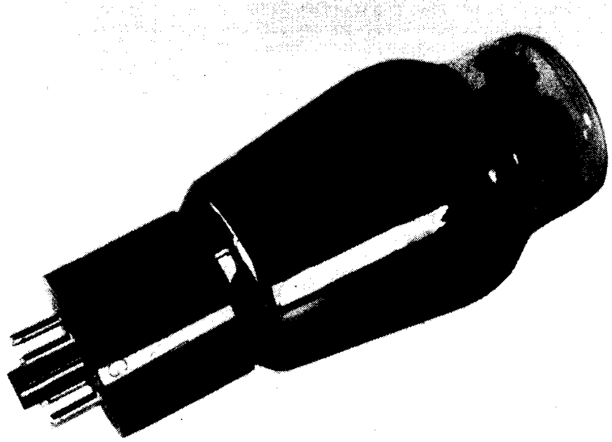
6L6G



BEAM TETRODE

APPLICATION REPORT

The 6L6G is an indirectly-heated beam tetrode. The heater is intended for operation in parallel with other valves in AC operated equipment. The valve is designed for use, either singly or in push-pull, in the output stage in receivers or in public address amplifiers.

NOTE: The maximum ratings given in this report are absolute maxima and should not be exceeded in any circumstances.

AN IT&T ASSOCIATE

Note that within the ratings, the electrical characteristics for 6L6G are the same as 6L6GB, 6L6GA, 6L6GT, 6L6GC, (the following have different pin-outs) 7027, 7027A 807, 5933, 6BG6G, 6BG6GA.

6L6G

DESCRIPTION: The valve consists of a beam tetrode unit capable of an output of the order of 10 watts. The unit is mounted in a standard ST16 bulb and is based with a moulded International Octal base. This report contains characteristics of the valve and details of its use as a triode or a tetrode in push-pull and in single-ended amplifiers.

CHARACTERISTICS: Indirectly-heated oxide-coated cathode

Heater Voltage*	6·3 volts
Heater Current (nominal)	0·9 amperes
Max. DC Heater-Cathode Potential	250 volts

* The voltage should not vary more than 5% from the rated value i the valve is used under Class AB2 conditions nor more than 7% if used under Class A or AB1 conditions.

DIMENSIONS:

Max. Overall Length	5-5/16 ins.
Max. Diameter	2-1/16 ins.
Max. Seated Height	4-3/4 ins.

BASE: International Octal 7-pin (medium shell).

BASE CONNECTIONS:

Pin 1 No connection
Pin 2 Heater
Pin 3 Plate
Pin 4 Screen
Pin 5 Grid
Pin 6 Omitted
Pin 7 Heater
Pin 8 Cathode

MAXIMUM RATINGS: **Tetrode Connected:**

Max. Plate Voltage	400 volts
Max. Screen Voltage	300 volts
Max. Plate Dissipation	21 watts
Max. Screen Dissipation	3 watts

Triode Connected (Plate and Screen strapped):

Note that to avoid parasitic oscillations the plate and screen should be connected together through a 100 ohm resistor or an RF choke of about 20 microhenries.

Max. Plate Voltage	350 volts
Max. Dissipation	15 watts

CAPACITIES (approx.): Measured without shield.

Grid-Plate	0·7 pF
Input	11·5 pF
Output	8·5 pF
Heater-Cathode	8·7 pF

MOUNTING: The valve should be mounted in a vertical position with the base downward. In exceptional circumstances it is permissible to mount the valve horizontally but only in such a way that the plane of the major axes of the control grid and screen are vertical. The plane of these grids is correct if the keyway is at 90° to the vertical.

AN IT&T ASSOCIATE

VENTILATION: As this valve runs very hot in operation the layout and design of equipment should be such that adequate ventilation is afforded to ensure a safe bulb temperature under all conditions.

CHARACTERISTIC CURVES: Attached are curves showing:

a. Plate current plotted against plate voltage for various values of grid voltage for the valve connected as a tetrode with a screen voltage of 250 volts (Curve No. 307·12).

b. Plate current plotted against plate voltage for various values of grid voltage for the valve connected as a tetrode with a screen voltage of 270 volts (Curve No. 307·29).

c. Plate current plotted against plate voltage for various values of grid voltage for the valve connected as a triode (Curve No. 307·30).

TYPICAL OPERATING CONDITIONS

CLASS A AMPLIFIER, Single-ended:

Triode Connected (Plate and Screen strapped):

Plate Voltage	250	250	volts
Grid Voltage	−20	—	volts
Autobias Resistor	—	500	ohms
Plate Current, Zero Signal	40	40	mA
Plate Impedance	1700	—	ohms
Amplification Factor	8	—	
Mutual Conductance	4·7	—	mA/V
Output Load	5000	6000	ohms
AF Grid Voltage, Peak	20	20	volts
Total Harmonic Distortion	4·5	4·0	%
Power Output	1·3	1·1	watts

Curves are attached to this report which show the relationship between power output, harmonic distortion and input signal voltage for fixed bias (Curve No. 307·14), and for autobias (Curve No. 307·15).

CLASS A AMPLIFIER, Push-Pull: (Values given are for two valves.)

Triode Connected (Plate and Screen strapped):

Plate Voltage	250	250	325	325	volts
Grid Voltage	−20	—	−30	—	volts
Autobias Resistor	—	250	—	375	ohms
Plate Current, Zero Signal	80	80	80	80	mA
Output Load, Plate-plate	5000	5000	8000	8000	ohms
AF Grid Voltage Peak, Grid-grid	40	40	60	60	volts
Total Harmonic Distortion	0·35	0·4	0·7	0·6	%
Power Output	3·5	3·1	5·75	6·0	watts

Curves are attached to this report showing the relationship between power output, harmonic distortion and input signal voltage for a plate voltage of 250 volts for autobias (Curve No. 307·16) and fixed bias (Curve No. 307·17). Similarly for a plate voltage of 325 volts for fixed bias (No. 307·18) and autobias (No. 307·19).

CLASS AB1 AMPLIFIER, Push-pull; (Values are for two valves.)

Triode Connected (Plate and Screen strapped):

Plate Voltage	325	325	volts
Grid Voltage	−33	—	volts
Autobias Resistor	—	550	ohms
Plate Current, Zero Signal	60	60	mA
Plate Current, Max. Signal	80	66	mA
Output Load, Plate-plate	8000	7000	ohms
AF Grid Voltage Peak, Grid-grid	66	73·5	volts
Total Harmonic Distortion	1·1	1·6	%
Power Output	7	7·25	watts

Curves are attached to this report which show the relationship between power output, harmonic distortion and input signal voltage for fixed bias (Curve No. 307·20) and autobias (Curve No. 307·21).

CLASS A AMPLIFIER, Single-ended:

Tetrode Connected:

Plate Voltage	250	350	250	300	volts
Screen Voltage*	250	250	250	200	volts
Grid Voltage	−14	−18	—	—	volts
Autobias Resistor	—	—	170	220	ohms
Plate Current	72	54	75	51	mA
Screen Current	5·0	2·5	5·4	3·0	mA
Plate Impedance	22,500	33,000	—	—	ohms
Mutual Conductance	6·0	5·2	—	—	mA/V
Output Load	2500	4200	2500	4500	ohms
AF Grid Voltage Peak	14	18	16	13	volts
Total Harmonic Distortion	10	15	10	11	%
Power Output	6·5	10·8	6·5	6·5	watts

* The screen voltage, where lower than the plate voltage, should not be obtained by means of a series resistor but from a potentiometer across the HT line to chassis, adequately by-passed to AF signals.

Curves are attached to this report which show the relationship between power output, distortion and input signal voltage for the 250 volt fixed bias conditions (Curve No. 307·22), and for autobias (Curve No. 307·23).

CLASS A AMPLIFIER, Push-pull: (Values given are for two valves.)

