12E13

BEAM TETRODE

Indirectly heated

GENERAL

The 12E13 is a beam tetrode which has a maximum anode dissipation of 35 watts and a maximum cathode current of 175 mA. It is intended for use as a series or parallel regulator valve in stabilised power supply units.

It is also suitable for use as the output stage of an AF amplifier for which two valves will provide up to 100 watts output. Under intermittent conditions, an output of 150 watts is obtainable under Class B conditions.

RATING

Heater Voltage	V_h	6·3	V
Heater Current	I_h	1·6	A
Maximum Anode Voltage	$V_{a(max)}$	600	V
Maximum Screen Voltage	$V_{g2(max)}$	600	V
Maximum Anode+Screen Voltage	$V_{a+g2(max)}$	600*	V
Maximum Anode Dissipation	$P_{a(max)}$	35	W
Maximum Screen Dissipation	$P_{g2(max)}$	6	W
Maximum Anode+Screen Dissipation	$P_{a+g2(max)}$	40*	W
Maximum Cathode Current	$I_{k(max)}$	175	mA
Maximum Heater/Cathode Voltage	$V_{h-k(max)}$	150	V
Maximum Grid/Cathode Resistance (cathode bias)		220**	kΩ
Maximum Grid/Cathode Resistance (fixed bias)		100**	kΩ

* Triode connection

** Resistance tolerance ± 20%

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INTER-ELECTRODE CAPACITANCES

Grid 1/Earth	c_{in}	16 pF
Anode/Earth	c_{out}	12 pF
Anode/Grid 1	$c_{a\text{-}g1}$	1·2 pF

DIMENSIONS

Maximum Overall Length	125 mm
Maximum Seated Height	110 mm
Maximum Diameter	52 mm

MOUNTING POSITION—Unrestricted.

If mounted horizontally, pins 4 and 8 should be in a vertical plane with an inter valve spacing of not less than 4 inches. With two or more valves, vertically mounted, pins 4 and 8 should preferably be in line. Free air circulation should be available and the hottest part of the bulb should not exceed 250°C.

CHARACTERISTICS—Pentode Connection

Anode Voltage	V_a	250 V
Screen Voltage	V_{g2}	250 V
Anode Current	I_a	140 mA
Mutual Conductance	gm	11mA/V
Anode Impedance	r_a	12 kΩ
Inner Mu	$\mu g1\text{-}g2$	8

CHARACTERISTICS—Triode Connection

Anode, Screen Voltage	$V_{a,g2}$	250 V
Anode Current	I_a	160 mA
Mutual Conductance	gm	12mA/V
Anode Impedance	r_a	670 Ω
Amplification Factor	μ	8

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TYPICAL OPERATION—Push-Pull Ultra-Linear. Cathode Bias

Supply Voltage	$V_{a(b)}$	500	V
Anode Voltage	V_a	425	V
Screen Voltage	V_{g2}	425	V
Anode+Screen Current (maximum signal)	$I_{a+g2(max\ sig)}$	2×100	mA
Anode+Screen Current (quiescent)	$I_{a+g2(o)}$	2×87	mA
Anode+Screen Dissipation (quiescent)	$P_{a+g2(o)}$	2×40	W
Anode+Screen Dissipation (maximum signal)	$P_{a+g2(max\ sig)}$	2×18	W
Grid Bias Applied (approx.)	V_{g1}	−50	V
Cathode Bias Resistance	R_k	2×525±5%*	Ω
Input Voltage (grid-grid)	$V_{in(g-g)}$	90	V
Anode Load (anode-anode)	$R_{L(a-a)}$	6	kΩ
Output Impedance	z_{out}	4·5	kΩ
Power Output	P_{out}	50	W
Distortion	D	1†	%
Intermodulation		5†	%

* Separate bias resistors are essential.

† Average pair.

