TECHNICAL HANDBOOK

VALVES AND CATHODE RAY TUBES

Ferranti

TECHNICAL HANDBOOK

VALVES
AND
CATHODE RAY TUBES

Issue 4
Oct., 1963

GENERAL

Ferranti

Technical Handbook - Valves & Cathode Ray Tubes

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FERRANTI

INTERPRETATION OF VALVE DATA

The data given on the Data Sheets includes Ratings, Typical Operation and Characteristics which show the distinguishing electrical features and values of the individual valves. In some instances, notes on particular applications are also included.

The following brief explanation will help in the interpretation of this data.

ELECTRODE VOLTAGES AND ELECTRODE SUPPLY VOLTAGES.

The positive potential electrode voltages and grid bias voltages are all referred to a specific datum point as follows:—

Directly Heated Valves. If the filament is heated with D.C. the negative filament connection.

If the filament is heated with A.C. the centre tap on the filament winding of the transformer, or the mid-point of a resistor shunting the filament.

Indirectly Heated Valves. The cathode connection.

Cold Cathode Valves. The cathode connection.

RATINGS.

It is important that the published ratings should be closely observed and the first maximum or minimum rating should be the limiting factor.

Two methods of rating are in normal use, the "absolute" system and the "Design Centre" system.

"*Absolute*" ratings are definite limiting values which should never be exceeded. The designer should therefore determine an average rating value below the absolute rating value by a sufficient amount to ensure that initially and throughout life the absolute values will never be exceeded under extreme operating conditions imposed by limit tolerance components (including other valves), supply voltage variations, load or signal variations, control adjustments or environmental conditions.

"*Design Centre*" ratings are such that if a valve is operated within the rated conditions, it will have a factor of safety to allow for normally encountered variations in the normal mains or battery supplies to the equipment.

The designer should ensure that due allowance is made for limit tolerances of the components (and for the effects of load variation where applicable) so that all valves operate within the ratings when the supply voltage is at its normal value.

In general ratings apply to operation at normal atmospheric pressure.

The ratings given in these Data Sheets are based on the "Design Centre" system unless they are shewn as "Absolute" ratings.

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TYPICAL OPERATION.

The values given under this heading should not be confused with ratings. The typical operating values shewn are given as a guide to the use of each valve in particular applications, but a valve can in general be used under many operating conditions within its rating limitations.

CHARACTERISTICS.

Both "Static" and "Dynamic" characteristics may be shewn in the form of curves or they may be tabulated.

The tabulated figures are the mean values of electrical measurements on a large number of valves under defined conditions and represent the characteristic of an average valve. Individual valves may have characteristics in a range above or below the average values shewn.

The curves shewn on the graphs included in the handbook are in general representative of average characteristics, but in some cases are typical of general production and in a few instances they may also shew limiting values.

TOP CAP AND SIDE CONTACT DIMENSIONS.

Type	Dimensions of Contact Area		
	Diameter		Length
	Min.	Max.	Min.
CT1	6.23 mm. (.245")	6.47 mm. (.255")	5.34 mm. (.21")
CT2	9.02 mm. (.355")	9.27 mm. (.365")	7.62 mm. (.30")
CT3	14.2 mm. (.559")	14.54 mm. (.573")	9.66 mm. (.38")
CT4	18.8 mm. (.740")	19.3 mm. (.760")	16.01 mm. (.63")
CT5	14.86 mm. (.585")	15.11 mm. (.595")	12.0 mm. (.47")
CT6	Screw-on Cap for Tag Connection. Screw 5BA.		
CT7	Recessed Ball Type. Ball Diameter 2.87 mm. (nom.)		
CT8	Cavity Type.		

SYMBOLS

(The letter symbols used in these specifications are based on British Standard Specification BS1409 : 1950).

GENERAL.

With the exception of symbols for voltage and current, the symbols applying to the valve itself are denoted by small letters whilst symbols for associated circuits are denoted by capital letters.

Values of voltages or current are denoted by letter symbols in capital type except that instantaneous values are denoted by small letter symbols.

Except in the case noted in the paragraph below referring to valves with two or more similar electrode systems, any qualification of a symbol is effected by means of a subscript. When two subscripts qualify the same symbol, the second is usually in brackets.

SYMBOLS FOR ELECTRODES AND OTHER VALVE ELEMENTS.

Anode	a	Fluorescent Screen or Target	t
Grid	g	Internal Conducting Coating	m
Cathode	k	External Conducting Coating	M
Heater	h	Deflector Electrodes	x or y
Filament	f	Deflector Electrode other than x or y	z
Internal Shield	s	Trigger Electrode	Trig.
Beam Forming Plates	bp	Resonator	Res.

In multiple valves the respective electrodes are distinguished by adding a letter subscript.

Diode	d
Triode	t
Tetrode	q
Pentode	p
Hexode, Heptode, etc.	h
Rectifier	r

e.g. The pentode anode of a triode-pentode valve is denoted a_p

When a valve electrode system has more than one grid the grids are distinguished by adding a figure to the electrode symbol, showing the sequence of grids counting from the cathode.

e.g. g_1 is the grid nearest the cathode, g_2 the next nearest, etc.

A similar convention applies to a sequence of anodes.

Where one valve has two or more similar electrode systems which cannot be distinguished by the above noted symbols, primes (or apostrophes) are added to denote the electrode system of which the electrode forms part.

e.g. g′ and a′ are respectively grid and anode of one triode section of a double triode, g″ and a″ are the grid and anode of the other section.

SYMBOLS FOR ELECTRIC MAGNITUDES.

Voltage.

Direct Voltage	V
Alternating Voltage (r.m.s.)	$V_{r.m.s.}$
Average Value of D.C. Component of a complex Voltage Wave	V_{av}
Peak Voltage	v_{pk}
Peak Inverse Voltage	P.I.V.

Current.

Direct Current	I
Alternating Current (r.m.s.)	$I_{r.m.s.}$
Average Value of D.C. Component of a Complex Current Wave	I_{av}
Peak Current	i_{pk}
No Signal Current	I_o

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SYMBOLS—contd.

ADDITIONAL SYMBOLS used in connection with valves.

Amplification factor	μ	Driving Power	P_{dr}
Mutual Conductance	g_m	Bulb Temperature	Tbulb
Conversion Conductance	g_c	Cathode Heating Time	t_{hk}
Distortion	D	Switching Delay Time	t_{sd}
Bandwidth	Δf	Ionisation Time	t_i
Sensitivity	S	De-ionisation Time	t_d
Brightness	B	Pulse Duration	t_p

	Inside Valve	Associated Circuits Outside Valve
Resistance	r	R
Reactance	x	X
Impedance	z	Z
Admittance	y	Y
Mutual Inductance	m	M
Capacitance	c	C
Capacitance (working)	c_w	—
Power	p	P

ADDITIONAL SUBSCRIPTS.

Battery or other source	b	Inverse (voltage or current)	**inv**
Input	in	Stabilised	**stab**
Output	out	Limiting	**lim**
Signal	sig	Total	tot
Heterodyne	het	Maximum	max
Ignition (voltage)	ign	Surge (voltage or current)	sur
Extinction (voltage)	ext	Total effective working load	L

GENERAL EXAMPLES OF COMPLEX SYMBOLS.

Voltage.		*Current.*	
Anode Voltage	V_a	Anode Current, D.C.	I_a
Control Grid Voltage	V_{g1}	Control Grid Current	I_{g1}
Supply Voltage for Anode	$V_{a(b)}$	No Signal Anode Current	$I_{a(o)}$
Extinction Voltage	V_{ext}	A.C. Anode Current (r.m.s.)	$I_{a(r.m.s.)}$

Capacitance (Cold).

Anode to all other electrodes	c_{a-all}
Anode to Control Grid	c_{a-g_1}
Input Capacitance. (Control grid to all electrodes except anode)	c_{in}
Output Capacitance. (Anode to all electrodes except control grid)	c_{out}

Capacitance (Working).

Control grid to cathode	$c_{g_1-k(w)}$

Resistance.	Inside Valve	Outside Valve
Anode resistance	r_a	R_a
Insulation resistance (heater to cathode)	r_{h-k}	—
Resistance between grid and cathode	r_{g_1-k}	R_{g_1-k}
Total effective load resistance	—	R_L
Cathode Bias Resistor	—	R_k

Power.

Anode dissipation	P_a	—
Grid 2 dissipation	P_{g_2}	—
Output Power	—	P_{out}

ABBREVIATIONS USED IN BASE DIAGRAMS.

Pin with an unspecified internal connection	IC
Pin with no internal connection	NC
Pin omitted from base	NP
Side contact	SC
Top Cap (contact)	TC
Trigger Electrode	tr
Jumper Connection	J

FERRANTI

GENERAL RECOMMENDATIONS FOR OPERATION OF RECEIVING VALVES

(These recommendations are based on the British Standard Code of Practice CP1005, "Use of Electronic Valves", and these notes should be interpreted in conjunction with that publication).

The following general limitations should be observed.

RATINGS as shown on individual data sheets are operating maxima which should never be exceeded.

HEATER OR FILAMENT VOLTAGE. The heater or filament voltage is given as a nominal value unless otherwise stated. The following general operating limits should be observed.

DIRECTLY HEATED VALVES.

(a) 2.0 Volt Battery Valves. This range of valves is designed to be operated from a 2 volt supply and in all cases the operating range should be maintained within the limits 1.8 to 2.2 volts.

(b) 1.4 Volt Battery Valves. The valves are designed to operate from a unit cell with a nominal voltage of 1.5 volts or a number of these valves may be operated in series from a dry battery, accumulator or mains supply. In any case the voltage across each 1.4 volt filament section should be maintained in the range 1.1 to 1.5 volts with a mean voltage drop on each section of 1.3 volts. To meet this condition in series filament chains it is usually necessary to employ shunting resistors across individual 1.4 volt sections.

INDIRECTLY HEATED VALVES.

(a) Parallel Operation. Valves supplied in parallel from a transformer will give satisfactory operation if the voltage across the heaters is within $\pm$ 7% of the rated value when the mains supply voltage is at its nominal value.

(b) Series Operation. When valve heaters are connected in series with a controlling resistance, the heater current should be within $\pm$ 5% of the rated value when the supply voltage is at its nominal value and valves with nominal heater characteristics are employed. It is undesirable to operate valves in series unless the valves are designed for constant current operation.

HEATER CATHODE INSULATION. The maximum potential between heater and cathode should be kept as low as possible. To avoid hum and instability the heater-cathode insulation resistance should not be included in RF circuits or in AF circuits followed by high gain.

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D.C. CONNECTION BETWEEN CATHODE AND GRID ELECTRODES. In no circumstances should valves be operated without a D.C. connection between each electrode and the cathode.

CONTROL GRID VOLTAGE. This negative voltage may be derived from a separate battery or a voltage divider across the H.T. Supply (fixed bias), from the voltage drop across a resistor in the cathode circuit (cathode bias), or from the voltage drop across a resistor in the grid circuit (grid bias). It is undesirable to provide the bias voltage solely by grid rectification unless precautions are taken to ensure that in the event of loss of drive the valve ratings are not exceeded. It is recommended that the resistance between control grid and cathode be kept as low as possible.

SCREEN GRID VOLTAGE may be derived from a tap on a voltage divider or through a series resistor connected to a high voltage source, usually the anode supply. The screen voltage for frequency changers and tetrodes should preferably be derived from a voltage divider, the resistance of which should be kept as low as practicable. In circuits in which large anode voltage variations occur care should be taken to ensure that the maximum screen grid dissipation is not exceeded.

SUPPRESSOR GRID VOLTAGE. The suppressor grid should normally be maintained at the same potential as the cathode. Valves should never be operated with a negative potential on the suppressor grid sufficiently great to cause the screen-grid dissipation to exceed its rated value.

ANODE VOLTAGE should in general not be applied unless the corresponding grid bias voltage is also applied.

MOUNTING. Even when mounting position is indicated on the data as "Any", it is still preferable to mount valves vertically base down. If they are mounted horizontally the major axis of the grid should preferably be vertical.

Valve holders for glass based valves should not have heavy gauge wires soldered to the floating contacts.

Adequate ventilation should be provided particularly for output valves and rectifiers.

RECEIVING VALVES.

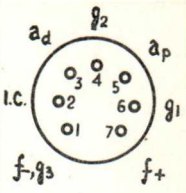
FERRANTI

DIODE PENTODE

DAF91

IS5

A directly heated miniature Pentode combined with a single diode, designed for use as a Detector and AF. Amplifier in battery operated Receivers. The filament is suitable only for DC. operation.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B7G—All Glass.
Max. Overall Length	... ...	54·5 mm. (2$\frac{5}{32}$in.).
Max. Seated Height	... ...	47·5 mm. (1$\frac{7}{8}$in.).
Max. Diameter	... ...	19·0 mm. ($\frac{3}{4}$in.).

BASE CONNECTIONS.

Pin 1—Filament (–).
Suppressor Grid (g_3).
Pin 2—Int. Connection.
Pin 3—Diode (a_d).
Pin 4—Screen Grid (g_2).
Pin 5—Anode.
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).

FILAMENT.

Filament Voltage	... ...	1·4 volts.
Filament Current	... ...	50 mA.

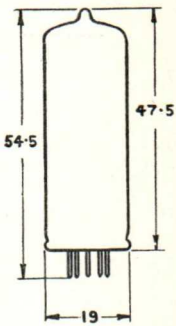
RATINGS.

Pentode Section.†

Max. Anode Supply Voltage	...	120 volts.
Max. Anode Voltage	... ...	90 volts.
Max. Screen Voltage	... ...	90 volts.
Max. Anode Dissipation	...	250 mW.
Max. Screen Dissipation	...	60 mW.
Max. Cathode Current	...	4·5 mA.
*R_{g1-f} max.	... ...	3 MΩ
‡V_{g1} max.	...	0 volt.

Diode Section.

Max. P.I.V.	... ...	100 volts.
Max. Mean Diode Current	...	0·2 mA.
Max. Peak Diode Current	...	1·2 mA.



All dimensions shown are in millimetres (max.).

CHARACTERISTICS.

Pentode Section.

Anode Voltage	... ...	67·5	90 volts.
Screen Voltage	... ...	67·5	90 volts.
Anode Current	...	1·6	2·7 mA.
Screen Current	... ...	0·4	0·63 mA.
Grid Voltage	... ...	0	0 volts.
Mutual Conductance	...	625	720 μA/volt.
Anode Impedance	...	0·6	0·5 MΩ
Inner μ (μ_{g1-g2})	...	13·5	13·5

Diode Section.

The diode section is situated at the negative end of the filament.

†This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 40 mV. for an output of 50 mW from the output stage.
*R_{g1-f} may be increased up to 22 MΩ if grid current biasing is employed.
‡For grid current of 0·3μA

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DAF91

IS5

TYPICAL OPERATION as Resistance Coupled A.F. Amplifier.

Pentode Connection.

Supply Voltage ...	45	45	45	67·5	67·5	67·5	90	90	90	volts.
Anode Load Resistor	0·27	0·47	1·0	0·27	0·47	1·0	0·27	0·47	1·0	MΩ
Screen Grid Feed Resistor ...	1·0	1·8	3·9	1·0	1·8	3·9	1·0	1·8	3·9	MΩ
Anode Current ...	80	50	25	145	87	45	220	130	65	μA.
Screen Current ...	23·2	14·6	7·7	41	25	13	61	36	18·7	μA.
Grid Resistor of following valve	1·0	4·7	4·7	1·0	4·7	4·7	1·0	4·7	4·7	MΩ
Stage Gain	38·8	55	65	50	68	82	60	83·5	104	
Output Voltage (r.m.s.) ...	1·94	2·75	3·25	5·0	6·8	8·2	6·0	8·35	10·4	volts.
Total Distortion ...	1·9	1·7	2·4	1·3	2·0	2·5	1·4	3·1	3·3	%

Triode Connection (g_2 connected to a)

H.T. Supply Voltage	90	90	volts.
Anode Load Resistor ...	0·22	0·47	MΩ
Anode Current	250	130	μA.
Grid Resistor of following valve	0·68	1·5	MΩ
Stage Gain	11	11·5	
Output Voltage (r.m.s.) ...	5	5	volts.
Distortion	1·0	0·8	%

CAPACITANCES.*

C_{in}	2·0 pF.
C_{out}	2·8 pF.
C_{a-g_1}	<0·4 pF.
C_{ad-all}	1·5 pF.

*Measured without external shield.

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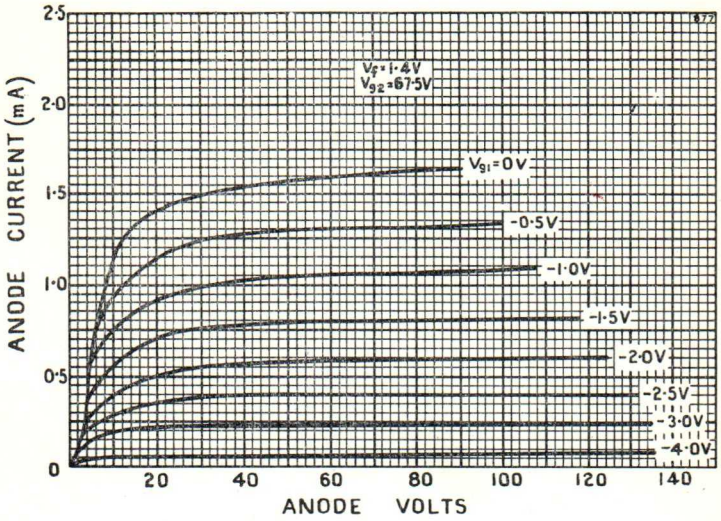

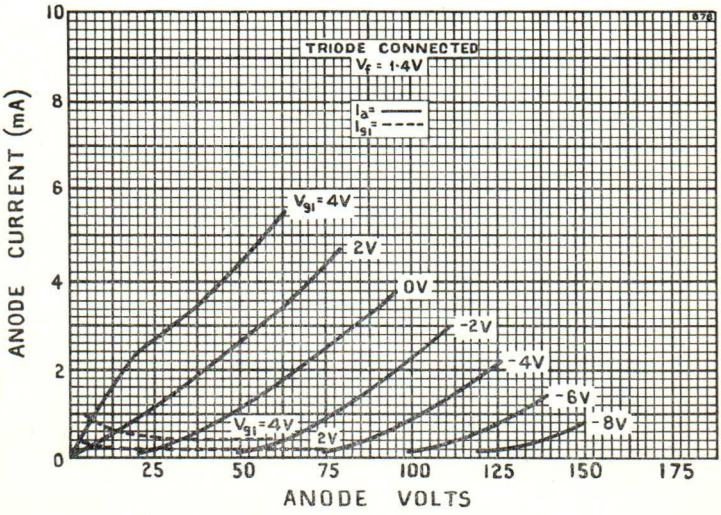

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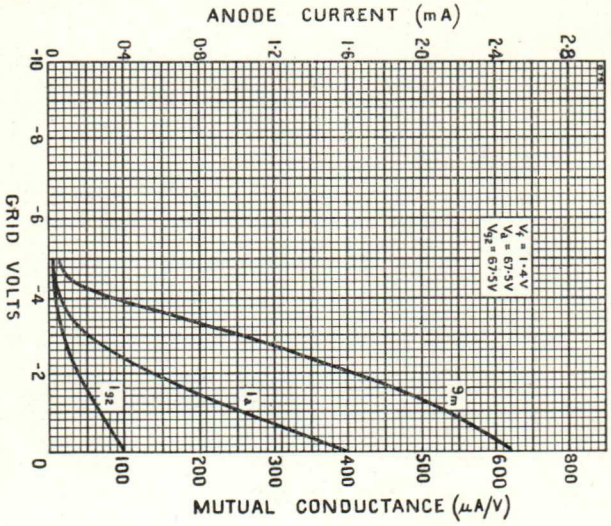
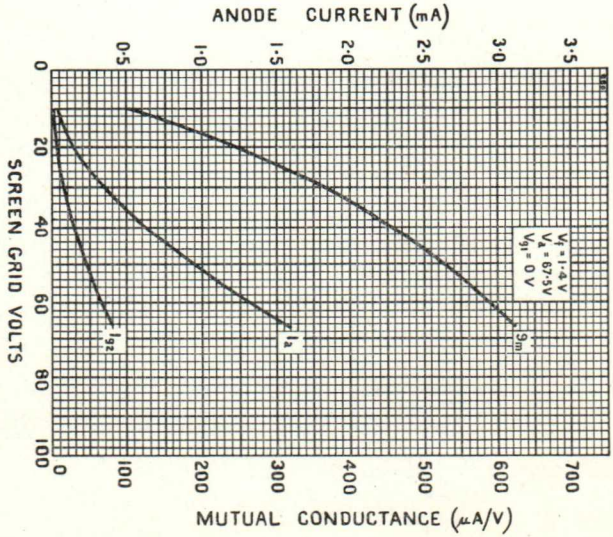

ANODE CURRENT (mA)
0
0·4
0·8
1·2
1·6
2·0
2·4
2·8
-10
-8
-6
-4
-2
0
GRID VOLTS
V_f = 1·4V
V_a = 67·5V
V_{g2} = 67·5V
I_{g2}
I_a
g_m
0
100
200
300
400
500
600
800
MUTUAL CONDUCTANCE (μA/V)


ANODE CURRENT (mA)
0
0·5
1·0
1·5
2·0
2·5
3·0
3·5
0
20
40
60
80
100
SCREEN GRID VOLTS
V_f = 1·4 V
V_a = 67·5V
V_{g1} = 0 V
I_{g2}
I_a
g_m
0
100
200
300
400
500
600
700
MUTUAL CONDUCTANCE (μA/V)

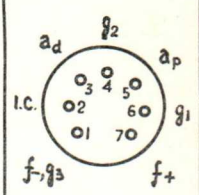
FERRANTI

DIODE PENTODE

DAF96

IAH5

A directly heated miniature Pentode combined with a single diode, designed for use as Detector and A.F. Amplifier in battery operated Receivers. The low drain filament is suitable only for d.c. operation either from a series or parallel supply.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

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Pin 5—Anode.
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).

FILAMENT.

	Series.	Parallel.	
Filament Voltage	1·3	1·4	volts.
Filament Current	24	25	mA.

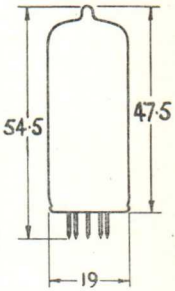
RATINGS.

Pentode Section.†

Max. H.T. Supply Voltage ...	120 volts.
Max. Anode Voltage	90 volts.
Max. Screen Voltage	90 volts.
Max. Anode Dissipation ...	30 mW.
Max. Screen Dissipation ...	10 mW.
Max. Cathode Current ...	0·25 mA.
*R_{g_1-f} (I_k <0·25 mA) ...	3 MΩ
V_{g_1} max. (I_{g_1} = +0·3 μA) ...	0 volt.

Diode Section.

Max. P.I.V.	100 volts.
Max. Mean Diode Current ...	0·2 mA.
Max. Peak Diode Current ...	1·2 mA.



All dimensions shown are in millimetres (max.).

CHARACTERISTICS.

Pentode Section.

Anode Voltage	67·5 volts.
Screen Voltage	67·5 volts.
Anode Current	170 μA.
Screen Current	55 μA.
Grid Voltage	–1·5 volts.
Mutual Conductance	170 μA/V.
Inner μ (μg_1–g_2)	16

Diode Section.

The diode section is situated at the negative end of the filament.

*R_{g_1-f} may be increased up to 22 MΩ if grid current biasing is employed and the cathode current is limited to 0·1 mA.

†This valve can be used without taking special precautions against microphony in circuits in which the input voltage is not less than 20 mV. for an output of 50 mW. from the output stage.

Issue 2
Dec.,1957

FERRANTI

TYPICAL OPERATION as Resistance coupled A.F. Amplifier.

Pentode Connection.

*Supply Voltage	64	64	64	85	85	85	volts.
Anode Load Resistor	1·0	1·0	1·0	1·0	1·0	1·0	MΩ
‡Screen Grid Feed Resistor	2·7	2·7	2·7	2·7	2·7	2·7	MΩ
Grid Resistor (R_{g1-k})	10	10	10	10	10	10	MΩ
Anode Current	42	42	42	64	64	64	μA.
Screen Current	13	13	13	21	21	21	μA.
Grid Resistor of following valve	1·0	2·0	2·2	1·0	2·0	2·2	MΩ
Stage Gain	50	57	63	55	65	70	
Output Voltage (r.m.s.)	5	5	5	5	5	5	volts.
Total Distortion	3·5	3·5	2·0	1·4	2·0	2·4	%

Triode Connection (g_2 connected to a)

*Supply Voltage	64	64	64	85	85	85	volts.
Anode Load Resistor	0·22	0·47	1·0	0·22	0·47	1·0	MΩ
Grid Resistor (R_{g1-k})	10	10	10	10	10	10	MΩ
Cathode Current	135	70	40	210	110	56	μA.
Grid Resistor of following valve	1	1	2·2	1	1	2·2	MΩ
Stage Gain	11	12	13	11	12·5	13·5	
Output Voltage* (r.m.s.)	5	5	5	5	5	5	volts.
Distortion	3	2·5	2·5	2	1·5	2	%

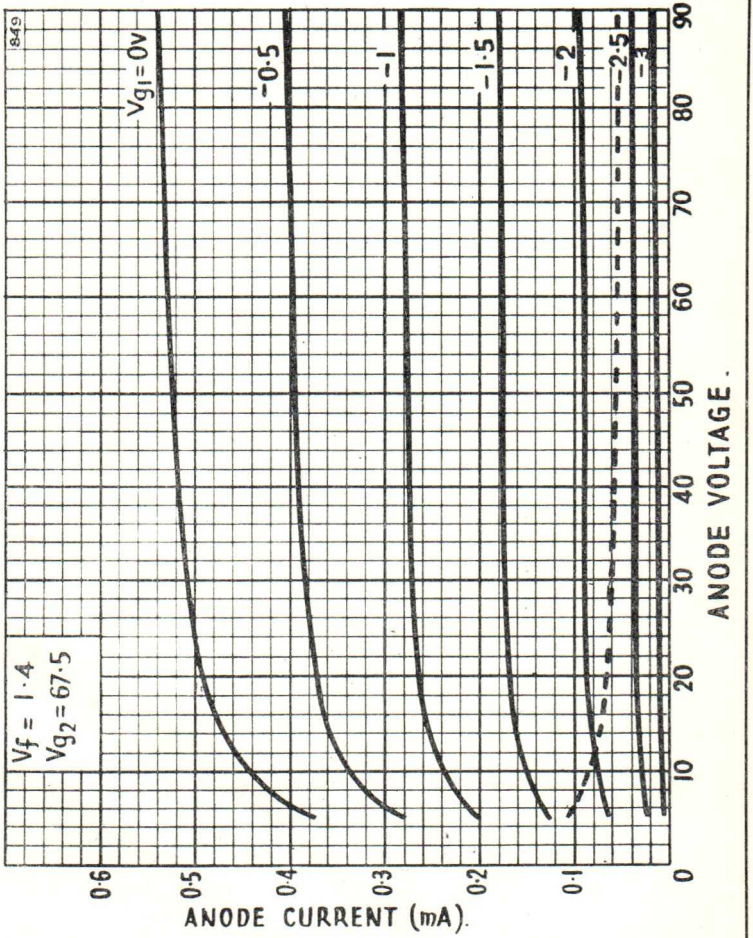
CAPACITANCES.†

C_{in}	1·8 pF.
C_{out}	2·7 pF.
C_{a-g1}	<0·3 pF.
C_{ad-g1}	0·03 pF.
C_{ad-ap}	<0·9 pF.
C_{ad-all}	1·1 pF.

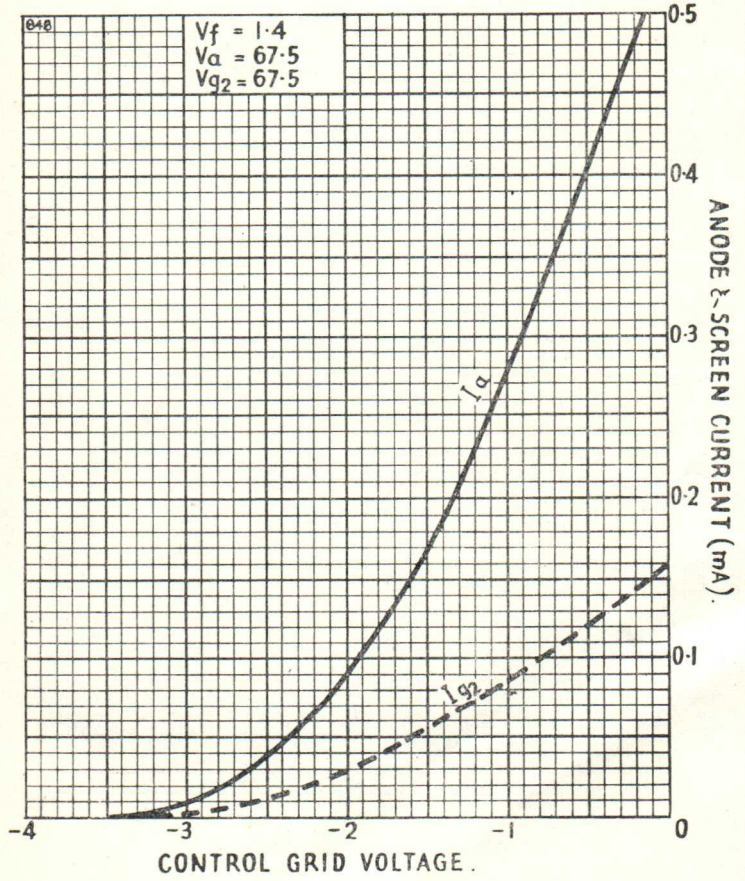
*These figures are based on Battery voltages of 67·5 volts and 90 volts decreased by the negative bias of the output valve.

‡By-passed to earth by 0·47 μF capacitor.

†Measured without external shield.



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

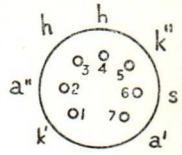

Vf = 1·4
Va = 67·5
Vg2 = 67·5
Ia
Ig2
0·5
0·4
0·3
0·2
0·1
0
-4
-3
-2
-1
ANODE & SCREEN CURRENT (mA).
CONTROL GRID VOLTAGE.

FERRANTI

DOUBLE DIODE

DD6

A miniature Double Diode with separate cathodes designed for high frequency operation. There is internal screening between the sections.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

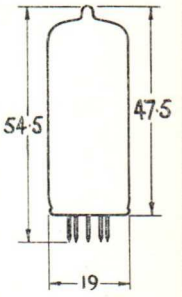
Base	... ...	B7G.
Max. Overall Length	... ...	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	... ...	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	... ...	19 mm. ($\frac{3}{4}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Cathode 1. Pin 4—Heater.
Pin 2—Anode 2. Pin 5—Cathode 2.
Pin 3—Heater. Pin 6—Internal Shield.
Pin 7—Anode 1.

HEATER.

Heater Voltage	... ...	6·3 volts.
Heater Current	... ...	0·3 amp.



RATINGS.

Max. Peak Inverse Voltage	...	420 volts.
Max. R.M.S. Input Voltage	...	150 volts.
*Max. Peak Anode Current	...	54 mA.
*Max. Rectified Current	... ...	9 mA.
*Max. Resonant Frequency	...	700 M/cs.
Max. V_{h-k}	... ...	330 volts DC.

TYPICAL OPERATING CONDITIONS.
(as Half-wave Rectifier)**

*R.M.S. Input Voltage	... ...	150 volts.
*Output Current	... ...	9 mA.
*Supply Impedance	... ...	300 ohms.

CAPACITANCES.

‡‡$C_{a'-a''}$	... ... <0·026 pF.
†$C_{a'-k'+h+s}$	... ... 3·0 pF.
‡$C_{a''-k''+h+s}$	... ... 3·0 pF.
§$C_{k'-a'+h+s}$	... ... 3·4 pF.
††$C_{k''-a''+h+s}$	... ... 3·4 pF.

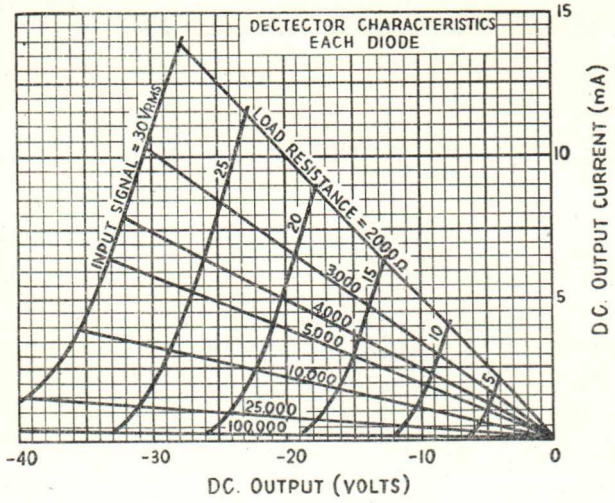
All dimensions shown are in millimetres (max.).

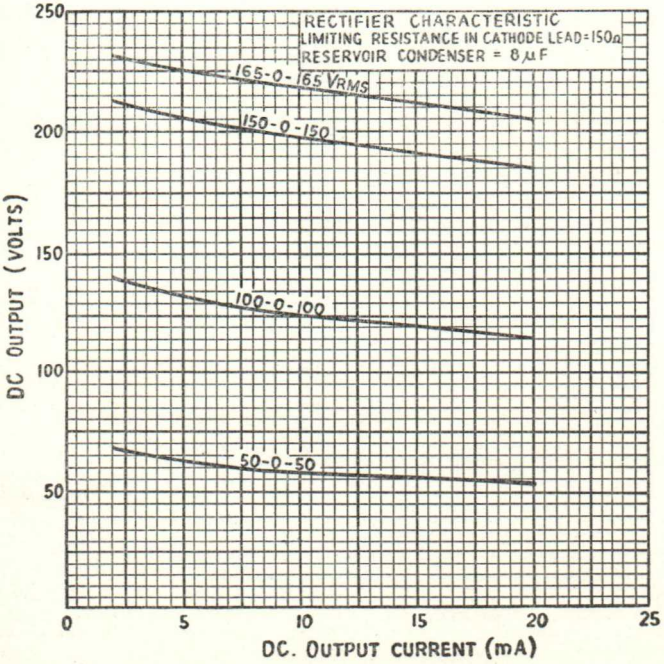
*Each Section.
‡‡With close-fitting external shield connected to Cathode No. 1
†With close-fitting external shield connected to Cathode No.2
‡With close-fitting external shield connected to Anode No. 1
§With close-fitting external shield connected to Anode No. 2
††With close-fitting external shield connected to earth.
**For half-wave operation, the two units may be used separately or in parallel.

FERRANTI

Issue 4
Aug.,1957

DD6


DECTECTOR CHARACTERISTICS
EACH DIODE
INPUT SIGNAL = 30 VRMS
LOAD RESISTANCE = 2000Ω
25
20
3000
15
4000
5000
10
10,000
5
25,000
100,000
15
10
5
-40
-30
-20
-10
0
DC. OUTPUT (VOLTS)
DC. OUTPUT CURRENT (mA)


RECTIFIER CHARACTERISTIC
LIMITING RESISTANCE IN CATHODE LEAD=150Ω
RESERVOIR CONDENSER = 8 μF
165-0-165 VRMS
150-0-150
100-0-100
50-0-50
250
200
150
100
50
0
5
10
15
20
25
DC OUTPUT (VOLTS)
DC. OUTPUT CURRENT (mA)

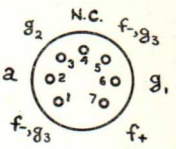
FERRANTI

VARIABLE-MU R.F. PENTODE

DF91

IT4

A directly heated Variable Mu Pentode, designed for use as an R.F. or I.F. Amplifier in Battery Operated Receivers. The filament is suitable only for DC. operation.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

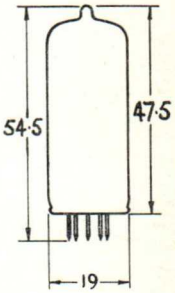
Pin 1—Filament (–), and Suppressor Grid (g_3).
Pin 2—Anode.
Pin 3—Screen Grid (g_2).
Pin 4—No Connection.
Pin 5—Filament (–), and Suppressor Grid (g_3).
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).

FILAMENT.

Filament Voltage	1·4 volts.
Filament Current	50 mA.

RATINGS.

Max. H.T. Supply Voltage ...	90 volts.
Max. Anode Voltage	90 volts.
Max. Screen Voltage	67·5 volts.
Max. Control Grid Voltage ...	0 volts.
Max. Cathode Current ...	5·5 mA.



TYPICAL OPERATION (as R.F. or I.F. Amplifier).

Anode Voltage ...	45	67·5	90	90	volts.
Screen Grid Voltage	45	67·5	45	67·5	volts.
Control Grid Voltage	0	0	0	0	volts.
Anode Current ...	1·7	3·4	1·8	3·5	μA.
Screen Current ...	0·7	1·5	0·65	1·4	μA.
Anode Impedance ...	350	250	800	500	kΩ
Mutual Conductance	700	875	750	900	μA/volts.
V_{g1} (for g_m = 10μA/V)	–10	–16	–10	–16	volts.

All dimensions shown are in millimetres (max.).

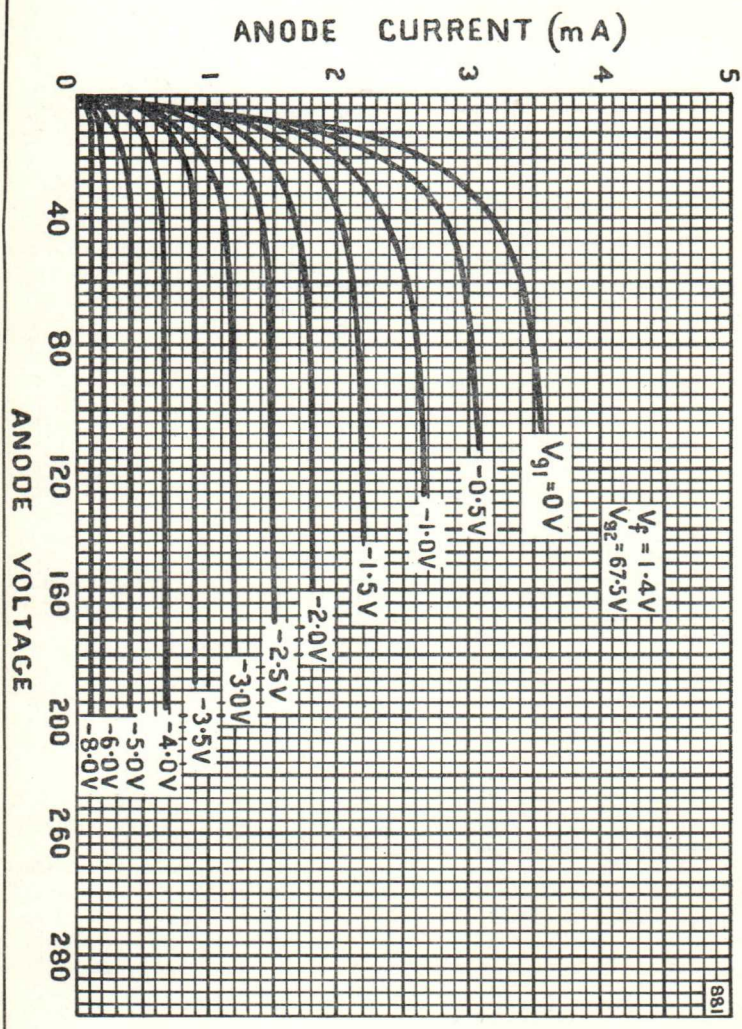
CAPACITANCES.

C_{in}	3·6 pF.
C_{out}	7·5 pF.
C_{a-g1}	<0·01 pF.

Issue 1
Dec., 1957

DF91

IT4


ANODE CURRENT (mA)
0
1
2
3
4
5
ANODE VOLTAGE
40
80
120
160
200
260
280
V_{g1}=0 V
-0·5V
-1·0V
-1·5 V
-2·0V
-2·5V
-3·0V
-3·5V
-4·0V
-5·0V
-6·0V
-8·0V
V_f = 1·4V
V_{g2} = 67·5V
881

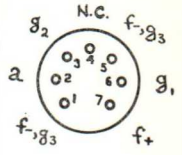
FERRANTI

R.F. PENTODE

DF92

IL4

A directly heated R.F. Pentode, designed for use in Battery Operated Receivers. The filament is suitable only for d.c. operation.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Filament (–), and Suppressor Grid (g_3).
Pin 2—Anode.
Pin 3—Screen Grid (g_2).
Pin 4—No Connection.
Pin 5—Filament (–), and Suppressor Grid (g_3).
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).

FILAMENT.

Filament Voltage	1·4 volts.
Filament Current	50 mA.

RATINGS.

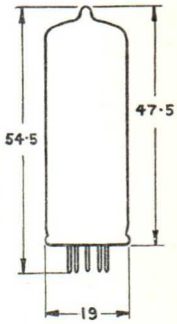
Max. Anode Supply Voltage ...	110 volts
Max. Anode Voltage	90 volts.
Max. Screen Supply Voltage ...	90 volts.
Max. Screen Voltage	70 volts.
Max. Cathode Current ...	6·0 mA.
Max. R_{g1-f}	3·0 MΩ
Max. V_{g1} ($I_{g1} = +0·3$ μA) ...	0 volts.

TYPICAL OPERATION.

Anode Voltage	90	90	volts.
Screen Voltage	45	67·5	volts.
Grid Bias Voltage	0	0	volts.
Anode Current	1·9	3·7	mA.
Screen Current	0·7	1·4	mA.
Mutual Conductance	850	1000	μA/V.
Anode Impedance	900	500	kΩ
Inner μ (μ_{g1-g2})	11	11	

CAPACITANCES*

C_{in}	3·6 pF.
C_{out}	7·5 pF.
C_{a-g1}	<0·01 pF.



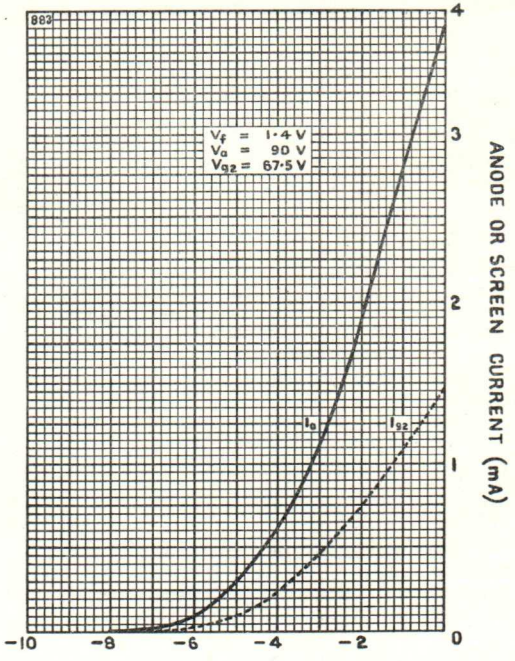
All dimensions shown are in millimetres (max.).

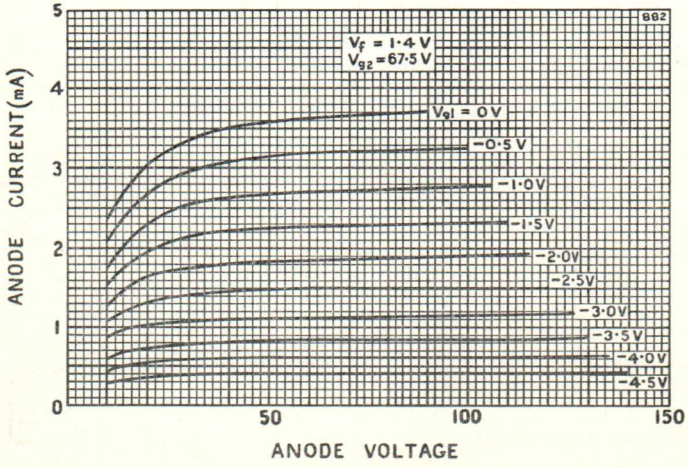
*Measured without external shield.

Issue 1
Dec.,1957

DF92

IL4


882
V_f = 1·4 V
V_a = 90 V
V_{g2} = 67·5 V
I_a
I_{g2}
ANODE OR SCREEN CURRENT (mA)
0
1
2
3
4
−10
−8
−6
−4
−2
GRID VOLTAGE


882
V_f = 1·4 V
V_{g2} = 67·5 V
V_{g1} = 0 V
−0·5 V
−1·0 V
−1·5 V
−2·0 V
−2·5 V
−3·0 V
−3·5 V
−4·0 V
−4·5 V
ANODE CURRENT (mA)
0
1
2
3
4
5
50
100
150
ANODE VOLTAGE

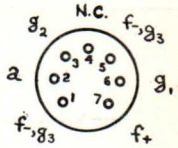
FERRANTI

VARIABLE-MU R.F. PENTODE

DF96

IAJ4

A directly heated Variable Mu Pentode, designed for use as an I.F. Amplifier in Battery Operated Receivers. The low drain filament is suitable only for DC. operation either from a series or parallel supply.



Base Connections

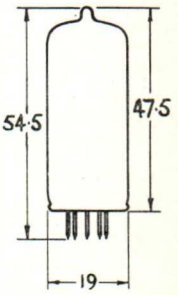
Underside View of Base

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Filament (–), Suppressor Grid (g_3), and Screen.
Pin 2—Anode.
Pin 3—Screen Grid (g_2).
Pin 4—Int. Connection.
Pin 5—Filament (–). Suppressor Grid (g_3), and Screen.
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).



FILAMENT.

	Series.	Parallel.	
Filament Voltage	1·3	1·4	volts.
Filament Current	24	25	mA.

RATINGS.

Max. H.T. Supply Voltage ...	110 volts.
Max. Anode Voltage	90 volts.
Max. Screen Voltage	90 volts.
Max. Anode Dissipation ...	0·25 watts.
Max. Screen Dissipation ...	0·1 watt.
Max. Cathode Current ...	2·2 mA.
Max. R_{g_1-k}	3·0 MΩ
Max. V_{g_1} ($I_{g_1} = +0·3\,\mu A$) ...	0 volts.

TYPICAL OPERATION (as I.F. Amplifier).

*Anode Voltage	64	85	volts.
Screen Feed Resistor	0	39	kΩ
Grid Bias Voltage	0	0	volts.
Screen Voltage	64	64	volts.
Anode Current	1·65	1·65	mA.
Screen Current	0·55	0·55	mA.
Mutual Conductance	850	850	μA/V.
Anode Impedance	0·7	1·0	MΩ
Inner μ ($\mu_{g_1-g_2}$)	18	18	
V_{g_1} (for $g_m = 10\,\mu A/V$) ...	–4·1	–5·5	volts.
Equiv. Noise Resistance ...	14	14	kΩ

All dimensions shown are in millimetres (max.).

CAPACITANCES.

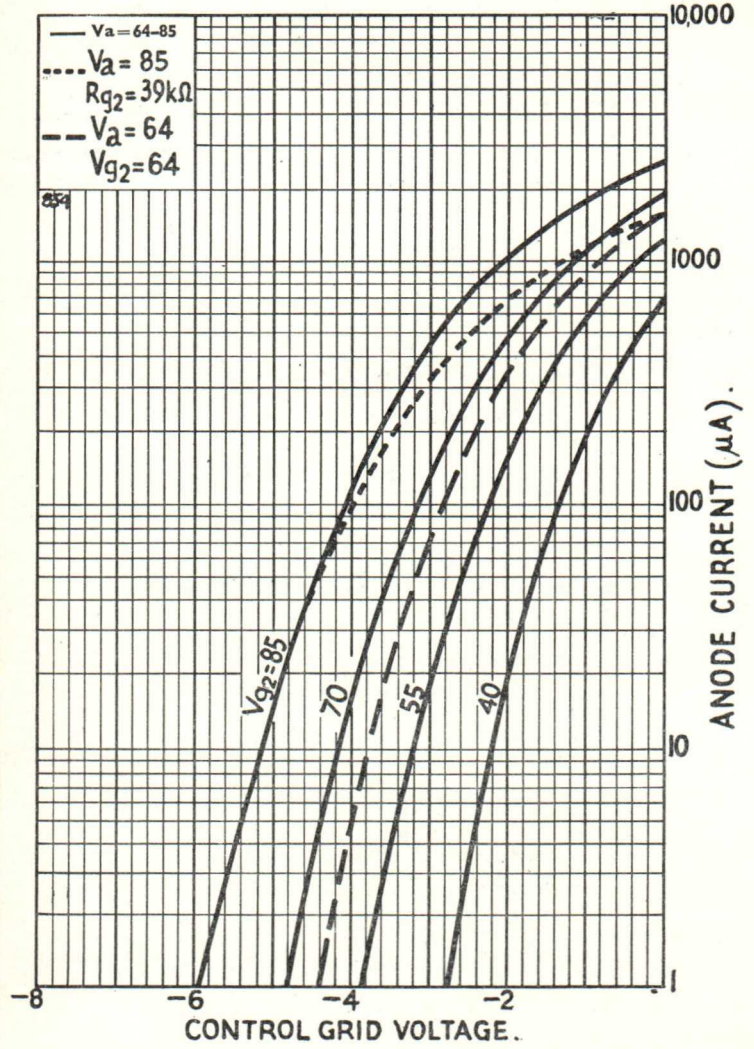
C_{in}	3·3 pF.
C_{out}	7·8 pF.
C_{a-g_1}	<0·01 pF.

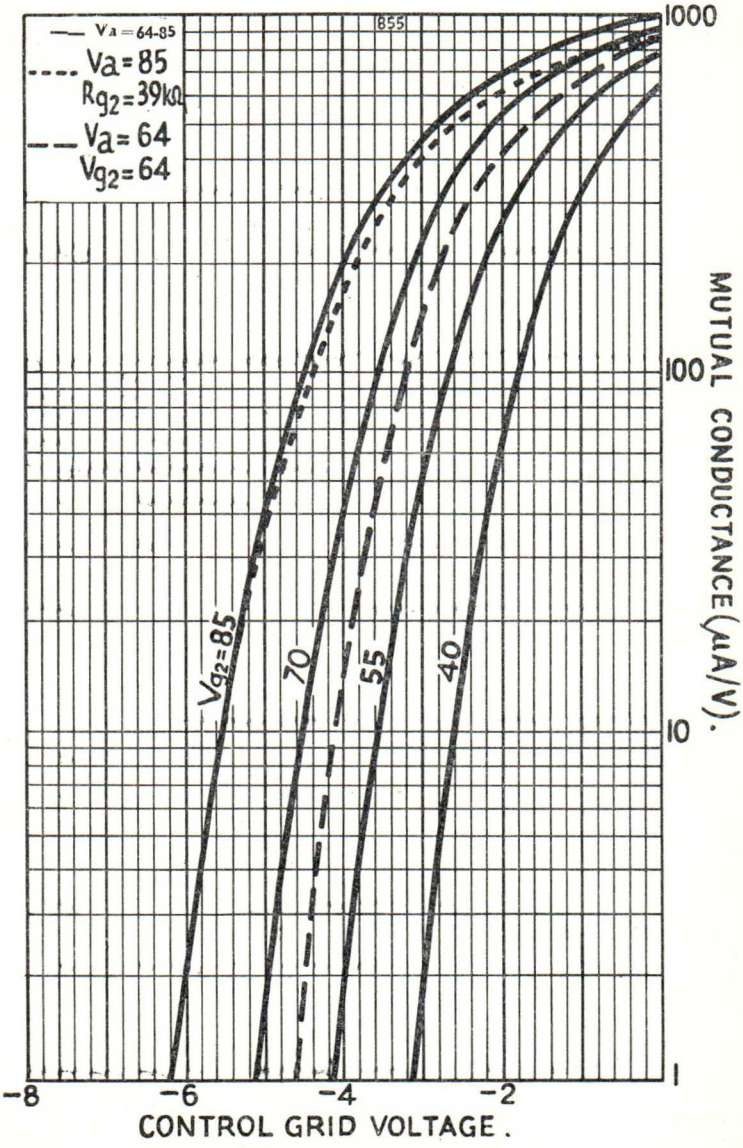
*Based on supply voltages of 67·5 volts, and 90 volts decreased by the negative bias for the output valve.

Issue 2
Dec.,1957

DF96

IAJ4

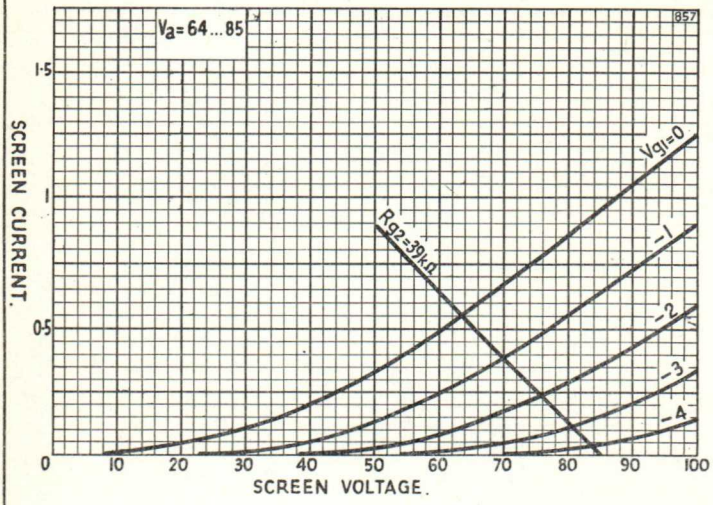

Va=64-85
Va = 85
Rg2 = 39kΩ
Va = 64
Vg2 = 64
Vg2=85
70
55
40
10,000
1000
100
10
1
ANODE CURRENT (μA).
−8
−6
−4
−2
CONTROL GRID VOLTAGE.

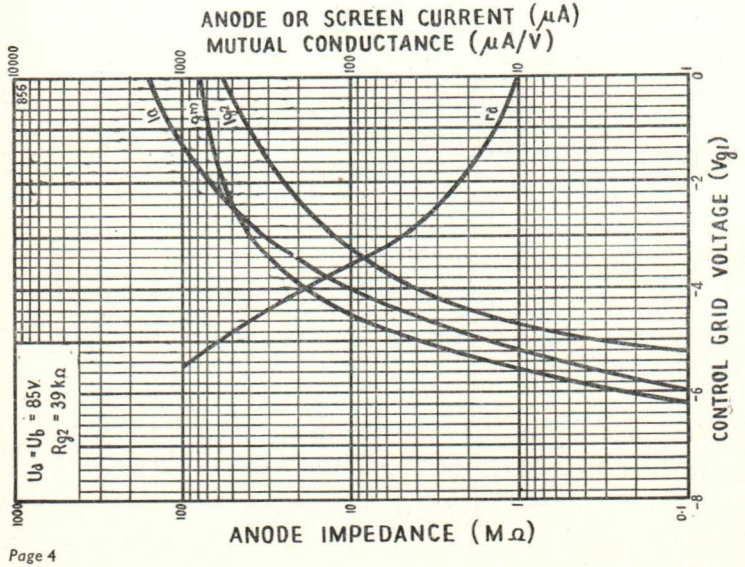

Va = 64-85
Va = 85
Rg2 = 39kΩ
Va = 64
Vg2 = 64
B55
1000
100
10
1
MUTUAL CONDUCTANCE (μA/V).
Vg2=85
70
55
40
−8
−6
−4
−2
CONTROL GRID VOLTAGE.

DF96

IAJ4

FERRANTI



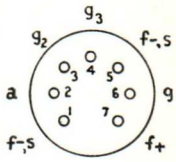


FERRANTI

R.F. PENTODE

DF97

A directly heated R.F. Pentode, designed for use as an I.F. Amplifier Frequency Changer or self-oscillating mixer in f.m./a.m. Battery Operated Receivers. The filament is suitable only for d.c. operation.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Filament (–), and Internal Shield.
Pin 2—Anode.
Pin 3—Screen Grid (g_2).
Pin 4—Suppressor Grid (g_3).
Pin 5—Filament (–), and Internal Shield.
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).

FILAMENT*

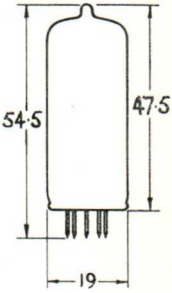
Filament Voltage	1·4 volts.
Filament Current	25 mA.

RATINGS.

Max. H.T. Supply Voltage	120 volts.
Max. Anode Voltage	120 volts.
Max. Screen Voltage	90 volts.
Max. Anode Dissipation	0·25 watts.
Max. Screen Dissipation	0·15 watts.
Max. Cathode Current	2·5 mA.
Max. R_{g1-f}	3·0 MΩ
Max. R_{g3-f}	1·5 MΩ
Max. V_{g1} ($I_{g1} = +0·3$ μA)	0 volts.

CHARACTERISTICS.

†Anode Voltage	64	64	85	85	volts.
Oscillator Voltage	0	0	0	0	volts.
Screen Feed Resistor	1·5	4·7	33	47	kΩ
Screen Voltage	63	61	62	57	volts.
Grid Bias Voltage	0	0	0	0	volts.
Anode Current	1·7	1·6	1·7	1·5	mA.
Screen Current	780	725	700	595	μA.
Mutual Conductance	880	870	940	900	μA/volt
Anode Impedance	250	270	450	525	kΩ
Inner μ (μ_{g1-g2})	20	20	20	20	
V_{g1} (gm = 10μA/volt)	–3·8	–3·8	–5·0	–5·0	volts.



TYPICAL OPERATION.

As Frequency Changer with oscillator voltage on g_3.

†Anode Voltage	64	85 volts.
Screen Feed Resistor	4·7	47 kΩ
Screen Voltage	58	47 volts.
Oscillator Feed Resistor	300	300 kΩ
Grid Bias Voltage	0	0 volts.
Anode Current	0·67	0·54 mA.
Screen Current	1·25	0·8 mA.
Oscillator Voltage	12	12 volts (r.m.s.).
Conversion Conductance	280	265 μA/V.
Anode Impedance	300	500 kΩ
V_{g1} (gm = 10μA/volt)	–3·5	–4·6 volts.

As Self-oscillating Mixer (triode connection);

†Anode Voltage	64	85 volts.
Anode Current	1·3	1·9 mA.
Rg–f	1·0	1·0 MΩ
Control Grid Current	3·1	4·4 μA.
Oscillator Voltage	3·0	4·0 volts.
Conversion Conductance	465	500 μA/volt.
Anode Impedance	29	26 kΩ

All dimensions shown are in millimetres (max.).

CAPACITANCES.

	Pentode connection	Triode connection
C_{in}	3·7 pF.	1·1 pF.
C_{out}	7·5 pF.	8·1 pF.
C_{a-g1}	<0·01 pF.	2·6 pF.
$C_{in(g2)}$	5·2 pF.	
C_{g1-g3}	<0·1 pF.	
C_{g1-g2}	2·5 pF.	

*Series filament chain operation not recommended.
†Based on supply voltages of 67·5 volts, and 90 volts decreased by the negative bias for the output valve.
§g_2 and g_3 connected to anode.

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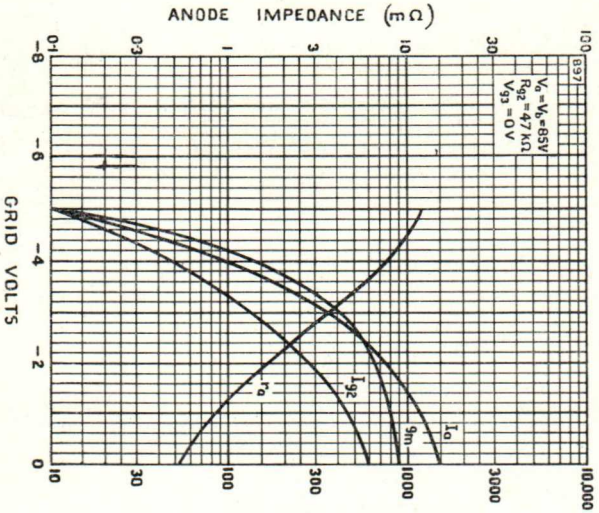
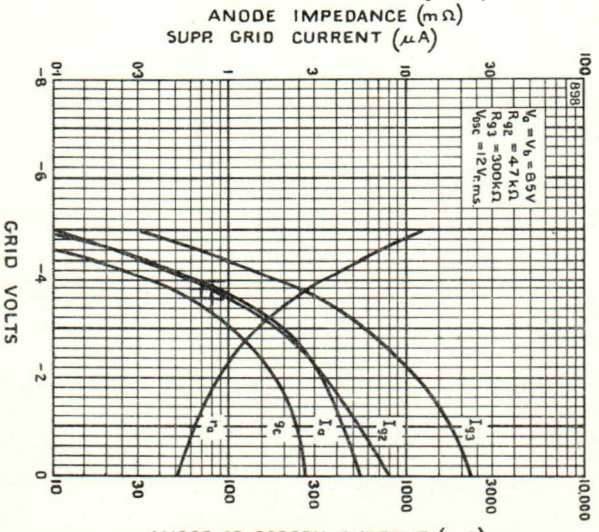

ANODE IMPEDANCE (mΩ)
0·1
0·3
1
3
10
30
100
GRID VOLTS
−8
−6
−4
−2
0
10
30
100
300
1000
3000
10,000
897
$V_a = V_b = 85V$
$R_{g2} = 47k\Omega$
$V_{g3} = 0V$
r_a
I_{g2}
g_m
I_a
ANODE OR SCREEN CURRENT (μA)
MUTUAL CONDUCTANCE (μA/V)


ANODE IMPEDANCE (mΩ)
SUPR. GRID CURRENT (μA)
0·1
0·3
1
3
10
30
100
GRID VOLTS
−8
−6
−4
−2
0
10
30
100
300
1000
3000
10,000
898
$V_a = V_b = 85V$
$R_{g2} = 47k\Omega$
$R_{g3} = 300k\Omega$
$V_{osc} = 12V_{r.m.s.}$
r_a
g_c
I_a
I_{g2}
I_{g3}
ANODE OR SCREEN CURRENT (μA)
CONVERSION CONDUCTANCE (μA/V)

FERRANTI

HEPTODE

DK91

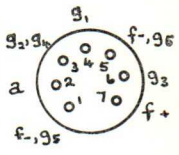
IR5

A directly heated Heptode, designed for use as a Frequency Changer in Battery Operated Receivers, suitable for A.V.C. It has a high-conversion conductance and will operate satisfactorily at frequences up to 20 Mc/s. The filament is suitable only for D.C operation.

PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	54·5 mm. (2 3/32 in.).
Max. Seated Height	47·5 mm. (1 7/8 in.).
Max. Diameter	19 mm. (3/4 in.).

Mounting position—Any.



Base Connections Underside View of Base

BASE CONNECTIONS.

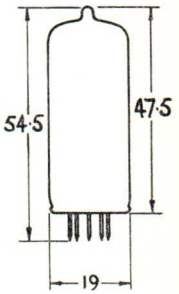
Pin 1—Filament (–), and Suppressor grid (g_5).
Pin 2—Anode
Pin 3—Oscillator Anode (g_2) and Screen grid (g_4).
Pin 4—Oscillator grid (g_1)
Pin 5—Filament (–), and Suppressor grid (g_5).
Pin 6—Signal grid (g_3).
Pin 7—Filament(+).

FILAMENT.

Filament Voltage	1·4 volts
Filament Current	50 mA.

RATINGS.

Max. Anode Voltage	90 volts.
Max. Oscillator Anode Voltage	67·5 volts.
Max. Screen Voltage	67·5 volts.
Max. Cathode Current	5·5 mA.
Max. Signal Grid Voltage ...	0 Volts.



All dimensions shown are in millimetres (max.).

TYPICAL OPERATION.

Va	45	67·5	90	90	volts.
$V_{g2}+g_4$	45	67·5	45	67·5	volts.
V_{g3}	0	0	0	0	volts.
V_{g3} (for gc=5μA/v)	–9	–14	–9	–14	volts.
R_{g1}	100	100	100	100	KΩ
ra	600	500	800	600	KΩ
gc	235	280	250	300	μA/volt.
Ia	0·7	1·4	0·8	1·6	mA.
$I_{g2}+g_4$	1·9	3.2	1·9	3·2	mA.
I_{g1}	150	250	150	250	μA.
Ik	2·75	5·0	2·75	5·0	mA.

OSCILLATOR SECTION.

$V_{g1}=V_{g3}$	0 volts.
$V_{g2}=V_{g4}=Va$	67·5 volts.
*gm	1·4 mA/volt.

CAPACITANCES.

C_{g1-all}	3·8 pF.	C_{a-g3}	<0·4 pF.
C_{g3-all}	7·0 pF.	C_{g1-g3}	<0·2 pF.
C_{a-all}	7·5 pF.	C_{a-g1}	<0·1 pF.

*$g_1-(g_2+g_4+a)$

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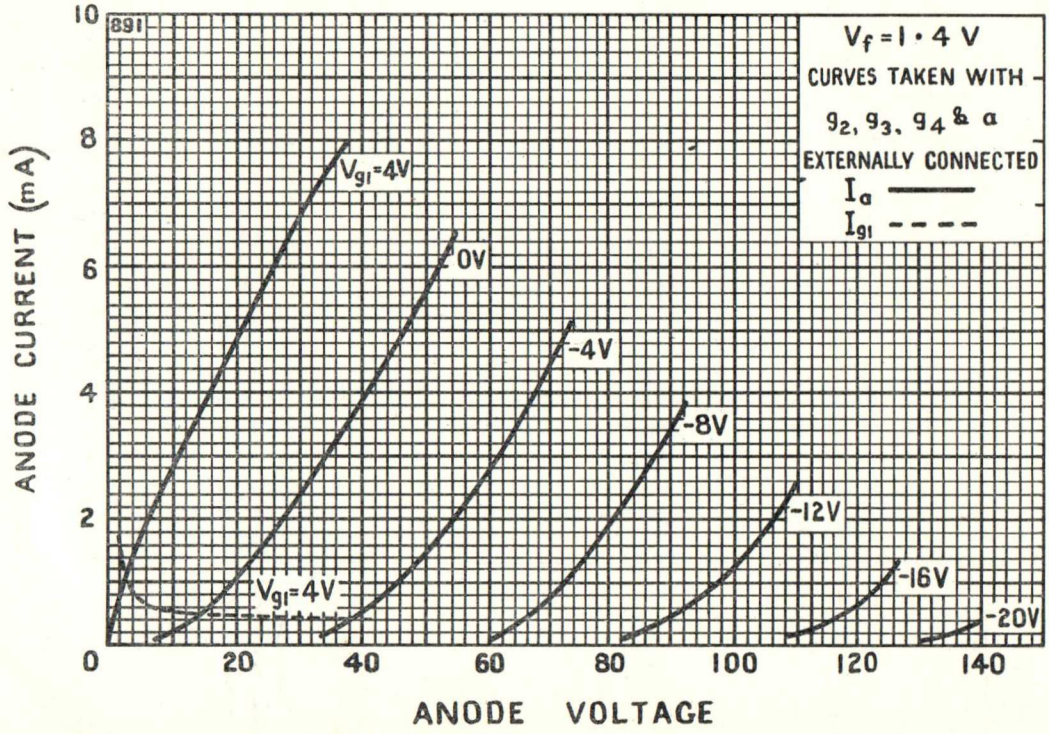
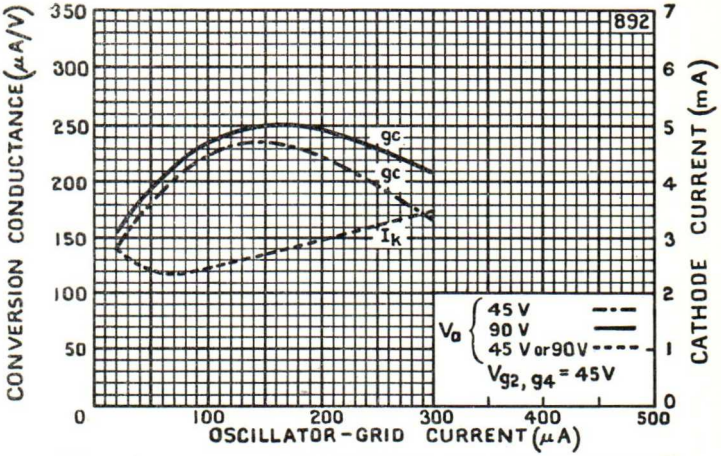
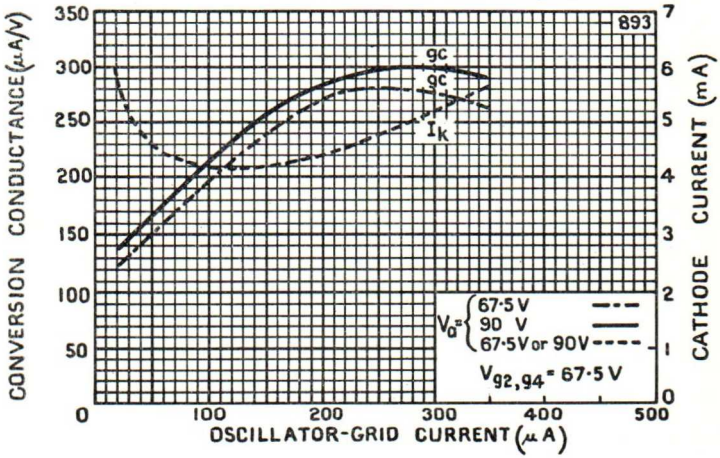


DK91
IR5

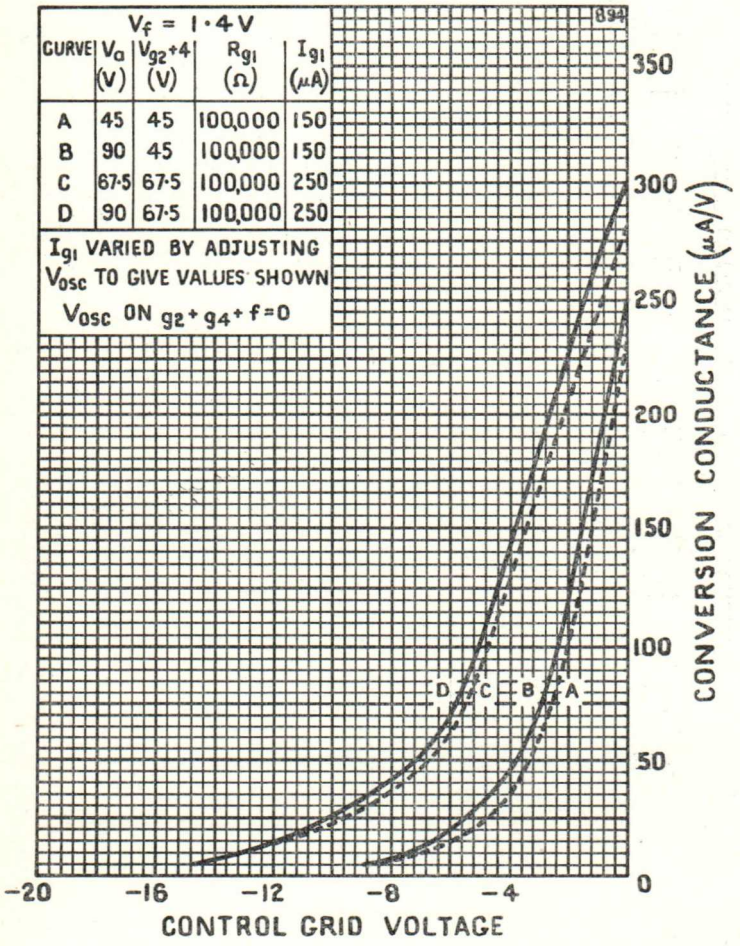
FERRANTI

FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.





FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.


V_f = 1·4V
CURVE | V_a (V) | V_{g2+4} (V) | R_{g1} (Ω) | I_{g1} (μA)
A | 45 | 45 | 100,000 | 150
B | 90 | 45 | 100,000 | 150
C | 67·5 | 67·5 | 100,000 | 250
D | 90 | 67·5 | 100,000 | 250
I_{g1} VARIED BY ADJUSTING V_{osc} TO GIVE VALUES SHOWN
V_{osc} ON $g_2 + g_4 + f = 0$
894
350
300
250
200
150
100
50
0
CONVERSION CONDUCTANCE (μA/V)
D
C
B
A
−20
−16
−12
−8
−4
CONTROL GRID VOLTAGE

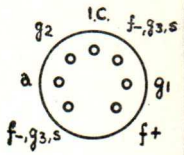
FERRANTI

HEPTODE

DK92

IAC6

A directly heated Heptode, designed for use as a Frequency Changer in Battery Operated Receivers, suitable for A.V.C. It has a high conversion conductance coupled with a low oscillator drive voltage. The filament is suitable only for DC. operation.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).

Mounting position—Any.

BASE CONNECTIONS.

Pin 1—Filament (–).
Pin 2—Anode.
Pin 3—Oscillator Anode (g_2).
Pin 4—Oscillator Grid (g_1).
Pin 5—Screen Grid (g_4).
Pin 6—Control Grid (g_3).
Pin 7—Filament (+), and Suppressor Grid (g_5).

FILAMENT.

Filament Voltage	1·4 volts.
Filament Current	50 mA.

RATINGS.

Max. H.T. Supply Voltage ...	120 volts.
Max. Anode Voltage	90 volts.
Max. Oscillator Anode Voltage	60 volts.
Max. Screen Voltage	90 volts.
Max. Cathode Current ...	4·0 mA.
Max. Rg_3–f	3 MΩ
Max. Rg_1–f	35 kΩ

TYPICAL OPERATION AND CHARACTERISTICS.

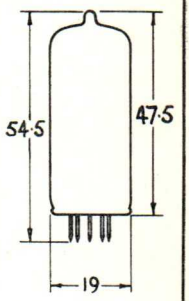
*Anode Voltage = Vb	85 volts.
Control Grid Voltage	0 volts.
Screen Feed Resistor	180 kΩ
Oscillator Anode Feed Resistor	33 kΩ
Oscillator Grid Resistor ...	27 kΩ
Screen Voltage	60 volts. (approx.).
Oscillator Anode Voltage ...	30 volts (approx.).
Oscillator Grid Voltage ...	4 volts (r.m.s.).
Total Cathode Current ...	2·55 mA.
Anode Current	0·7 mA.
Screen Current	0·15 mA.
Oscillator Anode Current ...	1·6 mA.
†Oscillator Grid Current ...	100 μA.
Conversion Conductance (gc) ...	325 μA/volt.
Anode Impedance	0·65 MΩ
Control Grid Voltage (for 100 : 1 reduction in gc)	–6 volts.

OSCILLATOR SECTION‡

*Anode Voltage = Vb	85 volts.
Screen Voltage	64 volts.
Control Grid Voltage	0 volts.
Oscillator Anode Voltage ...	30 volts.
Oscillator Anode Current ...	2·5 mA.
Mutual Conductance (g_1–g_2) ...	0·9 mA/V.
Inner Mμ (μg_1–g_2)	7·5

CAPACITANCES.

C_{g_1}–all ...	4 pF.	C_{a-g_3} ...	<0·4 pF.
C_{g_2}–all ...	5 pF.	$C_{g_1-g_2}$ ...	3·0 pF.
C_{g_3}–all ...	7·5 pF.	$C_{g_1-g_3}$ ...	<0·2 pF.
C_{a}–all ...	8·5 pF.	$C_{g_2-g_3}$ ...	1·6 pF.



All dimensions shown are in millimetres (max.).

*Based on supply voltage of 90V decreased by the negative bias for the output valve.

†Optimum value. In a typical circuit I_{g_1} will be between 50μA and 250μA.

‡With oscillator Grid (g_1) connected to filament (+).

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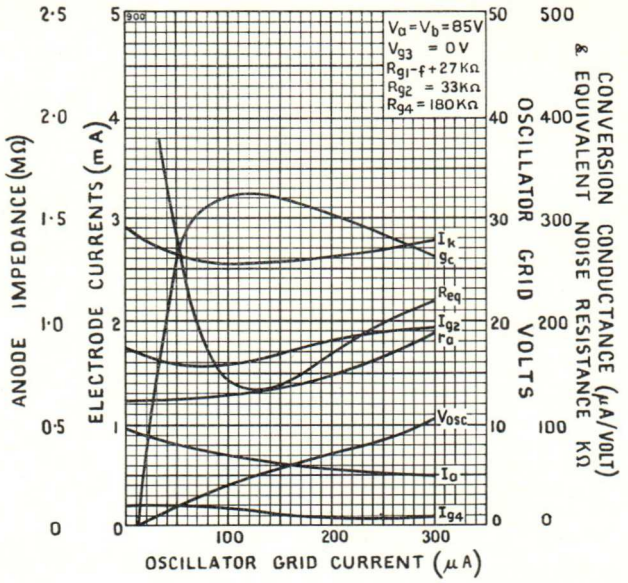
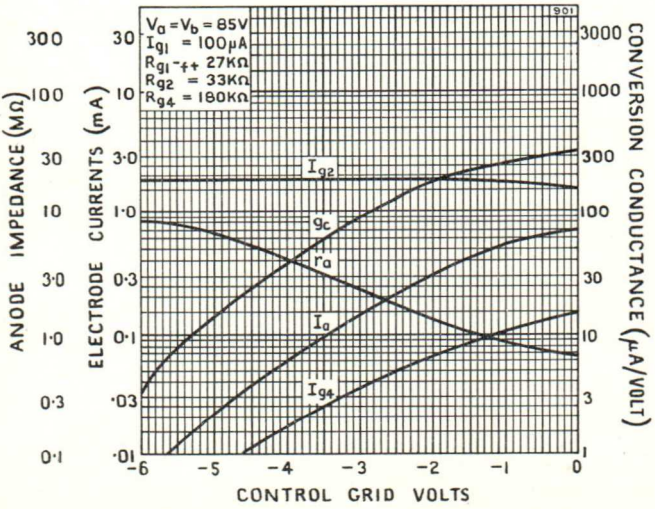
DK92

IAC6


900
$V_a = V_b = 85V$
V_{g3} = 0V
R_{g1-f} + 27KΩ
R_{g2} = 33KΩ
R_{g4} = 180KΩ
I_k
g_c
R_{eq}
I_{g2}
r_a
V_{osc}
I_a
I_{g4}
ANODE IMPEDANCE (MΩ)
ELECTRODE CURRENTS (mA)
OSCILLATOR GRID VOLTS
CONVERSION CONDUCTANCE (μA/VOLT) & EQUIVALENT NOISE RESISTANCE KΩ
OSCILLATOR GRID CURRENT (μA)


901
$V_a = V_b = 85V$
I_{g1} = 100μA
R_{g1-f} + 27KΩ
R_{g2} = 33KΩ
R_{g4} = 180KΩ
I_{g2}
g_c
r_a
I_a
I_{g4}
ANODE IMPEDANCE (MΩ)
ELECTRODE CURRENTS (mA)
CONVERSION CONDUCTANCE (μA/VOLT)
CONTROL GRID VOLTS

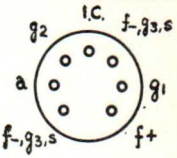
FERRANTI

HEPTODE

DK96

IAB6

A directly heated miniature Heptode designed for use as a Frequency Changer in Battery Operated Receivers. The low drain filament is suitable only for DC. operation either from a series or parallel supply.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	54·5 mm. (2$\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. (1$\frac{7}{8}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).

Mounting Position—Any.

BASE CONNECTIONS.

Pin 1—Filament (–).	Pin 5—Screen Grid (g_4).
Pin 2—Anode.	Pin 6—Control Grid (g_3).
Pin 3—OscillatorAnode (g_2).	Pin 7—Filament (+) and
Pin 4—Oscillator Grid (g_1).	Suppressor Grid (g_5).

FILAMENT.

	Series.	Parallel.	
Filament Voltage	1·3	1·4	volts.
Filament Current	24	25	mA.

RATINGS.

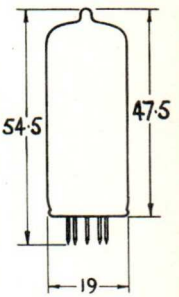
Max. H.T. Supply Voltage ...	110 volts.
Max. Anode Voltage	90 volts.
Max. Oscillator Anode Voltage	60 volts.
Max. Screen Voltage	90 volts.
Max. Anode Dissipation ...	0·15 watt.
Max. Oscillator Anode Dissipation	0·1 watt.
Max. Screen Dissipation ...	0·03 watt.
Max. Cathode Current ...	2·6 mA.
Max. R_{g3-k}	3 MΩ
Max. R_{g1-k}	0·1 MΩ
Max. V_{g3} (I_{g3} = +0·3 μA) ...	+1·0 volt.
Max. V_{g1} (I_{g1} = +0·3 μA) ...	0 volt.

TYPICAL OPERATION AND CHARACTERISTICS.

*Anode Voltage = Vb ...	64	85	volts.
Control Grid Voltage ...	0	0	volt.
Screen Feed Resistor ...	0	120	kΩ
Osc. Anode Feed Resistor	18	33	kΩ
Oscillator Grid Resistor	27	27	kΩ
Screen Voltage	64	68	volts (approx.).
Oscillator Anode Voltage	35	35	volts (approx.).
Oscillator Grid Voltage	4	4	volts (r.m.s.).
Total Cathode Current	2·45	2·4	mA.
Anode Current	0·55	0·6	mA.
Screen Current	0·12	0·14	mA.
Oscillator Anode Current	1·6	1·5	mA.
Oscillator Grid Current	85	85	μA.
Conv. Conductance (gc)	275	300	μA/volts.
Anode Impedance ...	0·75	0·8	MΩ
Control Grid Voltage (for 100:1 reduction in gc)	–4·5	–6·5	volts.

OSCILLATOR SECTION†

*Anode Voltage = Vb ...	64	85	volts.
Screen Voltage	64	64	volts.
Control Grid Voltage ...	0	0	volt.
Oscillator Anode Voltage	35	35	volts.
Oscillator Grid Voltage	+1·4	+1·4	volts.
Oscillator Anode Current	1·7	1·7	mA.
Mutual Conductance (g_1–g_2)	0·6	0·6	mA/V.
Inner μ (μg_1–g_2)	7·5	7·5	



All dimensions shown are in millimetres (max.).

CAPACITANCES.

C_{g1-all} ...	3·9 pF.	C_{a-g2} ...	<0·3 pF.
C_{g2-all} ...	4·8 pF.	C_{a-g3} ...	<0·36 pF.
C_{g3-all} ...	7·4 pF.	C_{g1-g2} ...	3·0 pF.
C_{a-all} ...	8·1 pF.	C_{g1-g3} ...	<0·2 pF.
C_{a-g1} ...	<0·11 pF.	C_{g2-g3} ...	1·6 pF.

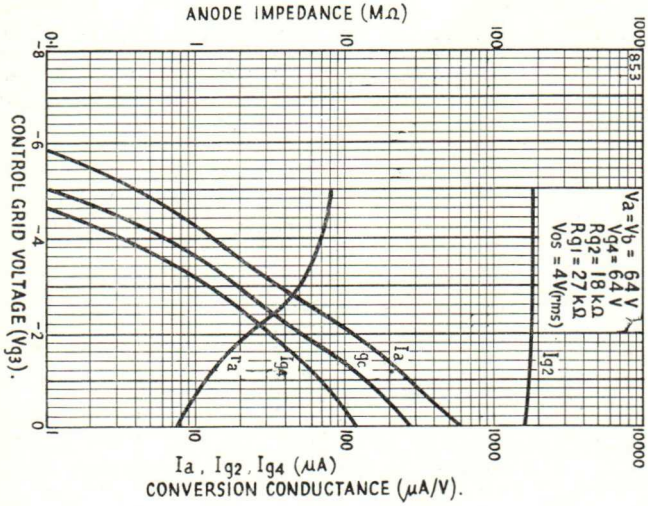
*Based on supply voltages of 67·5V and 90V decreased by the negative bias for the output valve.

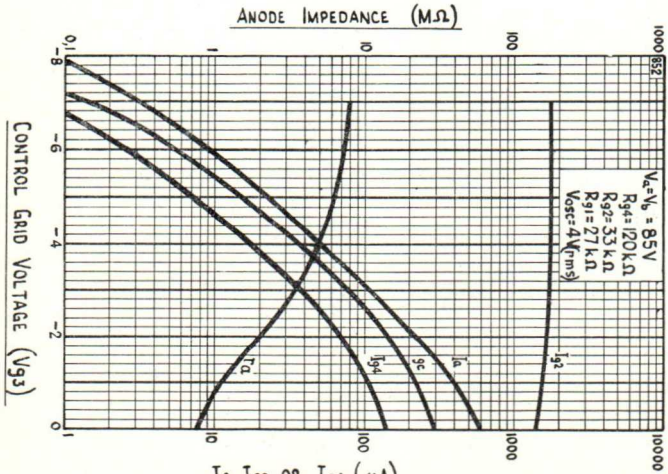
†With Oscillator Grid (g_1) connected to filament (+).

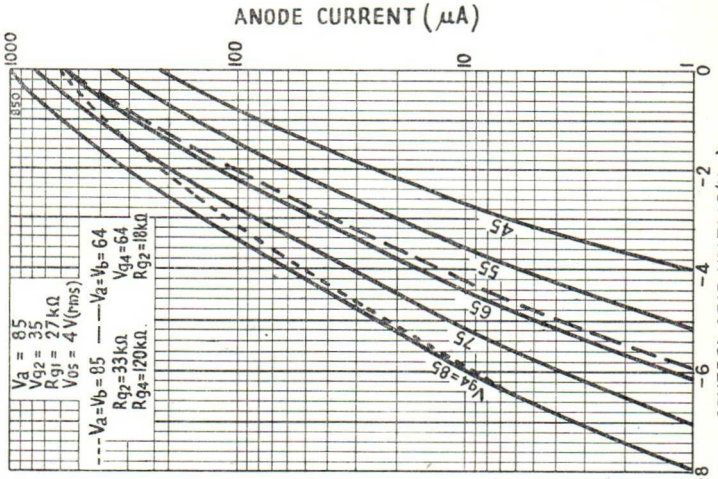
Issue 2
Dec.,1957

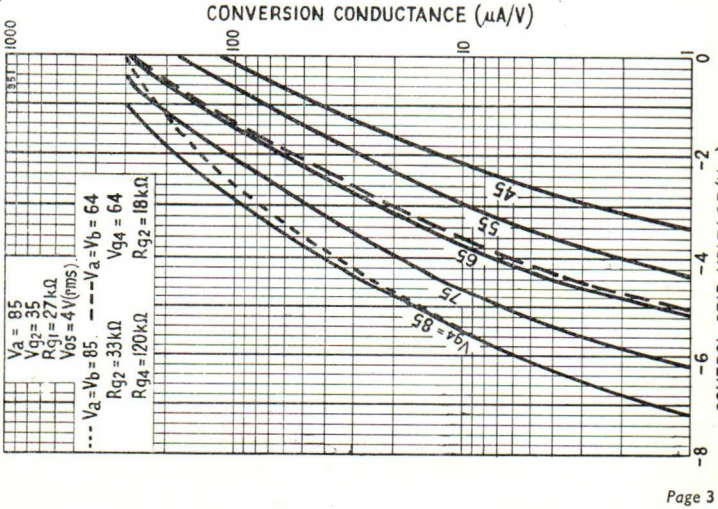
DK96

IAB6


ANODE IMPEDANCE (MΩ)
0·1
1
10
100
1000
853
-8
-6
-4
-2
0
CONTROL GRID VOLTAGE (Vg3).
Va=Vb = 64 V
Vg4 = 64 V
Rg2 = 18 kΩ
Rg1 = 27 kΩ
Vos = 4V(rms)
Ia
gc
Ia
Ig4
Ig2
1
10
100
1000
10000
Ia , Ig2 , Ig4 (μA)
CONVERSION CONDUCTANCE (μA/V).

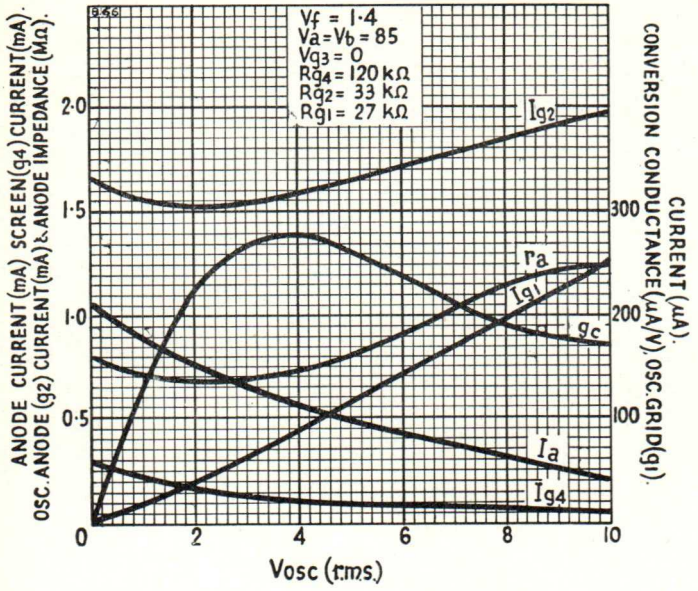

ANODE IMPEDANCE (MΩ)
0·1
1
10
100
1000
852
-8
-6
-4
-2
0
CONTROL GRID VOLTAGE (Vg3)
Va=Vb = 85V
Rg4=120kΩ
Rg2=33 kΩ
Rg1=27 kΩ
Vosc=4V(rms)
Ia
Ig4
gc
Ia
Ig2
1
10
100
1000
10000
Ia, Ig2 OR Ig4 (μA)
CONVERSION CONDUCTANCE (μA/V)

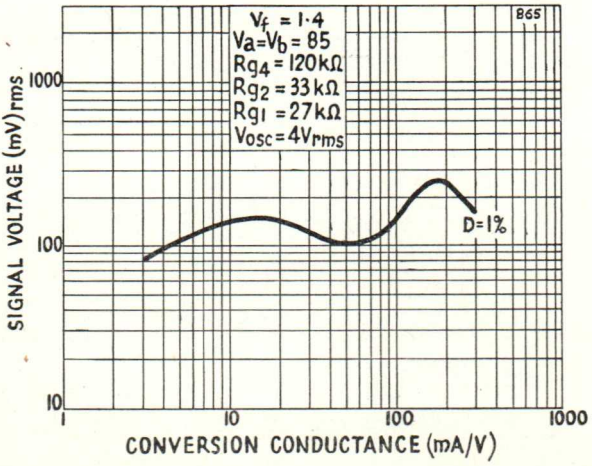

ANODE CURRENT (μA)
1000
100
10
1
0
-2
-4
-6
-8
CONTROL GRID VOLTAGE (Vg3).
850
Va = 85
Vg2 = 35
Rg1 = 27kΩ
Vos = 4 V(rms)
--- Va=Vb= 85 — — Va=Vb= 64
Rg2=33kΩ Vg4=64
Rg4=120kΩ Rg2=18kΩ
45
55
65
75
Vg4=85


CONVERSION CONDUCTANCE (μA/V)
1000
100
10
1
0
-2
-4
-6
-8
CONTROL GRID VOLTAGE (Vg3).
851
Va = 85
Vg2= 35
Rg1= 27kΩ
Vos=4 V(rms).
--- Va=Vb= 85 — — — Va=Vb= 64
Rg2=33kΩ Vg4 = 64
Rg4=120kΩ Rg2 = 18kΩ
45
55
65
75
Vg4=85

DK96

IAB6


B46
Vf = 1·4
Va = Vb = 85
Vg3 = 0
Rg4 = 120 kΩ
Rg2 = 33 kΩ
Rg1 = 27 kΩ
Ig2
ra
Ig1
gc
Ia
Ig4
ANODE CURRENT (mA) SCREEN (g4) CURRENT (mA).
OSC. ANODE (g2) CURRENT (mA) & ANODE IMPEDANCE (MΩ).
CONVERSION CONDUCTANCE (μA/V), OSC. GRID (g1) CURRENT (μA).
2·0
1·5
1·0
0·5
0
2
4
6
8
10
300
200
100
Vosc (rms.)


B65
Vf = 1·4
Va = Vb = 85
Rg4 = 120kΩ
Rg2 = 33kΩ
Rg1 = 27kΩ
Vosc = 4Vrms
D=1%
SIGNAL VOLTAGE (mV) rms.
1000
100
10
1
10
100
1000
CONVERSION CONDUCTANCE (mA/V)

FERRANTI

OUTPUT PENTODE

DL96

3C4

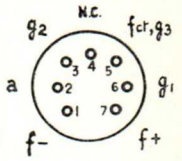
A directly heated miniature Pentode with a centre-tapped filament designed for use in the output stage of Battery Operated Receivers. The low drain filament is suitable only for DC. operation but the sections may be connected either in series or parallel.

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. (2$\frac{3}{16}$in.).
Max. Seated Height	47·5 mm. (1$\frac{7}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).

BASE CONNECTIONS.

Pin 1—Filament (–).
Pin 2—Anode.
Pin 3—Screen Grid (g_2).
Pin 4—No Connection.
Pin 5—Filament centre tap and Suppressor Grid (g_3).
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).



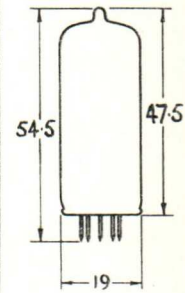
Base Connections Underside View of Base

FILAMENT*

	From a Parallel supply		From a Series supply		
	Series	Parallel	Series	Parallel	
Filament Voltage	2·8	1·4	2·6	1·3	volts.
Filament Current	25	50	24	48	mA.

RATINGS.

Max. H.T. Supply Voltage ...	110	volts.
Max. Anode Voltage	90	volts.
Max. Screen Voltage	90	volts.
Max. Anode Dissipation ...	0·6	watts.
Max. Screen Dissipation ...	0·2	watts.
†Max. Cathode Current (Pins 5—(1+7))	6	mA.
Max. R_{g1-f}	2	MΩ
Max. V_{g1} (I_{g1} = +0·3 μA) ...	0	volt.



CHARACTERISTICS.

(Parallel Filament Connection).

H.T. Supply Voltage	67·5	90	volts.
Anode Voltage	64	85	volts.
Screen Voltage	64	85	volts.
Negative Control Grid Voltage	3·3	5·2	volts.
Anode Current	3·5	5·0	mA.
Screen Current	0·65	0·9	mA.
Mutual Conductance	1·3	1·4	mA/V.
Inner μ (μg_1–g_2)	7·0	7·0	
Anode Impedance	170	150	kΩ

TYPICAL OPERATION.

As Single Valve Class "A" Amplifier.

	Series Filament Connection*	Parallel Filament Connection*		Single Section of Filament*		
V_b	90	67·5	90	67·5	90	volts.
V_a	85	64	85	64	85	volts.
V_{g2}	85	64	85	64	85	volts.
V_{g1}	–5·2	–3·3	–5·2	–3·3	–5·2	volts.
I_a	4·3	3·5	5·0	1·75	2·5	mA.
I_{g2}	700	650	900	330	450	μA.
R_a	15	15	13	30	25	kΩ
V_{in}	3·0	2·6	3·5	2·6	3·6	volts (r.m.s.).
P_{out}	160	100	200	50	100	mW.
D_{tot}	10	10	10	10	10	%

All dimensions shown are in millimetres (max.).

*†See notes on page 2.

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TYPICAL OPERATION—cont.

Two Valves in Class "AB" Push-Pull Amplifier.

(All filament sections in parallel*)

V_b	67·5	90	volts.
‡R_k	470	560	ohms.
$I_{a(o)}$	2×2·3	2×3·25	mA.
I_a (max. sig.)	2×3·4	2×4·75	mA.
$I_{g2(o)}$	2×430	2×600	μA.
I_{g2} (max. sig.)	2×0·95	2×1·5	mA.
R_{a-a}	20	20	kΩ
V_{in} (g_1–g_1)	11·4	15·8	volts (r.m.s.).
P_{out}	220	420	mW.
D_{tot}	3·0	4·0	%

Two Valves in Class "B" Push-Pull Amplifier.

