

V.H.F. POWER DOUBLE TETRODE

QQV03-20A

Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES included in this volume of the handbook.

CATHODE

Indirectly heated. The heater is centre-tapped and the two sections may be operated in series or parallel with one another.

	Series	Parallel	
V_h	12.6	6.3	V
I_h	0.65	1.3	A

MOUNTING POSITION

Fixed station operation

Vertical – base up or down

Horizontal – anode pins in horizontal plane

Mobile operation

Vertical – base up or down

CAPACITANCES

* c_{a-g1} (each section)	0.04	pF ←
c_{g1-all} (each section)	7.5	pF
c_{a-all} (each section)	2.6	pF
c_{out} (two sections in push-pull)	1.6	pF
c_{in} (two sections in push-pull)	4.4	pF

*Internally neutralised for push-pull operation

CHARACTERISTICS (each section) measured at $I_a = 20mA$

g_m	2.5	mA/V
$I_{g1} - \mu 2$	8.0	

COOLING

Maximum base pin temperature	180	°C
Maximum bulb and anode seal temperature	200	°C

Anode connectors providing a high degree of heat transfer by radiation or by conduction should be used.

Natural cooling is sufficient with—

$V_a = 600V$ at frequencies up to 150Mc/s

$V_a = 500V$ at frequencies up to 200Mc/s

$V_a = 300V$ at frequencies up to 430Mc/s

Above these limits or with high ambient temperatures it may be necessary to direct a flow of air (up to 5cu.ft. per min.) on the top of the bulb to keep the seal temperature within the stated limit.

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OPERATING CONDITIONS AS A PUSH-PULL R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)

Limiting Values

V_a max.	See page 14	
p_a max.	2×10	W
$V_{g2(b)}$ max.	600	V
V_{g2} max.	300	V ←
p_{g2} max.	2×1.5	W
p_{g1} max.	2×0.5	W
I_{g1} max.	2×2.5	mA ←
I_k max.	2×55	mA
$I_{k(pk)}$ max.	2×260	mA
$-V_{g1}$ max.	75	V
R_{g1-k} max. per section (fixed bias)	50	k Ω
R_{g1-k} max. per section (automatic bias)	100	k Ω
V_{h-k} max.	100	V

Typical operating conditions

f	200	200	200	200	Mc/s
V_a	200	300	400	600	V
V_{g2}	200	250	250	250	V
V_{g1}	-30	-40	-50	-60	V
I_a	2×50	2×50	2×50	2×50	mA
I_{g2}	2×4.0	2×4.5	2×4.0	2×4.0	mA
* I_{g1}	2×1.0	2×0.7	2×0.7	2×0.7	mA
$P_{load(driver)}$	<1.0	<1.0	1.0	1.5	W
p_a	2×3.5	2×4.5	2×5.0	2×6.0	W
P_{out}	13	21	30	48	W
η	65	70	75	80	%
P_{load}	11	18	25	39	W
f	400	400	400	600	Mc/s
V_a	200	300	400	400	V
V_{g2}	200	250	250	250	V
V_{g1}	-30	-40	-50	-50	V
I_a	2×50	2×50	2×50	2×50	mA
I_{g2}	2×3.0	2×2.5	2×2.5	2×2.5	mA
* I_{g1}	2×0.5	2×0.6	2×0.7	2×0.7	mA
$P_{load(driver)}$	1.0	1.5	2.0	6.0	W
p_a	2×4.5	2×6.5	2×7.5	2×10	W
P_{out}	11	17	25	20	W
η	55	57	63	50	%
P_{load}	9	14	20	15	W

* I_{g1} will vary between valves.



V.H.F. POWER DOUBLE TETRODE

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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.

OPERATING CONDITIONS AS ANODE AND SCREEN-GRID MODULATED R.F. POWER AMPLIFIER (CLASS "C" TELEPHONY)

Limiting values (carrier conditions for modulation factor of 1)

V_a max.	See page 16	
p_a max.	2×6.7	W
$V_{g2(b)}$ max.	600	V
V_{g2} max.	300	V ←
p_{g2} max.	2×1.2	W ←
p_{g1} max.	2×0.5	W
I_{g1} max.	2×2.5	mA
I_k max.	2×50	mA
$i_{k(pk)}$ max.	2×400	mA
$-V_{g1}$ max.	100	V
V_{h-k} max.	100	V

Typical operating conditions for unmodulated carrier

f	200	200	200	400	Mc/s
V_a	300	500	600	300	V
V_{g2}	250	250	250	250	V
V_{g1}	-50	-80	-80	-50	V
I_a	2×40	2×40	2×40	2×40	mA
I_{g2}	2×4.0	2×4.0	2×4.0	2×3.0	mA
$*I_{g1}$	2×1.0	2×1.0	2×1.0	2×1.0	mA
$P_{load(driver)}$	1.5	3.0	3.0	2.5	W
p_a	2×3.5	2×4.0	2×5.0	2×4.5	W
P_{out}	17	31	38	15	W ←
η	71	78	79	63	%
P_{load}	14	24	32	12	W ←
For 100% modulation					
$v_{g2(pk)}$	185	185	185	185	V
P_{mod}	13	21	25	13	W ←

* I_{g1} will vary between valves

OPERATING CONDITIONS AS FREQUENCY TREBLER

Limiting values

V_a max.	600	V
p_a max.	2×10	W
$V_{g2(b)}$ max.	600	V
V_{g2} max.	300	V ←
p_{g2} max.	2×1.5	W
$-V_{g1}$ max.	200	V
I_{g1} max.	2×2.5	mA
p_{g1} max.	2×0.5	W
I_k max.	2×50	mA
$i_{k(pk)}$ max.	2×275	mA
R_{g1-k} max. per section (fixed bias)	50	kΩ
R_{g1-k} max. per section (automatic bias)	100	kΩ
V_{h-k} max.	100	V

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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.

Typical operating conditions

f_{out}	200	400	Mc/s
V_a	300	300	V
V_{g2}	250	250	V
V_{g1}	-175	-175	V
I_a	2×45	2×45	mA
I_{g2}	2×3.0	2×2.8	mA
I_{g1}	2×1.5	2×1.2	mA
$P_{load(driver)}$	4.0	5.0	W
P_a	2×8.5	2×9.5	W
P_{out}	10	8.0	W
η	37	30	%
P_{load}	8.0	6.0	W

OPERATING CONDITIONS AS A.F. POWER AMPLIFIER AND MODULATOR (CLASS "B")

Limiting values

V_a max.	600	V
P_a max.	2×10	W
$V_{g2(b)}$ max.	600	V
V_{g2} max.	300	V
P_{g2} max.	2×1.5	W
$-V_{g1}$ max.	75	V
P_{g1} max.	2×0.5	W
I_k max.	2×55	mA
$i_{k(pk)}$ max.	2×120	mA
R_{g1-k} max. per section (fixed bias)	50	k Ω
R_{g1-k} max. per section (automatic bias)	100	k Ω
V_{h-k} max.	100	V

Typical operating conditions

V_a	300	500	V
V_{g2}	250	250	V
V_{g1}	-25	-26	V
$I_{a(o)}$	2×12.5	2×12.5	mA
I_a (max. sig.)	2×35	2×36.5	mA
$I_{g2(o)}$	2×0.6	2×0.35	mA
I_{g2} (max. sig.)	2×9.5	2×8.1	mA
$P_{a(o)}$	2×3.75	2×6.25	W
P_a (max. sig.)	2×3.9	2×6.5	W
P_{out}	13.2	23.5	W
R_{a-a}	11	20	k Ω
D_{tot}	3.5	3.5	%
$V_{in(g1-g1)r.m.s.}$	35	37	V

ACCESSORIES

Information on these items can be obtained from the Industrial Technical Service Dept., Mullard Ltd.,

WEIGHT

Valve only

$\left\{ \begin{array}{l} 2.0 \\ 53 \end{array} \right.$ oz
g

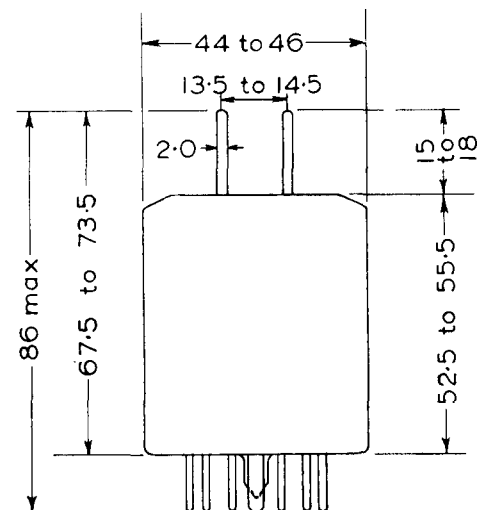


V.H.F. POWER DOUBLE TETRODE

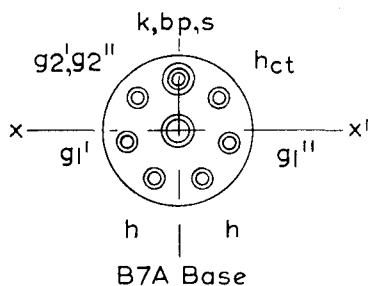
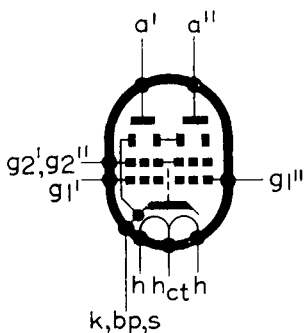
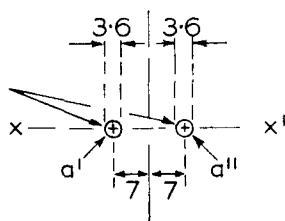
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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.

