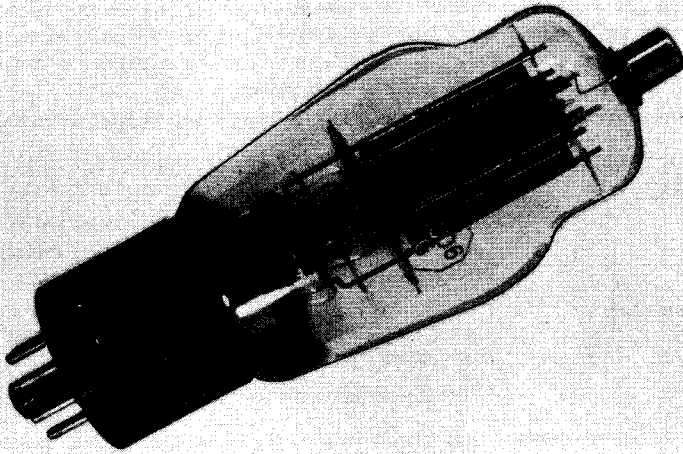




6CD6G



OUTPUT TETRODE

APPLICATION REPORT

The 6CD6G is a high slope tetrode designed for operation as the line scan output valve in television receivers employing wide angle deflection cathode ray tubes. A particular feature is its high peak plate current capacity with low plate and screen voltage making it suitable for use from a low voltage HT line. It is intended for use in conjunction with an efficiency diode so that the HT voltage is supplied partly by the receiver power supply and partly by the energy stored in the magnetic circuit. Used in this way the 6CD6G is capable of supplying the power necessary for the scan and E.H.T. voltage of wide angle CR tubes up to 17 in. diagonal at least.



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



DESCRIPTION: The valve consists of a low impedance tetrode utilising a twin cathode assembly to obtain high cathode emission. Special precautions have been taken to ensure adequate screen grid cooling to prevent screen primary emission. The top and bottom support micas are sprayed and slotted so that a long leakage path exists from the other electrodes to the plate, which is brought out to a top cap. This is necessary as the valve must withstand several thousand volts peak on its plate during the fly-back pulse.

The whole structure is mounted in an ST16 bulb and based with an International Octal Base.

CHARACTERISTICS:

Cathode:	Indirectly-heated	
	Voltage	6.3 volts
	Current (Nominal)	2.5 amperes
	Max. Heater to Cathode Voltage	250 volts
Dimensions:	Max. Overall Length	5-11/16 ins.
	Max. Diameter	2-1/16 ins.
	Max. Seated Height	5-1/8 ins.
Base:	International Octal, Medium Shell, 6 Pin	
Basing Connections:	Pin 1	No Connection NC
	Pin 2	Heater h
	Pin 3	Cathode, Beam Plates k, bp
	Pin 4	No Pin NP
	Pin 5	Control Grid g ₁
	Pin 6	No Pin NP
	Pin 7	Heater h
	Pin 8	Screen Grid g ₂
	T.C. Plate	p

Mounting Position: The valve may be mounted vertically with the base up or down, but in the former case the bulb should be supported in some way. Horizontal mounting may be used if the vertical plane passes through both Pins 2 and 7.

Inter-electrode Capacitances:

NO EXTERNAL SHIELD:

Input	26 pF
Output	10 pF
Plate to Grid	1.0 pF
Heater to Cathode	20 pF

Ratings:

TETRODE CONNECTED:

Max. DC Plate Voltage	700 volts
Max. Peak Positive Plate Voltage*	6,000 volts
Max. Peak Negative Plate Voltage*	-1,500 volts
Max. Plate Dissipation	15 watts
Max. DC Screen Voltage	175 volts
Max. Screen Dissipation	3.0 watts
Max. DC Plate Current	170 mA
Max. Peak Cathode Current	500 mA



RATINGS—continued

Max. DC Grid Voltage	—50 volts
Max. Peak Grid Voltage*	—150 volts
Max. Grid Circuit Resistance	1.0 MΩ
Max. Bulb Temperature (at hottest point)	210° C

* For normal television service where the pulse width does not exceed 15% of the duty cycle.

TRIODE CONNECTED (g_2 connected to plate):

Max. DC Plate Voltage	200 volts
Max. Plate Dissipation	16.5 watts
Max. DC Plate Current	180 mA
Max. DC Grid Voltage	—50 volts
Max. Grid Circuit Resistance	1 MΩ
Max. Bulb Temperature (at hottest point)	210° C

Static Characteristics:

TETRODE CONNECTION:

Plate Voltage	175	200	volts
Screen Voltage	175	150	volts
Grid Voltage	—30	—30	volts
Plate Current	100	64	mA
Screen Current	6	3	mA
Mutual Conductance	7.5	6.7	mA/V
Plate Impedance	10,000	15,000	ohms
Inner Amplification Factor	3.8	3.5	

TRIODE CONNECTION (g_2 connected to p):

Plate Voltage	200	volts
Grid Voltage	—42	volts
Plate Current	75	mA
Mutual Conductance	6.2	mA/V
Plate Impedance	570	ohms

Characteristic Curves: Curves are attached to this report as follows:

Plate and Screen Currents versus Plate Voltage E_{g2} 175 volts	307-323
Plate and Screen Currents versus Plate Voltage E_{g2} 150 volts	307-269
Plate and Screen Currents versus Plate Voltage E_{g2} 125 volts	307-322
Plate and Screen Currents versus Plate Voltage E_{g2} 100 volts	307-321
Plate Current versus Plate Voltage, Triode Connected	307-324

TYPICAL OPERATION:

Television Line Output Valve: A circuit is shown on 307-52 giving a basic arrangement for a television line output stage using the 6CD6G in conjunction with the 6U4GT efficiency diode. The energy stored in the magnetic field of the line output transformer and deflector coils is released in the oscillations appearing during the fly-back period. The efficiency diode permits only the normal overswing to take place and damps out the oscillations. The current in the overswing is forced to decay in a linear manner through the deflector coils by the





linearising coil and condensers, and provides nearly half the scan power. The remainder of the scanning current is supplied directly by the 6CD6G. The DC voltage available from the efficiency diode is connected in series with the plate supply to the 6CD6G from the HT line of the receiver. 150 to 250 volts of boost are available from this source making operation from an HT line as low as 180 volts quite possible. The power supply, therefore, has to supply the losses in the circuit, the recovered energy being available for recirculation at the beginning of each scanning cycle.

