Possible equivalences:
813: QY2-100
6146A: QV06-20
6360: QQV03-10
832A: QQV04-15
5894: QQV06-40A
829B: QQV07-50
4-65A: QY3-65
4-125A: QY3-125
4X150A: QV1-150A
4CX250B: QV2-250C

DEFINITIONS AND INTERPRETATION OF DATA

The characteristics and curves published in this Handbook are based upon the average of readings taken on a number of valves, and the performance figures given under "Typical Operating Data" are values to be expected when average valves are used under appropriate conditions. The conditions selected are those under which the power delivered and the efficiency are as high as possible compatible with good valve life.

Amplification Factor

The amplification factors quoted for pentodes and tetrodes are those of g_1 with respect to g_2.

Drive Power

The value given is the power actually absorbed at the grid of the driven valve. The previous stage should be capable of delivering from twice to three times this power to allow for circuit losses.

Input Voltage

The value quoted is the peak value (v_{pk}) unless otherwise stated. For push-pull stages the grid-to-grid value is given.

Output Power

The value given is the total output delivered by the valve. The useful power will be somewhat less, dependent upon circuit losses.

Mercury Vapour Rectifiers

The maximum peak inverse voltage figure applies up to a maximum supply frequency of 150 c/s. At 500 c/s this value must be reduced by 15% and at 800 c/s by 25%.

By "D.C. Output Voltage" is meant the mean value of the unsmoothed rectified voltage, i.e., the voltage input to the filter.

The following recommendations should be interpreted in conjunction with British Standard Code of Practice No. CP1005: Part 7: 1954, 'The Use of Electronic Valves', upon which these notes have, in part, been based.

GENERAL

The published characteristics and curves are based upon the average of readings taken on a number of valves and the operating conditions given are those which result in optimum power output and efficiency without over-running the valve. Failure to observe the various recommendations may seriously reduce the life of the valve and in some instances result in catastrophic failure.

LIMITING VALUES

The limiting values are absolute. It is important that none of these limits are ever exceeded and such variations as mains fluctuations, component tolerances and switching surges, must be taken into account in deciding the nominal valve operating conditions.

In some instances, such as pulse operation or intermittent service, it may be permitted to exceed the absolute values but, to ensure the validity of the guarantee, the desired operating conditions must be agreed with Mullard Limited, (Industrial Technical Service Department).

TYPICAL OPERATING CONDITIONS

Typical operating conditions are shown for various modes of operation, e.g. 'r.f. power amplifier class C telegraphy' or 'telephony', etc. Some of the typical operating conditions for a particular mode of operation may incorporate one or more of the absolute ratings; in such cases the designer should take precautionary steps to ensure that these ratings are never exceeded.

FILAMENT OR HEATER SUPPLY

Either a.c. or d.c. supply may be used for filament heating. The published negative grid bias voltages are based upon a.c. heating. When d.c. heating is employed for directly heated valves the grid bias should be reduced by one-half of the filament voltage and when the anode current is greater than 5% of the filament current the h.t. return should be taken to a centre point resistor or to a reversing switch. When a.c. is employed the h.t. return should be taken to the centre tap of the filament transformer.

Measurements of the filament or heater voltage should always be made after the valve and supply transformer have attained their working temperature, and should be taken at the valve pins or terminals.

(*a*) *Oxide-coated Filaments and Cathodes*

To obtain maximum life the filament or heater voltage must be within ±2.5% of the nominal value and temporary fluctuations should not exceed ±10%.

With valves specially designed for use in mobile transmitters, emergency operation of the filament or heater down to the specified voltage is allowed.

(*b*) *Thoriated Tungsten Filaments*

To obtain maximum life the filament voltage must be within ±1% of the nominal value and temporary fluctuations should not exceed ±5%.

(*c*) *Pure Tungsten Filaments*

It is essential, when using valves with pure tungsten filaments, that the recommended filament operating conditions are never exceeded. The filament voltage marked on such valves is that which provides the rated total emission (i.e. 90% of the saturation emission) when the valve is new. In order to maintain this emission over the whole life of the valve, the filament voltage must be increased progressively to a total maximum of 105%. When less than the rated total emission is required for a particular application, the life can be extended by operating the filament at a reduced voltage.

(*d*) *Filament Switching*

It may be necessary with some valves to limit the filament current when switching on the supply. Information on this will generally be included on individual data sheets but in cases of doubt Mullard Limited, (Industrial Technical Service Department) should be consulted.

COOLING

(*a*) *General*

With radiation-cooled valves the maximum base, seal and envelope temperatures are given in the published data. To avoid exceeding these it may sometimes be necessary to provide artificial cooling.

In the development stage of an equipment the various temperatures should be measured with due regard to the ultimate environmental conditions. Special paints and lacquers are available for this purpose but any other suitable method can be used.

In some cases the filament and grid seals of water-cooled, forced-air-cooled and silica valves require cooling and guidance is given on individual data sheets.

Where additional cooling is necessary for safe operation precautionary steps must be taken to switch off all supply voltages in the event of failure or reduction of the cooling medium.

(*b*) *Water-Cooling*

A water-cooled valve should always be used with the recommended type of water jacket. The circulating cooling water should be as free as possible from all solid matter and the dissolved oxygen content should be low. Whenever possible a closed water system using distilled or demineralised water should be employed. In general, the resistivity of the cooling water should not be less than 3.3kΩ/c.c and the inorganic solid content should not exceed 3 parts in 10^5, but for some applications and some types of valves it may be desirable for the resistivity to be considerably higher and the solid content to be less. If desired, Mullard Limited, (Industrial Technical Service Department) will undertake to analyse the available water supply.

The temperature limits given in the individual data sheets should in no circumstances be exceeded and it is essential to insert an automatic device in the water outlet to switch off the supply voltages in the event of the failure or reduction of the water supply.

(*c*) *Forced-Air Cooling*

The temperature limits laid down in the data sheets should in no circumstance be exceeded and precautions should be taken to switch off all supply voltages in the event of a fault in the air circulating system.

The use of an inlet filter in the air supply is recommended particularly in dusty or dirty locations to avoid clogging the radiator air ducts.

(*d*) *Auxiliary Air and Water-Cooling*

Where auxiliary cooling is specified, e.g. for grid seals, precautionary steps must be taken to switch off all supply voltages in the event of the failure or reduction of these auxiliaries.

VALVES IN R.F. HEATING APPLICATIONS

The service conditions associated with r.f. heating, i.e. induction heating, dielectric-loss heating and short wave diathermy, can be more severe than those associated with communication service.

These severe conditions are mainly due to the wide variations in load impedance usually encountered which, in turn, produce large variations in grid current, anode current, grid dissipation and anode dissipation. The risk of exceeding the valve ratings is, therefore, increased.

For valves recommended for r.f. heating applications, the data sheets include ratings and typical operating conditions calculated to provide margins of safety against variations of load and supply voltage. Since it is not possible to anticipate the degree of protection which a designer may wish to incorporate, these data generally give two sets of operating conditions:

(*a*) for the valve fed from an unsmoothed d.c. supply and where no protection is incorporated in the equipment against valve overload, under-drive or inefficient operation, and:

(*b*) for the valve fully protected; this offers a performance only slightly less than that allowed for maximum 'class C telegraphy.'

The designer may choose an operating condition between these extremes depending upon the degree of protection which he decides to incorporate in the equipment. However, no limiting values may be exceeded during the work cycle.

It may sometimes be desired to use a valve for which no industrial ratings are given. The following table considers five methods of operation of triodes and indicates the factors by which the maximum 'class C telegraphy' should be multiplied in order to arrive at a safe rating, and designers are strongly recommended to give due consideration to these factors:

Method 1. Equipments fitted with effective automatic mains voltage stabilisation and effective automatic protection against valve over-load and over-drive and in which the power supply is derived from a filtered source containing not more than 5% ripple. (Three-phase full-wave and six-phase half or full-wave rectifier systems whether filtered or unfiltered, may be taken as meeting this requirement.)

Method 2. D.C. smoothed but unprotected.

Method 3. Equipment supplied by unsmoothed full-wave biphase rectifier but not fitted with automatic regulation or over-load protection.

Method 4. Self-rectifying equipment half-wave operation.

Method 5. Self-rectifying equipment full-wave operation without smoothing choke.

FACTORS APPLICABLE TO EACH VALVE

Method	1	2	3	4	5
Anode voltage r.m.s.	—	—	—	0.8	0.8
Anode voltage d.c.	0.95	0.8	0.7	—	—
Anode current	0.95	0.8	0.7	0.4	0.4
Power input	0.9	0.65	0.6	0.3	0.3
Anode dissipation	0.95	0.6	0.6	0.6	0.6
Control-grid current	0.9	0.8	0.7	0.4	0.4
Control-grid dissipation	0.9	0.7	0.7	0.7	0.7

Should it be desired to use tetrodes for r.f. heating applications Mullard Limited, (Industrial Technical Service Department) should be consulted.

To avoid damage to the valve in the event of an overload it is recommended that the minimum protection incorporated in industrial heating equipment should include a rapid action device to cut off the h.t. when the anode or grid current exceeds the maximum rating. If the anode dissipation at zero grid bias exceeds the limiting value, then grid under-current protection is also recommended in case oscillation ceases while the h.t. is applied. Further, where water or forced-air cooling of the valve is used, protection against failure of the cooling system is necessary.

MOUNTING

It is strongly recommended that all valves be mounted vertically. It is, however, permissible to mount some of the smaller valves horizontally provided that, for directly heated valves, the plane of the filament is vertical or, for indirectly heated valves, the plane of the major axis of the first grid is vertical. Recommendations on mounting are given on the data sheets when necessary.

Leads having sufficient flexibility to allow for thermal expansion and other movements should be employed for the external connections to those valves whose construction is such that stress might otherwise be set up in the seals.

When designing a mounting for an r.f. valve, it is important to avoid closed circuits of conducting material in regions of strong r.f. fields, otherwise considerable loss of output may result. It is always preferable to keep the quantity of any material in the r.f. field to a minimum.

Where a valve with an internal anode (e.g. silica valve TYS5-3000) is mounted in a clamp, any large metal parts of the clamp which are located in the region of the anode should be connected to anode terminal. This will prevent heating of the glass or silica which would otherwise result from the r.f. potential gradient between the anode and the clamp.

Clamps used for supporting silica valves should be designed in such a way as to accommodate the usual envelope tolerances and thus avoid undue pressure being applied to the envelope.

DRIVE POWER

The value of grid current stated on the data sheets is intended only as a guide, and in making adjustments to the circuit the important factor to note is the grid driving voltage. Either over-driving or under-driving will result in a reduction in efficiency.

At low radio frequencies the drive power required for 'class C' operation can be calculated from the expression

$$P_{drive} = 0.9 \times v_{in\,(pk)} \times I_{g1} \text{ (d.c.)}$$

at higher frequencies more drive power is required due to input damping. The value given for the symbol $P_{load(driver)}$ is the power which must be available from the driver stage to provide for valve drive, input damping and circuit losses. It may be necessary to allow more for a circuit designed for a wide tuning range.

POWER OUTPUT

The valve output figures (P_{out}), represent the power which the valve will deliver to the circuit and load; a figure of load power (P_{load}) allowing for a typical circuit transfer efficiency for the type of service under consideration is stated.

When it is desired to operate power valves at frequencies so high that the efficiency is falling the input must be reduced.

REDUCED OPERATING LEVELS

(*a*) When it is desired to operate valves at reduced power levels at h.f. the valve conversion efficiency can be kept at the maximum by decreasing the input current rather than the voltage.

(*b*) When operating above about 100Mc/s however, circuit losses are higher and it is preferable to keep the input current high and reduce the voltage, thus minimising the circuit loss and obtaining a better load power.

(*c*) When the frequency of operation is so high that the efficiency is decreased the input power must be reduced in order to avoid excessive electrode dissipations. This should be achieved by reducing the anode voltage, see frequency/voltage characteristic in the individual data sheets.

POWER DISSIPATED IN VALVE ELECTRODES

Dissipation in the screen-grid is given by the product of d.c. voltage and current

$$p_{g2} = V_{g2} \times I_{g2}$$

Power in the control-grid for 'class C' operation at low radio frequencies can be closely approximated from the peak positive value of drive voltage and the d.c. grid current. (The peak positive voltage is the drive voltage less the magnitude of the bias voltage.)

$$p_{g1} = I_{g1} \left[0.9\, v_{in(pk)} - |V_{g1}|\right]$$

At higher radio frequencies the grid dissipation will be somewhat higher due to the increased capacitive current in the electrode.

In many radiation-cooled types the anode becomes visibly hot when near full dissipation and the temperature can be measured by a pyrometer. The temperature for full rated dissipation is usually given in the data sheets but any other loading may be checked by making comparative measurements with d.c. power, under non-oscillatory conditions.

For valves whose anodes are cooled by circulated water or by forced-air, the anode dissipation can be assessed by measuring the rise of temperature and flow of the cooling medium.

Radiation-cooled valves which do not colour may be assessed by covering with an insulating hood, vented to produce a reasonable equilibrium temperature and provided with some form of thermometer. The measured temperature under normal operating conditions may then be checked by making comparative measurements with d.c. power, under non-oscillatory conditions.

CLASS 'B' LOW FREQUENCY APPLICATIONS

The performance shown on the data sheets is based on an ideal circuit with no transformer losses, a resistive load, constant supply voltages and a sinusoidal input voltage. Allowances should be made for these factors in assessing the actual useful output power.

To reduce distortion due to the flow of grid current the impedance of the circuit supplying the input to the valve must be low. The use of a cathode follower driver stage is recommended, but an input transformer with a low output impedance or with a low damping resistance may be used.

The type of driver valve chosen must be able to deliver sufficient power to overcome the circuit losses in addition to providing the actual valve drive power.

STORAGE AND INSTALLATION

(a) *Mounting*

All large valves should be mounted with the filament vertical. The recommendation contained in individual data sheets as to the accuracy of the mounting should be complied with, otherwise the filament may sag towards the grid under its own weight.

In mobile or portable equipment, and in fixed installations subject to vibration, care should be exercised to ensure that the valve supports or chassis are suitably designed to protect the valve from mechanical shock and vibration.

(b) *Corona Effects*

Metal parts (particularly sharp points or edges), which might cause intense electrostatic fields, should not be located in the vicinity of valves operating at high voltages, since corona discharge may occur and cause damage to the valve. On installation, filament and other flexible leads should be kept well clear of the bulb and adjacent conductors.

(c) *Storage and Transit*

Valves not installed in equipment should be stored in their original packing or in racks. Any rack employed should be designed to protect the valve from excessive shaking or vibration and be so constructed that no stresses are imposed on the seals or the envelope.

Normal good storage conditions should be provided to prevent deterioration, such as corrosion of contacts or impairment of electrical insulation.

Valves should always be transported in the original packing designed for the purpose.

CONDITIONING

After transit or a period of storage it is recommended that power valves should be operated for not less than 15 minutes with the filaments only energised before being put into full service. In addition, with valves having anode voltages in excess of 5kV, the anode voltage and input power should be increased gradually or in several steps for a further period of 15 minutes, or longer, until normal operation is achieved. This treatment will clean-up traces of gases which may be present and which could cause premature failure of the valve.

Where valves are being held in store for an indefinite period it is recommended that periodic conditioning and testing is carried out as a safeguard against deterioration of vacuum. The interval of testing will, of course, depend upon the size and type of valve, and users are invited to contact Mullard Limited, (Industrial Technical Service Department) for details of treatment of individual valves.

LIST OF SYMBOLS

These symbols are based on British Standard Specification No. 1409 : 1950, " Letter Symbols for Electronic Valves ".

1. SYMBOLS FOR ELECTRODES

Anode	a	Fluorescent Screen or Target...	t
Cathode	k	External Metallisation	M
Grid	g	Internal Metallisation	m
Heater	h	Deflector Electrodes	x or y
Filament	f	Internal Shield	s
Beam Plates	bp	Resonator	Res ←

NOTE 1. In valves having more than one grid, the grids are distinguished by numbers—g_1, g_2, etc., g_1 being the grid nearest the cathode.

NOTE 2. In multiple valves, electrodes of the different sections may be distinguished by adding one of the following letters:

Diode	d	Hexode	h
Triode...	t	Heptode	h
Tetrode	q	Octode	h
Pentode	p	Rectifier	r

Thus, the grid of the triode section of a triode-hexode is denoted by g_{t}.

NOTE 3. Two or more similar electrodes which cannot be distinguished by any of the above means may be denoted by adding one or more primes to indicate to which electrode system the electrode forms a part.
Thus, the anode of the first diode in a double diode valve is denoted a′.

2. SYMBOLS FOR ELECTRIC MAGNITUDES

Voltages		Current	
Direct Voltage	V	Direct Current	I
Alternating Voltage (r.m.s.)	$V_{r.m.s.}$	Alternating Current (r.m.s.)	$I_{r.m.s.}$
Alternating Voltage (mean)	V_{av}	Alternating Current (mean)	I_{av}
Alternating Voltage (peak)	v_{pk}	Alternating Current (peak)	i_{pk}
Peak Inverse Voltage ...	P.I.V.	No Signal Current	I_o

Miscellaneous

Frequency	f	Anode Efficiency	η
Amplification Factor ...	μ	Sensitivity	S
Mutual Conductance ...	g_m	Brightness	B
Conversion Conductance...	g_c	Temperature	T
Distortion	D	Time	t

	Inside Valve	Outside Valve
Resistance	r	R
Reactance	x	X
Impedance	z	Z
Admittance	y	Y
Mutual Inductance	m	M
Capacitance	c	C
Capacitance at Working Temperature	c_w	
Power	p	P

3. AUXILIARY SYMBOLS

Battery or other source of supply	b
Inverse (Voltage or Current)	inv
Ignition (Voltage)	ign
Extinction (Voltage)	ext
No Signal	o
Input	in
Output	out
Total	tot
Centre Tap	ct

4. COMPLEX SYMBOLS

Symbols in Sections 1 and 3 above may be used as subscripts to symbols in Section 2, to denote such magnitudes as Anode Current, Grid Volts, etc., e.g.:—

Anode Voltage ...	V_a	Anode Current (A.C. r.m.s.)	$I_{a(r.m.s.)}$
Control-Grid Voltage	V_{g1}	No Signal Anode Current ...	$I_{a(o)}$
Anode Supply Voltage	$V_{a(b)}$	Control-Grid Current ...	I_{g1}
Filament Voltage ...	V_f	Total Distortion	D_{tot}
Heater Voltage ...	V_h	3rd Harmonic Distortion ...	D_3
Anode Dissipation ...	p_a	Equivalent Noise Resistance	R_{eq}
Output Power ...	P_{out}		
Drive Power	P_{drive}	Limiting Resistor	R_{lim}
Anode Current (D.C.)	I_a	Cathode Bias Resistor	R_k

	Internal	External
Anode Resistance	r_a	R_a
Insulation Resistance (heater to cathode)	r_{h-k}	
Resistance between Control-Grid and Cathode ...	r_{g1-k}	R_{g1-k}
Capacitance (cold)—		
Anode to all other electrodes		c_{a-all}
Anode to control-grid		c_{a-g1}
Control-grid to cathode at working temperature		$c_{g1-k(w)}$
Control-grid to all other electrodes except anode (Input Capacitance)		c_{in}
Anode to all other electrodes except control-grid (Output Capacitance)		c_{out}
Inner Amplification Factor		μ_{g1-g2}

PRESENTATION OF VALVE DATA

The symbols component and base references incorporated in the data are in accordance with the following British Standards:—

1409: 1950	Letter symbols for electronic valves.
1991: Part I: 1954	Letter symbols, signs and abbreviations.
530: 1948 (with supplements)	Graphical symbols for telecommunications.
448: 1953	Electronic valve bases, caps and holders.

OUTPUT OR MODULATOR TRIODE

MZ05-60

Power triode capable of dissipating 60 watts at the anode and suitable for use as an output valve in low frequency amplifiers or as a modulator in transmitting equipment.

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

FILAMENT

Oxide coated, suitable for operation on a.c. or d.c. supply.

V_f	6.0	V
I_f	1.7	A
Total Emission	1.0	A

CHARACTERISTICS At V_a=500 V I_a=120 mA

g_m	3.2	mA/V
μ	3	
r_a	940	Ω

CAPACITANCES

c_{out}	3.5	pF
c_{in}	5.5	pF
c_{a-g}	9.5	pF

LIMITING VALUES

V_a max.	650	V
p_a max.	60	W

OPERATING CONDITIONS—AS SINGLE CLASS A AMPLIFIER

V_a	500	V
V_g	–120	V
I_a	120	mA
$V_{in(r.m.s.)}$	85	V
p_a	60	W
P_{out} (D_{tot}=5%)	11	W
R_a	2,000	Ω

MZ05-60

OUTPUT OR MODULATOR TRIODE

OPERATING CONDITIONS—TWO VALVES AS CLASS AB_1 AMPLIFIER

V_a	650	650	V
V_g	−195	−195	V
I_a	2×82.5	2×115	mA
$V_{in\ (r.m.s.)}$	0	2×138	V
p_a	2×53.5	2×55	W
p_{out} (D_{tot}=5%)	—	40	W
R_{a-a}	7,500	7,500	Ω

OPERATING CONDITIONS—TWO VALVES AS CLASS AB_2 AMPLIFIER

V_a	600	600	V
V_g	−180	−180	V
I_a	2×65	2×112	mA
I_g	—	2×16	mA
p_a	2×39	2×34	W
p_{out} (D_{tot}=6%)	—	66	W
R_{a-a}	8,000	8,000	Ω

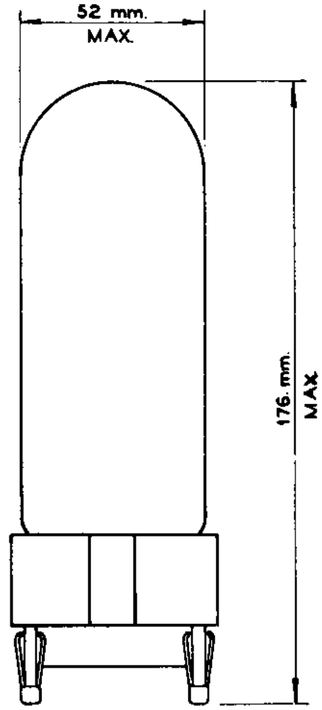
PUSH-PULL DRIVER STAGE USING TWO DO24 TRIODES

V_a	500	V
V_g	−48	V
I_a	2×50	mA
$V_{in\ (r.m.s.)}$	2×208	V

OUTPUT OR MODULATOR TRIODE

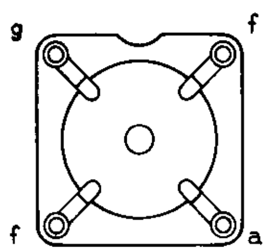
MZ05-60

DIMENSIONS AND BASE CONNECTIONS



4-pin Base to fit MHV.1 Holder

(Available from the Mullard Wireless Service Co., Ltd.)

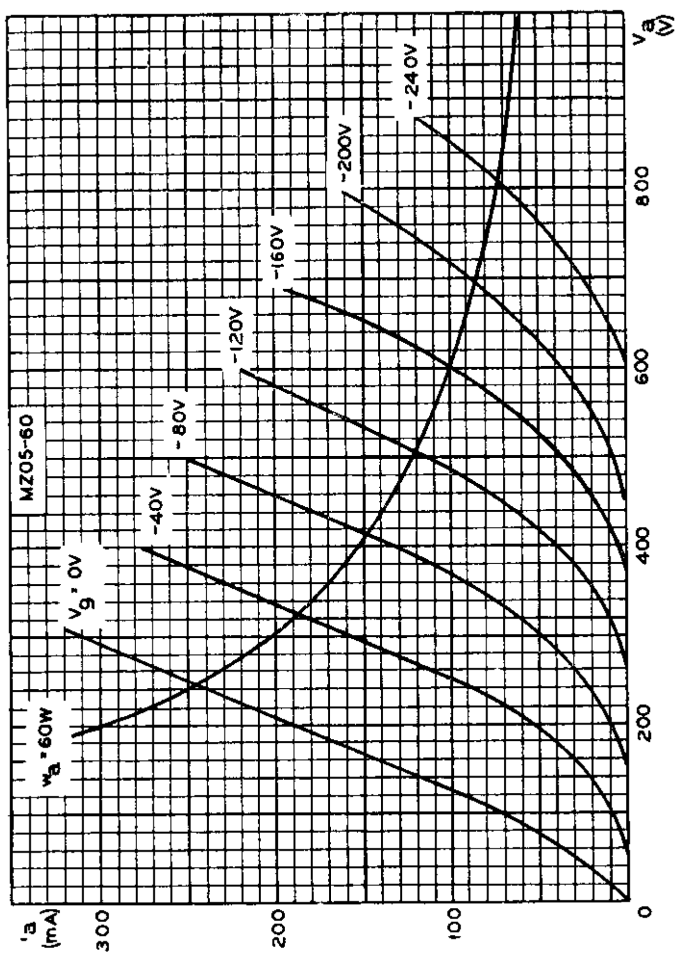


WEIGHTS

Valve only		8oz.
Valve and carton	3lb	6oz.

MZ05-60

OUTPUT OR MODULATOR TRIODE



OUTPUT OR MODULATOR TRIODE

MZI-100

Directly-heated power triode rated for a maximum anode dissipation of 100W, and primarily intended for use in the output stage of L.F. amplifiers or modulators.

MAINTENANCE TYPE

FILAMENT

Oxide-coated, for use on a.c. or d.c.

V_f	6.0	V
I_f (approx.)	2.5	A

CAPACITANCES

c_{g-k}	11.3	μμF
c_{a-k}	3.5	μμF
c_{a-g}	9.5	μμF

CHARACTERISTICS At $V_a = 1kV$, $I_a = 100mA$.

g_m	4.0	mA/V
μ	5.6	
r_a	1.4	kΩ

LIMITING VALUES

V_a max.	1.25	kV
p_a max.	100	W
I_k max.	250	mA
I_g max.	30	mA

OPERATING CONDITIONS AS CLASS "AB." PUSH-PULL AMPLIFIER (FIXED BIAS)

V_a	1.25	kV
$I_{a(o)}$	2x55	mA
I_a (max. sig.)	2x222	mA
I_g	2x27.5	mA
R_{a-a}	7.0	kΩ
$V_{in\ (r.m.s.)}$	2x243	V
P_{out}	380	W
D_{tot}	3.8	%

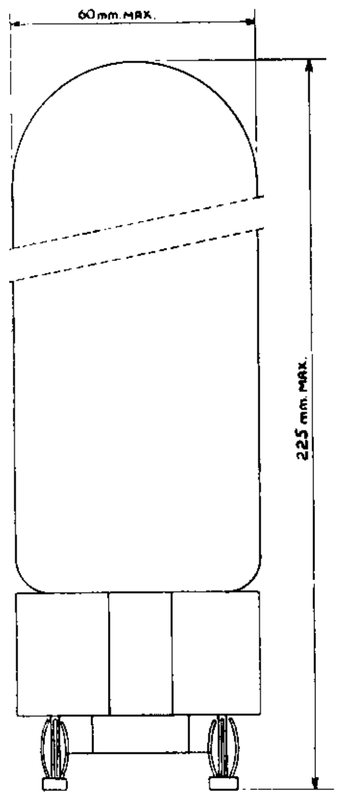
WEIGHT

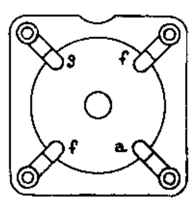
Valve only 9½ ozs. (266 grams).

MZI-100

OUTPUT OR MODULATOR TRIODE

Directly-heated power triode rated for a maximum anode dissipation of 100W, and primarily intended for use in the output stage of L.F. amplifiers or modulators.



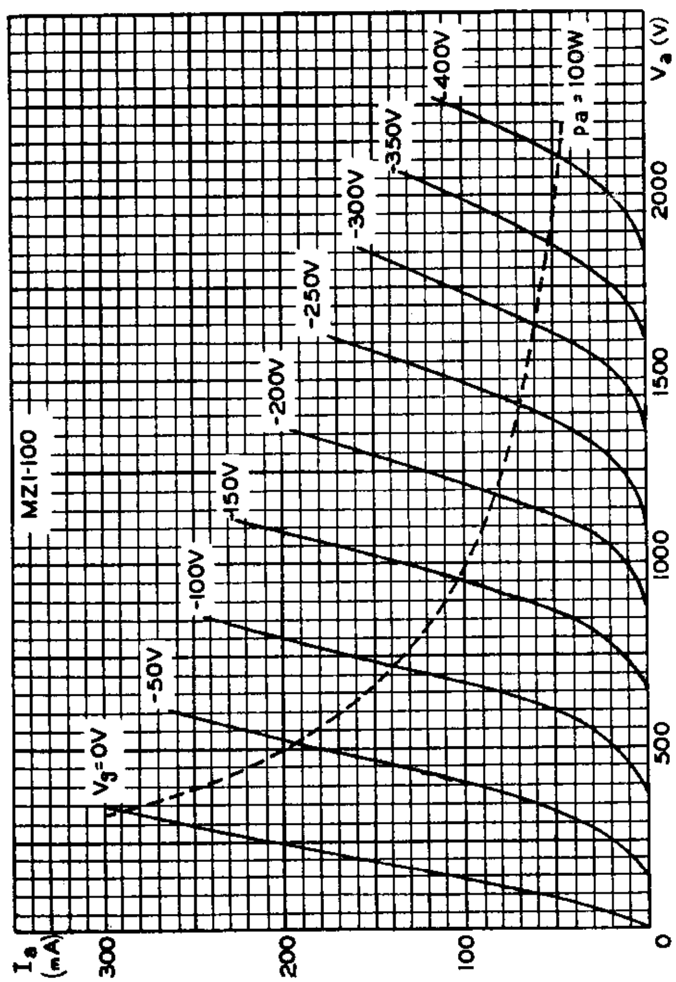


BASE TO FIT MVHI HOLDER

OUTPUT OR MODULATOR TRIODE

MZI-100

Directly-heated power triode rated for a maximum anode dissipation of 100W, and primarily intended for use in the output stage of L.F. amplifiers or modulators.

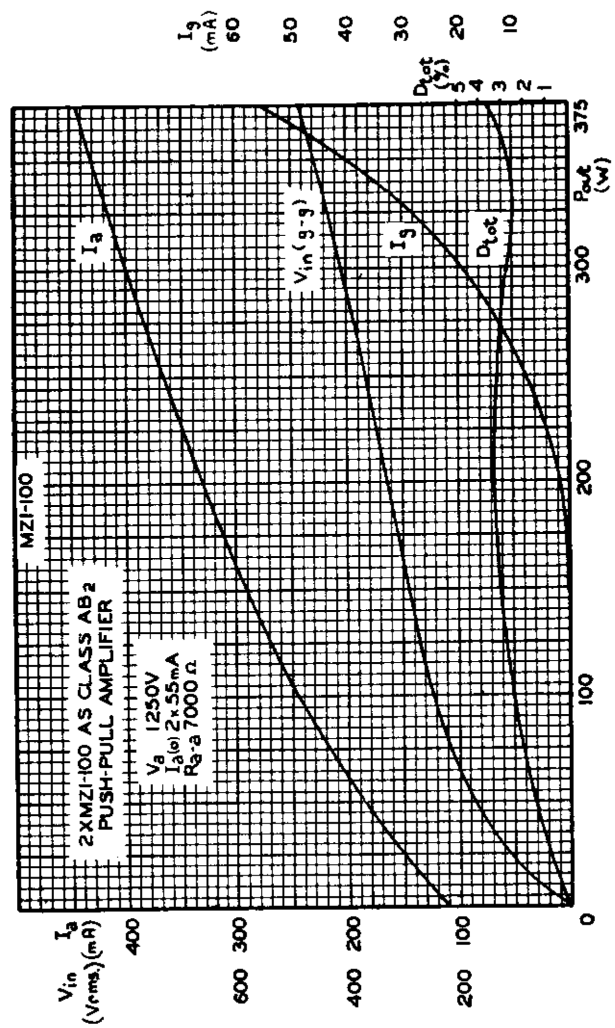


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH GRID VOLTAGE AS PARAMETER

MZI-100

OUTPUT OR MODULATOR TRIODE

Directly-heated power triode rated for a maximum anode dissipation of 100W, and primarily intended for use in the output stage of L.F. amplifiers or modulators.



ANODE CURRENT, INPUT VOLTAGE, GRID CURRENT AND TOTAL DISTORTION PLOTTED AGAINST POWER OUTPUT

R.F. POWER DOUBLE TETRODE

QQV02-6

Application: R.F. amplifier or frequency multiplier.
Power output: 5.8W at 500Mc/s.
Frequency: 500Mc/s at full ratings.
Construction: All-glass, natural cooling.

This data sheet should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES which precede this section 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	300	600	mA

*Emergency operation of the heater down to 5.7V (11.4V) and up to 7.0V (14V) is permissible.

MOUNTING POSITION — Any

For reasons of cooling and the performance of the valve at v.h.f. the use of a closed screening can is not permissible.

CAPACITANCES

$*c_{a\text{-}g1}$ (each section)	< 160	mpF
$c_{g1\text{-}all}$ (each section)	6.4	pF
$c_{a\text{-}all}$ (each section)	1.6	pF
c_{out} (two sections in push-pull)	950	mpF
c_{in} (two sections in push-pull)	3.8	pF

*Internally neutralised for push-pull operation

CHARACTERISTICS (each section) measured at $V_a = V_{g2} = 150V$, $I_a = 25mA$

g_m	10.5	mA/V
μ_{g1-g2}	31	

COOLING

Radiation and convection

T_{bulb} max.	225	°C
T_{pin} max.	120	°C

CLASS "C" TELEGRAPHY OR F.M. TELEPHONY

Limiting values

f max.	500	Mc/s
V_a max.	250	V
p_a max.	2×3.0	W
I_a max.	2×45	mA
V_{g2} max.	200	V
p_{g2} max.	2×1.5	W
$-V_{g1}$ max.	50	V
p_{g1} max.	2×100	mW
I_{g1} max.	2×3.0	mA
V_{h-k} max.	100	V

Typical operation

f	500	Mc/s
V_a	180	V
V_{g2}	180	V
V_{g1}	−20	V
R_{g1-k} (each section)	27	kΩ
I_a	2×27.5	mA
I_{g2}	2×6.25	mA
I_{g1}	2×1.0	mA
$v_{in(g1-g1)pk}$	50	V
$P_{load(driver)}$	1.2	W
p_a	2×2.1	W
p_{g2}	2×1.13	W
P_{out}	5.8	W
P_{load} ($\eta_{transfer}$ = 77%)	4.5	W
η_a	58	%

CLASS "C" ANODE AND SCREEN-GRID MODULATION

Limiting values (carrier condition for use with a modulation factor of 1)

f max.	500	Mc/s
V_a max.	200	V
p_a max.	2×2.0	W
I_a max.	2×32	mA
V_{g2} max.	200	V
p_{g2} max.	2×1.0	W
$-V_{g1}$ max.	50	V
p_{g1} max.	2×100	mW
I_{g1} max.	2×3.0	mA
V_{h-k} max.	100	V

Typical operation

f	500	Mc/s
V_a	180	V
$V_{g2(b)}$	180	V
R_{g2}	100	Ω
V_{g1}	–25	V
R_{g1-k} (each section)	68	kΩ
I_a	2×20	mA
I_{g2}	2×4.75	mA
I_{g1}	2×0.4	mA
$v_{in\ (g1-g1)\ pk}$	55	V
$P_{load(driver)}$	1.0	W
p_a	2×1.5	W
p_{g2}	2×850	mW
P_{out}	4.2	W
P_{load} ($\eta_{transfer}$ = 71%)	3.5	W
η_a	58	%
For 100% modulation		
$v_{g2(pk)mod}$	175	V
P_{mod}	4.5	W

FREQUENCY MULTIPLIER

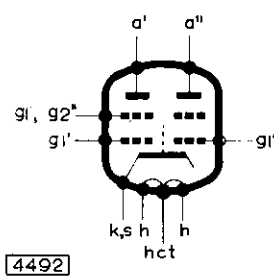
Limiting values

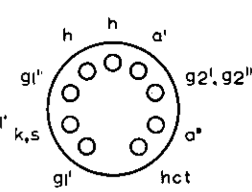
f max.	500	Mc/s
V_a max.	250	V
p_a max.	2×3.0	W
I_a max.	2×30	mA
V_{g2} max.	200	V
p_{g2}	2×1.5	W
$-V_{g1}$ max.	100	V
p_{g1} max.	2×100	mW
I_{g1} max.	2×3.0	mA
V_{h-k} max.	100	V

Typical operation

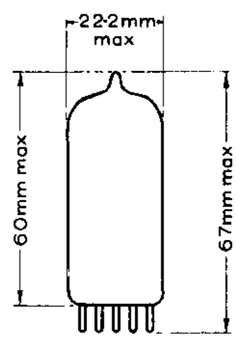
f_{in}	166.6	Mc/s
f_{out}	500	Mc/s
V_a	180	V
$V_{g2(b)}$	180	V
R_{g2}	1.2	kΩ
R_{g1-k} (each section)	82	kΩ
I_a	2×20	mA
I_{g2}	2×4.85	mA
I_{g1}	2×0.9	mA
$v_{in(g1-g1)pk}$	165	V
$P_{load(driver)}$	1.1	W
p_a	2×2.45	W
p_{g2}	2×830	mW
P_{out}	2.4	W
P_{load} ($\eta_{transfer}$ = 83%)	2.0	W
η_a	33	%

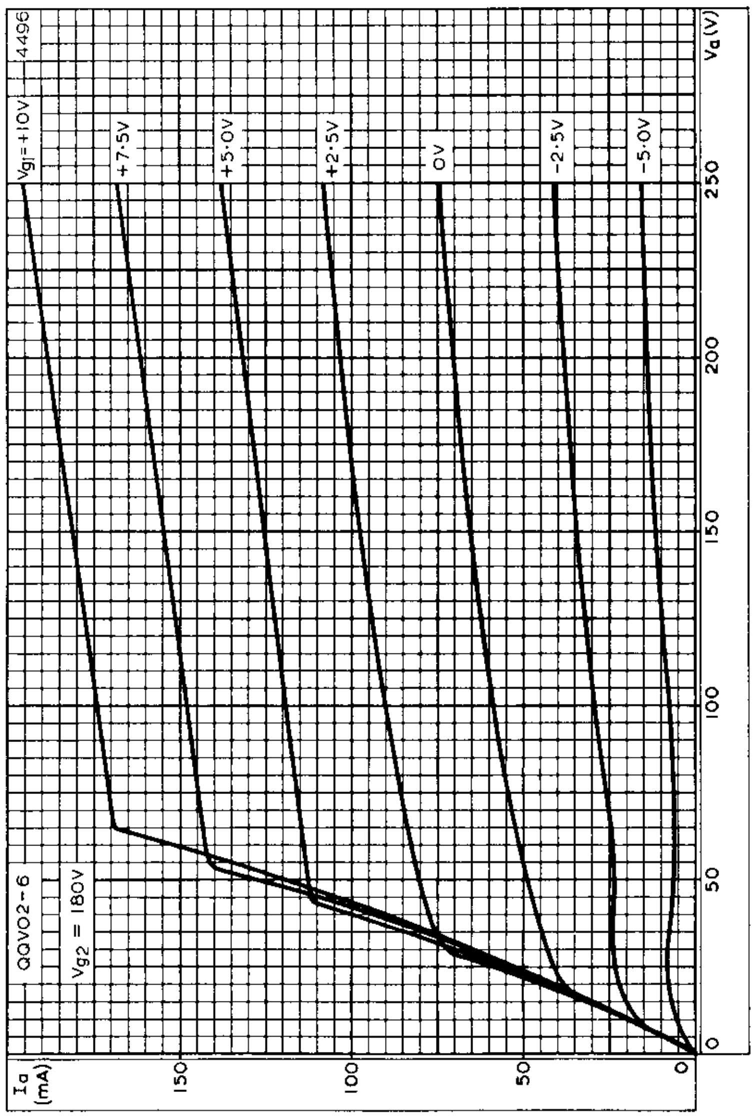
QQV02-6 R.F. POWER DOUBLE TETRODE





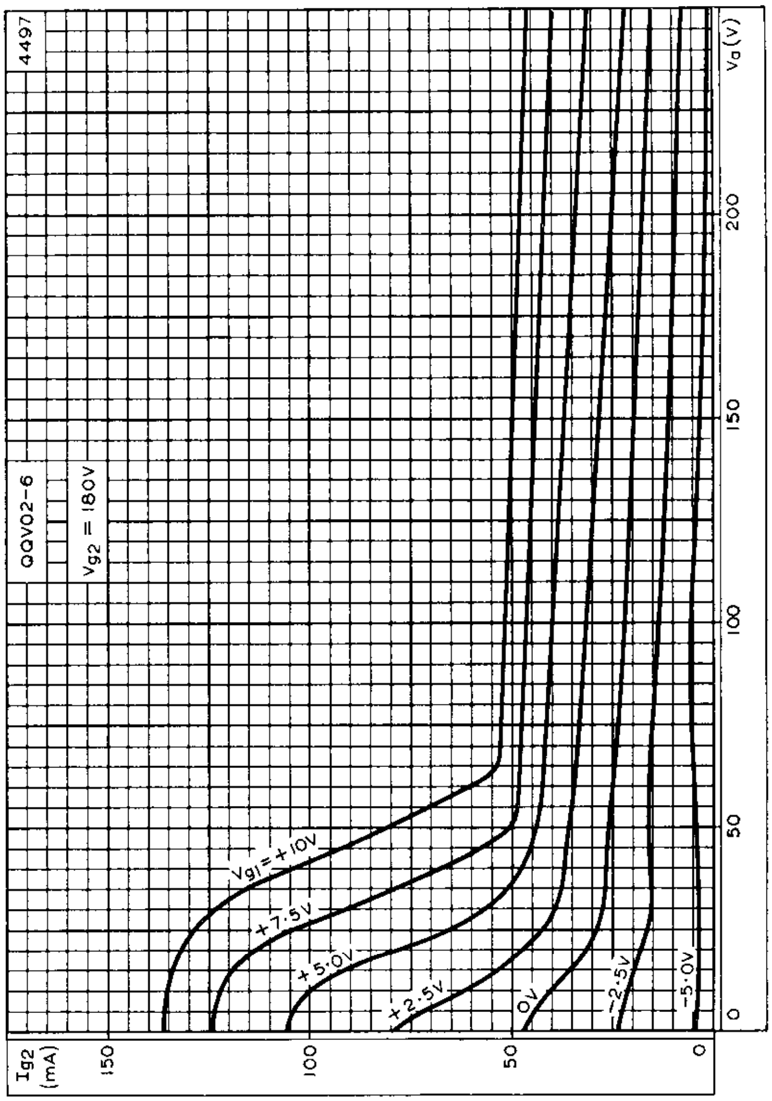
B9A Base





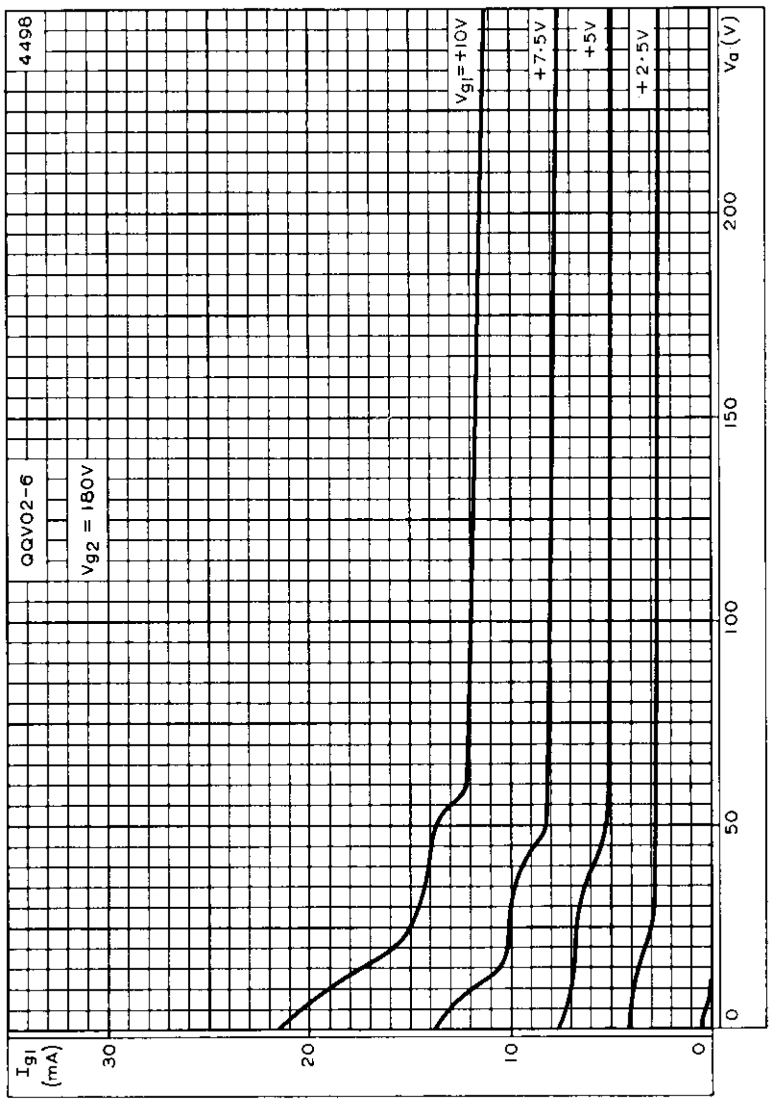
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE, V_{g2} = 180V

QQV02-6 R.F. POWER DOUBLE TETRODE

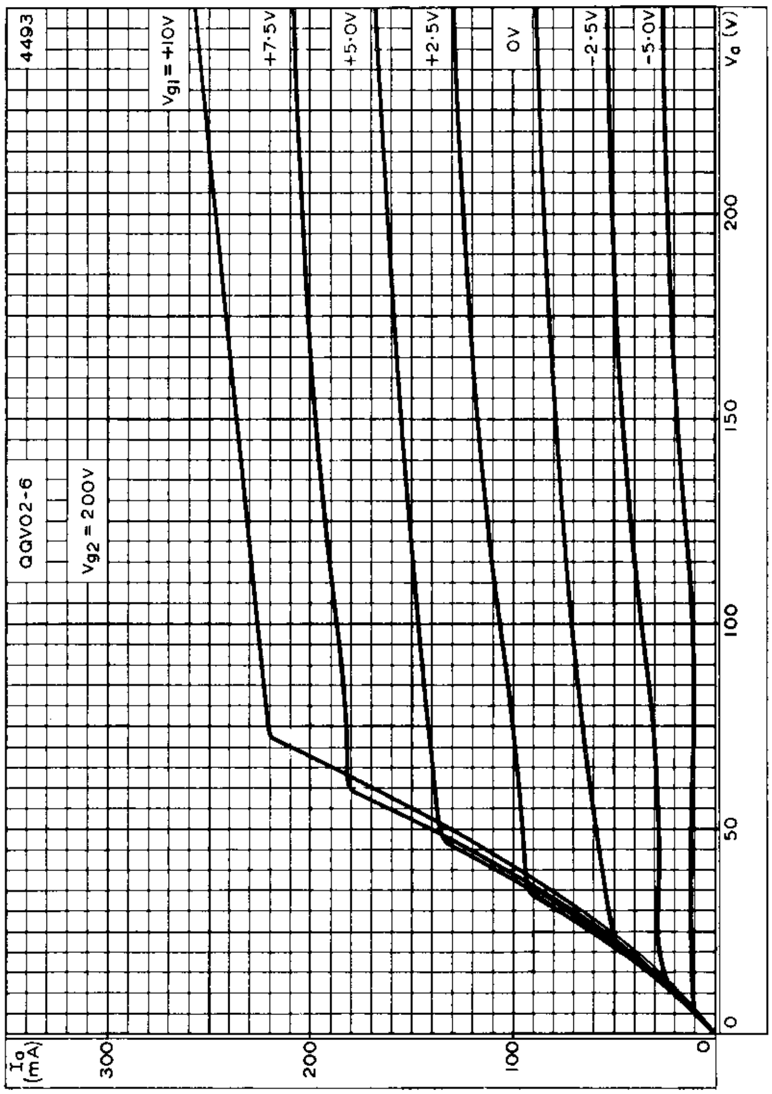


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, V_{g2} = 180V

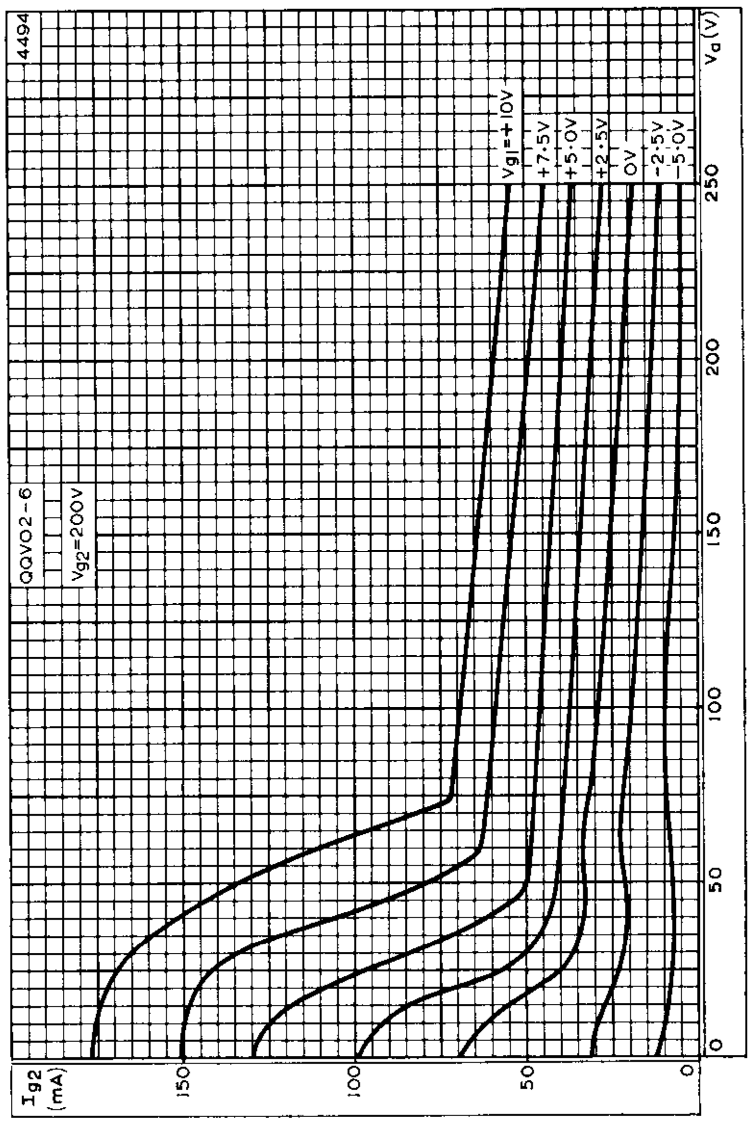
R.F. POWER DOUBLE TETRODE QQV02-6



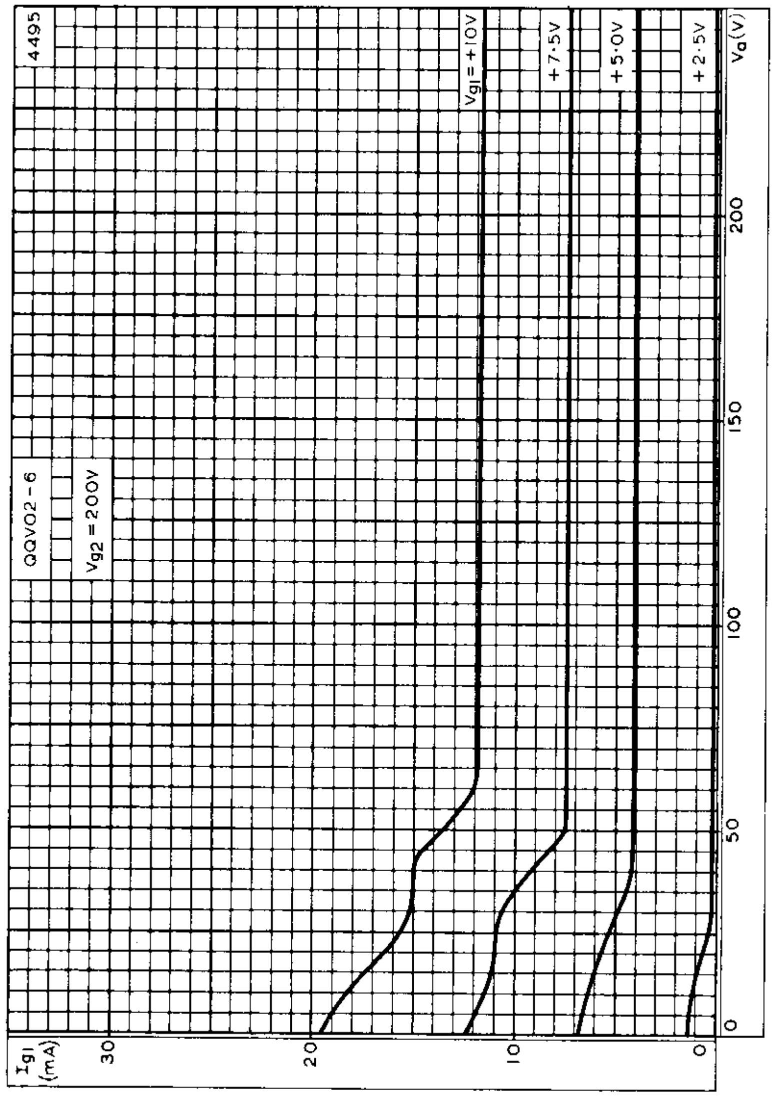
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, V_{g2} = 180V



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE, V_{g2} = 200V



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, V_{g2}=200V



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE, V_{g2} = 200V

R.F. POWER DOUBLE TETRODE QQV03-10

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225 Mc/s.

CATHODE

Indirectly heated

	Series	*Parallel*	
$^*V_h$	12.6	6.3	V
I_h	0.42	0.83	A
t_{h-k}		22	sec←

*Emergency operation of the heater down to 5.3V (10.6V) and up to 7.8V (15.6V) is permissible.

MOUNTING POSITION

Any

When the valve is mounted in a horizontal position it is essential that pins 2 and 7 are placed in a vertical plane.

For reasons of cooling and the performance of the valve at v.h.f. the use of a closed screening can is not permissible.

CAPACITANCES

$^*c_{a-g1}$ (each section)	<0.1	pF
c_{g1-all} (each section)	6.2	pF
c_{a-all} (each section)	2.6	pF
c_{out} (two sections in push-pull)	1.5	pF
c_{in} (two sections in push-pull)	5.0	pF

*Internally neutralised for push-pull operation.

CHARACTERISTICS (each section) measured at I_a = 30mA

g_m	3.3	mA/V
μ_{g1-g2}	7.5	

COOLING

Radiation and convection

T_{bulb} max.	225	°C
T_{pin} max.	120	°C ←

QQV03-10 R.F. POWER DOUBLE TETRODE

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225 Mc/s.

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

Limiting Values

V_a max.	300	V
p_a max.	2×5.0	W
V_{g2} max.	200	V
p_{g2} max.	2×1.0	W
I_{g1} max.	2×3.0	mA
p_{g1} max.	200	mW
I_k max.	2×50	mA
$i_{k(pk)}$ max.	2×225	mA
$-V_{g1}$ max.	150	V
V_{h-k} max.	100	V

Typical Operating Conditions

f	100	175	175	200	Mc/s
V_a	300	200	250	300	V
$*V_{g2}$	175	150	175	175	V
$*V_{g1}$	−40	−40	−40	−40	V
I_a	2×38	2×35	2×35	2×38	mA
I_{g2}	2×2.5	2×1.5	2×1.5	2×1.5	mA
I_{g1}	2×2.0	2×1.8	2×1.5	2×1.5	mA
$P_{load\ (driver)}$	250	500	400	500	mW
$v_{in(g1-g1)pk}$	110	115	105	110	V
p_a	2×3.4	2×3.0	2×3.0	2×4.5	W
P_{out}	16	8.5	11	14	W
P_{load}	14	7.0	8.5	10	W

*When V_{g2} and/or V_{g1} are obtained by means of resistors (R_{g2} and R_{g1}) the anode input power and therefore the output power is likely to vary considerably from valve to valve. For optimum operating conditions it will be necessary therefore to make R_{g2} adjustable.

R.F. POWER DOUBLE TETRODE QQV03-10

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225 Mc/s.

OPERATION AS SINGLE VALVE R.F. AMPLIFIER (CLASS "C" ANODE AND SCREEN-GRID MODULATION)

Limiting Values (carrier condition for use with modulation factor of 1) ←

V_a max.	250	V
p_a max.	2×3.3	W
V_{g2} max.	200	V
p_{g2} max.	2×650	mW
p_{g1} max.	2×200	mW
I_k max.	2×35	mA
$i_{k(pk)}$ max.	2×180	mA
$-V_{g1}$ max.	150	V
I_{g1} max.	2×3.0	mA
V_{h-k} max.	100	V

Typical Operating Conditions ←

f	175	Mc/s
V_a	200	V
V_{g2}	175	V
V_{g1}	−60	V
I_a	2×34	mA
I_{g2}	2×1.5	mA
I_{g1}	2×1.2	mA
$v_{in(g1-g1)pk}$	150	V
$P_{load\ (driver)}$	1.0	W
p_a	2×2.4	W
p_{out}	9.0	W
P_{load}	7.0	W
For 100% modulation		
*$v_{g2(pk)mod}$	125	V
P_{mod}	6.8	W

*Conveniently obtained from potential divider consisting of a 12kΩ and 39kΩ resistors across the secondary of the modulation transformer.

QQV03-10 R.F. POWER DOUBLE TETRODE

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225 Mc/s.

OPERATION AS A FREQUENCY TREBLER

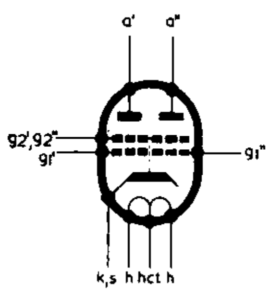
Limiting Values

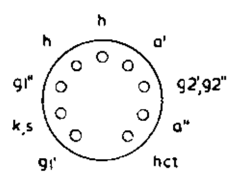
V_a max.	300	V
p_a max.	2×5.0	W
V_{g2} max.	200	V
p_{g2} max.	2×1.0	W
$-V_{g1}$ max.	150	V
p_{g1} max.	2×200	mW
I_{g1} max.	2×2.0	mA
I_k max.	2×35	mA
$i_{k(pk)}$ max.	2×225	mA
V_{h-k} max.	100	V

Typical Operating Conditions

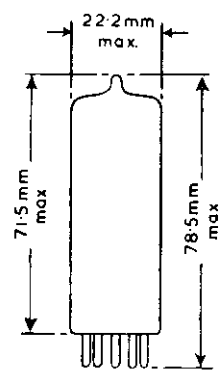
f_{out}	175	175	Mc/s
V_a	200	300	V
V_{g2}	150	150	V
V_{g1}	−100	−125	V
I_a	2×15	2×24	mA
I_{g2}	2×0.5	2×1.3	mA
I_{g1}	2×0.5	2×1.3	mA
$v_{in(g1-g1)pk}$	210	250	V
$P_{load\ (driver)}$	300	500	mW
p_a	2×2.0	2×4.5	W
P_{out}	2.0	5.5	W
P_{load}	1.5	3.5	W

1738





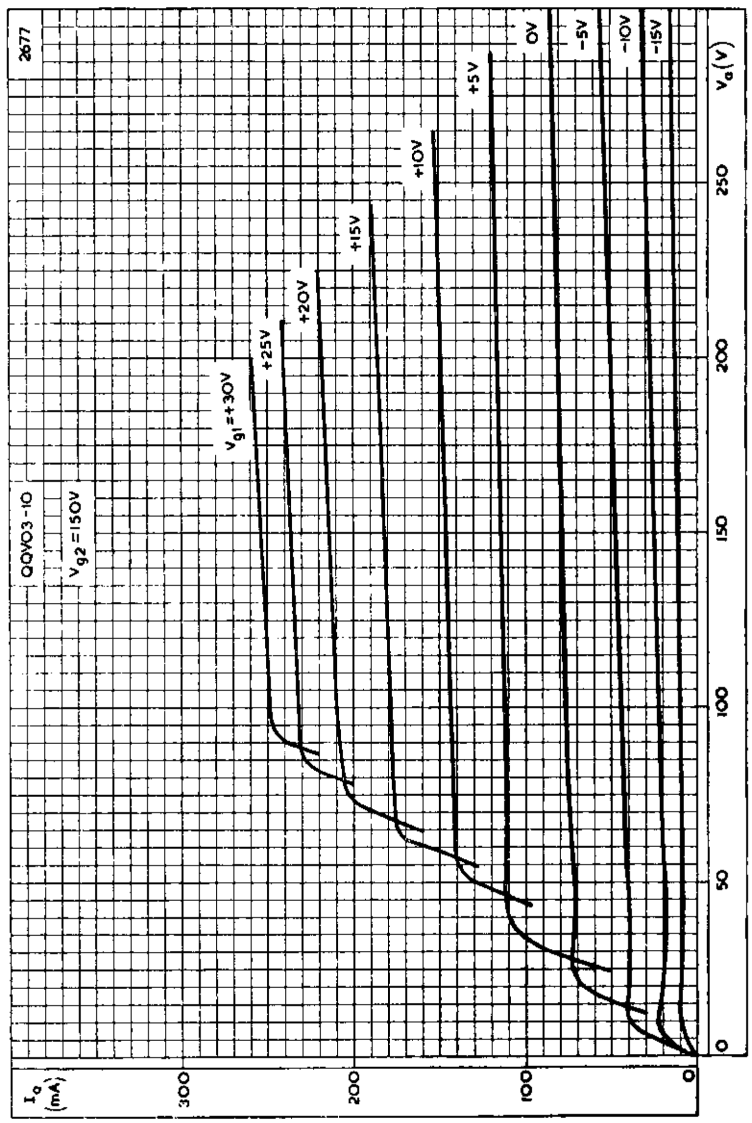
B9A
Noval Base



R.F. POWER DOUBLE TETRODE

QQV03-10

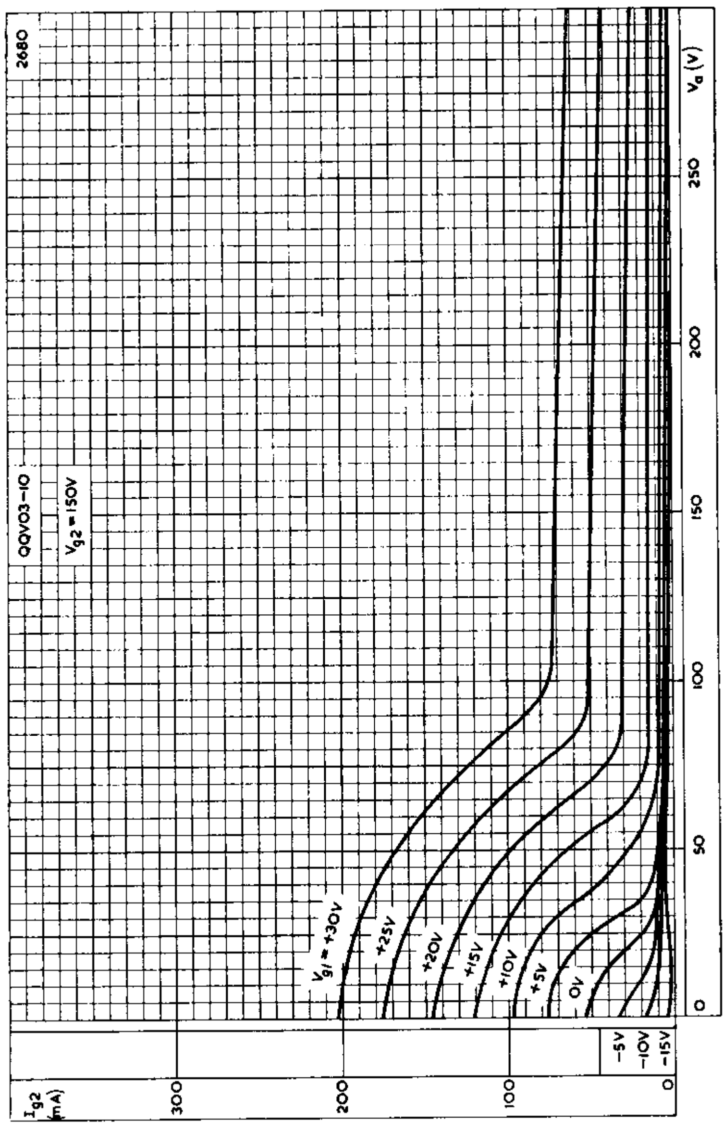
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2}=150V

QQV03-10 R.F. POWER DOUBLE TETRODE

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.

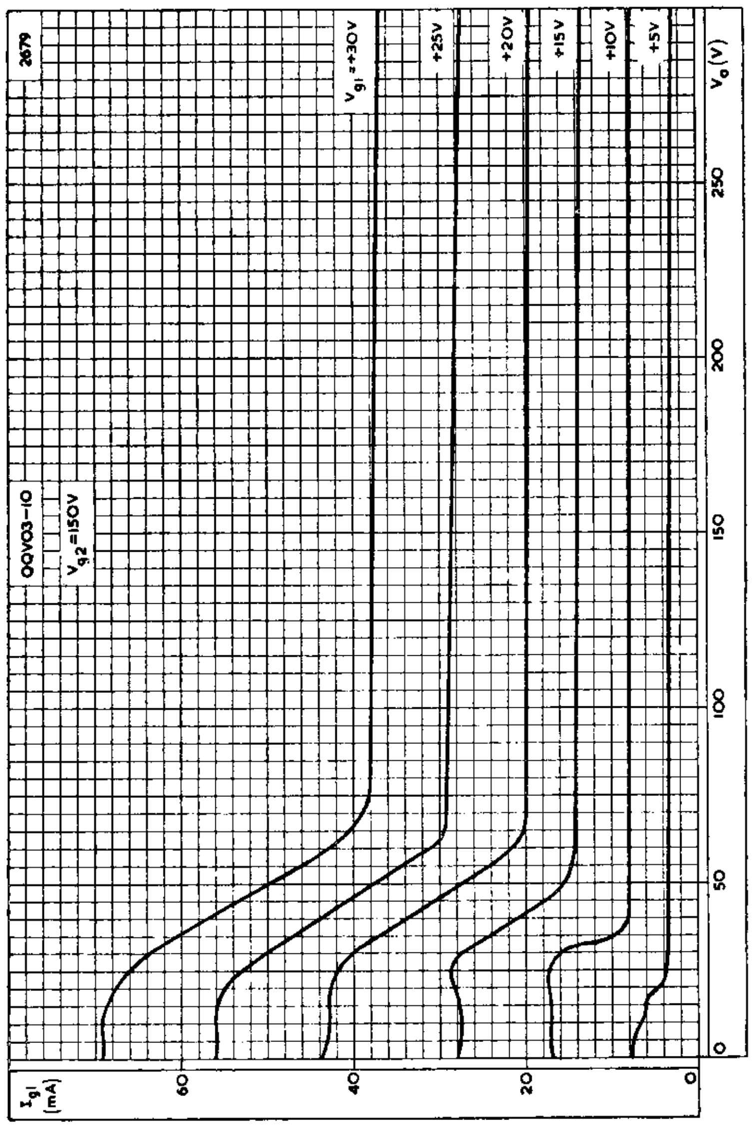


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2}=150V

R.F. POWER DOUBLE TETRODE

QQV03-10

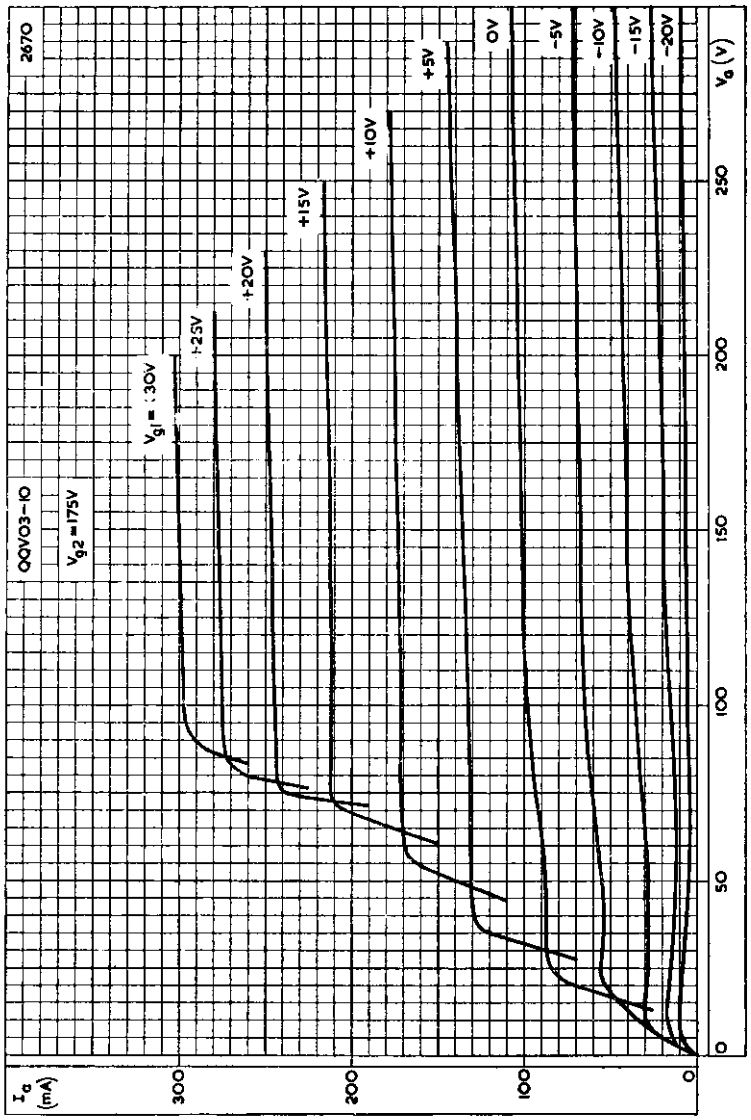
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
V_{g2}=150V

QQV03-10 R.F. POWER DOUBLE TETRODE

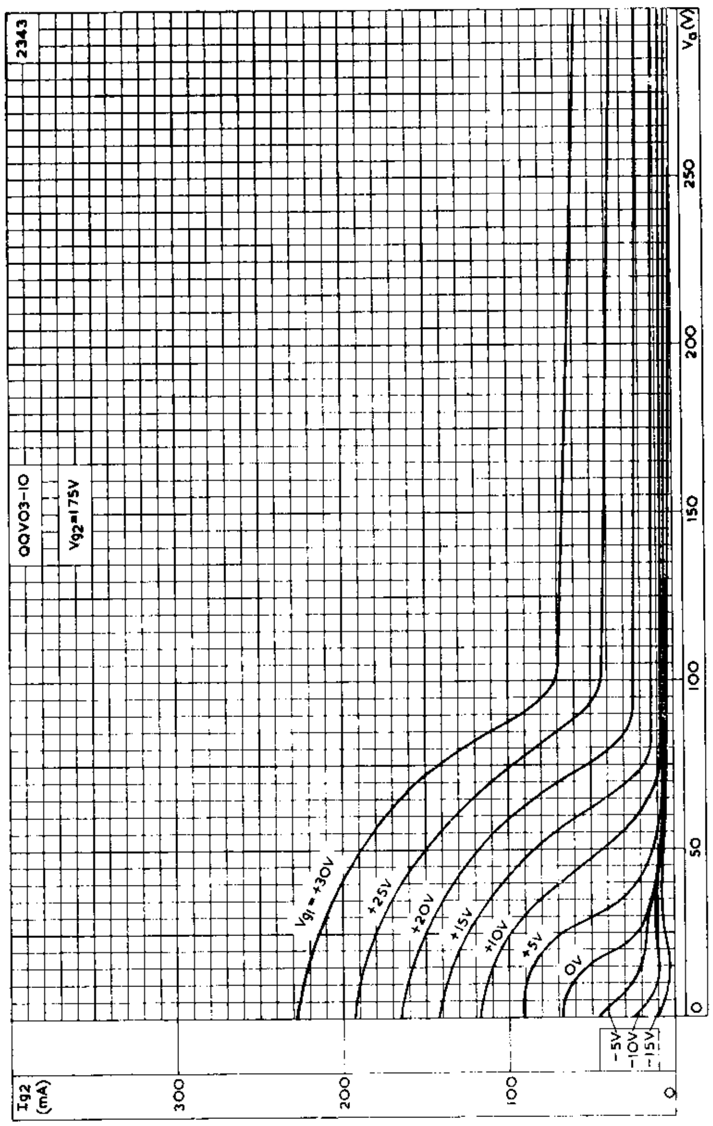
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2} = 175V

R.F. POWER DOUBLE TETRODE QQV03-10

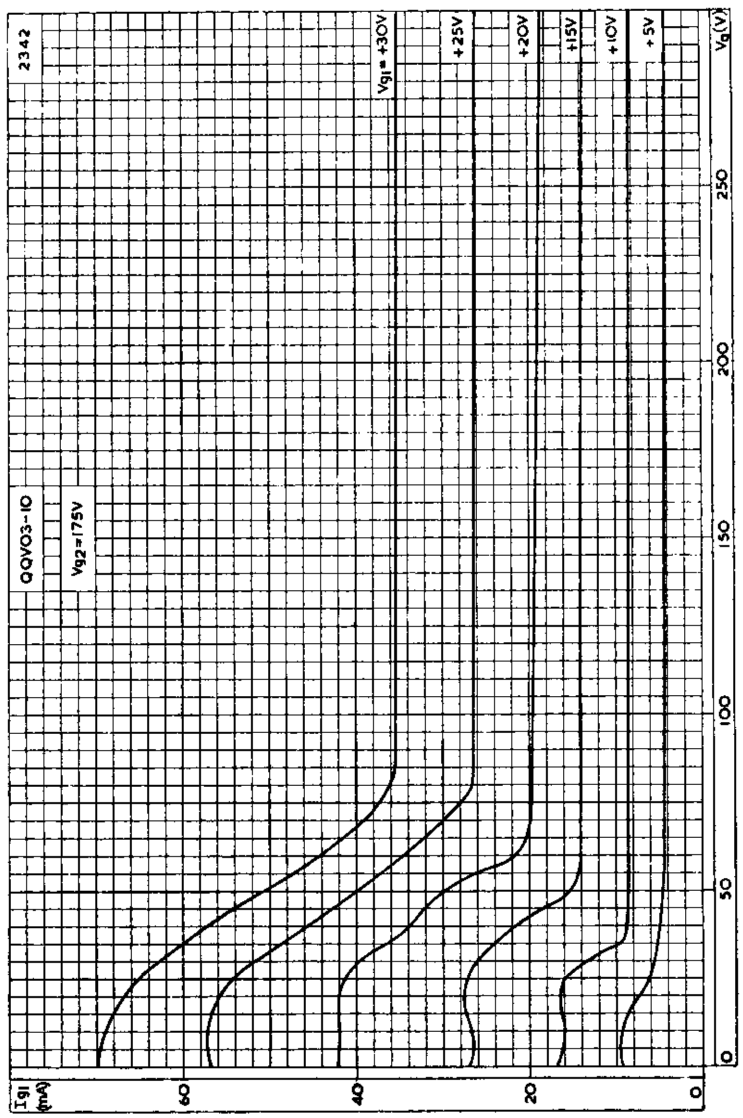
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2}=175V

QQV03-10 R.F. POWER DOUBLE TETRODE

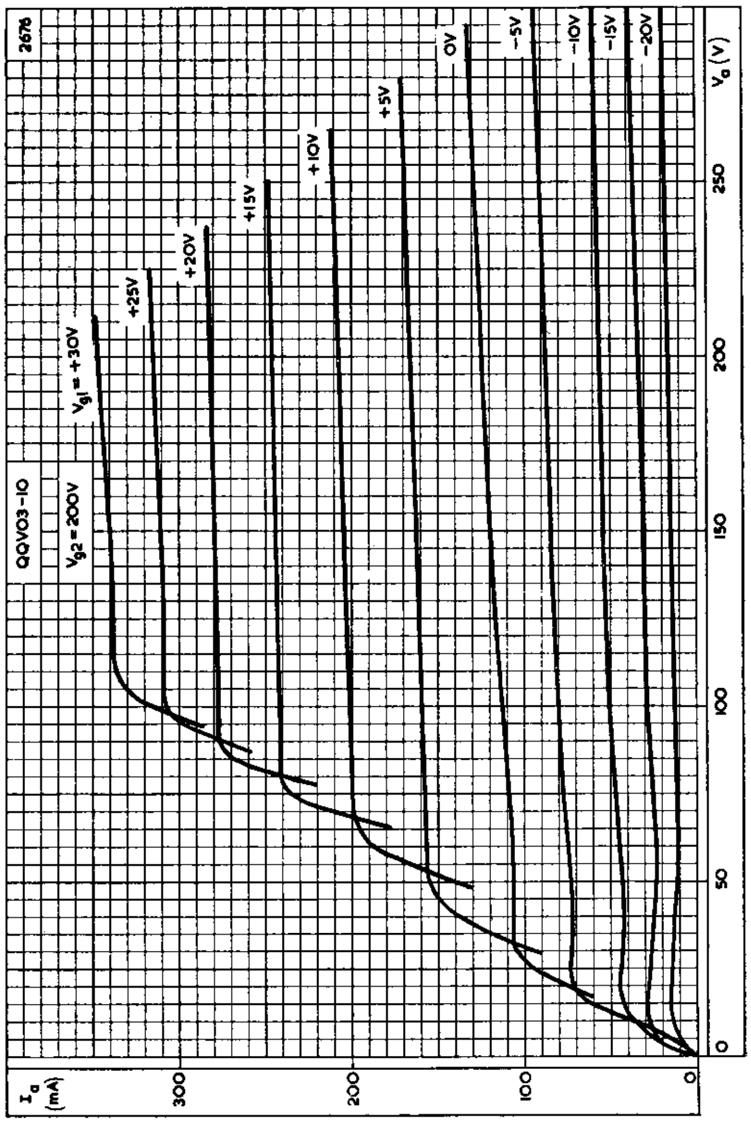
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
V_{g2}=175V

R.F. POWER DOUBLE TETRODE QQV03-10

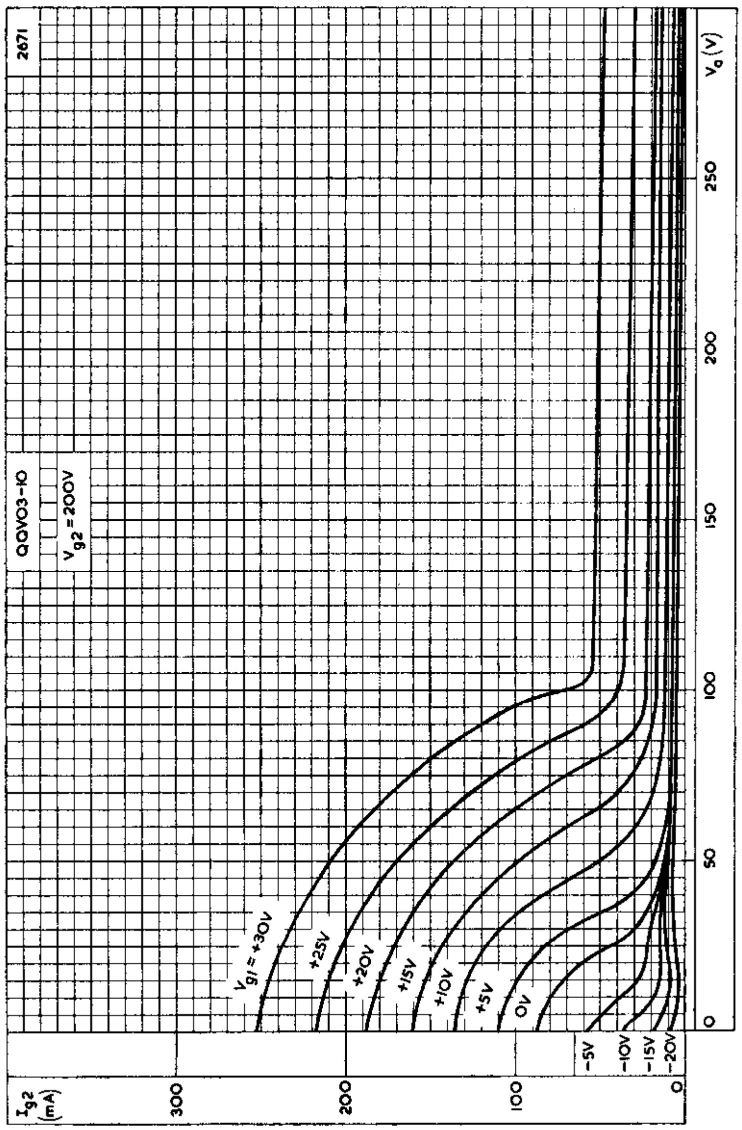
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2}=200V

QQV03-10 R.F. POWER DOUBLE TETRODE

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.

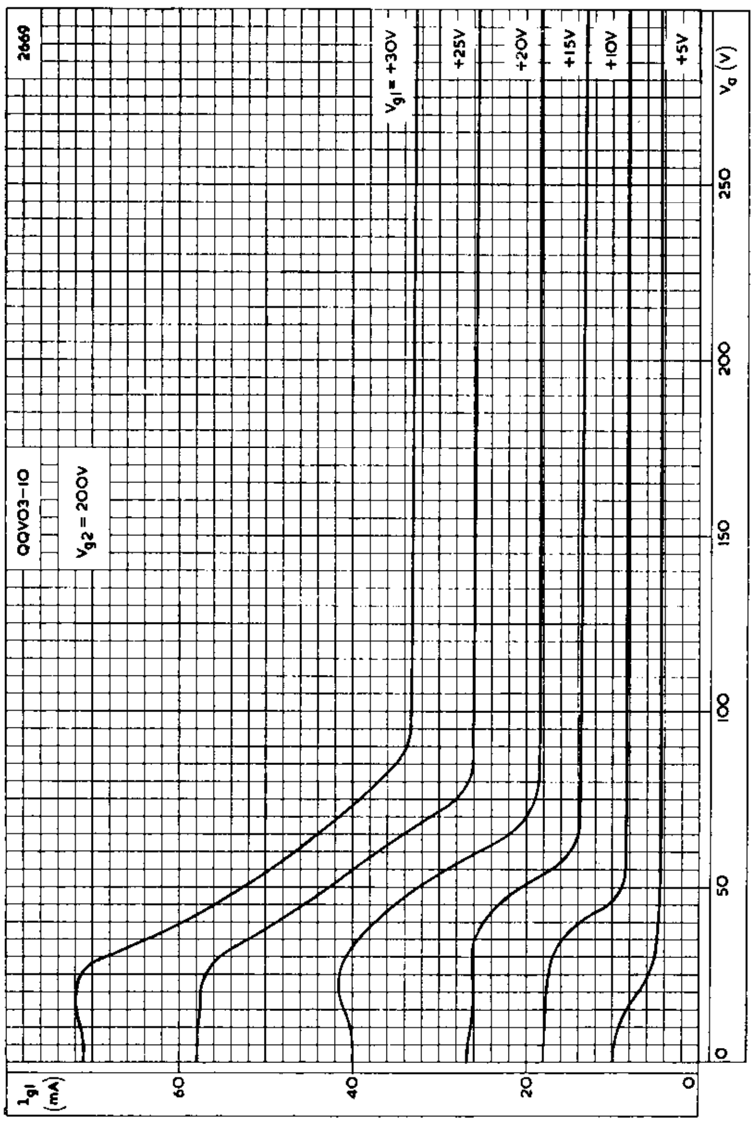


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2}=200V

R.F. POWER DOUBLE TETRODE

QQV03-10

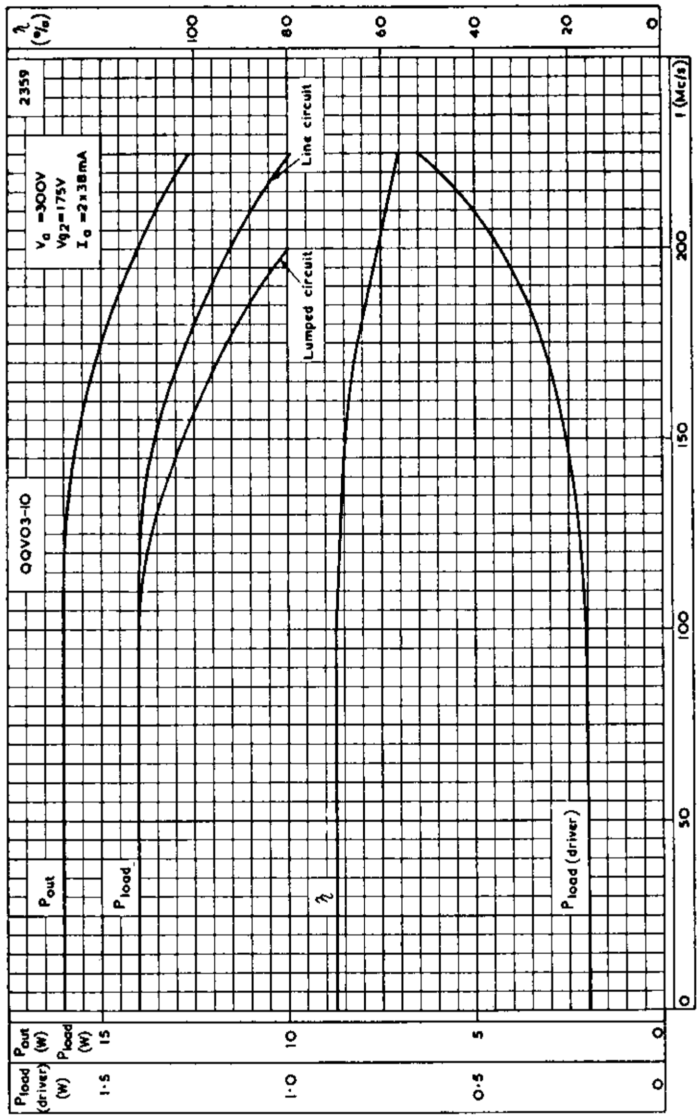
Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
V_{g2}=200V

QQV03-10 R.F. POWER DOUBLE TETRODE

Miniature r.f. double tetrode rated to dissipate 5W at each anode and intended for use at frequencies up to 225Mc/s.