4375



Location of
anode pins
within circles

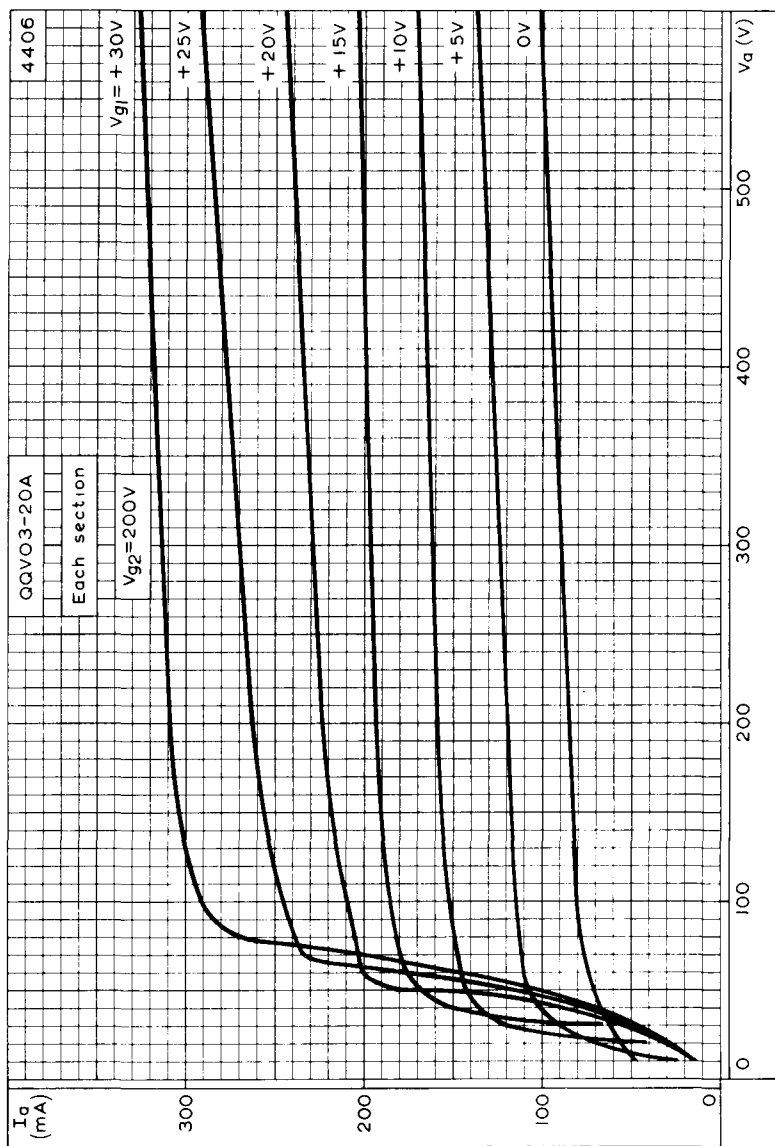


All dimensions in mm

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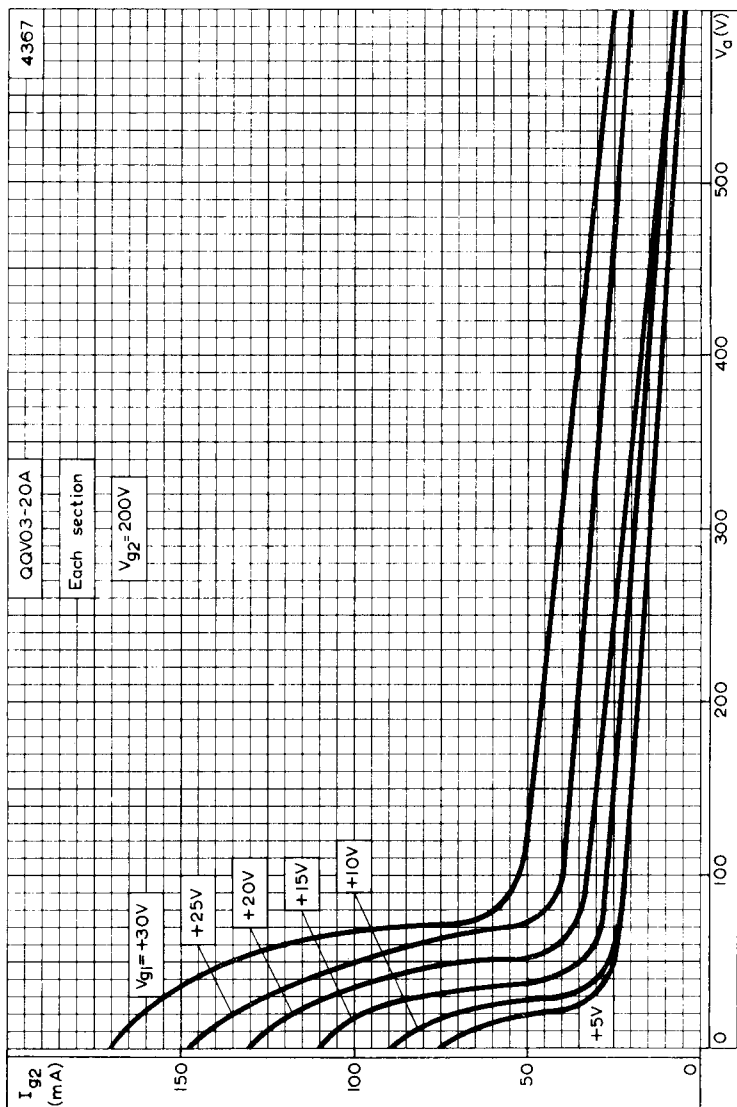


ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 200V$

V.H.F. POWER DOUBLE TETRODE

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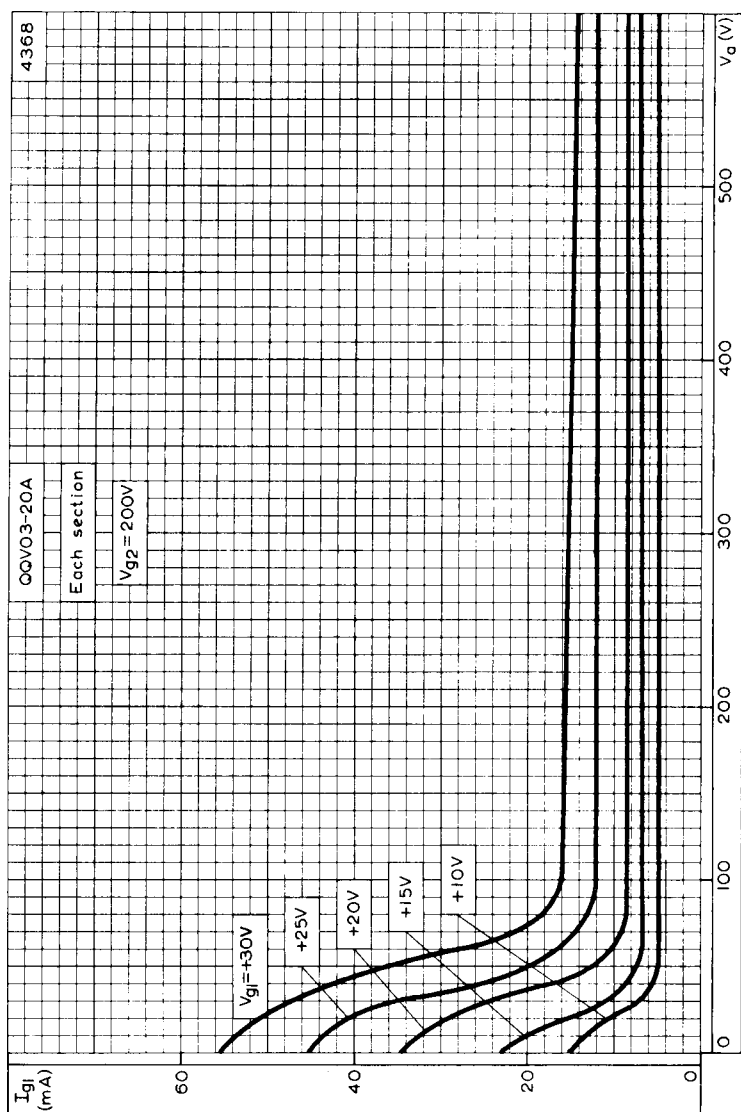


SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 200V$

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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.