To obtain the highest possible efficiency it is important that the iron and copper losses in the output transformer and deflector coils should be as low as possible. This requires that a low loss core material must be employed and that it should have a high permeability to reduce, as far as possible, the number of turns necessary for the required inductance.

Grid Drive Requirements: The 6CD6G must be cut off rapidly and maintained at cut-off during the fly-back period. The rapidity of cut-off is important as on it depends the maximum E.H.T. voltage that may be derived from the positive fly-back pulse. The 6CD6G must be maintained at cut-off during the fly-back period as if it is then conducting it absorbs the energy normally recoverable from the magnetic circuit. To accomplish this rapid cut-off the grid drive waveshape of the 6CD6G should have a sharp negative peak, which is normally obtained by shunting a resistance capacity peaking network across the grid to earth circuit.

Care must be taken that the maximum grid to cathode voltage of -150 volts is not exceeded. Normally a peak to peak drive voltage of 130 volts is adequate. The valve should be worked in a Class 'B' condition, the point of commencement of conduction coinciding with the point where the scan power from the efficiency diode is exhausted, which occurs a little to the left of screen centre. If too much drive is applied overlapping of the scan occurs at the centre and bright vertical lines appear in this region of the picture.

Protection in the Event of Drive Failure: A small amount of cathode bias is desirable to protect the 6CD6G in the event of failure of the drive voltage, as the valve would then be without bias. As the screen grid is supplied through a series resistor the electrode voltages fall to a low value and protection is not difficult. The 6CD6G will withstand short period overloads of up to 30 watts plate dissipation without harm.

Screen Dissipation: The maximum screen dissipation should not be exceeded under operating conditions or screen primary emission is liable to appear. This is caused by overheating of the screen which then emits electrons to the plate during the time the latter is highly positive. This occurs during the flyback period when the valve should be cut-off, and the effect is the same as if true cut-off has not been achieved. The valve then absorbs some of the recovery energy and amplitude of scan and E.H.T. voltage suffers.

Peak Plate Voltage: On the peak of the flyback pulse the plate voltage rises to a value the amplitude of which depends upon the rapidity of cut-off, the peak value of the plate current the instant before cut-off, the inductance of that portion of the line output transformer in series with the plate and the total effective stray capacitance appearing across the plate to earth circuit. This last factor, the stray capacitance, is of great importance; a few extra picofarads can cause several per cent reduction in the E.H.T. voltage, particularly on the overwind section where the lead to the plate of the E.H.T. rectifier is attached.



The peak plate voltage must not be allowed to exceed 6,000 volts positive. If there is any doubt as to whether this figure is being reached a check should be carried out with a peak reading voltmeter. A convenient arrangement for this purpose consists of a 1T2 rectifier, its filament supplied from a small 1.5 volt cell, connected in series with an electrostatic voltmeter and small reservoir condenser. The rectifier and battery can be mounted on a probe to reduce self capacity and simplify insulation problems. The application of the meter to the circuit will involve a slight drop in peak voltage due to capacity and leakage loading; the extent of this drop, which can normally be neglected, can be estimated by observation of the change in picture brightness of the CR Tube.

Peak Cathode Current: The circuit should be so designed that the peak cathode current is not greater than 400 mA, as although the 6CD6G is capable of supplying a higher peak current than this, due allowance must be made for deterioration during valve life.

Practical Circuits: For complete circuits with component specifications and full operating conditions reference should be made to the circuit reports on 'Time Bases for Wide Angle CR Tubes'. In these reports will be found specifications for the line output transformer width and linearity controls. Further similar circuit reports will be issued as new components and cathode ray tubes become available.

Audio Frequencies: The 6CD6G may be used as an audio frequency power output valve either tetrode or triode connected. Although not designed with this application in view, its low impedance and low operating screen voltage make it of use where the plate voltage supply is limited. Below is given a table summarizing the characteristics under Class 'A' conditions.

TRIODE CONNECTED (g_2 connected to p):

Single Ended Class 'A' Amplifier:

Plate Voltage	200 volts
Grid Voltage	-32 volts
Cathode Bias Resistor	470 ohms
Plate Current (no signal)	72.5 mA
Peak Grid Input Voltage	28 volts
Plate Load	2,000 ohms
Power Output	1.5 watts
Total Harmonic Distortion	5%

The relation between power output, distortion and input signal is shown on 307-325.

Push-Pull Class 'A' Amplifier:

Plate Voltage	200 volts
Grid Voltage	-33.5 volts
Cathode Bias Resistor	240 ohms
Plate Current (no signal)	140 mA
Peak Grid to Grid Input Voltage	62 volts
Plate to Plate Load	1,500 ohms
Power Output	4.8 watts
Total Harmonic Distortion	2.7%

The relation between power output, distortion and input signal is shown on 307.326.

NOTE—A low value resistor of 50 to 100 ohms should be connected between screen and plate when the valve is used triode connected to prevent parasitic oscillation.



