



PHILIPS

7704/
QBL5-4000

(1)

PROFESSIONAL TUBE REFERENCE DATA

GENERAL DESCRIPTION

Forced-air-cooled transmitting tetrode for use as R.F. amplifier, modulator or frequency multiplier.

ELECTRICAL DATA

Filament Voltage	6.3 volts
Filament current	32.5 amps
Amplification Factor $g_1 - g_2$	8.5
Transconductance	11000 Micromhos
$(E_b = 5000 \text{ V}, E_{c2} = 800 \text{ V}, I_b = 0.6 \text{ A})$	

DIRECT INTERELECTRODE CAPACITANCES

Grid No. 1 to plate	max. 0.35 pF
Input	23.5 pF
Output	8.4 pF

MECHANICAL DATA

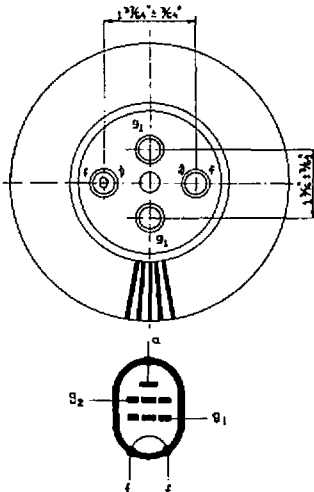
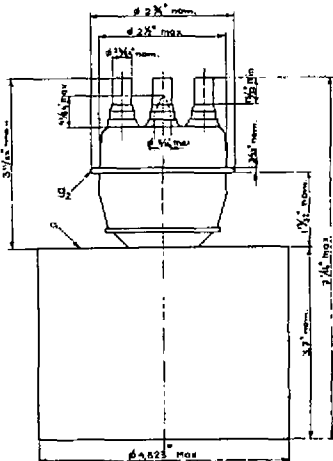
Cathode	Thoriated-tungsten filament
Weight	
tube net weight	10.5 lbs.
Shipping weight	18.2 lbs.
insulating net weight	4.65 lbs.
pedestal shipping weight	6.85 lbs.
Mounting position	vertical with anode up or down

COOLING DATA

Maximum temperature of seals	180°C
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In order to keep the temperature of the seals below the maximum permissible value, it may be necessary to direct an airflow to the seals. At frequencies above 30 Mc/s both Grid No. 1 base pins must be used.

Plate Dissipation (watts)	Height above sea level (feet)	Inlet air Temperature (°C)	Minimum air flow (cu. ft./min.)	Inlet air pressure (inches of water)
1000	0	35	106	0.31
1000	0	45	110	0.31
1000	5000	35	131	0.35
1000	10000	25	145	0.39
3000	0	35	184	0.90
3000	0	45	216	1.13
3000	5000	35	219	1.01
3000	10000	25	233	1.01



- 1) This pin is marked "O"
- 2) This pin should be used for connecting the anode return lead.

ACCESSORIES

Insulating Pedestal	40630
Clips for filament and grid No. 1	40634
Grid No. 2 connector	40650 or 40622
(connector 40650 may be used at frequencies below 30 Mc/s only)	

R.F. CLASS C TELEGRAPHY

ABSOLUTE MAXIMUM RATINGS

Frequency	30	110	220	Mc/s
Plate Voltage	5.5	5	4	kV
D.C. Plate Input Power	5.5			kW
Plate Dissipation	3			kW
Plate Current	1.1			A
Grid #2 Voltage	800			V
Grid #2 Dissipation	100			W
Grid #1 Voltage	-500			V
Grid #1 Dissipation	30			W

TYPICAL CHARACTERISTICS

Frequency	75	110	75	220	Mc/s
Plate Voltage	5	5	4	4	kV
Grid #2 Voltage	800	800	800	800	V
Grid #1 Voltage – DC	-250	-250	-250	-250	V
Grid #1 Voltage – AC	480	480	500	500	V _{ac}
Plate Current	1.1	1.1	1.1	1.1	A
Grid #2 Current	100	100	120	120	mA
Grid #1 Current	70	70	80	80	mA
Input Power Grid #1	30	30	36	36	W
Dissipation Grid #2	80	80	96	96	W
Plate Input Power	5.5	5.5	4.4	4.4	kW
Plate Dissipation	1.4	1.6	1.25	1.5	kW
Power Output	4.1	3.9	3.15	2.9	kW
Efficiency	74.5	71	72	66	%