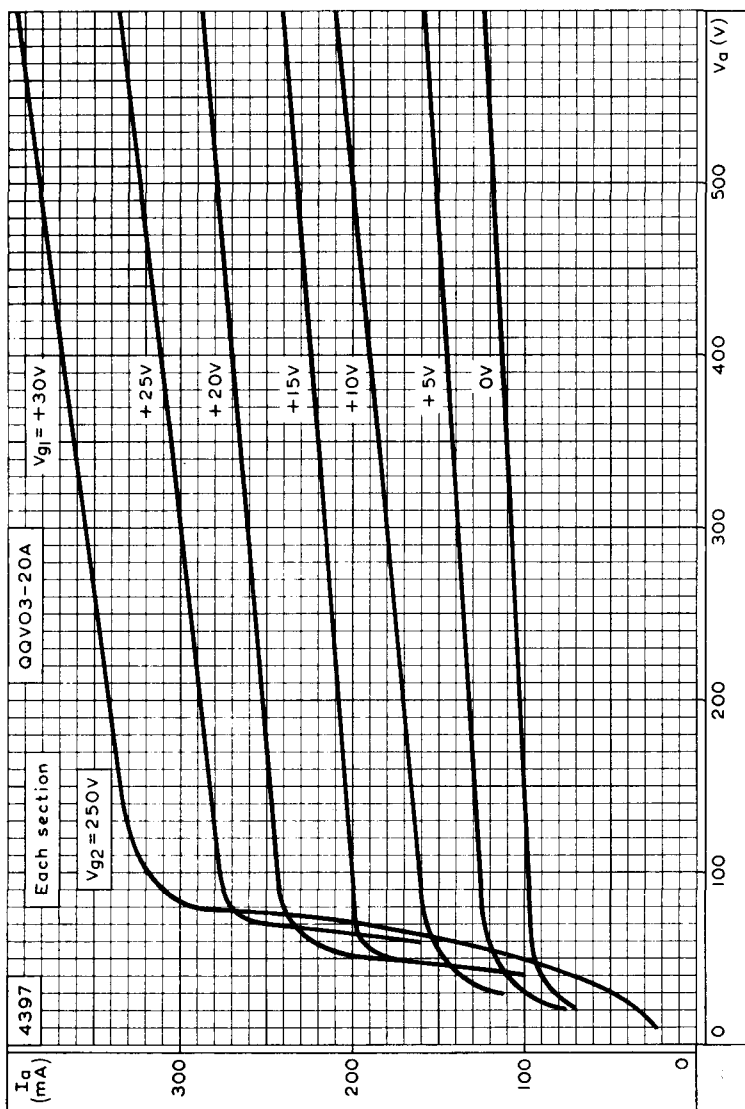


CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 200V$

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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.

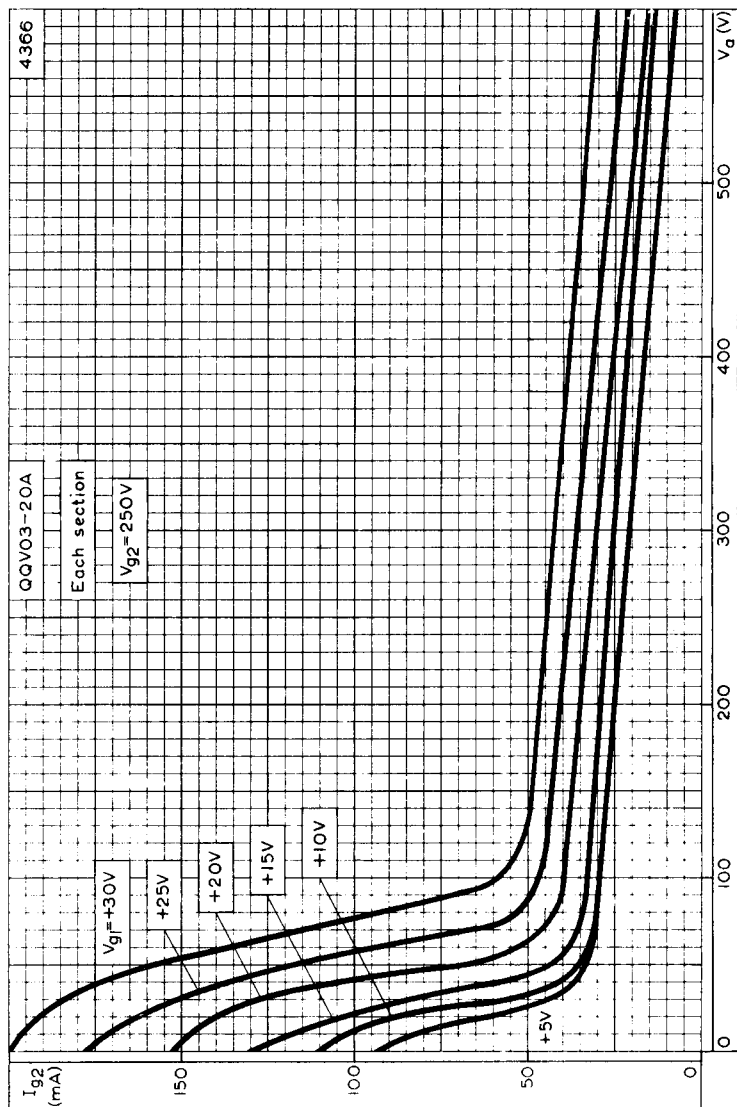


ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 250V$

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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc.s.



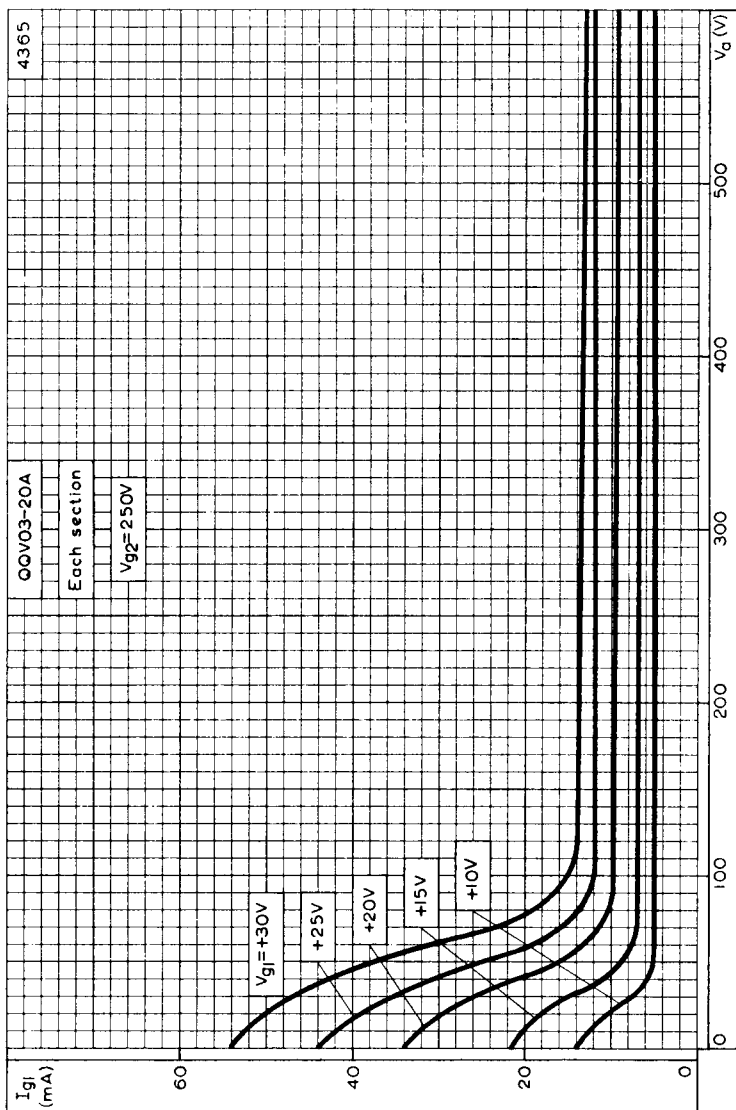
SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 250V$



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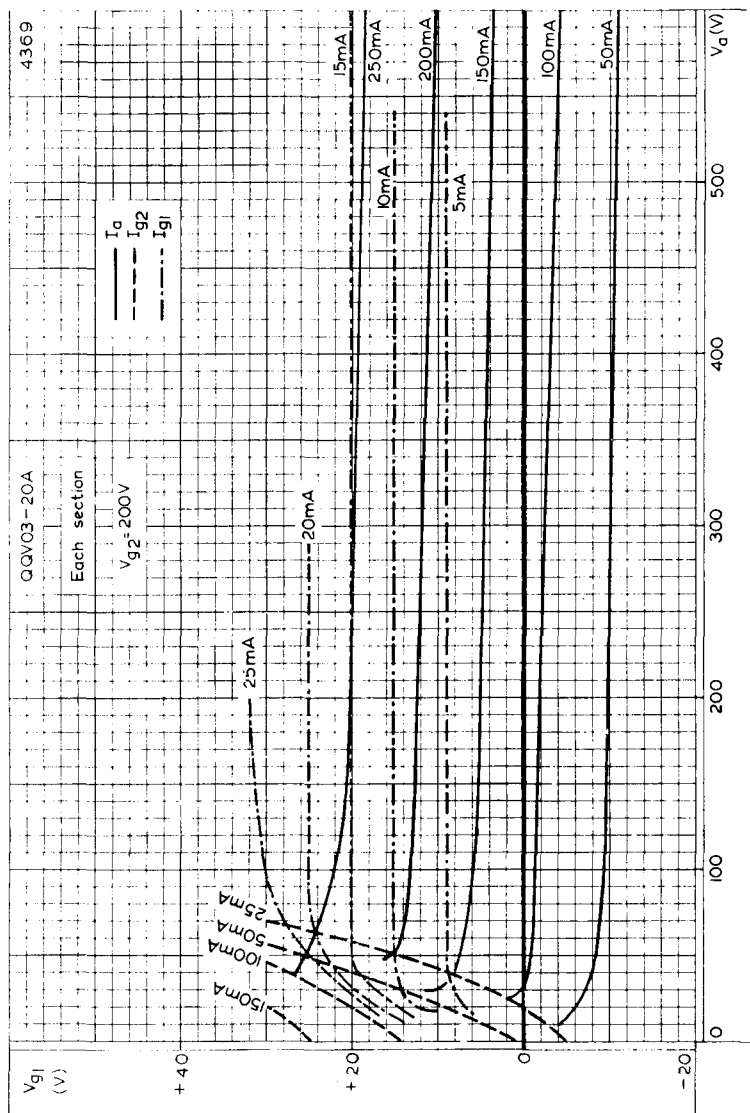


CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST
ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER
 $V_{g2} = 250V$

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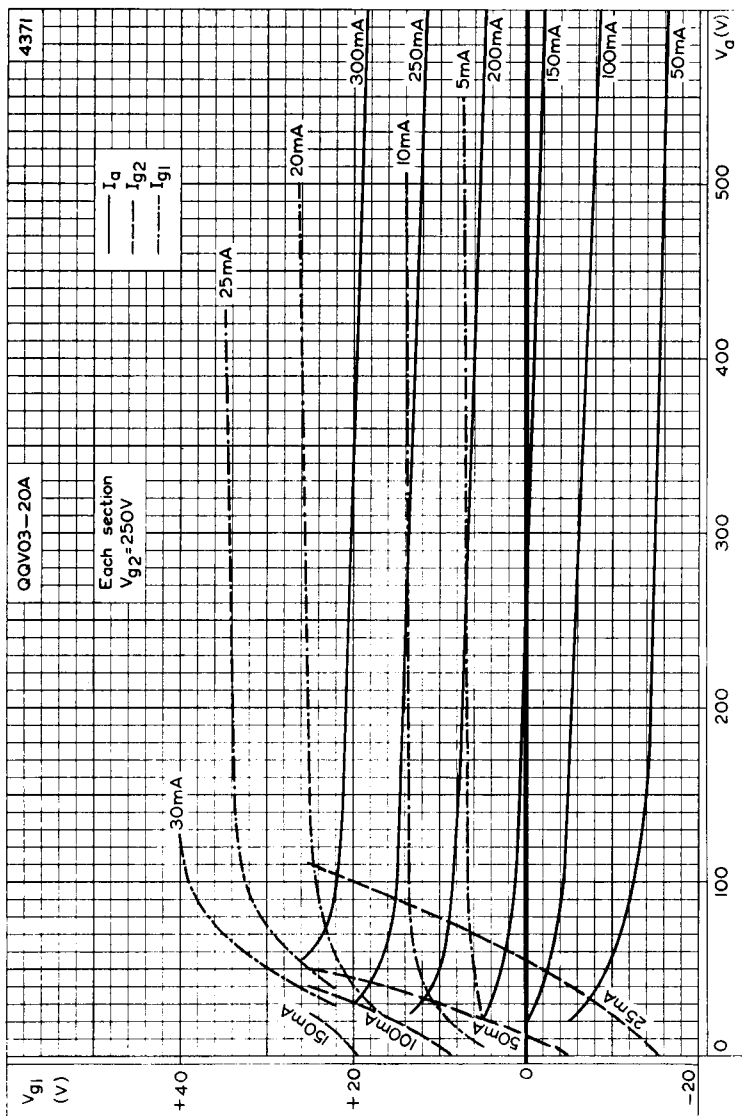


CONSTANT CURRENT CURVES FOR EACH SECTION $V_{g2} = 200V$

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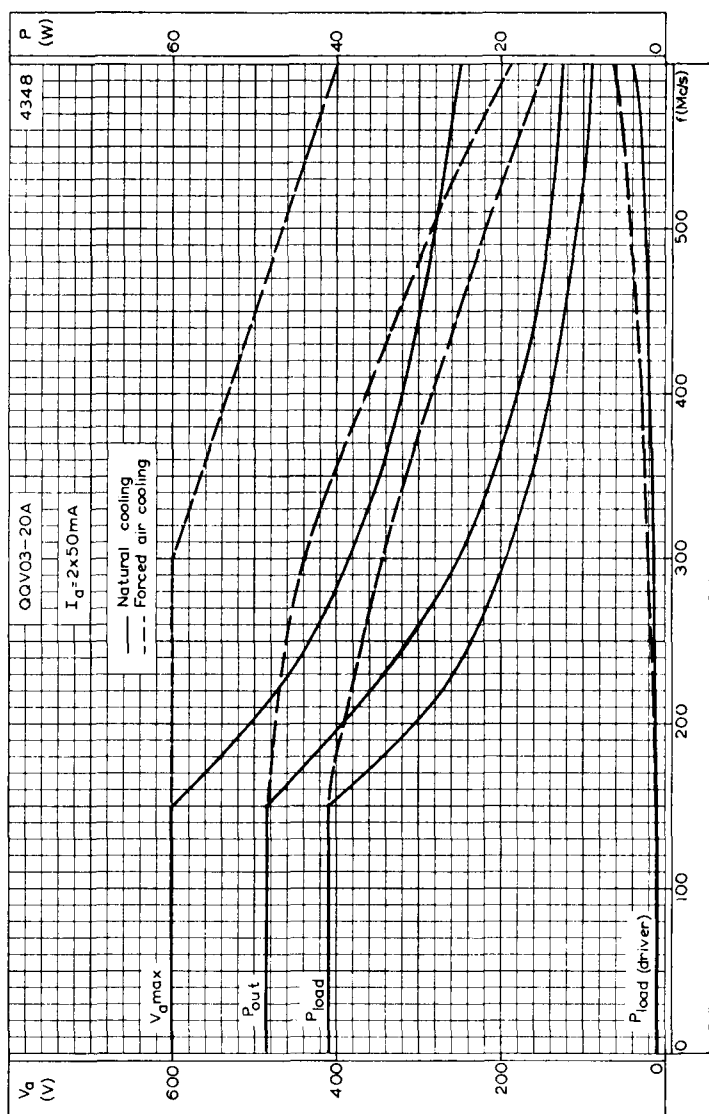


CONSTANT CURRENT CURVES FOR EACH SECTION $V_{g2} = 250V$

QQV03-20A

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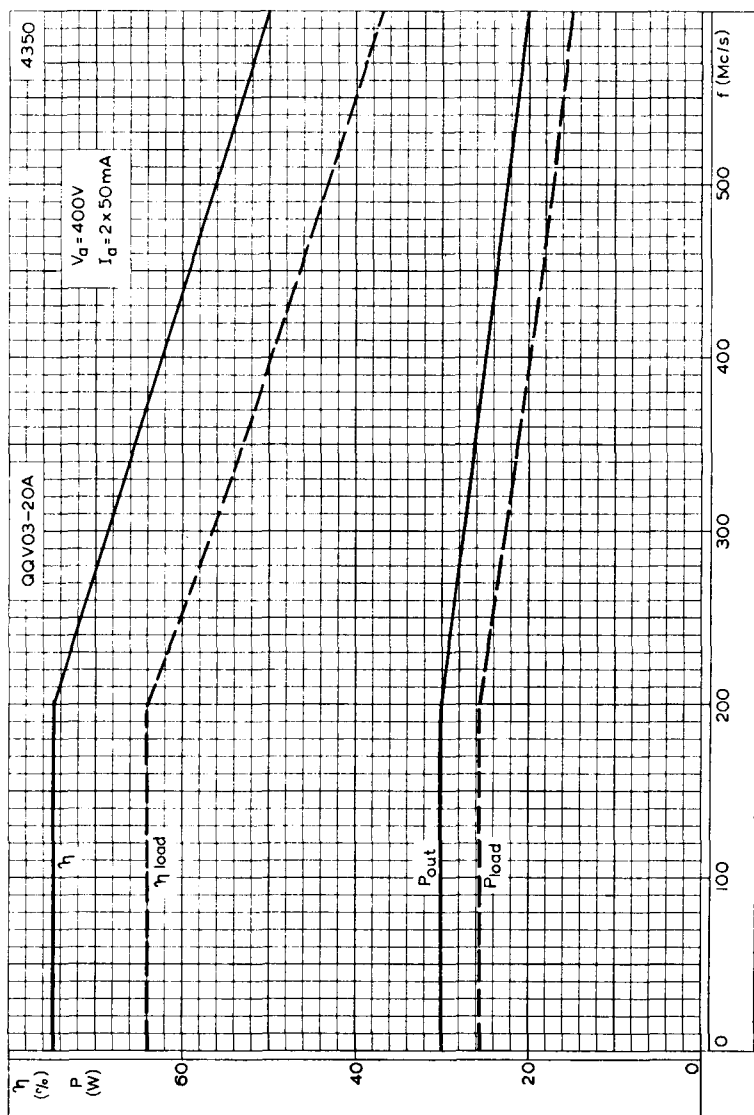


FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS A PUSH-PULL R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)

