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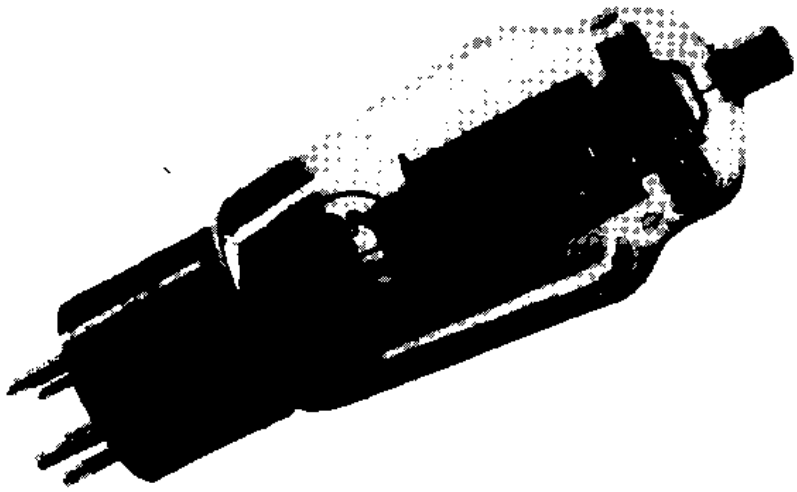

BEAM TETRODE

APPLICATION REPORT

This valve was previously coded 5B/250A

The valve type 807 is an indirectly heated beam tetrode designed for use in the output stages of Public Address equipment, or as an RF amplifier or frequency multiplier in transmitters. The heater is intended for operation in parallel with other valves in AC operated equipment.

This report contains characteristics of the valve and details of its use in AF and RF equipment.

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

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DESCRIPTION: The valve consists of a beam tetrode unit capable of an output of the order of 15 watts. The unit is mounted in a standard ST16 bulb, having the plate connection brought out to a top cap and is based with a 5 pin low loss base.

CHARACTERISTICS:

Cathode:	Indirectly heated	
	Voltage	6·3 volts*
	Current (Nominal)	0·9 ampere
	Max. DC Heater to Cathode potential	250 volts
	Max. Cathode Current	125 mA

* The voltage should not vary more than 5% from the rated value if the valve is used under Class AB2 conditions or where the operating conditions are close to the maximum ratings, nor more than 7% if used under Class A or AB1 conditions.

Dimensions:	Max. Overall Length	$5\frac{3}{4}$ ins.
	Max. Diameter	$2\frac{1}{16}$ ins.
	Max. Seated Height	$5\frac{1}{8}$ ins.
Base:	Medium shell small 5 pin low loss	
Basing Connections:	Pin 1 Heater	
	Pin 2 Screen g2	
	Pin 3 Control Grid g1	
	Pin 4 Cathode and Beam Confining Plates	
	Pin 5 Heater	
	Top Cap Plate	

Ratings:

TETRODE CONNECTION:	
Max. Plate Voltage	600 volts*
Max. Screen Voltage	300 volts*
Max. Plate Dissipation	25 watts*
Max. Screen Dissipation	3·5 watts*
Max. DC Grid Current	5 mA*
TRIODE CONNECTION (Plate and Screen Strapped):†	
Max. Plate Voltage	400 volts*
Max. Plate Dissipation	25 watts*
Max. Signal DC Plate Current	125 mA*

† In order to avoid parasitic oscillation the plate and pin 2 should be connected together through a 100 ohm resistance or an RF choke of about 20 microhenries.

* These ratings are absolute and must be reduced under certain specified conditions referred to later in this report.

Frequency Ratings: The ratings given in the above paragraphs apply to frequencies up to 60 Mc/s. Above this frequency the maximum plate voltage and plate dissipation must be reduced in the correct proportion. Thus at 80 Mc/s they are reduced to 80%, and at 120 Mc/s to 50% of the values specified. The valve is not normally satisfactory for operation at frequencies higher than 120 Mc/s.