FREQUENCY CHARACTERISTICS. SINGLE VALVE CLASS "C" TELEGRAPHY

U.H.F. POWER DOUBLE TETRODE

QQV03-20A

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
*Ig1	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
ηa	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
*Ig1	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←
ηa	55	50	58	50	%←
Pload	9	13	18	15	W←

*Ig1 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
Ig1 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

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 ←
ηa	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	kΩ
Rg1-k max. per section (automatic bias)	100	kΩ
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
ηa	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	kΩ
Rg1-k max. per section (automatic bias)	100	kΩ
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	kΩ
Dtot	3.5	3.5	%
Vin(g1-g1) r.m.s.	35	37	V

U.H.F. POWER DOUBLE TETRODE

QQV03-20A

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	^{o}C
Maximum bulb and anode seal temperature	250	^{o}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

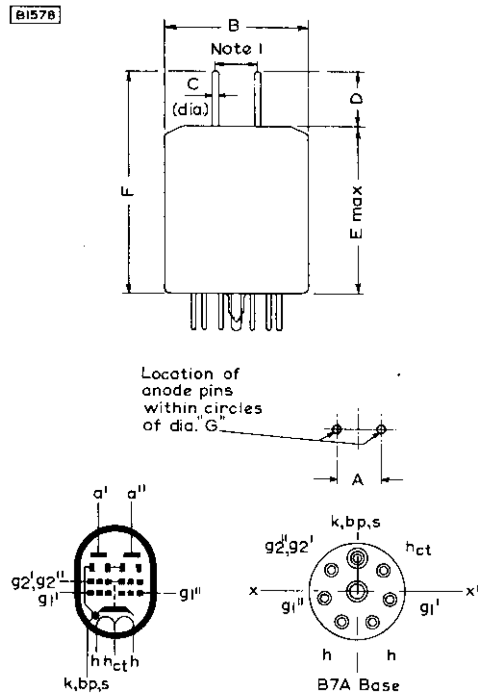
DIMENSIONS

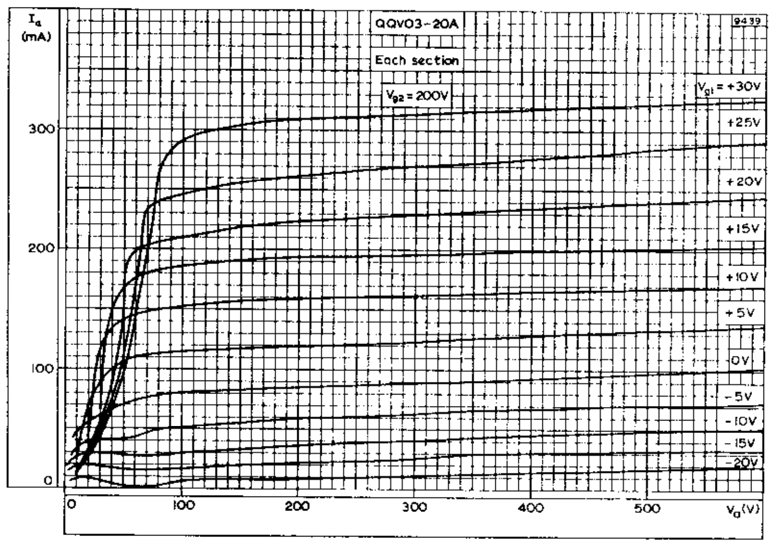
	Inches	Millimetres
A	0.551±0.001	14±0.03
B	1.772±0.039	45±1
C	0.079±0.004	2±0.1
D	0.650±0.059	16.5±1.5
E	2.165	55
F	2.677±0.118	68±3
G	0.098±0.001	2.5±0.03
H	0.118±0.004	3±0.1

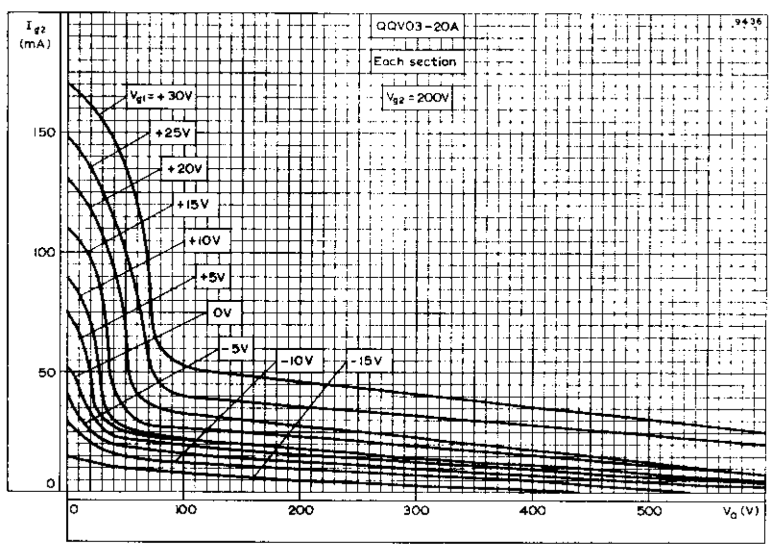
U.H.F. POWER DOUBLE TETRODE

QQV03-20A

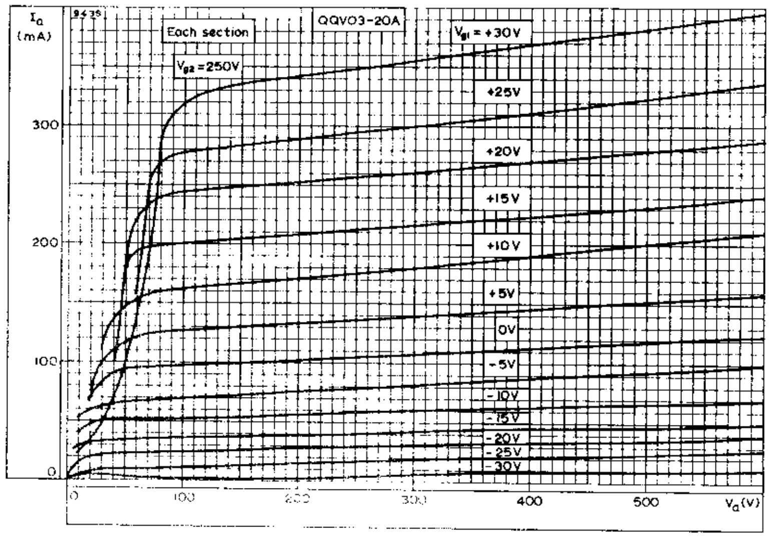
B1578

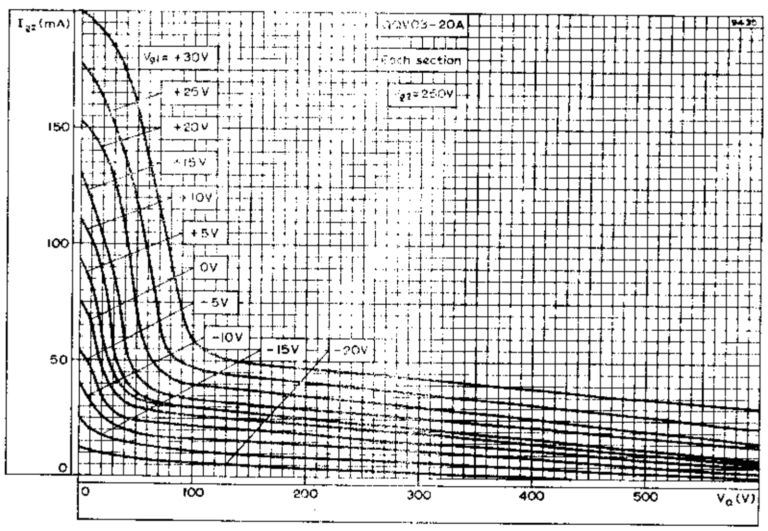




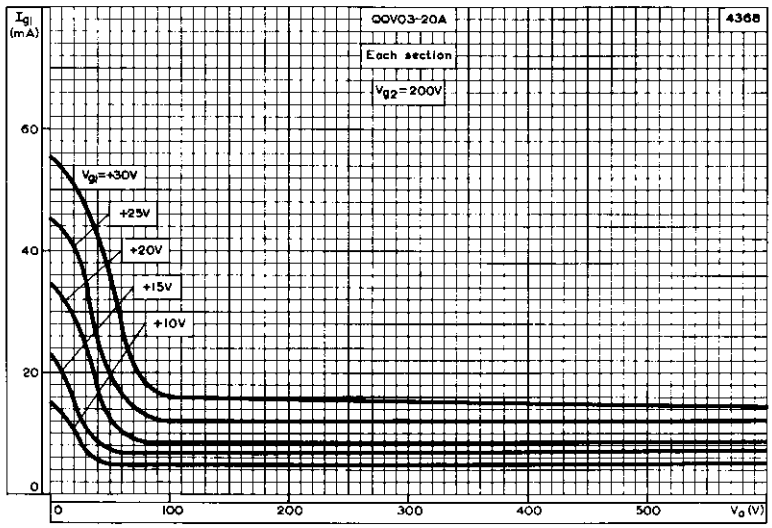


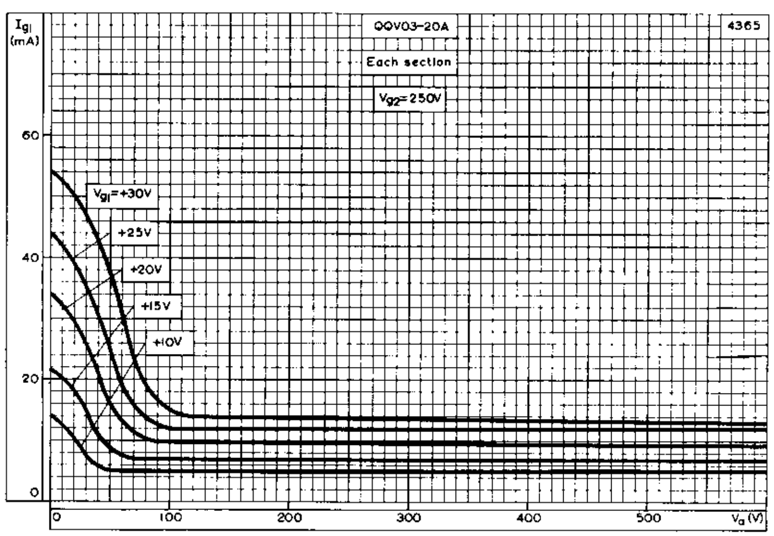
ANODE AND SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V.



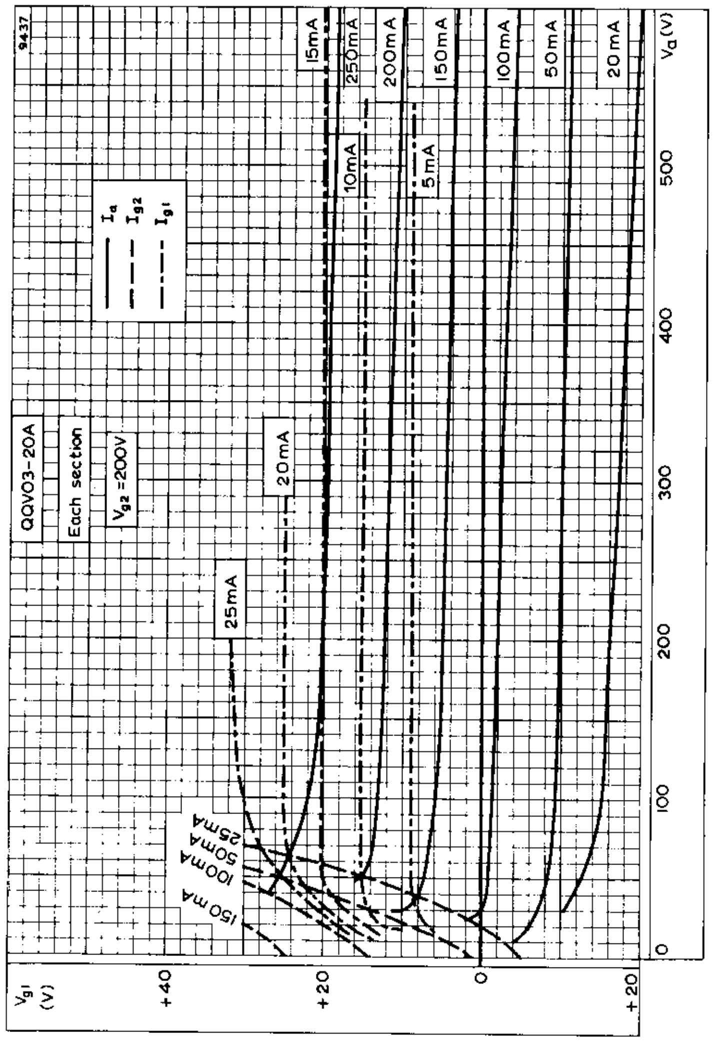


ANODE AND SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 250V.





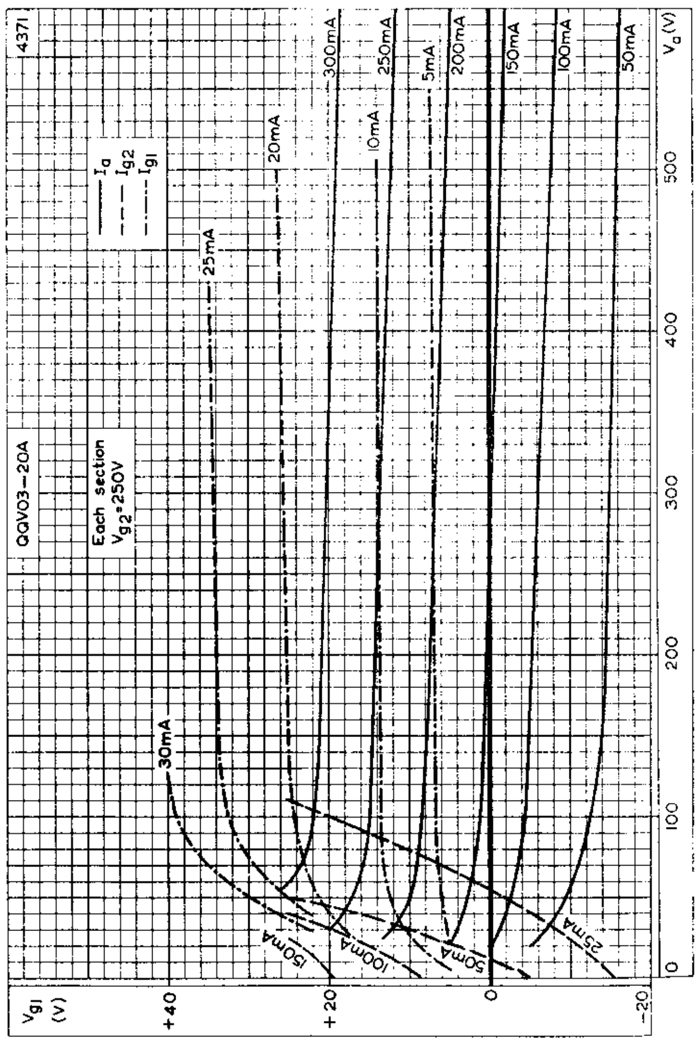
CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V AND V_{g2} = 250V.



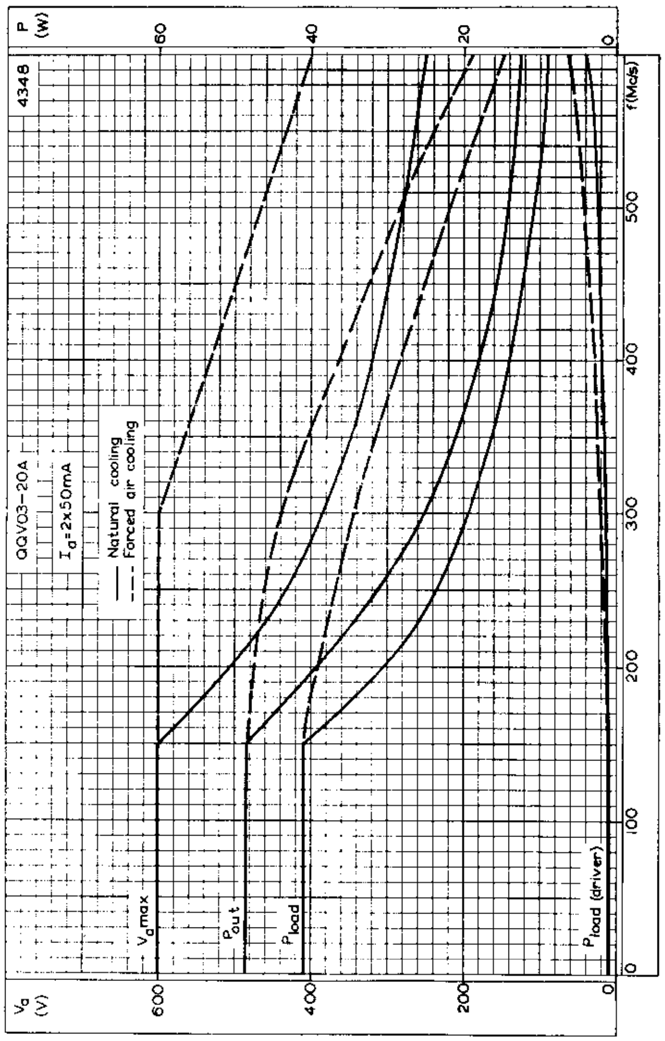
CONSTANT CURRENT CURVES FOR EACH SECTION V_{g2} = 200V.

U.H.F. POWER
DOUBLE TETRODE

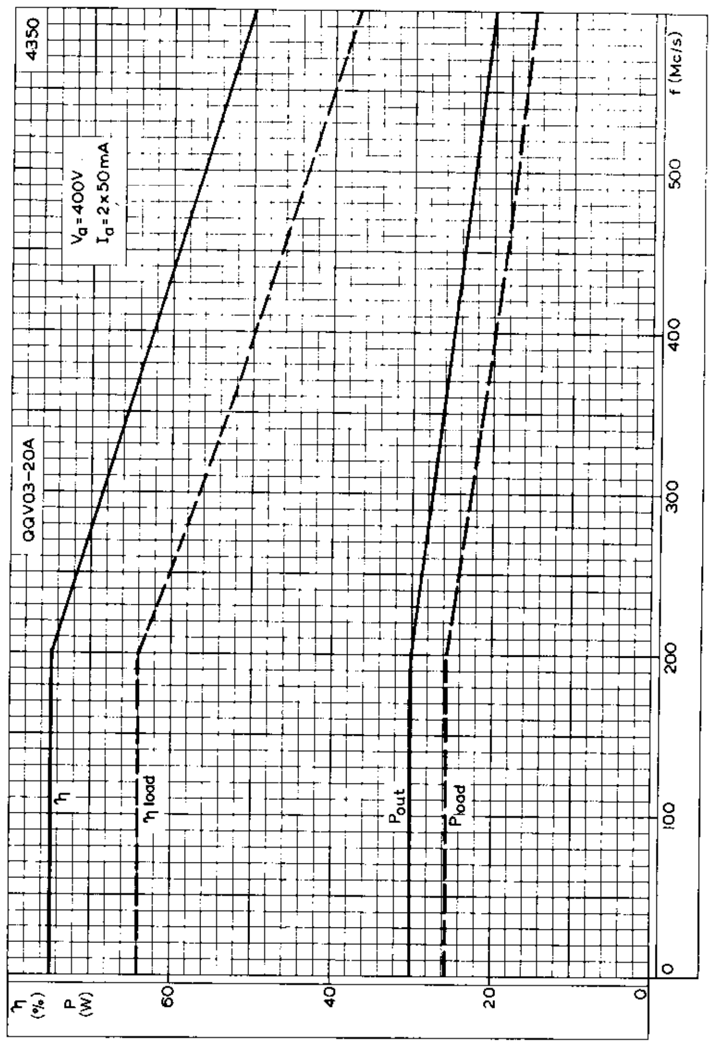
QQV03-20A



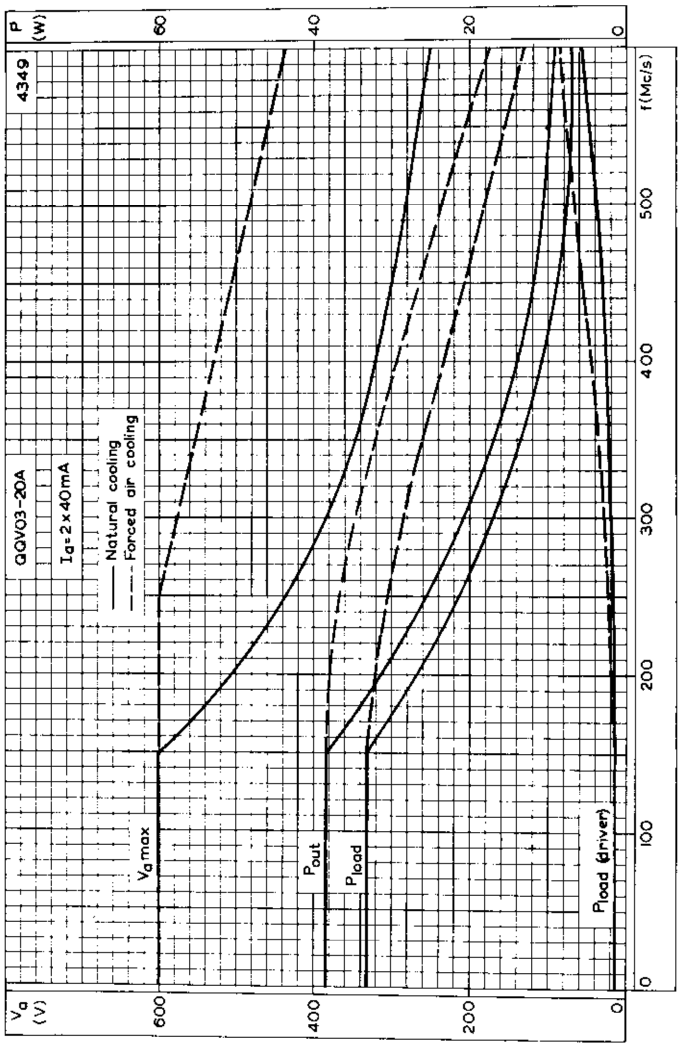
CONSTANT CURRENT CURVES FOR EACH SECTION V_{g2} = 250V.



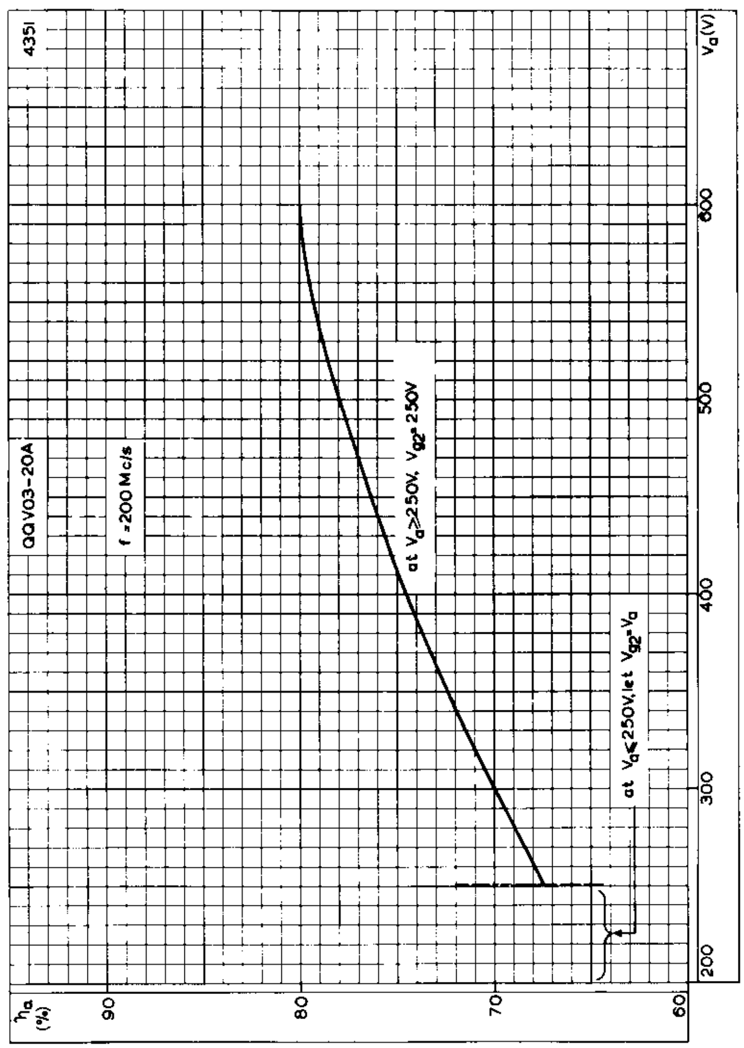
MAXIMUM OPERATING CONDITIONS FOR A PUSH-PULL R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)



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

U.H.F. POWER DOUBLE TETRODE

QQV03-25

QUICK REFERENCE DATA

Double tetrode intended for use as v.h.f. power amplifier or frequency multiplier.

		Frequency Multiplier	Class 'C' Telephony Anode and Screen Grid Modulation	Class 'C' Telegraphy or F.M. Telephony	
f		158/475	180	180	Mc/s
P_{out}		10	43	67	W
f max.		600	600	600	Mc/s
V_a max.	(f<250Mc/s)	750	600	750	V
	(f=600Mc/s)	600	400	500	V
p_a max.		2 x 12.5	2 x 8.3	2 x 12.5	W

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES.

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Maximum operating conditions

f	180	180	180	470	600	Mc/s
P_{out}	35	56	67	38	22	W
P_{load}	31	48	57	31	17	W
η_a	73	78	80	63	47	%
V_a	400	600	700	500	400	V
I_a	2 x 60	2 x 60	2 x 60	2 x 60	2 x 59	mA
V_{g2}	250	250	250	250	250	V
I_{g2}	2 x 4.5	2 x 4.5	2 x 4.5	2 x 3.0	2 x 3.0	mA
$-V_{g1}$	50	60	65	55	50	V
I_{g1}	2 x 1.0	2 x 1.0	2 x 1.0	2 x 1.0	2 x 0.8	mA
P_{load} (driver)	1.2	1.8	2.0	3.0	6.0	W
p_a	2 x 6.5	2 x 8.0	2 x 8.5	2 x 11	2 x 12.5	W

CLASS 'C' TELEPHONY ANODE AND SCREEN-GRID MODULATION

Maximum operating conditions (Carrier conditions for 100% modulation)

f	180	180	180	180	470	Mc/s
P_{out}	19.5	26	35.5	43	17.5	W
P_{load}	16.5	21	29	37	14.5	W
η_a	68	71	74	75	60	%
V_a	300	400	500	600	300	V
I_a	2 x 48	2 x 41	2 x 48	2 x 48	2 x 48	mA
V_{g2}	250	250	250	250	250	V
I_{g2}	2 x 4.5	2 x 4.5	2 x 4.5	2 x 4.5	2 x 3.5	mA
$-V_{g1}$	50	65	75	80	50	V
I_{g1}	2 x 1.5	2 x 1.5	2 x 1.5	2 x 1.5	2 x 1.5	mA
$P_{load\ (driver)}$	2.0	2.5	3.0	3.5	3.0	W
p_a	2 x 4.75	2 x 3.5	2 x 6.25	2 x 7.25	2 x 5.75	W

For 100% modulation

P_{mod}	16.5	18.5	25	31	16.5	W
$v_{g2(pk)}$	185	185	185	185	185	V

FREQUENCY MULTIPLIER

Maximum operating conditions

f_{out}/f_{in}	180/60	475/158	Mc/s
P_{out}	15	10	W
P_{load}	12	8.0	W
η_a	38	27	%
V_a	400	300	V
I_a	2 x 50	3 x 50	mA
V_{g2}	250	250	V
I_{g2}	2 x 4.0	2 x 4.0	mA
$-V_{g1}$	175	175	V
I_{g1}	2 x 1.5	2 x 1.5	mA
$P_{load\ (driver)}$	4.0	6.0	W
p_a	2 x 12.5	2 x 10	W

U.H.F. POWER DOUBLE TETRODE

QQV03-25

ABSOLUTE MAXIMUM RATINGS

	Frequency Multiplier	Class 'C' Telephony	Class 'C' Telegraphy	
V_a max.				
($f<250$Mc/s)	750	600	750	V
($f=600$Mc/s)	600	400	500	V
V_{g2} max.	300	300	300	V
$-V_{g1}$ max.	200	200	200	V
I_k max.	2 x 60	2 x 50	2 x 66	mA
p_a max.	2 x 12.5	2 x 8.3	2 x 12.5	W
p_{g2} max.	2 x 1.5	2 x 1.2	2 x 1.5	W
I_{g1} max.	2 x 2.5	2 x 2.5	2 x 2.5	mA
p_{g1} max.	2 x 0.5	2 x 0.5	2 x 0.5	W
R_{g1-k} max. per section (fixed bias)	50	50	50	kΩ
R_{g1-k} max. per section (automatic bias)	100	100	100	kΩ
V_{h-k} max.	100	100	100	V
$V_{g2(b)}$ max.	600	600	600	V

CATHODE

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

	Series	Parallel	
V_h	12.6	6.3	V
I_h	0.65	1.3	A

CAPACITANCES

* c_{a-g1} (each section	40	mpF
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 = 40mA

g_m	2.5	mA/V
μ_{g1-g2}	8.0	

MOUNTING POSITION

Any

COOLING

Radiation and convection cooled

Maximum temperatures

Base pin	180	°C
Bulb	250	°C
Anode seal	250	°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 5ft^3/min, 0.15m^3/min) on the top of the bulb to keep the seal temperature within the stated limit.

PHYSICAL DATA

	oz	g
Weight of valve	2.0	57

ACCESSORIES socket 40202

DIMENSIONS

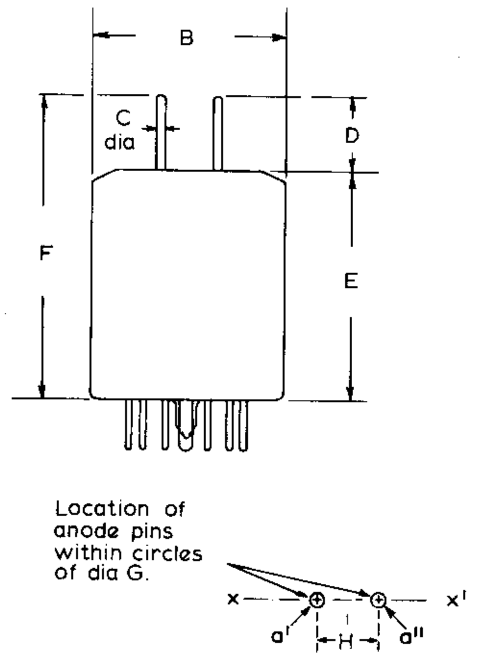
	Inches	millimetres
B	1.772 ± 0.039	45 ± 1
C	0.079 ± 0.001	2.0 ± 0.01
D	0.650 ± 0.059	16.5 ± 1.5
E	2.165	55 max
F	2.874	73 max
G	0.098 ± 0.001	2.5 ± 0.03
H	0.551 ± 0.001	14 ± 0.03

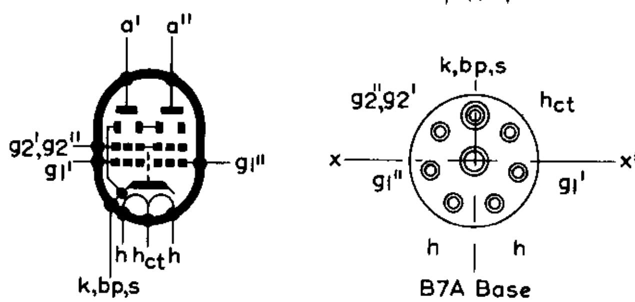
Inch dimensions are derived from original millimetre dimensions.

U.H.F. POWER DOUBLE TETRODE

QQV03-25

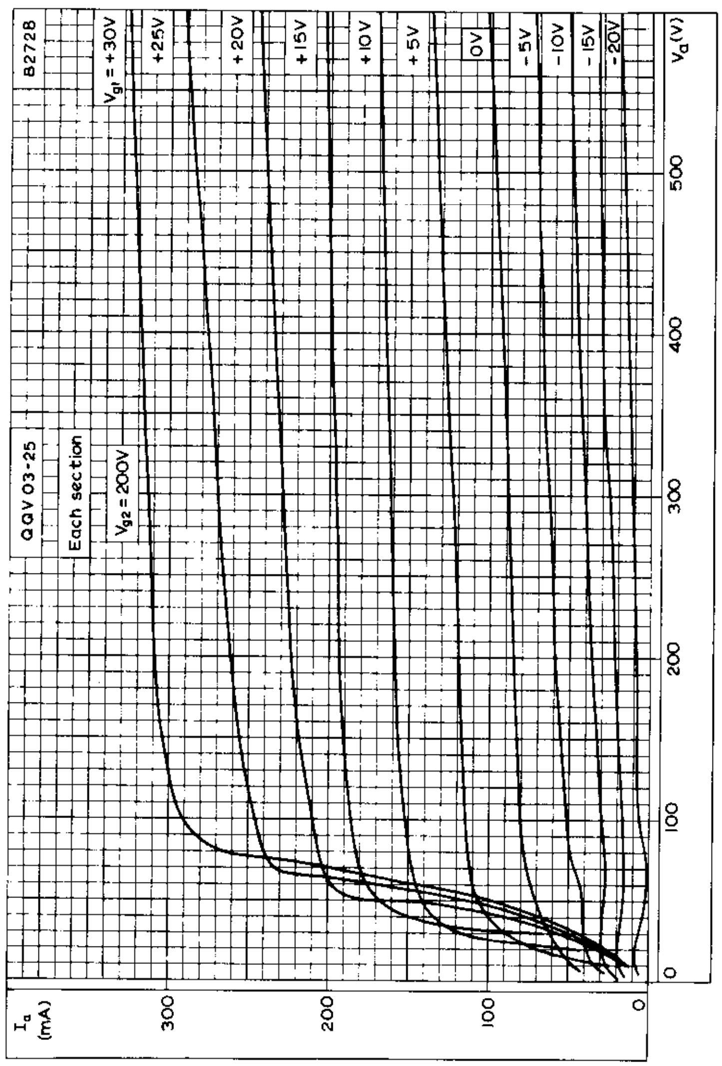
B2138



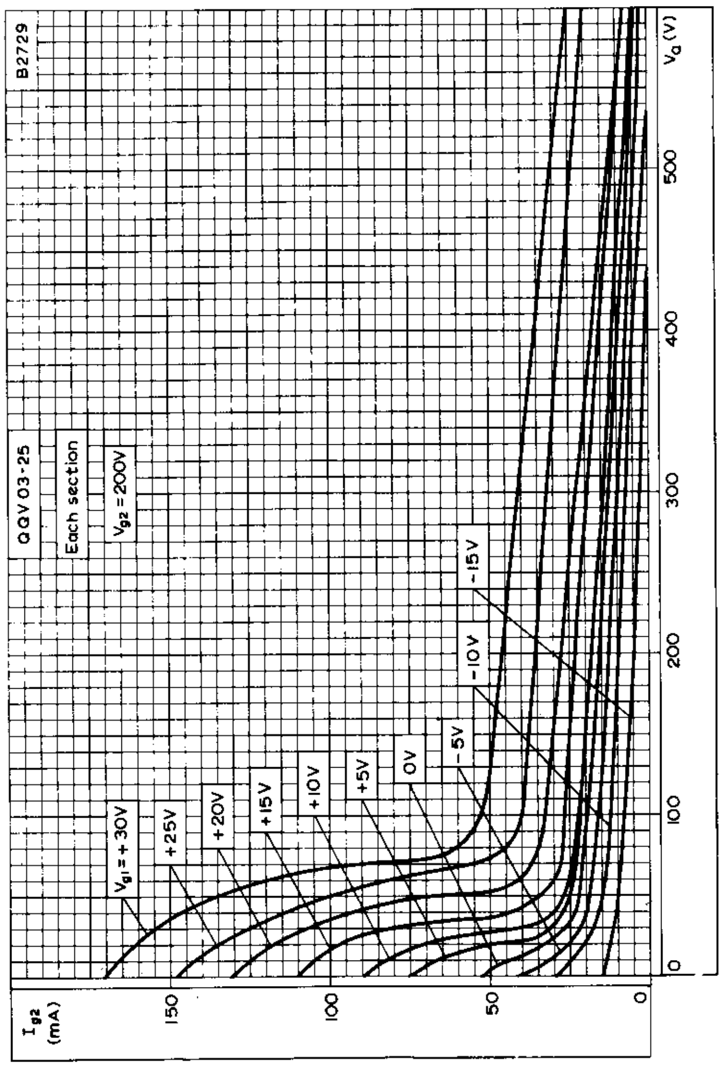


U.H.F. POWER DOUBLE TETRODE

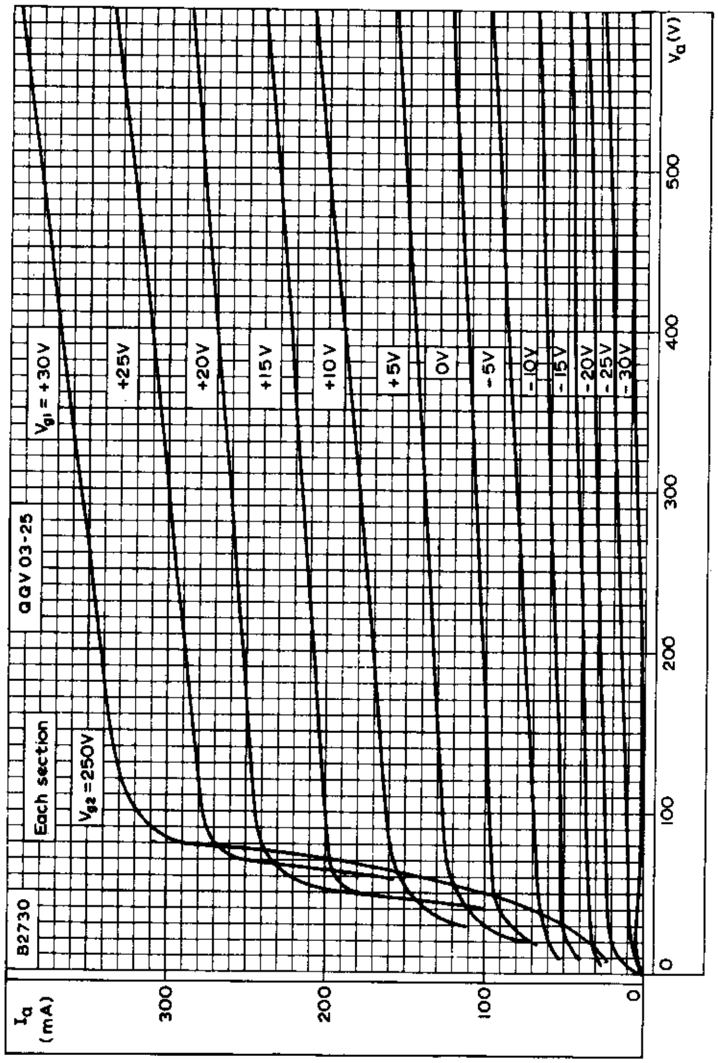
QQV03-25



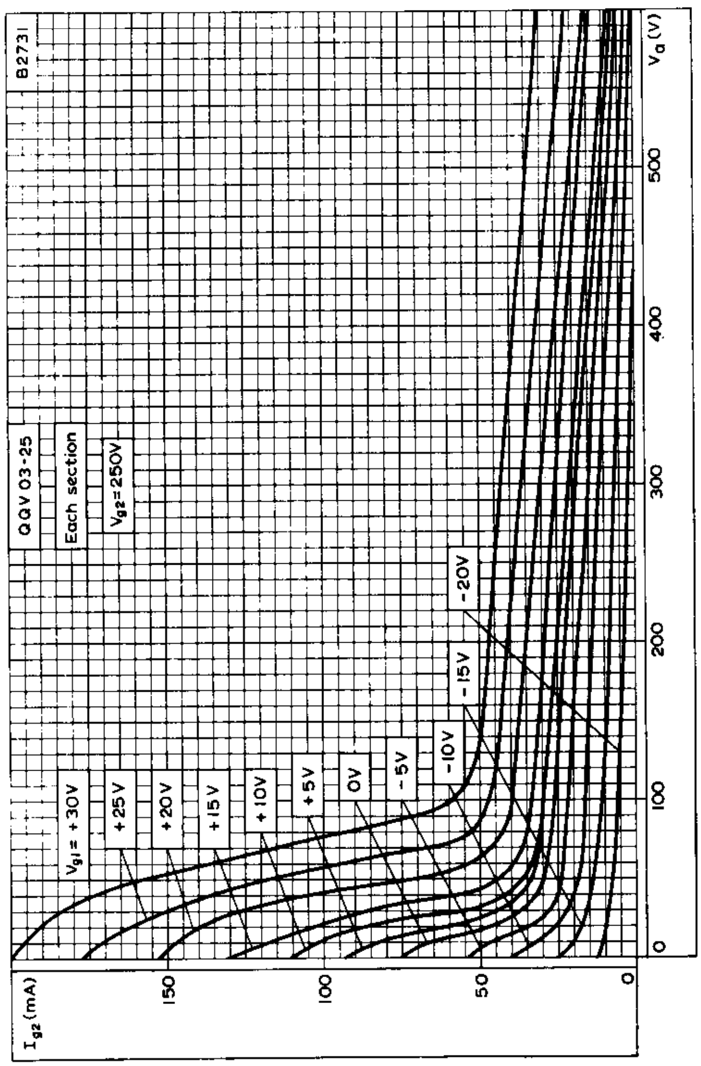
ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V



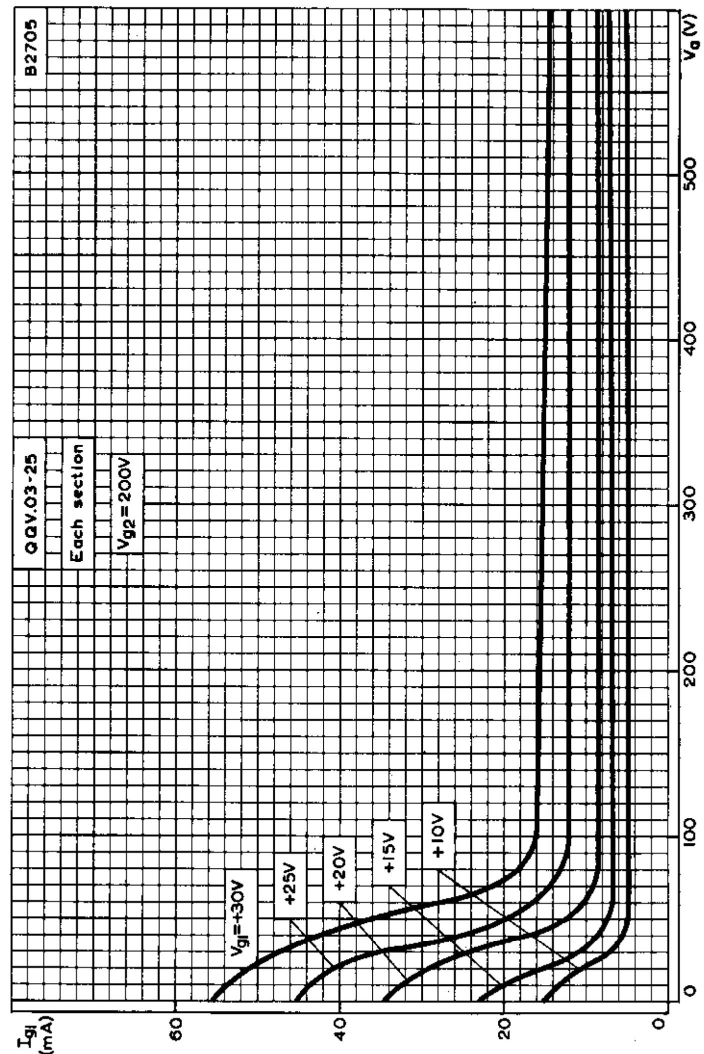
SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V



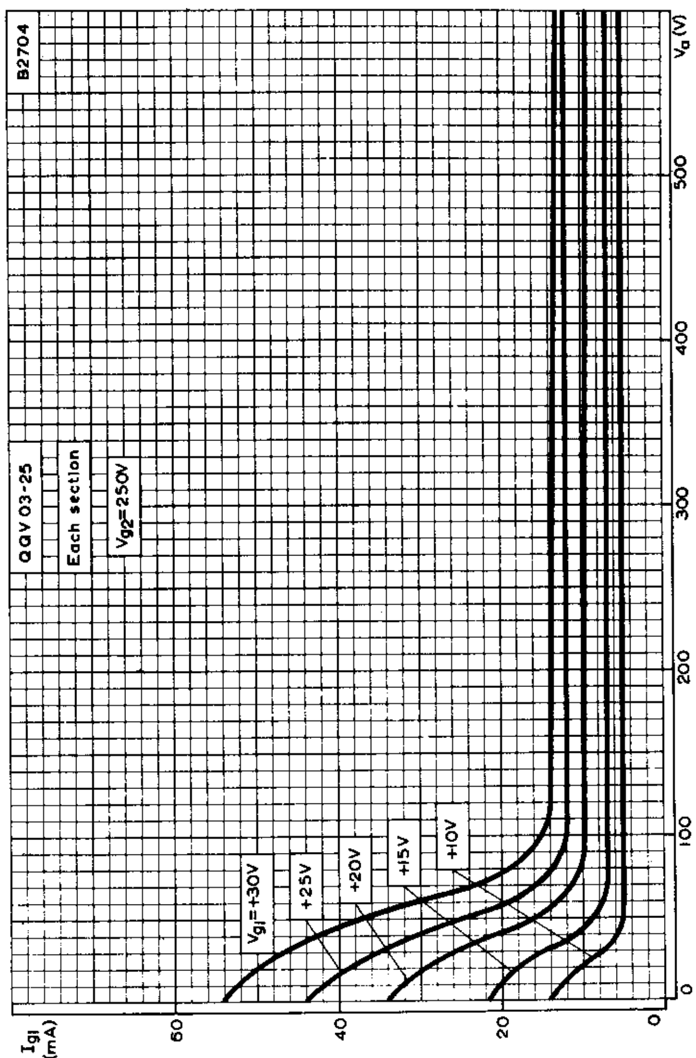
ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2}=250V



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



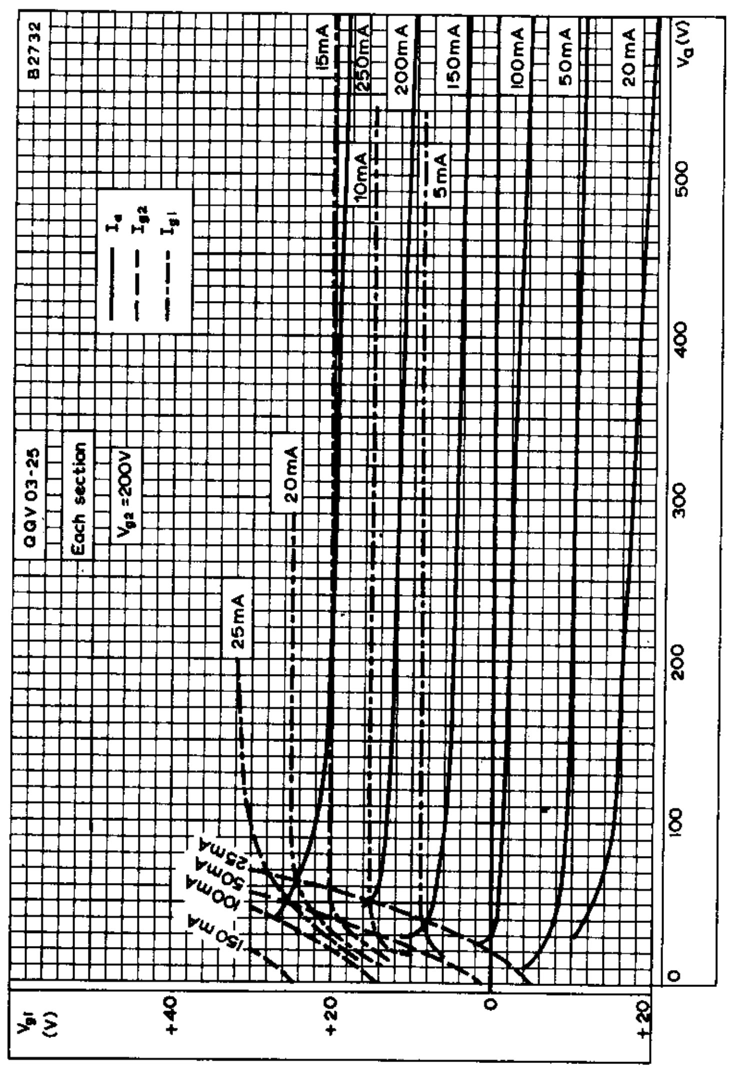
CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 200V$



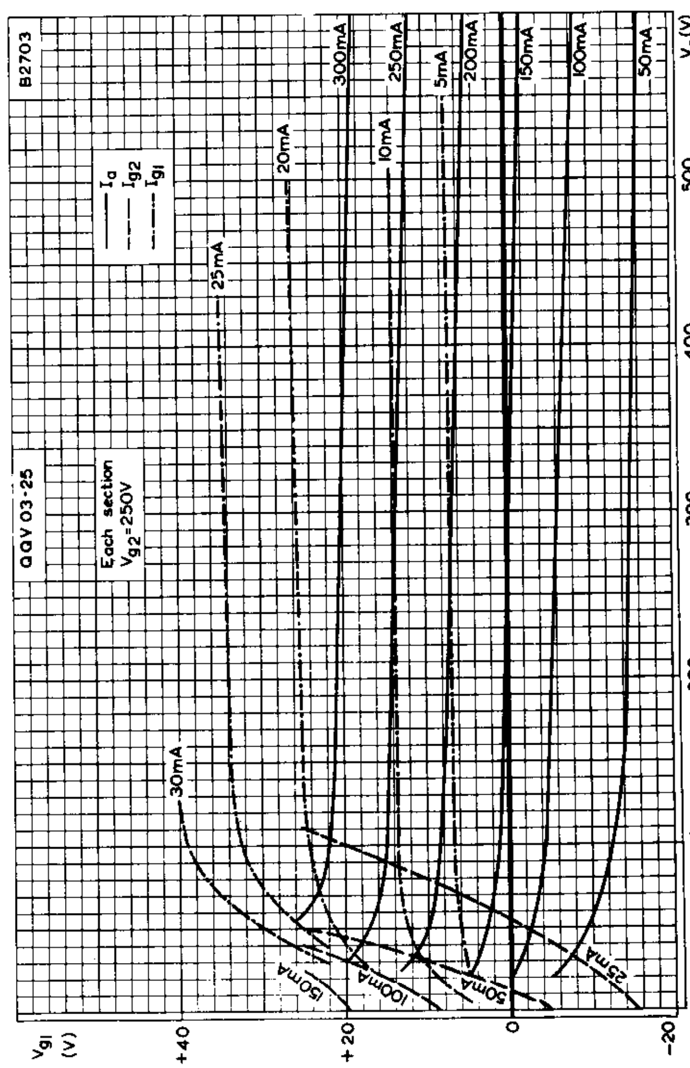
CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2}=250V

U.H.F. POWER DOUBLE TETRODE

QQV03-25



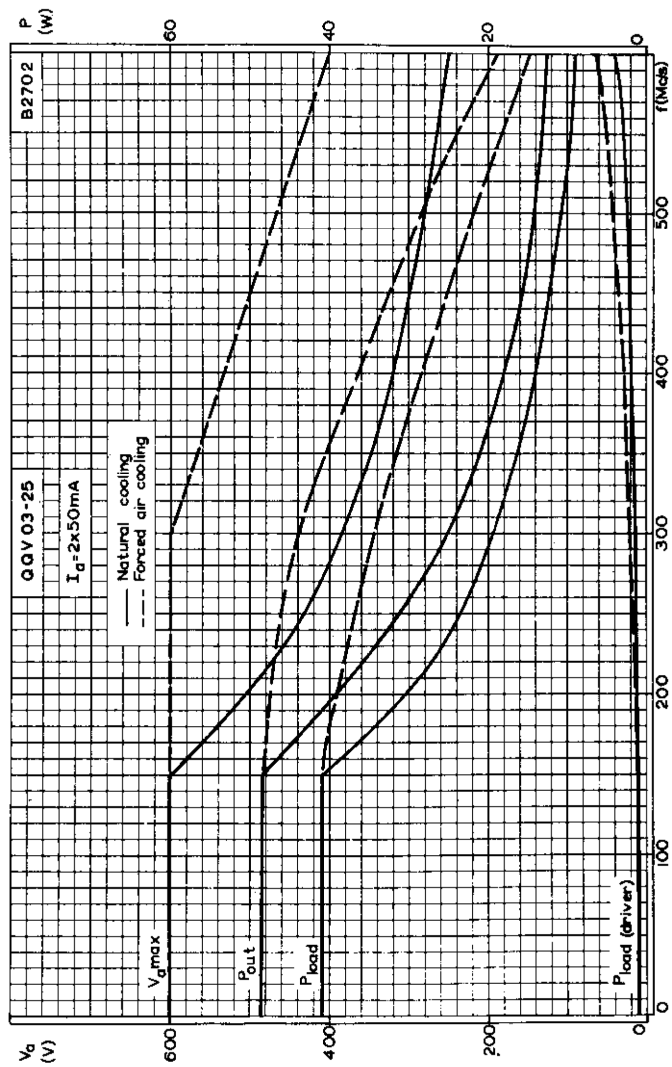
CONSTANT CURRENT CHARACTERISTICS FOR EACH SECTION V_{g2} = 200V



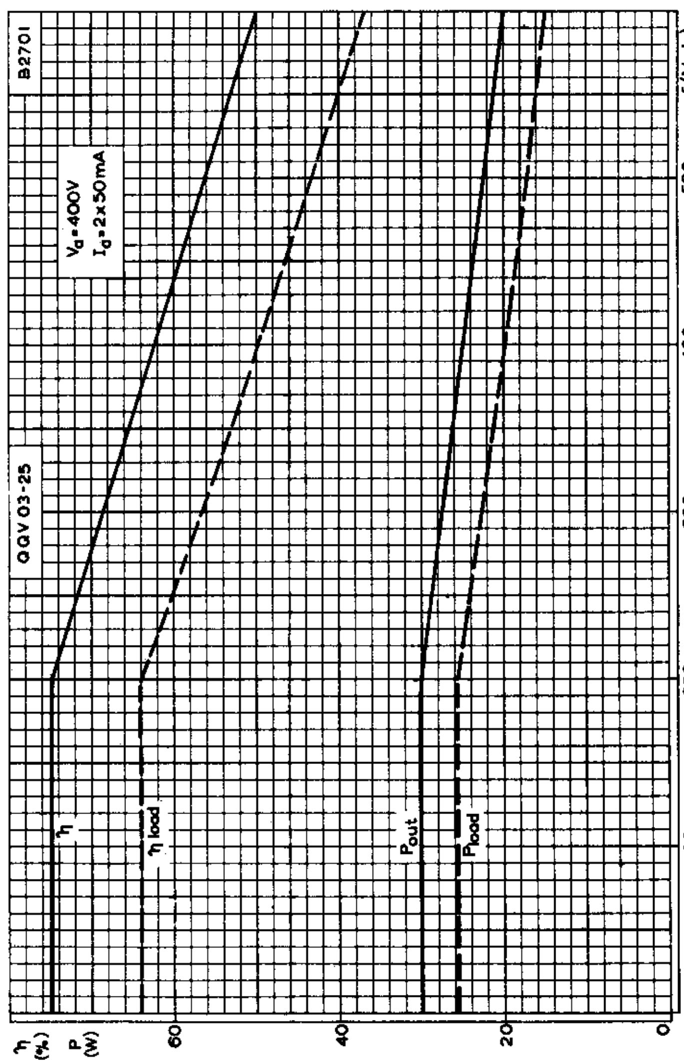
CONSTANT CURRENT CHARACTERISTICS FOR EACH SECTION V_{g2}=250V

U.H.F. POWER DOUBLE TETRODE

QQV03-25



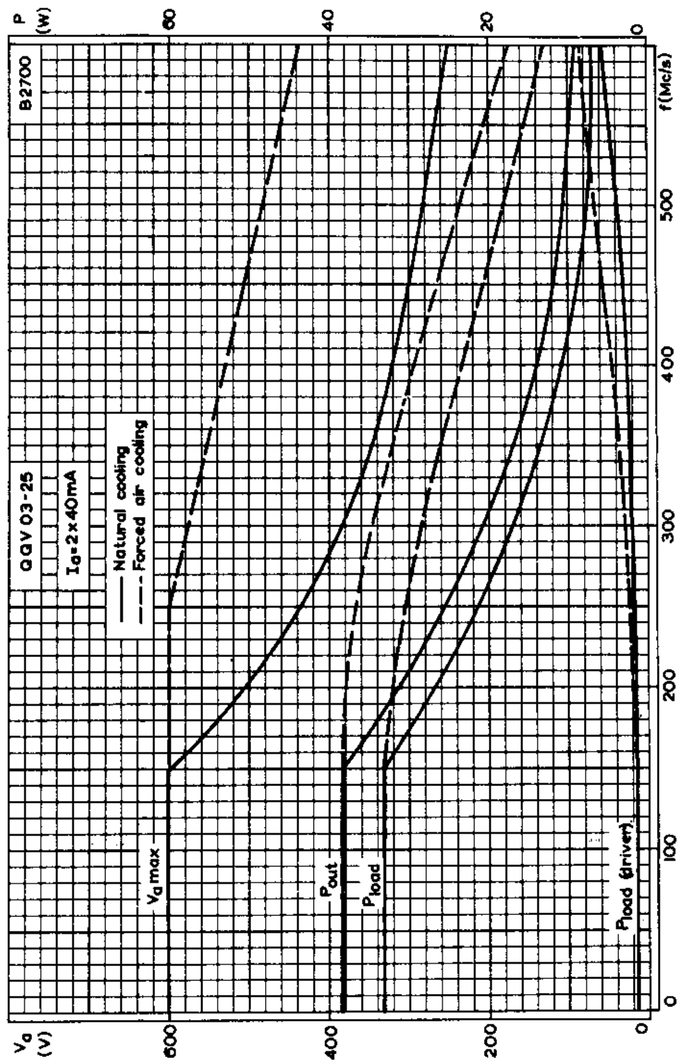
MAXIMUM OPERATING CONDITIONS FOR A PUSH-PULL R.F. POWER AMPLIFIER (CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY)



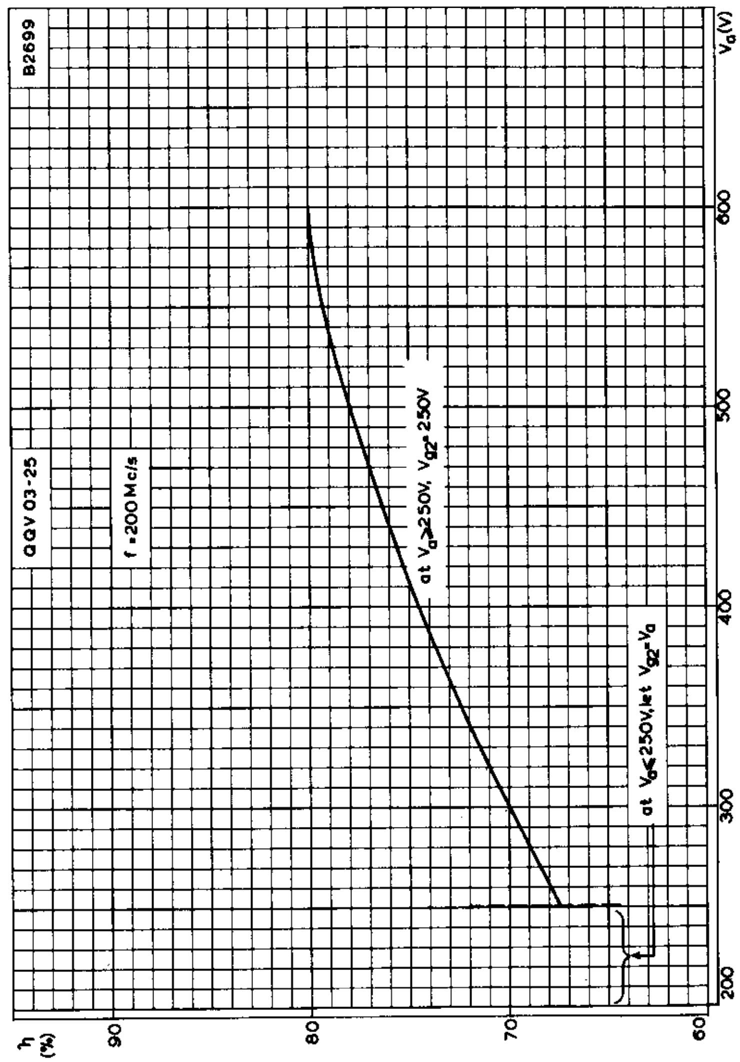
FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS A PUSH-PULL R. F. POWER AMPLIFIER (CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

U.H.F. POWER DOUBLE TETRODE

QQV03-25



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

DOUBLE TETRODE

QQV04-16

Application: U.H.F. amplifier, frequency trebler and oscillator.
Power output: 7W continuous rating.
Frequency: 960Mc/s at maximum ratings.
Construction: Glass, natural cooling.

PRELIMINARY DATA

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

CATHODE

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

	Series	*Parallel*	
*V_h	12.6	6.3	V
I_h	300	600	mA

*The heater has been designed to accept temporary fluctuations of ±10%.

MOUNTING POSITION

Any

CAPACITANCES

c_{a-g1} (each section)	145	mpF
c_{in} (two sections in push-pull)	4.5	pF
c_{out} (two sections in push-pull)	1.35	pF

CHARACTERISTICS (each section)

V_a	350	V
V_{g2}	250	V
I_a	25	mA
g_m	10.5	mA/V
μ_{g1-g2}	26	

COOLING

Radiation and convection

T_{bulb} max.	220	°C
T_{pins} max.	220	°C

WEIGHT

Valve only	1.2	oz
	35	g
Shipping weight	1.9	oz
	55	g

ACCESSORIES

Base socket assembly B8.700.71

QQV04-16

DOUBLE TETRODE

CLASS "C" TELEGRAPHY OR F.M. TELEPHONY

Limiting values (absolute ratings)	*C.C.S.*	*I.C.A.S.*	
f max.	960	960	Mc/s
V_a max.	400	400	V
I_a max.	2×45	2×50	mA
p_a max.	2×8.0	2×10	W
V_{g2} max.	225	225	V
p_{g2} max.	2×1.5	2×1.75	W
I_{g1} max.	2×4.0	2×5.0	mA
$-V_{g1}$ max	100	100	V

Operating conditions for push-pull amplifier			
f	960	960	Mc/s
V_a	250*	250	V
V_{g2}	160	170	V
V_{g1}	−15	−15	V
I_a	2×35	2×40	mA
I_{g2}	15	15	mA
I_{g1}	2×750	2×750	µA
$P_{load\ (driver)}$	1.4	1.4	W
p_a	2×5.4	2×5.4	W
P_{out}	7.0	8.0	W
η_a	40	40	%
P_{load}	4.0	5.0	W
$\eta_{transfer}$	57	62.5	%

*Adjust V_{g2} until $I_a = 2\times35$mA at P_{out} max.

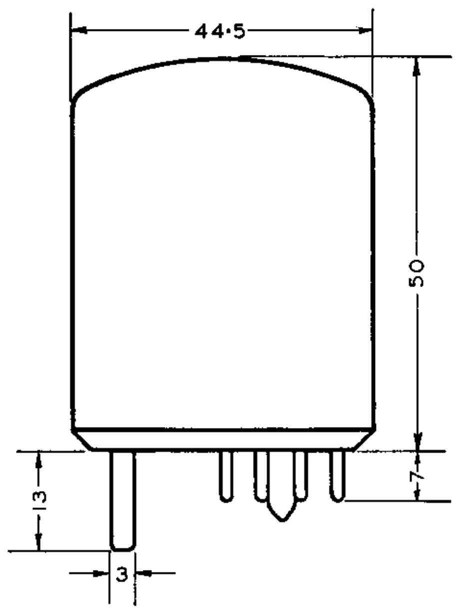
PUSH-PULL FREQUENCY TREBLER

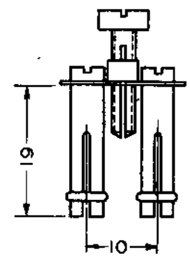
Limiting values (absolute ratings)	*C.C.S.*	*I.C.A.S.*	
f max.	960	960	Mc/s
V_a max.	400	400	V
I_a max.	2×40	2×40	mA
p_a max.	2×8.0	2×10	W
V_{g2} max.	225	250	V
p_{g2} max.	2×1.5	2×1.75	W
I_{g1} max.	2×4.0	2×5.0	mA
$-V_{g1}$ max.	100	100	V

Operating conditions			
f_{out}	960	960	Mc/s
V_a	250	250	V
V_{g2}	150	170	V
I_a	2×37.5	2×40	mA
I_{g2}	15	16	mA
I_{g1}	2×2.25	2×2.25	mA
$P_{load\ (driver)}$	3.0	3.0	W
p_a	2×8.0	2×8.5	W
P_{out}	2.75	3.0	W
η_a	14.7	15	%
P_{load}	1.5	1.8	W
$\eta_{transfer}$	54	60	%

DIMENSIONS

Maximum overall length	63	mm
Maximum seated height	50	mm
Maximum diameter	44.5	mm

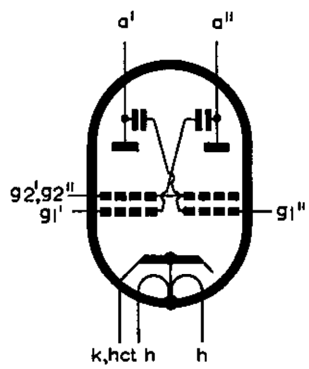


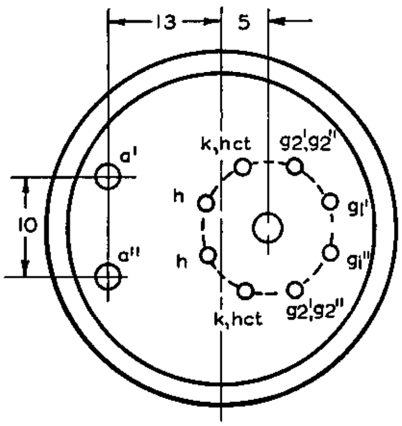


Typical anode connector at f = 960Mc/s

All dimensions in mm

6697

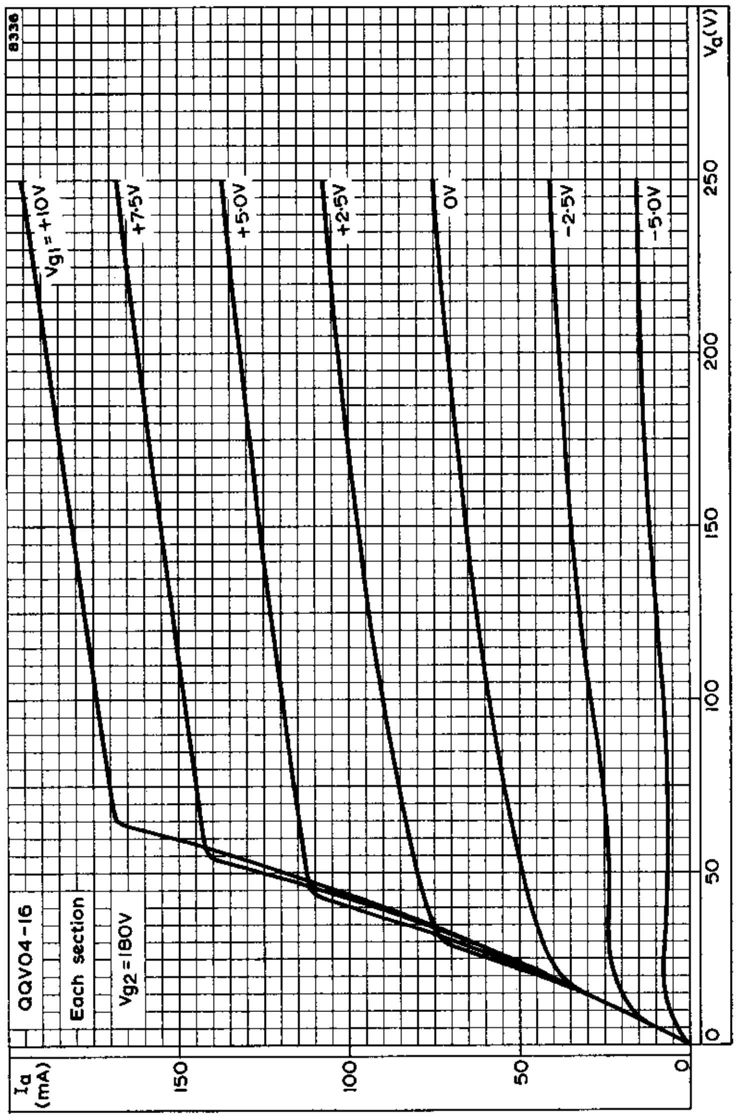




Loctal base with separate anode pins

6687

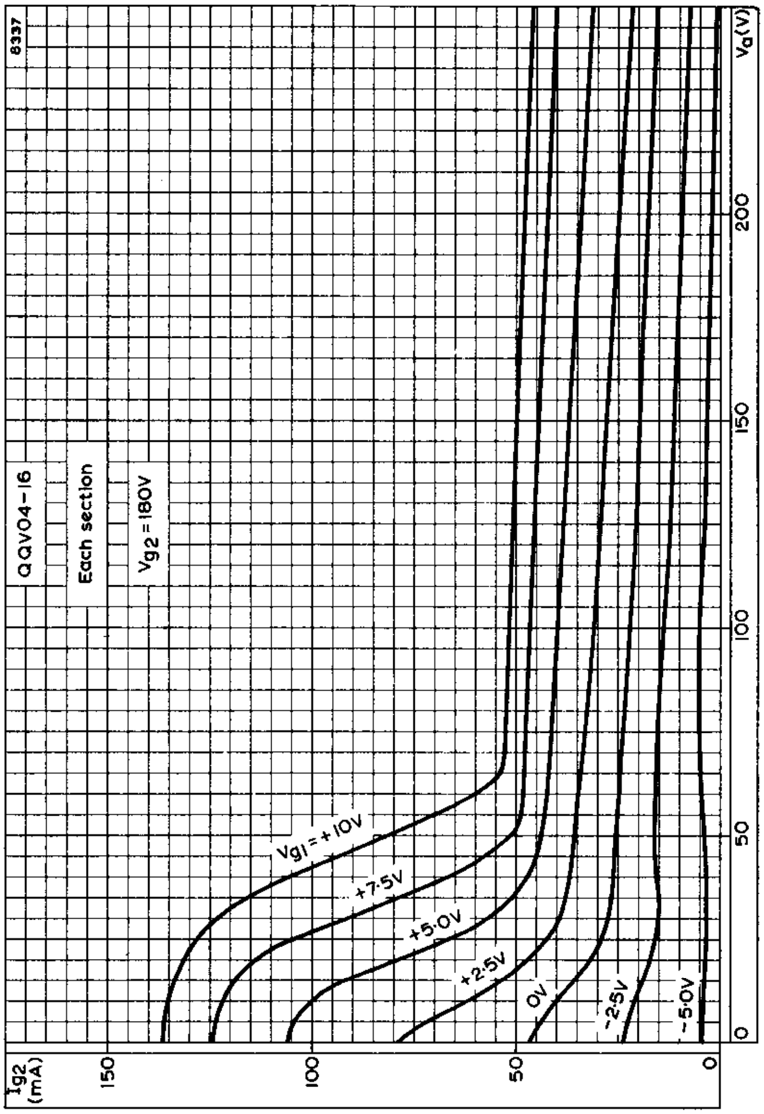
All dimensions in mm



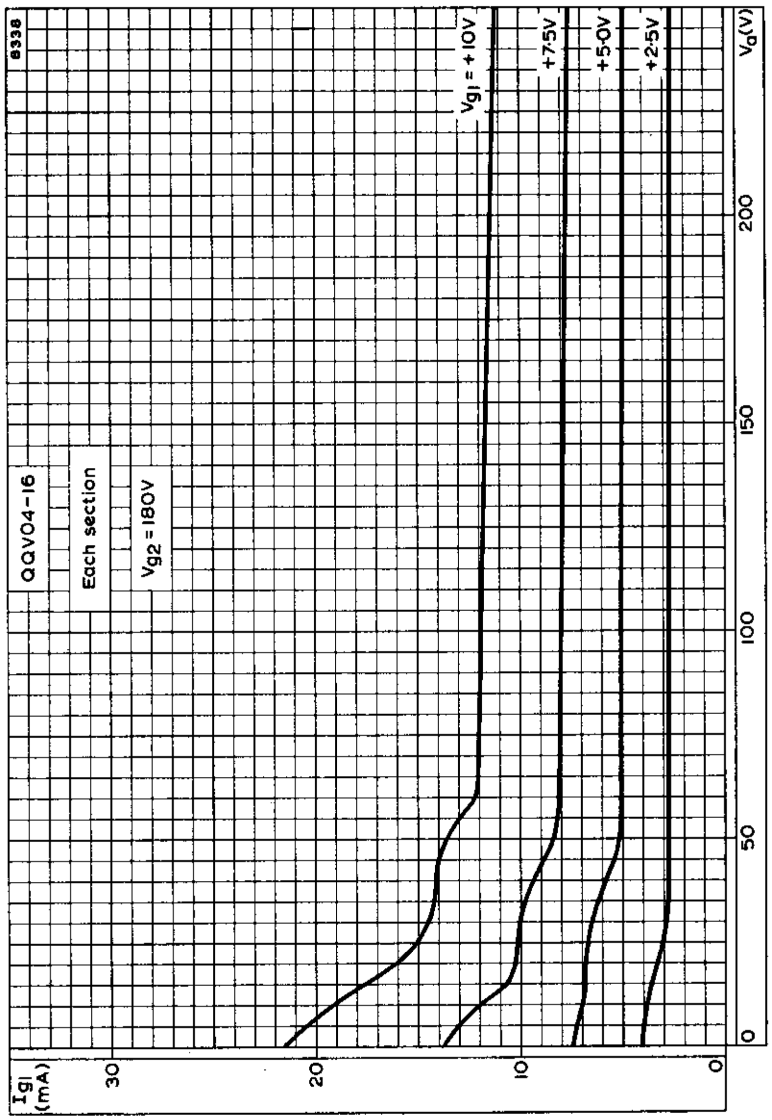
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 180V

QQV04-16

DOUBLE TETRODE



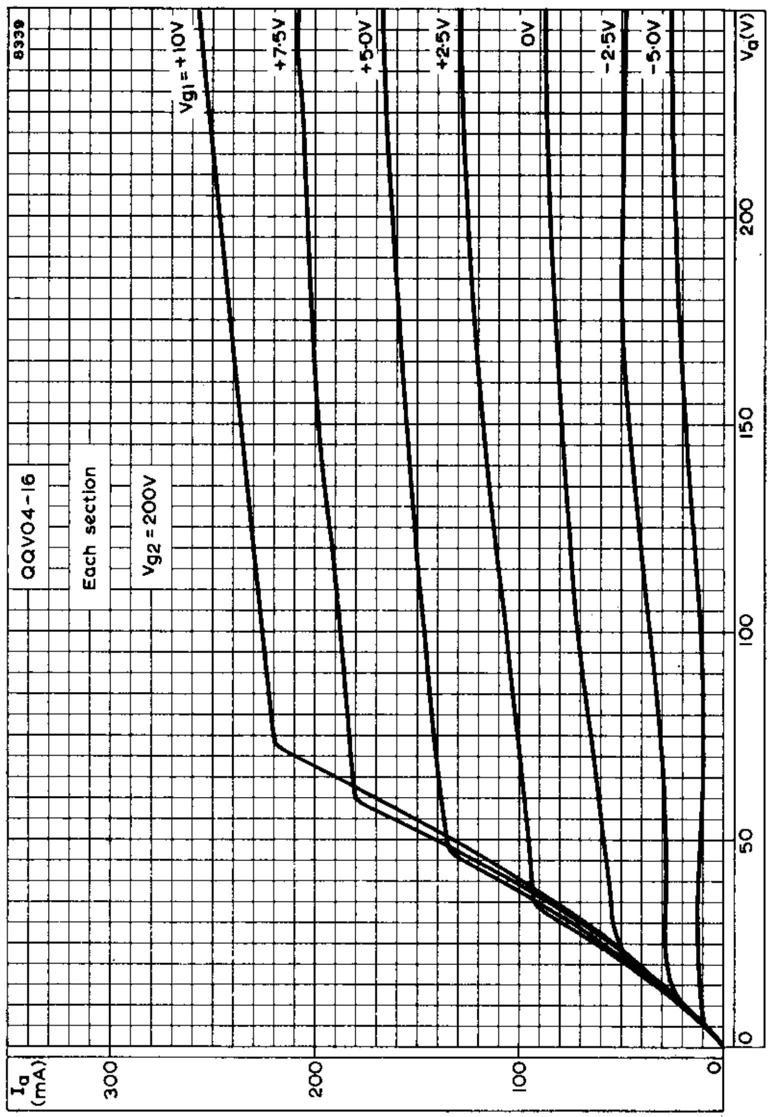
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 180V$



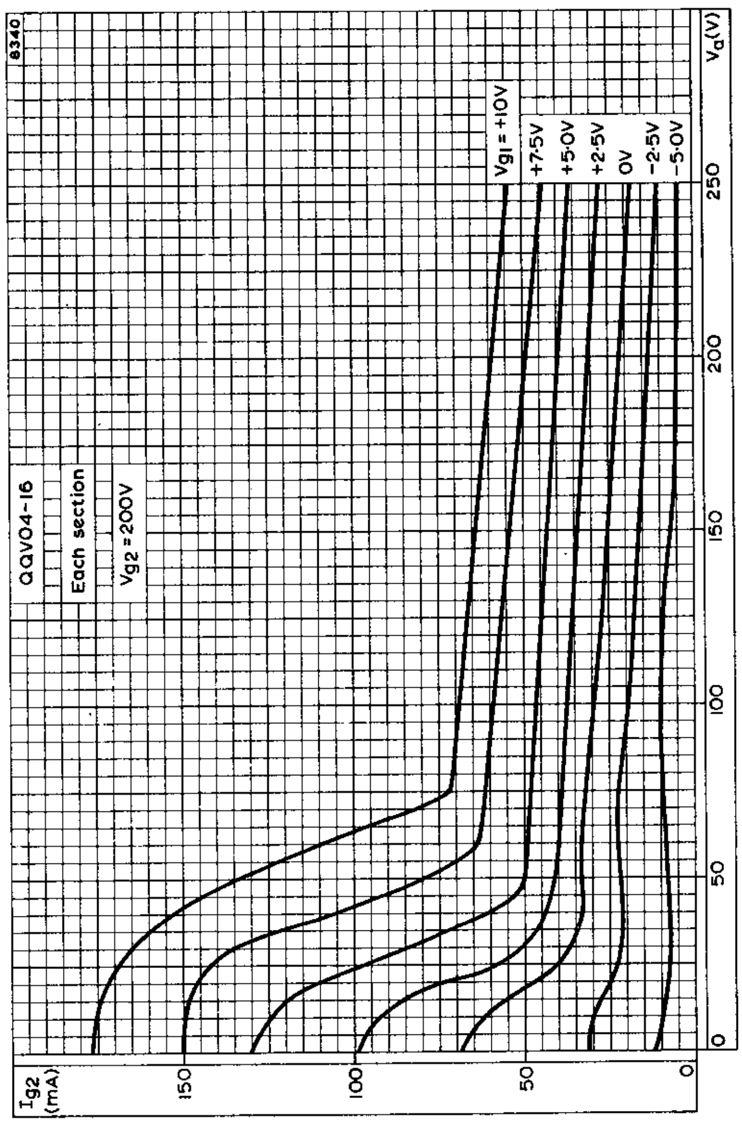
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 180V

QQV04-16

DOUBLE TETRODE



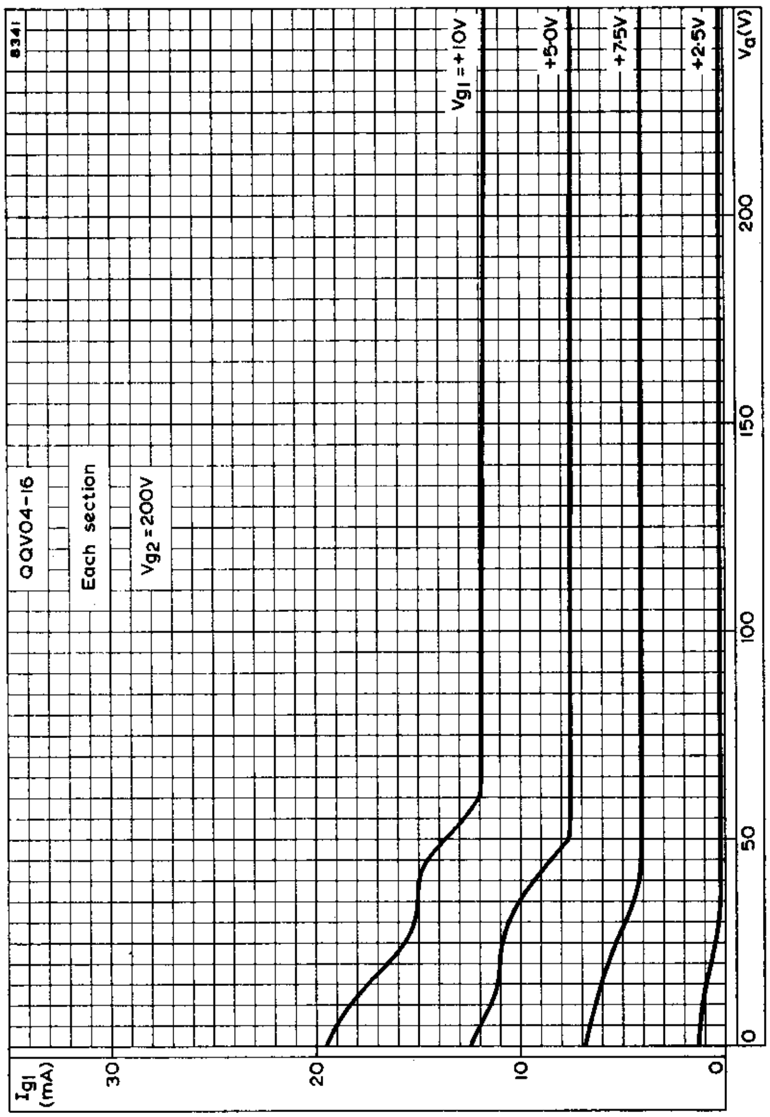
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 200V



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

QQV04-16

DOUBLE TETRODE



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

R.F. POWER DOUBLE TETRODE

QQV04-20

Twin beam-tetrode rated to dissipate 10 W at each anode, and primarily intended for use as a push-pull R.F. power amplifier or oscillator at frequencies up to 200 Mc/s. The metal base should be earthed by spring clips or some alternative method.

MAINTENANCE TYPE

This data sheet should be read in conjunction with "Operating Notes, Part 1—Power Valves," included in this Section of the Handbook.

CATHODE

Indirectly heated with centre-tapped heater for series or parallel connection.

	Series	Parallel	
V_h	12.6	6.3	V
I_h	0.8	1.6	A
Heating time			20 secs.

MOUNTING POSITION

Vertical—base down.
Horizontal—plane of anodes vertical.

CAPACITANCES

(each section)		
c_{in}	14	μμF
c_{out}	8.5	μμF
c_{a-g1}	<0.2	μμF
(between sections)		
c_{a-a}	0.8	μμF

CHARACTERISTICS (At V_a=400 V; V_{g2}=200 V; I_a=25 mA.)

g_m	4	mA/V
μ_{g1-g2}	6.5	

LIMITING VALUES

V_a max.	400	V
$v_{a(pk)}$ max.	1,400	V
$V_{g2(b)}$ max.	600	V
V_{g2} max.	125	V
V_{g1} max.	−275	V
I_k max.	2×100	mA
$i_{k(pk)}$ max.—each section	350	mA
I_{g2} max.	2×18	mA
I_{g1} max.	2×7	mA
$i_{g1(pk)}$ max.—each section	20	mA
p_a max.	2×10	W
p_{g2} max.	2×2.25	W
R_{g1-k} max.—each section	30	kΩ
V_{h-k} max.	100	V

Operating frequency (Mc/s)	Max. anode voltage (V)	Max. anode input power (W)
125	400	60
175	280	42
200	240	36

QQV04-20

R.F. POWER DOUBLE TETRODE

Twin beam-tetrode rated to dissipate 10 W at each anode, and primarily intended for use as a push-pull R.F. power amplifier or oscillator at frequencies up to 200 Mc/s. The metal base should be earthed by spring clips or some alternative method.

OPERATING CONDITIONS AS PUSH-PULL CLASS "C" R.F. POWER AMPLIFIER AND OSCILLATOR

V_a	400	V
$*V_{g2}$	145	V
R_{g2}	15,000	Ω
$**V_{g1}$	−45	V
R_{g1}	10,000	Ω
R_k	260	Ω
I_a	2×75	mA
I_{g2}	2×8.5	mA
I_{g1}	2×2.25	mA
$v_{in(pk)}$	2×58	V
P_{drive}	0.23	W
P_{out}	44	W

*May be obtained from a separate supply, or from the anode supply through series resistor (R_{g2}) of value shown, in which case provision must be made to ensure the $V_{g2(b)}$ does not exceed 600 V.

**May be obtained from a separate supply or by a grid or cathode resistor of value shown, or by a combination of these methods.

OPERATING CONDITIONS AS PUSH-PULL R.F. POWER AMPLIFIER (CLASS "B" TELEPHONY)

V_a	400	V
V_{g2}	125	V
V_{g1}	−25	V
I_a	2×37.5	mA
I_{g2}	2×2.0	mA
$v_{in(pk)}$	2×25	V
P_{drive}	0.8	W
P_{out}	10.5	W

OPERATING CONDITIONS AS PUSH-PULL GRID-MODULATED CLASS "C" R.F. POWER AMPLIFIER

V_a	400	V
V_{g2}	125	V
V_{g1}	−40	V
I_a	2×37.5	mA
I_{g2}	2×1.5	mA
I_{g1}	2×0.2	mA
$v_{in(pk)}$ (R.F.)	2×40	V
P_{drive}	0.32	W
P_{out}	10.5	W
$*v_{mod(pk)}$ (L.F.)	19	V

*For 100% modulation

R.F. POWER DOUBLE TETRODE

QQV04-20

Twin beam-tetrode rated to dissipate 10 W at each anode, and primarily intended for use as a push-pull R.F. power amplifier or oscillator at frequencies up to 200 Mc/s. The metal base should be earthed by spring clips or some alternative method.

OPERATING CONDITIONS AS PUSH-PULL ANODE MODULATED CLASS "C" R.F. POWER AMPLIFIER

V_a	325	V
$*V_{g2}$	165	V
R_{g2}	10,000	Ω
V_{g1}	−45	V
$**R_{g1-k}$	11,250	Ω
I_a	2×62	mA
I_{g2}	2×8	mA
I_{g1}	2×2	mA
$v_{in(pk)}$	2×56	V
P_{drive}	0.2	W
P_{out}	30	W

OPERATING CONDITIONS AS CLASS "A.B.2" L.F. POWER AMPLIFIER OR MODULATOR

V_a	400	V
V_{g2}	125	V
V_{g1}	−15	V
$I_{a(o)}$	2×10	mA
I_a (max. sig.)	2×75	mA
I_{g2} (max. sig.)	2×16	mA
$v_{in(pk)}$	2×30	V
R_{a-a}	6,200	Ω
$***P_{drive}$	0.36	W
P_{out}	42	W

*May be obtained from a separate supply, or from the anode supply through series resistor (R_{g2}) of value shown, in which case provision must be made to ensure that $V_{g2(b)}$ does not exceed 600 V.

**May be obtained from a separate supply or by a grid or cathode resistor of value shown, or by a combination of these methods.

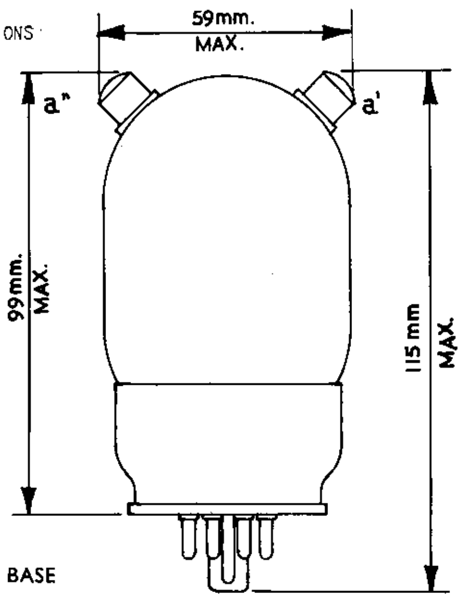
***The effective resistance in the grid circuit should be below 500 Ω, and the effective impedance should not exceed 700 Ω at the highest response frequency required.

QQV04-20

R.F. POWER DOUBLE TETRODE

Twin beam-tetrode rated to dissipate 10 W at each anode, and primarily intended for use as a push-pull R.F. power amplifier or oscillator at frequencies up to 200 Mc/s. The metal base should be earthed by spring clips or some alternative method.

DIMENSIONS

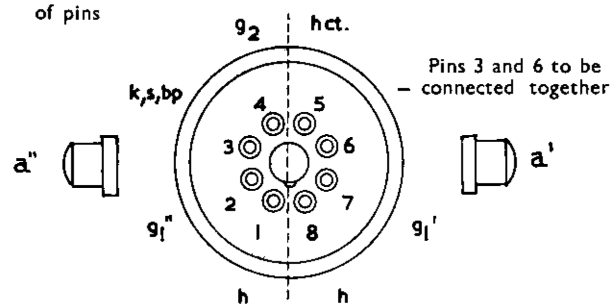


OCTAL BASE

BASE CONNECTIONS

Viewed from free end of pins

Dotted line indicates plane of electrodes of each unit



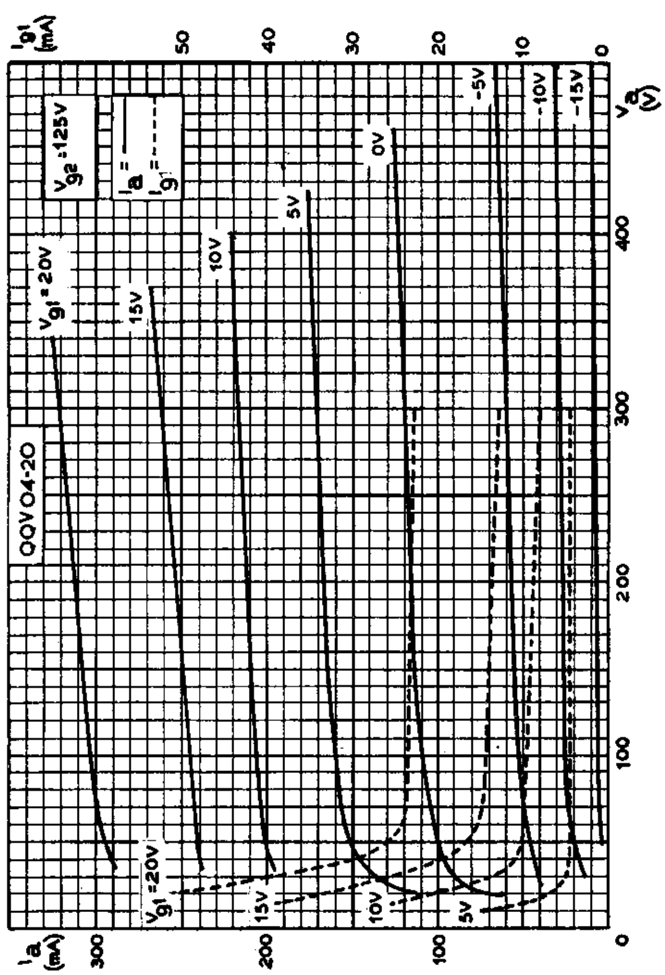
WEIGHTS

Valve only	3 oz.	(0.08 Kg.)
Valve and Carton	4½ oz.	(0.13 Kg.)

R.F. POWER DOUBLE TETRODE

QQV04-20

Twin beam tetrode rated to dissipate 10 W at each anode, and primarily intended for use as a push-pull R.F. power amplifier or oscillator at frequencies up to 200 Mc/s. The metal base should be earthed by spring clips or some alternative method.