V.H.F. POWER DOUBLE TETRODE

QQV03-20A

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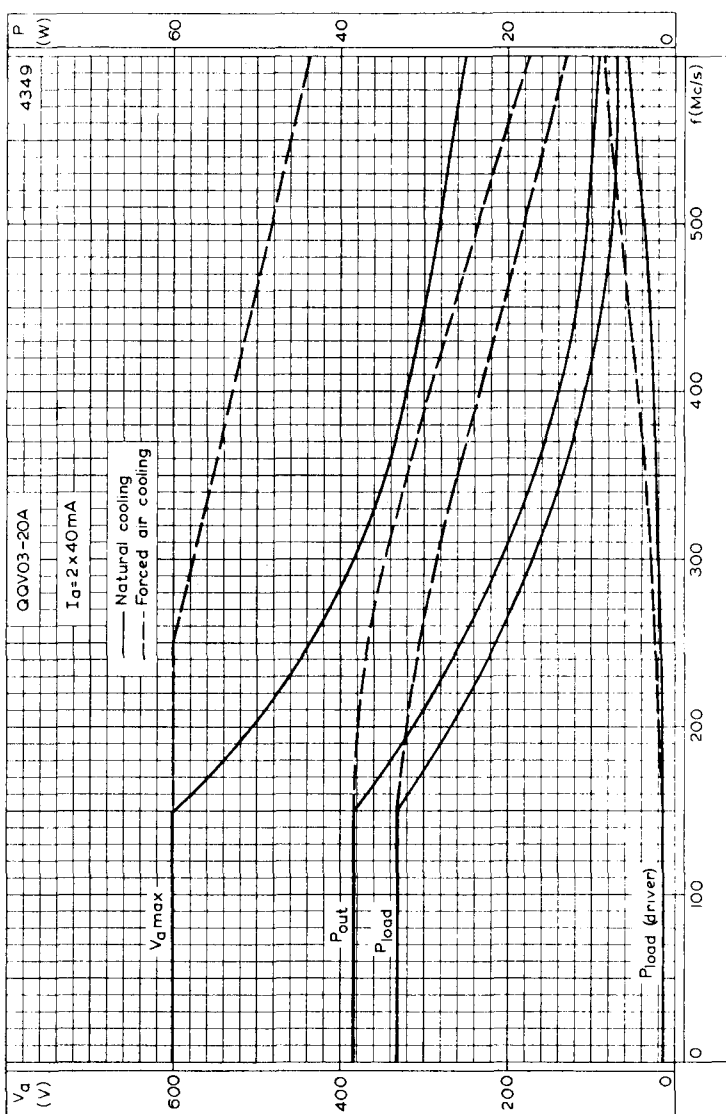
FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS A PUSH-PULL R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)



QQV03-20A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s.



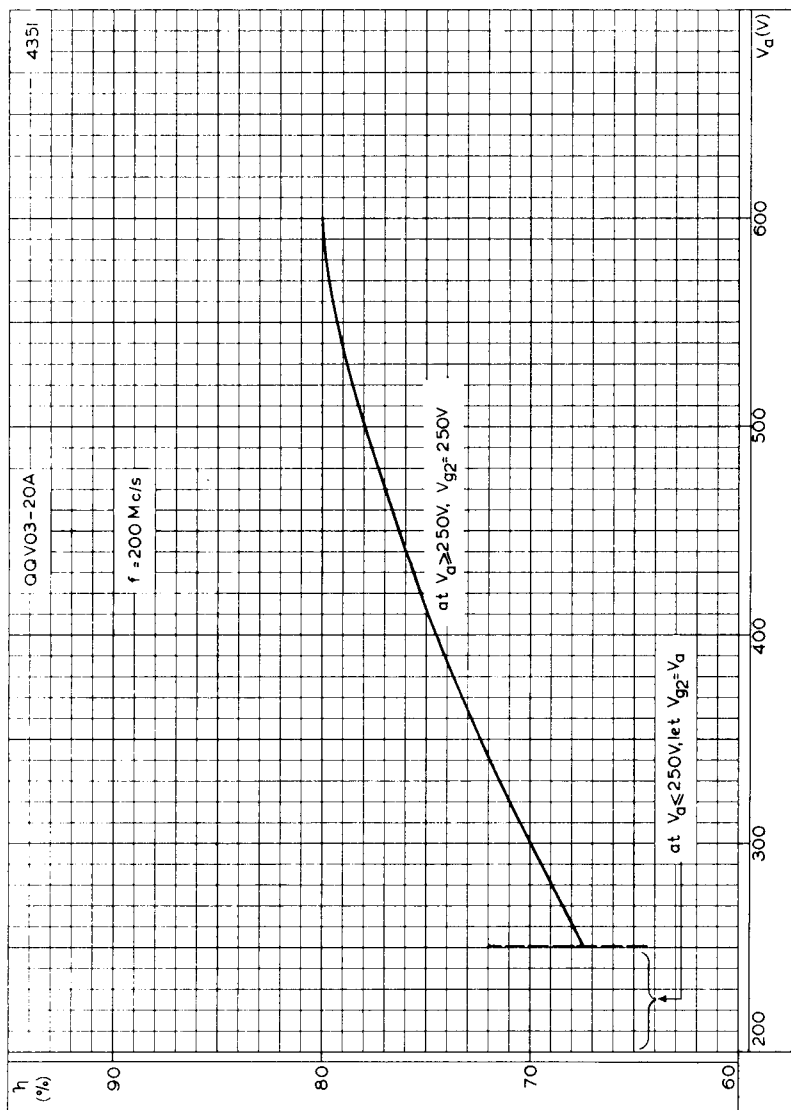
FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS ANODE AND SCREEN-GRID MODULATED R.F. POWER AMPLIFIER (CLASS "C" TELEPHONY)



V.H.F. POWER DOUBLE TETRODE

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Beam power double tetrode rated to dissipate 10W at each anode and intended for use at frequencies up to 600Mc/s



ANODE EFFICIENCY PLOTTED AGAINST ANODE VOLTAGE FOR CLASS "C" PUSH-PULL TELEGRAPHY

QUICK REFERENCE DATA

Natural or forced-air cooled beam power double tetrode. Intended for use as a U. H. F. power amplifier or frequency multiplier or A. F. power amplifier.

	Frequency Multiplier	Class 'C' Telephony Anode and Screen Modulated	Class 'C' Telegraphy or F. M. Telephony	
Performance				
f out	400	200	200	Mc/s
P out	8	38	48	W
f max.	600	600	600	Mc/s
Va max.	600	600	600	V
pa max.	2 x 10	2 x 6.7	2 x 10	W

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

OPERATING CONDITIONS AS A PUSH-PULL R. F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F. M. TELEPHONY)

Absolute maximum ratings

Va max.	600	V
pa max.	2 x 10	W
Vg2(b) max.	600	V
Vg2 max.	300	V
pg2 max.	2 x 1.5	W
pg1 max.	2 x 0.5	W
Ig1 max.	2 x 2.5	mA
Ik max.	2 x 55	mA
ik(pk) max.	2 x 260	mA
-Vg1 max.	75	V
Rg1-k max. per section (fixed bias)	50	kΩ
Rg1-k max. per section (automatic bias)	100	kΩ
Vh-k max.	100	V

Typical operating conditions

f	200	200	200	200	Mc/s
Va	200	300	400	600	V
Vg2	200	250	250	250	V
-Vg1	30	40	50	-60	V
Ia	2 x 50	2 x 50	2 x 50	2 x 50	mA
Ig2	2 x 4.0	2 x 4.5	2 x 4.0	2 x 4.0	mA
*Igl	2 x 1.0	2 x 0.7	2 x 0.7	2 x 0.7	mA
Pload (driver)	<1.0	<1.0	1.0	1.5	W
pa	2 x 3.5	2 x 4.5	2 x 5.0	2 x 6.0	W
Pout	13	21	30	48	W
η_a	65	70	75	80	%
Pload	11	18	25	39	W
f	470	470	470	600	Mc/s ←
Va	200	300	400	400	V
Vg2	200	250	250	250	V
Vg1	-30	-40	-50	-50	V
Ia	2 x 50	2 x 50	2 x 50	2 x 50	mA
Ig2	2 x 3.0	2 x 2.5	2 x 2.5	2 x 2.5	mA
*Igl	2 x 0.5	2 x 0.6	2 x 0.7	2 x 0.7	mA
Pload (driver)	1.0	2.5	3.0	6.0	W ←
pa	2 x 4.5	2 x 7.5	2 x 8.5	2 x 10	W ←
Pout	11	15	23	20	W ←
η_a	55	50	58	50	% ←
Pload	9	13	18	15	W ←

*Igl will vary between valves.

OPERATING CONDITIONS AS ANODE AND SCREEN-GRID MODULATED R. F. POWER AMPLIFIER (CLASS 'C' TELEPHONY)

Carrier conditions for a modulation factor of 1.

Absolute maximum ratings

Va max.	600	V
pa max.	2 x 6.7	W
Vg2(b) max.	600	V
Vg2 max.	300	V
pg2 max.	2 x 1.2	W
pg1 max.	2 x 0.5	W
Igl max.	2 x 2.5	mA
Ik max.	2 x 50	mA
ik(pk) max.	2 x 400	mA
-Vg1 max.	100	V
Vh-k max.	100	V

U.H.F. POWER DOUBLE TETRODE

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f	200	200	470	Mc/s
Va	300	500	300	V
Vg2	250	250	250	V
-Vg1	50	80	50	V
Ia	2 x 40	2 x 40	2 x 40	mA
Ig2	2 x 4.0	2 x 4.0	2 x 3.0	mA
*Ig1	2 x 1.0	2 x 1.0	2 x 1.0	mA
Pload (driver)	1.5	3.0	3.5	W ←
pa	2 x 3.5	2 x 4.0	2 x 5.5	W ←
Pout	17	31	13	W ←
η_a	71	78	50	% ←
Pload	14	24	11	W ←

For 100% modulation

vg2(pk)	185	185	185	V
Pmod	13	21	13	W

*Ig1 will vary between valves.