Tetrode Connected:

Plate Voltage	250	270	270	volts
Screen Voltage	250	270	270	volts
Grid Voltage	−16	−17·5	—	volts
Autobias Resistor	—	—	125	ohms
AF Peak Voltage, Grid-grid	32	35	40	volts
Plate Current, Zero Signal	120	134	134	mA
Plate Current, Max. Signal	140	155	145	mA
Screen Current, Zero Signal	10	11	11	mA
Screen Current, Max. Signal	16	17	17	mA
Plate Impedance	24,500	23,500	—	ohms
Mutual Conductance	5·5	5·7	—	mA/V
Output Load, Plate-plate	5000	5000	5000	ohms
Total Harmonic Distortion	2	2	4	%
Power Output	14·5	17·5	18·5	watts

Curves are attached showing the relationship between power output, distortion and input signal for the 270 volt fixed bias conditions (Curve No. 307·24), and for autobias (Curve No. 307·25)

CLASS AB1 AMPLIFIER, Push-pull: (Values given are for two valves.)

Tetrode Connected:

Plate Voltage	360	360	volts
Screen Voltage	270	270	volts
Grid Voltage	−22·5	—	volts
Autobias Resistor	—	250	ohms
AF Peak Voltage, Grid-grid	45	57	volts
Plate Current, Zero Signal	88	88	mA
Plate Current, Max. Signal	138	100	mA
Screen Current, Zero Signal	5	5	mA
Screen Current, Max. Signal	16	19	mA
Output Load, Plate-plate	6600	9000	ohms
Total Harmonic Distortion	1·8	4	%
Power Output	26·5	24	watts

AN IT&T ASSOCIATE

Curves are attached showing the relationship between power output, distortion and input signal voltage for the above conditions: Curve No. 307·26 for fixed bias and Curve No. 307·27 for autobias.

CLASS AB2 AMPLIFIER, Push-pull: (Values given are for two valves.)

Tetrode Connected:

Plate Voltage	360	360	volts
Screen Voltage	225	270	volts
Grid Voltage	−18	−22·5	volts
AF Peak Voltage, Grid-grid	60	85	volts
Plate Current, Zero Signal	78	88	mA
Plate Current, Max. Signal	162	220	mA
Screen Current, Zero Signal	3·5	5	mA
Screen Current, Max. Signal	21	35	mA
Grid Power Input, Peak	190	400	mW
Output Load, Plate-plate	6000	3800	ohms
Total Harmonic Distortion	8	10	%
Power Output	31	47	watts

It is essential for Class AB2 operation that the regulation of the plate, screen and grid bias supplies be such that the voltages remain constant within 5% between zero signal and maximum signal conditions. The driver stage should be capable of supplying the grids of the two valves with the specified peak voltages with low distortion. The effective resistance per grid circuit presented by the driver valve and/or transformer should not exceed 500 ohms, and the effective impedance represented by leakage inductance or equivalent at the highest desired response frequency should not exceed 700 ohms.

A curve (No. 307·28) is attached which shows the relationship between power output, distortion and input signal voltage for the 47 watts output conditions.

GENERAL RECOMMENDATIONS

AUDIO FREQUENCIES: Due to the relatively high slope of these valves they are prone to parasitic oscillation and it is advisable that a resistor of 100 ohms always be connected in series with the plate, connected directly to the valve holder plate contact. This resistor should be reduced to 47 ohms in the case of Class AB2 operation. A series grid resistor may also be employed, if necessary, wired directly to the valve holder grid contact, but the value must be chosen carefully bearing in mind the frequency response. Such resistance should never exceed 100,000 ohms for Class A operation and should not be employed for Class AB2 operation.

The type of input coupling used should not introduce too much resistance into the grid circuit. It is preferable that such resistance does not exceed 100,000 ohms, except in the case of Class A operation under autobias conditions where the value may be as high as 500,000 ohms if essential.

RADIO FREQUENCIES: Whilst these valves are not intended primarily for operation as oscillators or as radio frequency amplifiers, they may be used for such purposes up to a maximum frequency of 60 Mc/s.

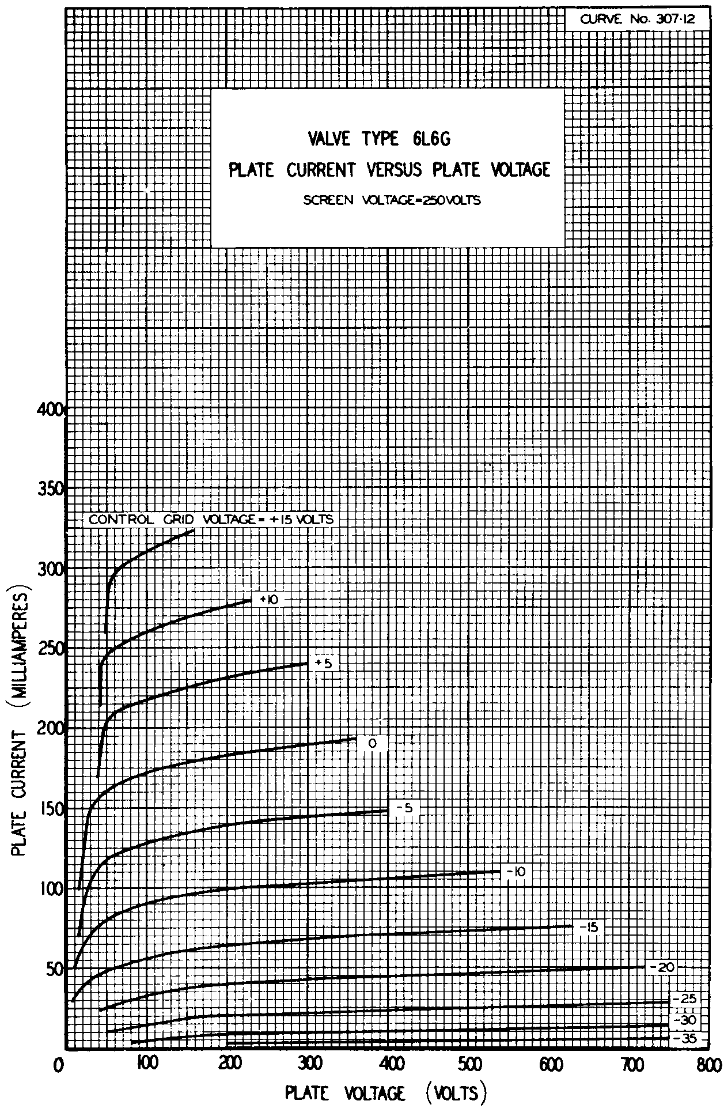
In no circumstances may the maximum ratings given on page 2 be exceeded nor may the DC grid current at any time exceed 3 mA.

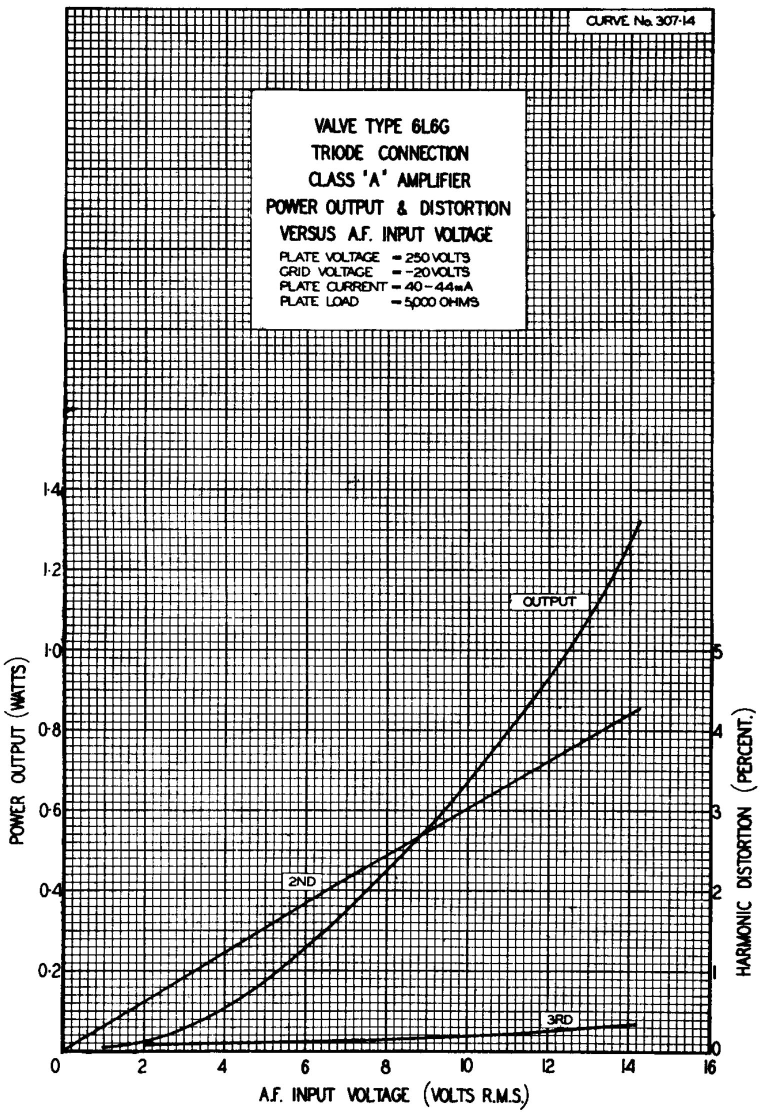
It is preferable that the screen supply voltage should not be obtained via a series dropping resistor and the DC bias should be obtained from a fixed bias supply or from a combination of grid leak bias and a cathode autobias resistor. The bias required for Class C telegraphy operation is of the order of −80 volts, and the power output approximately 30 watts per valve.