TYPICAL OPERATION—Push-Pull Ultra-Linear. Fixed Bias

Supply Voltage	$V_{a(b)}$	560	V
Anode Voltage	V_a	550	V
Screen Voltage	V_{g2}	550	V
Anode+Screen Current (quiescent)	$I_{a+g2(o)}$	2×50	mA
Anode+Screen Current (maximum signal)	$I_{a+g2(max\ sig)}$	2×150	mA

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Anode+Screen Dissipation (quiescent)	$P_{a+g2(o)}$	2×30	W
Anode+Screen Dissipation (maximum signal)	$P_{a+g2(max)}$	2×33	W
Grid Bias Applied (approx)	V_{g1}	−80*	V
Input Voltage (grid-grid)	$V_{in(g-g)}$	120	V
Anode Load (anode-anode)	$R_{L(a-a)}$	4·5	kΩ
Output Impedance	z_{out}	6·5	kΩ
Power Output	P_{out}	100	W
Distortion	D	3 to 6†	%
Intermodulation		12	%

* A negative bias range of 70±25% is recommended.
† The distortion will vary according to the degree of matching.

TYPICAL OPERATION—Push-Pull Triode Connection

		Cathode Bias		
Supply Voltage	$V_{a(b)}$	400	485	V
Anode Voltage	V_a	350	425	V
Screen Voltage	V_{g2}	350	425	V
Anode+Screen Current (quiescent)	$I_{a+g2(o)}$	2×67	2×85	mA
Anode+Screen Current (maximum signal)	$I_{a+g2(max)}$	2×72	2×90	mA
Anode+Screen Dissipation (quiescent)	$P_{a+g2(o)}$	2×24	2×40	W
Grid Bias Applied (approx)	V_{g1}	−38	−48	V
Cathode Bias Resistance	R_k	2×525±5%*	2×525±5%*	Ω
Input Voltage (grid-grid)	$V_{in(g-g)}$	60	70	V
Anode Load (anode-anode)	$R_{L(a-a)}$	4	4	kΩ
Output Impedance	z_{out}	2·5	2·5	kΩ
Power Output	P_{out}	15	27	W
Distortion	D	1 to 3†	1 to 3†	%
Intermodulation		6	6	%

* Separate bias resistors are essential.
† The distortion will vary according to the degree of matching

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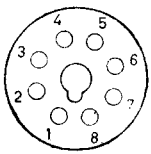
BASE—International Octal (108)



Viewed from free end of pins.

CONNECTIONS

Pin 1	Shield	s
Pin 2	Heater	h
Pin 3	Anode	a
Pin 4	Screen Grid	g2
Pin 5	Control Grid	g1
Pin 6	No Pin	NP
Pin 7	Heater	h
Pin 8	Cathode, Beam Plates	k,bp

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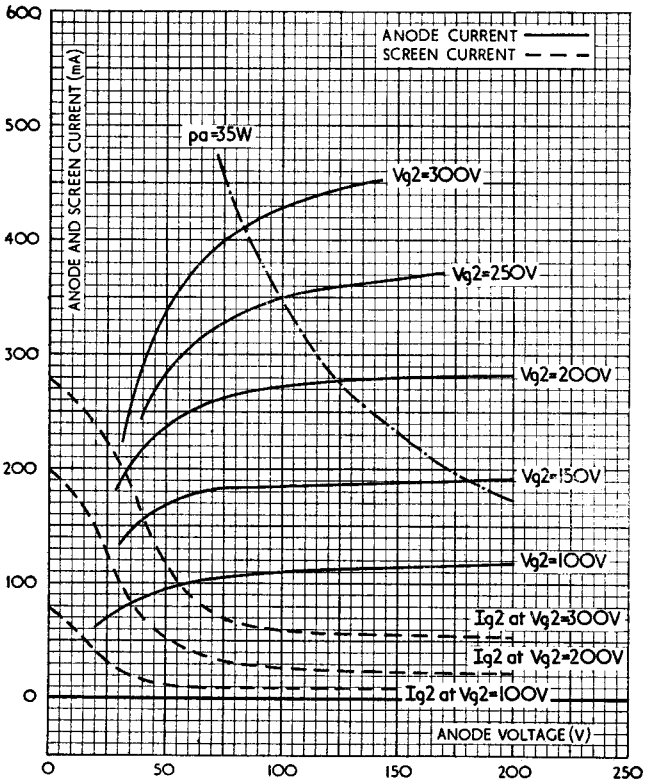
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$
($V_{g1}=0V$)