R.F. CLASS C PLATE AND SCREEN GRID MODULATION

(Screen grid modulated via a choke of 60 H)

ABSOLUTE MAXIMUM RATINGS

Frequency	30	110	220	Mc/s
Plate Voltage	4.5	4	3.2	kV
Plate Input Power	3.6			W
Plate Dissipation	2			kW
Plate Current	0.9			A
Grid #2 Voltage	800			V
Grid #2 Dissipation	100 ⁽¹⁾			W
Grid #1 Voltage	500			V
Grid #1 Dissipation	30			W

(1) For all other modulation methods Grid #2 Dissipation = 65 W max.

TYPICAL CHARACTERISTICS

Frequency	110	Mc/s
Plate Voltage	4	kV
Grid #2 Voltage	800	V
Grid #1 Voltage – DC	-375	V
Grid #1 Voltage – AC	625	V _{ac}
Plate Current	0.9	mA
Grid #2 Current	120	mA
Grid #1 Current	85	mA
Plate Input Power	3.6	kW
Plate Dissipation	0.9	kW
Power Output	2.7	kW
Grid #2 Dissipation	96	W
Grid #1 Input Power	48	W
Efficiency	75	%
Modulation	100	%
Modulation Power	1.8	kW

R.F. CLASS B AMPLIFIER – SINGLE SIDE BAND

ABSOLUTE MAXIMUM RATINGS

Frequency	110	Mc/s
Plate Voltage	5	kV
D.C. Plate Input Power	6.5	kW
Plate Dissipation	3	kW
Plate Current	1.3	A
Grid #2 Voltage	800	V
Grid #2 Dissipation	100	W
Grid #1 Voltage	80	mA

TYPICAL CHARACTERISTICS

Plate Voltage	5	5	4.5	4.5	4	4	kV
Grid #2 Voltage	800	800	800	800	800	800	V
Grid #1 Voltage – DC	-107	-107	-105	-105	-104	-104	V
Grid #1 Voltage – AC	0	277	0	275	0	274	V _{ac}
Plate Current	80	1300	80	1290	70	1280	mA
Grid #2 Current	0	75	0	75	0	78	mA
Grid #1 Current	0	55	0	55	0	54	mA
Input Power – Grid #1	0	15	0	15	0	15	W
Dissipation – Grid #2	0	60	0	60	0	62.5	W
Plate Input Power	0.4	6.5	0.36	5.8	0.28	5.1	kW
Plate Dissipation	0.4	2.1	0.36	1.95	0.28	1.8	kW
Power Output	–	4.4	–	3.85	–	3.3	kW
Efficiency	–	68	–	66.5	–	65	%

L.F. CLASS B AMPLIFIER AND MODULATOR

ABSOLUTE MAXIMUM RATINGS

Plate Voltage	5	kV
DC Plate Input Power	5.5	kW
Plate Dissipation	3	kW
Plate Current	1.1†	A
Grid #2 Voltage	800	V
Grid #2 Dissipation	100	W
Grid #1 Voltage	500	V
Grid #1 Dissipation	30	W

† At 100% modulation with single tone sine wave plate current = 1.5 A max.

TYPICAL CHARACTERISTICS

Plate Voltage	5	5	5	5	5	5	4	4	kV
Grid #2 Voltage	800	800	800	800	800	800	800	800	V
Grid #1 Voltage – DC	-107	-107	-107	-107	-107	-107	-103	-103	V
Grid #1 Voltage – AC	0	714	0	594	0	214	0	366	V
Resistance – Plate to Plate	3.7	3.7	5	5	17.6	17.6	7	7	kohms
Plate Current – 2x	0.1	1.46	0.1	1.1	0.1	0.32	0.1	0.6	A
Grid #2 Current – 2x	0	120	0	50	0	10	0	60	mA
Grid #1 Current – DC 2x	0	150	0	40	0	0	0	11	mA
Grid #1 Current – AC 2x	0	750	0	60	0	0	0	70	mA
Input Power – Grid #1 2x	0	50	0	11	0	0	0	2	W
Dissipation – Grid #2 2x	0	96	0	40	0	8	0	48	W
Plate Input Power 2x	0.5	7.3	0.5	5.5	0.5	1.6	0.4	2.4	kW
Plate Dissipation 2x	0.5	2.55	0.5	1.9	0.5	0.55	0.4	0.9	kW
Power Output	0	9.5	0	7.2	0	2.1	0	3.0	kW
Efficiency	–	65	–	65	–	65	–	62	%