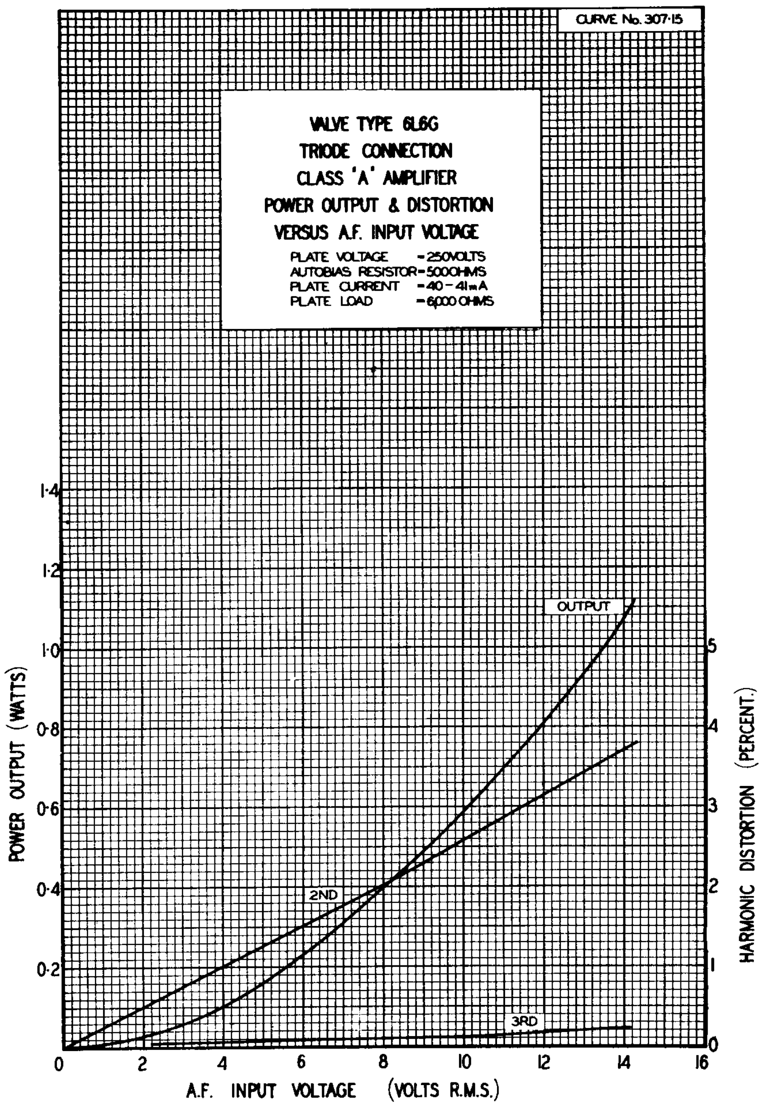
If keying is achieved by disconnecting the cathode, a resistor of not more than 100,000 ohms must be connected permanently between cathode and chassis earth.

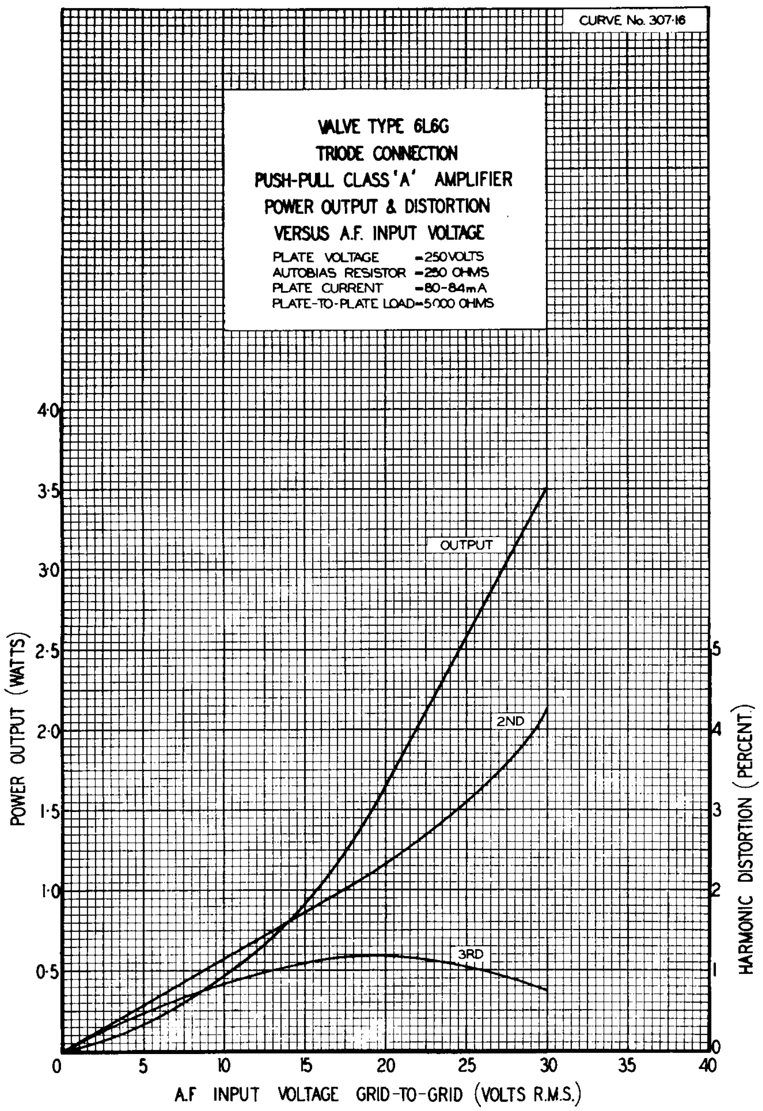
Valves used as Class B or C amplifiers normally will require neutralisation.