TETRODE CONNECTED:

Single Ended Class 'A' Amplifier:

Plate Voltage	200 volts
Screen Voltage	110 volts
Grid Voltage	—14 volts
Cathode Bias Resistor	180 ohms
Plate Current (no signal)	80 mA
Screen Current (no signal)	2.4 mA
Screen Current (max. signal)	5.3 mA
Peak Grid Input Voltage	11.2 volts
Plate Load	1,500 ohms
Power Output	4.7 watts
Total Harmonic Distortion	13%

The relation between power output, distortion and input signal is shown on 307-327.

Push-Pull Class 'A' Amplifier:

Plate Voltage	110	200	volts
Screen Voltage	110	110	volts
Grid Voltage	—11.7	—14	volts
Cathode Bias Resistor	56	90	ohms
Plate Current (no signal)	200	160	mA
Screen Current (no signal)	13.2	4.8	mA
Screen Current (max. signal)	16.3	11.6	mA
Peak Grid to Grid Input Voltage	22.6	28	volts
Plate to Plate Load	1,000	3,000	ohms
Power Output	5.0	13.5	watts
Total Harmonic Distortion	1.0	1.75	%

The relation between power output, distortion and input signal is shown on 307-328 for the 200 volt condition and 307-329 for the 110 volt condition.

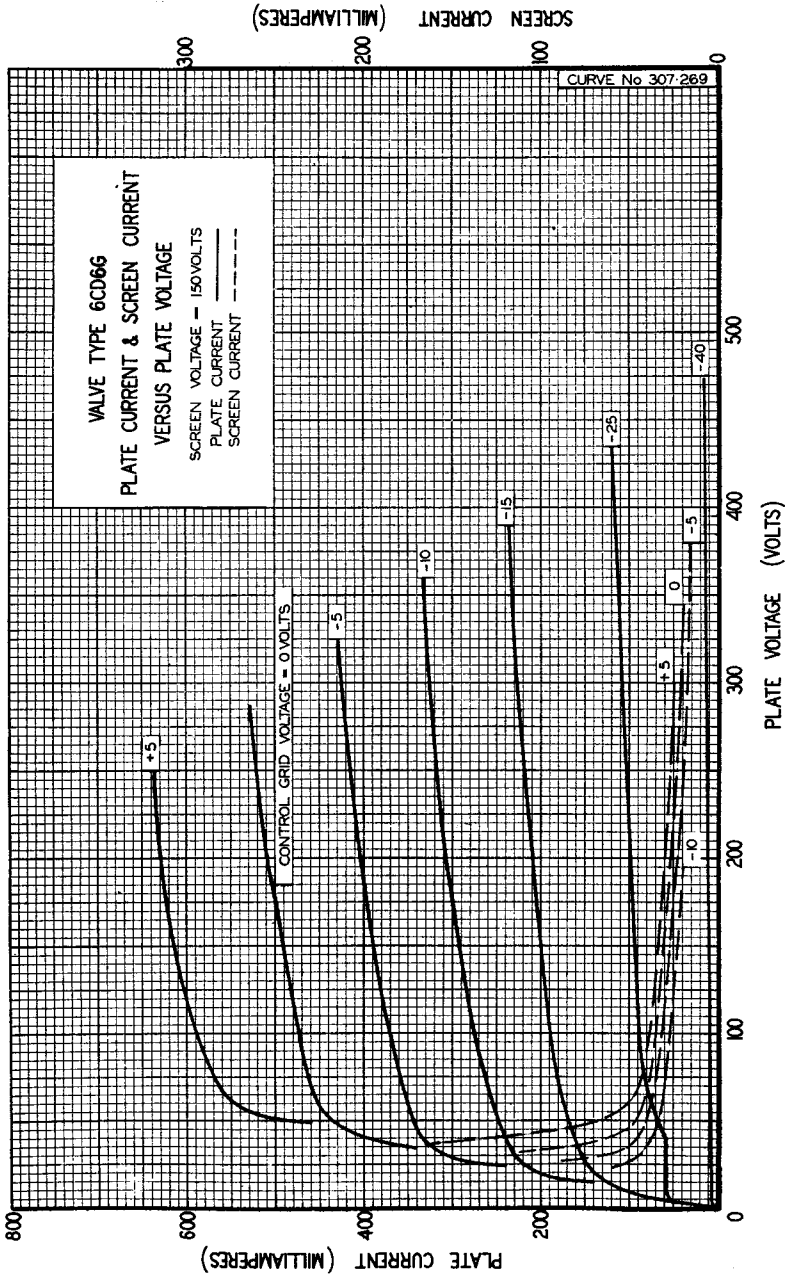
Because its primary application is in television where Class 'A' working is not normal, greater emphasis is placed on operational testing in typical circuitry than on normal static tests under Class 'A' conditions. Consequently when the 6CD6G is used as an audio amplifier, rather wider variations in characteristics may be experienced than those which are normally encountered and it is partly for this reason that this valve is not recommended for audio frequency amplifier work.