OPERATING CONDITIONS AS FREQUENCY TREBLER

Absolute maximum ratings

Va max.	600	V
pa max.	2 x 10	W
Vg2(b) max.	600	V
Vg2 max.	300	V
pg2 max.	2 x 1.5	W
-Vg1 max.	200	V
Ig1 max.	2 x 2.5	mA
pg1 max.	2 x 0.5	W
Ik max.	2 x 50	mA
ik(pk) max.	2 x 275	mA
Rg1-k max. per section (fixed bias)	50	k Ω
Rg1-k max. per section (automatic bias)	100	k Ω
Vh-k max.	100	V

Typical operating conditions

f out	200	470	Mc/s ←
Va	300	300	V
Vg2	250	250	V
Vg1	-175	-175	V
Ia	2 x 45	2 x 45	mA
Ig2	2 x 3.0	2 x 2.8	mA
Ig1	2 x 1.5	2 x 1.2	mA
Pload (driver)	4.0	5.0	W
pa	2 x 8.5	2 x 9.5	W
Pout	10	8.0	W
η_a	37	30	%
Pload	8.0	6.0	W

OPERATING CONDITIONS AS A.F. POWER AMPLIFIER AND MODULATOR (CLASS 'B')

Absolute maximum ratings

Va max.	600	V
pa max.	2 x 10	W
Vg2(b) max.	600	V
Vg2 max.	300	V
pg2 max.	2 x 1.5	W
-Vg1 max.	75	V
pg1 max.	2 x 0.5	W
Ik max.	2 x 55	mA
ik(pk) max.	2 x 120	mA
Rg1-k max. per section (fixed bias)	50	k Ω
Rg1-k max. per section (automatic bias)	100	k Ω
Vh-k max.	100	V

Typical operating conditions

Va	300	500	V
Vg2	250	250	V
-Vg1	25	26	V
Ia(o)	2 x 12.5	2 x 12.5	mA
Ia (max. sig.)	2 x 35	2 x 36.5	mA
Ig2(o)	2 x 0.6	2 x 0.35	mA
Ig2 (max. sig.)	2 x 9.5	2 x 8.1	mA
pa(o)	2 x 3.75	2 x 6.25	W
pa (max. sig.)	2 x 3.9	2 x 6.5	W
Pout	13.2	23.5	W
Ra-a	11	20	k Ω
Dtot	3.5	3.5	%
Vin(g1-g1) r.m.s.	35	37	V

U.H.F. POWER DOUBLE TETRODE

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CATHODE

Indirectly heated. The heater is centre-tapped and the two sections may be operated in series or parallel.

	Series	Parallel	
Vh	12.6	6.3	V
Ih	0.65	1.3	A

CAPACITANCES

*ca-g1 (each section)	0.04	pF
cg1-all (each section)	6.25	pF
ca-all (each section)	2.2	pF
cout (two sections in push-pull)	1.3	pF
cin (two sections in push-pull)	4.0	pF

*Internally neutralised for push-pull operation.

CHARACTERISTICS (each section) measured at Ia = 40mA

gm	2.5	mA/V
μg1-g2	8.0	

MOUNTING POSITION

Any

COOLING

Maximum base pin temperature	180	°C
Maximum bulb and anode seal temperature	250	°C

Anode connectors providing a high degree of heat transfer by radiation or by conduction should be used.

Natural cooling is sufficient with :-

Va = 600V at frequencies up to 150Mc/s

Va = 500V at frequencies up to 200Mc/s

Va = 300V at frequencies up to 430Mc/s

Above these limits or with high ambient temperatures it may be necessary to direct a flow of air (up to 5 cu. ft. per min.) on the top of the bulb to keep the seal temperature within the stated limit.

PHYSICAL DATA

Weight of valve only	2.0	oz
	53	g

ACCESSORIES

Socket	40202
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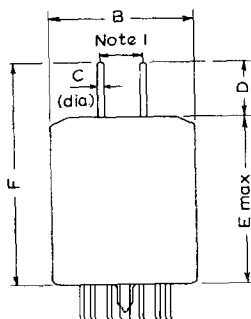
DIMENSIONS

	Inches	Millimetres
A	0.551 ± 0.001	14 ± 0.03
B	1.772 ± 0.039	45 ± 1
C	0.079 ± 0.004	2 ± 0.1
D	0.650 ± 0.059	16.5 ± 1.5
E	2.165	55
F	2.677 ± 0.118	68 ± 3
G	0.098 ± 0.001	2.5 ± 0.03
H	0.118 ± 0.004	3 ± 0.1

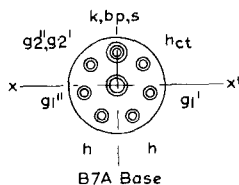
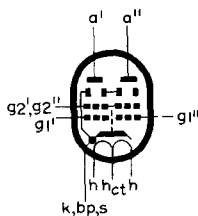
U.H.F. POWER DOUBLE TETRODE

QQV03-20A

81578

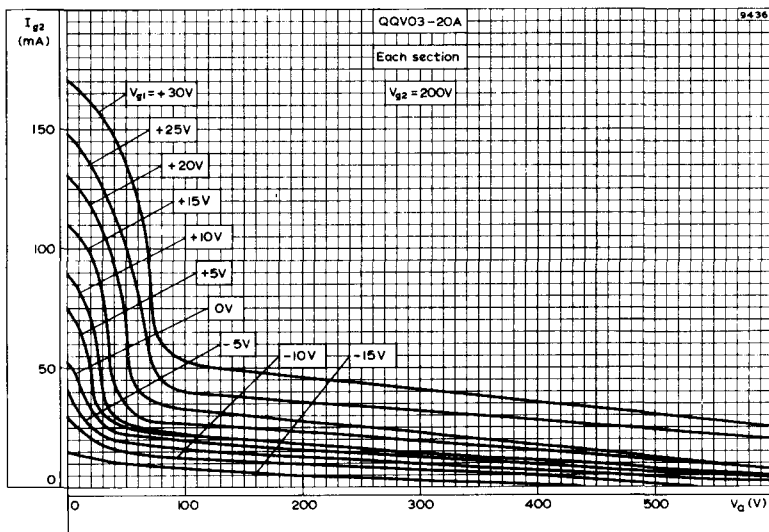
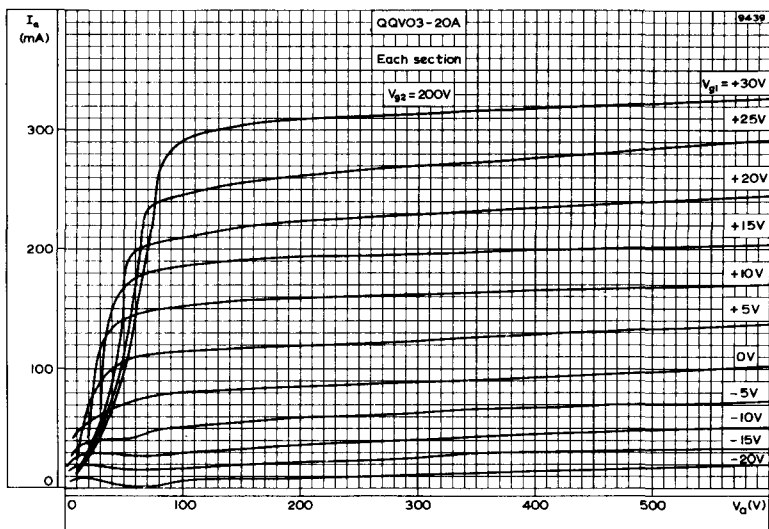


Location of
anode pins
within circles
of dia. G

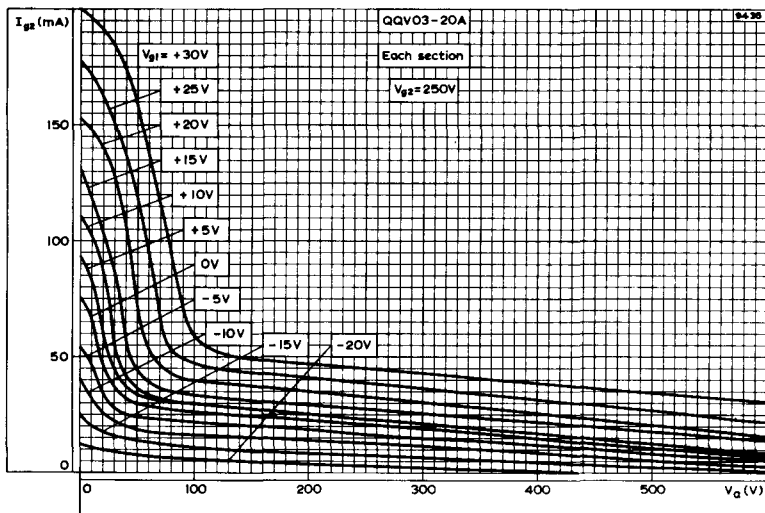
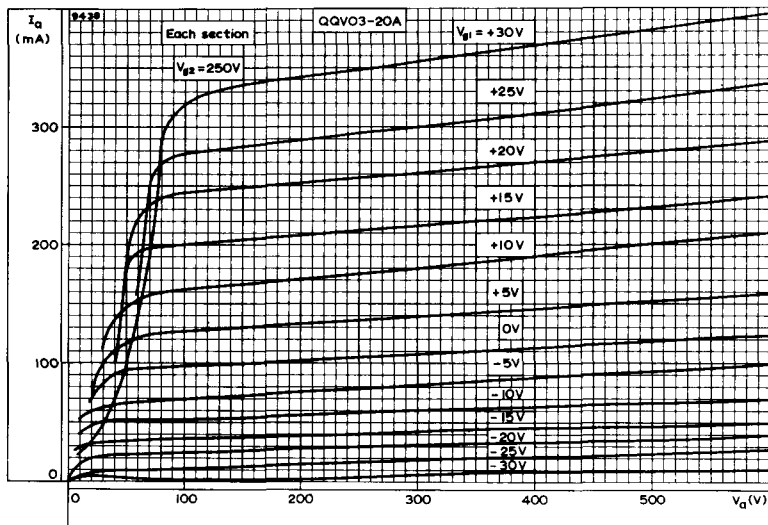