Inter-electrode Capacitances (approx.):

$C_{p,g}$	0·2 pF*
C_{in}	12·5 pF
C_{out}	8·2 pF
$C_{h,k}$	10·0 pF

* Measured with external shield.

Mounting: The valve should be mounted in equipment so that it operates 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 axis of the control grid and screen are vertical. The plane of these grids is correct if Pin 3 is on the vertical diameter of the valve base.

Ventilation: As this valve runs appreciably 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: Curves are attached to this report as follows:

I_b/E_b with E_{g2} = 250 volts and various values of E_{g1}	No. 307-210
I_b/E_b " " = 300 " " " " " "	No. 307-211
I_b/E_b for various values of E_{g1} with valve connected as a triode	No. 307-212
I_{g2}/E_b with E_{g2} = 250 volts and various values of E_{g1}	No. 307-213
I_{g2}/E_b " " = 300 " " " " " "	No. 307-214
I_{g1}/E_b " " = 250 " " " " " "	No. 307-215
I_{g1}/E_b " " = 300 " " " " " "	No. 307-216

TYPICAL OPERATION AT AUDIO FREQUENCIES:

General Recommendations: Due to the relatively high slope of this valve, trouble may be experienced with parasitic oscillation, and it is advised that a resistor of 100 ohms is wired in series with the plate, directly connected to the valve top cap contact. This resistance 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 after due consideration of the effect on the frequency response. Such a 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 should be designed to avoid the introduction of excessive 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 automatic bias conditions where, if essential, the value may be as high as 500,000 ohms.

Class 'A' Amplifier (Single Ended):

TRIODE CONNECTION (Pin 2 and top cap strapped):

Heater Voltage	6·3	6·3	volts
Plate Voltage	250	250	volts
Grid Voltage	—20	—	volts
Autobias Resistor	—	500	ohms
Plate Current (no signal)	40	40	mA
Plate Impedance	1700	—	ohms
Amplification Factor	8	—	
Mutual Conductance	4·7	—	mA/V
Plate Load Impedance	5000	6000	ohms
Peak AF Grid Voltage	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 relation between power output, harmonic distortion and input signal voltage for fixed bias (Curve 307-331) and for autobias (Curve 307-332).

Class 'A' Amplifier (Push-Pull):

TRIODE CONNECTION (Pin 2 and top cap strapped)

Plate Voltage	250	250	325	325	volts
Grid Voltage	—20	—	—30	—	volts
Autobias Resistor	—	250	—	375	ohms
Plate Current (no signal)	80	80	80	80	mA
Output Load Impedance (plate – plate)	5000	5000	8000	8000	ohms
Peak AF Grid Voltage	40	40	60	60	volts
Toral Harmonic Distortion	0·35	0·4	0·7	0·6	%
Power Output	3·5	3·1	5·75	6·0	watts

NOTE—Values are given for two valves.

Curves are attached to this report which show the relation between power output, harmonic distortion and input signal voltage for autobias at 250 volts HT (Curve 307·333) and at 325 volts HT (Curve 307·336) and for fixed bias at 250 volts HT (Curve 307·334) and at 325 volts HT (Curve 307·335).

Class 'A' Amplifier (single ended):

TETRODE CONNECTION:

Plate Voltage	250	250	350	500	500	volts
Screen Voltage	250	250	250	200	200	volts *
Grid Voltage	–14	—	–18	–14·5	—	volts
Autobias Resistor		170		—	280	ohms
Plate Current	72	75	54	50	50	mA
Screen Current	5·0	5·4	2·5	1·6	1·6	mA
Plate Impedance	22,500	—	33,000	38,500		ohms
Mutual Conductance	6·0	—	5·2	5·7	—	mA/V
Plate Load Impedance	2500	2500	4200	6000	6000	ohms
Peak AF Grid Voltage	14	16	18	14·5	15·5	volts
Total Harmonic Distortion	10	10	15	11·6	13·6	%
Power Output	6·5	6·5	10·8	11·5	11·0	watts

* In cases where the screen voltage is lower than the plate voltage it should be obtained from a potentiometer between the HT line and chassis, adequately by-passed to AF signals and not by means of a series resistor.