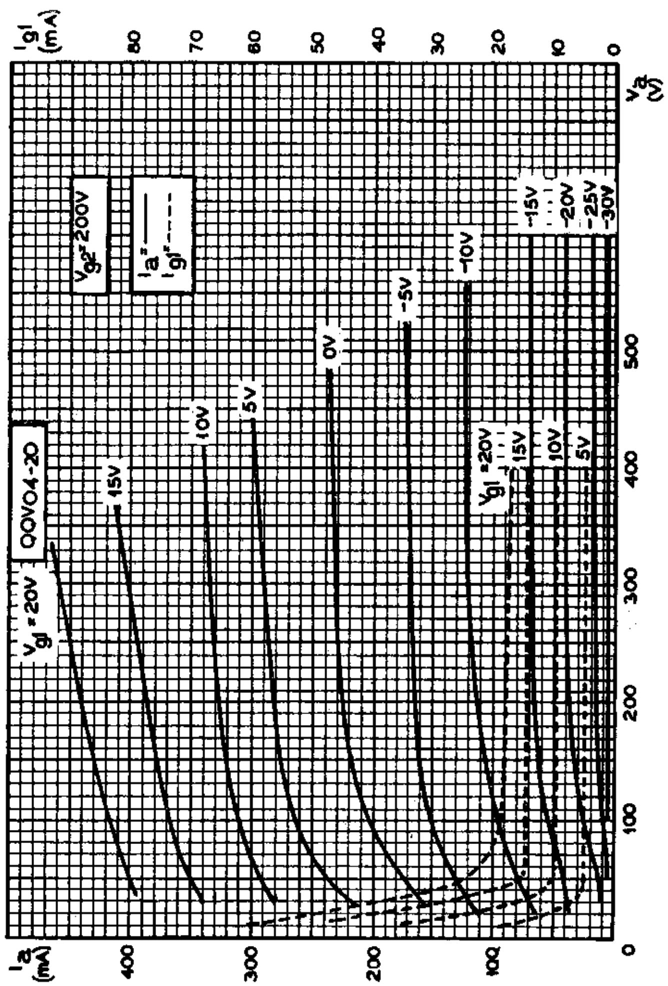


ANODE CURRENT AND CONTROL GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN VOLTAGE — 125V

QQV04-20

R.F. POWER DOUBLE TETRODE

Twin beam tetrode rated to dissipate 10 W at each anode, and primarily intended for use as a push-pull R.F. power amplifier or oscillator at frequencies up to 200 Mc/s. The metal base should be earthed by spring clips or some alternative method.



ANODE CURRENT AND CONTROL GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN VOLTAGE — 200V

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/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	0.9	1.8	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)	0.06	pF
c_{g1-all} (each section)	10.5	pF
c_{a-all} (each section)	3.2	pF
c_{out} (two sections in push-pull)	2.1	pF
c_{in} (two sections in push-pull)	6.7	pF

*Internally neutralised for push-pull operation

CHARACTERISTICS (each section) measured at $I_a = 30mA$

g_m	4.5	mA/V
μ_{g1-g2}	8.0	

COOLING

Max. base pin temperature	180	°C
Max. 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 –

$V_a = 750V$ at frequencies up to 100Mc/s
$V_a = 600V$ at frequencies up to 150Mc/s
$V_a = 300V$ at frequencies up to 450Mc/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.

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500 Mc/s.

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

Limiting values

V_a max.	See page 15	
p_a max.	2×20	W
$V_{g2(b)}$ max.	600	V ←
V_{g2} max.	300	V ←
p_{g2} max.	2×3.5	W
p_{g1} max.	2×1.0	W
I_{g1} max.	2×5.0	mA
I_k max.	2×120	mA
$i_{k(pk)}$ max.	2×700	mA
$-V_{g1}$ max.	100	V ←
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

Typical operating conditions

f	200	200	400	400	Mc/s
V_a	400	600	400	540	V
V_{g2}	250	250	250	250	V
V_{g1}	−60	−80	−50	−55	V
I_a	2×100	2×100	2×100	2×100	mA
I_{g2}	2×8.0	2×9.0	2×5.0	2×7.0	mA
I_{g1}	2×3.0	2×3.5	2×2.0	2×1.5	mA
$P_{load(driver)}$	3.0	3.0	11	12	W
p_a	2×12	2×15	2×15	2×20	W
P_{out}	56	90	50	70	W ←
η	70	75	63	65	%
P_{load}	47	78	42	59	W ←

f	475	475	Mc/s
V_a	350	500	V
V_{g2}	250	250	V
V_{g1}	−45	−50	V
I_a	2×100	2×100	mA
I_{g2}	2×4.5	2×4.5	mA
I_{g1}	2×2.0	2×2.0	mA
$P_{load(driver)}$	10	12	W
p_a	2×15	2×20	W
P_{out}	40	60	W ←
η	57	60	%
P_{load}	33	51	W ←

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

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

Limiting values (carrier condition for modulation factor of 1)

V_a max.	See page 17	
p_a max.	2×14	W
$V_{g2(b)}$ max.	600	V ←
V_{g2} max.	300	V ←
p_{g2} max.	2×2.3	W ←
$-V_{g1}$ max.	175	V ←
I_{g1} max.	2×5.0	mA
p_{g1} max.	2×1.0	W
I_k max.	2×120	mA
$i_{k(pk)}$ max.	2×1.0	A
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

Typical operating conditions ←

f	60	200	200	250	Mc/s
V_a	600	400	600	600	V
V_{g2}	250	250	250	250	V
V_{g1}	−80	−70	−80	−80	V
I_a	2×75	2×75	2×75	2×75	mA
I_{g2}	2×10	2×9.0	2×9.0	2×9.0	mA
I_{g1}	2×4.0	2×2.0	2×2.0	2×1.5	mA
p_a	2×9.5	2×9.5	2×11.5	2×13	W
P_{out}	71	41	67	64	W
η	79	69	75	71	%
P_{load}	60	35	57	54	W
For 100% modulation					
P_{mod}	47	47	47	47	W
$v_{g2(pk)}$	185	185	185	185	V

f	400	475	Mc/s
V_a	400	400	V
V_{g2}	250	250	V
V_{g1}	−70	−70	V
I_a	2×75	2×75	mA
I_{g2}	2×8.0	2×7.5	mA
I_{g1}	2×1.5	2×1.5	mA
p_a	2×11.5	2×13	W
P_{out}	37	34	W
η	62	57	%
P_{load}	32	30	W
For 100% modulation			
P_{mod}	47	47	W
$v_{g2(pk)}$	185	185	V

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

OPERATING CONDITIONS AS FREQUENCY TREBLER

Limiting values

V_a max.	750	V ←
p_a max.	2×20	W
$V_{g2(b)}$ max.	600	V ←
V_{g2} max.	300	V ←
p_{g2} max.	2×3.5	W ←
p_{g1} max.	2×1.0	W
I_k max.	2×100	mA
$i_{k(pk)}$ max.	2×700	mA
$-V_{g1}$ max.	175	V
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

Typical operating conditions

f_{out}	150	150	230	Mc/s
V_a	400	500	400	V
V_{g2}	250	250	250	V
V_{g1}	−150	−150	−150	V
I_a	2×72	2×60	2×65	mA
I_{g2}	2×8.0	2×5.0	2×10	mA
I_{g1}	2×2.5	2×3.0	2×1.5	mA
$v_{in(g1-g1)pk}$	360	360	360	V
p_a	2×20	2×20	2×20	W
P_{out}	18	20	12	W
η	31	33	23	%
P_{load}	14.5	16	10	W

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

Limiting values

V_a max.	600	V
p_a max.	2×20	W
$V_{g2(b)}$ max.	600	V
V_{g2} max.	300	V
p_{g2} max.	2×3.5	W
p_{g1} max.	2×1.0	W
I_k max.	2×140	mA
$i_{k(pk)}$ max.	2×450	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

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

Typical operating conditions (without grid current)

V_a	300	450	600	V
V_{g2}	250	250	250	V
V_{g1}	−26	−27	−27	V
$I_{a(o)}$	2×20	2×20	2×20	mA
I_a (max. sig.)	2×56	2×58	2×62	mA
$I_{g2(o)}$	2×1.0	2×0.7	2×0.45	mA
I_{g2} (max. sig.)	2×14	2×13.5	2×11.5	mA
$V_{in(g1-g1)r.m.s.}$	36	38	39	V
p_a	2×5.6	2×8.5	2×12	W
R_{a-a}	6.5	10	12.5	kΩ
P_{out}	22.5	35	50	W
η	67	67.5	67.5	%
D_{tot}	2.9	3.1	2.4	%

Typical operating conditions (with grid current)

V_a	300	450	600	V
V_{g2}	250	250	250	V
V_{g1}	−25	−25	−25	V
$I_{a(o)}$	2×25	2×25	2×25	mA
I_a (max. sig.)	2×94	2×97	2×100	mA
$I_{g2(o)}$	2×1.4	2×0.95	2×0.7	mA
I_{g2} (max. sig.)	2×14	2×14	2×13	mA
I_{g1}	2×2.6	2×2.6	2×2.6	mA
$V_{in(g1-g1)r.m.s.}$	52	54	55	V
p_a	2×9.7	2×13.5	2×17	W
R_{a-a}	4.0	6.0	8.0	kΩ
P_{out}	37	60	86	W
η	65.5	69	71.5	%
D_{tot}	5.0	5.0	5.0	%

ACCESSORIES

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

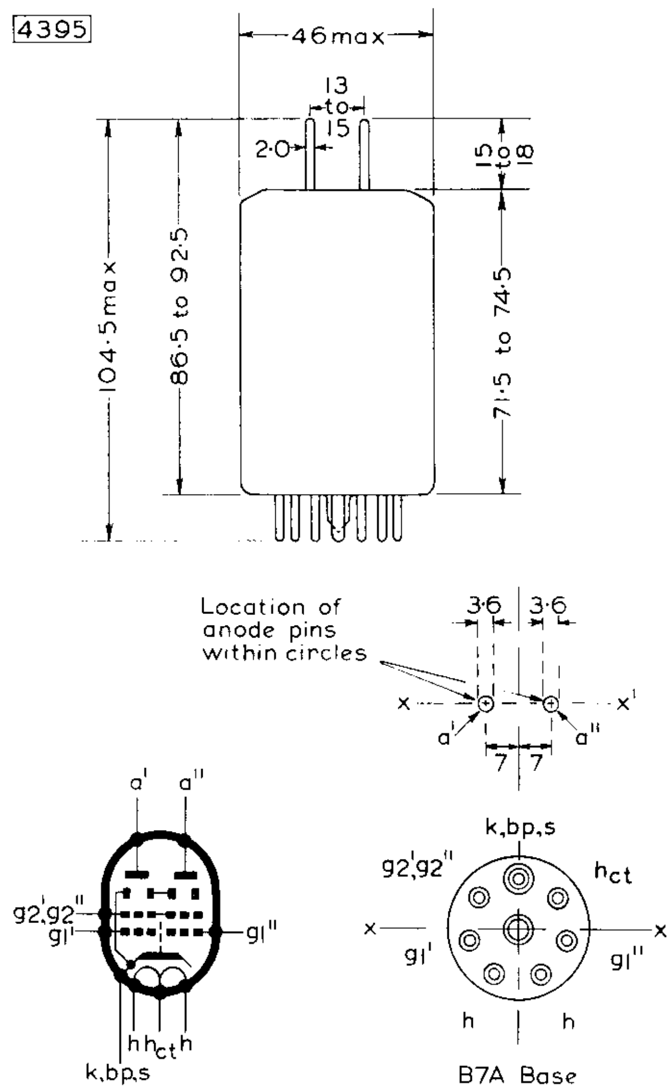
WEIGHT

Valve only { 2.3 oz / 65 g

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

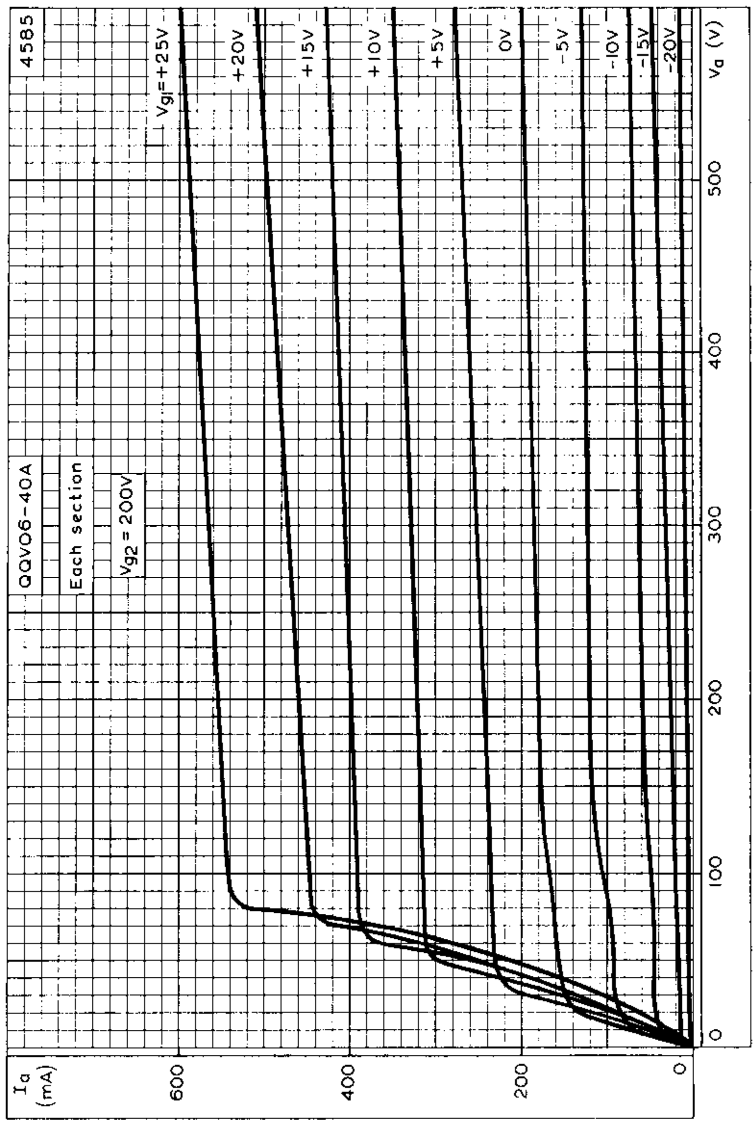


All dimensions in mm

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

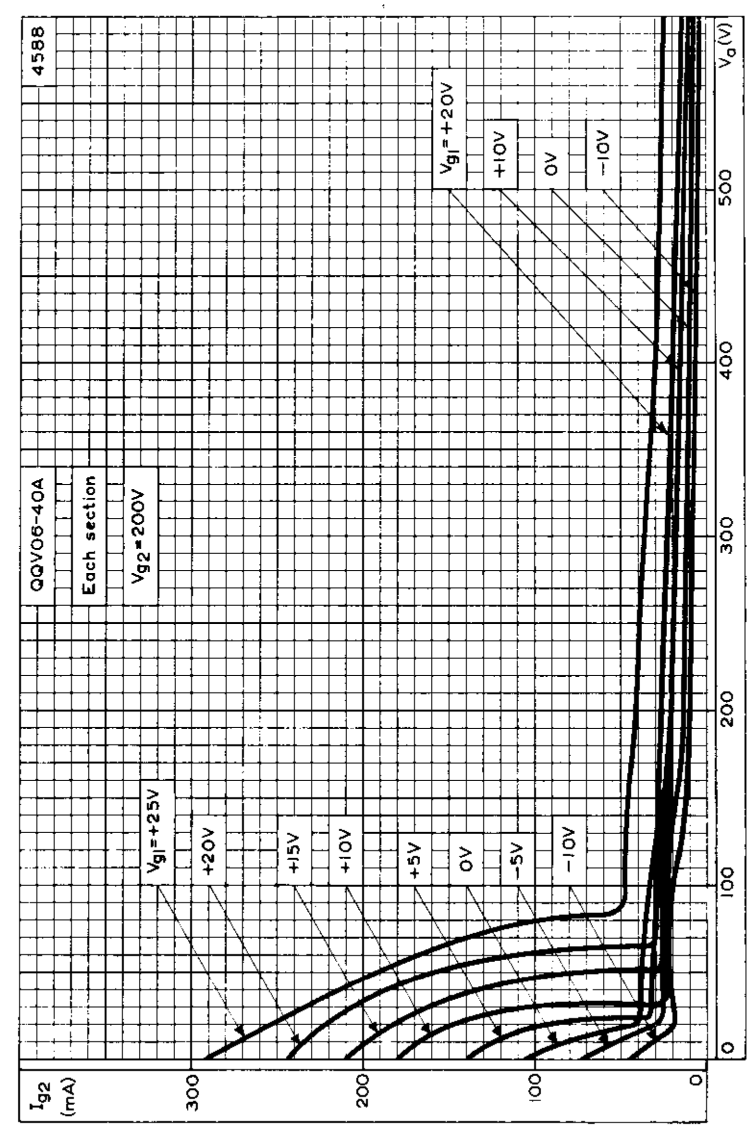


ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} 200V

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

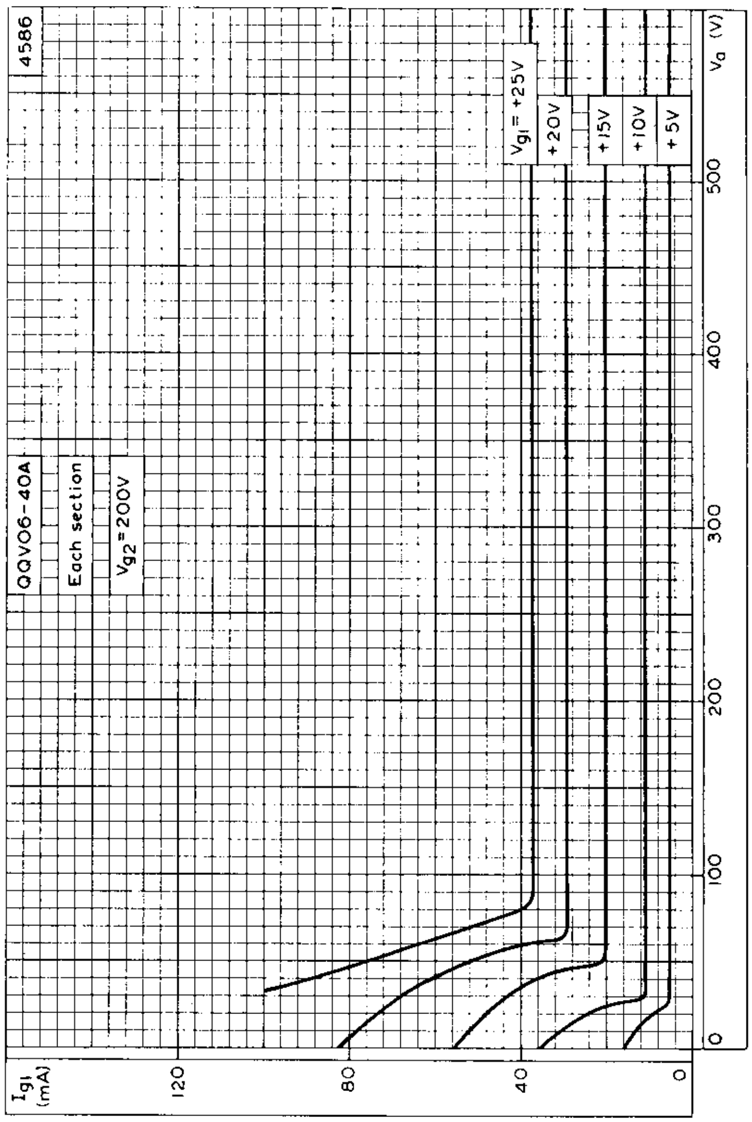


SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

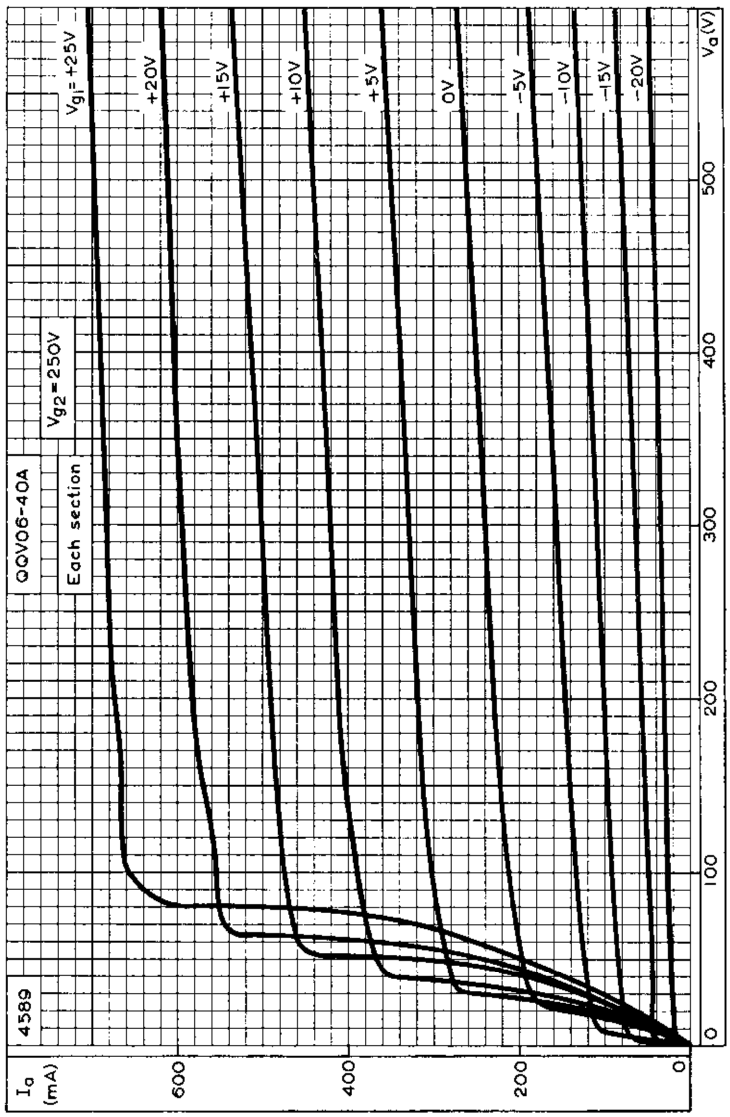


CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

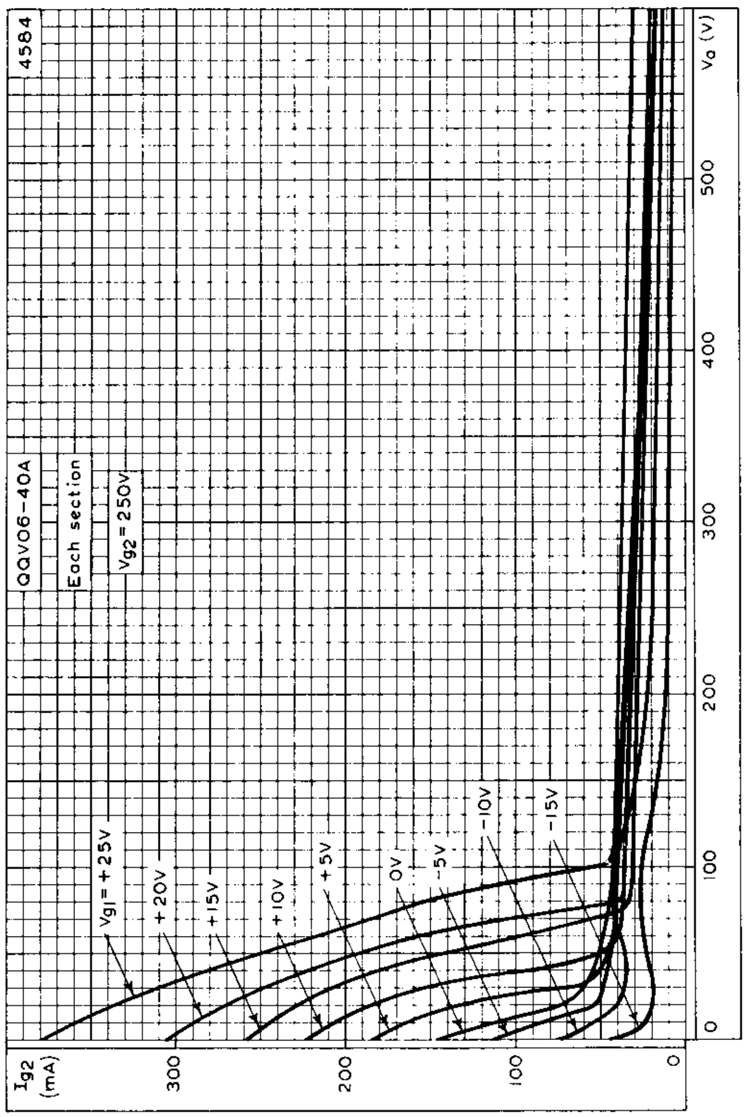


ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 250V

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

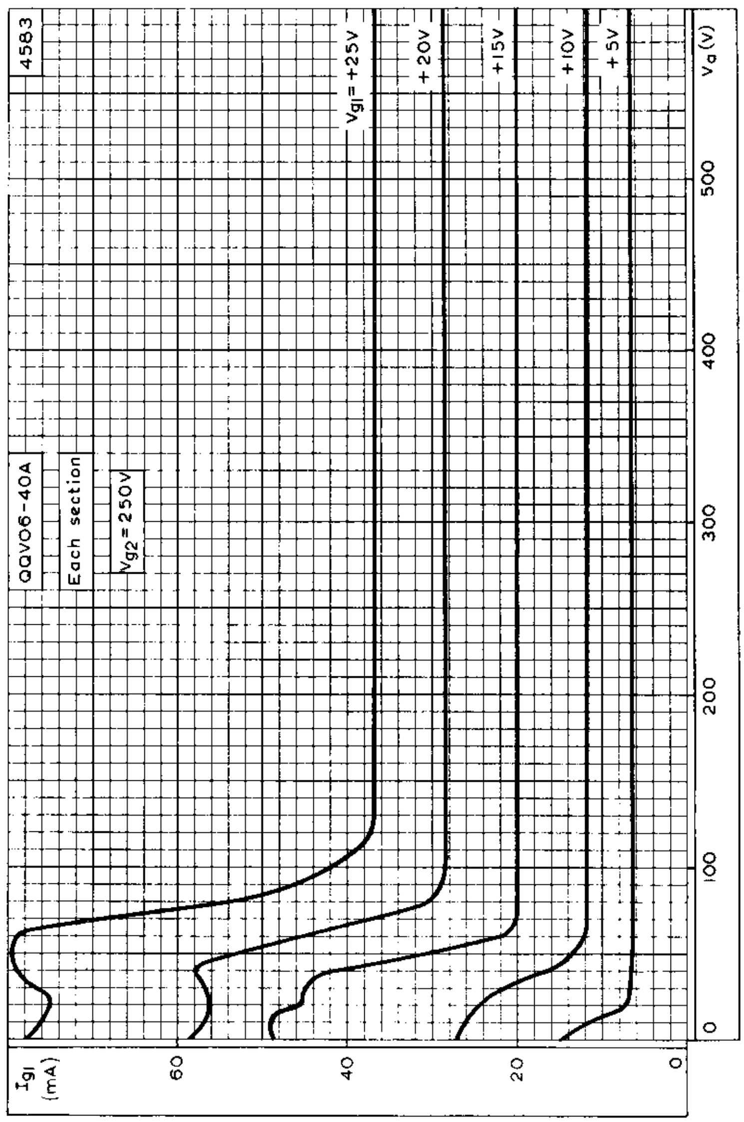


SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 250V

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

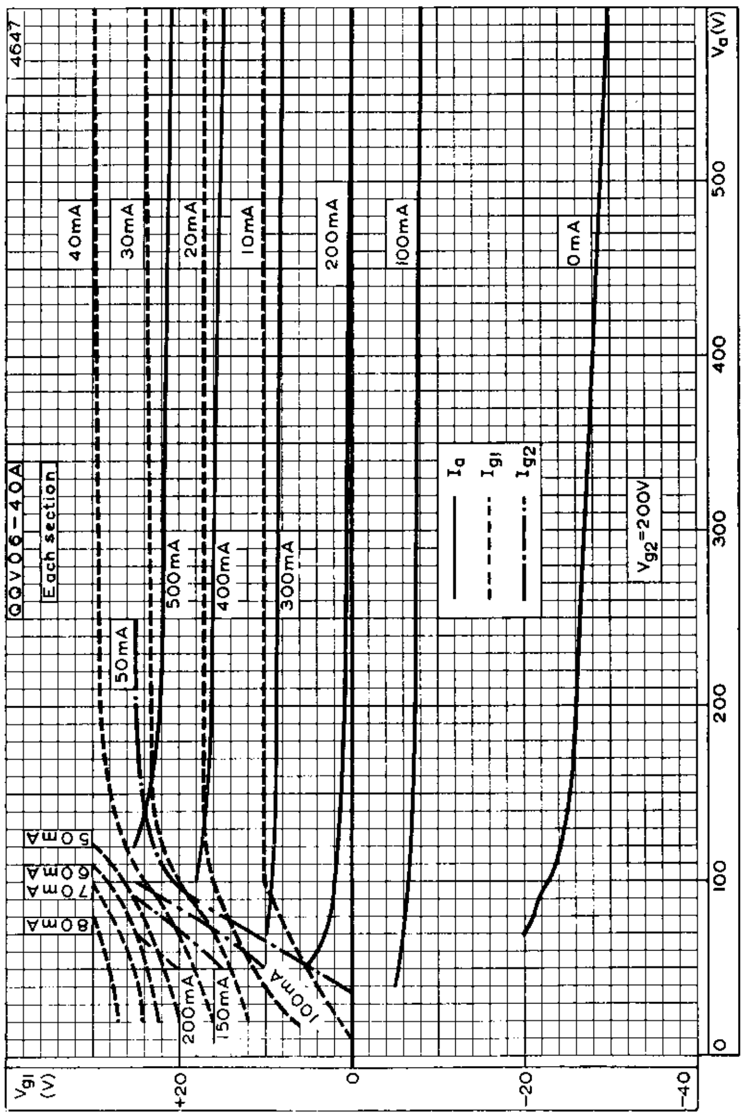


CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 250V

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

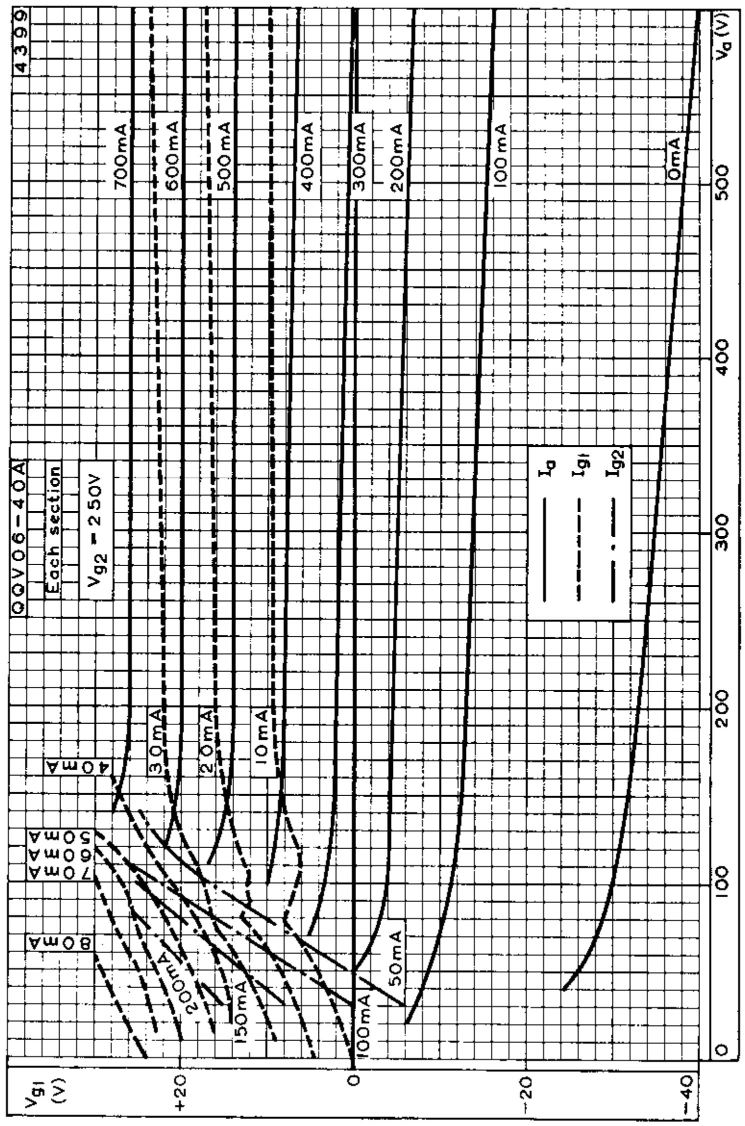


CONSTANT CURRENT CURVES FOR EACH SECTION $V_{g2} = 200V$

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.



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

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

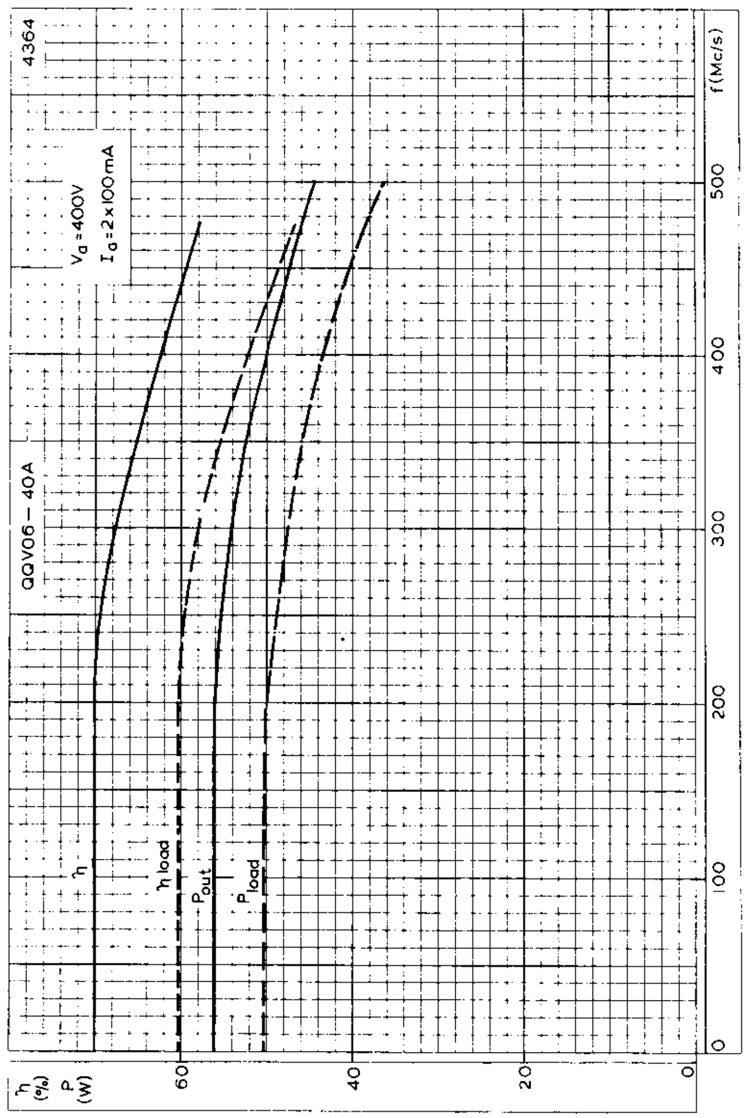
Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

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

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

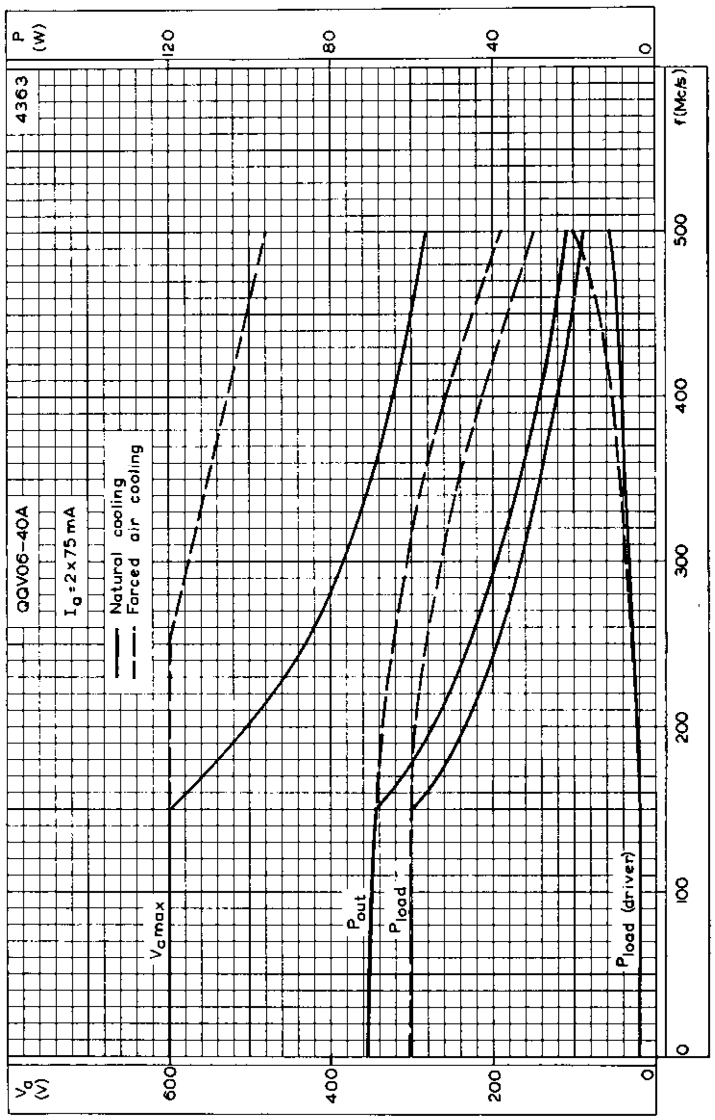


FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS A PUSH-PULL R.F. POWER AMPLIFIER (CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY)

V.H.F. POWER DOUBLE TETRODE

QQV06-40A

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.

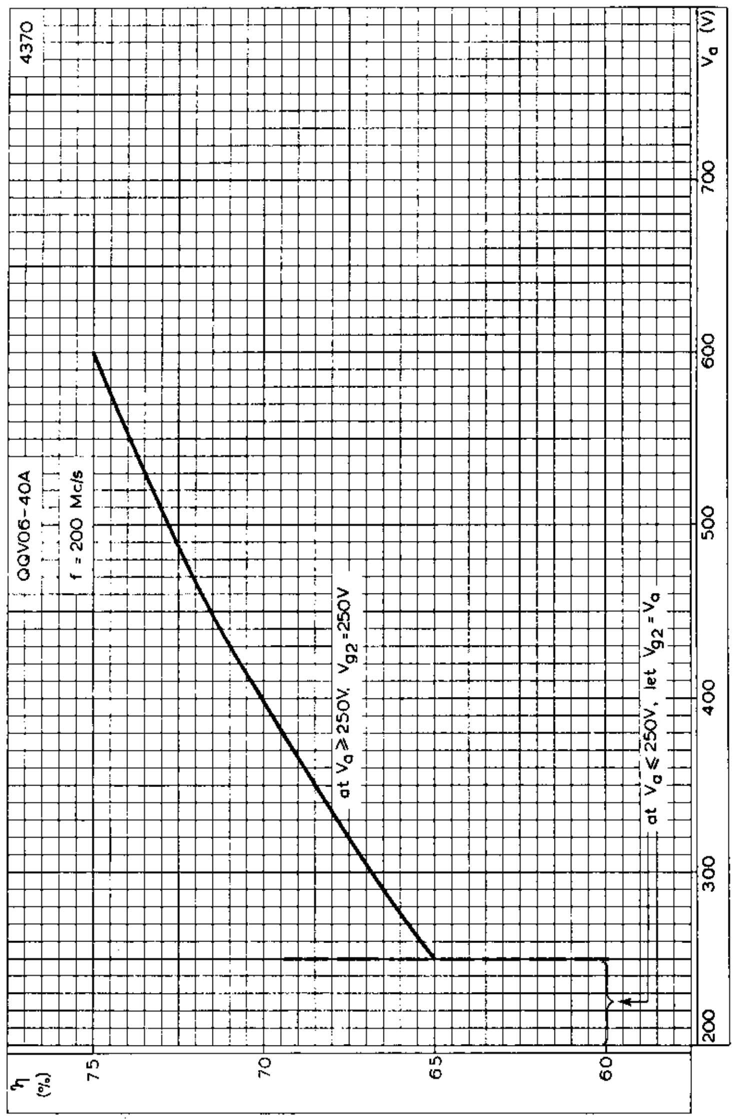


FREQUENCY CHARACTERISTICS FOR OPERATING CONDITIONS AS ANODE AND SCREEN-GRID MODULATED R.F. POWER AMPLIFIER (CLASS "C" TELEPHONY)

QQV06-40A

V.H.F. POWER DOUBLE TETRODE

Beam power double tetrode rated for a maximum anode dissipation of 20W at each anode and intended for use at frequencies up to 500Mc/s.



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

U.H.F. POWER DOUBLE TETRODE

QQV07-50

QUICK REFERENCE DATA

Double tetrode intended for use as u.h.f. power amplifier or frequency multiplier.

		Frequency Multiplier	Class 'C' Telephony Anode and Screen Grid Modulation	Class 'C' Telegraphy or F.M. Telephony	
f		180/60	60	200	Mc/s
P_{out}		27	80	103	W
f max.		500	500	500	Mc/s
V_a max.	($f < 250$ Mc/s)	750	600	750	V
	($f = 500$ Mc/s)	600	480	600	V
p_a max.		2 x 25	2 x 16.7	2 x 25	W

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Maximum operating conditions

f	180	180	470	470	Mc/s
P_{out}	64	103	52	69	W
P_{load}	54	87	44	59	W
η_a	70	75	57	60	%
V_a	400	600	400	500	V
I_a	2 x 115	2 x 115	2 x 115	2 x 115	mA
V_{g2}	250	250	250	250	V
I_{g2}	2 x 7.0	2 x 8.0	2 x 5.0	2 x 4.0	mA
$-V_{g1}$	60	80	50	60	V
I_{g1}	2 x 3.0	2 x 4.0	2 x 3.0	2 x 3.0	mA
$P_{load\ (driver)}$	4.0	4.0	12	14	W
p_a	2 x 14	2 x 17.5	2 x 20	2 x 23	W

CLASS 'C' TELEPHONY ANODE AND SCREEN-GRID MODULATION

Maximum operating conditions (Carrier conditions for 100% modulation)

f	60	180	180	470	Mc/s
P_{out}	80	47	61	37	W
P_{load}	68	40	52	26	W
η_a	78	69	72	55	%
V_a	600	400	500	400	V
I_a	2 x 85	2 x 85	2 x 85	2 x 85	mA
V_{g2}	250	250	250	250	V
I_{g2}	2 x 10	2 x 9.0	2 x 10	2 x 8.0	mA
$-V_{g1}$	90	70	90	70	V
I_{g1}	2 x 4.0	2 x 3.0	2 x 4.0	2 x 2.0	mA
$P_{load\ (driver)}$					W
p_a	2 x 11	2 x 10.5	2 x 12	2 x 15.5	W
For 100% modulation					
P_{mod}	60	36	45	35	W
$v_{g2\ (pk)}$	185	185	185	185	V

FREQUENCY MULTIPLIER

Maximum operating conditions

f_{out}/f_{in}	180/60	180/60	475/158	Mc/s
P_{out}	19	27	20	W
P_{load}	16	22	16	W
η_a	30	35	28	%
V_a	400	600	450	V
I_a	2 x 80	2 x 64	2 x 78	mA
V_{g2}	250	250	250	V
I_{g2}	2 x 8.0	2 x 4.0	2 x 9.0	mA
$-V_{g1}$	150	175	150	V
I_{g1}	2 x 3.0	2 x 3.0	2 x 3.0	mA
$P_{load\ (driver)}$				W
p_a	2 x 22.5	2 x 25	2 x 25	W

U.H.F. POWER DOUBLE TETRODE

QQV07-50

ABSOLUTE MAXIMUM RATINGS

	Frequency Multiplier	Class 'C' Telephony	Class 'C' Telegraphy	
V_a max. (f<250Mc/s)	750	600	750	V
(f =500Mc/s)	600	480	600	V
V_{g2} max.	300	300	300	V
$-V_{g1}$ max.	175	175	175	V
I_k max.	2 x 130	2 x 130	2 x 150	mA
p_a max.	2 x 25	2 x 16.7	2 x 25	W
p_{g2} max.	2 x 3.5	2 x 2.3	2 x 3.5	W
I_{g1} max.	2 x 5.0	2 x 5.0	2 x 5.0	mA
p_{g1} max.	2 x 1.0	2 x 1.0	2 x 1.0	W
R_{g1-k} max. per section (fixed bias)	50	50	50	kΩ
R_{g1-k} max. per section (automatic bias)	100	100	100	kΩ
V_{h-k} max.	100	100	100	V
$V_{g2(b)}$ max.	600	600	600	V

CATHODE

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

	Series	Parallel	
V_h	12.6	6.3	V
I_h	0.9	1.8	A

CAPACITANCES

* c_{a-g1} (each section)	60	mpF
c_{g1-all} (each section)	10.5	pF
c_{a-all} (each section)	3.2	pF
c_{out} (two sections in push-pull)	2.1	pF
c_{in} (two sections in push-pull)	6.7	pF

* Internally neutralised for push-pull operation.

CHARACTERISTICS (each section) measured at I_a = 30mA

g_m	4.5	mA/V
μ_{g1-g2}	8.0	

MOUNTING POSITION Any

COOLING

Radiation and convection cooled

Maximum temperatures

Pins	180	°C
Seals	250	°C
Bulb	250	°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 = 750V at frequencies up to 100 Mc/s
V_a = 600V at frequencies up to 150 Mc/s
V_a = 300V at frequencies up to 450 Mc/s

Above these limits or with high ambient temperatures it may be necessary to direct a flow of air (up to 5ft^3/min, 0.15m^3/min) on the top of the bulb to keep the seal temperature within the stated limit.

PHYSICAL DATA

	oz	g
Weight of valve	2.0	57

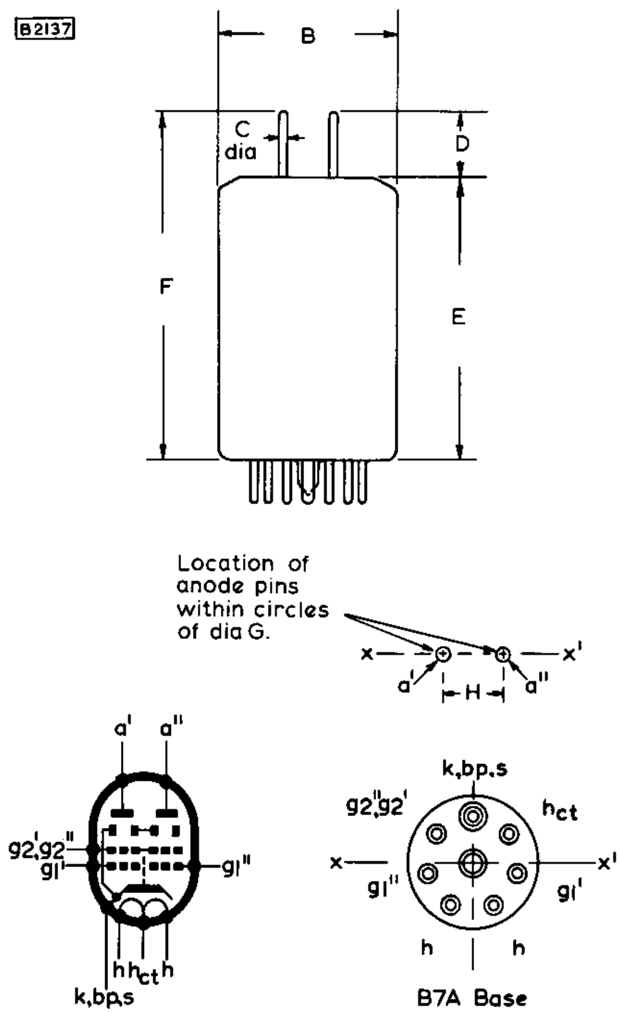
DIMENSIONS

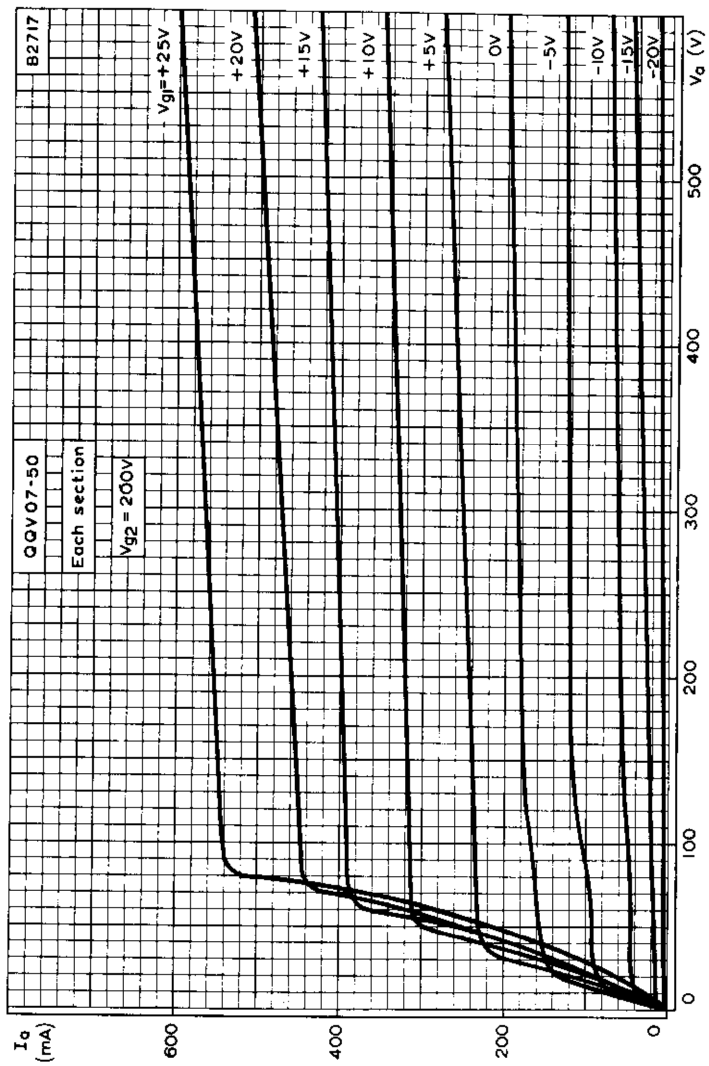
	Inches	Millimetres
B	1.732 ± 0.079	44 ± 2
C	0.079 ± 0.001	2.0 ± 0.1
D	0.650 ± 0.059	16.5 ± 1.5
E	2.874 ± 0.059	73 ± 1.5
F	3.524 ± 0.118	89.5 ± 3.0
G	0.098 ± 0.001	2.5 ± 0.03
H	0.551 ± 0.001	14 ± 0.03

Inch dimensions are derived from original millimetre dimensions.

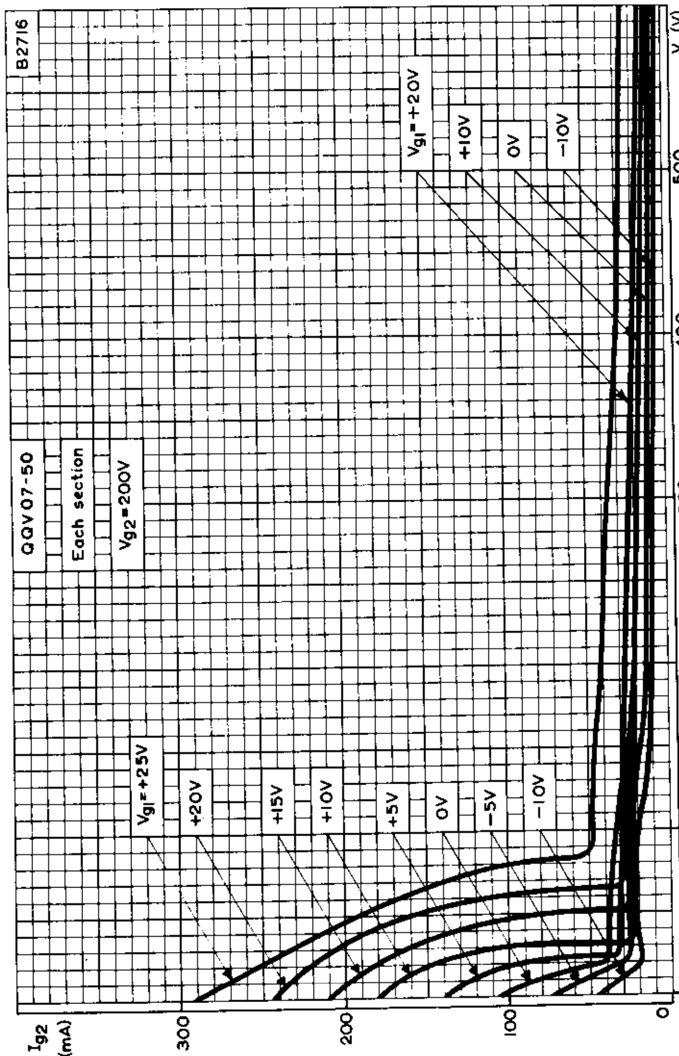
U.H.F. POWER DOUBLE TETRODE

QQV07-50

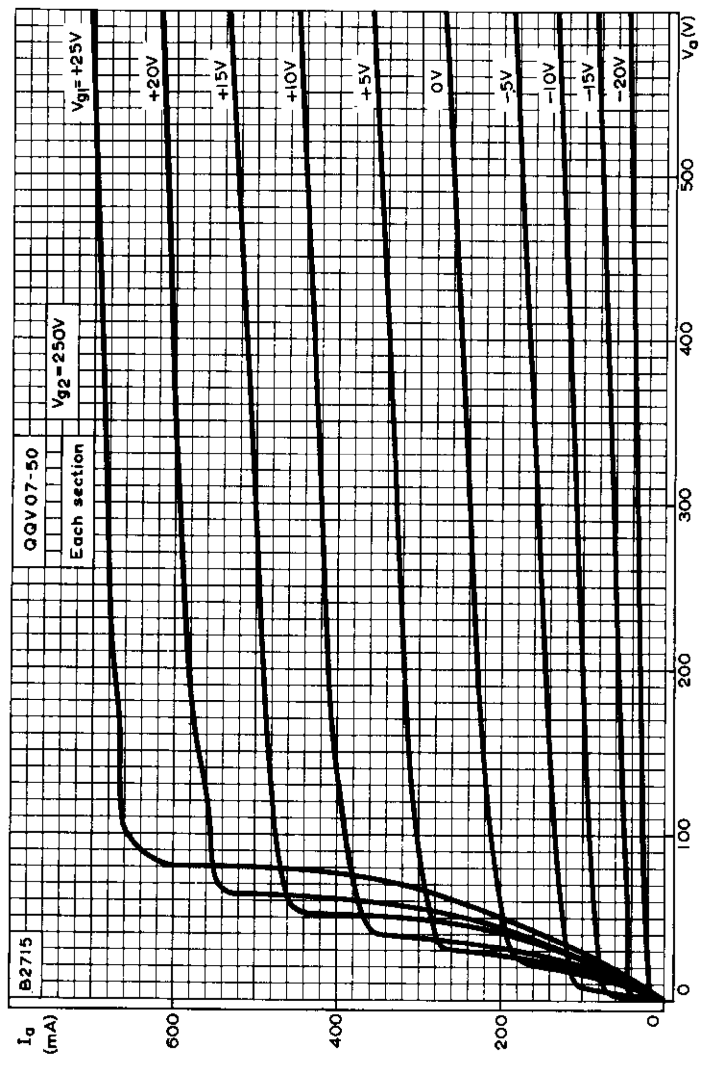




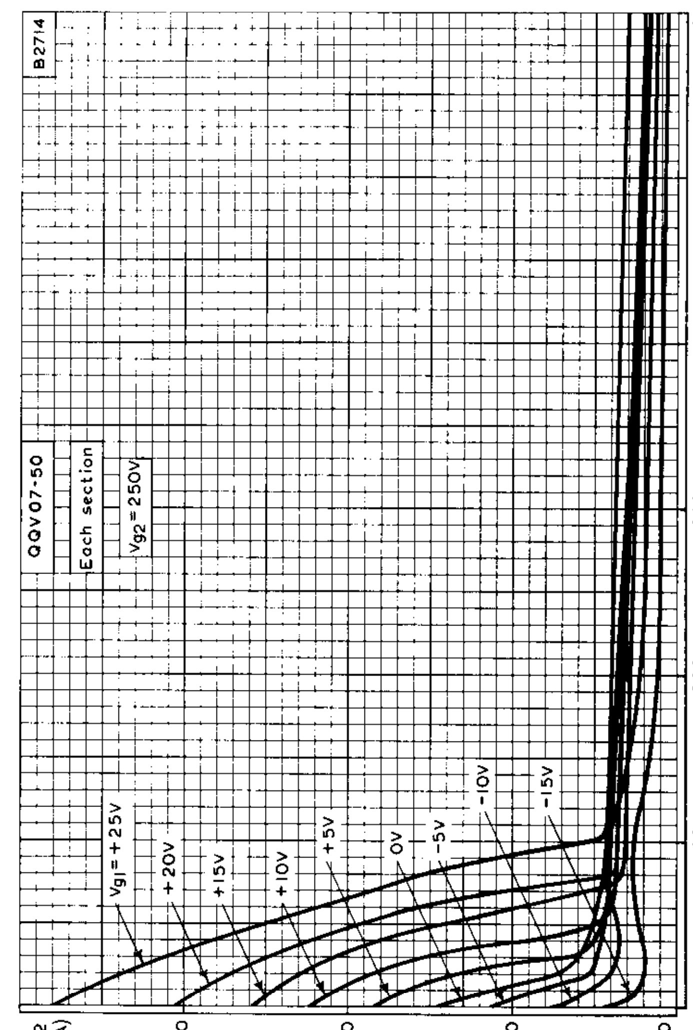
ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V



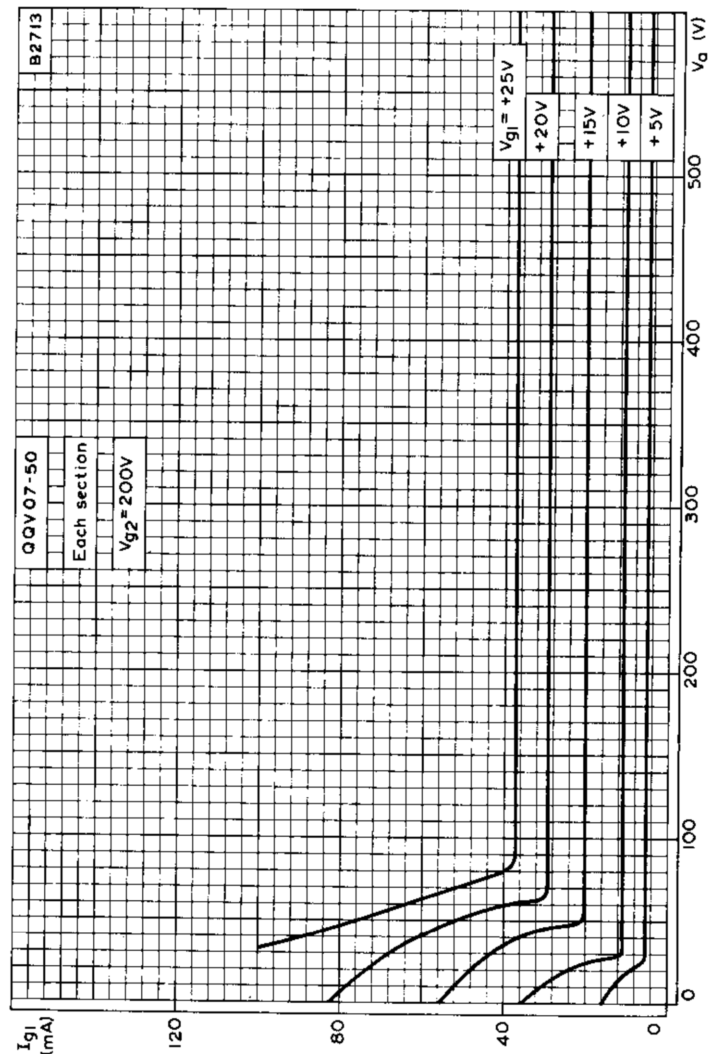
SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 200V$



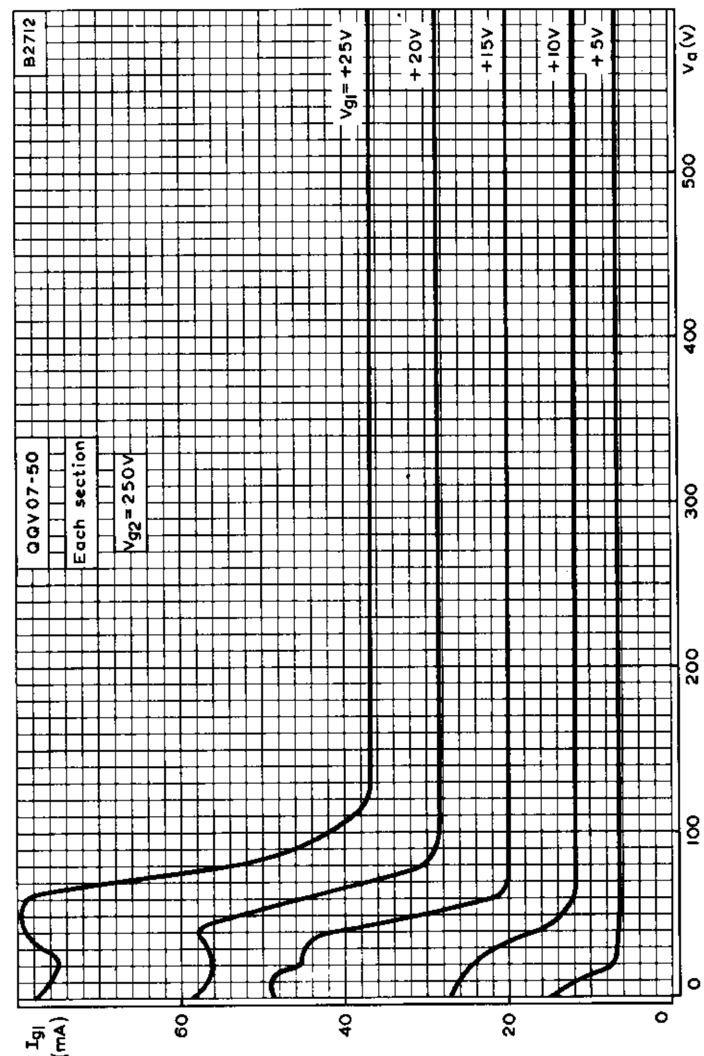
ANODE CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} =250V



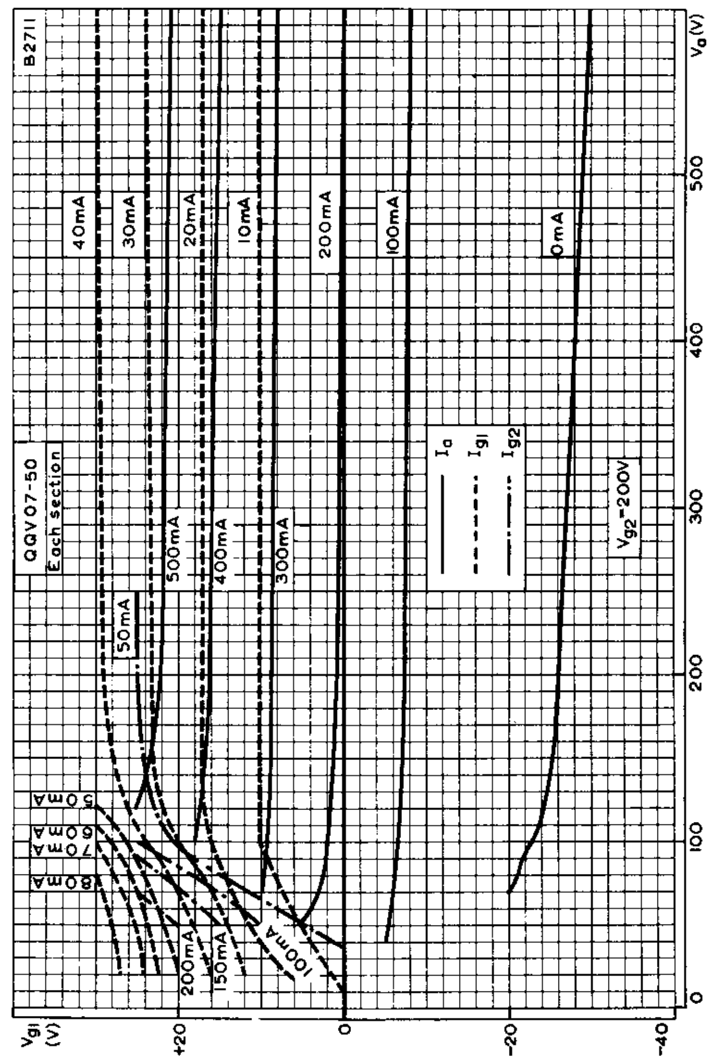
SCREEN-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 250V$



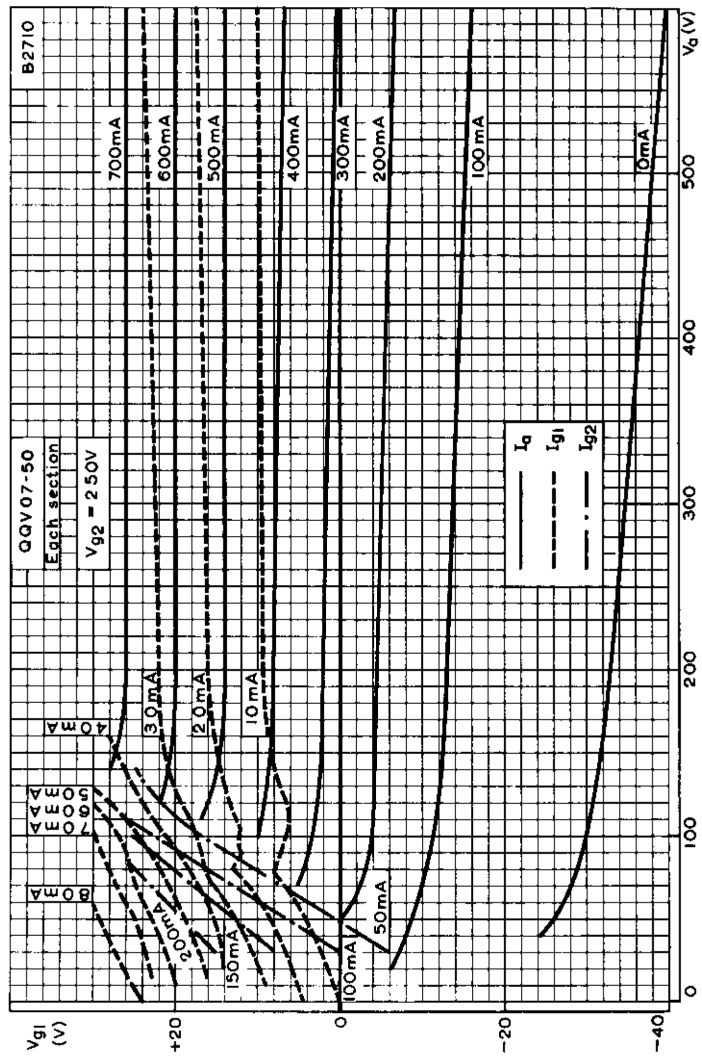
CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2} = 200V



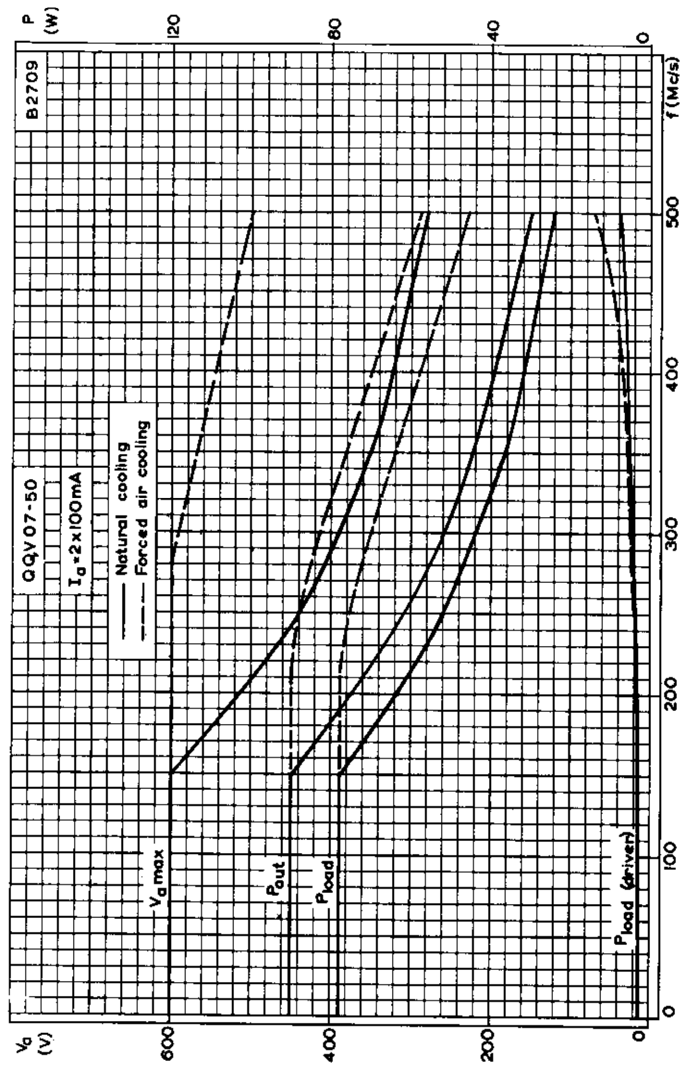
CONTROL-GRID CURRENT FOR EACH SECTION PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER V_{g2}=250V



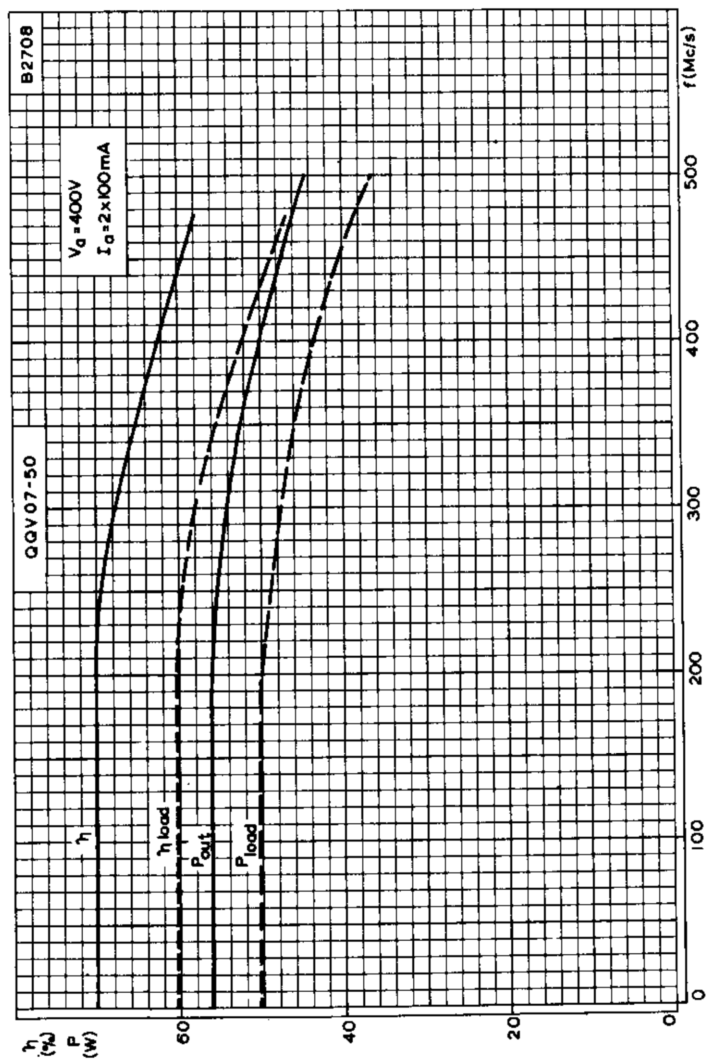
CONSTANT CURRENT CHARACTERISTICS FOR EACH SECTION V_{g2}=200V



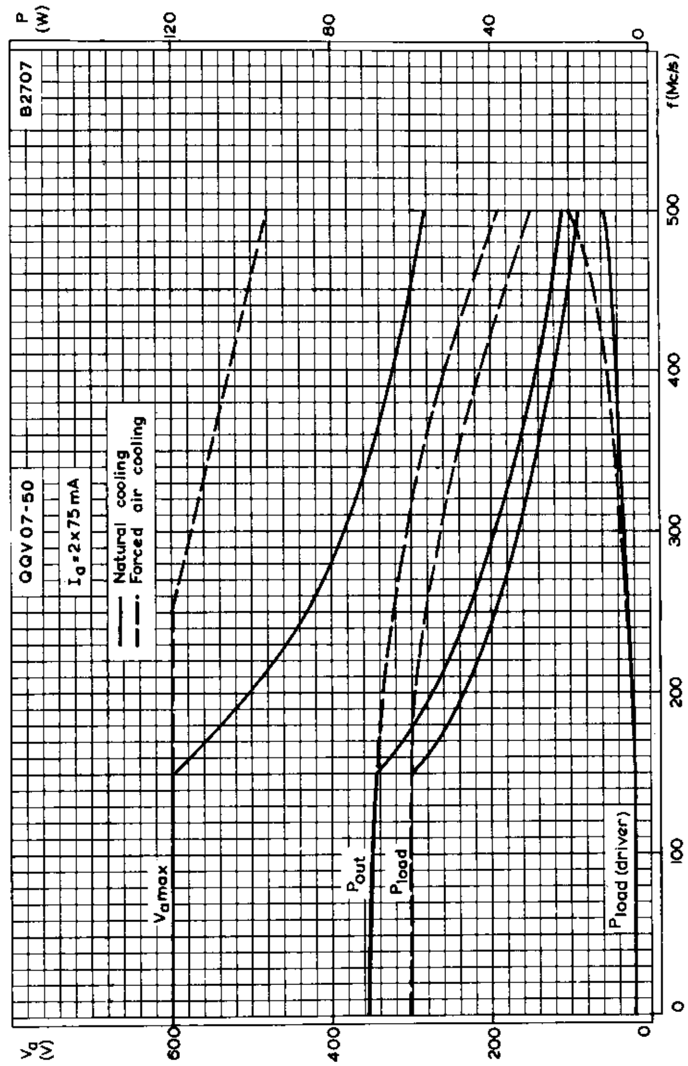
CONSTANT CURRENT CHARACTERISTICS FOR EACH SECTION V_{g2} = 250V



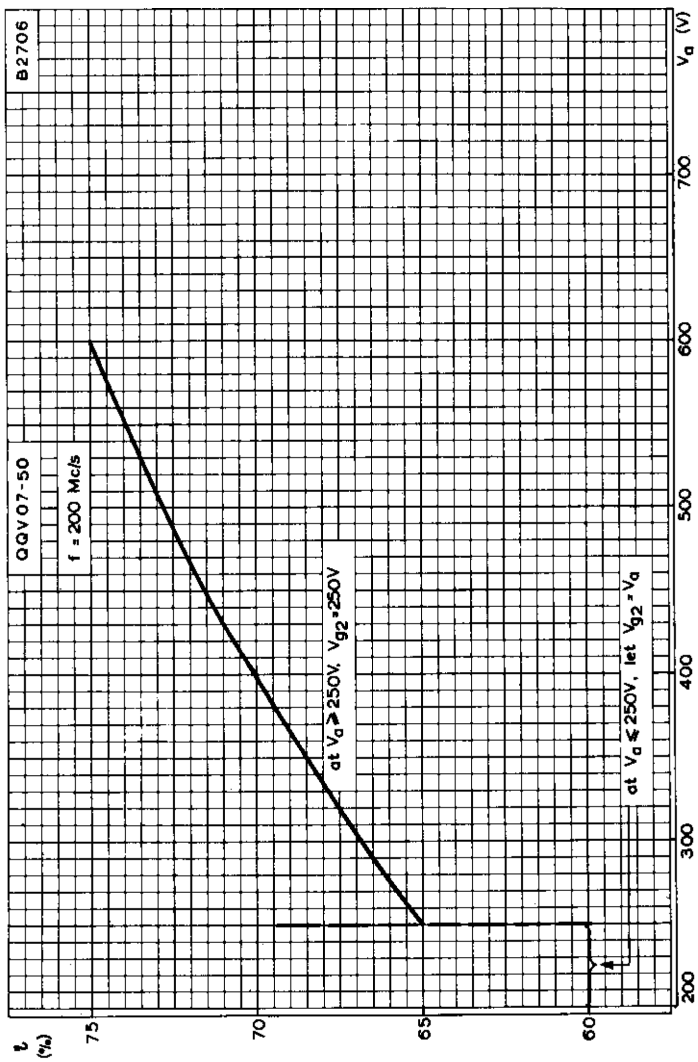
MAXIMUM OPERATING CONDITIONS FOR A PUSH-PULL R.F. POWER AMPLIFIER (CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY)



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



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

DOUBLE TETRODE PULSE MODULATOR

QQV5-P10

QUICK REFERENCE DATA

Double tetrode for pulsed applications

Performance

$i_{a(pulse)}$	10	A
V_a	5.0	kV
t_p	1.0	μs
$i_{a(pulse)}$ max.	10	A
V_a max.	5.0	kV

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

OPERATION AS PULSE MODULATOR

Design centre maximum operating conditions

				*	
t_p	0.1	1.0	3.0	1.0	μs
P.R.F.	1200	1200	330	1000	p/s
D.F.	0.00012	0.0012	0.001	0.001	
V_a	4.5	4.5	4.5	5.0	kV
V_{g2}	800	800	800	850	V
$-V_{g1}$	200	200	200	200	V
$v_{g1(pulse)}$	350	300	350	350	V
$i_{a(pulse)}$	9.0	8.0	9.0	10	A
I_a	1.1	9.6	9.0	10	mA
I_{g2}	0.25	1.5	2.0	2.0	mA
I_{g1}	0.125	0.625	1.0	1.0	mA
R_a	400	450	400	400	Ω

*This condition includes some of the absolute maximum ratings and therefore assumes protective conditions of operation.

ABSOLUTE MAXIMUM RATINGS
(Two sections in parallel)

V_a max.	5.0	kV
$v_{a(pulse)}$ max.	5.75	kV
V_{g2} max.	850	V
$-V_{g1}$ max.	225	V
$-v_{g1(pulse)}$ max.	600	V
$+v_{g1(pulse)}$ max.	250	V
$i_{a(pulse)}$ max.	See curve on page C2	
$i_{g2(pulse)}$ max.	3.5	A
$i_{g1(pulse)}$ max.	4.0	A
p_a max.	15	W
$p_{in(mean)}$ max.	85	W
$p_{g2(mean)}$ max.	3.0	W
$p_{g1(mean)}$ max.	1.0	W
V_{h-k} max.	100	V

CATHODE

Indirectly heated for series or parallel operation.

	Series	Parallel	
V_h	12.6	6.3	V
I_h	1.2	2.4	A

CAPACITANCES (each section)

c_{out}	7.0	pF
c_{in}	14.0	pF

CHARACTERISTICS (measured at I_a = 60mA)
(each section)

gm	8.5	mA/V
μg1-g2	9.0	

MOUNTING POSITION

Vertical - Base up or down.

Horizontal - Anode pins in horizontal plane.

DOUBLE TETRODE PULSE MODULATOR

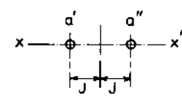
QQV5-P10

COOLING Natural

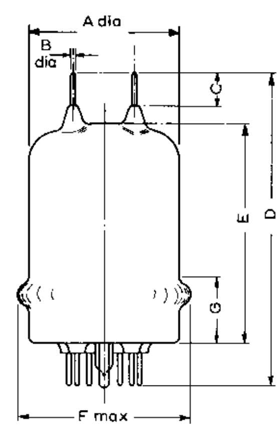
PHYSICAL DATA

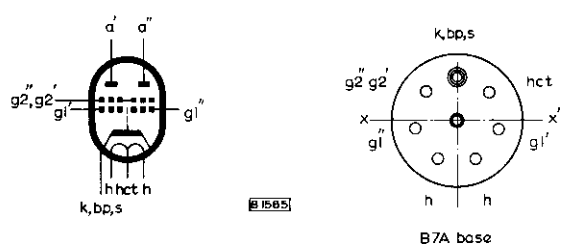
	oz	g
Weight of valve	4.00	110
Weight of valve and carton	9.25	270

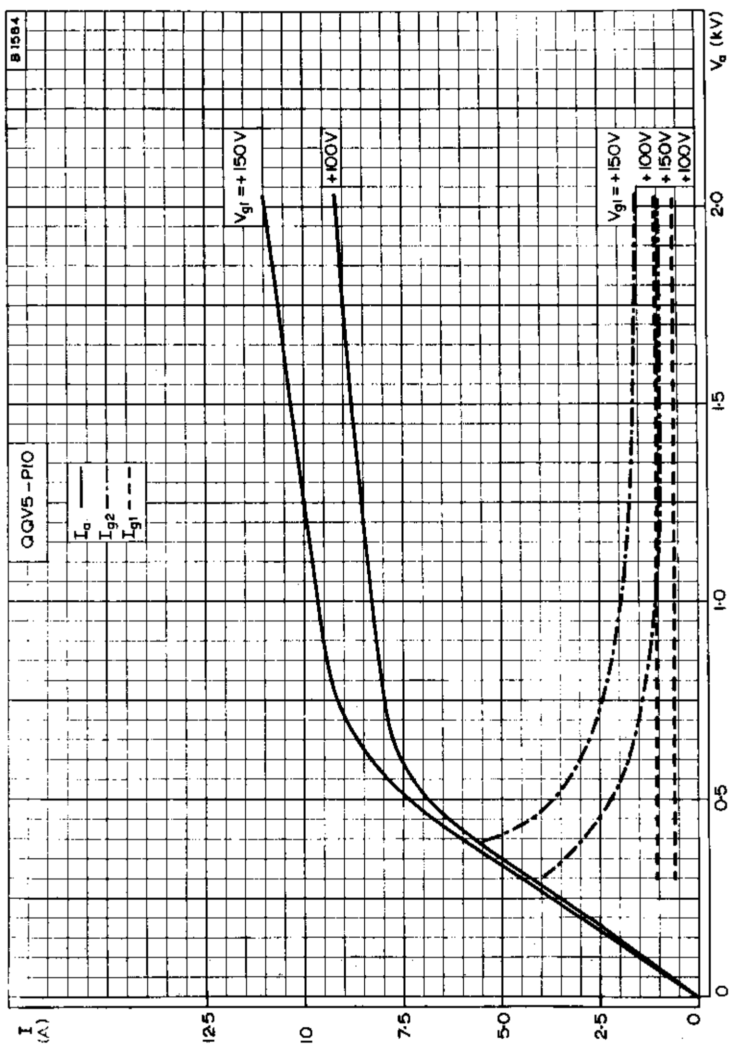
DIMENSIONS



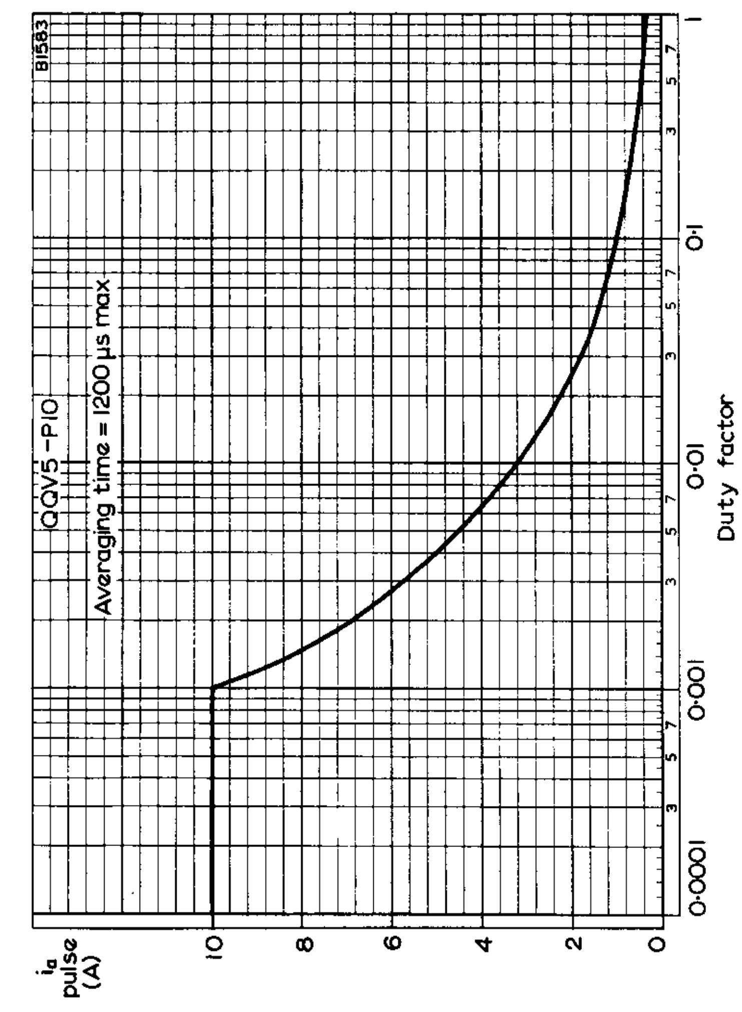
A	2.00	50.80
B	0.056±0.004	1.42±0.10
C	0.500±0.125	12.70±3.18
D	4.121±0.191	104.68±4.86
E	3.062±0.187	77.78±4.74
F	2.376	60.35
G	1.031±0.188	26.19±4.77
H	0.120±0.001	3.05±0.025
J	0.424±0.001	10.77±0.025







ANODE, SCREEN-GRID AND CONTROL-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE



MAXIMUM PULSE ANODE CURRENT PLOTTED AGAINST DUTY FACTOR

QUICK HEATING DOUBLE TETRODE

QQZ03-10

PRELIMINARY DATA

QUICK REFERENCE DATA

Quick heating single ended double tetrode for mobile transmitters.
70% P_{out} in less than 1 second.

	Class 'C' Telegraphy	Frequency Trebler	
f max.	200	200	Mc/s
V_a max.	300	330	V
p_a max.	2×7.0	2×5.0	W
Performance			
f	200	175	Mc/s
P_{out}	11	5.0	W

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

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY
(Intermittent mobile service)

Absolute maximum ratings

f max.	200	Mc/s
V_a max.	300	V
V_{g2} max.	200	V
$-V_{g1}$ max.	150	V
I_{g1} max.	2×4.0	mA
I_k max.	2×65	mA
$i_{k(pk)}$ max.	2×300	mA
p_a max.	2×7.0	W
p_{g2} max.	2×1.0	W
p_{g1} max.	2×200	mW
R_{g1-f} max.	100	kΩ

Typical operating conditions

f	200	200	Mc/s
V_a	250	200	V
$*V_{g2}$	175	175	V
$*-V_{g1}$	40	40	V
I_a	2×45	2×45	mA
I_{g2}	2×2.1	2×2.6	mA
I_{g1}	2×1.5	2×1.5	mA
$P_{load\ (driver)}$	1.0	1.0	W
p_a	2×4.5	2×3.5	W
η_a	62	67	%
P_{out}	13.5	11	W
P_{load}	11	9.5	W
$\eta_{transfer}$	80	80	%

QQZ03-10

QUICK HEATING DOUBLE TETRODE

OPERATING NOTE

*I_{g1} and I_{g2} will vary from valve to valve, hence the use of fixed resistors R_{g1} and R_{g2} will result in variation of input and output power. It is therefore recommended that R_{g2} be made adjustable.

ANODE AND SCREEN GRID MODULATED CLASS 'C' AMPLIFIER
(Intermittent mobile service).

Absolute maximum ratings

Carrier condition for a modulation factor of 1.

f max.	200	Mc/s
V_a max.	240	V
V_{g2} max.	200	V
$-V_{g1}$ max.	150	V
I_{g1} max.	2×4	mA
I_k max.	2×52	mA
$i_{k(pk)}$ max.	2×240	mA
p_a max.	2×4.6	W
p_{g2} max.	2×0.65	W
p_{g1} max.	2×0.2	W

Typical operating conditions

f	200	Mc/s
V_a	200	V
V_{g2}	175	V
$-V_{g1}$	50	V
$v_{in(pk)}$	130	V
I_a	2×43	mA
I_{g2}	2×1.5	mA
I_{g1}	2×1.6	mA
$P_{load\ (driver)}$	1.25	W
p_a	2×3.6	W
P_{load}	8.0	W
η_a	57	%
P_{out}	10	W

For 100% modulation

P_{mod}	9.0	W

OPERATION AS FREQUENCY TREBLER
(Intermittent mobile service)

Absolute maximum ratings

f max.	200	Mc/s
V_a max.	330	V
V_{g2} max.	200	V
$-V_{g1}$ max.	150	V
I_{g1} max.	2×2.0	mA
I_k max.	2×30	mA
$i_{k(pk)}$ max.	2×200	mA
p_a max.	2×5.0	W
p_{g2} max.	2×1.0	W
p_{g1} max.	2×0.2	W
R_{g1-f} max.	100	kΩ

QUICK HEATING DOUBLE TETRODE

QQZ03-10

Typical operating conditions

f_{out}	175	Mc/s
V_a	300	V
V_{g2}	150	V
$-V_{g1}$	125	V
I_a	2×24	mA
I_{g2}	2×1.0	mA
I_{g1}	2×0.75	mA
$P_{load\ (driver)}$	1.2	W
p_a	2×4.7	W
P_{out}	5.0	W
P_{load}	4.0	W

CATHODE

Quick heating filament. 70% P_{out} in less than 1 second.