TELEVISION SERVICE

GRID MODULATED R.F. CLASS C AND R.F. CLASS B

Negative Modulation – Positive Synchronization

ABSOLUTE MAXIMUM RATINGS

Frequency	110	220	Mc/s
Plate Voltage	5	4	kV
Plate Current – sync.	1.5	–	A
Plate Input Power – sync.	7	6	kW
Plate Dissipation – sync.	3	–	kW
Grid #2 Voltage	800	–	V
Grid #2 Dissipation – sync.	100	–	W
Grid #1 Voltage *	-500	–	V
Grid #1 Current – sync.	80	–	mA

TYPICAL CHARACTERISTICS

	Class B and C		Class C	Colour TV Class C	
Frequency	54-88 ⁽¹⁾	170-220 ⁽¹⁾	170-220	170-220 ⁽¹⁾	Mc/s
Bandwidth - 1.5 db ⁽²⁾	6.5	6.5	-	4	Mc/s
- 3 db ⁽²⁾	12	12	7.5	8.5	Mc/s
Plate Voltage	5	4	4	3.5	kV
Grid #2 Voltage	800	800	800	700	V
Grid #1 Voltage †	-175	-150	-	-	V
- sync *	-175	-150	-150	-120	V
- black *	-260	-230	-260	-170	V
- white *	-450	-450	-450	-320	V
A.C. Grid #1 Voltage * ⁽³⁾	900	850	850	640	V
- sync † ⁽³⁾	900	850	-	-	V
- black † ⁽³⁾	730	700	-	-	V
Plate Current - sync	2.7	2.75	2.75	2.0	A
- black	1.75	2.1	1.5	1.5	A
Grid #2 Current - sync	145	110	250	82	mA
- black	40	50	65	38	mA
Grid #1 Current - sync	82	100	80	100	mA
- black	35	50	20	50	mA
Input Power Grid #1					
- sync ⁽⁴⁾	200-300	300-400	200-300	100-200	W
Power Output - sync	8.0	5.0	5.9	3.0	kW
- black	4.5	2.8	3.3	1.7	kW

* Class C only

† Class B only

GRID MODULATED R.F. CLASS C AND R.F. CLASS B

Positive Modulation - Negative Synchronization

ABSOLUTE MAXIMUM RATINGS

Frequency	110	220	Mc/s
Plate Voltage	5	4	kV
Grid #2 Voltage	800	-	V
Grid #1 Voltage *	-500	-	V
Plate Current - White	1.1	-	A
Plate Input Power - White	5.5	4.4	kW
Plate Dissipation - White	3	-	kW
Grid #2 Dissipation - White	100	-	W
Grid #1 Current - White	80	-	mA