Curves are attached to this report which show the relation between power output, distortion and input signal for the 250 volt fixed bias condition (Curve 307·337) and for automatic bias (Curve 307·338).

Class 'A' Amplifier (Push-Pull):

TETRODE CONNECTION:

Plate Voltage	250	270	270	500	500	600	600	volts
Screen Voltage	250	270	270	300	300	300	300	volts
Grid Voltage	—16	—17·5	—	—27	—	—29·5	—	volts
Autobias Resistor	—	—	125	—	270	—	360	ohms
Peak AF Grid-Grid Voltage	32	35	40	54	72	59	81	volts
Plate Current (no signal)	120	134	134	100	100	80	80	mA
Plate Current (max. signal)	140	155	145	154	119	150	97	mA
Screen Current (no signal)	10	11	11	2·5	2·5	1·5	1·5	mA
Screen Current (max. signal)	16	17	17	20	16·5	17·5	17·5	mA
Output Load Impedance (plate–plate)	5000	5000	5000	8000	9000	10,000	10,000	ohms
Total Harmonic Distortion	2	2	4	2·6	2·7	2·2	4·1	%
Power Output	14·5	17·5	18·5	38	32·5	47·5	36·5	watts

NOTE—Values are given for two valves.

Curves are attached to this report which show the relation between power output, distortion and input signal for various conditions. Curves 307·206, 307·208 for fixed bias and plate voltages of 500 and 600 volts respectively; Curves 307·207, 307·209 for autobias and plate voltages of 500 and 600 volts respectively.

Class 'AB1' Amplifier (Push-Pull):

TRIODE CONNECTION (Pin 2 and top cap strapped):

Plate Voltage	400 volts*
Grid Voltage	—45 volts
Plate Current (no signal)	60 mA
Plate Current (max. signal)	140 mA
Output Load Impedance (plate – plate)	3000 ohms
Peak AF Grid-Grid Voltage	90 volts
Total Harmonic Distortion	3%
Power Output	15 watts

NOTE—Values are given for two valves.

*This voltage is based upon the absolute maximum ratings and if the HT line voltage is subject to mains or component variations the value should be reduced to ensure that it is not exceeded at any time.

Curve 307·238, which is attached to this report, shows the relation between power output, distortion and input signal.

Class 'AB1' Amplifier (Push-Pull):

TETRODE CONNECTION:

Plate Voltage	360	360	volts
Screen Voltage	270	270	volts
Grid Voltage	—22·5	—	volts
Autobias Resistor	—	250	ohms
Plate Current (no signal)	88	88	mA
Plate Current (max. signal)	138	100	mA
Screen Current (no signal)	5	5	mA
Screen Current (max. signal)	16	19	mA
Output Load Impedance (plate – plate)	6600	9000	ohms
Peak AF Grid-Grid Voltage	45	57	volts
Total Harmonic Distortion	1·8	4	%
Power Output	26·5	24	watts

NOTE—Values are given for two valves.

Curves are attached to this report which show the relation between power output, distortion and input signal voltage for the above conditions. Curve 307·339 for fixed bias, and Curve 307·340 for autobias.