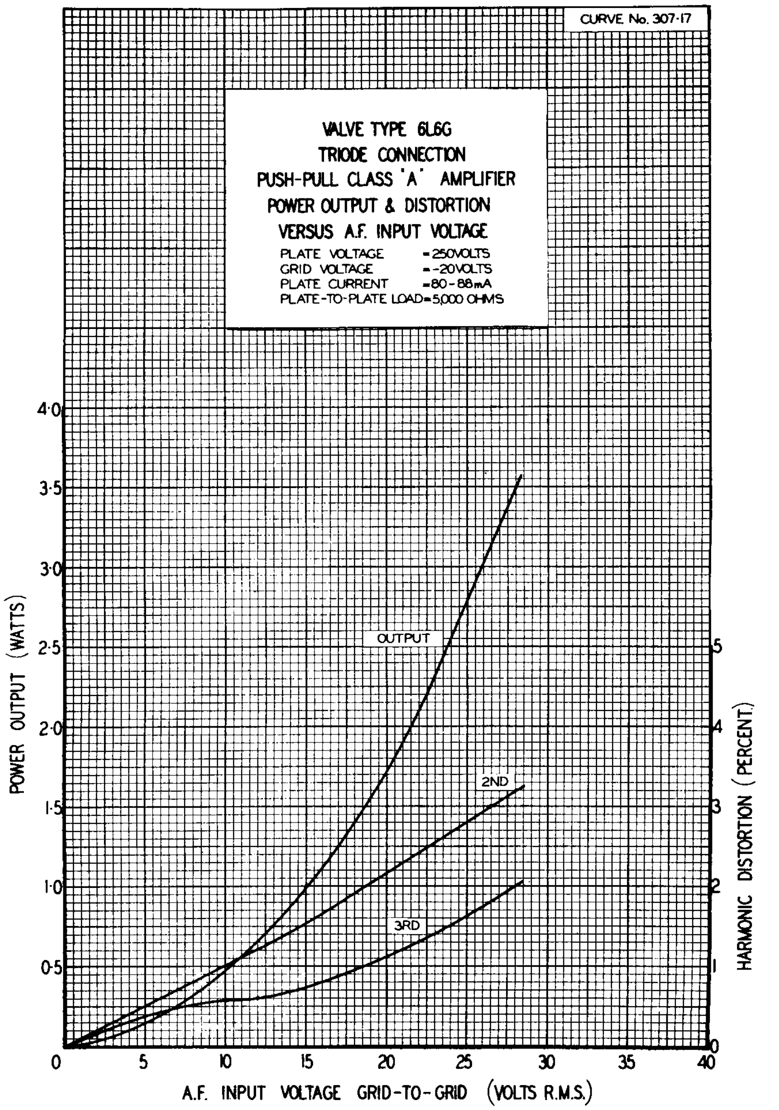
In no circumstances should the plate tank circuit of a Class B or C amplifier be tuned through resonance with the aerial or succeeding valve load disconnected. Such procedure causes a sharp drop in the plate current, a corresponding increase in the screen current (which may damage the screen), together with a very high voltage between plate and other electrodes, which is liable to break down the insulation of the valve pinch and base.


CURVE No. 307-12
VALVE TYPE 6L6G
PLATE CURRENT VERSUS PLATE VOLTAGE
SCREEN VOLTAGE=250VOLTS
CONTROL GRID VOLTAGE = +15 VOLTS
+10
+5
0
-5
-10
-15
-20
-25
-30
-35
PLATE CURRENT (MILLIAMPERES)
0
50
100
150
200
250
300
350
400
100
200
300
400
500
600
700
800
PLATE VOLTAGE (VOLTS)

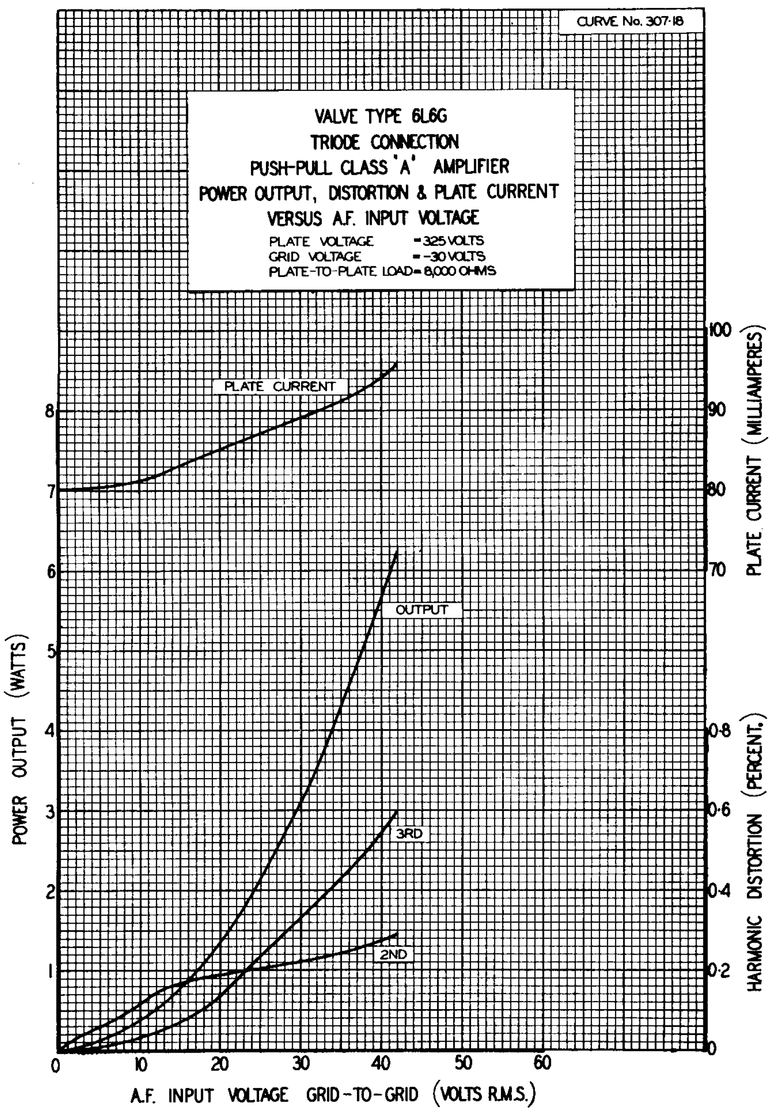

CURVE No. 307-14
VALVE TYPE 6L6G
TRIODE CONNECTION
CLASS 'A' AMPLIFIER
POWER OUTPUT & DISTORTION
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE = 250 VOLTS
GRID VOLTAGE = -20 VOLTS
PLATE CURRENT = 40-44 mA
PLATE LOAD = 5,000 OHMS
OUTPUT
2ND
3RD
POWER OUTPUT (WATTS)
HARMONIC DISTORTION (PERCENT.)
A.F. INPUT VOLTAGE (VOLTS R.M.S.)
0
0·2
0·4
0·6
0·8
1·0
1·2
1·4
1
2
3
4
5
0
2
4
6
8
10
12
14
16

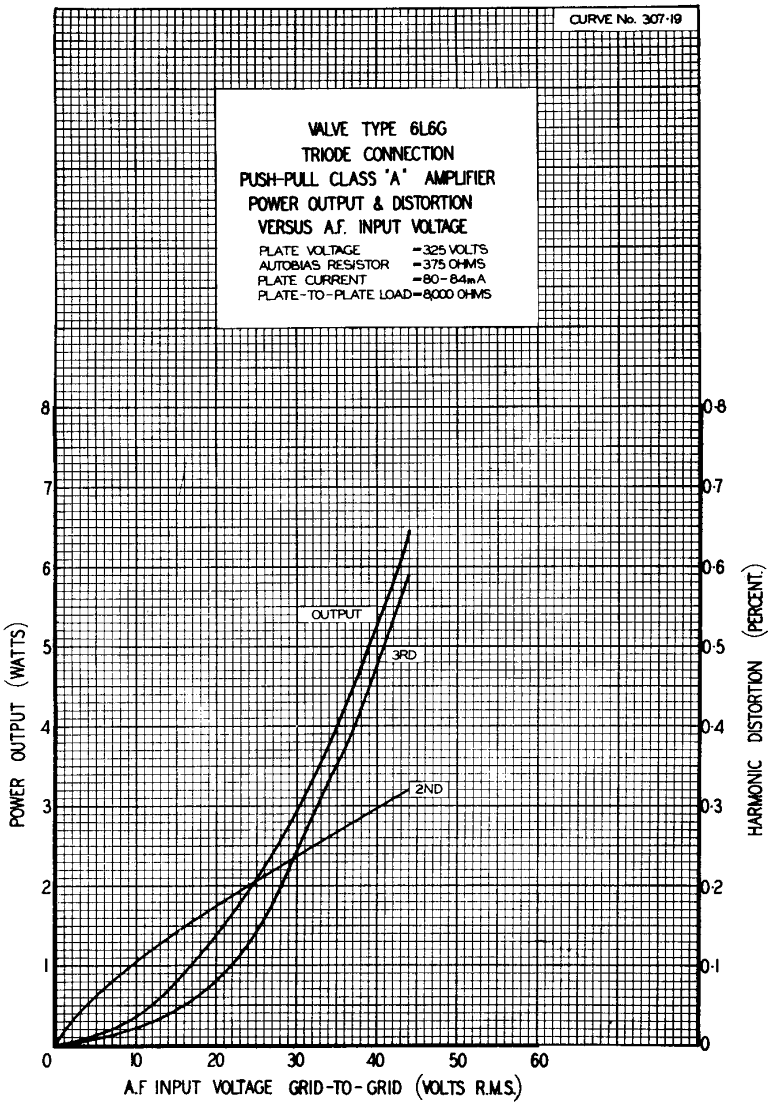

CURVE No. 307·15
VALVE TYPE 6L6G
TRIODE CONNECTION
CLASS 'A' AMPLIFIER
POWER OUTPUT & DISTORTION
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE = 250 VOLTS
AUTOBIAS RESISTOR = 500 OHMS
PLATE CURRENT = 40 - 41 mA
PLATE LOAD = 6,000 OHMS
POWER OUTPUT (WATTS)
1·4
1·2
1·0
0·8
0·6
0·4
0·2
HARMONIC DISTORTION (PERCENT.)
5
4
3
2
1
0
OUTPUT
2ND
3RD
0
2
4
6
8
10
12
14
16
A.F. INPUT VOLTAGE (VOLTS R.M.S.)