(All filament sections in parallel*)

V_b	67·5	90	volts.
V_a	61·5	81·5	volts.
V_{g2}	61·5	81·5	volts.
V_{g1}	–5·8	–8·5	volts.
$I_{a\ (o)}$	2×0·75	2×1·0	mA.
I_a (max. sig.)	2×3·4	2×5·0	mA.
$I_{g2\ (o)}$	2×140	2×180	μA.
I_{g2} (max. sig.)	2×0·95	2×1·3	mA.
R_{a-a}	20	16	kΩ
V_{in} (g_1–g_1)	11·4	15·8	volts (r.m.s.)
P_{out}	220	440	mW.
D_{tot}	3·0	2·6	%

CAPACITANCES.

C_{in}	5·0
C_{out}	4·7
C_{a-g1}	<0·4

*Series Filament Connection : V_f applied between pins 1 and 7. V_{g1} referred to pin 1.

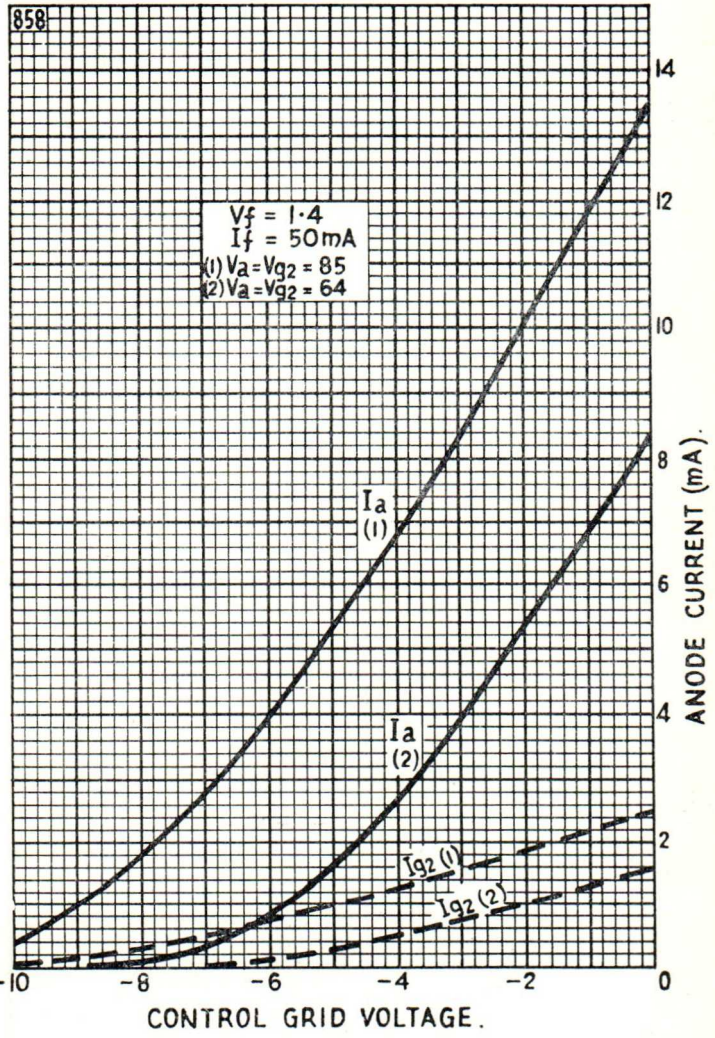
Parallel Filament Connection: V_f applied between pin 5 and pins 1 and 7 connected together. V_{g1} referred to pin 5.

Single Section of Filament : V_f applied between pin 5 and either pin 1 or pin 7.

The filament must be shunted to ensure correct filament voltage across each section. If separate h.t. and l.t. batteries are used each filament should be shunted separately to h.t. If a pair of valves are used in push-pull in a 50mA series heater chain, then the corresponding filament sections of each valve must be connected in parallel and the pairs of sections in series. A resistor must shunt the more negative pair of sections. V_{g1} is referred to pin 1.

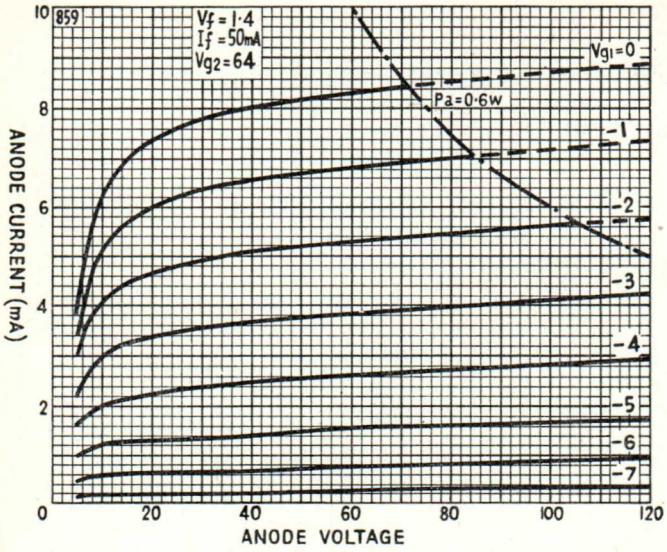
†Maximum cathode current for each 1·4 volt section of filament is 3 mA.

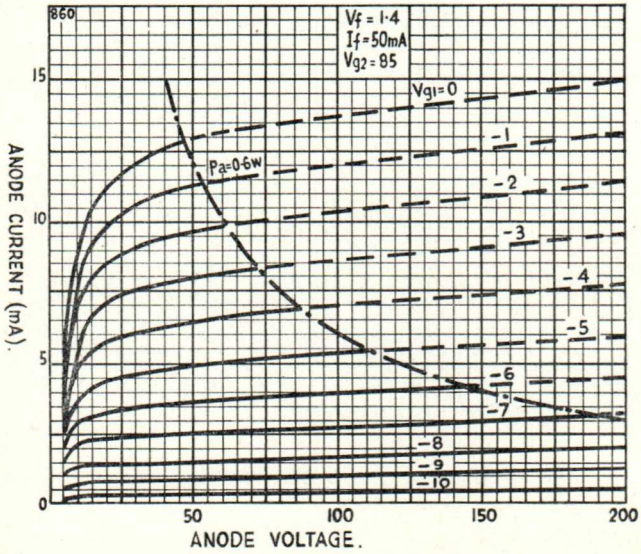
‡To simulate the current in the previous stages of a receiver an additional current of 3·5 mA. is fed through R_k.

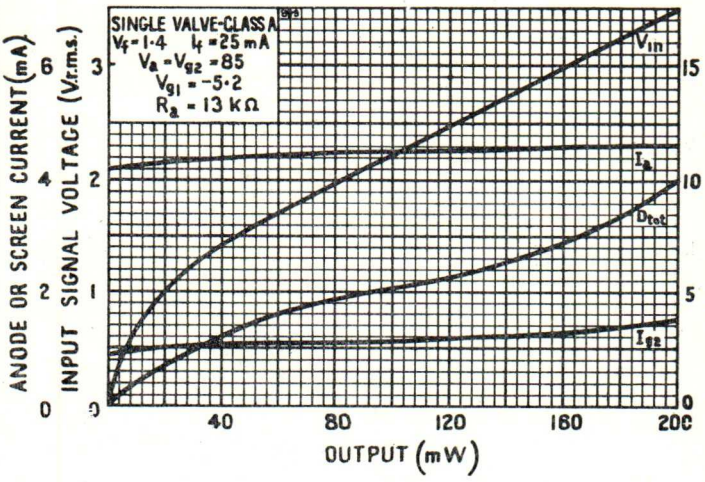

858
Vf = 1·4
If = 50mA
(1) Va = Vg2 = 85
(2) Va = Vg2 = 64
Ia (1)
Ia (2)
Ig2 (1)
Ig2 (2)
14
12
10
8
6
4
2
0
ANODE CURRENT (mA).
-10
-8
-6
-4
-2
0
CONTROL GRID VOLTAGE.

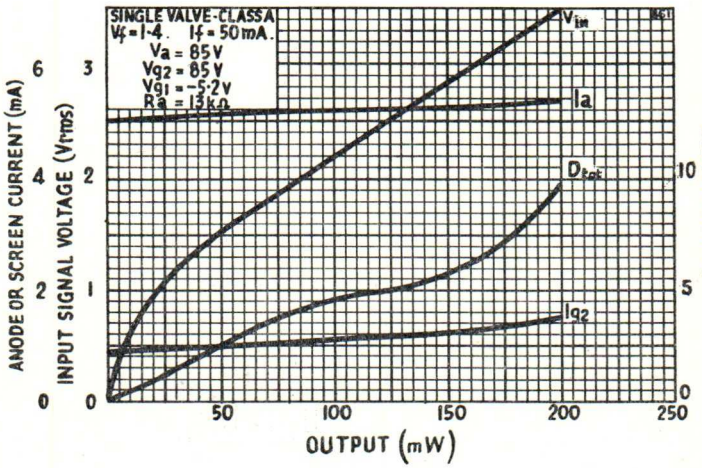
DL96

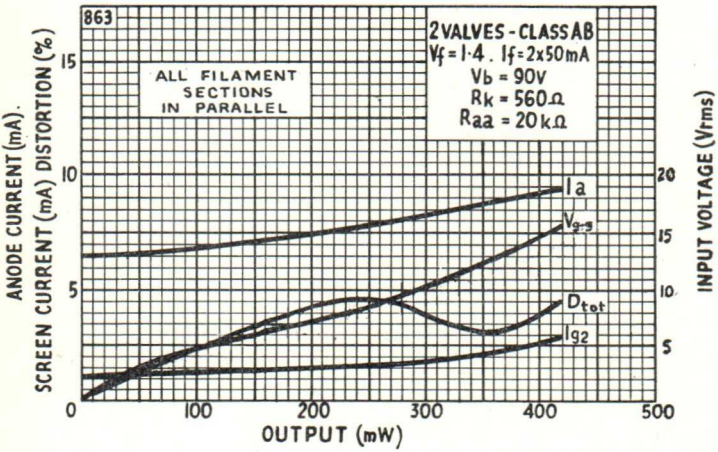
3C4

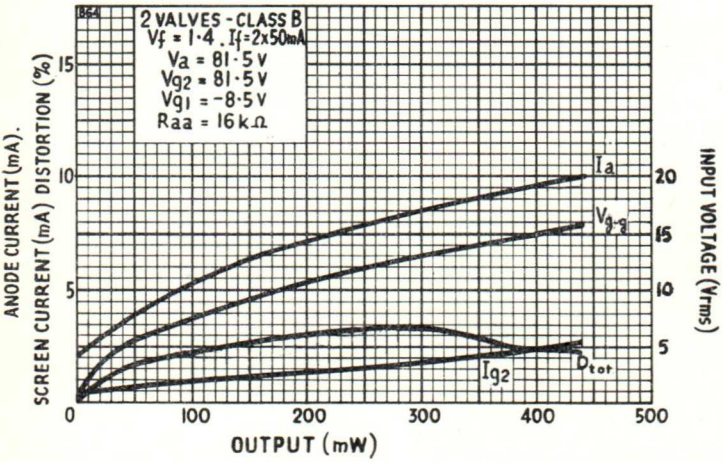

859
Vf = 1·4
If = 50mA
Vg2 = 64
Vg1 = 0
Pa = 0·6w
-1
-2
-3
-4
-5
-6
-7
ANODE CURRENT (mA)
ANODE VOLTAGE
0
2
4
6
8
10
20
40
60
80
100
120


860
Vf = 1·4
If = 50mA
Vg2 = 85
Vg1 = 0
Pa = 0·6w
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
ANODE CURRENT (mA).
ANODE VOLTAGE.
0
5
10
15
50
100
150
200


SINGLE VALVE-CLASS A
Vf = 1·4 If = 25 mA
Va = Vg2 = 85
Vg1 = −5·2
Ra = 13 kΩ
Vin
Ia
Dtot
Ig2
ANODE OR SCREEN CURRENT (mA)
INPUT SIGNAL VOLTAGE (V r.m.s.)
DISTORTION %
OUTPUT (mW)
0
40
80
120
160
200
5
10
15


SINGLE VALVE-CLASS A
Vf = 1·4. If = 50 mA.
Va = 85 V
Vg2 = 85 V
Vg1 = −5·2 V
Ra = 13 kΩ
Vin
Ia
Dtot
Ig2
ANODE OR SCREEN CURRENT (mA)
INPUT SIGNAL VOLTAGE (Vrms)
DISTORTION %
OUTPUT (mW)
0
50
100
150
200
250
5
10


863
2 VALVES - CLASS AB
Vf = 1·4 . If = 2x50mA
Vb = 90V
Rk = 560Ω
Raa = 20kΩ
ALL FILAMENT SECTIONS IN PARALLEL
ANODE CURRENT (mA).
SCREEN CURRENT (mA) DISTORTION (%)
INPUT VOLTAGE (Vrms)
Ia
Vg-g
Dtot
Ig2
0
100
200
300
400
500
OUTPUT (mW)


864
2 VALVES - CLASS B
Vf = 1·4 . If = 2x50mA
Va = 81·5 V
Vg2 = 81·5 V
Vg1 = -8·5 V
Raa = 16kΩ
ANODE CURRENT (mA).
SCREEN CURRENT (mA) DISTORTION (%)
INPUT VOLTAGE (Vrms)
Ia
Vg-g
Ig2
Dtot
0
100
200
300
400
500
OUTPUT (mW)

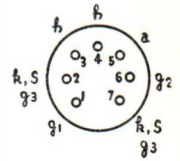
DP61

6AK5

Ferranti

R.F. AMPLIFIER PENTODE

A miniature high mutual conductance R.F. Pentode, designed for use in high frequency wide band applications. Can be used at frequencies up to 400 Mc/s. Two cathode connections are provided, allowing better isolation of input and output circuits.



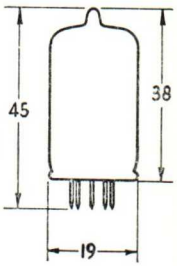
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	45 mm. (1$\frac{3}{4}$in.).
Max. Seated Height	38 mm. (1$\frac{1}{2}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Control Grid
Pin 2—Cathode.
Pin 3—Heater.
Pin 4—Heater.
Pin 5—Anode.
Pin 6—Screen Grid.
Pin 7—Cathode, Suppressor grid and shield.



HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·175 amp.

RATINGS.

Max. Anode Voltage	180 volts.
Max. Screen Grid Voltage ...	140 volts.
Max. Anode Dissipation... ...	1·7 watt.
Max. Screen Grid Dissipation ...	0·5 watt.
Max. Positive Grid Voltage ...	0 volts.
Max. Cathode Current	18 mA.
Max. V_{h-k} (Htr. neg. or pos.) ...	100 volts.

TYPICAL OPERATION.

Anode Voltage	120	150	180	volts.
Screen Grid Voltage ...	120	140	120	volts.
*Auto bias resistor ...	200	330	200	ohms.
Anode Impedance (approx)	0·34	0·45	0·6	MΩ
Mutual Conductance ...	5·0	4·3	5·1	mA/V.
Anode Current	7·5	7·0	7·7	mA.
Screen Grid Current ...	2·5	2·2	2·4	mA.
†Input Impedance ...	25	25	25	kΩ

All dimensions shown are in millimetres (Max.).

CAPACITANCES

	(without external shield.)	(with external shield).
C_{a-g} ...	0·03	0·02 pF. (Max.).
C_{in} ...	4·0	4·0 pF.
C_{out} ...	2·1	2·8 pF.

*Fixed bias operation is not recommended.

†At 50 c/s.

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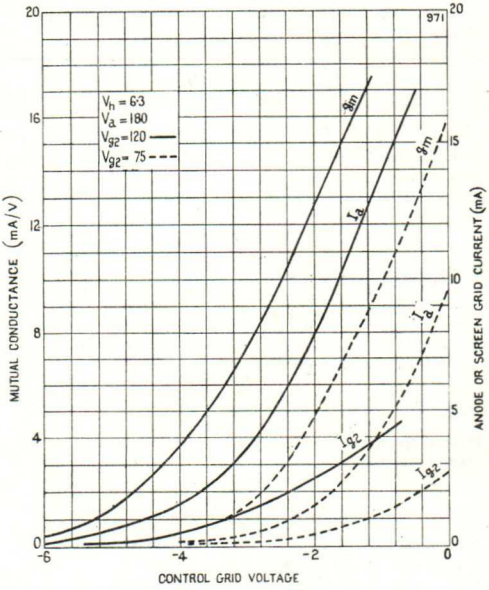
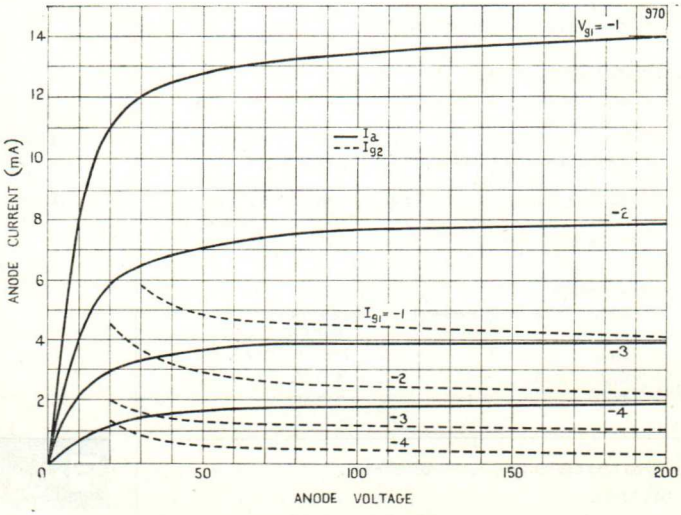
Ferranti

TYPICAL CHARACTERISTICS



Typical I_a/V_a characteristics at V_{g2} = 120



FERRANTI

TRIPLE DIODE TRIODE

EABC80

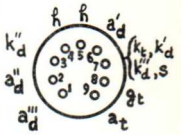
An indirectly heated triple diode triode. One diode has a separate cathode. Primarily designed for use as A.F. amplifier and demodulator in FM/AM Receivers.

PHYSICAL DETAILS.

Base	B9A. Noval
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Diode 3 Anode. Pin 6—Diode 1 Anode.
Pin 2—Diode 2 Anode. Pin 7—Triode Cathode.
Pin 3—Diode 2 Cathode. Diode 1 Cathode.
Pin 4—Heater. Diode 3 Cathode, Shield.
Pin 5—Heater. Pin 8—Triode Grid.
Pin 9—Triode Anode.



Base Connections

Underside View of Base

HEATER.

Heater Voltage	6.3 volts.
Heater Current	0.45 amp.

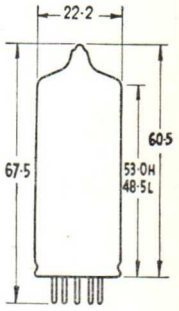
RATINGS.

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	1 watt.
Max. Cathode Current ...	5 mA.
*Max. R_{g-k}	3 MΩ
Max. R_{h-k}	20 kΩ
Max. V_{h-k}	150 volts.
†Min. Negative Grid Voltage ...	1·3 volts.

DIODE SECTIONS.

Max. P.I.V. (Each Diode) ...	350 volts.
Max. Peak Current Diode 1 ...	6 mA.
Max. Peak Current Diode 2 ...	75 mA.
Max. Peak Current Diode 3 ...	75 mA.
Max. Current Diode 1	1 mA.
Max. Current Diode 2	10 mA.
Max. Current Diode 3	10 mA.



CHARACTERISTICS.

TRIODE SECTIONS.

Anode Voltage	100	250	volts.
Grid Voltage	−1	−3	volts.
Anode Current	0·8	1	mA.
Mutual Conductance	1·45	1·4	mA/V.
Amplification Factor	70	70	
Anode Impedance	48	50	kΩ

DIODE SECTIONS.

Diode 1 Impedance ($V_{a'd}$ = 10v)	5 kΩ
Diode 2 Impedance ($V_{a''d}$ = 5v)	200 Ω
Diode 3 Impedance ($V_{a'''d}$ = 5v)	200 Ω
$r_{a''d}/r_{a'''d}$	0·65 to 1·5

MICROPHONY

This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	0·8	mA.
Stage Gain	51	53	47	55	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (for V_{out} = 8v r.m.s.)	1·1	0·9	0·8	0·6	%
Grid Resistor for following valve	680	680	330	680	kΩ

All dimensions shown are in millimetres (max. unless otherwise stated).

*For operation with grid current biasing R_{g-k} may be increased to 22 MΩ max.
†For grid current of 0.3 μA.

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Dec., 1957

EABC80

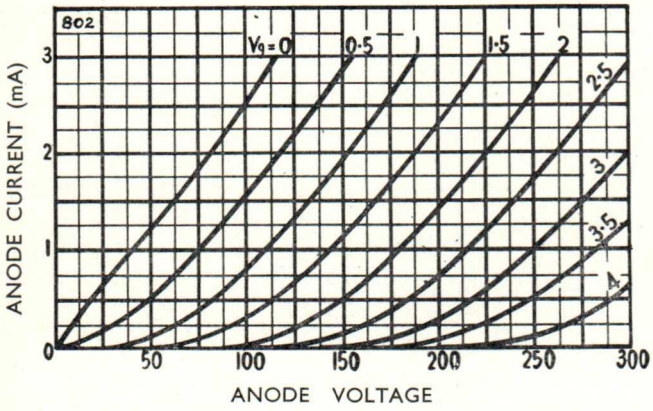
FERRANTI

CAPACITANCES. TRIODE SECTION.

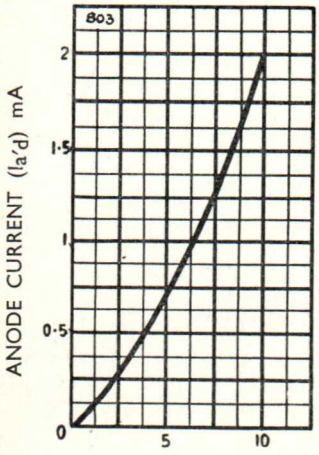
C_{in}	... ...	1.9 pF.
C_{out}	... ...	1.4 pF.
C_{a-g}	... ...	2.0 pF.
C_{g-h}	... ...	<0.04 pF.

DIODE SECTION.

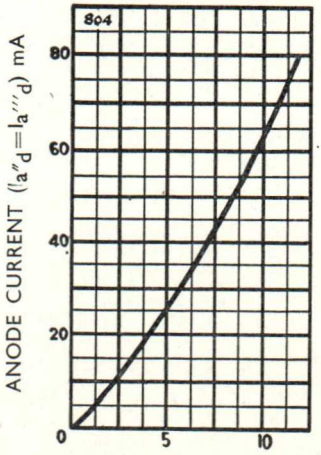
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$	...	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$		4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k'''d,\ s)}$	...	4.8 pF.
$C_{k''d-all}$	... ...	4.9 pF.
$C_{a'd-h}$	... ...	<0.25 pF.
$C_{a'''d-h}$	... ...	<0.2 pF.
$C_{k''d-h}$	... ...	2.5 pF.



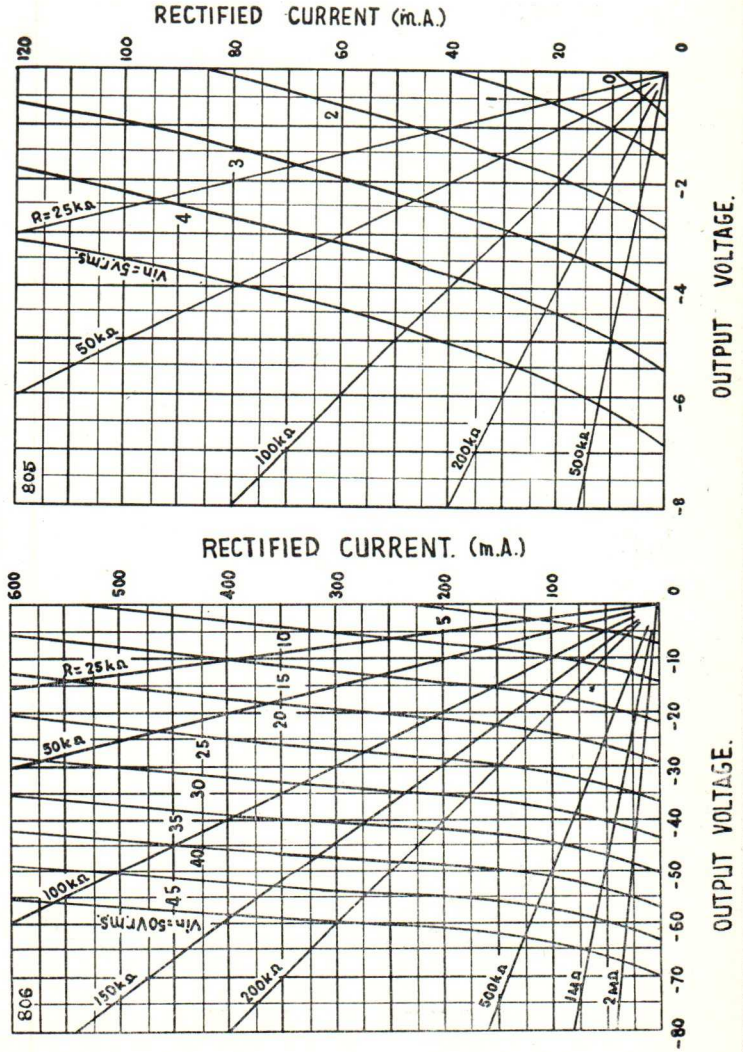
DIODE I



DIODE II - DIODE III

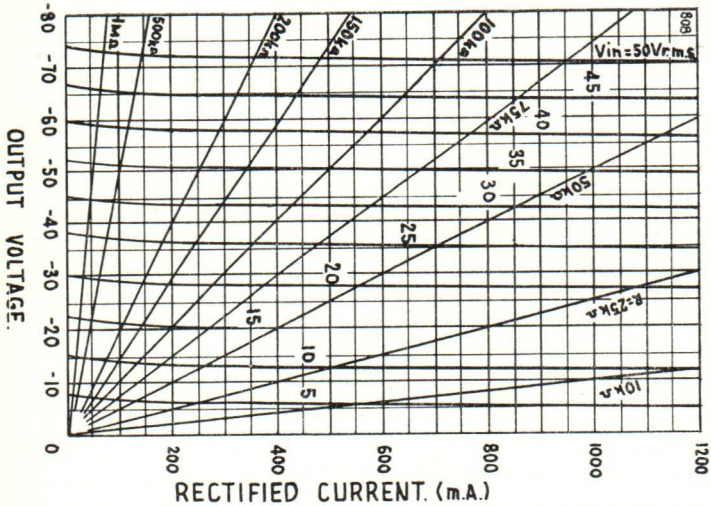


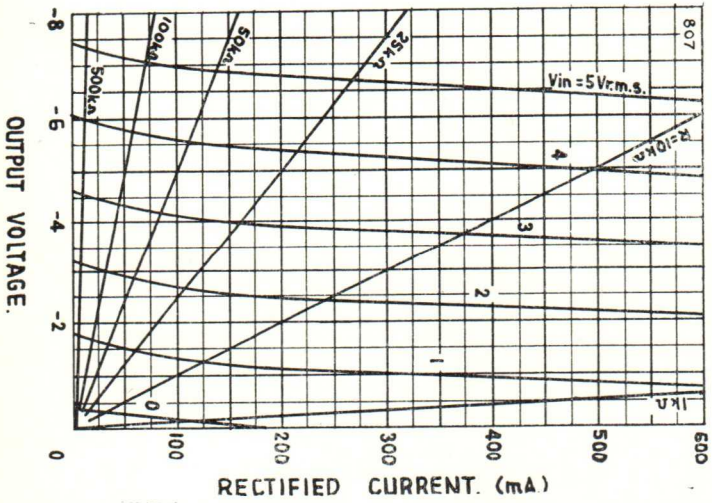
AVERAGE CHARACTERISTICS FOR DIODE I



FERRANTI

AVERAGE CHARACTERISTICS DIODE II AND DIODE III



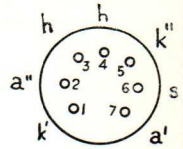


FERRANTI

DOUBLE DIODE

EB91

A miniature Double Diode with separate cathodes designed for high frequency operation. There is internal screening between the sections.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B7G.
Max. Overall Length	... ...	54·5 mm. ($2\frac{5}{32}$ in.).
Max. Seated Height	... ...	47·5 mm. ($1\frac{7}{8}$ in.).
Max. Diameter	... ...	19 mm. ($\frac{3}{4}$ in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

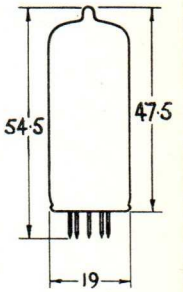
Pin 1—Cathode 1. Pin 4—Heater.
Pin 2—Anode 2. Pin 5—Cathode 2.
Pin 3—Heater. Pin 6—Internal Shield.
Pin 7—Anode 1.

HEATER.

Heater Voltage	... ...	6·3 volts.
Heater Current	... ...	0·3 amp.

RATINGS.

Max. Peak Inverse Voltage	...	420 volts.
Max. R.M.S. Input Voltage	...	150 volts.
*Max. Peak Anode Current	...	54 mA.
*Max. Rectified Current	...	9 mA.
*Max. Resonant Frequency	...	700 M/cs.
Max. V_{h-k}	... ...	330 volts DC.



TYPICAL OPERATING CONDITIONS.
(as Half-wave Rectifier)**

*R.M.S. Input Voltage	... ...	150 volts.
*Output Current	... ...	9 mA.
*Supply Impedance	... ...	300 ohms.

All dimensions shown are in millimetres (max.).

CAPACITANCES.

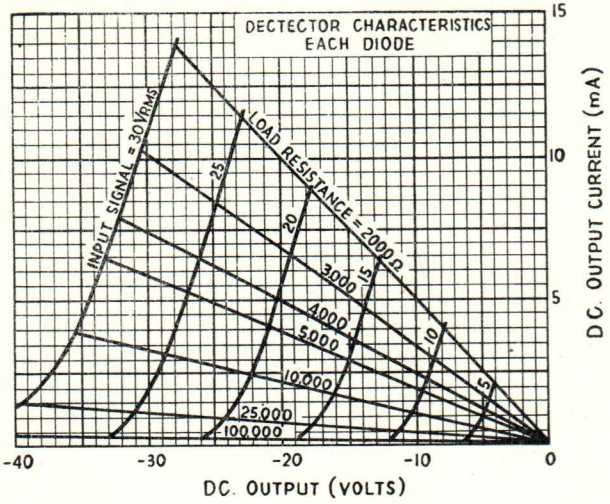
‡‡$C_{a'-a''}$	<0·026 pF.
†$C_{a'-k'+h+s}$	3·0 pF.
‡$C_{a''-k''+h+s}$	3·0 pF.
§$C_{k'-a'+h+s}$	3·4 pF.
††$C_{k''-a''+h+s}$	3·4 pF.

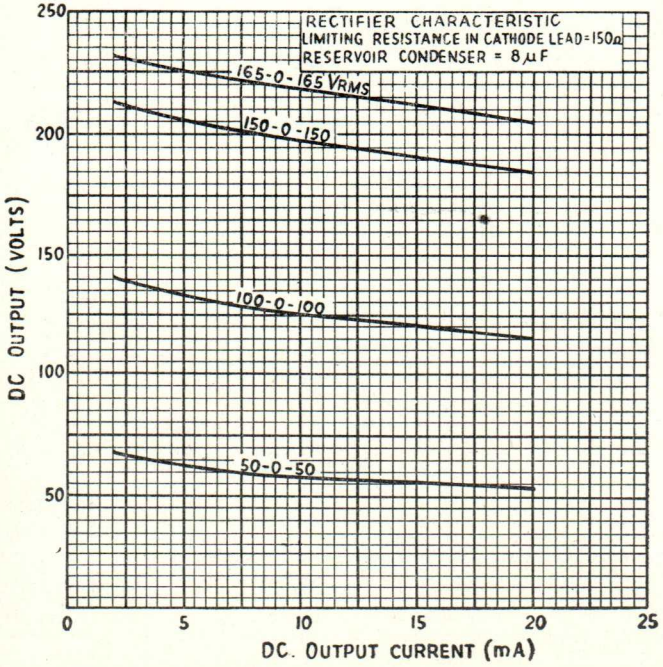
*Each Section.
‡‡With close-fitting external shield connected to Cathode No. 1
†With close-fitting external shield connected to Cathode No.2
‡With close-fitting external shield connected to Anode No. 1
§With close-fitting external shield connected to Anode No. 2
††With close-fitting external shield connected to earth.
**For half-wave operation, the two units may be used separately or in parallel.

Issue 4
Aug., 1957

EB91

FERRANTI





FERRANTI

DOUBLE DIODE PENTODE

EBF80

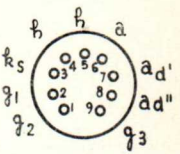
An indirectly heated double diode variable-mu pentode designed for use as detector, A.V.C. diode and R.F., I.F., or A.F. Amplifier.

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	67·5 mm. ($2\frac{41}{64}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Screen Grid (g_2).
Pin 2—Control Grid (g_1).
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Diode Anode 1.
Pin 8—Diode Anode 2.
Pin 9—Suppressor Grid (g_3).



Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage (I_a <2·5 mA)	300 volts.
Max. Screen Voltage (I_a=5 mA)	125 volts.
Max. Anode Dissipation ...	1·5 watts.
Max. Screen Dissipation ...	0·3 watts.
Max. Control Grid Voltage (Ig_1=+0·3μA)	−1·3 volts.
Max. Cathode Current ...	10 mA.
Max. V_{h-k}	100 volts.
*Max. R_{g1-k}	3 MΩ
Max. R_{h-k}	20 kΩ
Peak Diode Anode Voltage ...	200 volts.
Max. Diode Anode Current ...	0·8 mA.

TYPICAL OPERATION.

PENTODE SECTION.

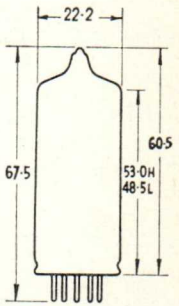
Anode Voltage	250 volts.
Screen Grid Resistor (R_{g2}) ...	95 kΩ
Suppressor Grid Voltage ...	0 volts.
Control Grid Voltage	−2 volts.
Anode Current	5 mA.
Screen Current	1·75 mA.
Mutual Conductance	2·2 mA/V.
Anode Impedance	1·5 MΩ
Inner μ (μg_1–g_2)	18
V_{g1} for gm=0·022 mA/V. ...	−41·5 volts.

Resistance Coupled Amplifier.

Supply Voltage	250	250	250	volts.
Anode Load Resistor ...	220	220	100	kΩ
Screen Feed Resistor ...	820	100	470	kΩ
Auto Bias Resistor ...	1·8	0	0	kΩ
Grid Resistor	0	10	10	MΩ
Peak Output Voltage ...	19	19	19	volts.
Stage Gain	110	160	110	
Grid Resistor for following Valve	680	680	330	kΩ
Total Distortion	5	5	5	%

CAPACITANCES.

C_{in}	4·0 pF.
C_{out}	4·9 pF.
C_{a-g}	<0·0025 pF.
$C_{ad'-ad''}$	<0·35 pF.
$C_{ad'-k}$	2·2 pF.
$C_{ad''-k'}$	2·35 pF.
C_{g1-h}	<0·07 pF.
$C_{ad'-g1}=C_{ad''-g1}$ ...	<0·001 pF.



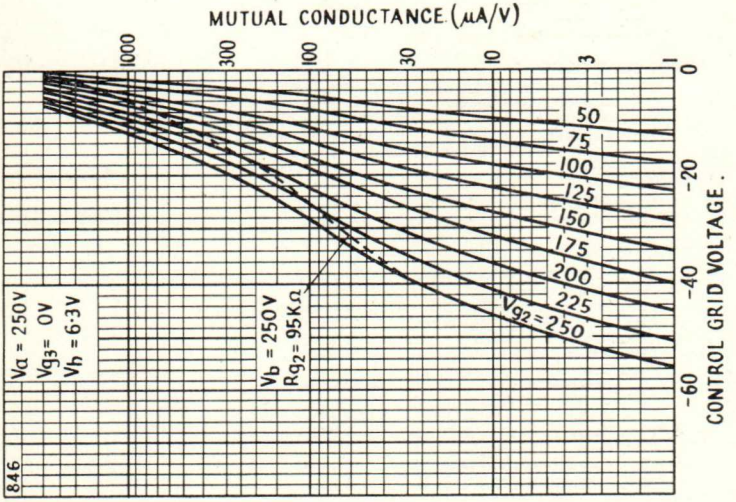
All dimensions shown are in millimetres (max.).

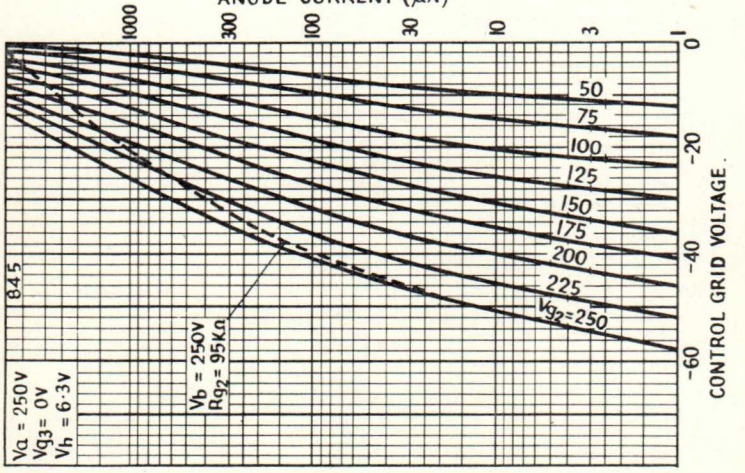
*If grid current biasing is employed R_{g1-k} may be increased up to 22 MΩ

Issue 1.
Jan., 1957

EBF80

FERRANTI



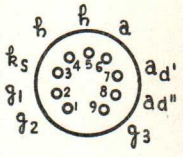


Ferranti

EBF89

DOUBLE DIODE PENTODE

An indirectly heated double diode variable-mu pentode. The pentode is designed for use as an R.F. or I.F. Amplifier, and the diodes for a.m. detection.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	...	B9A—All Glass
Max. Overall Length	...	...	67·5 mm. (2$\frac{21}{32}$in.)
Max. Seated Height	...	...	60·5 mm. (2$\frac{3}{8}$in.)
Max. Diameter	...	...	22·2 mm. ($\frac{7}{8}$in.)
Mounting Position	...	...	Any

BASE CONNECTIONS.

Pin 1—Screen Grid (g_2)	Pin 5—Heater
Pin 2—Control Grid (g_1)	Pin 6—Pentode Anode
Pin 3—Cathode	Pin 7—Diode Anode 1
Pin 4—Heater	Pin 8—Diode Anode 2
Pin 9—Suppressor Grid (g_3)	

HEATER.

Heater Voltage	...	...	6·3 volts
Heater Current	...	...	0·3 amp

RATINGS.

Pentode Section.

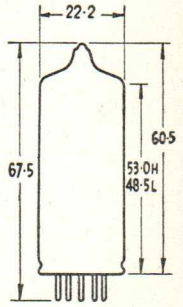
Max. H.T. Supply Voltage	...		550 volts
Max. Anode Voltage	...	...	300 volts
Max. Screen Voltage (I_a<4 mA.)			300 volts
Max. Screen Voltage (I_a>8 mA.)			125 volts
Max. Anode Dissipation	...	...	2·25 watts
Max. Screen Grid Dissipation	...		0·45 watts
Max. Control Grid Voltage (I_{g_1}=+0·3μA.)	...	...	−1·3 volts
Max. Cathode Current	...	...	16·5 mA
Max. V_{h-k}	... ...	...	100 volts
Max. R_{h-k}	... ...	...	20 kΩ
*Max. R_{g_1-k}	... ...	...	3 MΩ
Max. R_{g_3-k}	... ...	...	10 kΩ

Diode Sections.

Peak Diode Anode Voltage	...		200 volts
Max. Mean Diode Anode Current			0·8 mA
Max. Peak Diode Anode Current			5·0 mA

TYPICAL OPERATION.

			As R.F. or I.F. Amplifier.				
V_a=V_b	...	...	200	250	200	250	volts
V_{g_3}	...	...	0	0	0	0	volts
R_{g_2}	...	...	30	56	47	82	kΩ
R_k	...	...	105	170	—	—	ohms
V_{g_1}	...	...	−1·5	−2·0	0·5†	0·5†	volts
I_a	...	...	11	9·0	9·5	8·0	mA
I_{g_2}	...	...	3·3	2·7	2·8	2·2	mA
g_m	...	...	4·5	3·8	5·0	3·8	mA/V
r_a	...	...	0·6	1·0	0·6	0·8	MΩ
R_{eq}	...	...	3·5	4·0	2·5	2·3	k Ω
g_m	(V_{g_1}=−20)...		120	200	115	180	μA/V



CAPACITANCES.

Pentode Section.

C_{in}	...	5·0	pF
C_{out}	...	5·2	pF
C_{a-g_1}	...	<0·0025	pF
C_{g_1-h}	...	0·05	pF

Diode Sections.

$C_{ad'-k}$=$C_{ad''-k}$	...	2·5	pF
$C_{ad'-ad''}$	... ...	<0·25	pF
$C_{ad'-h}$	... ...	<0·015	pF
$C_{ad''-h}$	... ...	<0·003	pF

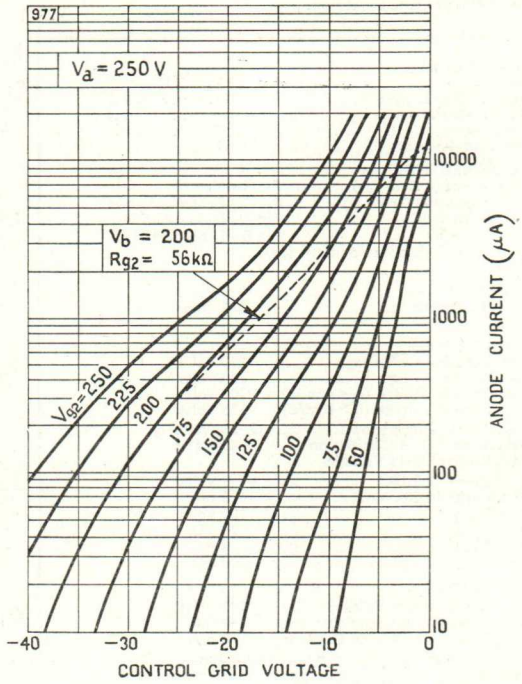
$C_{ad'-g_1}$	... ...	<0·0025	pF
$C_{ad''-g_1}$	... ...	<0·001	pF
$C_{ad'-ap}$	... ...	<0·15	pF
$C_{ad'-ap}$	... ...	<0·025	pF

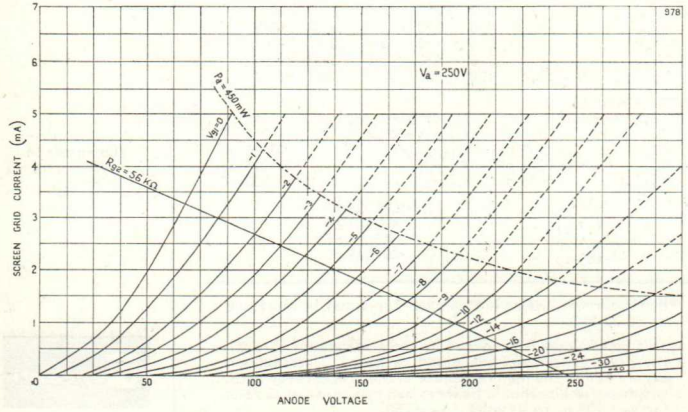
All dimensions shown are in millimetres (max.).

*If grid current biasing is employed R_{g_1-k} may be increased up to 22 MΩ

†This bias voltage is produced by the grid current through the grid resistor and the diode current. If attenuation occurs due to the high resistance of the grid cathode path, the negative bias should be increased to approx −1·5 volts for V_a=200 or to −2 volts if V_a=250.

Issue 2.
May, 1962.


977
V_a = 250 V
V_b = 200
R_{g2} = 56kΩ
V_{g2}=250
225
200
175
150
125
100
75
50
10,000
1000
100
10
ANODE CURRENT (μA)
−40
−30
−20
−10
0
CONTROL GRID VOLTAGE

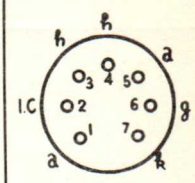

978
V_a = 250V
P_a = 450mW
V_{g1}=0
R_{g2} = 56 kΩ
SCREEN GRID CURRENT (mA)
ANODE VOLTAGE
0
50
100
150
200
250

FERRANTI

TRIODE

EC90

An indirectly heated triode designed for use as a power amplifier in FM or other high frequency circuits. May also be used as Class 'C' RF Amplifier. It will operate efficiently at frequencies up to 150 Mc/s.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

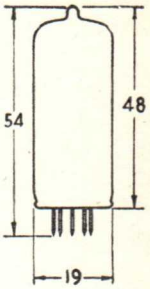
Base	B7G.
Max. Overall Length	54 mm. ($2\frac{1}{8}$in.).
Max. Seated Height	48 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode.	Pin 5—Anode.
Pin 2—Internal Connection.	Pin 6—Grid.
Pin 3—Heater.	Pin 7—Cathode.
Pin 4—Heater.	

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·15 amp.



RATINGS.	Class A_1	Class C Telegraphy
Max. Anode Voltage	300	300 volts.
Max. Anode Dissipation	3·5	5·0 watts.
Max. DC. Grid Voltage	—	–50 volts.
Max. Grid Current	—	8·0 mA.
Max. R_{g-k}	1·0	— MΩ
Max. V_{h-k}	100	100 volts DC.

TYPICAL OPERATION.

CLASS A_1 AMPLIFIER.		
Anode Voltage	100	250 volts.
Grid Voltage	0	–8·5 volts.
Anode Current	11·8	10·5 mA.
Mutual Conductance	3·1	2·2 mA/V.
Anode Impedance	6250	7700 ohms.
Amplification Factor	19·5	17

R.F. POWER AMPLIFIER. CLASS C TELEGRAPHY.

Anode Voltage (DC)	300 volts.
Anode Current	25 mA.
Grid Voltage (DC)	–27 volts.
Grid Current (DC)	7 mA.
Driving Power	0·35 watts (approx.).
Power Output	5·5 watts (approx.)*
	2·5 watts (approx.)†

All dimensions shown are in millimetres (max.).

CAPACITANCES (With close fitting metal shield).

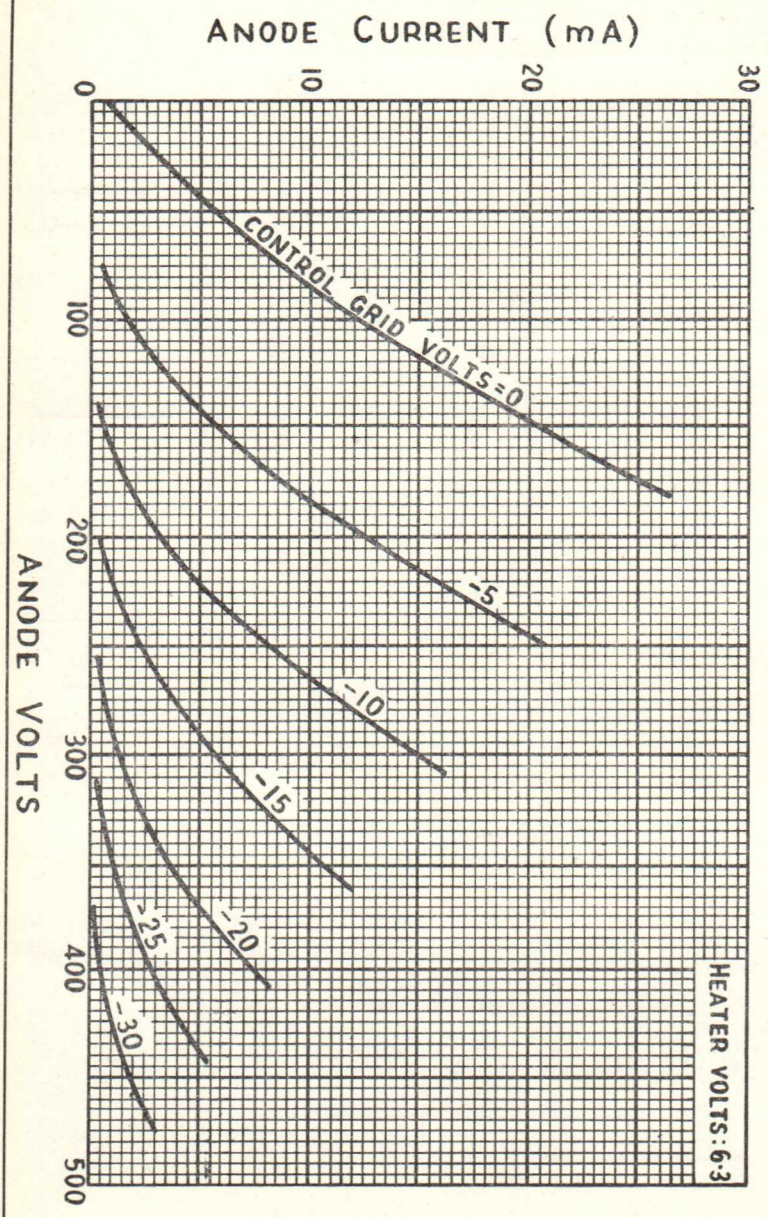
C_{in}	1·8 pF.
C_{out}	3·0 pF.
C_{a-g}	1·6 pF.

*At moderate frequencies.

†At 150 Mc/s. with $R_{g-k} = 10k\Omega$

Issue 1.
June, 1956

EC90

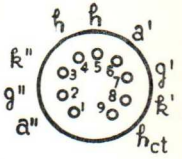

ANODE CURRENT (mA)
0
10
20
30
ANODE VOLTS
100
200
300
400
500
CONTROL GRID VOLTS = 0
-5
-10
-15
-20
-25
-30
HEATER VOLTS: 6·3

FERRANTI

DOUBLE TRIODE

ECC81

An indirectly heated double triode valve with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as a frequency changer or R.F. Amplifier at frequencies up to 300 Mc/s.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A (Noval).
Bulb	Clear.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{32}$in.).
Max. Diameter (Base)	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2.	Pin 5—Heater.
Pin 2—Grid Triode 2.	Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2.	Pin 7—Grid Triode 1.
Pin 4—Heater.	Pin 8—Cathode Triode 1.

Pin 9—Heater Centre Tap.

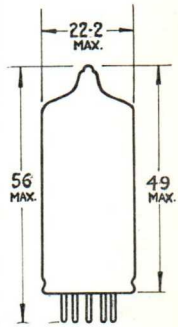
HEATER.

The heater is centre tapped and the two halves may be operated either in series or in parallel with one other.

	Series.†	Parallel.‡	
Heater Voltage	12·6	6·3	volts.
Heater Current	0·15	0·3	Amp.

RATINGS.*

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage (working)	300 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Cathode Current ...	15 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. V_{h-k}	150 volts.
Max. R_{g-k} (Cathode Bias) ...	1·0 MΩ
Max. R_{h-k}	20 kΩ



CHARACTERISTICS.*

Anode Voltage	100	170	200	250	volts.
Grid Voltage	−1	−1	−1	−2	volts.
Anode Current	3·0	8·5	11·5	10	mA.
Mutual Conduc.	3·75	5·9	6·7	5·5	mA/V.
Amplificat. Factor	62	66	70	60	
Anode Imped.	16·5	11	10·5	11	kΩ

CAPACITANCES.

*C_{in}	2·3 pF.
$C_{a'-k'+h}$	0·45 pF.
$C_{a''-k''+h}$	0·35 pF.
*C_{a-g}	1·6 pF.
*C_{a-k}	0·2 pF.
*C_{h-k}	2·5 pF.
*C_{k-g+h}	4·7 pF.
$C_{a'-a''}$	<0·4 pF.
$C_{g'-g''}$	<0·005 pF.
$C_{a'-g'+h}$	1·9 pF.
$C_{a''-g''+h}$	1·8 pF.
C_{g-h}	<0·17 pF.
$C_{a'-g''}$	<0·07 pF.
$C_{a''-g'}$	<0·04 pF.

All dimensions shown are in millimetres (max.).

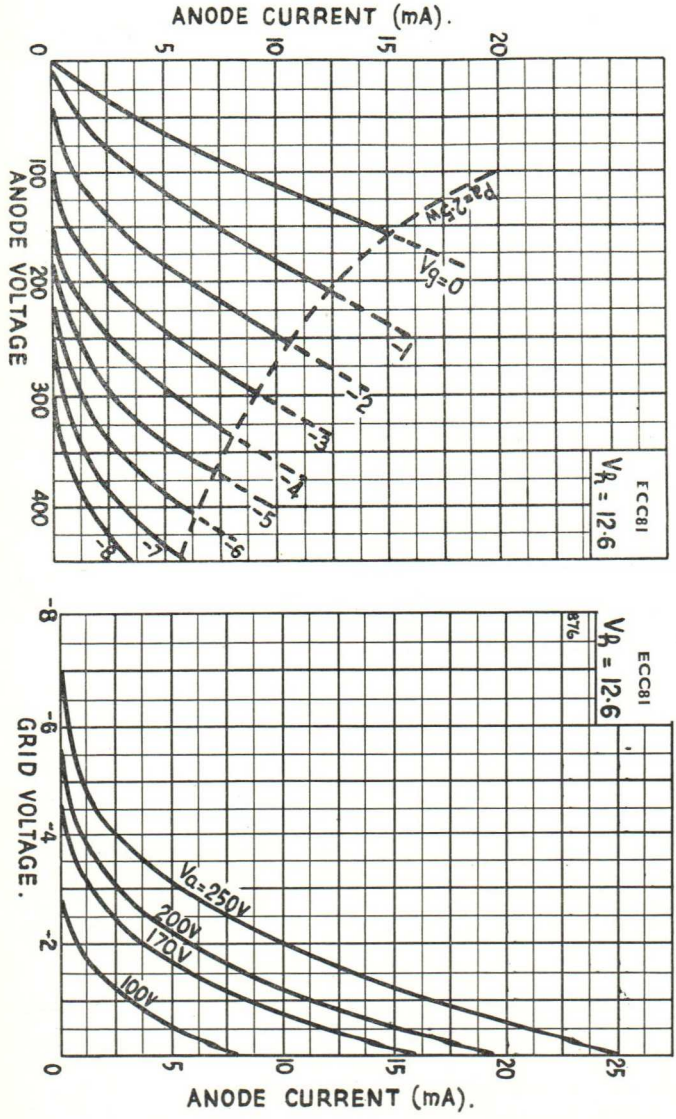
*Each Section.

†Vh applied between pins 4 and 5.

‡Vh applied between pins 9 and pins 4 and 5 connected together.

Issue 3
Aug.,1957

ECC81


ANODE CURRENT (mA).
0
5
10
15
20
ANODE VOLTAGE
100
200
300
400
I_a
$I_{g2}+I_{g1}$
$V_g=0$
-1
-2
-3
-4
-5
-6
-7
-8
ECC81
V_A = 12.6
876
ECC81
V_A = 12.6
-8
-6
-4
-2
0
GRID VOLTAGE.
V_a=250V
200V
170V
100V
0
5
10
15
20
25
ANODE CURRENT (mA).

FERRANTI

HIGH IMPEDANCE DOUBLE TRIODE

ECC82

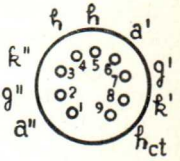
An indirectly heated double triode valve with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as an amplifier or phase inverter in AC/DC radio receivers, or in oscillator or multivibrator circuits for industrial applications.

PHYSICAL DETAILS.

Base	B9A Noval.
Bulb	Clear.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter (Base)	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Heater Centre Tap.



Base Connections Underside View of Base

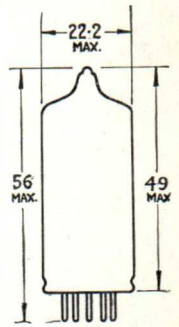
HEATER.

The heater is centre tapped and the two halves may be operated either in series or in parallel with one another.

	Series.†	Parallel.‡
Heater Voltage	12·6	6·3 volts.
Heater Current	0·15	0·3 Amp.

RATINGS.§

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	2·75 watts.
Max. Cathode Current	20 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. Pos. Grid Voltage	0 volts.
Max. V_{h-k} (Heater negative) ...	180 volts.
Max. V_{h-k} (Heater positive) ...	180 volts.
Max. R_{g-k} (Cathode Bias) ...	1·0 MΩ
Max. R_{g-k} (Fixed Bias)	0·25 MΩ
**Max. R_{h-k}	20 kΩ



CAPACITANCES.*

§C_{in}			1·6 pF.
C_{out}	Triode No. 1		0·5 pF.
	Triode No. 2		0·35 pF.
§C_{a-g}			1·5 pF.

CHARACTERISTICS.§

Anode Voltage	100	250	volts.
Anode Current	12	10·5	mA.
Grid Voltage	0	−8·5	volts.
Amplification Factor	19	17	
Anode Impedance	6200	7700	Ω
Mutual Conductance	3·1	2·2	mA/V.

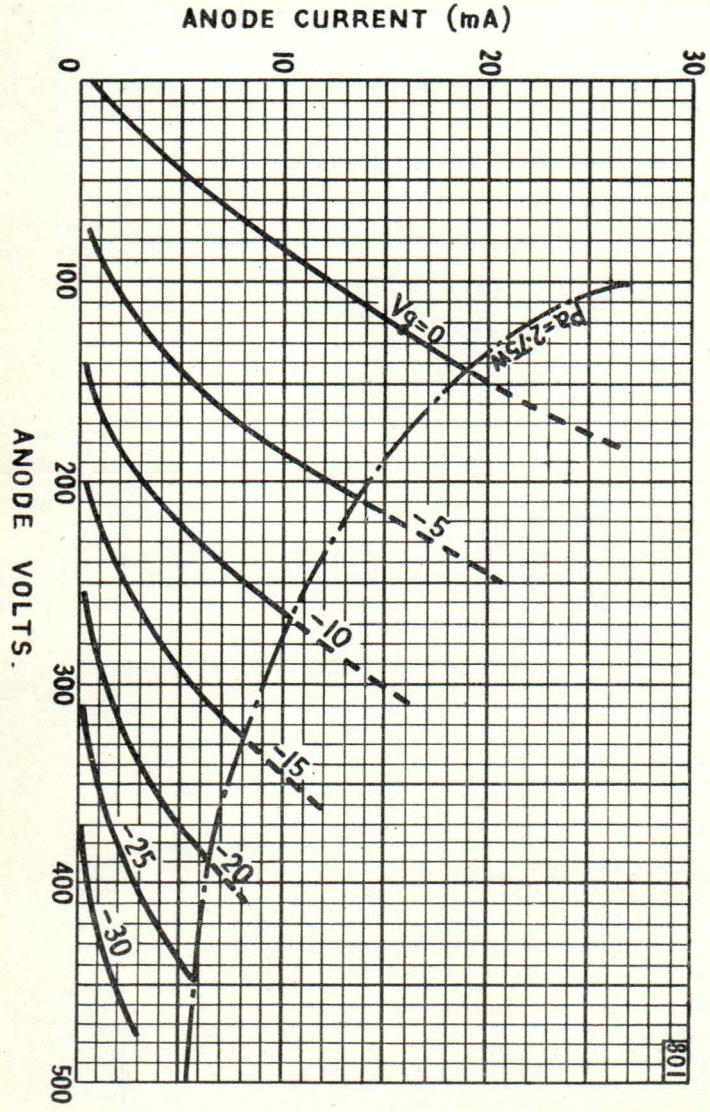
All dimensions shown are in millimetres (max.).

*Measured without external shield.
†Vh applied between pins 4 and 5.
‡Vh applied between pin 9 and pins 4 and 5 connected together.
**When used as a phase inverter immediately preceding the output stage R_{h-k} max. may be 120 kΩ
§Each Section, unless otherwise indicated.

Issue 2
Aug.,1957

ECC82

FERRANTI



FERRANTI

DOUBLE TRIODE

ECC83

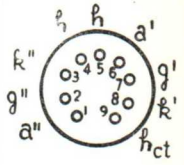
An indirectly heated high μ double triode with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as a Resistance coupled A.F. amplifier or phase inverter.

PHYSICAL DETAILS.

Base	B9A Noval.
Bulb	Clear.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter (Base)	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2.
Pin 2—Grid Triode 2.
Pin 3—Cathode Triode 2.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Anode Triode 1.
Pin 7—Grid Triode 1.
Pin 8—Cathode Triode 1.
Pin 9—Heater Centre Tap.



Base Connections Underside View of Base

HEATER.

The heater is centre tapped and the two halves may be operated either in series or in parallel with one other.

	Series†	Parallel‡	
Heater Voltage	12.6	6.3	volts.
Heater Current	0.15	0.3	Amp.

RATINGS.*

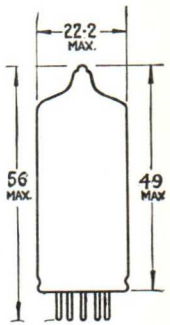
Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation...	1.0 watts.
Max. Cathode Current	8 mA.
Max. Neg. Grid Voltage	50 volts.
Max. Pos. Grid Voltage	0 volts.
Max. V_{h-k}	180 volts.
§Max. R_{g-k} (Fixed Bias)	0.5 MΩ
Max. R_{g-k} (Cathode Bias)	1.0 MΩ
Max. R_{g-k} (Cathode Bias) (Ia<1mA)	2.2 MΩ
**Max. R_{h-k}	20 kΩ

CHARACTERISTICS.*

Anode Voltage	100	250	volts.
Grid Voltage	−1.0	−2.0	volts.
Anode Current	0.5	1.2	mA.
Amplification Factor	100	100	
Anode Impedance	80	62.5	kΩ
Mutual Conductance	1.25	1.6	mA/V.

CAPACITANCES.

*C_{in}	1·6 pF.
$C_{a'-k'}$	0·46 pF.
$C_{a''-k''}$	0·34 pF.
*C_{a-g}	1·7 pF.
*C_{g-h}	<0·15 pF.
$C_{a'-a''}$	<1·2 pF.
$C_{g'-g''}$	<0·01 pF.
$C_{a''-g'} = C_{a'-g''}$	<0·1 pF.



All dimensions shown are in millimetres.

*Each Section.
**Max. R_{h-k} may be 120 kΩ when the valve is used as a phase inverter immediately preceding the output stage.
†V_h applied between pins 4 and 5.
‡V_h applied between pin 9 and pins 4 and 5 connected together.
§With grid current biasing Max. Rg-k = 22MΩ

Issue 2
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FERRANTI

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TYPICAL OPERATION as Resitance Coupled A.F. Amplifier

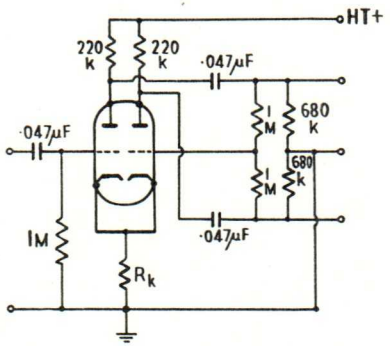
1. Cathode Bias.

Anode Supply Voltage	200	250	250	300	300	350	350	400	volts.
Anode Load Resistance	100	100	220	100	220	100	220	220	kΩ
Cathode Current ...	0·65	0·86	0·48	1·11	0·63	1·4	0·85	1·02	mA.
Cathode Bias Resistor ...	1·8	1·5	2·7	1·2	2·2	1·0	1·5	1·2	kΩ.
Grid Resistor of following valve ...	330	330	680	330	680	330	680	680	kΩ
Stage Gain	50	54·5	66·5	57	72	61	75·5	76·5	
*Output Voltage ...	20	26	28	30	36	36	37	38	volts (r.m.s.)
*Total Distortion ...	4·8	3·9	3·4	2·7	2·6	2·2	1·6	1·1	%

2. Grid Current Bias**

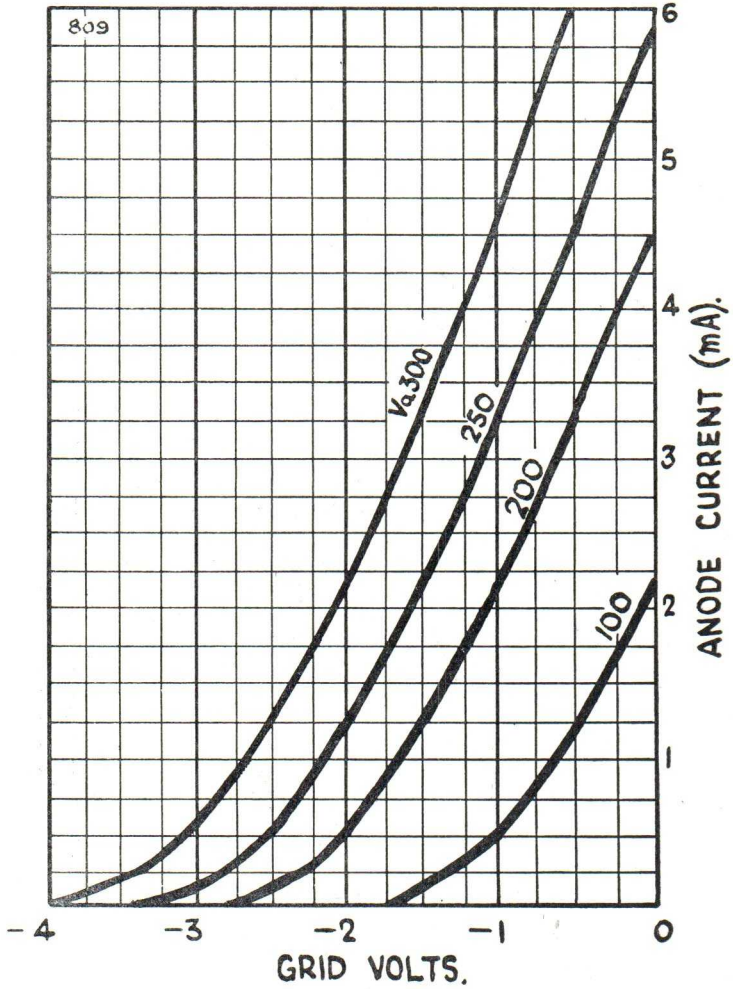
Anode Supply Voltage	200	250	250	300	300	350	350	400	volts.
Grid Resistance ...	10	10	10	10	10	10	10	10	MΩ
Anode Load Resistance	100	100	220	100	220	100	220	220	kΩ
Cathode Current ...	0·7	1·0	0·56	1·3	0·74	1·6	0·88	1·09	mA.
Grid Resistor of following valve ...	330	330	680	330	680	330	680	680	kΩ
Stage Gain	50	51	62	54	66	56	67	68	
Output Voltage ...	20	26	28	30	36	36	37	38	volts (r.m.s.)
Total Distortion ...	3·9	2·6	2·7	2·2	2·2	1·8	1·7	1·4	%

TYPICAL OPERATION AS PHASE INVERTER.



Anode Supply Voltage ...	250		350		volts.
Cathode Resistor	1·2		0·82		kΩ
Cathode Current	1·08		1·7		mA.
Stage Gain	58		62		
*Output Voltage ...	35	7	45	9	V.r.m.s.
Total Distortion ...	5·5	1·1	3·5	0·7	%

*At start of positive grid current. At lower output voltages distortion is approximately proportionate to output voltage.
**Measured with a signal source impedance of 100 Ω



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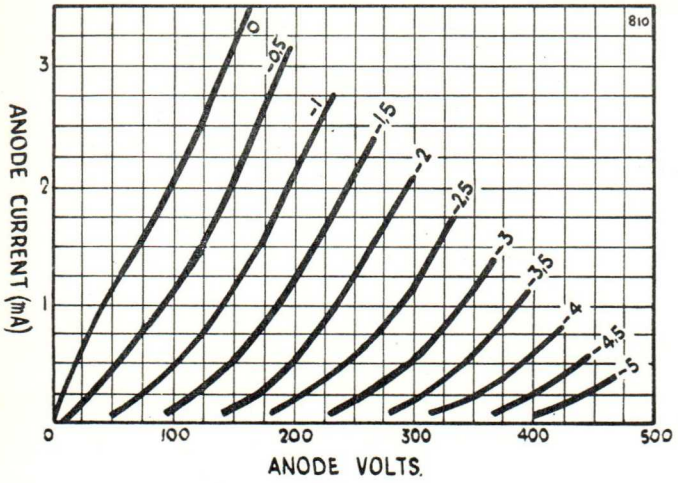

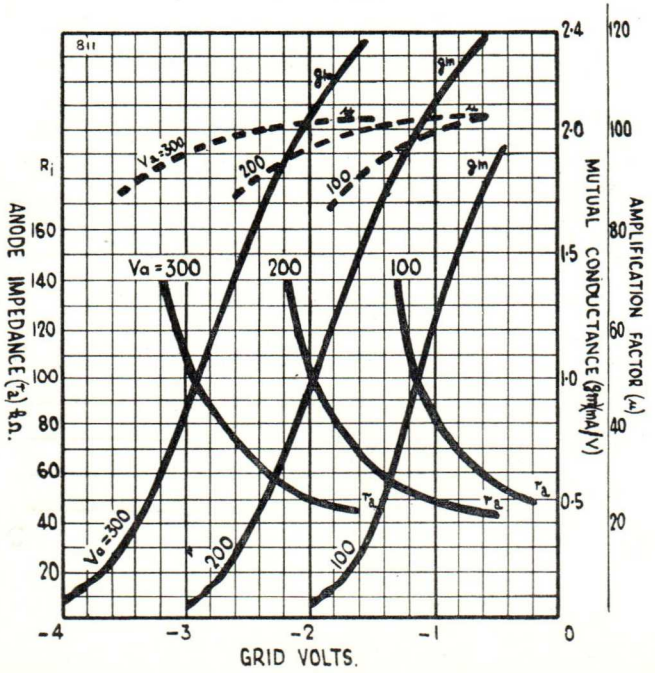

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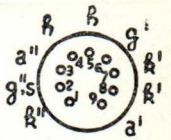
FERRANTI

DOUBLE TRIODE

ECC84

A double triode with separate cathodes, primarily designed for use as a cascode R.F. Amplifier in Television Receivers. Suitable for operation at frequencies up to 220 Mc/s.



Base Connections
Underside View of Base

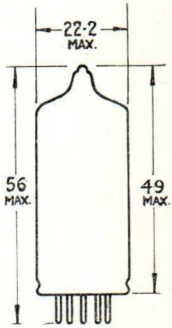
PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{45}{64}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode Triode 2.
Pin 2—Grid Triode 2, Shield.
Pin 3—Anode Triode 2.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Grid Triode 1.
Pin 7—Cathode Triode 1 (in).
Pin 8—Cathode Triode 1 (out).
Pin 9—Anode Triode 1.

The triode on Pins 6, 7, 8 and 9 should have grounded-cathode connection and that on pins 1, 2 and 3 should have grounded-grid connection.



HEATER.*

Heater Voltage	6·3 volts.
Heater Current	0·33 amp.

RATINGS.†

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	180 volts.
Max. Anode Dissipation ...	2 watts.
Max. Cathode Current ...	22 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. $V_{h-k'}$	100 volts.
Max. $V_{h-k''}$ (heater negative)	200 volts.
Max. $R_{g'-k'}$	1·5 MΩ
Max. $R_{g''-k''}$	0·5 MΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.†

Anode Voltage	90 volts.
Grid Voltage	−1·5 volts.
Anode Current	12 mA.
Amplification Factor	24
Mutual Conductance	6 mA/V.
§Input Impedance	2 kΩ

CAPACITANCES.‡

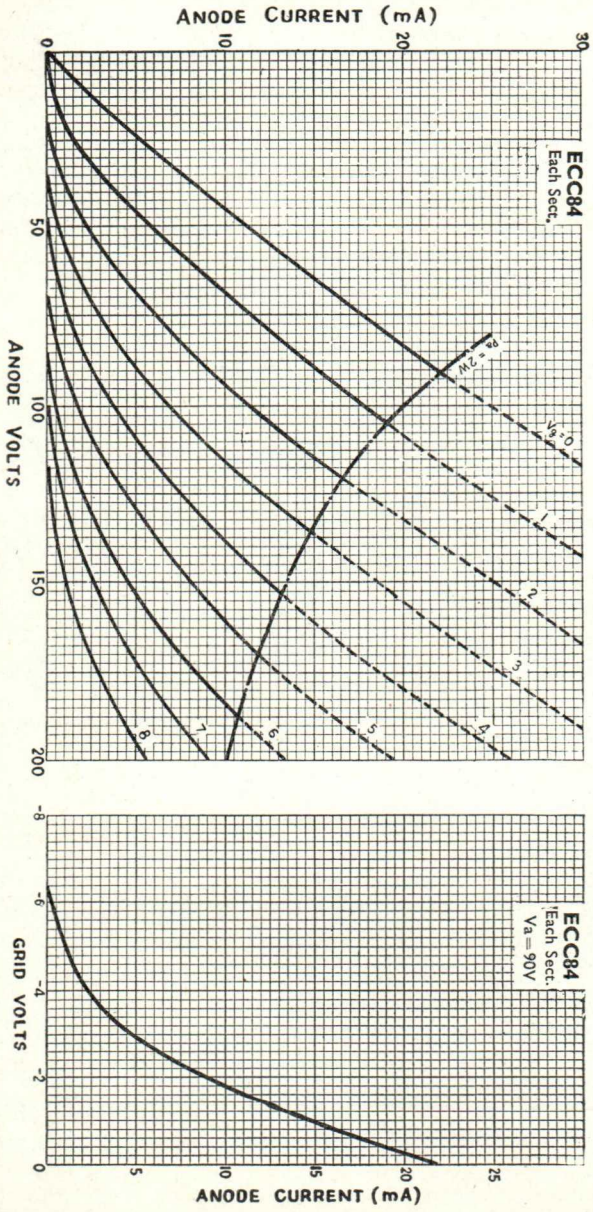
$C_{g'-k'}$	2·1 pF.
$C_{a'-k'}$	0·45 pF.
$C_{g'-h}$	<0·25 pF.
$C_{a'-g'}$	1·2 pF.
$C_{a''-g''}$	2·3 pF.
$C_{a''-k''}$	0·16 pF.
$C_{k''-g''+h}$	4·7 pF.
$C_{a''-g''+h}$	2·5 pF.
$C_{g'-a''}$	<0·006 pF.
$C_{a'-a''}$	<0·035 pF.
$C_{a'-k'+h+g''}$	1·2 pF.
$C_{h-k''}$	2·7 pF.

All dimensions shown are in millimetres.

*Suitable for parallel operation only, a.c. or d.c.
†Each section, unless otherwise indicated.
‡Measured without external shield.
§Measured at a frequency of 200 Mc/s. with cathode connections pins 7 and 8 strapped.

Issue 1
Aug., 1957

ECC84


ANODE CURRENT (mA)
0
10
20
30
ECC84
Each Sect.
ANODE VOLTS
50
100
150
200
Pa = 2W
Vg = 0
1
2
3
4
5
6
7
8
-8
-6
-4
-2
0
GRID VOLTS
ECC84
Each Sect.
Va = 90V
5
10
15
20
25
ANODE CURRENT (mA)

Ferranti

ECC85

6AQ8

DOUBLE TRIODE

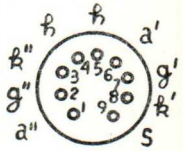
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length ...	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height ...	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Shield.



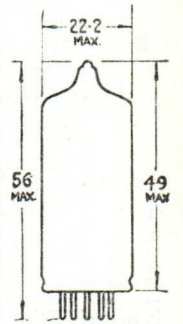
Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·435 amp.

RATINGS.*

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
†Max. Anode Dissipation ...	2·5 watts.
Max. Cathode Current ...	15 mA.
Max. Negative Grid Voltage ...	100 volts.
Max. R_{g-k}	1 mΩ
Max. R_{h-k}	20 kΩ
Max. V_{h-k}	90 volts.



CHARACTERISTICS.*

→ Anode Voltage	250 volts.
→ Grid Voltage	−2·2 volts.
Anode Current	10 mA.
Amplification Factor	57 mA.
→ Mutual Conductance	6·0 mA/V.

TYPICAL OPERATION.

As R.F. Amplifier in F.M. or A.M. receivers.

Anode Supply Voltage	250 volts.
Anode Load Resistance	1·2 kΩ
Anode Voltage	240 volts.
Anode Current	10 mA.
Grid Voltage	−2 volts.
Cathode Bias Resistor	200 Ω
Mutual Conductance	6·2 mA/V.
→ Anode Impedance	9·4 kΩ
Equivalent Noise Resistance ...	500 Ω
Input Resistance (at 100 Mc/s.)	6·0 kΩ

As a self-oscillating Frequency Changer for F.M./A.M.

Anode Supply Voltage	250 volts.
Anode Load Resistance	12 kΩ
Grid Resistor	1·0 MΩ
Oscillator Voltage	3·0 volts.
Anode Current	5·3 mA.
Conversion Conductance ...	2·7 mA/V.
Anode Impedance	20 kΩ
Input Resistance (at 100 Mc/s.)	15 kΩ

All dimensions shown are in millimetres.

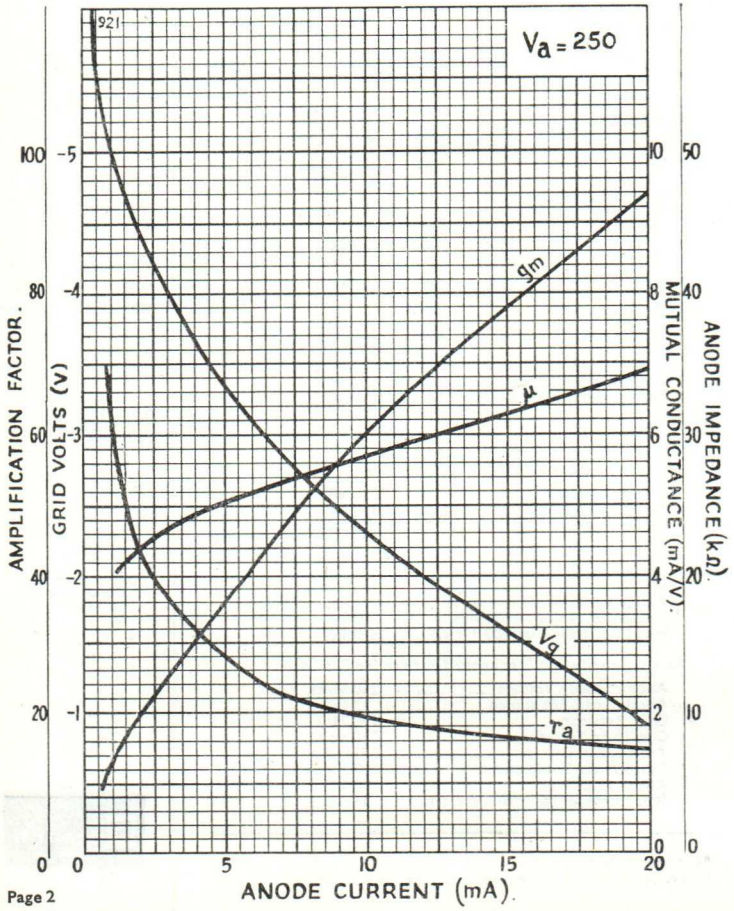
*Each section.
†Max. Total Anode Dissipation (pa′+pa″)=4.5 watts.

issue 2
June, 1960

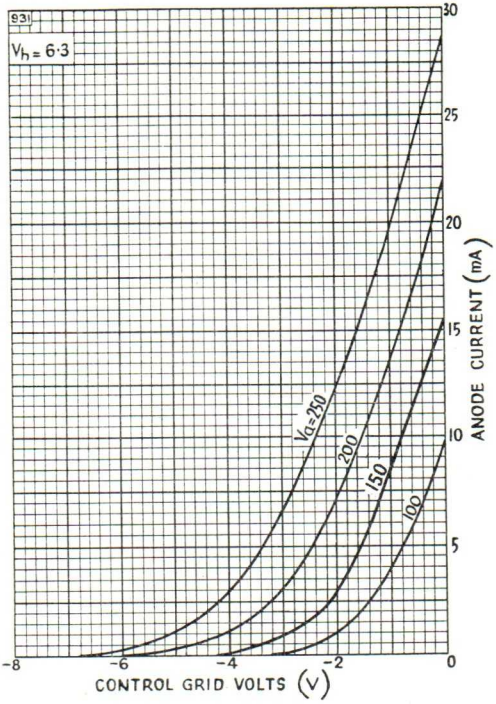
CAPACITANCES (measured without external shield).

*C_{in}	3·0 pF.
*C_{out}	1·2 pF.
†*C_{out}	1·9 pF.
*C_{a-k}	0·18 pF.
*C_{a-g}	1·6 pF.
$C_{a'-a''}$	<0·04 pF.
†$C_{a'-a''}$	<0·008 pF.
$C_{g'-g''}$	<0·003 pF.
$C_{a'-g''}=C_{a''-g'}$	<0·008 pF.
$C_{a'-k''}=C_{a''-k'}$	<0·008 pF.
$C_{g'-k''}=C_{g''-k'}$	<0·003 pF.

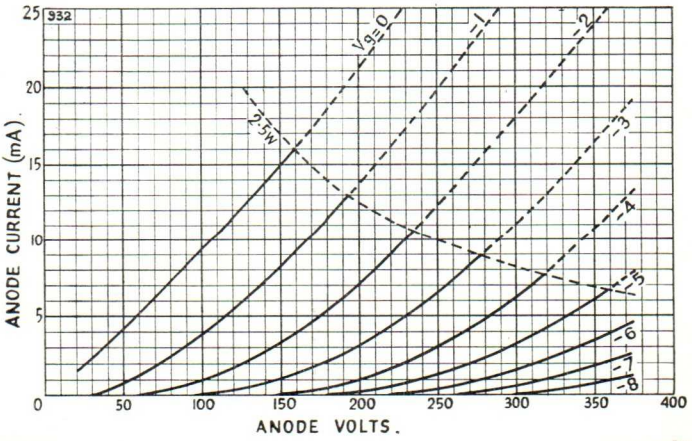
*Each Section.
†Measured with external shield.



Typical I_a/V_g Characteristics.



Typical I_a/V_a Characteristics.



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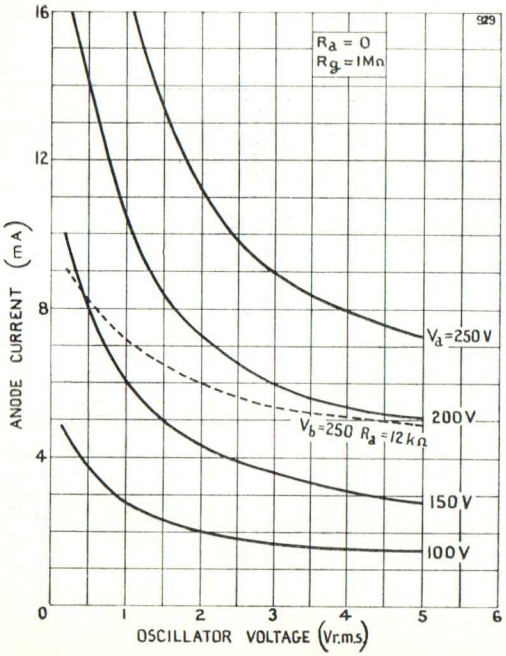
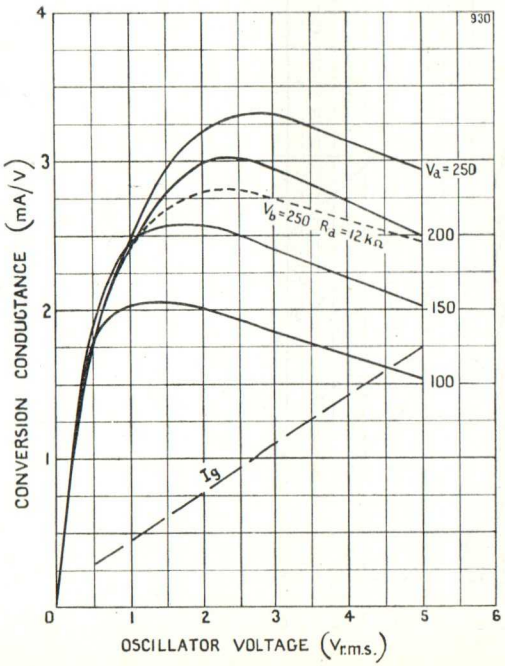
Ferranti

ECC85
6AQ8

Typical I_a/V_{osc} Characteristics.



Typical g_c/V_{osc} Characteristics.



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

R875

FERRANTI

V.H.F. DOUBLE TRIODE

ECC91

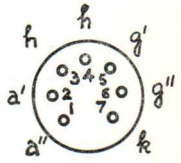
A double triode, with common cathode, designed for use as an R.F. power amplifier or oscillator.

PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	54·5 mm. (2 5/32 in.).
Max. Seated Height	47·5 mm. (1 7/8 in.).
Max. Diameter	19 mm. (3/4 in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 4—Heater.
Pin 2—Anode Triode 1. Pin 5—Grid Triode 1.
Pin 3—Heater. Pin 6—Grid Triode 2.
Pin 7—Cathode.



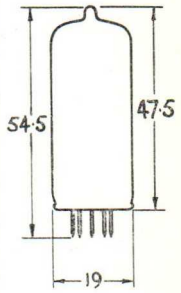
Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·45 amp.

RATINGS.§

Max. Anode Voltage	300 volts.
Max. Anode Current	15 mA.
Max. Anode Dissipation ...	1·5 watts.
Max. Negative Grid Voltage ...	40 volts.
Max. Grid Current	8 mA.
Max. V_{h-k}	100 volts.
Max. R_{g-k} (Cathode Bias) ...	1·0 MΩ



TYPICAL OPERATION.§

Class A1 Amplifier.

Anode Voltage	100 volts.
Anode Current	8·5 mA.
*Auto-bias Resistor	50 ohms†
Mutual Conductance	5·3 mA/V.
Amplification Factor	38
Anode Impedance	7100 ohms.

R.F. Power Amplifier. Class C Telegraphy**

Anode Voltage	150 volts.
Anode Current	15 mA.
‡Grid Voltage	−10 volts.
Auto Bias Resistor	220 ohms.
Grid Resistor	625 ohms.
Grid Current	8 mA.
Driving Power (both sections)	0.35 watts (approx.).
Power Output (both sections)	3·5 watts (approx.).

CAPACITANCES.§

C_{in}	2·2 pF.
C_{out}	0·4 pF.
C_{a-g}	1·6 pF.

All dimensions shown are in millimetres.

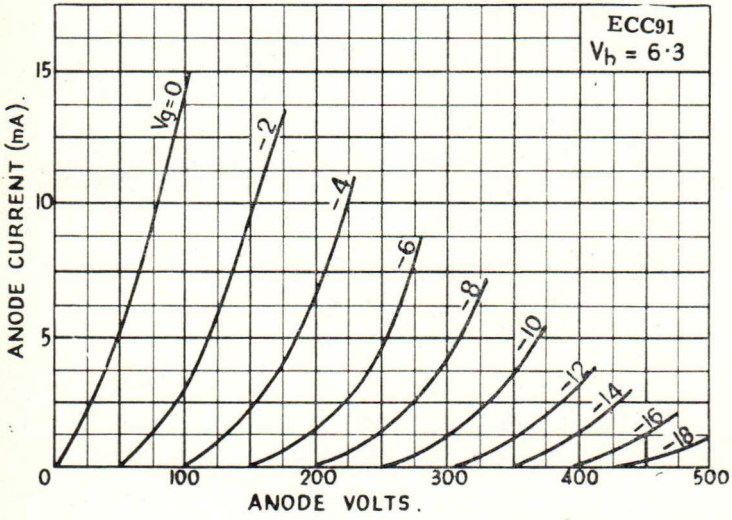
§Each Section, unless otherwise indicated.
*Fixed bias operation is not recommended.
†Value is for both units operating at the specified conditions.
‡Obtained from a fixed supply or from a grid or cathode resistor of the value shown.
**An output of 1 watt may be obtained from an ECC91 in a push-pull oscillator at 250 Mc/s. with Va = 150 volts, and maximum rated anode dissipation, and with a common grid resistor of 2000 ohms.

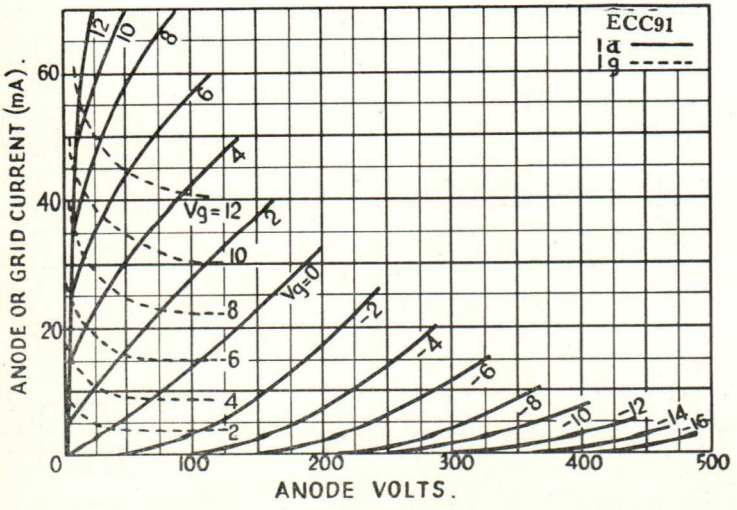
FERRANTI

Issue 1.
Dec., 1955

ECC91

FERRANTI



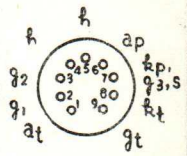


Ferranti

TRIODE PENTODE

ECF80

Combined high slope R.F. pentode and triode with separate cathodes. Designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 Mc/s.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode.	Pin 6—Pentode Anode.
Pin 2—Pentode g_1	Pin 7—Pentode Cathode, g_3 and shield.
Pin 3—Pentode g_2	
Pin 4—Heater.	Pin 8—Triode Cathode.
Pin 5—Heater.	Pin 9—Triode Grid.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·43 amp.

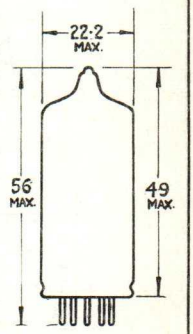
RATINGS.

PENTODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	175 volts.*
Max. Anode Dissipation	1·7 watts.
Max. Screen Dissipation	0·5 watts.†
Max. Cathode Current	14 mA.
**Min Negative Grid Voltage	−1·3 volts.
Max. V_{h-k} (heater positive) ...	100 volts.
‡Max. V_{h-k} (heater negative) ...	150 volts.
Max. R_{g1-k} (auto bias)	1·0 MΩ
Max. R_{g1-k} (fixed bias)	0·5 MΩ

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation	1·5 watts.
Max. Cathode Current	14 mA.
§Max. Peak Cathode Current ...	200 mA.
Max. R_{g-k}	0·5 MΩ
**Max. Negative Grid Voltage ...	−1·3 volts.
Max. Peak Instantaneous Negative Grid Voltage	350 volts.
‡Max. V_{h-k} (heater negative) ...	150 volts.
Max. V_{h-k} (heater positive) ...	100 volts.



CHARACTERISTICS.

	Pentode Sect.	Triode Sect.	
Anode Voltage ...	250	100	volts.
Screen Voltage ...	200	–	volts.
Grid Bias Voltage ...	−3·2	−2	volts.
Anode Current ...	7	14	mA.
Screen Current ...	1·8	–	mA.
Mutual Conductance	5·5	5·0	mA/V.
Anode Impedance ...	900	4	kΩ
μ	–	20	
Inner μ	47	–	
Input Impedance (f=50 Mc/s.)	11	–	kΩ
Equivalent Noise Resistance	1·5	–	kΩ

All dimensions shown are in millimetres.

*May be increased to 200 volts with cathode current not exceeding 10 mA.

†May be increased to 0·75 watts with anode dissipation not exceeding 1·2 watts.

‡Max. d.c. component 150 volts.

§Max. duration of pulse 200 μsecs.

**At grid current of 0·3 μA.

Issue 1.
May, 1960

Ferranti

TYPICAL OPERATION (as Frequency Changer)

Supply Voltage ...	Vb	250	250	volts.
Anode Voltage ...	Va	250	250	volts.
Screen Feed Resistor ...	V_{g2}	47	68	kΩ
Grid Resistor	R_{g1}	100	100	kΩ
Auto Bias Resistor ...	Rk	820	0	ohms.
Anode Current ...	Ia	5·7	5·6	mA.
Screen Current ...	I_{g2}	1·4	1·5	mA.
Oscillator Voltage ...	Vosc.	3·5	4·0	volts (r.m.s.)
Conversion Conductance	gc	2·1	1·95	mA/V.
Anode Impedance ...	ra	1·5	1·15	MΩ
Grid Current	I_{g1}	0	58	μA.

CAPACITANCES (without external shield).

$C_{a_p-a_t}$	<0·06 pF.
$C_{a_p-g_t}$	<0·02 pF.
$C_{g_p-a_t}$	<0·16 pF.
$C_{g_p-g_t}$	<0·02 pF.

Pentode Section.

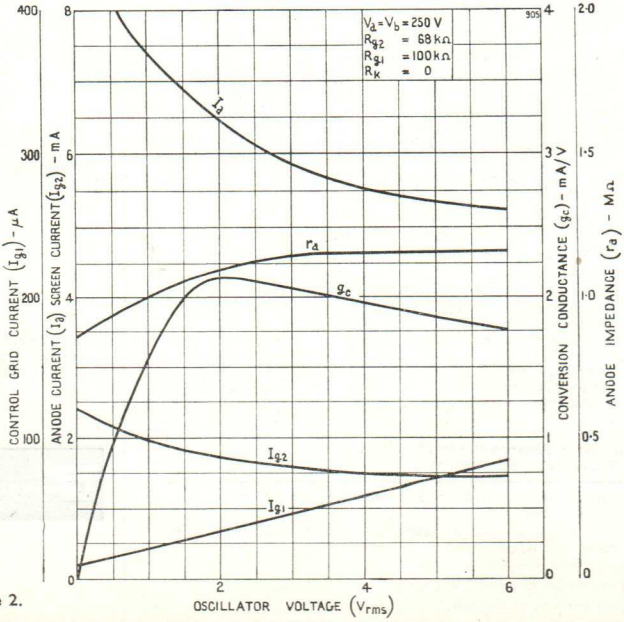
C_n	5·3 pF.
C_{out}	3·6 pF.
C_{a-g_1}	<0·025 pF.

Triode Section.

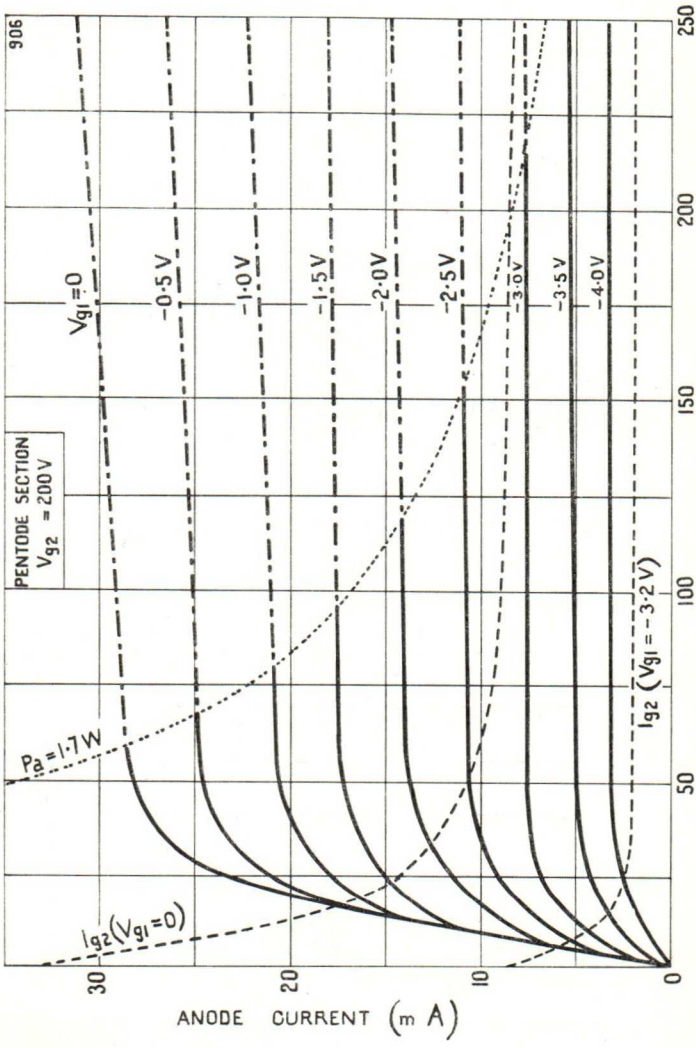
C_{g-k+h}	2·5 pF.
C_{a-k+h}	1·8 pF.
C_{a-g}	1·5 pF.