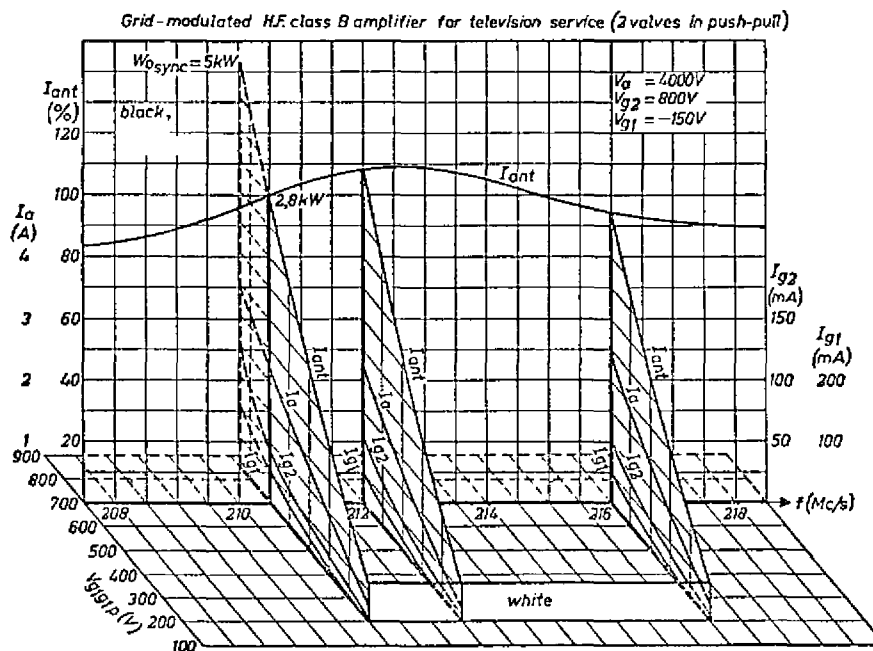
* Class C only

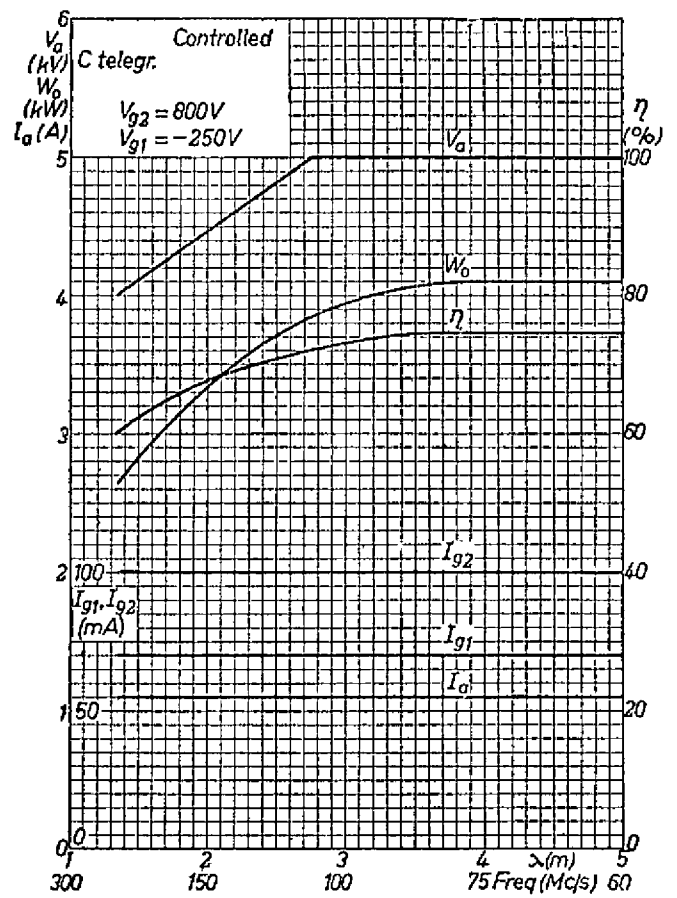
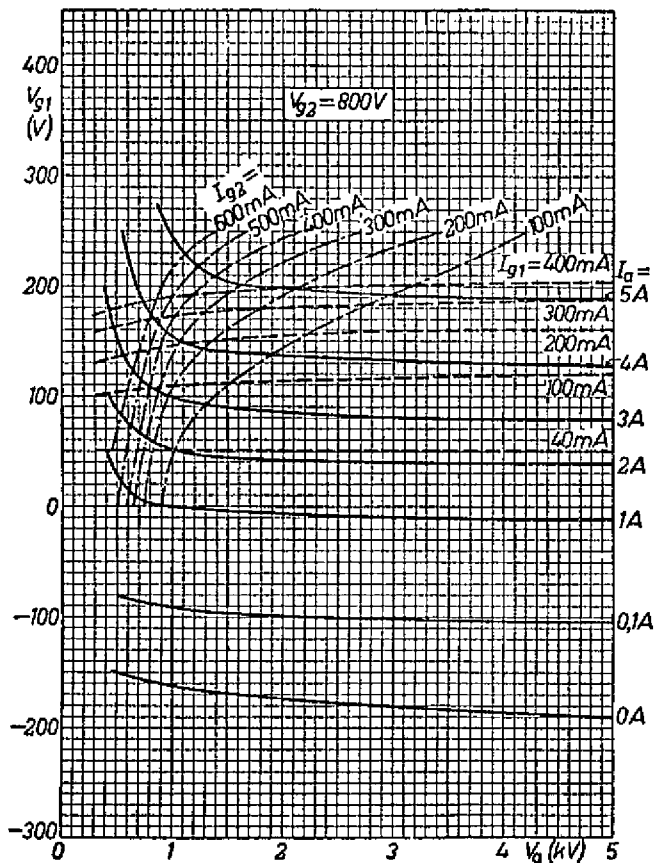
TYPICAL CHARACTERISTICS