V_f d.c. or r.m.s.	3.15	V
I_f	1.65	A

Frequency of filament supply

Sine wave	max. 200	c/s
Square wave	any	

The filament has been designed to accept temporary variations in supply voltage of $\pm15\%$.

CAPACITANCES (measured without external shield)

*c_{a-g1} (each section)	100	mpF
c_{out} (two sections in push-pull)	3.2	pF
c_{in} (two sections in push-pull)	6.8	pF
$c_{a''-g1'}$	<130	mpF
$c_{a'-g1''}$	<130	mpF
$c_{g1'-g1''}$	1.9	pF
$c_{a'-a''}$	90	mpF

*Internally neutralised for push-pull operation.

CHARACTERISTICS (measured at $V_a = 200V$; $V_{g2} = 200V$; $I_a = 30mA$)

g_m	3.2	mA/V
μ_{g1-g2}	7.5	

COOLING

Radiation and convection

T_{bulb} max.	225	°C
T_{pins} max.	120	°C

MOUNTING POSITION Any

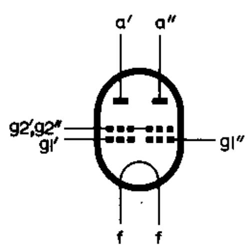
When the valve is mounted in a horizontal position, it is recommended that pins 2 and 7 are placed in a vertical plane.

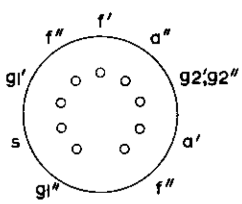
PHYSICAL DATA

Weight of valve	0.53	oz
	16	g
Weight of valve plus carton	0.8	oz
	23	g

QQZ03-10

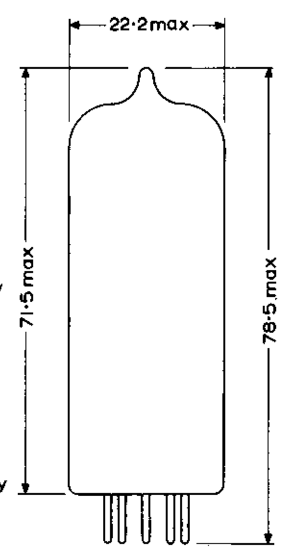
QUICK HEATING DOUBLE TETRODE





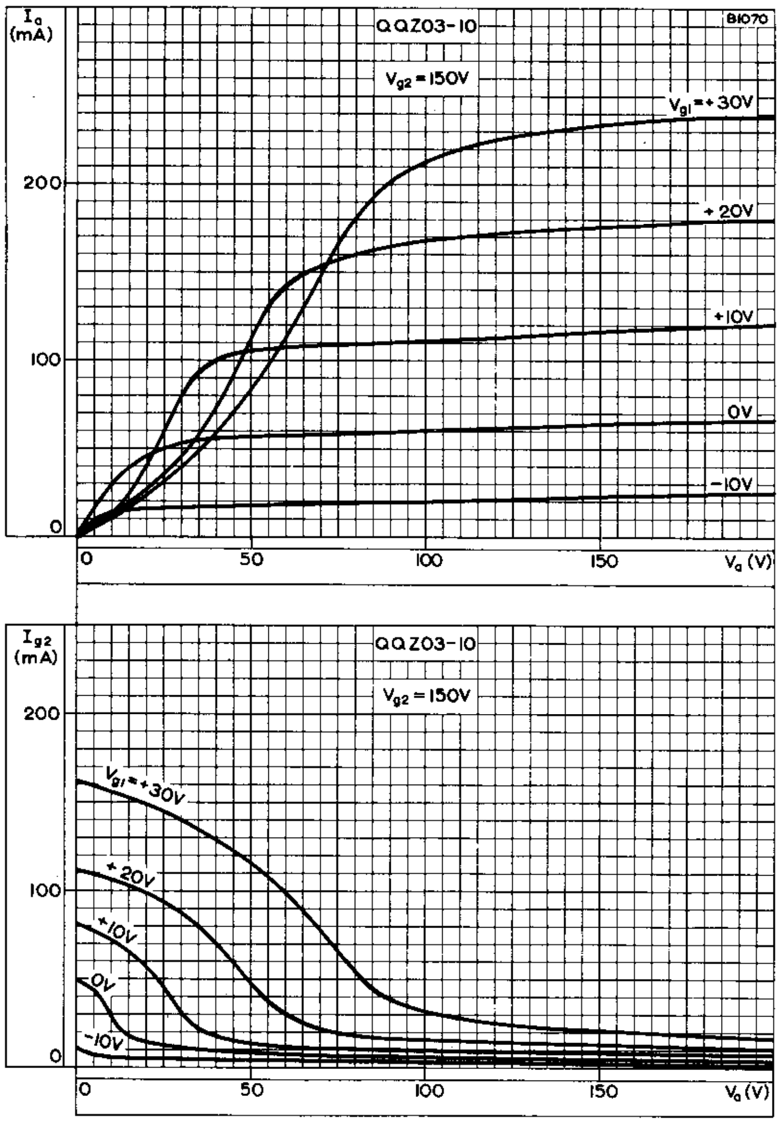
B9A Base

Contacts 4 and 9 should be strapped together externally to reduce the effective contact resistance



All dimensions in mm

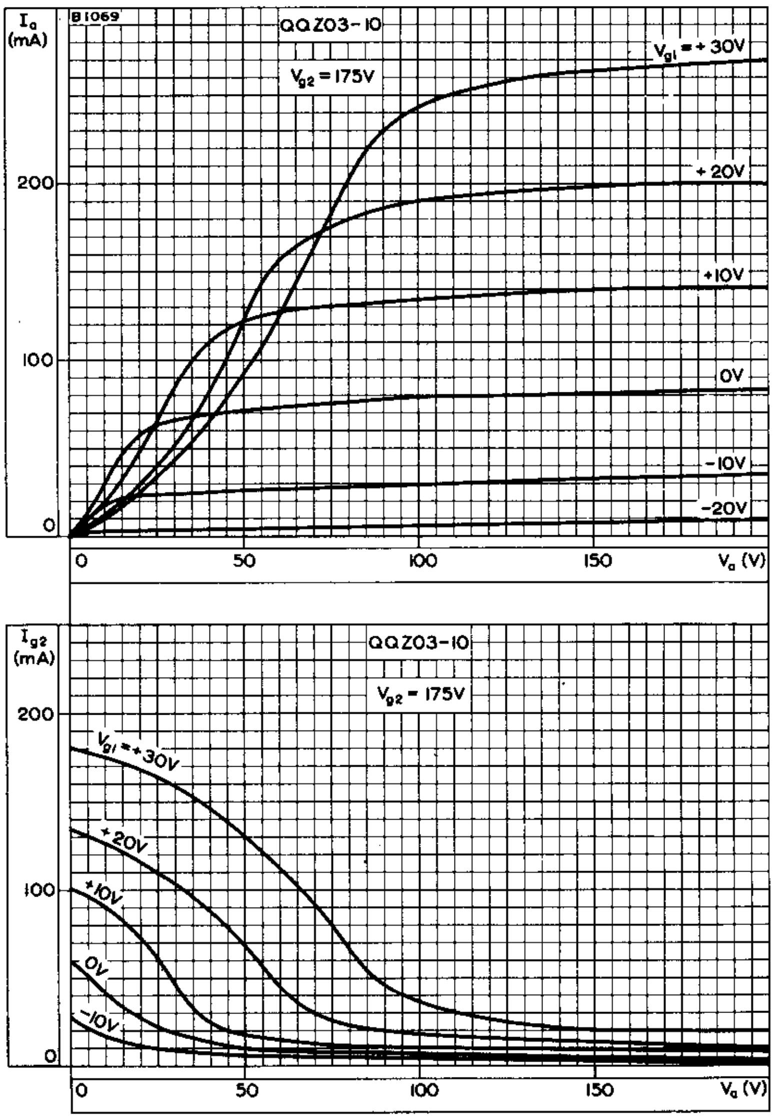
8229



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

QQZ03-10

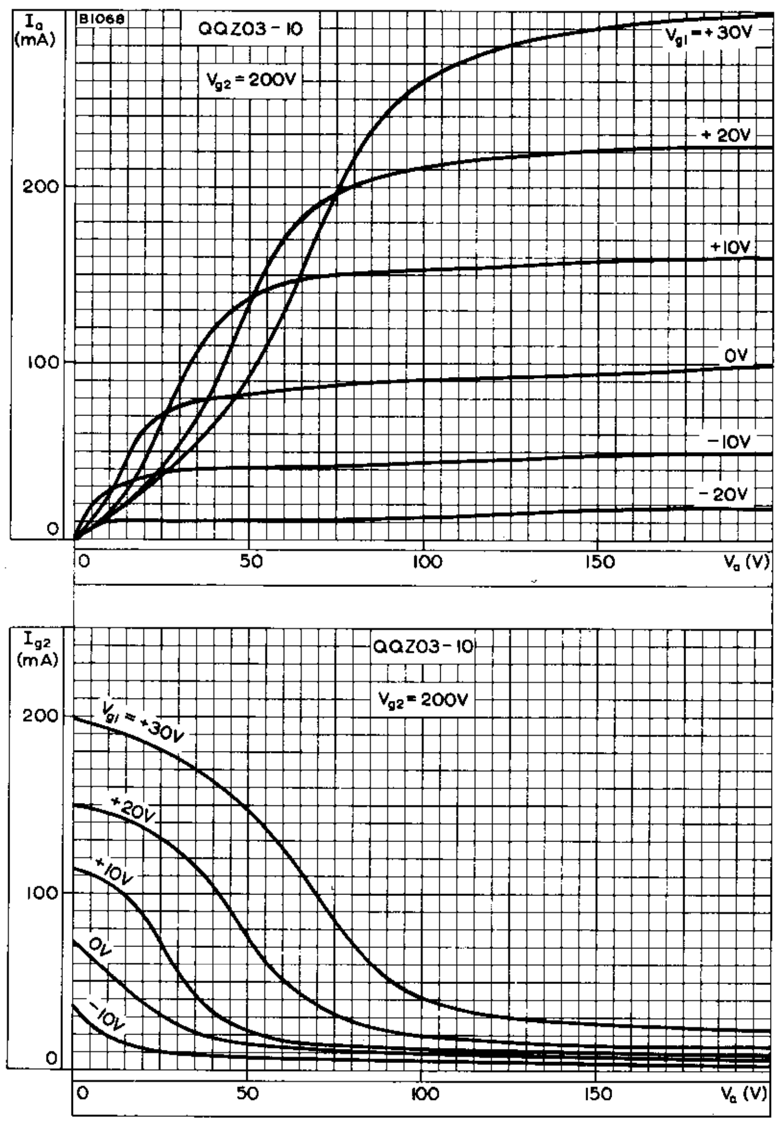
QUICK HEATING DOUBLE TETRODE



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

QUICK HEATING DOUBLE TETRODE

QQZ03-10



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

V.H.F. POWER TETRODE

QV03-12

Application: *V.H.F. power amplifier*
Power output: *10W*
Frequency: *175Mc/s at full ratings*
Construction: *Glass, natural cooling*

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

CATHODE

Indirectly heated

V_h	6.0	V
I_h	750	mA

MOUNTING POSITION

Any

CAPACITANCES (measured without external shield)

c_{a-g1}	<300	mpF
c_{in}	9.5	pF
c_{out}	4.5	pF

CHARACTERISTICS (measured at I_a = 45mA)

g_m	7.0	mA/V
μ_{g1-g2}	16	

COOLING

Natural cooling

T_{bulb} max.	250	°C

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Limiting values (absolute ratings)

V_a max.	300	V
p_a max.	12	W
V_{g2} max.	250	V
p_{g2} max.	2.0	W
$-V_{g1}$ max.	125	V
I_{g1} max.	5.0	mA
I_k max.	70	mA
$i_{k(pk)}$ max.	350	mA
R_{g1-k} max.	100	kΩ
$v_{h-k(pk)}$ max.	100	V

Operating conditions

f	<30	<50	Mc/s
V_a	300	300	V
V_{g2}	250	250	V
†V_{g1}	−29	−60	V
R_{g1-k}	18	22	kΩ
I_a	50	50	mA
I_{g2}	6.5	5.0	mA
I_{g1}	1.5	3.0	mA
$v_{in(pk)}$	38	80	V
P_{drive}	150	400	mW
P_{out}	10	8.0	W
P_{load}	8.0	6.4	W
$\eta_{transfer}$	80	80	%

†May be obtained by a fixed bias or by the grid resistor shown.

CLASS 'C' ANODE AND SCREEN-GRID MODULATION

Limiting values (absolute ratings)

V_a max.	250	V
p_a max.	8.0	W
V_{g2} max.	250	V
p_{g2} max.	1.5	W
$-V_{g1}$ max.	125	V
I_{g1} max.	5.0	mA
I_k max.	60	mA
$i_{k(pk)}$ max.	550	mA
R_{g1-k} max.	100	kΩ
$v_{h-k(pk)}$ max.	100	V

Operating conditions

f	<30	Mc/s
V_a	250	V
*V_{g2}	250	V
V_{g1}	-39	V
I_a	40	mA
I_{g2}	5.5	mA
I_{g1}	1.0	mA
$v_{in(pk)}$	47	V
P_{drive}	200	mW
P_{out}	6.4	W
P_{load}	5.1	W
$\eta_{transfer}$	80	%

*Obtained preferably from a separate modulated supply, or from the modulated anode supply.

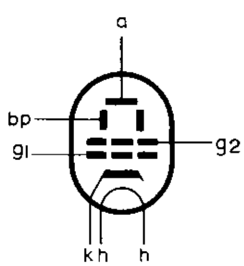
CLASS 'C' FREQUENCY MULTIPLIER

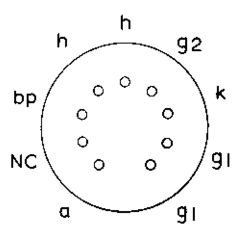
Limiting values (absolute ratings)

V_a max.	300	V
p_a max.	12	W
V_{g2} max.	250	V
p_{g2} max.	2.0	W
$-V_{g1}$ max.	125	V
I_{g1} max.	5.0	mA
I_k max.	70	mA
$i_{k(pk)}$ max.	450	mA
R_{g1-k} max.	100	kΩ
$v_{h-k(pk)}$ max.	100	V

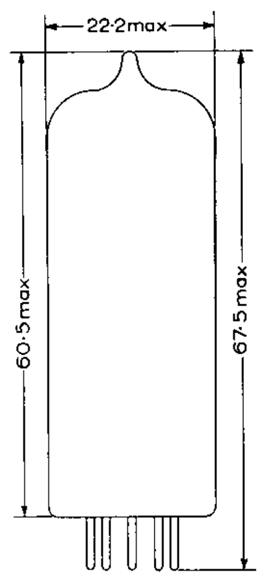
Operating conditions

	Doubler	Trebler	
f_{out}	175	175	Mc/s
V_a	300	300	V
V_{g2}	250	238	V
R_{g2}	12.5	12.5	kΩ
V_{g1}	–75	–100	V
R_{g1-k}	75	100	kΩ
I_a	40	35	mA
I_{g2}	4.0	5.0	mA
I_{g1}	1.0	1.0	mA
$v_{in(pk)}$	95	120	V
P_{drive}	600	600	mW
P_{out}	3.6	2.8	W
P_{load}	2.0	1.5	W
$\eta_{transfer}$	56	54	%





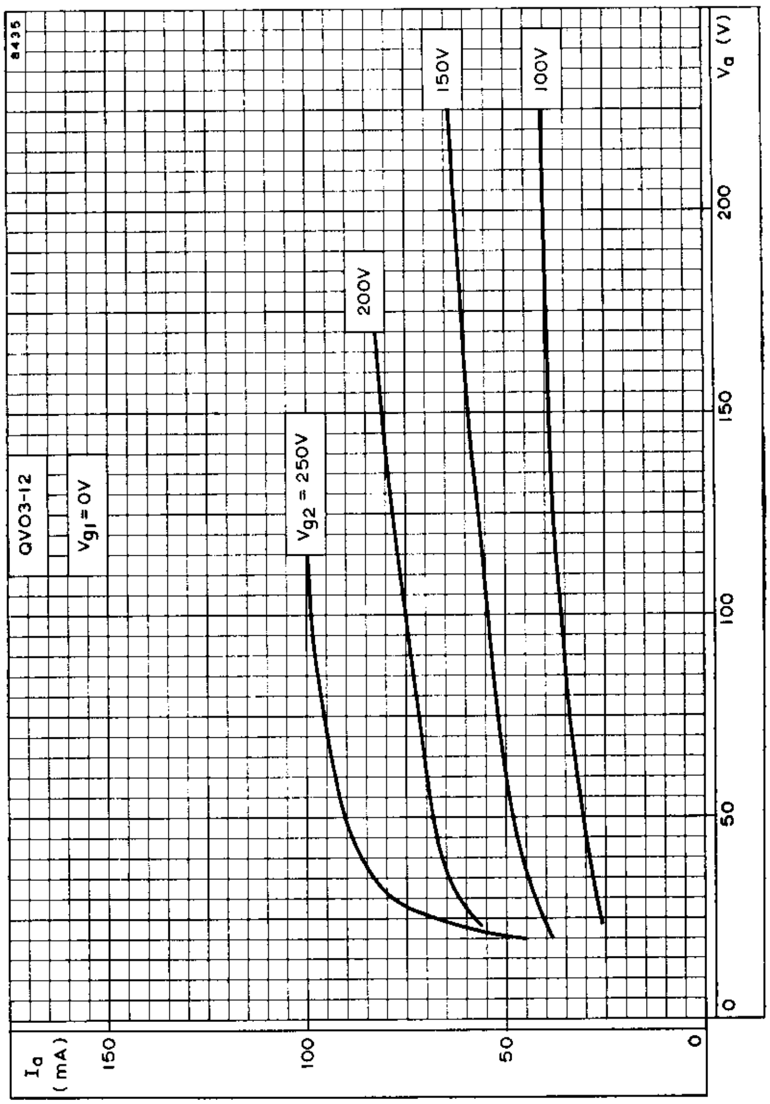
B9A Base



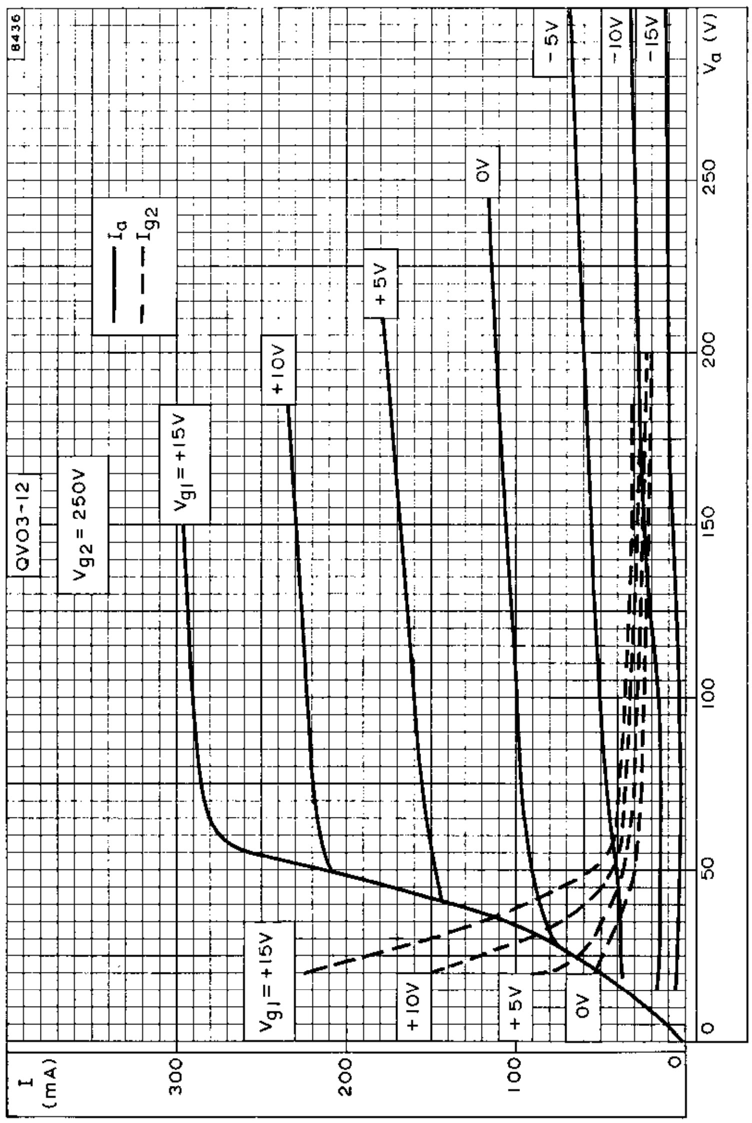
Contacts 3 and 7 should be connected together at the socket.
Contacts 8 and 9 should be connected to the external circuit with leads of equal length.

All dimensions in mm

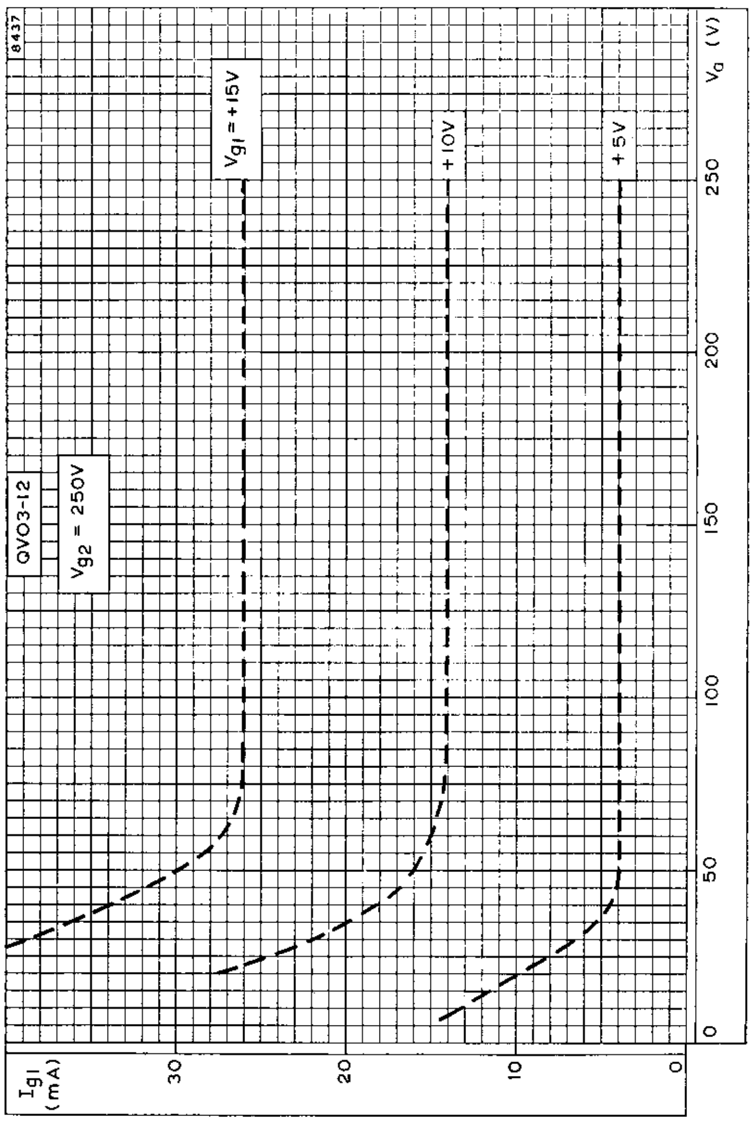
8438



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



ANODE AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE

R.F. POWER TETRODE

QV04-7

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s., as an R.F. amplifier or as a frequency multiplier.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES preceding this section of the Handbook.

CATHODE Indirectly heated.

V_h	6.3	V
I_h	0.6	A
t_{h-k}	22	s

CAPACITANCES

c_{in}	8.0	pF
c_{out}	5.4	pF
c_{a-g1}	<0.1	pF

CHARACTERISTICS at $V_a = 300$ V; $V_{g2} = 250$ V; $I_a = 25$ mA.

g_m	1.9	mA/V
μ_{g1-g2}	5.6	
r_a	67	kΩ

LIMITING VALUES

V_a max.	400	V
V_{g2} max.	250	V
p_a max.	7.5	W
p_{g2} max.	2.0	W
I_k max.	50	mA
I_{g1} max.	6.0	mA

QV04-7

R.F. POWER TETRODE

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s., as an R.F. amplifier or as a frequency multiplier.

OPERATING CONDITIONS FOR SINGLE VALVE CLASS "C" R.F. AMPLIFIER

f	3	3	20	20	Mc/s
V_a	300	300	300	300	V
V_{g2}	150	250	150	250	V
V_{g1}	−35	−50	−30	−60	V
I_a	40	43	43.5	43.7	mA
I_{g2}	7.2	6.6	4.7	5.9	mA
I_{g1}	2.8	0.4	1.8	0.4	mA
$v_{in(pk)}$	58	60	48	67	V
p_a	4.9	4.8	5.8	5.2	W
P_{out}	7.1	8.1	7.3	7.9	W
η	59	62	56	60	%

f	60	60	150	150	Mc/s
V_a	300	300	300	300	V
V_{g2}	150	250	150	250	V
V_{g1}	−30	−50	−30	−50	V
I_a	44	44	44	46	mA
I_{g2}	4.5	6.0	4.5	4.0	mA
I_{g1}	1.9	0.4	1.5	0.4	mA
$v_{in(pk)}$	48	57	52	57	V
p_a	6.2	5.5	6.9	7.5	W
P_{out}	7.0	7.7	6.3	6.3	W
η	53	58	48	46	%

OPERATING CONDITIONS FOR TWO VALVES CLASS "C" R.F. AMPLIFIER

	60	100	150	Mc/s
V_a	300	300	300	V
V_{g2}	250	250	250	V
V_{g1}	−60	−60	−50	V
I_a	2×43	2×44.4	2×46	mA
I_{g2}	2×6.7	2×5.3	2×4.0	mA
I_{g1}	2×0.5	2×0.4	2×0.4	mA
$v_{in(pk)}$	2×68	2×68	2×57	V
p_a	2×5.1	2×6.0	2×7.4	W
P_{out}	15.6	14.7	12.6	W
η	60	55	46	%

OPERATING CONDITIONS FOR SINGLE VALVE FREQUENCY DOUBLER

f_{out}	20	75	100	150	Mc/s
V_a	300	300	300	250	V
V_{g2}	250	250	200	200	V
V_{g1}	−80	−120	−120	−120	V
I_a	41	43.5	38.4	36.8	mA
I_{g2}	8.0	5.5	2.6	2.1	mA
I_{g1}	0.8	1.2	1.5	1.1	mA
$v_{in(pk)}$	81	124	120	144	V
p_a	6.8	7.4	7.1	6.9	W
P_{out}	5.6	5.6	4.4	2.3	W
η	45	44	38	25	%

QV04-7

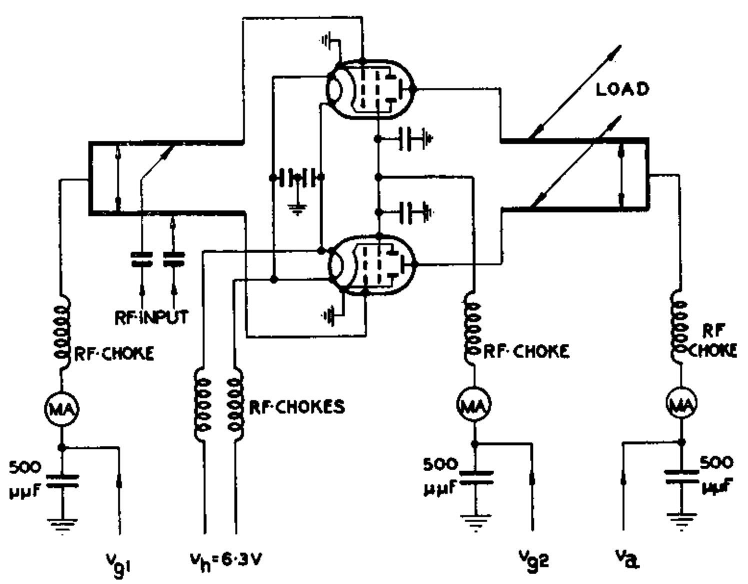
R.F. POWER TETRODE

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s., as an R.F. amplifier or as a frequency multiplier.

OPERATING CONDITIONS AS FREQUENCY TREBLER

	Single Valve			Push-Pull	
f_{out}	20	75	100	150	Mc/s
V_a	300	300	275	225	V
V_{g2}	250	250	200	200	V
V_{g1}	−120	−140	−140	−140	V
I_a	35	34	36	2×36	mA
I_{g2}	4.2	2.8	2.5	2×2.5	mA
I_{g1}	0.6	0.6	1.5	2×1.3	mA
$v_{in(pk)}$	109	130	142	2×152	V
p_a	7.3	7.1	7.1	2×6.6	W
P_{out}	3.3	3.2	2.8	3.1	W
η	31	31	28	19	%

WEIGHT Valve only ; 1½ oz.



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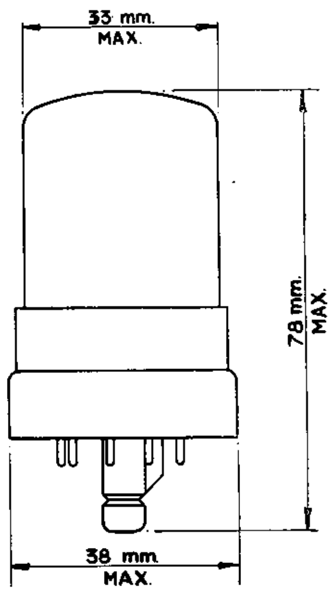
Parallel-line Push-pull R.F. Amplifier

QV04-7

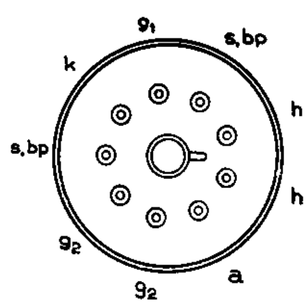
R.F. POWER TETRODE

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s., as an R.F. amplifier or as a frequency multiplier.

DIMENSIONS AND BASE CONNECTIONS



9-PIN PRESSED GLASS BASE TO FIT B9G VALVE HOLDER



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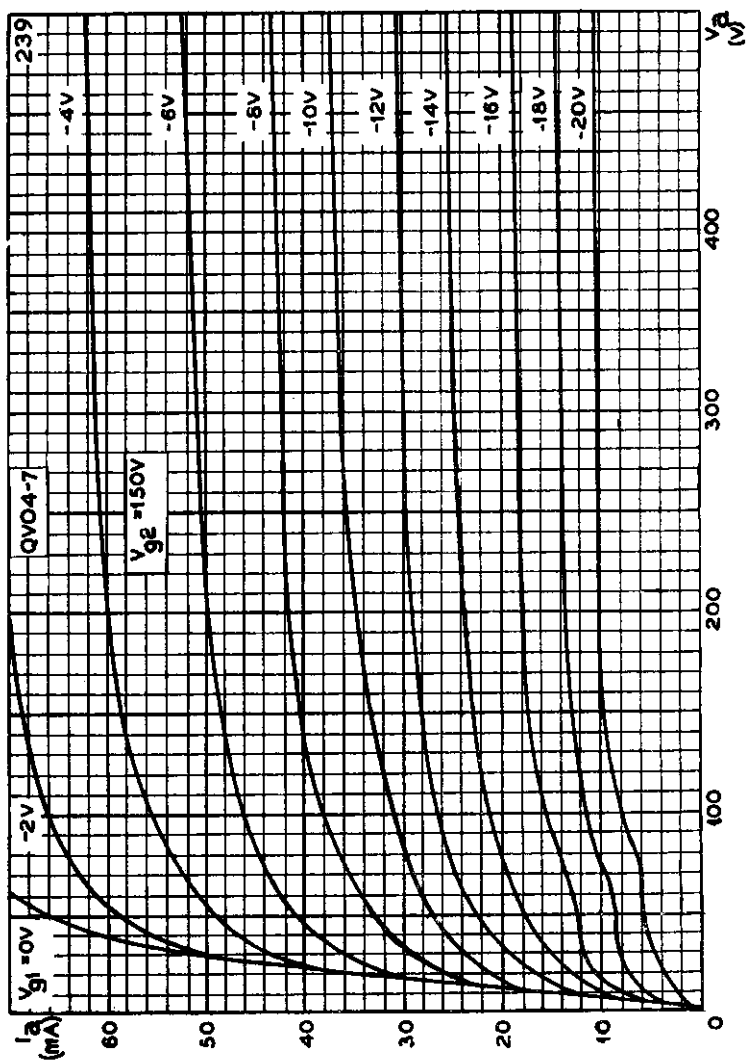
R.F. POWER TETRODE

QV04-7

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s., as an R.F. amplifier or as a frequency multiplier.

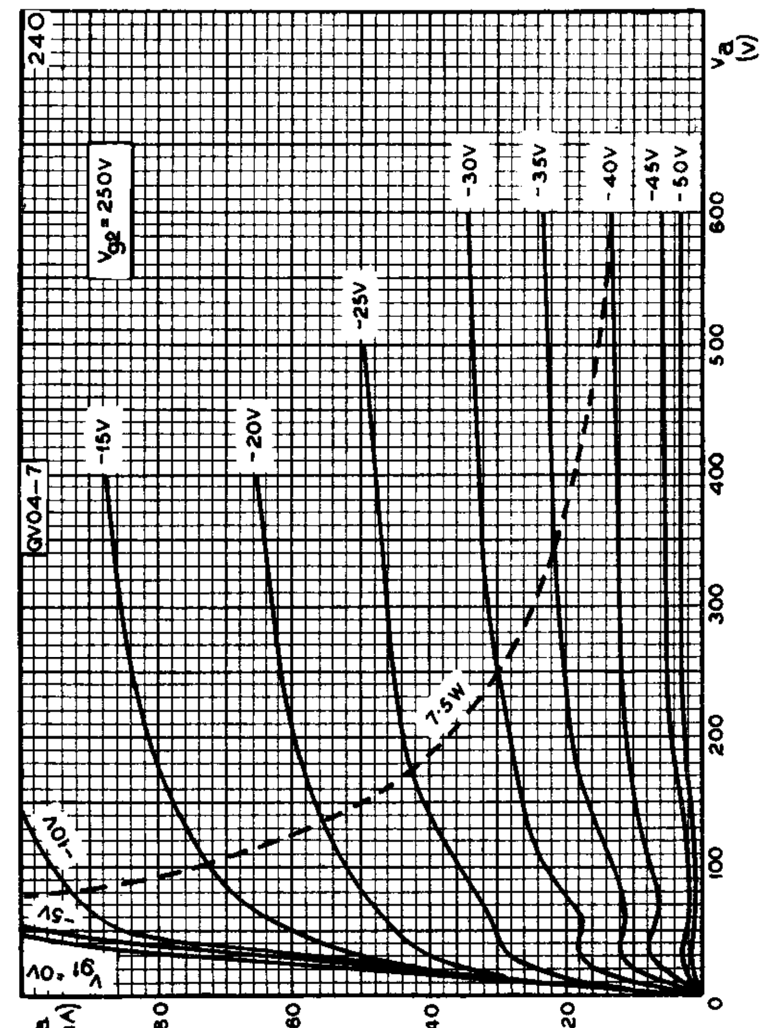


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. V_{g2}=150V

QV04-7

R.F. POWER TETRODE

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s, as an R.F. amplifier or as a frequency multiplier.

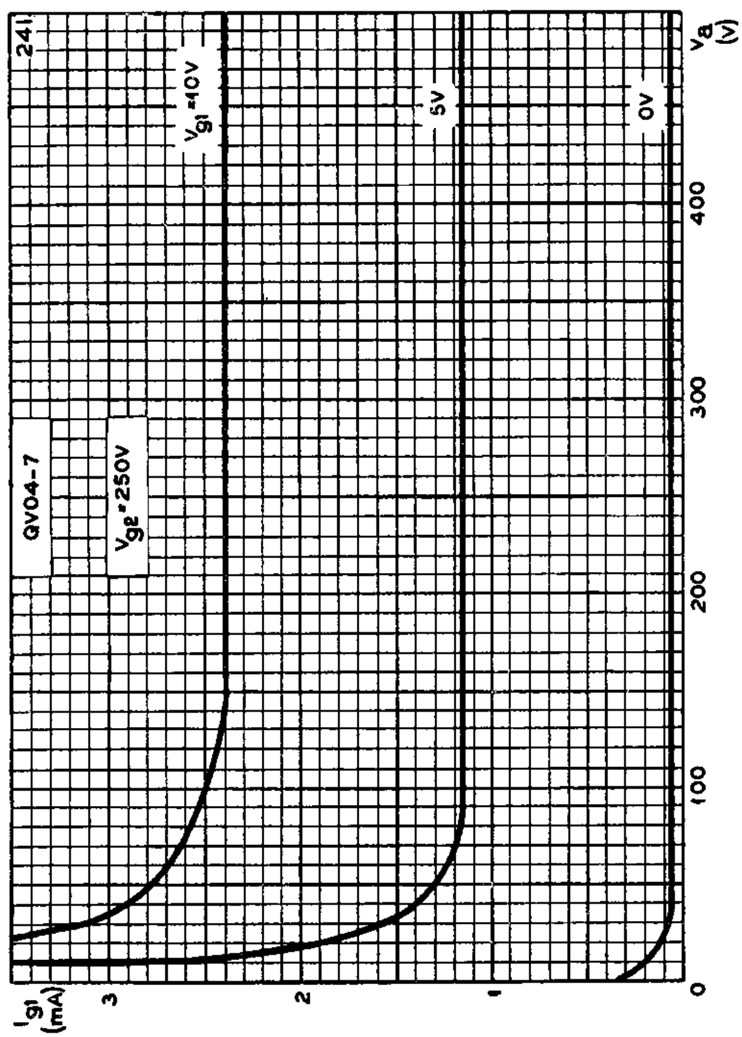


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE. V_{g2} = 250V

R.F. POWER TETRODE

QV04-7

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s., as an R.F. amplifier or as a frequency multiplier

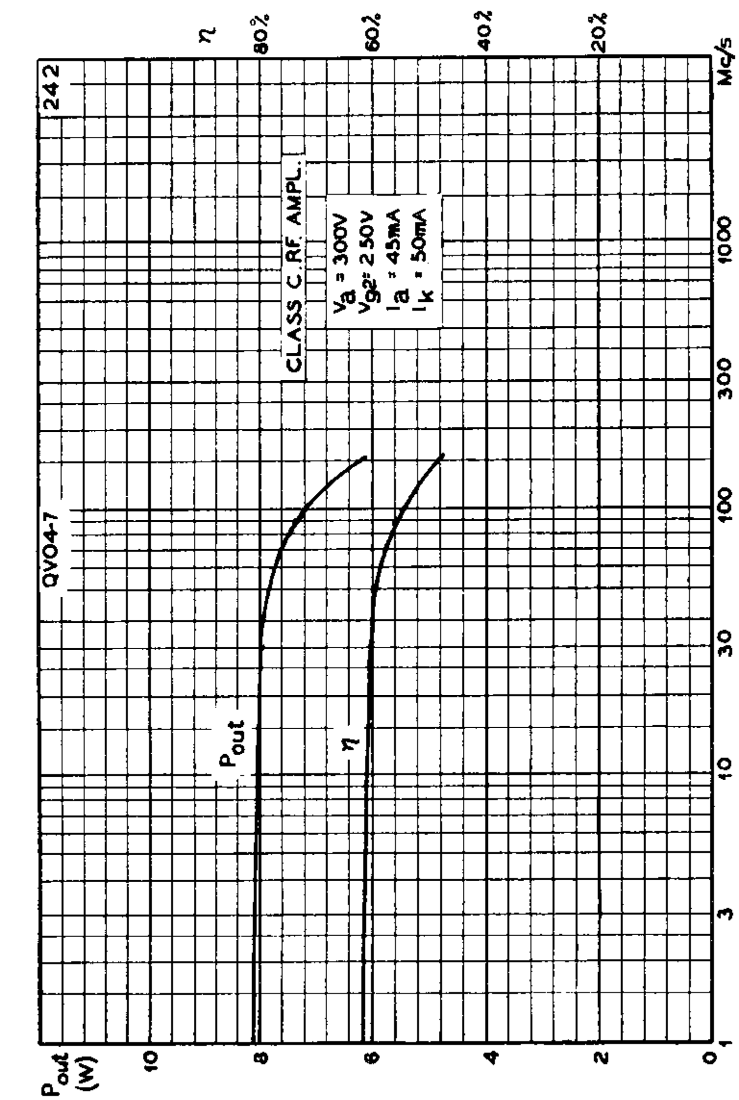


GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE V_{g2}=250V

QV04-7

R.F. POWER TETRODE

Indirectly heated Beam Tetrode with aligned grid construction to minimise screen current. It is rated to dissipate a maximum of 7.5 watts at the anode, and is particularly suitable for use at frequencies up to 150 Mc/s, as an R.F. amplifier or as a frequency multiplier.



FREQUENCY CHARACTERISTICS

R.F. POWER TETRODE

QV04-7R

Special quality beam tetrode with aligned grid construction to minimise screen current and a maximum anode dissipation of 7.5W. Suitable for use at frequencies up to 150Mc/s as an r.f. amplifier or as a frequency multiplier.

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

CATHODE Indirectly heated

V_h	6.3	V
I_h	600	mA
Heating time	22	s

CAPACITANCES (measured without external shield)

c_{in}	8.2	pF
c_{out}	6.0	pF
c_{a-g1}	0.07	pF

CHARACTERISTICS at $V_a = 250V$, $V_{g2} = 135V$, $V_{g1} = 10V$, $I_a = 30mA$

g_m	3.0	mA/V

LIMITING VALUES (absolute ratings)

$V_{a(b)}$ max.	550	V
V_a max.	400	V
$V_{g2(b)}$ max.	550	V
V_{g2} max.	250	V
p_a max.	7.5	W
p_{g2} max.	1.75	W
I_k max.	55	mA
I_{g1} max.	6.0	mA
V_{h-k} max.	150	V
T_{bulb} max.	200	°C

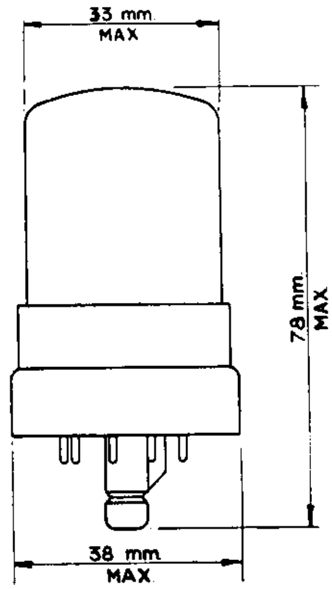
EQUIPMENT DESIGN RANGE

	Min.	Max.	
I_h ($V_h = 6.3V$)	540	660	mA
g_m ($V_a = 250V$, $V_{g2} = 135V$, $V_{g1} = -10V$, peak grid swing $\pm 1V$)	2.25	3.75	mA/V
I_a ($V_a = 250V$, $V_{g2} = 135V$, $V_{g1} = -10V$)	20	40	mA
$*c_{in}$	7.0	9.4	pF
$*c_{out}$	5.2	6.8	pF
$*c_{a-g1}$	—	0.09	pF

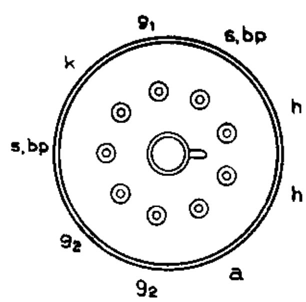
*Measured on 1Mc/s bridge with valve mounted in a fully shielded socket and no external screen.

The operating conditions and curves are identical with those given for QV04-7.

DIMENSIONS AND BASE CONNECTIONS



9-PIN PRESSED GLASS BASE TO FIT B9G VALVE HOLDER



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V.H.F. POWER TETRODE

QV06-20

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

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

CATHODE Indirectly heated.

V_h	6.3	V
I_h	1.25	A

MOUNTING POSITION Any

CAPACITANCES (measured with the base sleeve connected to earth)

c_{a-g1}	<0.22	pF
c_{in}	13.5	pF
c_{out}	8.5	pF

CHARACTERISTICS (measured at $V_a = V_{g2} = 200V$: $I_a = 100mA$)

g_m	7.0	mA/V
μ_{g1-g2}	4.5	

COOLING Natural cooling

T_{bulb} max.	220	°C

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

Limiting Values

V_a max.	600	V
p_a max.	20	W
V_{g2} max.	250	V
p_{g2} max.	3.0	W
I_k max.	160	mA
$i_{k(pk)}$ max.	800	mA
V_{g1} max.	−150	V
I_{g1} max.	8.0	mA←
*R_{g1-k} max.	30	kΩ
$v_{h-k(pk)}$ max.	±135	V

*At reduced input R_{g1-k} max. = 100kΩ

QV06-20

V.H.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175 Mc/s.

Typical Operating Conditions

f	60	60	175	Mc/s
V_a	500	600	320	V
$*V_{g2}$	170	150	180	V
$*V_{g1}$	−66	−58	−51	V
I_a	135	112	140	mA
I_{g2}	10	10	10	mA←
I_{g1} (approx.)	5.0	5.0	4.0	mA←
$v_{in(pk)}$	84	73	64	V
$P_{load(driver)}$	0.6	0.6	5.0	W←
P_{out}	48	52	25	W
P_{load}	38	42	20	W

*When V_{g2} and/or V_{g1} are obtained by means of resistors (R_{g2} and R_{g1}) the anode input power and therefore the output power is likely to vary considerably from valve to valve. For optimum operating conditions it will be necessary therefore to make R_{g2} adjustable.

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

Limiting Values (carrier condition for modulation factor of 1)

V_a max.	480	V
p_a max.	13.5	W
V_{g2} max.	250	V
p_{g2} max.	2.0	W
I_k max.	130	mA
$i_{k(pk)}$ max.	600	mA←
V_{g1} max.	−150	V
I_{g1} max.	9.0	mA←
$*R_{g1-k}$ max.	30	kΩ
$v_{h-k(pk)}$ max.	±135	V

*At reduced input R_{g1-k} max. = 100kΩ.

V.H.F. POWER TETRODE

QV06-20

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

Typical Operating Conditions

f	<60	Mc/s
V_a	400	V
*V_{g2}	150	V
*V_{g1}	−87	V
I_a	112	mA
I_{g2}	12	mA←
I_{g1}	6.0	mA←
$v_{in(pk)}$	107	V
$P_{load(driver)}$	1.2	W←
P_{out}	32	W
P_{load}	26	W

For 100% modulation ←

P_{mod}	25	W
$v_{g2(pk)}$	110	V

*When V_{g2} and/or V_{g1} are obtained by means of resistors (R_{g2} and R_{g1}) the anode input power and therefore the output power is likely to vary considerably from valve to valve. For optimum operating conditions it will be necessary therefore to make R_{g2} adjustable.

OPERATING CONDITIONS AS A.F. POWER AMPLIFIER OR MODULATOR (CLASS "AB$_1$")

Limiting Values

V_a max.	600	V
p_a max.	20	W
V_{g2} max.	250	V
p_{g2} max.	3.0	W
I_k max.	140	mA
$i_{k(pk)}$ max.	450	mA
†R_{g1-k} max. (fixed bias)	100	kΩ
$v_{h-k(pk)}$ max.	±135	V

†Under these conditions fixed bias is recommended and the control grid resistor should not exceed the specified value of 100kΩ For higher values of control-grid resistance cathode bias is required. Under no circumstances should the total d.c. control-grid resistor exceed 500kΩ.

QV06-20

V.H.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

Typical Operating Conditions (for two valves)

V_a	400	500	600	V
*V_{g2}	190	185	190	V
†V_{g1}	−40	−40	−45	V
$I_{a(o)}$	2×31	2×28	2×13	mA
I_a (max. sig.)	2×114	2×107	2×100	mA
$I_{g2(o)}$	2×1.2	2×1.0	2×0.5	mA
I_{g2} (max. sig.)	2×12.5	2×12.5	2×11.5	mA
$V_{in(g1-g1)}$ r.m.s.	56	56	64	V
P_{out}	55	70	82	W
R_{a-a}	4.0	5.0	7.0	kΩ
D_{tot}	8.0	8.0	8.0	%

*Obtained preferably from a separate source or from the anode supply using a voltage divider.

†Under these conditions fixed bias is recommended and the control grid resistor should not exceed the specified value of 100kΩ. For higher values of control-grid resistance cathode bias is required. Under no circumstances should the total d.c. control-grid resistor exceed 500kΩ.

OPERATING CONDITIONS AS A.F. POWER AMPLIFIER OR MODULATOR (CLASS "AB_2")

Limiting Values

V_a max.	600	V
p_a max.	20	W
V_{g2} max.	250	V
p_{g2} max.	3.0	W
p_{g1} max.	1.0	W
I_k max.	135	mA
$i_{k(pk)}$ max.	450	mA
*R_{g1-k} max. (fixed bias)	30	kΩ
$v_{h-k(pk)}$ max.	±135	V

*At reduced input R_{g1-k} max. = 100kΩ.

V.H.F. POWER TETRODE

QV06-20

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

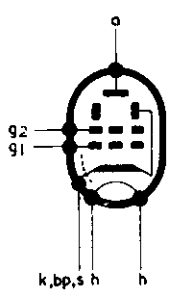
Typical Operating Conditions (for two valves)

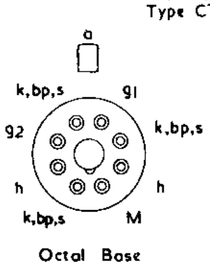
V_a	400	500	600	V
$^*V_{g2}$	175	175	165	V
$^\dagger V_{g1}$	−41	−44	−44	V
$I_{a(0)}$	2×16	2×13	2×11	mA
I_a (max. sig.)	2×116	2×121	2×103	mA
$I_{g2(0)}$	2×0.5	2×0.3	2×0.3	mA
I_{g2} (max. sig.)	2×9.0	2×9.0	2×8.5	mA
I_{g1} (max. sig.)	2×0.8	2×1.0	2×0.5	mA
$V_{in(g1-g1)r.m.s.}$	66	72	68	V
P_{out}	62	83	90	W
R_{a-a}	3.7	4.6	6.8	kΩ
D_{tot}	9.0	9.0	9.0	%

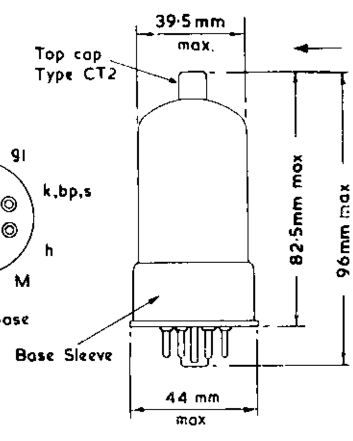
*Obtained preferably from a separate source, or from the anode supply using a voltage divider.

†Fixed bias is recommended.

2134



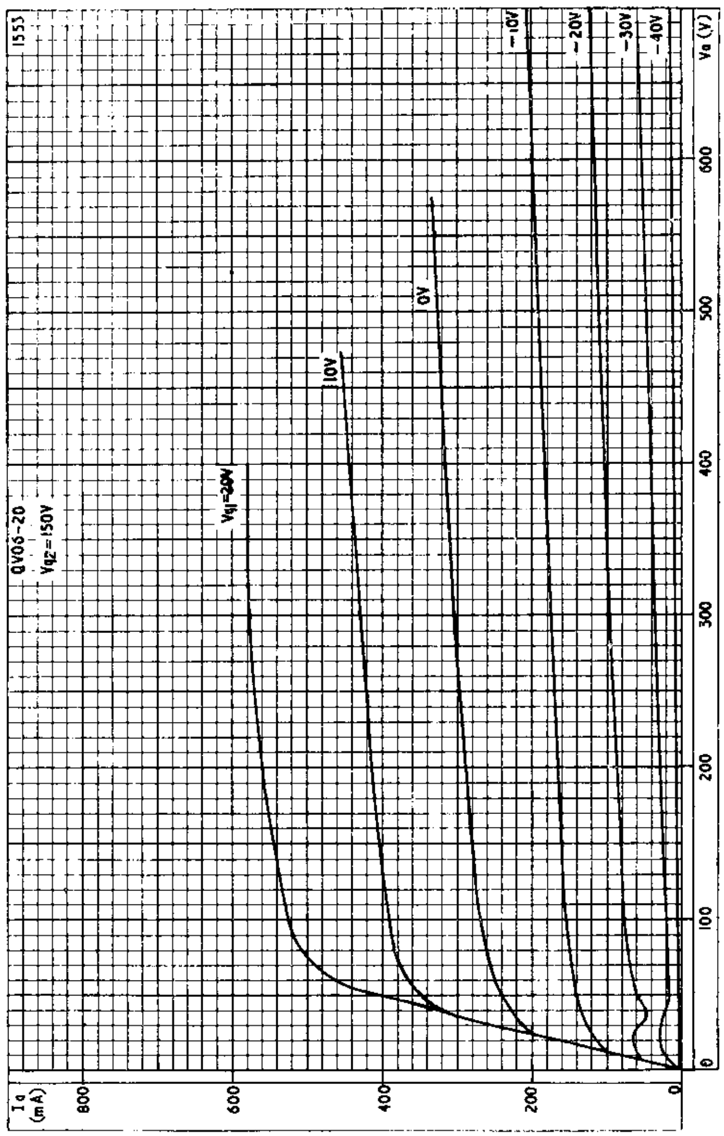




QV06-20

V.H.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

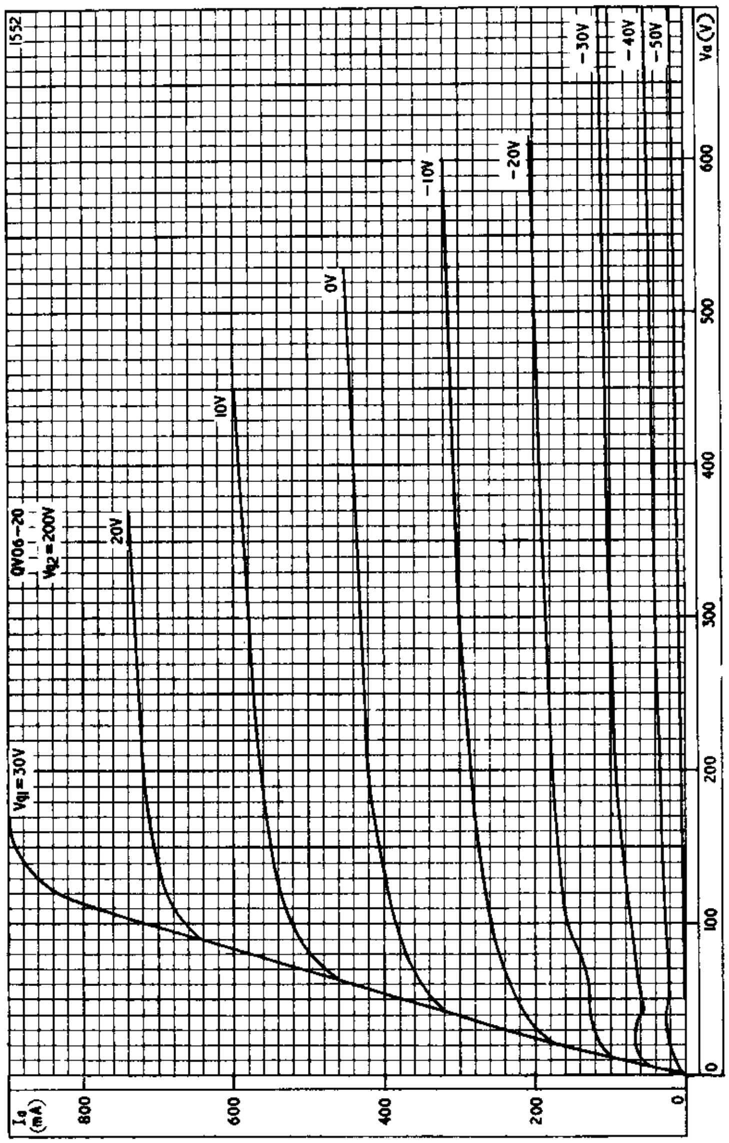


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE=150V

V.H.F. POWER TETRODE

QV06-20

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

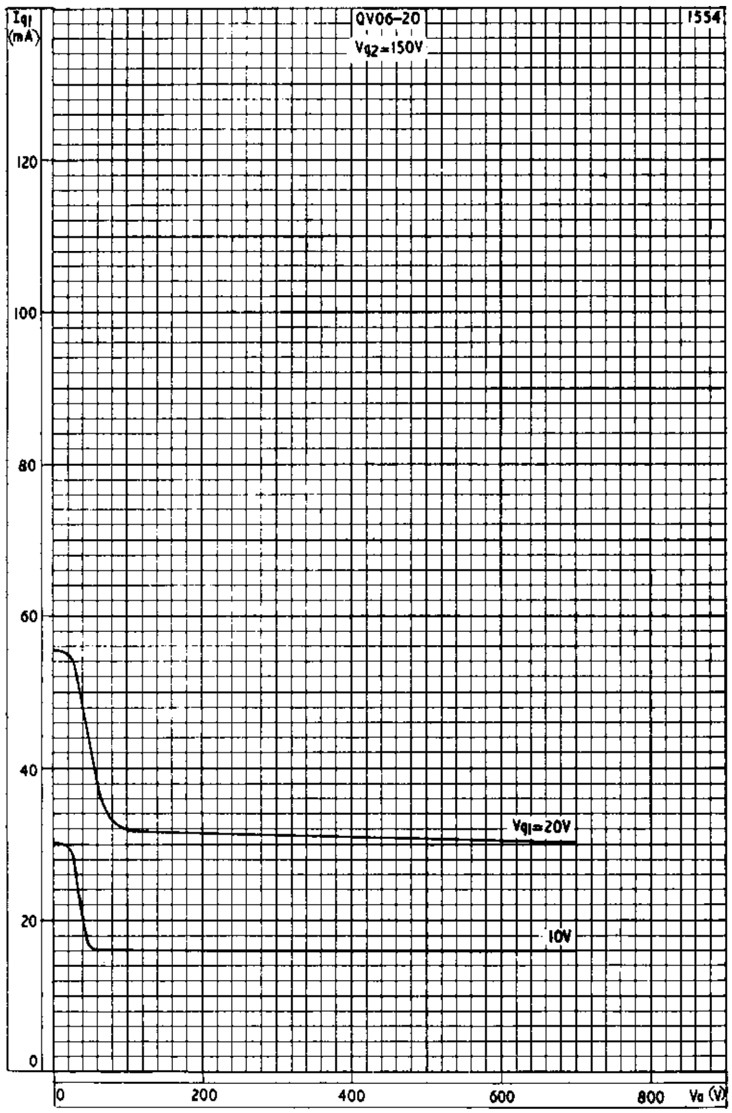


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE=200V

QV06-20

V.H.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

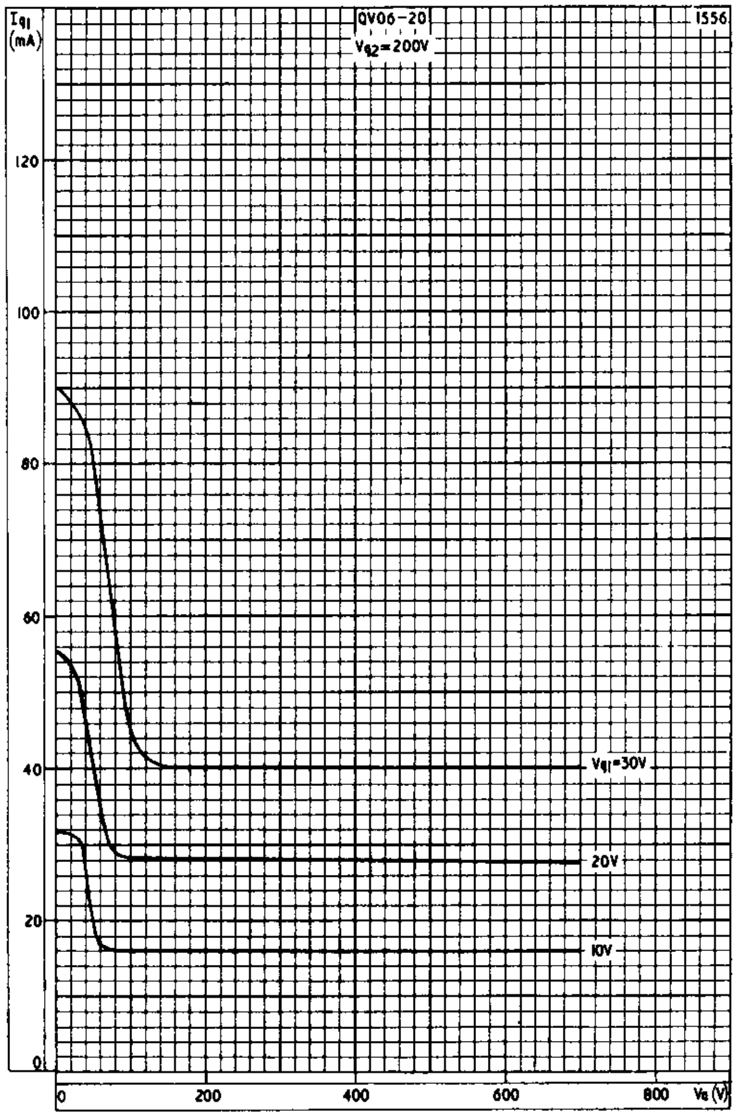


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE=150V

V.H.F. POWER TETRODE

QV06-20

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

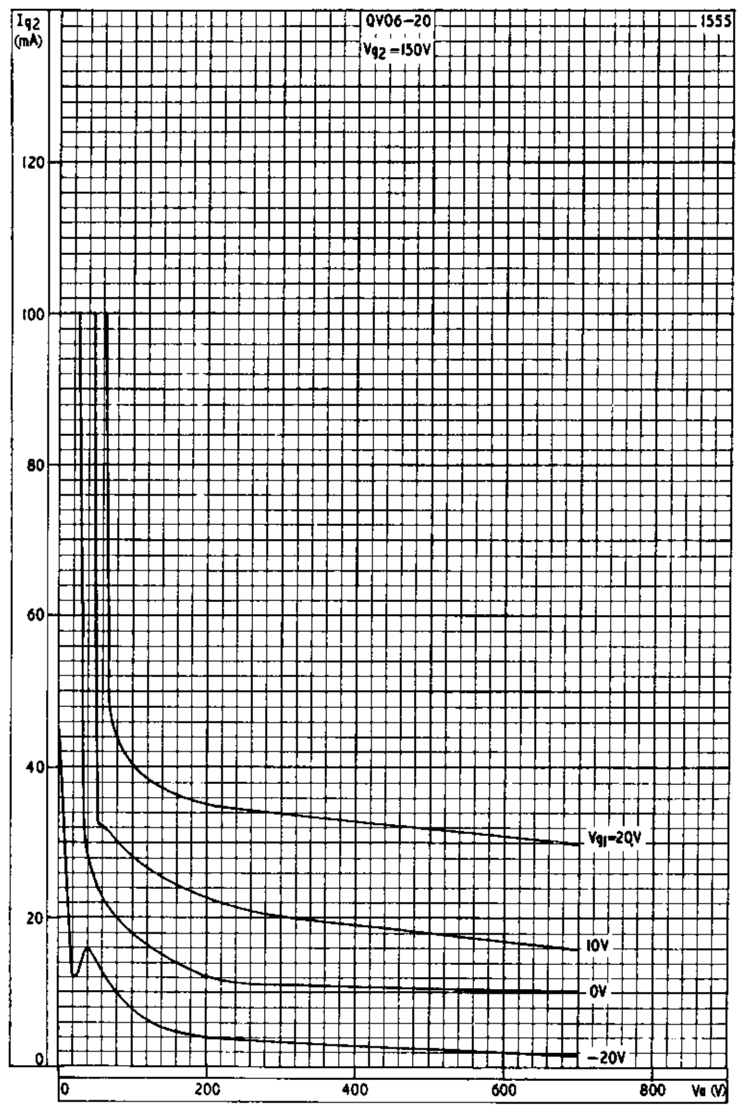


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE=200V

QV06-20

V.H.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

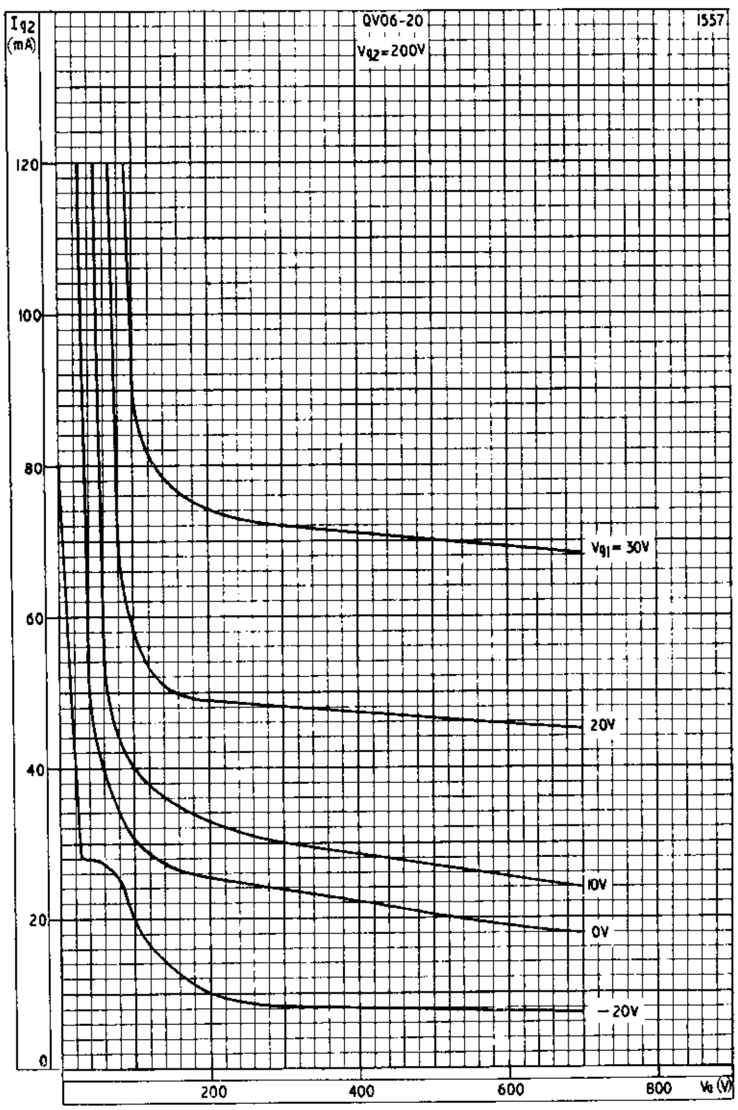


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE = 150V

V.H.F. POWER TETRODE

QV06-20

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.

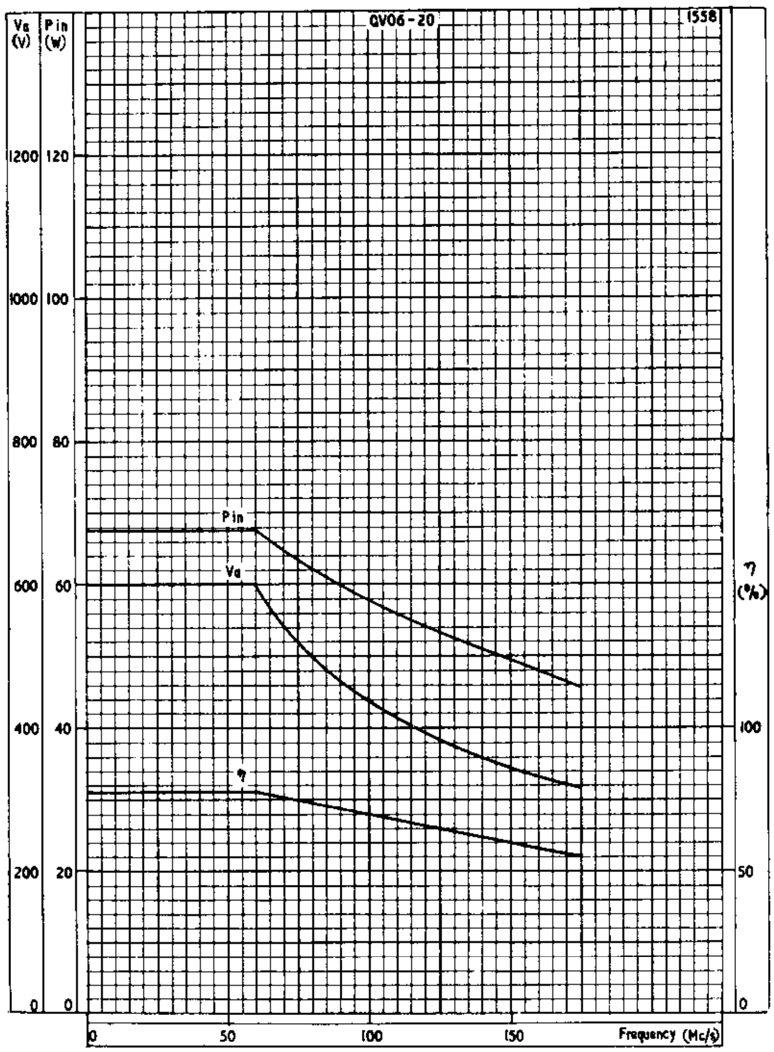


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE = 200 V

QV06-20

V.H.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 20W and suitable for use at frequencies up to 175Mc/s.



FREQUENCY CHARACTERISTICS

TETRODE

QV08-100

Application: *R.F. amplifier, suitable for single side-band applications.*
Power output: *200W.*
Frequency: *30Mc/s at full ratings.*
Construction: *Glass, natural cooling.*

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

CATHODE

Indirectly heated

V_h	6.3	V
I_h	3.9	A

MOUNTING POSITION

Vertical, or horizontal with plane of anode vertical

CAPACITANCES

c_{a-g1}	$<$900	mpF
c_{g1-k}	30	pF
c_{a-k}	12.7	pF

CHARACTERISTICS (measured at $V_a = 750V$, $V_{g2} = 250V$, $I_a = 100mA$)

g_m	9.0	mA/V
μ_{g1-g2}	5.7	

COOLING

Natural cooling

T_{bulb} max.	300	°C
$T_{anode\ seal}$ max.	220	°C
T_{pins} max.	180	°C

WEIGHT

Valve only	8	oz
	220	g
Shipping weight	15	oz
	400	g

ACCESSORIES

Base socket	40211/01
Anode cap	40619

QV08-100

TETRODE

CLASS 'C' TELEGRAPHY

Limiting values (absolute ratings)

f max.	30	Mc/s
V_a max.	825	V
I_k max.	450	mA
$i_{k(pk)}$ max.	2.1	A
V_{g2} max.	300	V
$-V_{g1}$ max.	150	V
I_{g1} max.	30	mA
p_a max.	100	W
p_{g2} max.	12	W
R_{g1-k} max.	25	kΩ
V_{h-k} max.	125	V

Operating conditions

f	$\leqslant$30	Mc/s
V_a	750	V
I_a	385	mA
V_{g2}	250	V
I_{g2}	20	mA
V_{g1}	−90	V
I_{g1}	7.0	mA
p_a	85	W
$v_{in(pk)}$	120	V
$P_{load(driver)}$	2.5	W
η_a	70	%
P_{out}	200	W
P_{load} ($\eta_{transfer}$ = 85%)	170	W

CLASS 'C' ANODE AND SCREEN GRID MODULATION

Limiting values (absolute ratings)

Carrier condition for a modulation factor of 1

f max.	30	Mc/s
V_a max.	650	V
I_k max.	380	mA
$i_{k(pk)}$ max.	1.8	A
V_{g2} max.	300	V
$-V_{g1}$ max.	150	V
I_{g1} max.	30	mA
p_a max.	67	W
p_{g2} max.	10	W
R_{g1-k} max.	25	kΩ
V_{h-k} max.	125	V

Operating conditions

f	≤30	Mc/s
V_a	600	V
I_a	300	mA
V_{g2}	250	V
I_{g2}	20	mA
V_{g1}	−100	V
I_{g1}	4.0	mA
p_a	50	W
p_{g2}	5.0	W
$v_{in(pk)}$	110	V
$P_{load(driver)}$	3.0	W
η_a	72	%
P_{out}	130	W
P_{load} ($\eta_{transfer}$ = 85%)	110	W

For 100% modulation

$P_{mod.}$	92	W
$v_{g2(pk)}$	220	V

QV08-100

TETRODE

CLASS 'B' R.F. AMPLIFIER (S.S.B.)

Limiting values (absolute ratings)

f max.	30	Mc/s
V_a max.	825	V
I_k max.	430	mA
V_{g2} max.	350	V
p_a max.	100	W
p_{g2} max.	12	W
R_{g1-k} max.	25	kΩ
V_{h-k} max.	125	V

Operating conditions (for two tone modulation)

The r.f. voltage is modulated by two sinusoidal a.f. signals of equal strength but different frequency.

f	$\leqslant$30	Mc/s
V_a	750	V
V_{g2}	310	V
*V_{g1}	−45	V
$I_{a(o)}$	130	mA
$I_{a\,(max.\,sig.)}$	270	mA
$I_{g2(o)}$	<5.0	mA
$I_{g2\,(max.\,sig.)}$ approx.	26	mA
I_{g1}	0	mA
†$v_{in(pk)}$	45	V
$p_{a\,(max.\,sig.)}$	90	W
$p_{g2\,(max.\,sig.)}$	8.0	W
η_a	55	%
P_{out} (two tone)	110	W
P.E.P.	220	W

*To be adjusted for $I_{a(o)} = 130$mA

†To be adjusted for $I_{g1} = 0$mA

CLASS 'B' A.F. AMPLIFIER AND MODULATOR

Limiting values (absolute ratings)

V_a max.	825	V
I_k max.	430	mA
$i_{k(pk)}$ max.	600	mA
V_{g2} max.	300	V
$-V_{g1}$ max.	150	V
I_{g1} max.	30	mA
p_a max.	100	W
p_{g2} max.	12	W
R_{g1-k} max.	25	kΩ
V_{h-k} max.	125	V

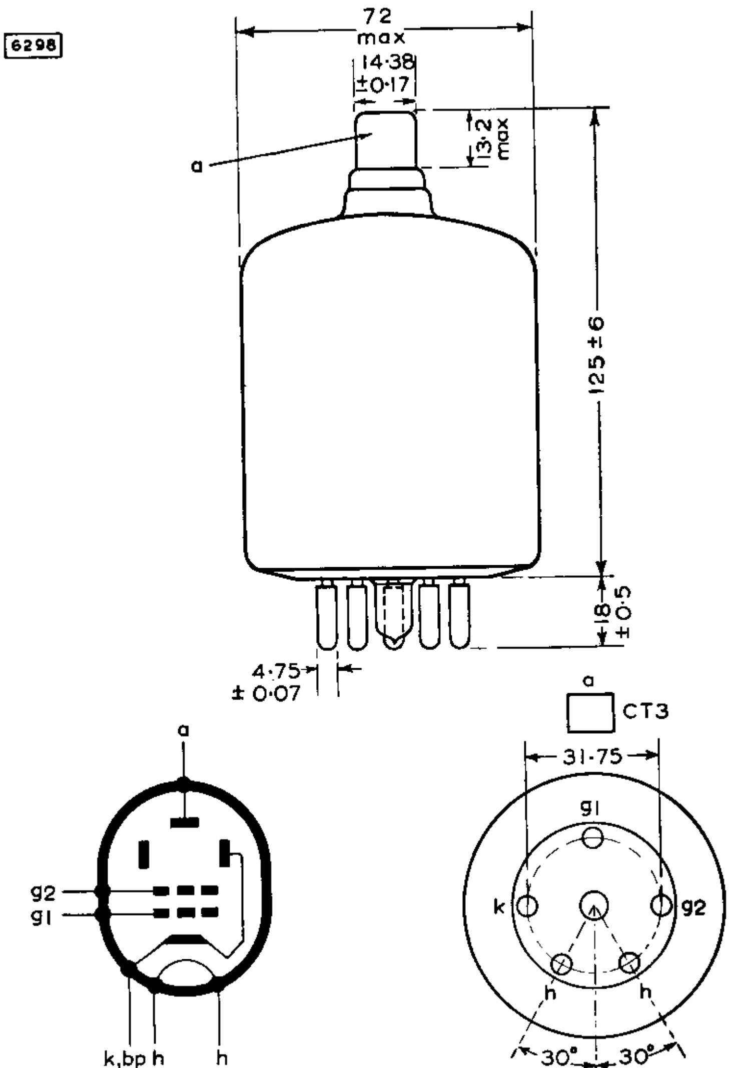
Operating conditions (two valves)

V_a	750	600	V
V_{g2}	250	250	V
V_{g1}	−45	−45	V
$I_{a(o)}$	2×45	2×25	mA
$I_{a\ (max.\ sig.)}$	2×280	2×235	mA
$I_{g2(o)}$	0	2×500	μA
$I_{g2\ (max.\ sig.)}$	2×40	2×24	mA
$I_{g1\ (max.\ sig.)}$	2×1.0	2×0.5	mA
$V_{in(g1-g1)r.m.s.}$	78	74	V
p_a	2×60	2×40	W
R_{a-a}	3.6	3.5	kΩ
η_a	71.5	71.5	%
P_{out}	300	200	W
D_{tot}	6.5	5.0	%

QV08-100

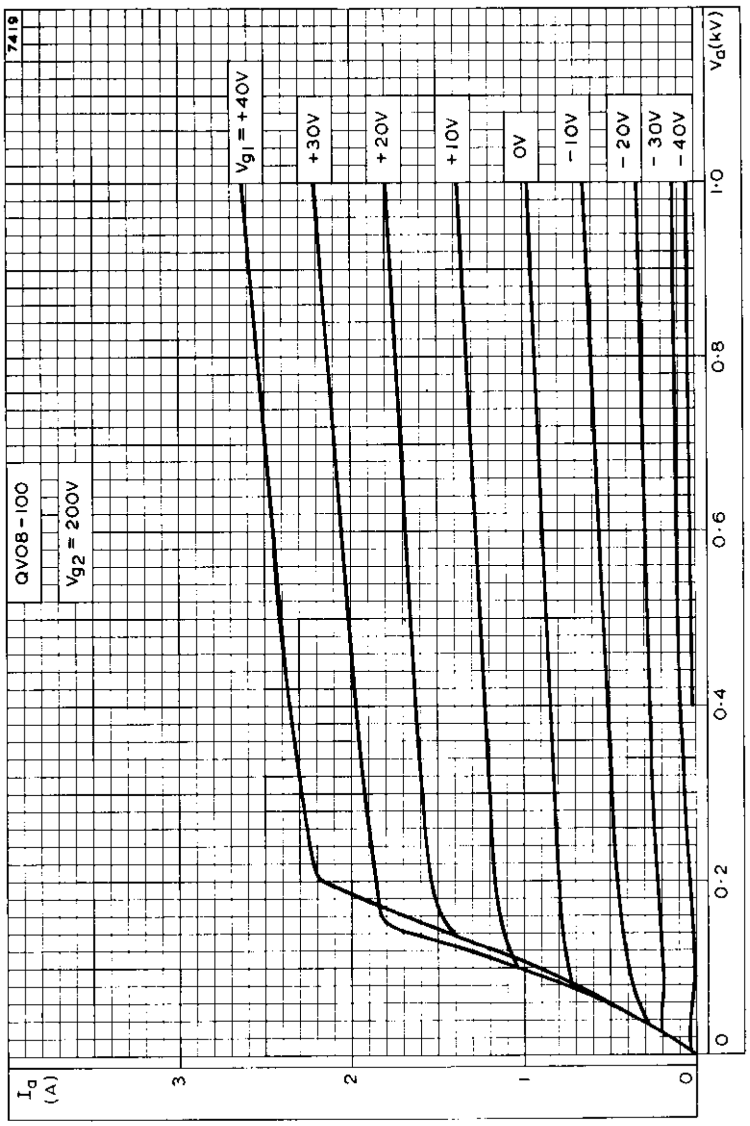
TETRODE

6298

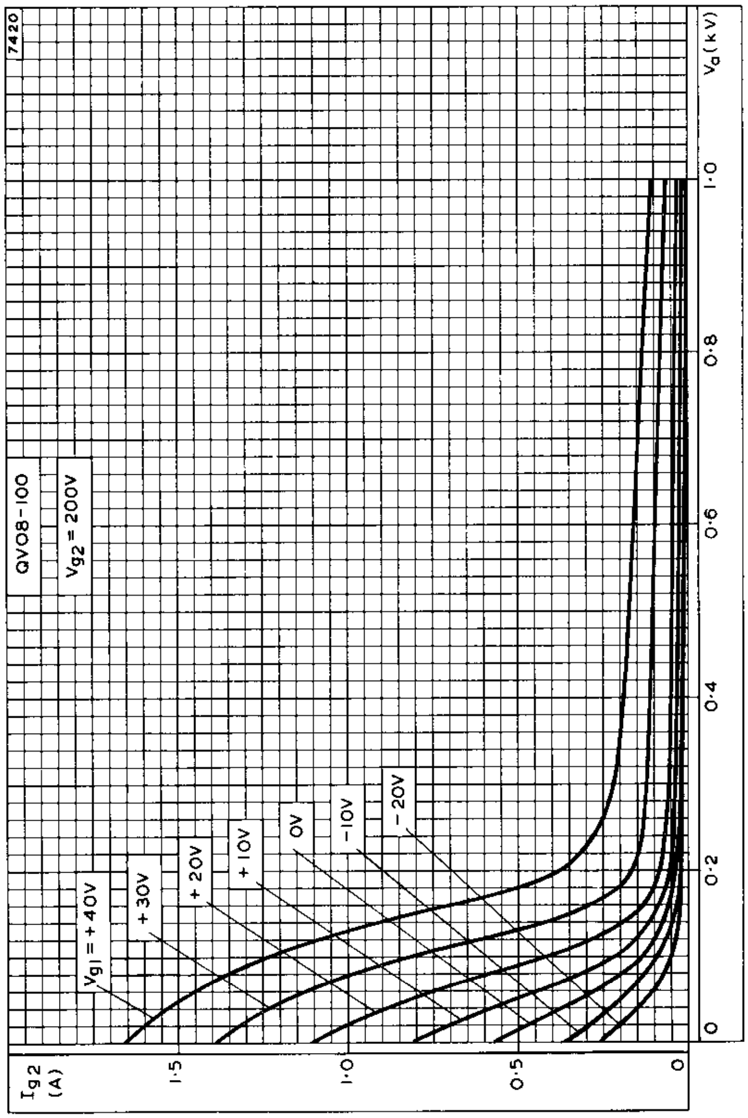


All dimensions in mm

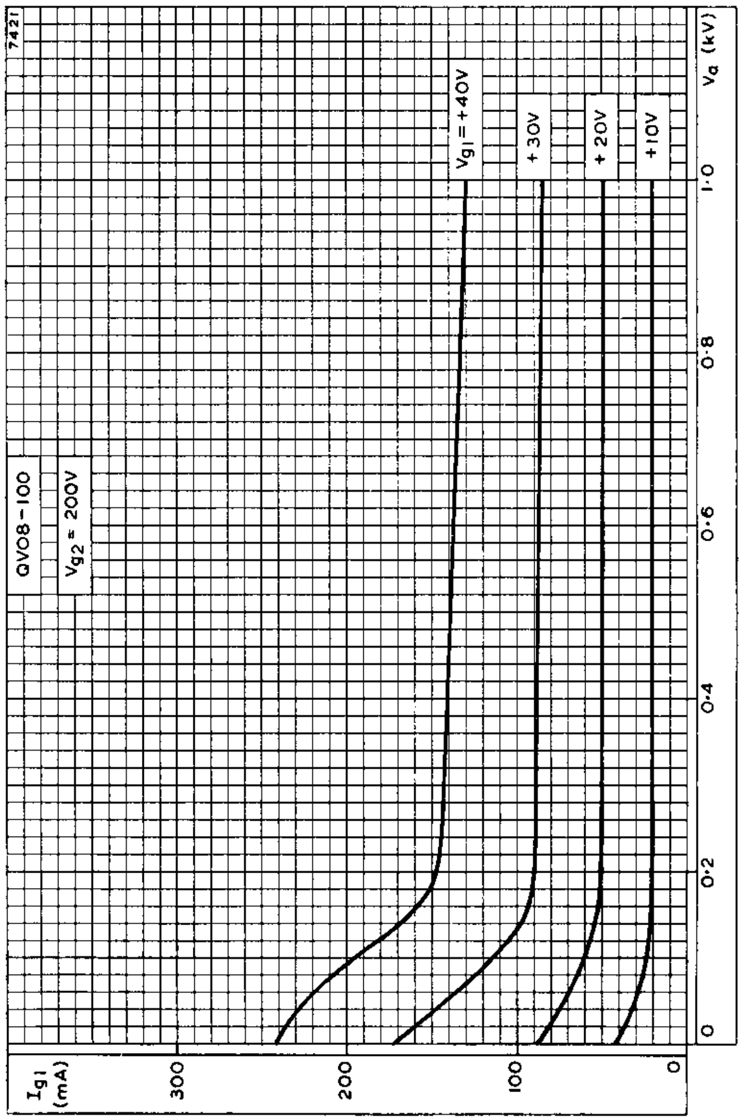
B5F Base



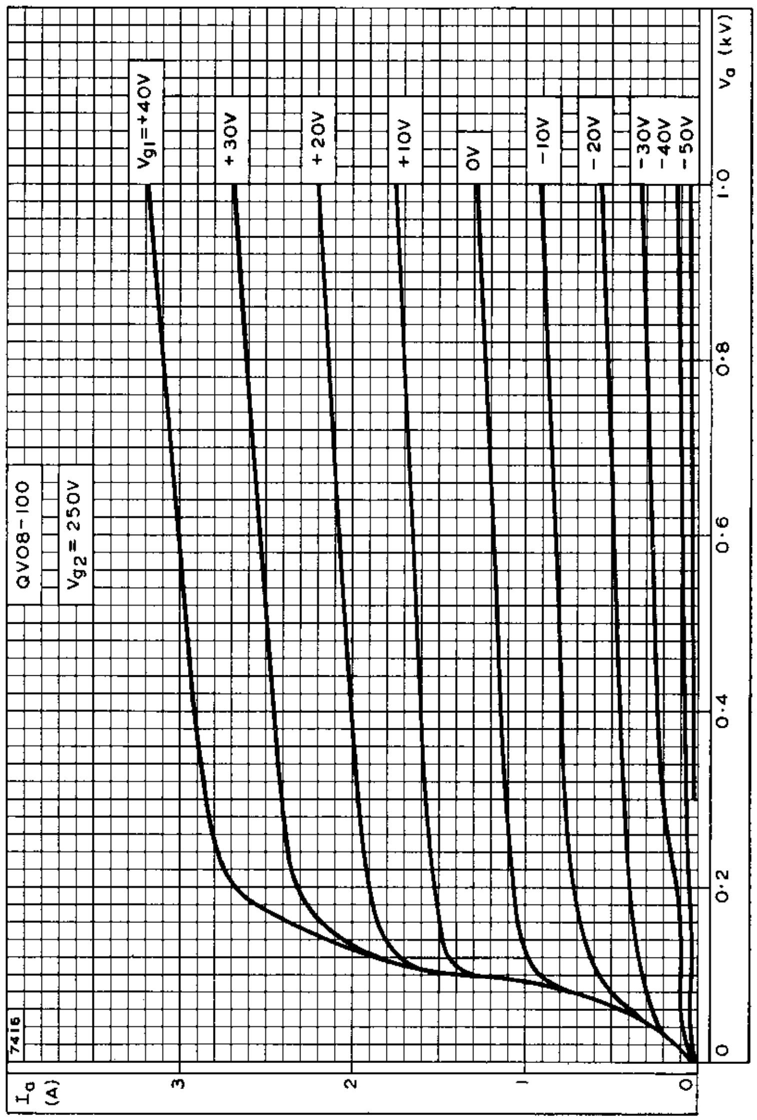
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



