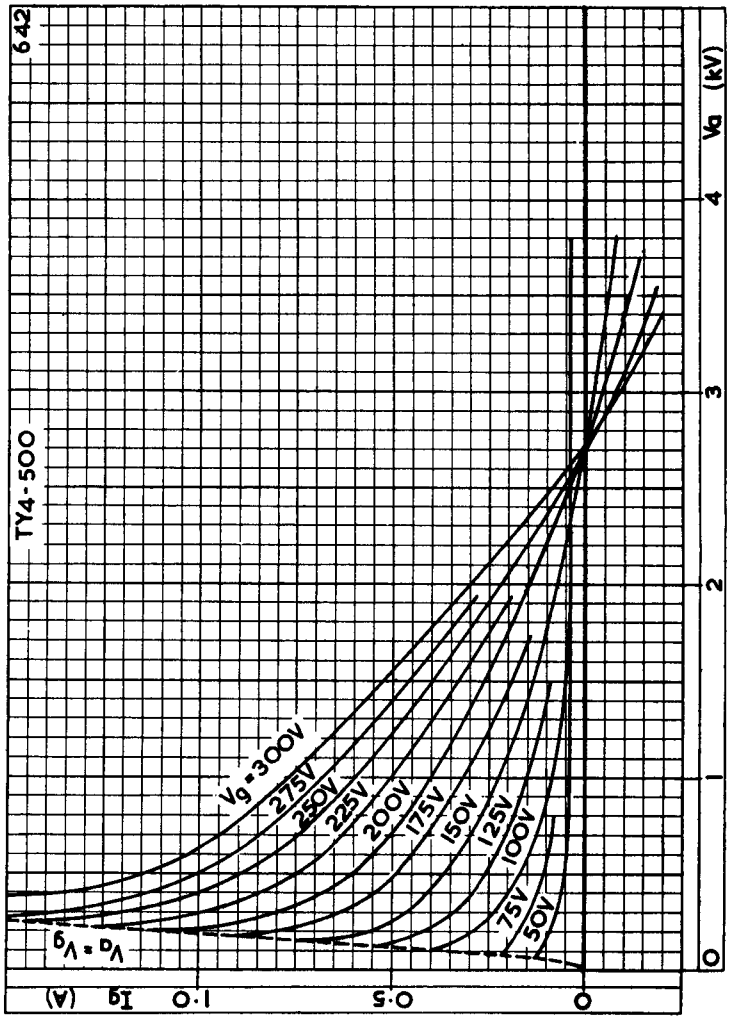


B5K Base

TY4-500

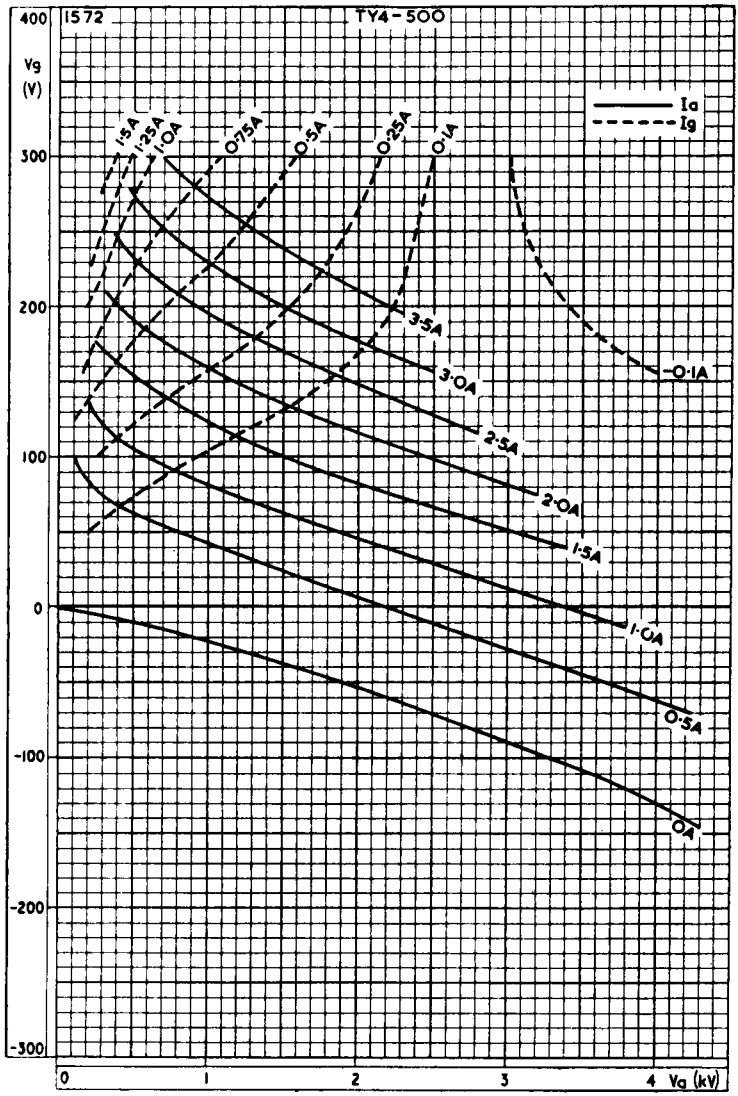


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE

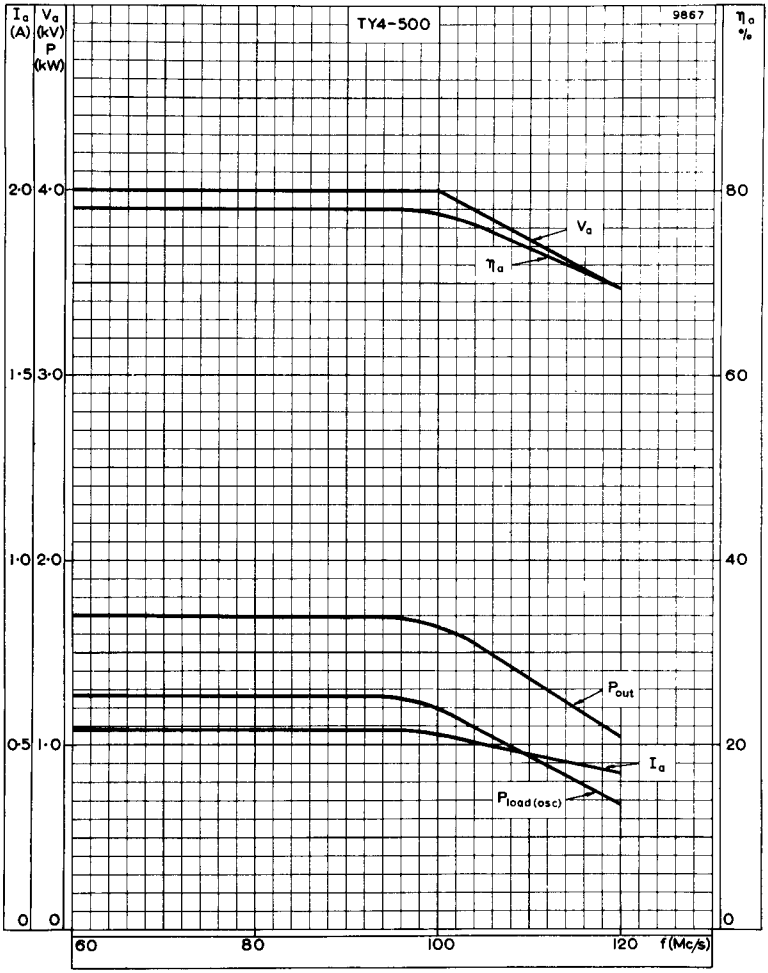


GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE

TY4-500

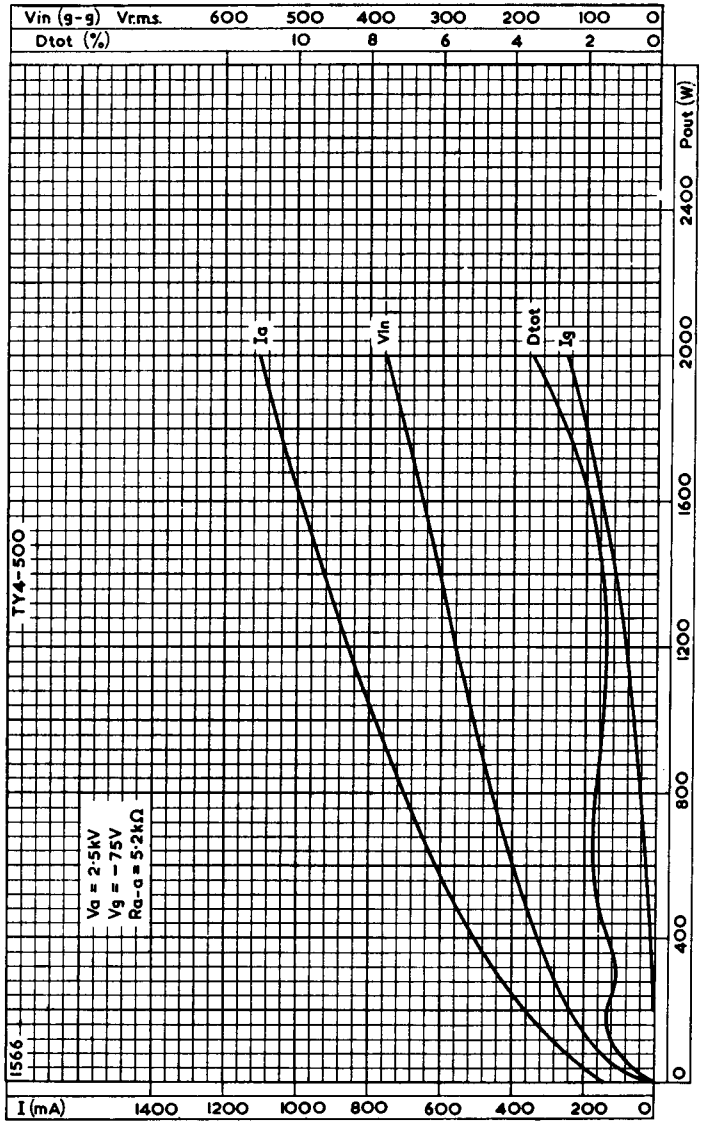


CONSTANT CURRENT CURVES

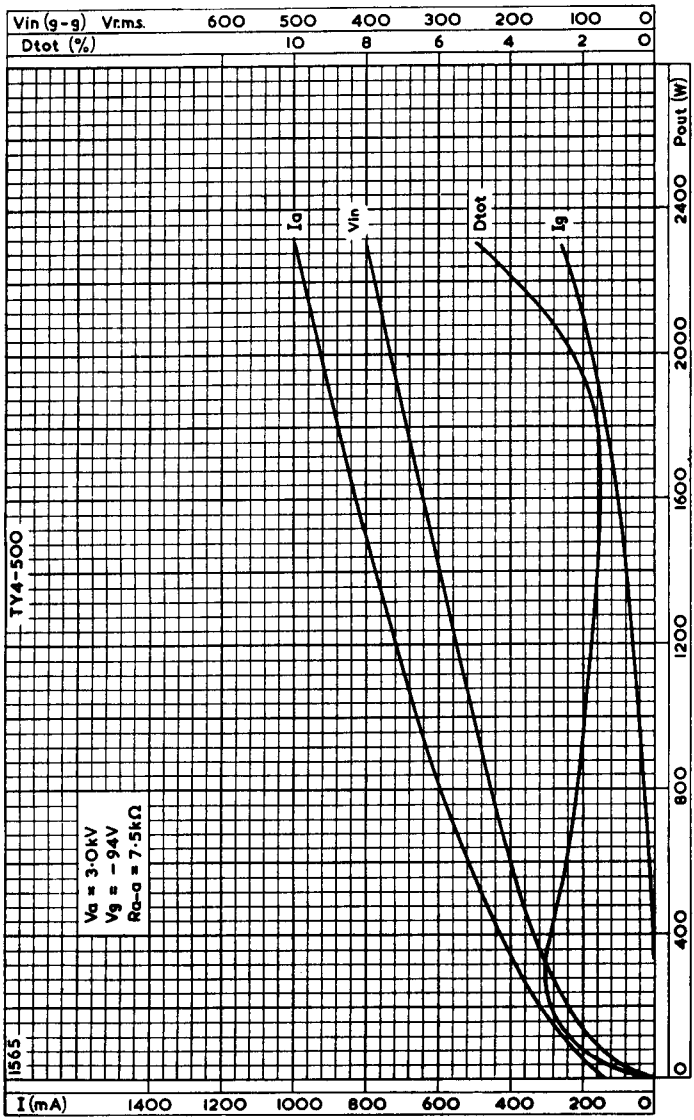


FREQUENCY CHARACTERISTICS, SINGLE VALVE