OPERATING NOTE.

*Variations in heater-cathode capacitance may render this valve unsuitable for use in Hartley oscillator circuits, particularly in F.M. receivers; it is recommended that a Colpitts type of circuit be employed.



Anode Current/Anode Voltage Characteristics—Pentode Section.



Issue 1
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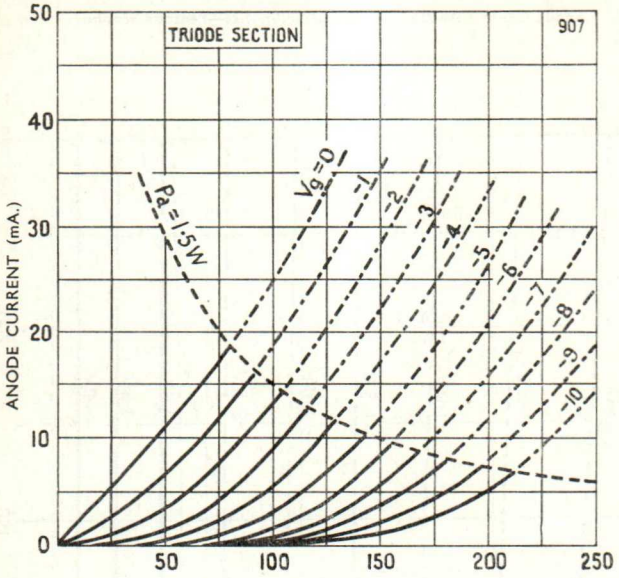
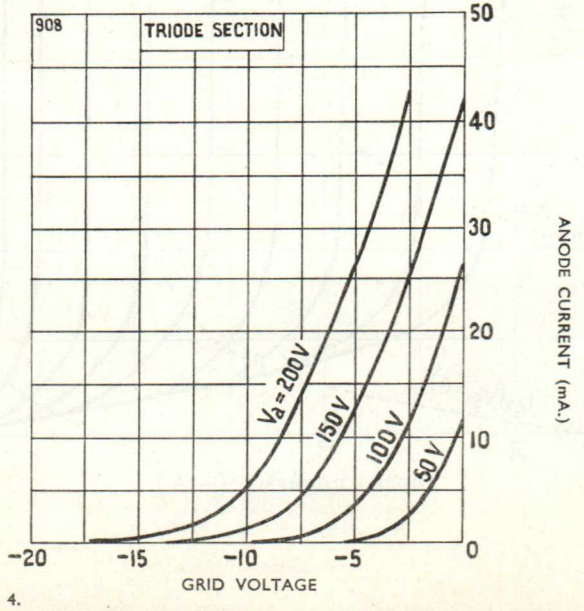
Anode Current/Anode Voltage Characteristic—Triode Section.



Anode Current/Grid Voltage Characteristics—Triode Section.



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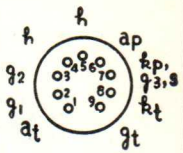
ECF82

6U8

TRIODE PENTODE

Designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 M/cs. The Triode and Pentode sections have separate cathodes.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{3}{32}$ins.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$ins.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode
Pin 2—Pentode g_1
Pin 3—Pentode g_2
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Pentode cathode, $g_{3,s}$.
Pin 8—Triode Cathode.
Pin 9—Triode Grid.

HEATER.

Heater Voltage	6·3 volts
Heater Current.	0·45 amp.

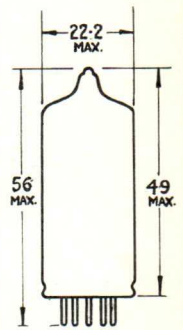
RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	300 volts.
Max. Anode Dissipation	2·8 watts.
Max. Screen Dissipation	0·5 watts.
Max. Neg. Grid Voltage (for $I_g < +0·3\mu A.$)	−1·3 volts.
Max. Cathode Current...	20 mA.
Max. V_{h-kp} (heater positive)	100 volts.
(heater negative)	100 volts.
Max. R_{g1-kp}	1·0 MΩ
Max. R_{h-kp}	20 kΩ

TRIODE SECTION.

Max. H.T. Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation	1·5 watts.
Max. Neg. Grid Voltage (for $I_g < +0·3\mu A.$)	−1·3 volts.
Max. Cathode Current	20 mA.
Max. V_{h-kt} (heater positive)	100 volts.
(heater negative)	100 volts.
Max. R_{gt-kt}	1·0 MΩ
Max. R_{h-kt}	20 kΩ



CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage	250 volts.
Screen Voltage	110 volts.
Cathode Bias Resistor	68 ohms
Anode Current	10 mA.
Screen Current	3·5 mA.
Mutual Conductance	5·2 mA/V.
Anode Impedance	400 kΩ
Inner μ	32
V_{g1} for cut-off	−10 volts.

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Issue 2
Nov. 1960

CHARACTERISTICS (Continued).

TRIODE SECTION.

Anode Voltage	150 volts.
Cathode Bias Resistor	180 ohms.
Anode Current	11 mA.
Mutual Conductance	5·6 mA/V.
Anode Impedance	6·0 kΩ
μ	34

TYPCIAL OPERATING CONDITIONS (As Frequency Changer).

TRIODE as Oscillator.

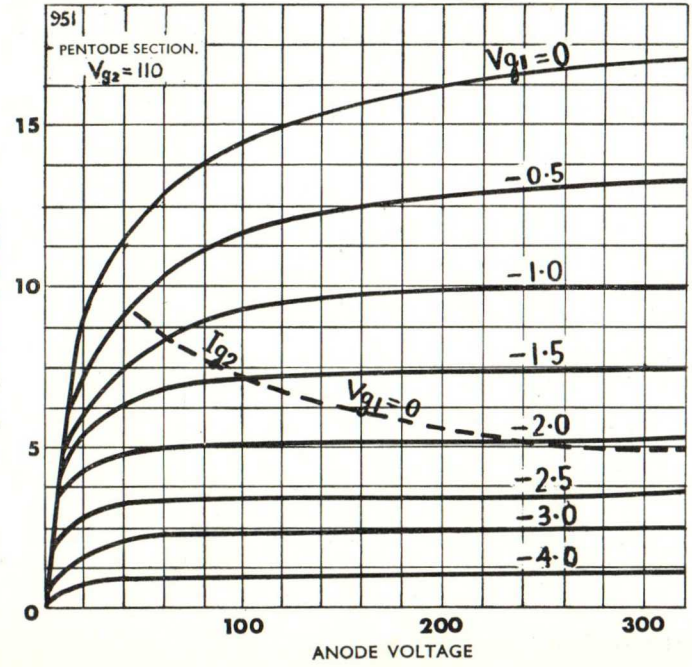
Anode Supply Voltage	$V_{a(b)}$	170	200	250	volts.
Anode Resistor ...	R_a	20	20	20	kΩ
Grid Resistor ...	R_g	20	20	20	kΩ
Oscillator Voltage ...	$V_{osc.}$	3	3	3	Volts. (r.m.s.).
Anode Current ...	I_a	3·3	4·1	5·7	mA.
Grid Current ...	I_g	160	160	160	μA.
Mutual Conductance	gm(eff)	2·8	3·2	3·9	mA/V.

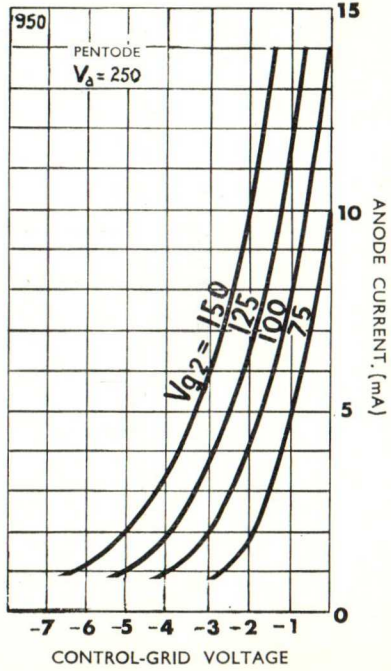
PENTODE as Mixer.

Anode Voltage ...	V_a	170	200	250	volts.
Screen Feed Resistor	R_{g_2}	30	45	70	kΩ
Grid Resistor ...	R_{g_1}	1	1	1	MΩ
Grid Voltage	V_{g_1}	0	0	0	volts.
Oscillator Voltage ...	$V_{osc.}$	3	3	3	volts. (r.m.s.).
Anode Current ...	I_a	5·0	5·0	5·2	mA.
Screen Current ...	I_{g_2}	2·0	2·0	2·0	mA.
Grid Current ...	I_{g_1}	3·7	3·7	3·7	μA.
Conversion Conductance	gc	1·75	1·65	1·8	mA/V.

CAPACITANCES	with ext. shield	without ext. shield
C_{ap-at}	0·018	<0·07 pF.
C_{ap-gt}...	0·0035	0·008 pF.
Pentode Section.		
C_{in}	5·0	5·0 pF.
C_{out}	3·5	2·6 pF.
C_{a-g_1}	<0·006	<0·01 pF.
C_{h-k}	3·0	3·0 pF.
Triode Section.		
C_{in}	2·5	2·5 pF.
C_{out}	1·0	0·4 pF.
C_{a-g}	1·8	1·8 pF.
C_{h-k}	3·0	3·0 pF.

Typical Characteristics – PENTODE Section





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ECF82
6U8

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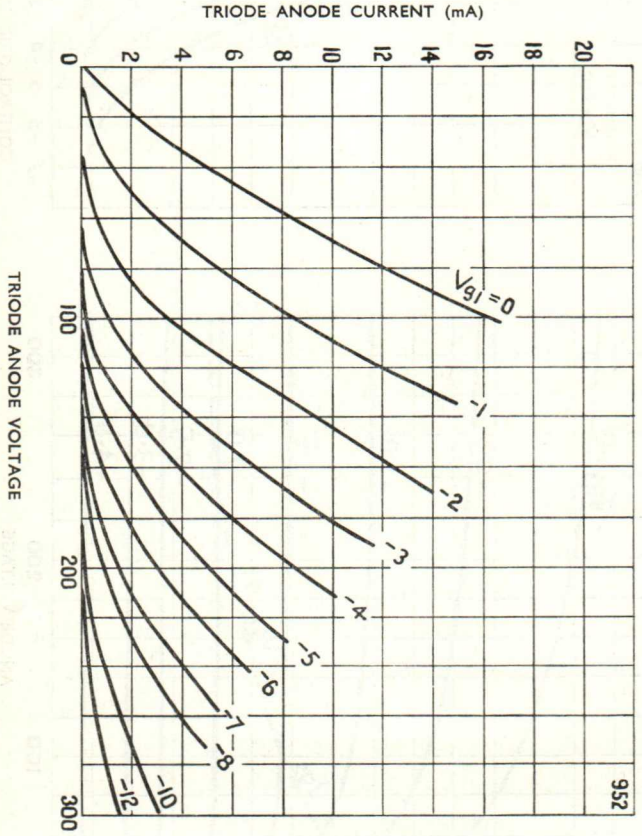
Typical Characteristics – TRIODE Section.



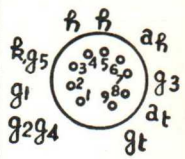
Ferranti

TRIODE HEPTODE

ECH81

6AJ8

An indirectly heated triode heptode for use with series or parallel heater connection on AC. or DC. mains. Primarily designed for use as a frequency changer, the heptode section can be used as R.F. or I.F. amplifier.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	67·5 mm. ($2\frac{11}{16}$ins.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$ins.).
Max. Diameter (Bulb)	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTION.

Pin 1—Heptode Grids, g_2, g_4
Pin 2—Heptode Grid g_1
Pin 3—Cathode, g_5, shield.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Heptode Anode.
Pin 7—Heptode Grid g_3.
Pin 8—Triode Anode.
Pin 9—Triode Grid.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amps.

RATINGS.

HEPTODE SECTION.

Max. Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Grid Voltage ...	125 volts.
Max. Screen Grid Voltage (Ia <1mA)	300 volts.
Max. Anode Dissipation	1·7 watts.
Max. Screen Grid Dissipation ...	1·0 watts.
Max. Cathode Current	12·5 mA.
Max. Grid No. 1 Voltage (I_{g1}=+0·3 μA)	−1·3 volts.
*Max. Grid No. 3 Voltage (I_{g3}=+0·3 μA)	−1·3 volts.
Max. R_{g1-k}	3·0 Megohms.
Max. R_{g3-k}	3·0 Megohms.

TRIODE SECTION.

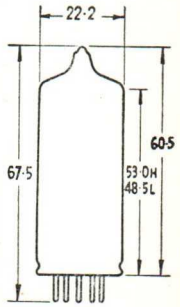
Max. Anode Voltage	250 volts.
Max. Anode Dissipation	0·8 watt.
Max. Mean Cathode Current ...	6·5 mA.
Max. Grid Voltage (I_g=+0·3 μA)	−1·3 volts.
Max. Grid-Cathode Resistor ...	3·0 Megohms.

Max. Heater-Cathode Voltage ...	100 volts
Max. Heater-Cathode Resistance	20,000 ohms.

CHARACTERISTICS.

TRIODE SECTION.

Anode Voltage	100 volts.
Grid Voltage	0 volts.
Anode Current	13·5 mA.
Amplification Factor	22
Mutual Conductance	3·7 mA/V.



Dimensions in millimetres.

*The maximum value of R_{g3-k} must not exceed 20kΩ if the two sections of the valve are switched in operation so that there is no direct connection between g_3 and g_t (e.g. in FM/AM applications.

Issue 2.
June, 1960

Ferranti

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TYPICAL OPERATING CONDITIONS.

HEPTODE SECTION.

(as A.M. Frequency Changer).

Anode Supply Voltage	$V_a = V_b$	250	250	250 volts.
Screen Grid Feed Resistor	Rg_2g_4	22	*22	†18 kΩ
Oscillator Grid Resistor	Rg_3g_t	47	47	47 kΩ
Oscillator Grid Current	Ig_3g_t	200	200	200 μA.
Grid Voltage	Vg_1	–2	–2	–1·9 volts.
Anode Current ...	I_a	3·25	2·5	3·0 mA.
Screen Grid Current	Ig_2g_4	6·7	5·5	6·1 mA.
Conversion Conductance	g_c	775	700	750 μA/V.
Anode Impedance ...	r_a	1	1	1 MΩ
Equivalent Noise Resistance ...	R_{eq}	70	66	70 kΩ
Grid Voltage (for 100/1 reduction in g_c)	Vg_1	–28·5	–28·5	–28·5 volts.

*Common screen grid resistor with valve type EBF80 or 6N8. Total Current 7·2 mA.

†Common screen grid resistor with EF85 or 6BY7. Total Current 8·5 mA.

(as I.F. or R.F. Amplifier).

Anode Supply Voltage ...	$V_a = V_b$	250	250	volts.
Screen Grid Feed Resistor ...	Rg_2g_4	39	‡22	kΩ
Screen Grid Voltage	Vg_2g_4	100	105	volts.
Suppressor Grid Voltage ...	Vg_3	0	0	volts.
Control Grid Voltage ...	Vg_1	–2	–2·1	volts.
Anode Current	I_a	6·5	6·5	mA.
Screen Grid Current ...	Ig_2g_4	3·8	4·1	mA.
Mutual Conductance ...	g_m	2·4	2·4	mA/V.
Anode Impedance	r_a	0·7	0·7	MΩ
Inner mu.	$\mu g_1 - g_2 g_4$	20	20	
Equivalent Noise Resistance	R_{eq}	8·5	8·5	kΩ
Input Resistance at 100 Mc/s.	r_{in}	2·0	2·0	kΩ
Grid Voltage (for 100:1 reduction in g_m) ...	Vg_1	–42	–42	volts.

‡Common screen grid resistor with valve type EF85 or 6BY7. Total Current is 6·7 mA.

TRIODE SECTION.

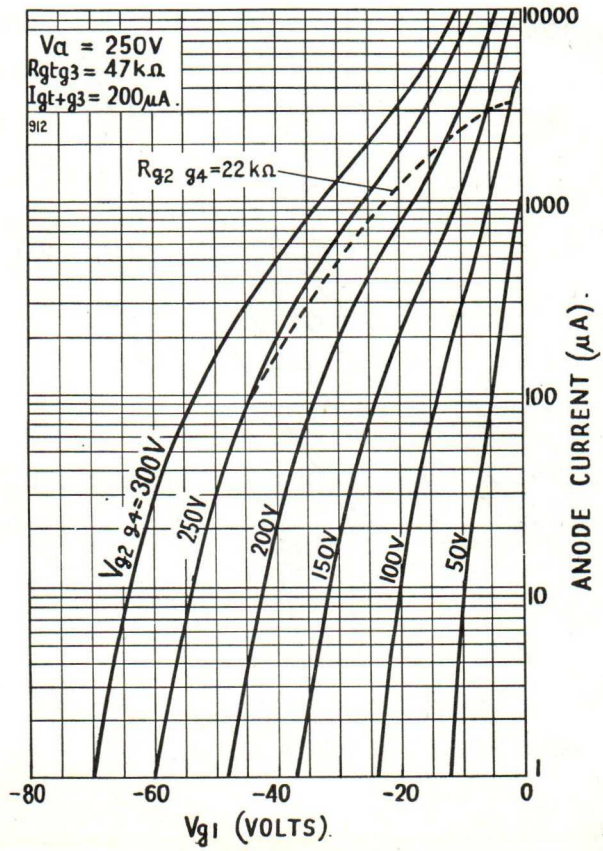
(as Oscillator).

Supply Voltage	V_b	250	volts.
Anode Load Resistor	R_{at}	33	kΩ
Grid Resistor	R_{gt}	47	kΩ
Grid Current	Ig_t	200	μA.
Anode Current	I_{a_t}	4·5	mA.
Mutual Conductance	g_m (eff)	650	μA/V.

CAPACITANCES.

	Triode.	Heptode.
C_{out}	2·2	7·9 pF.
C_{in}	2·6	(g_1) 4·8 pF.
		(g_3) 6·0 pF.
C_{a-g}	1·0	<0·01 pF.
C_{g-h}	<0·02	<0·02 pF.
$C_{g_1-g_3}$		<0·3 pF.
C_{g_3-h}		<0·06 pF.
C_{ah-at}	0·20 pF.	
C_{ah-gt}	<0·09 pF.	
$C_{ah-g_3g_t}$	<0·35 pF.	
$C_{g_1-g_t}$	<0·06 pF.	
C_{g_1-gt}	<0·17 pF.	
$C_{g_1-g_3g_t}$	<0·45 pF.	

Typical Anode Current/Grid Voltage Characteristics when used as Frequency Changer.



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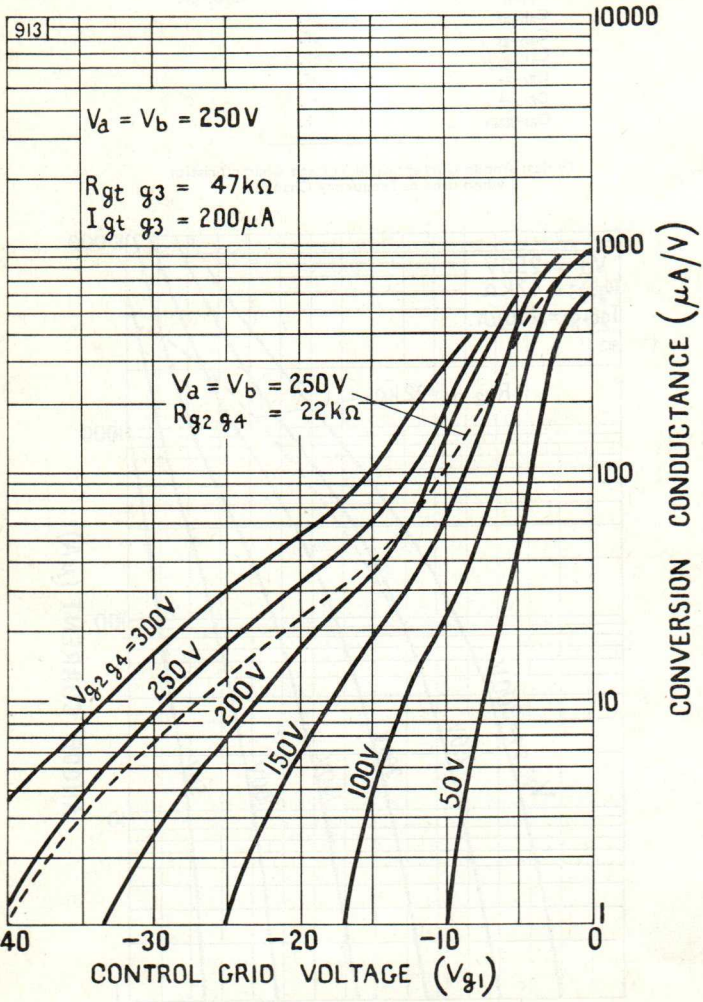
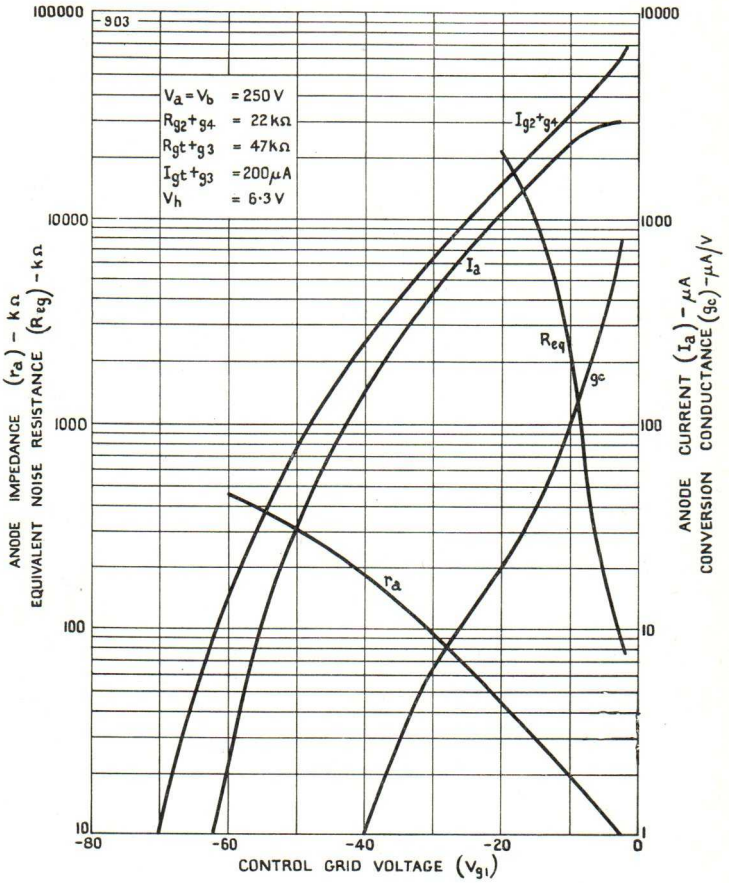
Typical Conversion Conductance/Grid Voltage/Screen Voltage when used as Frequency Changer.



Typical Characteristics as Frequency Changer.



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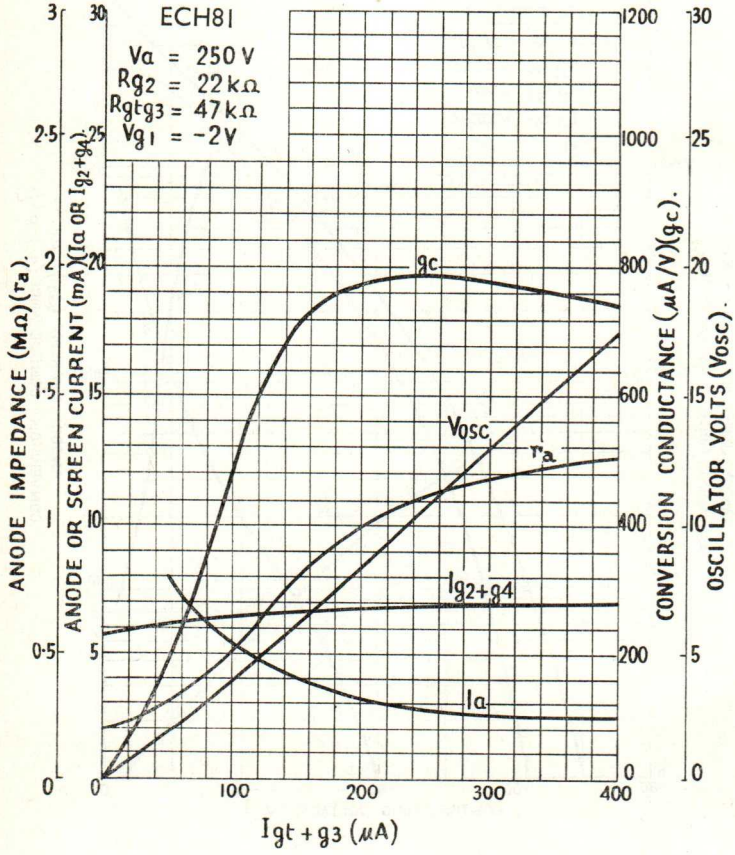
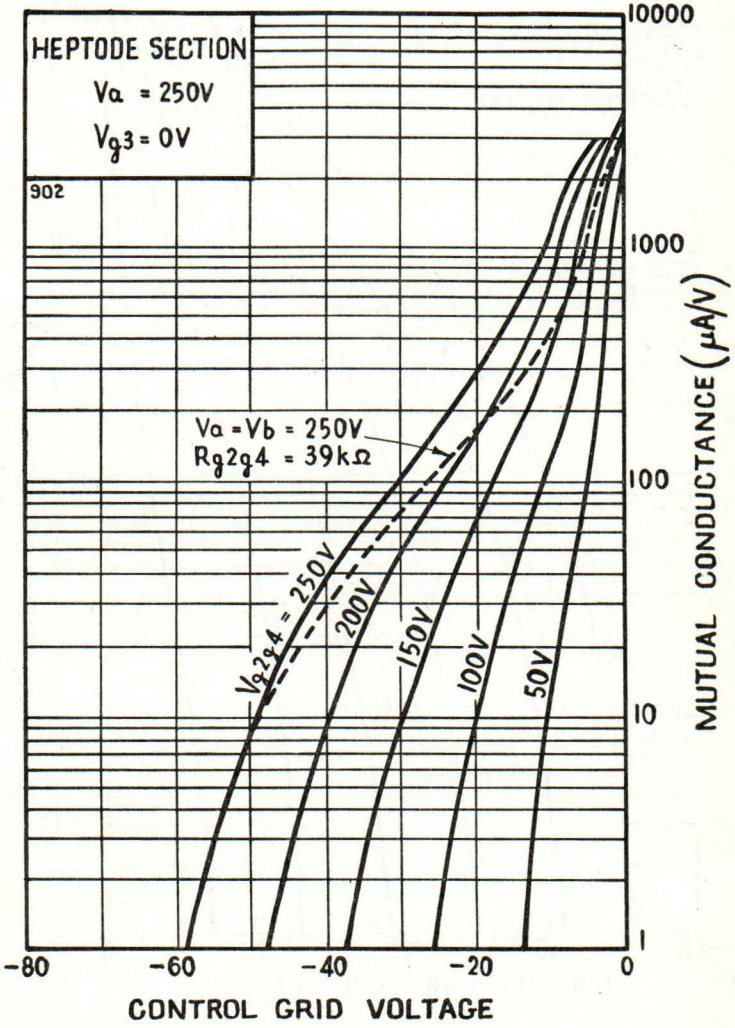
Typical Characteristics as Frequency Changer.



Typical Mutual Conductance/Grid Voltage Characteristics—Heptode Section.



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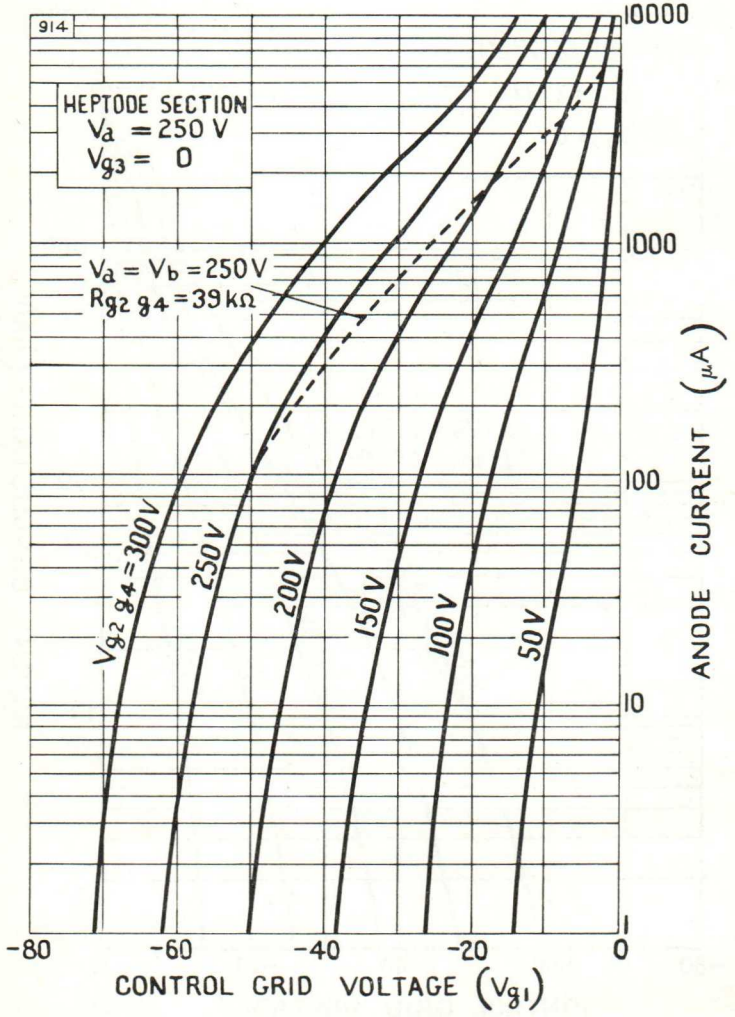
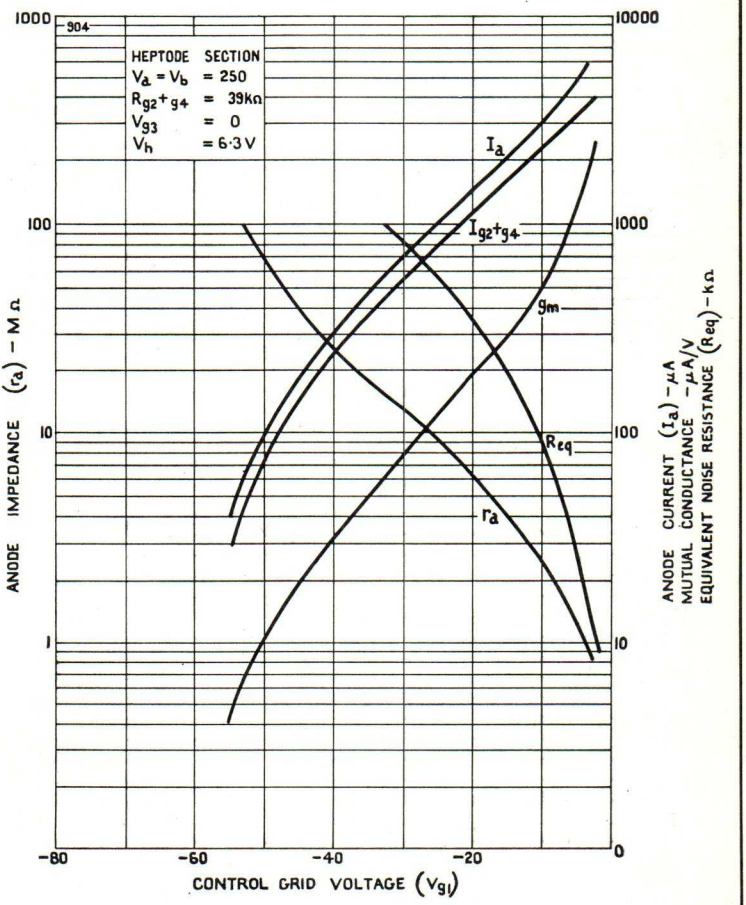
Typical Anode Current/Grid Voltage Characteristics—Heptode Section.



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Characteristics—Heptode Section.



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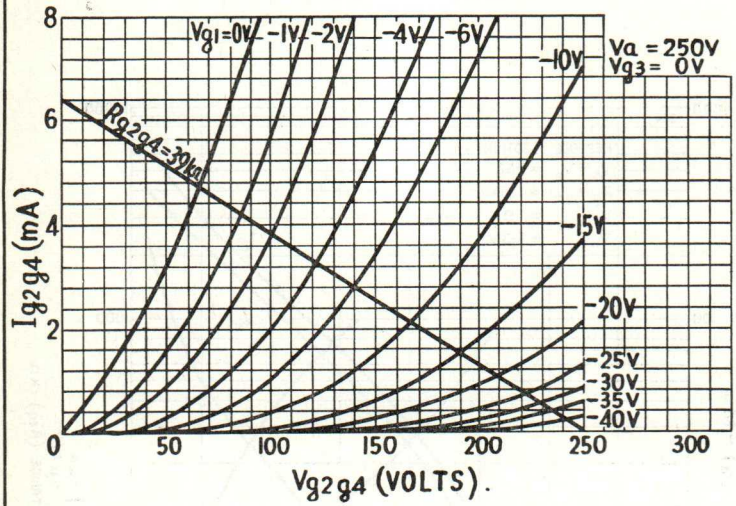
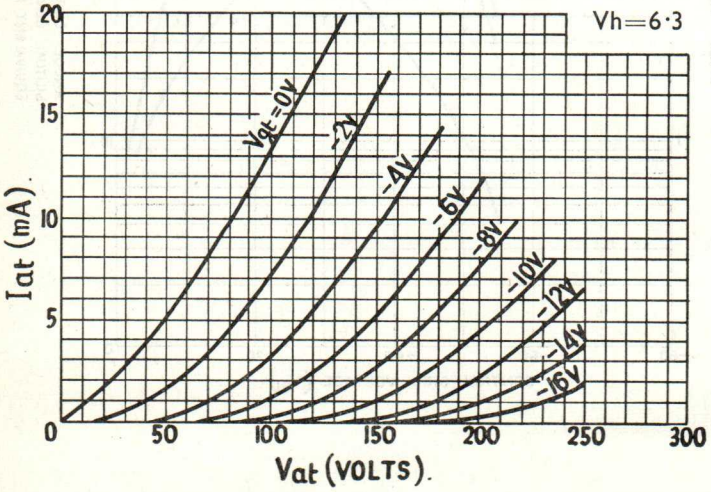
Typical Screen Grid Characteristics.
Heptode Section.



Typical Anode Current/Anode Voltage Characteristics.
Triode Section.



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

ECH84

TRIODE HEPTODE

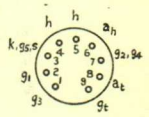
An indirectly heated triode heptode for use with series or parallel heater connection on AC. or DC. mains. Primarily designed for use as a synchronising pulse separator and time base oscillator.

PHYSICAL DETAILS.

Base	... ...	B9A—Noval
Max. Overall Length	... ...	67·5 mm. ($2\frac{21}{32}$")
Max. Seated Height	... ...	60·5 mm. ($2\frac{3}{8}$")
Max. Diameter (Bulb)	... ...	22·2 mm. ($\frac{7}{8}$")
Mounting Position	... ...	Any

BASE CONNECTIONS.

Pin 1—Heptode Grid g_3 Pin 5—Heater
Pin 2—Heptode Grid g_1 Pin 6—Heptode Anode
Pin 3—Cathode g_5 shield Pin 7—Heptode Grids g_2, g_4
Pin 4—Heater Pin 8—Triode Anode
Pin 9—Triode Grid



Base Connections Underside View of Base

HEATER.

Heater Voltage	... ...	6·3 volts
Heater Current	... ...	0·3 amps

RATINGS.

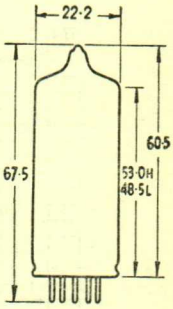
HEPTODE SECTION

Max. Supply Voltage	... ...	550 volts
Max. Anode Voltage	... ...	250 volts
Max. $V_{g_2+g_4}$	... ...	250 volts
Min. $V_{g_2+g_4}$	... ...	10 volts
Max. Anode Dissipation	...	1·7 watts
Max. g_2+g_4 Dissipation	...	0·8 watts
Max. Cathode Current	... ...	12·5 mA
Max. Negative V_{g_1}(pk)	... ...	150 volts
Max. Negative V_{g_3}(pk)	... ...	150 volts
Max. R_{g_1-k}	... ...	3·0 Megohms
Max. R_{g_3-k}	... ...	3·0 Megohms

TRIODE SECTION

Max. Supply Voltage	... ...	550 volts
Max. Anode Voltage	... ...	250 volts
Max. Anode Dissipation	...	1·3 watts
Max. Mean Cathode Current	...	10 mA
Max. Peak Grid Voltage	...	−200 volts
Max. Grid-Cathode Resistor	...	3·0 Megohms

Max. Heater-Cathode Voltage ... 100 volts



Dimensions in millimetres.

Tentative
Issue 1.
Mar., 1964

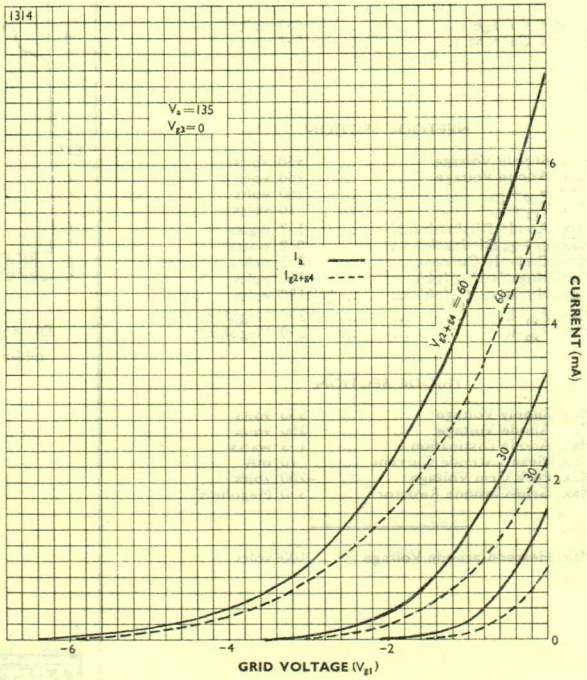
Ferranti

CHARACTERISTICS.

	Triode Section	Heptode Section
V_a	50	135 volts
V_{g3}	—	0 volts
V_{g2+g4}	—	14 volts
V_{g1}	0	0 volts
I_a	3·0	1·7 mA
$I_a(V_{at}=200\ V_{gt}=-11)$	<0·1	— mA
I_{g2+g4}	—	0·9 mA
gm	3·7	2·2 mA/V
μ	50	—
$V_{g3}(I_{ah}=20\mu A)$	—	−2·0 volts
$V_{g1}(I_{ah}=20\mu A)$	—	−1·9 volts

CAPACITANCES.

C_{ah-at}	<0·25 pF
C_{ah-gt}	<0·09 pF
C_{g1-at}	<0·08 pF
C_{g1-gt}	<0·1 pF
C_{g3-at}	<0·13 pF
Heptode Section.	
C_{a-g1}	<0·009 pF
Triode Section.	
C_{in}	3·0 pF
C_{a-g}	1·1 pF



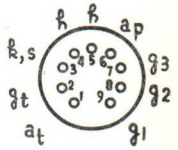
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS

FERRANTI

TRIODE PENTODE

ECL80

An indirectly heated triode pentode for use with series or parallel heater connection on a.c. or d.c. mains. Primarily designed for use with the triode as a frame blocking oscillator and the pentode as a frame output valve. The triode section may also be used as a line blocking oscillator or audio voltage amplifier, whilst the pentode section may be used as a sync. pulse separator or audio output valve.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	... ...	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter (Bulb)	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode. Pin 5—Heater.
Pin 2—Triode Grid. Pin 6—Pentode Anode.
Pin 3—Cathode, shield. Pin 7—Pentode Suppressor Grid.
Pin 4—Heater. Pin 8—Pentode Screen Grid.
Pin 9—Pentode Control Grid.

HEATER.

Heater Voltage	... ...	6·3 volts.
Heater Current	... ...	0·3 amps.

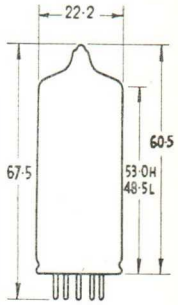
RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	550 volts.
Max. Anode Voltage	400 volts.
Max. Peak Instantaneous Anode Voltage	1·2 kV.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation	3·5 watts.
Max. Screen Dissipation	1·2 watts.
Max. Cathode Current	25 mA.
Max. Peak Instantaneous Cathode Current	350 mA.
§Min. Negative Grid Voltage	1·3 volts.
†Max. Grid Resistor (1k=12 mA) ...	2·2 MΩ
‡Max. Grid Resistor (1k=20 mA) ...	1·0 MΩ
Max. V_{h-k}	150 volts.
Max. R_{h-k}	20 kΩ

TRIODE SECTION.**

Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	200 volts.
Max. Anode Dissipation	1 watt.
Max. Cathode Current	8 mA.
*Max. Peak Instantaneous Cathode Current	200 mA.
Max. R_{gt-k}	3 MΩ
Max. V_{h-k}	150 volts.
Max. R_{h-k}	20 kΩ



CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage ...	0	0	volts.
Control Grid Voltage	−6·7	−8·0	volts.
Anode Current	15	17·5	mA.
Screen Current	2·8	3·3	mA.
Mutual Conductance	3·2	3·3	mA/V.
Anode Impedance	150	150	kΩ
Inner μ	14	14	

All dimensions shown are in millimetres (max.).

*Max. pulse duration 10% of one cycle, with a maximum of 2 millisecs.
§At grid current of 0·3 μA.
†As frame output valve.
‡As audio output valve.
**When the triode section is used in amplifier circuits where the input voltage for an output of 50 mW. is less than 50 mV. no special precautions need be taken against microphony.

Issue 2
Aug., 1957

FERRANTI

CHARACTERISTICS—continued.

TRIODE SECTION.

Anode Voltage	100 volts.
Grid Voltage	−2·3 volts.
Anode Current	4·0 mA.
Anode Impedance	12·5 kΩ
Amplification Factor	17·5
Mutual Conductance	1·4 mA/V.

TYPICAL OPERATION.

PENTODE SECTION

(as Audio Output Valve).

Anode Voltage	170	200	250	volts.
Screen Voltage	170	200	*	volts.
Suppressor Grid Voltage	0	0	0	volts.
Control Grid Voltage ...	−6·7	−8·0	−12.2	volts.
**Anode Current ...	15	17·5	14	mA.
**Screen Current	2·8	3·3	2·6	mA.
Mutual Conductance ...	3·2	3·3	2·6	mA/V.
Anode Load	11	11	17·5	kΩ
†Input Voltage	0·7	0·7	—	volts (r.m.s.)
‡Input Voltage	3·5	4·0	—	volts (r.m.s.)
‡Power Output	1·0	1·4	1·55	watts.

(as Frame Output Valve).

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage ...	0	0	volts.
Control Grid Voltage	−9	−10·6	volts.
**Anode Current	8·5	10·0	mA.
**Screen Current	1·6	1·9	mA.

(as Sync. Separator).

Anode Voltage	20	20	volts.
Screen Voltage	12	12	volts.
Suppressor Grid Voltage ...	0	0	volts.
Cathode Grid Voltage	0	−1.45	volts.
Anode Current	2	0·1	mA.

TRIODE SECTION.

(as A.F. Amplifier).

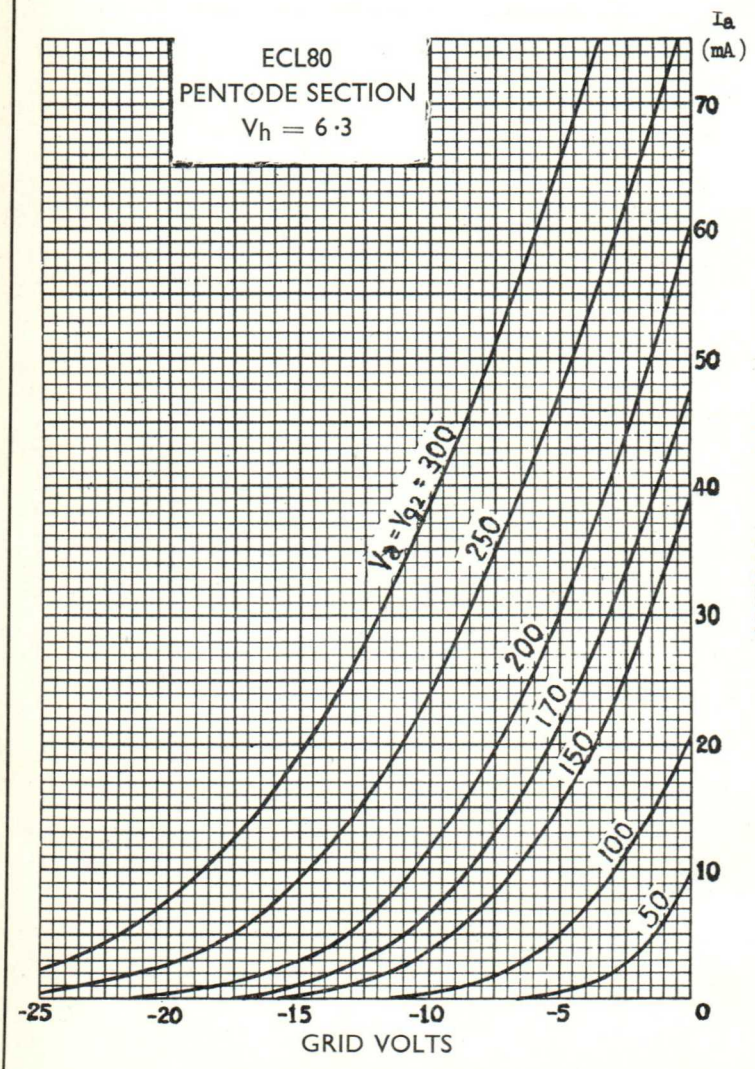
Anode Voltage	170	200	250	volts.
Grid Voltage	−3·5	−4·2	−5·5	volts.
Anode Current	1·0	0·6	0·75	mA.
Anode Load	400	220	220	kΩ
Stage Gain	10·5	11·0	11·0	
§Output Voltage ...	24	30	30	volts (r.m.s.)
Grid Resistor (following valve) ...	330	680	680	kΩ
§Total Distortion	7·6	6·5	5·5	%

CAPACITANCES.

	Pentode.		Triode.	
C_{in}	4·5		2·0	pF.
C_{out}	5·0		0·3	pF.
C_{a-g}	<0·2		0·9	pF.
C_{g-h}	<0·25		<0·05	pF.
$C_{g_t-a_p}$		<0·12		pF.
$C_{a_t-a_p}$		<1·2		pF.
$C_{a_t-g_p}$		<0·2		pF.
$C_{g_t-g_p}$		<0·2		pF.
C_{h-k}		3·7		pF.

*Screen Feed Resistor 4,700 ohms.
**No Signal.
†Power Output of 50 mW.
‡Total Distortion of 10%
§Output Voltage and Distortion at the start of positive grid current. At lower output voltages distortion is approximately proportional to the voltage.

ECL80
PENTODE SECTION
$V_{g2} = 170$ $V_h = 6{\cdot}3$
-1
-2
-4
-6
-8
-10
-12
$V_{g1} = 0$
$P_a = 3{\cdot}5$ W
$V_{g1} = 0$
0
50
100
150
200
250
300
350
ANODE VOLTS
50
40
30
20
10
0
ANODE CURRENT



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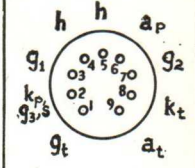
Ferranti

TRIODE PENTODE

ECL82

An indirectly heated triode pentode, primarily designed for use with the triode as a frame blocking oscillator and the pentode as a frame output valve, or as a combined audio voltage amplifier and output valve.



Underside View of Base

PHYSICAL DETAILS.

Base	... ...	... ...	B9A—Noval.
Max. Overall Length		... ...	78·5 mm. ($3\frac{9}{32}$in.).
Max. Seated Height		... ...	71·5 mm. (3in.).
Max. Diameter		... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position		... ...	Any.

BASE CONNECTIONS.

Pin 1—Triode Grid.
Pin 2—Pentode Cathode, g_3 and Shield.
Pin 3—Pentode Grid (g_1).
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Pentode Screen Grid (g_2).
Pin 8—Triode Cathode.
Pin 9—Triode Anode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·78 amps.

RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
*Max. Peak Positive Anode Voltage ...	+2·5 kV.
*Max. Peak Negative Anode Voltage ...	−500 volts.
Max. Anode Dissipation (frame output)	5 watts.
Max. Anode Dissipation (audio)	7 watts.
Max. Screen Grid Voltage	300 volts.
Max. Screen Grid Dissipation	1·8 watts.
Max. Screen Grid Dissipation (Speech and Music)	3·2 watts.
Max. Cathode Current	50 mA.
Max. V_{h-k}	100 volts.
Max. R_{g1-k} (fixed bias)	1·0 MΩ
Max. R_{g1-k} (cathode bias)	2·0 MΩ
Max. R_{h-k}	20 kΩ

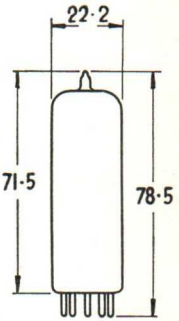
TRIODE SECTION.

Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
*Max. Peak Positive Anode Voltage ...	600 volts.
Max. Anode Dissipation	1 watt.
Max. Cathode Current	15 mA.
†Max. Peak Cathode Current	200 mA.
Max. R_{gt-k} (Fixed bias)	1 MΩ
Max. R_{gt-k} (Cathode bias)	3 MΩ
Max. R_{gt-k} (Grid current bias) ...	22 MΩ
Max. V_{h-k}	100 volts.
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage ...	100	200	250	volts.
Screen Grid Voltage	100	200	250	volts.
Suppressor Grid Voltage	0	0	0	volts.
Control Grid Voltage	−6	−16	−22·5	volts.
Anode Current ...	26	35	28	mA.
Screen Current ...	5	7	5·7	mA.
Mutual Conductance	6·8	6·4	5·0	mA/V.
Anode Impedance	15	20	25	kΩ
Inner μ	10	9·5	9·5	



Dimensions in millimetres

*Max. pulse duration 4% of one cycle, with a maximum of 800 μ sec.
†Max. pulse duration 200 μ sec.

Ferranti

Issue 2.
June, 1960

CHARACTERISTICS—continued.

TRIODE SECTION.

Anode Voltage	100 volts.
Grid Voltage	0 volts.
Anode Current	3·5 mA.
Mutual Conductance	2·5 mA/V.
Anode Impedance	28 kΩ
Amplification Factor	70

TYPICAL OPERATION

PENTODE SECTION.

As Frame Output Valve.

In order to allow for spread of characteristics and deterioration during life, the frame timebase output circuit should be designed around the following values.

Peak Anode Current	85 mA.
Anode Voltage (V_a)	50 volts.
Screen Grid Voltage (V_{g2})	170 volts.

For an average new valve with V_a and V_{g2} as above and V_{g1} adjusted so that $I_g = +0{\cdot}3\ \mu A$. The following value applies :

Peak Anode Current	135 mA.

As Audio Output Valve (Class A).

Anode Voltage ...	170	200	250	volts.
Screen Grid Voltage	170	200	*	volts.
Suppressor Grid Voltage	0	0	0	volts.
Control Grid Voltage	−12·5	−16	−22·5	volts.
Anode Current (no sig.)	35	35	28	mA.
Screen Grid Current (max. sig.) ...	6·5	7	5·5	mA.
Screen Current (max.sig.)	15	16	10·5	mA.
Anode Load ...	3·9	5·6	9·0	kΩ
Input Voltage ...	6	6·6	9·5	volts (rms.)
†Input Voltage ...	590	600	780	mV. (rms.)
‡Power Output ...	3·3	3·5	3·4	watts.

As Audio Amplifier (2 valves in Class AB push pull).

Anode Voltage	200	250	volts.
Screen Grid Supply Voltage	200	250	volts.
**Screen Grid Feed Resistor	0	2·7	kΩ
Supressor Grid Voltage	0	0	volts.
§Cathode Bias Resistor ...	190	390	ohms.
Anode Current (Zero signal)	2×35	2×21·5	mA.
Anode Current (Max. signal)	2×39·5	2×27·5	mA.
Screen Grid Current (Zero signal) ...	2× 7·0	2× 4·2	mA.
Screen Current (Max. signal)	2×16·5	2× 9·2	mA.
Input Voltage ($V_{in}(g_1-g_1)$)	25	38	volts
Optimum Load (Anode to Anode)	5	10	(rms. kΩ
Power Output	9·8	9·0	watts.

*Screen Grid Feed Resistor 2200 ohms, undecoupled.

†For Power Output of 50 mW.

‡Total Distortion of 10%. Output and Distortion measured at fixed bias and represent power output available for reproduction of speech and music.

**Common screen grid feed resistor, undecoupled.

§Common Cathode Bias Resistor.

TYPICAL OPERATION.

TRIODE SECTION.

As A.F. Voltage Amplifier.

Input Impedance = 220 kΩ.

V_b (V)	R_a (kΩ)	R_g (MΩ)	R_k (kΩ)	I_a (mA.)	* R_{g1} (kΩ)	† $\frac{V_{out}}{V_{in}}$	‡ D_{tot} (%)
250	100	3·3	1·5	1·05	330	44	0·75
200	100	3·3	1·5	0·85	330	43	0·85
150	100	3·3	1·8	0·62	330	42	1·05
100	100	3·3	1·8	0·38	330	34	3·6
250	220	3·3	2·2	0·63	680	52	0·7
200	220	3·3	2·2	0·52	680	50	0·5
150	220	3·3	2·7	0·36	680	47	1·0
100	220	3·3	2·7	0·23	680	38	3·75
250	100	22	0	1·4	330	48	2·2
200	100	22	0	1·05	330	46	2·1
150	100	22	0	0·7	330	43	1·6
100	100	22	0	0·37	330	39	5·9
250	220	22	0	0·78	680	53	2·2
200	220	22	0	0·6	680	52	2·0
150	220	22	0	0·4	680	49	1·4
100	220	22	0	0·22	680	43	3·1

MICROPHONY AND HUM.

In circuits where an input voltage of less than 10 mV. produces an output of 50 mW. from the output stage, the triode section can be used without special precautions against Microphony and Hum.

CAPACITANCES.

$C_{g_t-a_p}$	<0·02 pF.
$C_{a_t-a_p}$	<0·25 pF.
$C_{a_t-g_p}$	<0·02 pF.
$C_{g_t-g_p}$	<0·025 pF.

Pentode.

C_{in}	9·3 pF.
C_{out}	8·0 pF.
C_{a-g_1}	<0·3 pF.
C_{g_1-h}	<0·3 pF.

Triode.

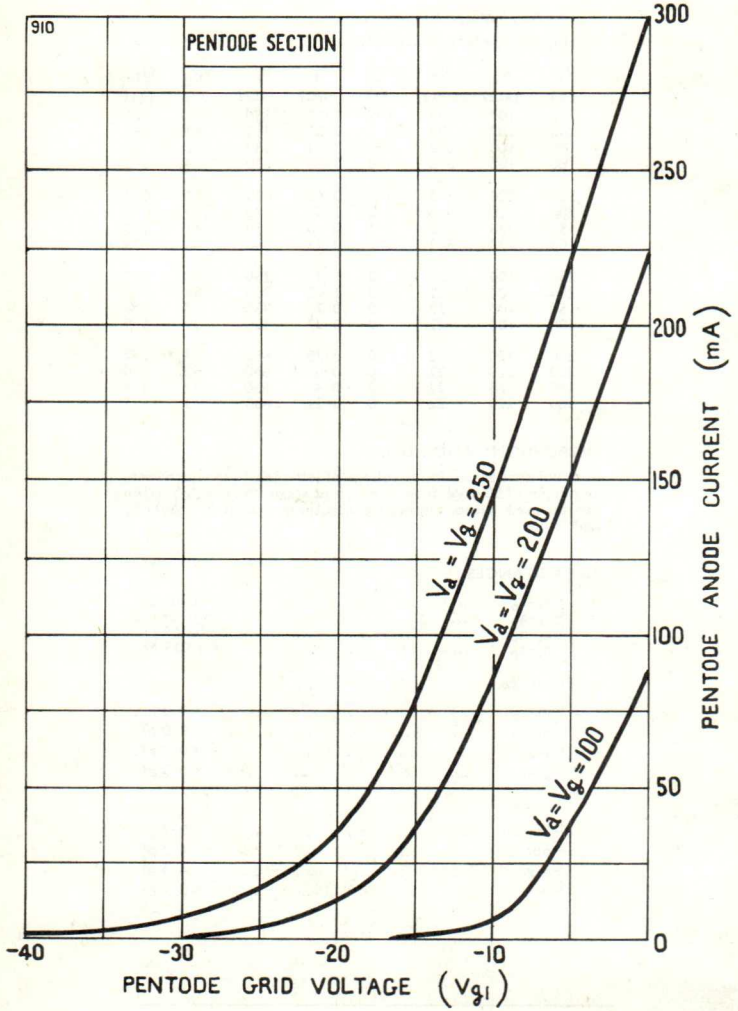
C_{in}	2·9 pF.
C_{out}	4·3 pF.
C_{a-g}	4·4 pF.
C_{g-h}	<0·1 pF.

*Grid Resistor of the following valve.

†Measured with an input of 100 mV.

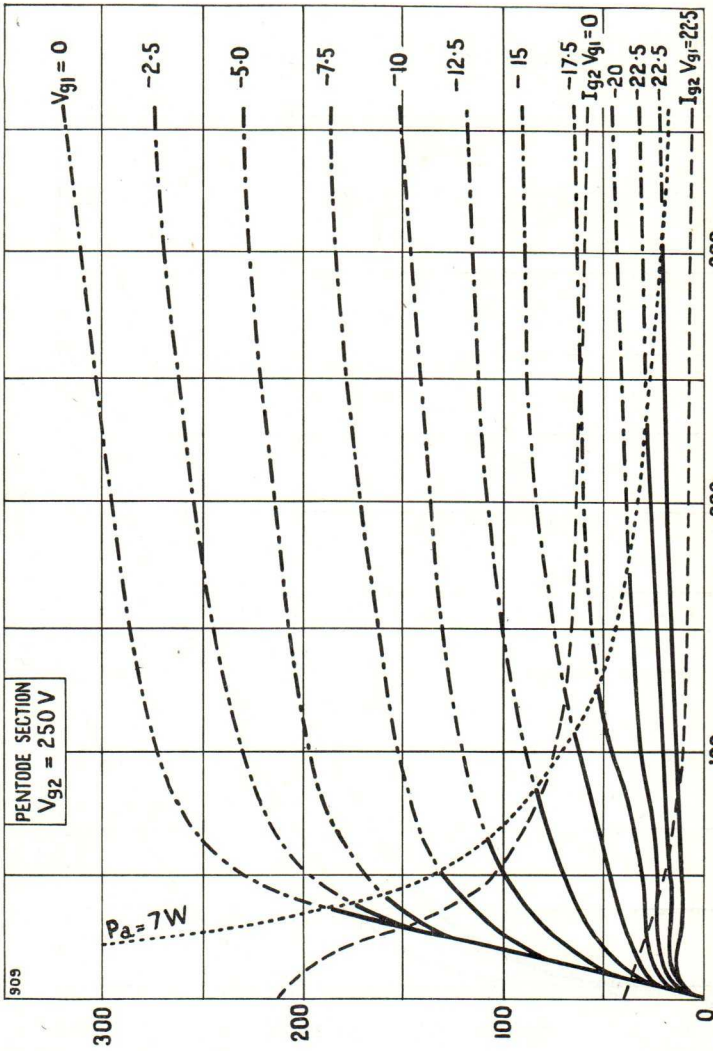
‡Measured at V_{out} = 10 volts.

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS
PENTODE SECTION



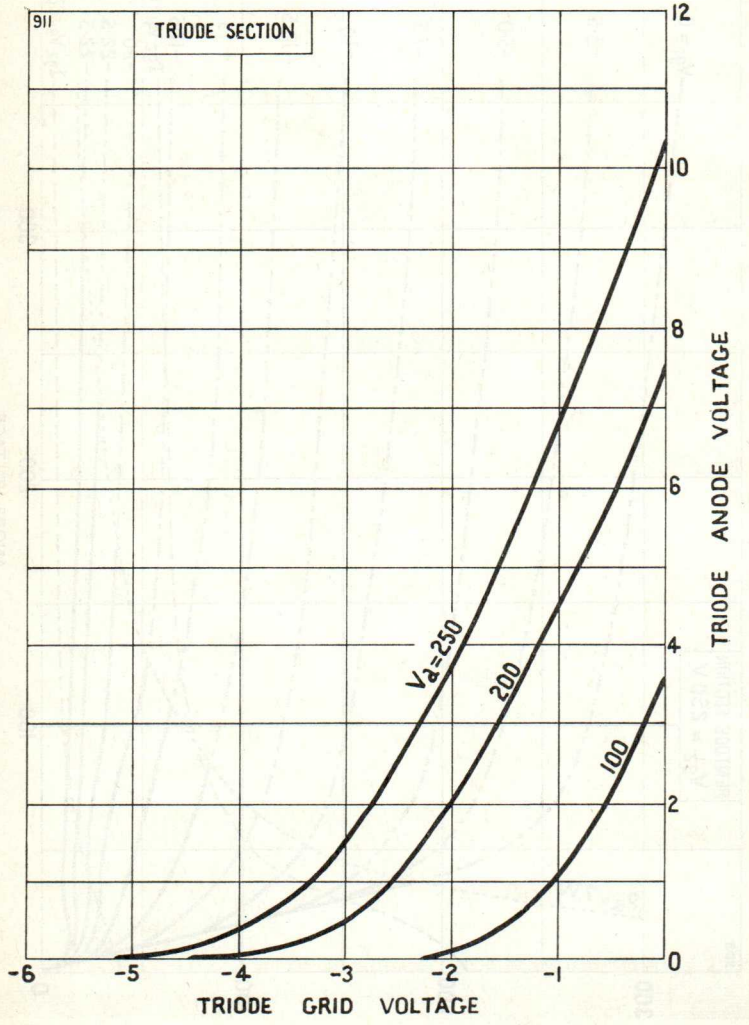
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

TYPICAL ANODE & SCREEN CURRENT/ANODE VOLTAGE CHARACTERISTICS
PENTODE SECTION



Ferranti

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS
TRIODE SECTION



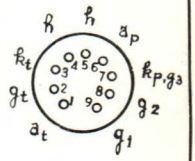
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

ECL83

TRIODE PENTODE

An indirectly heated triode-pentode with seperate cathodes primarily designed for use as a combined audio voltage amplifier and output valve.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any

BASE CONNECTIONS.

Pin 1—Triode Anode.	Pin 6—Pentode Anode.
Pin 2—Triode Grid.	Pin 7—Pentode Cathode, Suppressor Grid.
Pin 3—Triode Cathode.	Pin 8—Pentode Screen Grid.
Pin 4—Heater.	Pin 9—Pentode Control Grid.
Pin 5—Heater.	

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·6 amps.

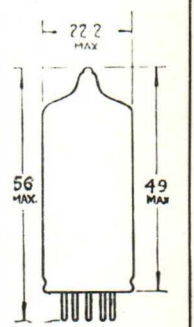
RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation	5·4 watts.
Max. Screen Grid Dissipation	1·2 watts.
Max. Screen Grid Dissipation (Audio)	2·4 watts.
Max. Cathode Current	45 mA.
Max. R_{gt-k} (fixed bias)	250 kΩ
(cathode bias)	500 kΩ
Max. V_{h-k} (heater neagtive)	250 volts.
Max. V_{h-k} (heater positive)	100 volts.

TRIODE SECTION.

Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation	3·5 watts.
Max. Cathode Current	15 mA.
Max. R_{gt-k} (Fixed bias)	1 MΩ
(Cathode bias)	3 MΩ
(Grid current bias)	22 MΩ
Max. V_{h-k}	250 volts.
Max. V_{h-k}	100 volts.



All dimensions shown are in millimetres (max.).

CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage	−9·5	−13	volts.
Anode Current	30	27	mA.
Screen Current	5·0	4·4	mA.
Mutual Conductance	5·5	5·0	mA/V.
Anode Impedance	53	65	kΩ
Inner μ	10	10	

TRIODE SECTION.

Anode Voltage	170	200	volts.
Grid Voltage	−1·5	−1·5	volts.
Anode Current	1·6	2·4	mA.
Mutual Conductance	2·1	2·5	mA/V.
Anode Impedance	40	34	kΩ
Amplification Factor	82	84	

Issue 2
July, 1961

Ferranti

ECL83

TYPICAL OPERATION.

PENTODE SECTION.

As Audio Output Valve (Class A).

Anode Voltage	170	200	volts.
Screen Grid Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage	−9·5	−13	volts.
Anode Current (no sig.)	30	27	mA.
Screen Grid Current (no sig.) ...	5·0	4·4	mA.
Anode Load	5·5	7·5	kΩ
Input Voltage	5·0	5·2	volts (rms.)
*Power Output	2·2	2·5	watts.

As Audio Amplifier (2 valves in Class AB push pull).

Anode Voltage	170	200	volts.
Screen Grid Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
†Cathode Bias Resistor	180	220	ohms
Anode Current (Zero signal) ...	2×24	2×25	mA.
Anode Current (Max. signal) ...	2×27	2×29	mA.
Screen Grid Current (Zero signal)	2×3·8	2×3·9	mA.
Screen Current (Max. signal) ...	2×6·3	2×8·5	mA.
Input Voltage (Vin)g_1—g_1)) ...	17	23·5	volts (rms.)
Optimum Load (Anode to Anode)...	6·5	7·5	kΩ
Power Output	5·0	7·2	watts.
Total Distortion	3·6	4·2	%

TRIODE SECTION.

As A.F. Voltage Amplifier.

Anode Supply Voltage	170	200	volts.
Anode Load	100	100	kΩ
Cathode Bias Resistor	1·8	2·2	kΩ
Anode Current	0·65	0·7	mA.
Stage Gain	49	47	
‡Output Voltage	15·3	17·7	volts (rms.)
Grid Resistor (following valve) ...	330	330	kΩ

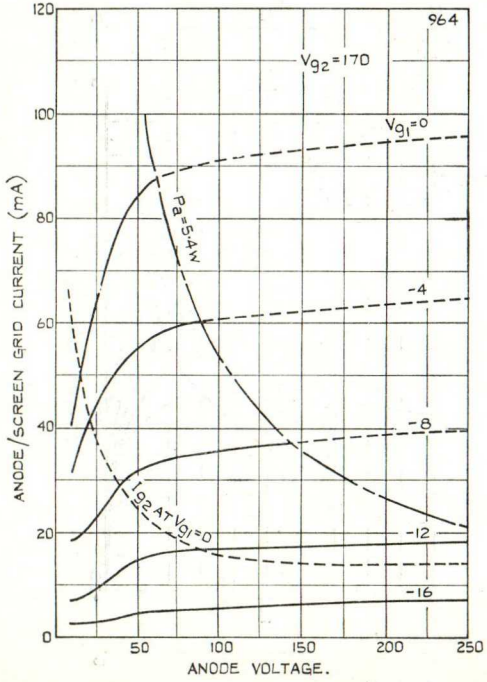
CAPACITANCES.

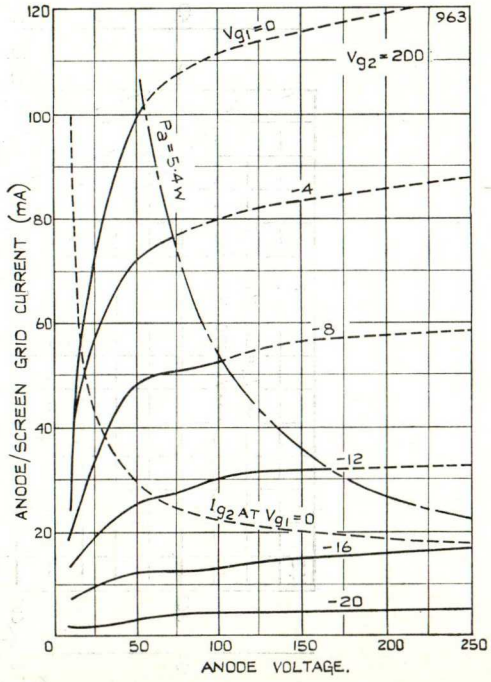
	Pentode.		Triode.	
C_{in}	5·7		2·3	pF.
C_{out}	4·7		0·3	pF.
C_{a-g}	<0·2		1·5	pF.
C_{g-h}	<0·45			pF.
$C_{g_t-a_p}$		<0·05		pF.
$C_{a_t-a_p}$		<1·6		pF.
$C_{a_t-g_p}$		<0·15		pF.
$C_{g_t-g_p}$		<0·03		pF.

*Total Distortion of 10%.

†Common Bias Resistor.

‡Output Voltage measured for total harmonic distortion of 5%.

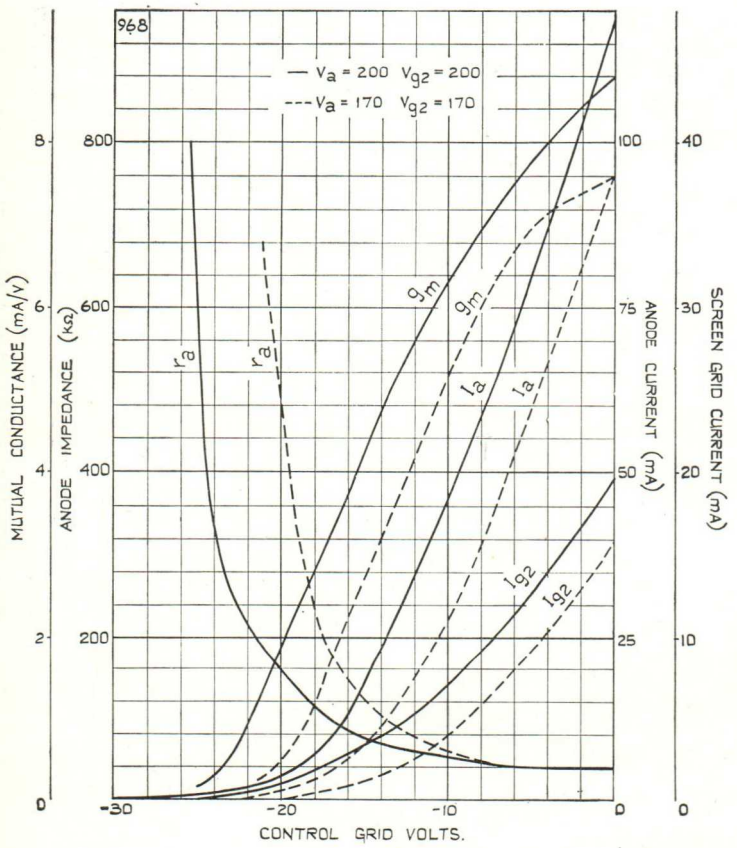




Typical Anode/Screen Grid Current and Anode Voltage Characteristics

Ferranti

TYPICAL ANODE CURRENT, SCREEN GRID CURRENT,
MUTUAL CONDUCTANCE and ANODE IMPEDANCE
and CONTROL GRID VOLTAGE



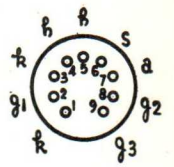
Ferranti

R.F. PENTODE

An indirectly heated R.F. Pentode for use with series or parallel heater connection on a.c. or d.c. mains. Primarily designed for use as an R.F. or I.F. amplifier in Television Receivers, it is also suitable for use as a video amplifier, mixer or synch. separator.

EF80

6BX6



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

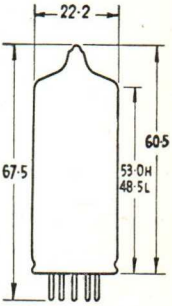
Pin 1—Cathode.	Pin 5—Heater.
Pin 2—Control Grid (g_1).	Pin 6—Shield.
Pin 3—Cathode.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).	

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	300 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Screen Dissipation ...	0·7 watts.
Max. Cathode Current ...	15 mA.
Max. V_{h-k}	150 volts.
Max. R_{g_1-k} (fixed bias) ...	0·5 MΩ
Max. R_{h-k}	20 kΩ
*Max. Negative Grid Voltage ...	−1·3 volts.



CHARACTERISTICS.

Anode Voltage	170	200 volts.
Screen Voltage	170	200 volts.
Suppressor Grid Voltage	0	0 volts.
Grid Voltage	−2	−2·5 volts.
Anode Current	10	10 mA.
Screen Current	2·5	2·6 mA.
Mutual Conductance ...	7·4	7·1 mA/V.
Anode Impedance ...	400	550 kΩ
Inner μ	50	50
Input Damping (at 50 Mc/s.)	10	12 kΩ
Equivalent Noise Resistance	1·0	1·1 kΩ

CAPACITANCES.

C_{in} (g_1)	7·0 pF.
C_{in} (g_1)	5·4 pF.
C_{out}	3·0 pF.
C_{a-g_1}	<0·007 pF.
C_{a-k}	<0·01 pF.
$C_{g_2-g_1}$	2·6 pF.
C_{g_1-h}	<0·15 pF.

All dimensions shown are in millimetres

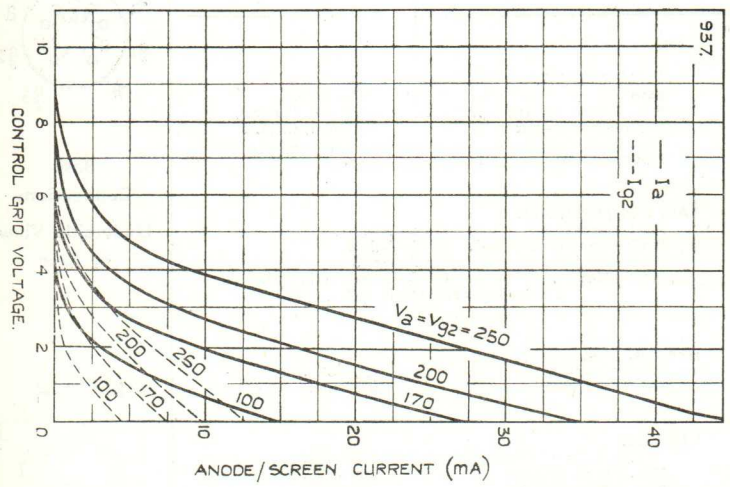
*For grid current of +0·3 μA.

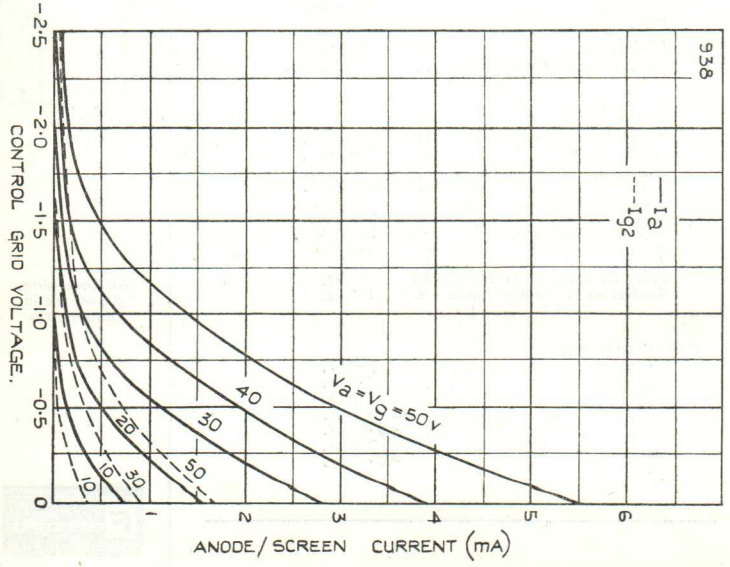
Issue 2
Oct. 1960

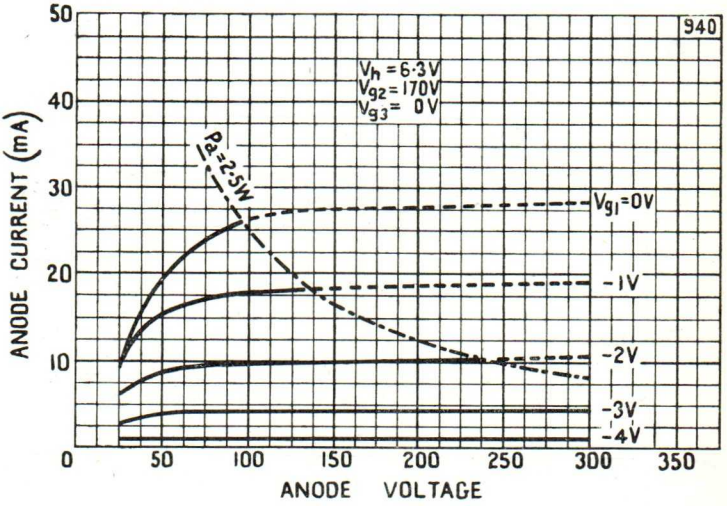
Ferranti

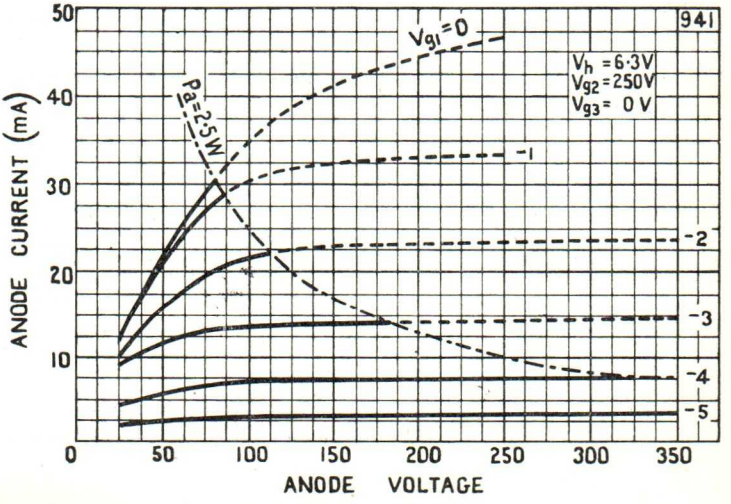
EF80

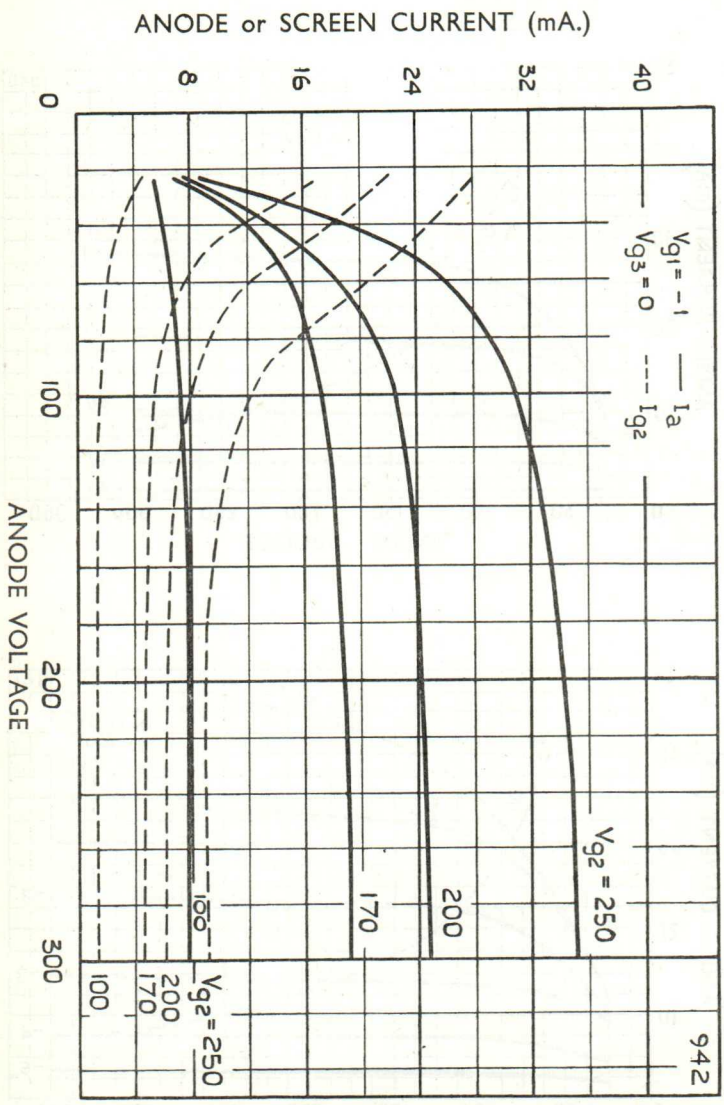
6BX6

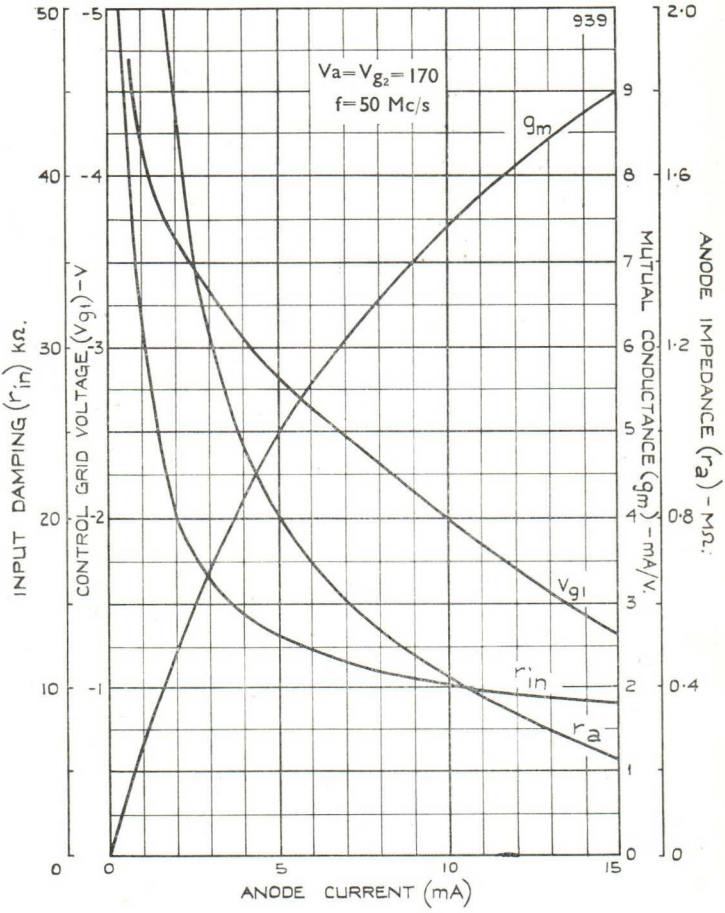





940
V_h = 6·3V
V_{g2} = 170V
V_{g3} = 0V
Pa=2·5W
V_{g1}=0V
-1V
-2V
-3V
-4V
ANODE CURRENT (mA)
ANODE VOLTAGE
0
10
20
30
40
50
50
100
150
200
250
300
350


941
V_{g1}=0
V_h = 6·3V
V_{g2} = 250V
V_{g3} = 0V
Pa=2·5W
-1
-2
-3
-4
-5
ANODE CURRENT (mA)
ANODE VOLTAGE
0
10
20
30
40
50
50
100
150
200
250
300
350

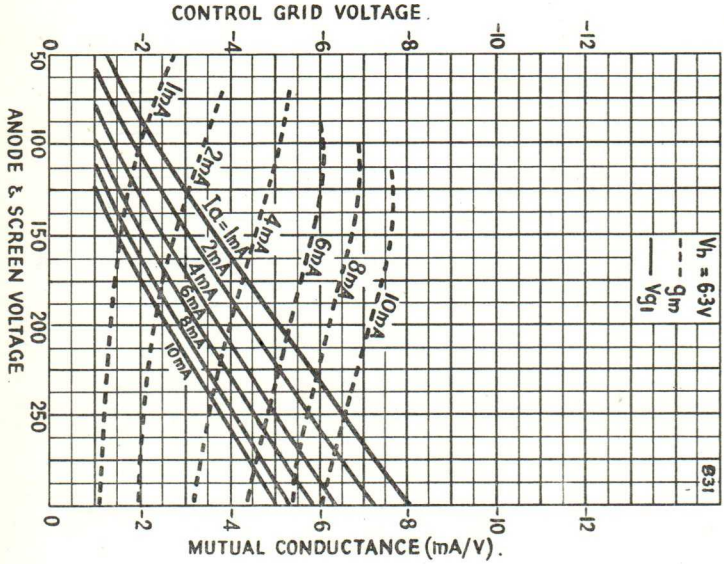

ANODE or SCREEN CURRENT (mA.)
0
8
16
24
32
40
100
200
300
ANODE VOLTAGE
V_{g1} = -1
V_{g3} = 0
I_a
I_{g2}
V_{g2} = 250
200
170
100
942
V_{g2} = 250
200
170
100

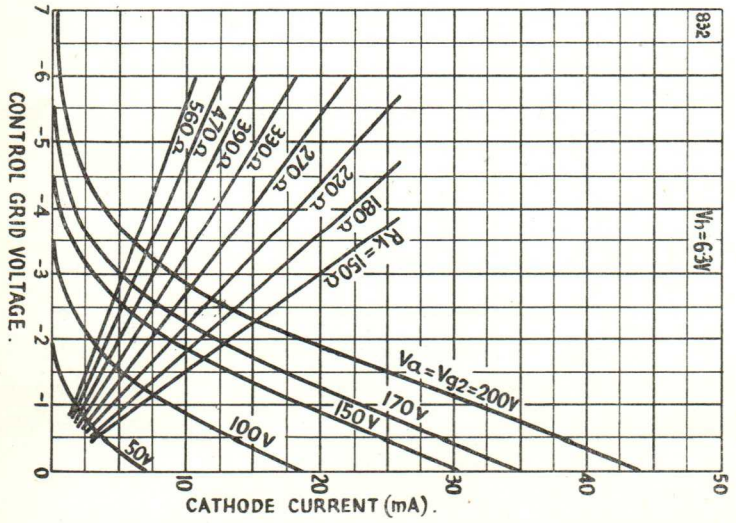

939
Va=Vg2=170
f=50 Mc/s
gm
Vg1
r'in
ra
INPUT DAMPING (r'in) KΩ.
CONTROL GRID VOLTAGE (Vg1) -V
MUTUAL CONDUCTANCE (gm) - mA/V.
ANODE IMPEDANCE (ra) - MΩ.
ANODE CURRENT (mA)
50
40
30
20
10
0
-5
-4
-3
-2
-1
0
9
8
7
6
5
4
3
2
1
0
2·0
1·6
1·2
0·8
0·4
0
5
10
15

Ferranti

EF80

6BX6





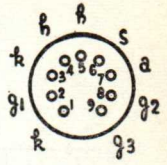
R0359

FERRANTI

VARIABLE-MU R.F. PENTODE

EF85

A high slope R.F. Pentode designed for use in F.M./A.M. Receivers.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	67·5 mm. (2$\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode.	Pin 5—Heater.
Pin 2—Control Grid (g_1)	Pin 6—Shield.
Pin 3—Cathode.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Screen Grid (g_2).

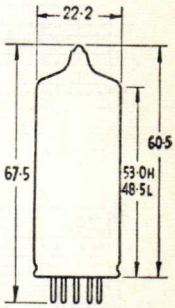
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Screen Dissipation ...	0·65 watts.
Max. Control Grid Voltage ($I_{g_1}=+0·3\mu A$) ...	−1·3 volts.
Max. Cathode Current ...	15 mA.
Max. V_{h-k}	150 volts.
Max. R_{g_1-k}	3·0 MΩ
Max. R_{h-k}	20 kΩ



Dimensions shown are in millimetres

CHARACTERISTICS.

$V_a=V_b$	250	250	250	volts.
V_{g_3}	0	0	0	volts.
R_{g_2}	80	*18	†22	kΩ
V_{g_2}	85	97	103	volts.
V_{g_1}	−1·8	−1·9	−2·1	volts.
I_a	8	10	10	mA.
I_{g_2}	2	2·4	2·6	mA.
g_m	5·7	6·0	6·0	mA/V.
r_a	500	500	500	kΩ
R_{eq}	1·5	1·5	1·5	kΩ
V_{g_1} for 100 : 1 reduction of gm	−30	−33	−35	volts.

CAPACITANCES‡

C_{in}	7·5 pF.
C_{out}	3·7 pF.
C_{a-g_1}	0·007 pF. (max.).
C_{g_1-h}	0·15 pF. (max.).

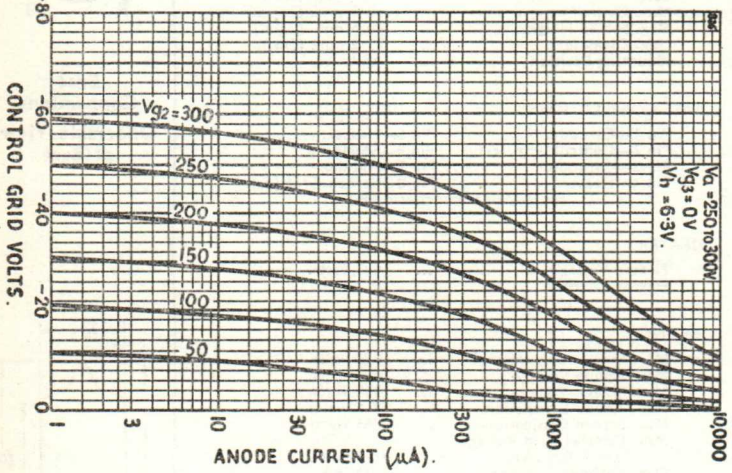
*Common screen resistor with ECH81 used as a frequency changer. Total current through resistor is 8·5 mA.

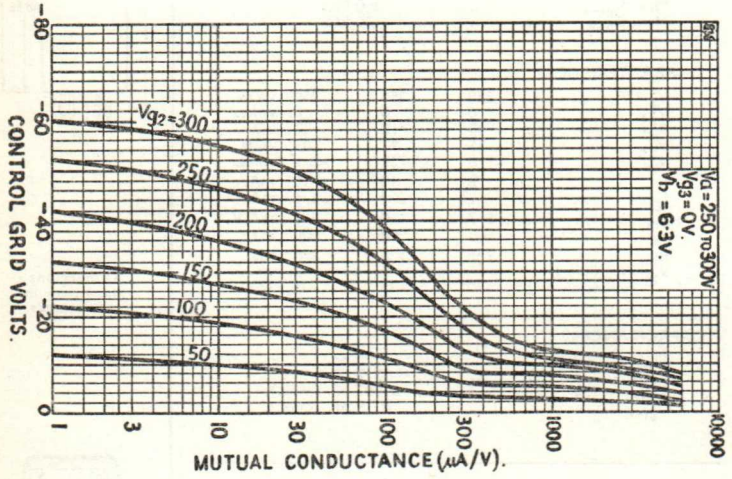
†Common screen resistor with ECH81 used as I.F. or R.F. Amplifier. Total current through resistor is 6·7 mA.

‡Measured without external shield.

Issue 1
Mar., 1956

EF85


CONTROL GRID VOLTS.
-80
-60
-40
-20
0
V_{g2}=300
250
200
150
100
50
V_a =250 to 300V
V_{g3}= 0V
V_h = 6·3V.
1
3
10
30
100
300
1000
10,000
ANODE CURRENT (μA).

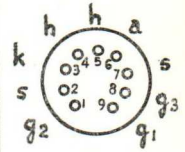

CONTROL GRID VOLTS.
-80
-60
-40
-20
0
V_{g2}=300
250
200
150
100
50
V_a =250 to 300V
V_{g3}= 0V
V_h = 6·3V.
1
3
10
30
100
300
1000
10000
MUTUAL CONDUCTANCE (μA/V).

Ferranti

VOLTAGE AMPLIFIER PENTODE

EF86

A pentode developed for use as an R.C. coupled A.F. voltage amplifier. The low noise characteristic makes it particularly suitable for early stages of high gain audio amplifiers, for tape recorders and microphone pre-amplifiers. It is suitable for series or parallel operation a.c. or d.c.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Screen Grid (g_2). Pin 5—Heater.
Pin 2—Shield. Pin 6—Anode.
Pin 3—Cathode. Pin 7—Shield.
Pin 4—Heater. Pin 8—Suppressor Grid (g_3).
Pin 9—Control Grid (g_1).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·2 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	200 volts.
Max. Anode Dissipation ...	1·0 watts.
Max. Screen Dissipation ...	0·2 watts.
‡Min. Negative Grid Voltage ...	1·3 volts.
Max. Cathode Current ...	6·0 mA.
Max. V_{h-k} (Heater Negative) ...	100 volts.
Max. V_{h-k} (Heater Positive) ...	50 volts.
*Max. R_{g_1-k}	3 MΩ
Max. R_{g_3-k}	10 kΩ
†Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

Anode Voltage	250 volts.
Supressor Grid Voltage ...	0 volts.
Screen Voltage	140 volts.
Anode Current	3 mA.
Screen Current	0·6 mA.
Control Grid Voltage	–2 volts.
Mutual Conductance	2·0 A/V.
Inner μ ($\mu_{g_1-g_2}$)	38
Anode Impedance	2·5 MΩ

Noise :—

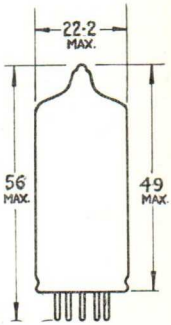
With line voltage=250v. and R_a=100kΩ the equivalent noise voltage on the grid of the EF86 is approximately 2 μV. for the frequency range of 25–10,000 c/s.

Hum :—

In use as a normal voltage amplifier with a line voltage of 250 volts anode load of 100kΩ and grid resistor of 470 kΩ, the maximum hum level of the valve is 5 μV. The average is approx. 3 μV. when one side of the heater is earthed.

Microphony :—

There are no appreciable internal resonances at frequencies below 1000 c/s. and the effect of vibration at frequencies above 1000 c/s. is usually negligible due to the damping provided by the chassis, valve holder, etc.



All dimensions shown are in millimetres.

*With anode dissipation less than 0·2W. the value of R_{g_1-k} may be increased up to 10 MΩ

†For use as a phase inverter immediately preceding the output stage, R_{h-k} may be increased up to 120 kΩ

‡For grid current of 0·3μA.

Issue 2
June, 1960

Ferranti

Ferranti

TYPICAL OPERATION as Resistance Coupled A.F. Amplifier.

Pentode Connection.

H.T. Supply Voltage ...	400	400	300	300	200	200	150	150	volts.
Anode Load Resistor ...	100	220	100	220	100	220	100	220	kΩ
Screen Grid Feed Resistor	0·39	1·0	0·39	1·0	0·39	1·0	0·47	1·0	MΩ
Anode Current ...	2·6	1·2	1·95	0·9	1·35	0·7	0·8	0·51	mA.
Screen Grid Current ...	550	250	400	190	280	120	180	100	μA.
Cathode Bias Resistor ...	1·0	2·2	1·0	2·2	1·0	2·2	1·5	2·7	kΩ
Grid Resistor of following valve ...	330	680	330	680	330	680	330	680	kΩ
Stage Gain	135	210	120	190	110	180	100	160	
Output Voltage	95	77	67	57	38	36	26	25	volts. (r.m.s.)
Total Distortion ...	5	5	5	5	5	5	5	5	%

Triode Connection (g_2 to a ; g_3 to k).