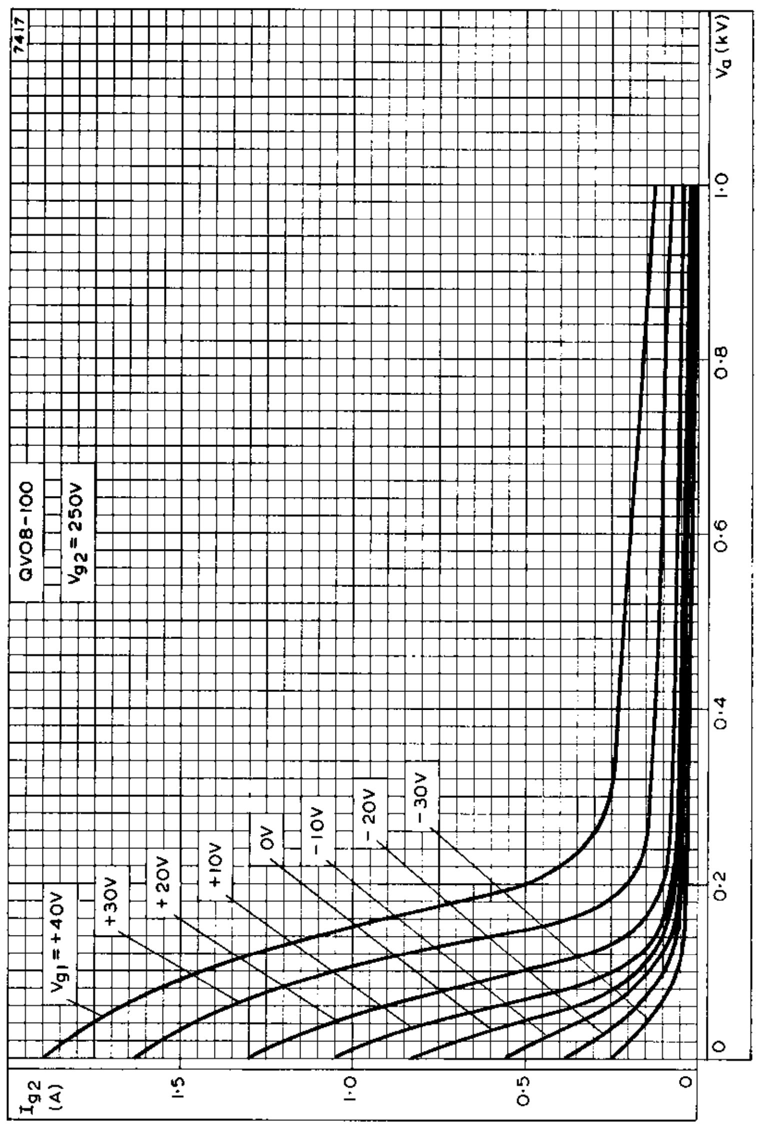
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



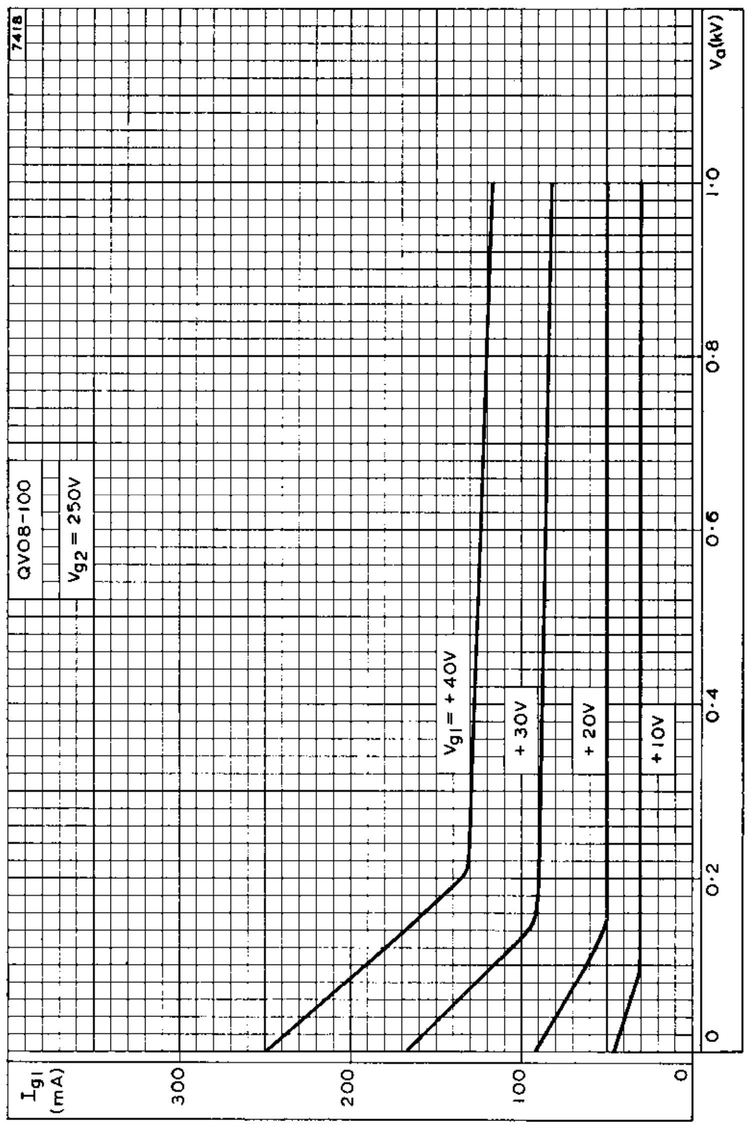
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 200V$



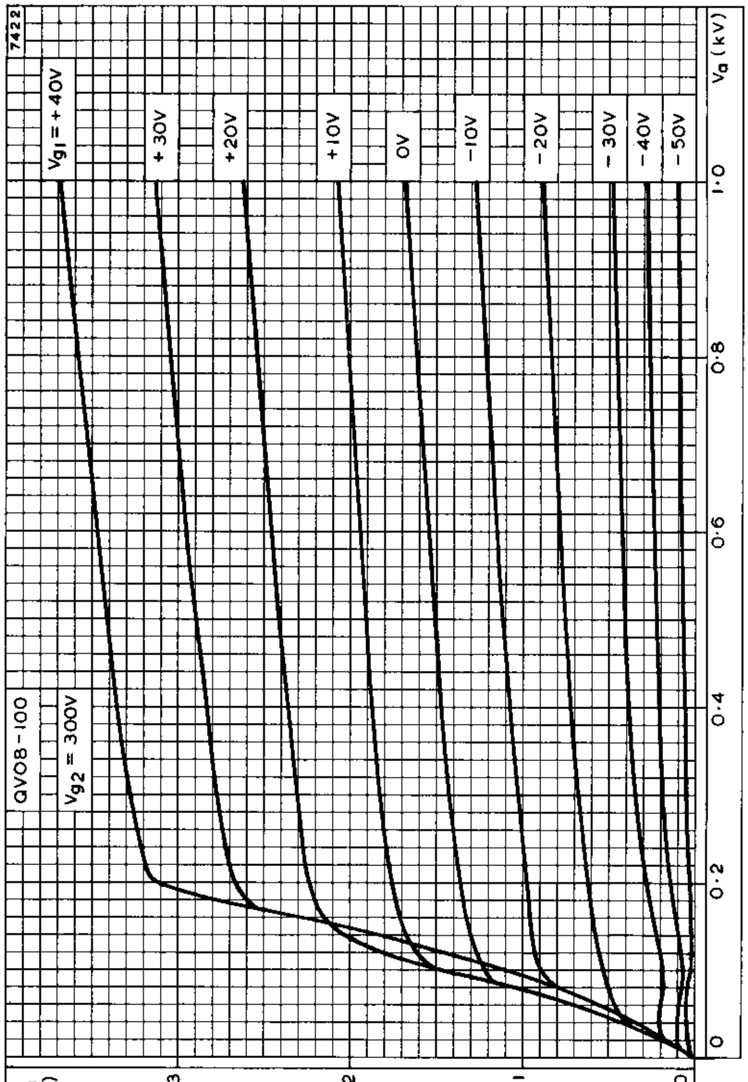
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 250V



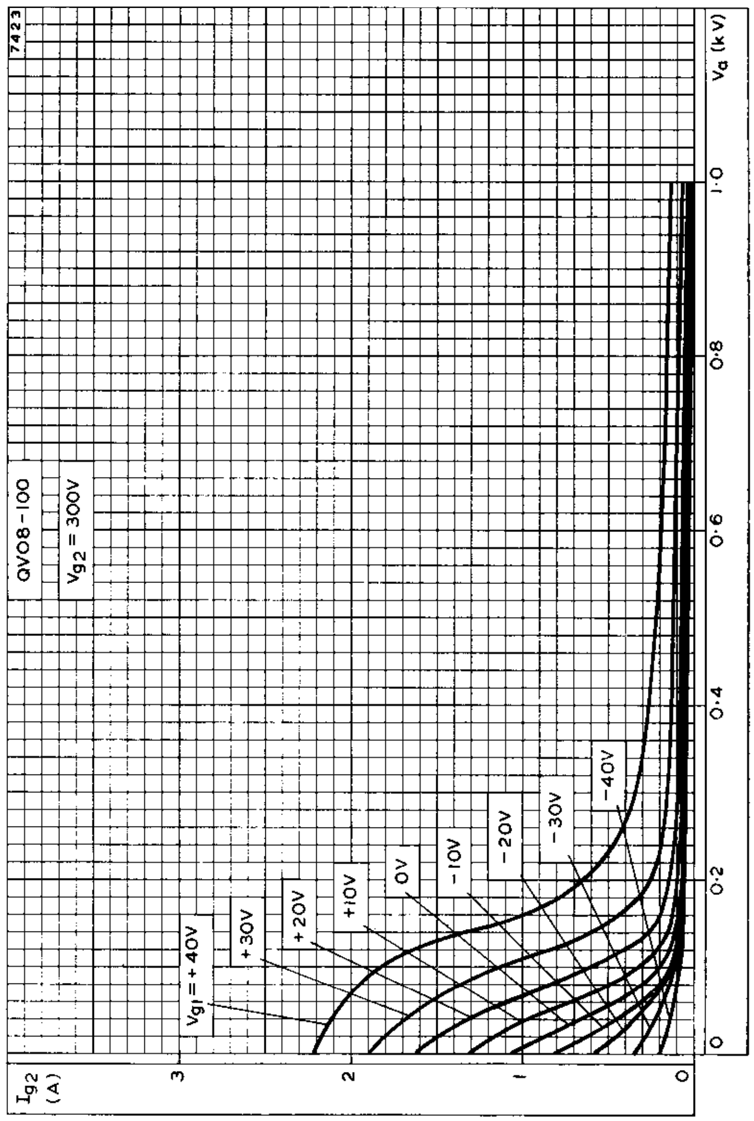
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 250V



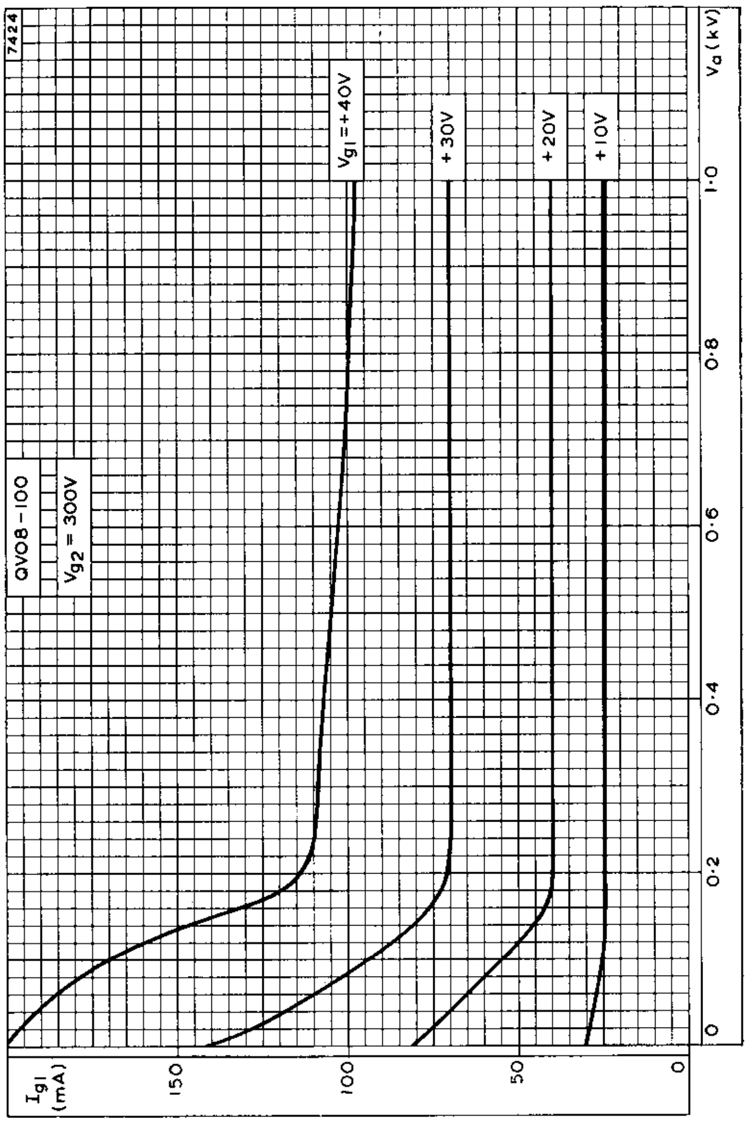
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 250V



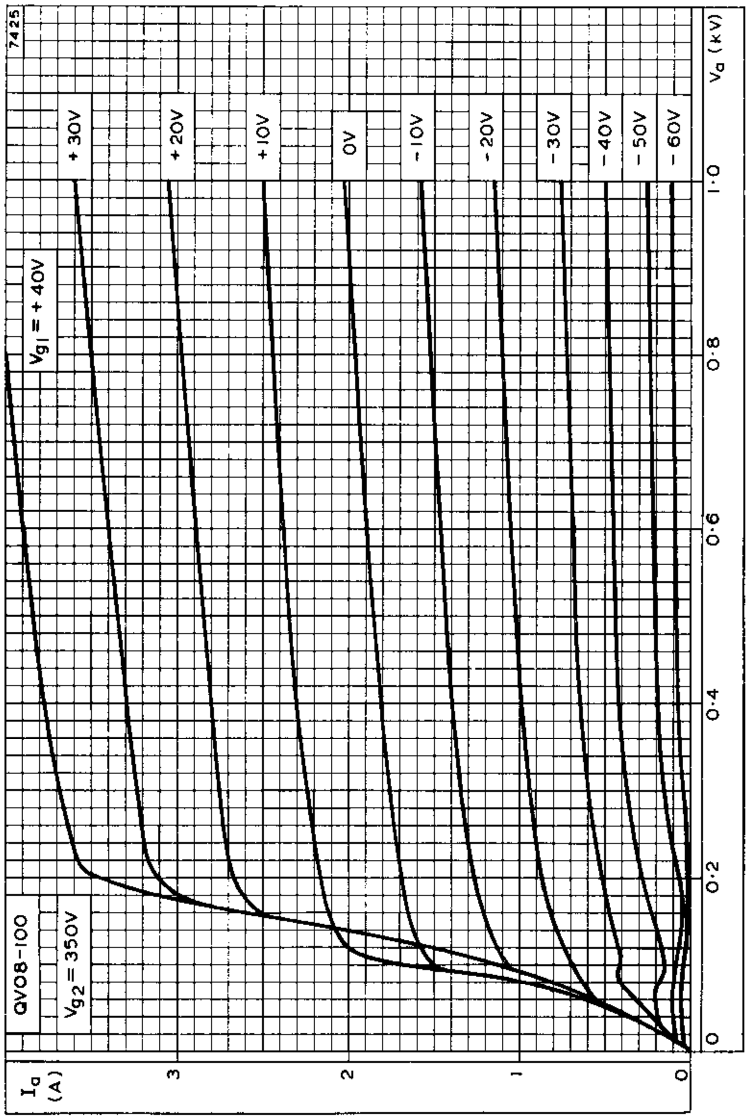
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 300V$



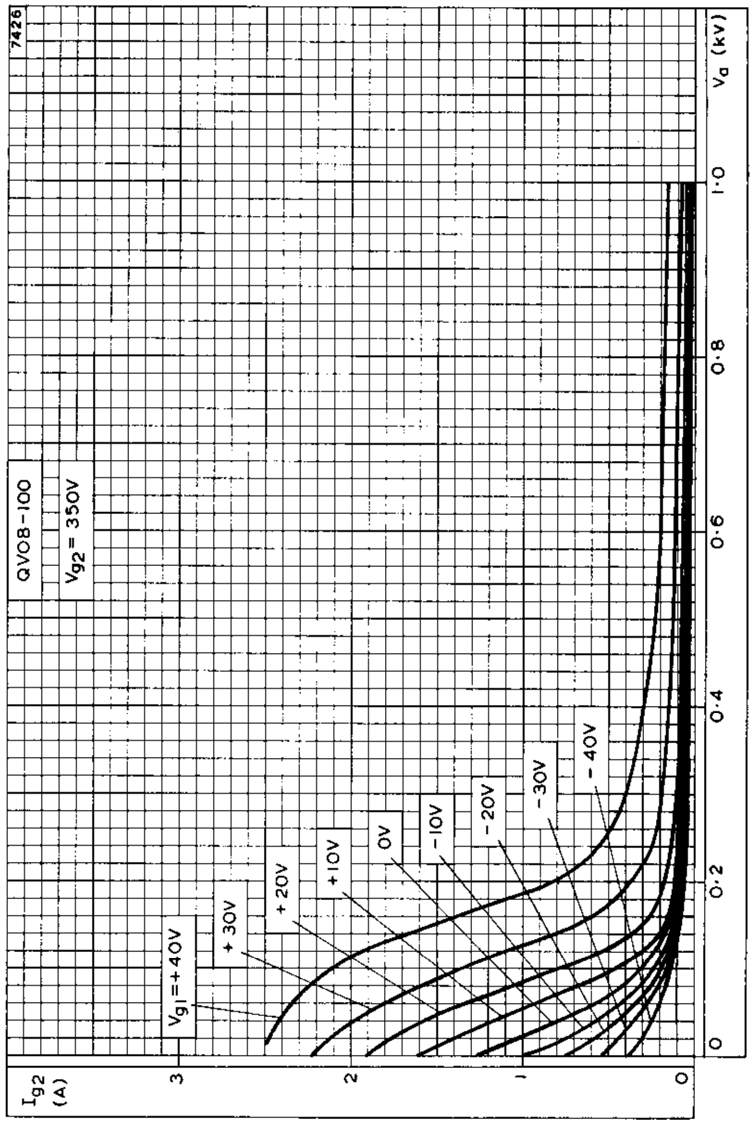
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 300V$



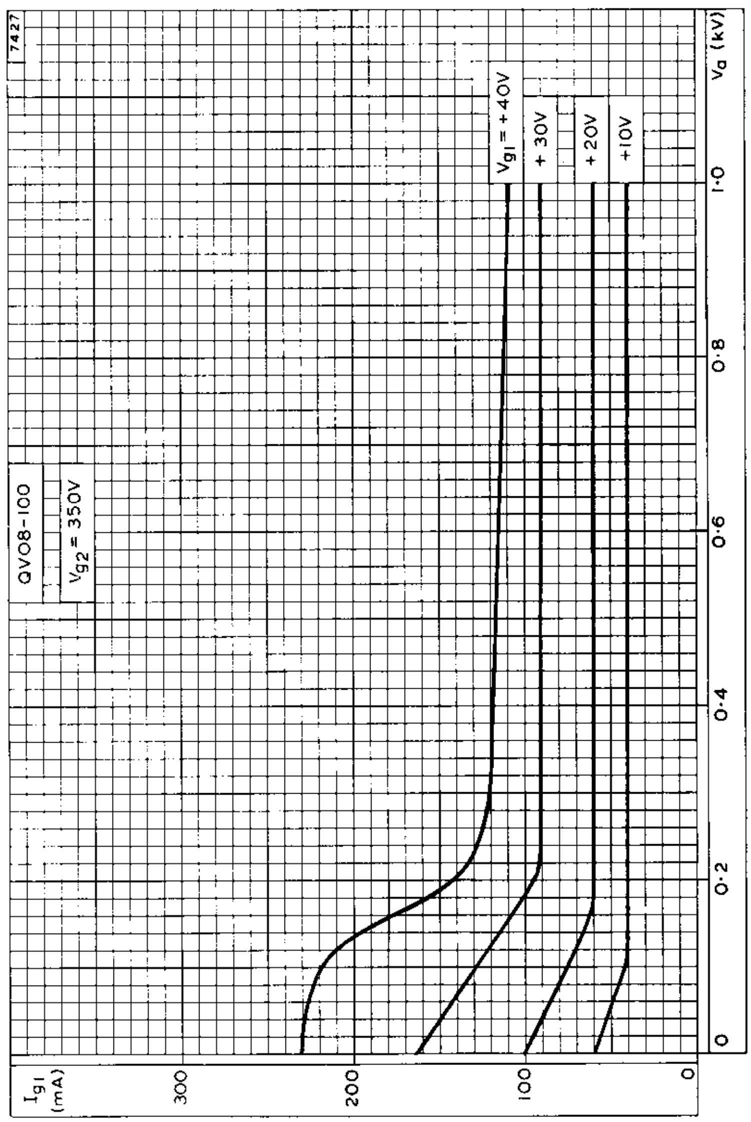
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 300V



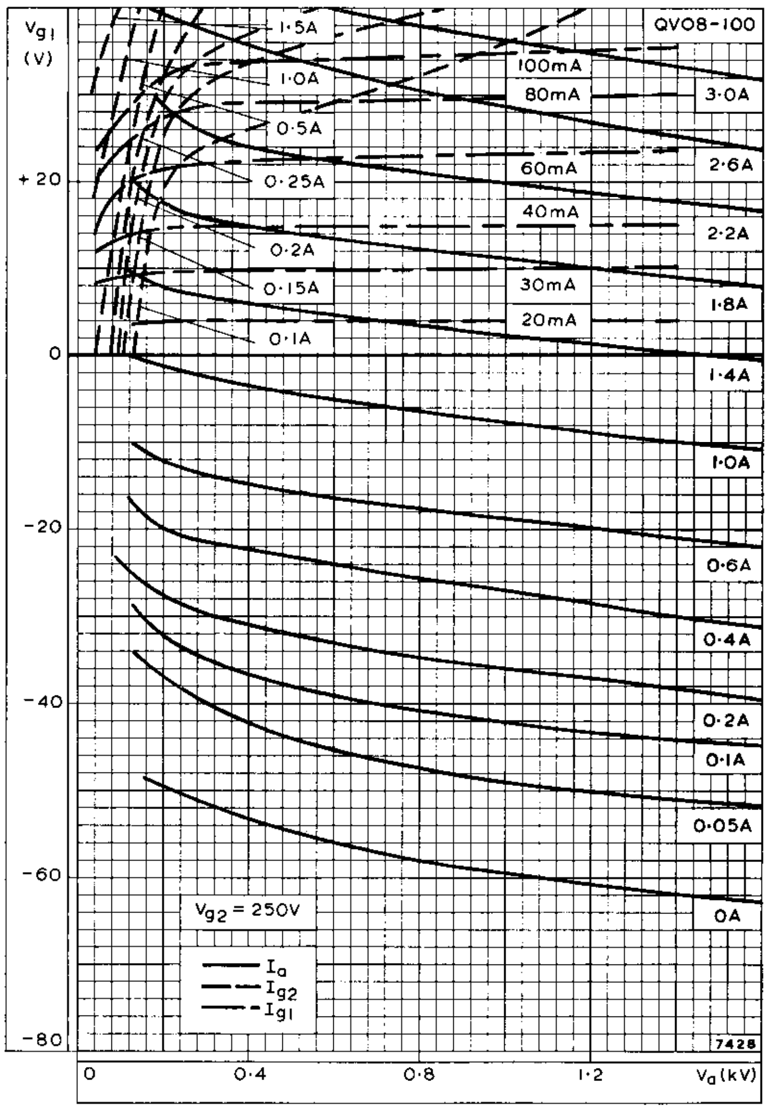
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 350V



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 350V



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 350V



CONSTANT CURRENT CURVES

U.H.F. POWER TETRODE

QV1-150A

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.

PRELIMINARY DATA

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES preceding this section of the Handbook.

HEATER Indirectly heated.

V_h	6.0	V
I_h	2.6	A
t_{h-k} min.	30	s

MOUNTING POSITION Any

CAPACITANCES (Measured without external shield)

c_{a-g1}	<0.06	pF
c_{in}	15.5	pF
c_{out}	4.5	pF

CHARACTERISTICS (Measured at $V_a=500$ V, $V_{g2}=250$ V, $I_a=200$ mA)

μ_{g1-g2}	5.0	
g_m	12	mA/V

COOLING

Max. temperature of base and envelope seals 150 °C

Air cooling must start simultaneously with the application of heater voltage. A base must be used which directs air on to the base seals, past the screen-grid seal and glass envelope, and through the radiator.

A typical value of air flow for maximum anode dissipation is given in the following table.

Anode dissipation p_a (W)	Height above sea-level h (m)	Input temperature T_{in} °C	Rate of flow of air (m³/min)	Pressure difference between inlet and outlet (mm of H_2O)
150	0	20	0.22	15

QV1-150A

U.H.F. POWER TETRODE

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" TELEPHONY, ANODE AND SCREEN-GRID MODULATION)

Limiting Values

f max.	500	Mc/s
V_a max.	1.0	kV
p_a max.	100	W
V_{g2} max.	300	V
p_{g2} max.	12	W
I_k max.	250	mA
$i_{k(pk)}$ max.	2.1	A
$-V_{g1}$ max.	250	V
p_{g1} max.	2.0	W
R_{g1-k} max.	25	kΩ

Typical Operating Conditions at f≦165 Mc/s.

V_a	400	600	800	1000	V
V_{g2}	250	250	250	250	V
V_{g1}	-90	-95	-100	-105	V
I_a	200	200	200	200	mA
I_{g2}	40	35	25	20	mA
I_{g1} (approx.)	7.0	8.0	10	15	mA
$v_{in(pk)}$	110	120	120	125	V
p_a	25	40	60	60	W
P_{drive}	1.0	1.0	1.5	2.0	W
P_{out}	55	80	100	140	W
*P_{load}	44	64	80	112	W
η	69	66	63	70	%
For 100% modulation					
$v_{g2(pk)}$ mod.	140	150	160	170	V
$P_{mod.}$	40	60	80	100	W

*With a circuit transfer efficiency of 80%.

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

Limiting Values

f max.	500	Mc/s
V_a max.	1.25	kV
p_a max.	150	W
V_{g2} max.	300	V
p_{g2} max.	12	W
I_k max.	250	mA
$i_{k(pk)}$ max.	1.25	A
$-V_{g1}$ max.	250	V
p_{g1} max.	2.0	W
R_{g1-k} max.	25	kΩ

U.H.F. POWER TETRODE

QV1-150A

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.

Typical Operating Conditions at f≦165 Mc/s.

V_a	600	750	1000	1250	V
V_{g2}	250	250	250	250	V
V_{g1}	−75	−80	−80	−90	V
I_a	200	200	200	200	mA
I_{g2}	37	37	30	20	mA
I_{g1} (approx.)	10	10	10	10	mA
$v_{in(pk)}$	90	95	95	105	V
*P_{drive}	1.0	1.0	1.0	1.2	W
p_a	35	40	50	55	W
P_{out}	85	110	150	195	W
†P_{load}	68	88	120	156	W
η	71	73	75	78	%

*Circuit losses not included.

†With a circuit transfer efficiency of 80%.

Typical Operating Conditions with Coaxial Cavity at f≦500 Mc/s.

V_a	600	800	1000	1250	V
V_{g2}	250	250	250	280	V
V_{g1}	−110	−110	−110	−115	V
I_a	170	200	200	200	mA
I_{g2}	6.0	7.0	7.0	5.0	mA
I_{g1} (approx.)	6.0	10	10	10	mA
p_a	52	65	80	110	W
*P_{drive}	15	20	25	30	W
P_{out}	50	95	120	140	W
†P_{load}	40	76	96	112	W
η	49	60	60	56	%

*Output of driver stage.

†With a circuit transfer efficiency of 80%.

OPERATING CONDITIONS AS R.F. POWER AMPLIFIER CLASS "B" FOR TELEVISION SERVICE (Negative modulation and positive synchronisation).

Limiting Values

f max.	220	Mc/s
V_a max.	1.25	kV
p_a max.	150	W
$I_{a(sync)}$ max.	335	mA
I_a max.	250	mA
V_{g2} max.	400	V
p_{g2} max	12	W
$-V_{g1}$ max.	250	V
p_{g1} max.	2.0	W

QV1-150A

U.H.F. POWER TETRODE

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.

Typical Operating Conditions

f	170–220	170–220	170–220	Mc/s
Bandwidth	5.0	5.0	5.0	Mc/s
V_a	750	1000	1250	V
V_{g2}	300	300	300	V
V_{g1}	−60	−65	−70	V
I_a (sync)	335	330	305	mA
I_a (black)	245	240	230	mA
I_{g2} (sync)	50	45	45	mA
I_{g2} (black)	20	15	10	mA
I_{g1} (sync)	15	20	25	mA
I_{g1} (black)	4.0	4.0	4.0	mA
$v_{in(pk)}$ (sync)	85	95	100	V
$v_{in(pk)}$ (black)	65	70	75	V
P_{drive} (sync)	7.0	8.0	9.0	W
P_{drive} (black)	4.25	4.7	5.5	W
P_{out} (sync)	135	200	250	W
P_{out} (black)	75	110	140	W

CIRCUIT NOTES

1. All four cathode connections must be used.
2. For low frequency operation the screen-grid connection is made to Pin 1. At higher frequencies the contact ring must be used for connecting the screen-grid.

WEIGHT

Valve only	5.5	ozs
	150	g

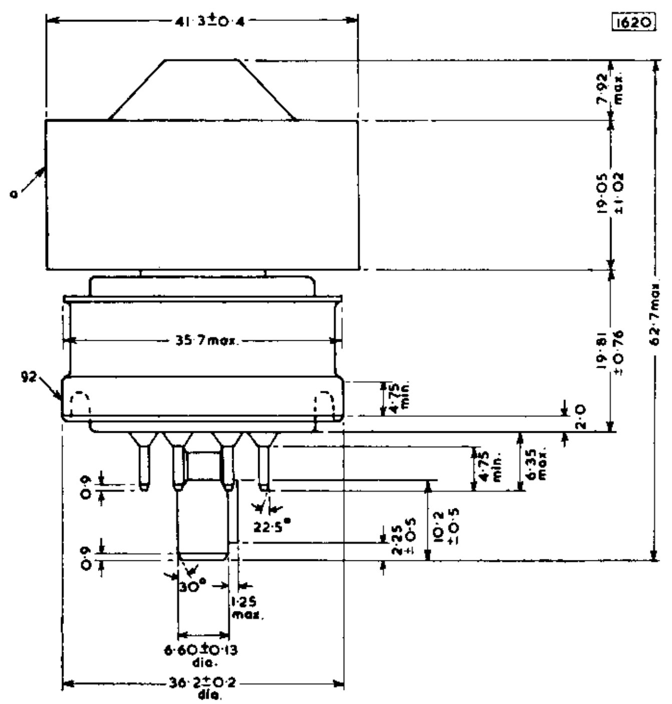
ACCESSORIES

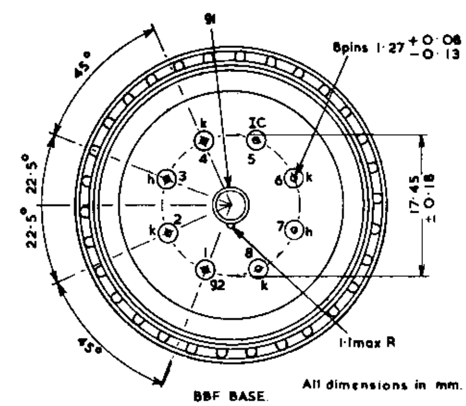
Information on these items can be obtained from the Industrial Technical Service Department, Mullard Ltd.

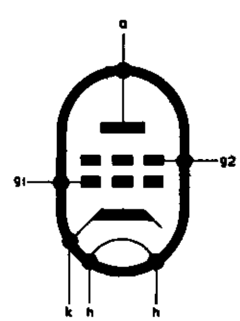
U.H.F. POWER TETRODE

QV1-150A

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.





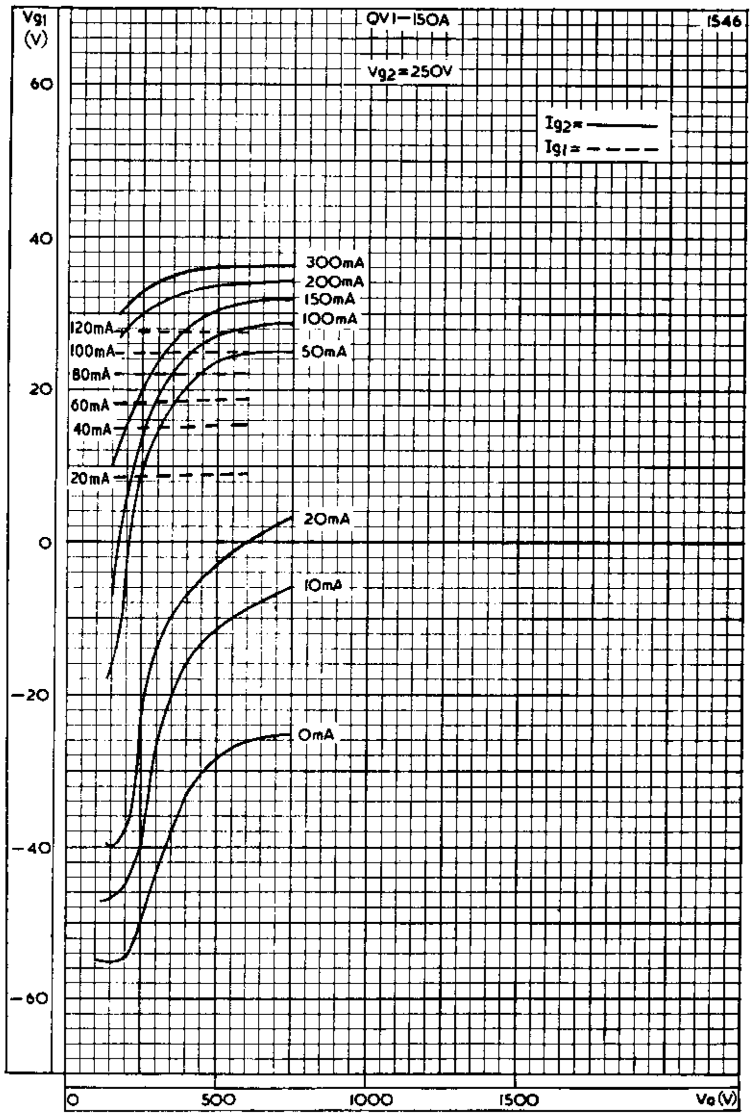


All dimensions in mm.

QV1-150A

U.H.F. POWER TETRODE

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.

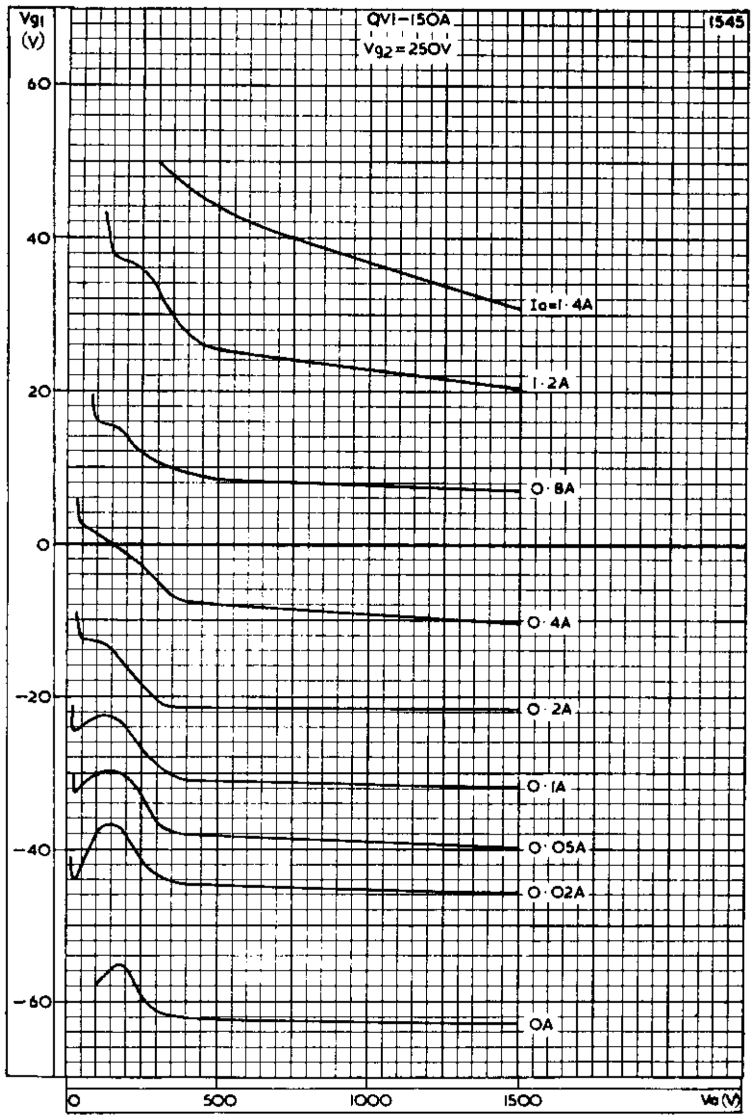


SCREEN-GRID AND CONTROL-GRID CONSTANT CURRENT CURVES

U.H.F. POWER TETRODE

QV1-150A

Forced air-cooled power tetrode rated for a maximum anode dissipation of 150W and suitable for use at frequencies up to 500 Mc/s.



CONSTANT ANODE CURRENT CURVES

U.H.F. BEAM POWER TETRODE

(4CX250B) QV2-250C
(4CX250F) QV2-250F

QUICK REFERENCE DATA

Ceramic to metal construction, forced air cooled tetrode for use as a power amplifier, oscillator, frequency multiplier and linear amplifier for single sideband applications.

	Telegraphy or F.M. Telephony Class 'C'	Single Sideband Class 'AB'	Television Service Class 'B'	Anode and Screen Grid Modulation Class 'C'	
f	175	175	216	-	MHz
P_{out}	280	215	300	235	W
f max.	500	500	216	500	MHz
V_a max.	2.0	2.0	2.0	2.0	kV
p_a max.	250	250	250	250	W

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATION - TRANSMITTING VALVES

TELEGRAPHY AND F.M. TELEPHONY, CLASS 'C'
OPERATING CONDITIONS

f	175	175	175	175	500*	MHz
P_{out}	390	280	190	70	250	W
P_{out} (less P_{drive})	387.1	276.8	186.5	66	-	W
P_{load}	330	240	160	60	225	W
η_a	78	75	76	56	-	%
V_a	2.0	1.5	1.0	0.5	2.0	kV
I_a	250	250	250	250	250	mA
V_{g2}	250	250	250	250	300	V
I_{g2}	19	21	38	45	10	mA
$-V_{g1}$	90	90	90	90	90	V
I_{g1}	26	28	31	35	25	mA
P_{drive}	2.9	3.2	3.5	4.0	18	W
p_a	110	95	60	55	-	W
p_{g2}	7.5	9.0	11	12	-	W
V_f	6.0	6.0	6.0	6.6	5.5	V

*With coaxial cavity.

AMPLIFIER FOR SINGLE SIDEBAND OPERATION, CLASS 'AB'

OPERATING CONDITIONS (Single tone signal)

f	175		175		175		MHz
V_a	1.0		1.5		2.0		kV
V_{g2}	350		350		350		V
$-V_{g1}$	55		55		55		V
P_{out}	0	120	0	215	0	300	W
p_a	100	130	150	160	200	200	W
I_a	100	250	100	250	100	250	mA
I_{g2}	0	10	0	8.0	0	5.0	mA
$v_{in(pk)}$	0	50	0	50	0	50	V
η_a		48		57.5		60	%

AMPLIFIER FOR TELEVISION SERVICE, CLASS 'B'

OPERATING CONDITIONS (Negative modulation, positive sync)

f		216	216	216	MHz
Bandwidth		5.0	5.0	5.0	MHz
P_{out}	sync	160	300	440	W
	black	90	170	250	W
V_a		1.0	1.5	2.0	kV
V_{g2}		350	350	350	V
$-V_{g1}$		60	65	70	V
$v_{in(pk)}$	sync	65	71	76	V
	black	52	57	62	V
I_a	sync	355	360	360	mA
	black	250	250	250	mA
I_{g2}	sync	27	29	29	mA
	black	4.0	0	0	mA
I_{g1}	sync	2.0	5.0	5.0	mA
	black	0	0	0	mA

AMPLIFIER, ANODE AND SCREEN GRID MODULATION, CLASS 'C'

OPERATING CONDITIONS

f	175	175	175	MHz
P_{out}	235	145	60	W
P_{load}	200	125	50	W
η_a	78	73	60	%
V_a	1.5	1.0	0.5	kV
I_a	200	200	200	mA
$*V_{g2}$	250	250	250	V
I_{g2}	20	22	31	mA
$-V_{g1}$	100	100	100	V
I_{g1}	14	14	15	mA
$v_{in(pk)}$	117	117	118	V
P_{drive}	1.7	1.7	1.8	W
p_a	65	55	40	W

*The d.c. grid 2 voltage must be modulated approximately 55% in phase with the anode modulation in order to obtain 100% modulation.

A.F. POWER AMPLIFIER AND MODULATOR, CLASS 'AB'

OPERATING CONDITIONS (Without grid current) Two valves

V_a	1.0		1.5		2.0		kV
V_{g2}	350		350		350		V
$-V_{g1}$	55		55		55		V
R_{a-a}	3.5		6.2		9.5		kΩ
$v_{in(g1-g1)(pk)}$	0	100	0	100	0	100	V
P_{out}	0	240	0	430	0	600	W
P_{in}	2×100	2×250	2×150	2×375	2×200	2×500	W
I_a	2×100	2×250	2×100	2×250	2×100	2×250	mA
I_{g2}	0	2×10	0	2×8	0	2×5	mA
p_a	2×100	2×130	2×150	2×160	2×200	2×200	W

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Telegraphy or F.M. Telephony Class 'C'	Single Sideband Class 'AB'	Television Service Class 'B'	Anode and Screen Grid Modulation Class 'C'	A.F. Amplifier and Modulator Class 'AB'	
V_a max.	2.0	2.0	2.0	1.5	2.0	kV
V_{g2} max.	300	400	400	300	400	V
$-V_{g1}$ max.	250	-	250	250	250	V
I_a max.	250	250	250	200	250	mA
p_a max.	250	250	250	165	-	W
p_{g2} max.	12	12	12	12	12	W
p_{g1} max.	2.0	-	2.0	2.0	-	W
P_{in} max.	-	-	-	-	250	W
$v_{h-k(pk)}$ max.	150	150	150	150	150	V
R_{g1-k} max.	25	25	-	25	100	kΩ

CATHODE

Indirectly heated, oxide coated	QV2-250C	QV2-250F	
$V_h \pm 10\%$	6.0	26.5	V
I_h	2.6	0.58	A
t_{h-k} min.	30		s

The heater voltage should be reduced as follows:-

Up to 300MHz	6.0	26.5	V
300 to 400MHz	5.75	25.4	V
400 to 500MHz	5.5	24.3	V

CAPACITANCES

	g1, g2 earthed	k earthed	
c_{out}	4.5	4.5	pF
c_{in}	13	15.7	pF
c_{a-g1}	0.01	<0.06	pF

U.H.F. BEAM POWER TETRODE

(4CX250B) QV2-250C
(4CX250F) QV2-250F

CHARACTERISTICS

g_m (measured at $V_a = 500V$, $V_{g2} = 250V$, $I_a = 200mA$)	12	mA/V
μ_{g1-g2} (measured at $V_{g2} = 300V$, $I_{g2} = 50mA$)	5.2	

MOUNTING POSITION — Any

COOLING

Forced air

Temperatures

Anode core and seals max. — 250 °C

Air cooling must commence simultaneously with the application of heater voltage.
A socket and air system chimney can be used to direct air on the base seals, past the screen-grid seal and envelope, and through the radiator.
A typical value of air flow for maximum anode dissipation is given in the following table:-

Anode dissipation (W)	Height above sea level (m)	Inlet temperature (°C)	Rate of air flow (m^3/mm)	Pressure difference Inlet and Outlet (mm Water)
250	0	20	0.11	8.0

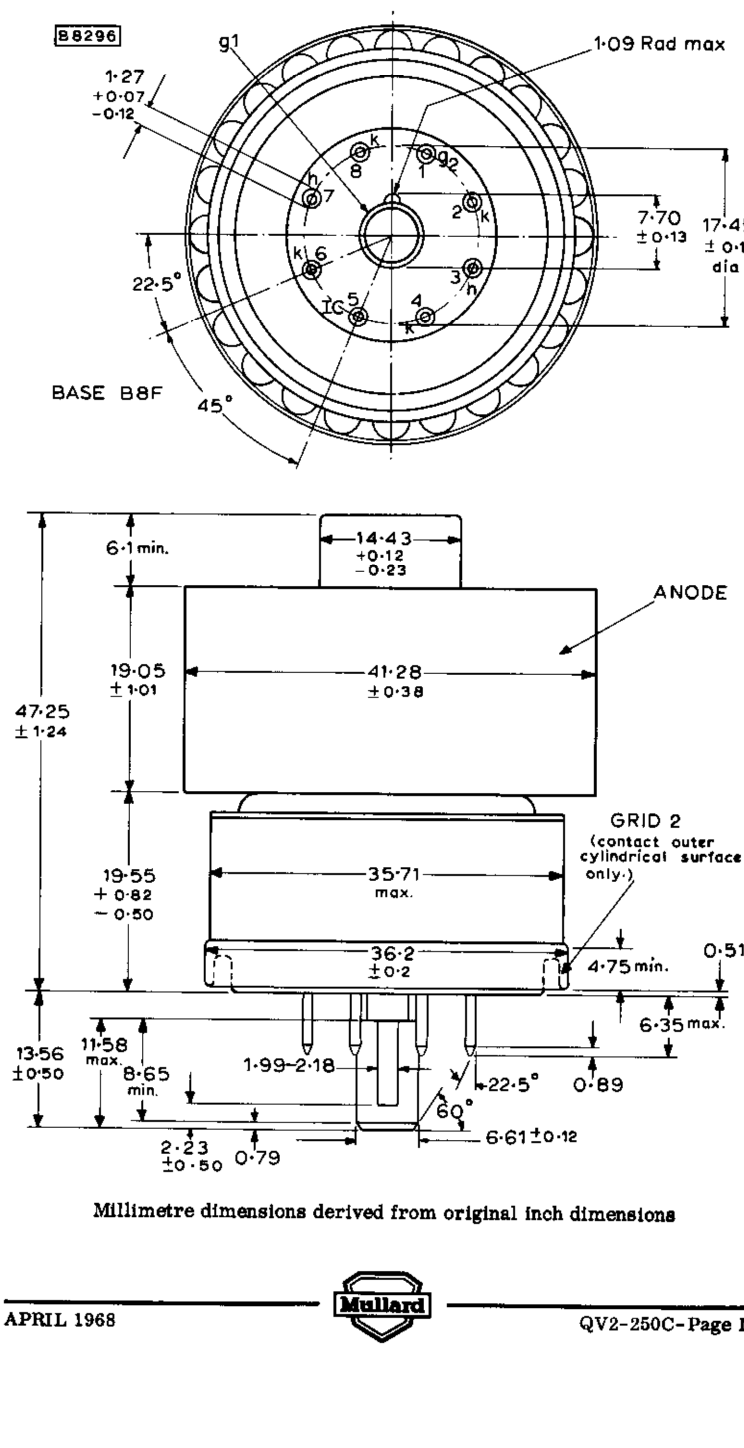
At higher altitudes or ambient temperatures the air flow required to maintain the temperature of the anode core and all seals within the permitted maximum must be increased.

PHYSICAL DATA

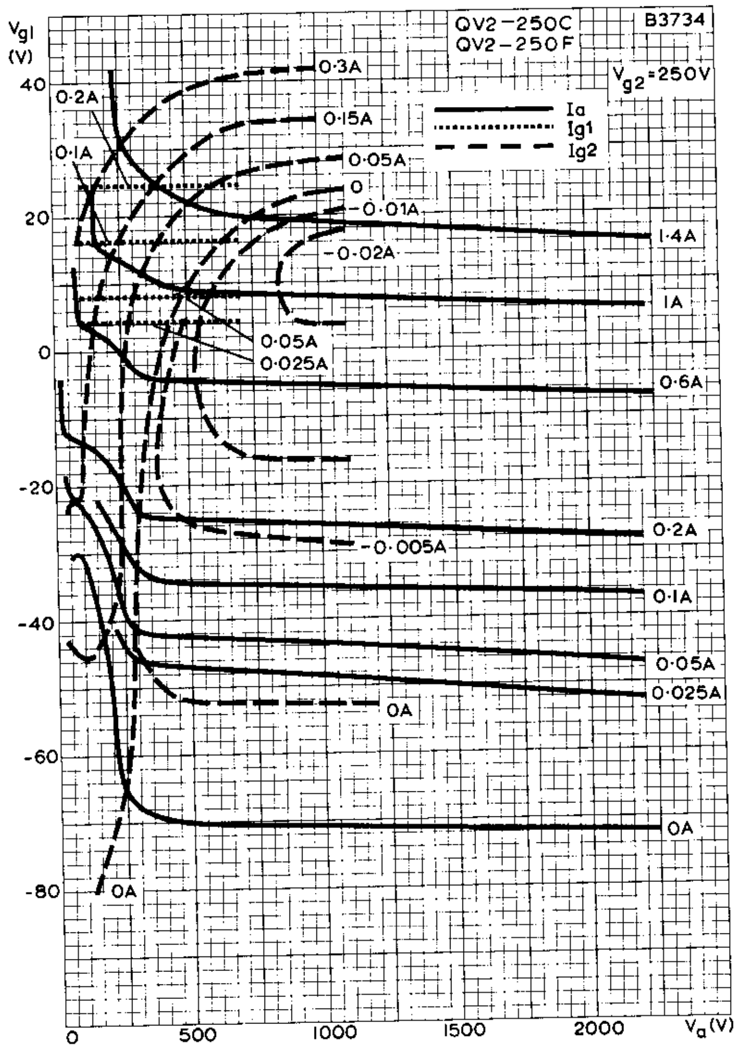
Weight of valve — 120 g

ACCESSORIES

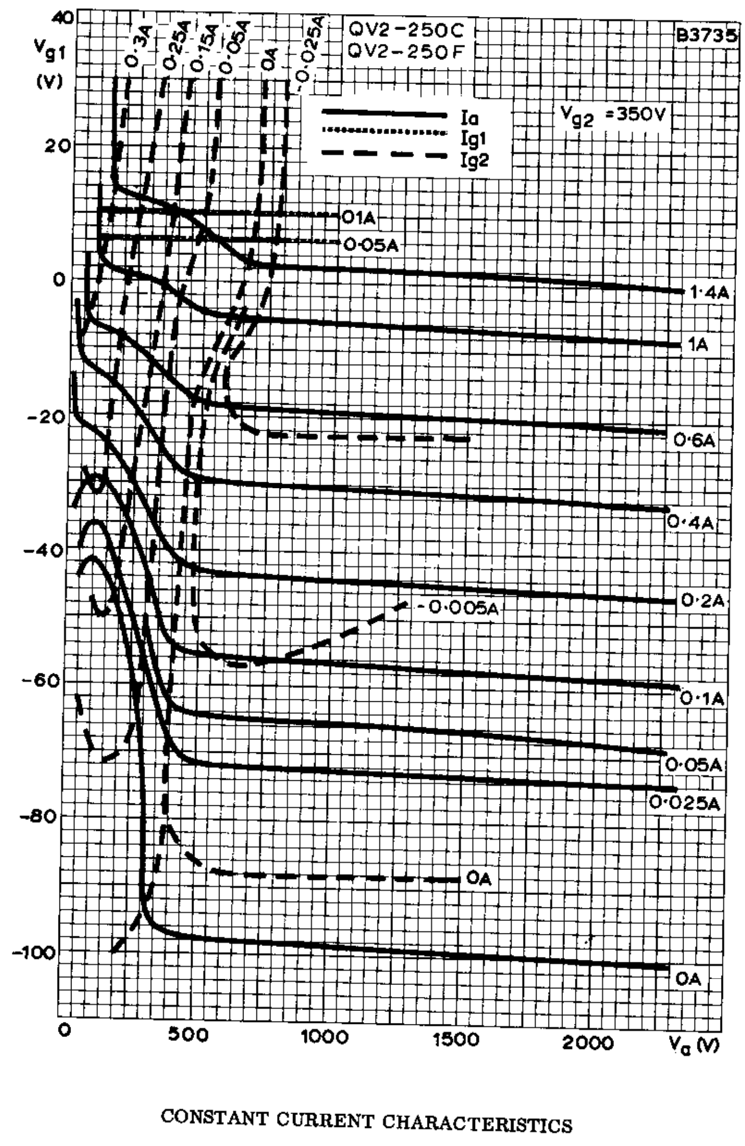
Air system socket (air system chimney included)	2422 513 01001
Air system chimney	4322 026 11701



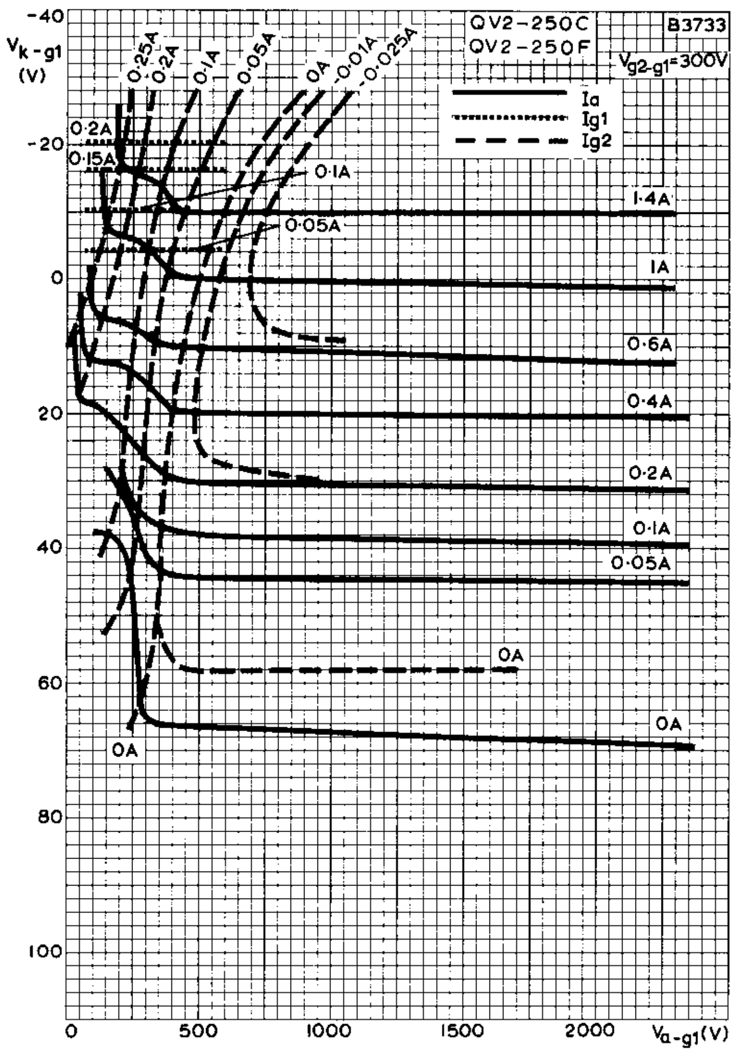
Millimetre dimensions derived from original inch dimensions



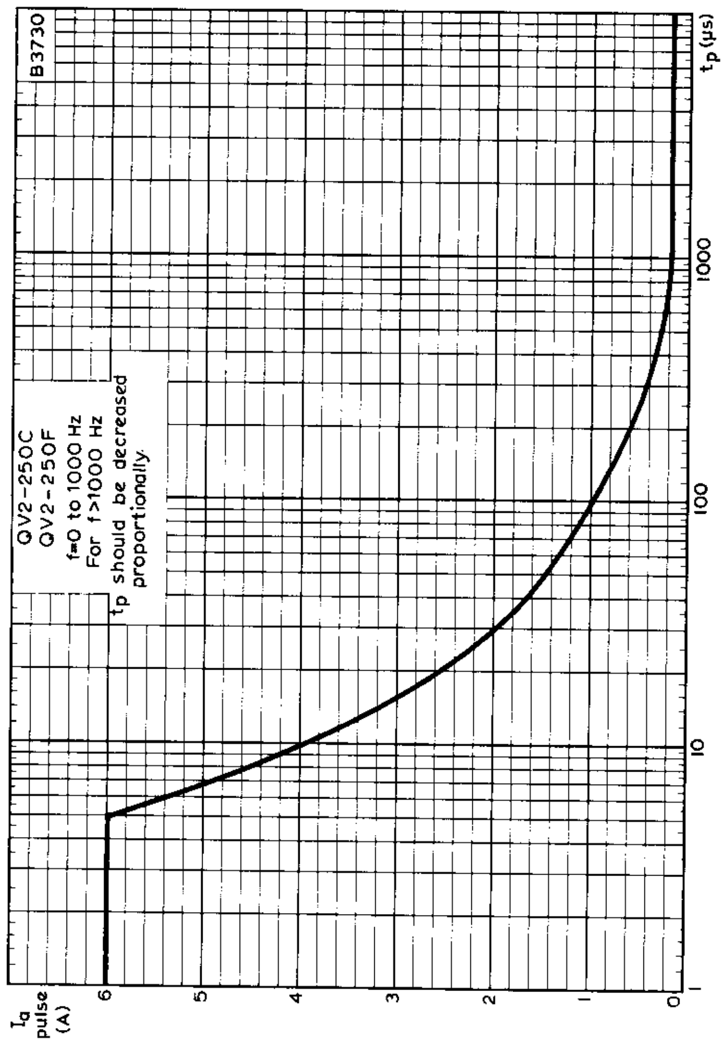
CONSTANT CURRENT CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS. GROUNDED GRID



MAXIMUM PULSE ANODE CURRENT PLOTTED AGAINST PULSE TIME

V.H.F. POWER TETRODE

(4CX350A) QV2-350A
(4CX350F) QV2-350F

QUICK REFERENCE DATA			
Forced-air cooled, ceramic-metal construction. For use in R.F. amplifiers and audio service.			
	A.F. Amplifier and Modulator Class 'AB$_1$'	R.F. Amplifier Single Sideband Class 'AB$_1$'	
f	$\leq$175	$\leq$175	MHz
P_{out}	770	385	W
f max.	175	175	MHz
V_a max.	2.5	2.5	kV
p_a max.	350	350	W

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS-TRANSMITTING VALVES

R.F. AMPLIFIER FOR SINGLE SIDEBAND OPERATION, CLASS 'AB$_1$'

OPERATING CONDITIONS

f		$\leq$175		MHz
V_{g2}		400		V
$-V_{g1}$		27		V
$I_{a(o)}$		100		mA
V_a	1.0	1.5	2.2	kV
P.E.P load	85	170	340	W
P.E.P. out	95	200	385	W
I_a (single tone)	260	265	290	mA
I_a (two tone)	210	215	195	mA
I_{g2} (single tone)	-4.0	-5.0	-3.0	mA
I_{g2} (two tone)	-7.0	-8.0	-8.0	mA
$v_{g(pk)}$	21	21	25	V
p_a (single tone)	165	200	255	W
p_a (two tone)	163	223	237	W

AMPLIFIER AND MODULATOR, CLASS 'AB$_1$'

OPERATING CONDITIONS (Two valves)

V_a	1.0	1.5	2.2	V
V_{g2}	400	400	400	V
$-V_{g1}$	-27	-27	-27	V
$I_{a(o)}$	2×100	2×100	2×100	mA
$R_{(a-a)}$	2.6	5.0	7.8	kΩ
$v_{in(pk)g-g}$	42	42	100	V
P_{out}	190	400	770	W
P_{in}	560	800	1260	W
I_a (max. sig.)	2×280	2×265	2×290	mA
I_{g2} (max. sig.)	2× 4.0	2× 5.0	2× 3.0	mA
p_a	2×185	2×200	2×255	W

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	A.F.Amplifier and Modulator Class 'AB$_1$'	R.F.Amplifier Single Sideband Class 'AB$_1$'	
V_a max.	2.5	2.5	kV
V_{g2} max.	450	450	V
$-V_{g1}$ max.	200	200	V
I_a max.	300	300	mA
p_a max.	350	350	W
p_{g2} max.	8.0	8.0	W
I_{g1} max.	2.0	2.0	mA
R_{g1-k} max.	25	25	kΩ

CATHODE

Indirectly heated, oxide coated

	QV2-350A	QV2-350F	
*V_h	6.0	26.5	V
I_h	3.2	0.73	A

*The heater has been designed to accept temporary fluctuations of supply voltage of ±5%.

V.H.F. POWER TETRODE

(4CX350A) QV2-350A
(4CX350F) QV2-350F

CAPACITANCES (Grounded cathode)

C_{a-g1}	0.05	pF
C_{in}	24.2	pF
C_{out}	5.5	pF

CHARACTERISTICS

g_m (I_a = 150mA)	22	mA/V
μ_{g1-g2}	13	

MOUNTING POSITION Any

COOLING

Forced-air

Temperatures

Anode core and all seals max. 250 °C

Air cooling must commence simultaneously with the application of heater voltage.

A socket and air system chimney can be used to direct air on the base seals, past the screen-grid seal and envelope and through the radiator.

A minimum value of air flow for three values of anode dissipation are shown in the following table.

Anode dissipation (W)	Height above sea level (m)	Inlet temperature (°C)	Rate of air flow (m^3/min.)	Pressure drop (mm Water)
250	3100	50	0.218	21.6
250	0	50	0.148	15.2
300	0	50	0.184	22.8
350	0	50	0.220	30.5

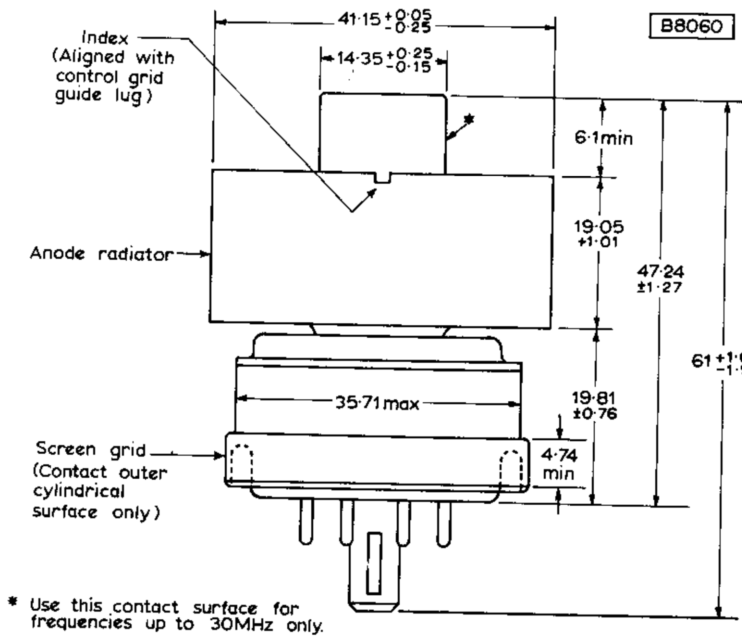
PHYSICAL DATA

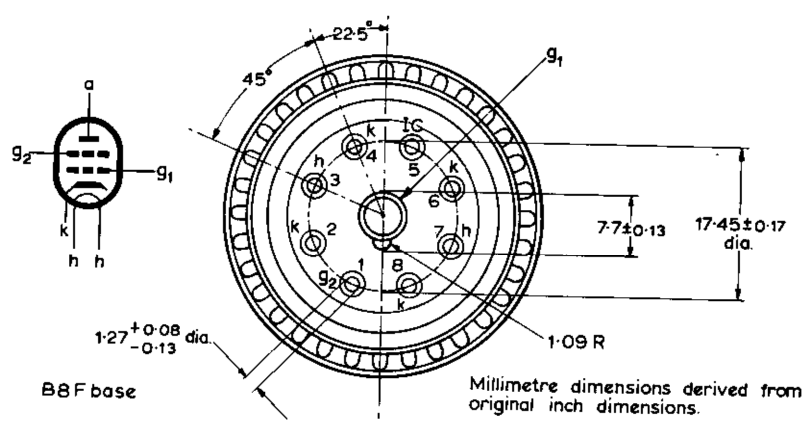
Weight of valve	113	g

ACCESSORIES

Air system socket	40222
Air system chimney	56 590 81/40

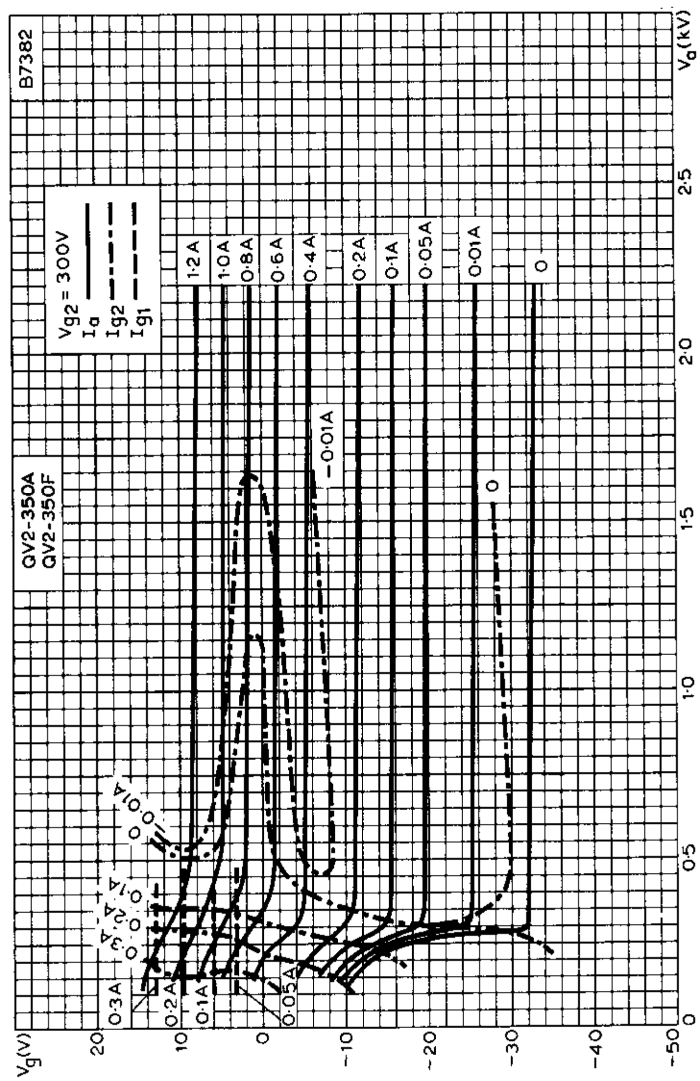
OUTLINE DRAWING



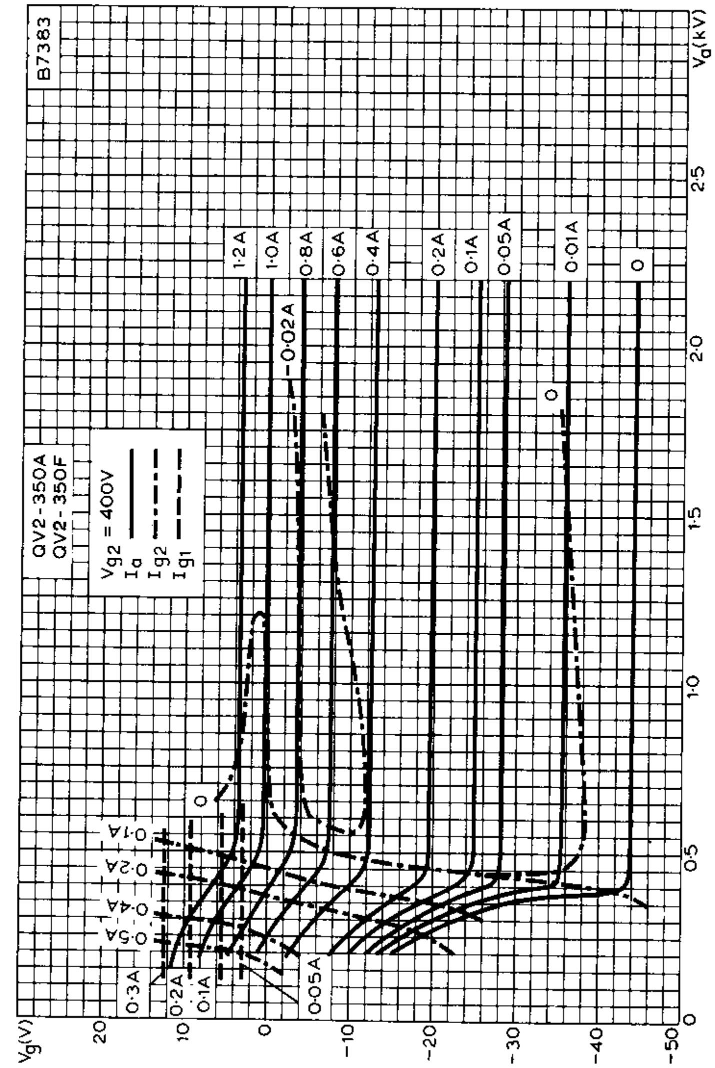


V.H.F. POWER TETRODE

(4CX350A) QV2-350A
(4CX350F) QV2-350F



CONSTANT CURRENT CHARACTERISTICS



CONSTANT CURRENT CHARACTERISTICS

R.F. POWER TETRODE

QY2-100

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s.

FILAMENT

Thoriated Tungsten		
V_f	10.0	V
I_f	5.0	A
Total Emission	2.7	A

CAPACITANCES

c_{in}	16.3	µµF
c_{out}	14.0	µµF
c_{a-g1}	<0.25	µµF

CHARACTERISTICS At $V_a = 2{,}000$ V, $V_{g2} = 400$ V, $I_a = 50$ mA.

g_m	3.75	mA/V
r_a	45,000	Ω
$\mu_{(g1-g2)}$	8.5	

LIMITING VALUES

V_a max.	2,000	V
$v_{a(pk)}$ max.	7,000	V
V_{g2} max.	400	V
V_{g1} max.	−300	V
I_k max.	225	mA
$i_{k(pk)}$ max.	800	mA
I_{g2} max.	55	mA
I_{g1} max.	25	mA
$i_{g1(pk)}$ max.	75	mA
p_a max.	100	W
p_{g2} max.	15	W
Max. operating frequency at full ratings	30	Mc/s
Max. operating frequency at 50% of max. anode voltage and input	120	Mc/s

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "B" TELEPHONY)

V_a	1,500	2,000	V
V_{g2}	400	400	V
V_{g1}	−60	−75	V
I_a	100	75	mA
I_{g2}	4	3	mA
$v_{(pk)\ drive}$	70	80	V
P_{drive}	<2	<2	W
P_{out}	50	50	W

QY2-100

R.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" UNMODULATED) OR AS OSCILLATOR

V_a	1,250	1,500	2,000	V
$*V_{g2}$	300	300	400	V
R_{g2}	27,000	40,000	36,000	Ω
$**V_{g1}$	−75	−90	−120	V
R_{g1}	6,000	7,500	12,000	Ω
R_k	330	400	520	Ω
I_a	180	180	180	mA
I_{g2}	35	30	45	mA
I_{g1}	12	12	10	mA
$v_{(pk)drive}$	160	175	205	V
P_{drive}	1.7	1.9	1.9	W
P_{out}	170	210	275	W

*May be obtained from a fixed supply, or from the anode supply through a series resistor of value shown. In the latter case provision must be made to ensure the $V_{g2}(b)$ does not exceed 800 V.

**May be obtained either from a fixed supply or by a grid or cathode resistor of value shown, or by a combination of these methods.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" GRID MODULATED)

V_a	1,500	2,000	V
V_{g2}	400	400	V
V_{g1}	−140	−120	V
I_a	70	75	mA
I_{g2}	3	3	mA
$v_{(pk)drive}$ R.F.	145	120	V
$v_{(pk)drive}$ L.F.	60	60	V
P_{drive} R.F.	<2	<2	W
P_{mod}	<1	<1	W
P_{out}	40	50	W

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

V_a	1,250	1,600	V
$*V_{g2}$	300	300	V
R_{g2}	27,000	43,000	Ω
$**V_{g1}$	−160	−160	V
R_{g1}	12,500	13,500	Ω
I_a	150	150	mA
I_{g2}	35	30	mA
I_{g1} (approx.)	13	12	mA
$v_{(pk)drive}$ R.F.	250	250	V
P_{drive} (approx.)	2.9	2.7	W
P_{out} (approx.)	140	180	W

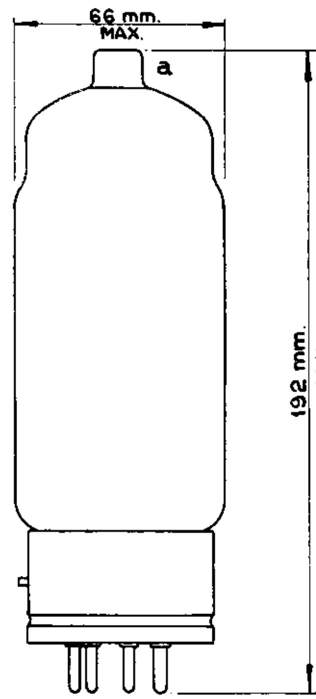
*May be obtained from a separate supply modulated simultaneously with the anode supply, or from modulated anode supply through a series resistor of value shown.

**May be obtained from a fixed supply or by grid resistor of value shown.

R.F. POWER TETRODE

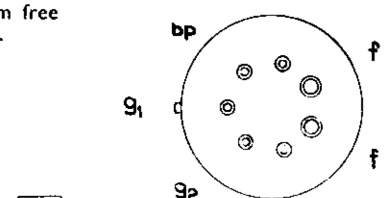
QY2-100

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s.



M.V.H.15 GIANT 7-PIN BASE

Viewed from free end of pins.



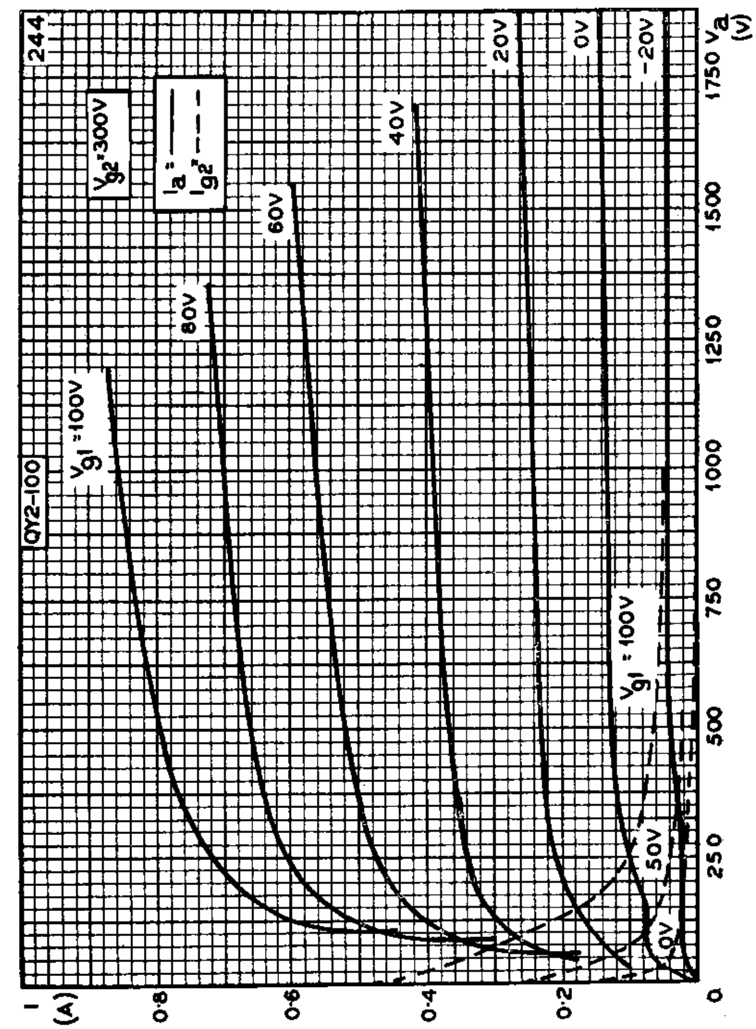
WEIGHT

Valve only 9 oz.

QY2-100

R.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s.

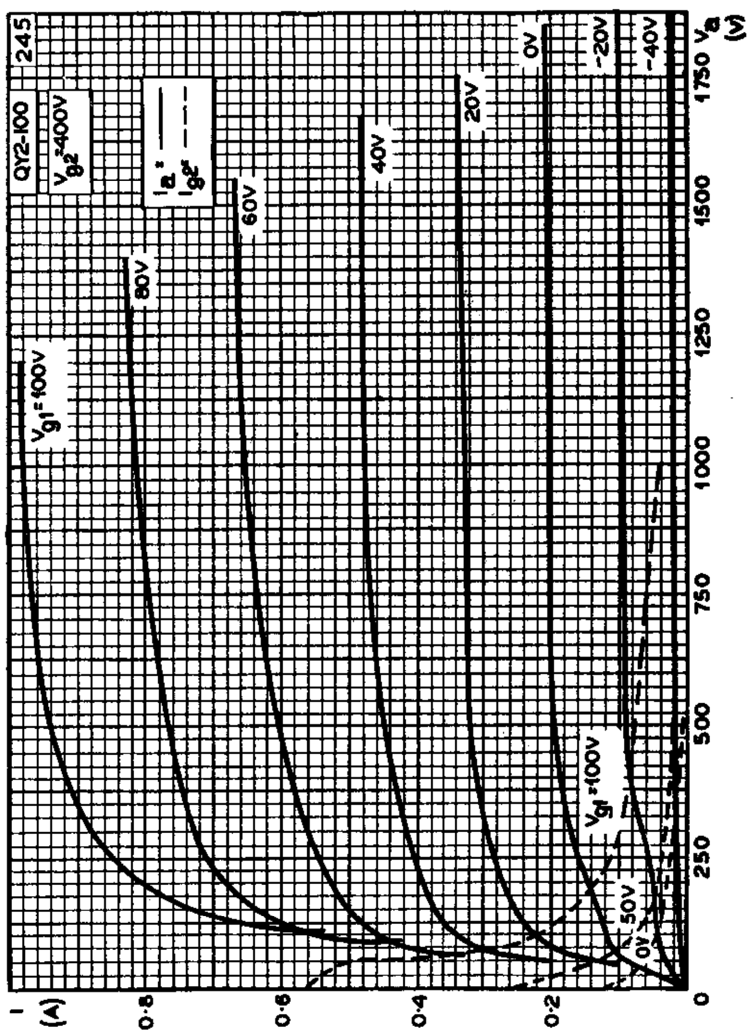


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE OF 300 V.

R.F. POWER TETRODE

QY2-100

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s.

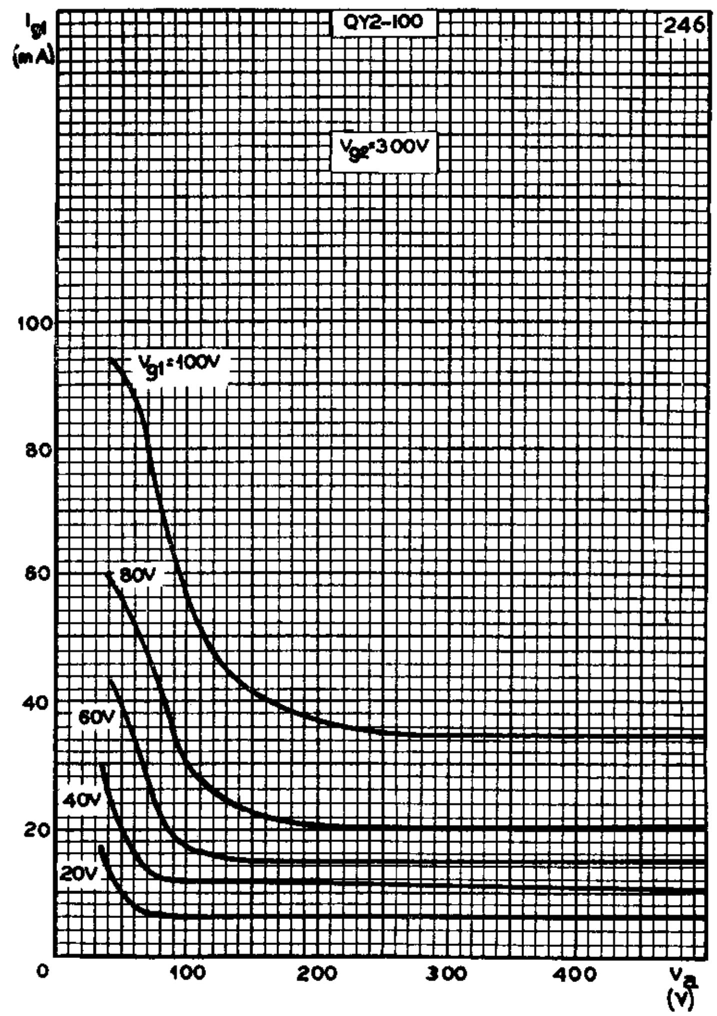


ANODE CURRENT AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE OF 400 V.

QY2-100

R.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s.

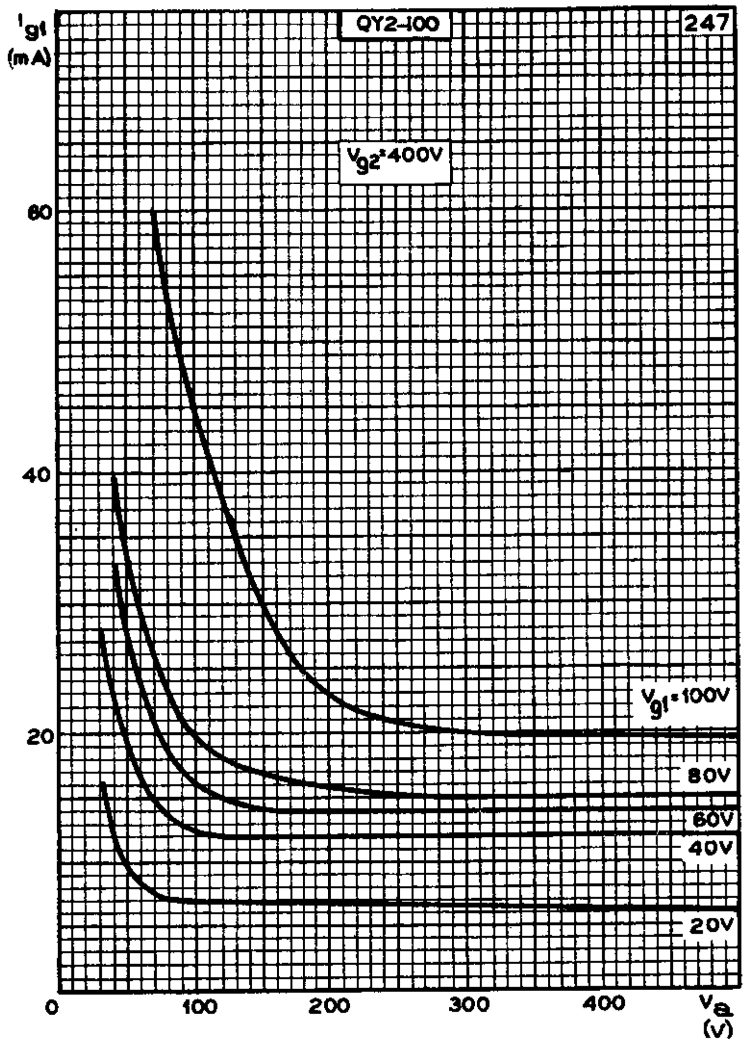


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE OF 300 V.

R.F. POWER TETRODE

Beam power tetrode rated for a maximum anode dissipation of 100 W, and primarily intended for use as a Class "C" R.F. amplifier at frequencies up to 120 Mc/s

QY2-100



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE OF 400 V.

QUICK REFERENCE DATA

Power tetrode suitable for use as v.h.f. amplifier or a.f. amplifier or modulator.

	Amplifier or Modulator Class 'AB'	Telephony, Anode and Screen Grid Modulation, Class 'C'		Telegraphy or F.M. Telephony, Class 'C'		
f	-	50	220	50	220	Mc/s
P_{out}	270	230	75	280	110	W
f max.	-	250		250		Mc/s
V_a max.	3.0	2.5		3.0		kV
p_a max.	65	45		65		W

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

TELEGRAPHY OR F.M. TELEPHONY, CLASS 'C'

OPERATING CONDITIONS

f	50	50	50	220	Mc/s
P_{out}	45	165	280	110	W
P_{load}	36	130	224	88	W
η_a	50	73	81	63	%
V_a	0.6	1.5	3.0	1.5	kV
I_a	150	150	115	117	mA
V_{g2}	250	250	250	250	V
I_{g2}	40	24	8.0	24	mA
$-V_{g1}$	75	85	100	85	V
I_{g1}	15	12	5.0	12	mA
$v_{in\,(pk)}$	170	185	180	190	V
$P_{load\,(driver)}$ (approx.)	4.0	4.0	3.0	10	W
p_a	45	60	65	65	W
p_{g2}	10	6.0	2.0	6.0	W←

A.F. POWER AMPLIFIER OR MODULATOR, CLASS 'AB'
(Two valves in push-pull)

OPERATING CONDITIONS ($I_{g1} = 0$)

P_{out}	80	145	175	W
R_{a-a}	9.0	15	20	kΩ
V_a	1.0	1.5	1.75	kV
$I_{a(o)}$	2 x 30	2 x 30	2 x 20	mA
I_a (max. sig.)	2 x 85	2 x 90	2 x 85	mA
V_{g2}	500	500	500	V
I_{g2} (max.sig.)	2 x 15	2 x 10	2 x 12	mA
V_{g1}	-100	-110	-115	V
$V_{in(g1-g1)r.m.s.}$	120	120	128	V
p_a	2 x 45	2 x 63	2 x 62	W
p_{g2}	2 x 7.5	2 x 5.0	2 x 6.0	W←
η	47	54	59	%
d_{tot}	3.0	3.0	4.5	%←

OPERATING CONDITIONS ($I_{g1} > 0$)

P_{out}	90	170	250	270	W
R_{a-a}	3.6	6.8	14	20	kΩ
V_a	0.6	1.0	1.5	1.8	kV
$I_{a(o)}$	2 x 30	2 x 30	2 x 30	2 x 25	mA
I_a (max.sig.)	2 x 150	2 x 150	2 x 125	2 x 110	mA
V_{g2}	250	250	250	250	V
I_{g2} (max. sig.)	2 x 40	2 x 30	2 x 20	2 x 16	mA
V_{g1}	-40	-40	-45	-50	V
I_{g1} (max. sig.)	2 x 15	2 x 14	2 x 10	2 x 9.0	mA
$V_{in(g1-g1)r.m.s.}$	170	148	141	127	V
$P_{load\ (driver)}$	2 x 4.0	2 x 3.0	2 x 3.8	2 x 2.6	W←
p_a	2 x 45	2 x 65	2 x 63	2 x 63	W
p_{g2}	2 x 10	2 x 7.5	2 x 5.0	2 x 4.0	W←
η	50	57	67	68	%
d_{tot}	10	6.0	6.0	5.0	%←

TELEPHONY, ANODE AND SCREEN-GRID MODULATION, CLASS 'C'

OPERATING CONDITIONS (Carrier conditions for 100% modulation)

f	50	50	50	220	Mc/s
P_{out}	45	140	230	75	W
$^*P_{load}$	36	112	185	60	W
η_a	62	78	84	63	%
V_a	0.6	1.5	2.5	1.5	kV
I_a	120	120	110	80	mA
V_{g2}	250	250	250	250	V
I_{g2}	30	15	10	27	mA
$-V_{g1}$	120	125	135	85	V
I_{g1}	12	8.0	6.0	12	mA
$v_{in\ (pk)}$	215	220	215	185	V
$P_{load\ (driver)}$	4.0	4.5	3.5	10	W
p_a	27	40	45	45	W
p_{g2}	7.5	3.8	2.5	6.8	W
For 100% modulation					
P_{mod}	36	90	137	60	W
$v_{g2\ (pk)}$	250	250	250	250	V

*With a circuit transfer efficiency of 80%.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Amplifier or Modulator Class 'AB'	Telegraphy Class 'C'	Telephony, Class 'C'	
V_a max.	3.0	3.0	2.5	kV
V_{g2} max.	600	400	400	V
$-V_{g1}$ max.	500	500	500	V
I_a max.	150	150	120	mA
p_a max.	65	65	45	W
p_{g2} max.	20	10	10	W
I_{g1} max.	20	30	25	mA
p_{g1} max.	-	5.0	-	W
R_{g1-k} max.	250	-	-	kΩ

CATHODE

Directly heated

V_f	6.0	V
I_f	3.5	A

CAPACITANCES

c_{a-g1}	0.08	pF
c_{out}	2.1	pF
c_{in}	8.0	pF

CHARACTERISTICS (measured at $V_a = 500V$, $V_{g2} = 250V$, $I_a = 125mA$)

g_m	4.0	mA/V
μ_{g1-g2}	5.0	

MOUNTING POSITION

Vertical, with base up or down

COOLING

Radiation/low velocity air flow

Maximum temperatures

Seals	225	°C
Bulb	225	°C

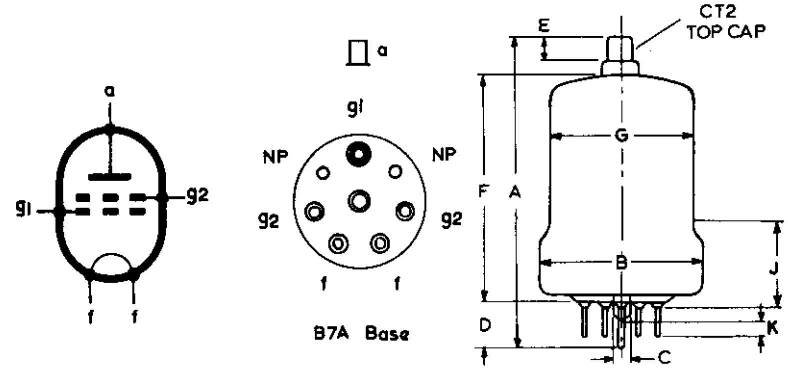
PHYSICAL DATA

	oz	g
Weight of valve (approx.)	3.0	85

ACCESSORIES

Socket	40202
Anode connector	40624

V.H.F. POWER TETRODE QY3-65



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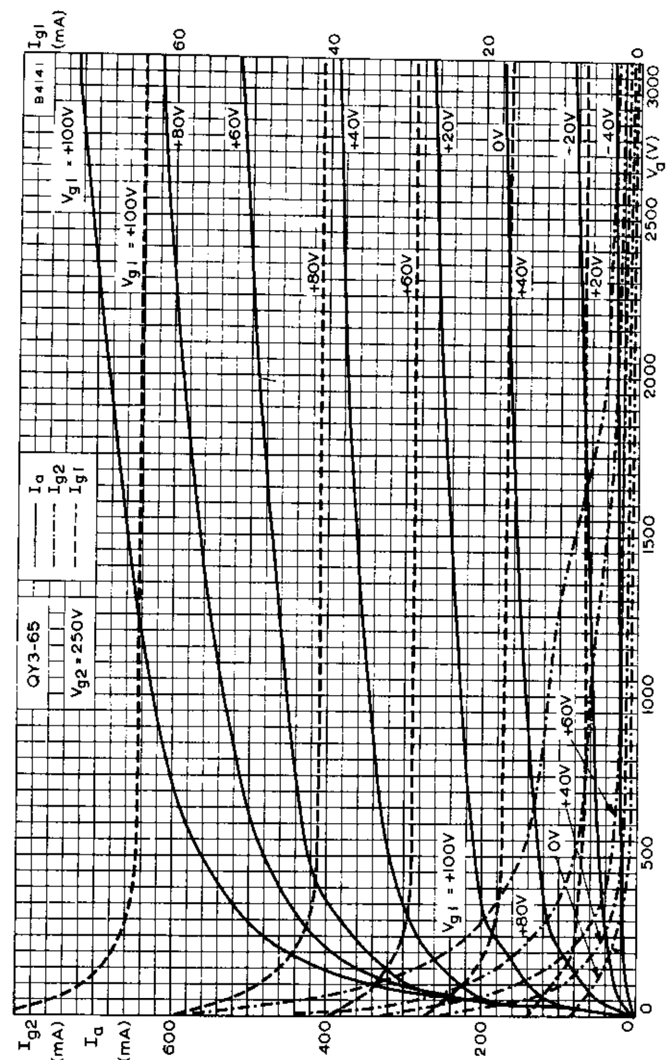
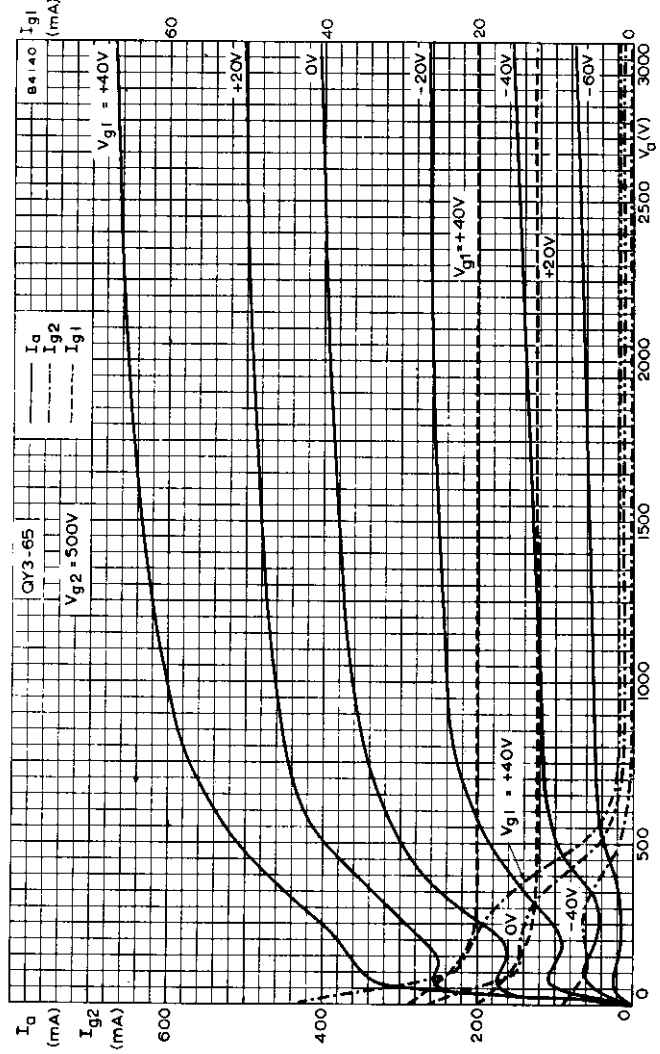
DIMENSIONS

	Inches	Millimetres	
A	4.37	110.9	max.
B	2.375	60.32	max.
C	0.375	9.52	max.
D	0.562	14.27	max.
E	0.328	8.34	min.
F	3.312	84.12	max.
G	2.125	53.97	max.
J	1.218	30.93	max.
K	0.000	0.000	min.