U.H.F. POWER DOUBLE TETRODE

QQV03-20A



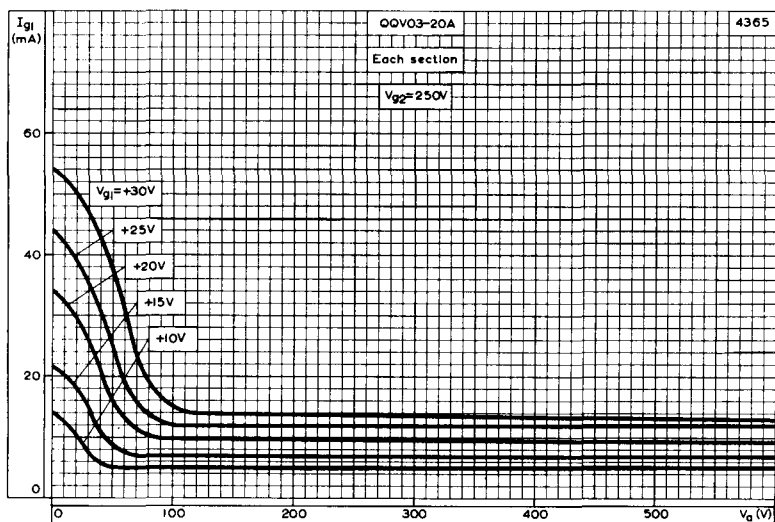
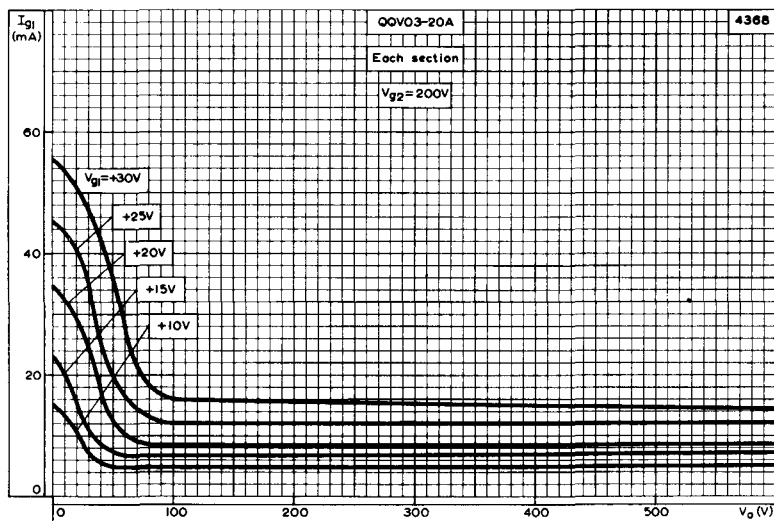
ANODE AND SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED
AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS
PARAMETER $V_{g2} = 200V$.



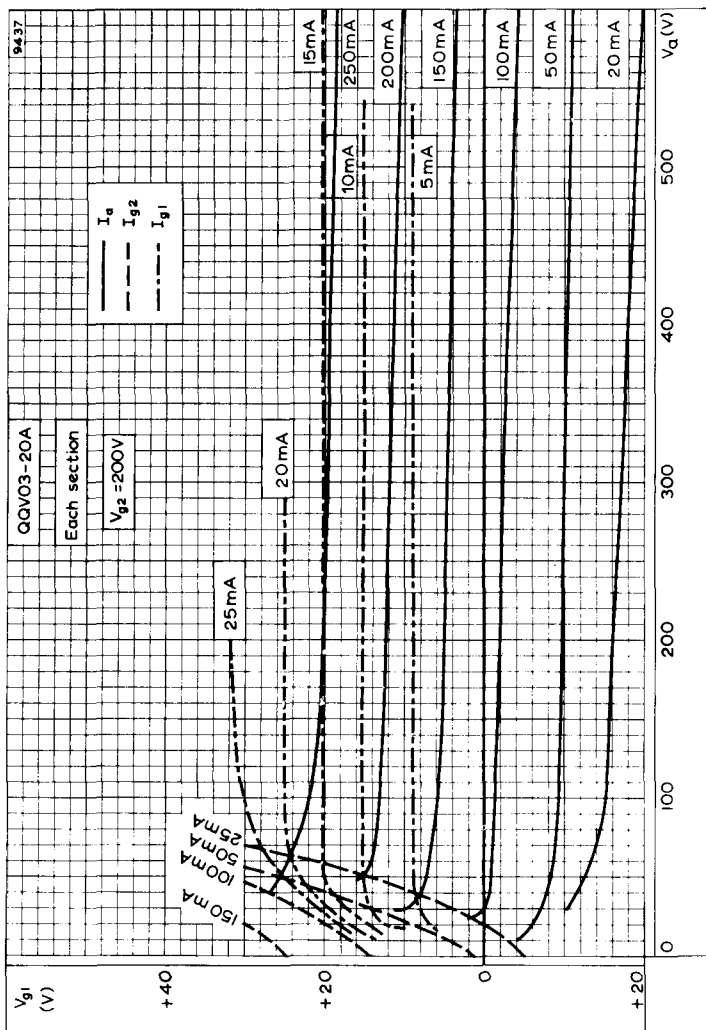
ANODE AND SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED
AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS
PARAMETER $V_{g2} = 250V$.

U.H.F. POWER DOUBLE TETRODE

QQV03-20A



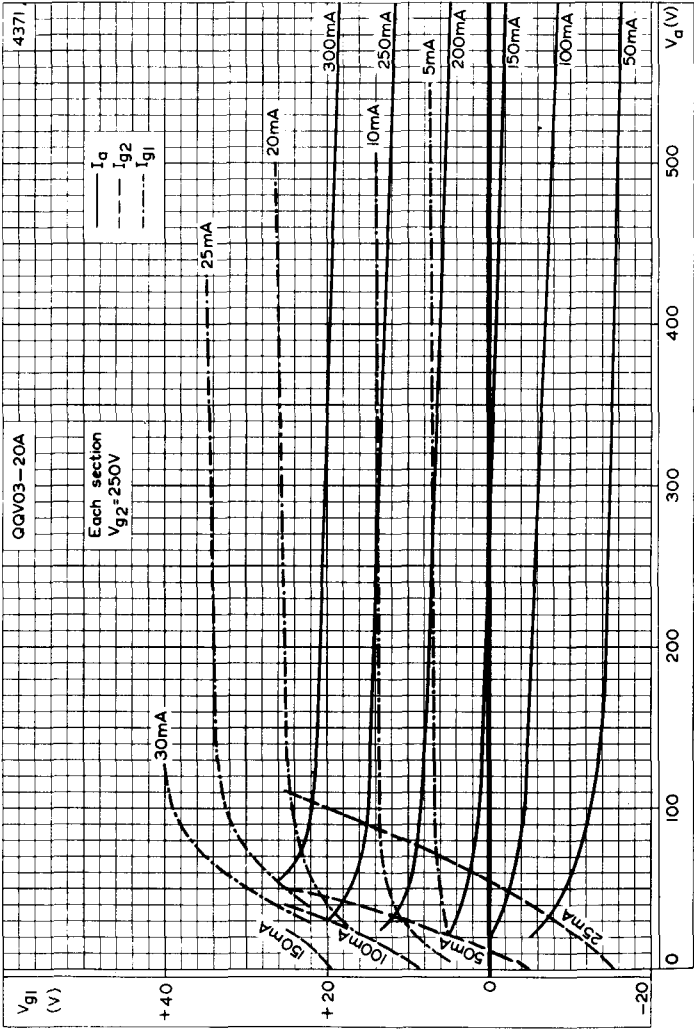
CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST
ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER
 $V_{g2} = 200V$ AND $V_{g2} = 250V$.