AS CLASS 'C' AMPLIFIER AND OSCILLATOR

TY4-500

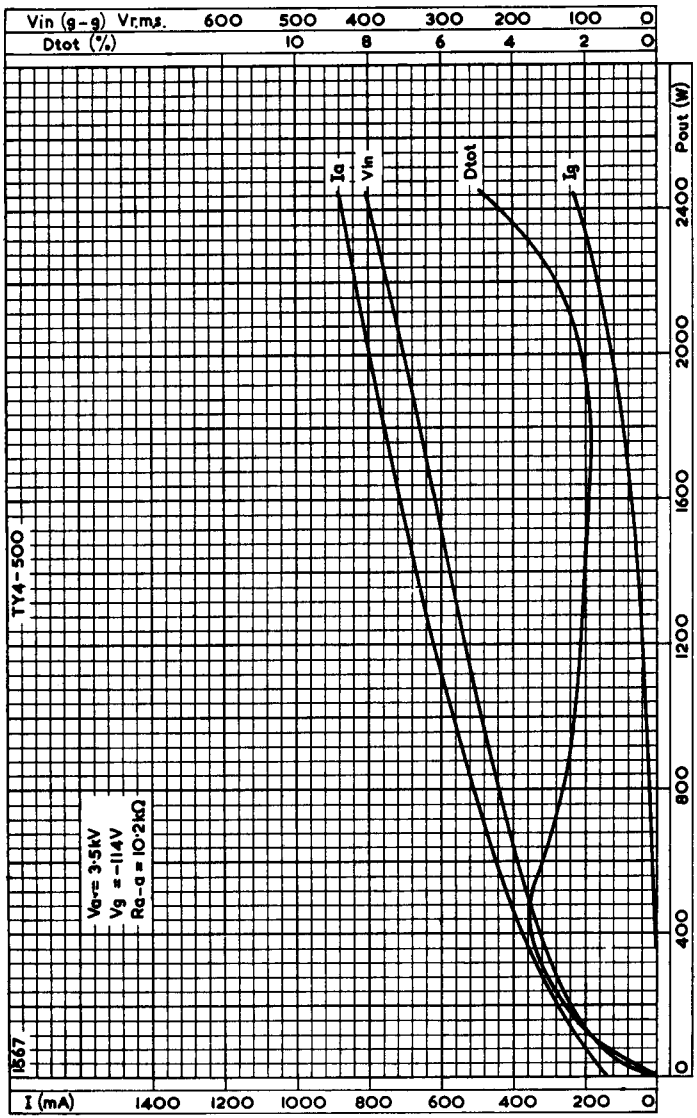


TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=2.5 kV



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=3.0 kV