Millimetre dimensions derived from original inch dimensions



ANODE, SCREEN-GRID AND CONTROL-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 250V$.



ANODE, SCREEN-GRID AND CONTROL-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 500V$.

V.H.F. POWER TETRODE

QY3-125

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

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

FILAMENT Thoriated tungsten.

V_f	5.0	V
I_f	6.5	A

MOUNTING POSITION Vertical, base up or down.

CAPACITANCES

c_{in}	10.8	pF
c_{out}	3.1	pF
c_{a-g1}	0.05	pF

CHARACTERISTICS (At V_a=2.5 kV, V_{g2}=350 V, I_a=40 mA)

g_m	2.2	mA/V
μ_{g1-g2}	6.2	

COOLING

$T_{anode\ seal}$ max.	220	°C
T_{pins} max.	180	°C

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the anode seal and the base of the valve 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 of the envelope is sufficient, but an anode terminal connector of large surface area is necessary in order to keep the anode seal cool.

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

Limiting Values

V_a max.	3.0	kV
p_a max. (corresponding to an anode temperature of 850°C, *i.e.*, red heat)	125	W
I_k max.	300	mA
$i_{k(pk)}$ max.	1.6	A
V_{g2} max.	400	V
p_{g2} max.	20	W
p_{g1} max.	5.0	W
$-V_{g1}$ max.	500	V
I_{g1} max.	15	mA

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

Typical Operating Conditions at f ≤120 Mc/s.

V_a	2.0	2.5	3.0	kV
V_{g2}	350	350	350	V
V_{g1}	−100	−150	−150	V
I_a	200	200	167	mA
I_{g2}	50	40	30	mA
I_{g1}	9.0	9.0	6.5	mA
$v_{in(pk)}$	260	330	300	V
P_{drive}	2.4	3.0	2.0	W
p_a	125	125	125	W
p_{g2}	17.5	14	10.5	W
P_{out}	275	375	375	W
$^*P_{load}$	220	300	300	W
η	69	75	75	%

* With a circuit transfer efficiency of 80%.

OPERATION AS SINGLE VALVE R.F. POWER AMPLIFIER (Class "B" Telephony)

Limiting Values

V_a max.	3.0	kV
p_a max. (corresponding to an anode temperature of 850°C, *i.e.*, red heat)	125	W
I_k max.	120	mA
$i_{k(pk)}$ max.	350	mA
V_{g2} max.	400	V
p_{g2} max.	14	W

Typical Operating Conditions at f ≤120 Mc/s.

V_a	2.0	2.5	3.0	kV
V_{g2}	350	350	350	V
V_{g1}	−50	−50	−50	V
I_a	83	70	60	mA
I_{g2}	1.5	1.0	1.0	mA
$v_{in(pk)}$	65	55	50	V
p_a	112	120	122	W
p_{g2}	0.52	0.35	0.35	W
P_{out}	54	55	58	W
$^*P_{load}$	43	45	46	W
η	32.5	31.5	32	%
For 100% modulation				
I_{g1}	4.0	4.0	4.5	mA
P_{drive}	0.52	0.44	0.45	W

* With a circuit transfer efficiency of 80%.

V.H.F. POWER TETRODE

QY3-125

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

OPERATION AS SINGLE VALVE R.F. POWER AMPLIFIER CLASS "C" TELEPHONY (Anode and screen grid modulated)

Limiting Values

V_a max.	2.5	kV
p_a max.	83	W
I_k max.	200	mA
$i_{k(pk)}$ max.	2.0	A
V_{g2} max.	400	V
p_{g2} max.	20	W
$-V_{g1}$ max.	500	V
I_{g1} max.	15	mA

Typical Operating Conditions at f $\leq$120 Mc/s.

V_a	2.0	2.5	kV
V_{g2}	350	350	V
V_{g1}	−220	−210	V
I_a	150	152	mA
I_{g2}	33	30	mA
I_{g1}	5.0	4.5	mA
P_{drive}	2.0	1.7	W
$v_{in(pk)}$	390	380	V
p_a	75	80	W
p_{g2}	11.5	10.5	W
P_{out}	225	300	W
$*P_{load}$	180	240	W
η	75	79	%
For 100% modulation			
P_{mod}	150	190	W
$v_{g2(pk)\ mod.}$	300	300	V

* With a circuit transfer efficiency of 80%.

OPERATION OF TWO VALVES IN PUSH-PULL AS CLASS "B" A.F. POWER AMPLIFIER OR MODULATOR

Limiting Values

V_a max.	3.0	kV
p_a max. (corresponding to an anode temperature of 850°C, *i.e.*, red heat)	125	W
I_k max.	320	mA
$i_{k(pk)}$ max.	1.0	A
V_{g2} max. (I_{g1}=0)	600	V
V_{g2} max. (I_{g1}>0)	400	V
p_{g2} max.	20	W
$-V_{g1}$ max.	500	V
R_{g1-k} max.	150	kΩ

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

Typical Operating Conditions (Without I_{g1})

V_a	1.5	2.0	2.5	kV
V_{g2}	600	600	600	V
V_{g1}	−94	−96	−97	V
$I_{a(0)}$	2×30	2×30	2×30	mA
I_a (max. sig.)	2×109	2×111	2×108	mA
I_{g2} (max. sig.)	2×13.5	2×12	2×13	mA
$V_{in(g-g)\ (r.m.s.)}$	130	132	134	V
p_a	2×78	2×92	2×95	W
P_{out}	170	260	345	W
R_{a-a}	12	17.6	25	kΩ
η	52	58.5	64	%
D_{tot}	3.5	3.6	4.0	%

Typical Operating Conditions (With I_{g1})

V_a	1.5	2.0	2.5	kV
V_{g2}	350	350	350	V
V_{g1}	−48	−50	−51	V
$I_{a(0)}$	2×30	2×30	2×30	mA
I_a (max. sig.)	2×225	2×197	2×151	mA
I_{g2} (max. sig.)	2×42	2×32	2×18	mA
I_{g1}	2×16	2×12	2×8.5	mA
$V_{in\ (g-g)\ (r.m.s.)}$	234	210	170	V
P_{drive}	2×2.4	2×1.6	2×0.9	W
p_a	2×114	2×120	2×103	W
P_{out}	455	550	550	W
R_{a-a}	7.2	12	20	kΩ
η	66.5	69.5	72.5	%
D_{tot}	5.0	5.0	5.0	%

CIRCUIT NOTES

1. The R.F circuit returns must be brought to the filament connection on Pin No. 1.

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

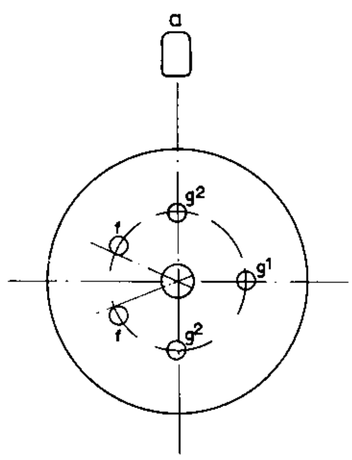
WEIGHT

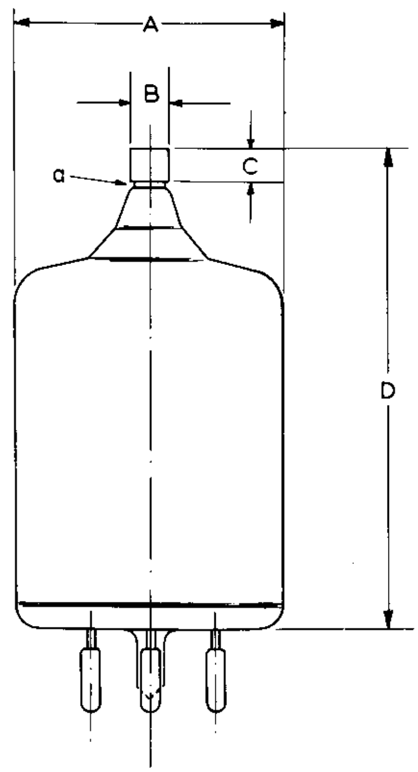
Valve only	3.5	oz
	100	g

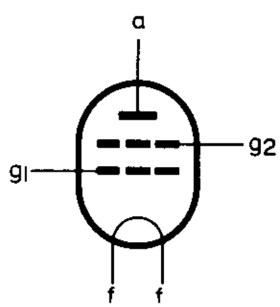
V.H.F. POWER TETRODE

QY3-125

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.







B 2608

DIMENSIONS

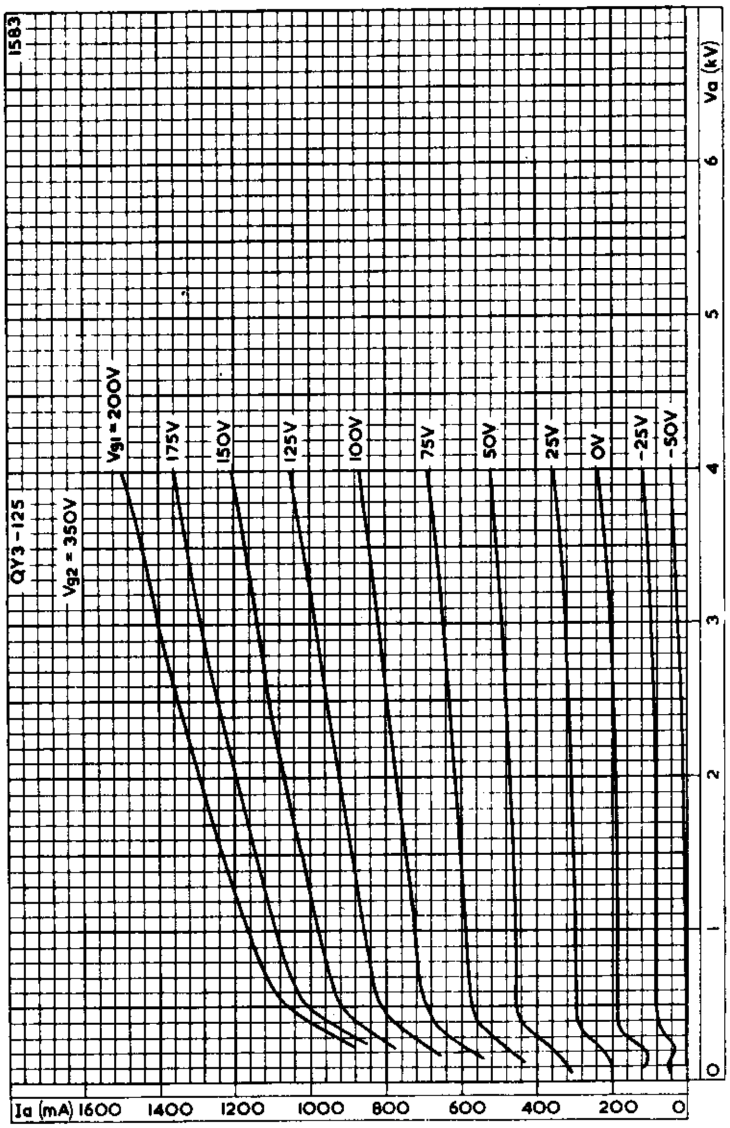
	Inches	Millimetres	
A	2.362 ± 0.020	60 ± 0.5	
B	0.354 ± 0.004	9.0 ± 0.1	
C	0.354	9.0	min
D	4.173 ± 0.157	106 ± 4.0	

Inch dimensions derived from original millimetre dimensions.

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

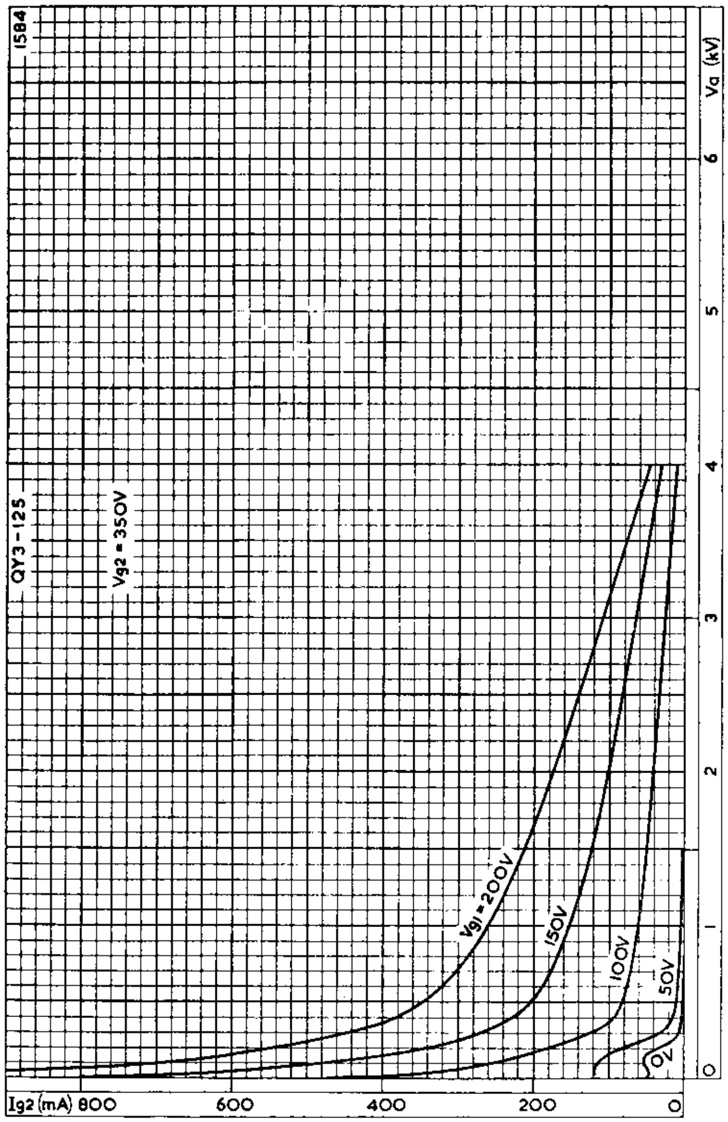


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE=350 V

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

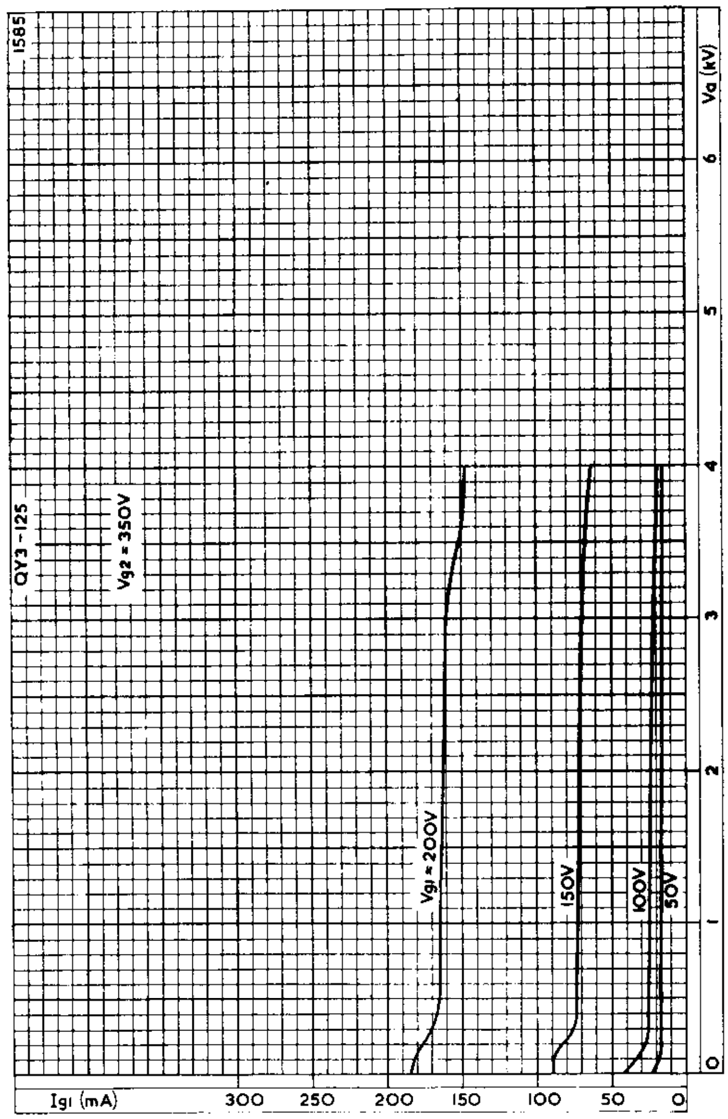


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
FOR SCREEN-GRID VOLTAGE –350V

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

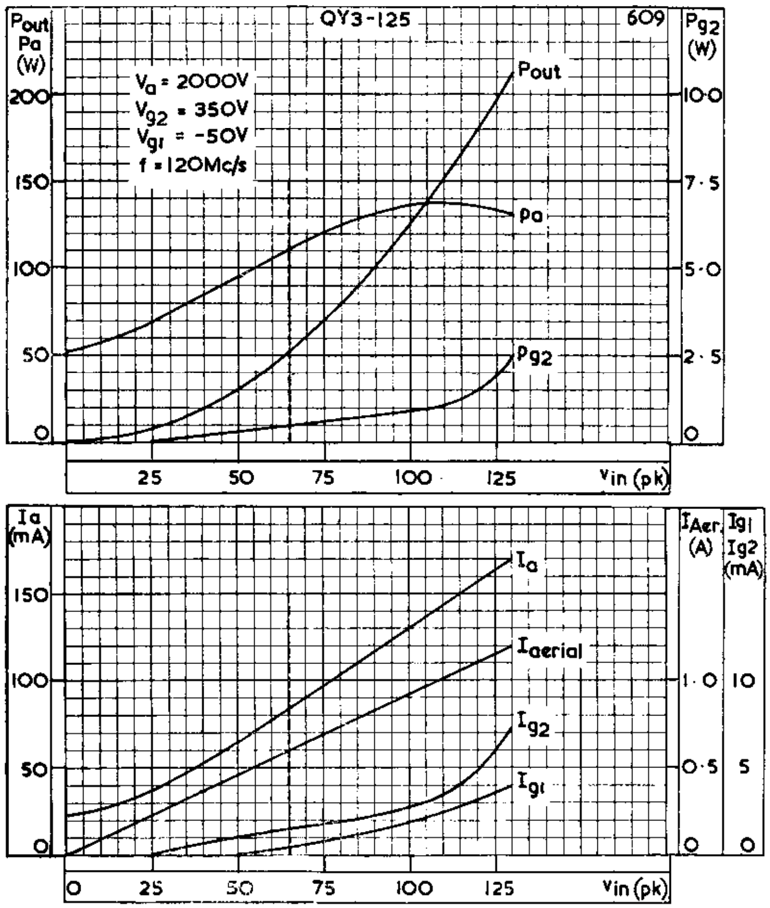


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE OF 350 V

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

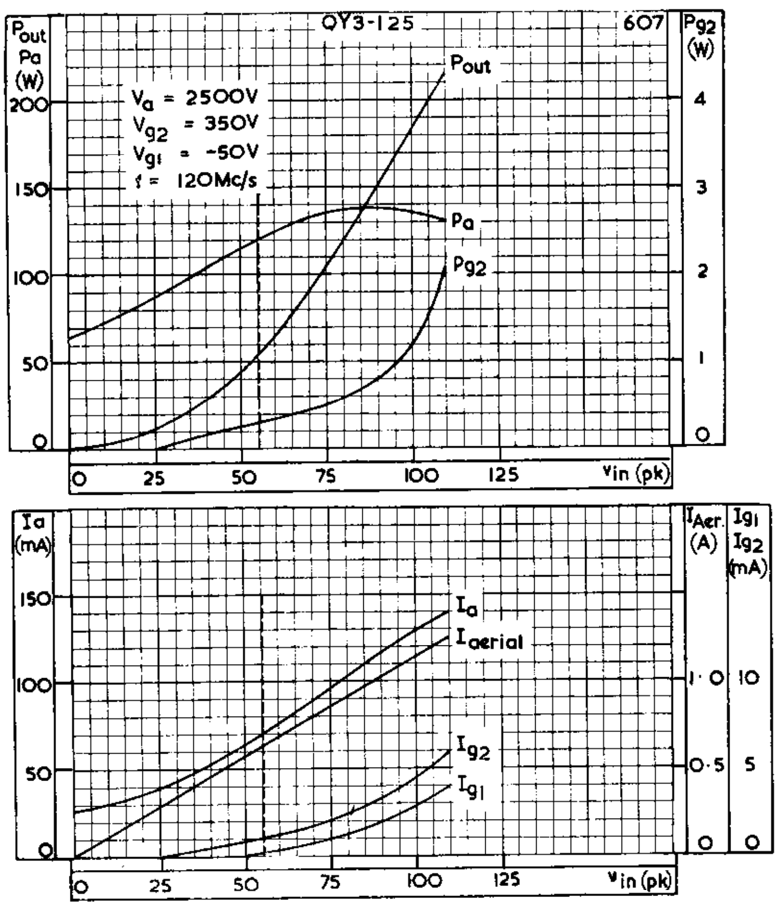


OPERATING CHARACTERISTICS FOR CLASS "B" TELEPHONY
AT $V_a = 2$ kV

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

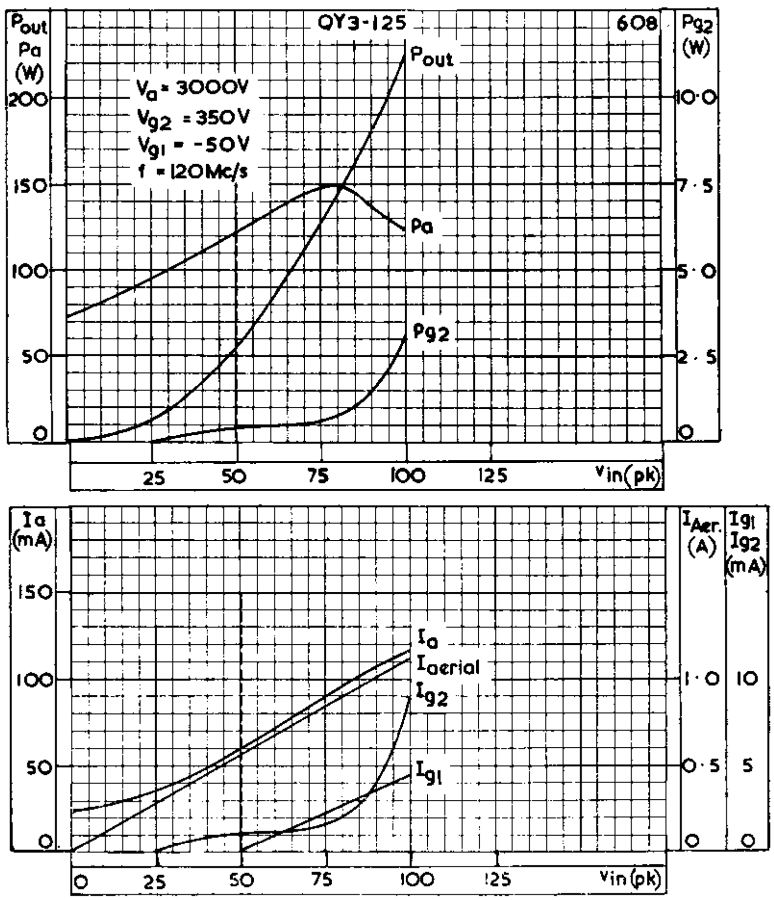


OPERATING CHARACTERISTICS FOR CLASS "B" TELEPHONY
AT $V_a = 2.5$ kV

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125



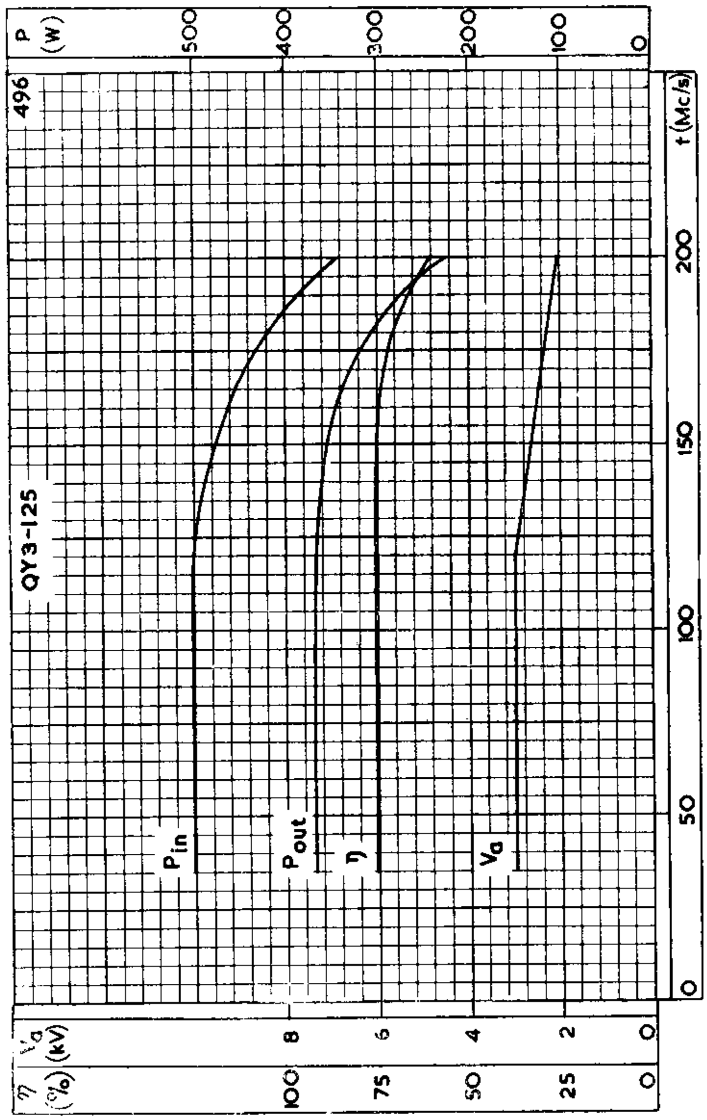
OPERATING CHARACTERISTICS FOR CLASS " B " TELEPHONY

AT V_a = 3.0 kV

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

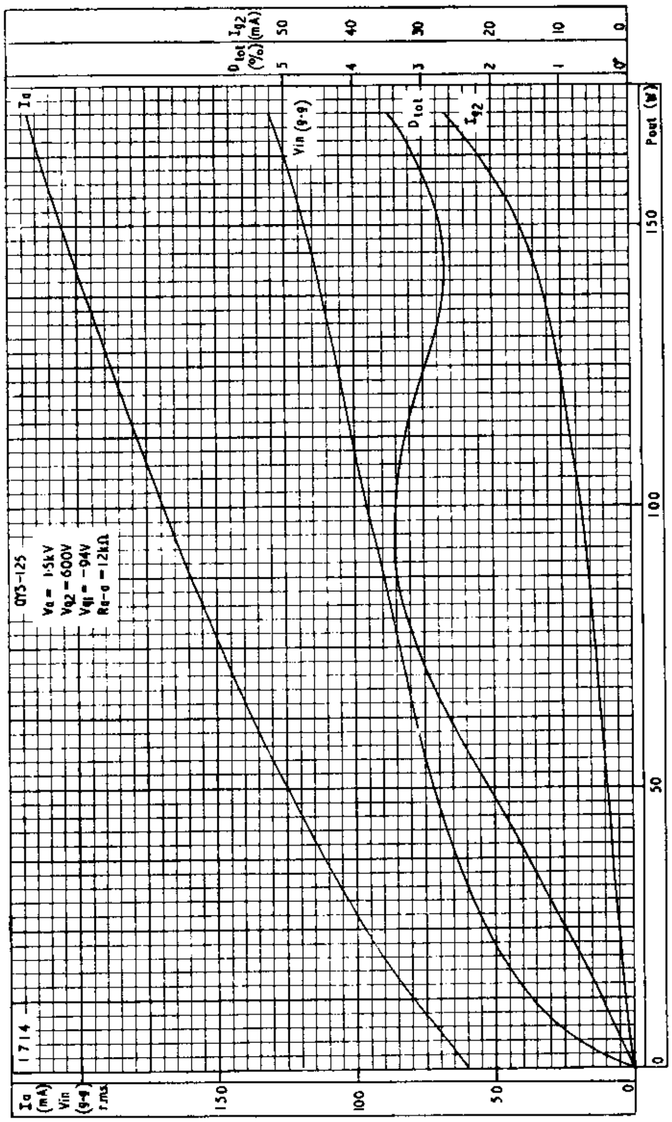


FREQUENCY CHARACTERISTICS AS CLASS "C" TELEGRAPHY AMPLIFIER

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

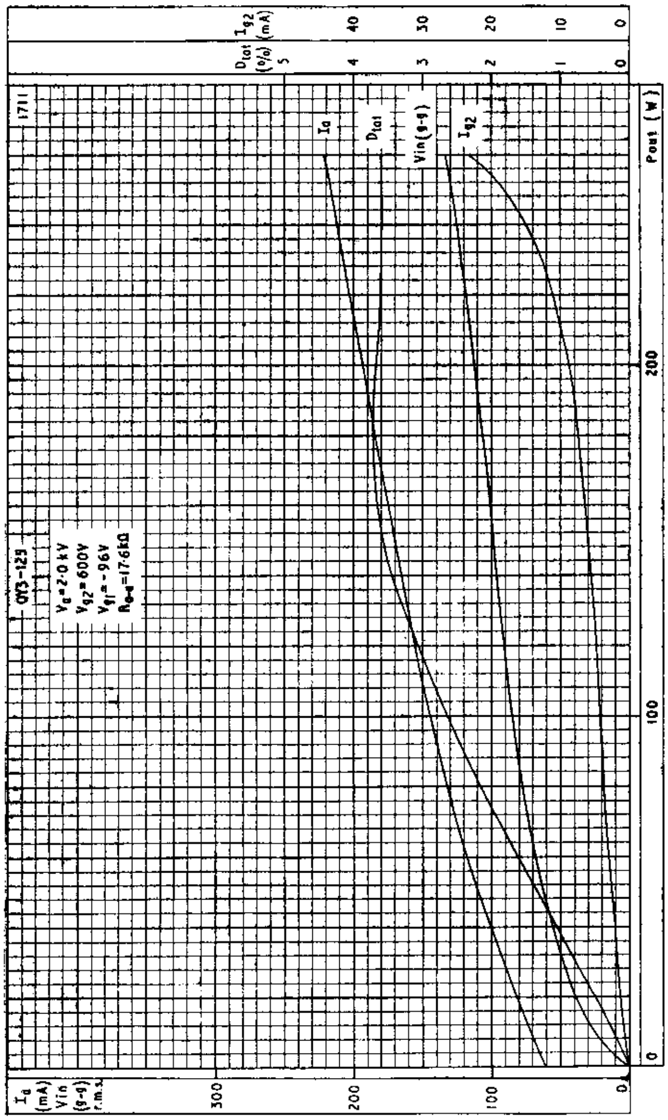


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITHOUT GRID CURRENT AND $V_a = 1.5$ kV

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

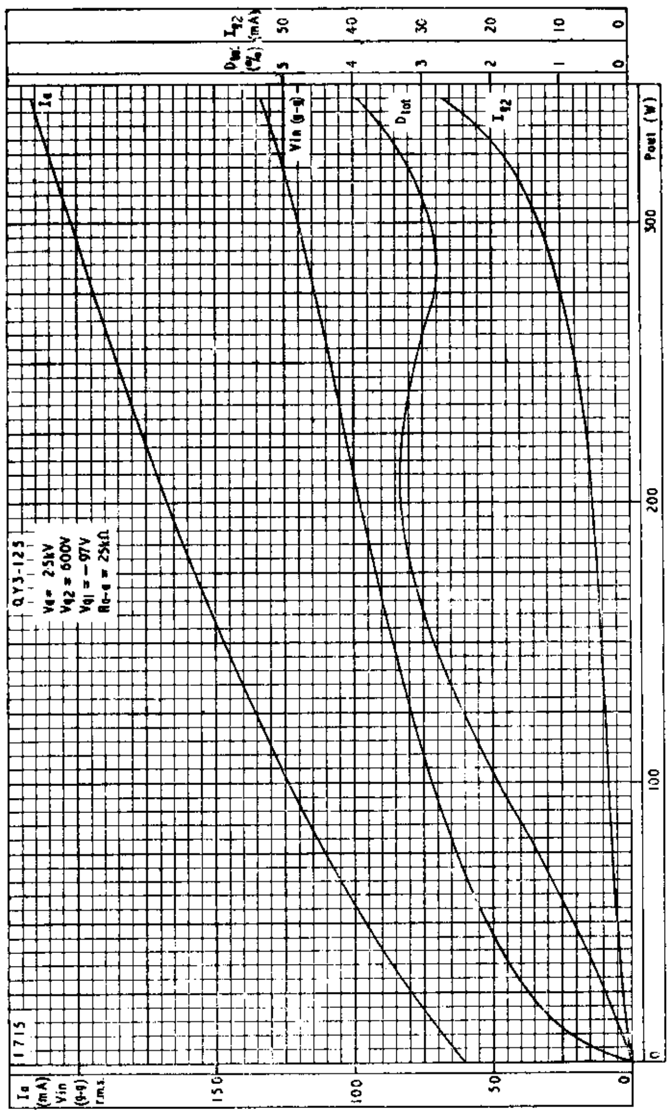


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITHOUT GRID CURRENT AND $V_a = 2.0$kV

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

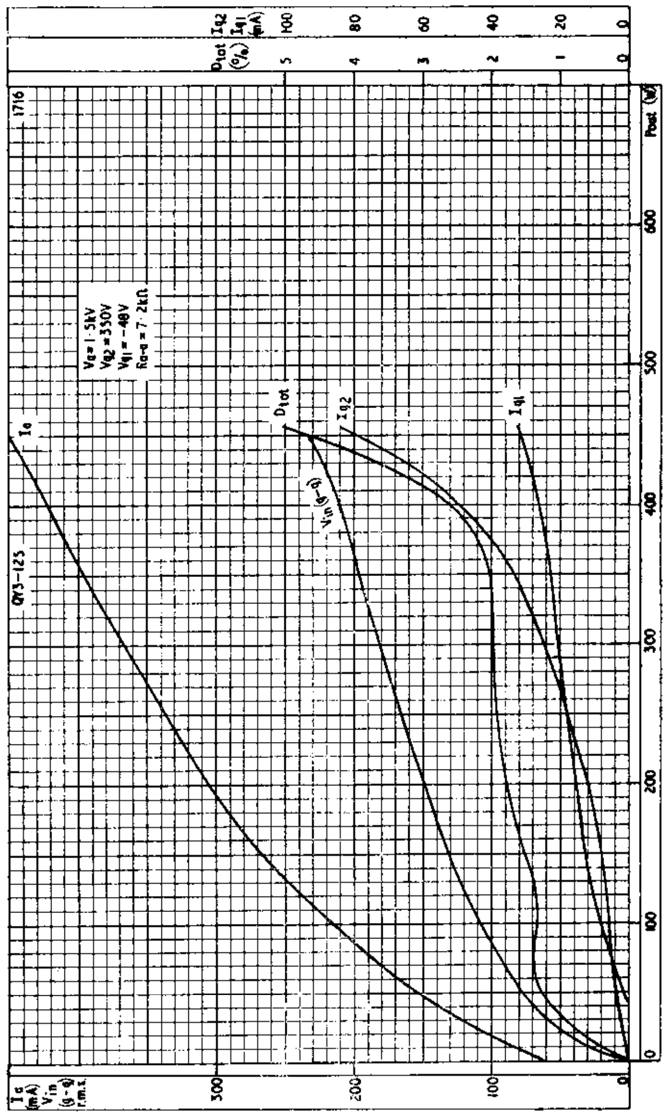


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITHOUT GRID CURRENT AND $V_a = 2.5$ kV

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

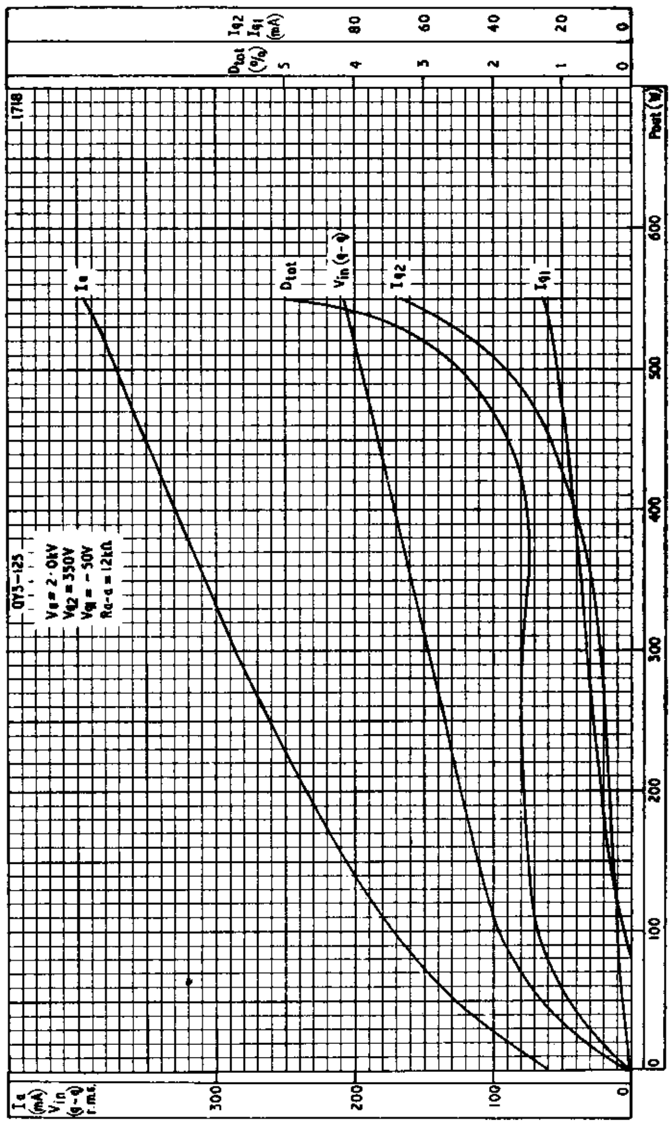


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITH GRID CURRENT AND $V_a = 1.5$ kV

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

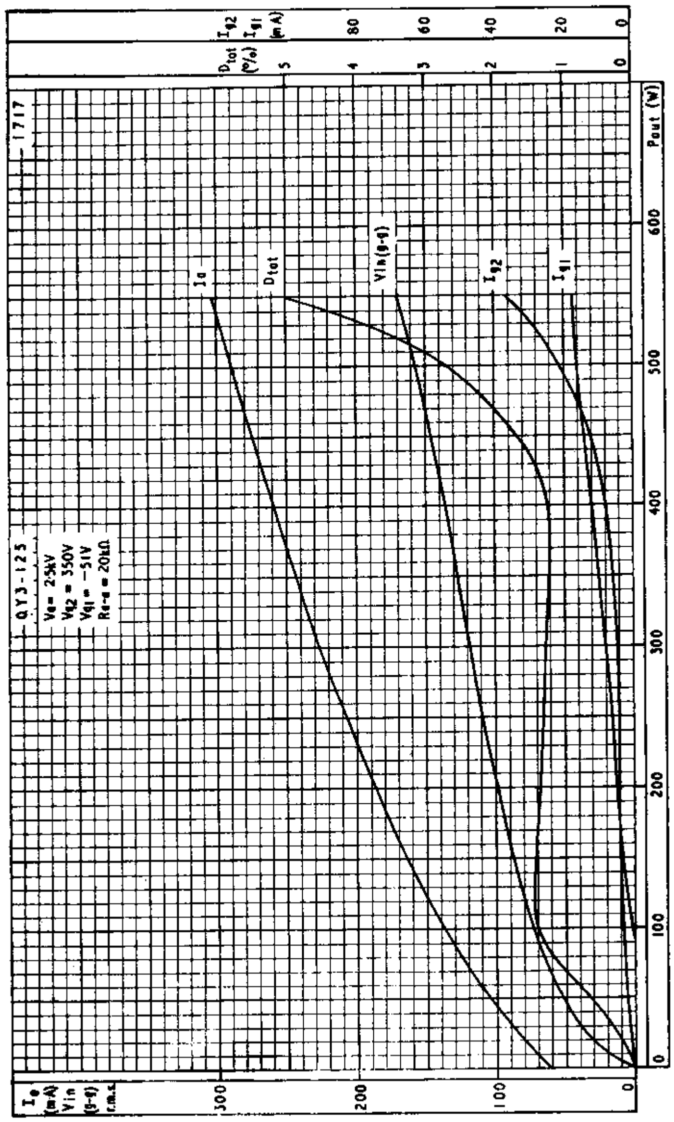


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITH GRID CURRENT AND $V_a = 2.0$ kV

QY3-125

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s



OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITH GRID CURRENT AND $V_a = 2.5$ kV

QUICK REFERENCE DATA				
Tetrode, external anode, forced-air cooled, intended for use as u.h.f. power amplifier.				
	Amplifier for Television Service		Telegraphy or F.M. Telephony	
	Linear, Class 'AB_1'	Class 'C'		
f	790	800	800	Mc/s
P_{out}	0.25	2.7	2.5	kW
f max.	1000	1000	1000	Mc/s
V_a max.	3.0	4.5	4.5	kV
p_a max.	1.5	1.5	1.5	kW

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

TELEGRAPHY OR F.M. TELEPHONY, CLASS 'C'

OPERATING CONDITIONS for valve in common grid circuit.

f	800	Mc/s
P_{out}	2.4 + 0.1*	kW
P_{load}	2.1	kW
η_a	66	%
V_{a-g1}	4.3	kV
I_a	850	mA
V_{g2-g1}	600	V
I_{g2}	28	mA
V_{k-g1}	110	V
I_{g1}	50	mA
$P_{load(driver)}$	180	W
p_a	1.16	kW

*Includes power transferred from driver stage.

AMPLIFIER FOR TELEVISION SERVICE, CLASS 'C'

Negative modulation, positive synchronisation.

OPERATING CONDITIONS for valve in common grid circuit

f	800	Mc/s
Bandwidth (-3dB)	6.0	Mc/s
P_{out} (sync)	2.7	kW
P_{load} (sync)	2.2	kW
V_{a-g1}	4.32	kV
V_{g2-g1}	600	V
V_{k-g1} (sync)	120	V
black	175	V
white	345	V
I_a (sync)	900	mA
black	680	mA
I_{g2} (sync)	15	mA
black	5.0	mA
I_{g1} (sync)	50	mA
black	35	mA
$P_{load\ (driver)}$ (sync)	220	W
Power gain	10	

U.H.F. POWER TETRODE QY3-1000A

LINEAR AMPLIFIER FOR TELEVISION SERVICE, CLASS 'AB_1' ←

Sound and vision

OPERATING CONDITIONS for valve in common grid circuit

f	790	Mc/s
Bandwidth (-1dB)	6.0	Mc/s
$p_{load(pk)}$	210	W
*Intermodulation products	-52	dB
V_{a-g1}	2.5	kV
V_{g2-g1}	500	V
**V_{k-g1}	28	V
$I_{a(o)}$	580	mA
$I_{a(max.sig.)}$	640	mA
I_{g2}	5.0	mA
I_{g1}	0	mA
†$p_{load(driver)pk}$	16	W

*The intermodulation product in the passband of the output signal is measured with reference to 0dB.

**Adjust to give the desired value of $I_{a(o)}$.

†The driver signal consists of three independent r.f. signal voltages

i.e. Picture carrier	-8dB	with respect to the sum
Sideband signal	-17dB	signal amplitude of the
Sound carrier	-7dB	composite signal

RATINGS (ABSOLUTE MAXIMUM SYSTEM) - Reference point for electrode voltages is g1 terminal

	Linear Amplifier, Class 'AB$_1$'	Television Class 'C'	Telegraphy Class 'C'	
f max.	1000	1000	1000	Mc/s
V_{a-g1} max.	3.0	4.5	4.5	kV
V_{g2-g1} max	700	700	700	V
V_{k-g1} max.	300	500	300	V
I_a max.	800	950	900	mA
p_a max.	1.5	1.5	1.5	kW
p_{g2} max.	50	50	50	W
I_{g1} max.	100	100	100	mA

CATHODE

Directly heated, thoriated tungsten

*V_f	4.0	V
I_f	60	A
I_f (surge) max.	150	A

*It may be necessary to adjust the filament voltage for optimum performance depending upon the operating condition and frequency. The filament connection must be carefully screened from high frequency sources.

CAPACITANCES

With filament earthed.

c_{a-g1}	150	mpF
c_{a-f+g2}	6.0	pF
$c_{g1-f+g2}$	46	pF

With g1 and g2 earthed

c_{a-g2}	7.0	pF
c_{a-f}	20	mpF
c_{g1-f}	20	pF

CHARACTERISTICS (measured at $V_a = 3.0$kV, $V_{g2} = 500$V, $I_a = 480$mA)

g_m	20 mA/V
μ_{g1-g2}	9.0

COOLING

Forced-air cooled

T_{anode} max. (measured at point indicated on page D7)	180	^{o}C
T_{seals} max.	200	^{o}C

The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea level. The airflow should be directed on the valve as shown on page D8. Typical values of inlet temperature, rate of airflow and pressure difference between the inlet and outlet of the radiator are given in the following table:-

Anode dissipation P_a (kW)	Height above sea level h (km)	(ft)	Max. inlet temperature T_{in} max. (^{o}C)	Min. rate of airflow per min. (m^3)	(ft^3)	Pressure difference between inlet and outlet of radiator (mm of water)
1.5	0	0	45	3.2	113	75

MOUNTING POSITION — Vertical, with anode up or down

PHYSICAL DATA

	lb	kg
Weight of valve only	4.19	1.9

OPERATING NOTE

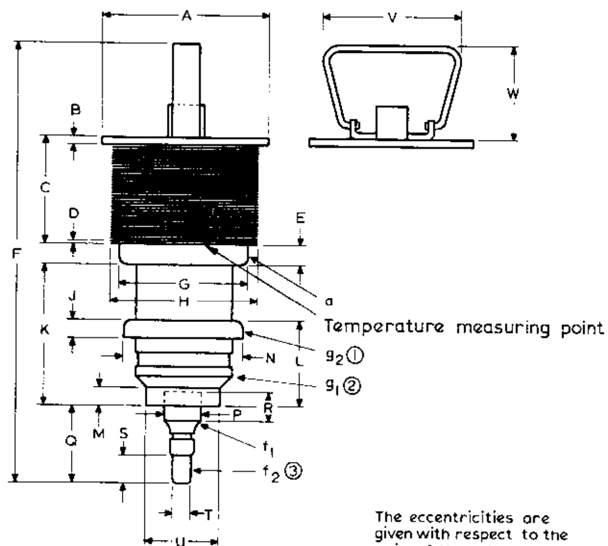
In a cathode driven v.h.f. amplifier circuit, a tunable coaxial circuit is incorporated between g1 and g2 which introduces a variable capacitive reactance between the grids. This results in increased efficiency and negligible feedback from anode to cathode in the amplifier circuit.

DIMENSIONS

	Inches	Millimetres	
A	3.50	89	dia
B	0.118	3.0	
C	2.17	55	
D	0.079	2.0	
E	0.374	9.5	min
F	8.46	215	max
G	2.756±0.012	70±0.3	dia
H	3.228±0.012	82±0.3	dia
J	0.355	9.0	min
K	2.913±0.039	74±1	
L	1.811±0.039	46±1	
M	0.374	9.5	min
N	2.520±0.012	64±0.3	dia
P	0.661±0.008	16.8±0.2	dia
Q	1.299±0.039	33±1	
R	0.374	9.5	min
S	0.52	13	min
T	0.358±0.008	9.1±0.2	dia
U	1.535±0.012	39±0.3	dia
V	2.48	63	
W	1.57	40	

Inch dimensions derived from original millimetre dimensions

U.H.F. POWER TETRODE **QY3-1000A**

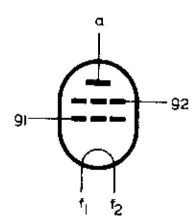


The eccentricities are given with respect to the axis of the valve.

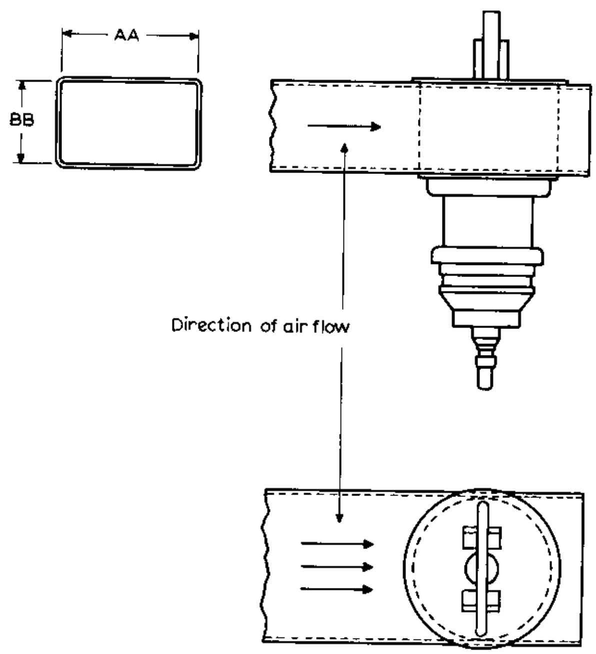
① Maximum eccentricity of screen grid=0·3mm

② Maximum eccentricity of control grid=0·4mm

③ Maximum eccentricity of filament connections = 0·8mm



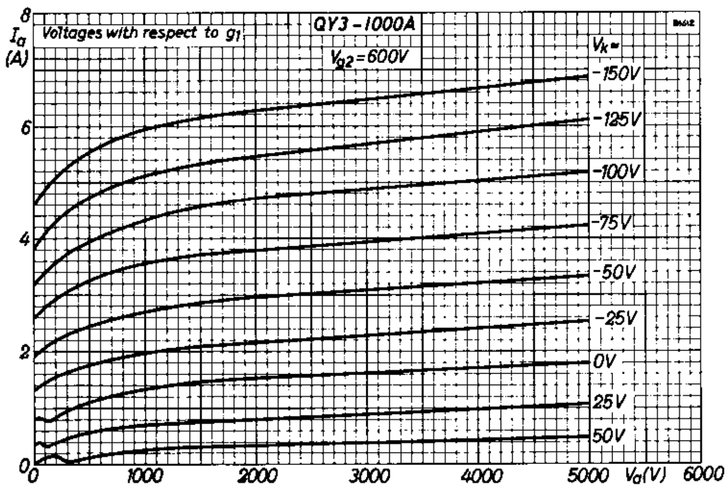
B5060

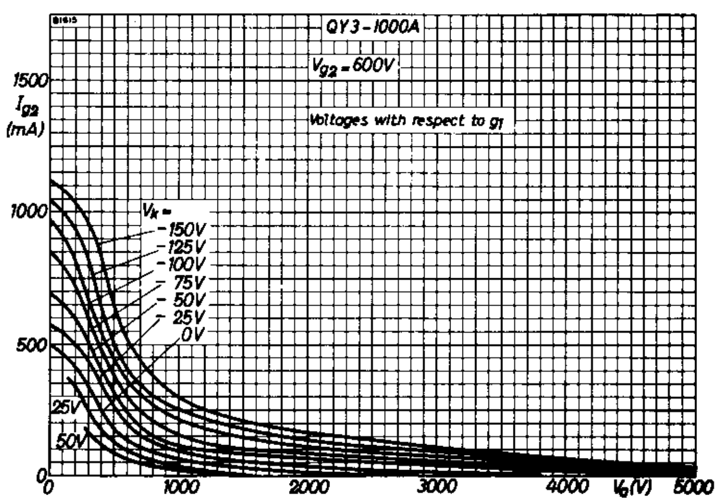


DIMENSIONS

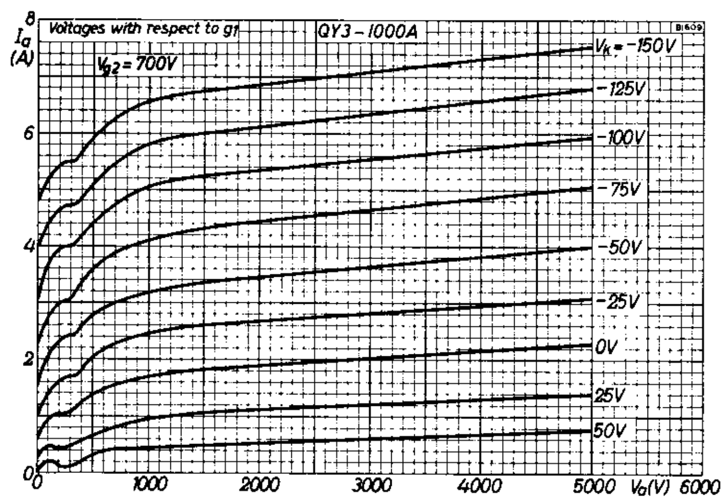
	Inches	Millimetres
AA	3.327	84.5
BB	1.97	50

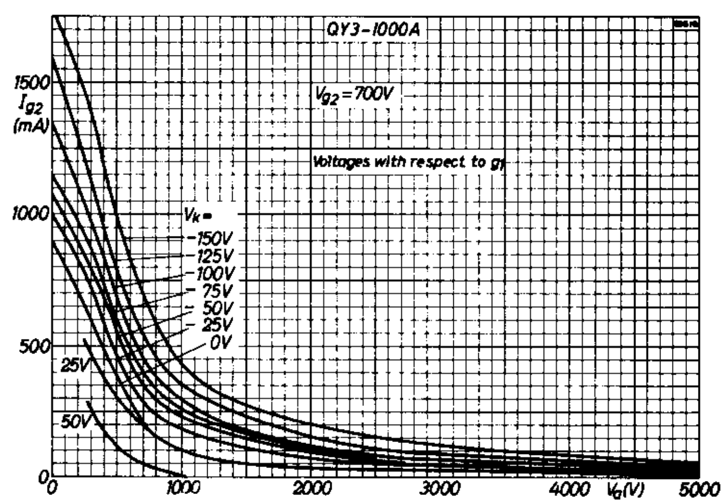
Inch dimensions derived from
original millimetre dimensions



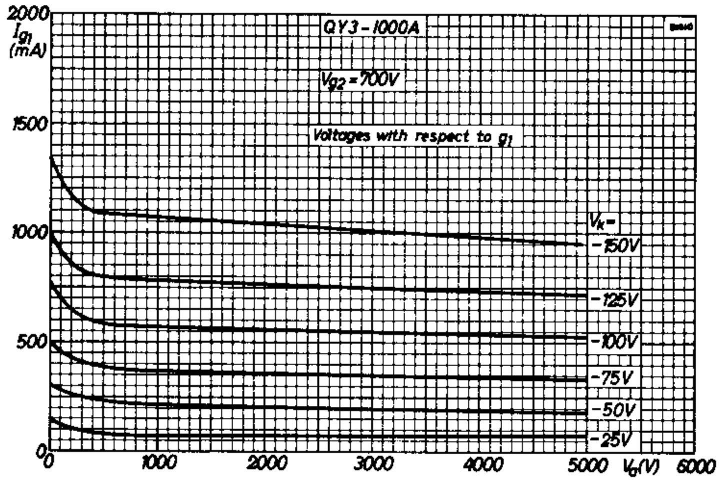


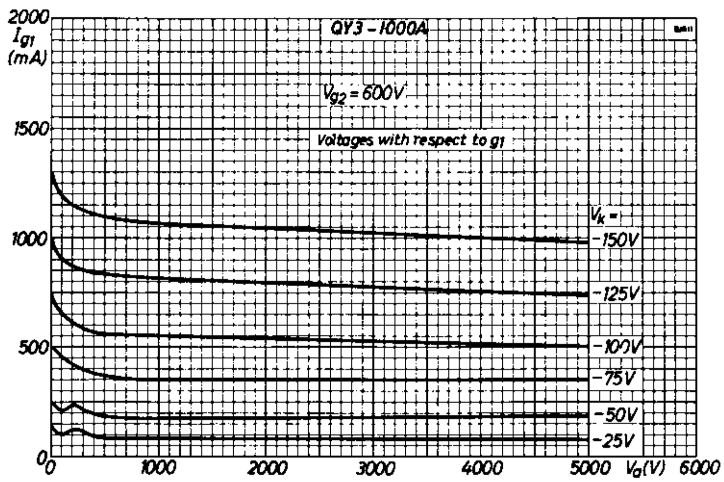
ANODE AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CATHODE VOLTAGE AS PARAMETER V_{g2} = 600V



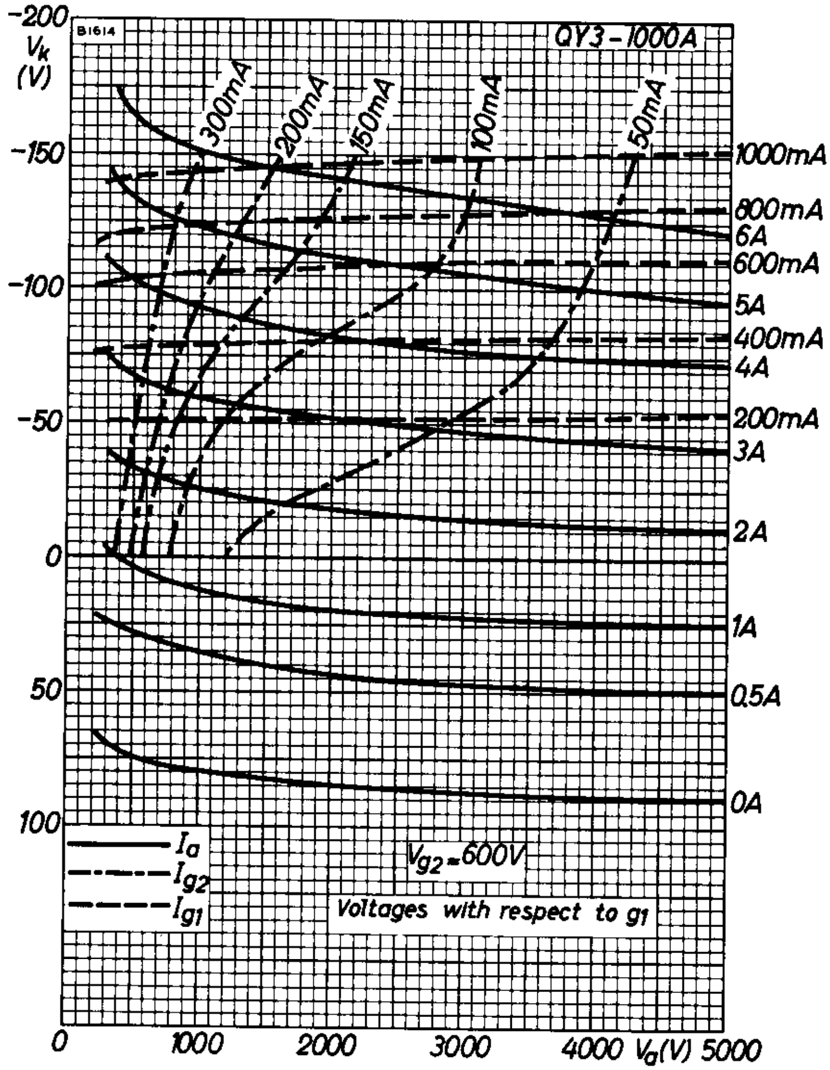


ANODE AND SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CATHODE VOLTAGE AS PARAMETER V_{g2} = 700V

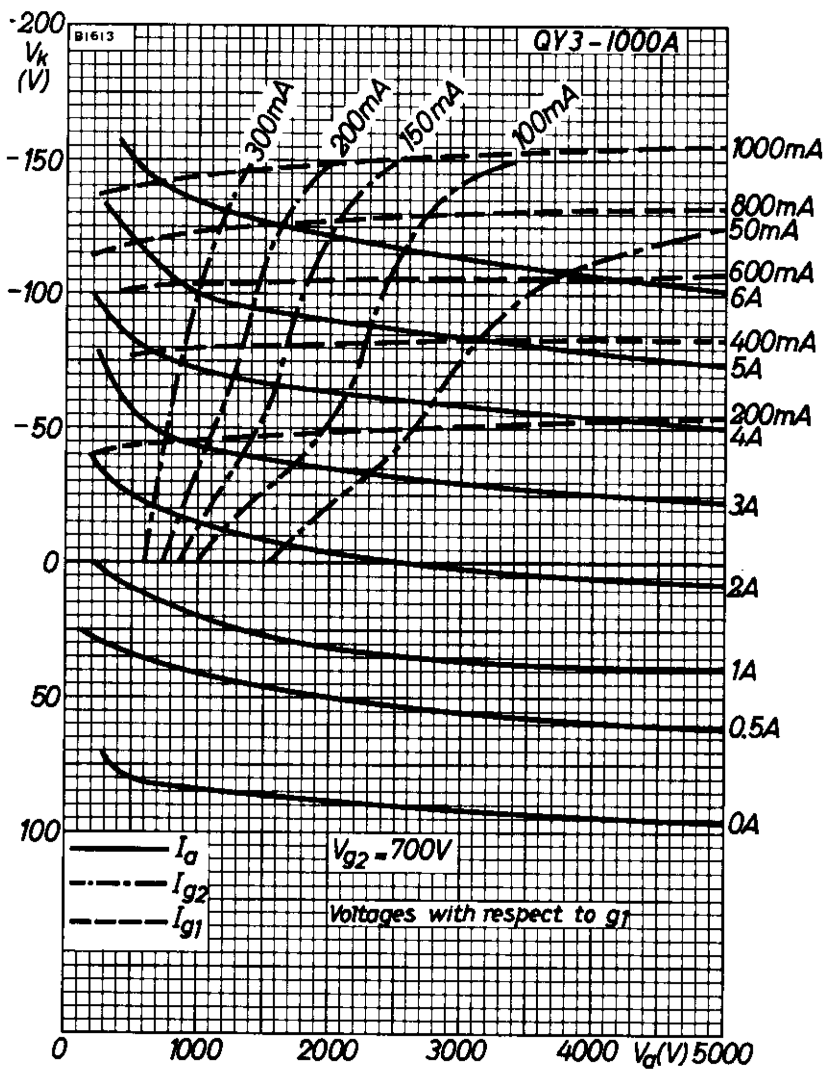




CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CATHODE VOLTAGE AS PARAMETER V_{g2} = 600V AND V_{g2} = 700V



CONSTANT CURRENT CHARACTERISTICS V_{g2} = 600V



CONSTANT CURRENT CHARACTERISTICS V_{g2} = 700V

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

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

FILAMENT Thoriated tungsten.

V_f	5.0	V
I_f	14.1	A

MOUNTING POSITION

Vertical base up or down.

CAPACITANCES

c_{in}	12.7	pF
c_{out}	4.5	pF
c_{a-g1}	0.12	pF

CHARACTERISTICS (measured at $I_a = 100mA$)

g_m	4.0	mA/V
μ_{g1-g2}	5.1	

COOLING

Max. temperature of anode seal	220	°C
Max. temperature of base seals	180	°C←
Max. bulb temperature	350	°C←

In order to keep within the temperature limits of the base seals, an← air flow of at least 5cu.ft./min. must be directed at the base and commence immediately the filament is energised.
A small movement of air over the envelope is generally sufficient to maintain the temperature of the anode seals below the limit when operating below 30Mc/s, but above this frequency it will be necessary to direct an air flow at the anode terminal.
An anode terminal connector of large surface area is necessary.

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.	250	W
V_{g2} max.	600	V
p_{g2} max.	35	W
p_{g1} max.	10	W
I_k max.	420	mA
$i_{k(pk)}$ max.	2.2	A
R_{g1-f} max.	250	kΩ

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

Typical operation at f≤75 Mc/s

V_a	2.5	3.0	4.0	kV
V_{g2}	500	500	500	V
V_{g1}	−150	−180	−225	V
I_a	300	345	312	mA
I_{g2}	60	60	45	mA
I_{g1}	9.0	10	9.0	mA
$v_{in(pk)}$	220	265	303	V←
$P_{load(driver)}$	2.1	2.8	3.0	W←
p_a	175	235	248	W
p_{g2}	30	30	22.5	W
P_{out}	575	800	1,000	W
$*P_{load}$	460	640	800	W
η	77	77	80	%

*With a circuit transfer efficiency of 80%.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" TELEPHONY, ANODE AND SCREEN GRID MODULATION)

Limiting values (carrier conditions for modulation factor of 1)

V_a max.	3.2	kV←
p_a max.	165	W←
V_{g2} max.	600	V
p_{g2} max.	35	W
p_{g1} max.	10	W
I_k max.	270	mA
$i_{k(pk)}$ max.	2.6	A
R_{g1-f} max.	250	kΩ

Typical operation at f≤75 Mc/s

V_a	2.5	3.0	kV
V_{g2}	400	400	V
V_{g1}	−200	−310	V
I_a	200	225	mA
I_{g2}	30	30	mA
I_{g1}	9.0	9.0	mA
$v_{in(pk)}$	280	400	V←
$P_{load(driver)}$	2.7	3.9	W←
p_a	125	165	W
p_{g2}	12	12	W
P_{out}	375	510	W
$*P_{load}$	300	410	W
η	75	75.5	%
For 100% modulation			
$P_{mod.}$	256	344	W
$v_{g2(pk)\ mod.}$	350	350	V

*With a circuit transfer efficiency of 80%.

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "B" TELEPHONY)

Limiting values (carrier condition for a modulation factor of 1)

V_a max.	4.0	kV
p_a max.	250	W
V_{g2} max.	600	V
p_{g2} max.	23	W←
p_{g1} max.	6.5	W←
I_k max.	200	mA
$i_{k(pk)}$ max.	1.5	A
R_{g1-f} max.	250	kΩ

Typical operation at f≤75 Mc/s

Unmodulated				
V_a	2.5	3.0	4.0	kV
V_{g2}	500	500	500	V
V_{g1}	−84	−90	−100	V
I_a	150	125	94	mA
I_{g2}	0	0	0	mA
$v_{in(pk)}$	66	61	56	V
p_a	250	250	250	W
P_{out}	125	125	126	W
*P_{load}	100	100	100	W
η	33	33	33.5	%
Modulated 100%				
I_{g1}	5.5	2.0	0.5	mA
$P_{load(driver)}$	1 0	0.4	0.25	W←
p_{g2}	6.0	3.8	4.0	W

*With a circuit transfer efficiency of 80%.

OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL AS CLASS "B" A.F. POWER AMPLIFIER OR MODULATOR

Limiting values

V_a max.	4.0	kV
p_a max.	250	W
V_{g2} max.	600	V
p_{g2} max.	35	W
p_{g1} max.	10	W
I_k max.	450	mA
$i_{k(pk)}$ max.	1.5	A
R_{g1-f} max.	250	kΩ

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

Typical operation (without I_{g1})

V_a	1.5	2.0	2.5	3.0	kV
V_{g2}	500	500	500	500	V
V_{g1}	−85	−88	−91	−94	V
$I_{a(o)}$	2×50	2×50	2×50	2×50	mA
I_a (max. sig.)	2×150	2×150	2×155	2×155	mA
I_{g2} (max. sig.)	2×15	2×14	2×10	2×10	mA
$V_{in(g1-g1)\ r.m.s.}$	117	122	126	130	V
p_a	2×91	2×105	2×132	2×147	W
P_{out}	268	390	510	635	W
R_{a-a}	10	14.5	18	22	kΩ
η	60	65	66	68	%
D_{tot}	3.0	3.2	2.6	2.8	%

Typical operation (with I_{g1})

V_a	1.5	2.0	2.5	3.0	kV
V_{g2}	300	300	300	300	V
V_{g1}	−45	−49	−51	−55	V
$I_{a(o)}$	2×50	2×50	2×50	2×50	mA
I_a (max. sig.)	2×347	2×347	2×312	2×275	mA
I_{g2} (max. sig.)	2×58	2×55	2×44	2×34.5	mA
I_{g1}	2×28	2×27	2×21	2×15	mA
$V_{in(g1-g1)\ r.m.s.}$	228	232	216	198	V
P_{drive}	2×4.0	2×4.0	2×2.9	2×1.9	W
p_a	2×190	2×207	2×210	2×205	W
P_{out}	660	974	1,140	1,240	W
R_{a-a}	4.55	6.6	9.2	14	kΩ
η	63.5	70	73	75	%
D_{tot}	5.0	5.0	5.0	5.0	%

OPERATING CONDITIONS AS SINGLE SIDE BAND CLASS "B" R.F. AMPLIFIER

Limiting values

V_a max.	4.0	kV
p_a max. (max. averaging time = 5s)	250	W
p_a max. (during modulation cycle)	275	W
V_{g2} max.	600	V
p_{g2} max.	35	W
I_a max.	350	mA
R_{g1-f} max.	250	kΩ

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

Typical operation at f = 30Mc/s

V_a	2.5	3.0	3.5	4.0	kV
V_{g2}	500	500	500	500	V
V_{g1}	−91	−94	−98	−105	V
$I_{a(o)}$	50	50	50	50	mA
I_a (single tone)	164	164	164	164	mA
I_a (two tone)	118	118	118	118	mA
$I_{g2(o)}$	0	0	0	0	mA
I_{g2} (max. signal)	10.5	10	9.0	8.0	mA
$v_{in(pk)}$	91	94	98	105	V
p_a (max. signal)	140	157	175	200	W
p_{g2} (max. signal)	5.3	5.0	4.5	4.0	W
P_{out} (single tone)	270	333	400	460	W
η	66	68	69	70	%

V_a	3.5	4.0	kV
V_{g2}	600	550	V
V_{g1}	−110	−105	V
$I_{a(o)}$	50	50	mA
I_a (single tone)	207	182	mA
I_a (two tone)	145	128	mA
$I_{g2(o)}$	0	0	mA
I_{g2} (max. signal)	12	9	mA
$v_{in(pk)}$	110	105	V
p_a (max. signal)	235	220	W
p_{g2} (max. signal)	7.2	5.0	W
P_{out} (single tone)	490	510	W
η	67	69	%

CIRCUIT NOTES

1. The r.f. circuit returns must be brought to the filament connection on pin No. 1.
2. To ensure equal distribution of the currents through the seals the g_2 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.

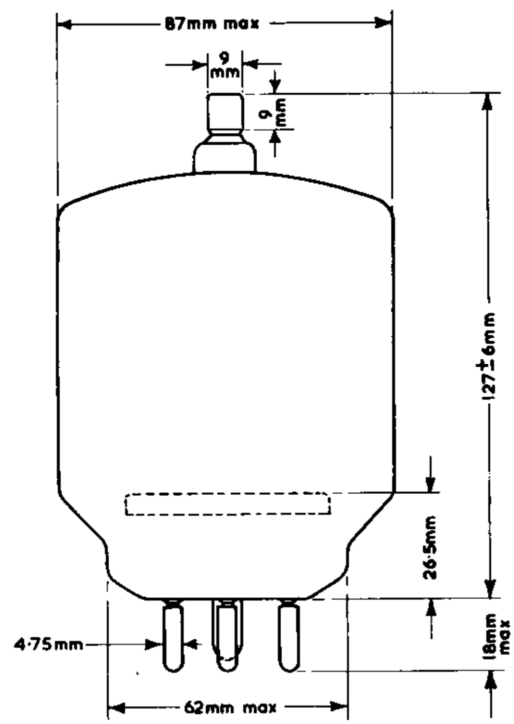
WEIGHT

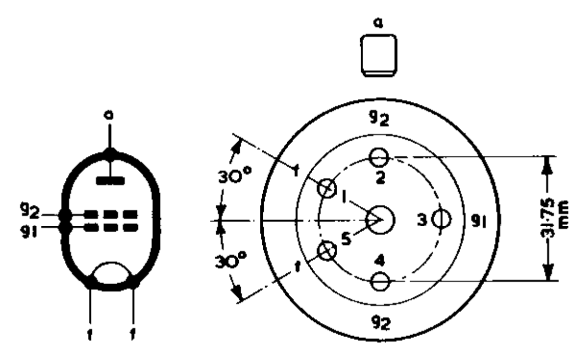
$\begin{cases} 6 & \text{oz} \\ 180 & \text{g} \end{cases}$