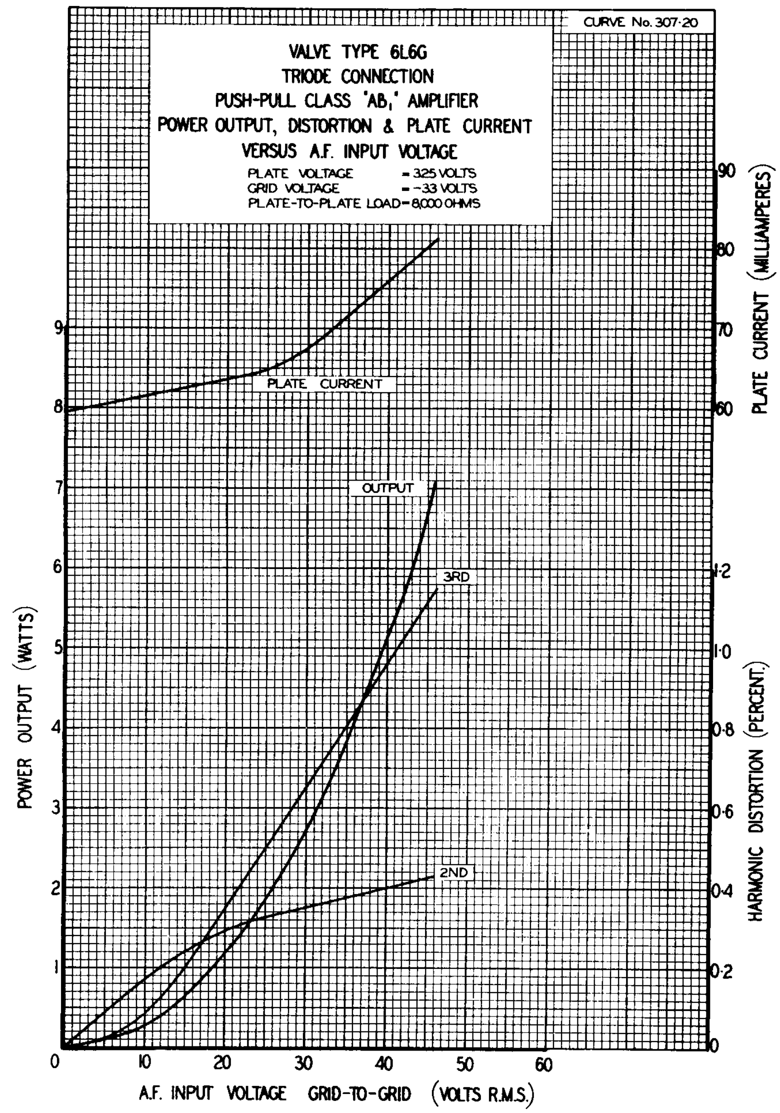

CURVE No. 307·16
VALVE TYPE 6L6G
TRIODE CONNECTION
PUSH-PULL CLASS 'A' AMPLIFIER
POWER OUTPUT & DISTORTION
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE =250 VOLTS
AUTOBIAS RESISTOR =250 OHMS
PLATE CURRENT =80-84mA
PLATE-TO-PLATE LOAD=5000 OHMS
OUTPUT
2ND
3RD
POWER OUTPUT (WATTS)
HARMONIC DISTORTION (PERCENT)
A.F INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)