H.T. Supply Voltage ...	400	400	400	300	300	200	200	200	volts.
Anode Load Resistor ...	47	100	220	47	220	47	100	220	kΩ
Cathode Bias Resistor ...	1·2	2·2	3·9	1·2	3·9	1·2	2·2	3·9	kΩ
Cathode Current ...	3·5	2·0	1·1	2·7	0·8	1·85	1·0	0·5	mA.
Grid Resistor of following valve ...	150	330	680	150	680	150	330	680	kΩ
Stage Gain	27·3	31·5	33	26	33	25·5	30	32	
*Output Voltage	68	77	78	46	54	26	31	31	volts. (r.m.s.)
†Distortion	5·2	4·8	4·3	4·6	4·2	3·9	4·0	3·7	%

CAPACITANCES†

C_{in}	...	...	3·8 pF.
C_{out}	...	...	5·3 pF.
C_{a-g_1}	...	...	<0·05 pF.
C_{g_1-h}	...	...	<0·0025 pF.

NOTES ON OPERATION.

The low hum level attained with this valve, noted under "Characteristics," can be further reduced by the provision of an earthed centre tap to the heater. On the contrary the use of an unsuitable valve holder with excessive leakage and capacitative coupling between the pins can introduce considerable hum.

To avoid microphony at higher frequencies in high gain amplifiers care should be taken in siting the valve to minimise the effect of a loud speaker in the same cabinet. In such cases and also when motors or speakers are mounted on the same chassis, as in tape recorders, it is advisable to provide a flexible mounting for the valve holder or a separate sub-chassis which should be heavy gauge metal.

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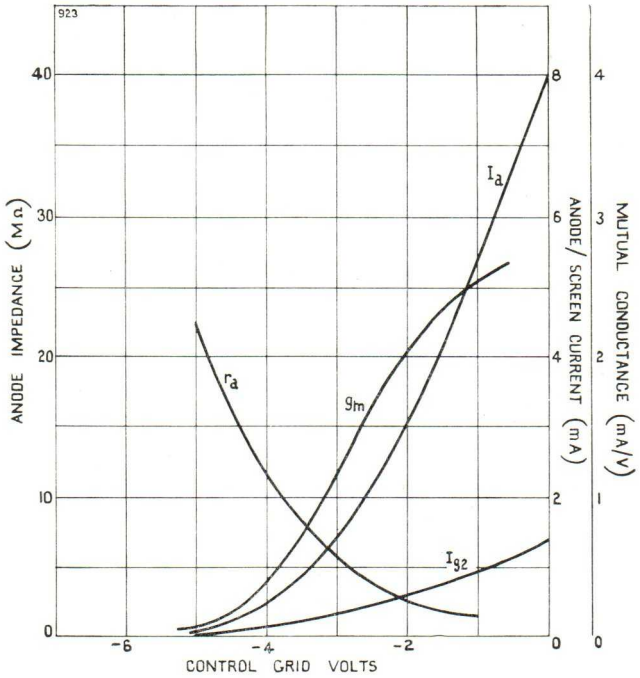
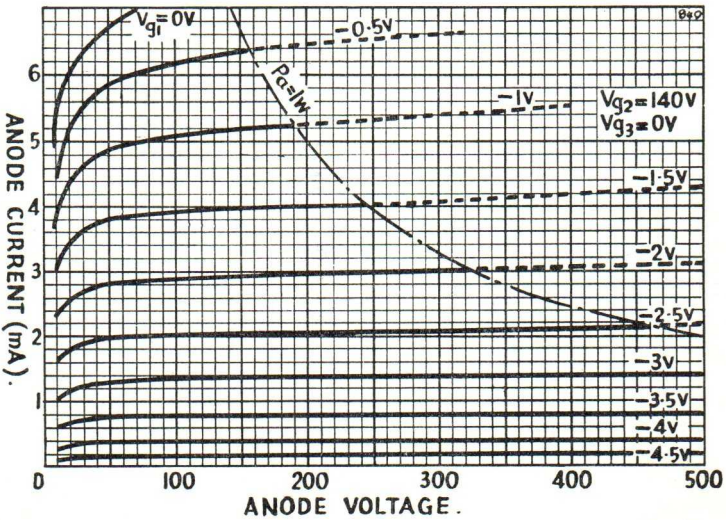
*Figures quoted are typical figures at the start of positive grid current. For lower output voltages the distortion is approximately proportional to the voltage.

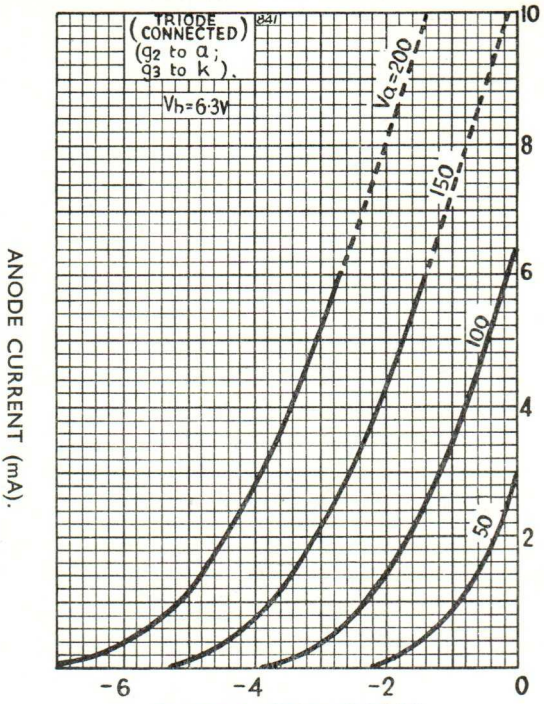
†Measured without external shield.

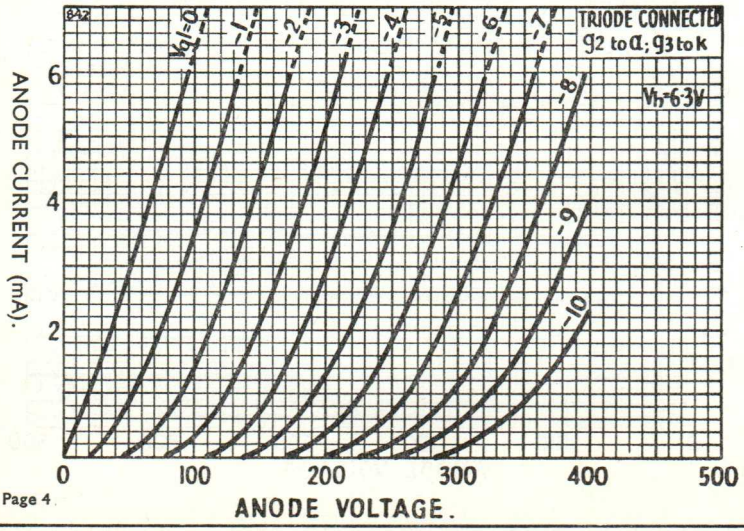
TYPICAL CHARACTERISTICS





TYPICAL CHARACTERISTICS - CONNECTED AS TRIODE





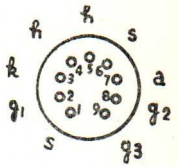
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

VARIABLE-MU R.F. PENTODE

A variable-mu Pentode designed for use in F.M./A.M. Receivers as R.F. or I.F. Amplifier.

EF89



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	61·7 mm. ($2\frac{7}{16}$in.).
Max. Seated Height	54·7 mm. ($2\frac{5}{32}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Shield. Pin 5—Heater.
Pin 2—Control Grid (g_1). Pin 6—Shield.
Pin 3—Cathode. Pin 7—Anode.
Pin 4—Heater. Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·2 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	300 volts.
Max. Anode Dissipation... ...	2·25 watts.
Max. Screen Dissipation... ...	0·45 watts.
Max. Cathode Current	16·5 mA.
Max. V_{h-k}	100 volts.
Max. R_{g_1-k}	3 MΩ
Max. R_{g_3-k}	10 kΩ
Max. R_{h-k}	20 kΩ.

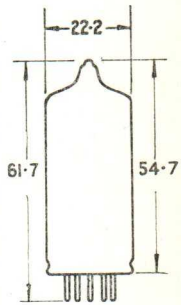
CHARACTERISTICS.

Anode Voltage ...	250	250 volts.			
Suppressor Grid Voltage	0	0 volts.			
Screen Grid Voltage	85	100 volts.			
Anode Current ...	9	9 mA.			
Screen Grid Current	3·2	3·0 mA.			
Control Grid Voltage	−1	−2 volts.			
Mutual Conductance	4·0	3·6 A/V.			
Inner μ ($\mu_{g_1-g_2}$) ...	19	—			
Anode Impedance	>0·8	1·0 MΩ			

$V_a=V_b$ ...	200	250	250	250	volts.
V_{g_3} ...	0	0	0	0	volts.
R_{g_2} ...	24	51	*18	*22	kΩ
V_{g_1} ...	−2·0	−2·0	−0·5	−2·0	volts.
R_k ...	160	160	—	—	ohms
I_a ...	11·0	9·0	8·0	8·7	mA.
I_{g_2} ...	3·8	3·0	2·6	2·9	mA.
g_m ...	3·8	3·5	4·2	3·5	mA/V.
r_a ...	0·6	1·0	1·05	1·0	MΩ
R_{eq} ...	4·2	4·2	2·3	4·2	kΩ
g_m at $V_{g_1}=-20$	0·16	0·24	0·23	0·23	mA/V.

CAPACITANCES.

C_{in}	5·5 pF.
C_{out}	5·1 pF.
C_{a-g_1}	0·002 pF. (max.).
$C_{g_1-g_2}$	2·1 pF.
C_{g_1-h}	0·05 pF. (max.).



All dimensions shown are in millimetres (max.).

*Common screen resistor with ECH81 used as a frequency changer. Total current through resistor is 8·6 mA. at $V_{g_1}=-20$ and 9·3 mA. at $V_{g_1}=-0·5$.

†For grid current bias operation with $R_{g_1}=10M\Omega$. If this condition is not acceptable the negative grid bias should be increased to −2 volts.

Issue 2.
Nov., 1961.

Ferranti

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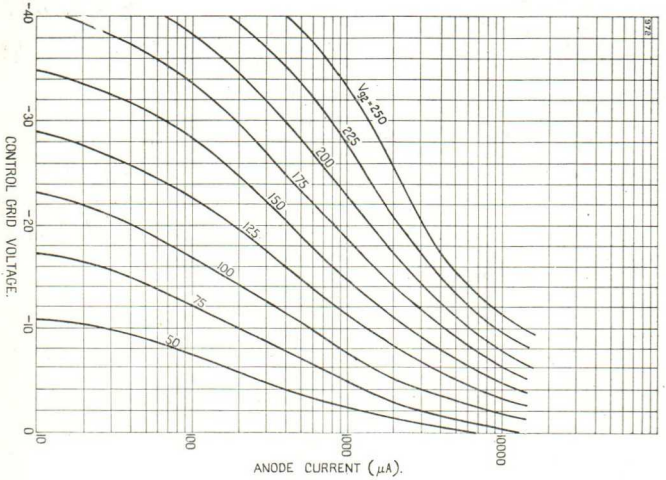
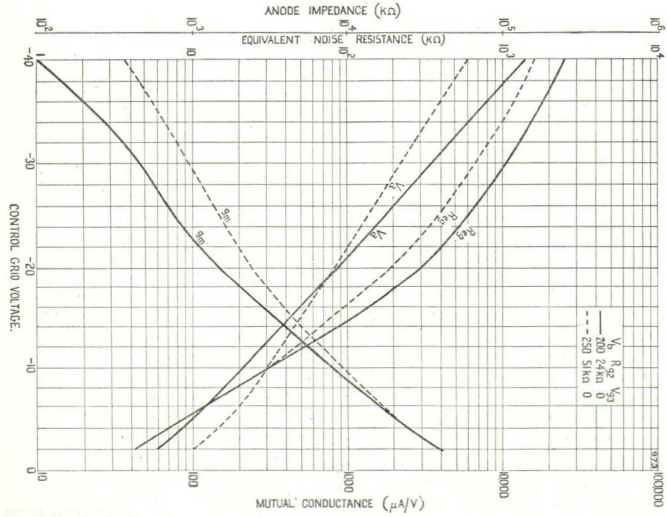
TYPICAL CHARACTERISTICS





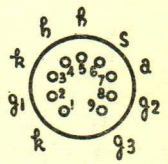
Ferranti

EF183

6EH7

VARIABLE-MU R.F. PENTODE

A variable-mu R.F. pentode primarily designed for use in automatic gain controlled I.F. amplifiers of television receivers.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	61·7 mm. ($2\frac{7}{16}$in.).
Max. Seated Height	54·7 mm. ($2\frac{5}{32}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode. Pin 5—Heater.
Pin 2—Control Grid (g_1). Pin 6—Shield.
Pin 3—Cathode. Pin 7—Anode.
Pin 4—Heater. Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation... ...	2·5 watts.
Max. Screen Grid Dissipation ...	0·65 watts.
Max. Cathode Current	20 mA.
Max. Neg. $V_{g1(pk)}$	−50 volts.
Max. V_{h-k}	150 volts.
Max. R_{g1-k}	1 MΩ
Max. R_{g3-k}	50 kΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

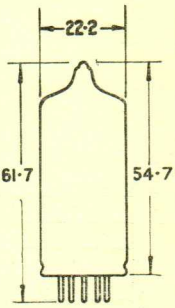
Anode Voltage ...	170	200	230	volts.
Screen Grid Voltage	90	90	90	volts.
Suppressor Grid Voltage	0	0	0	volts.
Grid Voltage ...	−1·8	−2·0	−2·1	volts.
Anode Current ...	14	12	10·5	mA.
Screen Grid Current	5·3	4·5	3·6	mA.
Mutual Conductance	14	12·5	10·6	mA/V.
Anode Impedance	350	500	640	kΩ
Input Damping (at 50 Mc/s.) ...	11·5	13	15	kΩ

TYPICAL OPERATION.*

$V_a = V_b$	170	190	230	volts.
V_{g3}	0	0	0	volts.
R_{g2}	15	22	39	kΩ
V_{g1}	−1·9	−2·0	−2·1	volts.
R_k	100	120	150	ohms.
I_a	13·9	11·7	10·5	mA.
I_{g2}	5·2	4·3	3·6	mA.
g_m	14·0	12·4	10·6	mA/V.
r_a	370	480	640	kΩ
g_m at V_{g1} = −15...	0·1	0·26	0·37	mA/V.

CAPACITANCES.

C_{in}	9·5 pF.
C_{out}	3·0 pF.
C_{a-g1}	<0·0055 pF.
C_{g1-g2}	2·8 pF.



All dimensions shown are in millimetres (max.).

*Auto-bias operation is recommended.

Tentative Issue 2. Mar. 1962.

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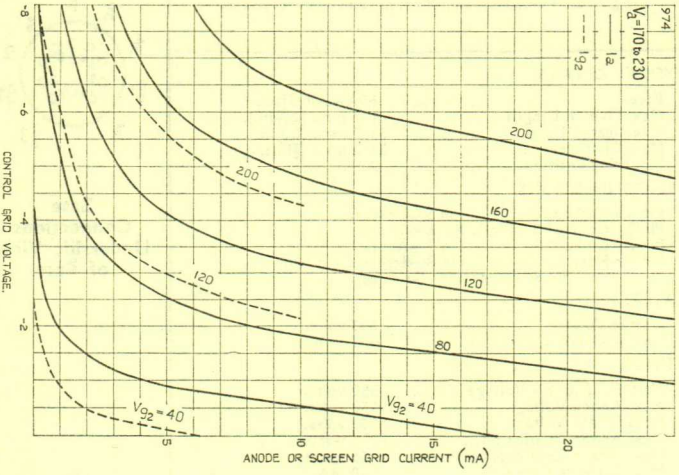
EF183

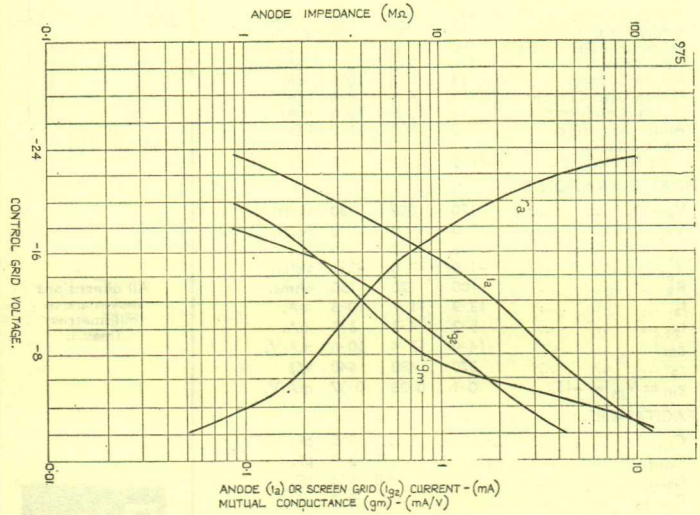
6EH7

TYPICAL I_a and I_{g_2} CHARACTERISTICS.



TYPICAL CHARACTERISTICS.

at $V_a = V_{g_2}$ = 200V. - R_{g_2} = 24 kΩ.



Ferranti

EL81

OUTPUT PENTODE

An indirectly heated output pentode suitable for use in Television Receivers as a Line Time Base Output Valve.

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
Max. Overall Length	83 mm. ($3\frac{5}{32}$in.).
Max. Seated Height	76 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Control Grid.	Pin 7—Internal Connection.
Pin 3—Cathode.	Pin 8—Screen Grid
Pin 4—Heater.	Pin 9—Suppressor Grid.
Pin 5—Heater.	Top Cap—Anode.

Heater

Heater Voltage	6·3 volts.
Heater Current	1·05 amp.

RATINGS

Max. D.C. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
*Max. Peak Anode Voltage ...	7 kV.
†Max. Anode Dissipation ...	8 watts.
Max. Screen Voltage	300 volts.
†Max Screen Dissipation ...	4·5 watts.
Max. Cathode Current ...	180 mA.
‡Min. Neg. Grid Voltage ...	−1·3 volts.
Max. V_{h-k}	100 volts.
Max. R_{h-k}	20 kΩ
§Max. R_{g1-k}	500 kΩ

CHARACTERISTICS.

Pentode Connected.

Anode Voltage	250 volts.
Screen Voltage	250 volts.
Suppressor Grid Voltage ...	0 volts.
Control Grid Voltage	−38·5 volts.
Anode Current	3·2 mA.
Screen Current	2·4 mA.
Mutual Conductance	4·6 mA/V.
Anode Impedance	15 kΩ
Inner μ (μ_{g1-g2})	5·1

Triode Connected.

Anode Voltage	250 volts.
Grid Bias Voltage	−38 volts.
Anode Current	40 mA.
Mutual Conductance	5·5 mA/V.
Anode Impedance	1·0 kΩ
μ	5·5

CAPACITANCES (Measured without external shield).

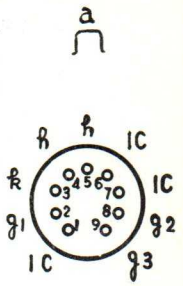
Pentode Connected.

C_{in}	14·7 pF.
C_{out}	6·0 pF.
C_{a-g1}	<0·8 pF.
C_{a-k}	<0·1 pF.
C_{g1-h}	<0·2 pF.

Triode Connected.

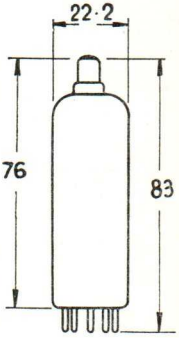
C_{in}	8·7 pF.
C_{out}	11·4 pF.
C_{a-g}	6·6 pF.

*Max. pulse duration of 22% of one cycle, with a maximum of 18 μsecs.
†$p_a + p_{g2}$ should not exceed 8·5 watts.
‡For grid current of +0·3 μA.
§For line output operation the max. value of R_{g1-k} may be 3·3 MΩ



Base Connections

Underside View of Base



All Dimensions shown are in millimetres (max.).

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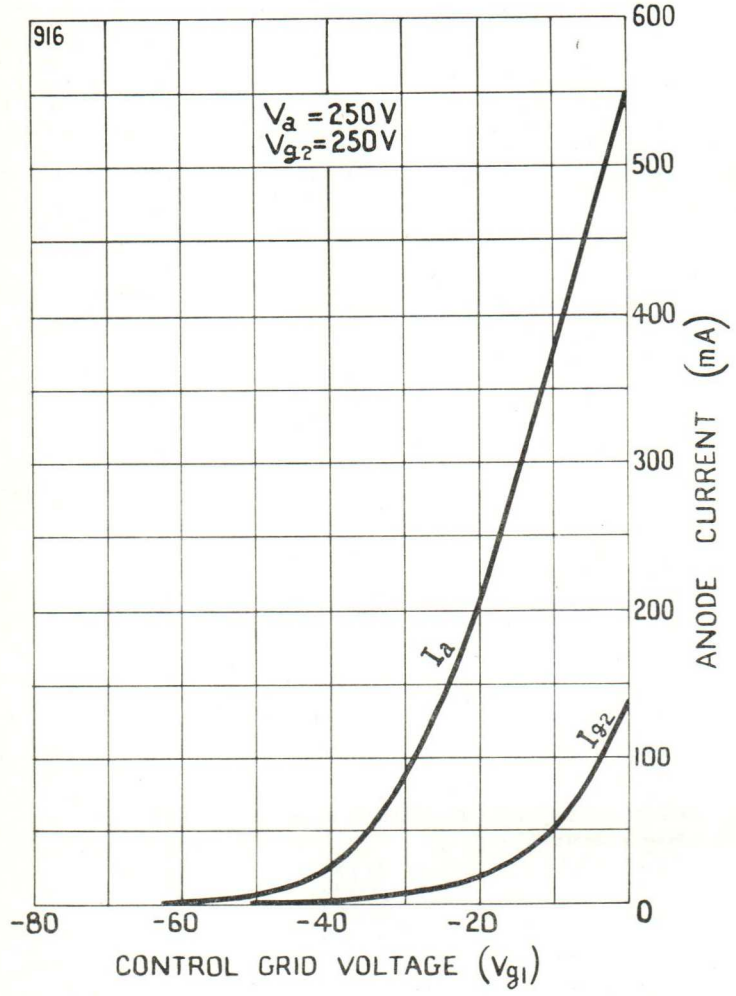
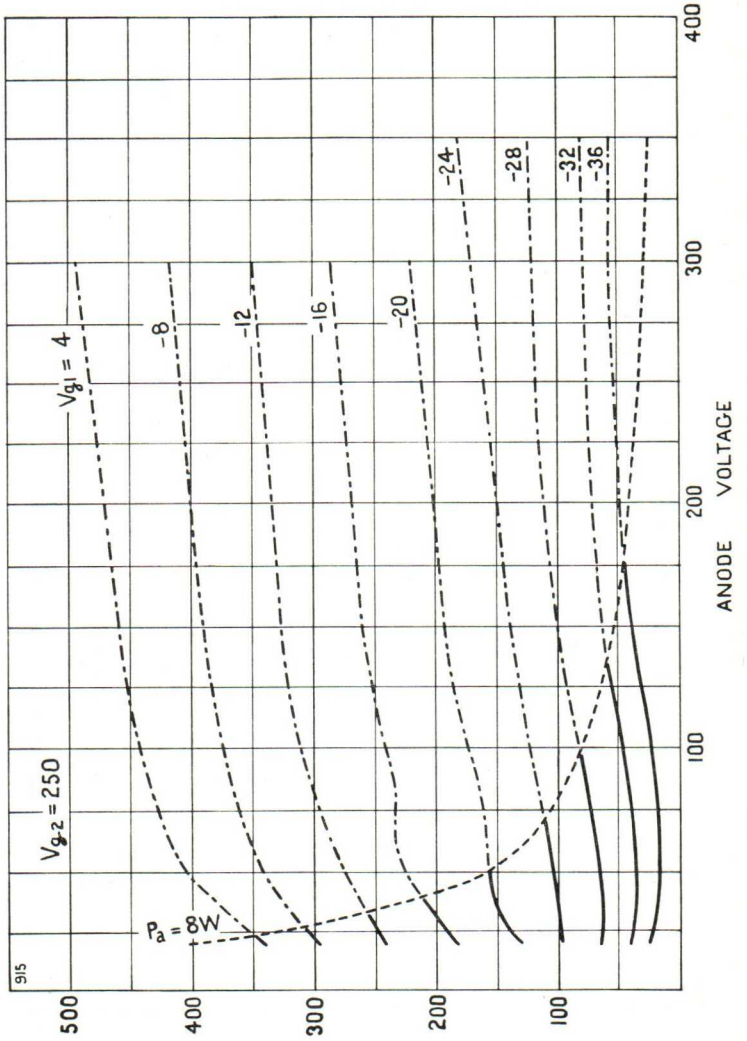
Issue 2
Feb., 1960

Ferranti

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS.



TYPICAL ANODE CURRENT/ANODE VOLTAGE CHARACTERISTICS.



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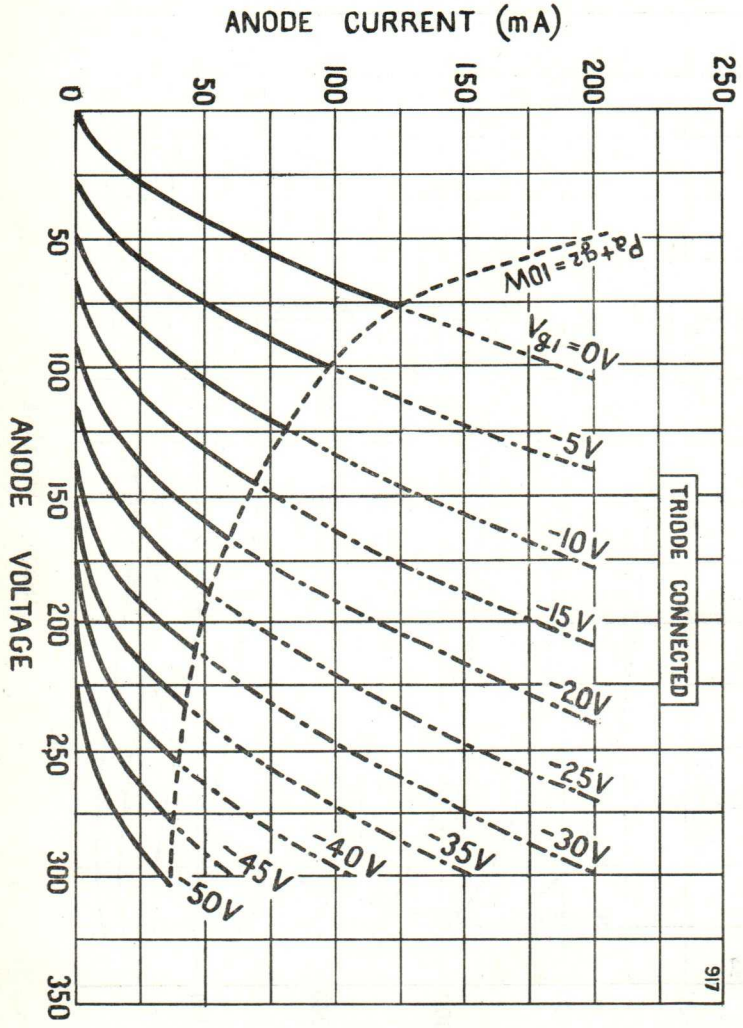
TYPICAL ANODE CURRENT/ANODE VOLTAGE CHARACTERISTICS.
TRIODE CONNECTED.
(g_2 to a, g_3 to k).



Ferranti

OUTPUT PENTODE

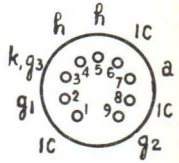
EL84

6BQ5

An indirectly heated pentode rated for an anode dissipation of 12 watts. Designed for use in the output stage of A.C. mains operated equipments.

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	78·5 mm. ($3\frac{9}{32}$in.).
Max. Seated Height	71·5 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.



Base Connections
Underside View of Base

BASE CONNECTIONS.

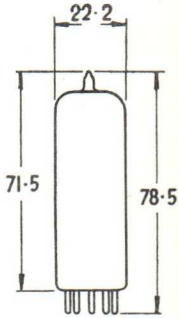
Pin 1—Internal Connection.	Pin 5—Heater.
Pin 2—Control Grid.	Pin 6—Internal Connection.
Pin 3—Cathode, Suppressor Grid.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Screen Grid.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·76 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	300 volts.
Max. Anode Dissipation ...	12 watts.
Max. Screen Dissipation (zero sig.)	2 watts.
Max. Screen Dissipation (max. sig.)	4 watts.
Max. Cathode Current ...	65 mA.
Max. Negative V_{g1}	−100 volts.
Max. V_{h-k}	100 volts.
Max. R_{g1-k}	0·3 MΩ
Max. R_{h-k}	20 kΩ



All Dimensions shown are in millimetres (max.).

CHARACTERISTICS.

Pentode Connection.

Anode Voltage	250 volts.
Screen Voltage	250 volts.
Control Grid Voltage ...	−7·3 volts.
Anode Current	48 mA.
Screen Current	5·5 mA.
Mutual Conductance	11·3 mA/V.
Inner μ (μ_{g1-g2})	19
Anode Impedance	40 kΩ

Triode Connection
(g_2 connected to a.)

Anode Voltage	250 volts.
Grid Voltage	−9·0 volts.
Anode Current	34 mA.
Anode Impedance	2·0 kΩ
Amplification Factor	19
Mutual Conductance	10 mA/V.

Issue 2.
May, 1964.

Ferranti

TYPICAL OPERATION.

As Audio Output Valve (Class A).

Pentode Connection.

V_a	250 volts.
V_{g2}	250 volts.
V_{g1}	−7·3 volts.
I_a	48 mA.
I_{g2}	5·5 mA.
R_a	5·2 kΩ
V_{in} (r.m.s.)	4·3 volts.
P_{out}	5·7 watts.
D_{tot}	10 %

Triode Connection
(g_2 connected to a.)

V_a	250 volts.
R_a	3·5 kΩ
V_{g1}	−9 volts.
$I_{a(o)}$	34 mA.
I_a (max. sig.)	39 mA.
V_{in} (r.m.s.)	6·0 volts.
P_{out}	1·5 watts.
D_{tot}	9·0 %

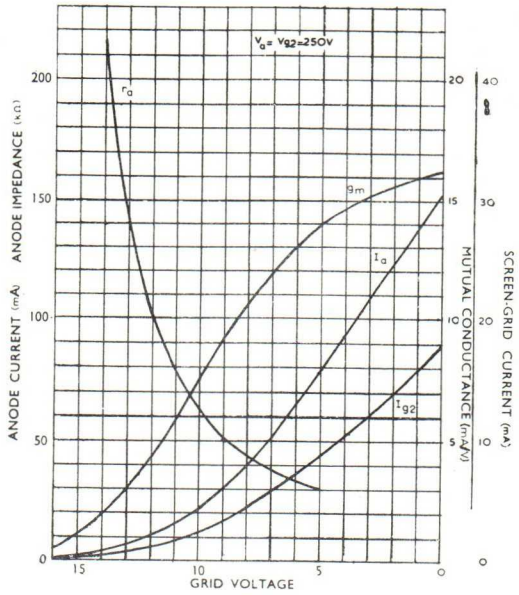
As Audio Amplifier (2 valves in Class AB push pull).

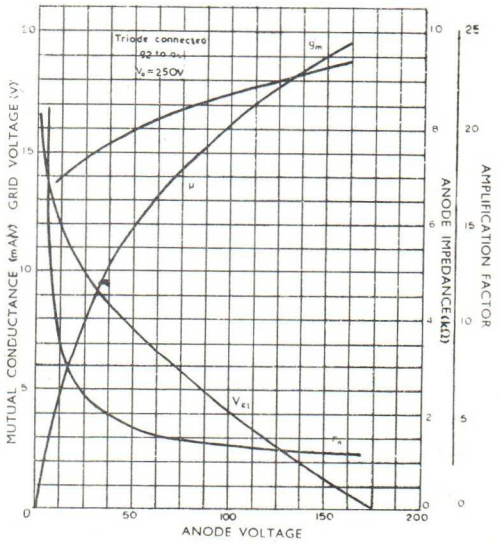
Pentode Connection.

V_a	250	300	volts.
V_{g2}	250	300	volts.
R_k	130	130	ohms.
$I_{a(o)}$	2 x 31	2 x 36	mA.
$I_{g(o)}$	2 x 3·5	2 x 4	mA.
I_a (max. sig.)	2 x 37·5	2 x 46	mA.
I_{g2} (max. sig.) ...	2 x 7·5	2 x 11	mA.
R_{a-a}	8	8	kΩ
V_{g1-g1} (r.m.s.) ...	16	20	volts.
P_{out}	11	17	mW.
D_{tot}	3	4	%

CAPACITANCES.

C_{in}	11·0 pF.
C_{out}	6·5 pF.
C_{a-g1}	<0·5 pF.
C_{g1-h}	<0 25 pF.

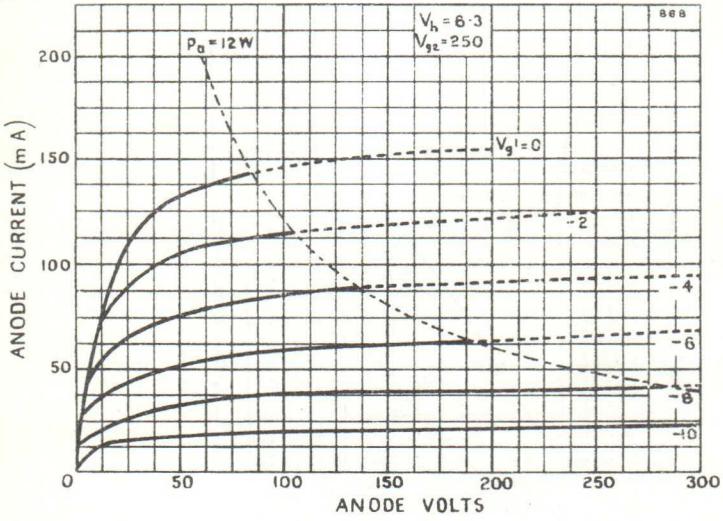


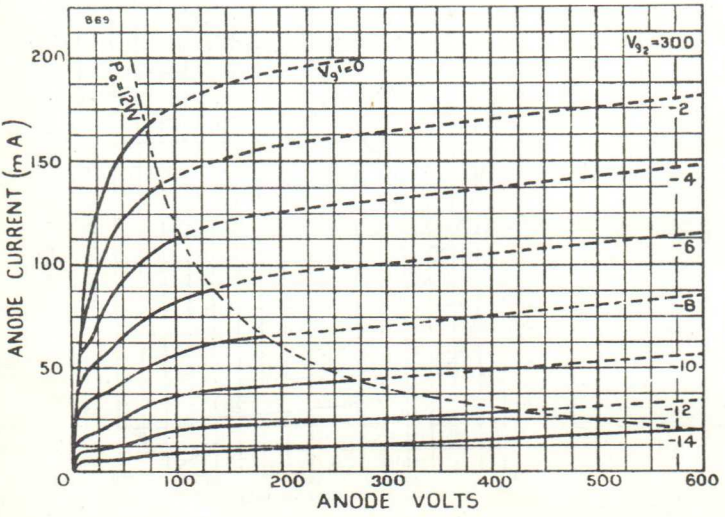


Issue 2.
May, 1964.

EL84

6BQ5


868
$V_h = 6{\cdot}3$
$V_{g2} = 250$
$P_a = 12W$
$V_g = 0$
-2
-4
-6
-8
-10
ANODE CURRENT (mA)
200
150
100
50
0
50
100
150
200
250
300
ANODE VOLTS

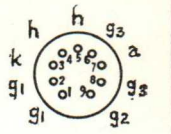

869
$V_{g2} = 300$
$P_a = 12W$
$V_g = 0$
-2
-4
-6
-8
-10
-12
-14
ANODE CURRENT (mA)
200
150
100
50
0
100
200
300
400
500
600
ANODE VOLTS

Ferranti

EL85

OUTPUT PENTODE

An indirectly heated pentode rated for an anode dissipation of 6 watts. Designed for use as an RF Amplifier up to 120 Mc/s or as an AF output valve.



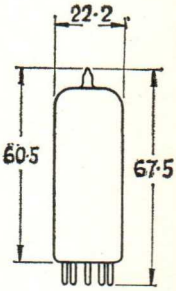
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A Glass
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$")
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$")
Max. Diameter	22·2 mm. ($\frac{7}{8}$")

BASE CONNECTIONS.

Pin 1—Control Grid (g_1) Pin 5—Heater
Pin 2—Control Grid (g_1) Pin 6—Suppressor Grid (g_3)
Pin 3—Cathode Pin 7—Anode
Pin 4—Heater Pin 8—Suppressor Grid (g_3)
Pin 9—Screen Grid (g_2)



All dimensions shown are in millimetres (max.)

HEATER.

Heater Voltage	6·3 volts
Heater Current	0·2 amp

RATINGS.

Max. HT. Supply Voltage	550 volts
Max. Anode Voltage	300 volts
Max. Screen Voltage	300 volts
Max. Anode Dissipation...	6 watts
Max. Screen Dissipation (Zero Sig.) ...	1 watt
*Max. Screen Dissipation (Max. Sig.) ...	2 watts
Max. Cathode Current (AF Operation)	35 mA
Max. Cathode Current (RF Operation)	25 mA
Max. Negative V_{g1}	100 volts
Max. Negative V_{g1} (pk)...	250 volts
Max. V_{h-k}	100 volts
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

Anode Voltage	200	225	250	volts
Screen Voltage	200	225	250	volts
Control Grid Voltage	−9·4	−10·8	−13·5	volts
Anode Current	22·5	26	24	mA
Screen Current	3·6	4·1	4·1	mA
Mutual Conductance	3·2	3·2	3·1	mA/V
Inner μ (μ_{g1-g2})	11	11	11	
Anode Impedance	90	90	100	kΩ

TYPICAL OPERATION.

Single Valve as Class "A" Amplifier.

V_a	200	225	250	volts
V_{g2}	200	225	250	volts
R_k	360	360	470	ohms
I_a	22·5	26	24	mA
I_{g2}	3·6	4·1	4·1	mA
R_a	9·0	9·0	11	kΩ
V_{in}(r.m.s.)	6·4	7·2	7·5	volts
P_{out}	2·0	2·6	2·6	watts
†D_{tot}	10	10	10	%
V_{in} (r.m.s.) ... ... (for P_{out}=50 mW)	0·8	0·8	0·7	volts

*For speech and music.
†Measured at fixed bias and represents power output for speech and music. A sustained sine wave input results in altered bias voltage and anode and screen grid currents causing approximately 10% reduction in power output.

Issue 1
Feb., 1963

TYPICAL OPERATION (Contd.)

2–Valves in Class "AB" Push Pull Amplifier.

Pentode Connection

V_a	200	250	volts
V_{g_2}	200	250	volts
*R_k	310	310	Ω
$I_{a(o)}$	2×16	2×20	mA
$I_{g_2(o)}$	2×2·9	2×3·3	mA
I_a (Max. Sig.)	2×17·5	2×22·1	mA
I_{gz} (Max. Sig.)	2×4·4	2×7·1	mA
R_{a-a}	12	12	kΩ
$V_{g_1-g_1}$	19	24·4	volts
†P_{out}	4·0	6·8	watts
D_{tot}	4·5	5·4	%

2–Valves in Class "B" Push Pull Amplifier.

Pentode Connection

V_a	250	250	volts
V_{g_2}	250	250	volts
V_{g_1}	−17·5	−23	volts
$I_{a(o)}$	2×5·0	2×5·0	mA
$I_{g_2(o)}$	2×0·8	2×0·9	mA
I_a (Max. Sig.)	2×15	2×19	mA
I_{g_2} (Max. Sig.)	2×5	2×7·3	mA
R_{a-a}	16	16	kΩ
$V_{g_1-g_1}$ (r.m.s.)	24·4	32	volts
P_{out}	3·9	6·8	watts
D_{tot}	3·5	4·3	%

CAPACITANCES.

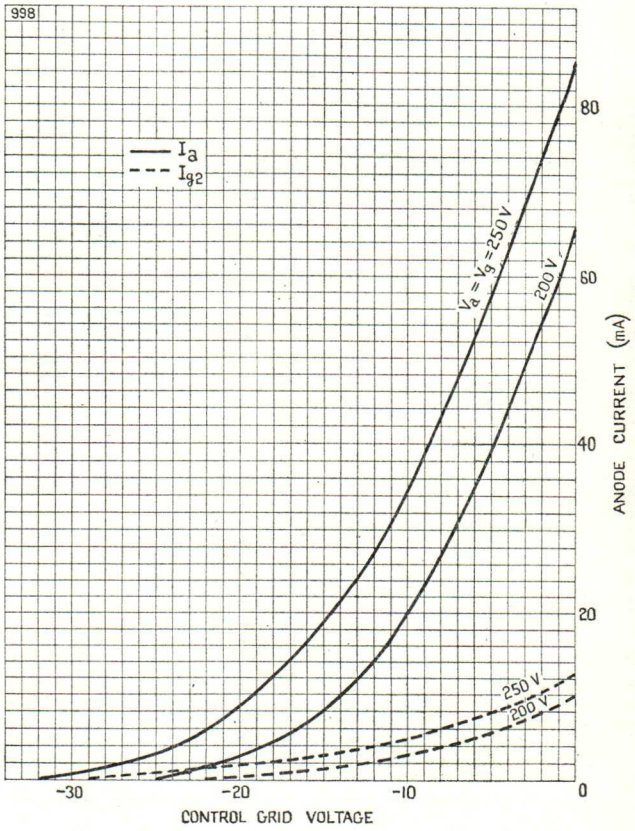
C_{in}	4·3	pF
C_{out}	5·1	pF
C_{a-g_1}	<0·2	pF

*Common bias resistor.

†Measured at fixed bias and represents power output for speech and music. A sustained sine wave input results in altered bias voltage and anode and screen grid currents causing approximately 10% reduction in power output.

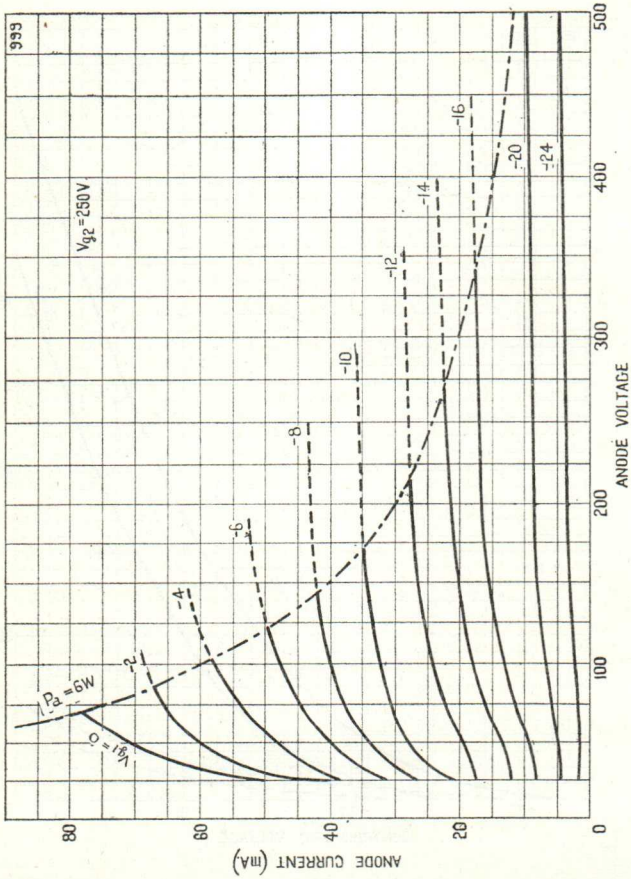
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

TYPICAL ANODE CURRENT v GRID VOLTAGE CHARACTERISTICS



Ferranti

TYPICAL ANODE CURRENT v GRID VOLTAGE CHARACTERISTICS



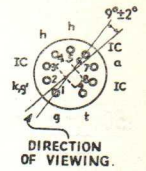
R859

FERRANTI

TUNING INDICATOR

EM80

Type EM80 is an electron beam tube designed for use as a tuning indicator in F.M. or A.M. radio receivers. The display consists of three curved green petals radiating from the centre of the lower edge of a fluorescent screen, which is viewed through the side of the bulb.



PHYSICAL DETAILS.

Base		B9A (Noval).
Max. Overall Length		67·5 mm. ($2\frac{7}{16}$in.).
Max. Seated Height		60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter		22·2 mm. ($\frac{7}{8}$in.).
Mounting Position		Any.

For dimensions and location of display area see outline drawing.

BASE CONNECTIONS.

Base Connections Underside View of Base

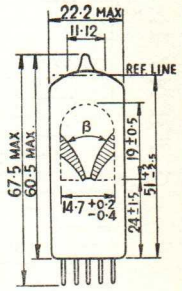
Pin 1—Grid.	Pin 5—Heater.
Pin 2—Cathode.	Pin 6—Internal Connection.
Pin 3—Internal Connection.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Target.

HEATER.

Heater Voltage		6·3 volts.
Heater Current		0·3 amp.

RATINGS.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	0·2 watt.
Max. Target Supply Voltage ...	500 volts.
Max. Target Voltage	300 volts.
Min. Target Voltage	165 volts.
Max. Negative Grid Voltage ...	1·3 volts.
Max. Grid Resistor	3·0 MΩ
Max. Total Cathode Current ...	3·0 mA.
Max. Heater-Cathode Voltage ...	100 volts.
Max. Insulation Resistance Heater-Cathode ...	20000 ohms.



All dimensions shown are in millimetres.

TYPICAL OPERATION.

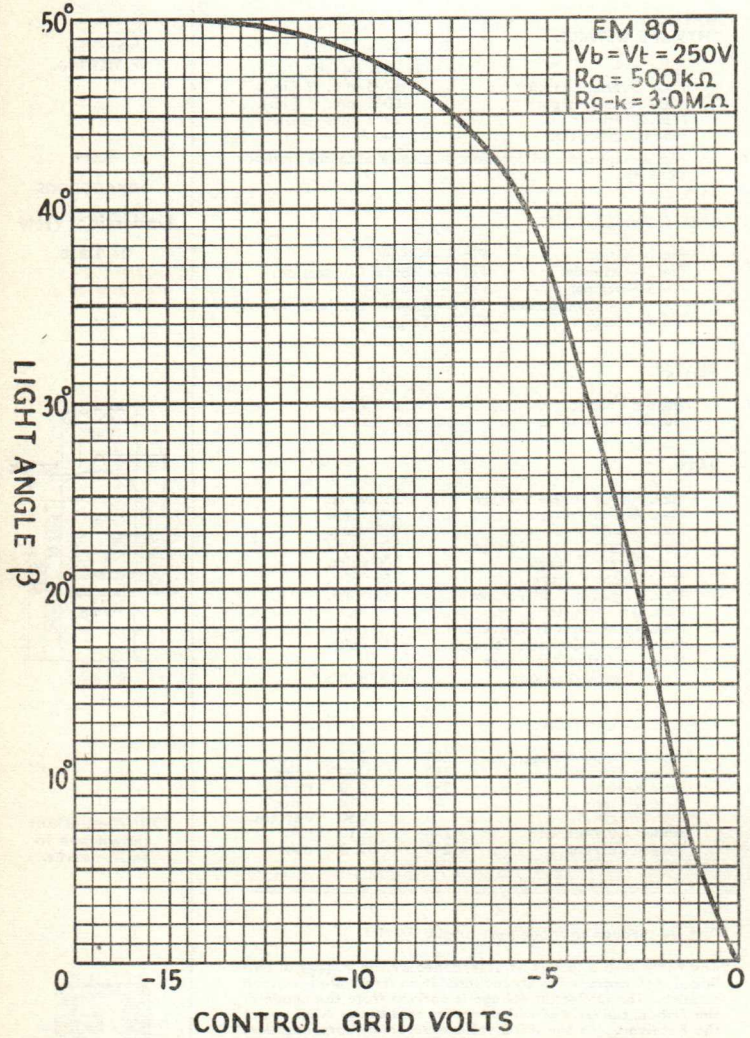
*Anode Supply Voltage ...	250	250	volts.
Target Voltage	250	250	volts.
Grid Resistor	3·0	3·0	MΩ
Grid Voltage	−1	−14	volts.
†Light Angle /3	5	50	degrees.
Anode Current	370	10	μA.
Target Current	2·0	2·3	mA.

*Applied through an anode resistor of 0·56 MΩ

†The width of the 'petals' is determined by the voltage of two linked deflectors which are mounted in an accelerated electron stream. The Deflector Voltage is derived from the anode of the Triode, the Grid of which is connected to the AGC line of the Receiver. As the AGC voltage becomes more negative, the Deflector Voltage rises and the 'petal' width is increased, indicating correct tuning. At low signal levels the area of the 'petals' shows the most marked rate of change ; but with stronger signals the shadow areas are relatively small and the increased rate of change with AGC voltage is most noticeable.

FERRANTI

Issue 1.
Dec., 1955

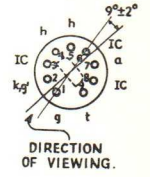

EM 80
Vb = Vt = 250V
Ra = 500kΩ
Rg-k = 3·0MΩ
50°
40°
30°
20°
10°
0
LIGHT ANGLE β
0
-15
-10
-5
0
CONTROL GRID VOLTS

FERRANTI

TUNING INDICATOR

EM81

Type EM81 is an electron beam tube designed for use as a tuning indicator in F.M. or A.M. radio receivers, or as a level indicator in tape recorders. The display is green and has a dark fan shaped area in the centre, this being viewed through the side of the bulb.

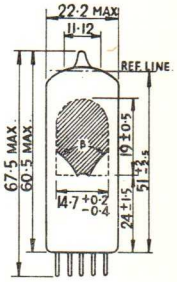


PHYSICAL DETAILS.

Base		B9A (Noval).
Max. Overall Length		67·5 mm. ($2\frac{37}{32}$in.)
Max. Seated Height		60·5 mm. ($2\frac{7}{16}$in.).
Max. Diameter		22·2 mm. ($\frac{7}{8}$in.).
Mounting Position		Any.

For dimensions and location of display area see outline drawing.

Base Connections Underside View of Base



BASE CONNECTIONS.

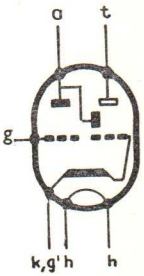
Pin 1—Grid.	Pin 5—Heater.
Pin 2—Cathode.	Pin 6—Internal Connection.
Pin 3—Internal Connection.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Target.

HEATER.

Heater Voltage		6·3 volts.
Heater Current		0·3 amp.

RATINGS.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	0·2 watt.
Max. Target Supply Voltage ...	550 volts.
Max. Target Voltage	300 volts.
Min. Target Voltage	165 volts.
Max. Negative Grid Voltage ...	1·3 volts.
Max. Grid Resistor	3·0 MΩ
Max. Total Cathode Current ...	3·0 mA.
Max. Heater-Cathode Voltage	100 volts.
Max. Insulation Resistance Heater-Cathode ...	20000 ohms.



All dimensions shown are in millimetres

TYPICAL OPERATION

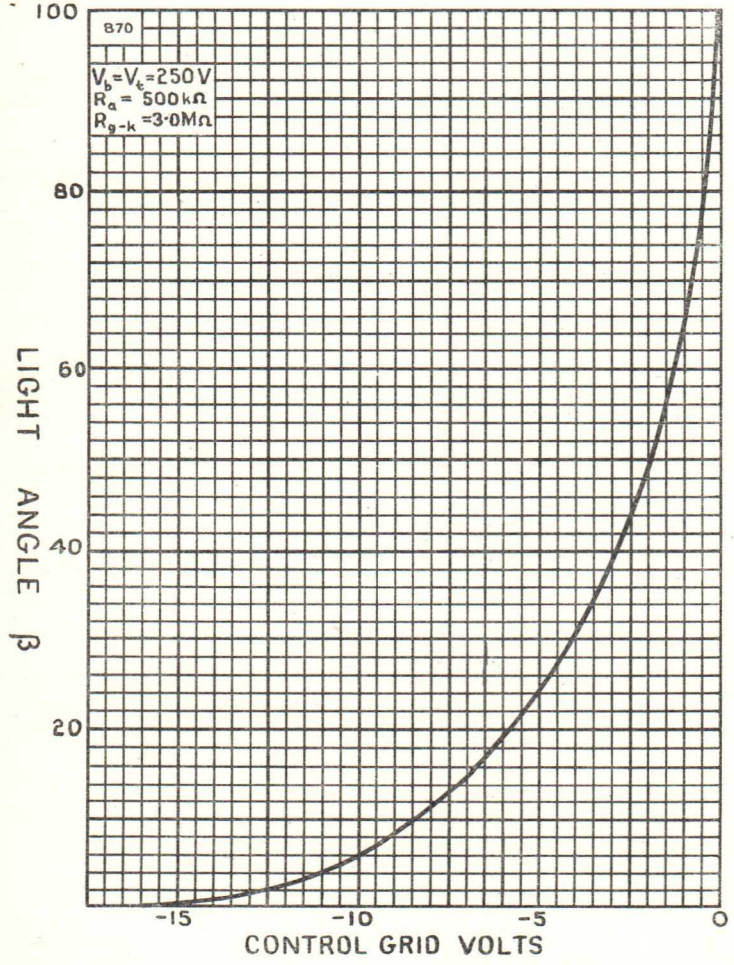
*Anode Supply Voltage ...	250	250	volts.
Target Voltage	250	250	volts.
Grid Resistor	3·0	3·0	MΩ
Grid Voltage	−1	−10·5	volts.
†Light Angle ß	65	5	degrees.
Anode Current	370	20	μA.
Target Current	2·0	2·3	mA.

*Applied through an anode load resistor of 0·5 MΩ

†The width of the dark area is determined by the voltage of a deflector which is mounted in an accelerated electron stream. The Deflector Voltage is derived from the anode of the Triode the Grid of which is connected to the AGC line of the Receiver. As the AGC voltage becomes more negative, the Deflector Voltage rises and the width of the dark area is decreased, indicating correct tuning.

Issue IT
Mar, 1957

EM81

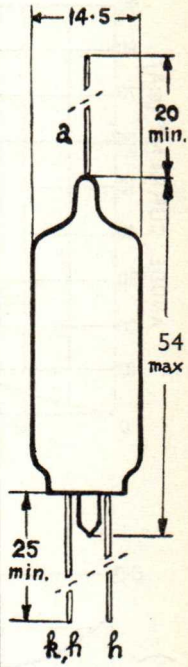

100
80
60
40
20
LIGHT ANGLE β
870
$V_b = V_c = 250V$
$R_a = 500k\Omega$
$R_{g-k} = 3{\cdot}0M\Omega$
-15
-10
-5
0
CONTROL GRID VOLTS

FERRANTI

HIGH VOLTAGE RECTIFIER

EY51

An indirectly heated miniature high voltage, half wave rectifier, designed for providing the E.H.T. supply in Television Receivers. The low heater wattage makes it particularly suitable for operation from line time base fly-back pulses, and the flexible leads facilitate mounting on or near the line output transformer.



All Dimensions shown are in millimetres.

PHYSICAL DETAILS.

Base	Flexible leads.
Max. Overall Length (excl. leads)	54 mm. (2⅛in.)
Max. Diameter	14·5 mm. (⅝in.)
*Mounting Position	Any.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·09 amp.
Heater Voltage Tolerance	
For I_{out} <200 μA ...	±15%
For I_{out} =500 μA ...	± 7%

RATINGS.

1. Sinusoidal Input (50 c/s.)

Max. r.m.s. Input Voltage	5·0 kV.
Max. Rectified Current ...	3·0 mA.
Max. Reservoir Capacitor	0·1 μF.
Min. Supply Impedance ...	100 kΩ

2. Sinusoidal Input (10 kc/s. to 500 kc/s.).

Max. P.I.V.	17 kV.
Max. Rectified Current ...	3·0 mA.
Max. Reservoir Capacitor	0·01 μF.

3. Pulse Input

Max. P.I.V.	17 kV.
Max. Rectified Current ...	350 μA.
†Max. Peak Cathode Current	80 mA.
Max. Reservoir Capacitor	5000 pF.

CAPACITANCE.

C_{a-k}	0·8 pF.

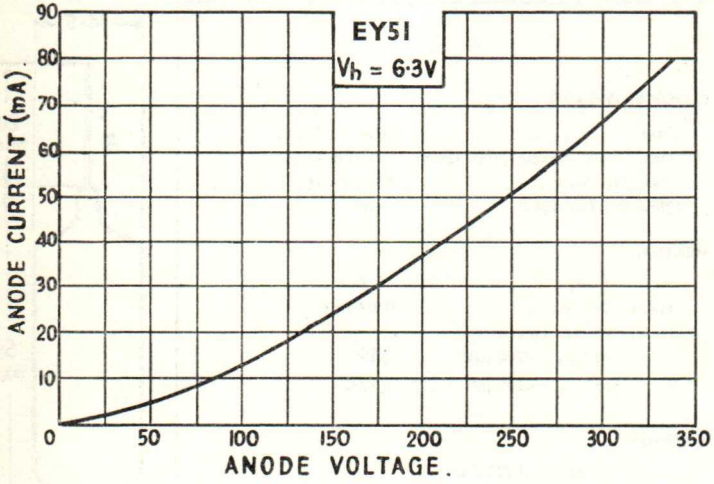
*Connections should not be soldered to the leads at any point less than 10 mm. from the seal, nor should the leads be bent near to the seal.

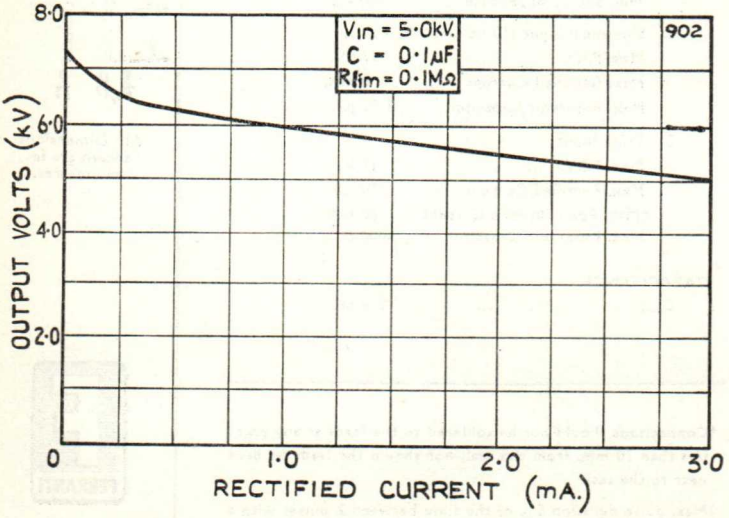
†Max. pulse duration 5% of the time between 2 pulses with a maximum duration of 5 μsecs.

Issue 2
Mar., 1959

FERRANTI

TYPICAL CHARACTERISTICS





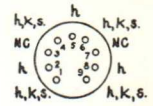
Ferranti

HIGH VOLTAGE RECTIFIER

EY86

6S2

An indirectly heated high voltage half-wave rectifier designed for use in Television Receiver E.H.T. supply units. The low heater wattage makes it particularly suitable for operation from line time base fly-back pulses.



Base Connections

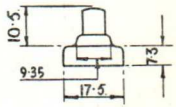
Underside View of Base

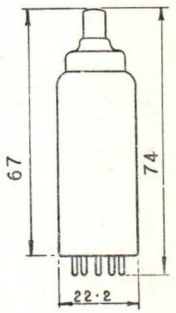
PHYSICAL DETAILS.

Base	... ...	B9A (Noval)
Max. Overall Length	... ...	74 mm. ($2\frac{29}{32}$in.)
Max. Seated Height	... ...	67 mm. ($2\frac{5}{8}$in.)
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.)

BASE CONNECTIONS.

*Pin 1—Heater, Cathode, Shield	*Pin 6—Heater, Cathode, Shield
Pin 2—Heater	†Pin 7—No Connection
†Pin 3—No Connection	Pin 8—Heater
*Pin 4—Heater, Cathode, Shield	*Pin 9—Heater, Cathode, Shield
Pin 5—Heater	Top Cap—Anode





Dimensions shown are in millimetres (max.)

HEATER.

Heater Voltage	6·3 volts
Heater Current	0·09 amp
Heater Voltage Tolerance:	
For I_{out} <200μA	± 15 %
For I_{out} >200μA	± 7 %

RATINGS.

Pulse Input:	
‡Max. P.I.V.	22 kV
Max. Rectified Current	800 μA
**Max. Peak Anode Current ...	40 mA
Max. Reservoir Capacitor ...	2000 pF
Sinusoidal Input:	
Max. r.m.s. Input Voltage ...	5 kV
Max. Rectified Current	3 mA
Max. Reservoir Capacitor ...	0·2 μF
Min. Limiting Resistance ...	100 kΩ

CAPACITANCE.

$C_{a-(h+k+s)}$	1·8 pF

WARNING.

When operated at an anode voltage in excess of 16kV. X-ray shielding may be required to give protection against the possible danger of injury from prolonged exposure at close range. The level of X-radiation is likely to be considerably higher when the EY86 heater circuit is open.

*Pins 1, 4, 6 and 9 may be used for fixing an anti-corona shield.

†Pins 3 and 7 should be used only for connections in the heater circuit. Under no circumstances must they be earthed.

‡Max. duration 18% of a line scanning cycle with a maximum of 18μsecs.

**Max. duration 10% of a line scanning cycle with a maximum of 10μsecs.

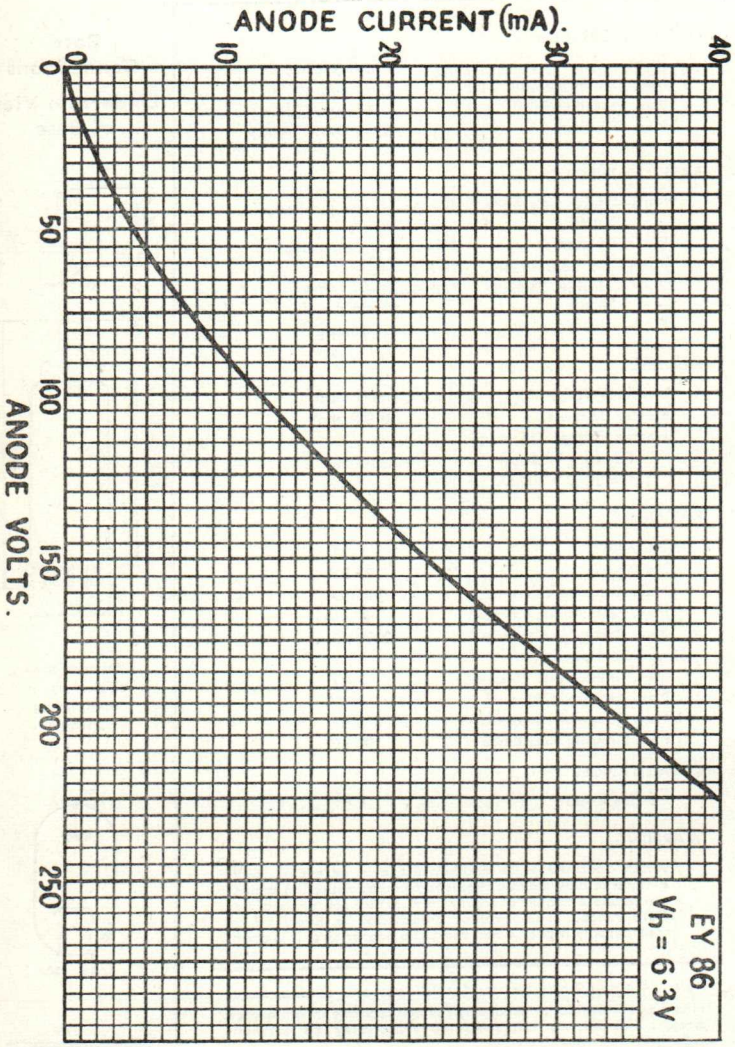
Issue 2.
June, 1962

Ferranti

Ferranti

EY86

6S2



FERRANTI

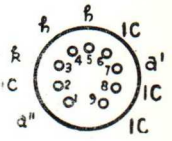
FULL WAVE RECTIFIER

EZ80

An indirectly heated, full wave rectifier.

PHYSICAL DETAILS.

Base	B9A—Noval.
Bulb	Clear.
Max. Overall Length	67·5 mm. ($2\frac{3}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.



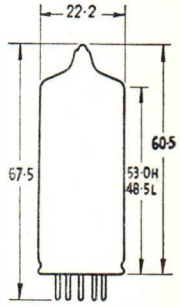
Base Connections Underside View of Base

BASE CONNECTIONS.

Pin 1—Anode 2.	Pin 5—Heater.
Pin 2—Internal Connection.	Pin 6—Internal Connection.
Pin 3—Cathode.	Pin 7—Anode 1.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Internal Connection.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amps.



RATINGS.

Max. Peak Inverse Voltage ...	980 volts.
*Max. R.M.S. Anode Voltage ...	350 volts.
Max. Rectified Current	90 mA.
*Max. Peak Anode Current ...	270 mA.
*Min. Limiting Resistance ...	125 ohms.
Max. Reservoir Capacitor ...	50 μF.
Max. Peak V_{h-k}	500 volts.

TYPICAL OPERATING CONDITIONS.

CAPACITOR INPUT.

*R.M.S. Input Voltage	250	275	300	350	volts.
Rectified Current	90	90	90	90	mA.
*Min. Supply Impedance	125	175	215	300	ohms.
Max. Reservoir Capacitor	50	50	50	50	μF.
DC. Output Voltage	265	285	310	360	volts.

All dimensions shown are in millimetres.

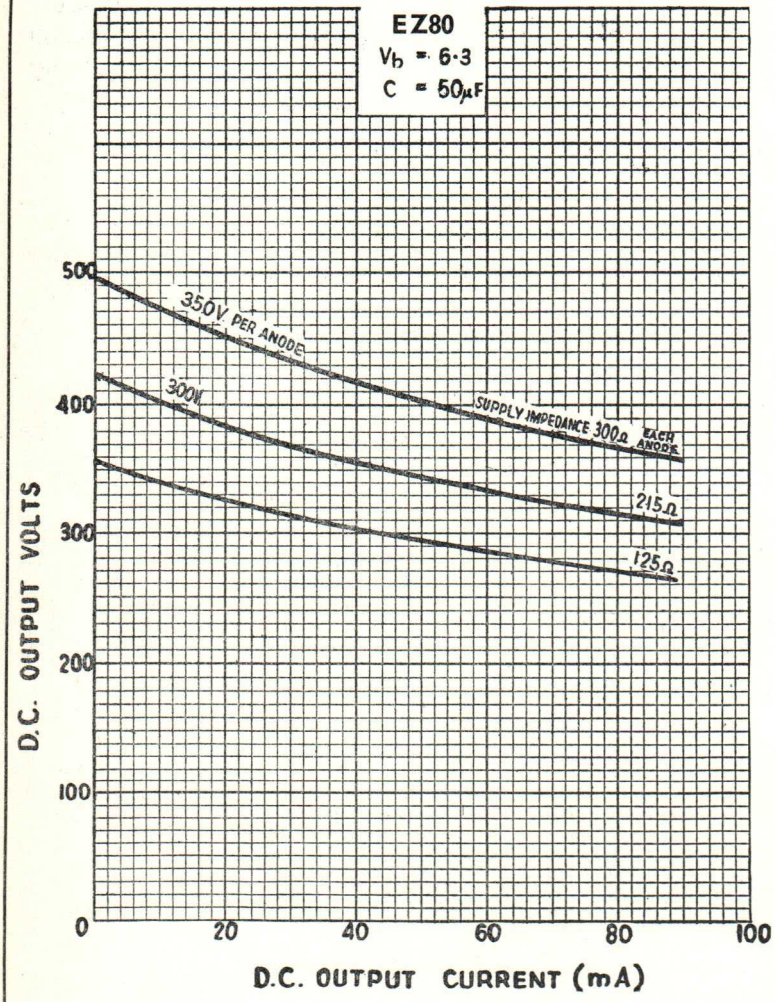
*Each Anode.

FERRANTI

Issue 2 (Tentative) Dec., 1957

EZ80

FERRANTI

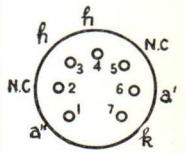


FERRANTI

FULL WAVE RECTIFIER

EZ90

A miniature indirectly heated, full wave rectifier.



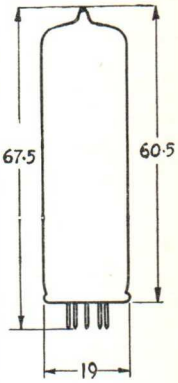
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Bulb	Clear.
Max. Overall Length	67·5 mm. (2$\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode 2. Pin 4—Heater.
Pin 2—No Connection. Pin 5—No Connection.
Pin 3—Heater. Pin 6—Anode 1.
Pin 7—Cathode.



HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·6 amp.

RATINGS.

Max. Peak Inverse Voltage ...	1250 volts.
Max. Rectified Current ...	70 mA.
Max. Peak Anode Current ...	210 mA.*
Max. Reservoir Capacitor ...	16 μF.
*Min. Supply Impedance	250 ohms.
Max. V_{h-k} (pk)	450 volts.

TYPICAL OPERATION.

CAPACITOR INPUT.

*Input Voltage	325 volts (r.m.s.).
Rectified Current	70 mA.
*Supply Impedance	520 ohms.
Reservoir Capacitor	8 μF.
DC. Output Voltage	300 volts.

CHOKE INPUT.

*Input Voltage	450 volts (r.m.s.).
Min. Choke Inductance	10 henries.
Rectified Current	70 mA.
Output Voltage	370 volts.

All dimensions shown are in millimetres (max.).

*Each Anode.

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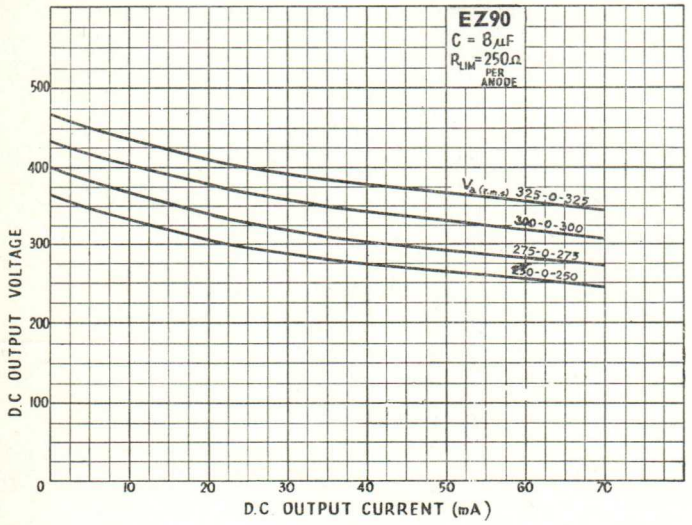
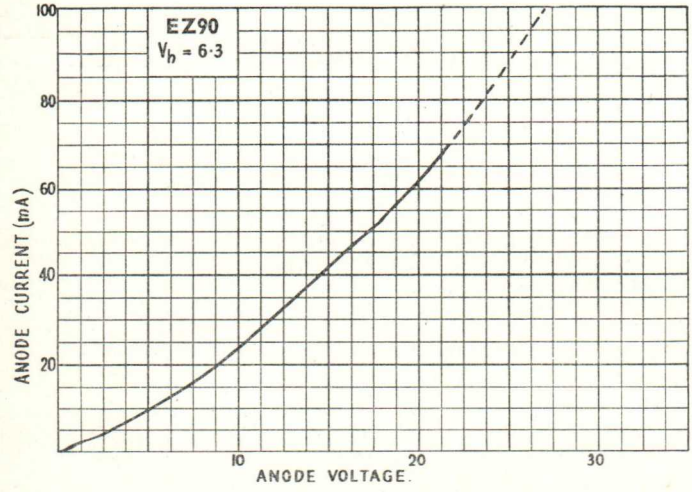
FERRANTI


EZ90
C = 8 μF
R_{LIM} = 250Ω PER ANODE
$V_{a(r.m.s)}$ 325-0-325
300-0-300
275-0-275
250-0-250
D.C OUTPUT VOLTAGE
0
100
200
300
400
500
10
20
30
40
50
60
70
D.C OUTPUT CURRENT (mA)


EZ90
V_h = 6·3
ANODE CURRENT (mA)
20
40
60
80
100
10
20
30
ANODE VOLTAGE.

FERRANTI

TRIPLE DIODE TRIODE

PABC80

An indirectly heated triple diode triode. One diode has a separate cathode. Primarily designed for use as A.F. amplifier and demodulator in FM/AM Receivers.

PHYSICAL DETAILS.

Base	B9A Noval
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{23}{32}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Diode 3 Anode. Pin 6—Diode 1 Anode.
Pin 2—Diode 2 Anode. Pin 7—Triode Cathode.
Pin 3—Diode 2 Cathode. Diode 1 Cathode.
Pin 4—Heater. Diode 3 Cathode, Shield.
Pin 5—Heater. Pin 8—Triode Grid.
Pin 9—Triode Anode.

HEATER.

Heater Current	0·3 amp.
Heater Voltage	9·5 volts.

RATINGS.

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	1 watt.
Max. Cathode Current ...	5 mA.
*Max. R_{g-k}	3 MΩ
Max. R_{h-k}	20 kΩ
§Max. V_{h-k}	150 volts.
†Min. Negative Grid Voltage ...	1·3 volts.

DIODE SECTIONS.

Max. P.I.V. (Each Diode) ...	350 volts.
Max. Peak Current Diode 1 ...	6 mA.
Max. Peak Current Diode 2 ...	75 mA.
Max. Peak Current Diode 3 ...	75 mA.
Max. Current Diode 1	1 mA.
Max. Current Diode 2	10 mA.
Max. Current Diode 3	10 mA.

CHARACTERISTICS.

TRIODE SECTIONS.

Anode Voltage	170	200	volts.
Grid Voltage	−1·85	−2·3	volts.
Anode Current	1	1	mA.
Mutual Conductance	1·45	1·4	mA/V.
Amplification Factor	70	70	
Anode Impedance	48	50	kΩ

DIODE SECTIONS.

Diode 1 Impedance ($V_{a'd}$ = 10v)	5 kΩ
Diode 2 Impedance ($V_{a''d}$ = 5v)	200 Ω
Diode 3 Impedance ($V_{a'''d}$ = 5v)	200 Ω
$r_{a''d}/r_{a'''d}$	0·65 to 1·5

MICROPHONY

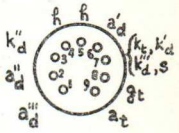
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

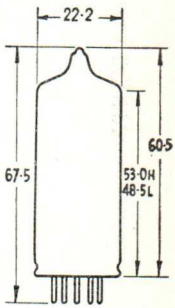
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	·76	mA.
Stage Gain	51	53	47	54	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (for V_{out} = 8v r.m.s.)	1·1	0·9	0·8	0·6	%
Grid Resistor for following valve	680	680	330	680	kΩ

*For operation with grid current biasing R_{g-k} may be increased to 22 MΩ max.
†For grid current of 0.3 μA.



Base Connections

Underside View of Base



All dimensions shown are in millimetres (max. unless otherwise stated).

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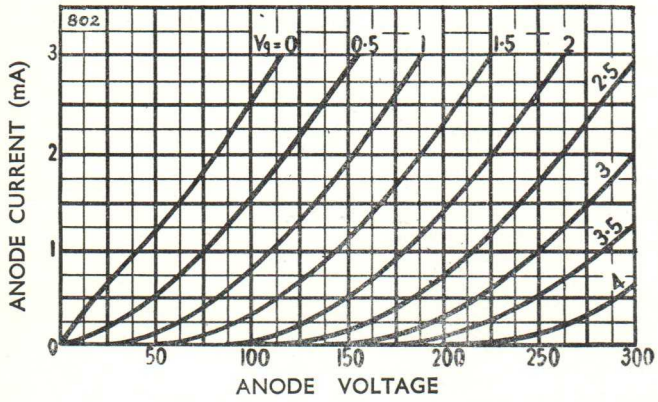
CAPACITANCES. TRIODE SECTION.

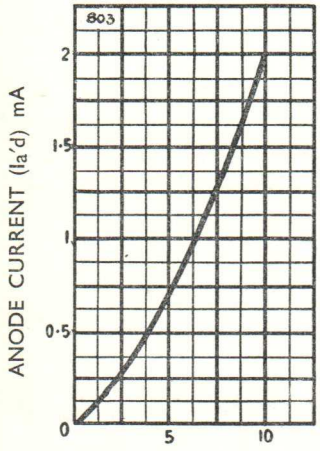
C_{in}	... ...	1.9 pF.
C_{out}	... ...	1.4 pF.
C_{a-g}	... ...	2.0 pF.
C_{g-h}	... ...	<0.04 pF.

DIODE SECTION.

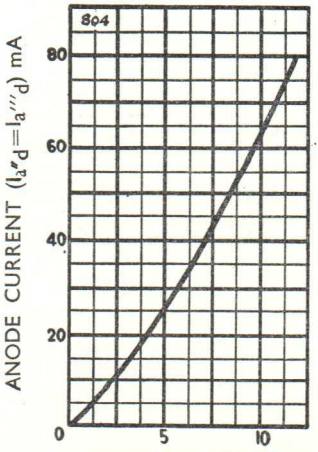
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$ ...	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$	4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k'''d,\ s)}$ ...	4.8 pF.
$C_{k''d-all}$	5.0 pF.
$C_{a'd-h}$	<0.25 pF.
$C_{a'''d-h}$	<0.2 pF.
$C_{k''d-h}$	2.5 pF.



DIODE I



DIODE II - DIODE III

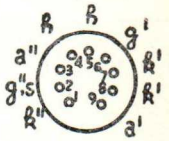


FERRANTI

DOUBLE TRIODE

PCC84

A double triode with separate cathodes, primarily designed for use as a cascode R.F. Amplifier in Television Receivers. Suitable for operation at frequencies up to 220 Mc/s.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	... ...	49 mm. ($1\frac{9}{16}$in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Cathode Triode 2.
Pin 2—Grid Triode 2, Shield.
Pin 3—Anode Triode 2.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Grid Triode 1.
Pin 7—Cathode Triode 1 (in).
Pin 8—Cathode Triode 1 (out).
Pin 9—Anode Triode 1.

The triode on Pins 6, 7, 8 and 9 should have grounded-cathode connection and that on pins 1, 2 and 3 should have grounded-grid connection.

HEATER.*

Heater Current	... ...	0·3 amp.
Heater Voltage	... ...	7·0 volts.

RATINGS.†

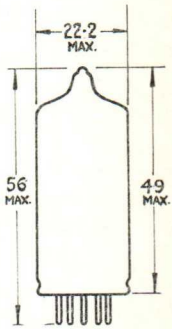
Max. Anode Supply Voltage	...	550 volts.
Max. Anode Voltage	... ...	180 volts.
Max. Anode Dissipation	...	2 watts.
Max. Cathode Current	...	18 mA.
Max. Neg. Grid Voltage	...	50 volts.
Max. $V_{h-k'}$	... ...	90 volts.
Max. $V_{h-k''}$	(heater positive)	90 volts.
**Max. $V_{h-k''}$ (pk)	(heater negative)	250 volts.
Max. $R_{g'-k'}$	... ...	1·0 MΩ
Max. $R_{g''-k''}$	... ...	0·5 MΩ
Max. R_{h-k}	... ...	20 kΩ

CHARACTERISTICS.†

Anode Voltage	... ...	90 volts.
Grid Voltage	... ...	−1·5 volts.
Anode Current	... ...	12 mA.
Amplification Factor	... ...	24
Mutual Conductance	... ...	6 mA/V.
§Input Impedance	... ...	2 kΩ

CAPACITANCES.‡

$C_{g'-k'}$	2·1 pF.
$C_{a'-k'}$	0·45 pF.
$C_{g'-h}$	<0·25 pF.
$C_{a'-g'}$	1·2 pF.
$C_{a''-g''}$	2·3 pF.
$C_{a''-k''}$	0·16 pF.
$C_{k''-g''+h}$	4·7 pF.
$C_{a''-g''+h}$	2·5 pF.
$C_{g'-a''}$	<0·006 pF.
$C_{a'-a''}$	<0·035 pF.
$C_{a'-k'+h+g}$	1·2 pF.
C_{h-k}	2·7 pF.



All dimensions shown are in millimetres (max.).

*Suitable for series operation only, a.c. or d.c.
†Each section, unless otherwise indicated.
‡Measured without external shield.
§Measured at a frequency of 200 Mc/s. with cathode connections pins 7 and 8 strapped.
**Max. d.c. component 180 volts.

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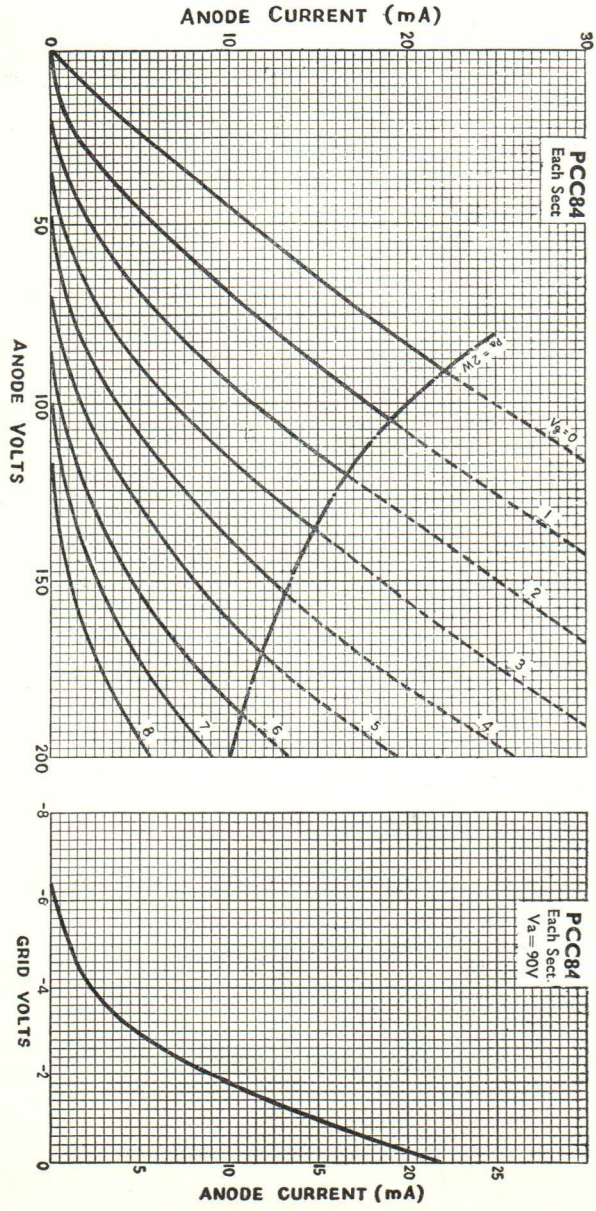
PCC84


ANODE CURRENT (mA)
0
10
20
30
PCC84
Each Sect
ANODE VOLTS
50
100
150
200
Vg = -2V
Vg = 0
1
2
3
4
5
6
7
8
-8
-6
-4
-2
0
GRID VOLTS
PCC84
Each Sect.
Va = 90V
5
10
15
20
25
ANODE CURRENT (mA)

FERRANTI

DOUBLE TRIODE

PCC85

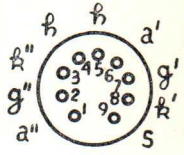
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Shield.



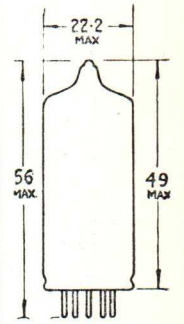
Base Connections
Underside View of Base

HEATER.

Heater Current	0·3 amp.
Heater Voltage	9·0 volts (approx.).

RATINGS*

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
†Max. Anode Dissipation ...	2·5 watts.
Max. Cathode Current ...	15 mA.
Max. Negative Grid Voltage ...	100 volts.
Max. R_{h-k}	20 kΩ
Max. V_{h-k}	90 volts.
Max. R_{g-k}	1 MΩ



CHARACTERISTICS.*

Anode Voltage	100	170	200	volts.
Negative Grid Voltage ...	1·1	1·5	2·1	volts.
Anode Current	4·5	10	10	mA.
Amplification Factor ...	50	50	48	
Mutual Conductance ...	4·6	6·2	5·8	mA/V.

TYPICAL OPERATION.

As R.F. Amplifier in F.M. or A.M. receivers.

Anode Supply Voltage ...	100	100	170	volts.
Anode Resistor	1·5	1·5	1·3	kΩ
Anode Voltage	92	155	160	volts.
Anode Current	5·2	8·7	6·0	mA.
Grid Voltage	0·85	1·4	2·0	volts.
Cathode Bias Resistor ...	160	160	330	Ω
Mutual Conductance ...	5·2	6·0	4·7	mA/V.
Anode Impedance ...	10	8·4	10·5	kΩ
Equivalent Noise Resistance	580	500	650	Ω
Input Resistance (at 100 Mc/s.) ...	5·0	6·0	8·0	kΩ

As a self-oscillating Frequency Changer for F.M./A.M.

Anode Supply Voltage ...	100	170	200	volts.
Anode Resistor	4·7	4·7	8·2	kΩ
‡Grid Resistor	1·0	1·0	1·0	MΩ
Oscillator Voltage ...	1·8	2·8	2·8	volts.
Anode Current	2·2	4·8	5·8	mA.
Conversion Conductance	1·7	2·2	2·3	mA/V.
Anode Impedance ...	20	16	15	kΩ

All dimensions shown are in millimetres.

*Each section, unless otherwise indicated.

†Max. Total Anode Dissipation (pa′ + pa″) = 4·5 watts.

‡The presence of i.f. feedback voltage tends to stabilise the performance of the oscillator and hence permits a relatively high value for the grid leak.

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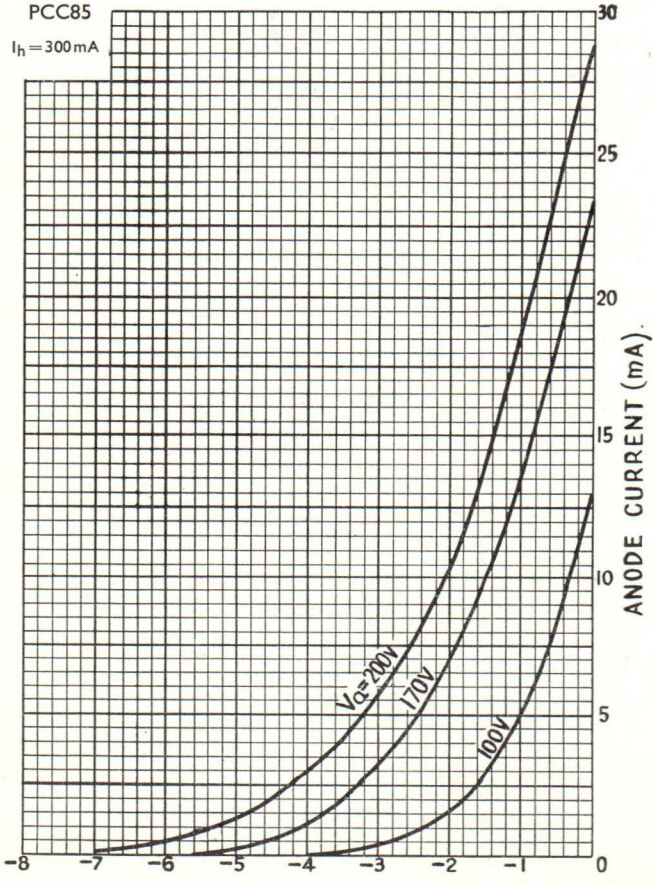
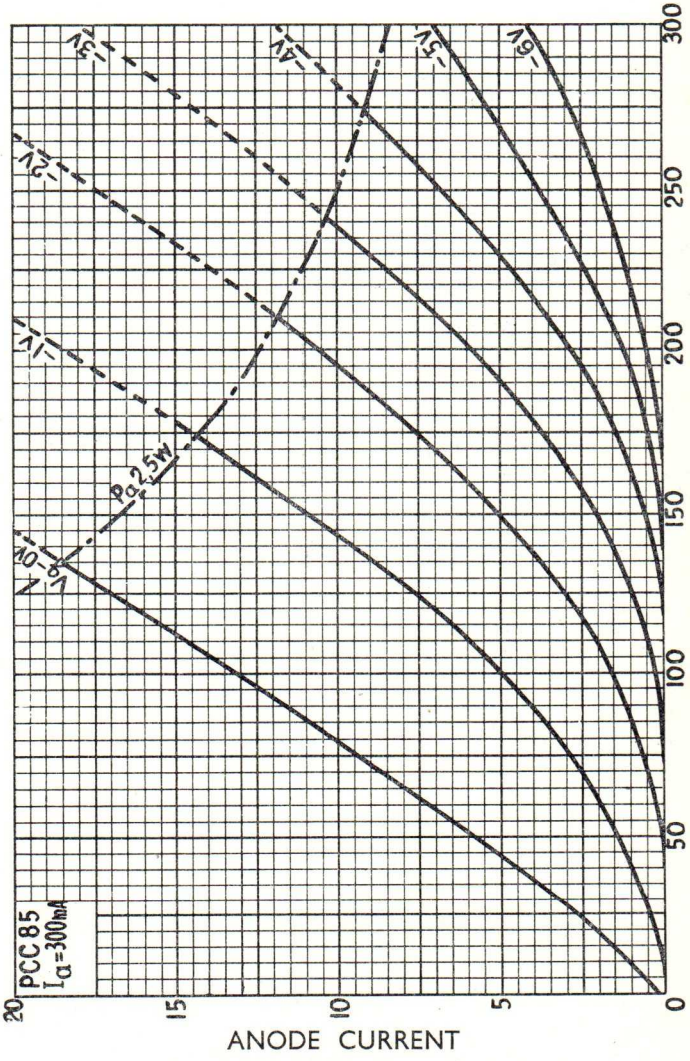
CAPACITANCES.

*C_{in}	3·0 pF.
*C_{out}	1·2 pF.
†*C_{out}	1·9 pF.
*C_{a-k}	0·18 pF.
*C_{a-g}	1·5 pF.
$C_{a'-a''}$	<0·04 pF.
†$C_{a'-a''}$	<0·008 pF.
$C_{g'-g''}$	<0·003 pF.
$C_{a'-g''} = C_{a''-g'}$	<0·008 pF.
$C_{a'-k''} = C_{a''-k'}$	<0·008 pF.
$C_{g'-k''} = C_{g''-k'}$	<0·003 pF.

*Each Section.
†Measured with external shield.





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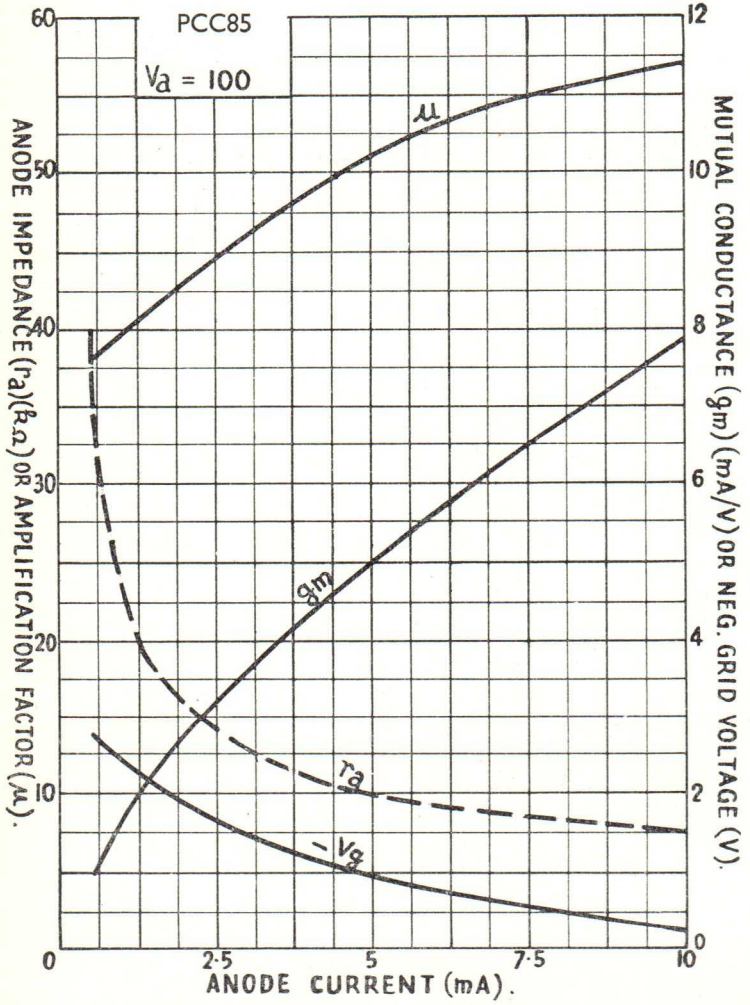
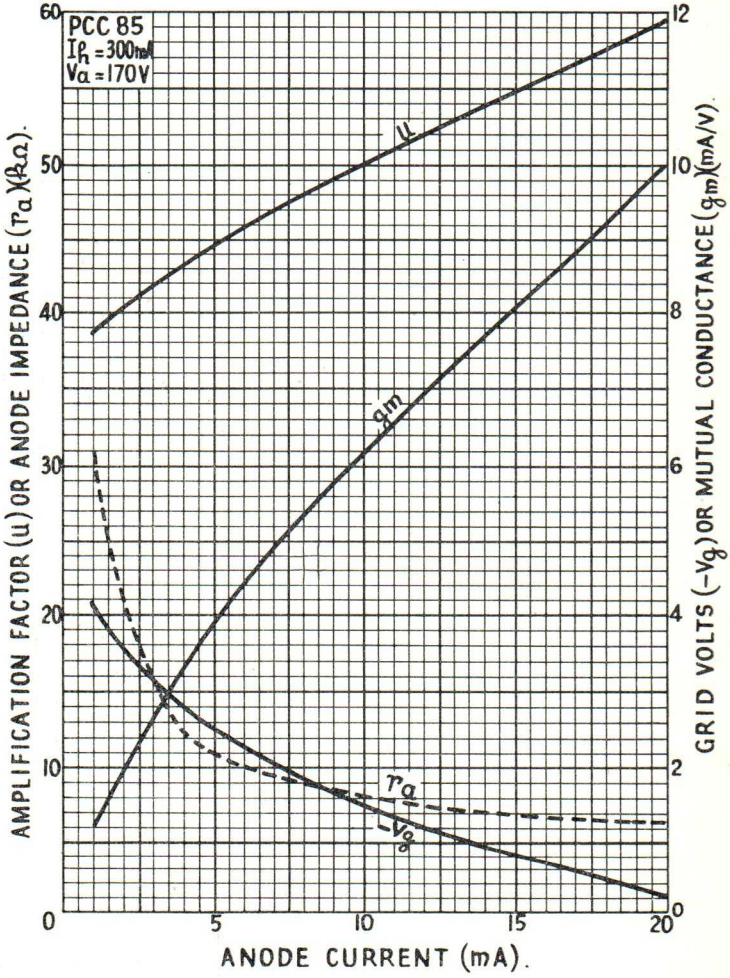

PCC85
Va = 100
μ
gm
ra
-Vg
60
50
40
30
20
10
0
12
10
8
6
4
2
0
2·5
5
7·5
10
ANODE IMPEDANCE (ra)(Ω.Ω) OR AMPLIFICATION FACTOR (μ).
MUTUAL CONDUCTANCE (gm) (mA/V) OR NEG. GRID VOLTAGE (V).
ANODE CURRENT (mA).