Class 'AB2' Amplifier (Push-Pull):

TETRODE CONNECTION:

Ratings:

Max. Plate Voltage	600 volts
Max. Screen Voltage	300 volts
Max. Signal DC Plate Current	120 mA
Max. Signal Plate Input Power	60 watts
Max. Signal Screen Input Power	3·5 watts
Max. Plate Dissipation	25 watts

Typical Operating Conditions:

Plate Voltage	360	360	400	500	600	volts
Screen Voltage	225	270	300	300	300	volts
Grid Voltage	—18	—22·5	—25	—29	—30	volts
Plate Current (no signal)	78	88	90	72	60	mA
Plate Current (max. signal)	162	220	240	240	200	mA
Screen Current (no signal)	3·5	5	5	5	5	mA
Screen Current (max. signal)	21	35	23	22	21	mA
Output Load Impedance (plate – plate)	6000	3800	3200	4240	6400	ohms
Peak Grid-Grid Input Power	190	400	200	200	100	mW
Total Harmonic Distortion	8	10	4	4·5	3·5	%
Power Output	31	47	55	75	80	watts

NOTE—Values are given for two valves.

It is essential for Class 'AB2' operation that the regulation of the plate and screen supplies is such that the voltages remain constant within 5% and that of the grid bias within 3%, between no signal and maximum signal conditions. The driver stage should be capable of supplying the grids of the two valves with the specified peak voltages at 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.

Curves are attached to this report which show the relation between power output, distortion and input signal voltage for the above conditions. Curve 307-341 for 360 volts, Curve 307-217 for 400 volts, Curve 307-218 for 500 volts and Curve 307-219 for 600 volts.

The circuit of a typical amplifier giving 75 watts output from two type 807 valves in Class 'AB2' push-pull is given on 401-20. In this unit the output stage is driven by a 6SN7GT operating as a cathode follower which is fed from a 6SN7GT phase splitter stage. A pre-amplifier which is suitable for use with the output unit is also shown on 401-20. This pre-amplifier gives a choice of two inputs: Input 1 is used for microphones or LP lightweight pickups, whereas Input 2 is for a normal pickup. The cathode follower output stage of the pre-amplifier is matched to 10,000 ohms and permits the use of an appreciable length of cable between the two units. The power supply for the output unit is given on 401-12 and the transformer and choke details on 401-21. Details of the performance of each of the units is given on 401-22.

Class 'B' Amplifier (Push-Pull): In order to avoid the necessity of good regulation of the screen and grid bias supplies when used in Class 'AB2' a circuit of the type shown on 432-1 may be used. In this case the screen is connected directly to the secondary of the input transformer and to the control grid via a resistance. The drive required with this type of circuit is higher than that given above, but it may be obtained without difficulty in the manner shown.

TYPICAL OPERATION AT RADIO FREQUENCIES:

General Recommendations: Due to their relatively high slope these valves are prone to parasitic oscillation and it is advised that a small resistance of the order of 47 ohms, or less if essential, should be wired in series with the plate, directly connected to the top cap.

The total effective grid circuit resistance should not exceed 25,000 ohms and the DC grid circuit should not exceed 5 mA at any time. Attention is drawn to the paragraph regarding frequency ratings.

Neutralisation is not required normally when used as an RF amplifier but it is advantageous for the valve to be mounted through a hole in a screen or sunk in the chassis so that the edges of the screen or chassis are on the same plane as the shield just below the lower mica insulator. This method of mounting will reduce the plate-control grid capacity to a minimum. The valve should never be enclosed in a metal screening can, because it would result in over-heating.

When used as an oscillator the heater to cathode insulation should not be across any part of the oscillator tuned circuit as this will give rise to frequency drift and hum modulation. The valve may be used in an electron coupled oscillator circuit if the heater voltage is supplied via RF chokes, or via a winding interwound with the part of the coil associated with the cathode tap.

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If cathode keying is employed a resistance not exceeding 0·25 megohm should be wired permanently between heater and cathode. Keying by opening the screen circuit alone should not be employed because the plate current may not be cut off completely by disconnection of the screen. Further, if the valve is operated near the maximum ratings there may be sufficient screen emission to maintain the screen voltage during the 'key up' periods and prevent the use of 'break in' facilities. If it is necessary to interrupt the plate current by disconnecting the screen supply, the lowest practicable resistance should be connected permanently between the screen and cathode.