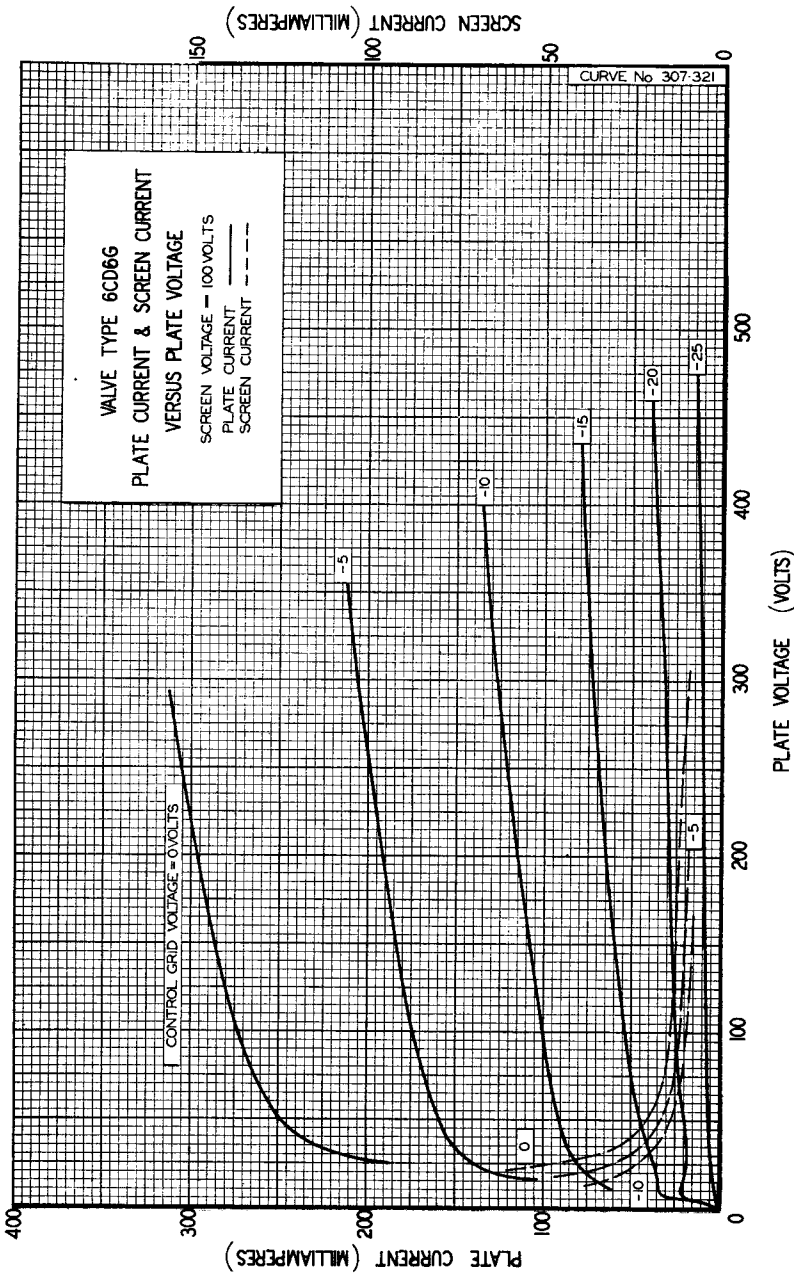
Nevertheless, there may be occasions when it is desired to take advantage of the special characteristics of this valve, so operating data and curves for AF amplifier service are included in this report.

Series Stabiliser Valve in Regulated Power Supply: The 6CD6G is suitable for this application connected as a triode. Although the plate dissipation is rather low for this work (16.5 watts), the lower volt drop somewhat outweighs this disadvantage. Care must be taken that the plate dissipation is not allowed to exceed the rated figure when the power supply is delivering high current at low output voltage.