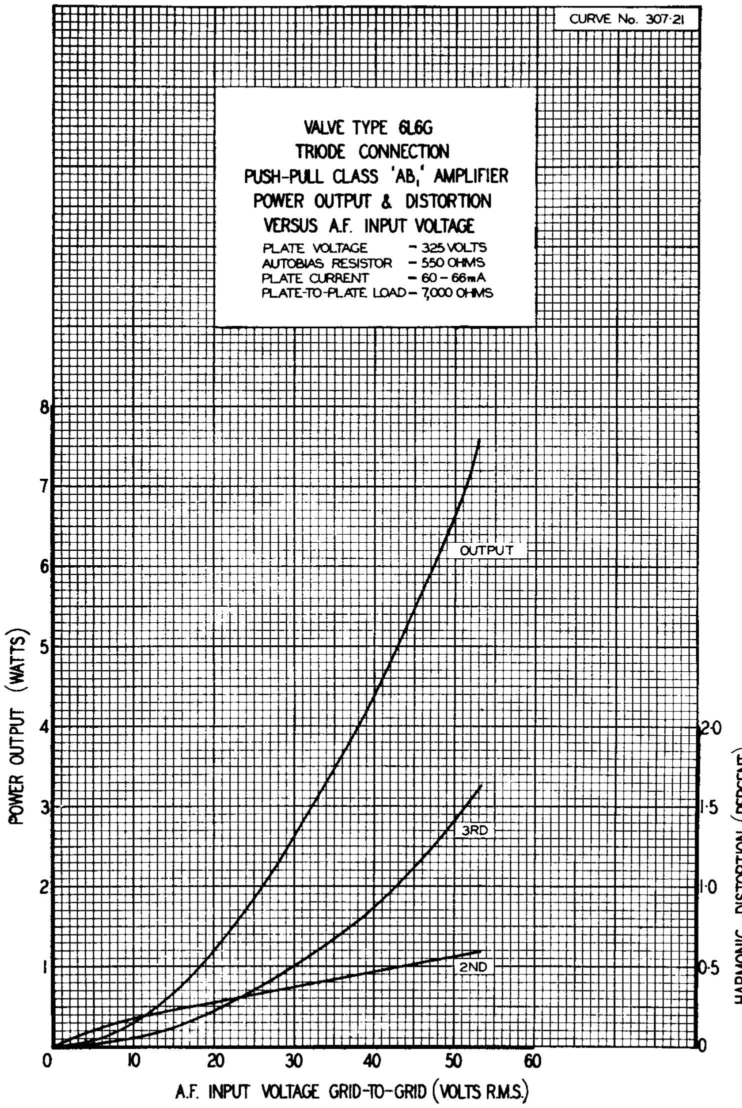


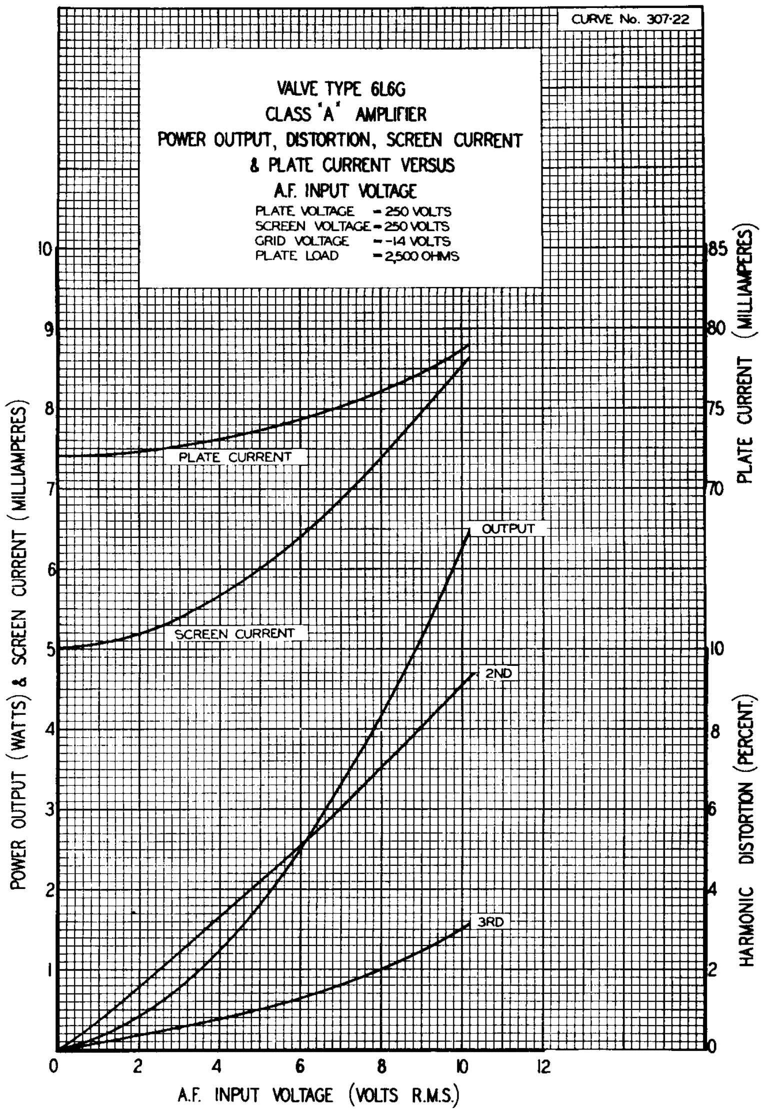
AN IT&T ASSOCIATE

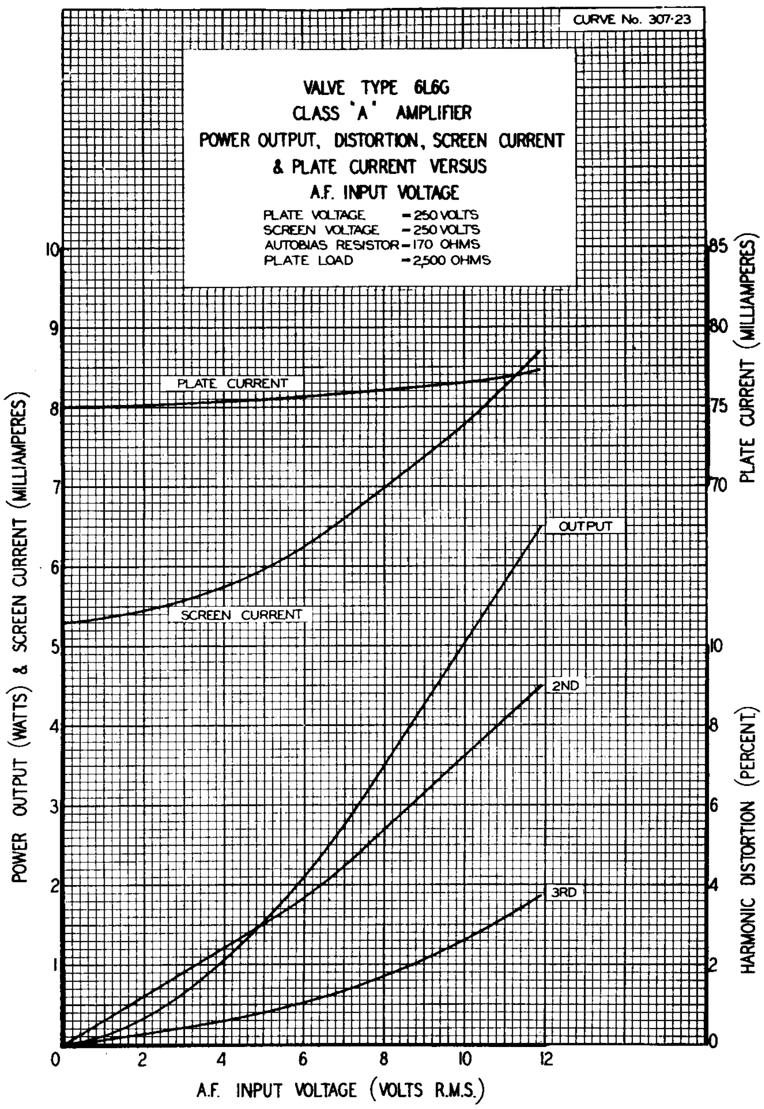

CURVE No. 307-18
VALVE TYPE 6L6G
TRIODE CONNECTION
PUSH-PULL CLASS 'A' AMPLIFIER
POWER OUTPUT, DISTORTION & PLATE CURRENT
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE =325 VOLTS
GRID VOLTAGE =-30 VOLTS
PLATE-TO-PLATE LOAD=8,000 OHMS
PLATE CURRENT
OUTPUT
3RD
2ND
POWER OUTPUT (WATTS)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT.)
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)
AN IT&T ASSOCIATE

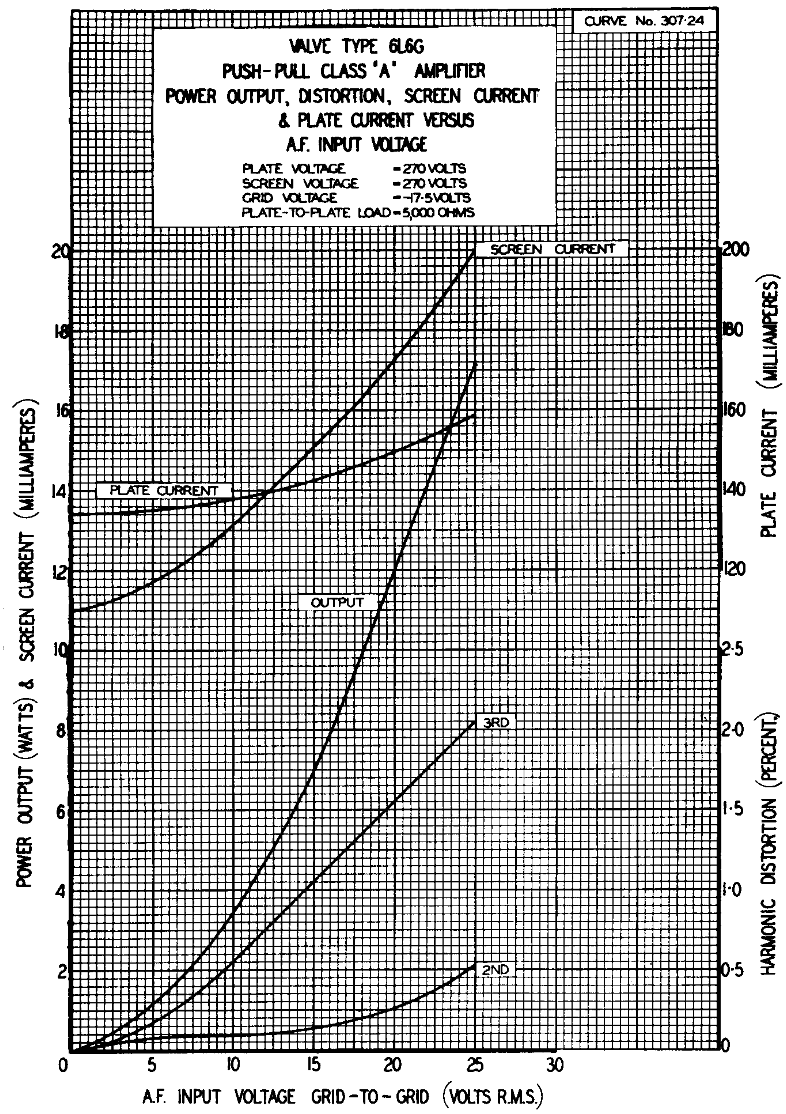

CURVE No. 307·19
VALVE TYPE 6L6G
TRIODE CONNECTION
PUSH-PULL CLASS 'A' AMPLIFIER
POWER OUTPUT & DISTORTION
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE =325 VOLTS
AUTOBIAS RESISTOR =375 OHMS
PLATE CURRENT =80-84mA
PLATE-TO-PLATE LOAD=8,000 OHMS
OUTPUT
3RD
2ND
POWER OUTPUT (WATTS)
HARMONIC DISTORTION (PERCENT.)
A.F INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)
0
10
20
30
40
50
60
1
2
3
4
5
6
7
8
0·1
0·2
0·3
0·4
0·5
0·6
0·7
0·8