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



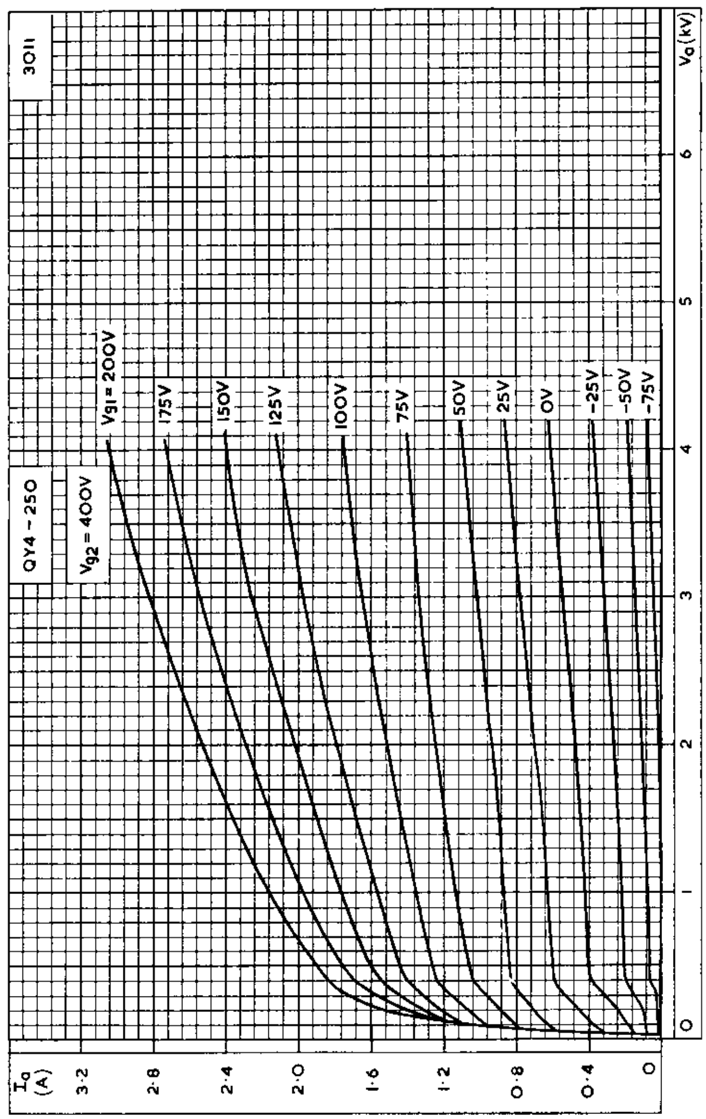


B5F Base

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

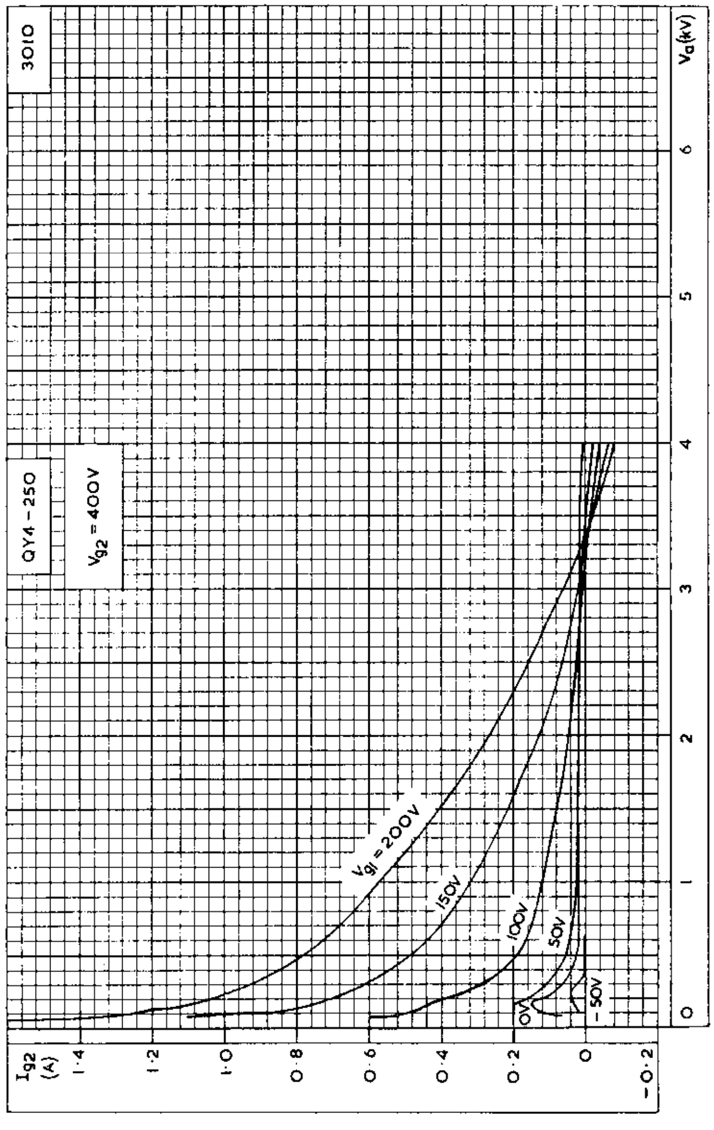


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2}—400V

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

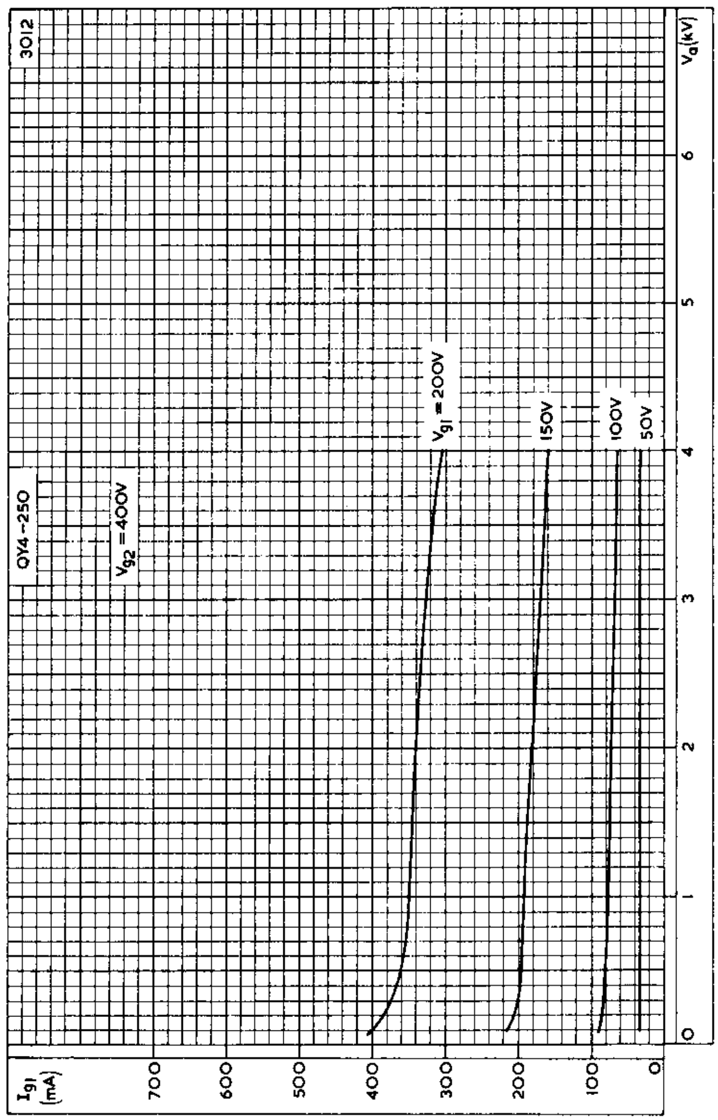


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2} = 400V

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

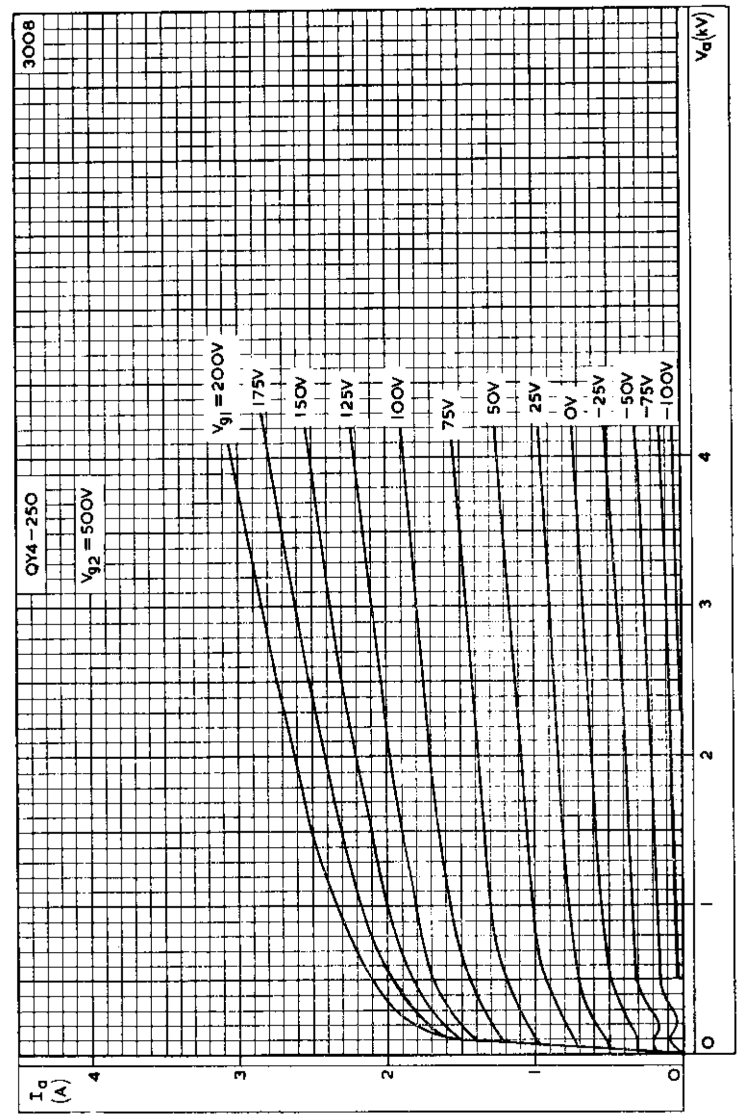


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2} = 400V

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

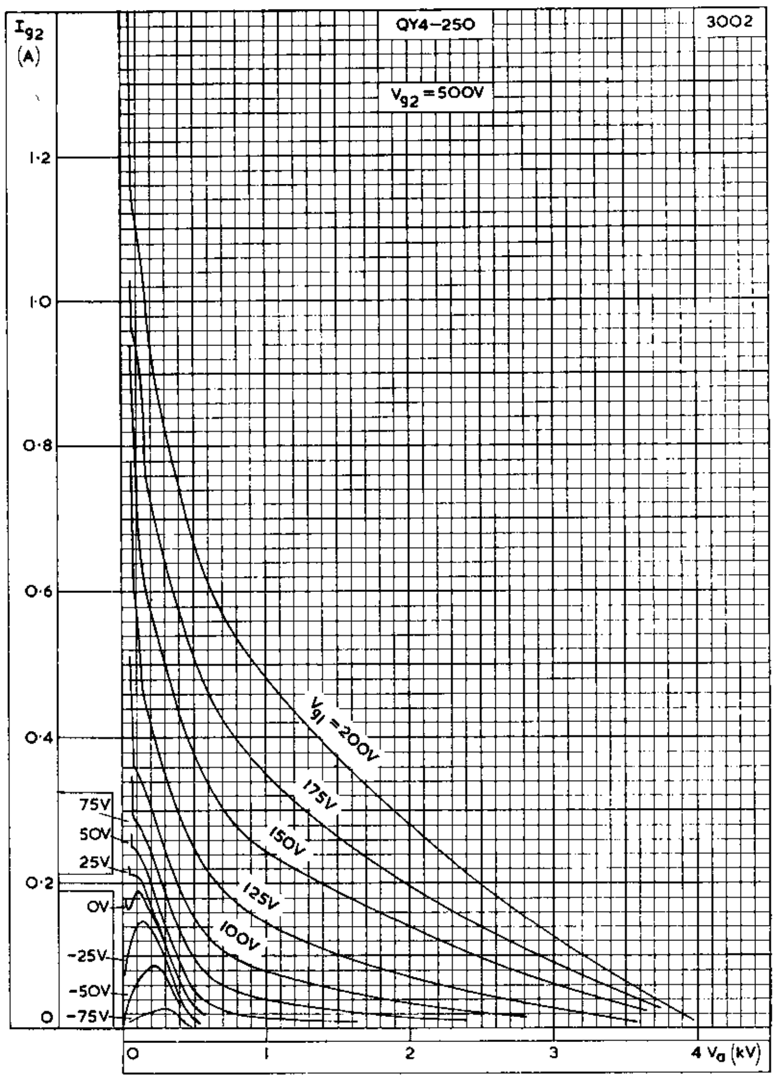


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2} 500V

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

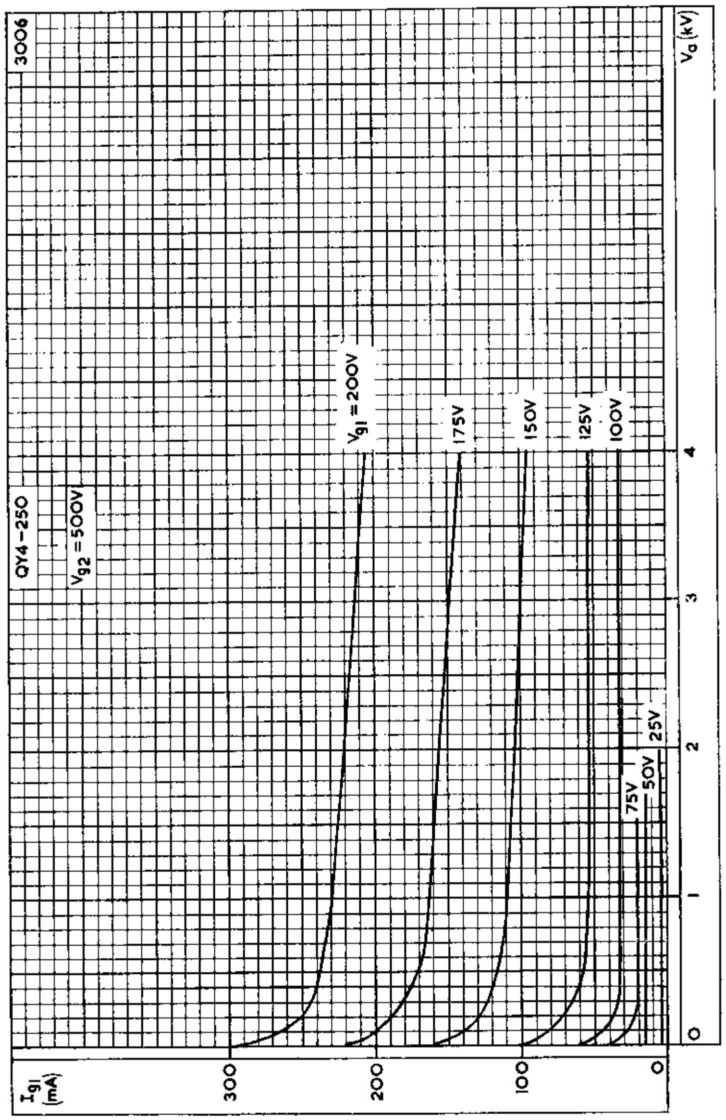


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2} = 500V

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

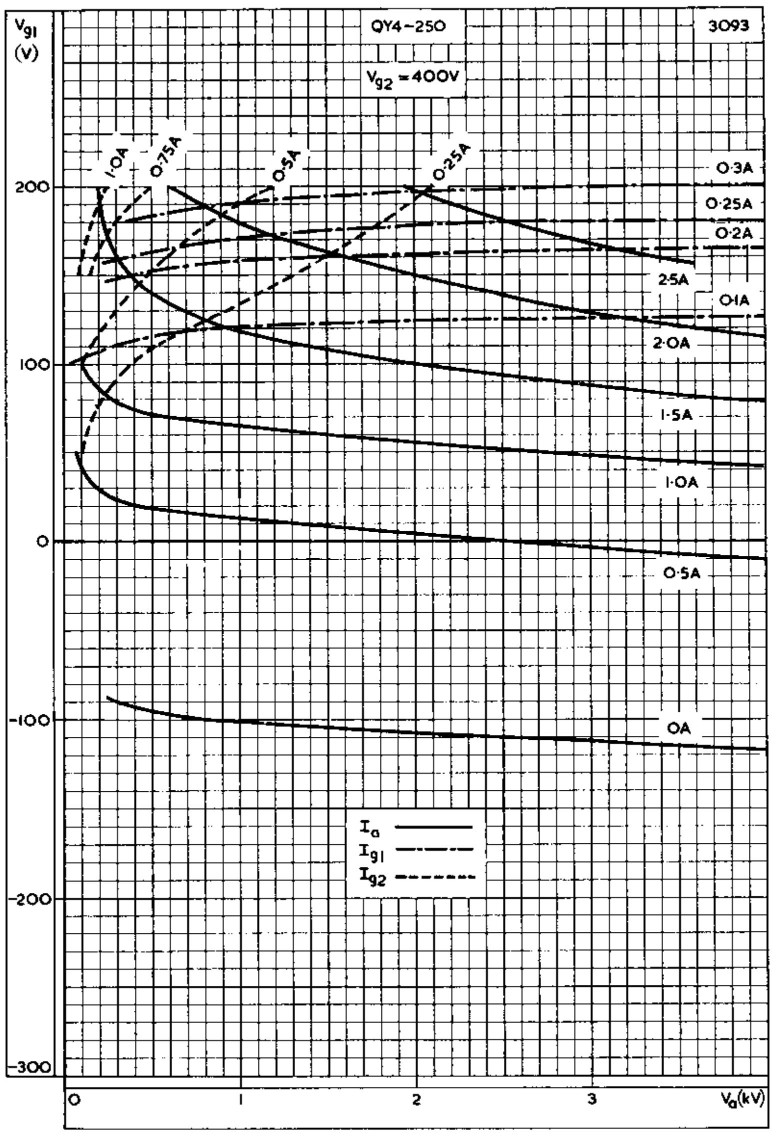


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2} -500V

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

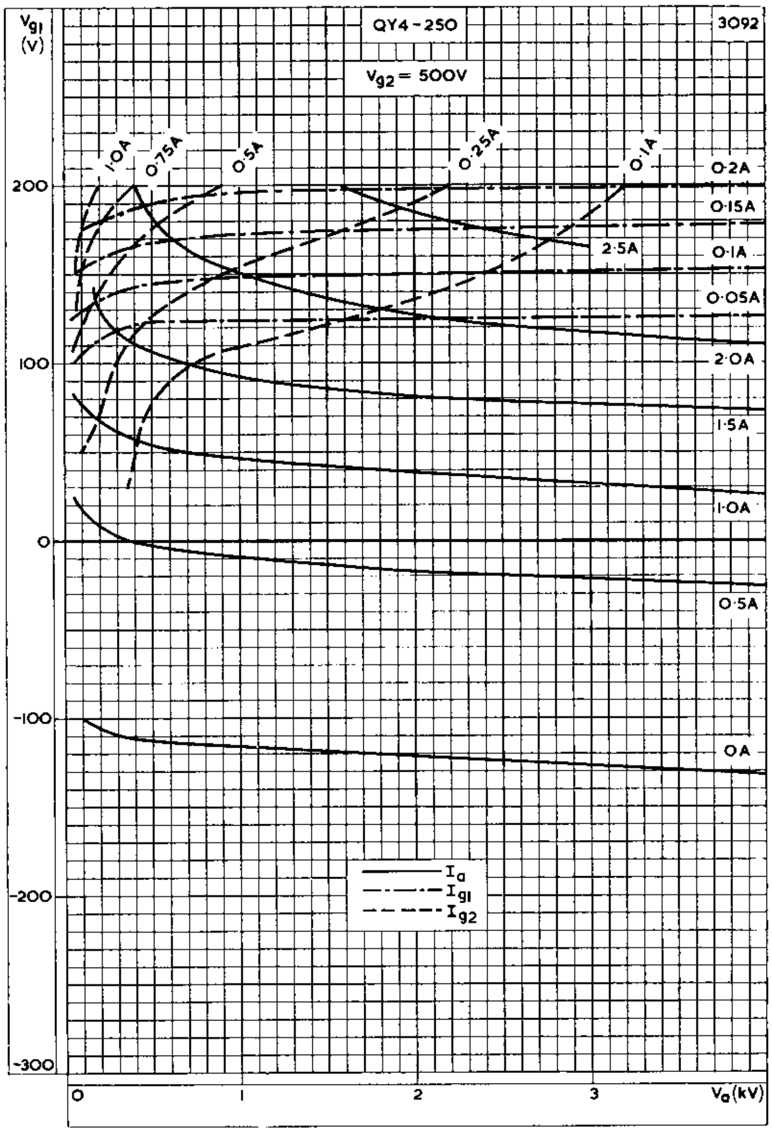


CONSTANT CURRENT CURVES FOR V_{g2} 400V

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

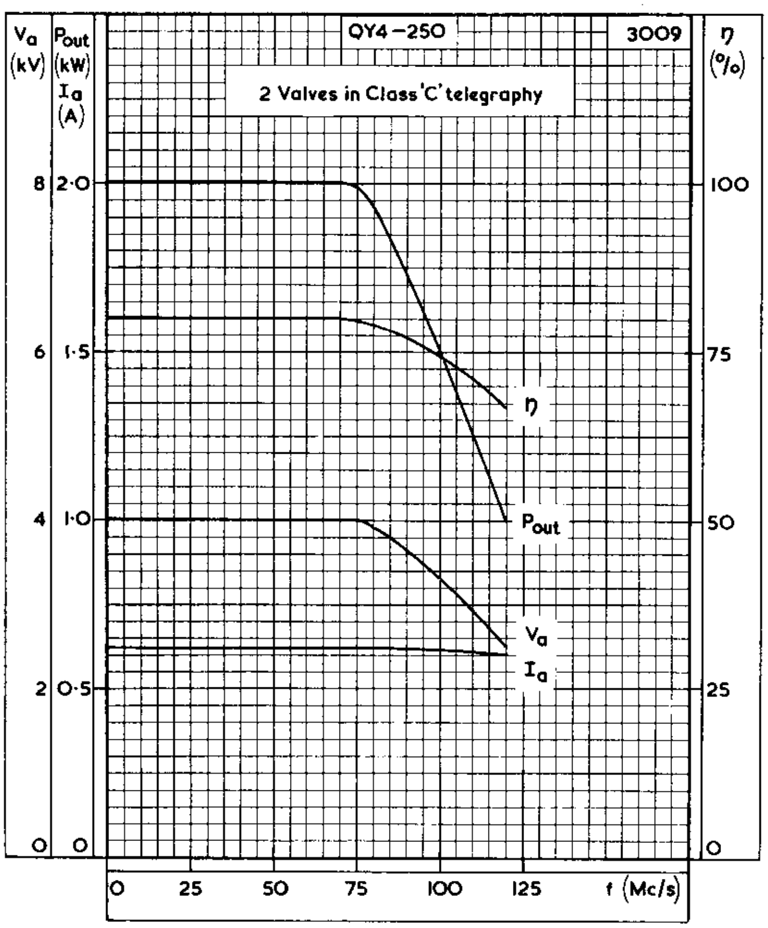


CONSTANT CURRENT CURVES FOR V_{g2} = 500V

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

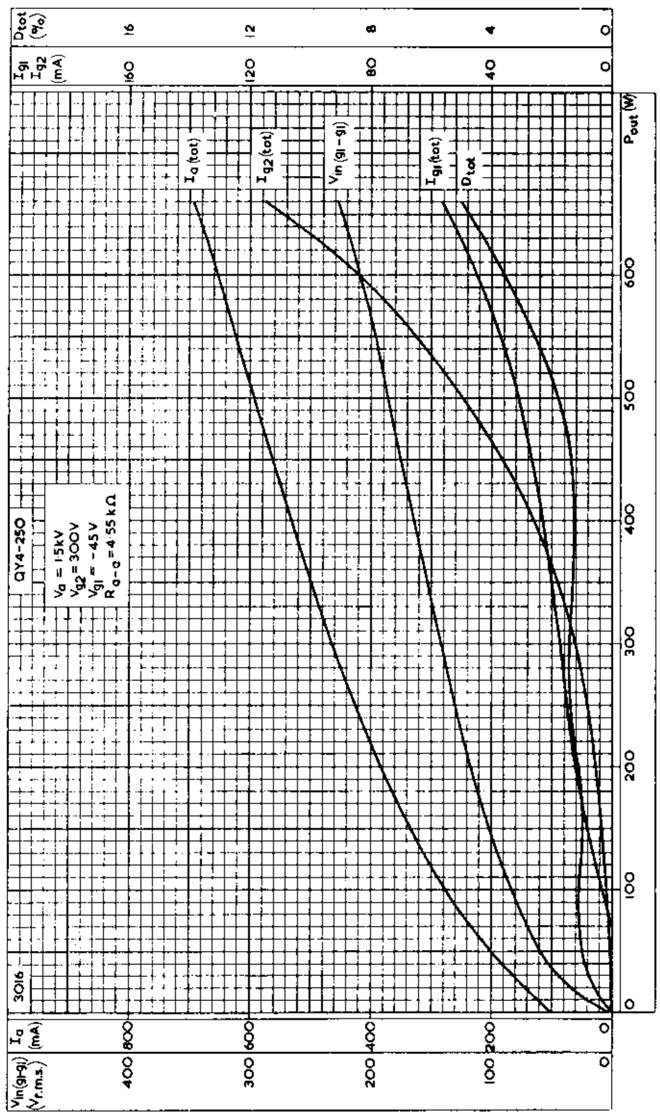


FREQUENCY CHARACTERISTICS

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

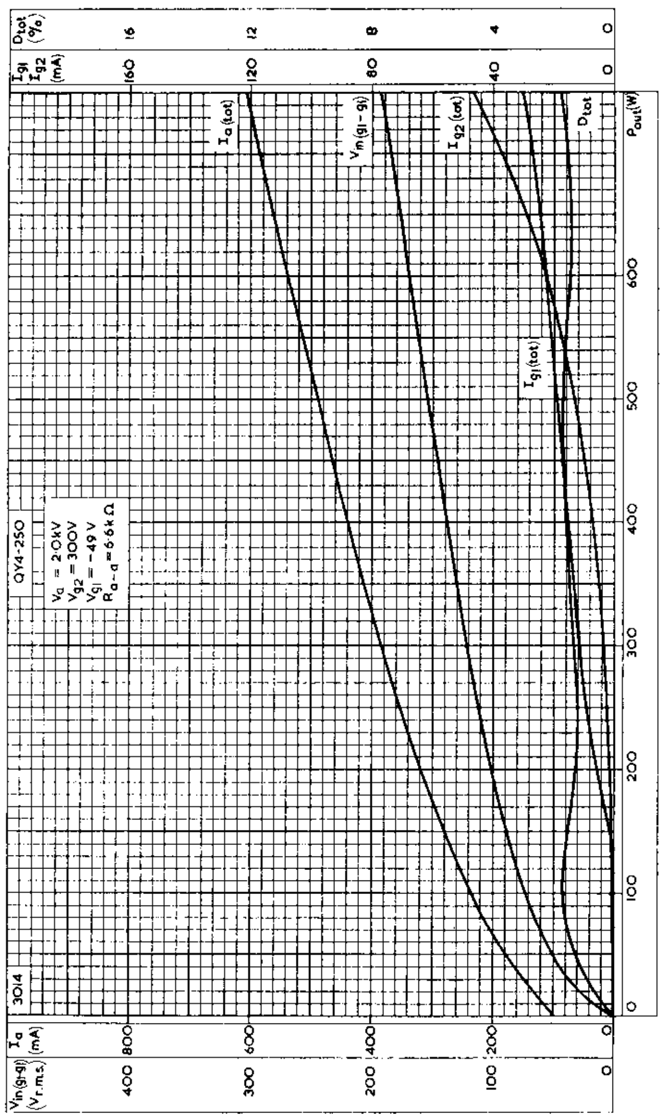


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. V_a=1.5kV

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

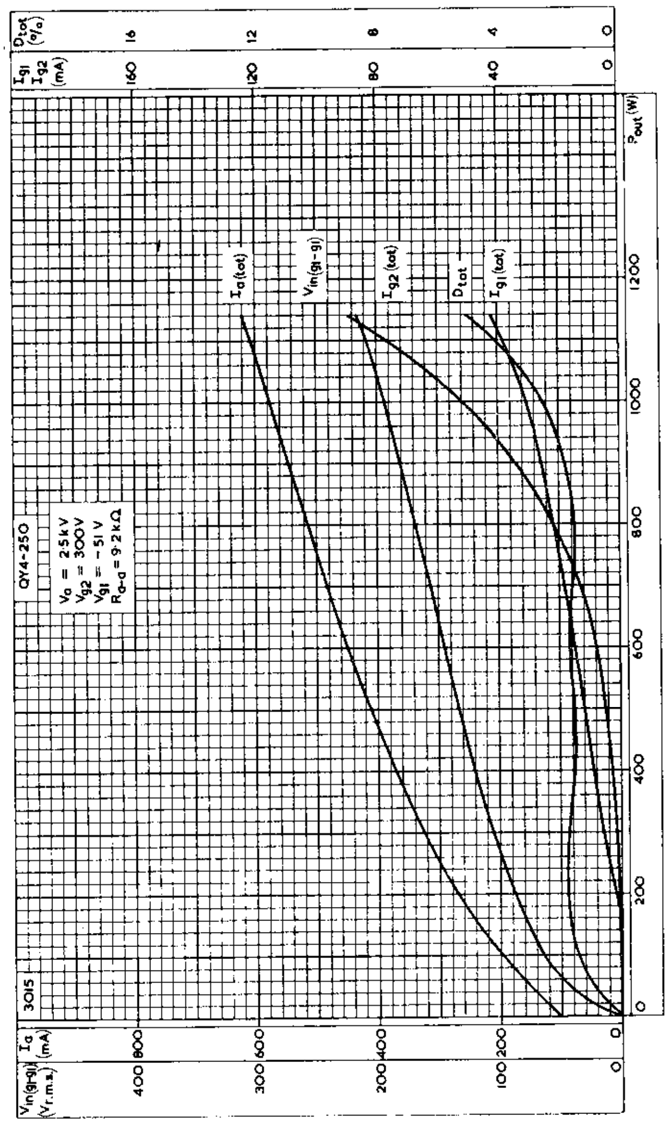


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. $V_a = 2.0kV$

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

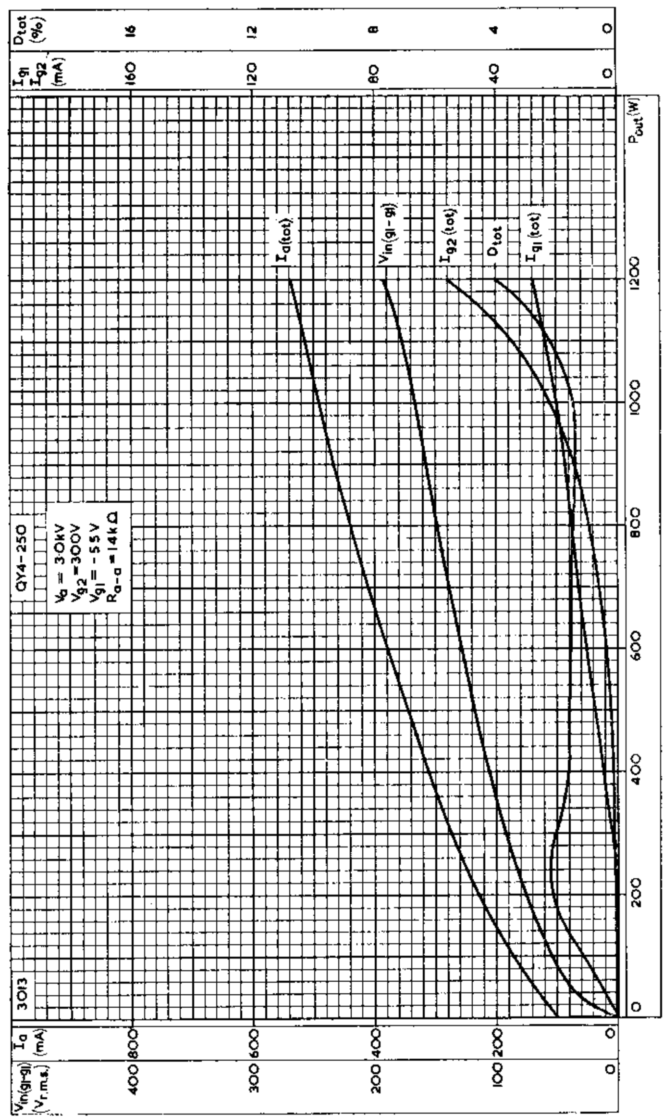


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. $V_a - 2.5kV$

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

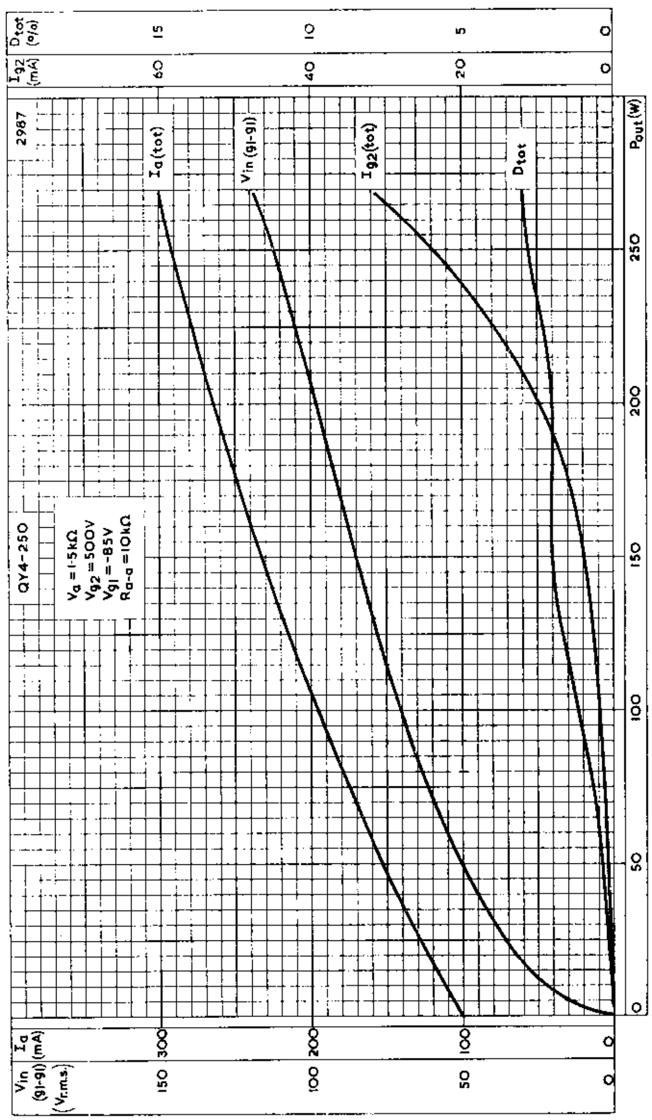


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. V_a 3.0kV

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

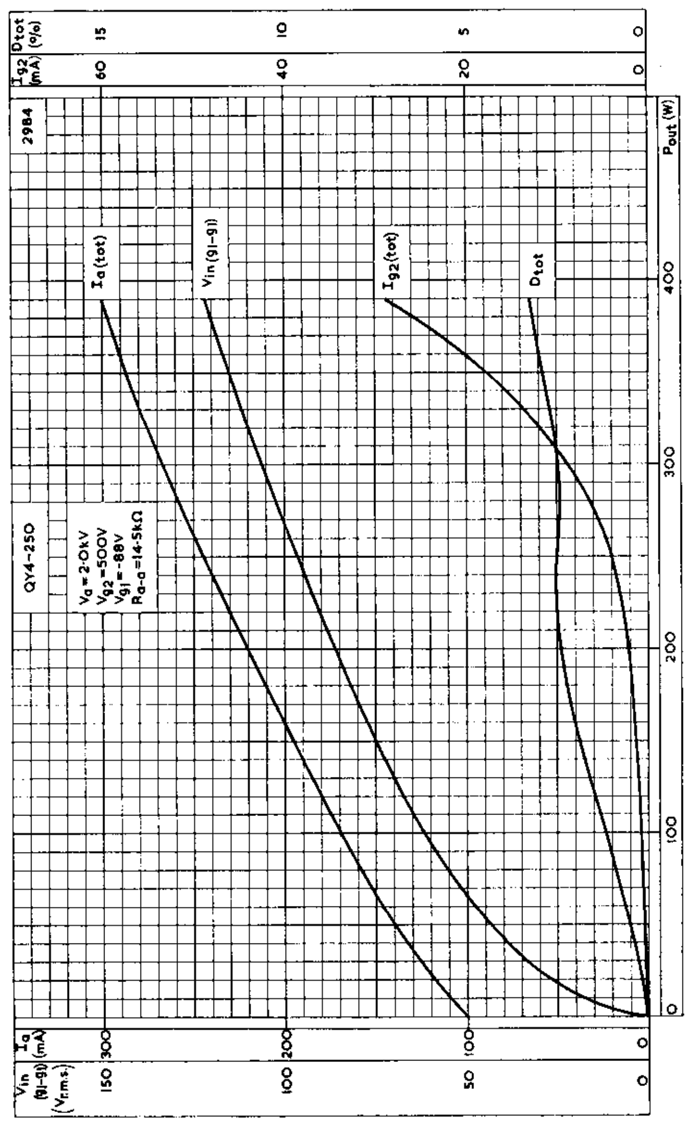


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER. $V_a = 1.5kV$

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

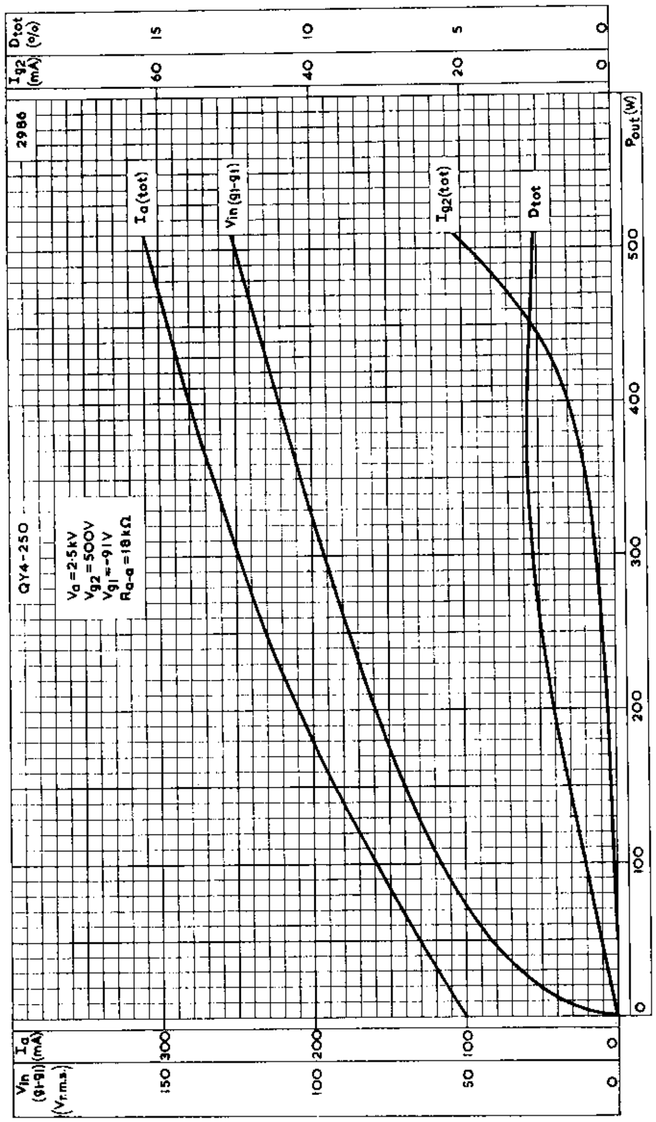


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER. V_a 2.0kV

QY4-250

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

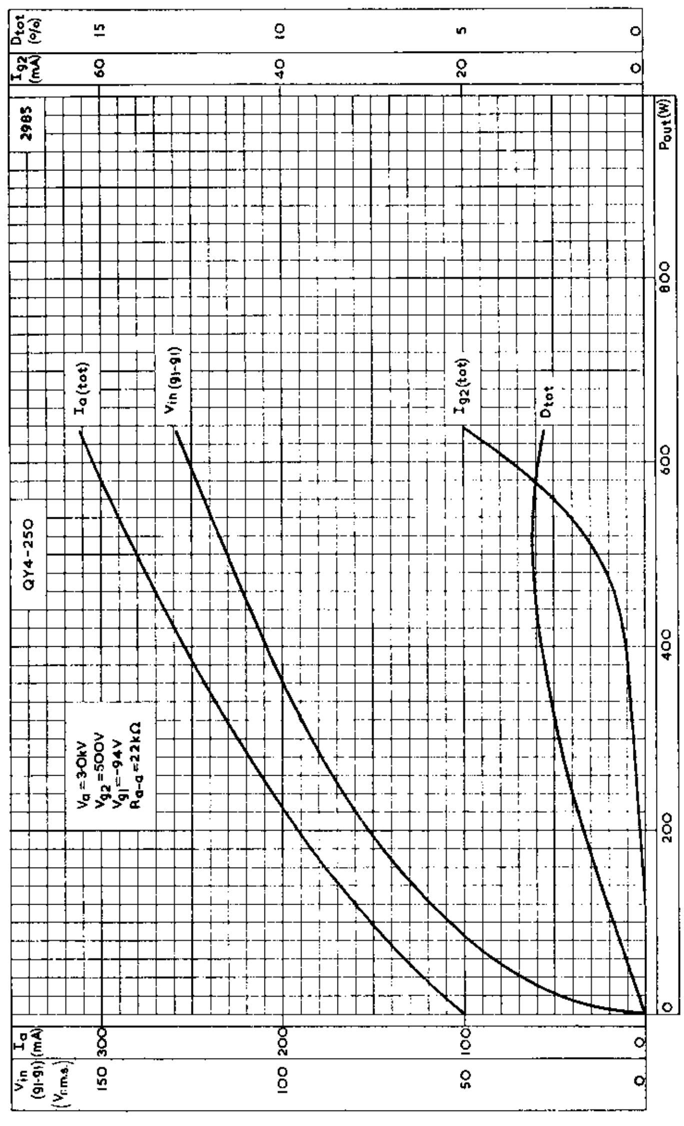


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER V_a = 2.5kV

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



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

BEAM POWER TETRODE QY4-400

QUICK REFERENCE DATA

Forced-air cooled beam power tetrode suitable for use as power amplifier, oscillator or modulator.

	Class 'B' Linear Amplifier for S.S.B. operation	Class 'C' Telephony Anode and Screen Grid Modulation	Class 'C' Telegraphy or F.M. Telephony	
f	60	75	100	Mc/s
P_{out}	*650	630	800	W
f max.	110	75	110	Mc/s
V_a max.	4.0	3.2	4.0	kV
p_a max.	400	270	400	W

* P.E.P_{out}

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Maximum operating conditions

f	<75	<75	<75	100	100	Mc/s
P_{out}	640	800	1100	650	800	W
P_{load}	550	680	940	520	640	W
η_a	73	76	79	74	74	%
V_a	2.5	3.0	4.0	3.5	4.0	kV
I_a	350	350	350	250	270	mA
V_{g2}	500	500	500	500	500	V
I_{g2}	35	30	25	17	16	mA
$-V_{g1}$	200	220	220	170	170	V
I_{g1}	6.5	6.0	6.0	9.0	10	mA
$v_{in (pk)}$	290	305	305	235	240	V
P_{load} (driver)	12	12	12	20	20	W
p_a	235	250	300	225	280	W
p_{g2}	17.5	15	12.5	8.5	8.0	W

CLASS 'C' TELEPHONY ANODE AND SCREEN-GRID MODULATION

Maximum operating conditions

	C.C.S.			I.C.A.S.	
f	75	75	75	30	Mc/s
P_{out}	380	510	630	765	W
P_{load}	324	435	540	650	W
η_a	69	74	76	77	%
V_a	2.0	2.5	3.0	3.65	kV
I_a	275	275	275	275	mA
V_{g2}	500	500	500	500	V
I_{g2}	40	38	36	30	mA
$-V_{g1}$	220	220	220	225	V
I_{g1}	6.0	6.0	6.0	6.0	mA
$v_{in(pk)}$	305	308	305	308	V
P_{load} (driver)	3.5	3.5	3.5	-	W
p_a	170	178	195	235	W
p_{g2}	20	19	18	15	W
For 100% modulation					
P_{mod}	275	344	413	500	W
$v_{g2\,(pk)}$	400	400	400	400	V

CLASS 'B' LINEAR AMPLIFIER FOR SINGLE SIDEBAND OPERATION

Maximum operating conditions at $I_{a(o)} = 90mA$

f	60	Mc/s
$P.E.P_{out}$	500	W
$P.E.P_{load}$	425	W
$**d_3$	36	dB
$**d_5$	42	dB
V_a	3.0	kV
V_{g2}	810	V
$***-V_{g1}$	140	V
$I_{a(o)}$	90	mA
$I_{g2(o)}$	0	mA

	Single tone	Double tone	
I_a	300	215	mA
I_{g2}	15	11	mA
I_{g1}	0	0	mA
$v_{in(pk)}$	140	-	V
P_{load} (driver)	3.0	-	W
p_a	400	395	W
η_a	56	39	%

Maximum operating conditions at $I_{a(o)}$ = 75mA

f		60	Mc/s
P.E. P_{out}		600	W
P.E. P_{load}		510	W
**d_3		36	dB
**d_5		40	dB
V_a		3.5	kV
V_{g2}		750	V
***$-V_{g1}$		135	V
$I_{a(o)}$		75	mA
$I_{g2(o)}$		0	mA
	Single tone	Double tone	
I_a	280	200	mA
I_{g2}	12	8.4	mA
I_{g1}	0	0	mA
$v_{in(pk)}$	135	-	V
P_{load} (driver)	3.0	-	W
p_a	380	400	W
η_a	61	43	%

Maximum operating conditions at $I_{a(o)} = 65mA$

f		60	Mc/s
P.E. P_{out}		650	W
P.E. P_{load}		550	W
$**d_3$		34	dB
$**d_5$		40	dB
V_a		4.0	kV
V_{g2}		705	V
$***-V_{g1}$		130	V
$I_{a(o)}$		65	mA
$I_{g2(o)}$		0	mA
	Single tone	Double tone	
I_a	250	175	mA
I_{g2}	10	7.0	mA
I_{g1}	0	0	mA
$v_{in\ (pk)}$	130	-	V
P_{load} (driver)	3.0	-	W
p_a	350	375	W
η_a	65	47	%

**Third and fifth order intermodulation products.
Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two tones at that level.

***Adjust to give the desired value of $I_{a(o)}$.

CLASS 'AB2' AUDIO AMPLIFIER

Maximum operating conditions for two valves in push-pull

P_{out}	1.11	1.38	1.65	1.75	kW
R_{a-a}	9.0	10	11.3	15	kΩ
V_a	2.5	3.0	3.5	4.0	kV
V_{g2}	500	500	500	500	V
**$-V_{g1}$	75	80	85	90	V
$I_{a(o)}$	2 x 95	2 x 90	2 x 80	2 x 80	mA
I_a (max. sig)	2 x 350	2 x 350	2 x 350	2 x 319	mA
I_{g2} (max. sig)	2 x 30	2 x 20	2 x 20	2 x 20	mA
I_{g1}	2 x 7.0	2 x 6.5	2 x 6.5	2 x 6.0	mA
$V_{in\ (g1-g1)\ r.m.s.}$	205	205	215	215	V
P_{load} (driver)	8.6	9.0	10.2	7.0	W
p_a	2 x 320	2 x 362	2 x 400	2 x 400	W
η_a	64	66	68	69	%

CLASS 'AB1' AUDIO AMPLIFIER

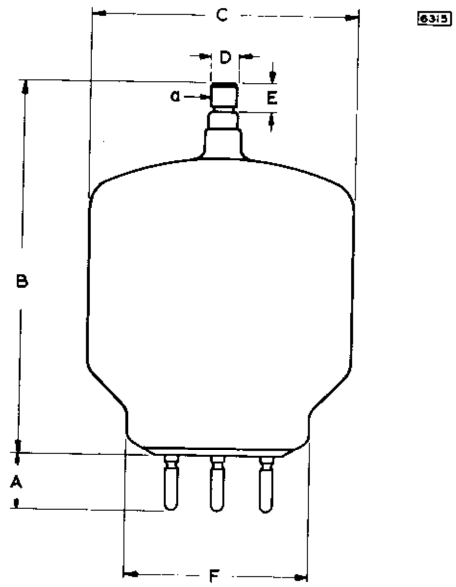
Maximum operating conditions for two valves in push-pull

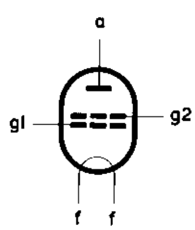
P_{out}	0.85	1.11	1.33	1.54	kW
R_{a-a}	6.8	8.9	11.5	14.5	kΩ
V_a	2.5	3.0	3.5	4.0	kV
V_{g2}	750	750	750	750	V
**$-V_{g1}$	130	137	145	150	V
$I_{a(o)}$	2 x 95	2 x 80	2 x 70	2 x 60	mA
I_a (max. sig)	2 x 318	2 x 318	2 x 305	2 x 293	mA
I_{g2} (max. sig)	2 x 11.6	2 x 11	2 x 13.5	2 x 15	mA
$V_{in\ (g1-g1)\ r.m.s.}$	184	194	205	212	V
p_a	2 x 370	2 x 400	2 x 400	2 x 400	W
η_a	54	58	63	66	%

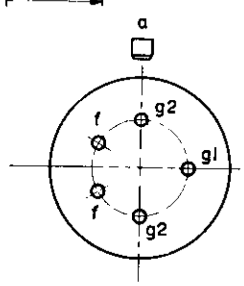
**Adjust to give the desired value of $I_{a(o)}$.

BEAM POWER TETRODE

QY4-400

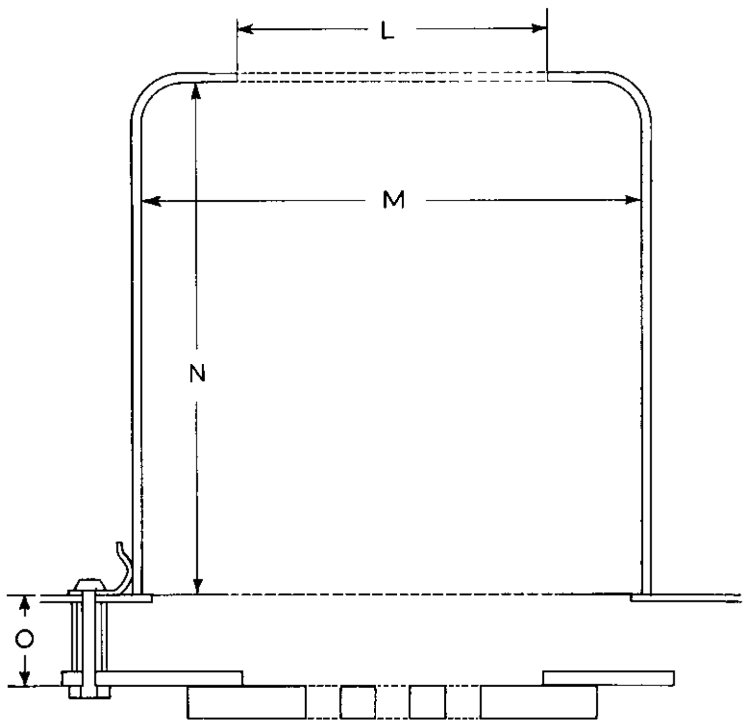






B5F Base

(According to B.S.448)



Glass chimney
All dimensions in mm

6451

DIMENSIONS OF GLASS CHIMNEY

	Inches	Millimetres
L	2.441	62
M	3.937	100
N	4.016	102
O	0.709	18

Inch dimensions derived from original millimetre dimensions

BEAM POWER TETRODE QY4-400

ABSOLUTE MAXIMUM RATINGS

	Class 'AB1' or 'AB2' audio	Class 'B' S.S.B.	Class 'C' Telephony C.C.S.	Class 'C' Telephony I.C.A.S.	Class 'C' Telegraphy	
f max.	-	110	75	30	110	Mc/s
V_a max.	4.0	4.0	3.2	4.0	4.0	kV
V_{g2} max.	*800	850	600	600	600	V
$-V_{g1}$ max.	-	-	500	500	500	V
I_k max.	400	400	330	330	420	mA
p_a max.	400	400	270	270	400	W
p_{g2} max.	35	35	35	35	35	W
I_{g1} max.	25	-	25	25	25	mA
p_{g1} max.	10	-	10	10	10	W
R_{g1-f} max.	250	250	50	50	50	kΩ

*This can be increased to 1.0kV if $T_{base-seals} < 120^{\circ}C$.

CATHODE

Directly heated, thoriated tungsten

V_f	5.0	V
I_f	14.1	A

CAPACITANCES

c_{a-g1}	120	mpF
c_{out}	4.9	pF
c_{in}	12.7	pF

CHARACTERISTICS (measured at V_a=2.5kV, V_{g2}=500V, I_a=100mA)

g_m	4.0	mA/V
μ_{g1-g2}	5.1	

MOUNTING POSITION

Vertical, base up or down

COOLING

Forced-air

Maximum temperatures

Anode seal	220	^{o}C
Base seals	180	^{o}C
Bulb	350	^{o}C

p_a < 250W

In order to keep within the temperature limits of the base seals, an air flow of at least $5ft^3$/min ($0.15m^3$/min) must be directed at the base and commence immediately the filament is energised.

p_a > 250W

An air flow over the envelope up to $14ft^3$/min ($0.4\ m^3$/min) will be required. In order to assist the circulation of the cooling air, a glass chimney surrounding the valves should be used.

PHYSICAL DATA

	lb	kg
Weight of valve	0.42	0.19
Weight of valve and carton (9 valves per carton)	6.5	2.95

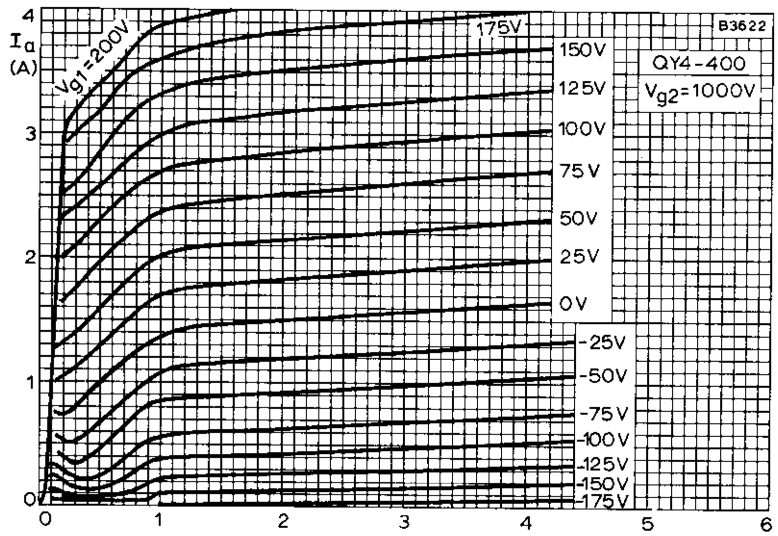
ACCESSORIES

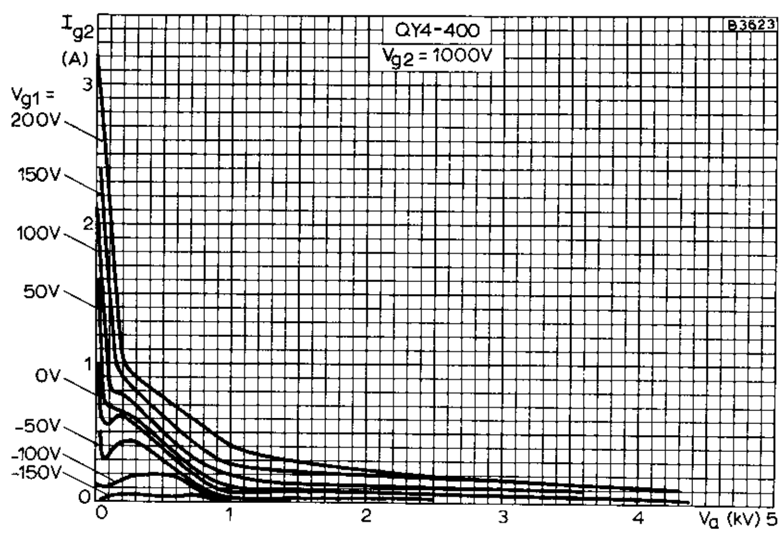
Socket	40211/01
Anode connector	40624
Glass chimney	40666

DIMENSIONS OF VALVE

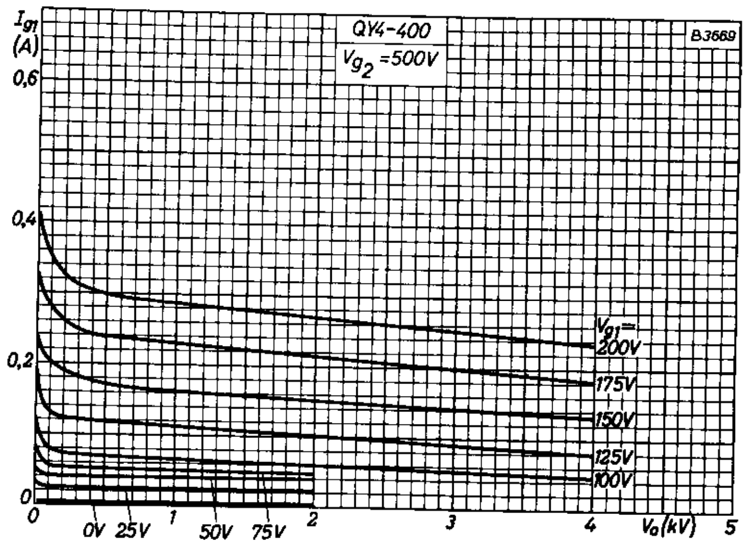
	Inches	Millimetres		Inches	Millimetres
A	0.728	18.5 max.	D	0.354	9.0
B	5.000 ± 0.236	127 ± 6.0	E	0.354	9.0
C	3.425	87	F	2.441	62 max.

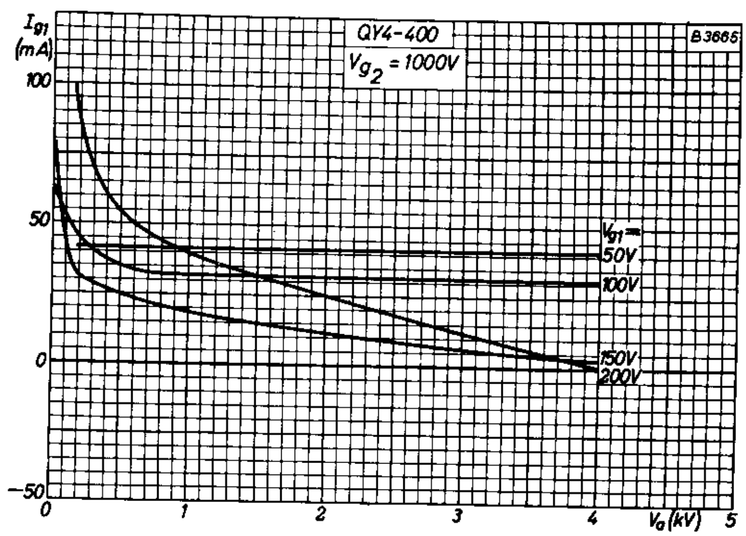
Inch dimensions derived from original millimetre dimensions



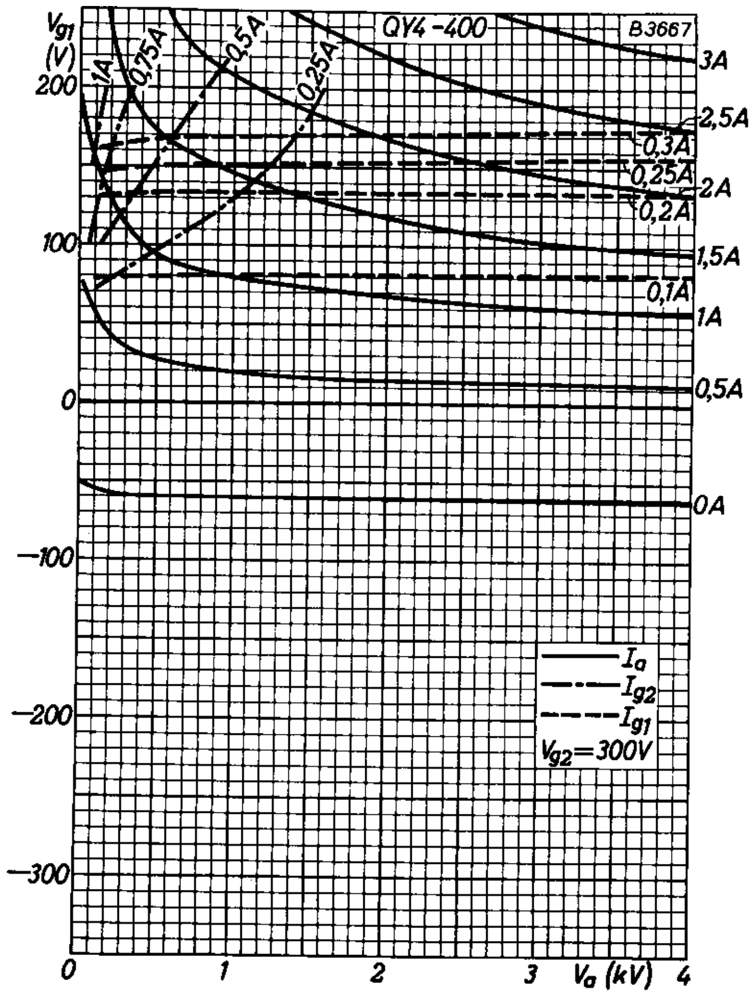


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2}=1000V

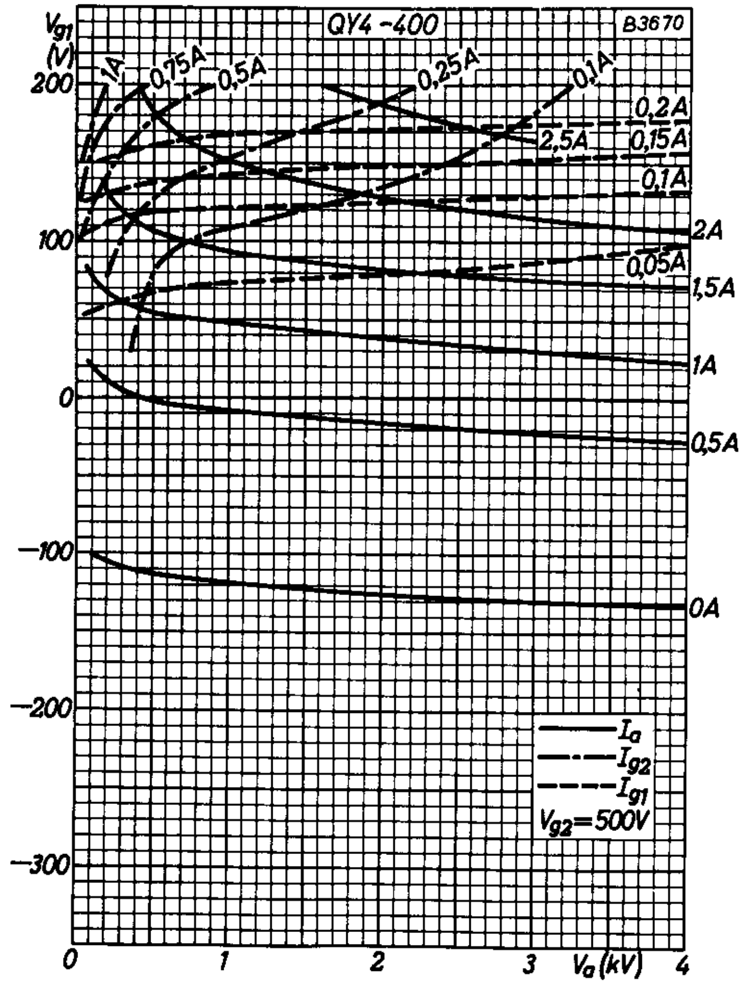




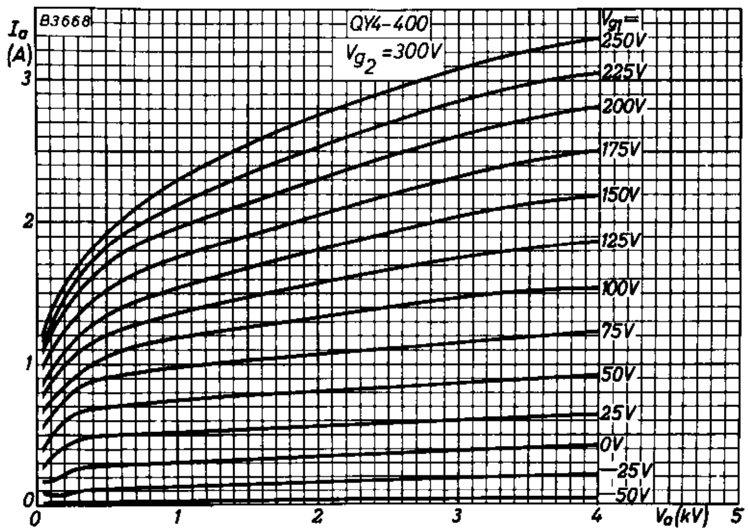
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =500V AND 1000V

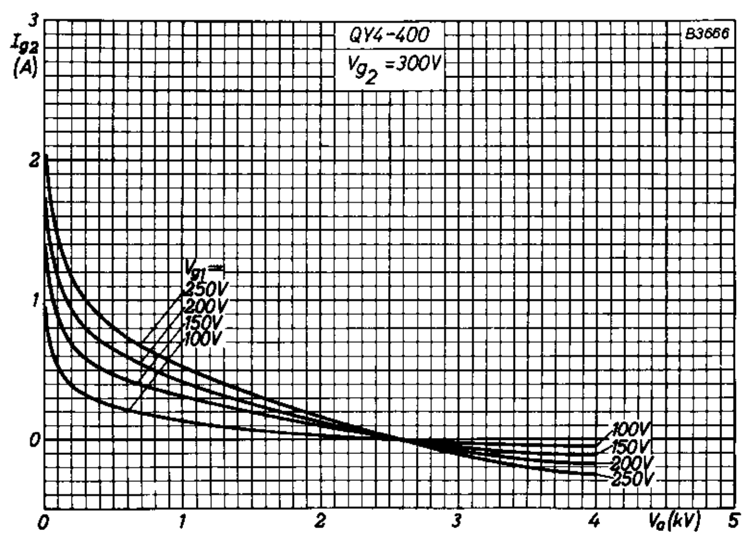


CONSTANT CURRENT CHARACTERISTICS. $V_{g2}=300V$

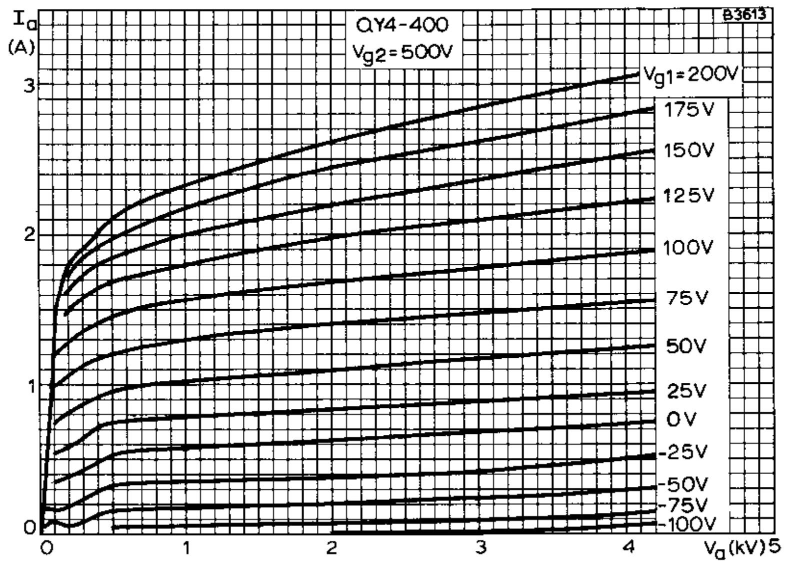


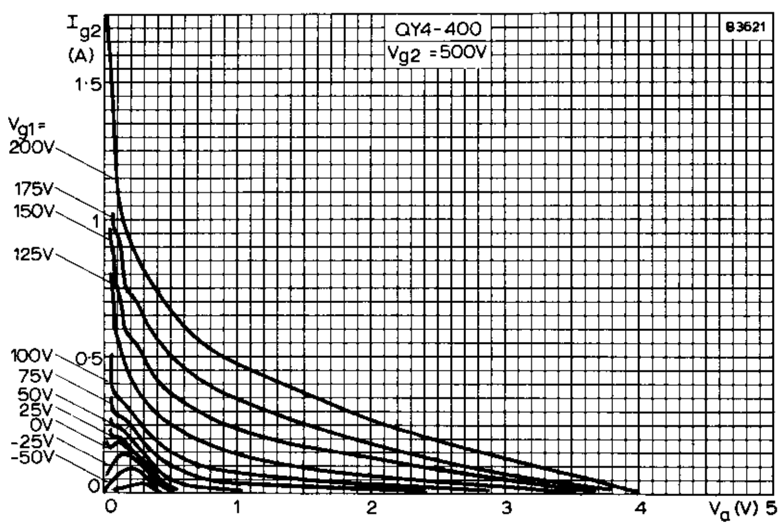
CONSTANT CURRENT CHARACTERISTICS. V_{g2} = 500V





ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =300V





ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =500V

V. H. F. POWER TETRODE QY4-500A

PRELIMINARY DATA

QUICK REFERENCE DATA

Forced-air cooled power tetrode, intended for use as v.h.f. power amplifier or oscillator.

	Class 'B' Television	Class 'C' Telegraphy or F.M. Telephony	
fout	220	186	Mc/s
Pout	1200	630	W
f max.	220	220	Mc/s
Va max.	3.0	4.0	V
pa max.	500	500	W

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

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Absolute maximum ratings

f max.	220	Mc/s
Va max.		
f < 120 Mc/s	4.0	kV
f < 220 Mc/s	3.0	kV
Vg2 max.	500	V
-Vg1 max.	500	V
Ia max.	350	mA
Ig2 max.	60	mA
Ig1 max.	30	mA
pa max.	500	W
pg2 max.	30	W
pg1 max.	10	W

Typical operating conditions

f	110	110	110	186	Mc/s
Va	2.5	3.0	4.0	3.0	kV
Vg2	500	500	500	500	V
-Vg1	150	150	150	150	V
Ia	310	310	315	300	mA
Ig2	26	24	22	22	mA
Ig1	15	16	16	11	mA
vin(pk)	230	230	230	220	V
Pload (driver)	15	15	15	20	W
pa	245	260	330	270	W
Pout	530	670	930	630	W
Pload	475	600	835	570	W
ηa	68.5	72	73.5	70	%

CLASS 'B' TELEVISION SERVICE

Negative modulation, positive synchronisation.

Absolute maximum ratings - each valve

f max.	220	Mc/s
Va max.	3.0	kV
Vg2 max.	500	V
Ia (black) max.	350	mA
Ia (sync) max.	465	mA
pa (sync) max.	500	W
pg2 (sync) max.	30	W
pg1 (sync) max.	10	W

Typical operating conditions - two valves in push-pull.

f	220	220	Mc/s
B (-3.0dB)	5.0	5.0	Mc/s
Va	1.85	2.4	kV
Vg2	500	500	V
-Vg1	100	100	V
vin (g1-g1) pk (sync)	280	370	V
Ia (sync)	2 x 285	2 x 400	mA
Ia (black)	2 x 215	2 x 300	mA
Ig2 (sync)	2 x 20	2 x 35	mA
Ig2 (black)	2 x 2.0	2 x 3.0	mA
Ig1 (sync)	2 x 10	2 x 15	mA
Ig1 (black)	2 x 2.0	2 x 5.0	mA
Pload (driver)	40	75	W
pa (black)	2 x 230	2 x 380	W
Pout (sync)	600	1200	W
Pout (black)	340	680	W
Pload (sync)	480	960	W
Pload (black)	270	560	W

CATHODE

Directly heated, thoriated tungsten

Vf	5.0	V
If	13.5	A

CAPACITANCES

cin	12.8	pF
cout	5.6	pF
ca-g1	0.05	pF

CHARACTERISTICS (measured at Va = 2.5kV, Vg2 = 500V, Ia = 200mA)

gm	5.0	mA/V
μg1-g2	6.0	

COOLING

Tseals max.	150	^{o}C
Tanode max.	150	^{o}C

COOLING

In order to keep within both temperature limits at p_a = 500 W it may be necessary to pass a minimum flow of air of 1.15 m^3/min. (40 ft^3/min.) through the anode cooler. A flow of air must also be directed on the base and screen seals. This cooling should be applied before the application of filament voltage and continued for three minutes after filament voltage has been removed.

MOUNTING POSITION

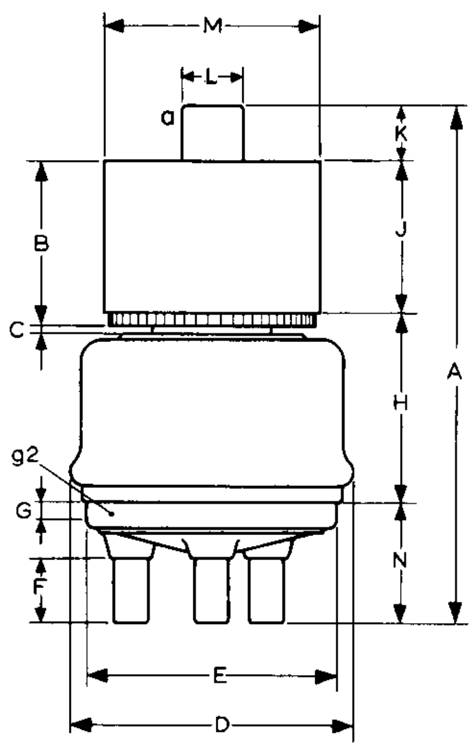
Vertical, base up or down.

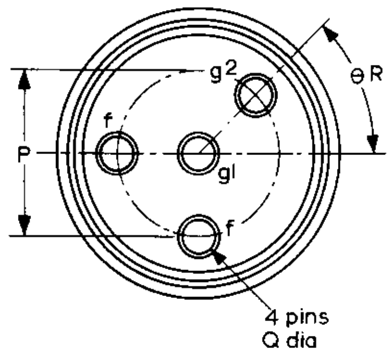
PHYSICAL DATA

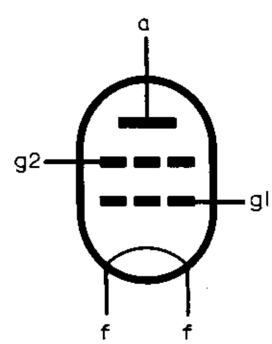
	oz	g
Weight of valve	17	490
Weight of valve and carton	40	1135

DIMENSIONS

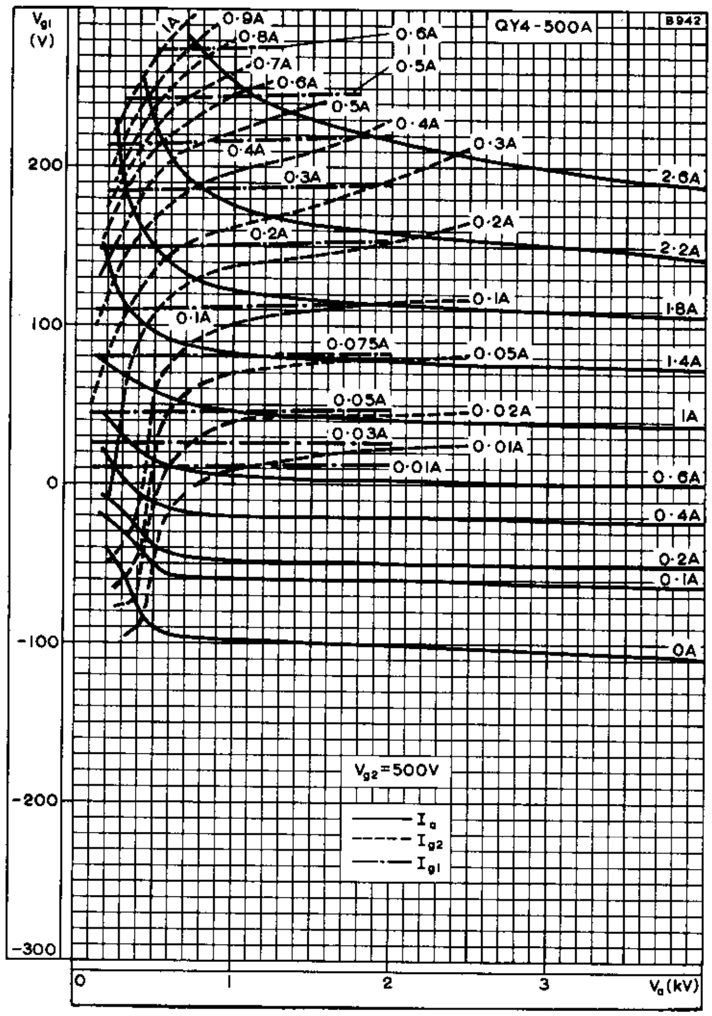
	Inches	Millimetres	
A	4.724	120	
B	1.496	38	
C	0.063	1.6	min.
D	2.638	67	
E	2.374 ± 0.014	60.3 ± 0.35	
F	0.563	14.3	min.
G	0.158	4	
H	1.575	40	
J	1.378	35	
K	0.500	12.7	
L	0.563	14.3	
M	2.008	51	
N	1.000	25.4	
P	1.496	38	
Q	0.315	8	
θR	45°		


B1653
M
L
a
K
B
J
C
A
H
g2
G
N
F
E
D


g2
θR
f
P
gl
f
4 pins
Q dia


a
g2
gl
f
f

V. H. F. POWER TETRODE **QY4-500A**



CONSTANT CURRENT CURVES Vg2 = 500V

QY5-500

R.F. POWER TETRODE

Application: *R.F. power amplifier, frequency multiplier or modulator.*
Power output: *1.76kW continuous rating.*
Frequency: *75Mc/s at full ratings, 110Mc/s at reduced ratings.*
Construction: *Glass, radiation or low velocity air cooled.*

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, base up or down

CAPACITANCES

c_{in}	24	pF
c_{out}	8.3	pF
c_{a-g1}	250	mpF

CHARACTERISTICS (measured at I_a = 120mA)

g_m	7.0	mA/V
μ_{g1-g2}	9.5	

COOLING

In order to keep the temperature below the maximum permitted values it may be necessary to direct an air flow onto the seals.

$T_{anode\ seal}$ max.	220	°C
$T_{base\ seals}$ max.	180	°C
T_{bulb} max.	250	°C

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Limiting values (absolute ratings)

V_a max. (f ≤ 75Mc/s)	5.0	kV
V_a max. (f = 110Mc/s)	4.5	kV
p_a max.	500	W
V_{g2} max.	700	V
p_{g2} max.	65	W
$-V_{g1}$ max.	500	V
p_{g1} max.	25	W
I_k max.	600	mA
$i_{k(pk)}$ max.	3.0	A
R_{g1-f} max.	5.0	kΩ

Typical operation

f	≤60	≤60	100	Mc/s
V_a	4.0	5.0	4.5	kV
V_{g2}	600	600	600	V
V_{g1}	−200	−200	−200	V
I_a	450	440	400	mA
I_{g2}	90	80	70	mA
I_{g1}	39	35	30	mA
$v_{in(pk)}$	350	350	340	V
$P_{load(driver)}$	22	20	30	W
p_a	390	440	500	W
η_a	78	80	72	%
P_{out}	1.41	1.76	1.3	kW
P_{load} ($\eta_{transfer}$ = 85%)	1.2	1.5	1.1	kW

QY5-500

R.F. POWER TETRODE

CLASS 'C' AMPLIFIER (ANODE AND SCREEN-GRID MODULATION)

Limiting values (absolute ratings)

Carrier conditions for a modulation factor of 1

f max.	75	Mc/s
V_a max.	4.0	kV
p_a max.	330	W
V_{g2} max.	700	V
p_{g2} max.	50	W
$-V_{g1}$ max.	500	V
p_{g1} max.	25	W
I_k max.	520	mA
$i_{k(pk)}$ max.	4.7	A
R_{g1-f} max.	50	kΩ

Typical operation

Screen grid modulated via a choke of 2H

f	60	Mc/s
V_a	4.0	kV
V_{g2}	600	V
V_{g1}	−240	V
I_a	380	mA
I_{g2}	80	mA
I_{g1}	20	mA
$v_{in(pk)}$	415	V
$P_{load(driver)}$	22	W
p_a	320	W
p_{g2}	48	W
η_a	79	%
P_{out}	1.2	kW
P_{load} ($\eta_{transfer} = 85\%$)	1.02	kW

For 100% modulation

$P_{mod.}$	760	W

CLASS 'B' R.F. AMPLIFIER (S.S.B.)

Limiting values (absolute ratings)

f max.	75	Mc/s
V_a max.	5.0	kV
p_a max.	500	W
V_{g2} max.	700	V
p_{g2} max.	65	W
I_k max.	550	mA
$i_{k(pk)}$ max.	1.8	A
R_{g1-f} max.	50	kΩ

Typical operation

f	60	Mc/s
V_a	5.0	kV
V_{g2}	700	V
V_{g1}	−90	V
$I_{a(o)}$	56	mA
I_a (single tone)	280	mA
I_a (two tone)	200	mA
$I_{g2(o)}$	0	mA
$I_{g2\ (max.\ sig.)}$	25	mA
$I_{g1\ (max.\ sig.)}$	1.0	mA
$v_{in(pk)}$	130	V
$p_{a\ (max.\ sig.)}$	500	W
$p_{g2\ (max.\ sig.)}$	18	W
P_{out} (two tone)	450	W
η_a	64.5	%
P.E.P.	900	W
P_{load} ($\eta_{transfer}$ = 85%)	760	W

CLASS 'B' AUDIO AMPLIFIER AND MODULATOR (TWO VALVES IN PUSH-PULL)

Limiting values (absolute ratings)

V_a max.	5.0	kV
p_a max.	500	W
V_{g2} max.	700	V
p_{g2} max.	65	W
$-V_{g1}$ max.	500	V
I_{g1} max.	45	mA
I_k max.	550	mA
$i_{k(pk)}$ max.	1.8	A
R_{g1-f} max.	50	kΩ

Typical operation

V_a	4.0	4.0	5.0	kV
V_{g2}	600	600	600	V
V_{g1}	−62.5	−60	−62.5	V
$I_{a(o)}$	2×45	2×55	2×50	mA
$I_{a\ (max.\ sig.)}$	2×285	2×366	2×290	mA
$I_{g2\ (max.\ sig.)}$	2×40	2×60	2×43	mA
I_{g1}	2×13.5	2×18	2×13	mA
$V_{in(g1-g1)\ r.m.s.}$	178	214	182	V
P_{drive}	2×1.5	2×2.5	2×1.5	W
p_a	2×300	2×340	2×340	W
P_{out}	1.68	2.25	2.22	kW
R_{a-a}	20	16	26	kΩ
η_a	74	76.5	76.5	%
D_{tot}	4.7	5.0	5.0	%

QY5-500

R.F. POWER TETRODE

WEIGHT

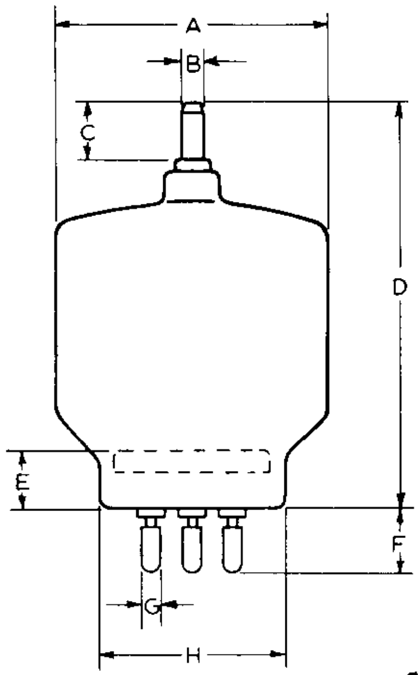
Valve only	13.22	oz
	375	g

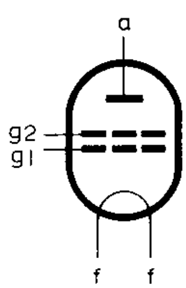
ACCESSORIES

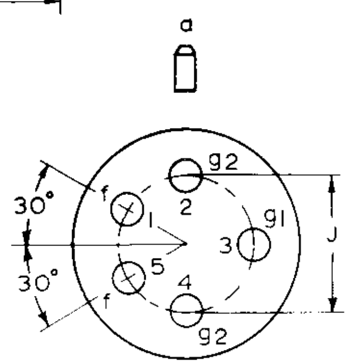
Socket	40216
Clip for anode connection	40626

DIMENSIONS

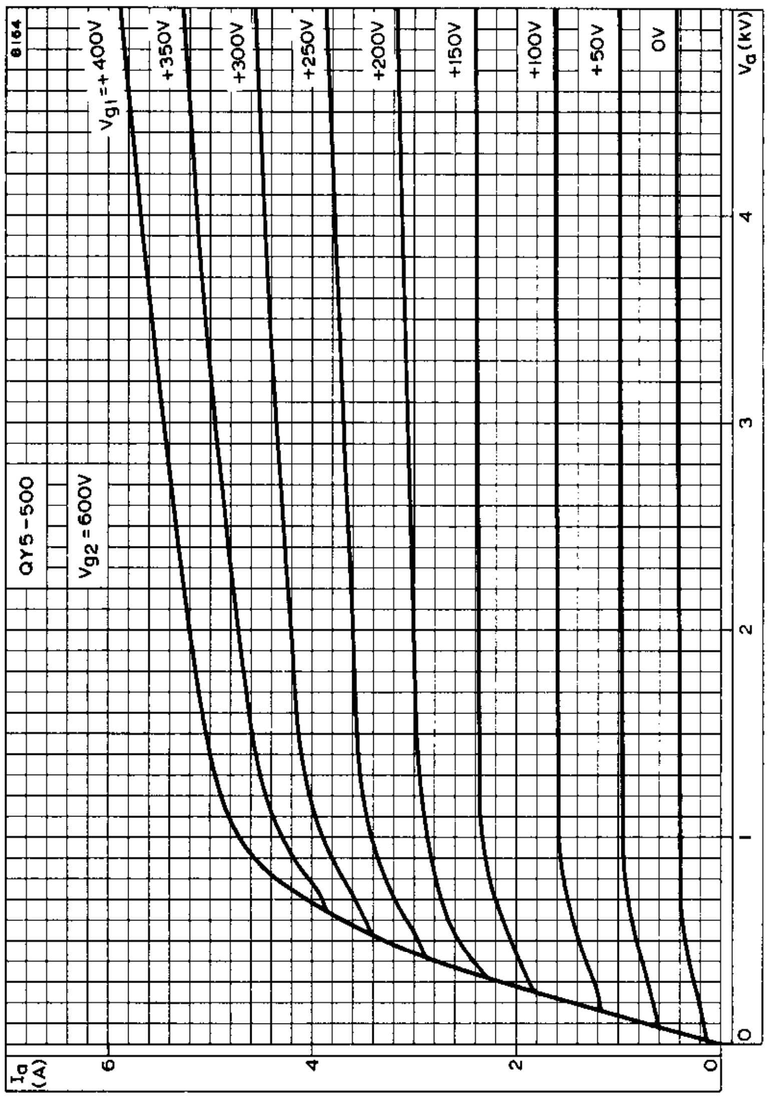
	Inches	*Millimetres*	
A	4.65	118	max.
B	0.374	9.5	
C	0.984	25	
D	6.93±0.24	176±6	
E	0.984	25	
F	1.06	27	
G	0.374	9.5	
H	3.19	81	max.
J	1.50	38.1	



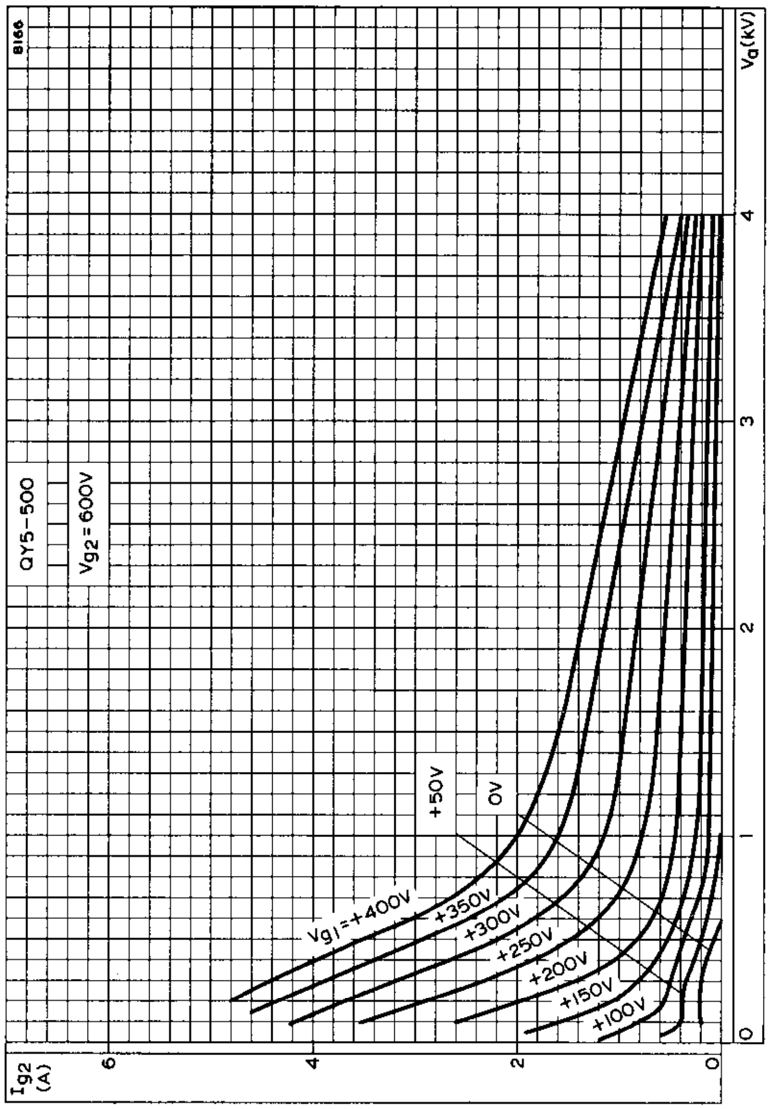




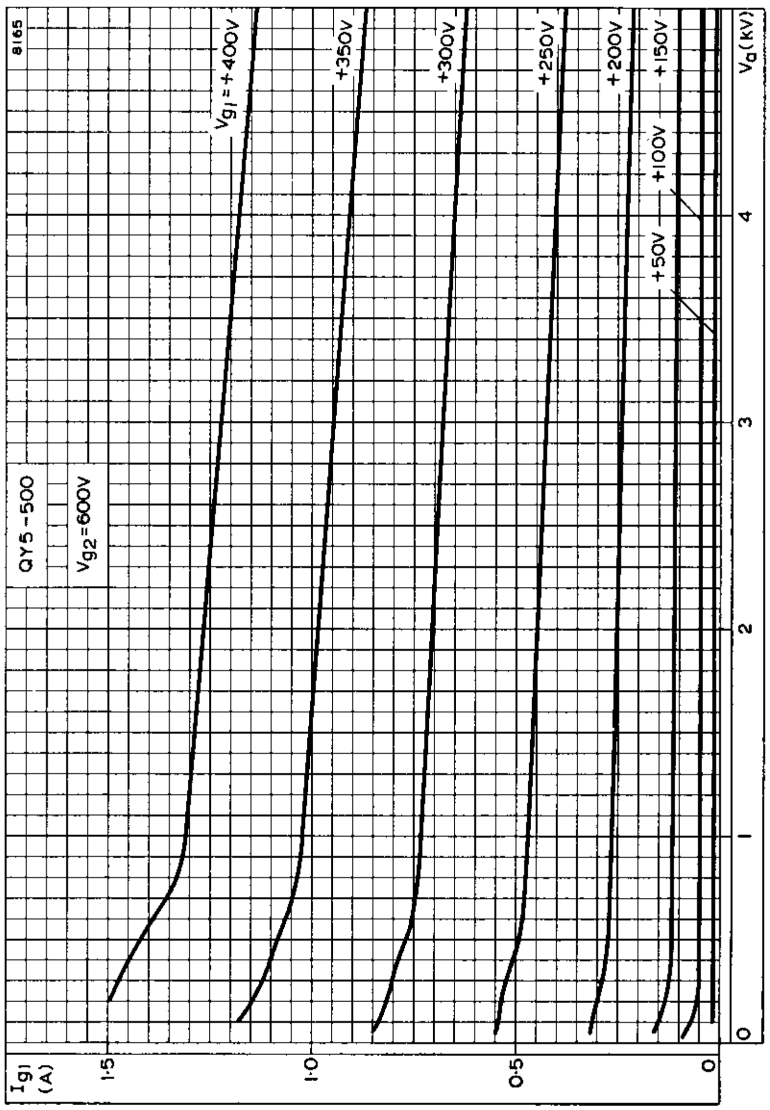
B5K Base



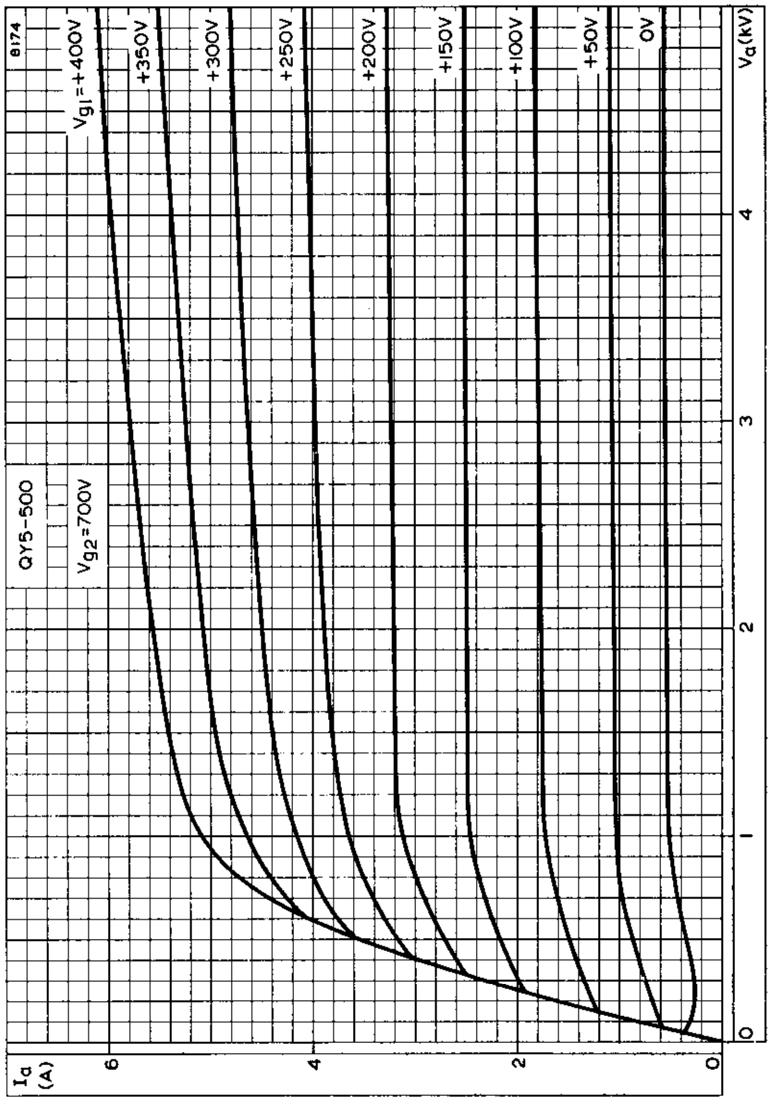
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 600V.



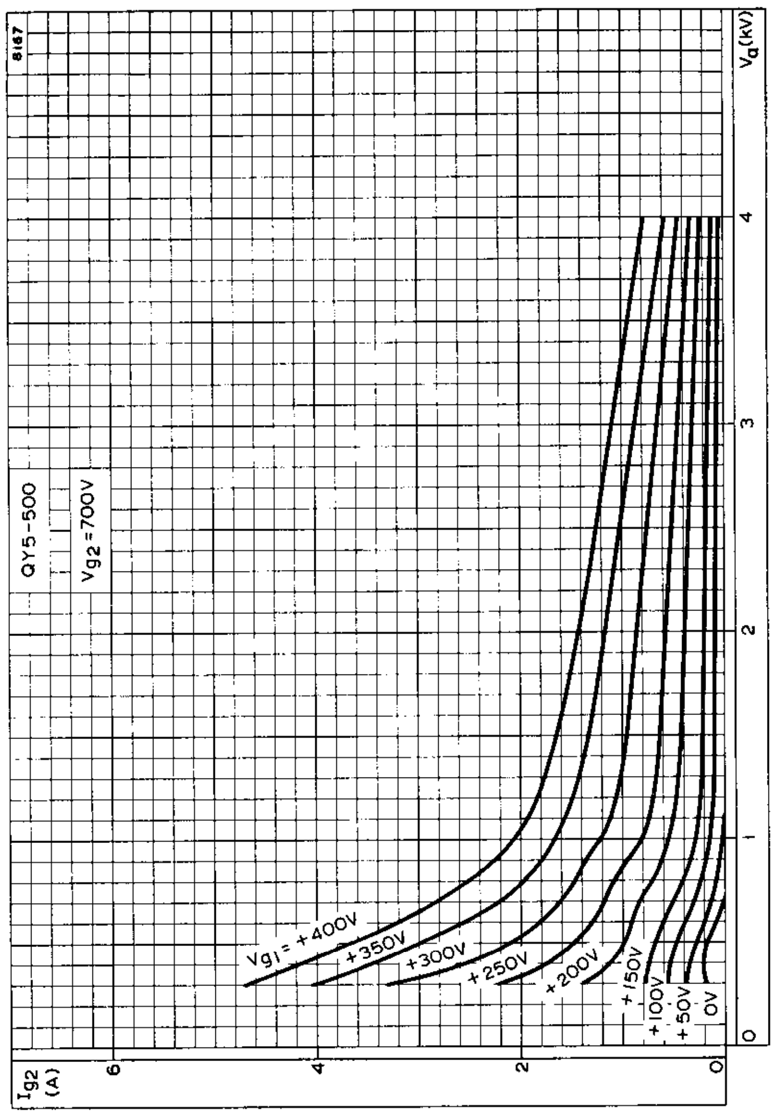
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 600V.



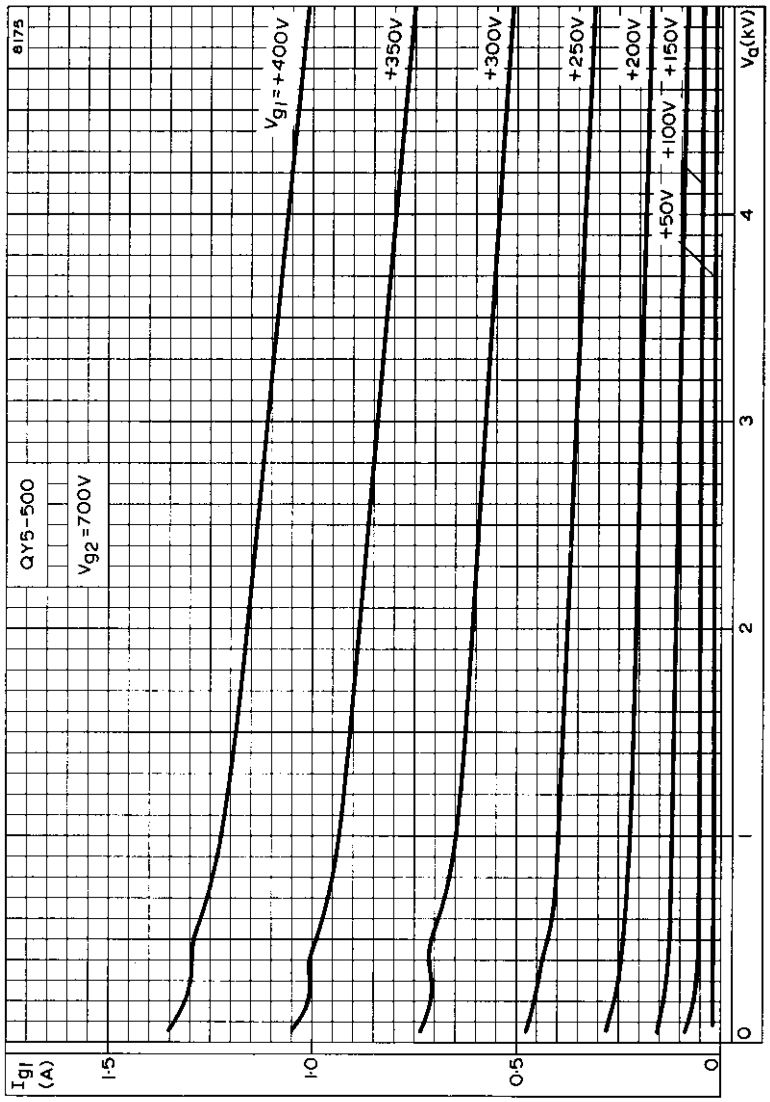
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 600V.