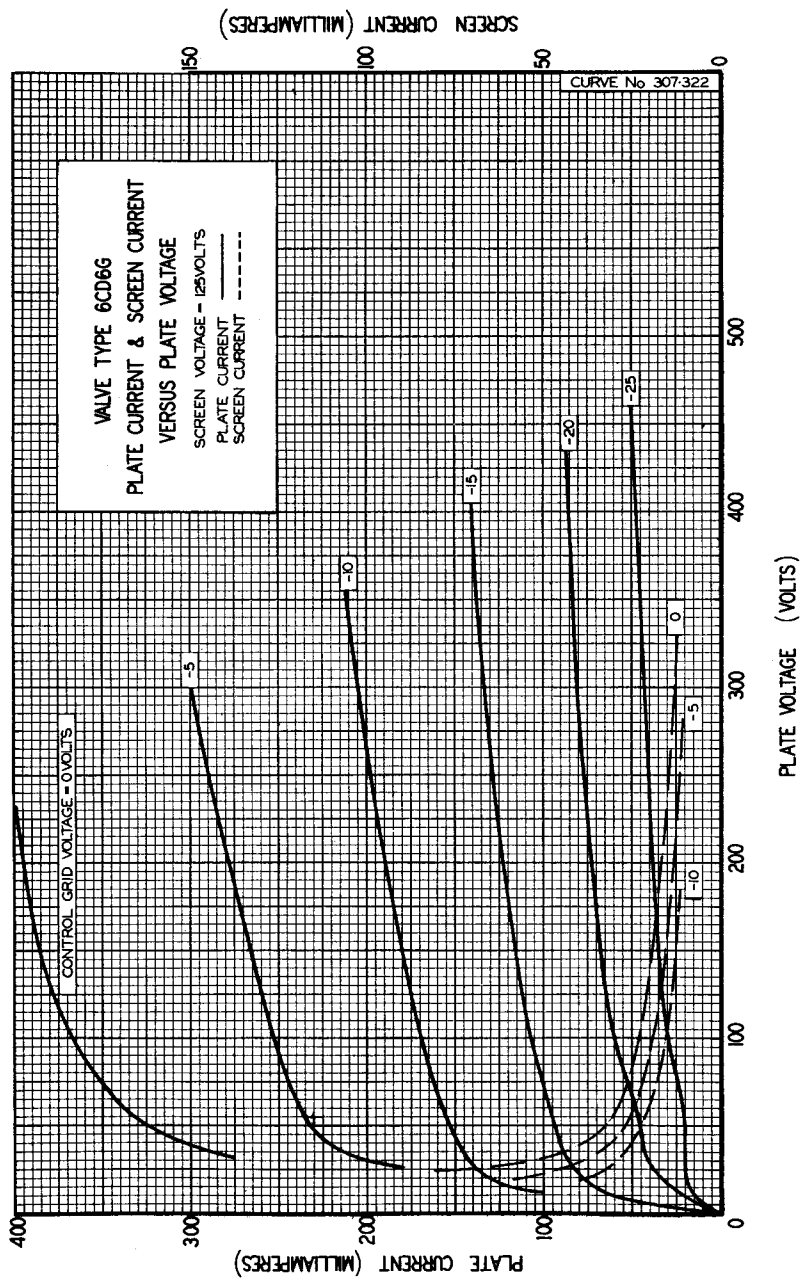
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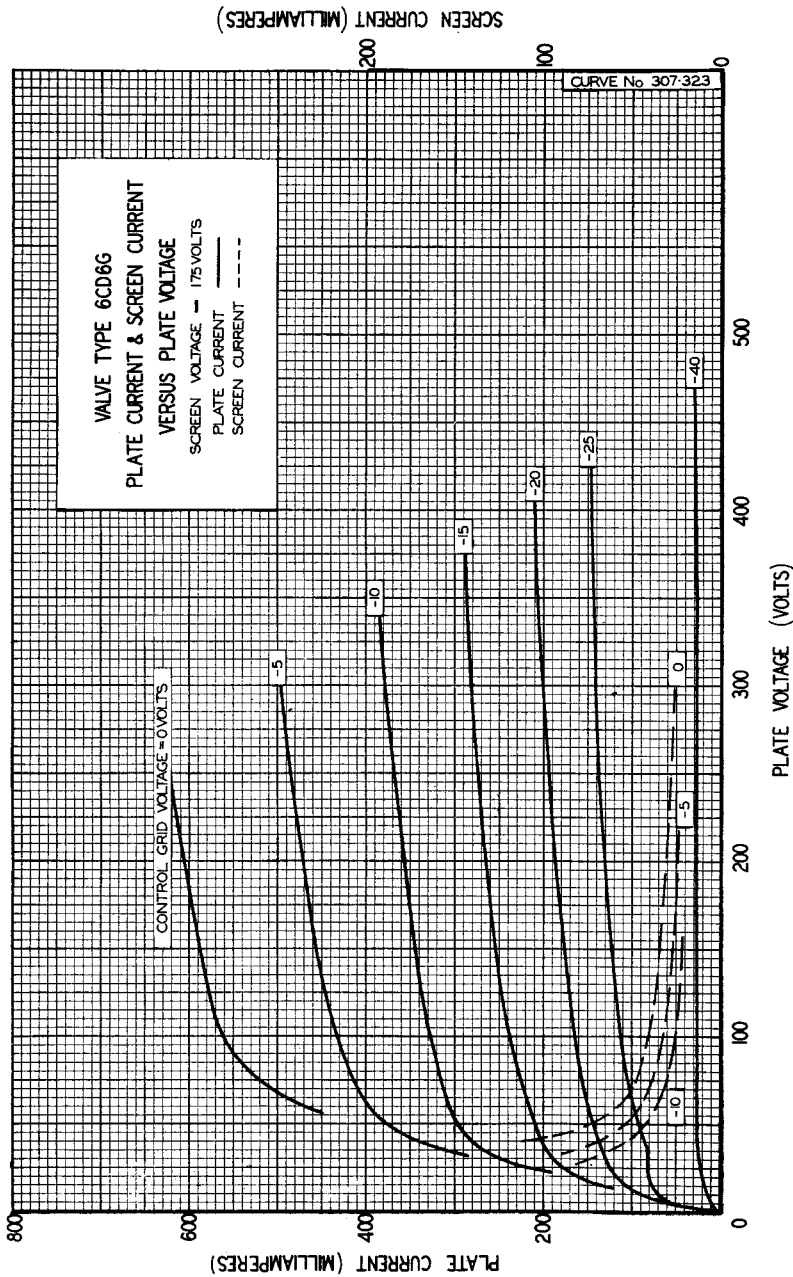