CURVE No. 307·20
VALVE TYPE 6L6G
TRIODE CONNECTION
PUSH-PULL CLASS 'AB1' AMPLIFIER
POWER OUTPUT, DISTORTION & PLATE CURRENT
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE = 325 VOLTS
GRID VOLTAGE = -33 VOLTS
PLATE-TO-PLATE LOAD = 8,000 OHMS
PLATE CURRENT
OUTPUT
3RD
2ND
POWER OUTPUT (WATTS)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT.)
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)
0 10 20 30 40 50 60
1 2 3 4 5 6 7 8 9
60 70 80 90
0 0·2 0·4 0·6 0·8 1·0 1·2

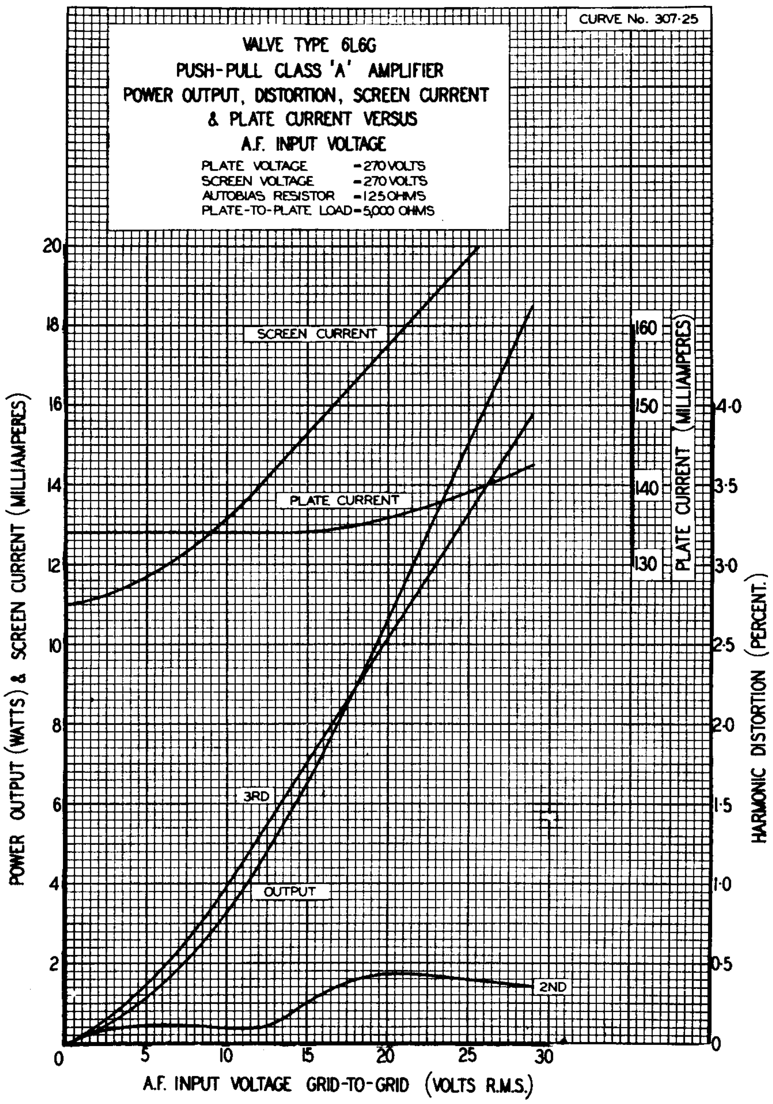

CURVE No. 307·21
VALVE TYPE 6L6G
TRIODE CONNECTION
PUSH-PULL CLASS 'AB₁' AMPLIFIER
POWER OUTPUT & DISTORTION
VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE - 325 VOLTS
AUTOBIAS RESISTOR - 550 OHMS
PLATE CURRENT - 60 - 66mA
PLATE-TO-PLATE LOAD - 7,000 OHMS
OUTPUT
3RD
2ND
POWER OUTPUT (WATTS)
HARMONIC DISTORTION (PERCENT.)
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)
0
10
20
30
40
50
60
1
2
3
4
5
6
7
8
0·5
1·0
1·5
2·0


CURVE No. 307-22
VALVE TYPE 6L6G
CLASS 'A' AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT & PLATE CURRENT VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE = 250 VOLTS
SCREEN VOLTAGE = 250 VOLTS
GRID VOLTAGE = -14 VOLTS
PLATE LOAD = 2,500 OHMS
PLATE CURRENT
SCREEN CURRENT
OUTPUT
2ND
3RD
POWER OUTPUT (WATTS) & SCREEN CURRENT (MILLIAMPERES)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT)
A.F. INPUT VOLTAGE (VOLTS R.M.S.)
0
1
2
3
4
5
6
7
8
9
10
12
70
75
80
85

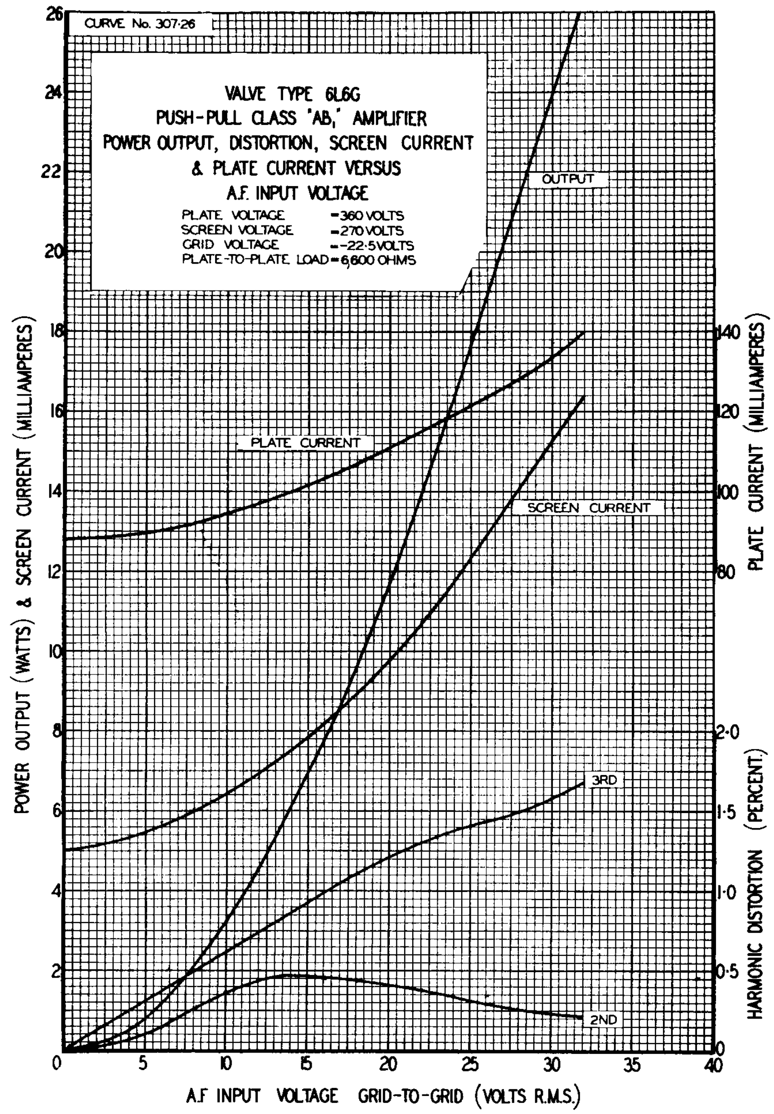

CURVE No. 307·23
VALVE TYPE 6L6G
CLASS 'A' AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT & PLATE CURRENT VERSUS A.F. INPUT VOLTAGE
PLATE VOLTAGE - 250 VOLTS
SCREEN VOLTAGE - 250 VOLTS
AUTOBIAS RESISTOR - 170 OHMS
PLATE LOAD - 2,500 OHMS
PLATE CURRENT
SCREEN CURRENT
OUTPUT
2ND
3RD
POWER OUTPUT (WATTS) & SCREEN CURRENT (MILLIAMPERES)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT)
A.F. INPUT VOLTAGE (VOLTS R.M.S.)
0
2
4
6
8
10
12
1
2
3
4
5
6
7
8
9
10
70
75
80
85