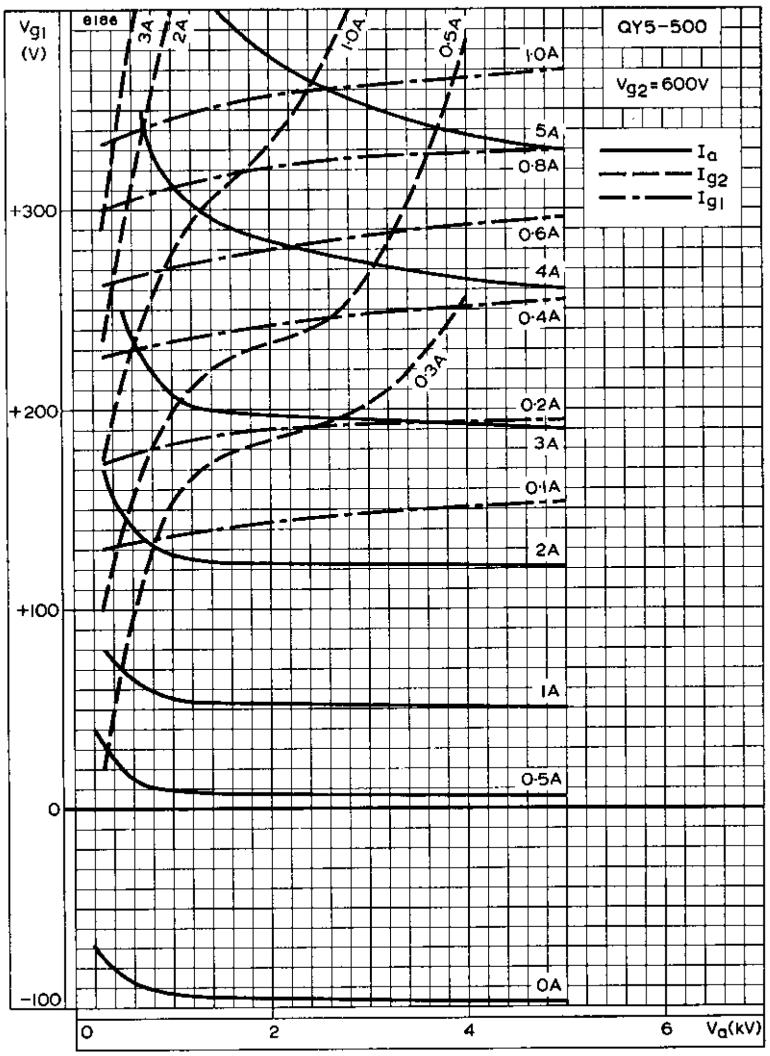
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 700V.



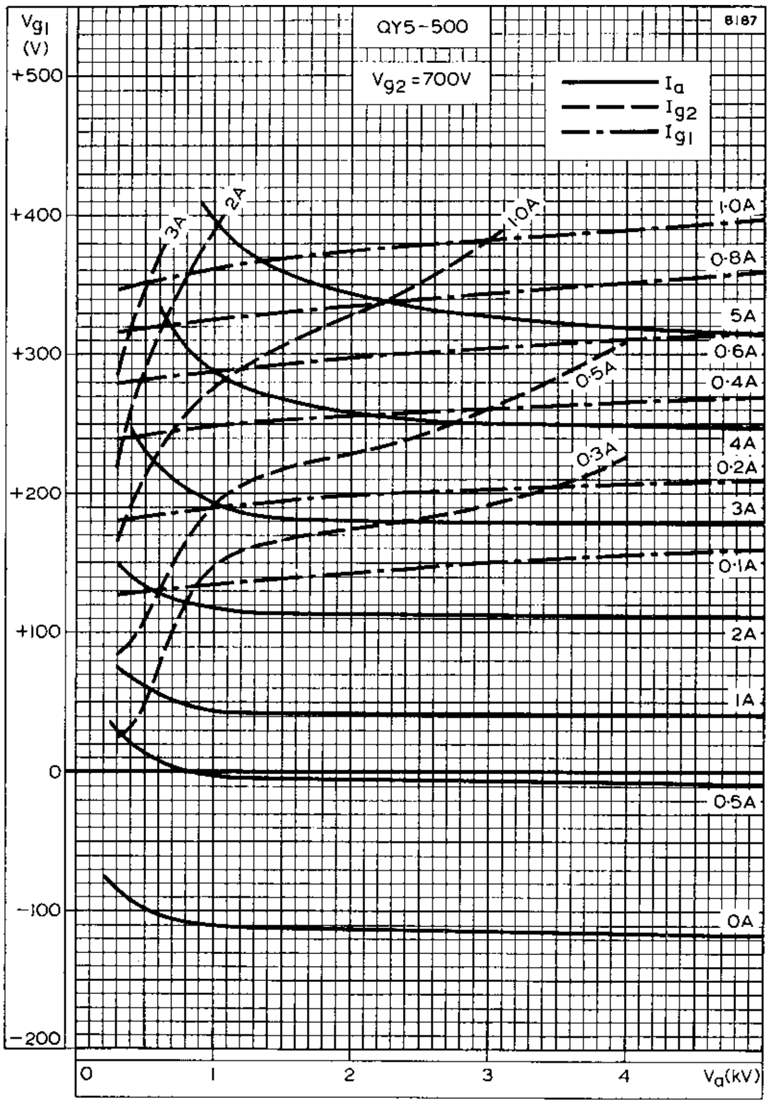
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 700V.



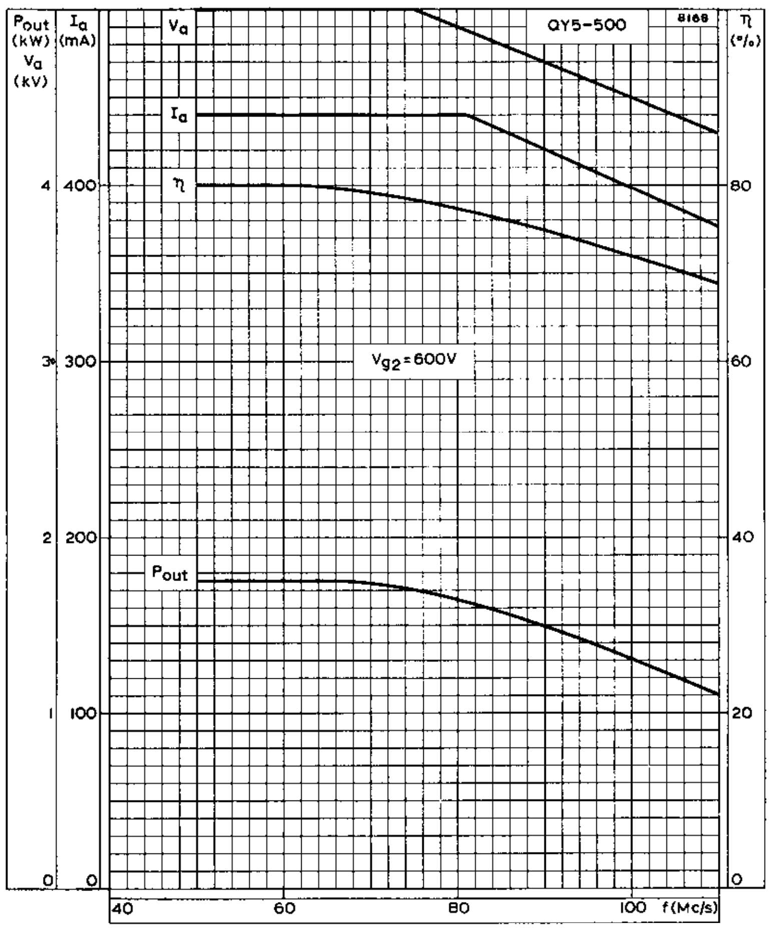
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 700V.



CONSTANT CURRENT CURVES $V_{g2} = 600V$.



CONSTANT CURRENT CURVES. V_{g2} = 700V.



FREQUENCY CHARACTERISTICS

V.H.F. POWER TETRODE QY5-800

QUICK REFERENCE DATA

Radiation and convection cooled tetrode intended for use as a linear amplifier in single sideband suppressed carrier applications.

	Class 'AB1' Linear Amplifier for S.S.B. operation	Class 'C' Telegraphy or F.M. Telephony	
f	30	30	Mc/s
P_{out}	*1.3	2.4	kW
f max.	30	30	Mc/s
V_a max.	5.5	5.5	kV
p_a max.	800	800	W

*P.E.P_{out}

To be read in conjunction with

GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Maximum operating conditions

f	30	Mc/s
P_{out}	2.4	kW
P_{load}	2.0	kW
η_a	80	%
V_a	5.0	kV
I_a	600	mA
V_{g2}	600	V
I_{g2}	185	mA
$-V_{g1}$	240	V
I_{g1}	20	mA
v_{in} pk	300	V
P_{load} (driver)	10	W
p_a	600	W

CLASS 'AB1' LINEAR AMPLIFIER FOR SINGLE SIDEBAND OPERATION

Maximum operating conditions

f		30	Mc/s
$P.E.P_{out}$		1.3	kW
$P.E.P_{load}$		1.1	kW
**d_3		35	dB
**d_5		40	dB
V_a		4.0	kV
V_{g2}		600	V
***$-V_{g1}$		110	V
$I_{a(o)}$		150	mA
$I_{g2(o)}$		8.0	mA
	Single tone	Double tone	
I_a	465	330	mA
I_{g2}	85	40	mA
I_{g1}	0	0	mA
$v_{in(pk)}$	100	100	V
P_{load} (driver)	3.0	-	W
p_a	560	670	W
η_a	69	49	%

**Third and fifth order intermodulation products. Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two tones at that level.

***Adjust to give the desired value of $I_{a(o)}$.

ABSOLUTE MAXIMUM RATINGS

	Class 'AB1' S.S.B.	Class 'C' Telegraphy	
f max.	30	30	Mc/s
V_a max.	5.5	5.5	kV
V_{g2} max.	800	800	V
$-V_{g1}$ max.	500	500	V
I_k max.	700	925	mA
p_a max.	800	800	W
p_{g2} max.	120	120	W
I_{g1} max.	0	35	mA
p_{g1} max.	0	40	W
R_{g1-f} max.	20	20	kΩ

V.H.F. POWER TETRODE QY5-800

CATHODE

Directly heated, thoriated tungsten

V_f	7.5	V
I_f	22.6	A
I_f (surge)	45	A

CAPACITANCES

c_{a-g1}	100	nF
c_{out}	9.5	pF
c_{in}	47.6	pF

CHARACTERISTICS (measured at V_a = 4.0kV, V_{g2} = 600V, I_a = 200mA)

g_m	10	mA/V
μ_{g1-g2}	5.1	

MOUNTING POSITION

Vertical

COOLING

Radiation and convection.

Maximum temperatures

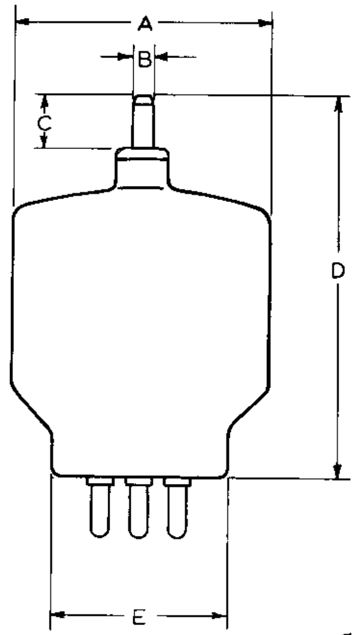
Anode seal	220	°C
Base seals	180	°C
Bulb	350	°C

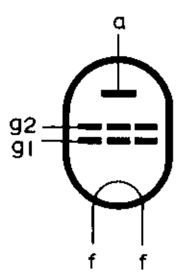
PHYSICAL DATA

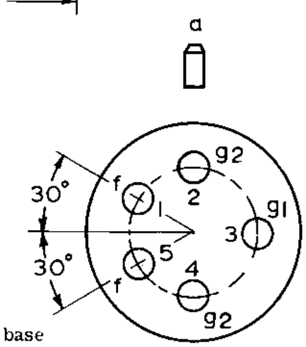
	lb	kg
Weight of valve	1.4	0.62
Weight of valve and carton	5.0	2.25

ACCESSORIES

Socket	40216
Anode clip	40665







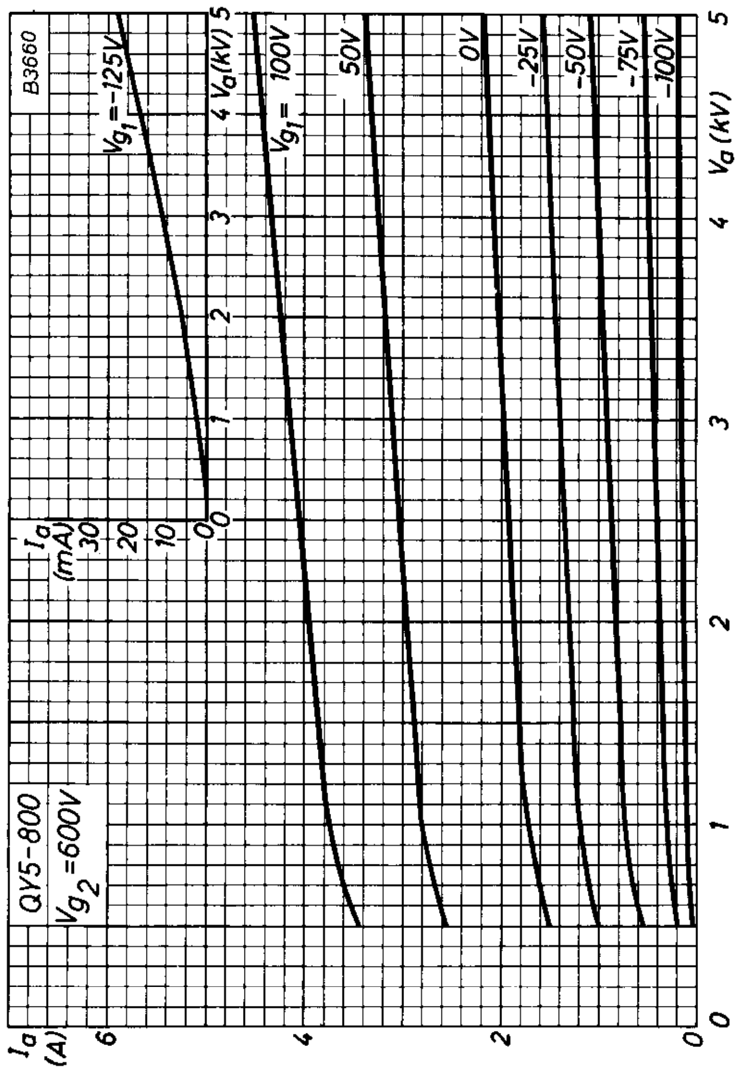
B5K base
(according to BS448)

9321

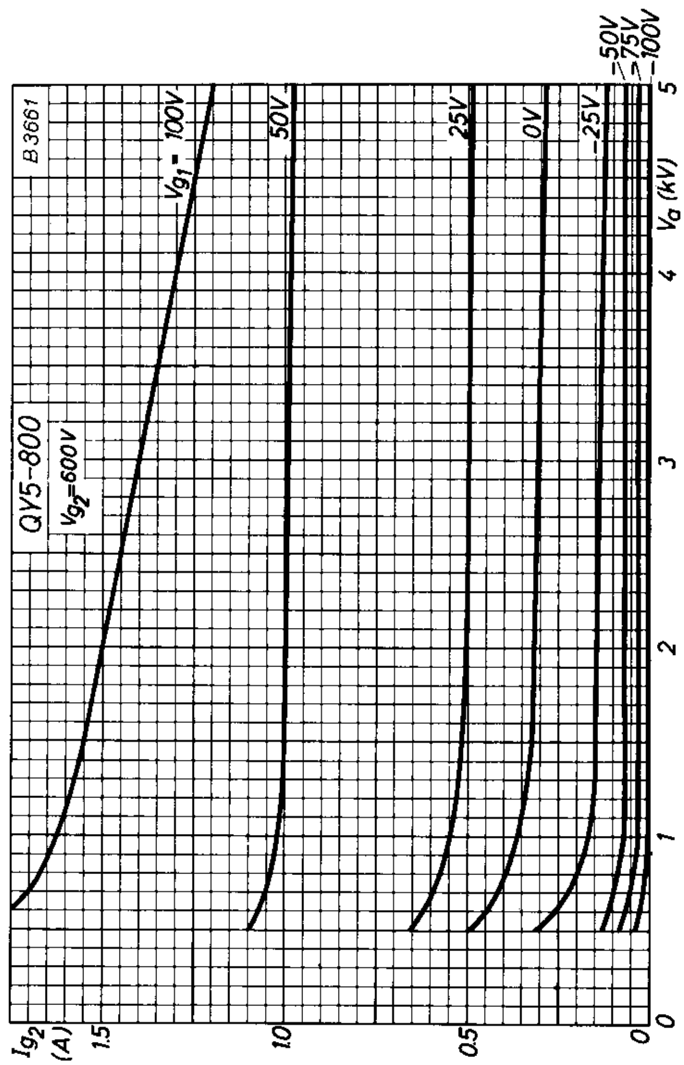
DIMENSIONS

	Inches	Millimetres	
A	6.023	153	max.
B	0.374	9.5	
C	0.984	25	
D	8.465 ± 0.236	215 ± 6.0	
E	3.189	81	max.

Inch dimensions derived from original millimetre dimensions.

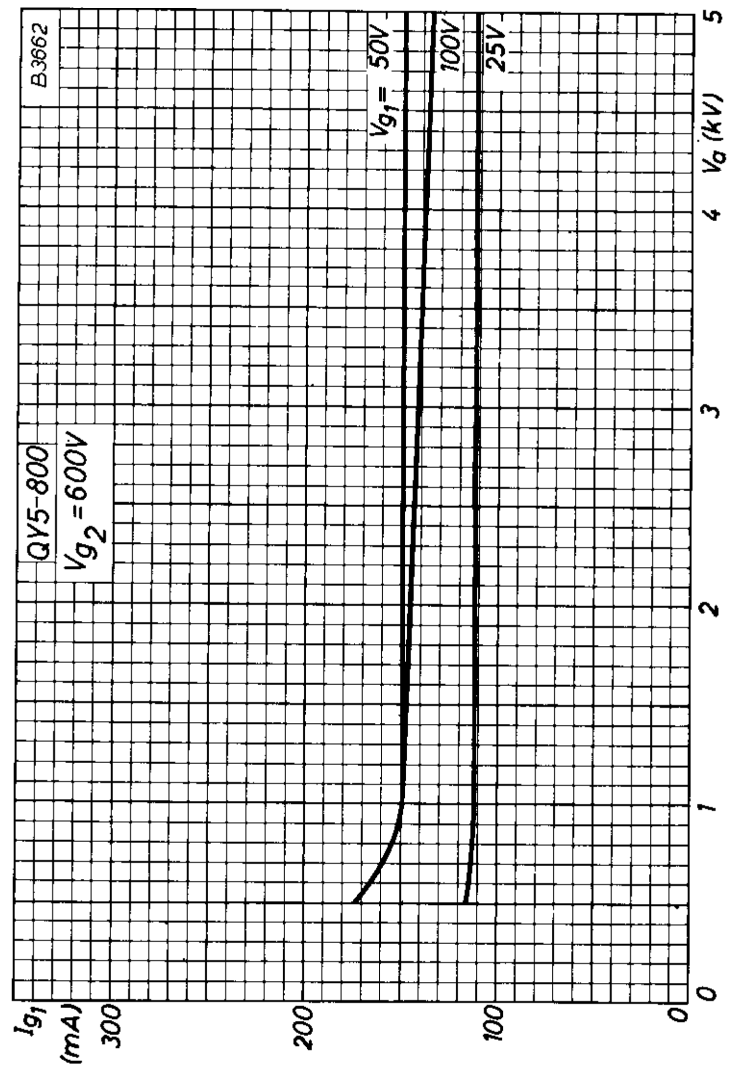


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER, V_{g2} = 600V

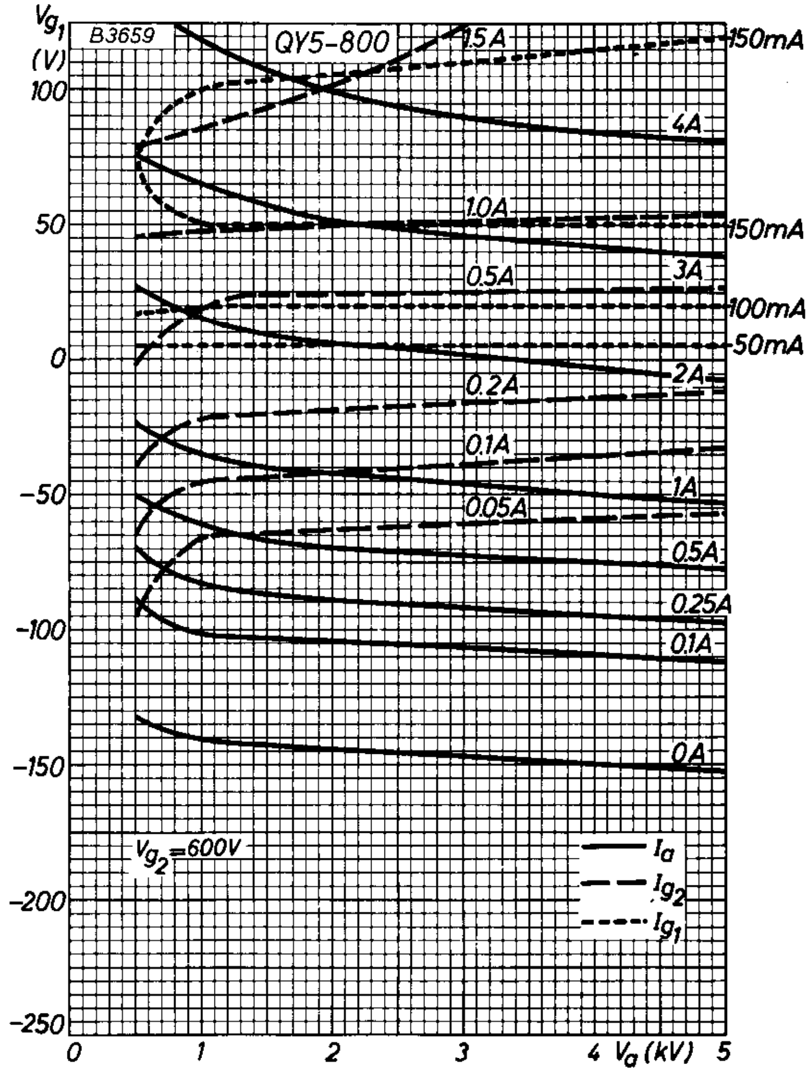


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

V_{g2} = 600V



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 600V



CONSTANT CURRENT CHARACTERISTICS. V_{g2} = 600V

R.F. POWER TETRODE

QY5-3000A
QY5-3000W

QUICK REFERENCE DATA

Power tetrodes intended for use in V.H.F. television transmitters. The QY5-3000A is forced-air cooled, and the QY5-3000W water cooled.

	Class 'C' telegraphy	Class 'C' television	Class 'AB' S.S.B.	Class 'B' A.F.	
f max.	220	220	220	—	Mc/s
V_a max.	5.0	4.0	5.0	5.0	kV
p_a max.	3.0	3.0	3.0	3.0	kW
Performance					
f	75	220	30	—	Mc/s
P_{out}	4.1	4.0	1.57	9.5	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	6.3	V
I_f	32.5	A

CAPACITANCES

c_{in}	23.5	pF
c_{out}	8.4	pF
c_{a-g1}	< 350	mpF

CHARACTERISTICS (measured at V_a = 4.0kV, I_a = 2.0A)

g_m	19	mA/V
μ_{g1-g2}	8.5	

QY5-3000A
QY5-3000W

R.F. POWER TETRODE

COOLING

T_{seals} max.	180	°C
T_{bulb} max.	250	°C

QY5-3000A

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals.

The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea-level.

Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet of the housing are given in the following table.

Anode Dissipation	Height above sea-level		Inlet Temperature	Rate of flow of air per minute		Pressure difference between inlet and outlet	
p_a (kW)	h (m)	(ft)	T_{in} (°C)	(m^3)	(ft^3)	(mm H_2O)	(in H_2O)
1.0	0	0	35	1.8	63.6	10	0.39
1.0	0	0	45	2.2	74.2	15	0.59
1.0	1,500	4,921	35	2.2	74.2	13	0.51
1.0	3,000	9,842	25	2.3	81.2	13	0.51
2.5	0	0	35	4.5	158.9	60	2.36
2.5	0	0	45	5.4	190.7	85	3.35
2.5	1,500	4,921	35	5.4	190.7	73	2.87
2.5	3,000	9,842	25	5.8	204.8	75	2.95
3.0	0	0	35	5.7	201.3	95	3.74

QY5-3000W

Typical values of inlet temperature, rate of flow of water and pressure difference between the inlet and outlet housing at various anode dissipations are given in the following table:—

Anode Dissipation	Inlet Temperature	Rate of flow of water per minute		Pressure difference between inlet and outlet
p_a (kW)	T_{in} (°C)	(litres)	(gal)	(atm)
1.0	20	2.5	0.55	0.073
1.0	50	3.0	0.66	0.1
2.0	20	2.5	0.55	0.073
2.0	50	4.8	1.06	0.25
3.0	20	3.0	0.66	0.105
3.0	50	6.9	1.52	0.55

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals. Air cooling will in general not be necessary at frequencies $\leqslant$75 Mc/s and $V_a \leqslant 4.0$ kV ($V_a \leqslant 3.2$ kV for class "C" anode and screen-grid modulation). At $V_a \leqslant 5.0$ kV ($V_a \leqslant 4.0$ kV for class "C" anode and screen-grid modulation) air cooling will in general be necessary at all frequencies.

CLASS "C" TELEGRAPHY OR F.M. TELEPHONY

Absolute maximum ratings

V_a max. (f < 110Mc/s)	5.0	kV
V_a max. (f < 220Mc/s)	4.0	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a max.	1.1	A
p_a max.	3.0	kW
p_{g2} max.	100	W
p_{g1} max.	30	W

Typical operating conditions

f	75	110	75	110	Mc/s
V_a	5.0	5.0	4.0	4.0	kV
V_{g2}	800	800	800	800	V
V_{g1}	−250	−250	−250	−250	V
I_a	1.1	1.1	1.1	1.1	A
I_{g2}	100	100	120	120	mA
I_{g1}	70	70	80	80	mA
$v_{in(pk)}$	480	480	500	500	V
P_{drive}	30	30	36	36	W
P_{out}	4.1	3.9	3.15	2.9	kW
η_a	74.5	71.5	72	69	%

CLASS "C" ANODE AND SCREEN-GRID MODULATION

Screen-grid modulated through a choke of 60H

Absolute maximum ratings Carrier condition for a modulation factor of 1.

V_a max. (f < 110Mc/s)	4.0	kV
V_a max. (f < 220Mc/s)	3.2	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a max.	900	mA
p_a max.	2.0	kW
*p_{g2} max.	100	W
p_{g1} max.	30	W

*For other methods of modulation, P_{g2} max. = 65W.

Typical operating conditions

V_a	4.0	kV
V_{g2}	800	V
V_{g1}	−375	V
I_a	900	mA
I_{g2}	120	mA
I_{g1}	85	mA
$v_{in(pk)}$	625	V
P_{drive}	48	W
P_{out}	2.7	kW
η_a	75	%
For 100% modulation		
$P_{mod.}$	1.8	kW

QY5-3000A
QY5-3000W

R.F. POWER TETRODE

CLASS "C" GRID-MODULATION FOR TELEVISION SERVICE

(with positive modulation and negative synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a (peak white) max.	1.1	A
I_{g1} (peak white) max.	80	mA
P_{in} (peak white) max.	4.4	kW
p_a (peak white) max.	3.0	kW
p_{g2} (peak white) max.	100	W

Typical operating conditions for 2 valves in push-pull

f	170–220	170–220	Mc/s
*Bandwidth (–1.5db)	—	6.5	Mc/s
*Bandwidth (–3.0db)	7.5	12	Mc/s
V_a	4.0	4.0	kV
V_{g2}	800	800	V
V_{g1} (peak white)	–230	–230	V
V_{g1} (black)	–380	–380	V
$v_{in(g1-g1)pk}$	850	850	V
I_a (peak white)	1.7	2.1	A
I_a (black)	0.5	0.6	A
I_{g2} (peak white)	80	50	mA
I_{g2} (black)	10	10	mA
I_{g1} (peak white)	25	50	mA
I_{g1} (black) approx.	0	0	mA
†P_{drive} (peak white)	200–300	300–400	W
P_{out} (peak white)	4.0	2.8	kW
P_{out} (black)	360	250	W
‡P_{load} (peak white)	2.8	1.96	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

R.F. POWER TETRODE

QY5-3000A
QY5-3000W

CLASS "B" FOR TELEVISION SERVICE

(with positive modulation and negative synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
I_a (peak white) max.	1.1	A
I_{g1} (peak white) max.	80	mA
P_{in} (peak white) max.	4.4	kW
p_a (peak white) max.	3.0	kW
p_{g2} (peak white) max.	100	W

Typical operating conditions for 2 valves in push-pull

f	170–220	Mc/s
*Bandwidth (–1.5 db)	6.5	Mc/s
*Bandwidth (–3.0 db)	12	Mc/s
V_a	4.0	kV
V_{g2}	800	V
V_{g1}	–150	V
$V_{in(g1-g1)(pk)}$ (peak white)	700	V
$v_{in(g1-g1)(pk)}$ (black)	350	V
I_a (peak white)	2.1	A
I_a (black)	0.6	A
I_{g2} (peak white)	50	mA
I_{g2} (black)	10	mA
I_{g1} (peak white)	50	mA
I_{g1} (black) (approx.)	0	mA
†P_{drive} (peak white)	200 to 300	W
P_{out} (peak white)	2.8	kW
P_{out} (black)	250	W
‡P_{load} (peak white)	1.96	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

QY5-3000A
QY5-3000W

R.F. POWER TETRODE

CLASS "C" GRID-MODULATION FOR TELEVISION SERVICE

(with negative modulation and positive synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a (sync.) max.	1.5	A
P_{in} (sync.) max.	6.0	kW
p_a (sync.) max.	3.0	kW
p_{g2} (sync.) max.	100	W
p_{g1} (sync.) max.	30	W

Typical operating conditions for 2 valves in push-pull

f	170–220	170–220	Mc/s
*Bandwidth (–1.5 db)	6.5	—	Mc/s
*Bandwidth (–3 db)	12	7.5	Mc/s
V_a	4.0	4.0	kV
V_{g2}	800	800	V
V_{g1} (sync.)	–150	–150	V
V_{g1} (black)	–230	–230	V
V_{g1} (white)	–450	–450	V
$v_{in(g1-g1)pk}$	850	850	V
I_a (sync.)	2.75	2.75	A
I_a (black)	2.1	1.7	A
I_{g2} (sync.)	110	250	mA
I_{g2} (black)	50	80	mA
I_{g1} (sync.)	100	80	mA
I_{g1} (black)	50	25	mA
†P_{drive} (sync.)	300–400	200–300	W
P_{out} (sync.)	5.0	5.9	kW
P_{out} (black)	2.8	4.0	kW
‡P_{load} (sync.)	3.5	4.13	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

R.F. POWER TETRODE

QY5-3000A
QY5-3000W

CLASS "B" FOR TELEVISION SERVICE

(with negative modulation and positive synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
I_a (sync.) max.	1.5	A
P_{in} (sync.) max.	6.0	kW
p_a (sync.) max.	3.0	kW
p_{g2} (sync.) max.	100	W
p_{g1} (sync.) max.	30	W

Typical operating conditions for 2 valves in push-pull

f	170–220	Mc/s
*Bandwidth (–1.5 db)	6.5	Mc/s
*Bandwidth (–3 db)	12	Mc/s
V_a	4.0	kV
V_{g2}	800	V
V_{g1}	–150	V
$v_{in(g1-g1)pk}$ (sync.)	850	V
$v_{in(g1-g1)pk}$ (black)	700	V
I_a (sync.)	2.75	A
I_a (black)	2.1	A
I_{g2} (sync.)	110	mA
I_{g2} (black)	50	mA
I_{g1} (sync.)	100	mA
I_{g1} (black)	50	mA
†P_{drive} (sync.)	300–400	W
P_{out} (sync.)	5.0	kW
P_{out} (black)	2.8	kW
‡P_{load} (sync.)	3.5	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

QY5-3000A
QY5-3000W

R.F. POWER TETRODE

CLASS "AB" SINGLE SIDEBAND SUPPRESSED CARRIER

Absolute maximum ratings

f max.	200	Mc/s
V_a max.	5.0	kV
V_{g2} max.	1.0	kV
p_a max.	3.0	kW
p_{g2} max.	100	W
I_k max.	1.2	A
$i_{k(pk)}$ max.	3.8	A
$-V_{g1}$ max.	500	V

Typical operating conditions

Envelope peak to average $\geqslant 1$ and < 2

f	30	30	30	Mc/s
V_a	5.0	5.0	5.0	kV
V_{g2}	1.0	1.0	1.0	kV
$^*V_{g1}$	−120	−117	−85	V
$I_{a(o)}$	200	200	500	mA

"Single tone" modulation, maximum signal conditions

I_a	474	505	640	mA
I_{g2}	20	70	15	mA
I_{g1}	0	20	0	mA
$v_{in(pk)}$	120	134	85	V
$P_{load(driver)}$	3.0	5.0	3.0	W
p_a	1.02	0.96	1.82	kW
p_{g2}	20	70	15	W
P_{out}	1.35	1.57	1.38	kW
η_a	57	63	43	%
P_{load}	1.15	1.34	1.17	kW

"Two tone" modulation, maximum signal conditions

I_a	351	380	576	mA
I_{g2}	8.5	25	7.0	mA
I_{g1}	0	1.5	0	mA
$v_{in(pk)}$	120	134	85	V
$P_{load(driver)}$	1.5	2.5	1.5	W
p_a	1.08	1.12	2.19	kW
p_{g2}	8.5	25	7.0	W
P.E.P_{out}	1.35	1.57	1.38	kW
P_{out} (mean)	675	785	690	W
η_a	38	41	24	%
P.E.$P_{(load)}$	1.15	1.34	1.17	kW
†$D_{i.m.}$	33	30	42	dB

$^*V_{g1}$ is set to give the $I_{a(o)}$ and will vary slightly from valve to valve.

†The voltage amplitude of all intermodulation products are below this level, which is referred to the amplitude of either of the two tone frequencies. Relative to the peak envelope power these figures will be increased by 6dB. The figures are measured at full drive.

R.F. POWER TETRODE

QY5-3000A
QY5-3000W

CLASS "B" A.F.

Absolute maximum ratings

V_a max.	5.0	kV
V_{g2} max.	800	V
I_k max.	1.7	A
$i_{k(pk)}$ max.	5.3	A
p_a max.	3.0	kW
p_{g2} max.	100	W
p_{g1} max.	30	W

Typical operating conditions for 2 valves in push-pull

V_a	5.0	5.0	4.0	4.0	kV
V_{g2}	800	800	800	800	V
V_{g1}	−107	−107	−103	−93	V
$I_{a(o)}$	2×100	2×100	2×100	2×150	mA
I_a (max. sig.)	2×1.1	2×1.46	2×0.6	2×1.37	A
I_{g2} (max. sig.)	2×50	2×120	2×60	2×75	mA
I_{g1}	2×40	2×150	2×11	2×84	mA
$V_{in(g1-g1)r.m.s.}$	420	505	259	414	V
P_{drive}	2×11	2×50	2×2.0	2×40	W
p_a	2×1.9	2×2.55	2×0.9	2×2.36	kW
η_a	65	65	62	57	%
R_{a-a}	5.0	3.7	7.0	3.43	kΩ
P_{out}	7.2	9.5	3.0	6.25	kW

ACCESSORIES

Filament and control grid clips	40634
Screen grid connector	40622
Insulating pedestal (QY5-3000A)	40635
Water jacket (QY5-3000W)	K713

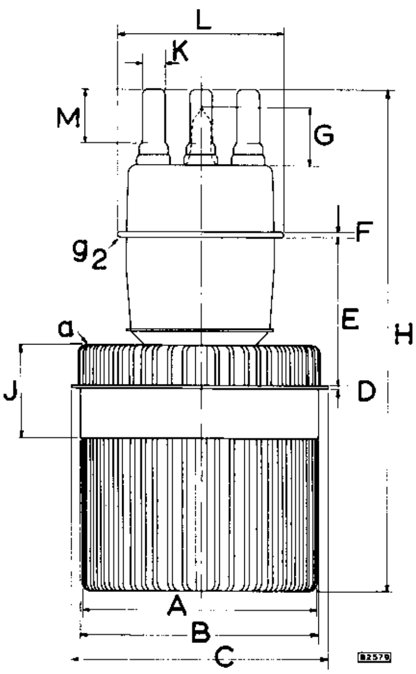
PHYSICAL DATA

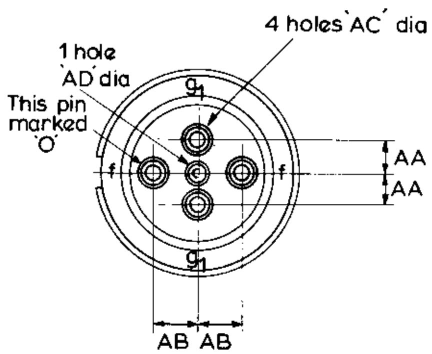
	QY5-3000A	QY5-3000W	
Weight of valve	4.96	0.77	lb
	2.25	0.35	kg
Weight of valve plus carton	12.6	2.4	lb
	5.7	1.1	kg

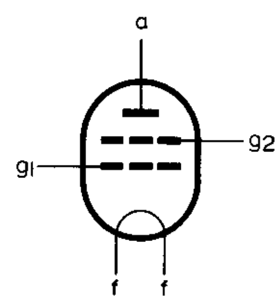
QY5-3000A
QY5-3000W

R.F. POWER TETRODE

OUTLINE DRAWING OF QY5-3000A







R.F. POWER TETRODE

QY5-3000A
QY5-3000W

DIMENSIONS

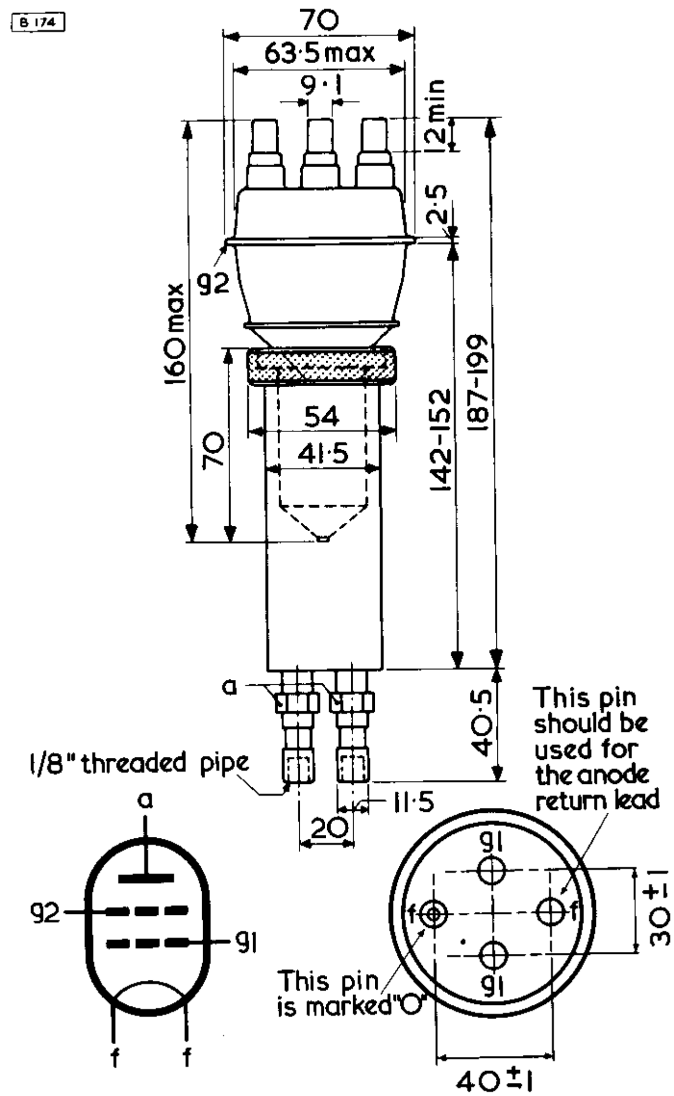
	Inches	Millimetres	
A	3.445	87.5	max
B	3.583 ± 0.031	91 ± 0.8	
C	3.799 ± 0.015	96.5 ± 0.4	
D	0.098 ± 0.020	2.5 ± 0.5	
E	2.008 ± 0.015	51 ± 0.4	
F	0.098 ± 0.020	2.5 ± 0.5	
G	0.630	16	max
H	6.614	168	max
J	1.535 ± 0.039	39 ± 1.0	
K	0.354 ± 0.004	9.0 ± 0.1	
L	2.756 ± 0.015	70 ± 0.4	
M	0.394	10	min
AA	0.591 ± 0.002	15 ± 0.05	
AB	0.787 ± 0.002	20 ± 0.05	
AC	0.394 ± 0.002	10 ± 0.05	
AD	0.295 ± 0.002	7.5 ± 0.5	

Inch dimensions derived from original millimetre dimensions.

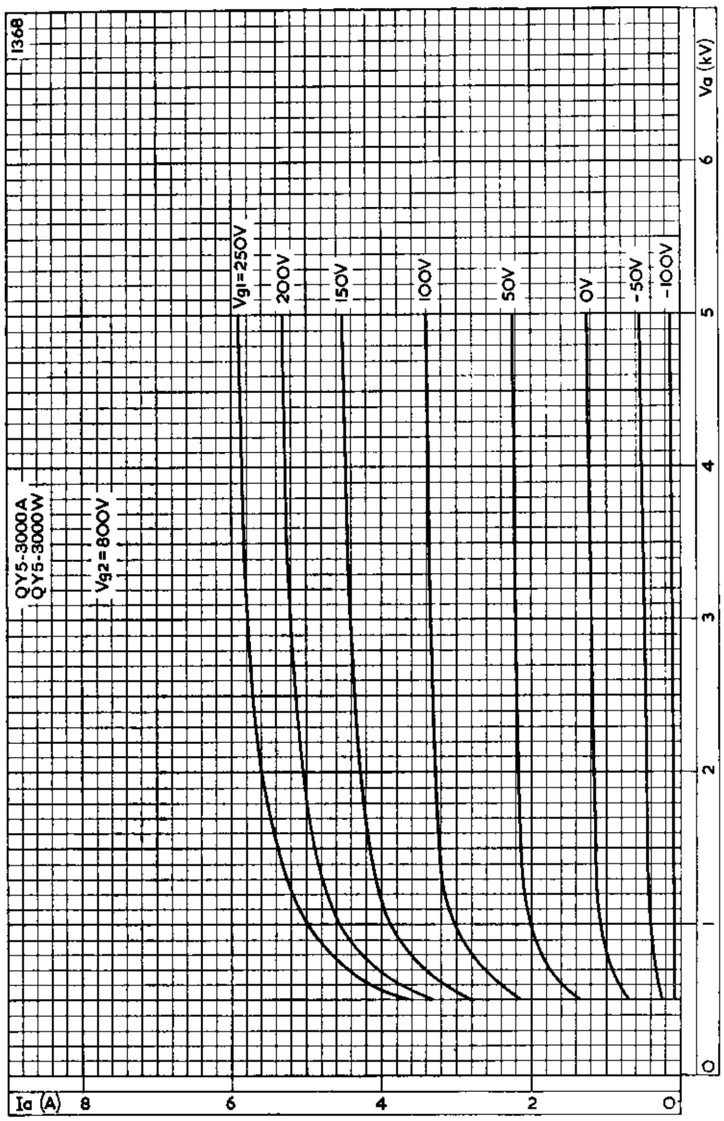
QY5-3000A
QY5-3000W

R.F. POWER TETRODE

OUTLINE DRAWING OF QY5-3000W



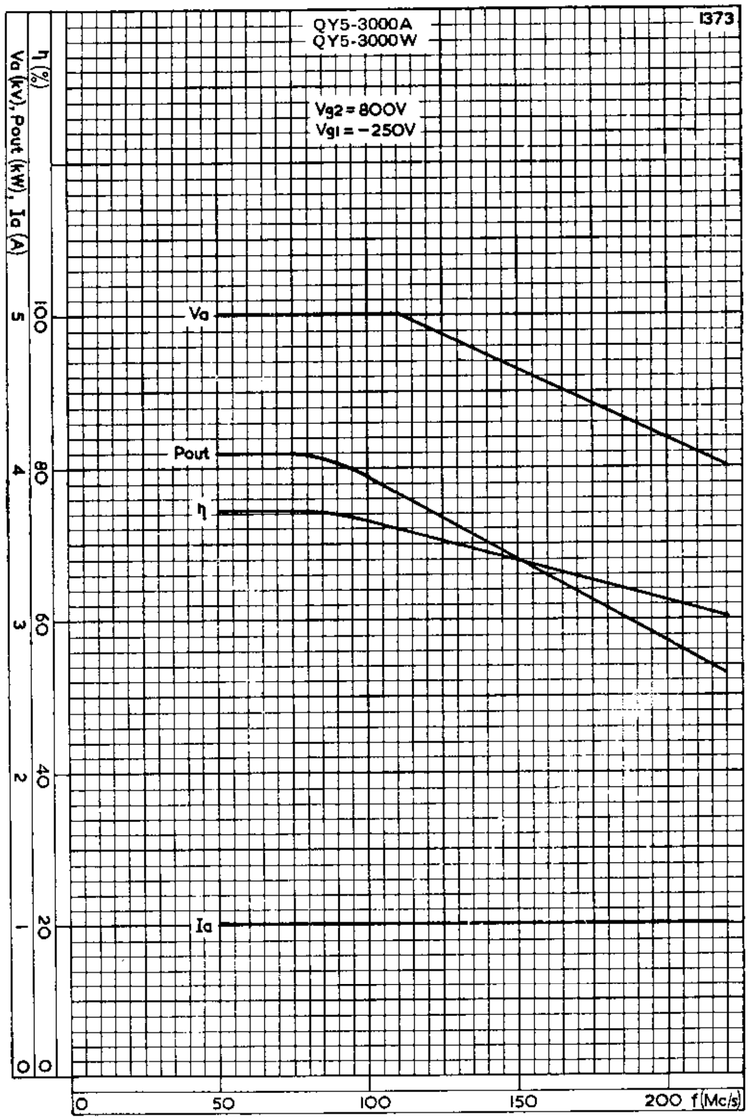
All dimensions in mm.



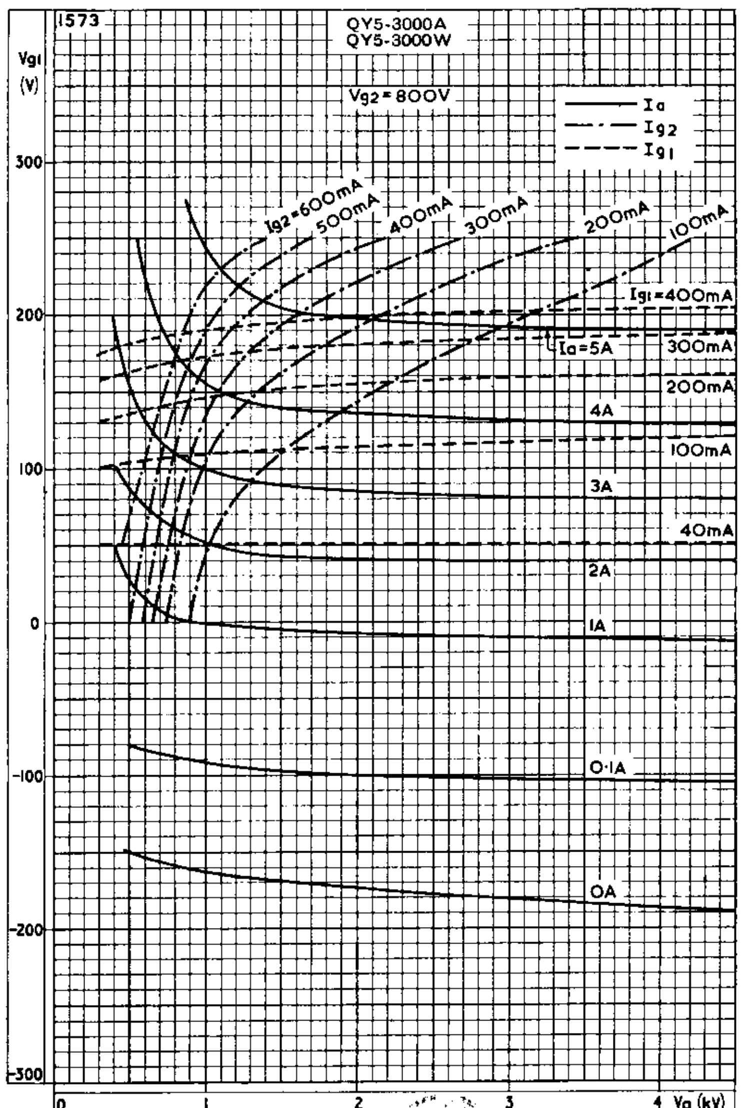
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

QY5-3000A
QY5-3000W

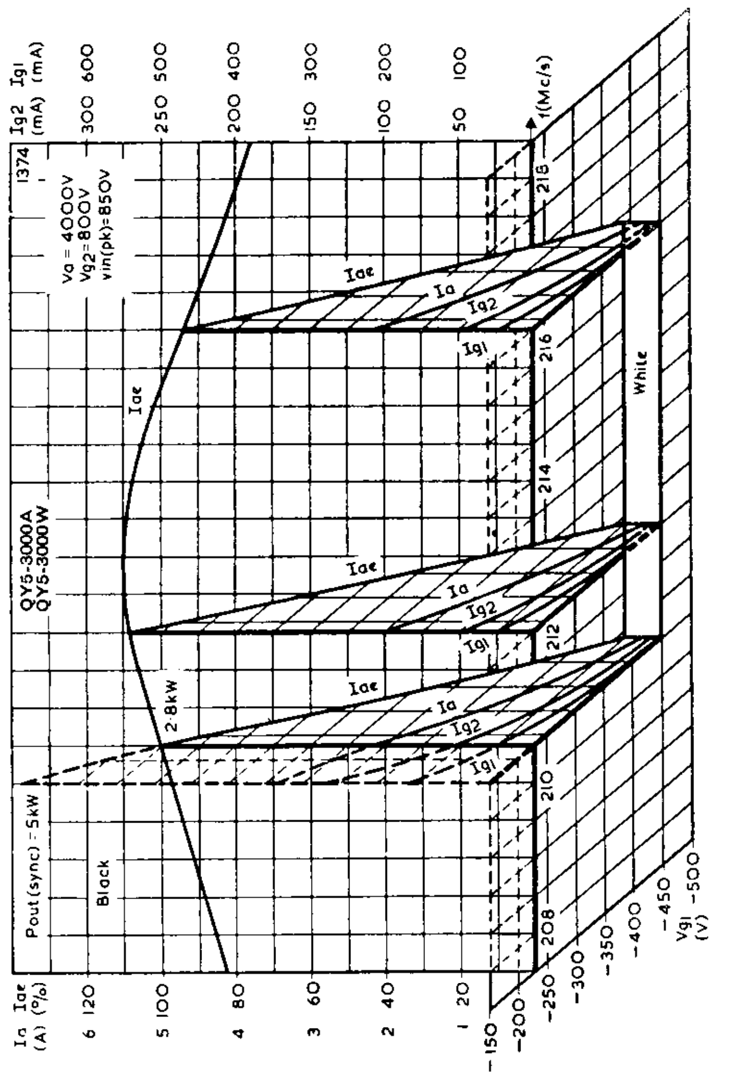
R.F. POWER TETRODE



FREQUENCY CHARACTERISTICS.
SINGLE VALVE CLASS "C" TELEGRAPHY

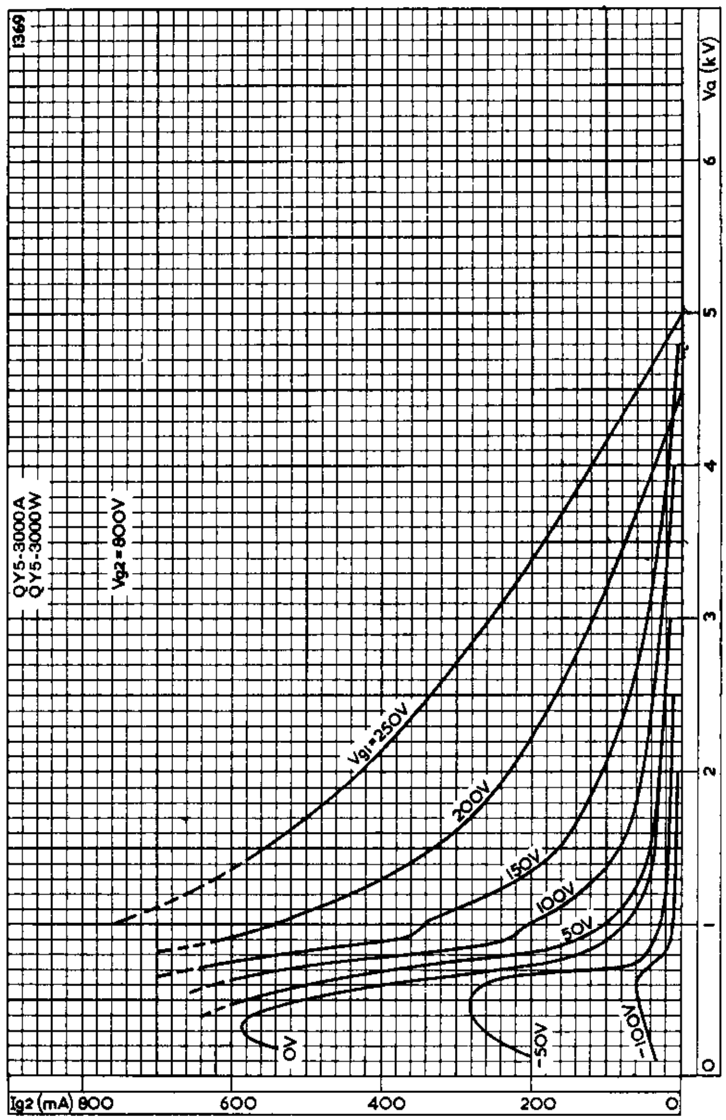


CONSTANT CURRENT CURVES



OPERATION OF TWO VALVES AS R.F. AMPLIFIER CLASS "C" GRID MODULATION FOR TELEVISION SERVICE, WITH NEGATIVE MODULATION AND POSITIVE SYNCHRONISATION

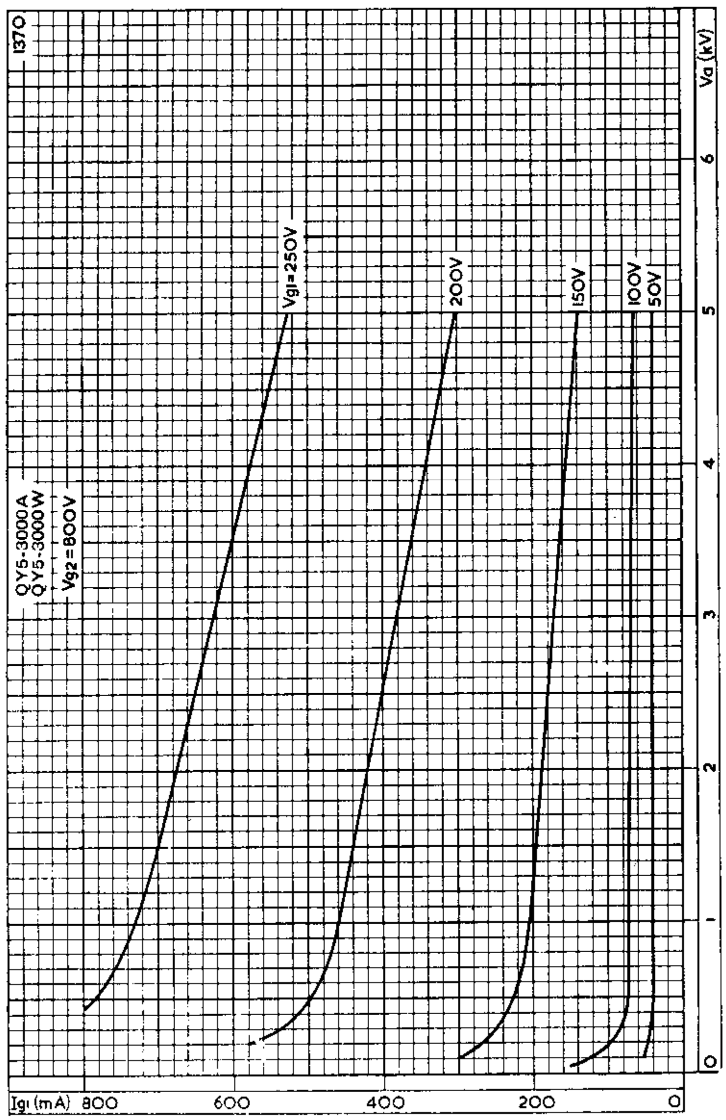
P_{out} (sync.) = 5.0kW



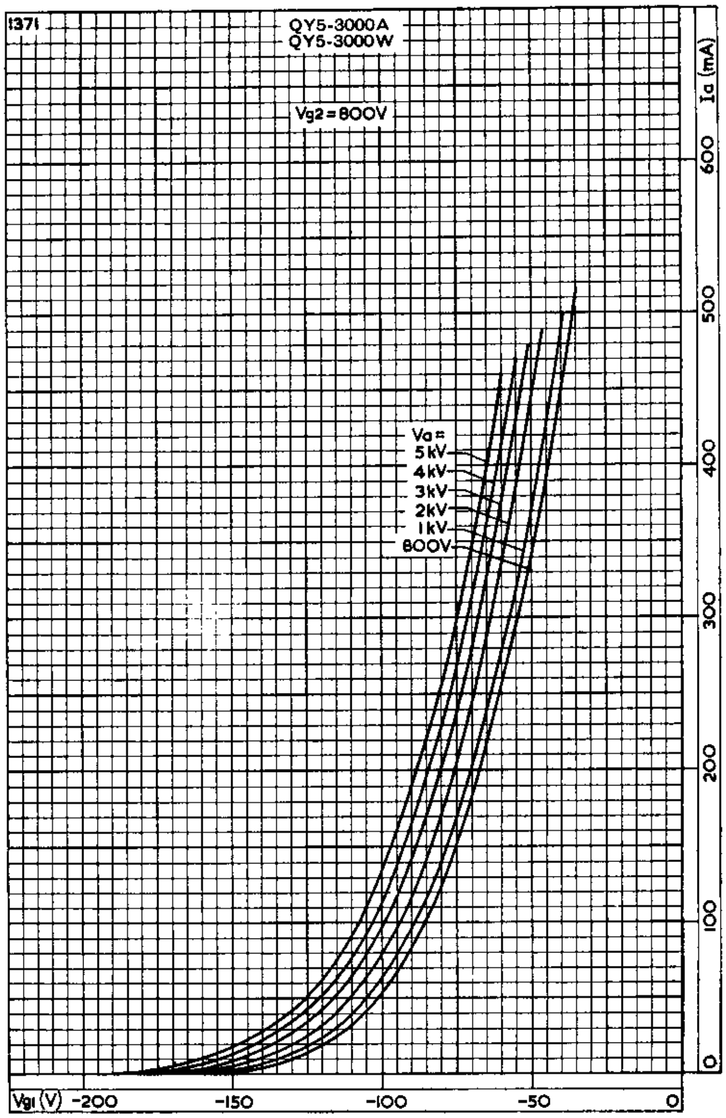
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

QY5-3000A
QY5-3000W

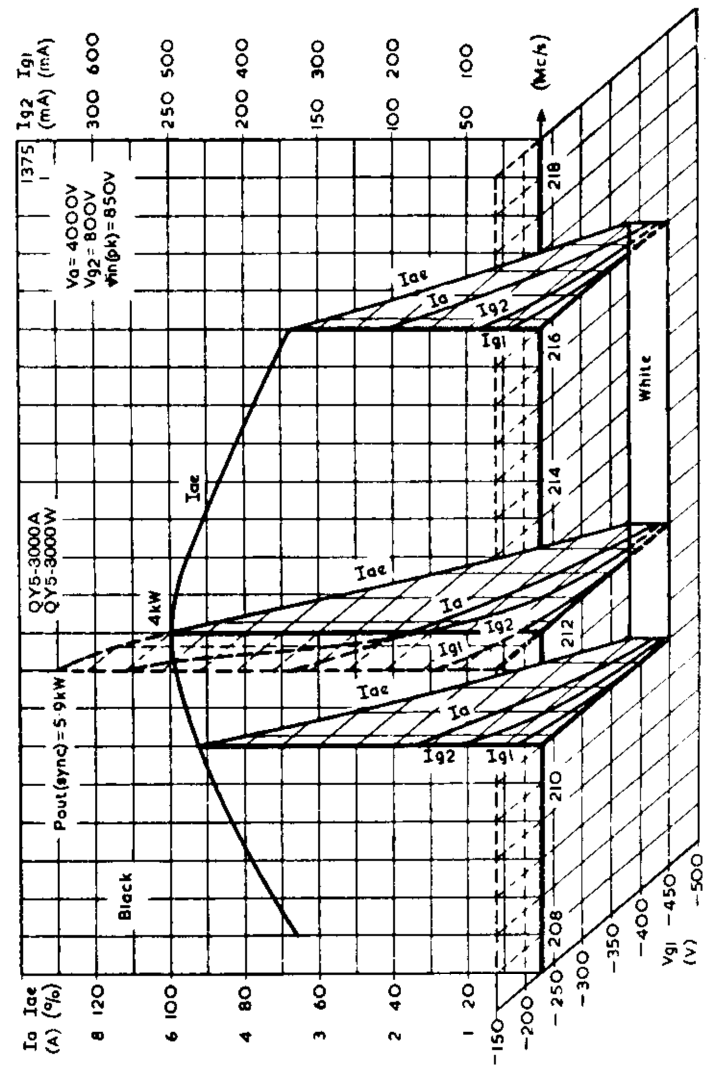
R.F. POWER TETRODE



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

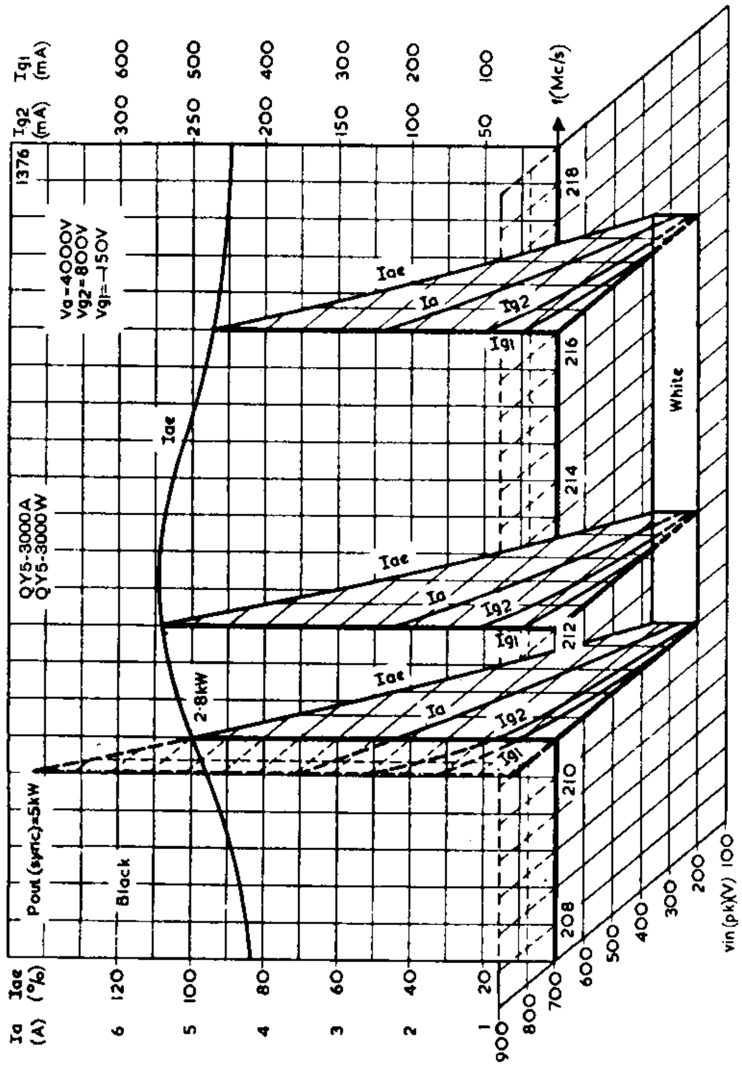


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER



OPERATION OF TWO VALVES AS R.F. AMPLIFIER CLASS "C" GRID MODULATION FOR TELEVISION SERVICE, WITH NEGATIVE MODULATION AND POSITIVE SYNCHRONISATION

P_{out} (sync.) = 5.9kW



OPERATION OF TWO VALVES AS R.F. AMPLIFIER CLASS "B" FOR TELEVISION SERVICE, WITH NEGATIVE MODULATION AND POSITIVE SYNCHRONISATION

TETRODE

QYS50-P40

Application: *Pulse Modulator*
Ratings: *50kV, 40A*
Construction: *Silica envelope*

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	$11.5^{+0.5}_{-0.2}$	V
I_f	64	A

The filament current must never exceed a surge value of 100A at any time during the warming-up period.

MOUNTING

Position — Vertical, anode terminal uppermost

The valve may be supported by a semi-rigid, or cushioned, insulating clamp around the silica envelope. Alternatively, it may be purchased already fitted in a holder with plug-in contacts.

CAPACITANCES

c_{a-g1}	3.0	pF
c_{g1-all}	45	pF
c_{a-all}	31	pF

CHARACTERISTICS

g_m (V_a = 10kV, I_a = 30A)	38	mA/V
μ_{g1-g2} (V_a = 10kV, I_a = 80mA)	4.0	
$-V_{g1}$ (I_a = 1mA at V_a = 55kV, V_{g2} = 5.0kV)	<3.4	kV

COOLING

Natural cooling

T_{seals} max.	260	°C
T_{anode} max.	810	°C

RADIATION HAZARD

There is considerable X-radiation from this valve and equipment should incorporate adequate shielding for the safety of operator. Lead sheet of 1mm thickness is satisfactory but it must extend far enough to stop reflections through small gaps and holes as well as the direct radiation from the valve.

QYS50-P40

TETRODE

PULSE MODULATOR

Limiting values (absolute ratings)

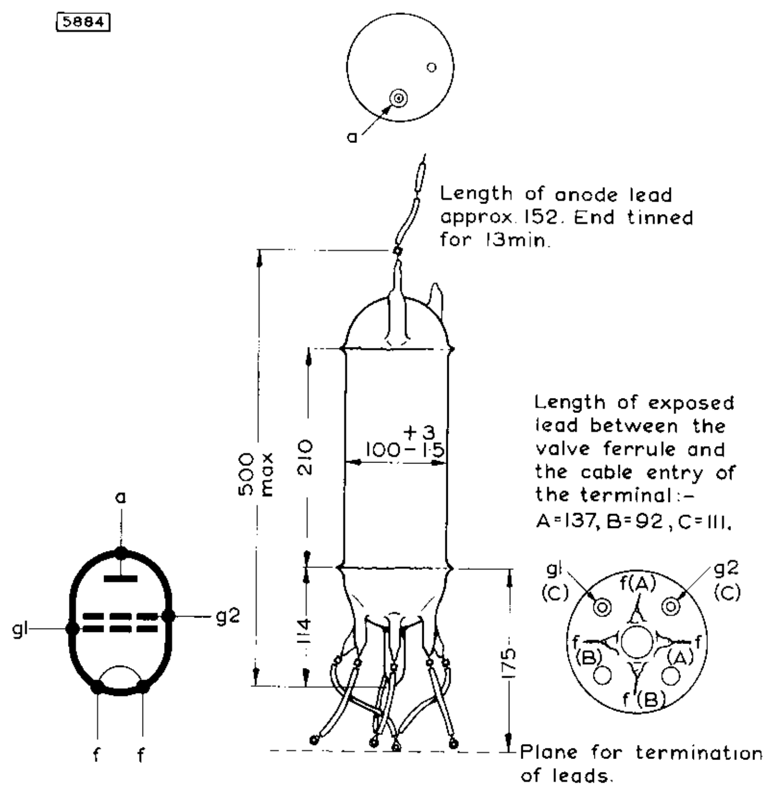
$v_{a(pk)}$ max.	55	kV
V_a max.	50	kV
$V_{g2(b)}$ max.	6.0	kV
V_{g2} max.	5.5	kV
$-V_{g1}$ max.	7.0	kV
I_k(pulse) max. for $t_p < 5\mu s$	50	A
Duty factor max.	0.001	
p_a max.	700	W
p_{g2} max.	250	W

Operating conditions

t_p	5.0	1.0	µs
Duty factor	0.0005	0.0005	
V_a	50	45	kV
V_{g2}	5.0	5.0	kV
V_{g1}	−4.0	−3.2	kV
V_{g1}(pulse)	4.3	3.8	kV
I_a(pulse)	30	40	A
I_a	15	20	mA
I_{g2}	1.0	1.0	mA
I_{g1}	*	*	
R_a	6.0	20	kΩ
I_{Ra}(pulse)	7.0	2.0	A
R_{load}(effective)	1.8	1.0	kΩ
I_{load}(pulse)	23	38	A
V_{load}(pulse)	43	37	kV

*The grid current is negative and the power supply should have an impedance of approximately 300Ω.

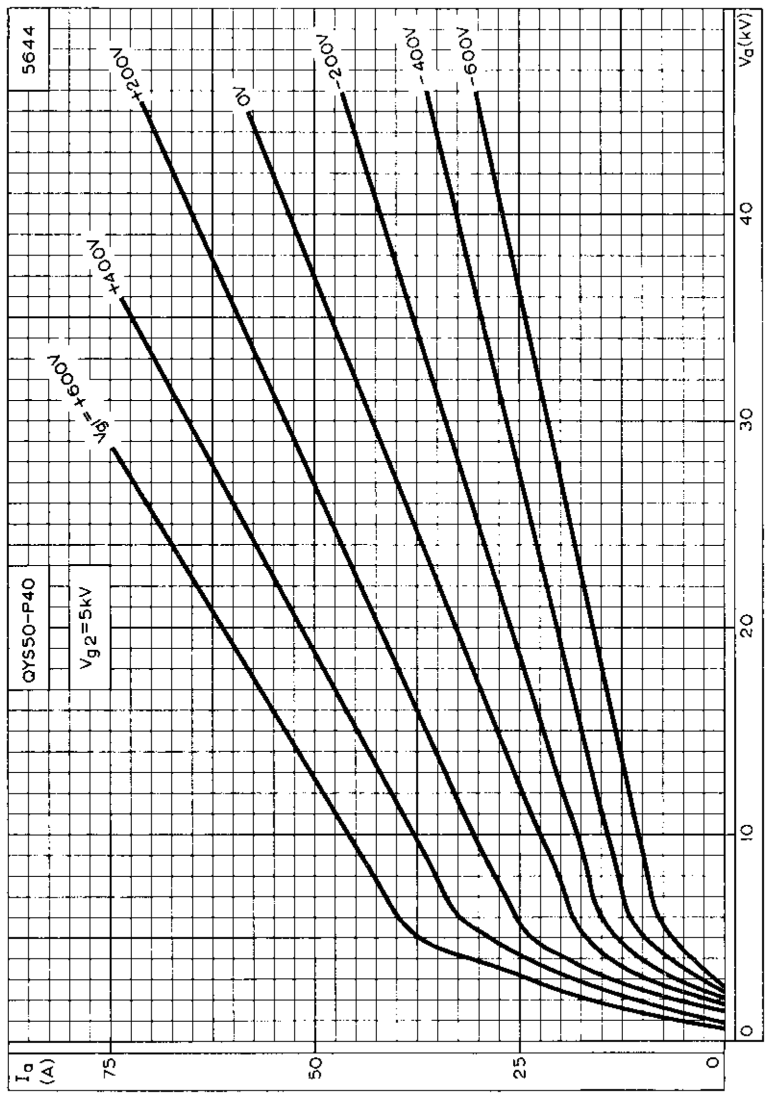
5884



All dimensions in mm

TETRODE

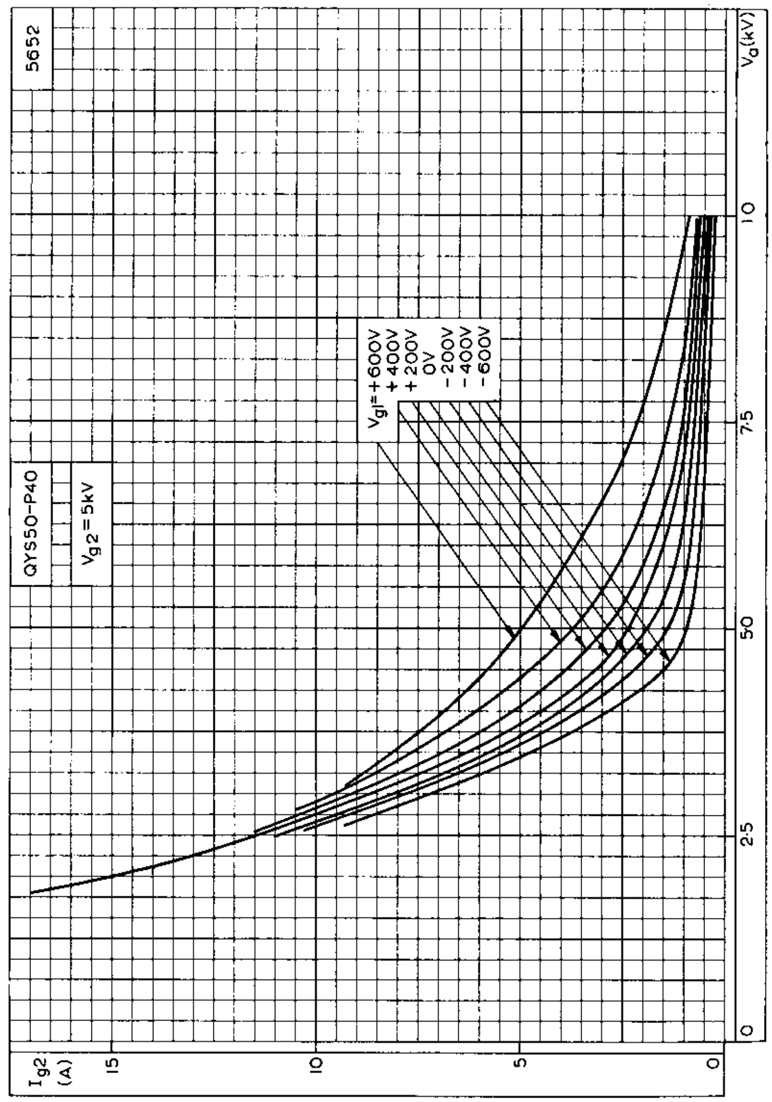
QYS50-P40



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE = 5kV

QYS50-P40

TETRODE



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE = 5kV

QUICK HEATING TETRODE

QZ06-20

QUICK REFERENCE DATA

Quick heating V.H.F. power amplifier for mobile transmitters.
70% power output in less than half a second.

f max.	175	Mc/s
V_a max.	650	V
p_a max.	25	W
Performance		
f	60	Mc/s
P_{out}	65	W

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

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY (Intermittent mobile service)

Absolute maximum ratings

f max.	175	Mc/s
V_a max.		
f < 60Mc/s	650	V
f = 175Mc/s	400	V
V_{g2} max.	200	V
$-V_{g1}$ max.	150	V
I_a max.	160	mA
I_{g1} max.	5.0	mA
p_a max.	25	W
p_{g2} max.	5.0	W
R_{g1-k} max.	30	kΩ

Typical operating conditions

f	60	175	Mc/s
V_a	600	400	V
V_{g2}	180	190	V
$-V_{g1}$	71	54	V
I_a	150	150	mA
I_{g2}	15	15	mA
I_{g1}	2.8	2.2	mA
$v_{in(pk)}$	91	68	V
P_{load} (driver)	2.0	5.0	W
p_a	25	25	W
p_{g2}	2.7	2.9	W
η_a	73.5	58	%
P_{out}	65	35	W
P_{load}	53	28	W

QZ06-20

QUICK HEATING TETRODE

CLASS 'C' ANODE AND SCREEN GRID MODULATION (Intermittent mobile service)

Absolute maximum ratings

Carrier condition for a modulation factor of 1

f max.	175	Mc/s
V_a max.		
f < 60Mc/s	480	V
f = 175Mc/s	350	V
V_{g2} max.	250	V
$-V_{g1}$ max.	150	V
I_a max.	120	mA
I_{g1} max.	3.5	mA
p_a	14	W
p_{g2} max.	2.0	W
R_{g1-k} max.	30	kΩ

Typical operating conditions

f	60	60	Mc/s
V_a	475	400	V
V_{g2}	135	150	V
$-V_{g1}$	77	87	V
I_a	94	112	mA
I_{g2}	9.0	12	mA
I_{g1}	2.8	3.4	mA
$v_{in(pk)}$	95	107	V
P_{load} (driver)	0.3	0.4	W
p_a	11	13	W
p_{g2}	1.2	1.8	W
η_a	75	71	%
P_{out}	34	32	W
P_{load}	29	27	W
$\eta_{transfer}$	85	85	%

CATHODE

Quick heating filament. 70% P_{out} in less than 0.5 second.

V_f	1.6	V
I_f	3.2	A

Frequency of filament supply

Sine wave	max. 200	c/s
Square wave	Any	

The filament has been designed to accept temporary variations in supply voltage of ±15%.

CAPACITANCES

c_{a-g1}	< 240	mpF
c_{in}	13.5	pF
c_{out}	8.5	pF

QUICK HEATING TETRODE

QZ06-20

CHARACTERISTICS (measured at V_a = 200V, V_{g2} = 200V, I_a = 100mA)

g_m	7.0	mA/V
μ_{g1-g2}	4.5	

COOLING

Radiation and convection

T_{bulb} max.	220	°C

MOUNTING POSITION

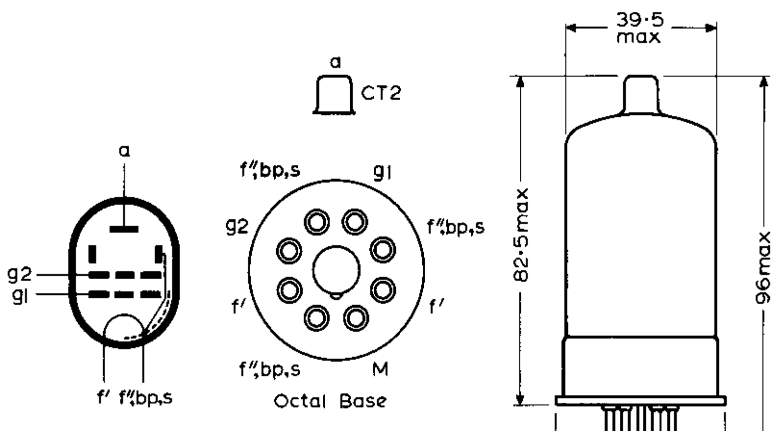
Any

PHYSICAL DATA

Weight of valve	2.08	oz
	59	g
Weight of valve plus carton	3.0	oz
	85	g

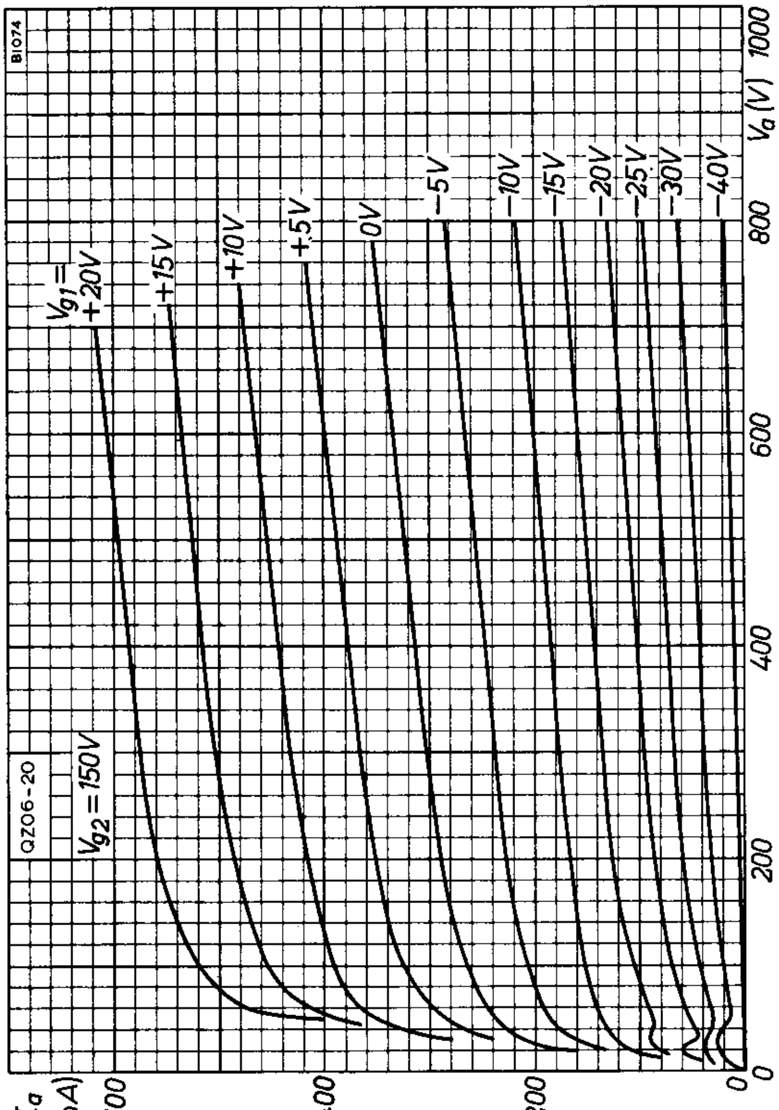
ACCESSORIES

Socket	5903/13
Anode cap	28906 022

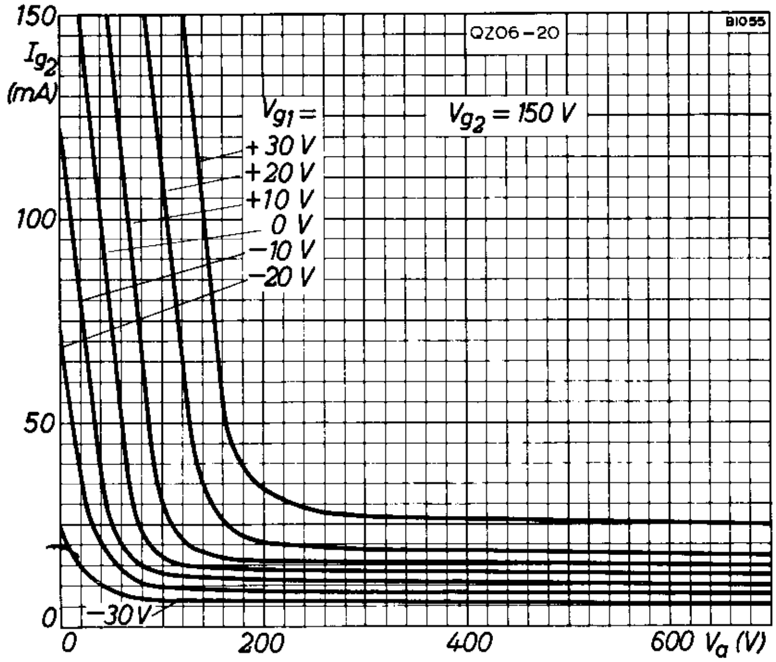


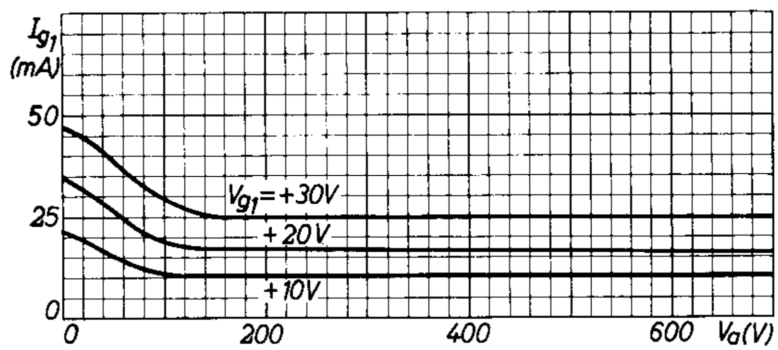
Connect contacts 1,4 and 6 together and contacts 2 and 7 together externally to reduce the effective contact resistance .

All dimensions in mm

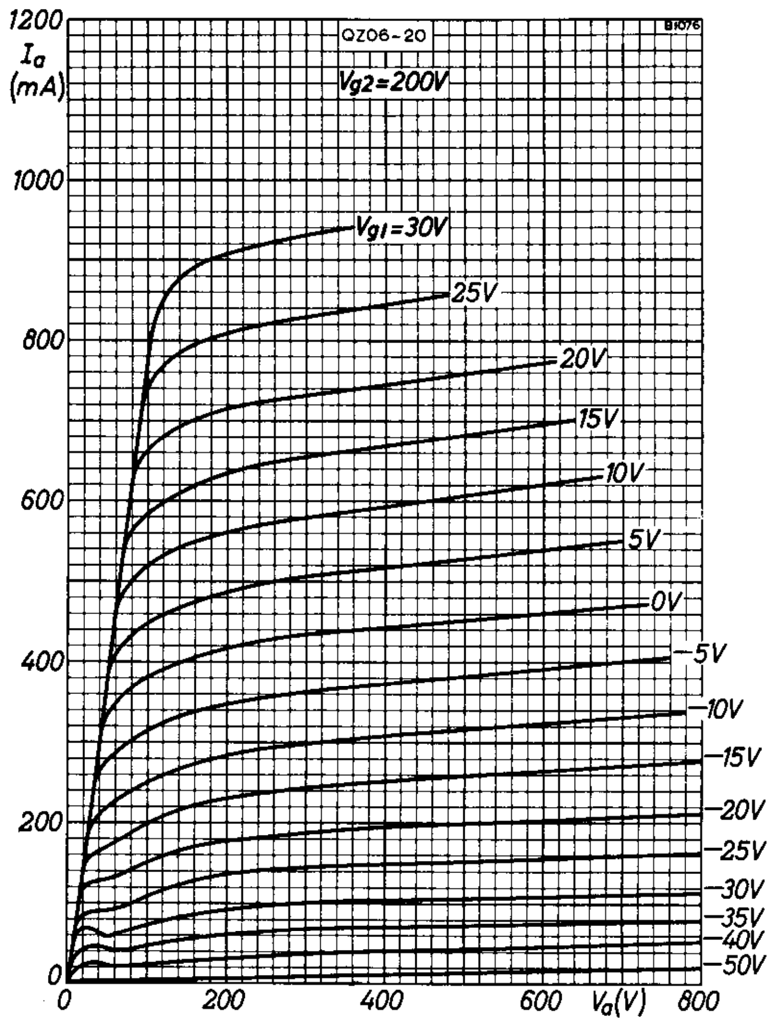


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER.
$V_{g2} = 150V$

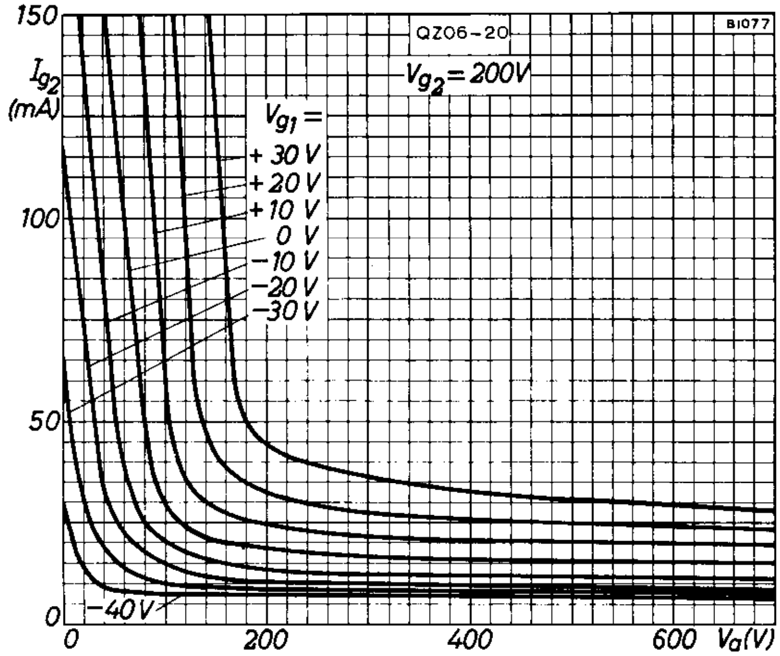


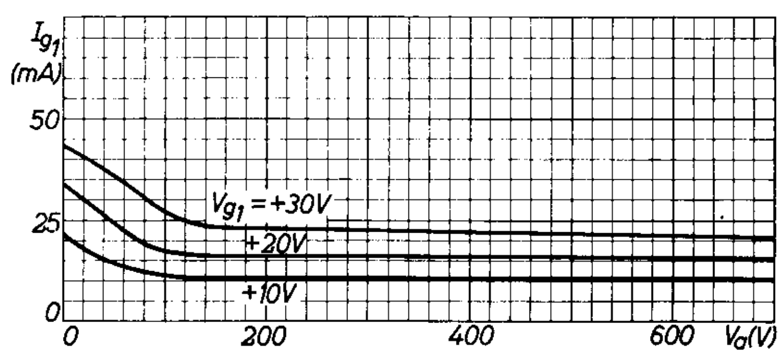


SCREEN-GRID AND CONTROL-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.
V_{g2} = 150V



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





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