	Class B	Class C		
Frequency	170–220 ⁽¹⁾	170–220 ⁽¹⁾	170–220 ⁽¹⁾	Mc/s
Bandwidth – 1.5 db ⁽²⁾	6.5	6.5	–	Mc/s
– 3 db ⁽²⁾	12	12	7.5	Mc/s
Plate Voltage	4	4	4	kV
Grid #2 Voltage	800	800	800	V
Grid #1 Voltage	-150	–	+ –	V
– white	–	-230	-230	V
– black	–	-380	-380	V
AC Grid #1 Voltage ⁽³⁾	–	850	850	V
– white ⁽³⁾	700	–	–	V
– black ⁽³⁾	350	–	–	V
Plate Current – white	2.1	2.1	1.7	A
– black	0.6	0.6	0.5	A
Grid #2 Current – white	50	50	80	mA
– black	10	10	10	mA
Grid #1 Current – white	50	50	25	mA
– black	0	0	0	mA
Input Power – Grid #1 ⁽⁴⁾	200–300	300–400	200–300	W
Power Output – white	2.8 ⁽⁵⁾	2.8 ⁽⁵⁾	4.0	kW
– black	0.25	0.25	0.36	kW

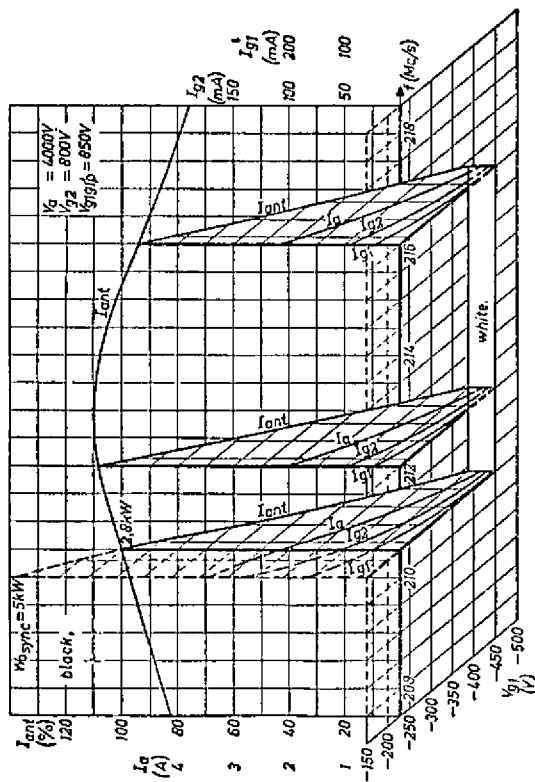
Footnotes

- (1) The operating conditions are given at a frequency slightly below the peak of the resonance curve.
- (2) This value of bandwidth is based on measurements on a circuit with a single LC section.
- (3) Measured by the "slide-back" method.
- (4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.
- (5) In the peak of the resonance curve Power Output – white = 3.3 kW.





Grid-modulated H.F. class C amplifier for television service (2 valves in push-pull)



Grid-modulated H.F. class C amplifier for television service (2 valves in push-pull)