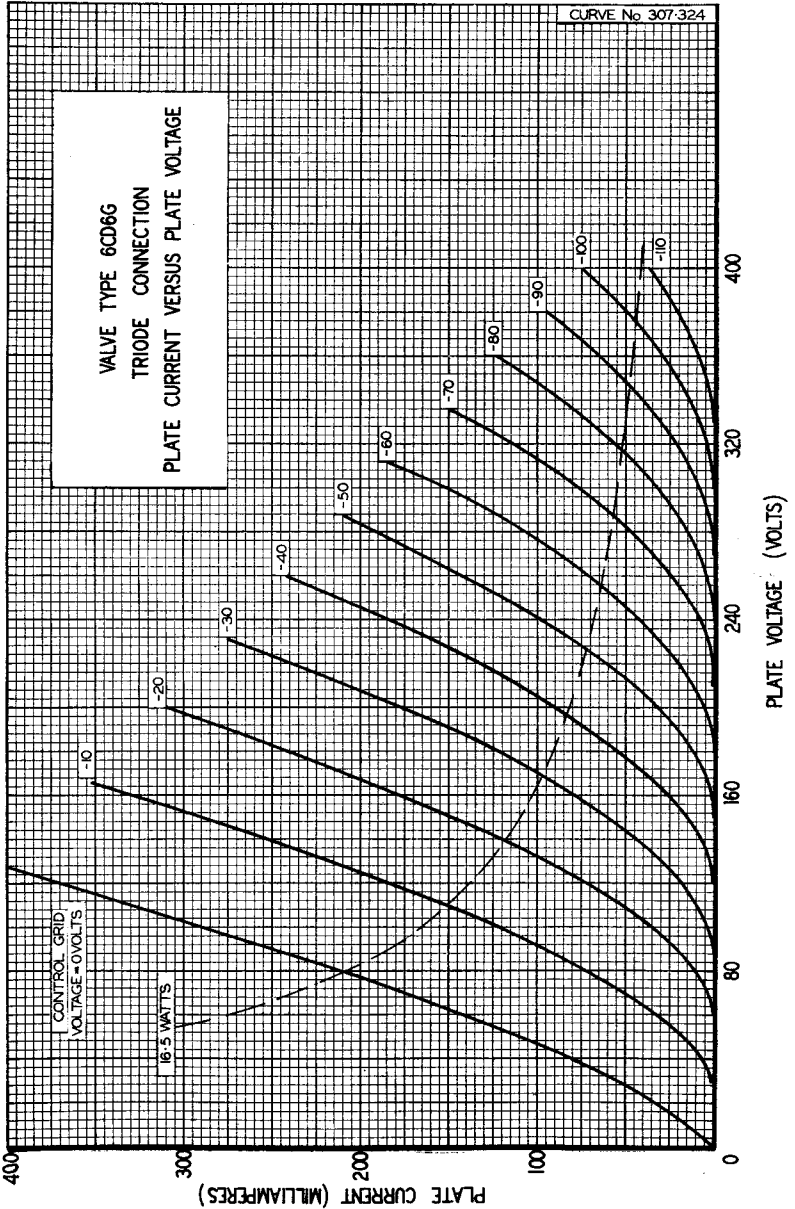
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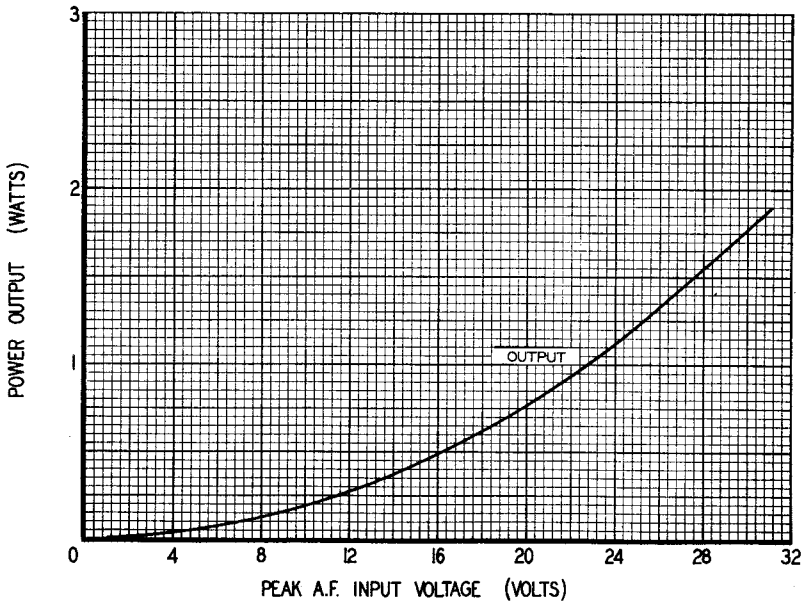
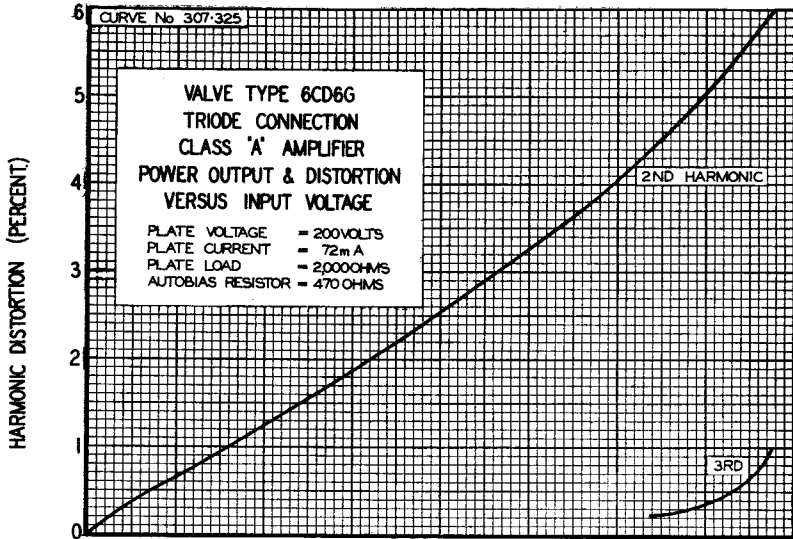