RF Amplifier, Class 'B' Telephony:

Carrier conditions per valve for use at maximum modulation factor of 1·0.

Ratings:

Plate Voltage	600 volts max.
Screen Voltage	300 volts max.
Plate Input Power	37·5 watts max.
Screen Input Power	2·5 watts max.
Plate Dissipation	25 watts max.
DC Plate Current	80 mA

Typical Operating Conditions:

Plate Voltage	400	500	600	volts
Screen Voltage	250	250	250	volts
Grid Voltage	—25	—25	—25	volts
DC Plate Current	75	75	62·5	mA
DC Screen Current	4	4	4	mA
DC Grid Current	0	0	0	mA
Peak RF Grid Voltage	30	30	20	volts*
Driving Power (approx.)	0·25	0·25	0·2	watts†
Power Output (approx.)	9	12·5	12·5	watts

* Total effective grid circuit resistance should not exceed 25,000 ohms.

† At crest of AF cycle with modulation factor of 1·0.

RF Amplifier, Class 'C' Plate Modulated:

Carrier conditions per valve for use at maximum modulation factor of 1·0.

Ratings:

Plate Voltage	475 volts max.
Screen Voltage	300 volts max.
Grid Voltage	—200 volts max.
Plate Input Power	40 watts max.
Screen Input Power	2·5 watts max.
Plate Dissipation	16·5 watts max.
DC Plate Current	83 mA max.
DC Grid Current	5 mA max.

Typical Operating Conditions:

Plate Voltage	325	400	475	volts
Screen Voltage	225	225	225	volts*
Screen Series Resistor	20,000	30,000	50,000	ohms*
Grid Voltage	—75	—80	—85	volts†
Grid Resistor	25,000	22,800	21,300	ohms†
DC Plate Current	80	80	83	mA
DC Screen Current	5	5·75	5	mA
DC Grid Current (approx.)	3	3·5	4	mA
Peak RF Grid Voltage	90	95	110	volts
Driving Power (approx.)	0·25	0·3	0·4	watts
Power Output (approx.)	17·5	22·5	27·5	watts

* Preferably obtained from a modulated fixed supply or from the modulated plate supply via the resistance value shown.

† The total effective grid circuit resistance should not exceed 25,000 ohms, the voltage may be obtained from the resistor shown, or by a combination of cathode resistor and grid leak bias or preferably fixed supply and grid leak bias.

5.4 RF Amplifier and Oscillator, Class 'C' Telegraphy:

Key down conditions per valve without modulation:*

Ratings:

Plate Voltage	600 volts max.
Screen Voltage	300 volts max.
Grid Voltage	—200 volts max.
Plate Input Power	60 watts max.
Screen Input Power	3·5 watts max.
Plate Dissipation	25 watts max.
DC Plate Current	100 mA max.
DC Grid Current	5 mA max.

Typical Operating Conditions:

Plate Voltage	400	500	600	volts
Screen Voltage	250	250	250	volts
Screen Series Resistor	20,000	42,000	50,000	ohms
Grid Voltage	—45	—45	—45	volts†
Grid Resistor	12,800	12,800	12,800	ohms†
Cathode Resistor	410	410	410	ohms†
DC Plate Current	100	100	100	mA
DC Screen Current	7·5	6·0	7·0	mA
DC Grid Current (approx.)	3·5	3·5	3·5	mA
Peak RF Grid Voltage	6·5	6·5	6·5	volts
Driving Power (approx.)	0·2	0·2	0·2	watts
Power Output (approx.)	25	30	40	watts

* Modulation essentially negative may be used if the positive peak of the AF envelope does not exceed 115% of the carrier amplitude.

† The total effective grid circuit resistance should not exceed 25,000 ohms; the voltage may be obtained from a fixed supply or by the grid resistor shown, or a cathode resistor of 410 ohms or by combination methods. If the preceding stage is keyed some fixed bias is essential.