CURVE No. 307·24
VALVE TYPE 6L6G
PUSH-PULL CLASS 'A' AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT
& PLATE CURRENT VERSUS
A.F. INPUT VOLTAGE
PLATE VOLTAGE = 270 VOLTS
SCREEN VOLTAGE = 270 VOLTS
GRID VOLTAGE = -17·5 VOLTS
PLATE-TO-PLATE LOAD = 5,000 OHMS
SCREEN CURRENT
PLATE CURRENT
OUTPUT
3RD
2ND
POWER OUTPUT (WATTS) & SCREEN CURRENT (MILLIAMPERES)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT)
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)
0
5
10
15
20
25
30
2
4
6
8
10
12
14
16
18
20
120
140
160
180
200
0·5
1·0
1·5
2·0
2·5

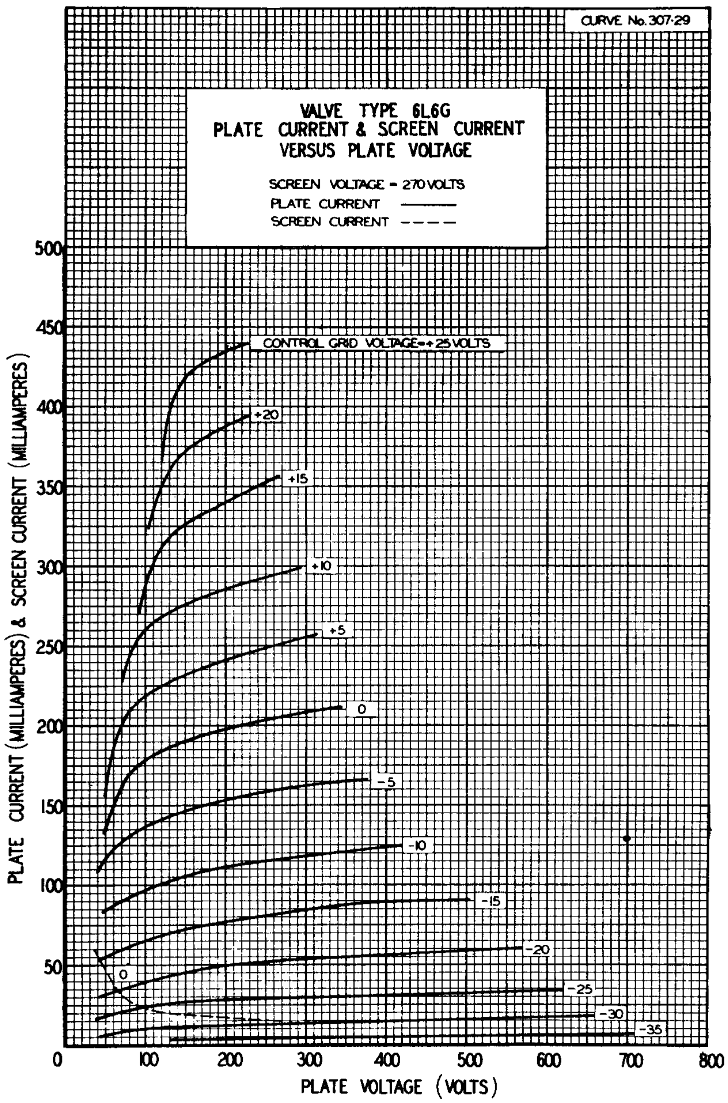
6L6G



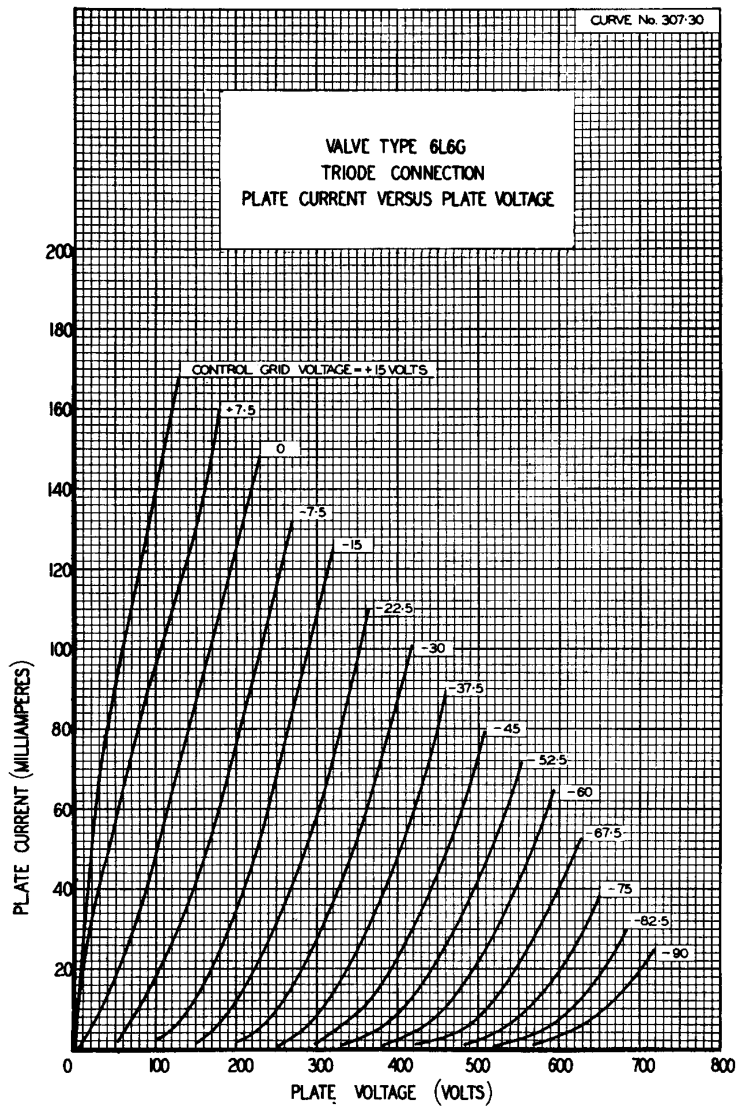
CURVE No. 307·25
VALVE TYPE 6L6G
PUSH-PULL CLASS 'A' AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT
& PLATE CURRENT VERSUS
A.F. INPUT VOLTAGE
PLATE VOLTAGE =270 VOLTS
SCREEN VOLTAGE =270 VOLTS
AUTOBIAS RESISTOR =125 OHMS
PLATE-TO-PLATE LOAD=5,000 OHMS
SCREEN CURRENT
PLATE CURRENT
3RD
OUTPUT
2ND
POWER OUTPUT (WATTS) & SCREEN CURRENT (MILLIAMPERES)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT.)
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)


CURVE No. 307-26
VALVE TYPE 6L6G
PUSH-PULL CLASS "AB1" AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT
& PLATE CURRENT VERSUS
A.F. INPUT VOLTAGE
PLATE VOLTAGE =360 VOLTS
SCREEN VOLTAGE =270 VOLTS
GRID VOLTAGE =-22.5 VOLTS
PLATE-TO-PLATE LOAD=6,600 OHMS
OUTPUT
PLATE CURRENT
SCREEN CURRENT
3RD
2ND
POWER OUTPUT (WATTS) & SCREEN CURRENT (MILLIAMPERES)
PLATE CURRENT (MILLIAMPERES)
HARMONIC DISTORTION (PERCENT.)
A.F INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)

6L6G



AN IT&T ASSOCIATE


CURVE No. 307·30
VALVE TYPE 6L6G
TRIODE CONNECTION
PLATE CURRENT VERSUS PLATE VOLTAGE
CONTROL GRID VOLTAGE = +15 VOLTS
+7·5
0
−7·5
−15
−22·5
−30
−37·5
−45
−52·5
−60
−67·5
−75
−82·5
−90
PLATE CURRENT (MILLIAMPERES)
0
20
40
60
80
100
120
140
160
180
200
0
100
200
300
400
500
600
700
800
PLATE VOLTAGE (VOLTS)