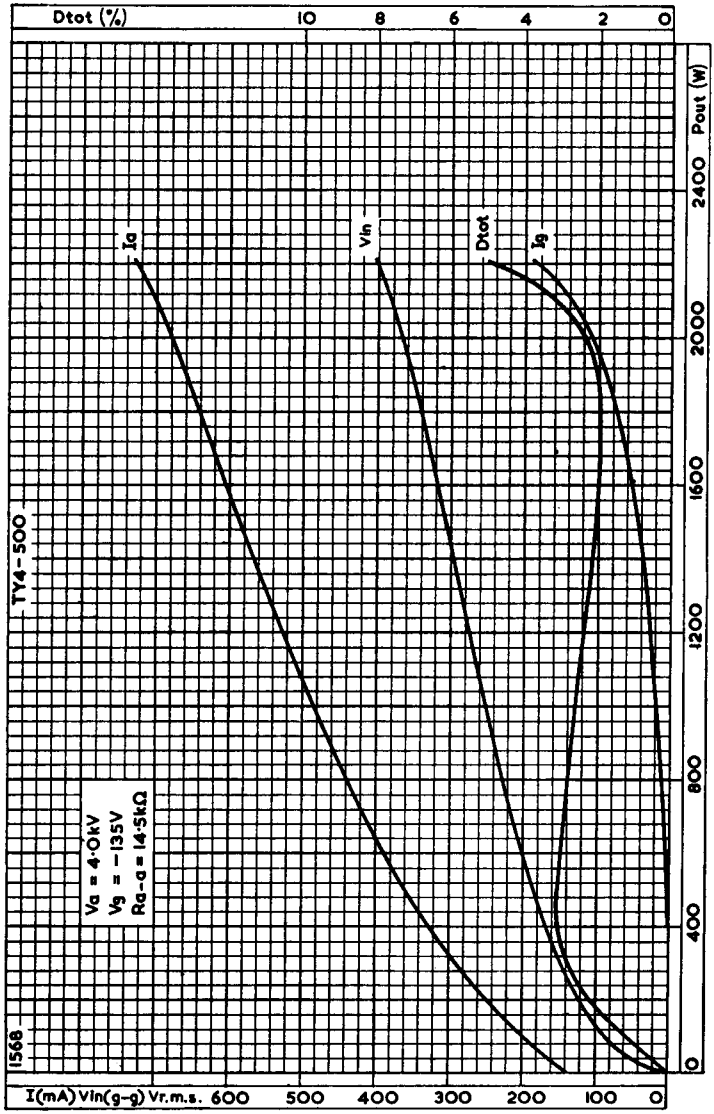
TY4-500



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=3.5 kV

TY4-500

V.H.F. POWER TRIODE



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=4.0 kV