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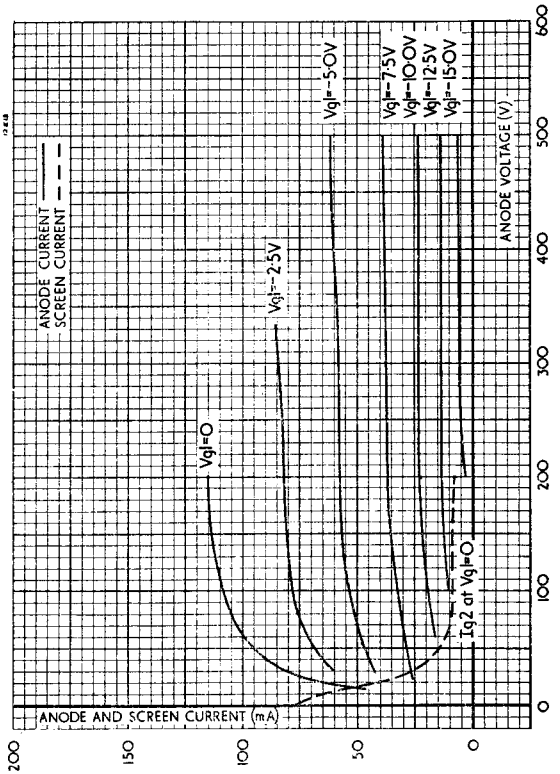
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$
(V_{g2}=100V)



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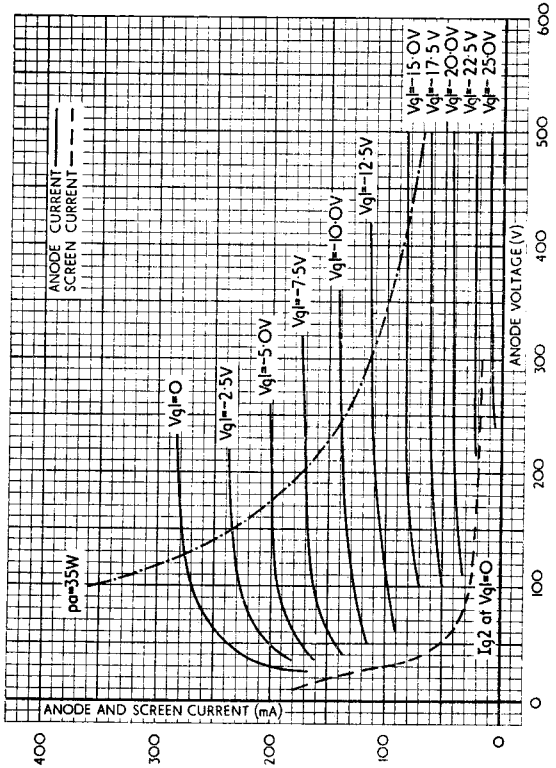
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$
(V_{g2}=200V)