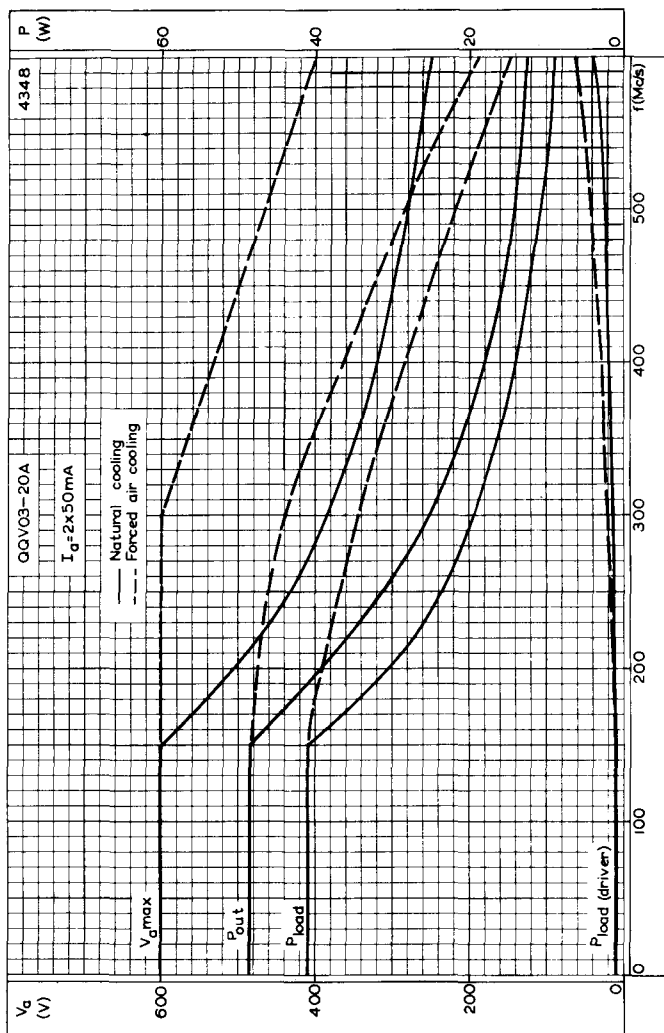
CONSTANT CURRENT CURVES FOR EACH SECTION $V_{g2} = 200V$.

U.H.F. POWER DOUBLE TETRODE

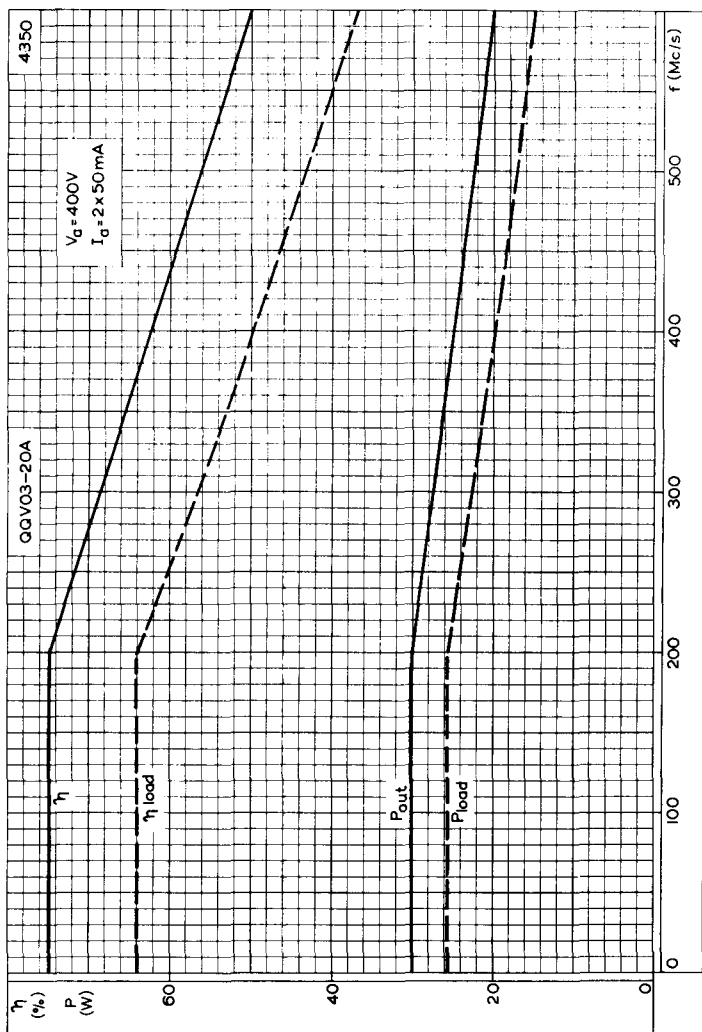
QQV03-20A



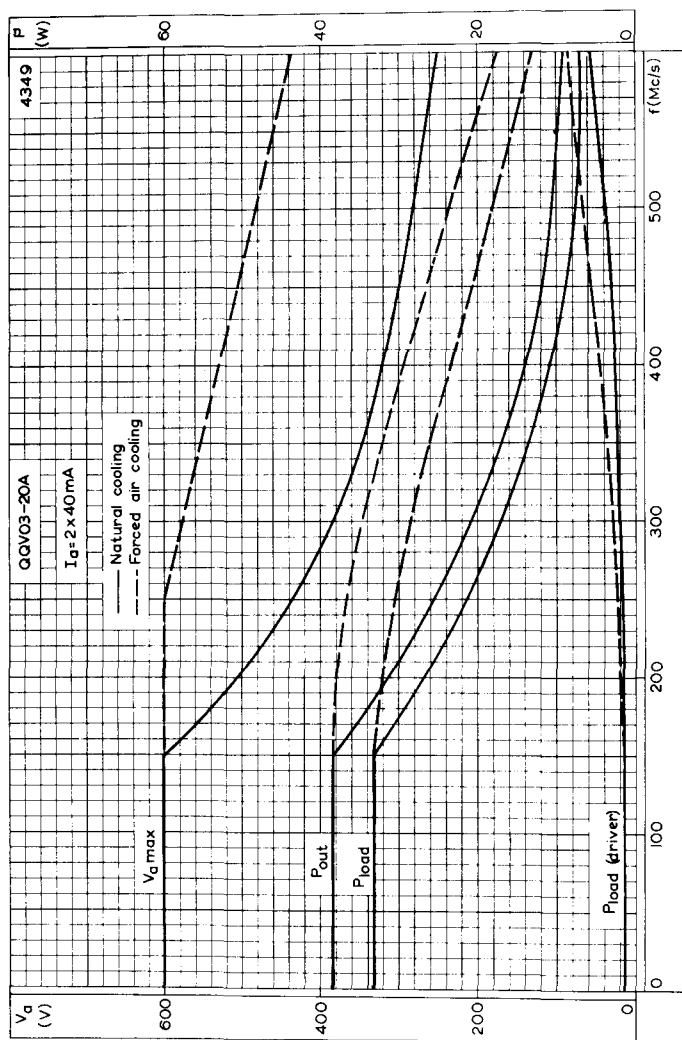
CONSTANT CURRENT CURVES FOR EACH SECTION $V_{g2} = 250V$.



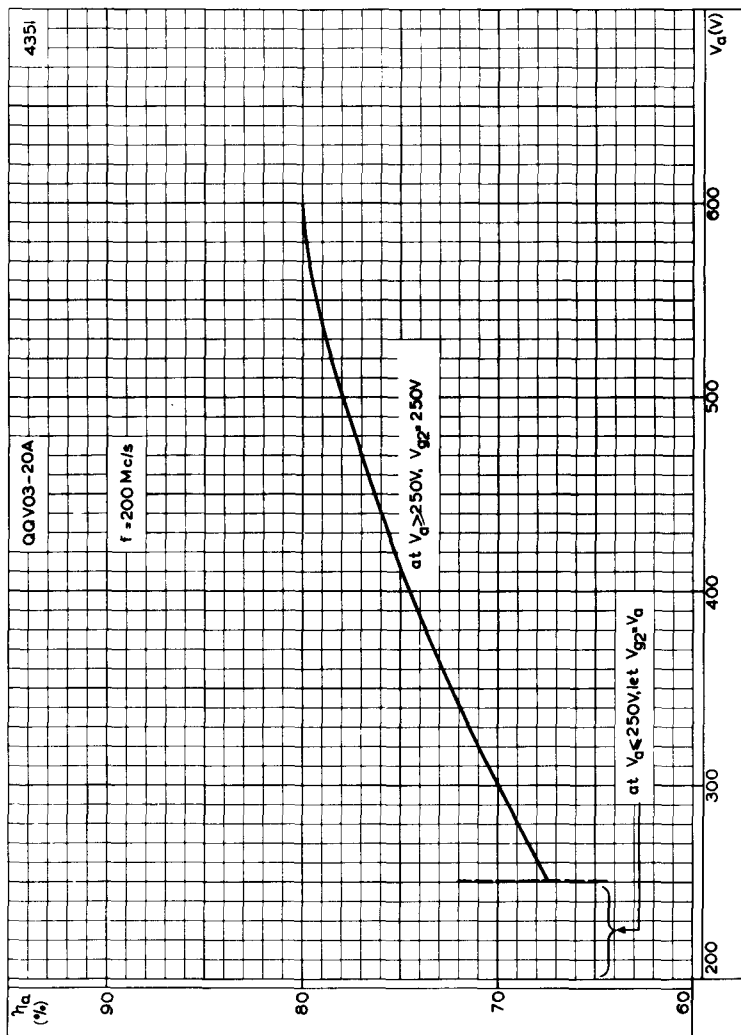
MAXIMUM OPERATING CONDITIONS FOR A PUSH-PULL R. F. POWER
 AMPLIFIER (CLASS "C" TELEGRAPHY OR F. M. TELEPHONY)



FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS A
PUSH-PULL R.F. POWER AMPLIFIER (CLASS 'C' TELEGRAPHY OR
F.M. TELEGRAPHY)



MAXIMUM OPERATING CONDITIONS FOR AN ANODE AND
 SCREEN-GRID MODULATED R. F. POWER AMPLIFIER
 (CLASS 'C' TELEPHONY)



ANODE EFFICIENCY PLOTTED AGAINST ANODE VOLTAGE FOR CLASS
"C" PUSH-PULL TELEGRAPHY