Issue 2
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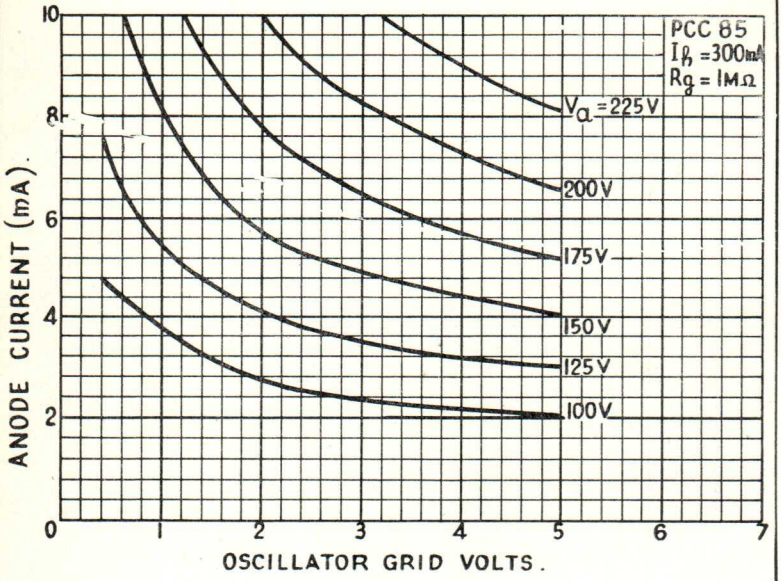
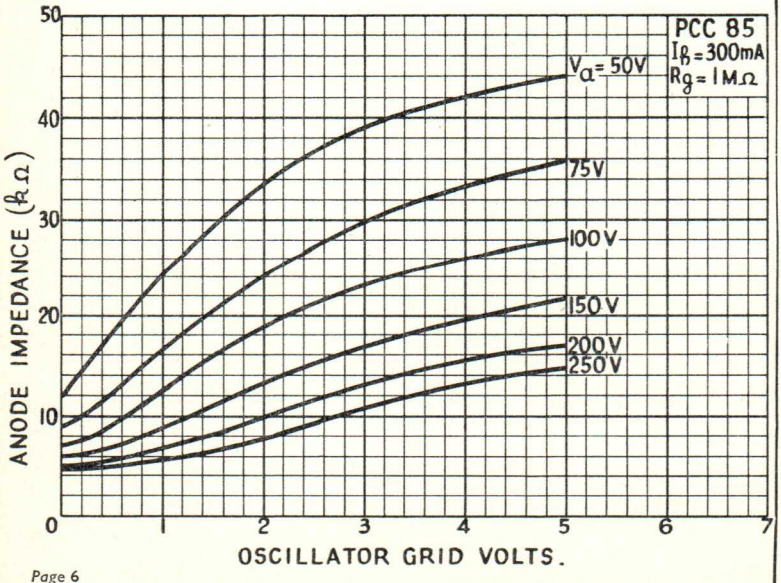
Dec., 1957





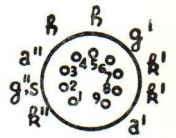
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

R.F. DOUBLE TRIODE

PCC89

A double triode with separate cathodes, primarily designed for use as a Cascode Amplifier in Television Receivers with series heater chains. Suitable for operation at frequencies up to 220 Mc/s.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	56 mm. ($2\frac{7}{32}$ in.).
Max. Seated Height	... ...	49 mm. ($1\frac{13}{16}$ in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$ in.).
Mounting Position	... ...	Any.

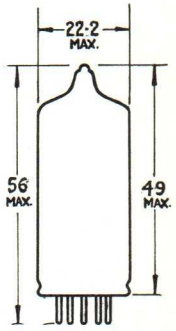
BASE CONNECTIONS.

Pin 1—Cathode Triode 2.	Pin 5—Heater.
Pin 2—Grid Triode 2, Shield.	Pin 6—Grid Triode 1.
	Pin 7—Cathode Triode 1.
Pin 3—Anode Triode 2.	Pin 8—Cathode Triode 1.
Pin 4—Heater.	Pin 9—Anode Triode 1.

The triode on Pins 6, 7, 8 and 9 should have grounded-cathode connection and that on pins 1, 2 and 3 should have grounded-grid connection. Pins 7 and 8 should preferably be strapped.

HEATER.

Heater Current	... ...	0·3 amp.
Heater Voltage	... ...	7·5 volts.



RATINGS. *

Max. Anode Supply Voltage	...	550 volts.
Max. Anode Voltage	... ...	130 volts.
Max. Anode Dissipation	... ...	1·8 watts.
Max. Cathode Current	... ...	18 mA.
Max. Neg Grid Voltage	... ...	−50 volts.
Max. R_{h-k}	... ...	20 kΩ
Max. $V_{h-k'}$	... ...	50 volts (r.m.s.).
Max. $V_{h-k''}$ (pk) (heater negative)		200 volts.
Max. $R_{g'-k'}$	... ...	1·0 MΩ
Max. $R_{g''-k''}$	... ...	0·5 MΩ

CHARACTERISTICS.

Anode Voltage	... ...	90 volts.
Grid Voltage	... ...	−1·2 volts.
Anode Current	... ...	15·5 mA.
Amplification Factor	... ...	36
Mutual Conductance	... ...	12 mA/V.
Anode Impedance	... ...	2·9 kΩ

CAPACITANCES.†

$C_{g'-a''}$	... <·005 pF.
$C_{a'-a''}$	... <·015 pF.

Grounded Cathode Section.

$C_{a'-g'}$	... 1·9 pF.
$C_{g'-k'+h+g''+s}$	... ... 3·8 pF.
$C_{a'-k'+h+g''+s}$	... ... 2·5 pF.
$C_{g'-h}$	... <0·3 pF.

Grounded Grid Section.

$C_{a''-g''}$	... 4·1 pF.
$C_{a''-k''}$	... <0·2 pF.
$C_{k''-g''+h+s}$	... 6·3 pF.
$C_{a''-g''+h+s}$	... 4·5 pF.
$C_{h-k''}$	... 2·9 pF.

All dimensions shown are in millimetres (max.).

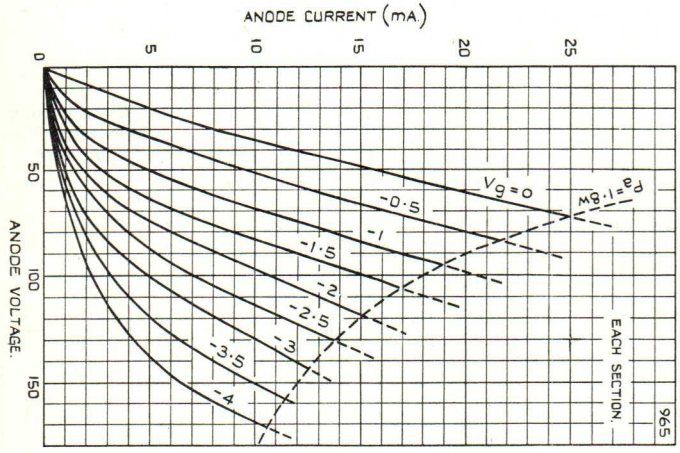
*Each section, unless otherwise indicated.
†Measured with external shield.

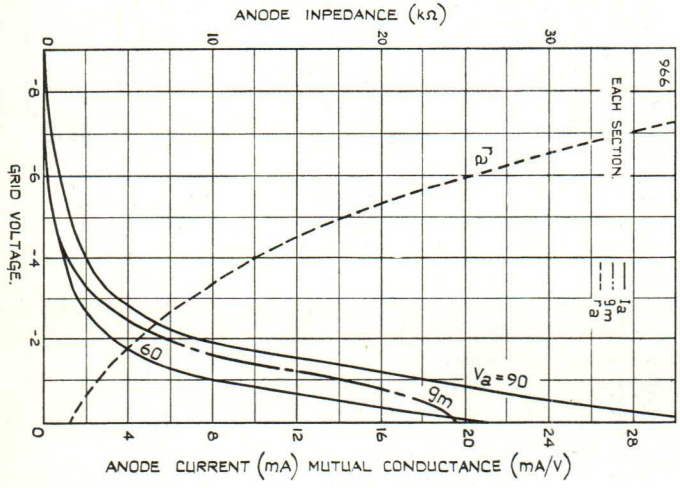
Issue 1.
Oct. 1961.

Ferranti

Ferranti

TYPICAL CHARACTERISTICS





Ferranti

V.H.F. DOUBLE TRIODE

PCC189

A variable-mu, low noise frame grid double triode with separate cathodes. Designed for use as a Cascode Amplifier.

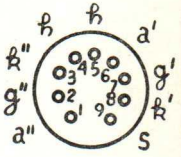
PHYSICAL DETAILS.

Base		B9A—Noval
Max. Overall Length ...	56	mm ($2\frac{7}{32}$in.)
Max. Seated Height ...	49	mm ($1\frac{11}{16}$in.)
Max. Diameter	22·2	mm ($\frac{7}{8}$in.)
Mounting Position	Any	

BASE CONNECTIONS.

Pin 1—Anode Triode 2	Pin 5—Heater
Pin 2—Grid Triode 2	Pin 6—Anode Triode 1
Pin 3—Cathode Triode 2	Pin 7—Grid Triode 1
Pin 4—Heater	Pin 8—Cathode Triode 1
Pin 9—Shield	

The triode on Pins 6, 7 and 8 should have grounded cathode connection and that on Pins 1, 2 and 3 should have grounded grid connection.



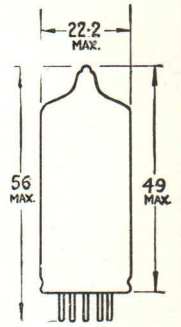
Base Connections Underside View of Base

HEATER.

Heater Current	0·3	amp
Heater Voltage	7·6	volts

RATINGS. *

Max. Anode Supply Voltage	550	volts
Max. Anode Voltage ...	130	volts
Max. Anode Dissipation ...	1·8	watts
Max. Cathode Current ...	22	mA
Max. Neg. Grid Voltage ...	−50	volts
Max. $V_{h-k'}$	80	volts
Max. $V_{h-k''}$ (heater negative)	180	volts
Max. R_{h-k}	20	kΩ
Max. $R_{g'-k'}$	1·0	MΩ
Max. $R_{g''-k''}$	0·5	MΩ



CHARACTERISTICS.*

Anode Voltage	90	volts
Grid Voltage	−1·4	volts
Anode Current	15·0	mA
Amplification Factor ...	34	
Mutual Conductance ...	12·5	mA/V
Anode Impedance	2·5	kΩ

To avoid exceeding the maximum anode voltage rating when the cascode amplifier is controlled, the grid of the grounded grid section must be connected to a voltage divider.

CAPACITANCES.

	With shield	Unshielded	
$C_{g'-a''}$	<·004	<·004	pF
$C_{a'-a''}$	<·015	<·045	pF
Grounded Cathode Section.			
$C_{a'-g'}$	1·9	1·9	pF
$C_{g'-k'+h+s}$	3·5	3·5	pF
$C_{a'-k'+h+s}$	2·3	1·7	pF
$C_{g'-h}$	<0·3	<0·3	pF
Grounded Grid Section.			
$C_{a''-g''}$	1·9	1·9	pF
$C_{a''-k''}$	0·17	0·18	pF
$C_{k''-g''+h+s}$	6·0	6·0	pF
$C_{a''-g''+h+s}$	4·0	3·4	pF
$C_{h-k''}$	3·0	3·0	pF

Dimensions shown are in millimetres

*Each section, unless otherwise indicated.

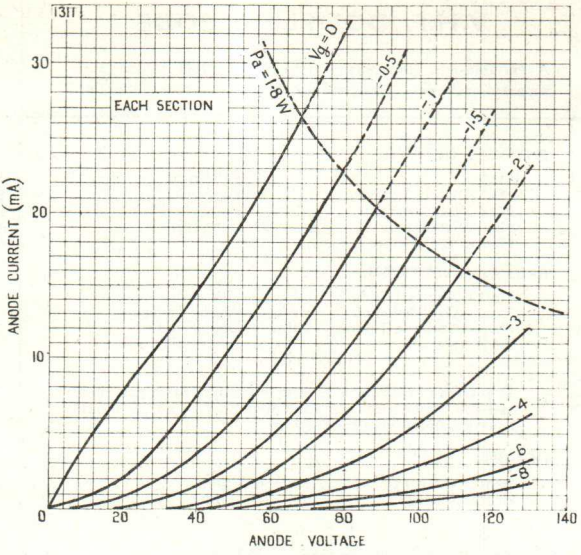
Issue 1
May, 1963

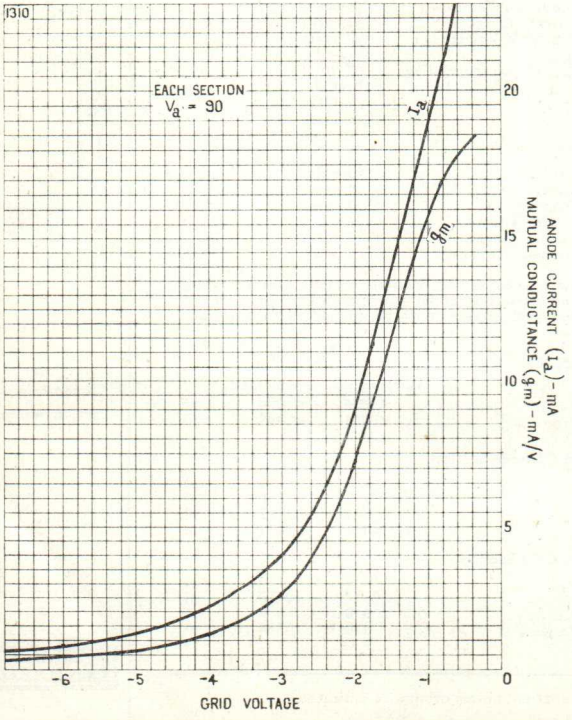
Ferranti

Ferranti

PCC189

TYPICAL CHARACTERISTICS

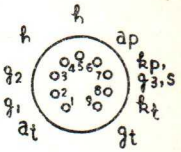




FERRANTI
TRIODE PENTODE

PCF80

Combined triode and high slope pentode with separate cathodes designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 Mc/s. It is suitable for series connected heater operation, a.c. or d.c.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode.	Pin 6—Pentode Anode.
Pin 2—Pentode g_1	Pin 7—Pentode Cathode, g_3 and shield.
Pin 3—Pentode g_2	
Pin 4—Heater.	Pin 8—Triode Cathode.
Pin 5—Heater.	Pin 9—Triode Grid.

HEATER.

Heater Current	0.3 amp.
Heater Voltage	9.0 volts.

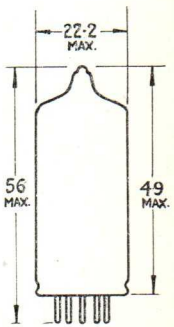
RATINGS.

PENTODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	175 volts.*
Max. Anode Dissipation ...	1.7 watts.
Max. Screen Dissipation ...	0.5 watts.†
Max. Cathode Current ...	17 mA.
**Min. Negative Grid Voltage ...	1.3 volts.
Max. V_{h-k} (heater positive) ...	100 volts.
‡Max. V_{h-k} (heater negative)	225 volts.
Max. R_{g_1-k} (auto bias)	1.0 MΩ
Max. R_{g_1-k} (fixed bias) ...	0.5 MΩ

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	1.7 watts.
Max. Cathode Current ...	17 mA.
§Max. Peak Instantaneous Cathode Current	200 mA.
Max. R_{g-k}	0.5 MΩ
**Min. Negative Grid Voltage ...	1.3 volts.
Max. Peak Instantaneous Negative Grid Voltage	350 volts.
‡Max. V_{h-k} (heater negative)	225 volts.
Max. V_{h-k} (heater positive) ...	100 volts.



CHARACTERISTICS.

	Pentode Sect.	Triode Section
Anode Voltage	170	100 volts.
Screen Voltage	170	– volts.
Grid Bias Voltage ...	–2	–2 volts.
Anode Current ...	10	14 mA.
Screen Current	2.8	– mA.
Mutual Conductance ...	6.2	5.0 mA/V.
Anode Impedance ...	400	4 kΩ
μ	–	20
Inner μ	47	–
Input Impedance (f=50 Mc/s.)	10	– kΩ
Equivalent Noise Resistance	1.5	– kΩ

All dimensions shown are in millimetres.

*May be increased to 200 volts with cathode current not exceeding 10 mA.
†May be increased to 0.75 volts with anode dissipation not exceeding 1.2 watts.
‡Max. d.c. component 150 volts.
§Max. duration of pulse 200 μsecs.
**At grid current of 0.3 μA.

Issue 2
Aug., 1957

PCF80

FERRANTI

TYPICAL OPERATION (as Frequency Changer)*

Anode Voltage	V_a	170	170	volts.
Screen Voltage ...	V_{g2}	170	170	volts.
Grid Resistor	R_{g1}	0·1	0·1	MΩ
Auto Bias Resistor ...	Rk	820	0	ohms.
Anode Current ...	Ia	5·2	6·3	mA.
Screen Current ...	I_{g2}	1·5	2·5	mA.
Oscillator Voltage ...	Vosc.	3·5	4·0	volts (r.m.s.)
Conversion Conductance	gc	2·1	2·05	mA/V.
Anode Impedance ...	ra	0·87	0·72	MΩ
Grid Current	I_{g1}	0	53	μA.

CAPACITANCES.†

C_{ap-at}	<0·06 pF.
C_{ap-gt}	<0·02 pF.
C_{gp-at}	<0·16 pF.
C_{gp-gt}	<0·02 pF.

Pentode Section.

C_{in}	5·5 pF.
C_{out}	3·8 pF.
C_{a-g1}	<0·025 pF.

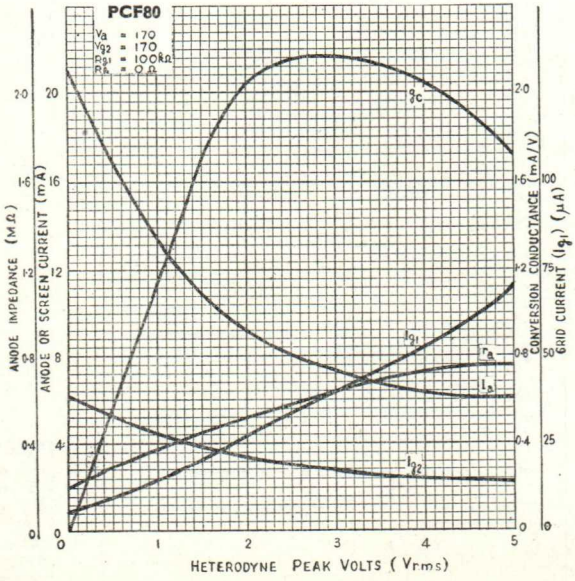
Triode Section.

C_{g-k+h}	2·5 pF.
C_{a-k+h}	1·8 pF.
C_{a-g}	1·5 pF.

*Variations in heater-cathode capacitance may render this valve unsuitable for use in Hartley oscillator circuits, particularly in F.M. receivers ; it is recommended that a Colpitts type of circuit be employed.

†Measured without external shield.

AVERAGE CHARACTERISTIC CURVES AS FREQUENCY CHANGER.



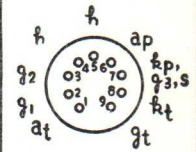
Ferranti

PCF82

9U8

TRIODE PENTODE

Designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 M/cs. It is suitable for series connected heater operation, a.c. or d.c. The Triode and Pentode sections have separate cathodes.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	56 mm. ($2\frac{7}{32}$ins.).
Max. Seated Height	... ...	49 mm. ($1\frac{15}{16}$ins.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode
Pin 2—Pentode g_1
Pin 3—Pentode g_2
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Pentode cathode g_3,s.
Pin 8—Triode Cathode.
Pin 9—Triode Grid.

HEATER.

Heater Current.	... ...	0·3 amp.
Heater Voltage	... ...	9·0 volts (approx.)

RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	... ...	550 volts.
Max. Anode Voltage	... ...	300 volts.
Max. Screen Voltage	... ...	300 volts.
Max. Anode Dissipation	... ...	2·0 watts.
Max. Screen Dissipation	... ...	0·5 watts.
Max. Neg. Grid Voltage (for I_g < +0·3μA.)	... ...	−1·3 volts.
Max. V_{h-kp} (heater positive)	... ...	90 volts.
(heater negative)	... ...	220 volts.
Max. R_{g_1-kp} (auto bias)	... ...	1·0 MΩ
Max. R_{g_1-kp} (fixed bias)	... ...	0·5 MΩ
Max. R_{h-kp}	... ...	20 kΩ

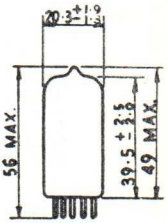
TRIODE SECTION.

Max. H.T. Supply Voltage	... ...	550 volts.
Max. Anode Voltage	... ...	300 volts.
Max. Anode Dissipation	. ...	1·5 watts.
Max. Neg. Grid Voltage (for I_g < +0·3μA.)	... ...	−1·3 volts.
Max. Cathode Current	... ...	20 mA.
Max. V_{h-kt} (heater positive)	... ...	90 volts.
(heater negative)	... ...	220 volts.
Max. R_{gt-kt}	... ...	1·0 MΩ
Max. R_{h-kt}	... ...	20 kΩ

CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage	... ...	170–200 volts.
Screen Voltage	... ...	110 volts.
Grid Bias Voltage	... ...	−0·9 volt.
Anode Current	... ...	10 mA.
Screen Current	... ...	3·3 mA.
Mutual Conductance	... ...	5·5 mA/V.
Anode Impedance	... ...	400 kΩ
Inner μ	... ...	32
V_{g_1} for cut-off	... ...	−10 volts.



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Issue 2
Oct. 1960

CHARACTERISTICS (Continued).

TRIODE SECTION.

Anode Voltage	150 volts.
Grid Bias Voltage	−2 volts.
Anode Current	11 mA.
Mutual Conductance	5·8 mA/V.
Anode Impedance	5 kΩ
μ	35

TYPCIAL OPERATING CONDITIONS (As Frequency Changer).

TRIODE as Oscillator.

Anode Supply Voltage	$V_{a(b)}$	170	200	250	volts.
Anode Resistor ...	R_a	20	20	20	kΩ
Grid Resistor ...	R_g	20	20	20	kΩ
Oscillator Voltage ...	$V_{osc.}$	3	3	3	Volts. (r.m.s.).
Anode Current ...	I_a	3·3	4·1	5·7	mA.
Grid Current ...	I_g	160	160	160	µA.
Mutual Conductance	gm(eff)	2·8	3·2	3·9	mA/V.

PENTODE (As Mixer).

Anode Voltage ...	V_a	170	200	250	volts.
Screen Feed Resistor	R_{g2}	30	45	70	kΩ
Grid Resistor ...	R_{g1}	1	1	1	MΩ
Grid Voltage	V_{g1}	0	0	0	volts.
Oscillator Voltage ...	$V_{osc.}$	3	3	3	volts. (r.m.s.).
Anode Current ...	I_a	5·1	5·1	5·6	mA.
Screen Current ...	I_{g2}	2·1	2·0	1·9	mA.
Grid Current ...	I_{g1}	3·7	3·7	3·7	µA.
Conversion Conductance	gc	1·8	1·85	1·9	mA/V.

CAPACITANCES (Measured without external shield).

C_{ap-at}	<0·07 pF.
C_{h-k}	3 pF. (approx.).

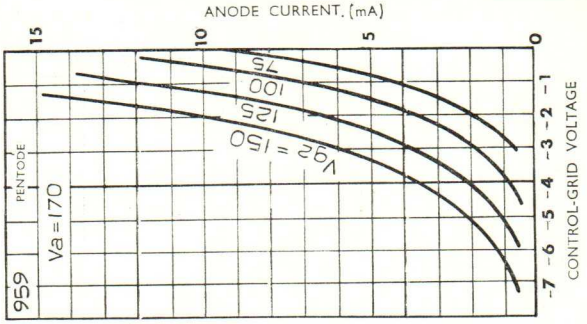
Pentode Section.

C_{in}	5·0 pF.
C_{out}	2·6 pF.
C_{a-g1}	<0·01 pF.

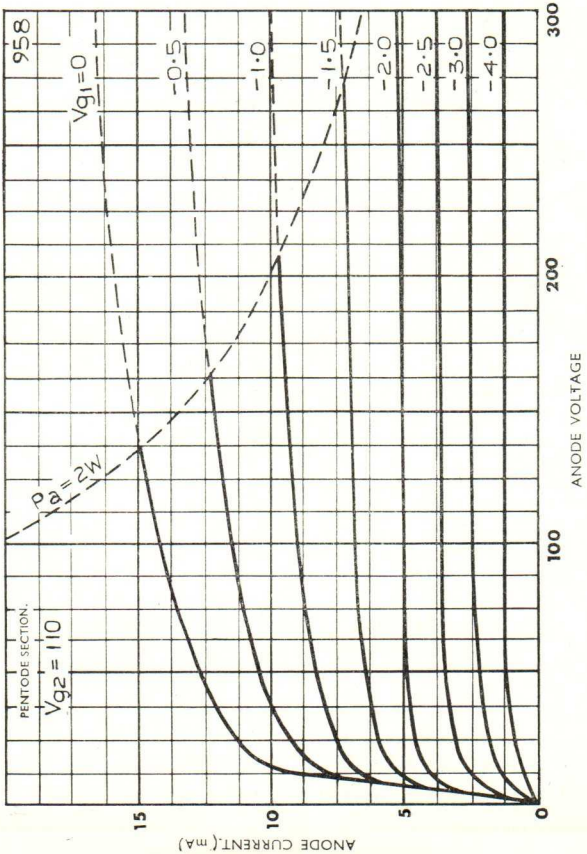
Triode Section.

C_{in}	2·5 pF.
*C_{in}	3·5 pF.
C_{out}	0·4 pF.
*C_{out}	1·6 pF.
C_{a-g}	1·8 pF.

*Capacitance with common cathode connection (i.e. pin 7 connected to pin 8.).



TYPICAL CHARACTERISTICS OF PENTODE SECTION.

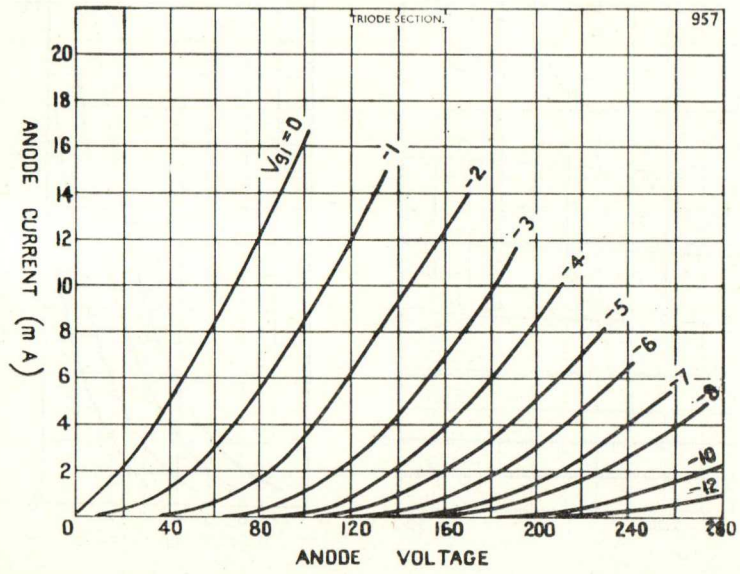


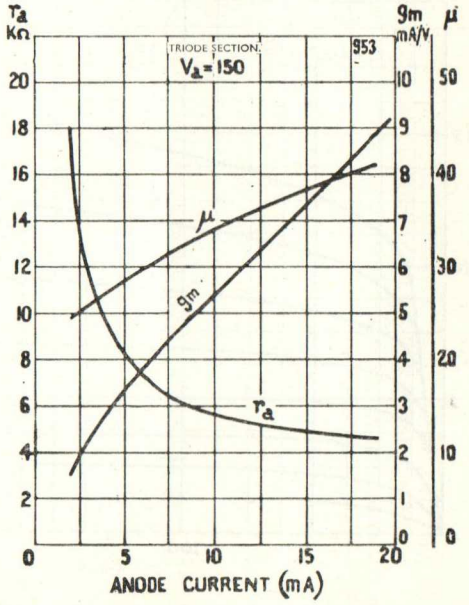
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM. LANCS.

Ferranti

PCF82
9U8

TYPICAL CHARACTERISTICS OF TRIODE SECTION.

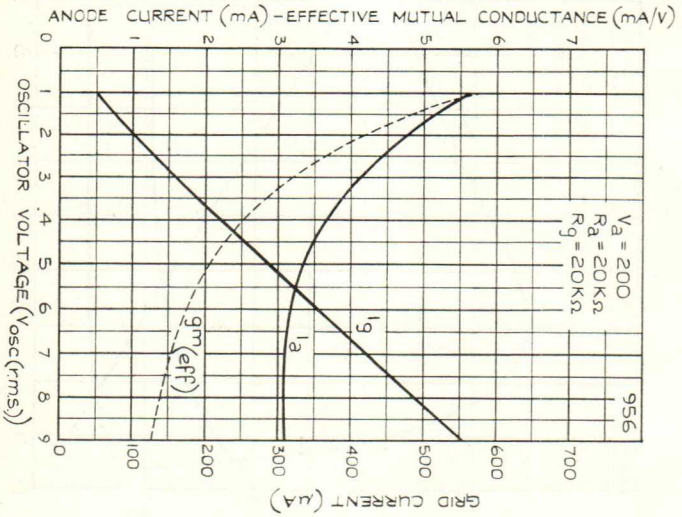


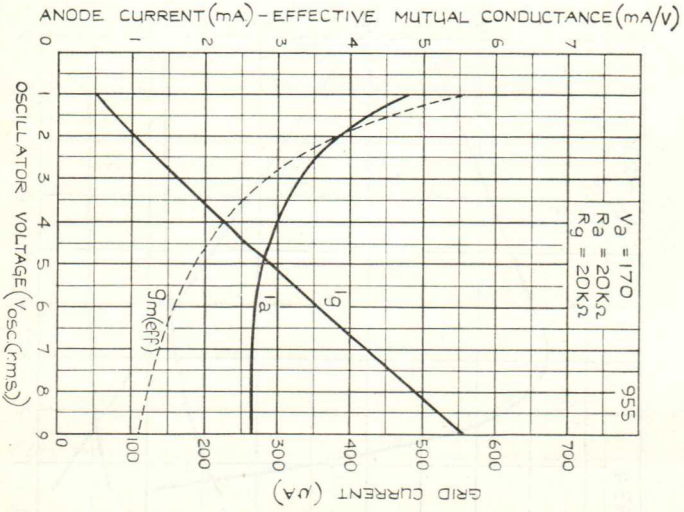


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

TYPICAL CHARACTERISTICS OF PENTODE SECTION AS MIXER.

TYPICAL CHARACTERISTICS OF TRIODE SECTION AS OSCILLATOR.



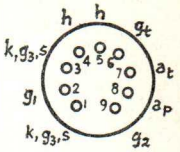


Ferranti

TRIODE PENTODE

PCF86

Combined triode and high slope frame grid pentode with separate cathodes designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 Mc/s. It is suitable for series connected heater operation, AC. or DC.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base		B9A—Noval
Max. Overall Length		56 mm. ($2\frac{7}{32}$")
Max. Seated Height		49 mm. ($1\frac{13}{16}$")
Max. Diameter		22·2 mm. ($\frac{7}{8}$")
Mounting Position		Any

BASE CONNECTIONS.

Pin 1—Cathode, g_3 shield	Pin 6—Triode Grid
Pin 2—Pentode g_1	Pin 7—Triode Anode
Pin 3—Cathode, g_3, shield	Pin 8—Pentode Anode
Pin 4—Heater	Pin 9—Pentode g_2
Pin 5—Heater	

HEATER.

Heater Current	0·3	amp
Heater Voltage	8·0	volts

RATINGS.

Pentode Section.

Max. Anode Voltage	250	volts
Max. Screen Grid Voltage	150	volts
Max. Anode Dissipation	2·0	watts
Max. Screen Grid Dissipation	0·5	watts
Max. Cathode Current	18	mA
Max. R_{g1-k} (auto bias)	500	kΩ
Max. R_{g1-k} (fixed bias)	250	kΩ

Triode Section.

Max. Anode Voltage	125	volts
Max. Anode Dissipation	1·5	watts
Max. Cathode Current	15	mA
Max. R_{g-k}	0·5	MΩ
*Max. V_{h-k}	100	volts

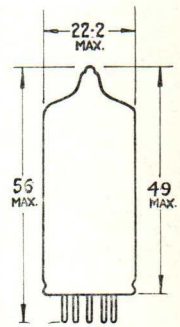
CHARACTERISTICS.

Pentode Section.

Anode Voltage	170	volts
Screen Grid Voltage	150	volts
Grid Bias Voltage	−1·2	volts
Anode Current	10	mA
Screen Current	3·3	mA
Mutual Conductance	12	mA/V
Anode Impedance	> 350	kΩ
Inner μ	70	
Equivalent Noise Resistance	1·0	kΩ

Triode Section.

Anode Voltage	100	volts
Grid Bias Voltage	−3	volts
Anode Current	14	mA
Mutual Conductance	5·5	mA/V
Anode Impedance	3	kΩ
μ	17	



Dimensions are in millimetres

*To avoid excessive hum on a.m. sound it is necessary to limit V_{h-k} to less than 50 volts (r.m.s.).

Issue 1
Mar., 1963

Ferranti

TYPICAL OPERATION (As Frequency Changer).

Pentode (As Mixer).

V_a	...	190	volts
$V_{g2(b)}$	...	190	volts
R_{g2}	...	18	kΩ
R_{g1}	...	100	kΩ
V_{osc}	...	2·3	volts(r.m.s.)
I_a	...	8·5	mA
I_{g2}	...	2·7	mA
g_c	...	4·5	mA/V

Triode (As Oscillator).

$V_{a(b)}$	...	190	volts
R_g	...	10	kΩ
V_{osc}	...	4·5	volts(r.m.s.)
I_a	...	12·0	mA
$g_{m(eff)}$	...	3·5	mA/V

CAPACITANCES (Measured without external shield.)

C_{ap-at}	...	0·14	pF
C_{ap-gt}	...	0·015	pF
C_{gp-at}	...	0·01	pF
C_{gp-gt}	...	0·01	pF

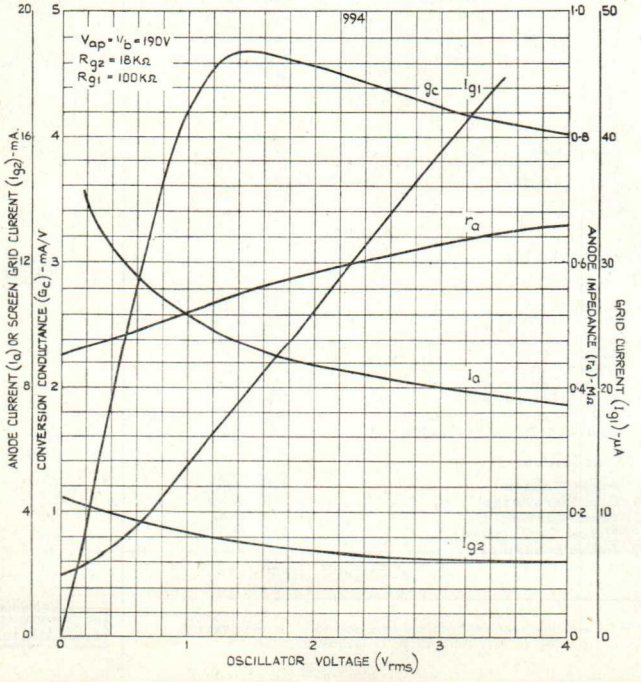
Pentode Section.

C_{in}	...	6·0	pF
C_{out}	...	3·5	pF
C_{a-g1}	...	0·012	pF
C_{g1-g2}	...	1·7	pF

Triode Section.

C_{g-k+h}	...	2·4	pF
C_{a-k+h}	...	1·1	pF
C_{a-g}	...	2·0	pF

TYPICAL CHARACTERISTIC CURVES AS FREQUENCY CHANGER

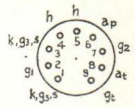


Ferranti

PCF806

TRIODE PENTODE

Combined triode and high slope frame grid pentode designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 Mc/s. Suitable for series connected heater operation, AC. or DC.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval
Max. Overall Length	56 mm. ($2\frac{7}{32}$")
Max. Seated Height	49 mm. ($1\frac{15}{16}$")
Max. Diameter	22·2 mm. ($\frac{7}{8}$")
Mounting Position	Any

BASE CONNECTIONS.

Pin 1—Cathode, g_3 shield	Pin 6—Pentode Anode
Pin 2—Pentode g_1	Pin 7—Pentode g_2
Pin 3—Cathode, g_3, shield	Pin 8—Triode Anode
Pin 4—Heater	Pin 9—Triode Grid
Pin 5—Heater	

HEATER.

Heater Current	0·3 amp
Heater Voltage	8·0 volts

RATINGS.

Pentode Section.

Max. Anode Voltage	250 volts
Max. Screen Grid Voltage	150 volts
Max. Anode Dissipation...	2·0 watts
Max. Screen Grid Dissipation	0·5 watts
Max. Cathode Current	18 mA
Max. R_{g1-k}	250 kΩ

Triode Section.

Max. Anode Voltage	125 volts
Max. Anode Dissipation...	1·5 watts
Max. Cathode Current	15 mA
Max. R_{g-k}	0·5 MΩ
*Max. V_{h-k}	100 volts

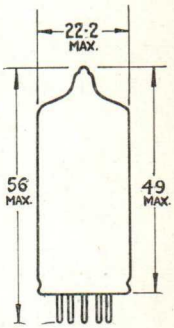
CHARACTERISTICS.

Pentode Section.

Anode Voltage	170 volts
Screen Grid Voltage	150 volts
Grid Bias Voltage	−1·2 volts
Anode Current	10 mA
Screen Current	3·3 mA
Mutual Conductance	12 mA/V
Anode Impedance	> 350 kΩ
Inner μ	70
Equivalent Noise Resistance	1·0 kΩ

Triode Section.

Anode Voltage	100 volts
Grid Bias Voltage	−3 volts
Anode Current	14 mA
Mutual Conductance	5·5 mA/V
μ	17



Dimensions are in millimetres

*To avoid excessive hum on a.m. sound it is necessary to limit V_{h-k} to less than 50 volts (r.m.s.).

Issue 1
July, 1963

Ferranti

TYPICAL OPERATION (As Frequency Changer).

Pentode (As Mixer)

V_a	190	volts
$V_{g2(b)}$	190	volts
R_{g2}	18	kΩ
R_{g1}	100	kΩ
V_{osc}	2·3	volts(r.m.s.)
I_a	8·5	mA
I_{g2}	2·7	mA
g_c	4·5	mA/V

CAPACITANCES (Measured without external shield)

C_{ap-at}	< 0·03	pF
C_{ap-gt}	< 0·01	pF
C_{g1-at}	< 0·01	pF
C_{g1-gt}	< 0·01	pF

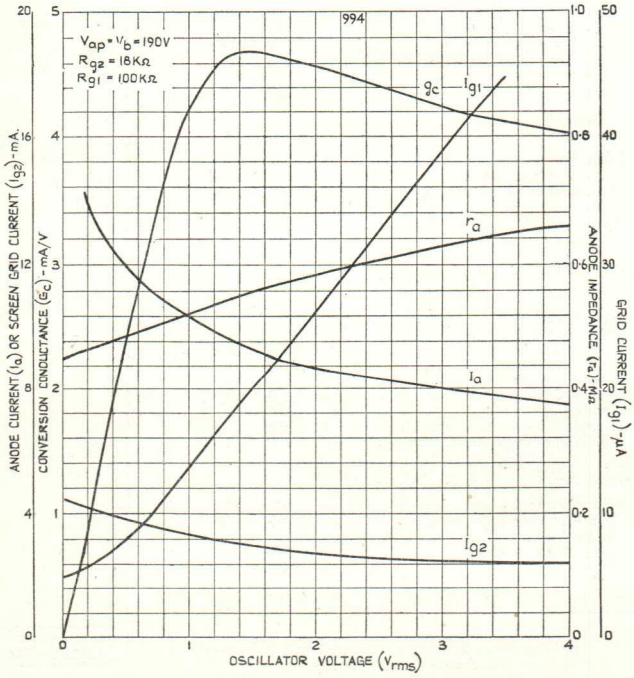
Pentode Section

C_{in}	6·0	pF
C_{out}	3·5	pF
C_{a-g1}	0·012	pF
C_{g1-g2}	1·7	pF

Triode Section.

C_{g-k+h}	2·4	pF
C_{a-k+h}	1·1	pF
C_{a-g}	2·0	pF

TYPICAL CHARACTERISTIC CURVES AS FREQUENCY CHANGER



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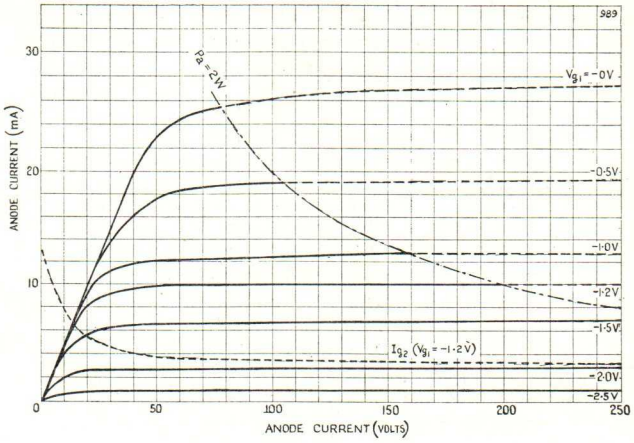
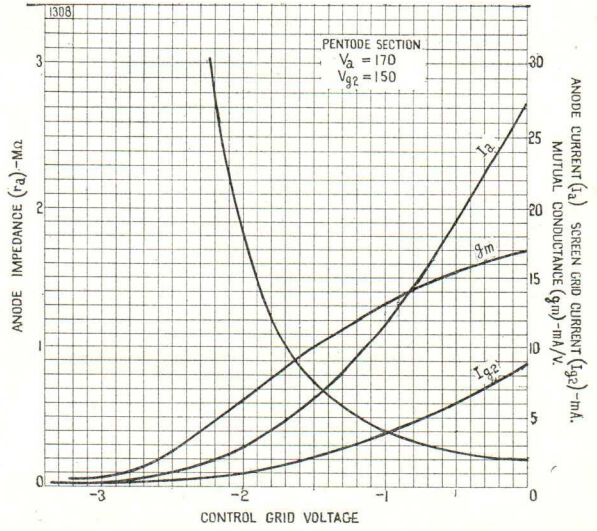
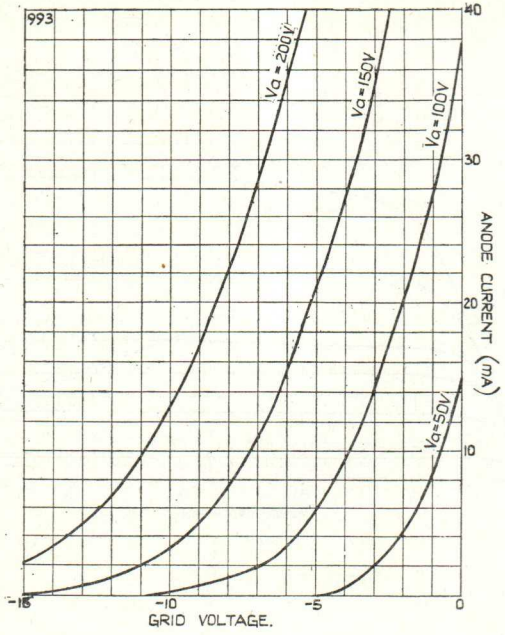
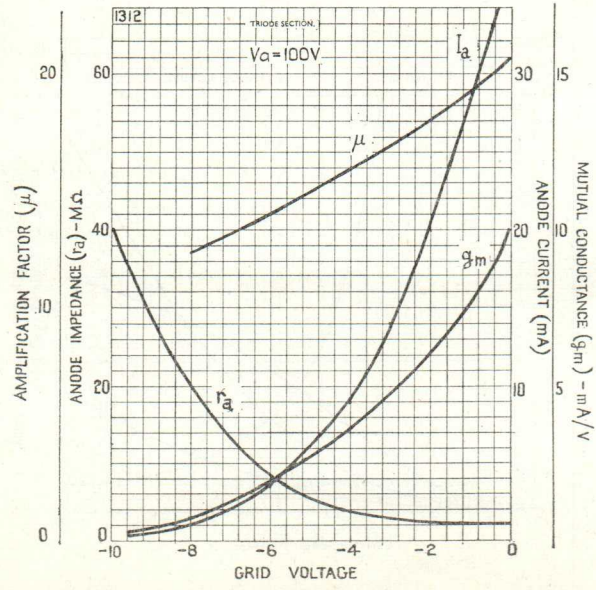
TYPICAL PENTODE CHARACTERISTICS





TYPICAL TRIODE CHARACTERISTICS





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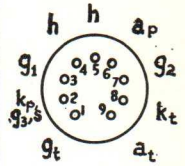
Ferranti

PCL82

TRIODE PENTODE

An indirectly heated triode pentode, primarily designed for use with the triode as a frame blocking oscillator and the pentode as a frame output valve, or it may be used as a combined audio voltage amplifier and output valve.



Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	...	78·5 mm. ($3\frac{5}{32}$in.).
Max. Seated Height	...	71·5 mm. (3in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	...	Any.

BASE CONNECTIONS.

Pin 1—Triode Grid.
Pin 2—Pentode Cathode, g_3 and Shield.
Pin 3—Pentode Grid (g_1).
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Pentode Screen Grid (g_2).
Pin 8—Triode Cathode.
Pin 9—Triode Anode.

HEATER.

Heater Current	... ...	0·3 amps.
Heater Voltage	... ...	16 volts.

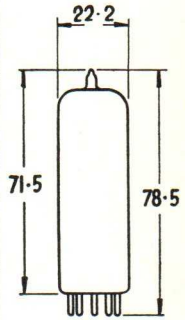
RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	... ...	550 volts.
Max. Anode Voltage	... ...	250 volts.
*Max. Peak Positive Anode Voltage	...	+2·5 kV.
*Max. Peak Negative Anode Voltage	...	−500 volts.
Max. Screen Grid Voltage	... ...	250 volts.
Max. Anode Dissipation (frame output)	...	5 watts.
Max. Anode Dissipation (Audio)	...	7 watts.
Max. Screen Grid Dissipation	... ...	2·2 watts.
Max. Cathode Current	... ...	50 mA.
Max. V_{h-k}	... ...	200 volts.
Max. R_{g1-k} (fixed bias)	... ...	1·0 MΩ
(cathode bias)	... ...	2·0 MΩ
Max. R_{h-k}	... ...	20 kΩ

TRIODE SECTION.

Max. Anode Supply Voltage	... ...	550 volts.
Max. Anode Voltage	... ...	250 volts.
†Max. Peak Positive Anode Voltage	...	600 volts.
Max. Anode Dissipation	... ...	1 watt.
Max. Cathode Current	... ...	15 mA.
†Max. Peak Cathode Current	... ...	100 mA.
Max. R_{gt-k} (Fixed bias)	... ...	1 MΩ
(Cathode bias)	... ...	3 MΩ
(Grid current bias)	... ...	22 MΩ
Max. V_{h-k}	... ...	200 volts.
Max. R_{h-k}	... ...	20 kΩ



Dimensions in millimetres.

CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage	...	170	200	220 volts.
Screen Grid Voltage		170	200	220 volts.
Suppressor Grid Voltage		0	0	0 volts.
Control Grid Voltage		−11·5	−16	−19 volts.
Anode Current	...	41	35	32 mA.
Screen Current	...	9	8	7 mA.
Mutual Conductance		7·5	6·4	6·2 mA/V.
Anode Impedance	...	16	20	22 kΩ
Inner μ	... ...	9·5	9·5	9·5

*Max. pulse duration 4% of one cycle, with a maximum of 800 μ secs.

†Max. pulse duration of 200 μ secs.

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Nov. 1960

Ferranti

CHARACTERISTICS—continued.

TRIODE SECTION.

Anode Voltage	100	volts.
Grid Voltage	0	volts.
Anode Current	3·5	mA.
Mutual Conductance	2·2	mA/V.
Anode Impedance	32	kΩ
Amplification Factor	70	

TYPICAL OPERATION.
IN FRAME TIME BASE CIRCUITS.

TRIODE as OSCILLATOR.

In order to allow for tolerances on characteristics and deterioration of emission during life, the oscillator circuit should be designed so that the peak cathode current does not exceed 100 mA.

PENTODE as Frame Output Valve.

To allow for tolerances and the spread of characteristics during life, it is recommended that the frame time base output circuit should be designed around the following values .

Anode Voltage :	50	60	70	volts.
Screen Grid Voltage	170	230	230	volts.
Peak Anode Current	85	125	130	mA.

For new valves with $I_{g_1} = +0{\cdot}3$ μA. the average of peak anode current is as follows :

Anode Voltage	50	60	70	volts.
Screen Grid Voltage	170	230	230	volts.
Peak Current Anode ...	135	200	210	mA.

PENTODE SECTION.

As Audio Output Valve (Class A).

Anode Voltage	170	200	200	volts.
Screen Grid Voltage	170	170	200	volts.
Suppressor Grid Voltage	0	0	0	volts.
Control Grid Voltage	−11·5	−12·5	−16	volts.
Anode Current	41	35	35	mA.
Screen Grid Current	8	6·5	7	mA.
Anode Load	3·9	5·6	5·6	kΩ
Input Voltage	6	5·8	6·6	volts (rms.).
†Input Voltage	590	560	600	mV. (rms.).
‡Power Output	3·3	3·4	3·5	watts.

As Audio Amplifier (2 valves in Class AB push pull).

Anode Voltage ...	170	200	volts.
Screen Grid Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
§Cathode Bias Resistor	135	165	ohms.
Anode Current (Zero signal)	2×33	2×35	mA.
Anode Current (Max. signal) ...	2×37	2×38	mA.
Screen Grid Current (Zero signal)	2×6·2	2×6·5	mA.
Screen Current (Max. signal) ...	2×15	2×16·5	mA.
Input Voltage (g_1–g_1)	18	20	volts (rms.).
Optimum Load (Anode to Anode)	5	5	kΩ
Power Output ...	7	9	watts.

†For Power Output of 50 mW.
‡Total Distortion of 10%. Output and Distortion measured at fixed bias and represent power output available for reproduction of speech and music.
§Common Cathode Bias Resistor.

TYPICAL OPERATION.—continued.

TRIODE SECTION.

As Resistance Coupled Amplifier.
R_{source}=220 kΩ.

V_b (V)	R_a (kΩ)	R_g (MΩ)	R_k (kΩ)	I_a (mA.)	*R_{g1} (kΩ)	†$\frac{V_{out}}{V_{in}}$	V_{out} (r.m.s.)
200	100	3·3	1·5	0·84	330	44	30
170	100	3·3	1·8	0·67	330	41	25
100	100	3·3	1·8	0·40	330	36	12
200	220	3·3	2·2	0·52	680	52	26
170	220	3·3	2·7	0·43	680	51	25
100	220	3·3	2·7	0·25	680	47	15
200	100	22	0	1·06	330	51	24
170	100	22	0	0·86	330	49	20
100	100	22	0	0·40	330	42	9
200	220	22	0	0·61	680	55	25
170	220	22	0	0·50	680	53	21
100	220	22	0	0·23	680	47	10

MICROPHONY AND HUM.

In circuits where an input voltage of less than 10mV. produces an output of 50 mW. from the output stage, the triode section can be used without special precautions against Microphony and Hum. The a.c. voltage between Heater (Pin 4) and Triode Cathode should not exceed 6·3 volts.

CAPACITANCES.

$C_{g_t-a_p}$	<0·02 pF.
$C_{a_t-a_p}$	<0·25 pF.
$C_{a_t-g_p}$	<0·02 pF.
$C_{g_t-g_p}$	<0·025 pF.

Pentode.

C_{in}	9·3 pF.
C_{out}	8·0 pF.
C_{a-g_1}	<0·3 pF.
C_{g_1-h}	<0·3 pF.

Triode.

C_{in}	3·0 pF.
C_{out}	4·4 pF.
C_{a-g}	4·1 pF.
C_{g-h}	<0·02 pF.

*Grid Resistor of the following valve.

†Measured with an input of 100 mV.

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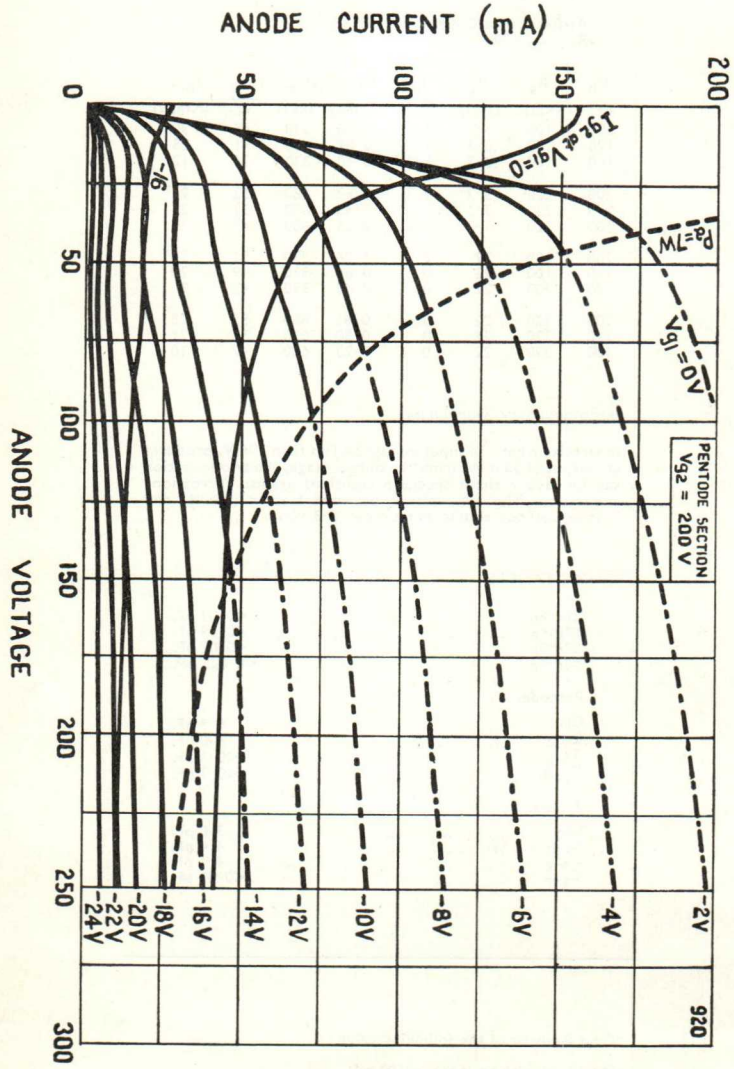
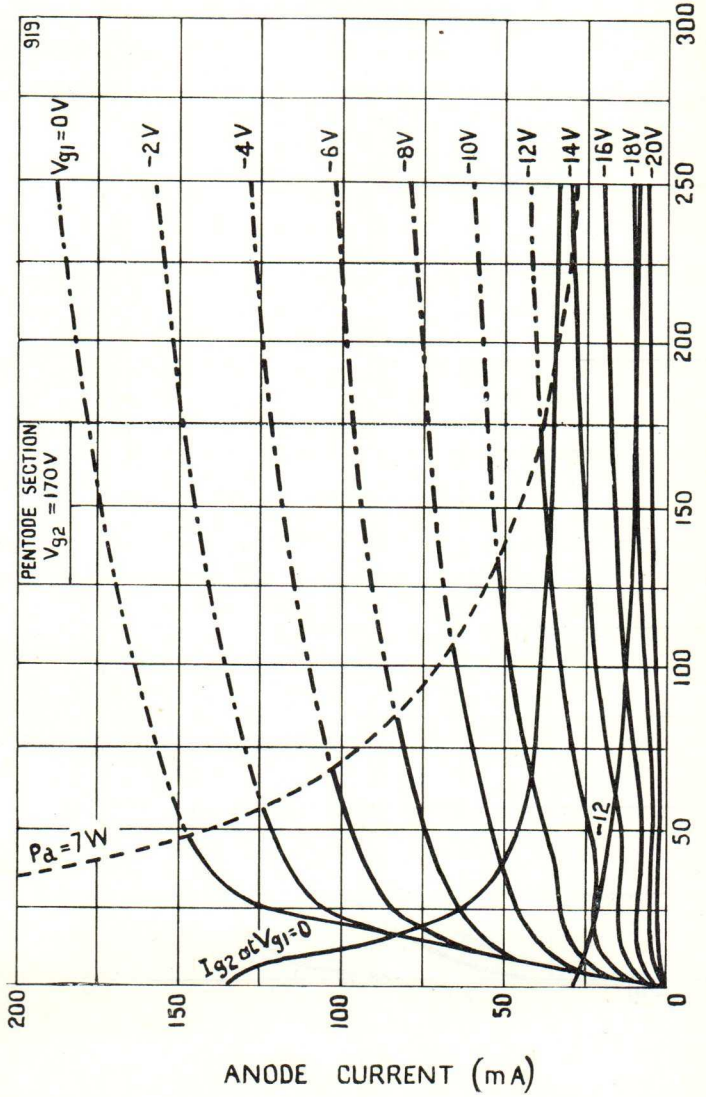
TYPICAL ANODE & SCREEN CURRENT/ANODE VOLTAGE CHARACTERISTICS

PENTODE SECTION



TYPICAL ANODE & SCREEN CURRENT/ANODE VOLTAGE CHARACTERISTICS

PENTODE SECTION



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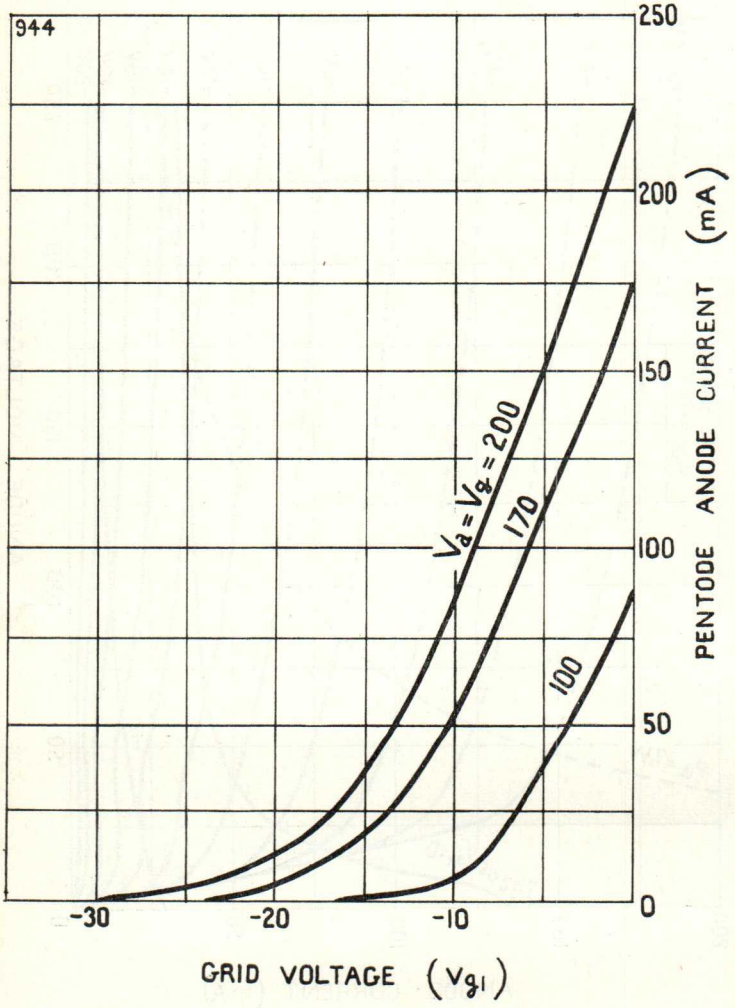
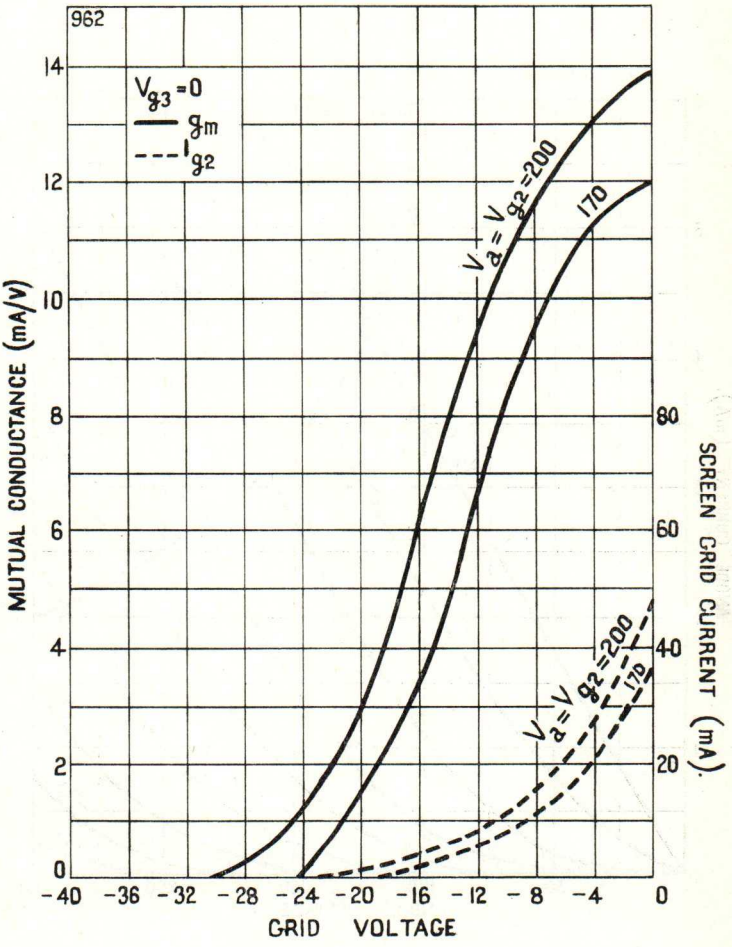
TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS

PENTODE SECTION



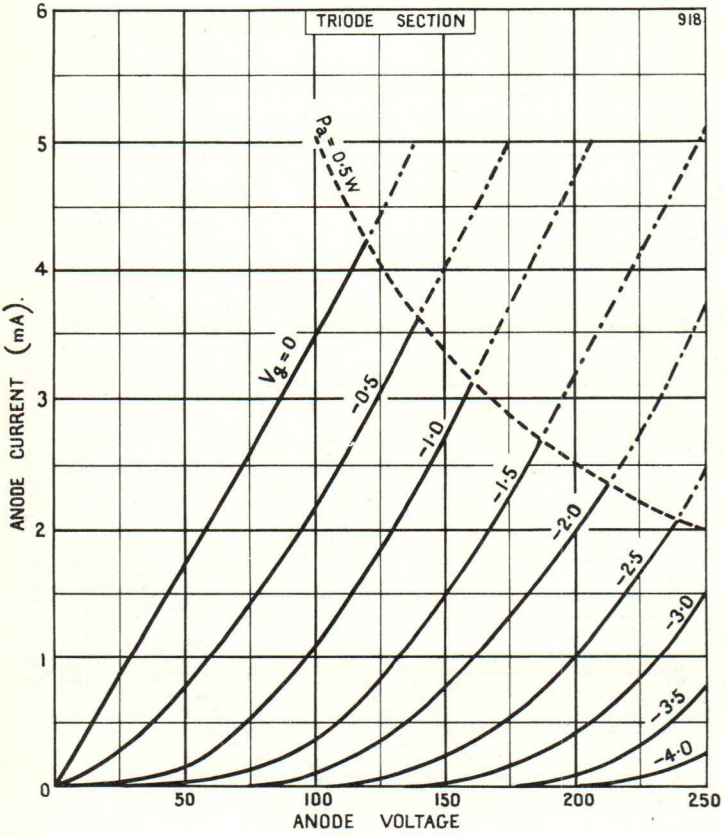
TYPICAL MUTUAL CONDUCTANCE & SCREEN GRID CURRENT CHARACTERISTICS

PENTODE SECTION



TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS

TRIODE SECTION

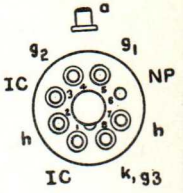


Ferranti

PL36

LINE OUTPUT PENTODE

An indirectly heated output pentode. It is designed for use as a Line Time Base Output Valve in Television Receivers employing television tubes with 90° scanning angle and is intended for use in series heater chains.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	Octal.
Top Cap	CTI.
Max. Overall Length	110 mm. ($4\frac{3}{8}$")
Max. Seated Height	95 mm. ($3\frac{3}{4}$")
Max. Diameter	33 mm. ($1\frac{5}{16}$")
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 5—Control Grid.
Pin 2—Heater.	Pin 6—No Pin.
Pin 3—Internal Connection.	Pin 7—Heater.
Pin 4—Screen Grid.	Pin 8—Cathode and Suppressor Grid.

HEATER. Top Cap—Anode.

Heater Current	0·3 amp.
Heater Voltage	25 volts.

RATINGS.

Max. D.C. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
*Max. Peak Anode Voltage (Positive)	7 kV.
*Max. Peak Anode Voltage (Negative)	1·5 kV.
Max. Anode Dissipation (p_a) ...	12 watts.
Max. Screen Voltage	250 volts.
†Max. Screen Dissipation (p_{g_2}) ...	5 watts.
Max. $p_a + p_{g_2}$	13 watts.
Max. Cathode Current	200 mA.
*Max. Peak Neg. Grid Voltage ...	−1·0 kV.
Max. V_{h-k} (Cathode Negative)	200 volts.
Max. V_{h-k} (Cathode Positive) ...	250 volts.
Max. R_{g_1-k} (Fixed Bias) ...	500 kΩ
Max. R_{g_1-k} (Line Timebase) ...	3·3 mΩ

CHARACTERISTICS.

Anode Voltage	100 volts.
Screen Voltage	100 volts.
Control Grid Voltage	−8·2 volts.
Anode Current	100 mA.
Screen Current	7 mA.
Mutual Conductance	14 mA/V.
Anode Impedance	5·0 kΩ
Inner μ ($\mu_{g_1-g_2}$)	5·6

TYPICAL OPERATION.

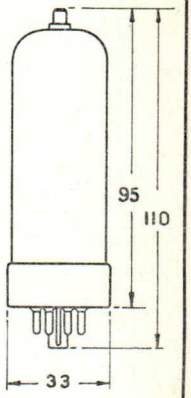
As Line Timebase Output Valve.

Curves of anode current against anode voltage for a range of control grid voltages and screen grid resistors are shown on page 4 of the data.

These curves are of average values for a new valve. To allow for valve tolerances and deterioration during life the line output circuit should be designed to accomodate a change to values 25% lower than the values indicated on the curves.

For operation below the "knee" of the anode current/anode voltage characteristics, R_{g_2} should not be less than 2·2 kohms.

For operation above the "knee" it is recommended that an effective feedback stabilising circuit should be incorporated.



All dimensions shown are in millimetres (max.)

*Max. pulse duration of 22% of one cycle, with a maximum of 18 μsecs.

†Max. average p_{g_2} is 7 watts for the period between the start of screen current and the instant when the anode current attains one half of its normal operating value.

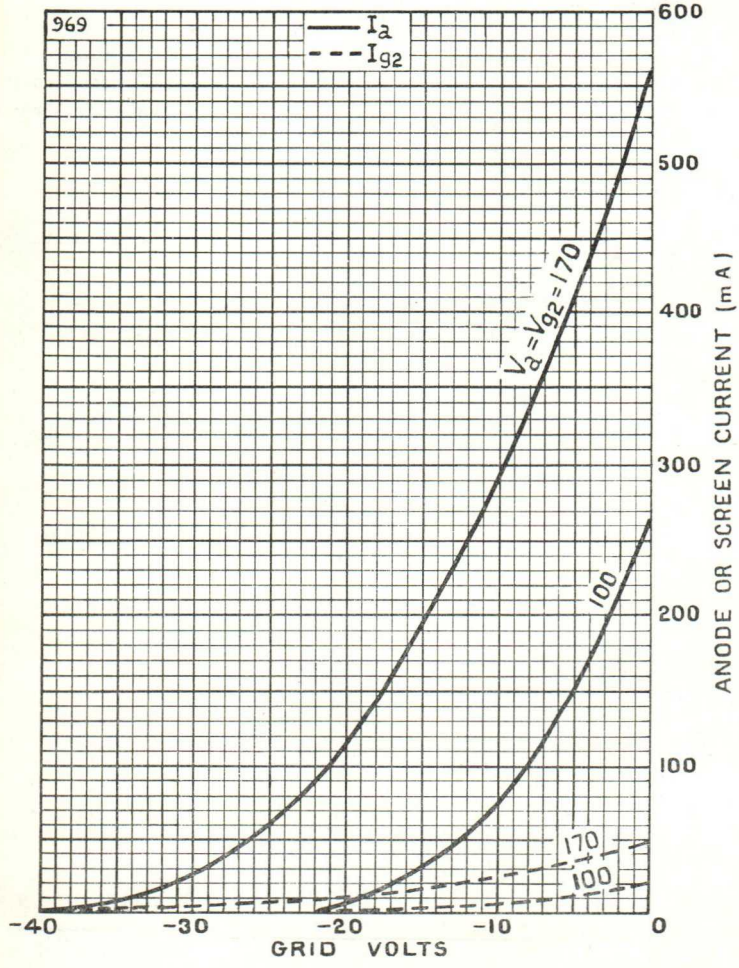
Ferranti

Issue 2. July, 1961

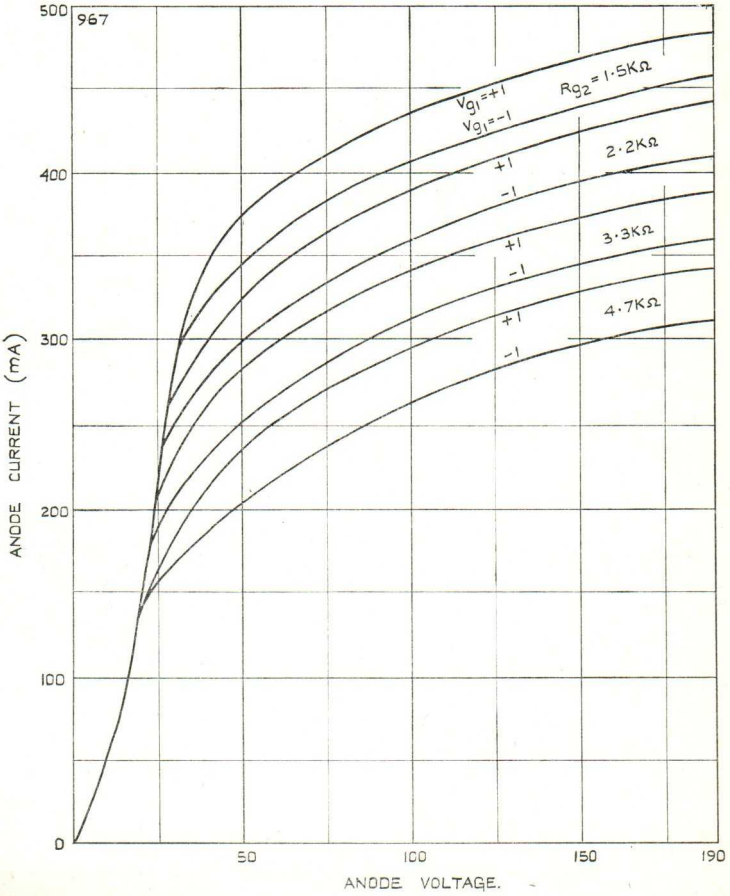
CAPACITANCES.

C_{in}	... ...	18 pF.
C_{out}	... ...	9 pF.
C_{a-g_1}	... ...	<1·1 pF.

TYPICAL ANODE CURRENT / GRID VOLTAGE CHARACTERISTIC



TYPICAL ANODE CURRENT / ANODE VOLTAGE WITH SCREEN GRID FEED RESISTOR AS PARAMETER. (Supply Voltage 190 Volts)



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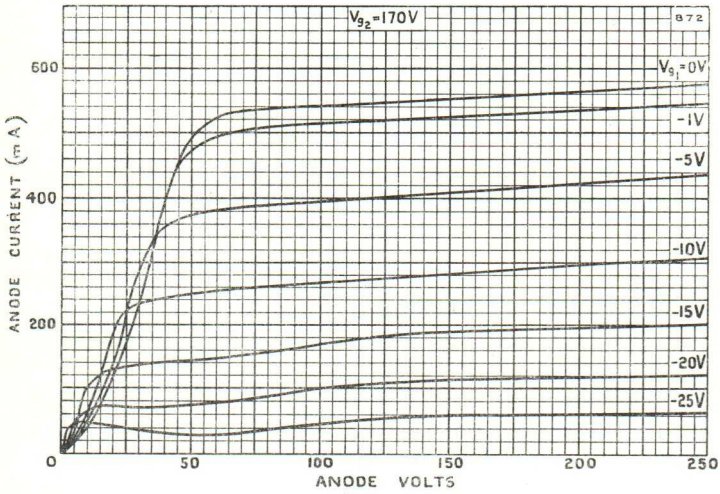
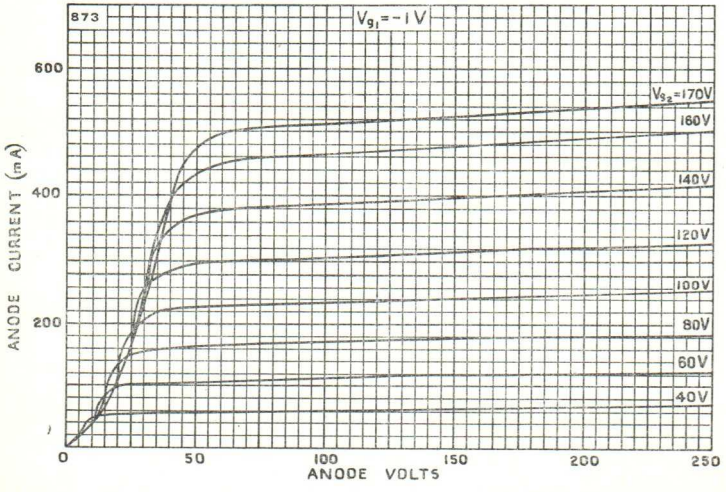
TYPICAL ANODE CURRENT / ANODE VOLTAGE CHARACTERISTICS





R1257

FERRANTI
LINE OUTPUT PENTODE

PL81

An indirectly heated output pentode designed for use in Television Receivers as a Line Time Base Output Valve. It is intended for use in a.c. or d.c. series heater chains.

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
Max. Overall Length	83 mm. (3 5/32 in.).
Max. Seated Height	76 mm. (3in.).
Max. Diameter	22·2 mm. (7/8in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Control Grid.	Pin 7—Internal Connection.
Pin 3—Cathode.	Pin 8—Screen Grid.
Pin 4—Heater.	Pin 9—Suppressor Grid.
Pin 5—Heater.	Top Cap—Anode.

HEATER.

Heater Current	0·3 amp.
Heater Voltage	21·5 volts.

RATINGS.

Max. DC. Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
*Max. Peak Anode Voltage	7 kV.
†Max. Anode Dissipation	8 watts.
Max. Screen Voltage	250 volts.
‡†Max. Screen Dissipation	4·5 watts.
Max. Cathode Current	180 mA.
**Min. Neg. Grid Voltage	1·3 volts.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	20 kΩ
§Max. R_{g1-k}	500 kΩ
Max. Bulb Temperature	185 °C.

CHARACTERISRICS.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage	–22	–28	volts.
Anode Current	45	40	mA.
Screen Current	3	2·8	mA.
Mutual Conductance	6·2	6·0	mA/V.
Anode Impedance	10	11	kΩ
Inner μ (μg_1–g_2)	5·5	5·5	

TYPICAL OPERATION.

As Line Output Pentode.

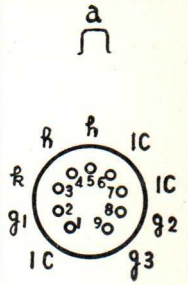
Anode Voltage	70	70	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage	–1	–1	volt.
Anode Current	380	470	mA.

The above figures are for an average new valve. To allow for manufacturing spread of characteristics, and to cover change during life, the output circuit should be designed around the following values :—

Anode Voltage	70	70	volts.
Screen Voltage	170	200	volts.
Anode Current	<250	<310	mA.

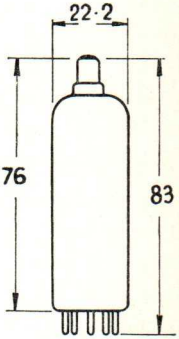
As Audio Amplifier (2 valves in push pull).

Anode Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Screen Grid Voltage	170	200	volts.
Control Grid Voltage	–27	–31·5	volts.
Screen Feed Resistor	1	1	kΩ
Anode Current (Zero signal)	2 x 20	2 x 25	mA.
Anode Current (Max. signal)	2 x 73	2 x 87	mA.
Screen Current (Zero signal)	2 x 1·5	2 x 2	mA.
Screen Current (Max. signal)	2 x 10	2x12·5	mA.
Optimum Load (Anode to Anode)	2·5	2·5	kΩ



Base Connections

Underside View of Base



All Dimensions shown are in millimetres (max.).

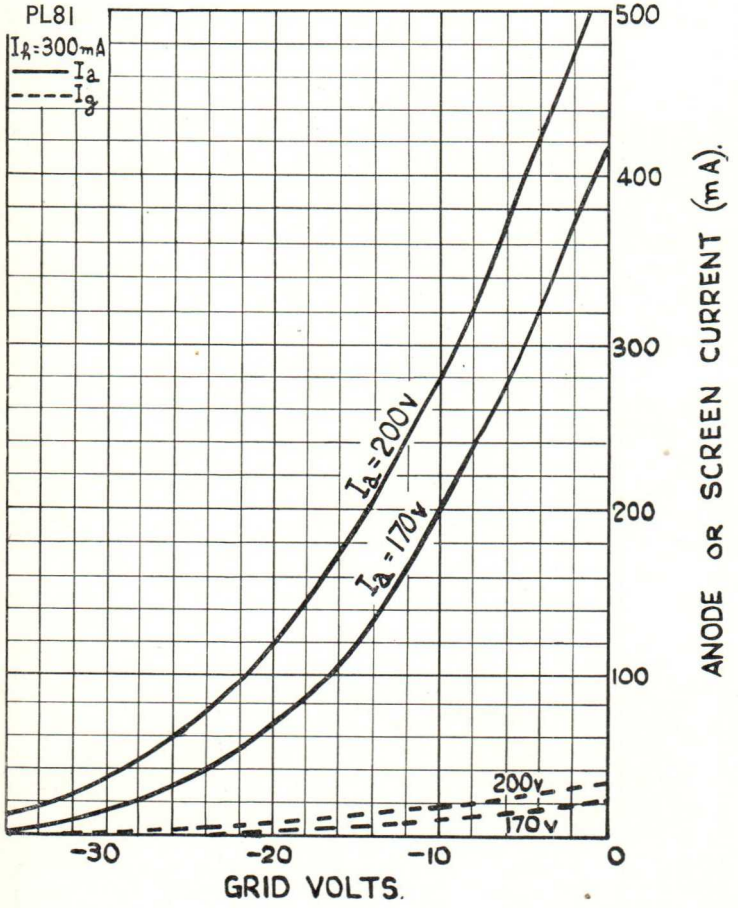
*Max. pulse duration of 18% of one cycle, with a maximum of 18 μsecs.
†$pa + pg_2$ should not exceed 10 watts.
‡Max. average pg_2 is 6 watts for the period between the start of screen current and the instant when the anode current attains one half of its normal operating value.
**For grid current of 0·3 μA.
§For line output operation the max. value of Rg_1–k may be 3·3 MΩ

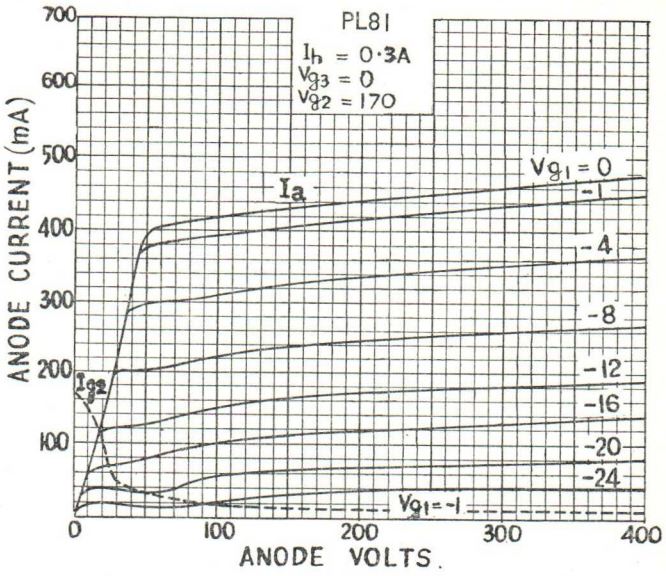
Issue 1
Dec.,1955

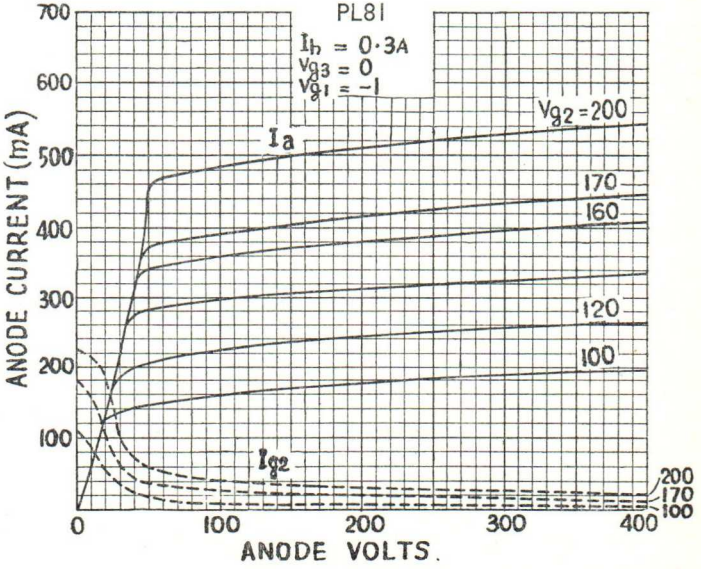
FERRANTI

CAPACITANCES.

C_{in}	...	...	...	...	14·7 pF.
C_{out}	...	...	...	...	6·4 pF.
C_{a-g_1}	...	...	...	...	<0·8 pF.
C_{a-k}	...	...	...	...	<0·1 pF.
C_{g_1-h}	...	...	...	...	<0·2 pF.







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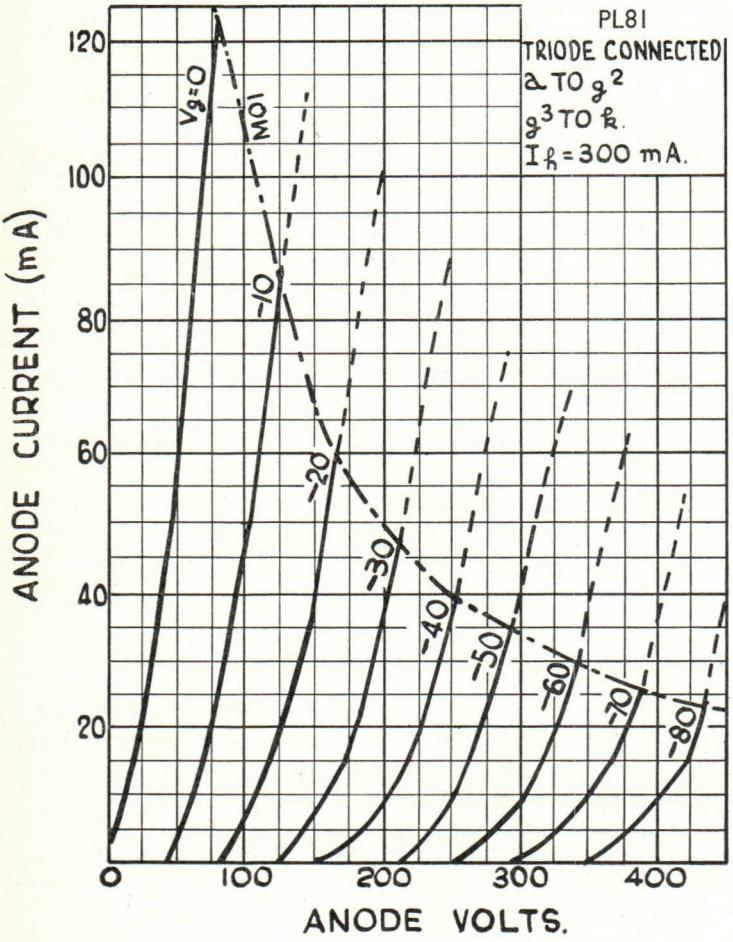

PL81
TRIODE CONNECTED
a TO g2
g3 TO k.
Ik = 300 mA.
ANODE CURRENT (mA)
120
100
80
60
40
20
0
100
200
300
400
ANODE VOLTS.
Vg=0
-10
-20
-30
-40
-50
-60
-70
-80

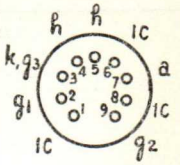
R0359

FERRANTI

OUTPUT PENTODE

PL82

An indirectly heated output pentode. It is suitable for use in Television Receivers as a Frame Time Base Output Valve, or an Audio Output Valve. It is intended for use in series heater chains.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	78·5 mm. ($3\frac{3}{32}$in.).
Max. Seated Height	71·5 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 5—Heater.
Pin 2—Control Grid.	Pin 6—Internal Connection.
Pin 3—Cathode, Suppressor Grid.	Pin 7—Anode. Pin 8—Internal Connection.
Pin 4—Heater.	Pin 9—Screen Grid.

HEATER.

Heater Current	0·3 Amp.
Heater Voltage	16·5 volts.

RATINGS.

Max. DC. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
*Max. Peak Anode Voltage ...	2·5 kV.
Max. Anode Dissipation ...	9 watts.
Max. Screen Voltage	250 volts.
Max. Screen Dissipation ...	2·5 watts.
Max. Cathode Current ...	75 mA.
Max. Neg. Grid Voltage ...	−1·3 volts.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	20 kΩ
§Max. R_{g1-k}	1 MΩ

CHARACTERISTICS.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage	−10·4	−14·2	volts.
Anode Current	53	45	mA.
Screen Current	10	8·5	mA.
Mutual Conductance ...	9	7·6	mA/V.
Anode Impedance ...	20	24	kΩ
Inner μ (μg_1-g_1) ...	10	10	

TYPICAL OPERATION.

As Frame Time Base Output

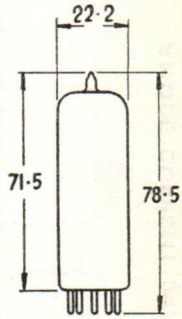
Anode Voltage	50	60	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage ...	−1	−1	volt.
Anode Current	140	175	mA.

The above figures are for an average new valve. To allow for manufacturing spread of characteristics, and to cover change during life, the output circuit should be designed round the following values :—

Anode Voltage	50	60	volts.
Screen Voltage	170	200	volts.
Anode Current	90	120	mA.

As Audio Amplifier.

Anode Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Screen Grid Voltage ...	170	200	volts.
Control Grid Voltage ...	−10·4	−13·2	volts.
Anode Load Resistor ...	3	4	kΩ
Anode Current	53	45	mA.
Screen Current	10	8·5	mA.
Input A.F. Voltage ...	6	7	volts (r.m.s.)
Power Output (D=10%)	4·0	4·2	watts.



All Dimensions shown are in millimetres (max.).

*Max. pulse duration of 10% of one cycle, with a maximum of 2 m/sec.
§For frame output operation the max. value of R_{g1-k} may be 2·2 MΩ

Issue 1
Mar.,1956

FERRANTI

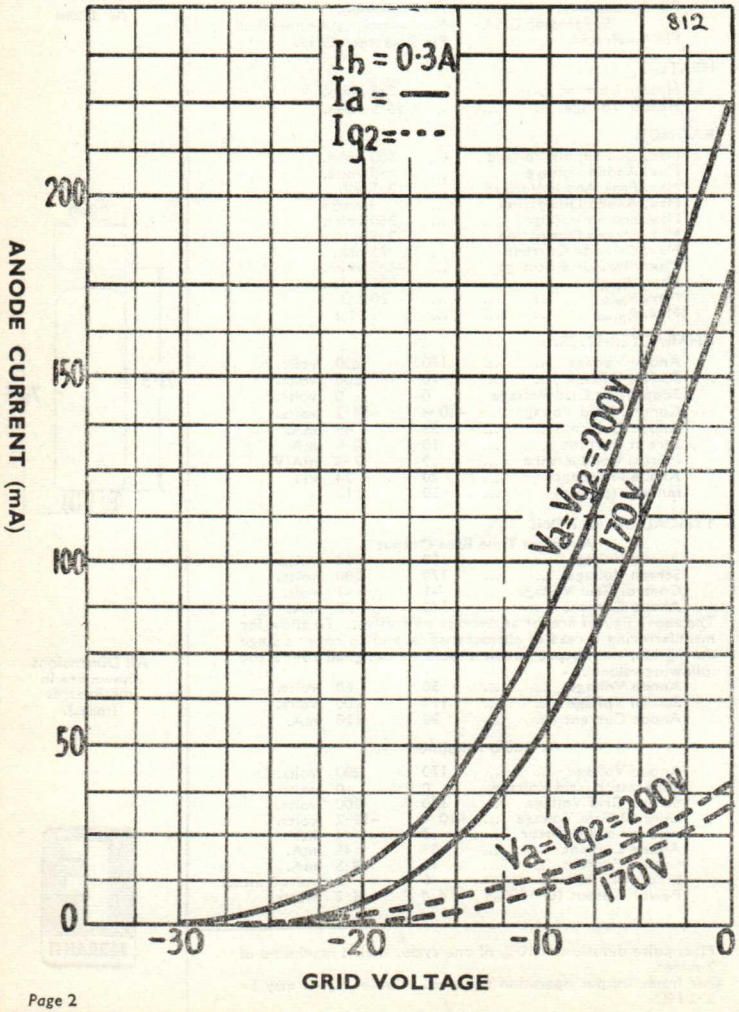
TYPICAL OPERATION (cont.)

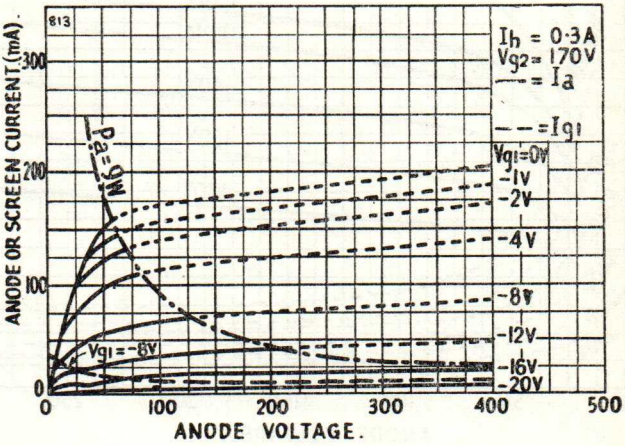
As Audio Amplifier (2 valves in push pull).

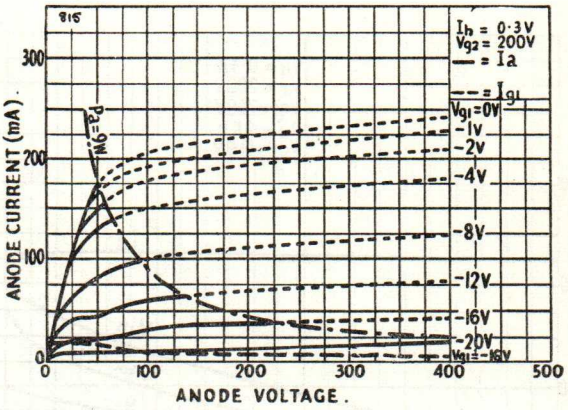
Anode Voltage	200 volts.
Screen Voltage	200 volts.
Auto Bias Resistor (Rk) ...	135 ohms.
Optimum Load Resistance (Anode to Anode)	4 kΩ
Input A.F. Voltage	13·5 volts (r.m.s.).
Power Output (D=5%) ...	12 watts.

CAPACITANCES.

C_{in}	11·0 pF.
C_{out}	6·2 pF.
C_{a-g1}	<1·0 pF.
C_{g1-h}	<0·15 pF.







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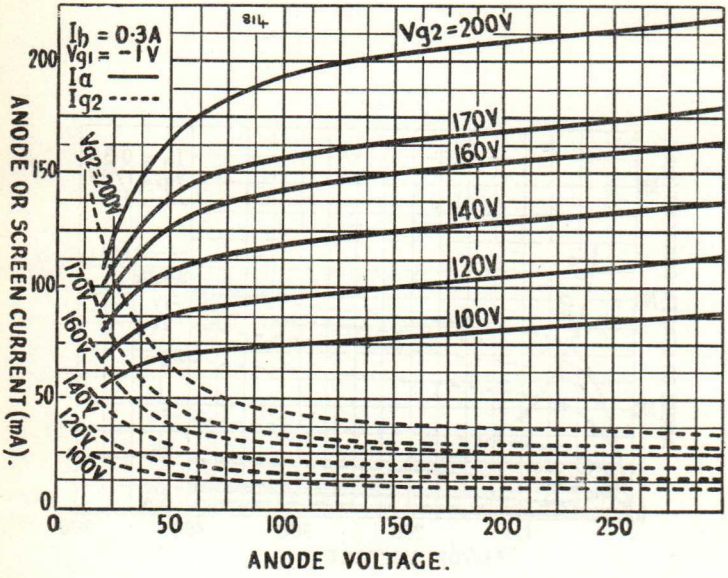
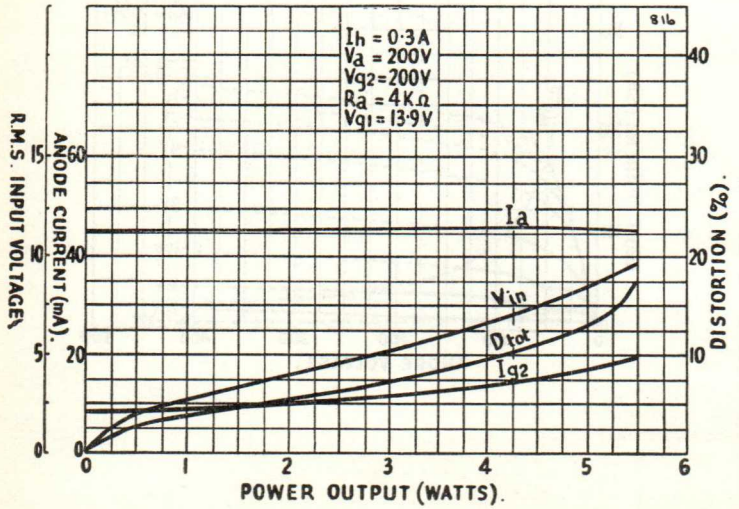
FERRANTI





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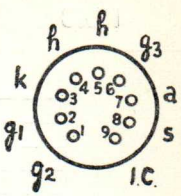
FERRANTI

VIDEO OUTPUT PENTODE

PL83

An indirectly heated output pentode. It is designed for use as a Video Output Valve, in Television Receivers with series heater chains.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
Max. Overall Length	78·5 mm. ($3\frac{3}{32}$in.).
Max. Seated Height	71·5 mm. ($2\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Screen Grid.	Pin 5—Heater.
Pin 2—Control Grid.	Pin 6—Suppressor Grid.
Pin 3—Cathode.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Shield.

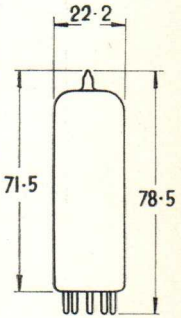
Pin 9—Internal Connection.

HEATER.

Heater Current	0·3 Amp.
Heater Voltage	15·0 volts.

RATINGS.