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RF Frequency Multiplier, Telegraphy:

RF Doubler:

Continuous ratings as a doubler without modulation:

Plate Voltage	400	500	600	volts
Screen Voltage	250	250	250	volts
Screen Series Resistor	18,700	38,500	46,500	ohms
Grid Voltage	—84	—84	—84	volts
Grid Resistor	12,500	15,500	18,000	ohms
Cathode Resistor	350	350	350	ohms
DC Plate Current	90	80	75	mA
DC Screen Current	8·0	6·5	7·5	mA
DC Grid Current (approx.)	4·0	3·5	3·0	mA
Peak RF Grid Voltage	105	105	105	volts
Driving Power (approx.)	0·4	0·35	0·3	watts
Power Output	14	16	20	watts*

* Measured with typical tank coil doubling from 7 to 14 Mc/s.

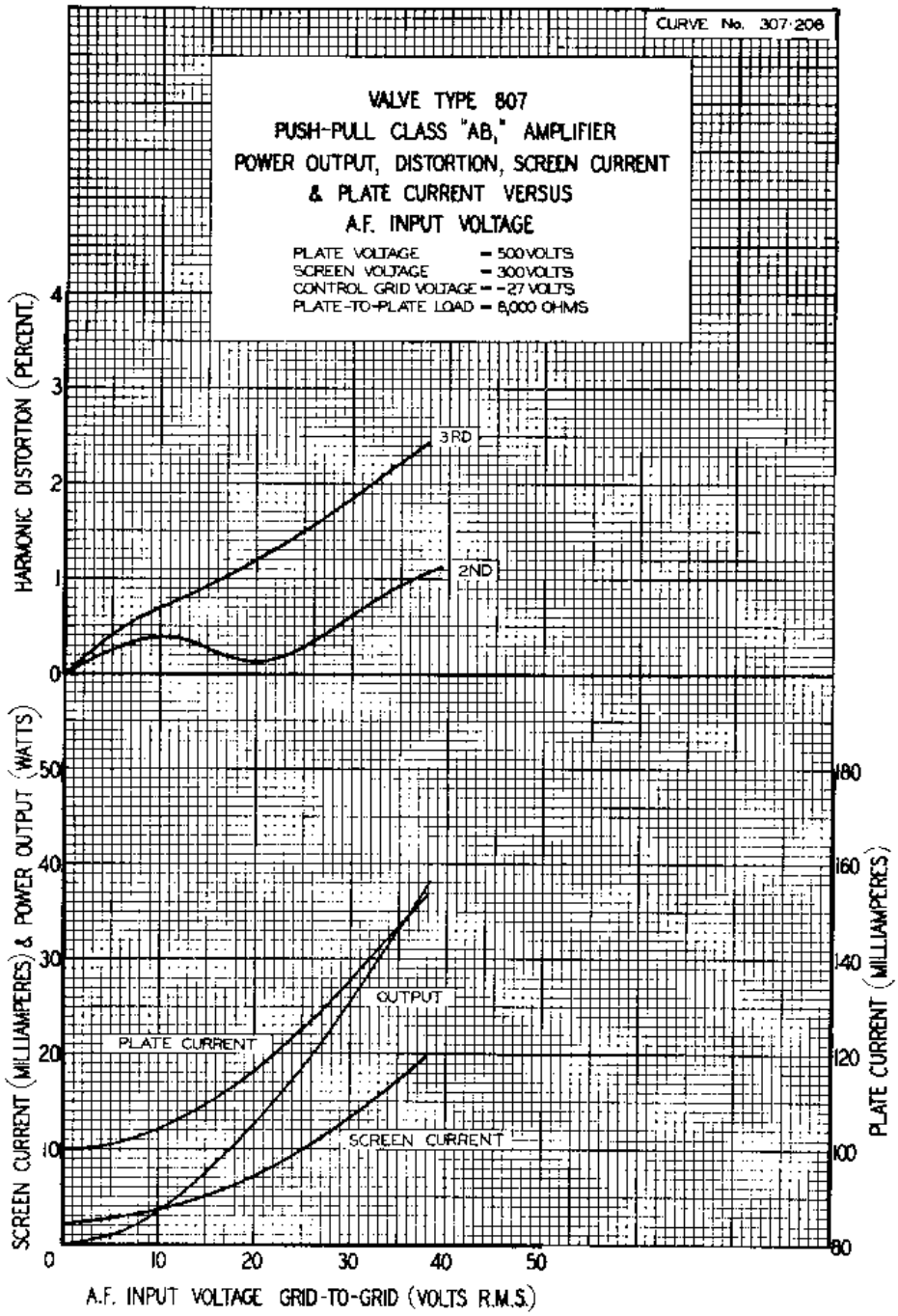
RF Trebler:

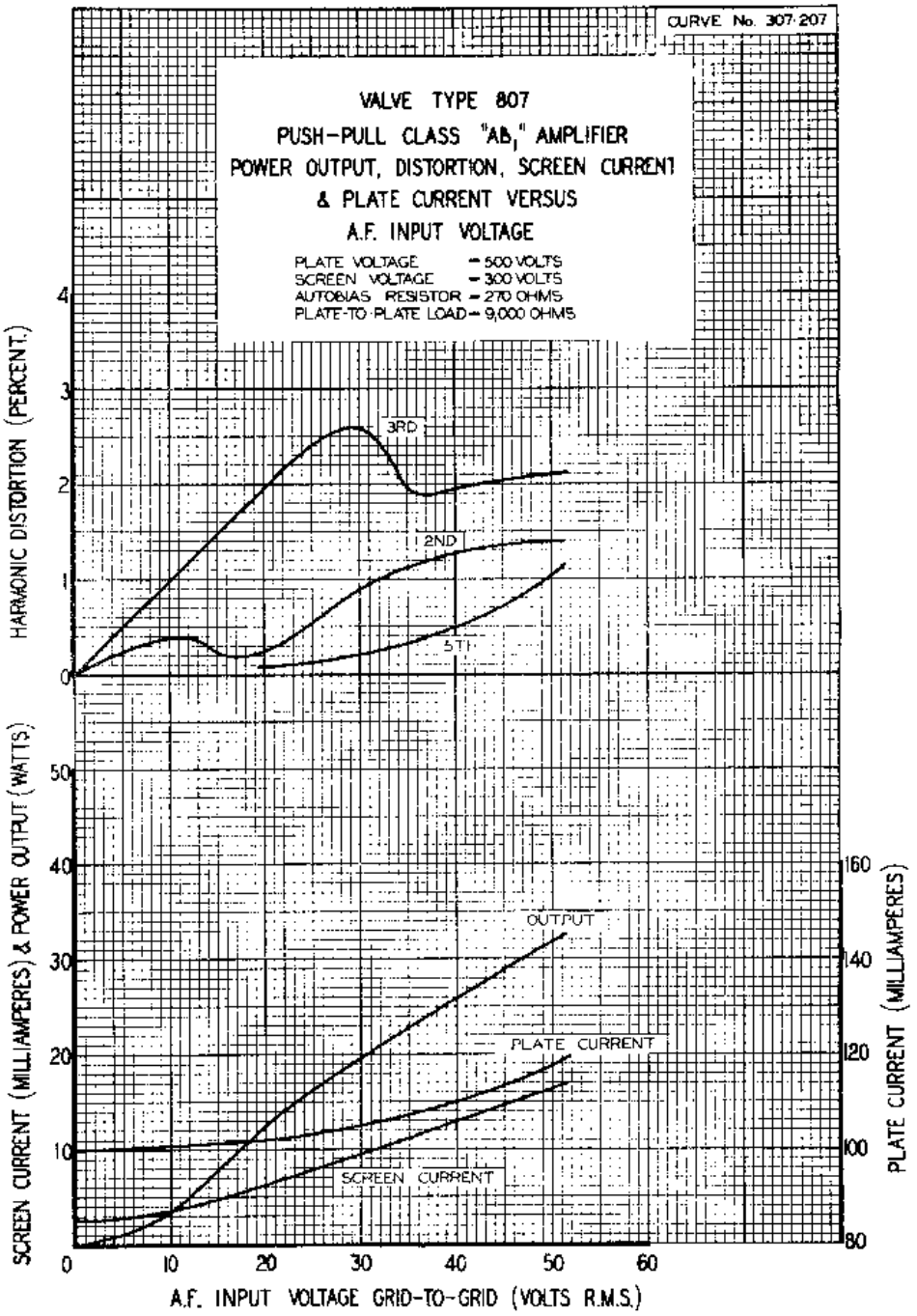
Continuous ratings as a trebler without modulation:

Plate Voltage	400	500	600	volts
Screen Voltage	250	250	250	volts
Screen Series Resistor	25,000	62,500	115,000	ohms
Grid Voltage	—95	—95	—100	volts
Grid Resistor	16,250	20,000	25,000	ohms
Cathode Resistor	400	400	450	ohms
DC Plate Current	70	60	53	mA
DC Screen Current	6	4	3	mA
DC Grid Current (approx.)	4	3·5	3	mA
Peak RF Grid Voltage	115	115	120	volts
Driving Power (approx.)	0·45	0·4	0·35	watts
Power Output	5	6	7	watts*

* Measured with typical tank coil trebling from 7 to 21 Mc/s.

Operation as Series Valve in Voltage Stabilisers: Due to the fairly high DC cathode current obtainable with this valve it is suitable for use as the series valve in a voltage stabiliser. The valve should be strapped as a triode, observing those precautions mentioned in "ratings" on page 2. Care should be taken to ensure that the maximum ratings are not exceeded under the worst possible operating conditions of the stabiliser unit, i.e., maximum supply voltage, maximum current drain and minimum DC output voltage.


CURVE No. 307-208
VALVE TYPE 807
PUSH-PULL CLASS "AB," AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT
& PLATE CURRENT VERSUS
A.F. INPUT VOLTAGE
PLATE VOLTAGE = 500 VOLTS
SCREEN VOLTAGE = 300 VOLTS
CONTROL GRID VOLTAGE = -27 VOLTS
PLATE-TO-PLATE LOAD = 8,000 OHMS
HARMONIC DISTORTION (PERCENT.)
3RD
2ND
SCREEN CURRENT (MILLIAMPERES) & POWER OUTPUT (WATTS)
PLATE CURRENT (MILLIAMPERES)
OUTPUT
PLATE CURRENT
SCREEN CURRENT
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)


CURVE No. 307-207
VALVE TYPE 807
PUSH-PULL CLASS "AB1" AMPLIFIER
POWER OUTPUT, DISTORTION, SCREEN CURRENT
& PLATE CURRENT VERSUS
A.F. INPUT VOLTAGE
PLATE VOLTAGE = 500 VOLTS
SCREEN VOLTAGE = 300 VOLTS
AUTOBIAS RESISTOR = 270 OHMS
PLATE-TO-PLATE LOAD = 9,000 OHMS
3RD
2ND
5TH
OUTPUT
PLATE CURRENT
SCREEN CURRENT
HARMONIC DISTORTION (PERCENT.)
SCREEN CURRENT (MILLIAMPERES) & POWER OUTPUT (WATTS)
PLATE CURRENT (MILLIAMPERES)
A.F. INPUT VOLTAGE GRID-TO-GRID (VOLTS R.M.S.)
0
1
2
3
4
10
20
30
40
50
60
80
100
120
140
160