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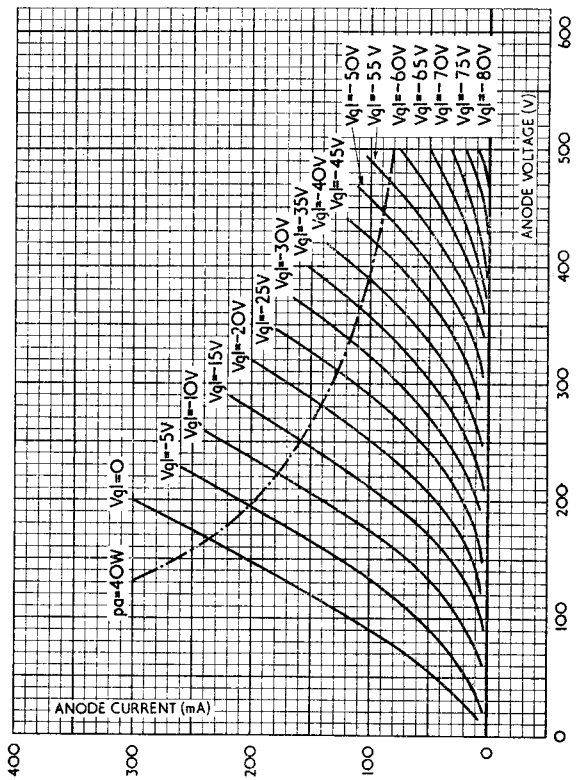
CHARACTERISTIC CURVES: I_a/V_a

Triode Connection



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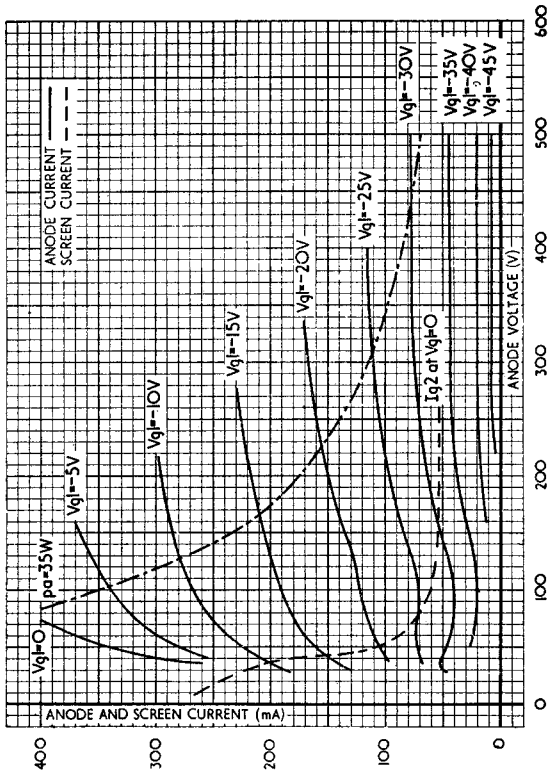
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a$
($V_{g2}=300V$)



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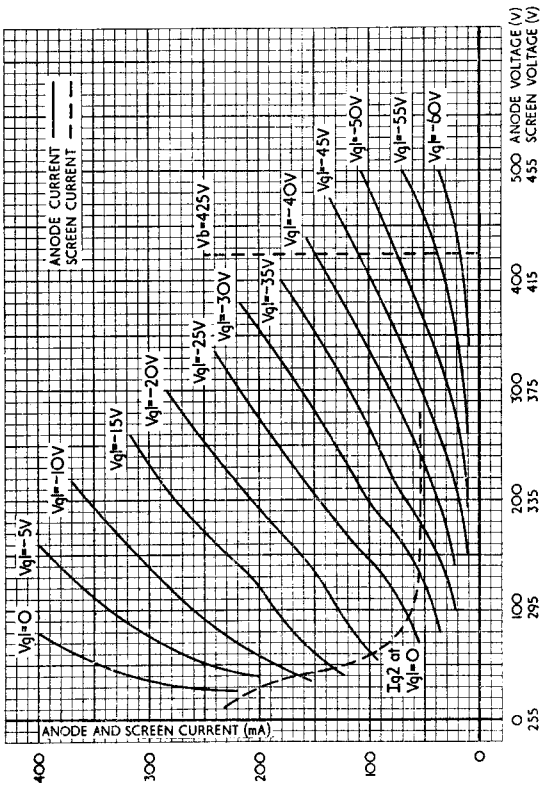
CHARACTERISTIC CURVES: $I_a, I_{g2}/V_a, V_{g2}$
(V_b=425V)
Ultra-Linear Connection — 40% taps*



* Position of the screen grid taps on the output transformer.

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