Max. DC Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation	9 watts.
Max. Screen Voltage	250 volts.
Max. Screen Dissipation	2·0 watts.
Max. Cathode Current	70 mA.
Max. Neg. Grid Voltage ($I_{g_1} = +0{\cdot}3\mu A$)	−1·3 volts.
Max. V_{h-k}	150 volts.
Max. R_{h-k}	20 kΩ
Max. R_{g_1-k} Fixed Bias	500 kΩ
Max. R_{g_1-k} Auto Bias	1·0 MΩ



CHARACTERISTICS.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage	−2·3	−3·5	volts.
Anode Current	36	36	mA.
Screen Current	5	5	mA.
Mutual Conductance	10·5	10·5	mA/V.
Anode Impedance	100	100	kΩ
Inner μ (μ_{g_1-g2})	25	25	

TYPICAL OPERATION.

Anode Supply Voltage	170 volts.
Screen Voltage	170 volts.
Suppressor Grid Voltage	0 volts.
Control Grid Voltage	−6·7 volts.
Anode Current	4 mA.
Screen Current	0·25 mA.
Anode Load Resistance	2·2 kΩ
Peak Output Voltage	>70 volts.

CAPACITANCES.

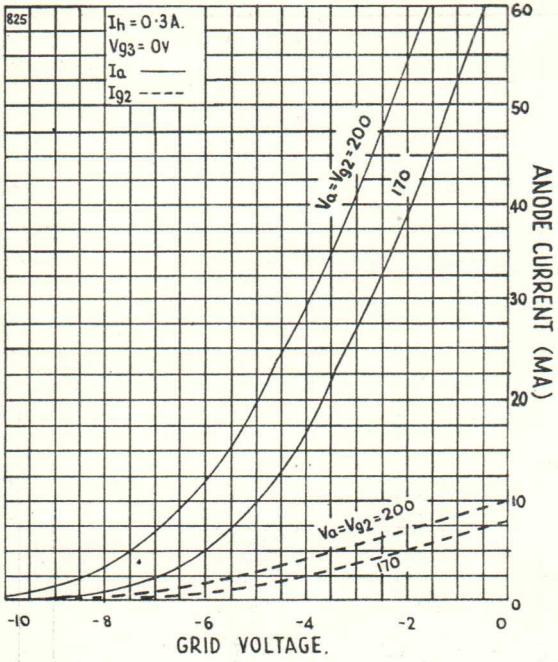
C_{in}	10·4 pF.
C_{out}	6·6 pF.
C_{a-g_1}	<0·1 pF.
C_{g_1-h}	<0·15 pF.

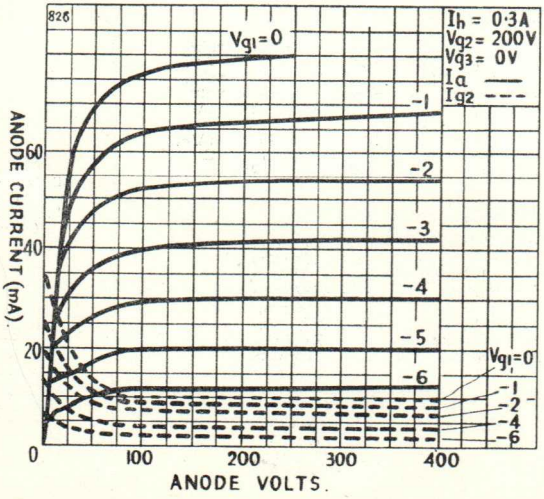
All Dimensions shown are in Millimetres. (Max.)

Issue 1.
Mar., 1956

PL83

FERRANTI





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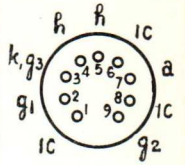
PL84

OUTPUT PENTODE

An indirectly heated output pentode. It is suitable for use in Television Receivers as a Frame Time Base Output Valve, or an Audio Output Valve. Designed for use in series heater chains.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	78·5 mm. ($3\frac{9}{32}$in.).
Max. Seated Height	71·5 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 5—Heater.
Pin 2—Control Grid.	Pin 6—Internal Connection.
Pin 3—Cathode, Suppressor Grid.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Screen Grid.

HEATER.

Heater Current	0·3 Amp.
Heater Voltage	15 volts.

RATINGS.

Max. D.C. Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
*Max. Positive Peak Anode Voltage	2 kV.
Max. Neg. Peak Anode Voltage	−500 volts.
Max. Anode Dissipation	12 watts.
Max. Screen Voltage	200 volts.
Max. Screen Dissipation	1·75 watts.
Max. Cathode Current	100 mA.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	20 kΩ
§Max. R_{g1-k} (cathode bias)	1 MΩ

CHARACTERISTICS.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage	−12·5	−17·3	volts.
Anode Current	70	60	mA.
Screen Current	4·0	3·0	mA.
Mutual Conductance	11	8·8	mA/V.
Anode Impedance	24	28	kΩ
Inner μ (μg_1-g_2)	8	8	

TYPICAL OPERATION.

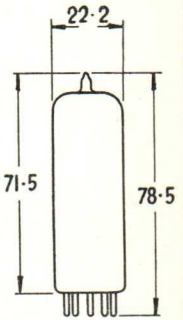
As Frame Time Base Output.

To allow for tolerances and the spread of characteristics during life, it is recommended that the frame time base output circuit should be designed around the following values.

Anode Voltage	60	70	80	volts.
Screen Grid Voltage	170	200	220	volts.
Peak Anode Current	145	190	220	mA.

As Audio Output Valve (Class A).

Anode Voltage	170	200	volts.
Screen Grid Voltage	170	—	volts.
Screen Grid Feed Resistor	—	470	ohms.
Control Grid Voltage	−12·5	−17·3	volts.
Anode Current	70	60	mA.
Screen Grid Current	4·0	3·1	mA.
Anode Load	2·4	2·4	kΩ
Input Voltage	7	7	volts (rms.).
Power Output (D_{tot}=10%)	5·6	5·2	watts.



All Dimensions shown are in millimetres (max.).

*Max. pulse duration 4% of one cycle, with a maximum of 800 μ secs.

§For frame output operation the max. value of R_{g1}–k may be 3·3 MΩ

Ferranti

Issue 2.
Mar., 1961

Ferranti

TYPICAL OPERATION (cont.)

As Audio Amplifier (2 valves in Class AB push pull).

Anode Voltage	170 volts.
Screen Grid Voltage	170 volts.
*Cathode Bias Resistor	120 ohms.
Anode Current (Zero signal)	2×56 mA.
Anode Current (Max. signal)	2×57·5 mA.
Screen Grid Current (Zero signal) ...	2×3 mA.
Screen Current (Max. signal) ...	2×20·5 mA.
Input Voltage (g_1–g_1)	13·1 volts (rms.).
Optimum Load (Anode to Anode) ...	3·5 kΩ
†Power Output	13 watts.
Input Voltage (P_{out} = 50mW) ...	450 mV. (rms.).

As Audio Amplifier (2 valves in Class B).

Anode Voltage	170 volts.
Screen Grid Supply Voltage	170 volts.
Control Grid Voltage	20·5 volts.
Anode Current (Zero signal)	2×15 mA.
Anode Current (Max. signal) ...	2×57·5 mA.
Screen Grid Current (Zero signal) ...	2×0·7 mA.
Screen Current (Max. signal) ...	2×20·5 mA.
Input Voltage (g_1–g_1)	14·5 volts. (rms.).
Optimum Load (Anode to Anode) ...	3·5 kΩ
†Power Output	13·5 watts.

TRIODE CONNECTED. (Screen Grid connected to Anode).

As Audio Amplifier Class A.

Anode Voltage	170 volts.
Control Grid Voltage	−15 volts.
Anode Current	51 mA.
Anode Load	1·2 kΩ
Input Voltage	10·8 volts (rms.).
‡Power Output	2·1 watts.
Input Voltage (P_{out} = 50mW) ...	1·75 volts (rms.).

CAPACITANCES.

C_{in}	12 pF.
C_{out}	6 pF.
C_{a-g_1}	<0·6 pF.
C_{g_1-h}	<0·25 pF.

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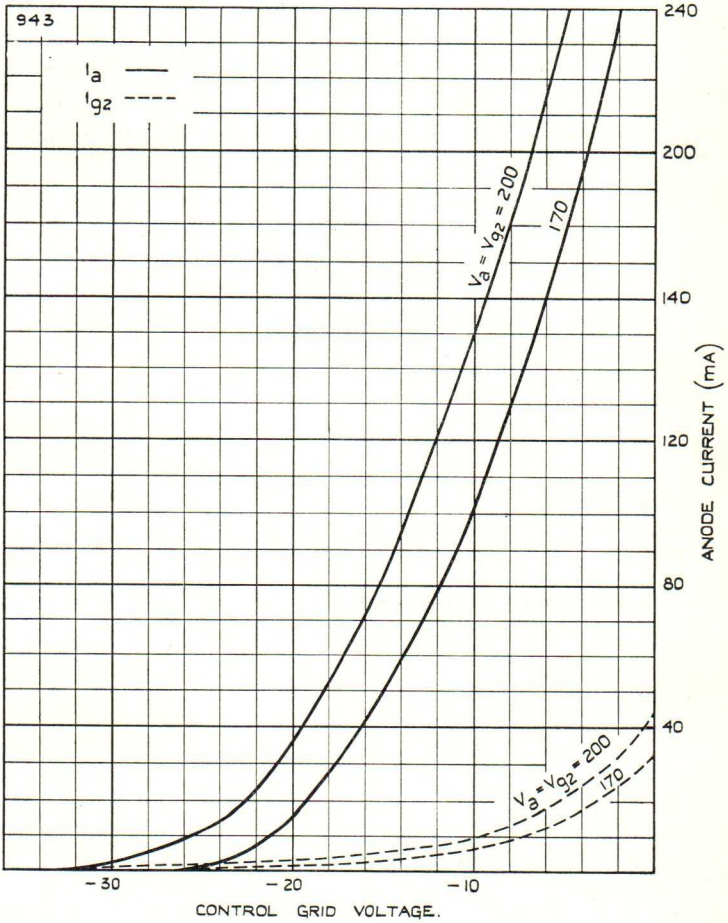
*Common Bias Resistor.

†Total Distortion 5%.

‡Total Distortion of 10%.

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS



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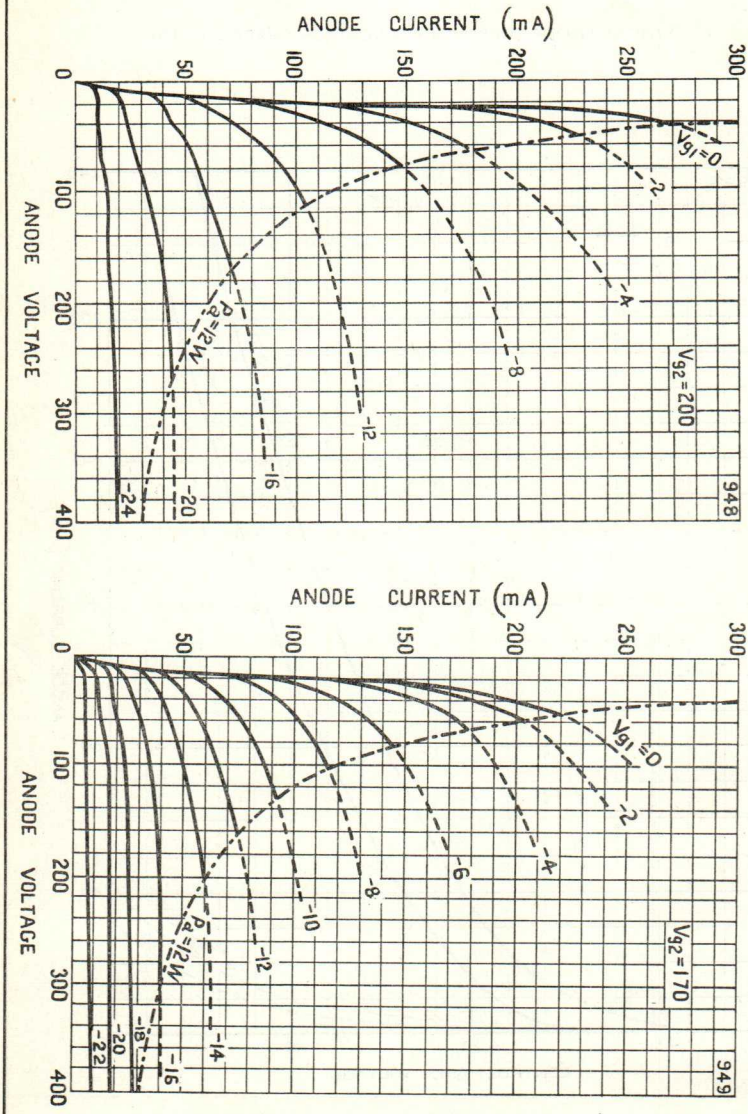


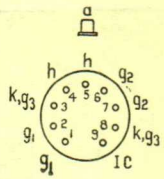
TYPICAL ANODE CURRENT/ANODE VOLTAGE CHARACTERISTICS

Ferranti

LINE OUTPUT PENTODE

PL500

An indirectly heated output pentode designed for use as a Line Time Base Output Valve in Television Receivers with series heater chains.



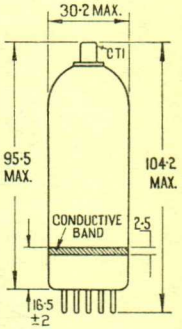
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9D
Top Cap	CT1
Max. Overall Length	104·2 mm ($4\frac{3}{32}$″)
Max. Seated Height	95·5 mm ($3\frac{3}{4}$″)
Max. Diameter	30·2 mm ($1\frac{3}{16}$″)

BASE CONNECTIONS.

Pin 1—, Pin 2— } Control Grid
Pin 3—Cathode, Suppressor Grid
Pin 4—Heater
Pin 5—Heater
Pin 6—, Pin 7— } Screen Grid
Pin 8—Cathode, Suppressor Grid
Pin 9—Internal Connection
T.C.—Anode



Dimensions in millimetres

HEATER.

Heater Current	0·3 amp
Heater Voltage	27 volts

RATINGS.

Max. DC. Supply Voltage	550 volts
Max. Anode Voltage	250 volts
Max. Peak Anode Voltage	7 kV
Max. Screen Grid Voltage	250 volts
*Max. Anode Dissipation (p_a)	12 watts
*Max. Screen Grid Dissipation (p_{g_2})	5 watts
*Max. $p_a + p_{g_2}$	13 watts
Max. Cathode Current	250 mA
Max. R_{g_1-k} (Fixed Bias)	500 kΩ
Max. R_{g_1-k} (Line Timebase)	2·2 mΩ

CHARACTERISTICS.

Anode Voltage	75 volts
Screen Grid Voltage	200 volts
Control Grid Voltage	−10 volts
Anode Current	440 mA
Screen Grid Current	30 mA

TYPICAL OPERATION. As Line Output Valve.

Stabilised Circuits (operation above the knee)

V_b	170			200			230			volts
†R_{g_2}	1·2			1·5			2·2			kΩ
V_{g_2}	130	150	130	150	170	150	170	190	volts
‡V_a	62	66	65	69	73	72	76	80	volts
§V_{g_1}	−6	−7	−6	−7	−8	−7	−8	−9	volts
$i_{a(pk)}$	250	310	250	310	360	310	360	420	mA

To allow for valve spread and deterioration and 10% mains voltage fluctuation, the values of $i_{a(pk)}$ shown should not be exceeded at nominal mains voltage.

Non Stabilised Circuits (operation below the knee)

V_b	190	230	volts
R_{g_2} (min)	2·2	2·2	kΩ
§V_{g_1}	+1·0	+1·0	volt
$i_{a(pk)}$	230	320	mA

*See Graph overleaf.

†This is the minimum value of R_{g_2} necessary to prevent excessive screen grid dissipation during warm up.

‡The minimum anode voltage at end of scan at nominal mains voltage. The valve will still operate above the knee at a mains voltage 10% below nominal.

§At end of scan the nominal V_{g_1} for cut off during the flyback period is −120 volts.

Tentative
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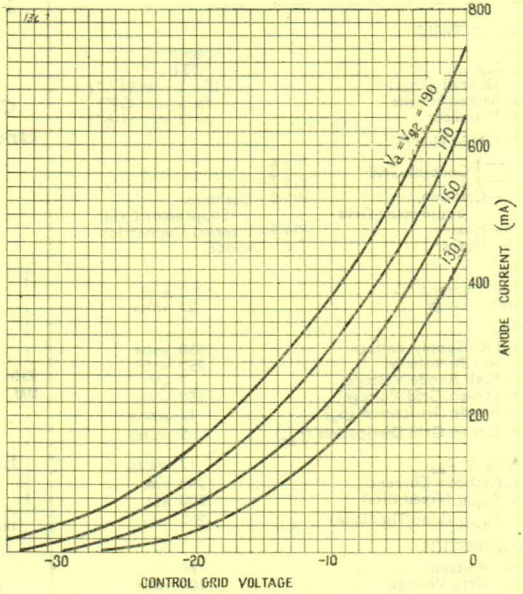
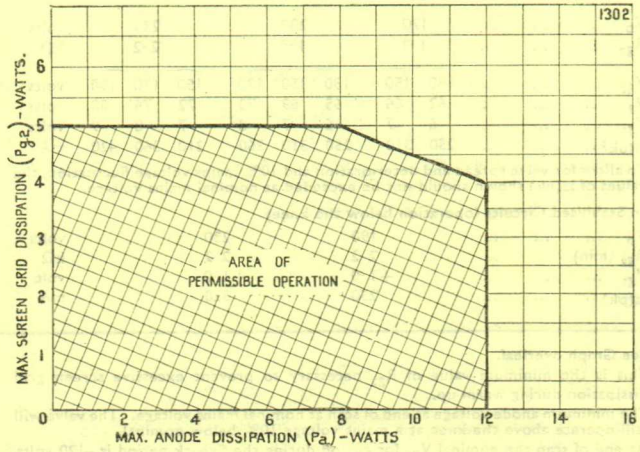
April, 1963

TYPICAL i_a/V_g CHARACTERISTICS



ANODE AND SCREEN GRID DISSIPATION RATINGS

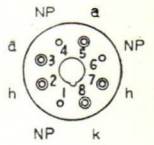


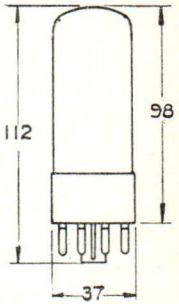
PY33

Ferranti

FULL WAVE RECTIFIER

An indirectly heated half wave rectifier with a 0·3 amp. heater designed for series connected heater operation in Television Receivers.





PHYSICAL DETAILS.

Base	Octal
Max. Overall Length	112 mm. (4·41")
Max. Seated Height	98 mm. (3·86")
Max. Diameter	37 mm. (1·46")
Mounting Position	Any

BASE CONNECTIONS.

Pin 1—No Pin	Pin 5—Anode
Pin 2—Heater	Pin 6—No Pin
Pin 3—Anode	Pin 7—Heater
Pin 4—No Pin	Pin 8—Cathode

HEATER.

Heater Current	0·3 amps
Heater Voltage	29 volts

RATINGS.

Max. Peak Inverse Voltage ...	700 volts
Max. R.M.S. Anode Voltage ...	250 volts
Max. Rectified Current	325 mA
Max. Peak Anode Current ...	2·6 amps
Max. Surge Anode Current ...	9·5 amps
*Max. $V_{h-k\ (pk)}$ (Heater negative)	625 volts
Max. Reservoir Capacitor ...	200 μF

TYPICAL OPERATING CONDITIONS.

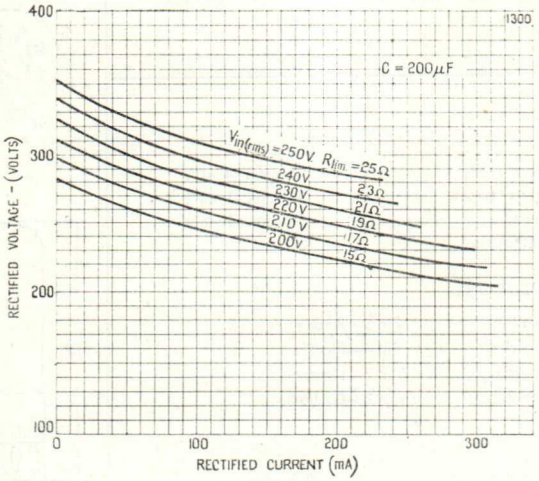
R.M.S. Input Voltage per Anode	200	210	220	230	240	250	volts
Supply Impedance per Anode	15	17	19	21	23	25	ohms
Reservoir Capacitor	200	200	200	200	200	200	μF
Rectified Current	325	325	295	270	240	220	mA
DC. Output Voltage	209	219	234	249	264	280	volts

To choose the required value of limiting resistor when a constant output voltage is required at different input voltages, as in Television Receivers, the graph overleaf should be consulted.

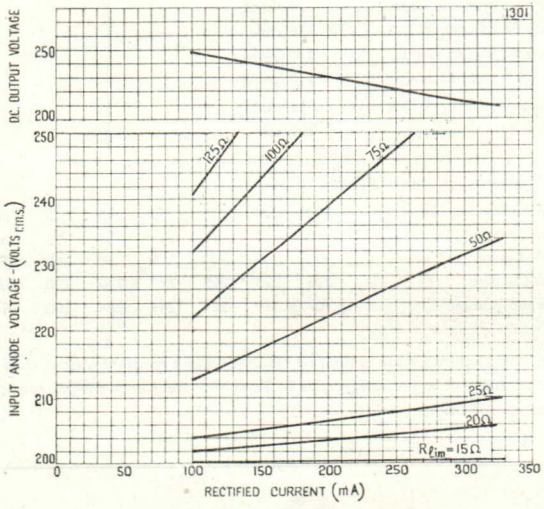
*Mains voltage of not more than 250V. r.m.s., plus a maximum DC. component of 275 volts.

Issue 2.
Feb., 1963.

REGULATION CURVES



TO DETERMINE THE VALUE OF LIMITING RESISTOR WHEN A CONSTANT OUTPUT VOLTAGE IS REQUIRED.



Ferranti

BOOSTER DIODE

PY81

17Z3

An indirectly heated booster diode with high heater-cathode insulation designed for operation in AC/DC Television Receivers with series heater chains.

PHYSICAL DETAILS.

Base	B9A—Noval.
Bulb	Clear.
Max. Overall Length	83 mm. ($3\frac{9}{32}$in.).
Max. Seated Height	76 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Top Cap	CT1

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Internal Connection.	Pin 7—Internal Connection.
Pin 3—Internal Connection.	Pin 8—Internal Connection.
Pin 4—Heater.	Pin 9—Anode.
Pin 5—Heater.	T.C.—Cathode.

HEATER.

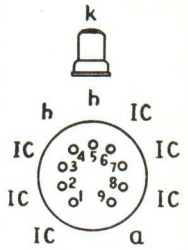
Heater Current	0·3 amp.
Heater Voltage	17·0 volts.

RATINGS.

*Max. Peak Inverse Voltage ...	4750 volts.
Max. Mean Anode Current ...	150 mA.
*Max. Peak Anode Current ...	450 mA.
Max. Reservoir Capacitor ...	4 μF.
*Max. V_{h-k} (pk) (Htr. Negative)	4750 volts.
Max. V_{a-h} (pk) (Anode Negative)	3000 volts.
Max. V_{h-e}	220 volts (r.m.s.)

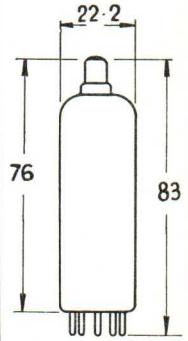
CAPACITANCES.

C_{a-k}	6·4 pF.
C_{h-k}	2·8 pF.



Base Connections

Underside View of Base



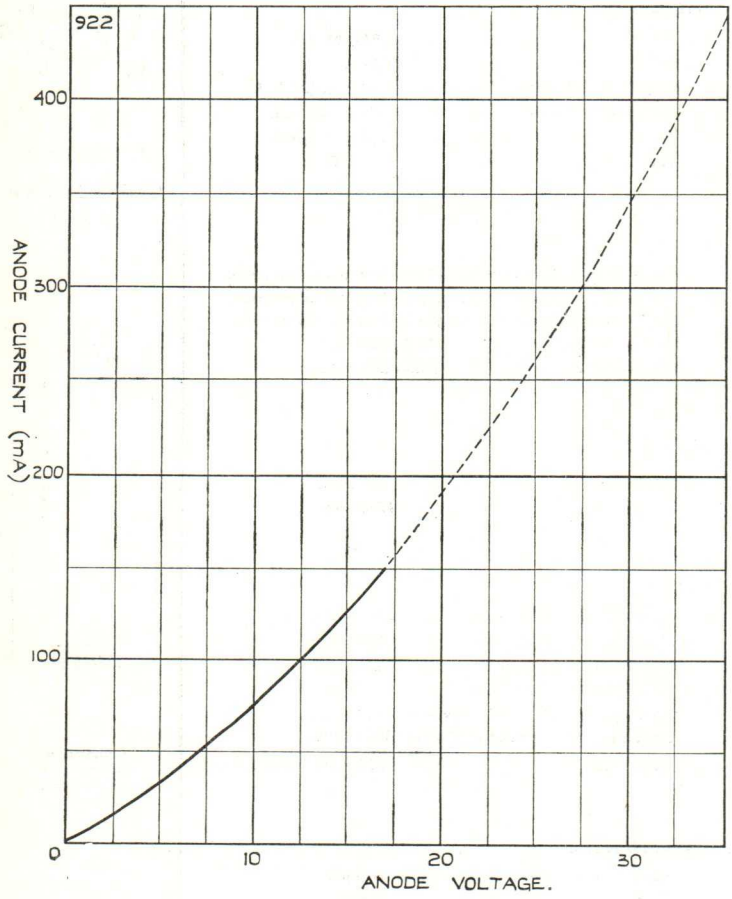
Dimensions shown are in millimetres (max)

*Max. pulse duration of 22% of one cycle with a maximum of 18 μsecs.

Issue 2
May, 1960

Ferranti

Typical Anode Current/Anode Voltage Characteristic

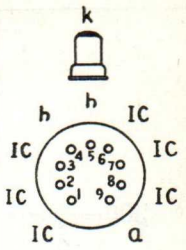


Ferranti

BOOSTER DIODE

PY83

An indirectly heated booster diode. The high heater-cathode insulation permits operation in transformerless AC/DC Television Receivers.



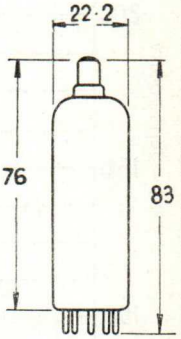
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Bulb	Clear.
Max. Overall Length	83 mm. ($3\frac{5}{32}$in.).
Max. Seated Height	76 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Internal Connection.	Pin 7—Internal Connection.
Pin 3—Internal Connection.	Pin 8—Internal Connection.
Pin 4—Heater.	Pin 9—Anode.
Pin 5—Heater.	T.C.—Cathode.



Dimensions shown are in millimetres (max)

HEATER.

Heater Current	0·3 amp.
Heater Voltage	20·0 volts.

RATINGS.

*Max. Peak Inverse Voltage ...	5000 volts.
Max. Mean Anode Current ...	175 mA.
*Max. Peak Anode Current ...	500 mA.
Max. Reservoir Capacitor ...	4 μF.
*Max. $V_{h-k\ (pk)}$ Htr. Negative	5000 volts.

CAPACITANCES.

C_{a-k}	9·2 pF.

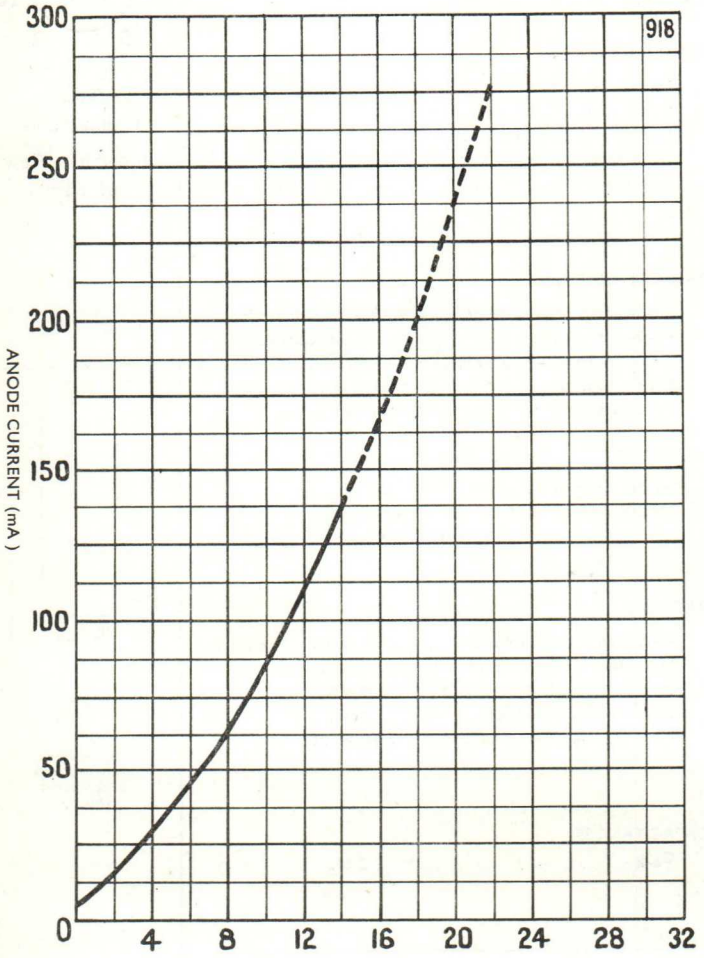
*Max. pulse duration of 22% of one cycle with a maximum of 18 μsecs.

Issue 1
May, 1960

Ferranti

Ferranti

Typical Anode Current/Anode Voltage Characteristic

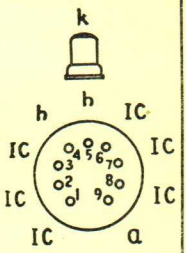


Ferranti

BOOSTER DIODE

PY88

An indirectly heated booster diode. Designed for use with 110° deflection Cathode Ray Tubes in Television Receivers with series heater chains.



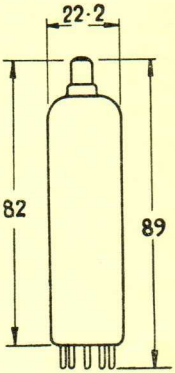
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Bulb	Clear.
Max. Overall Length	89 mm. ($3\frac{1}{2}$in.).
Max. Seated Height	82 mm. ($3\frac{7}{32}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Internal Connection.	Pin 7—Internal Connection.
Pin 3—Internal Connection.	Pin 8—Internal Connection.
Pin 4—Heater.	Pin 9—Anode.
Pin 5—Heater.	T.C.—Cathode.



Dimensions shown are in millimetres (max.)

HEATER.

Heater Current	0·3 amp.
Heater Voltage	30·0 volts (approx.).

RATINGS.

*Max. Peak Inverse Voltage ...	6600 volts.
Max. Mean Anode Current ...	220 mA.
*Max. Peak Anode Current ...	550 mA.
*Max. $V_{h-k\ (pk)}$ Htr. Negative	6600 volts.

CAPACITANCES.

C_{a-k}	9·0 pF.
C_{k-h}	2·0 pF.

*Max. pulse duration of 22% of one cycle with a maximum of 18 μsecs.

Ferranti

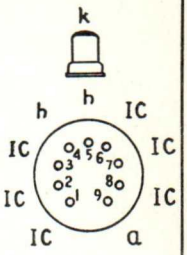
Tentative
Issue 1
Oct., 1960

Ferranti

BOOSTER DIODE

PY800

An indirectly heated booster diode with high heater cathode insulation. Designed for use with 110° deflection Cathode Ray Tubes in Television Receivers.



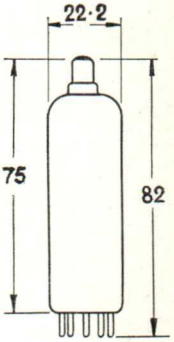
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval
Bulb	Clear
Max. Overall Length	82 mm. ($3\frac{1}{4}$in.)
Max. Seated Height	75 mm. ($2\frac{31}{32}$in.)
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.)

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection
Pin 2—Internal Connection.	Pin 7—Internal Connection
Pin 3—Internal Connection.	Pin 8—Internal Connection
Pin 4—Heater.	Pin 9—Anode
Pin 5—Heater.	T.C.—Cathode



HEATER.

Heater Current	0·3 amp
Heater Voltage	19·0 volts (approx.)

RATINGS.

*Max. Peak Inverse Voltage ...	5250 volts
Max. Mean Anode Current ...	150 mA
Max. Peak Anode Current ...	350 mA
*Max. $V_{h-k\ (pk)}$ (Htr. Negative)	5750 volts
*Max. $V_{h-a\ (pk)}$ (Anode Negative)	3000 volts

Dimensions shown are in millimetres (max.)

CAPACITANCES.

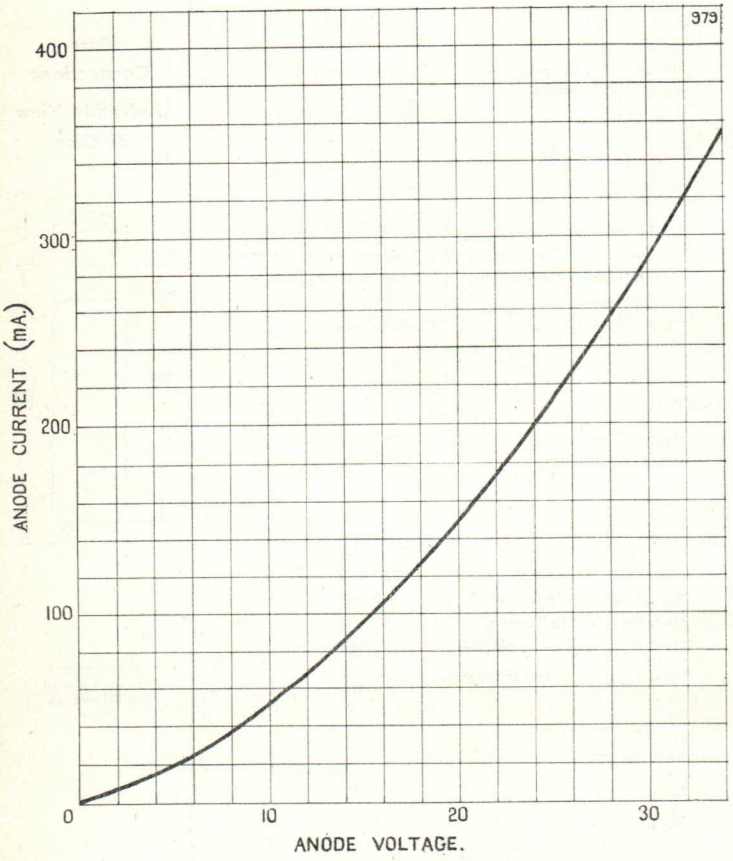
C_{a-k}	4·7 pF
C_{k-h}	1·9 pF

*Max. pulse duration of 22% of one cycle with a maximum of 22 μsecs.

Issue 1.
May, 1962

Ferranti

TYPICAL ANODE CURRENT/ANODE VOLTAGE CHARACTERISTIC

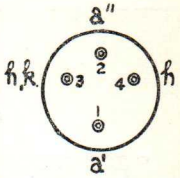


FERRANTI

FULL WAVE RECTIFIER

R42

An indirectly heated, high vacuum full wave rectifier. The Cathode is connected internally to one side of the heater.



Base Connections

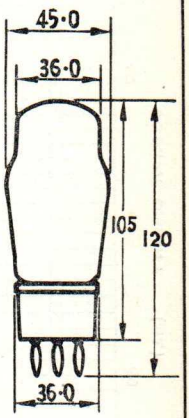
Underside View of Base

PHYSICAL DETAILS.

Base	British 4-pin.
Bulb	Clear.
Max. Overall Length	120 mm. ($4\frac{3}{4}$in.).
Max. Overall Bulb Diameter ...	45 mm. ($1\frac{25}{32}$in.).
Max. Seated Height	104 mm. ($4\frac{3}{32}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode 1.	Pin 3—Heater Cathode.
Pin 2—Anode 2.	Pin 4—Heater.



HEATER.

Heater Voltage	4·0 volts.
Heater Current	2·5 amps.

RATINGS.

Max. Peak Inverse Voltage ...	1400 volts.
*Max. Peak Anode Current ...	375 mA.
*Max. R.M.S. Anode Voltage ...	500 volts.
Max. Rectified Current ...	125 mA.
*Min. Limiting Resistance ...	30 ohms.

TYPICAL OPERATING CONDITIONS.

CONDENSER INPUT.

*R.M.S. Input Voltage	350 volts.
Rectified Current	125 mA.
*Min. Supply Impedance	50 ohms.
Max. Reservoir Condenser ...	32 μF.

CHOKE INPUT.

*R.M.S. Input Voltage	500 volts.
Rectified Current	125 mA.
Min. Input Choke Inductance ...	4 Henries.

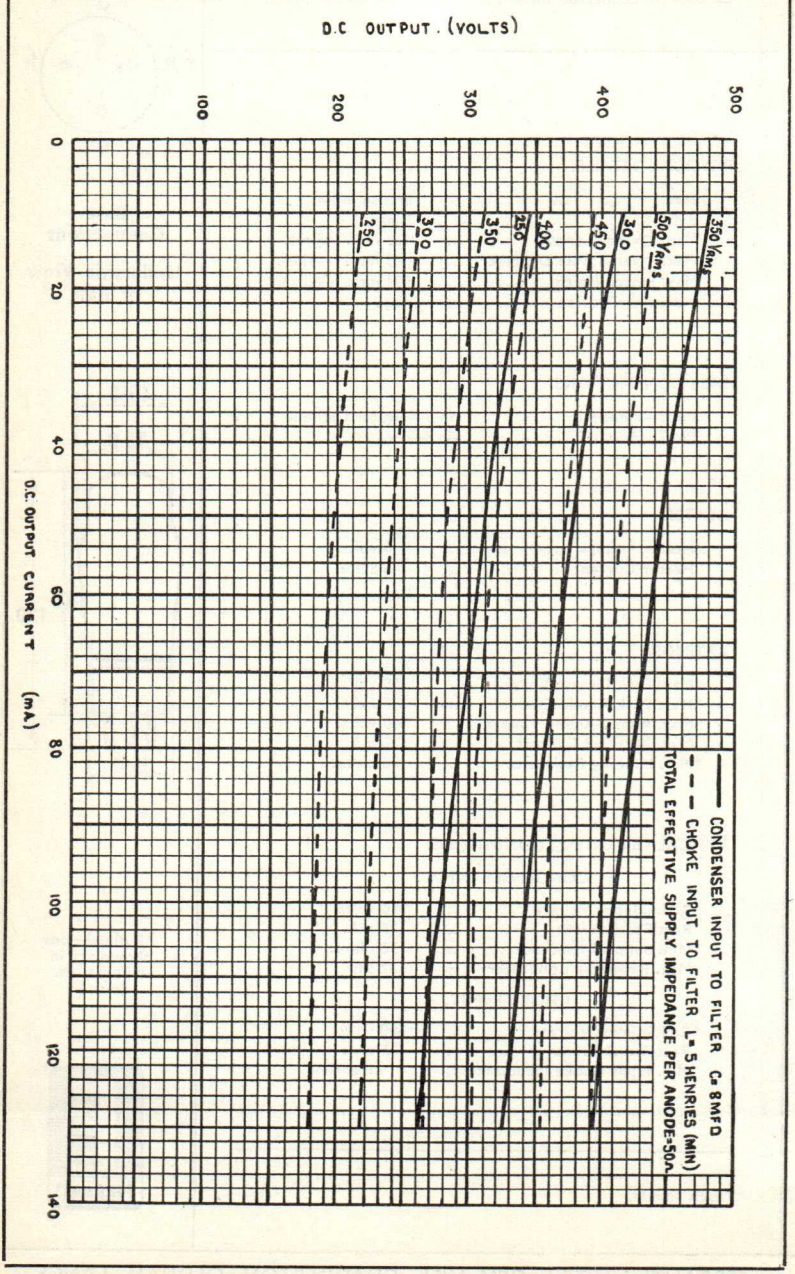
All dimensions shown are in millimetres. (max.).

*Each Anode.

Issue 2
Sept., 1952

R42

FERRANTI



FERRANTI

TRIPLE DIODE TRIODE

UABC80

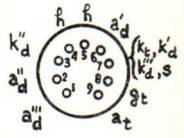
An indirectly heated triple diode triode. One diode has a separate cathode. Primarily designed for use as A.F. amplifier and demodulator in FM/AM Receivers.

PHYSICAL DETAILS.

Base	B9A Noval
Max. Overall Length	67·5 mm. (2$\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Diode 3 Anode. Pin 6—Diode 1 Anode.
Pin 2—Diode 2 Anode. Pin 7—Triode Cathode.
Pin 3—Diode 2 Cathode. Diode 1 Cathode.
Pin 4—Heater. Diode 3 Cathode, Shield.
Pin 5—Heater. Pin 8—Triode Grid.
Pin 9—Triode Anode.



Base Connections

Underside View of Base

HEATER.

Heater Current	0·1 amp.
Heater Voltage	28 volts.

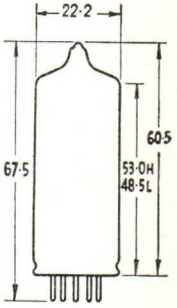
RATINGS.

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	1 watt.
Max. Cathode Current ...	5 mA.
*Max. R_{g-k}	3 MΩ
Max. R_{h-k}	20 kΩ
§Max. V_{h-k}	150 volts.
†Min. Negative Grid Voltage ...	1·3 volts.

DIODE SECTIONS.

Max. P.I.V. (Each Diode) ...	350 volts.
Max. Peak Current Diode 1 ...	6 mA.
Max. Peak Current Diode 2 ...	75 mA.
Max. Peak Current Diode 3 ...	75 mA.
Max. Current Diode 1	1 mA.
Max. Current Diode 2	10 mA.
Max. Current Diode 3	10 mA.



CHARACTERISTICS.

TRIODE SECTIONS.

Anode Voltage	170	200	volts.
Grid Voltage	−1·85	−2·3	volts.
Anode Current	1	1	mA.
Mutual Conductance	1·45	1·4	mA/V.
Amplification Factor	70	70	
Anode Impedance	48	50	kΩ

DIODE SECTIONS.

Diode 1 Impedance ($V_{a'd}$ = 10v)	5 kΩ
Diode 2 Impedance ($V_{a''d}$ = 5v)	200 Ω
Diode 3 Impedance ($V_{a'''d}$ = 5v)	200 Ω
$r_{a''d}/r_{a'''d}$	0·65 to 1·5

MICROPHONY

This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	·76	mA.
Stage Gain	51	53	47	54	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (for V_{out} = 8v r.m.s.)	1·1	0·9	0·8	0·6	%
Grid Resistor for following valve	680	680	330	680	kΩ

All dimensions shown are in millimetres (max. unless otherwise stated).

*For operation with grid current biasing R_{g-k} may be increased to 22 MΩ max.
†For grid current of 0.3 μA.
§To avoid excessive hum the a.c. component should be kept as low as possible (<30$V_{r.m.s.}$)

Issue 2
Dec.,1957

UABC80

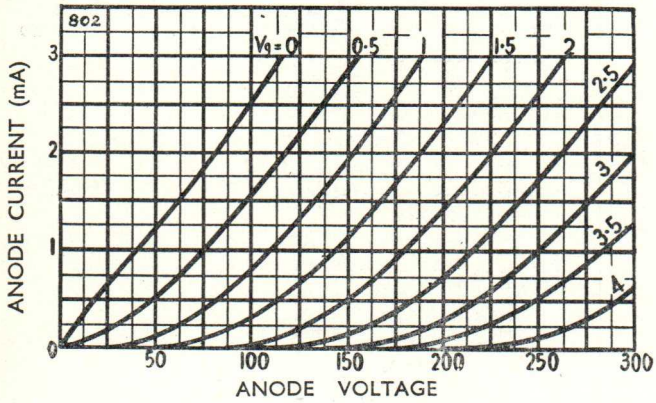
FERRANTI

CAPACITANCES. TRIODE SECTION.

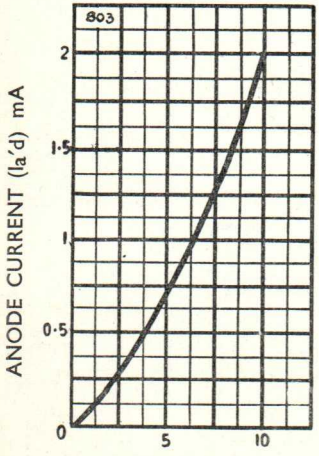
C_{in}	1.9 pF.
C_{out}	1.4 pF.
C_{a-g}	2.0 pF.
C_{g-h}	<0.04 pF.

DIODE SECTION.

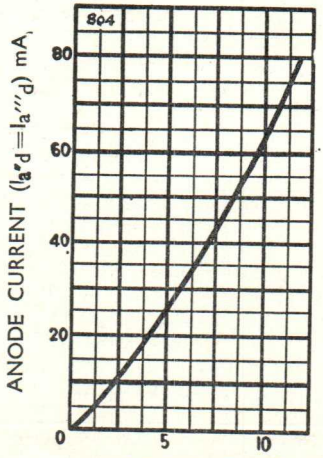
$C_{a'd-(h+kt, k'd, k''d, s)}$ ...	0.8 pF.
$C_{a''d-(h+k''d+kt, k'd, k''d, s)}$	4.8 pF.
$C_{a'''d-(h+kt, k'd, k'''d, s)}$ ...	4.8 pF.
$C_{k''d-all}$	5.0 pF.
$C_{a'd-h}$	<0.25 pF.
$C_{a'''d-h}$	<0.2 pF.
$C_{k''d-h}$	2.5 pF.



DIODE I



DIODE II - DIODE III

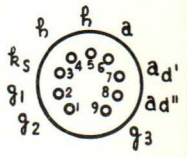


UBF89

Ferranti

DOUBLE DIODE PENTODE

An indirectly heated double diode variable-mu pentode designed for use as detector, A.V.C. diode and R.F., I.F., or A.F. Amplifier in equipments with series heater chains. The diode sections are only suitable for A.M. detection.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—All Glass.
Max. Overall Length	... ...	67·5 mm. ($2\frac{11}{16}$in.).
Max. Seated Height	... ...	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Screen Grid (g_2).
Pin 2—Control Grid (g_1).
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Diode Anode 1.
Pin 8—Diode Anode 2.
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Current	... ... 0·1 Amp.
Heater Voltage	... ... 19·0 Volts.

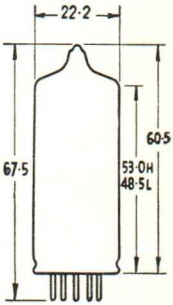
RATINGS.

Pentode Section.

Max. H.T. Supply Voltage	... 550 volts.
Max. Anode Voltage	... ... 250 volts.
Max. Screen Voltage (I_a<4 mA.)	250 volts.
Max. Screen Voltage (I_a>8 mA.)	125 volts.
Max. Anode Dissipation	... 2·25 watts.
Max. Screen Dissipation	... 0·45 watts.
Max. Control Grid Voltage (I_{g1}=+0·3μA.).	... −1·3 volts.
*Max. R_{g1-k}	... ... 3 MΩ
Max. R_{g3-k}	... ... 10 kΩ

Diode Sections.

Peak Diode Anode Voltage	... 200 volts.
Max. Mean Diode Anode Current	0·8 mA.
Max. Peak Diode Anode Current	5·0 mA.
Max. Cathode Current	... 16·5 mA.
Max. V_{h-k}	... ... 100 volts.
Max. R_{h-k}	... ... 20 kΩ



Dimensions shown are in millimetres.

CHARACTERISTICS.

Pentode Section

Anode Voltage	... ...	100	200 volts.
Screen Voltage	... ...	100	100 volts.
Suppressor Grid Voltage	...	0	0 volts.
Grid Voltage	... ...	−2	−1·5 volts.
Anode Current	... ...	8·5	11·0 mA.
Screen Current	... ...	2·8	3·3 mA.
Mutual Conductance	... ...	3·5	4·5 mA/V.
Anode Impedance	... ...	300	600 kΩ
Inner μ	... ...	20	20
Grid Voltage for gm=120 μA/V		−10	−20 volts.

*If grid current biasing is employed R_{g1-k} may be increased up to 22 MΩ

Ferranti

Issue 1.
Oct., 1960

Ferranti

TYPICAL OPERATION.

As R.F. or I.F. Amplifier with Cathode bias.

$V_a = V_b$	100	170	200	volts.
V_{g3}	0	0	0	volts.
R_{g2}	0	21	30	kΩ
R_k	175	105	105	ohms.
V_{g1}	−2	−1·5	−1·5	volts.
I_a	8·5	11	11	mA.
I_{g2}	2·8	3·4	3·3	mA.
g_m	3·5	4·5	4·5	mA/V.
r_a	300	450	600	kΩ
R_{eq}	—	3·5	3·5	kΩ
g_m (V_{g1}=−20)	—	60	120	μA/V.

As R.F. or I.F. Amplifier with Grid current bias.

$V_a = V_b$	170	200	volts.
V_{g3}	0	0	volts.
R_{g2}	27	47	kΩ
†V_{g1}	0·5†	0·5†	volts.
I_a	11	9·5	mA.
I_{g2}	3·4	2·8	mA.
g_m	5·0	5·0	mA/V.
r_a	450	600	kΩ
R_{eq}	2·5	2·5	kΩ
g_m (V_{g1}=−20)	60	115	μA/V.

MICROPHONY.

No special precautions against Microphony are required in circuits where the output valve produces an output of 50 mW. from an input voltage of less than 25 mV.

CAPACITANCES.

Pentode Section.

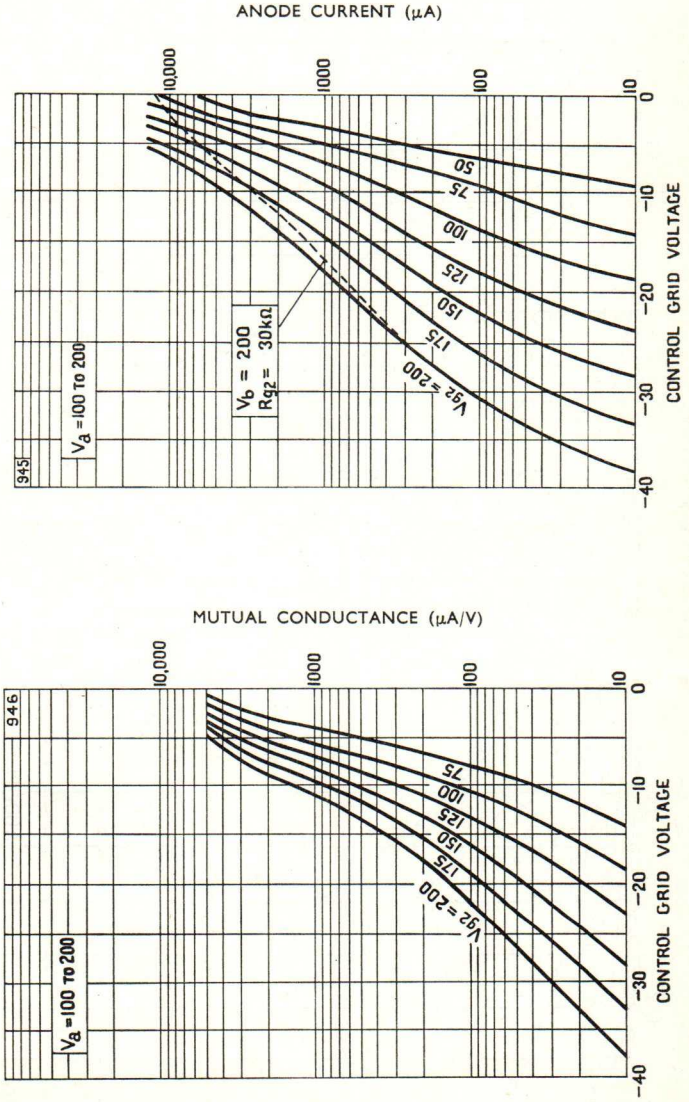
C_{in}	5·0 pF.
C_{out}	5·2 pF.
C_{a-g1}	<0·0025 pF.
C_{g1-h}	0·05 pF.

Diode Sections.

$C_{ad'-k} = C_{ad''-k}$	2·5 pF.
$C_{ad'-ad''}$	<0·25 pF.
$C_{ad'-h}$	<0·015 pF.
$C_{ad''-h}$	<0·003 pF.

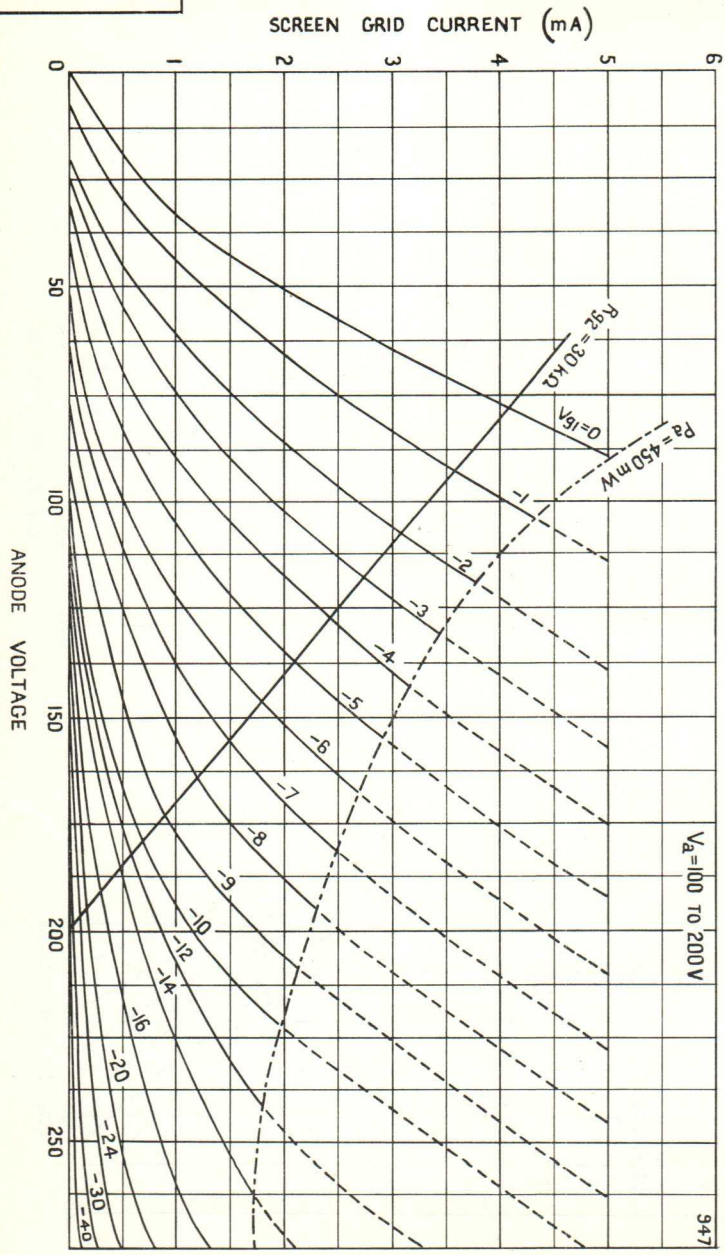
$C_{ad'-g1}$	<0·0025 pF.
$C_{ad''-g1}$	<0·001 pF.
$C_{ad'-ap}$	<0·15 pF.
$C_{ad'-ap}$	<0·025 pF.

†This bias voltage is produced by the grid current through the grid resistor and the diode current. If attenuation occurs due to the high resistance of the grid cathode path, the negative bias should be increased to approx −1·5volts.


ANODE CURRENT (μA)
10,000
1000
100
10
0
−10
−20
−30
−40
CONTROL GRID VOLTAGE
945
V_a = 100 TO 200
V_b = 200
R_{g2} = 30kΩ
V_{g2} = 200
175
150
125
100
75
50
MUTUAL CONDUCTANCE (μA/V)
946
V_a = 100 TO 200
V_{g2} = 200
175
150
125
100
75

Ferranti

UBF89

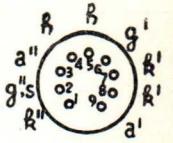


FERRANTI

DOUBLE TRIODE

UCC84

A double triode with separate cathodes, primarily designed for use as a cascode R.F. Amplifier in Television Receivers. Suitable for operation at frequencies up to 220 Mc/s.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode Triode 2.	Pin 5—Heater.
Pin 2—Grid Triode 2, Shield.	Pin 6—Grid Triode 1.
	Pin 7—Cathode Triode 1 (in).
Pin 3—Anode Triode 2.	Pin 8—Cathode Triode 1 (out).
Pin 4—Heater.	Pin 9—Anode Triode 1.

The triode on Pins 6, 7, 8 and 9 should have grounded-cathode connection and that on pins 1, 2 and 3 should have grounded-grid connection.

HEATER.*

Heater Current	100 μA
Heater Voltage	21 volts.

RATINGS.†

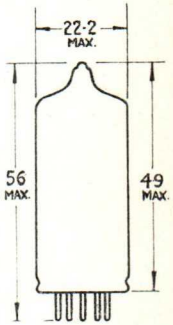
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	180 volts.
Max. Anode Dissipation ...	2 watts.
Max. Cathode Current ...	18 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. $V_{h-k'}$	90 volts.
Max. $V_{h-k''}$ (heater positive)	90 volts.
**Max. $V_{h-k''}$ (pk) (heater negative)	250 volts.
Max. $R_{g'-k'}$	1·0 MΩ
Max. $R_{g''-k''}$	0·5 MΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.†

Anode Voltage	90 volts.
Grid Voltage	−1·5 volts.
Anode Current	12 mA.
Amplification Factor	24
Mutual Conductance	6 mA/V.
§Input Impedance	2 kΩ

CAPACITANCES.‡

$C_{g'-k'}$	2·1 pF.
$C_{a'-k'}$	0·45 pF.
$C_{g'-h}$	<0·25 pF.
$C_{a'-g'}$	1·2 pF.
$C_{a''-g''}$	2·3 pF.
$C_{a''-k''}$	0·16 pF.
$C_{k''-g''+h}$	4·7 pF.
$C_{a'-g'+h}$	2·5 pF.
$C_{g'-a'}$	<0·006 pF.
$C_{a'-a''}$	<0·035 pF.
$C_{a'-k'+}$ $_{+g}$	1·2 pF.
C_{h-k}	2·7 pF.



All dimensions shown are in millimetres (max.).

*Suitable for series operation only, a.c. or d.c.

†Each section, unless otherwise indicated.

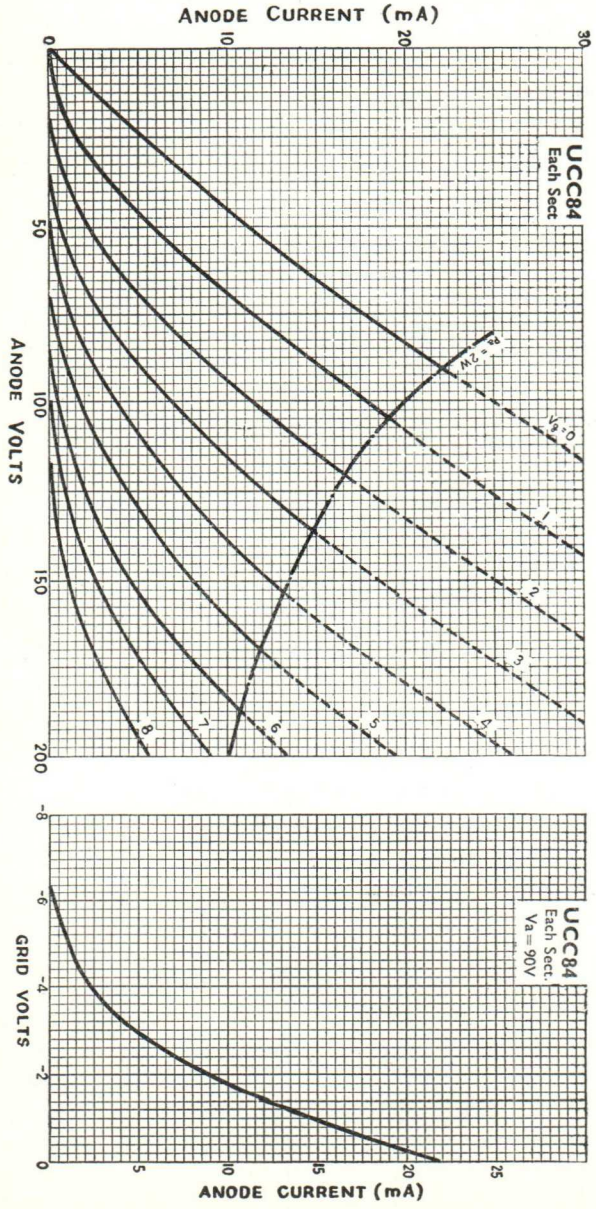
‡Measured without external shield.

§Measured at a frequency of 200 Mc/s. with cathode connections pins 7 and 8 strapped.

**Max. d.c. component 180 volts.

Issue 1
Dec., 1957

UCC84


ANODE CURRENT (mA)
0
10
20
30
50
100
150
200
ANODE VOLTS
UCC84
Each Sect
-2V
0
1
2
3
4
5
6
7
8
-8
-6
-4
-2
0
5
10
15
20
25
GRID VOLTS
UCC84
Each Sect.
Va = 90V
ANODE CURRENT (mA)

FERRANTI

DOUBLE TRIODE

UCC85

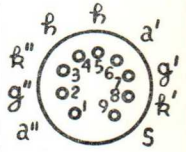
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Shield.



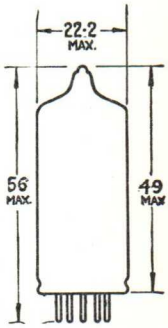
Base Connections
Underside View of Base

HEATER.

Heater Current	100 mA.
Heater Voltage	26 volts.

RATINGS*

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
†Max. Anode Dissipation ...	2·5 watts.
Max. Cathode Current ...	15 mA.
Max. Negative Grid Voltage ...	100 volts.
Max. R_{h-k}	20 kΩ
Max. V_{h-k}	90 volts.
Max. R_{g-k}	1 MΩ



CHARACTERISTICS.*

Anode Voltage	100	170	200	volts.
Negative Grid Voltage ...	1·1	1·5	2·1	volts.
Anode Current	4·5	10	10	mA.
Amplification Factor ...	50	50	48	
Mutual Conductance ...	4·6	6·2	5·8	mA/V.

TYPICAL OPERATION.

As R.F. Amplifier in F.M. or A.M. receivers.

Anode Supply Voltage ...	100	100	170	volts.
Anode Resistor	1·5	1·5	1·3	kΩ
Anode Voltage	92	155	160	volts.
Anode Current	5·2	8·7	6·0	mA.
Grid Voltage	0·85	1·4	2·0	volts.
Cathode Bias Resistor ...	160	160	330	Ω
Mutual Conductance ...	5·2	6·0	4·7	mA/V.
Anode Impedance ...	10	8·4	10·5	kΩ
Equivalent Noise Resistance	580	500	650	Ω
Input Resistance (at 100 Mc/s.) ...	5·0	6·0	8·0	kΩ

As a self-oscillating Frequency Changer for F.M./A.M.

Anode Supply Voltage ...	100	170	200	volts.
Anode Resistor	4·7	4·7	8·2	kΩ
‡Grid Resistor	1·0	1·0	1·0	MΩ
Oscillator Voltage ...	1·8	2·8	2·8	volts.
Anode Current	2·2	4·8	5·8	mA.
Conversion Conductance	1·7	2·2	2·3	mA/V.
Anode Impedance ...	20	16	15	kΩ

All dimensions shown are in millimetres.

*Each section, unless otherwise indicated.
†Max. Total Anode Dissipation (pa′ + pa″) = 4·5 watts.
‡The presence of i.f. feedback voltage tends to stabilise the performance of the oscillator and hence permits a relatively high value for the grid leak.

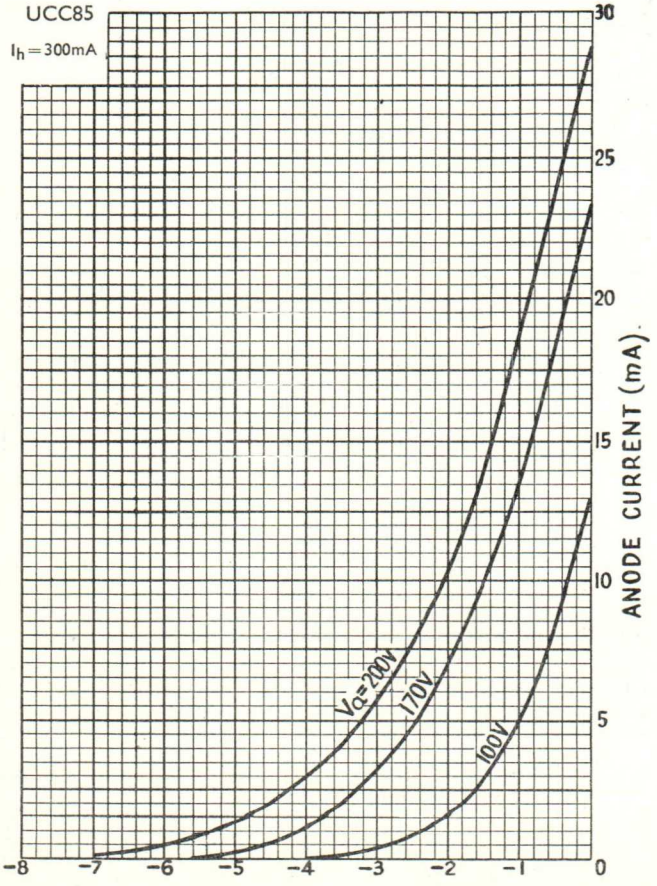
Issue 2
(Tentative)
Dec.,1957

FERRANTI

CAPACITANCES.

*C_{in}	3·0 pF.
*C_{out}	1·2 pF.
†*C_{out}	1·9 pF.
*C_{a-k}	0·18 pF.
*C_{a-g}	1·5 pF.
$C_{a'-a''}$	<0·04 pF.
†$C_{a'-a''}$	<0·008 pF.
$C_{g'-g''}$	<0·003 pF.
$C_{a'-g''}=C_{a''-g'}$	<0·008 pF.
$C_{a'-k''}=C_{a''-k'}$	<0·008 pF.
$C_{g'-k''}=C_{g''-k'}$	<0·003 pF.

*Each Section.
†Measured with external shield.



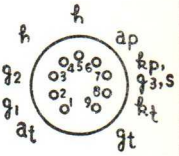
For other curves applicable to this valve refer to pages 3-6 of PCC85

FERRANTI

TRIODE PENTODE

UCF80

Combined triode and high slope pentode with separate cathodes designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 Mc/s. It is suitable for series connected heater operation, a.c. or d.c.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode.	Pin 6—Pentode Anode.
Pin 2—Pentode g_1	Pin 7—Pentode Cathode, g_3 and shield.
Pin 3—Pentode g_2	
Pin 4—Heater.	Pin 8—Triode Cathode.
Pin 5—Heater.	Pin 9—Triode Grid.

HEATER.

Heater Current	100 mA.
Heater Voltage	27 volts.

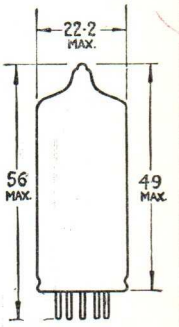
RATINGS.

PENTODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	175 volts.*
Max. Anode Dissipation ...	1.7 watts.
Max. Screen Dissipation ...	0.5 watts.†
Max. Cathode Current ...	17 mA.
**Min. Negative Grid Voltage ...	1.3 volts.
Max. V_{h-k} (heater positive) ...	100 volts.
‡Max. V_{h-k} (heater negative)	225 volts.
Max. R_{g1-k} (auto bias)	1.0 MΩ
Max. R_{g1-k} (fixed bias) ...	0.5 MΩ

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	1.7 watts.
Max. Cathode Current ...	17 mA.
§Max. Peak Instantaneous Cathode Current	200 mA.
Max. R_{g-k}	0.5 MΩ
**Min. Negative Grid Voltage ...	1.3 volts.
Max. Peak Instantaneous Negative Grid Voltage	350 volts.
‡Max. V_{h-k} (heater negative)	225 volts.
Max. V_{h-k} (heater positive) ...	100 volts.



CHARACTERISTICS.

	Pentode Section	Triode Section	
Anode Voltage	170	100	volts.
Screen Voltage	170	–	volts.
Grid Bias Voltage ...	–2	–2	volts.
Anode Current ...	10	14	mA.
Screen Current	2.8	–	mA.
Mutual Conductance ...	6.2	5.0	mA/V.
Anode Impedance ...	400	4	kΩ
μ	–	20	
Inner μ	47	–	
Input Impedance (f=50 Mc/s.)	10	–	kΩ
Equivalent Noise Resistance	1.5	–	kΩ

All dimensions shown are in millimetres.

*May be increased to 200 volts with cathode current not exceeding 10 mA.
†May be increased to 0.75 volts with anode dissipation not exceeding 1.2 watts.
‡Max. d.c. component 150 volts.
§Max. duration of pulse 200 μsecs.
**At grid current of 0.3 μA.

Issue 1
Dec., 1957

UCF80

FERRANTI

TYPICAL OPERATION (as Frequency Changer)*

Anode Voltage	V_a	170	170	volts.
Screen Voltage ...	V_{g2}	170	170	volts.
Grid Resistor	R_{g1}	0·1	0·1	MΩ
Auto Bias Resistor ...	R_k	820	0	ohms.
Anode Current ...	I_a	5·2	6·3	mA.
Screen Current ...	I_{g2}	1·5	2·5	mA.
Oscillator Voltage ...	Vosc.	3·5	4·0	volts (r.m.s.)
Conversion Conductance	gc	2·1	2·05	mA/V.
Anode Impedance ...	ra	0·87	0·72	MΩ
Grid Current	I_{g1}	0	53	μA.

CAPACITANCES.†

$C_{a_p-a_t}$	<0·06 pF.
$C_{a_p-g_t}$	<0·02 pF.
$C_{g_p-a_t}$	<0·16 pF.
$C_{g_p-g_t}$	<0·02 pF.

Pentode Section.

C_{in}	5·5 pF.
C_{out}	3·8 pF.
C_{a-g_1}	<0·025 pF.

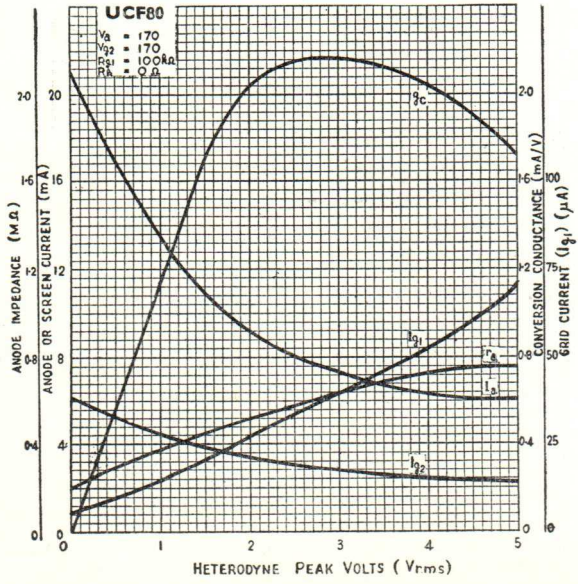
Triode Section.

C_{g-k+h}	2·5 pF.
C_{a-k+h}	1·8 pF.
C_{a-g}	1·5 pF.

*Variations in heater-cathode capacitance may render this valve unsuitable for use in Hartley oscillator circuits, particularly in F.M. receivers ; it is recommended that a Colpitts type of circuit be employed.

†Measured without external shield.

AVERAGE CHARACTERISTIC CURVES AS FREQUENCY CHANGER.



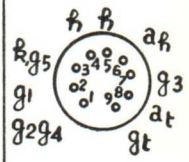
Ferranti

TRIODE HEPTODE

UCH81

19D8

An indirectly heated triode heptode for use with series or parallel heater connection on AC. or DC. mains. Primarily designed for use as a frequency changer, the heptode section can be used as R.F. or I.F. amplifier.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	67·5 mm. ($2\frac{11}{16}$ins.).
Max. Seated Height	... ...	60·5 mm. ($2\frac{3}{8}$ins.).
Max. Diameter (Bulb)	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTION.

Pin 1—Heptode Grids, g_2, g_4.
Pin 2—Heptode Grid g_1.
Pin 3—Cathode, k, shield.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Heptode Anode.
Pin 7—Heptode Grid g_3.
Pin 8—Triode Anode.
Pin 9—Triode Grid.

HEATER.

Heater Current	... ...	0·1 amps
Heater Voltage	... ...	19·0 volts.

RATINGS.

HEPTODE SECTION.

Max. Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Grid Voltage	125 volts.
Max. Screen Grid Voltage (Ia <1mA)...	200 volts.
Max. Anode Dissipation	1·7 watts.
Max. Screen Grid Dissipation	1·0 watts.
Max. Cathode Current	12·5 mA.
Max. Grid No. 1 Voltage ...	
(I_{g1}=+0·3 μA.)	−1·3 volts.
*Max. Grid No. 3 Voltage ...	
(I_{g3}=+0·3 μA.)	−1·3 volts.
Max. R_{g1-k}	3·0 Megohms.
Max. R_{g3-k}	3·0 Megohms.

TRIODE SECTION.

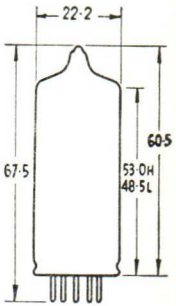
Max. Anode Voltage	250 volts.
Max. Anode Dissipation	0·8 watt.
Max. Mean Cathode Current	6·5 mA.
Max. Grid Voltage	
(I_g=−0·3 μA.)	−1·3 volts.
Max. Grid-Cathode Resistor	3·0 Megohms.

Max. Heater-Cathode Voltage	100 volts.
Max. Heater-Cathode Resistance ...	20,000 ohms.

CHARACTERISTICS.

TRIODE SECTION.

Anode Voltage	100 volts.
Grid Voltage	0 volts.
Anode Current	13·5 mA.
Amplification Factor	22
Mutual Conductance	3·7 mA/V.



Dimensions in millimetres.

*The maximum value of R_{g3-k} must not exceed 20kΩ if the two sections of the valve are switched in operation so that there is no direct connection between g_3 and g_t (e.g. in FM/AM applications.)

Ferranti

Issue 1
June, 1960

Ferranti

TYPICAL OPERATING CONDITIONS.

HEPTODE SECTION.

(As A.M. Frequency Changer).

Anode Supply Voltage	$V_a = V_b$	100	170	200	volts.
Screen Grid Feed Resistor	$R_{g_2g_4}$	10	10	10	kΩ
Oscillator Grid Resistor	$R_{g_3g_t}$	47	47	47	kΩ
Oscillator Grid Current	$I_{g_3g_t}$	115	200	230	μA.
Grid Voltage	V_{g_1}	−1·2	−2·2	−2·6	volts.
Cathode Bias Resistor	R_k	150	150	150	Ω
Anode Current ...	I_a	1·7	3·2	3·7	mA.
Screen Grid Current	$I_{g_2g_4}$	3·7	6·8	8·1	mA.
Conversion Conductance	g_c	620	750	775	μA/V.
Anode Impedance ...	r_a	0·8	0·9	1·0	MΩ
Equivalent Noise Resistance ...	R_{eq}	62	70	75	kΩ
Grid Voltage (for 100/1 reduction in gc)	V_{g_1}	−14·5	−24	−28	volts.

(As I.F. or R.F. Amplifier).

Anode Supply Voltage	$V_a = V_b$	100	170	200	volts.
Screen Grid Feed Resistor	$R_{g_2g_4}$	18	18	18	kΩ
Screen Grid Voltage ...	$V_{g_2g_4}$	60	100	125	volts.
Suppressor Grid Voltage	V_{g_3}	0	0	0	volts.
Control Grid Voltage	V_{g_1}	−1·2	−2·2	−2·6	volts.
Anode Current ...	I_a	3·4	6·2	7·6	mA.
Screen Grid Current	$I_{g_2g_4}$	2·2	3·8	4·3	mA.
Mutual Conductance	g_m	2·0	2·3	2·4	mA/V.
Anode Impedance ...	r_a	0·5	0·6	0·6	MΩ
Inner mu.	$\mu g_1 - g_2g_4$	20	20	20	
Equivalent Noise Resistance	R_{eq}	5·8	8·8	9·7	kΩ
Grid Voltage (for 100:1 reduction in gm,	V_{g_1}	−16·5	−28	−33	volts.

TRIODE SECTION.

(As R.F. Oscillator).

Supply Voltage ...	V_b	100	170	200	volts.
Anode Load Resistor	R_{at}	15	15	15	kΩ
Grid Resistor	R_{gt}	47	47	47	kΩ
Grid Current	I_{gt}	120	200	240	μA.
Anode Current ...	I_{at}	2·5	4·5	5·4	mA.
Mutual Conductance	g_m (eff)	530	580	580	μA/V.

Microphony.

This valve can be used without special precautions against microphony provided that for an output of 50 mW. the required input voltage for the heptode section is not less than 50 mV. For the triode section the corresponding figure is 25 mV.

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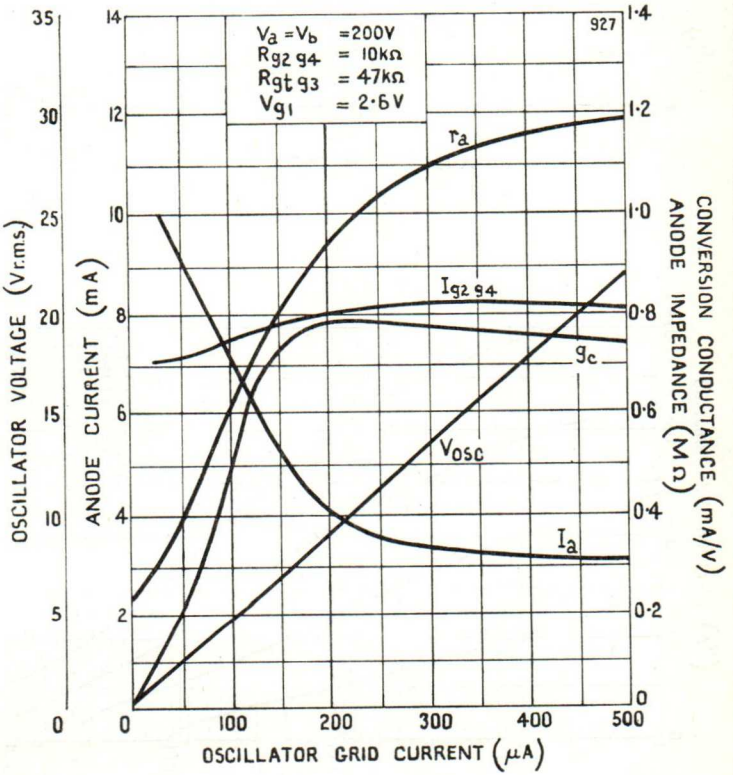
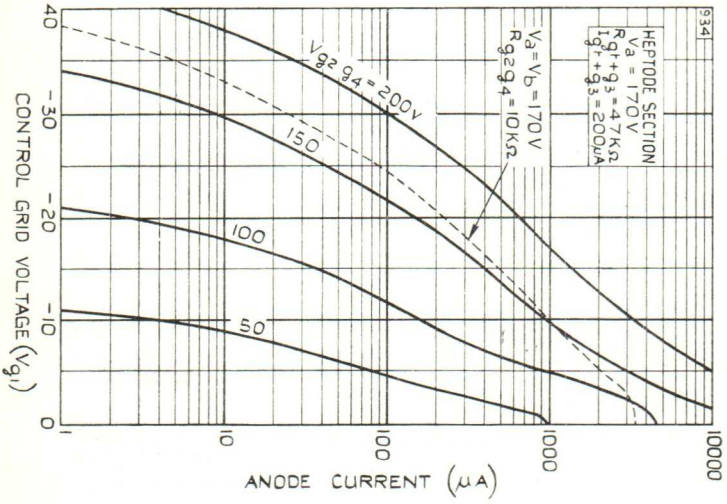
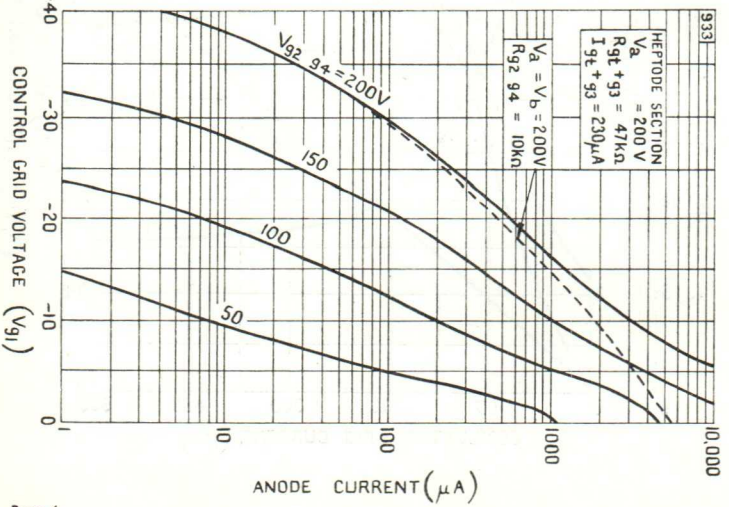
CAPACITANCES.

	Triode.	Heptode.
C_{out}	2·2	7·9 pF.
C_{in}	2·6	(g_1) 4·8 pF.
		(g_3) 6·0 pF.
C_{a-g}	1·0	<0·01 pF.
C_{g-h}	<0·02	<0·02 pF.
$C_{g_1-g_3}$		<0·3 pF.
C_{g_3-h}		<0·06 pF.
C_{ah-at}	0·20 pF.	
C_{ah-gt}	<0·09 pF.	
C_{ah-g_3gt}	<0·35 pF.	
C_{g_1-gt}	<0·06 pF.	
C_{g_1-gt}	<0·17 pF.	
$C_{g_1-g_3gt}$	<0·45 pF.	



Typical Conversion Conductance/Grid Voltage/Screen Voltage when used as Frequency Changer.



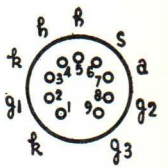


FERRANTI

R.F. PENTODE

UF80

An indirectly heated R.F. Pentode for use with series heater connection on a.c. or d.c. mains. Primarily designed for use as an R.F. Amplifier or Mixer in F.M. Receivers.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

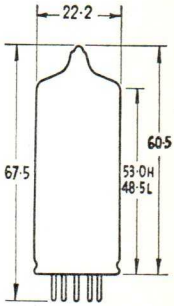
Pin 1—Cathode. Pin 5—Heater.
Pin 2—Control Grid (g_1) Pin 6—Shield.
Pin 3—Cathode. Pin 7—Anode.
Pin 4—Heater. Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Current	0·1 amp.
Heater Voltage	19 volts.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation... ...	2·5 watts.
Max. Screen Dissipation ...	0·7 watts.
Max. Cathode Current ...	15 mA.
Max. V_{h-k}	150 volts.
Max. R_{g1-k} (auto bias) ...	1·0 MΩ
Max. R_{g1-k} (fixed bias) ...	0·5 MΩ
Max. R_{h-k}	20 kΩ
*Min. Negative Grid Voltage ...	1·3 volts.



CHARACTERISTICS.

Anode Voltage	170 volts.
Screen Voltage	170 volts.
Suppressor Grid Voltage ...	0 volts.
Grid Voltage	−2 volts.
Anode Current	10 mA.
Screen Current	2·5 mA.
Mutual Conductance	7·4 mA/V.
Anode Impedance	400 kΩ
Inner μ	50
Input Damping (at 50 Mc/s.) ...	10 kΩ
Equivalent Noise Resistance ...	1·0 kΩ

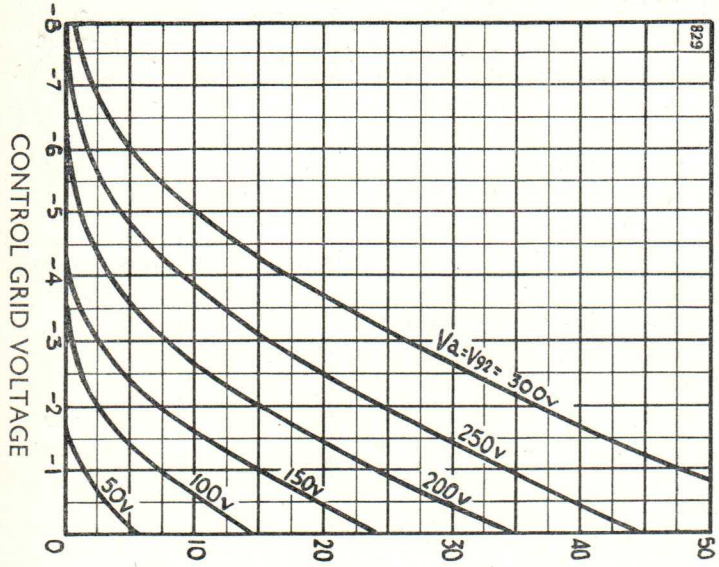
CAPACITANCES.

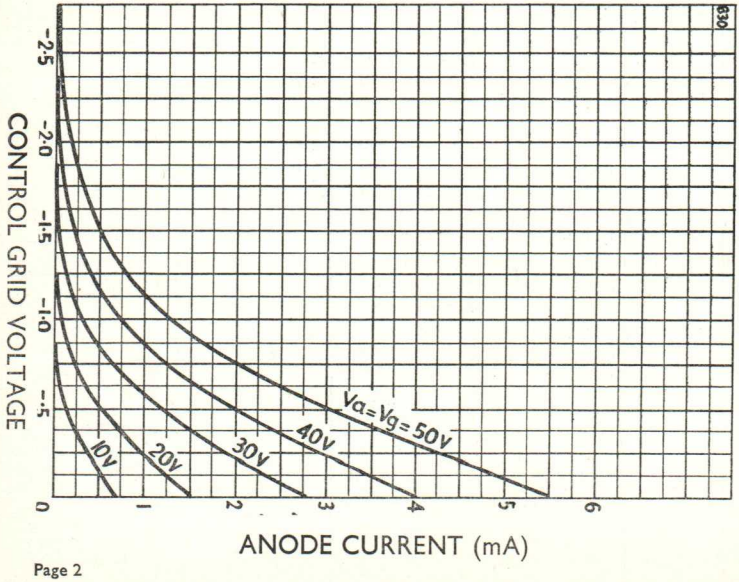
C_{in} (g_1)	7·5 pF.
C_{in} (g_1)	5·4 pF.
C_{out}	3·3 pF.
C_{a-g1}	<0·007 pF.
C_{a-k}	<0·01 pF.
C_{g2-g1}	2·6 pF.
C_{g1-h}	<0·15 pF.

All dimensions shown are in millimetres (max.).

*For grid current of 0.3 μA.

Issue 1
Aug., 1957





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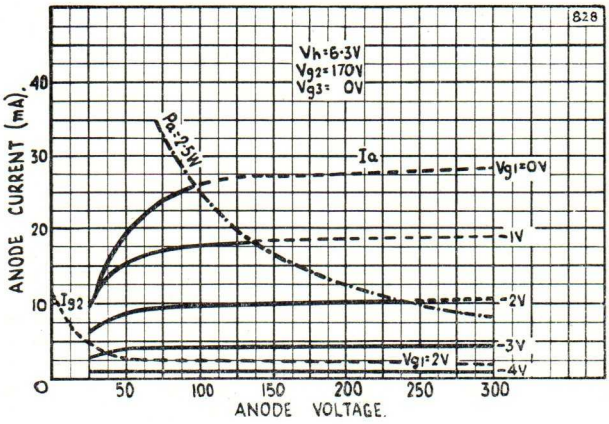

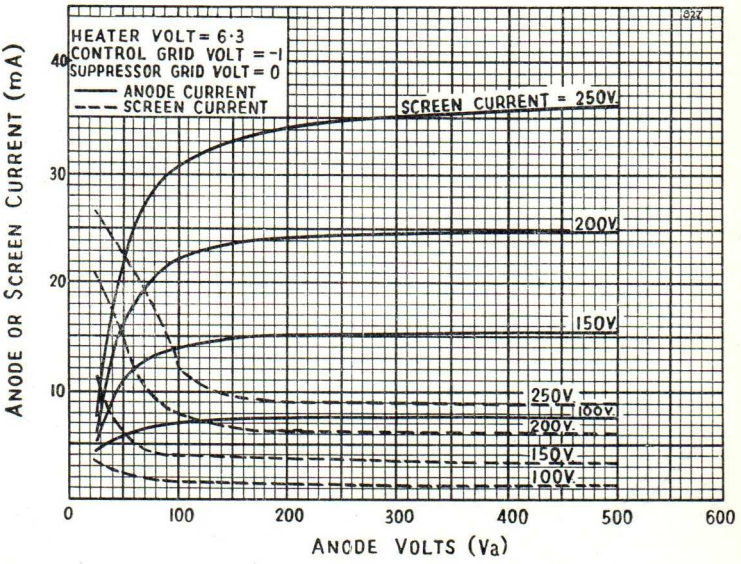

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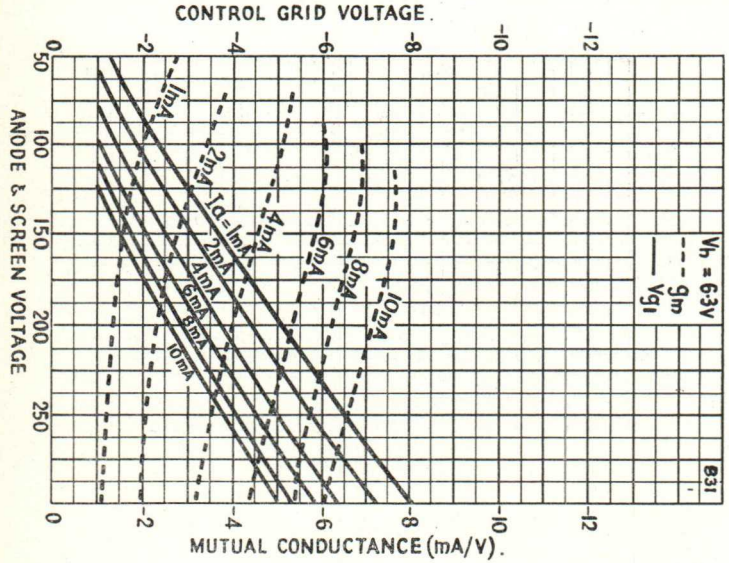
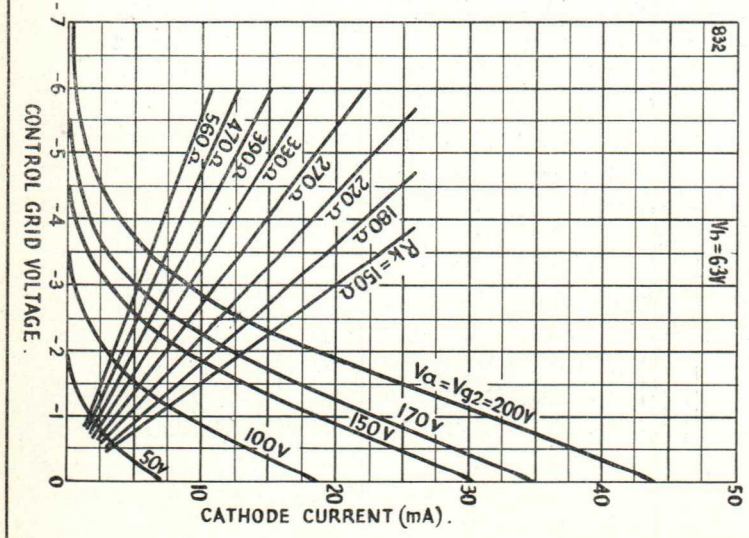
FERRANTI


CONTROL GRID VOLTAGE.
ANODE & SCREEN VOLTAGE
MUTUAL CONDUCTANCE (mA/V).
Vh = 6·3v
9m
Vg1
Ia = 1mA
2mA
4mA
6mA
8mA
10mA
831


CONTROL GRID VOLTAGE.
CATHODE CURRENT (mA).
832
Vh = 6·3v
Rk = 150Ω
180Ω
220Ω
270Ω
330Ω
390Ω
470Ω
560Ω
Va = Vg2 = 200V
170V
150V
100V
50V

Ferranti

VARIABLE-MU R.F. PENTODE

A variable-mu Pentode designed for use as R.F. or I.F. Amplifier in F.M./A.M. Receivers with series heater chains.

UF89

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	61·7 mm. ($2\frac{7}{16}$in.).
Max. Seated Height	54·7 mm. ($2\frac{5}{32}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Shield.	Pin 5—Heater.
Pin 2—Control Grid (g_1).	Pin 6—Shield.
Pin 3—Cathode.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).	

HEATER.

Heater Current	0·1 amp.
Heater Voltage	12·6 volts.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts
Max. Anode Voltage	250 volts.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation ...	2·25 watts.
Max. Screen Dissipation ...	0·45 watts.
Max. Cathode Current ...	16·5 mA.
Max. V_{h-k}	150 volts.
*Max. R_{g1-k}	3 MΩ
Max. R_{g3-k}	10 kΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

Anode Voltage	170	170	volts.
Screen Voltage	100	110	volts.
Suppressor Grid Voltage ...	0	0	volts.
Grid Voltage	−1·2†	−2·0	volts.
Anode Current	12	12	mA.
Screen Current	4·4	3·9	mA.
Mutual Conductance	4·4	3·8	mA/V.
Anode Impedance	0·4	0·5	kΩ
Inner μ	21	—	

TYPICAL OPERATION.

As R.F. or I.F. Amplifier with Cathode bias.

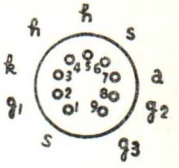
$V_a=V_b$	100	170	200	volts.
V_{g3}	0	0	0	volts.
R_{g2}	15	15	24	kΩ
R_k	130	130	130	ohms.
V_{g1}	−1·05	−2	−2	volts.
I_a	6	11	11·1	mA.
I_{g2}	2·1	3·9	3·8	mA.
g_m	3·2	3·8	3·85	mA/V.
r_a	475	450	550	kΩ
R_{eq}	3·5	4·5	4·2	kΩ
g_m (V_{g1}=−20)	150	110	160	μA/V.

As R.F. or I.F. Amplifier with Grid current bias.

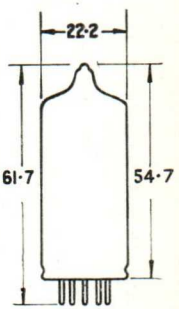
$V_a=V_b$	100	170	200	volts.
V_{g3}	0	0	0	volts.
Rg_2	22	22	33	kΩ
R_k	0	0	0	Ω
R_{g1}	10	10	10	MΩ
I_a	6·1	11·8	11·3	mA.
I_{g2}	2·3	4·3	3·9	mA.
g_m	5	5·2	5·2	mA/V.
r_a	450	400	475	kΩ
R_{eq}	2·5	2·6	2·5	kΩ
g_m (V_{g1}=−20)	—	110	150	μA/V.

*With grid current bias, this resistance may be increased up to 22 MΩ max.

†Grid current may occur at this voltage. If this condition is not acceptable the negative grid bias should be increased to −2 volts.