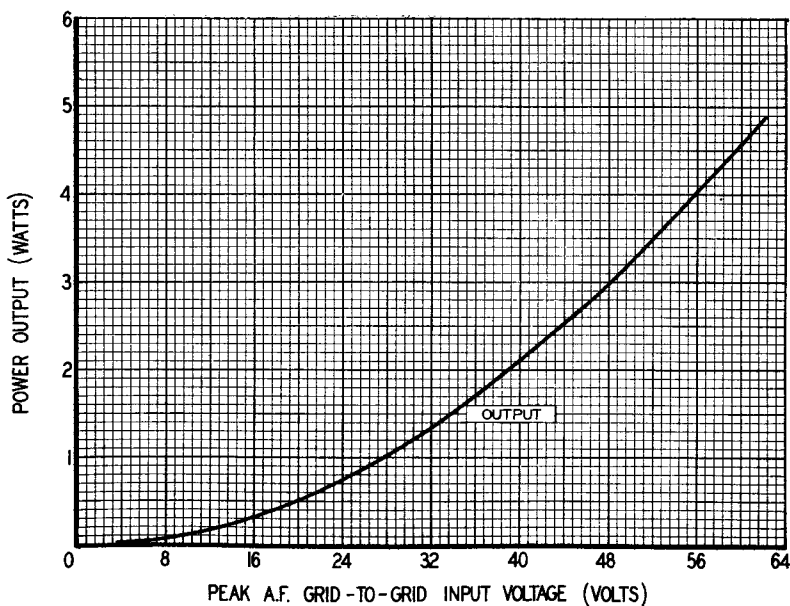
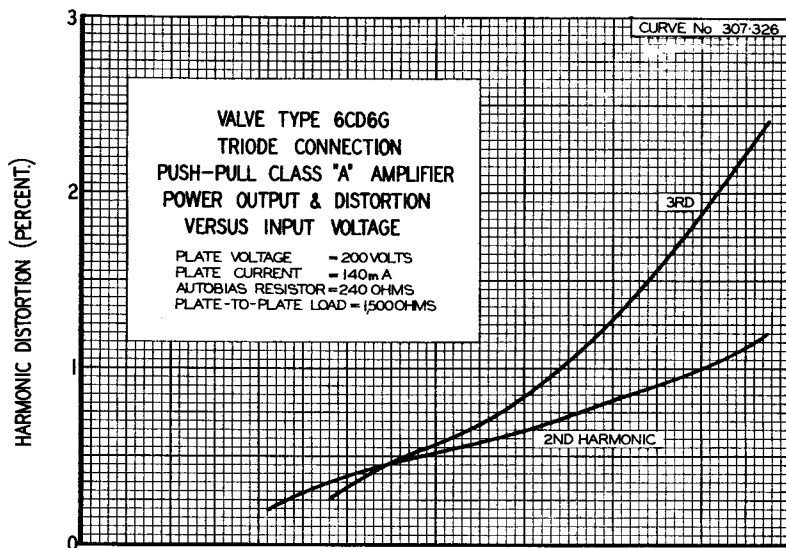


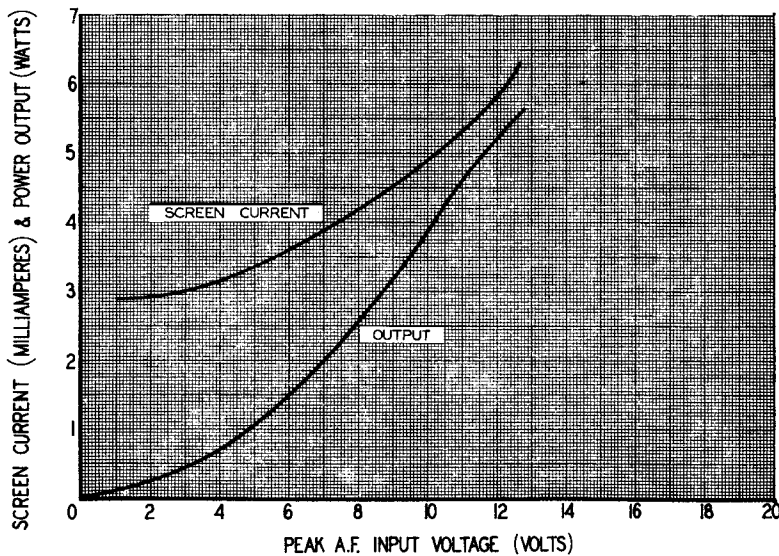
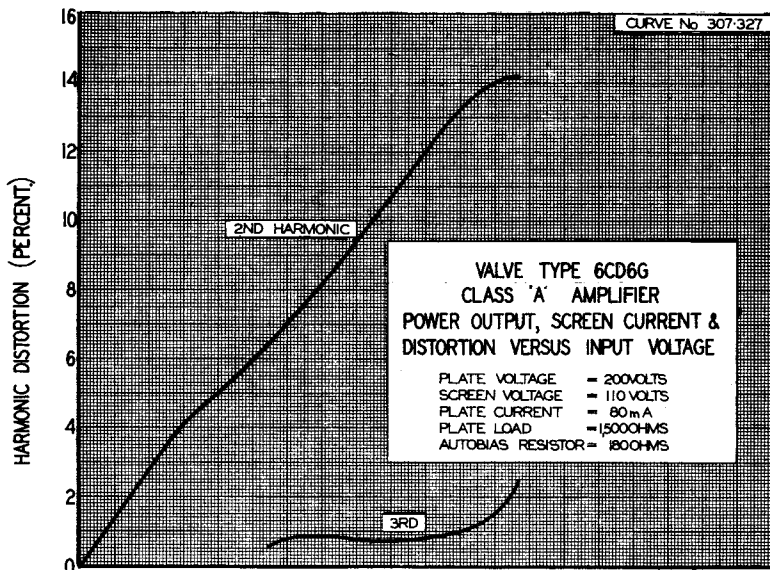