Base Connections Underside View of Base



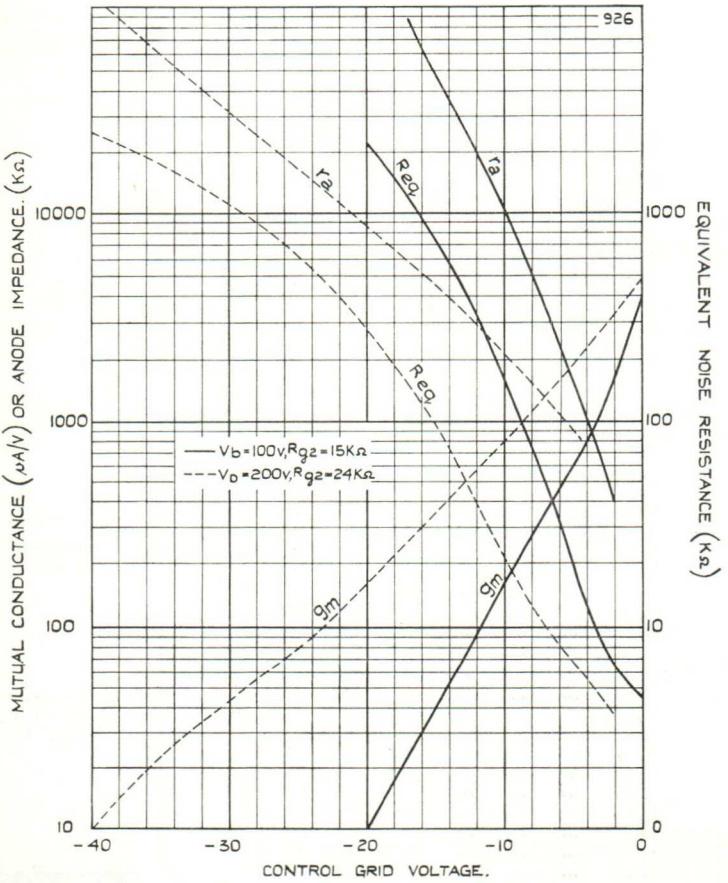
All dimensions shown are in millimetres (max.).

Ferranti

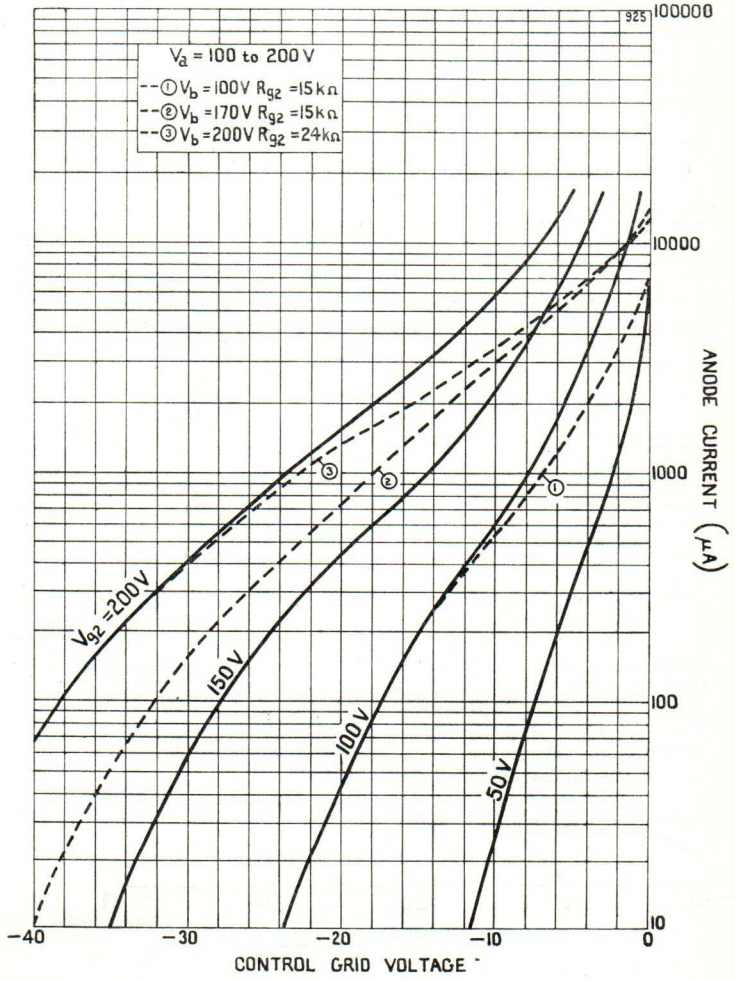
Issue 1.
May, 1960

CAPACITANCES

C_{in}	... ...	5·5 pF.
C_{out}	... ...	5·1 pF.
C_{a-g1}	... ...	0·002 pF. (max.).
C_{g1-h}	... ...	0·05 pF.
C_{g1-g2}	... ...	2·1 pF.



TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS



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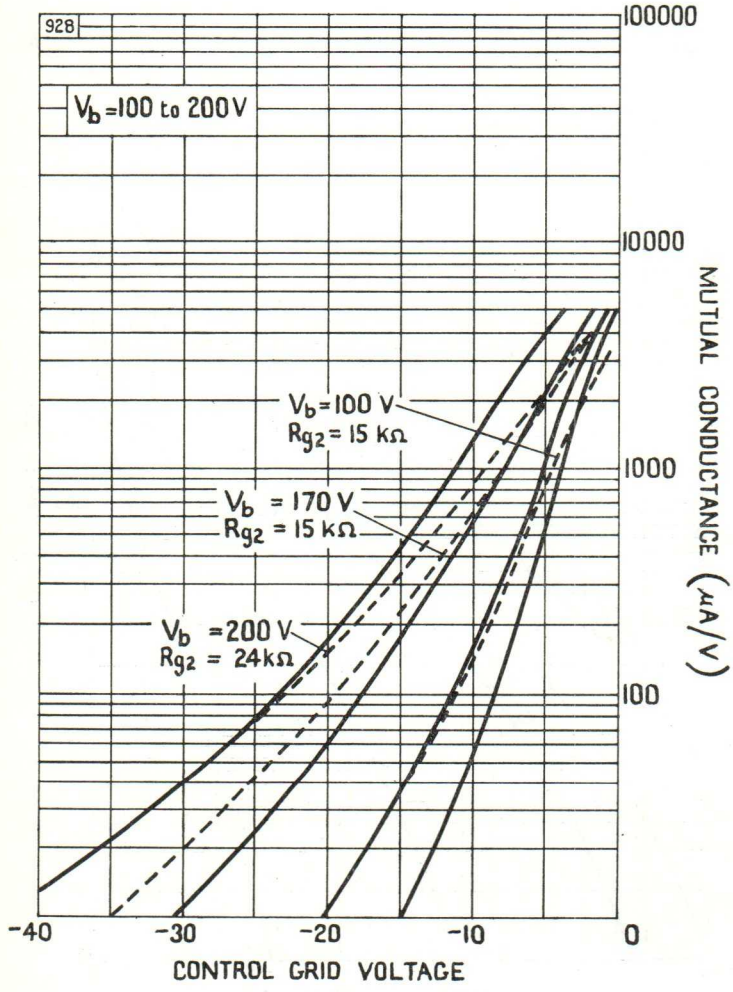
Ferranti

TYPICAL MUTUAL CONDUCTANCE/GRID VOLTAGE CHARACTERISTICS

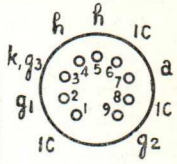


UL84

Ferranti

OUTPUT PENTODE

An indirectly heated output pentode rated for 12 watts anode dissipation. It has a 100mA. heater designed for use in series heater chains.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	78·5 mm.($3\frac{9}{32}$in.).
Max. Seated Height	71·5 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 5—Heater.
Pin 2—Control Grid.	Pin 6—Internal Connection.
Pin 3—Cathode, Suppressor Grid.	Pin 7—Anode.
	Pin 8—Internal Connection.
Pin 4—Heater.	Pin 9—Screen Grid.

HEATER.

Heater Current	0·1 amp.
Heater Voltage	45 volts.

RATINGS.

Max. D.C. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	12 watts.
Max. Screen Grid Voltage ...	200 volts.
Max. Screen Grid Dissipation	1·75 watts.
Max. Cathode Current	100 mA.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	20 kΩ
Max. R_{g1-k}	0·3 MΩ

CHARACTERISTICS.

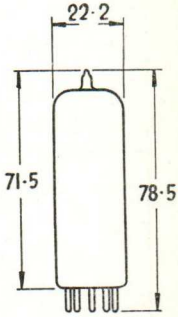
Anode Voltage ...	100	170	200	volts.
Screen Voltage ...	100	170	*	volts.
Control Grid Voltage	−6·7	−12·5	−17·3	volts.
Anode Current ...	43	70	60	mA.
Screen Current ...	3·0	5·0	4·0	mA.
Mutual Conductance	9	10	8·8	mA/V.
Anode Impedance	23	24	28	kΩ
Inner μ (μg_1-g_2) ...	8	8	8	

TYPICAL OPERATION.

As Audio Output Valve (Class A).

Anode Voltage ...	100	170	200	volts.
Screen Grid Voltage	100	170	*	volts.
Cathode Bias Resistor	145	170	270	ohms.
Anode Current ...	43	70	60	mA.
Screen Grid Current (no sig.)	3·0	5·0	4·0	mA.
Screen Grid Current (max. sig.)	11	22	12·5	mA.
Anode Load ...	2·4	2·4	2·4	kΩ
Input Voltage ...	4·3	7	7·8	volts(rms.)
Power Output (D_{tot}=10%)	1·9	5·6	5·2	watts.

*Screen Grid Supply Voltage=200. R_{g2}=470 ohms, not decoupled.



All Dimensions shown are in millimetres (max.).

Ferranti

Issue 2.
June, 1962

TYPICAL OPERATION (cont.)

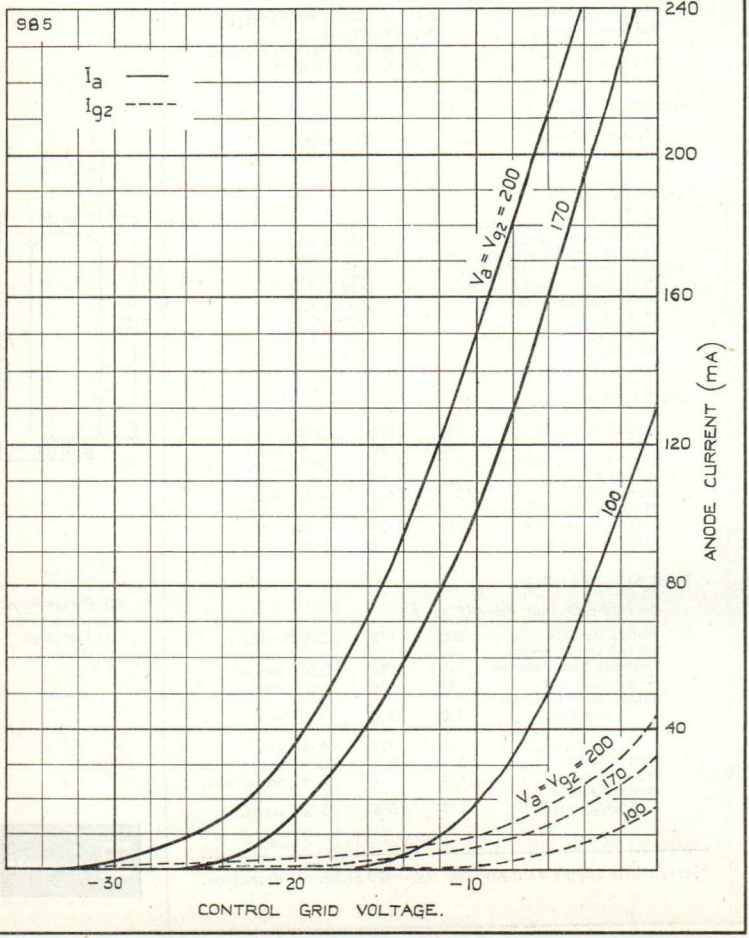
As Audio Amplifier (2 valves in push pull).

Anode Voltage	100	170	200	volts.
Screen Grid Voltage	100	170	200	volts.
*Cathode Bias Resistor	270	240	300	ohms.
*Anode Current (Zero signal)	29	56	55	mA.
*Anode Current (Max. Signal)	31	57·5	60	mA.
*Screen Grid Current (Zero signal)	1·6	3·0	2·8	mA.
*Screen Current (Max. signal)	7	20·5	15	mA.
Input Voltage (g_1–g_1)	14	26	29	volts(rms.)
Optimum Load (Anode to Anode)	3·5	3·5	3·5	kΩ
Power Output	3·6	13	15	watts.
Total Distortion	3·0	4·5	3·5	%

CAPACITANCES.

C_{in}	12	pF.	C_{a-g_1}	<0·6	pF.
C_{out}	6·5	pF.	C_{g_1-h}	<0·25	pF.

*per Valve.



Ferranti

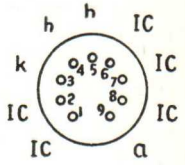
HALF WAVE RECTIFIER

UY85

An indirectly heated, half wave rectifier, for use in equipments with series heater chains.

PHYSICAL DETAILS.

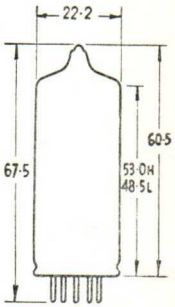
Base	B9A—Noval.
Max. Overall Length	67·5 mm. ($2\frac{11}{16}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.



Base Connections Underside View of Base

BASE CONNECTIONS.

Pin 1—Internal Connection. Pin 5—Heater.
Pin 2—Internal Connection. Pin 6—Internal Connection.
Pin 3—Cathode. Pin 7—Internal Connection.
Pin 4—Heater. Pin 8—Internal Connection.
Pin 9—Anode.



All dimensions shown are in millimetres.

HEATER.

Heater Current	0·1 amp.
Heater Voltage	38 volts.

RATINGS.

Max. Peak Inverse Voltage ...	700 volts.
Max. R.M.S. Anode Voltage ...	250 volts.
Max. Rectified Current ...	110 mA.
Max. Peak Anode Current ...	660 mA.
Max. $V_{h-k(pk)}$(Htr. neg.) ...	550 volts.

TYPICAL OPERATING CONDITIONS.

	Capacitor Input.			
R.M.S. Input Voltage ...	110	220	250	volts.
Rectified Current ...	110	110	110	mA.
Min. Supply Impedance ...	0	90	100	ohms.
Max. Reservoir Capacitor	100	100	100	μF.
DC. Output Voltage ...	112	215	245	volts.

Issue 2
Sept, 1960

Ferranti

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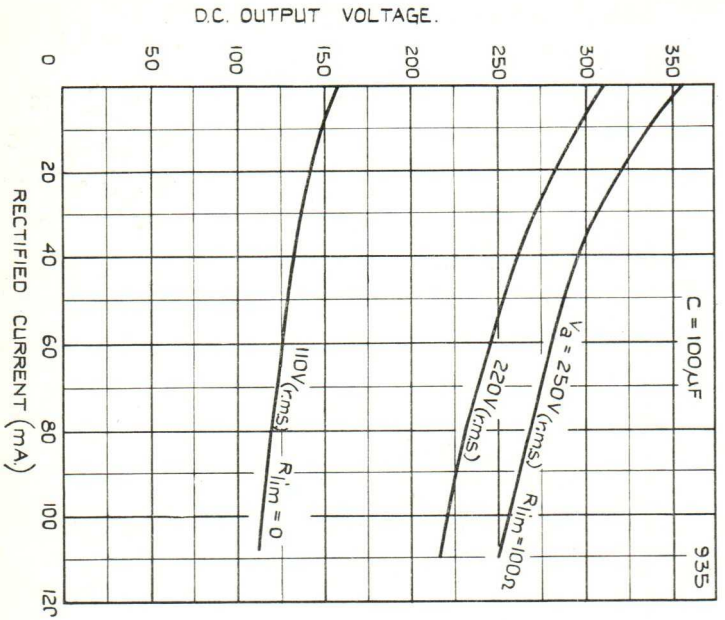
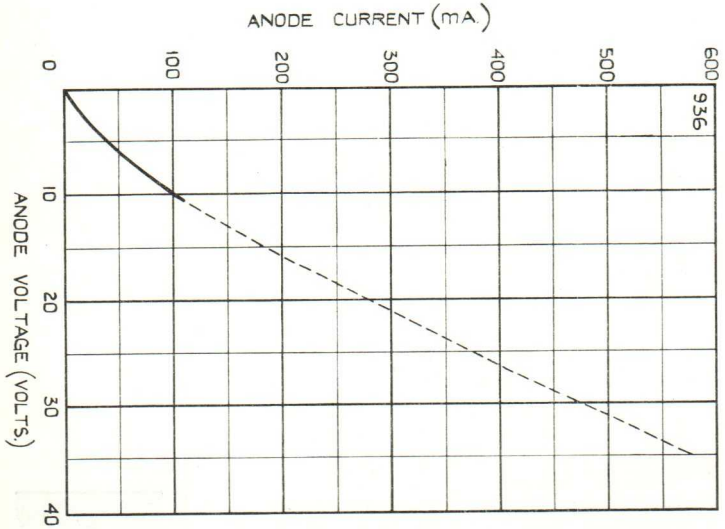
UY85





FERRANTI

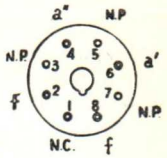
FULL WAVE RECTIFIER

A directly heated, high vacuum full wave rectifier.

5U4G

PHYSICAL DETAILS

Base	International Octal
Bulb	Clear
Max. Overall Length...	135 mm. ($5\frac{5}{16}$")
Max. Seated Height ...	121 mm. ($4\frac{3}{4}$")
Max. Diameter (Bulb)	52 mm. ($2\frac{1}{16}$")
Mounting Position ...	Vertical, base down; or horizontal with pins 1 and 4 in vertical plane.



Base Connections

Underside View of Base

BASE CONNECTIONS

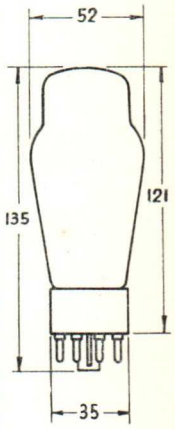
Pin 1.—No connection.	Pin 5.—No Pin.
Pin 2.—Filament.	Pin 6.—Anode 1.
Pin 3.—No Pin.	Pin 7.—No Pin.
Pin 4.—Anode 2.	Pin 8.—Filament.

FILAMENT

Filament Voltage	5·0 volts.
Filament Current	3·0 amps.

RATINGS

Max. Peak Inverse Voltage	1550 volts.
→ Max. R.M.S. Anode Voltage	See Rating Chart.
→ Max. Rectified Current...	See Rating Chart.
*Max. Peak Anode Current	675 mA.
→ *Min. Limiting Resistance...	170 ohms.
→ *†Max. Hot-switching Transient Anode Current...	2·35 amps.



→ TYPICAL OPERATION

	Capacitor-Input Filter		
*R.M.S. Input Voltage	450	550	volts
‡Filter-Input Capacitor	10	10	μF.
*Min. Supply Impedance	170	230	ohms
DC Output Voltage at Input to Filter (approx.):—			
At Half-Load { 112·5 mA.	510	—	volts
Current of { 78 mA.	—	660	volts
At Full-Load { 225 mA.	430	—	volts
Current of { 156 mA.	—	590	volts
Voltage Regulation, Half-load to Full-load Current (approx.)	80	70	volts

All dimensions shown are in millimetres

*Each Anode.

†For maximum duration of 0·2 sec.

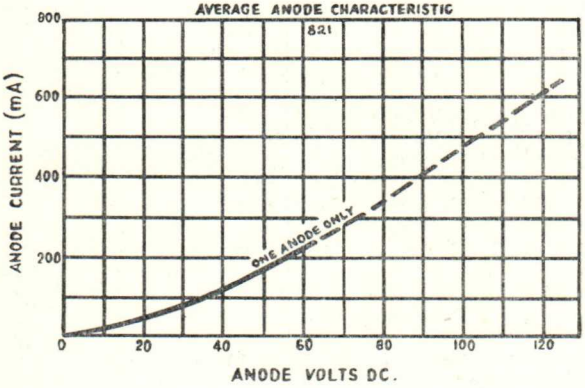
‡When a filter input capacitor greater than 10μF. is used, it may be necessary to increase the effective supply impedance to avoid exceeding the hot-switching transient anode current.

Issue 3.
Mar., 1956

FERRANTI

TYPICAL OPERATION (cont.)

	Choke-Input Filter	
*R.M.S. Input Voltage	450	550 volts
Filter Input Choke	10†	10‡ henries
DC Output Voltage at Input to Filter (approx.):—		
Current of 135 mA.	365	— volts
At Half-Load 112·5 mA.	—	460 volts
At Full-Load 270 mA.	345	— volts
Current of 225 mA.	—	440 volts
Voltage Regulation, Half-load to Full-load Current (approx.)	20	20 volts



*Each Anode.

†This value is adequate to maintain optimum regulation in the region to the right of line L = 10H on curve Operation Characteristics with Choke-Input Filter, provided the load current is not less than 35mA. For load currents less than 35 mA., a larger value of inductance is required for optimum regulation.

‡This value is adequate to maintain optimum regulation in the region to the right of line L = 10H on curve Operation Characteristics with Choke-Input Filter, provided the load current is not less than 50 mA. For load currents less than 50 mA., a larger value of inductance is required for optimum regulation.

FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

RATING CHART

(Page 4)

The graphical presentation of the relationships between maximum AC. voltage input and maximum DC. output current derived from the fundamental ratings for conditions of capacitor-input and choke-input filters. The use of this chart together with the graphs of Operation Characteristics will enable the equipment designer to select operating conditions within the specified ratings.

OPERATION CHARACTERISTICS.

FULL-WAVE CIRCUIT, CAPACITOR-INPUT FILTER

(Page 5)

This shows the typical operating curves for such a circuit and by means of the boundary lines "ADK" the limiting current and voltage relationships presented on the Rating Chart.

FULL-WAVE CIRCUIT, CHOKE-INPUT FILTER

(Page 6)

This shows the typical operating curves for such a circuit and by means of the boundary lines "CEK" the limiting current and voltage relationships presented on the Rating Chart, together with information as to the effects on regulation of various sizes of chokes. The inter-section of one of the long-dash lines with a continuous-line curve indicates the point on the curve at which the choke behaves as though it had infinite inductance. To the left of the choke boundary line the regulation curves depart from the solid line curves as shown by the representative short-dash regulation curves.

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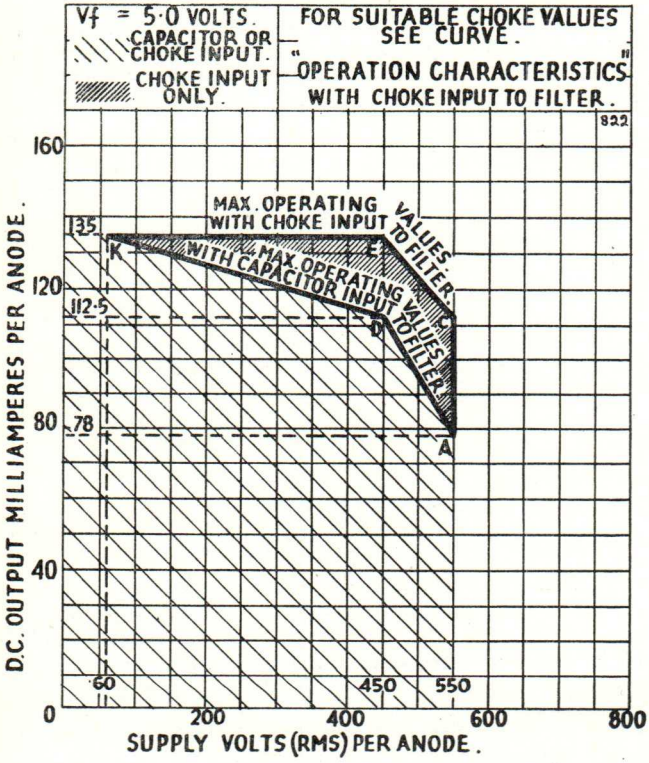
FERRANTI

RATING CHART



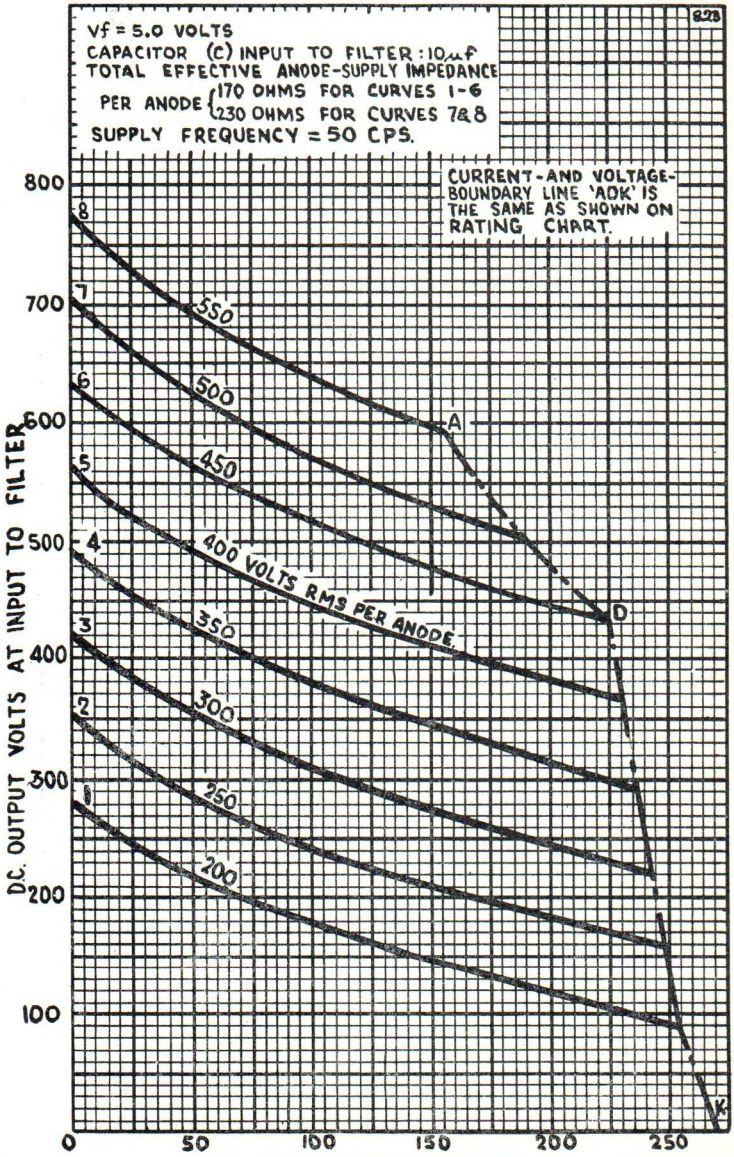
SEE NOTE ON PAGE 3

FERRANTI

5U4G

OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CAPACITOR-INPUT FILTER



SEE NOTE ON PAGE 3

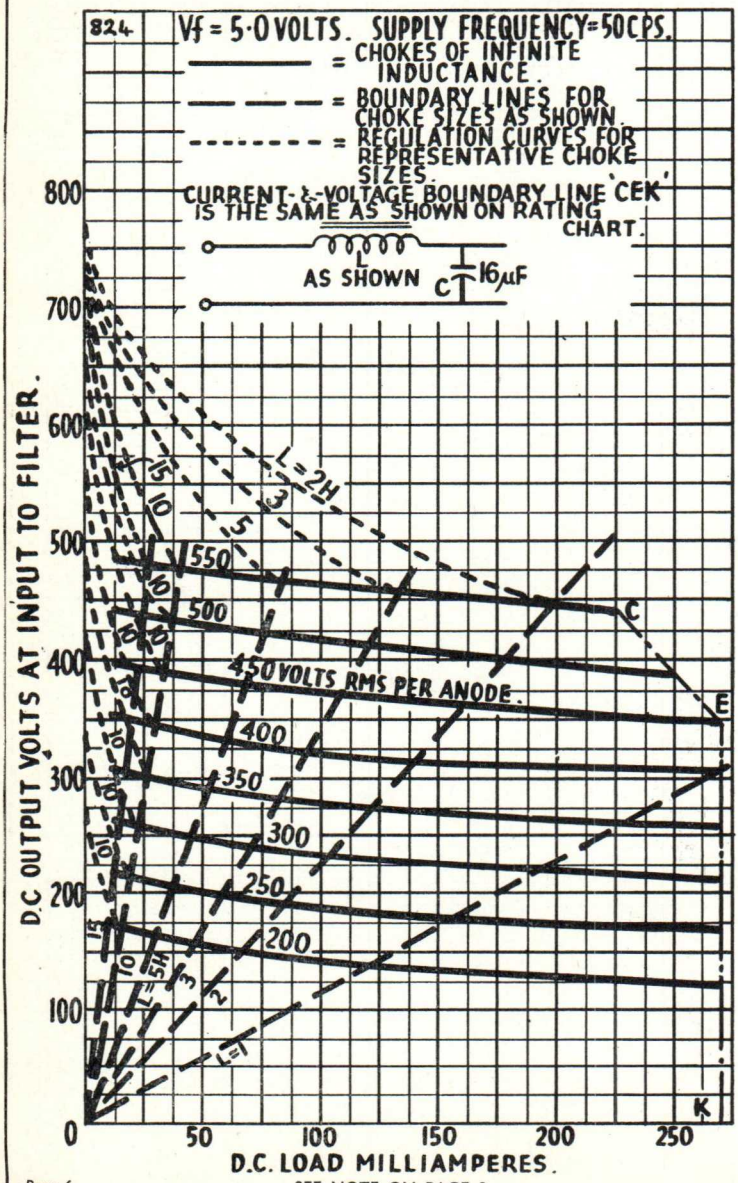
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

5U4G

FERRANTI

OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CHOKE-INPUT FILTER



SEE NOTE ON PAGE 3

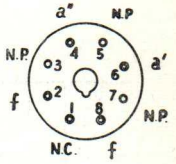
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS

Ferranti

FULL WAVE RECTIFIER

A directly heated high vacuum full wave rectifier.

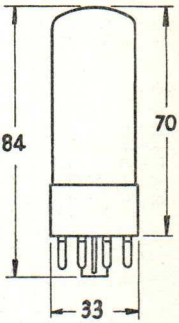
5Y3GT



Base Connections Underside View of Base

PHYSICAL DETAILS

Base	... ...	International Octal.
Bulb	... ...	Clear.
Max. Overall Length	... ...	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	... ...	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Base)	... ...	33 mm. ($1\frac{5}{16}$in.).
Mounting Position	... ...	Vertical, base down; or horizontal with pins 2 and 4 in vertical plane.



BASE.

Pin 1—No Connection.
Pin 2—Filament.
Pin 3—No Pin.
Pin 4—Anode 2.
Pin 5—No Pin.
Pin 6—Anode 1.
Pin 7—No Pin.
Pin 8—Filament.

FILAMENT.

Filament Voltage	... ...	5·0 volts.
Filament Current	... ...	2·0 amps.

*RATINGS.

Max. Peak Inverse Voltage	...	1400 volts.
R.M.S. Anode Supply Voltage	...	See graph on Page 2.
Rectified Current	... ...	See graph on Page 2.
†Min. Limiting Resistance	...	See graph on Page 3.
†Max. Peak Anode Current	...	440 mA.
§†Max. Hot-switching Transient Anode Current		2·5 amps.

TYPICAL OPERATION.

	Capacitor-Input.	Choke Input.
*R.M.S. Input Voltage	350	500 volts.
Filter-Input Capacitor	20	— μF.
Filter Input Choke	—	10 Henries.
*Min. Supply Impedance	50	— ohms.
DC. Output Voltage at Input to Filter (approx.)	360	380 volts.
DC. Output Current	125	125 mA.

All dimensions shown are in milimetres (max.).

*For supply frequency 25 to 1000 c/s.
†Each Anode.
§For maximum duration of 0·2 sec.

Issue 4.
Sept., 1962

Ferranti

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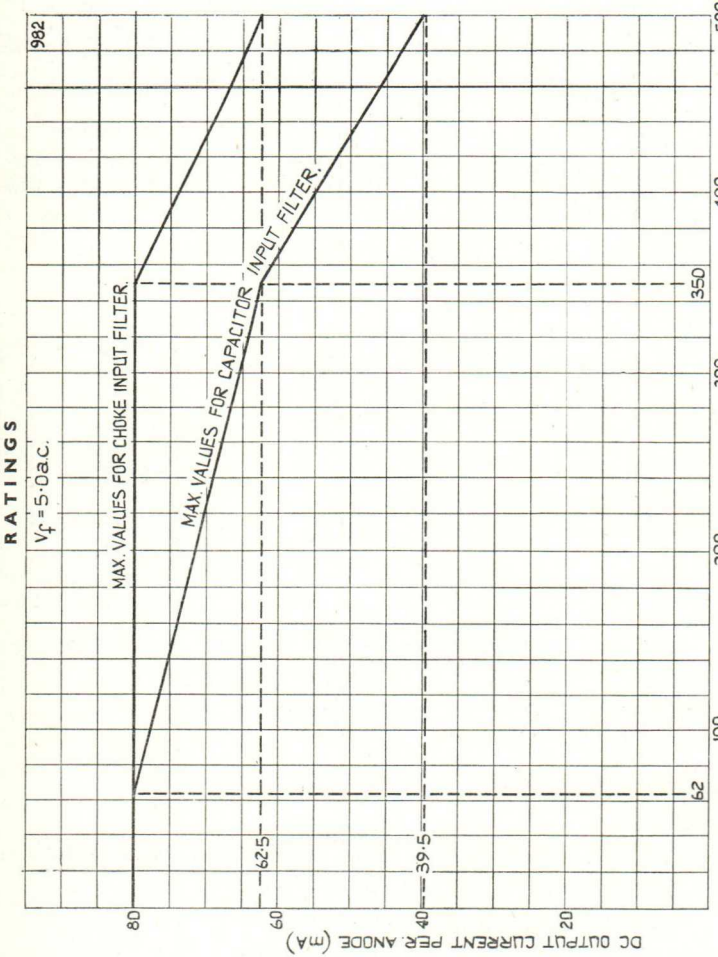

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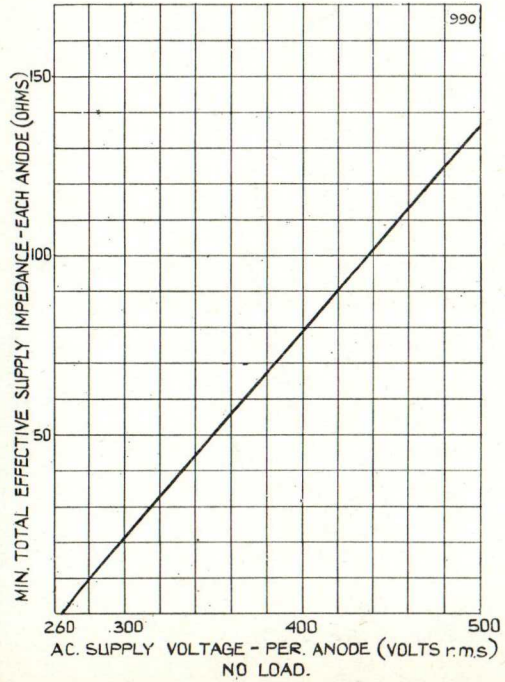
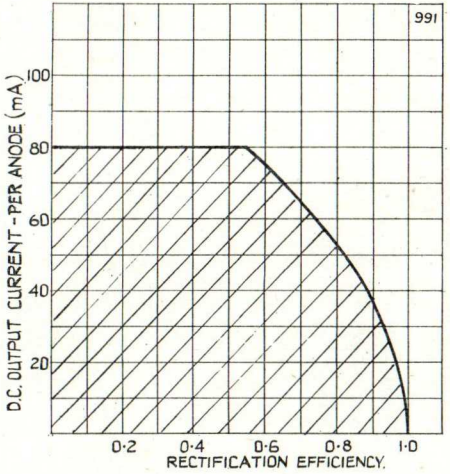
RATINGS (with Capacitor-Input Filter)

Max. transient peak anode current = 2·5A



Max. Steady static peak anode current = 440mA



$$\text{Rectification Efficiency} = \frac{V_{out}}{\sqrt{2}\, V_{in\ (rms)}}$$

where

V_{out} = DC output (at input to filter)

$V_{in\ (rms)}$ = AC supply volts (rms) per anode

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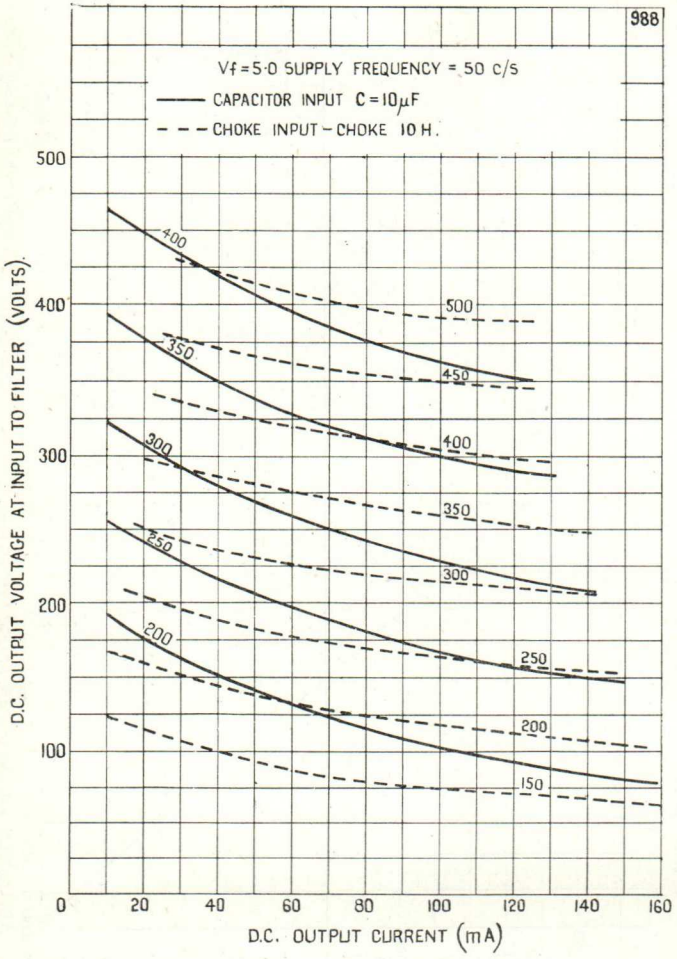
TYPICAL OPERATING CHARACTERISTICS

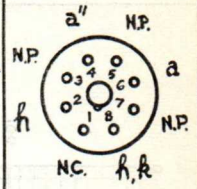


FERRANTI

FULL WAVE RECTIFIER

5Z4G

An indirectly heated, high vacuum, full wave rectifier. The cathode is internally connected to one side of the heater.



Base Connections

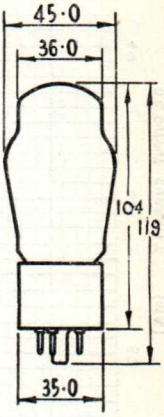
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Bulb	Clear.
Max. Overall Length	119 mm. (4 11/16 ins).
Max. Overall Bulb Diameter ...	45 mm. (1 25/32 in.).
Max. Seated Height	104 mm. (4 3/32 in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No connection.	Pin 5—No Pin.
Pin 2—Heater.	Pin 6—Anode 1.
Pin 3—No Pin.	Pin 7—No Pin.
Pin 4—Anode 2.	Pin 8—Heater, Cathode.



HEATER.

Heater Voltage	5·0 volts.
Heater Current	2·0 amps.

RATINGS.

Max. Peak Inverse Voltage ...	1400 volts.
*Max. Peak Anode Current ...	375 mA.
*Max. R.M.S. Anode Voltage ...	500 volts.
Max. Rectified Current ...	125 mA.
*Min. Limiting Resistance ...	30 ohms.

TYPICAL OPERATING CONDITIONS.

CONDENSER INPUT.

*R.M.S. Input Voltage	350 volts.
Rectified Current	125 mA.
*Min. Supply Impedance	50 ohms.
Max. Reservoir Condenser ...	32 μF.

CHOKE INPUT.

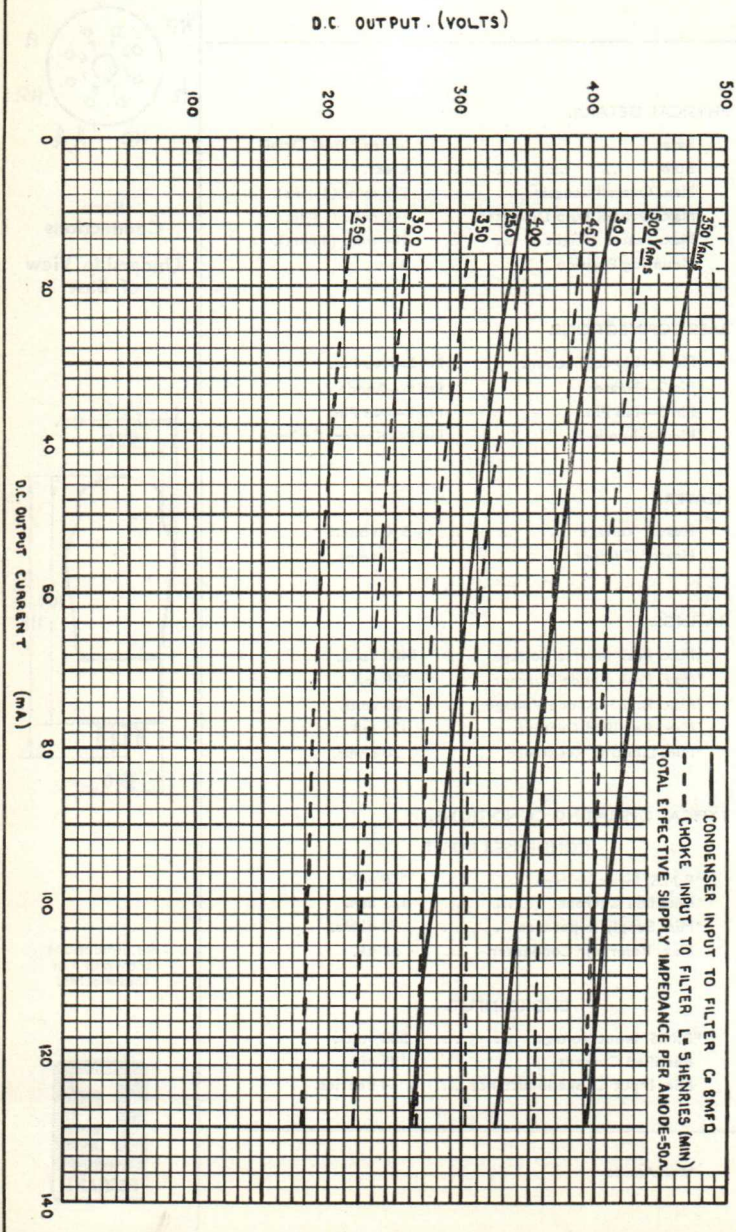
*R.M.S. Input Voltage	500 volts.
Rectified Current	125 mA.
Min. Input Choke Inductance ...	4 henries.

All dimensions shown are in millimetres.

*Per Anode

Issue 2
June, 1953

5Z4G

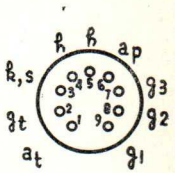

D.C. OUTPUT. (VOLTS)
100
200
300
400
500
0
20
40
60
80
100
120
140
D.C. OUTPUT CURRENT (mA.)
350 Vrms
300 Vrms
250
300
350
400
450
CONDENSER INPUT TO FILTER C= 8MFD
CHOKE INPUT TO FILTER L= 5 HENRIES (MIN)
TOTAL EFFECTIVE SUPPLY IMPEDANCE PER ANODE=50Ω

FERRANTI

TRIODE PENTODE

6AB8

An indirectly heated triode pentode for use with series or parallel heater connection on a.c. or d.c. mains. Primarily designed for use with the triode as a frame blocking oscillator and the pentode as a frame output valve. The triode section may also be used as a line blocking oscillator or audio voltage amplifier, whilst the pentode section may be used as a sync. pulse separator or audio output valve.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	67·5 mm. (2$\frac{21}{32}$in.).
Max. Seated Height	... ...	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter (Bulb)	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode. Pin 5—Heater.
Pin 2—Triode Grid. Pin 6—Pentode Anode.
Pin 3—Cathode, shield. Pin 7—Pentode Suppressor Grid.
Pin 4—Heater. Pin 8—Pentode Screen Grid.
Pin 9—Pentode Control Grid.

HEATER.

Heater Voltage	... ...	6·3 volts.
Heater Current	... ...	0·3 amps.

RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage	550 volts.
Max. Anode Voltage	400 volts.
Max. Peak Instantaneous Anode Voltage	1·2 kV.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation	3·5 watts.
Max. Screen Dissipation	1·2 watts.
Max. Cathode Current	25 mA.
Max. Peak Instantaneous Cathode Current	350 mA.
§Min. Negative Grid Voltage	1·3 volts.
†Max. Grid Resistor (1k=12 mA) ...	2·2 MΩ
‡Max. Grid Resistor (1k=20 mA) ...	1·0 MΩ
Max. V_{h-k}	150 volts.
Max. R_{h-k}	20 kΩ

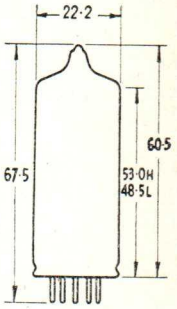
TRIODE SECTION.**

Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	200 volts.
Max. Anode Dissipation	1 watt.
Max. Cathode Current	8 mA.
*Max. Peak Instantaneous Cathode Current	200 mA.
Max. R_{gt-k}	3 MΩ
Max. V_{h-k}	150 volts.
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

PENTODE SECTION.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage ...	0	0	volts.
Control Grid Voltage	−6·7	−8·0	volts.
Anode Current	15	17·5	mA.
Screen Current	2·8	3·3	mA.
Mutual Conductance	3·2	3·3	mA/V.
Anode Impedance	150	150	kΩ
Inner μ	14	14	



All dimensions shown are in millimetres (max.).

*Max. pulse duration 10% of one cycle, with a maximum of 2 millisecs.
§At grid current of 0·3 μA.
†As frame output valve.
‡As audio output valve.
**When the triode section is used in amplifier circuits where the input voltage for an output of 50 mW. is less than 50 mV. no special precautions need be taken against microphony.

Issue 2
Aug., 1957

FERRANTI

CHARACTERISTICS—continued.

TRIODE SECTION.

Anode Voltage	100 volts.
Grid Voltage	−2·3 volts.
Anode Current	4·0 mA.
Anode Impedance	12·5 kΩ
Amplification Factor	17·5
Mutual Conductance	1·4 mA/V.

TYPICAL OPERATION.

PENTODE SECTION

(as Audio Output Valve).

Anode Voltage	170	200	250	volts.
Screen Voltage	170	200	*	volts.
Suppressor Grid Voltage	0	0	0	volts.
Control Grid Voltage ...	−6·7	−8·0	−12.2	volts.
**Anode Current ...	15	17·5	14	mA.
**Screen Current	2·8	3·3	2·6	mA.
Mutual Conductance ...	3·2	3·3	2·6	mA/V.
Anode Load	11	11	17·5	kΩ
†Input Voltage	0·7	0·7	—	volts (r.m.s.)
‡Input Voltage	3·5	4·0	—	volts (r.m.s.)
‡Power Output	1·0	1·4	1·55	watts.

(as Frame Output Valve).

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage ...	0	0	volts.
Control Grid Voltage	−9	−10·6	volts.
**Anode Current	8·5	10·0	mA.
**Screen Current	1·6	1·9	mA.

(as Sync. Separator).

Anode Voltage	20	20	volts.
Screen Voltage	12	12	volts.
Suppressor Grid Voltage ...	0	0	volts.
Cathode Grid Voltage	0	−1.45	volts.
Anode Current	2	0·1	mA.

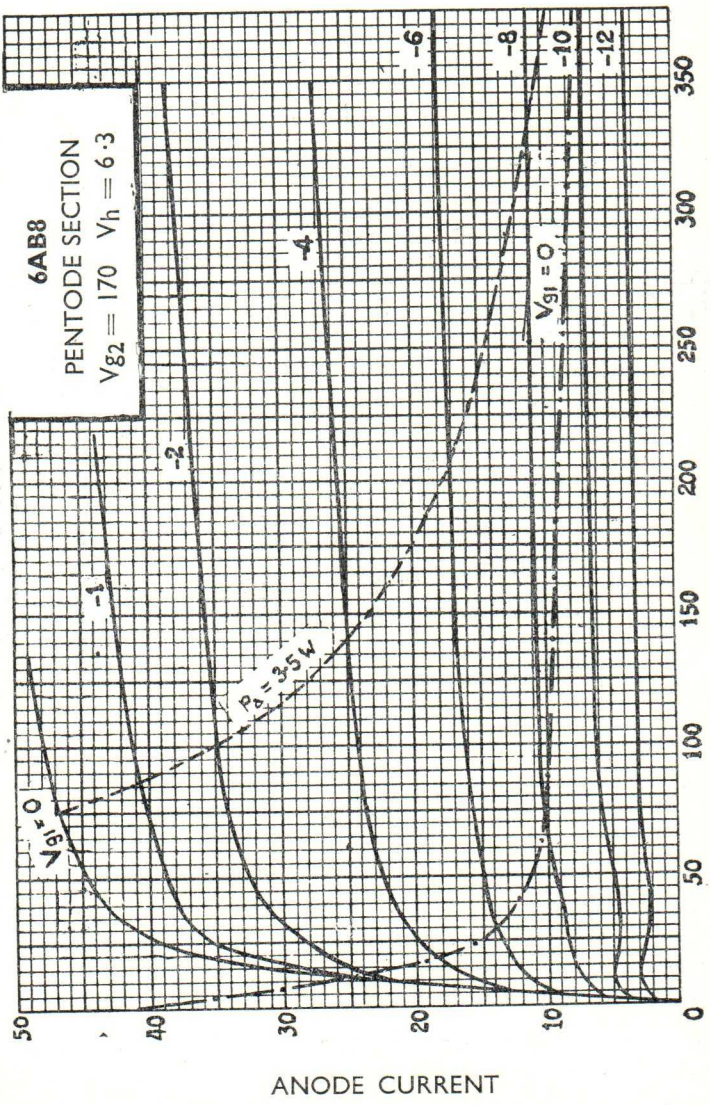
TRIODE SECTION.

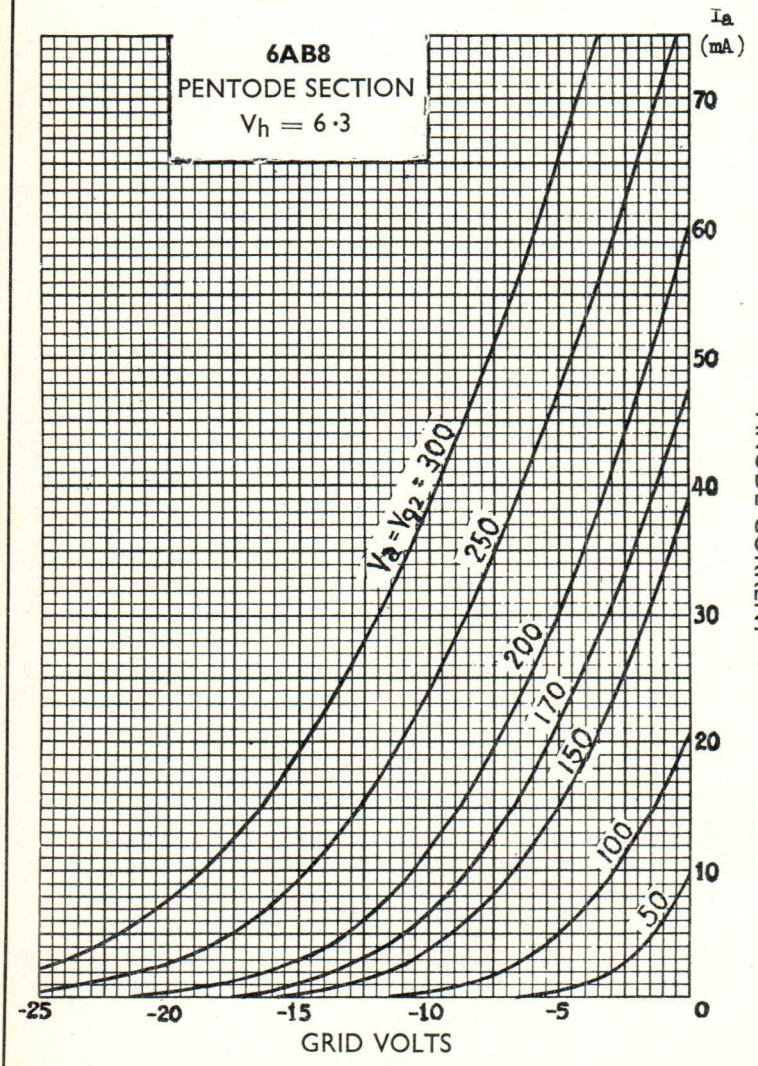
(as A.F. Amplifier).

Anode Voltage	170	200	250	volts.
Grid Voltage	−3·5	−4·2	−5·5	volts.
Anode Current	1·0	0·6	0·75	mA.
Anode Load	400	220	220	kΩ
Stage Gain	10·5	11·0	11·0	
§Output Voltage	24	30	30	volts (r.m.s.)
Grid Resistor (following valve) ...	330	680	680	kΩ
§Total Distortion	7·6	6·5	5·5	%

CAPACITANCES.	Pentode.		Triode.	
C_{in}	4·5		2·0	pF.
C_{out}	5·0		0·3	pF.
C_{a-g}	<0·2		0·9	pF.
C_{g-h}	<0·25		<0·05	pF.
$C_{g_t-a_p}$		<0·12		pF.
$C_{a_t-a_p}$		<1·2		pF.
$C_{a_t-g_p}$		<0·2		pF.
$C_{g_t-g_p}$		<0·2		pF.
C_{h-k}		3·7		pF.

*Screen Feed Resistor 4,700 ohms.
**No Signal.
†Power Output of 50 mW.
‡Total Distortion of 10%
§Output Voltage and Distortion at the start of positive grid current. At lower output voltages distortion is approximately proportional to the voltage.


6AB8
PENTODE SECTION
$V_{g2} = 170$ $V_h = 6{\cdot}3$
-1
-2
-4
-6
-8
-10
-12
$V_{g1} = 0$
$P_a = 3{\cdot}5W$
$V_{g1} = 0$
0
50
100
150
200
250
300
350
ANODE VOLTS
50
40
30
20
10
0
ANODE CURRENT


6AB8
PENTODE SECTION
Vh = 6·3
Ia (mA)
70
60
50
40
30
20
10
0
ANODE CURRENT
Va = Vg2 = 300
250
200
170
150
100
50
-25
-20
-15
-10
-5
0
GRID VOLTS

FERRANTI

TRIPLE DIODE TRIODE

6AK8

An indirectly heated triple diode triode. One diode has a separate cathode. Primarily designed for use as A.F. amplifier and demodulator in FM/AM Receivers.

PHYSICAL DETAILS.

Base	B9A. Noval
Max. Overall Length ...	67·5 mm. (2$\frac{21}{32}$in.).
Max. Seated Height ...	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Diode 3 Anode. Pin 6—Diode 1 Anode.
Pin 2—Diode 2 Anode. Pin 7—Triode Cathode.
Pin 3—Diode 2 Cathode. Diode 1 Cathode.
Pin 4—Heater. Diode 3 Cathode, Shield.
Pin 5—Heater. Pin 8—Triode Grid.
Pin 9—Triode Anode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·45 amp.

RATINGS.

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	1 watt.
Max. Cathode Current ...	5 mA.
*Max. R_{g-k}	3 MΩ
Max. R_{h-k}	20 kΩ
Max. V_{h-k}	150 volts.
†Min. Negative Grid Voltage ...	1·3 volts.

DIODE SECTIONS.

Max. P.I.V. (Each Diode) ...	350 volts.
Max. Peak Current Diode 1 ...	6 mA.
Max. Peak Current Diode 2 ...	75 mA.
Max. Peak Current Diode 3 ...	75 mA.
Max. Current Diode 1	1 mA.
Max. Current Diode 2	10 mA.
Max. Current Diode 3	10 mA.

CHARACTERISTICS.

TRIODE SECTIONS.

Anode Voltage	100	250	volts.
Grid Voltage	−1	−3	volts.
Anode Current	0·8	1	mA.
Mutual Conductance	1·45	1·4	mA/V.
Amplification Factor	70	70	
Anode Impedance	48	50	kΩ

DIODE SECTIONS.

Diode 1 Impedance ($V_{a'd}$=10v)	5 kΩ
Diode 2 Impedance ($V_{a''d}$=5v)	200 Ω
Diode 3 Impedance ($V_{a'''d}$=5v)	200 Ω
$r_{a''d}/r_{a'''d}$	0·65 to 1·5

MICROPHONY

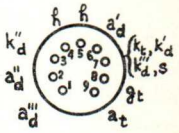
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

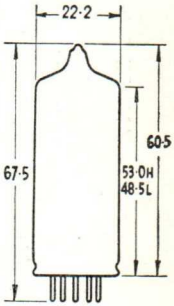
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	0·8	mA.
Stage Gain	51	53	47	55	
Total Distortion (for V_{out}=3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (for V_{out}=8v r.m.s.)	1·1	0·9	0·8	0·6	%
Grid Resistor for following valve	680	680	330	680	kΩ

*For operation with grid current biasing R_{g-k} may be increased to 22 MΩ max.
†For grid current of 0.3 μA.



Base Connections

Underside View of Base



All dimensions shown are in millimetres (max. unless otherwise stated).

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Issue 2
Dec.,1957

6AK8

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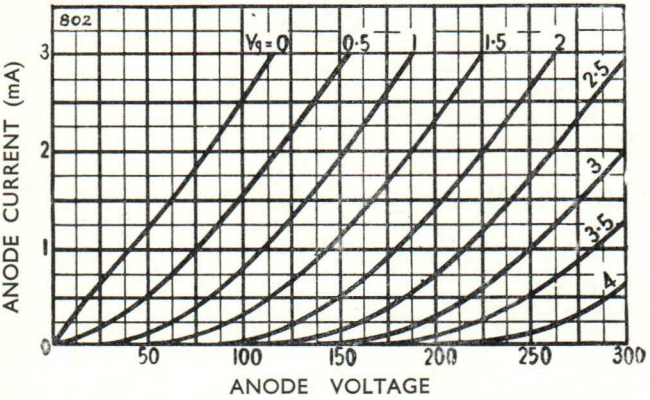
CAPACITANCES. TRIODE SECTION.

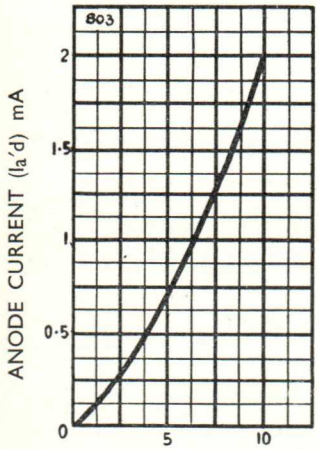
C_{in}	1.9 pF.
C_{out}	1.4 pF.
C_{a-g}	2.0 pF.
C_{g-h}	<0.04 pF.

DIODE SECTION.

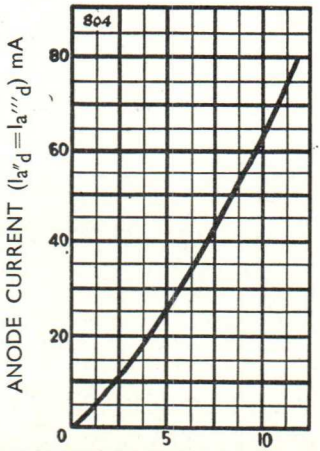
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$	4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k''d,\ s)}$	4.8 pF.
$C_{k''d-all}$	4.9 pF.
$C_{a'd-h}$	<0.25 pF.
$C_{a'''d-h}$	<0.2 pF.
$C_{k''d-h}$	2.5 pF.



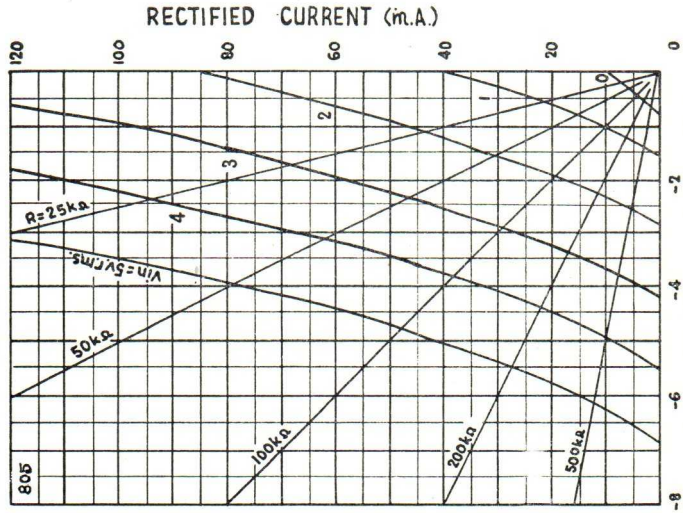
DIODE I

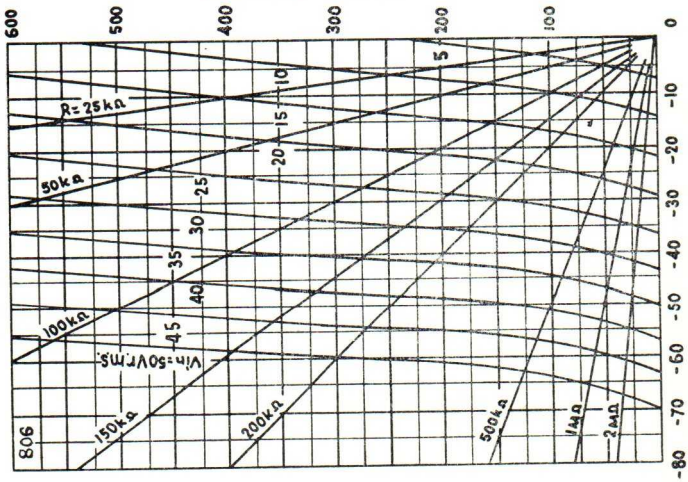


DIODE II - DIODE III



AVERAGE CHARACTERISTICS FOR DIODE I





FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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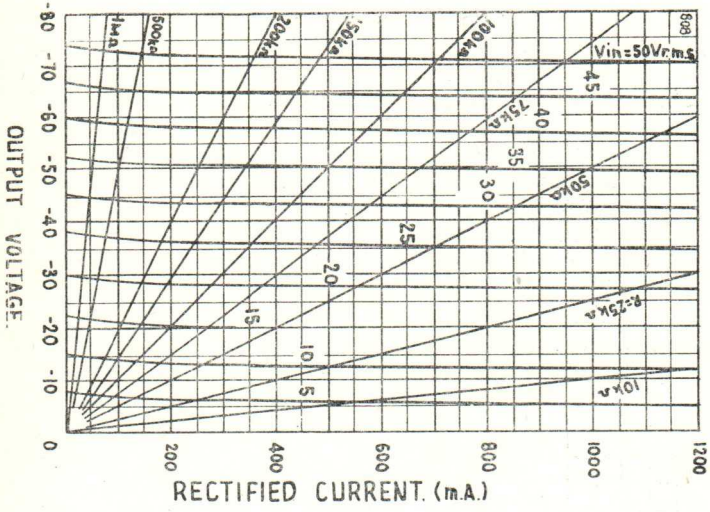
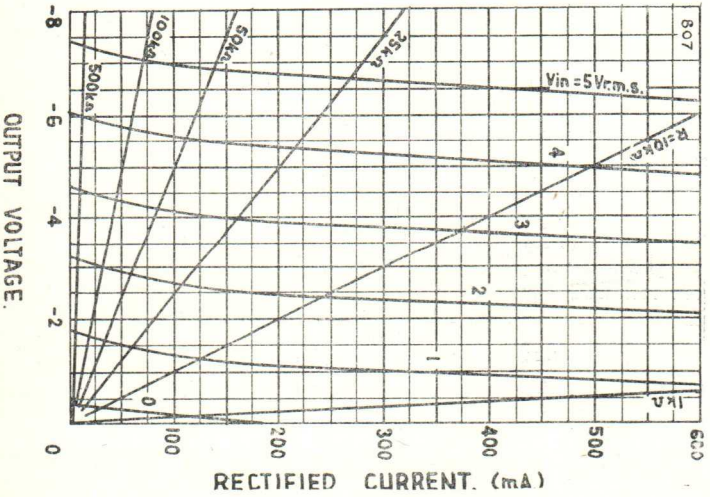
AVERAGE CHARACTERISTICS DIODE II AND DIODE III



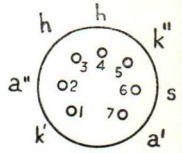


FERRANTI

DOUBLE DIODE

6AL5

A miniature Double Diode with separate cathodes designed for high frequency operation. There is internal screening between the sections.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B7G.
Max. Overall Length	... ...	54·5 mm. (2 5/32 in.).
Max. Seated Height	... ...	47·5 mm. (1 7/8 in.).
Max. Diameter	... ...	19 mm. (3/4 in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

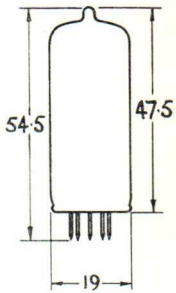
Pin 1—Cathode 1. Pin 4—Heater.
Pin 2—Anode 2. Pin 5—Cathode 2.
Pin 3—Heater. Pin 6—Internal Shield.
Pin 7—Anode 1.

HEATER.

Heater Voltage	... ...	6·3 volts.
Heater Current	... ...	0·3 amp.

RATINGS.

Max. Peak Inverse Voltage	...	420 volts.
Max. R.M.S. Input Voltage	...	150 volts.
*Max. Peak Anode Current	...	54 mA.
*Max. Rectified Current	... ...	9 mA.
*Max. Resonant Frequency	...	700 M/cs.
Max. V_{h-k}	... ...	330 volts DC.



TYPICAL OPERATING CONDITIONS.
(as Half-wave Rectifier)**

*R.M.S. Input Voltage	... ...	150 volts.
*Output Current	... ...	9 mA.
*Supply Impedance	... ...	300 ohms.

CAPACITANCES.

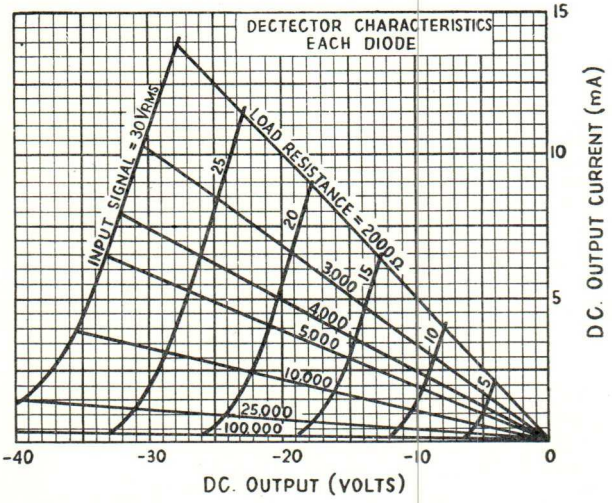
‡‡$C_{a'-a''}$	<0·026 pF.
†$C_{a'-k'+h+s}$	3·0 pF.
‡$C_{a''-k''+h+s}$	3·0 pF.
§$C_{k'-a'+h+s}$	3·4 pF.
††$C_{k''-a''+h+s}$	3·4 pF.

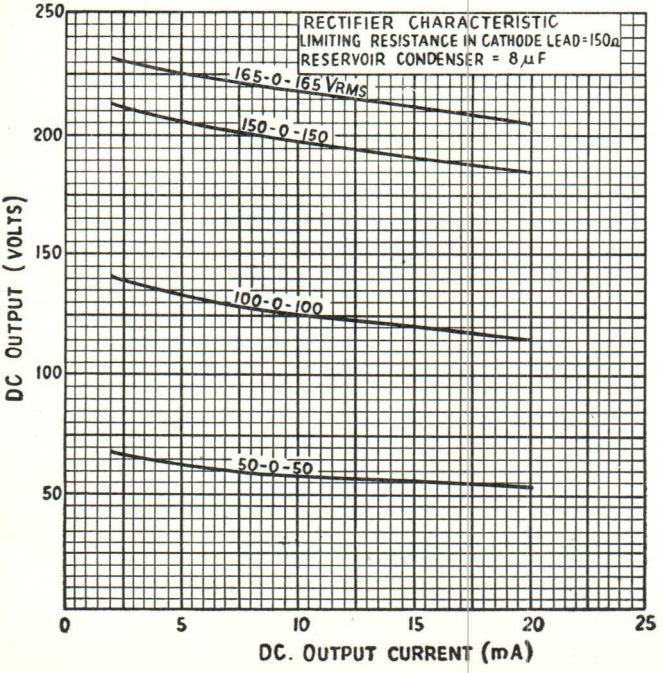
All dimensions shown are in millimetres (max.).

*Each Section.
‡‡With close-fitting external shield connected to Cathode No. 1
†With close-fitting external shield connected to Cathode No.2
‡With close-fitting external shield connected to Anode No. 1
§With close-fitting external shield connected to Anode No. 2
††With close-fitting external shield connected to earth.
**For half-wave operation, the two units may be used separately or in parallel.

Issue 4
Aug.,1957

6AL5


DECTECTOR CHARACTERISTICS
EACH DIODE
INPUT SIGNAL = 30 VRMS
25
20
15
10
5
LOAD RESISTANCE = 2000Ω
3000
4000
5000
10,000
25,000
100,000
-40
-30
-20
-10
0
15
10
5
DC. OUTPUT CURRENT (mA)
DC. OUTPUT (VOLTS)


RECTIFIER CHARACTERISTIC
LIMITING RESISTANCE IN CATHODE LEAD = 150Ω
RESERVOIR CONDENSER = 8 μF
165-0-165 VRMS
150-0-150
100-0-100
50-0-50
250
200
150
100
50
0
5
10
15
20
25
DC OUTPUT (VOLTS)
DC. OUTPUT CURRENT (mA)

FERRANTI
DOUBLE TRIODE

6AQ8

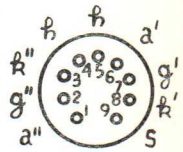
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Shield.



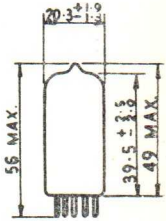
Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·435 amp.

RATINGS (Each Unit, unless otherwise indicated).

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
†Max. Anode Dissipation ...	2·5 watts.
Max. Cathode Current ...	15 mA.
Max. Neg. Grid Voltage ...	100 volts.
Max. R_{h-k}	20 kΩ
Max. V_{h-k}	90 volts.
Max. R_{g-k}	1 MΩ



CHARACTERISTICS (Each Unit).

Anode Voltage	200 volts.
Grid Voltage	−2·3 volts.
Anode Current	10 mA.
Amplification Factor	57
Mutual Conductance	5·9 mA/V.

TYPICAL OPERATION.

As R.F. Amplifier in F.M. or A.M. receivers.

Supply Voltage	250 volts.
Anode resistor	1·8 kΩ
Anode Voltage	230 volts.
Grid Voltage	−2 volts.
Cathode Bias Resistor	200 Ω
Anode Current	10 mA
Mutual Conductance	6·0 mA/V.
Anode Impedance	9·7 kΩ
Equivalent Noise Resistance ...	500 Ω
Input Resistance (at 100 Mc/s.)	6·0 kΩ

As a self-excited Frequency Changer for F.M./A.M.

Supply Voltage	250 volts.
Anode Resistor	12 kΩ
Grid Resistor	1·0 MΩ
Oscillator Voltage	3·0 volts.
Anode Current	5·2 mA
Conversion Conductance ...	2·3 mA/V.
Anode Impedance	22 kΩ
Input Resistance (at 100 Mc/s.)	15 kΩ

All dimensions shown are in millimetres.

†Max. Total Anode Dissipation ($p_{a'}+p_{a''}$) = 4·5 watts.

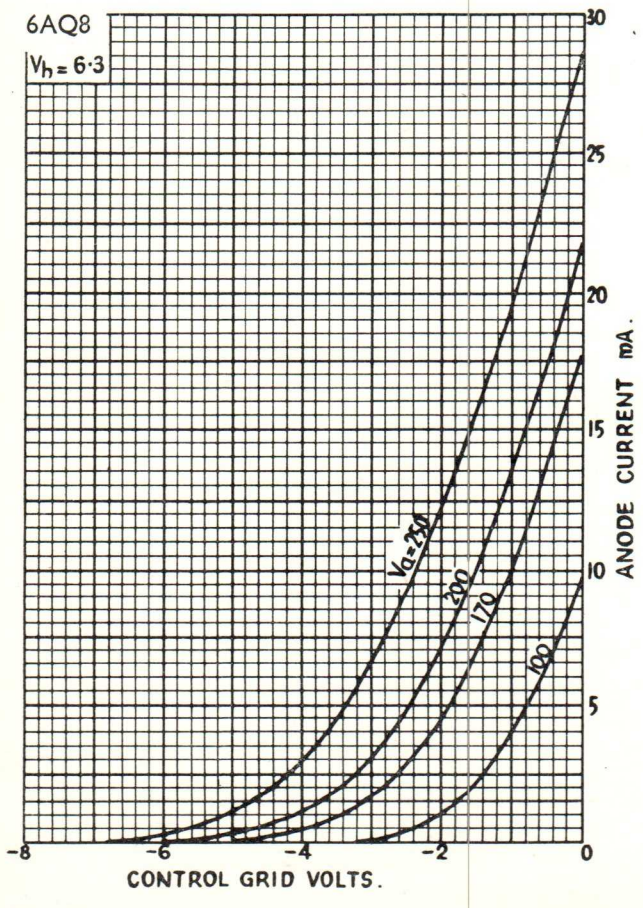
Issue 1.
(Tentative)
Dec., 1955

FERRANTI

CAPACITANCES (without external shield).

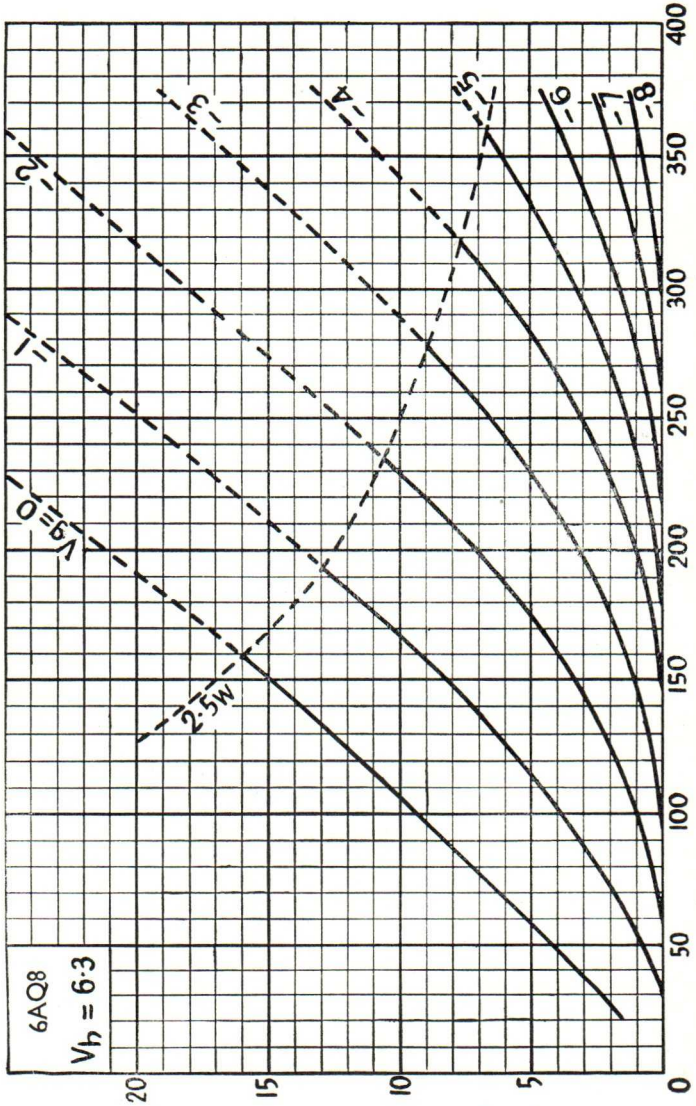
*C_{in}	3·0 pF.
*C_{out}	1·2 pF.
†*C_{out}	1·9 pF.
*C_{a-k}	0·18 pF.
*C_{a-g}	1·5 pF.
$C_{a'-a''}$	<0·04 pF.
†$C_{a'-a''}$	<0·008 pF.
$C_{g'-g''}$	<0·003 pF.
$C_{a'-g''} = C_{a''-g'}$	<0·008 pF.
$C_{a'-k''} = C_{a''-k'}$	<0·008 pF.
$C_{g'-k''} = C_{g''-k'}$	<0·003 pF.

*Each Unit.
†With external shield.

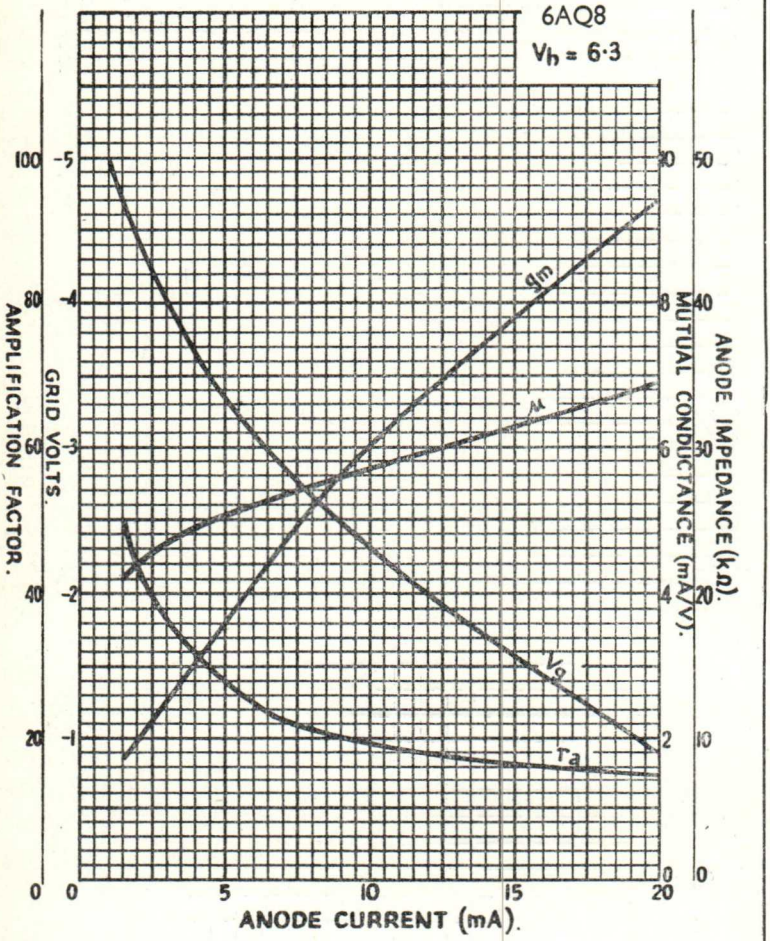


FERRANTI

6AQ8



Issue 1
(Tentative)
Dec., 1955

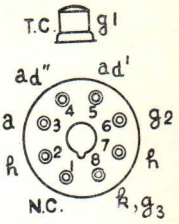

6AQ8
Vh = 6·3
AMPLIFICATION FACTOR.
GRID VOLTS.
MUTUAL CONDUCTANCE (mA/V).
ANODE IMPEDANCE (kΩ).
ANODE CURRENT (mA).
gm
μ
Vg
ra
100
80
60
40
20
0
-5
-4
-3
-2
-1
0
8
6
4
2
0
50
40
30
20
10
0
5
10
15
20

FERRANTI

DOUBLE DIODE PENTODE

Type 6B8G is an indirectly heated double diode pentode designed for use as a detector, A.V.C., and A.F. amplifier in radio receivers.

6B8G



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Top Cap	Skirted Miniature(CTI)
Max. Overall Length	114 mm. ($4\frac{1}{2}$in.).
Max. Seated Height	99 mm. ($3\frac{5}{16}$in.).
Max. Diameter (Bulb)	40 mm. ($1\frac{9}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Heater.
Pin 3—Pentode Anode.
Pin 4—Diode Anode 2.
Pin 5—Diode Anode 1.
Pin 6—Screen Grid (g_2).
Pin 7—Heater.
Pin 8—Cathode, Suppressor Grid (g3).
Top Cap—Control Grid (g_1).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. Anode Voltage	300 volts.
Max. Screen Voltage	125 volts.
Max. Screen Supply Voltage ...	300 volts.
Max. Anode Dissipation ...	2·25 watts.
Max. Heater-Cathode Voltage ...	100 volts DC.
Max. Screen Dissipation ...	0·3 watt.
Max. Diode Current (each diode)	1·0 mA.
Min. Grid Voltage	0 volts.

TYPICAL OPERATION.

PENTODE SECTION.

Class A1 Amplifier.

Anode Voltage ...	100	250	250	volts.
Screen Voltage ...	100	100	125	volts.
Grid Voltage ...	−3	−3	−3	volts.
Anode Current ...	5·8	6·0	2·0	mA.
Screen Current ...	1·7	1·5	2·3	mA.
Grid Volts for Cut off	−17	−17	−21	volts.
Mutual Conductance	0·95	1·0	1·12	mA/V.
Anode Impedance	0·3	0·8	0·6	MΩ

Resistance Coupled Amplifier.

Supply Voltage		90	300	volts.
Anode Load Resistor ...		0·25	0·25	MΩ
Screen Feed Resistor ...		1·2	1·5	MΩ
Auto Bias Resistor ...		3500	1800	ohms.
Peak Output Voltage ...		33	95	volts.
Stage Gain		55	100	
Grid Resistor for following valve		0·5	1·0	MΩ

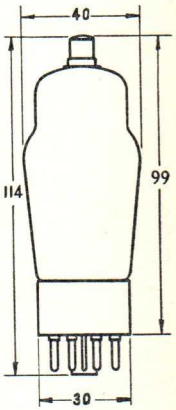
DIODE SECTION.

Refer to curves for Type 6Q7G.

CAPACITANCES.*

C_{in}	3·6
C_{out}	9·5
C_{a-g}	0·01 max.

*Pentode Section.



All Dimensions shown are in millimetres (max.).

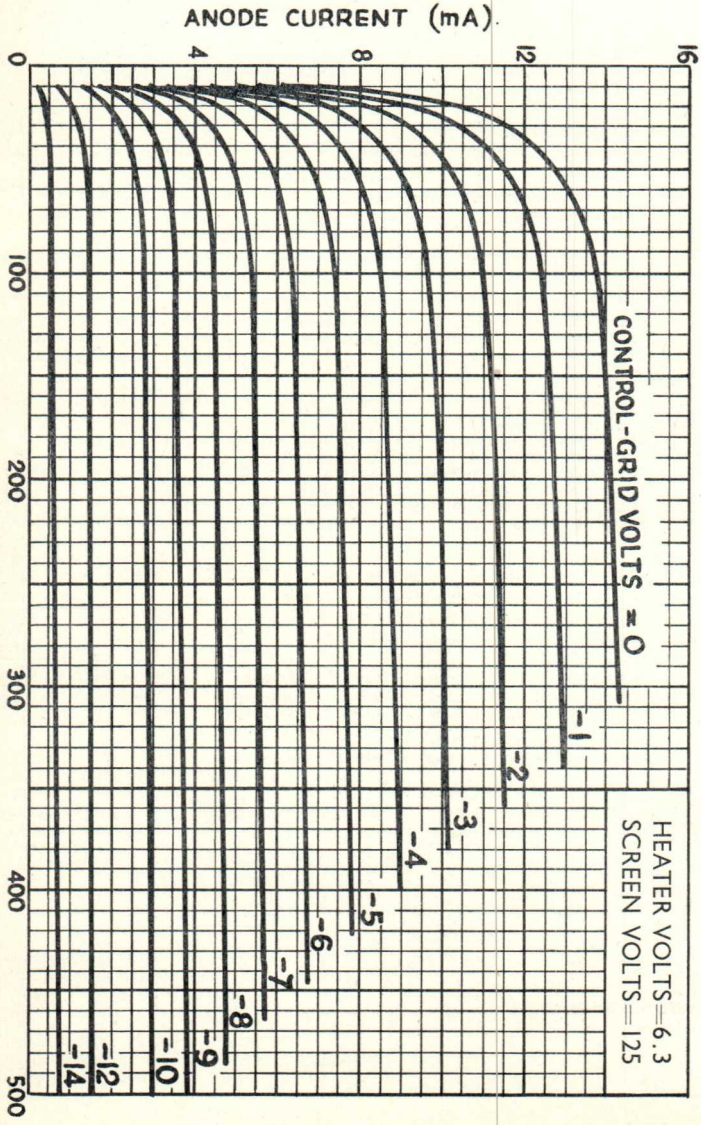
FERRANTI

Issue 2.
Oct., 1952

6B8G

FERRANTI

AVERAGE CHARACTERISTICS PENTODE SECTION

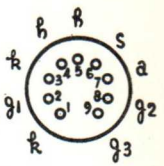


FERRANTI

R.F. PENTODE

6BX6

An indirectly heated R.F. Pentode for use with series or parallel heater connection on a.c. or d.c. mains. Primarily designed for use as an R.F. or I.F. Amplifier in Television Receivers, it is also suitable for use as a video amplifier, mixer or synch. separator.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode. Pin 5—Heater.
Pin 2—Control Grid (g_1) Pin 6—Shield.
Pin 3—Cathode. Pin 7—Anode.
Pin 4—Heater. Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

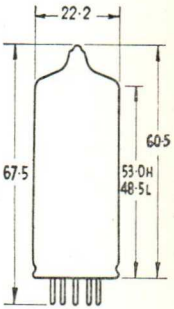
Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	300 volts.
Max. Anode Dissipation... ...	2·5 watts.
Max. Screen Dissipation ...	0·7 watts.
Max. Cathode Current ...	15 mA.
Max. V_{h-k}	150 volts.
Max. R_{g1-k} (auto bias)	1·0 MΩ
Max. R_{g1-k} (fixed bias) ...	0·5 MΩ
Max. R_{h-k}	20 kΩ
*Min. Negative Grid Voltage ...	1·3 volts.

CHARACTERISTICS.

Anode Voltage	170 volts.
Screen Voltage	170 volts.
Suppressor Grid Voltage ...	0 volts.
Grid Voltage	−2 volts.
Anode Current	10 mA.
Screen Current	2·5 mA.
Mutual Conductance	7·4 mA/V.
Anode Impedance	400 kΩ
Inner μ	50
Input Damping (at 50 Mc/s.) ...	10 kΩ
Equivalent Noise Resistance ...	1·0 kΩ

CAPACITANCES.

C_{in} (g_1)	7·5 pF.
C_{in} (g_1)	5·4 pF.
C_{out}	3·3 pF.
C_{a-g_1}	<0·007 pF.
C_{a-k}	<0·01 pF.
$C_{g_2-g_1}$	2·6 pF.
C_{g_1-h}	<0·15 pF.



All dimensions shown are in millimetres (max.).

*For grid current of 0.3 μA.

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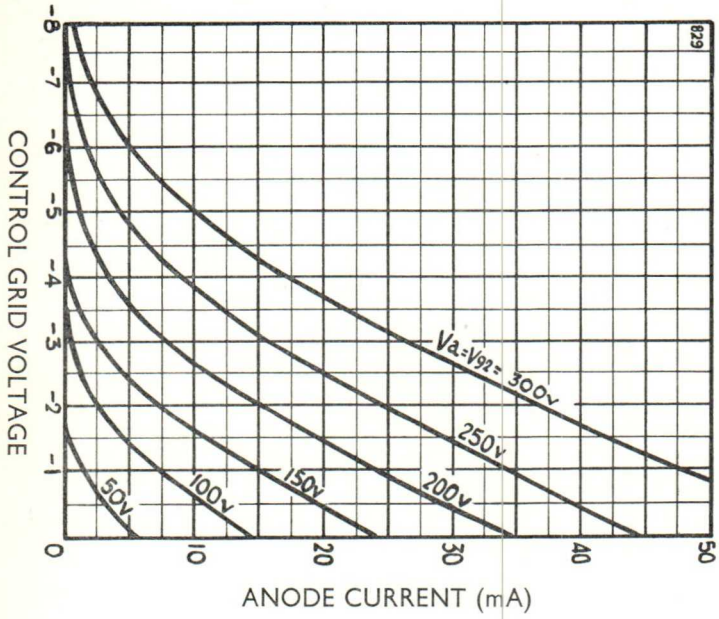
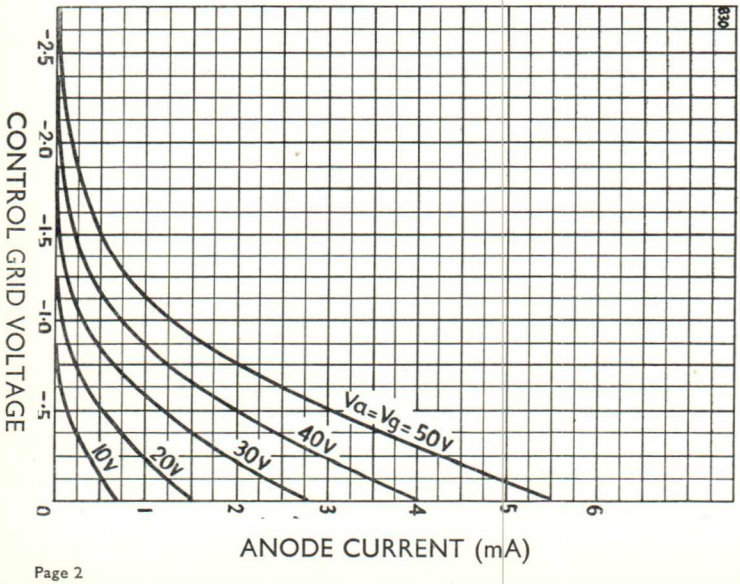
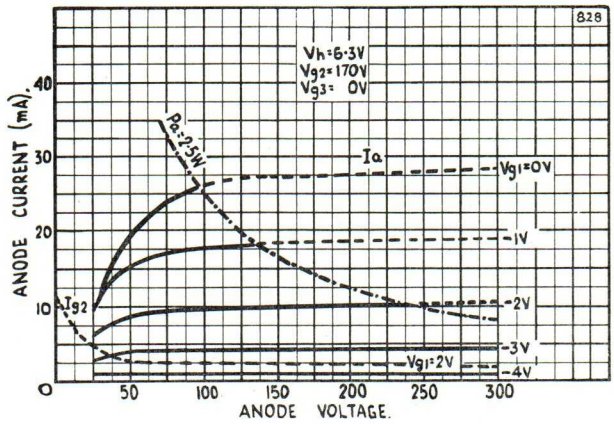
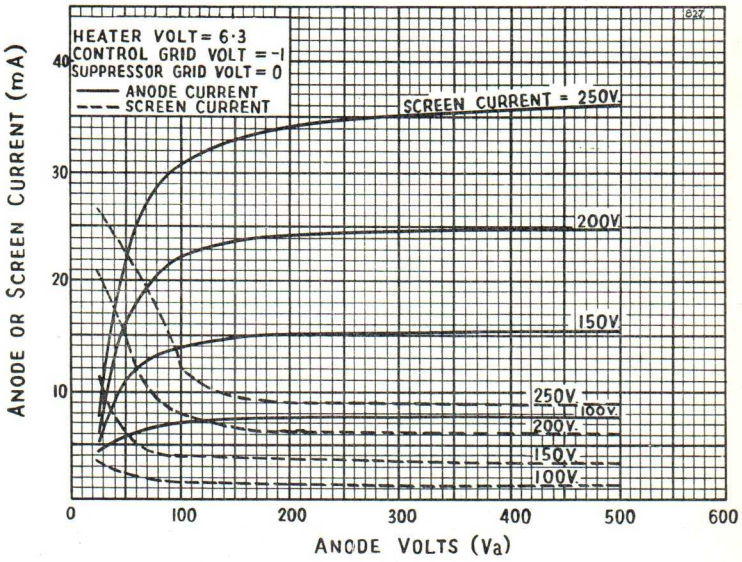

829
CONTROL GRID VOLTAGE
-8
-7
-6
-5
-4
-3
-2
-1
0
10
20
30
40
50
Va=Vg2= 300v
250v
200v
150v
100v
50v
ANODE CURRENT (mA)


830
CONTROL GRID VOLTAGE
-2·5
-2·0
-1·5
-1·0
-·5
0
1
2
3
4
5
6
Va=Vg= 50v
40v
30v
20v
10v
ANODE CURRENT (mA)

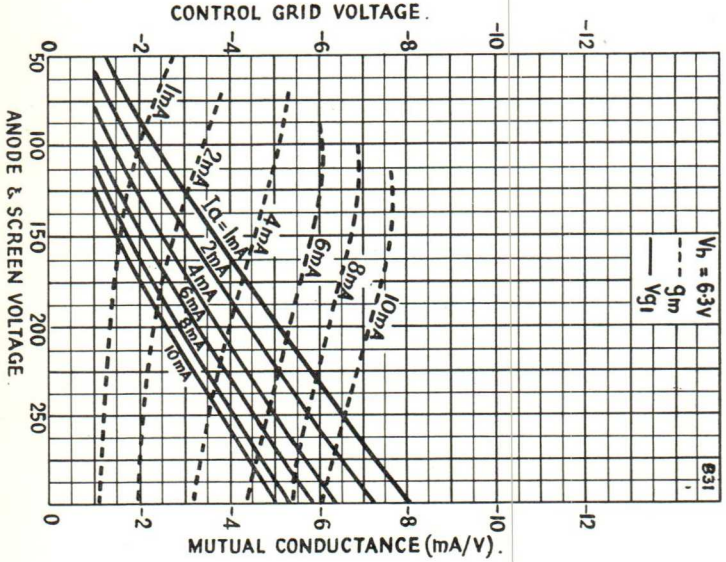


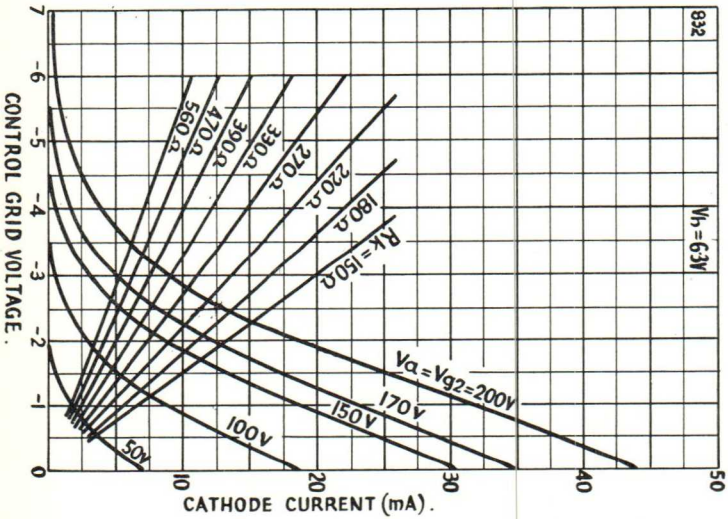


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

6BX6

FERRANTI



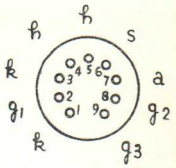


FERRANTI

VARIABLE-MU. R.F. PENTODE

6BY7

A high slope R.F. Pentode designed for use in F.M/A.M. Receivers.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	67·5 mm. (2$\frac{21}{32}$in.)
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.)
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.)
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode.
Pin 2—Control Grid (g_1)
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Shield.
Pin 7—Anode.
Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

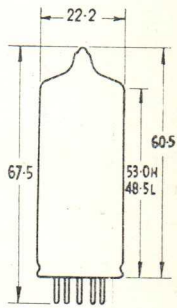
Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	250 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Screen Dissipation ...	0·65 watts.
Max. Control Grid Voltage (I_{g1} = +0·3μA)	−1·3 volts.
Max. Cathode Current ...	15 mA.
Max. V_{h-k}	150 volts.
Max. R_{g1-k}	3·0 MΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.