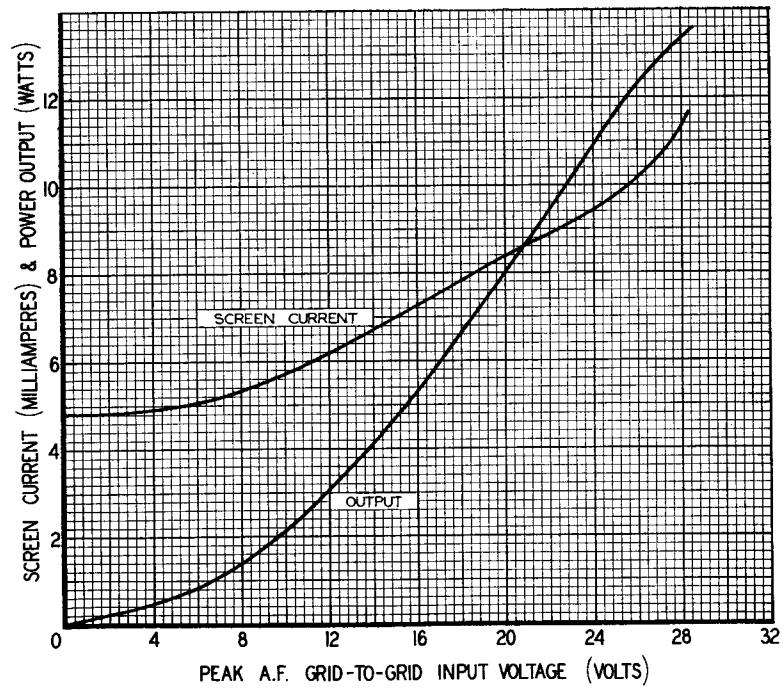
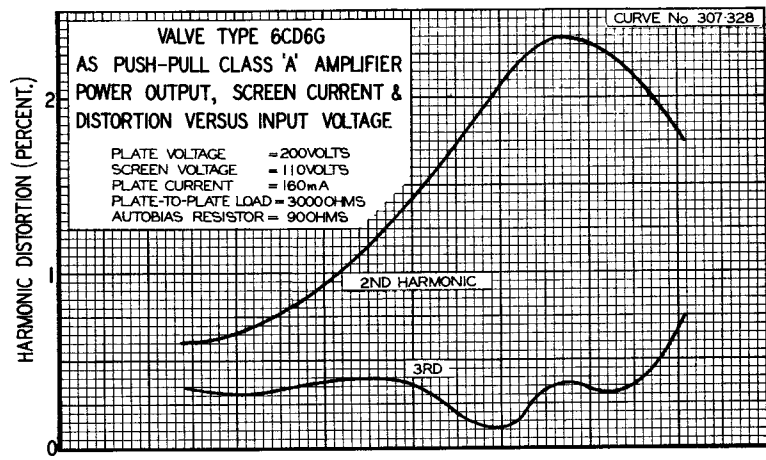
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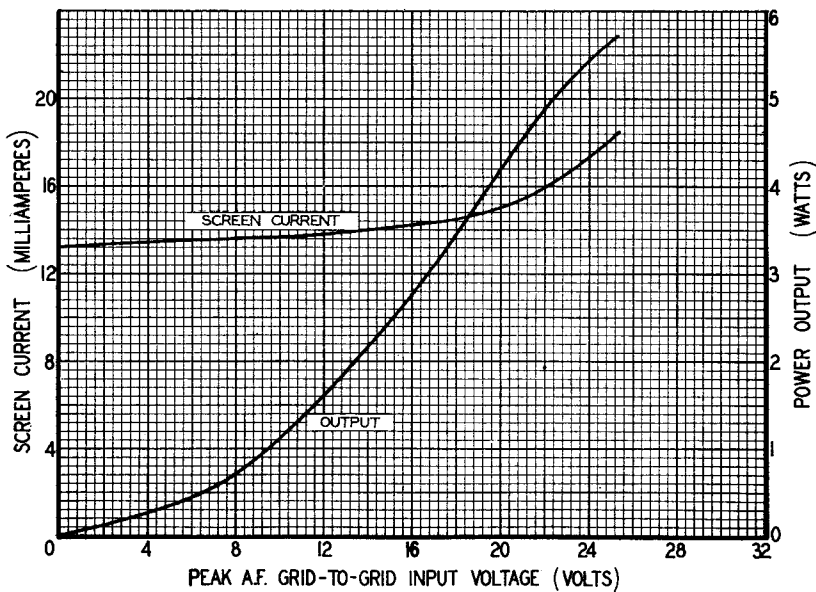
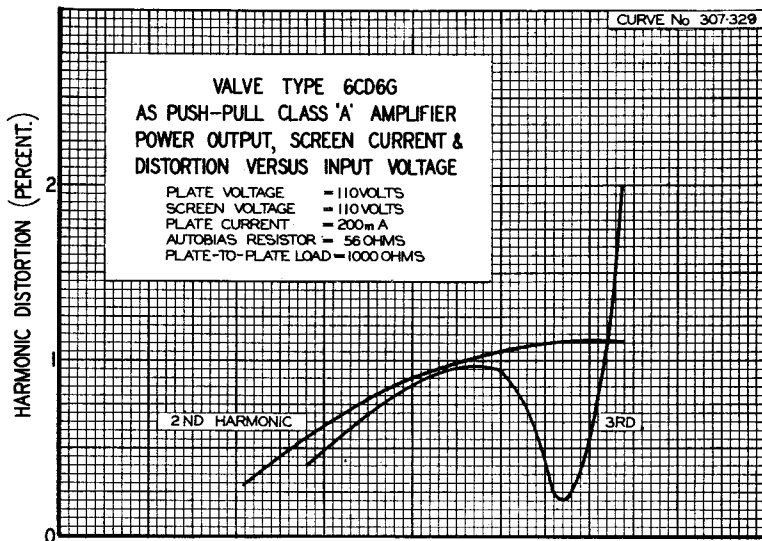












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6CD6G

REF. No. 307-52

TELEVISION LINE OUTPUT CIRCUIT