$V_a = V_b$ ...	250	250	250	volts.
V_{g3}	0	0	0	volts.
R_{g2}	80	*18	†22	kΩ
V_{g2}	85	97	103	volts.
V_{g1}	−1·8	−1·9	−2·1	volts.
I_a	8	10	10	mA.
I_{g2}	2	2·4	2·6	mA.
g_m	5·7	6·0	6·0	mA/V.
r_a	500	500	500	kΩ
R_{eq}	1·5	1·5	1·5	kΩ
V_{g1} for 100 : 1 reduction of gm	−30	−33	−35	volts.

CAPACITANCES.‡

C_{in}	7·5 pF.
C_{out}	3·7 pF.
C_{a-g1}	0·007 pF (max.).
C_{g1-h}	0·15 pF (max.).



All dimensions shown are in millimetres (max.).

*Common screen resistor with 6AJ8 used as a frequency changer. Total current through resistor is 8·5 mA.
†Common screen resistor with 6AJ8 used as I.F. or R.F. Amplifier. Total current through resistor is 6·7 mA.
‡Measured without external shield.

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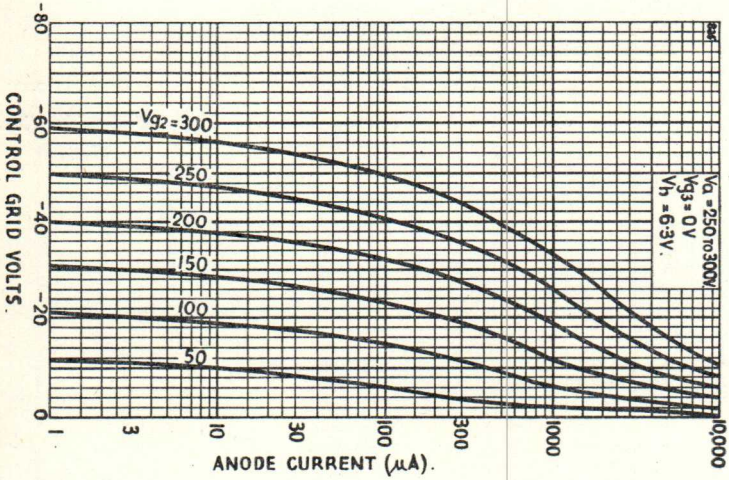
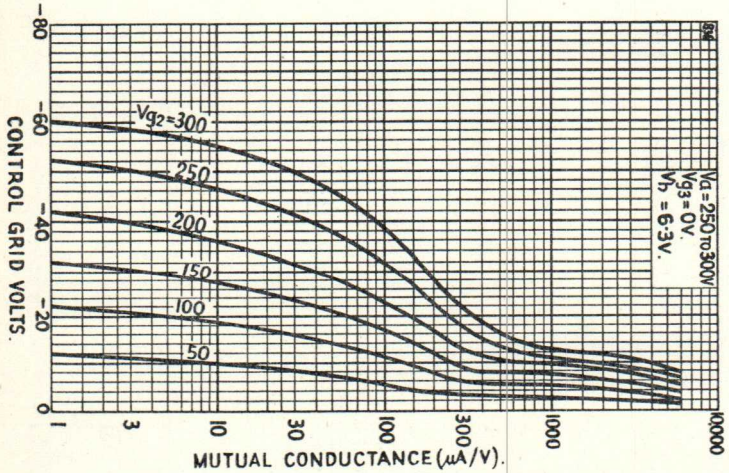
6BY7

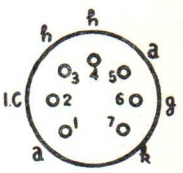

CONTROL GRID VOLTS.
-80
-60
-40
-20
0
V_{g2}=300
250
200
150
100
50
Va = 250 to 300V.
Vg3 = 0V.
Vh = 6·3V.
1
3
10
30
100
300
1000
10,000
ANODE CURRENT (μA).


CONTROL GRID VOLTS.
-80
-60
-40
-20
0
V_{g2}=300
250
200
150
100
50
Va = 250 to 300V.
Vg3 = 0V.
Vh = 6·3V.
1
3
10
30
100
300
1000
10000
MUTUAL CONDUCTANCE (μA/V).

FERRANTI
TRIODE

6C4

Type 6C4 is an indirectly heated triode of single ended construction, designed for use as a power amplifier in FM or other high frequency circuits. May also be used as Class 'C' RF Amplifier. It will operate efficiently at frequencies up to 150 Mc/s.



Base Connections Underside View of Base

PHYSICAL DETAILS.

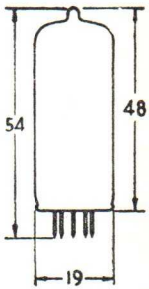
Base	B7G.
Max. Overall Length	54 mm. ($2\frac{1}{8}$in.).
Max. Seated Height	48 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode.
Pin 2—Internal Connection.
Pin 3—Heater.
Pin 4—Heater.
Pin 5—Anode.
Pin 6—Grid.
Pin 7—Cathode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·15 amp.



RATINGS.

	Class A_1	Class C Telegraphy
Max. Anode Voltage ...	300	300 volts.
Max. Anode Dissipation	3·5	5·0 watts.
Max. DC. Grid Voltage ...	—	–50 volts.
Max. Grid Current ...	—	8·0 mA.
Max. R_{g-k}	1·0	— MΩ
Max. V_{h-k}	100	100 volts DC.

TYPICAL OPERATION.

CLASS A_1 AMPLIFIER.

Anode Voltage	100	250 volts.
Grid Voltage	0	–8·5 volts.
Anode Current ...	11·8	10·5 mA.
Mutual Conductance ...	3·1	2·2 mA/V.
Anode Impedance ...	6,250	7,700 ohms.
Amplification Factor ...	19·5	17

R.F. POWER AMPLIFIER. CLASS C TELEGRAPHY.

Anode Voltage (DC)	300 volts.
Anode Current	25 mA.
Grid Voltage (DC)	–27 volts.
Grid Current (DC)	7 mA.
Driving Power	0·35 watts (approx).
Power Output	5·5 watts (approx.)*
	2·5 watts (approx.)†

CAPACITANCES (With close fitting metal shield).

C_{in}	1·8 pF.
C_{out}	3·0 pF.
C_{a-g}	1·6 pF.

All dimensions shown are in Millimetres (max.)

*At moderate frequencies.
†At 150 Mc/s.

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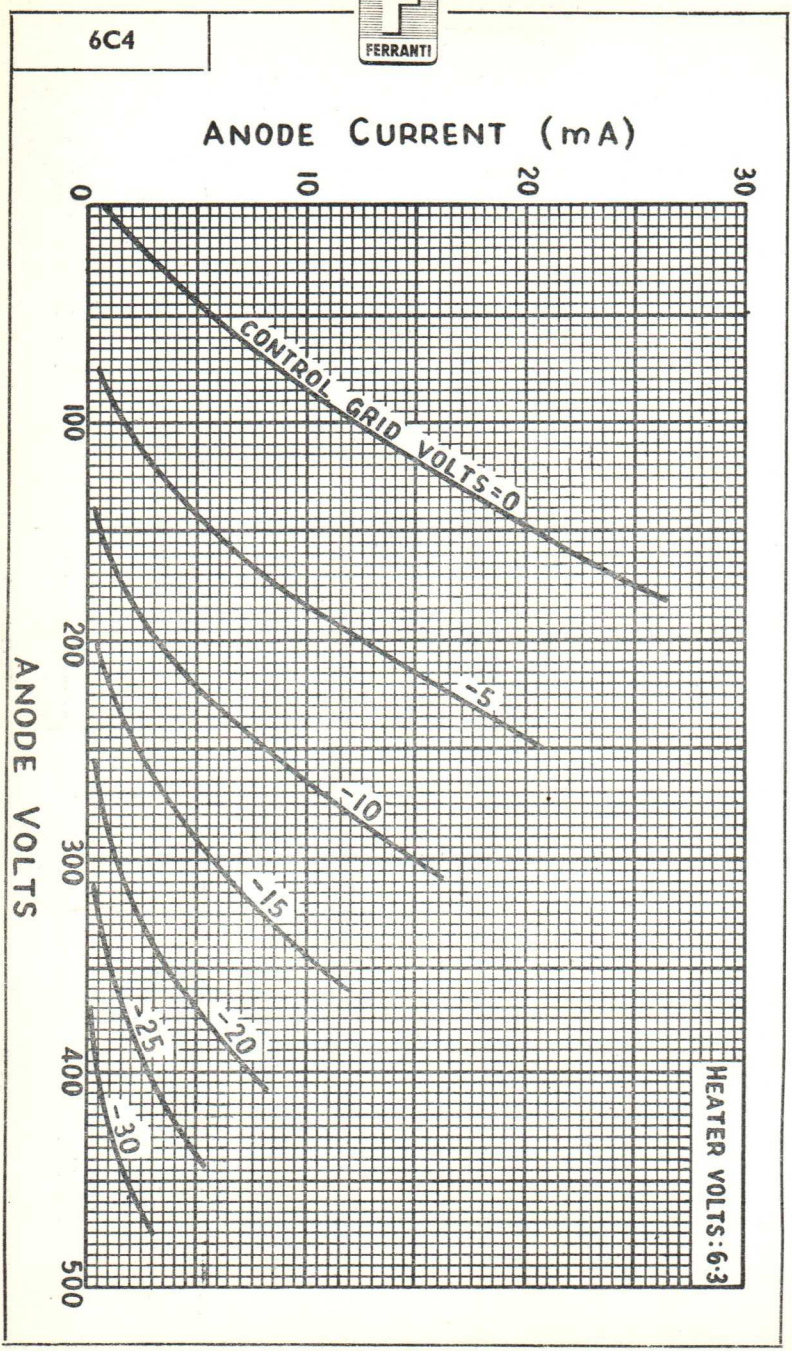
6C4


ANODE CURRENT (mA)
0
10
20
30
ANODE VOLTS
100
200
300
400
500
CONTROL GRID VOLTS=0
-5
-10
-15
-20
-25
-30
HEATER VOLTS: 6·3

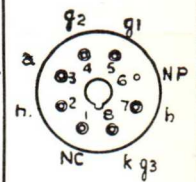
R1255

FERRANTI

OUTPUT PENTODE

Type 6F6G is an indirectly heated pentode designed for use in the output stage of AC radio receivers and audio amplifiers.

6F6G



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Max. Overall Length	119 mm. ($4\frac{11}{16}$in.).
Max. Seated Height	104 mm. ($4\frac{3}{32}$in.).
Max. Diameter (Bulb)	45 mm. ($1\frac{49}{32}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No Connection. Pin 5—Control Grid (g_1).
Pin 2—Heater. Pin 6—No Pin.
Pin 3—Anode. Pin 7—Heater.
Pin 4—Screen Grid (g_2). Pin 8—Cathode, Suppressor Grid (g_3).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·7 amp.

RATINGS.

Max. Anode Voltage	375 volts.
Max. Screen Voltage	285 volts.
Max. Anode Dissipation ...	11 watts.
Max. Screen Dissipation ...	3·75 watts.
Max. Heater-Cathode Voltage ...	100 volts DC.

TYPICAL OPERATION.

Single Valve Class A_1 Amplifier.

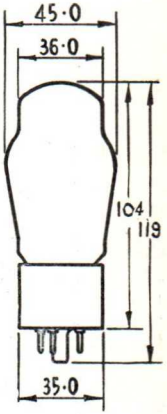
Anode Voltage	250	285	volts.
Screen Voltage	250	285	volts.
Control Grid Voltage ...	−16·5	−20	volts.
Anode Current (Zero Signal)	34	38	mA.
Anode Current (Max. Signal)	36	40	mA.
Screen Current (Zero Signal)	6·5	7	mA.
Screen Current (Max. Signal)	10·5	12	mA.
Anode Impedance (Approx.)	80000	78000	ohms.
Mutual Conductance ...	2·5	2·55	mA/V.
Cathode Bias Resistor ...	410	440	ohms.
Anode Load	7000	7000	ohms.
Power Output	3·2	4·8	watts.
Total Harmonic Distortion	8	9	%

2 Valves Push Pull Class AB_1 Amplifier.

	Fixed Bias	Auto Bias	
Anode Voltage	315	315	volts.
Screen Voltage	285	285	volts.
Control Grid Voltage ...	−24	−	volts.
Auto Bias Resistor ...	−	320	ohms.
Peak Input Voltage (Grid to Grid) ...	48	58	volts.
Anode Current (Zero Signal)	62	62	mA.
Anode Current (Max. Signal)	80	73	mA.
Screen Current (Zero Signal)	12	12	mA.
Screen Current (Max. Signal)	19·5	18·1	mA.
Optimum Load Resistance Anode to Anode ...	10000	10000	ohms.
Power Output	11	10·5	watts.
Total Harmonic Distortion	4	3·0	%

CAPACITANCES.

C_{in}	8·0 pF.
C_{out}	6·5 pF.
C_{a-g}	0·5 pF.



All Dimensions shown are in millimetres (max.).

FERRANTI

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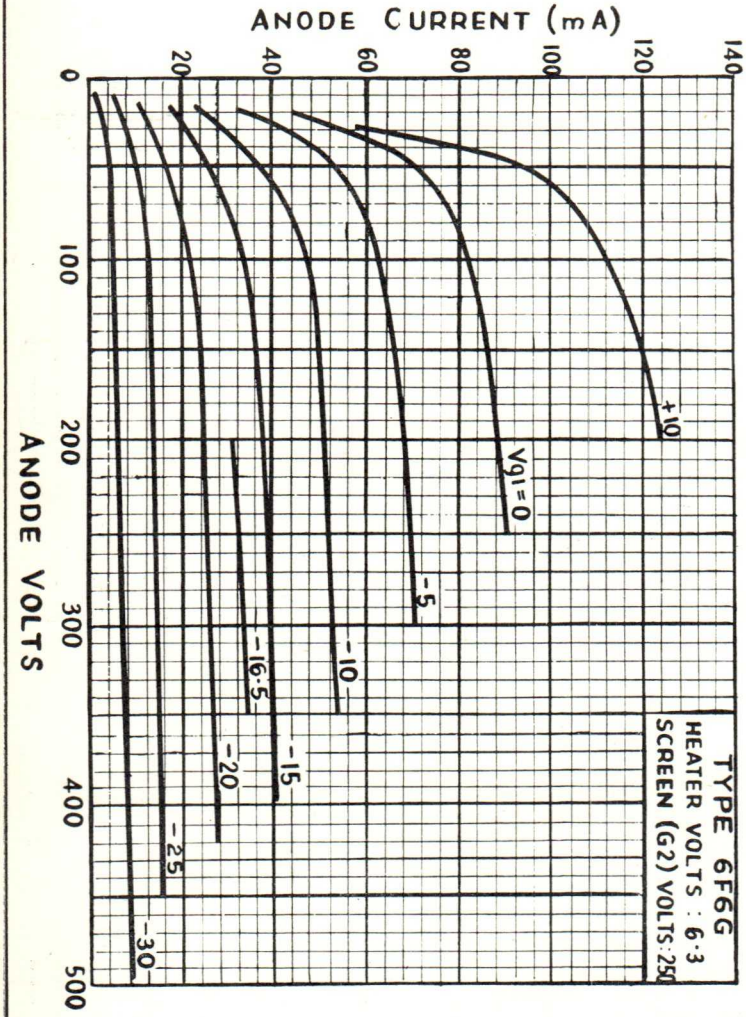
6F6G


ANODE CURRENT (mA)
0
20
40
60
80
100
120
140
ANODE VOLTS
0
100
200
300
400
500
+10
Vg1 = 0
-5
-10
-16·5
-15
-20
-25
-30
TYPE 6F6G
HEATER VOLTS : 6·3
SCREEN (G2) VOLTS: 250

R875

FERRANTI

V.H.F. DOUBLE TRIODE

6J6

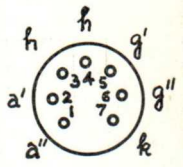
A double triode, with common cathode, designed for use as an R.F. power amplifier or oscillator.

PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 4—Heater.
Pin 2—Anode Triode 1. Pin 5—Grid Triode 1.
Pin 3—Heater. Pin 6—Grid Triode 2.
Pin 7—Cathode.



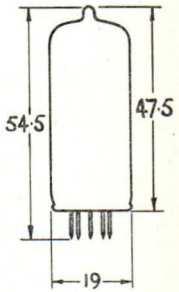
Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·45 amp.

RATINGS.§

Max. Anode Voltage	300 volts.
Max. Anode Current	15 mA.
Max. Anode Dissipation ...	1·5 watts.
Max. Negative Grid Voltage ...	40 volts.
Max. Grid Current	8 mA.
Max. V_{h-k}	100 volts.
Max. R_{g-k} (Cathode Bias) ...	1·0 MΩ



TYPICAL OPERATION.§

Class A1 Amplifier.

Anode Voltage	100 volts.
Anode Current	8·5 mA.
*Auto-bias Resistor	50 ohms†
Mutual Conductance	5·3 mA/V.
Amplification Factor	38
Anode Impedance	7100 ohms.

R.F. Power Amplifier. Class C Telegraphy**

Anode Voltage	150 volts.
Anode Current	15 mA.
‡Grid Voltage	−10 volts.
Auto Bias Resistor	220 ohms.
Grid Resistor	625 ohms.
Grid Current	8 mA.
Driving Power (both sections)	0.35 watts (approx.).
Power Output (both sections)	3·5 watts (approx.).

All dimensions shown are in millimetres.

CAPACITANCES.§

C_{in}	2·2 pF.
C_{out}	0·4 pF.
C_{a-g}	1·6 pF.

§Each Section, unless otherwise indicated.

*Fixed bias operation is not recommended.

†Value is for both units operating at the specified conditions.

‡Obtained from a fixed supply or from a grid or cathode resistor of the value shown.

**An output of 1 watt may be obtained from an ECC91 in a push-pull oscillator at 250 Mc/s. with Va = 150 volts, and maximum rated anode dissipation, and with a common grid resistor of 2000 ohms.

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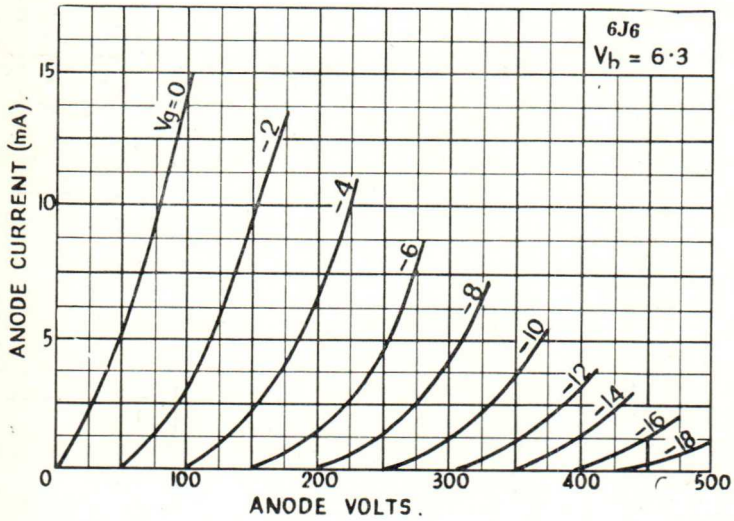
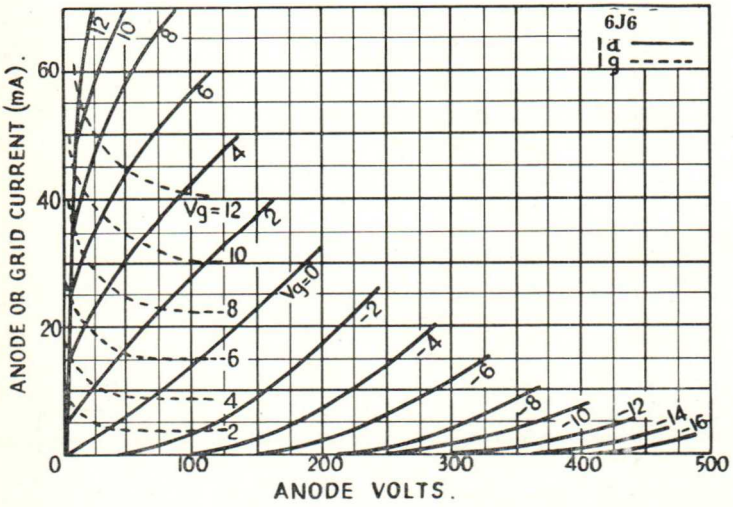

6J6
Vh = 6·3
ANODE CURRENT (mA).
15
10
5
0
100
200
300
400
500
ANODE VOLTS.
Vg=0
-2
-4
-6
-8
-10
-12
-14
-16
-18


6J6
Ia
Ig
ANODE OR GRID CURRENT (mA).
60
40
20
0
100
200
300
400
500
ANODE VOLTS.
12
10
8
6
4
Vg=12
2
10
8
6
4
2
Vg=0
-2
-4
-6
-8
-10
-12
-14
-16

FERRANTI
R.F. PENTODES

6J7G

6J7GT

Indirectly heated pentodes designed for use in High-gain Amplifiers or Anode Bend Detectors in AC. or AC/DC. equipments.

PHYSICAL DETAILS.	6J7G	6J7GT
Base	International Octal.	
Top Cap	Skirted Miniature.	
Max. Overall Length	114 mm. (4½in.)	84 mm. (3⅜in.).
Max. Seated Height	99 mm. (3 1/16in.)	70 mm. (2⅞in.).
Max. Diameter ...	40 mm. (1 9/16in.)	34 mm. (1 5/16in.).
Mounting Position	Any.	

BASE CONNECTIONS.

Pin 1—Int. Shield (6J7G). Base Sleeve (6J7GT).
Pin 2—Heater.
Pin 3—Anode.
Pin 4—Screen Grid (g_2).
Pin 5—Suppressor Grid (g_3).
Pin 6—No Pin.
Pin 7—Heater.
Pin 8—Cathode.
Top Cap—Control Grid (g_1).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

	Pentode Connection	Triode Connection*	
Max. Anode Voltage ...	300	250	volts.
Max. Screen Voltage ...	125	—	volts.
Max. Anode Dissipation	0·75	1·75	watts.
Max. Screen Dissipation	0·1	—	watt.
Max. Heater-Cathode Voltage	100	100	volts DC.
Max. Positive Grid Voltage	0	0	volts.
Max. R_{g-k}	1·0	1·0	MΩ

TYPICAL OPERATION.

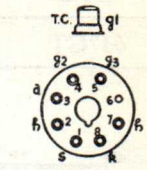
Class A_1 Amplifier.	Pentode Connection		Triode Connection*	
Anode Voltage ...	100	250	250	volts.
Screen Voltage ...	100	100	*	
Suppressor	Connect to Cathode		*	
Grid Voltage ...	–3	–3	–8	volts.
Anode Current ...	2·0	2·0	6·5	mA.
Screen Current ...	0·5	0·5	—	mA.
Mutual Conductance	1·1	1·25	1·9	mA/V.
Anode Impedance	1·0	1·5	·01	MΩ
Grid Volts for Cut off	–7	–7	—	volts.
Amplification Factor	—	—	20	
Anode Bend Detector‡				
Anode and Screen Supply Voltage		100	250	volts.
Anode Load		0·25	0·5	MΩ
Screen Feed Resistor		2·5	4·7	MΩ
Cathode Bias Resistor		0·01	0·01	MΩ
Cathode Current (Zero Signal)		0·19	0·45	mA.
‡R.F. Signal (R.M.S.)		1·6	1·4	volts.
‡Peak Output Voltage		17	17	volts.
Grid Resistor of following valve		0·5	0·25	MΩ

Resistance Coupled Amplifier.	Pentode Connection†		Triode Connection*	
H.T. Supply Voltage ...	180	300	300	volts.
Anode Load	0·25	0·5	0·1	MΩ
Screen Feed Resistor ...	1·2	3·0	—	MΩ
Cathode Bias Resistor ...	1600	2200	6000	ohms.
Peak Output Voltage ...	60	97	88	volts.
Voltage Gain	118	200	13	
Grid Resistor of following valve ...	0·5	1·0	0·5	MΩ

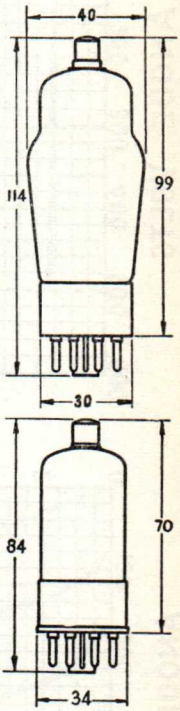
CAPACITANCES.

PENTODE CONNECTION§	6J7G	6J7GT	
C_{a-g}	·007	·005	pF. max.
C_{in}	4·6	4·6	pF.
C_{out}	12·0	12·0	pF.
TRIODE CONNECTION**			
C_{a-g}	1·8	1·8	pF.
C_{in}	2·6	2·6	pF.
C_{out}	17·0	17·0	pF.

*Screen Grid (g_2) and suppressor grid (g_3) connected to anode.
†Suppressor Grid (g_3) connected to cathode.
‡For 20% modulated R.F. Input.
§With external shield connected to cathode.
**Without external shield.



Base Connections Underside View of Base

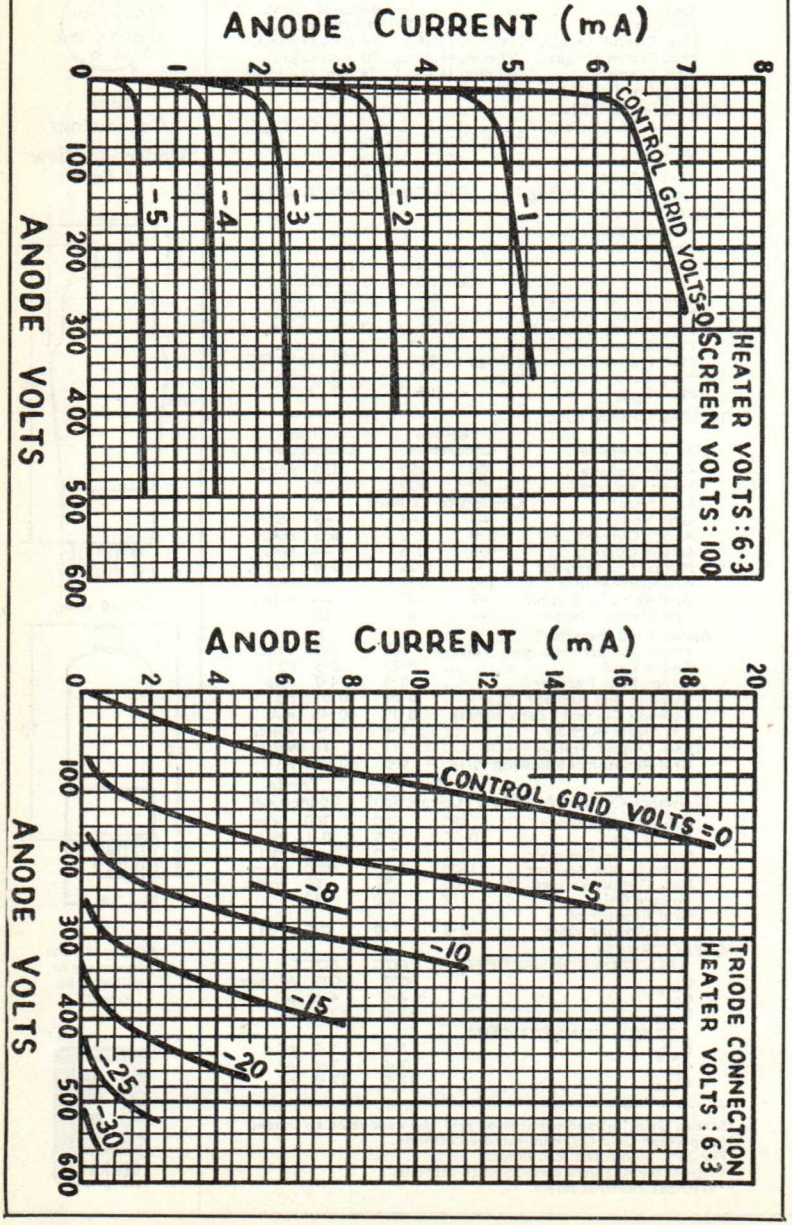


All dimensions shown are in millimetres (max.).

Issue 2
Feb.,1953

6J7G

6J7GT


ANODE CURRENT (mA)
0
1
2
3
4
5
6
7
8
ANODE VOLTS
100
200
300
400
500
600
CONTROL GRID VOLTS=0
-1
-2
-3
-4
-5
HEATER VOLTS: 6·3
SCREEN VOLTS: 100
ANODE CURRENT (mA)
0
2
4
6
8
10
12
14
16
18
20
ANODE VOLTS
100
200
300
400
500
600
CONTROL GRID VOLTS=0
-5
-8
-10
-15
-20
-25
-30
TRIODE CONNECTION
HEATER VOLTS: 6·3

R1055

FERRANTI

VARIABLE-MU R.F. PENTODES

6K7G

6K7GT

Types 6K7G and 6K7GT are indirectly heated variable-mu pentodes designed for use in the I.F. or R.F. stages of AC Radio Receivers. Their internal shields will provide sufficient shielding except in the case of very high gain circuits.

PHYSICAL DETAILS.

6K7G.

Base	International Octal.
Top Cap	Skirted Miniature.
Max. Overall Length	114 mm. ($4\frac{1}{2}$in.).
Max. Seated Height	100 mm. ($3\frac{5}{16}$in.).
Max. Diameter (Bulb)	40 mm. ($1\frac{9}{16}$in.).
Mounting Position	Any.

6K7GT.

Base	International Octal (Small Wafer-metal Sleeve).
Top Cap	Skirted Miniature.
Max. Overall Length	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Base)	34 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No connection—6K7G. Base Sleeve—6K7GT.
Pin 2—Heater.
Pin 3—Anode.
Pin 4—Screen Grid.
Pin 5—Suppressor Grid.
Pin 6—No Pin.
Pin 7—Heater.
Pin 8—Cathode.
Top Cap—Control Grid.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

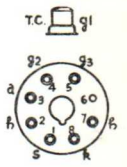
Max. Anode Voltage	300 volts.
Max. Screen Voltage	125 volts.
Min. Grid Voltage	0 volts.
Max. Anode Dissipation ...	2·75 watts.
Max. Screen Dissipation ...	0·35 watt.
Max. Heater-Cathode Voltage ...	100 volts DC.

TYPICAL OPERATION.

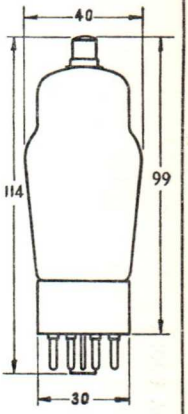
Anode Voltage	100	250	250	volts.
Screen Voltage	100	100	125	volts.
Grid Voltage	−1	−3	−3	volts.
Suppressor	Connected to Cathode.			
Auto. Bias Resistor ...	−	330	220	ohms.
Anode Current ...	9·5	7·0	10·5	mA.
Screen Current	2·7	1·7	2·6	mA.
Mutual Conductance ...	1·65	1·45	1·65	mA/V.
Anode Impedance ...	0·15	0·8	0·6	MΩ
Grid Volts for Cut off ...	−38	−42	−52	volts.

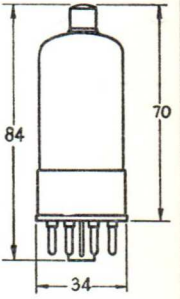
CAPACITANCES.

	6K7G.	6K7GT.	
C_{in}	5·0	4·6	pF.
C_{out}	12·0	12·0	pF.
C_{a-g}	0·007	0·005	pF.



Base Connections Underside View of Base



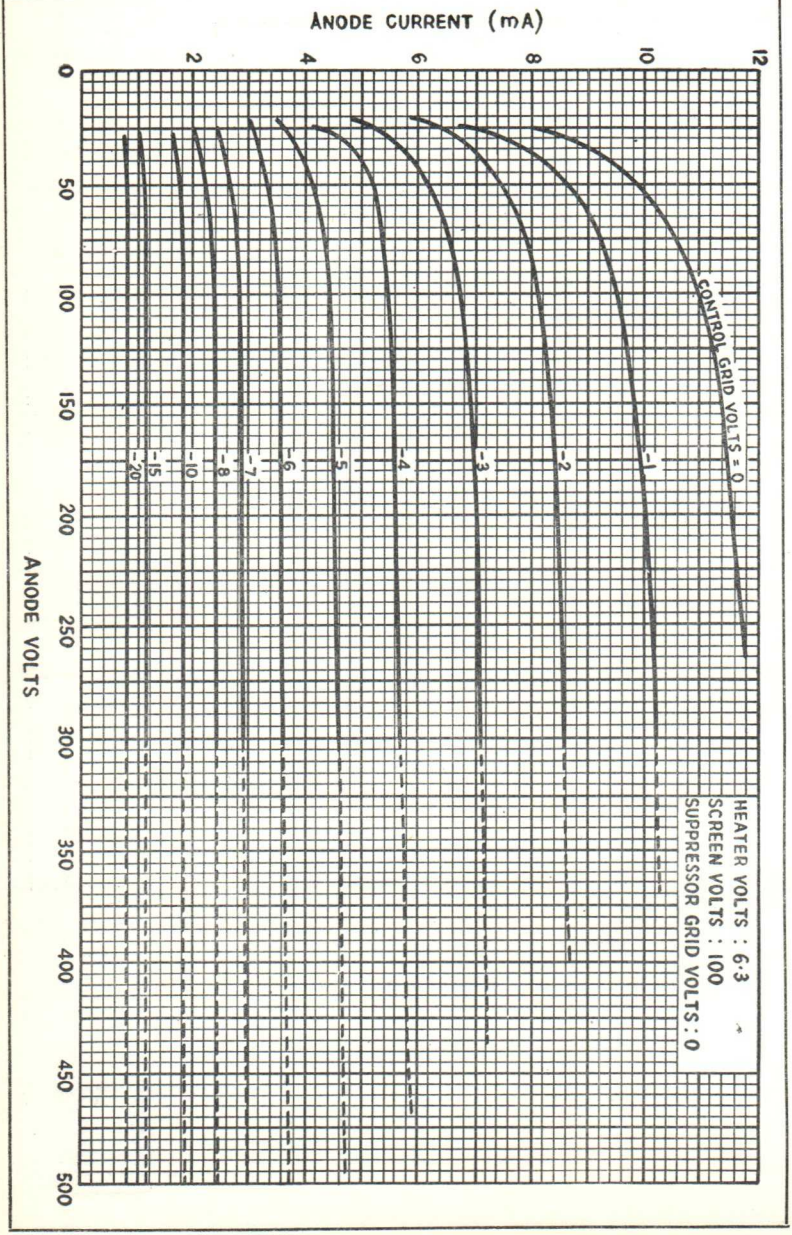


All dimensions shown are in Millimetres (Max.).

Issue 4.
Mar., 1954

FERRANTI

6K7G
6K7GT



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

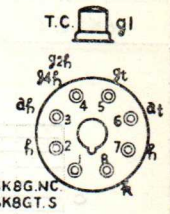
FERRANTI

TRIODE HEXODES

6K8G

6K8GT

Indirectly heated triode-hexodes designed for use as frequency changers in superheterodyne receivers. As these valves are not critical to changes in oscillator anode voltage or control grid bias they are particularly useful in all-wave receivers in order to minimise frequency drift at the higher frequencies.



Base Connections Underside View of Base

PHYSICAL DETAILS.

	6K8G.	6K8GT.
Base	International Octal.	International Octal (Small Wafer-Metal Sleeve).
Top Cap ...	Skirted Miniature (CT1).	
Max. Overall Length	114 mm. ($4\frac{1}{2}$in.).	90 mm. ($3\frac{7}{16}$in.).
Max. Seated Height	99 mm. ($3\frac{13}{16}$in.).	76 mm. (3in.).
Max. Diameter ...	40 mm. ($1\frac{9}{16}$in.).	34 mm. ($1\frac{5}{16}$in.).
Mounting Posiion	Any.	

BASE CONNECTIONS.

Pin 1—No Connection—6K8G. Base Sleeve—6K8GT.
Pin 2—Heater.
Pin 3—Hexod Anode.
Pin 4—Hexode Grids 2 and 4.
Pin 5—Triode Grid, and Hexode Grid 1.
Pin 6—Triode Anode.
Pin 7—Heater.
Pin 8—Cathode.
Top Cap—Hexode Control Grid.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

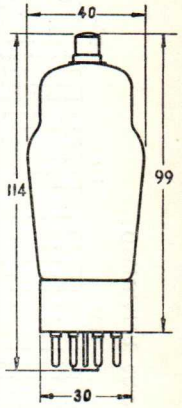
Max. Hexode Anode Voltage	300 volts.
Max. Hexode Screen Voltage (Grids 2, 4)	150 volts.
Min. Hexode Control Grid Voltage (Grid 3)	0 volts.
Max. Hexode Anode Dissipation	0·75 watt.
Max. Hexode Screen Dissipation	0·7 watt.
Max. Triode Anode Voltage ...	125 volts.
Max. Triode Anode Dissipation	0·75 watt.
Max. Total Cathode Current ...	16 mA.
Max. Heater-Cathode Voltage ...	100 volts DC.

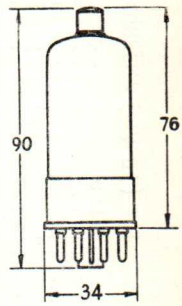
TYPICAL OPERATION.

Hexode Anode Voltage ...	100	250	volts.
Hexode Screen Voltage ...	100	100	volts.
Hexode Control Grid Voltage	–3	–3	volts.
Hexode Anode Current ...	2·3	2·5	mA.
Hexode Screen Current ...	6·2	6·0	mA.
Auto Bias Resistor	220	300	ohms.
Hexode Anode Impedance ...	0·4	0·6	MΩ
Triode Anode Voltage	100	100	volts.
Triode Anode Current ...	3·8	3·8	mA.
Triode Grid Resistor	50000	50000	ohms.
†Oscillator Grid Current ...	0·15	0·15	mA.
Conversion Conductance ...	0·33	0·36	mA/V.
Conversion Conductance with Hexode Control Grid ...	0·002	0·002	mA/V.

CAPACITANCES.

	Triode.	Hexode.	
C_{in}	6·5	4·6	pF.
C_{out}	3·4	4·8	pF.
C_{a-g}	1·8	*0·08	pF.
Hexode Control Grid to Oscillator Grid†		0·2 pF. Max.	
Hexode Control Grid to Oscillator Anode‡		0·05 pF. Max.	
Hexode Anode to Oscillator Grid† ...		0·15 pF.	





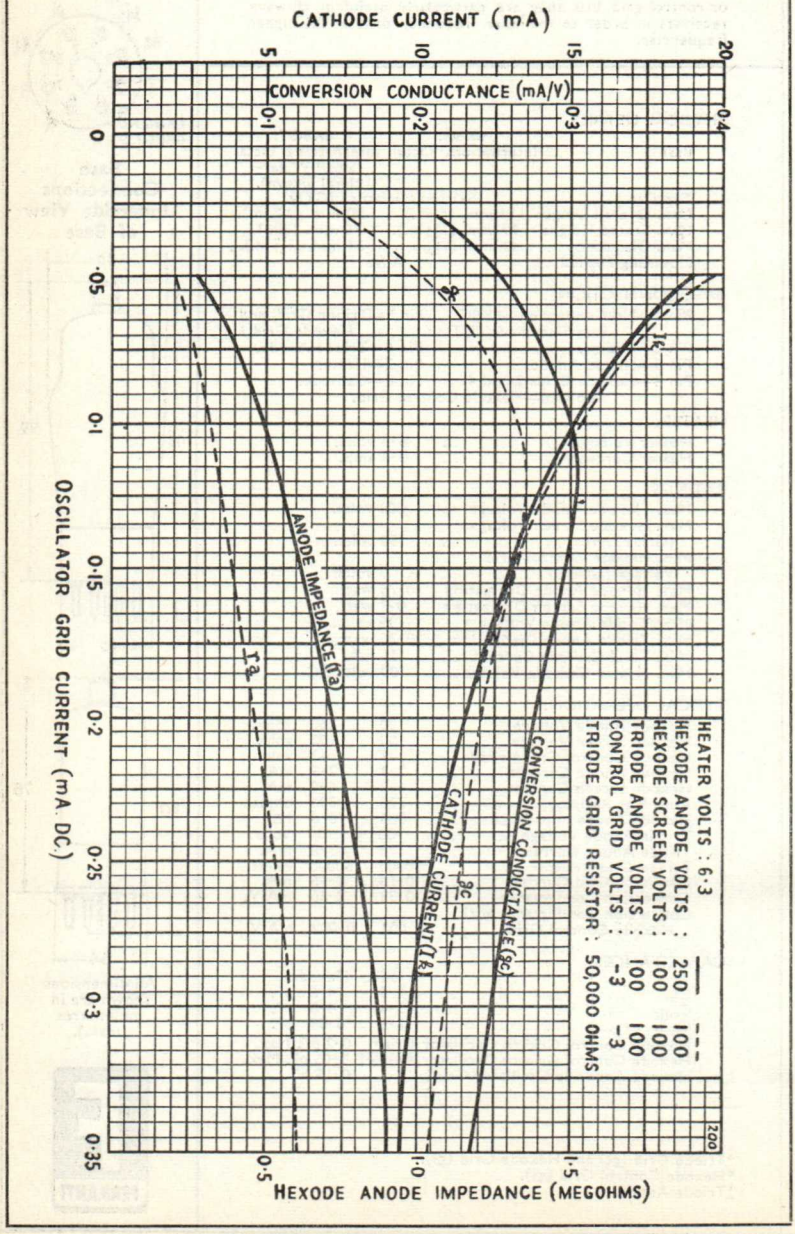
All dimensions shown are in millimetres (max.).

†Triode Grid (gt) and Hexode Grid (g1).
*Hexode Control Grid (g3).
‡Triode Anode.

Issue 3
Sept., 1952

6K8G

6K8GT


CATHODE CURRENT (mA)
5
10
15
20
CONVERSION CONDUCTANCE (mA/V)
0·1
0·2
0·3
0·4
0
·05
0·1
0·15
0·2
0·25
0·3
0·35
OSCILLATOR GRID CURRENT (mA. DC.)
0·5
1·0
1·5
HEXODE ANODE IMPEDANCE (MEGOHMS)
gc
Ik
ANODE IMPEDANCE (ra)
ra
CONVERSION CONDUCTANCE (gc)
CATHODE CURRENT (Ik)
HEATER VOLTS : 6·3
HEXODE ANODE VOLTS : 250 100
HEXODE SCREEN VOLTS : 100 100
TRIODE ANODE VOLTS : 100 100
CONTROL GRID VOLTS : -3 -3
TRIODE GRID RESISTOR : 50,000 OHMS
200

FERRANTI

DOUBLE DIODE PENTODE

6N8

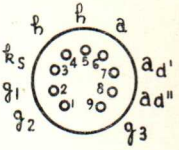
An indirectly heated double diode variable-mu pentode designed for use as detector, A.V.C. diode and R.F., I.F., or A.F. Amplifier.

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	67·5 mm. (2$\frac{5}{8}$in.).
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Screen Grid (g_2).
Pin 2—Control Grid (g_1).
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Pentode Anode.
Pin 7—Diode Anode 1.
Pin 8—Diode Anode 2.
Pin 9—Suppressor Grid (g_3).



Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage (I_a <2·5 mA)	300 volts.
Max. Screen Voltage (I_a=5 mA)	125 volts.
Max. Anode Dissipation ...	1·5 watts.
Max. Screen Dissipation ...	0·3 watts.
Max. Control Grid Voltage (I_{g1}=+0·3μA)	−1·3 volts.
Max. Cathode Current ...	10 mA.
Max. V_{h-k}	100 volts.
*Max. R_{g1-k}	3 MΩ
Max. R_{h-k}	20 kΩ
Peak Diode Anode Voltage ...	200 volts.
Max. Diode Anode Current ...	0·8 mA.

TYPICAL OPERATION.

PENTODE SECTION.

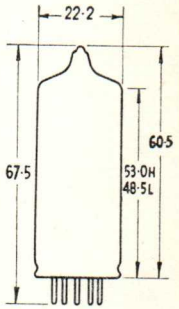
Anode Voltage	250 volts.
Screen Grid Resistor (R_{g2}) ...	95 kΩ
Suppressor Grid Voltage ...	0 volts.
Control Grid Voltage	−2 volts.
Anode Current	5 mA.
Screen Current	1·75 mA.
Mutual Conductance	2·2 mA/V.
Anode Impedance	1·5 MΩ
Inner μ (μ_{g1-g2})	18
V_{g1} for gm=0·022 mA/V. ...	−41·5 volts.

Resistance Coupled Amplifier.

Supply Voltage	250	250	250	volts.
Anode Load Resistor ...	220	220	100	kΩ
Screen Feed Resistor ...	820	100	470	kΩ
Auto Bias Resistor ...	1·8	0	0	kΩ
Grid Resistor	0	10	10	MΩ
Peak Output Voltage ...	19	19	19	volts.
Stage Gain	110	160	110	
Grid Resistor for following Valve	680	680	330	kΩ
Total Distortion	5	5	5	%

CAPACITANCES.

C_{in}	4·0 pF.
C_{out}	4·9 pF.
C_{a-g}	<0·0025 pF.
$C_{ad'-ad''}$	<0·35 pF.
$C_{ad'-k}$	2·2 pF.
$C_{ad''-k'}$	2·35 pF.
C_{g1-h}	<0·07 pF.
$C_{ad'-g1}=C_{ad''-g1}$ ...	<0·001 pF.



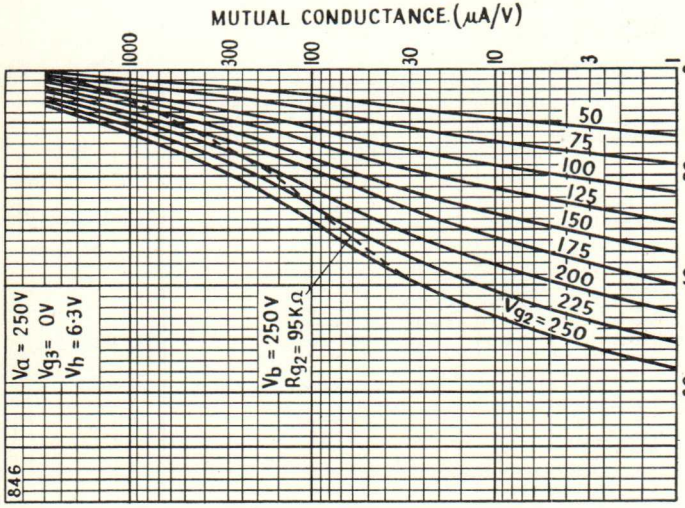
All dimensions shown are in millimetres (max.).

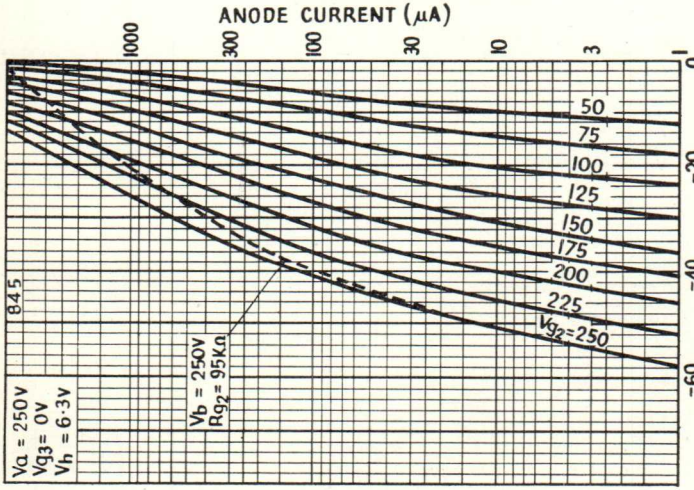
*If grid current biasing is employed R_{g1-k} may be increased up to 22 MΩ

Issue 1.
Jan., 1957

6N8

FERRANTI





FERRANTI

DOUBLE DIODE TRIODES

Indirectly heated double diode triodes designed for use as detector, A.V.C. and L.F. amplifiers in radio receivers.

6Q7G

6Q7GT

PHYSICAL DETAILS.

6Q7G.

Base	International Octal.
Top Cap	Skirted Miniature CT1
Max. Overall Length	114 mm. (4½in.).
Max. Seated Height	99 mm. (3 1/16 in.).
Max. Diameter (Bulb)	40 mm. (1 9/16 in.).
Mounting Position	Any.

6Q7GT.

Base	International Octal. (Small Wafer-metal Sleeve).
Top Cap	Skirted Miniature.
Max. Overall Length	84 mm. (3 5/16 in.).
Max. Seated Height	70 mm. (2¾in.).
Max. Diameter (Base)	34 mm. (1 5/16 in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No Connection—6Q7G. Base Sleeve—6Q7GT.
Pin 2—Heater.
Pin 3—Triode Anode.
Pin 4—Diode Anode 2.
Pin 5—Diode Anode 1.
Pin 6—No Pin.
Pin 7—Heater.
Pin 8—Cathode.
Top Cap—Triode Grid.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. Anode Voltage (Triode)	300 volts.
Max. Diode Voltage (each Diode)	200 volts.
Max. Diode Current (each Diode)	1·0 mA.
Max. Heater-Cathode voltage	100 volts DC.
Min. Grid Voltage	0 volts.

TYPICAL OPERATION.

TRIODE SECTION.

Class A_1 Amplifier.

Anode Voltage	100	250	volts.
Grid Voltage	−1	−3	volts.
Anode Current	0·8	1·0	mA.
Mutual Conductance ...	1·2	1·2	mA/volts.
Anode Impedance ...	58000	58000	ohms.
Amplification Factor ...	70	70	

Resistance Coupled Amplifier.

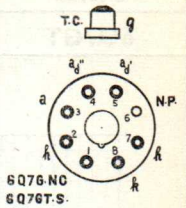
Anode Voltage	100	250	volts.
Anode Load Resistor ...	0·25	0·47	MΩ
Grid Resistor	1·0	1·0	MΩ
Auto Bias Resistor ...	5600	6800	ohms.
Peak Output Voltage ...	12	49	volts.
Stage Gain	45	56	
Total Harmonic Distortion	4·5	5	%

DIODE SECTION.

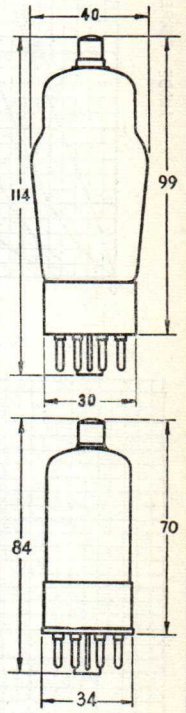
Refer to curves.

CAPACITANCES.

	6Q7G	6Q7GT	
C_{in}	2·0	1·8	pF.
C_{out}	4·0	3·4	pF.
C_{a-g}	2·0	1·8	pF.
$C_{a_d'-kC=a_d''-k}$ ...	2·5	2·8	pF.



Base Connections Underside View of Base



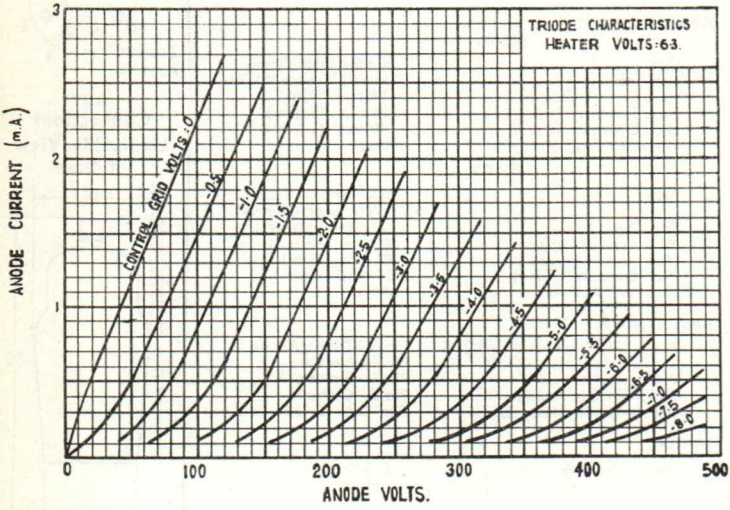
All dimensions shown are in millimetres (max.).

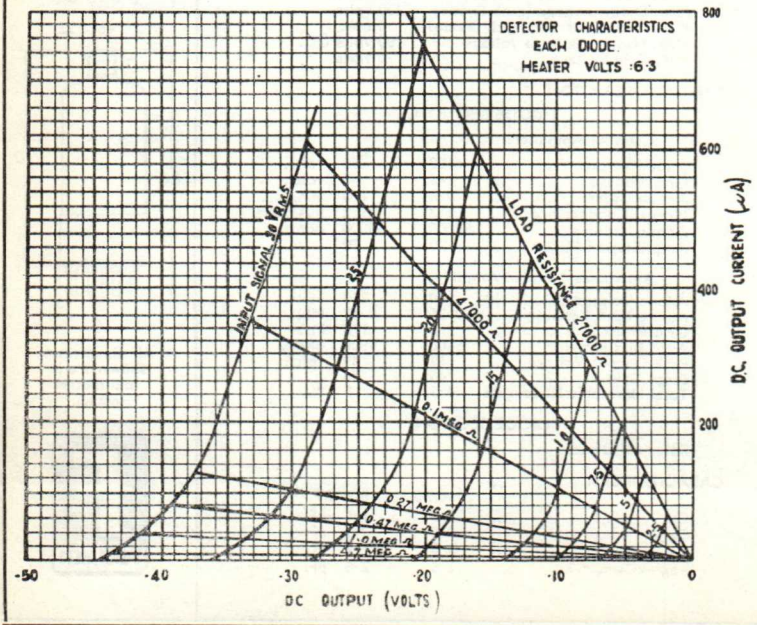
FERRANTI

Issue 3
Sept., 1952

6Q7G

6Q7GT


TRIODE CHARACTERISTICS
HEATER VOLTS: 6·3.
ANODE CURRENT (m.A.)
CONTROL GRID VOLTS: 0
-0·5
-1·0
-1·5
-2·0
-2·5
-3·0
-3·5
-4·0
-4·5
-5·0
-5·5
-6·0
-6·5
-7·0
-7·5
-8·0
0
100
200
300
400
500
ANODE VOLTS.


DETECTOR CHARACTERISTICS
EACH DIODE.
HEATER VOLTS: 6·3
INPUT SIGNAL 30 VOLTS R.M.S.
LOAD RESISTANCE 27000 Ω
47000 Ω
0·1 MEG Ω
0·27 MEG Ω
0·47 MEG Ω
1·0 MEG Ω
2·7 MEG Ω
D.C. OUTPUT CURRENT (μA)
800
600
400
200
-50
-40
-30
-20
-10
0
D.C. OUTPUT (VOLTS)

R0558

FERRANTI

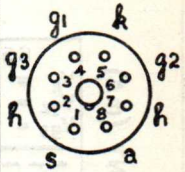
R.F. PENTODE

6SJ7GT

An indirectly heated, single ended R.F. Pentode designed for use in High-gain Amplifiers or as Anode Bend Detector in AC. or AC./DC. equipments. The internal screening, connected to the cathode, will provide sufficient shielding except in the case of very high gain circuits.

PHYSICAL DETAILS.

Base	International Octal. (Small Wafer-Metal Sleeve).
Max. Overall Length	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Base)	34 mm. ($1\frac{5}{16}$in.).
Max. Base Sleeve Diameter ...	32 mm. ($1\frac{1}{4}$in.).
Mounting Position	Any.



Base Connections

Underside View of Base

BASE CONNECTIONS.

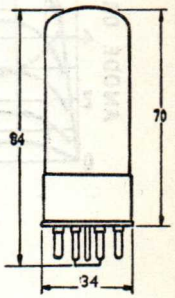
Pin 1—Base Sleeve.
Pin 2—Heater.
Pin 3—Suppressor Grid (g_3).
Pin 4—Control Grid (g_1).
Pin 5—Cathode.
Pin 6—Screen Grid (g_2).
Pin 7—Heater.
Pin 8—Anode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. Anode Voltage	300 volts.
Max. Screen Voltage	125 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Screen Dissipation ...	0·7 watt.
Max. Heater-Cathode Voltage ...	100 volts DC.
Min. Grid Voltage	0 volt.
Max. R_{g_1-k}	1 MΩ



TYPICAL OPERATION.

CLASS AI AMPLIFIER.

Pentode Connection.

Anode Voltage	100	250	volts.
Screen Voltage	100	100	volts.
Suppressor Grid	Connect to Cathode.		
Grid Voltage	−3	−3	volts.
Auto Bias Resistor	790	790	ohms.
Anode Current	2·9	3·0	mA.
Screen Current	0·9	0·8	mA.
Mutual Conductance	1·575	1·65	mA/V.
Anode Impedance	0·7	>1·0	MΩ
Grid Volts for Cut-off	−8	−8	volts.

Triode Connection†

Anode Voltage	180	250	volts.
Grid Voltage	−6	−8·5	volts.
Auto Bias Resistor	1000	925	ohms.
Anode Current	6·0	9·2	mA.
Mutual Conductance	2·3	2·5	mA/V.
Anode Impedance	8250	7600	ohms.

CAPACITANCES.

	Pentode Connection	Triode Connection
C_{a-g}	0·005 max.	2·8 pF.
C_{in}	7	3·4 pF.
C_{out}	7	11·0 pF.

All dimensions shown are in millimetres (max.).

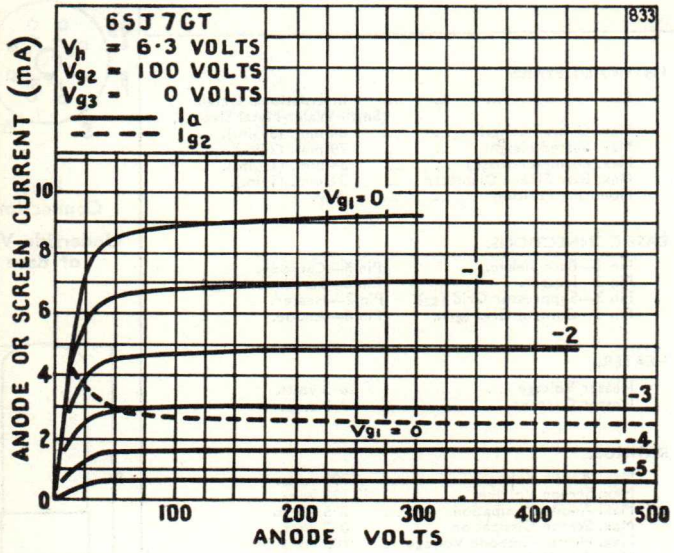
†g_2 and g_3 connected to anode.

Issue 3
Oct.,1952

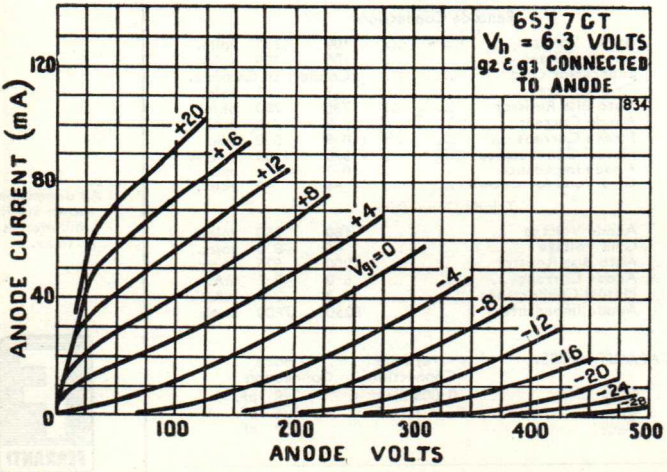
6SJ7GT

FERRANTI

PENTODE CONNECTION



TRIODE CONNECTION

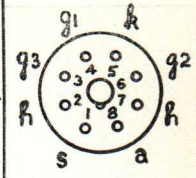


FERRANTI

VARIABLE-MU R.F. PENTODE

6SK7GT

An indirectly heated, single ended, variable-mu R.F. Pentode designed for use in the I.F. or R.F. stages of radio receivers. The internal screening, connected to the cathode, will provide sufficient shielding except in the case of very high gain circuits.



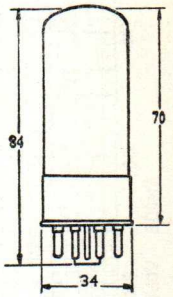
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal. (Small Wafer-metal Sleeve.)
Max. Overall Length	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Base)	34 mm. ($1\frac{5}{16}$in.).
Max. Base Sleeve Diameter ...	34 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Base Sleeve.	Pin 5—Cathode.
Pin 2—Heater.	Pin 6—Screen Grid.
Pin 3—Suppressor Grid.	Pin 7—Heater.
Pin 4—Control Grid.	Pin 8—Anode.



HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. Anode Voltage	300 volts.
Max. Screen Voltage	125 volts.
Max. Anode Dissipation ...	4·0 watts.
Max. Screen Dissipation ...	0·4 watts.
Max. Heater-Cathode Voltage ...	100 volts DC.
Min. Grid Voltage	0 volts.

TYPICAL OPERATION.

Anode Voltage	100	250	volts.
Screen Voltage	100	100	volts.
Suppressor Grid ...	Connect to Cathode.		
Grid Voltage	−1	−3	volts.
Auto Bias Resistor ...	60	260	ohms.
Anode Current	13·0	9·2	mA.
Screen Current	4·0	2·6	mA.
Mutual Conductance ...	2·35	2·0	mA/V.
Anode Impedance ...	0·12	0·8	MΩ (approx.).
Grid Volts for Cut-off ...	−35	−35	volts.

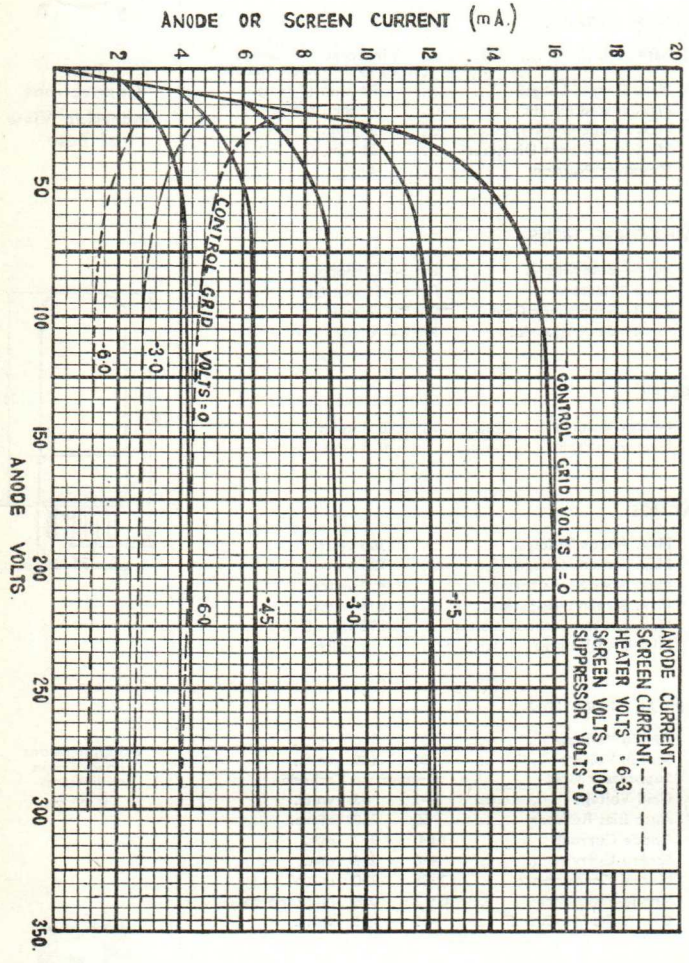
All Dimensions shown are in millimetres (Max.).

CAPACITANCES.

C_{in}	6·5 pF.
C_{out}	7·5 pF.
C_{a-g}	0·005 pF.

Issue 3
Oct., 1952

6SK7GT


ANODE OR SCREEN CURRENT (mA.)
2
4
6
8
10
12
14
16
18
20
50
100
150
200
250
300
350
ANODE VOLTS.
CONTROL GRID VOLTS = 0
-1·5
-3·0
-4·5
-6·0
CONTROL GRID VOLTS = 0
-6·0
-3·0
ANODE CURRENT
SCREEN CURRENT
HEATER VOLTS = 6·3
SCREEN VOLTS = 100.
SUPPRESSOR VOLTS = 0

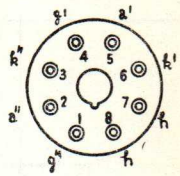
R0558

FERRANTI

HIGH IMPEDANCE DOUBLE TRIODE

6SL7GT

An indirectly heated double triode valve designed for use as an amplifier or phase inverter. Except for the common heater each triode unit is independent of the other.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Bulb	Clear.
Max. Overall Length	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Base)	33 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

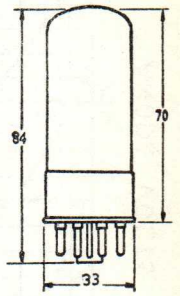
Pin 1—Grid Triode 2.	Pin 5—Anode Triode 1.
Pin 2—Anode Triode 2.	Pin 6—Cathode Triode 1.
Pin 3—Cathode Triode 2.	Pin 7—Heater.
Pin 4—Grid Triode 1.	Pin 8—Heater.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS*

Max. Anode Voltage	250 volts.
Max. Anode Dissipation	1 watt.
Min. Grid Voltage	0 volt.
Max. V_{h-k}	100 volts.



TYPICAL OPERATION*

Class AI Amplifier.

Anode Voltage	250 volts.
Grid Voltage	−2 volts.
Anode Current	2·3 mA.
Amplification Factor	70
Anode Impedance	44000 ohms.
Mutual Conductance	1·6 mA/V.

Resistance Coupled Amplifier.

Anode Supply Voltage	100	250	volts.
Anode Load Resistor	0·25	0·25	MΩ
Auto Bias Resistor	4700	3300	ohms.
Peak Output	21	62	volts.
Stage Gain	23	50	

CAPACITANCES†

	Triode 1		Triode 2	
C_{in}	2·15		2·15	pF.
C_{out}	0·9		0·9	pF.
C_{a-g}	3·4		3·5	pF.
$C_{a'-a''}$		1·4		pF.
$C_{g'-g''}$		0·25		pF.
$C_{g'-a''}$		0·45		pF.
$C_{g''-a'}$		0·35		pF.

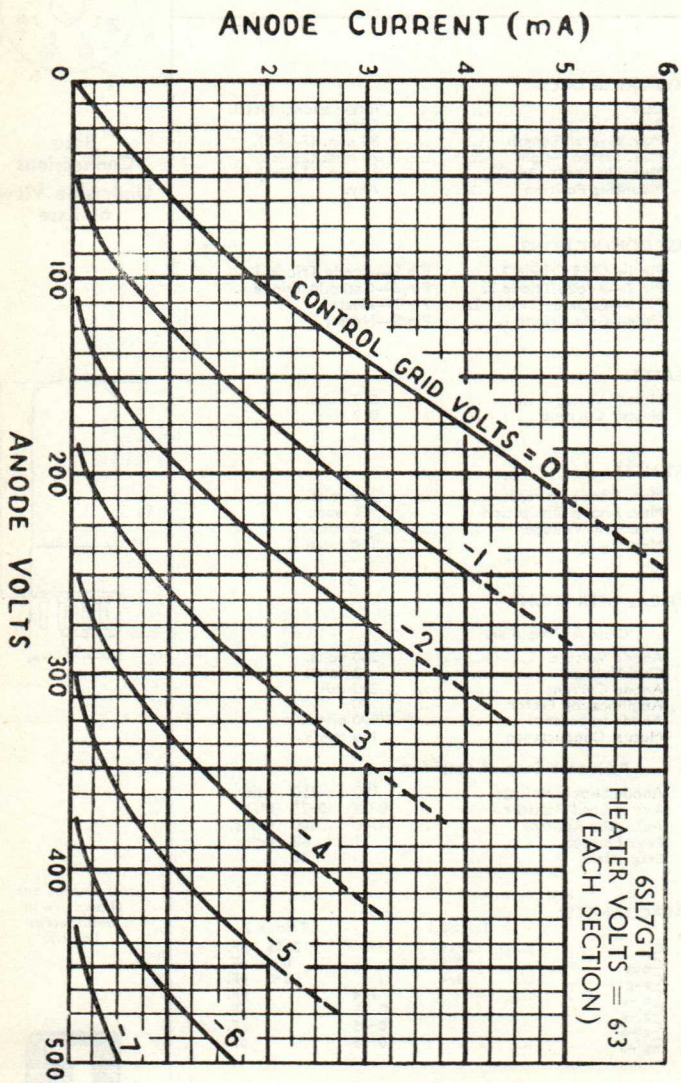
All dimensions shown are in millimetres (max.).

*Each Section.

†Without external shield.

Issue 2
Dec., 1955

6SL7GT


ANODE CURRENT (mA)
0
1
2
3
4
5
6
ANODE VOLTS
100
200
300
400
500
CONTROL GRID VOLTS = 0
-1
-2
-3
-4
-5
-6
-7
6SL7GT
HEATER VOLTS = 6·3
(EACH SECTION)

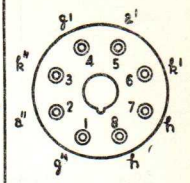
R0359

FERRANTI

LOW IMPEDANCE DOUBLE TRIODE

6SN7GT

Type 6SN7GT is an indirectly heated double triode in which the electrical characteristics of each triode unit are identical to those of type 6J5GT. It is suitable for use as a phase invertor, oscillator or resistance coupled amplifier, and as the two triode units are independent of each other, except for a common heater, they may be connected in cascade.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	International Octal.
Max. Overall Length	... ...	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	... ...	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (base)	... ...	33 mm. ($1\frac{5}{16}$in.).
Mounting Position	... ...	Any.

BASE CONNECTION.

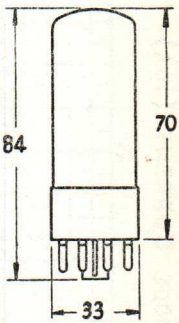
Pin 1—Grid Triode 2.	Pin 5—Anode Triode 1.
Pin 2—Anode Triode 2.	Pin 6—Cathode Triode 1.
Pin 3—Cathode Triode 2.	Pin 7—Heater.
Pin 4—Grid Triode 1.	Pin 8—Heater.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·6 amp.

RATINGS.

Max. Anode Voltage	300 volts.
Max. Anode Dissipation (each anode)	2·5 watts.
Max. Cathode Current ...	20 mA.
Max. Heater-Cathode Voltage ...	100 volts.



TYPICAL OPERATION.

Class A_1 Amplifier*

Anode Voltage	100	250	volts.
Anode Current	10·5	9·0	mA.
Grid Voltage	0	–8	volts.
Auto Bias Resistor ...	—	1100	ohms.
Mutual Conductance ...	2·5	2·6	mA/V.
Anode Impedance ...	8000	7700	ohms.
Amplification Factor ...	20	20	

Resistance Coupled Amplifier*

Anode Supply Voltage	100	200	300	volts.
Anode Load Resistor	50	100	250	kΩ
Auto Bias Resistor	2500	3300	6000	ohms.
Peak Output Voltage	17	38	57	volts.
Voltage Gain ...	13	14	14	volts.

CAPACITANCES†

	Triode 1.		Triode 2.	
C_{in}	2·6		2·6	pF.
C_{out}	0·8		0·8	pF.
C_{a-g}	4·0		4·1	pF.
$C_{a'-a''}$		0·5		pF.
$C_{g'-g''}$		0·1		pF.
$C_{g'-a''} = C_{g''-a'}$ ...		0·2		pF.

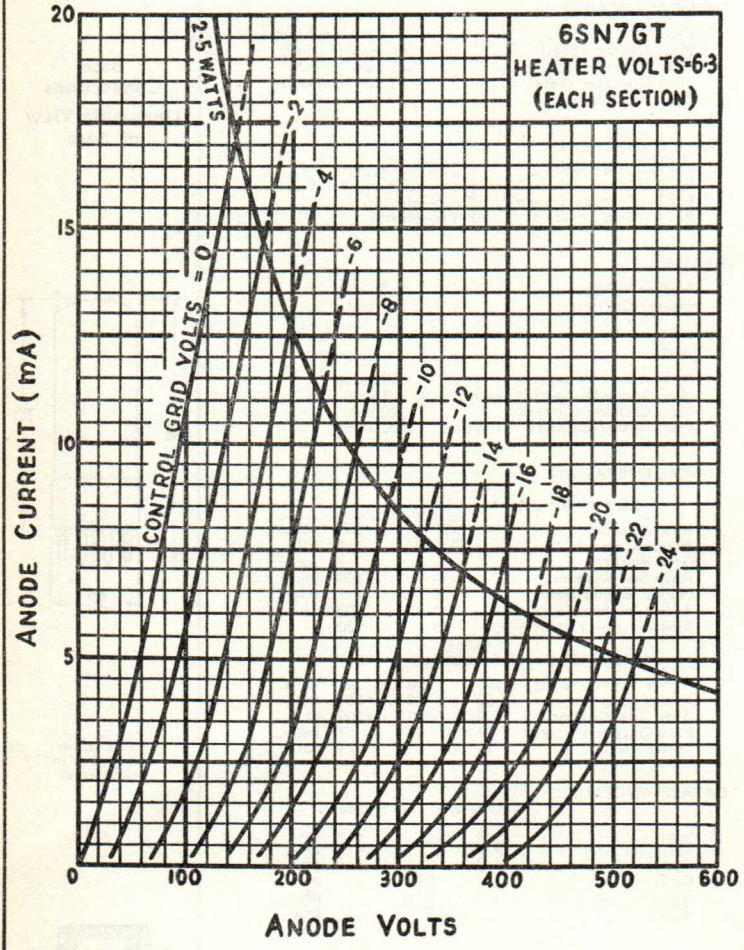
Dimensions shown are in millimetres (max.).

*Each section.

†Without external shield.

Issue 1.
Feb., 1954

6SN7GT

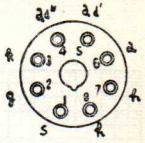

6SN7GT
HEATER VOLTS-6·3
(EACH SECTION)
2·5 WATTS
CONTROL GRID VOLTS = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
ANODE CURRENT (mA)
20
15
10
5
0
100
200
300
400
500
600
ANODE VOLTS

FERRANTI

DOUBLE DIODE TRIODE

6SQ7GT

An indirectly heated double diode triode of single ended construction, designed for use as a detector, A.V.C. and A.F. amplifier in radio receivers.



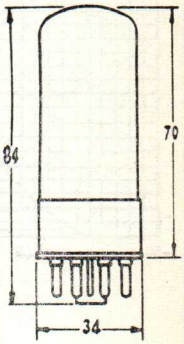
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	International Octal. (Small Wafer-metal Sleeve).
Max. Overall Length	... ...	84 mm. (3⅜in.).
Max. Seated Height	... ...	70 mm. (2¾in.).
Max. Diameter	... ...	34 mm. (1⅜in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Base Sleeve.	Pin 5—Diode Anode 1.
Pin 2—Triode Grid.	Pin 6—Triode Anode.
Pin 3—Cathode.	Pin 7—Heater.
Pin 4—Diode Anode 2.	Pin 8—Heater.



HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. Anode Voltage (Triode)	300 volts.
Max. Diode Voltage (each Diode)	200 volts.
Max. Diode Current (each Diode)	1·0 mA.
Max. V_{h-k}	100 volts DC.
Min. Grid Voltage	0 volts.

TYPICAL OPERATION.

TRIODE SECTION.

Class A1 amplifier.

Anode Voltage	100	250	volts.
Grid Voltage	−1	−2	volts.
Anode Current	0·4	0·9	mA.
Mutual Conductance ...	0·9	1·1	mA/V.
Anode Impedance ...	110,000	91,000	ohms.
Amplification Factor ...	100	100	

Resistance Coupled Amplifier.

Anode Voltage	100	250	volts.
Anode Load Resistor ...	0·25	0·47	MΩ
Grid Resistor	1·0	1·0	MΩ
Auto Bias Resistor ...	6,800	4,700	ohms.
Peak Output Voltage ...	8	36	volts.
Stage Gain	48	67	
Total Harmonic Distortion	4·5	4	%

DIODE SECTION.

Refer to curves overleaf.

CAPACITANCES.

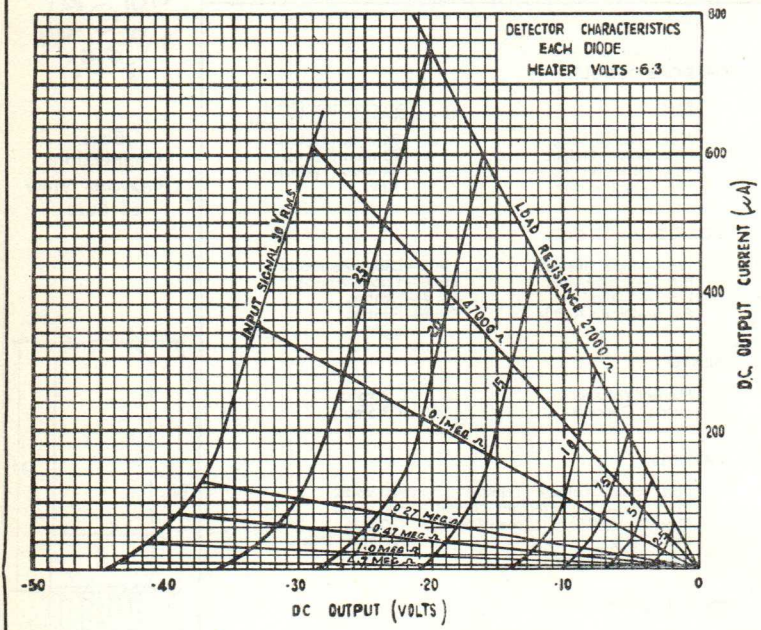
C_{in}	3·0 pF.
C_{out}	2·4 pF.
$C_{a_t-g_t}$	1·6 pF.
$C_{a_d'-g_t}$	0·01 pF.
$C_{a_d''-g_t}$	0·04 pF.

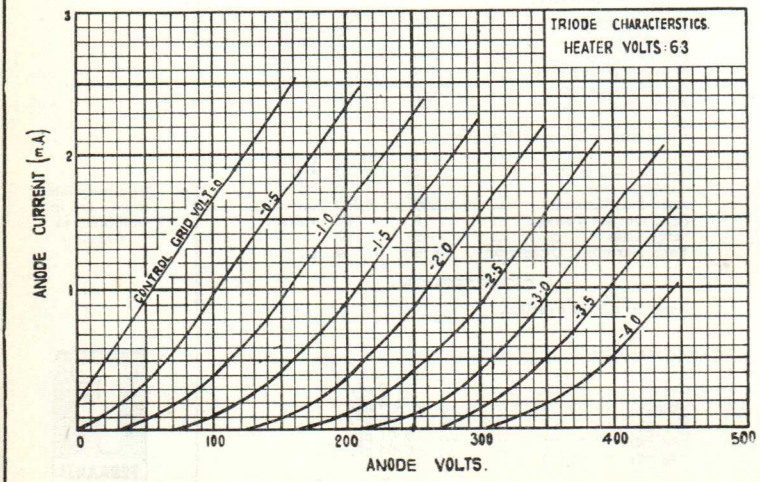
All dimensions shown are in millimetres (max.)

Issue 3
Oct., 1952

6SQ7GT

FERRANTI





FERRANTI

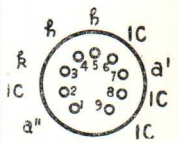
FULL WAVE RECTIFIER

6V4

An indirectly heated, full wave rectifier.

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Bulb	... ...	Clear.
Max. Overall Length	... ...	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	... ...	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.



Base Connections

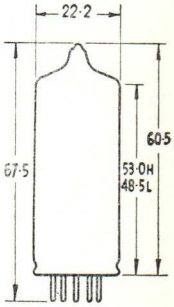
Underside View of Base

BASE CONNECTIONS.

Pin 1—Anode 2.
Pin 2—Internal Connection.
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Internal Connection.
Pin 7—Anode 1.
Pin 8—Internal Connection.
Pin 9—Internal Connection.

HEATER.

Heater Voltage	... ...	6·3 volts.
Heater Current	... ...	0·3 amps.



RATINGS.

Max. Peak Inverse Voltage	...	980 volts.
*Max. R.M.S. Anode Voltage	...	350 volts.
Max. Rectified Current	...	90 mA.
*Max. Peak Anode Current	...	270 mA.
*Min. Limiting Resistance	...	125 ohms.
Max. Reservoir Capacitor	...	50 μF.
Max. Peak V_{h-k}	... ...	500 volts.

TYPICAL OPERATING CONDITIONS.

CAPACITOR INPUT.

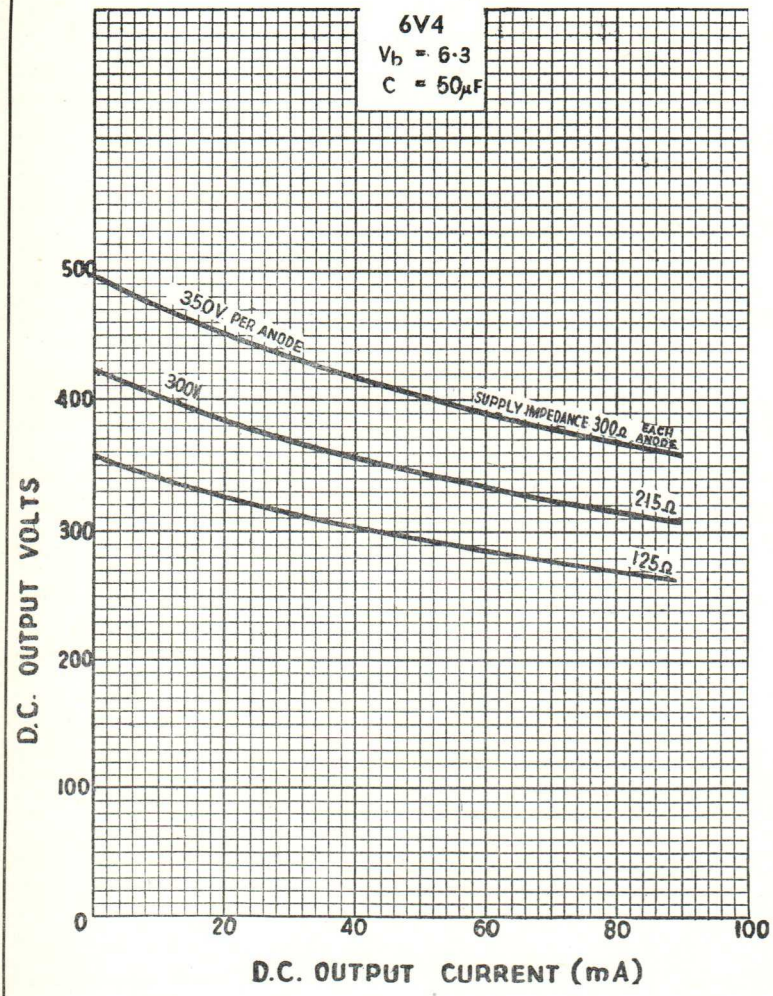
*R.M.S. Input Voltage	250	275	300	350	volts.
Rectified Current	90	90	90	90	mA.
*Min. Supply Impedance	125	175	215	300	ohms.
Max. Reservoir Capacitor	50	50	50	50	μF.
DC. Output Voltage	265	285	310	360	volts.

All dimensions shown are in millimetres.

*Each Anode.

FERRANTI

Issue 2 (Tentative) Dec., 1957


6V4
Vb = 6·3
C = 50μF
350V PER ANODE
300V
SUPPLY IMPEDANCE 300Ω EACH ANODE
215Ω
125Ω
500
400
300
200
100
0
20
40
60
80
100
D.C. OUTPUT VOLTS
D.C. OUTPUT CURRENT (mA)

R0559

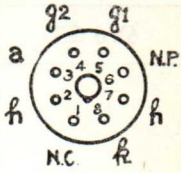
FERRANTI

OUTPUT BEAM TETRODES

Indirectly heated beam tetrodes designed for use in the output stages of radio receivers and audio amplifiers.

6V6 G

6V6 GT



Base Connections Underside View of Base

PHYSICAL DETAILS.

	6V6G.	6V6GT.
Base	International Octal.	International Octal.
Max. Overall Length	119 mm. (4$\frac{11}{16}$in.).	84 mm. (3$\frac{5}{16}$in.).
Max. Seated Height	104 mm. (4$\frac{3}{32}$in.).	70 mm. (2$\frac{3}{4}$in.).
Max. Diameter (Bulb)	45 mm. (1$\frac{25}{32}$in.).	33 mm. (1$\frac{5}{16}$in.).
Mounting Position	Any.	Any.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Heater.
Pin 3—Anode.
Pin 4—Screen Grid.
Pin 5—Control Grid.
Pin 6—No Pin.
Pin 7—Heater.
Pin 8—Cathode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·45 amp.

RATINGS.

Max. Anode Voltage	315 volts.
Max. Screen Voltage	285 volts.
Max. Anode Dissipation	12 watts.
Max. Screen Dissipation	2 watts.
Max. Heater-Cathode Voltage	100 volts DC.

TYPICAL OPERATING CONDITIONS.

Single Valve Class A_1 Amplifier.

Anode Voltage	180	250	315 volts.
Screen Voltage	180	250	225 volts.
Control Grid Voltage	−8·5	−12·5	−13 volts.
Peak AF. Input Voltage	8·5	12·5	13 volts.
Anode Current (Zero Signal)	29	45	34 mA.
Anode Current (Max. Signal)	30	47	35 mA.
Screen Current (Zero Signal)	3	4·5	2·2 mA.
Screen Current (Max. Signal)	4	7	6 mA.
Anode Impedance (approx.)	50	50	80 kΩ
Mutual Conductance	3·7	4·1	3·75 mA/V.
Cathode Bias Resistor	270	250	360 ohms.
Anode Load	5·5	5·0	8·5 kΩ
Power Output	2·0	4·5	5·5 watts.
Total Harmonic Distortion	8	8	12 %

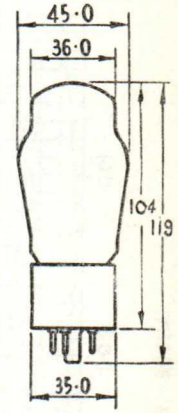
2 Valves Push Pull Class AB_1 Amplifier.

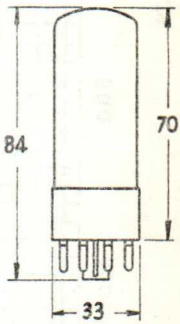
Anode Voltage	250	285 volts.
Screen Voltage	250	285 volts.
Control Grid Voltage	−15	−19 volts.
Peak AF. Input Voltage		
Grid to Grid	30	38 volts.
Anode Current (Zero Signal)	70	70 mA.
Anode Current (Max. Signal)	79	92 mA.
Screen Current (Zero Signal)	5	4 mA.
Screen Current (Max. Signal)	13	13·5 mA.
Anode Impedance (approx.)	60	70 kΩ
Mutual Conductance	3·7	3·6 mA/V.
Optimum Load Resistance		
Anode to Anode	10	8 kΩ
Power Output (Max.)	10	14 watts.
Total Harmonic Distortion	5	3·5 %

CAPACITANCES (approx.)*

	6V6G	6V6GT
C_{in}	10·0	9·5 pF.
C_{out}	8·0	9·1 pF.
C_{a-g}	1·0	1·0 pF.
C_{h-k}	6·0	6·0 pF.

*Measured without external shield.





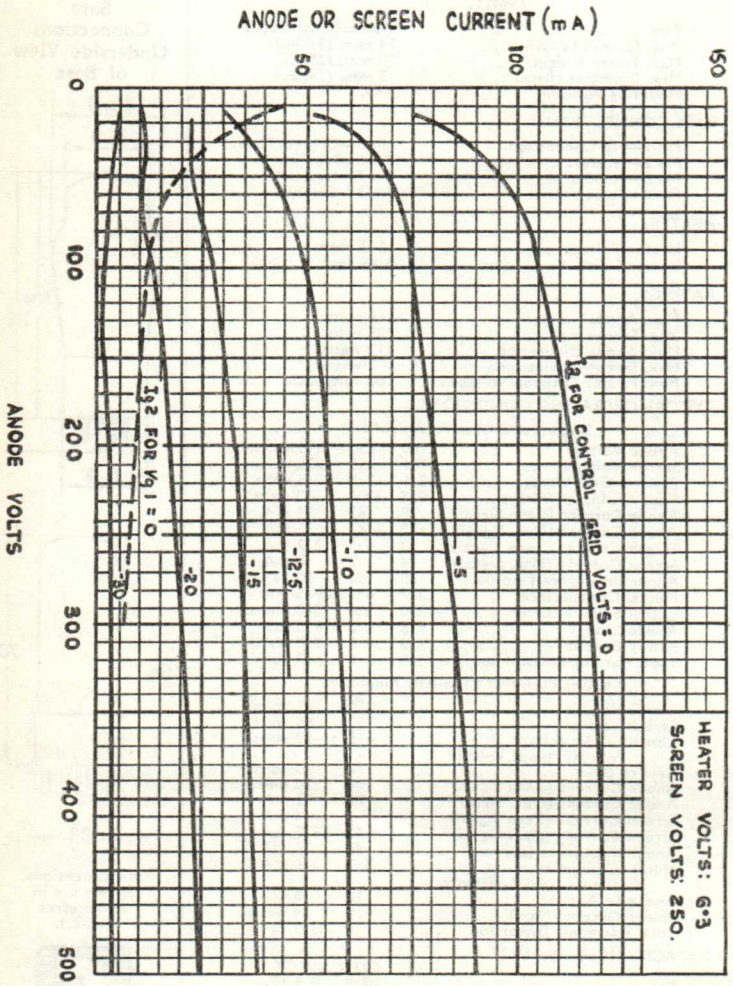
All dimensions shown are in millimetres (max.).

FERRANTI

Issue 5
Dec., 1955

6V6 G

6V6 GT

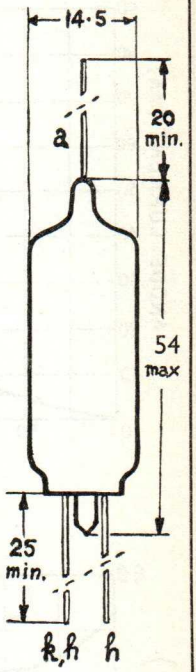

ANODE OR SCREEN CURRENT (mA)
0
50
100
150
ANODE VOLTS
0
100
200
300
400
500
Ig2 FOR Vg1 = 0
Ig FOR CONTROL GRID VOLTS = 0
-5
-10
-12·5
-15
-20
-30
HEATER VOLTS: 6·3
SCREEN VOLTS: 250.

FERRANTI

HIGH VOLTAGE RECTIFIER

6X2

An indirectly heated miniature high voltage, half wave rectifier, designed for providing the E.H.T. supply in Television Receivers. The low heater wattage makes it particularly suitable for operation from line time base fly-back pulses, and the flexible leads facilitate mounting on or near the line output transformer.



All Dimensions shown are in millimetres.

PHYSICAL DETAILS.

Base	Flexible leads.
Max. Overall Length (excl. leads)	54 mm. (2⅛in.)
Max. Diameter	14·5 mm. (⅝in.)
*Mounting Position	Any.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·09 amp.
Heater Voltage Tolerance	
For I_{out} <200 μA ...	±15%
For I_{out} =500 μA ...	± 7%

RATINGS.

1. Sinusoidal Input (50 c/s.)	
Max. r.m.s. Input Voltage	5·0 kV.
Max. Rectified Current ...	3·0 mA.
Max. Reservoir Capacitor	0·1 μF.
Min. Supply Impedance ...	100 kΩ
2. Sinusoidal Input (10 kc/s. to 500 kc/s.).	
Max. P.I.V.	17 kV.
Max. Rectified Current ...	3·0 mA.
Max. Reservoir Capacitor	0·01 μF.
3. Pulse Input	
Max. P.I.V.	17 kV.
Max. Rectified Current ...	350 μA.
†Max. Peak Cathode Current	80 mA.
Max. Reservoir Capacitor	5000 pF.

CAPACITANCE.

C_{a-k}	0·8 pF.

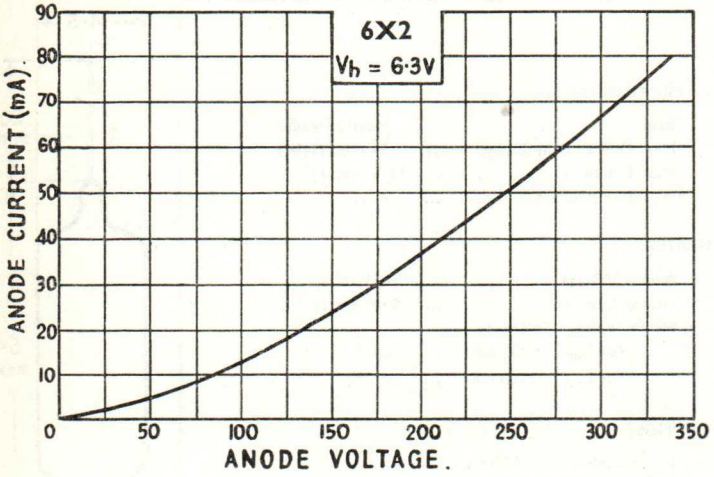
*Connections should not be soldered to the leads at any point less than 10 mm. from the seal, nor should the leads be bent near to the seal.

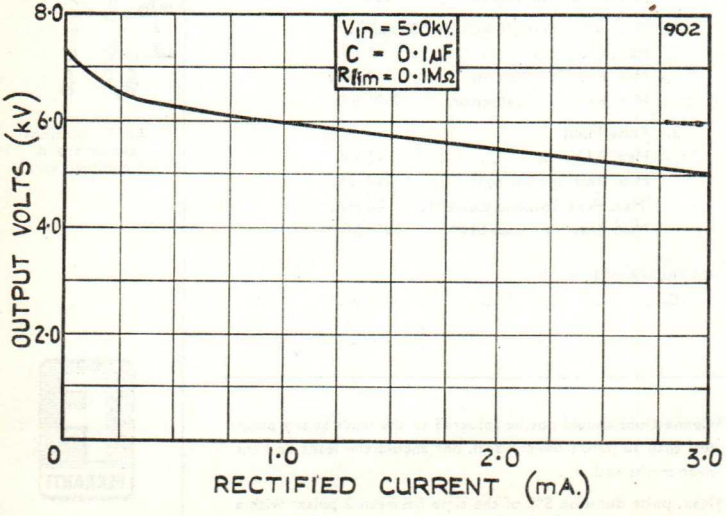
†Max. pulse duration 5% of the time between 2 pulses with a maximum duration of 5 μsecs.

Issue 2
Mar., 1959

FERRANTI

TYPICAL CHARACTERISTICS



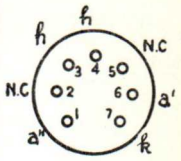


FERRANTI

FULL WAVE RECTIFIER

6X4

A miniature indirectly heated, full wave rectifier.



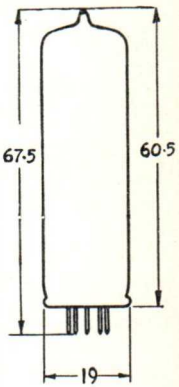
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Bulb	Clear.
Max. Overall Length	67·5 mm. (2$\frac{3}{32}$in.).
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	19·0 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode 2. Pin 4—Heater.
Pin 2—No Connection. Pin 5—No Connection.
Pin 3—Heater. Pin 6—Anode 1.
Pin 7—Cathode.



HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·6 amp.

RATINGS.

Max. Peak Inverse Voltage ...	1250 volts.
Max. Rectified Current ...	70 mA.
Max. Peak Anode Current ...	210 mA.*
Max. Reservoir Capacitor ...	16 μF.
*Min. Supply Impedance	250 ohms.
Max. V_{h-k} (pk)	450 volts.

TYPICAL OPERATION.

CAPACITOR INPUT.

*Input Voltage	325 volts (r.m.s.).
Rectified Current	70 mA.
*Supply Impedance	520 ohms.
Reservoir Capacitor	8 μF.
DC. Output Voltage	300 volts.

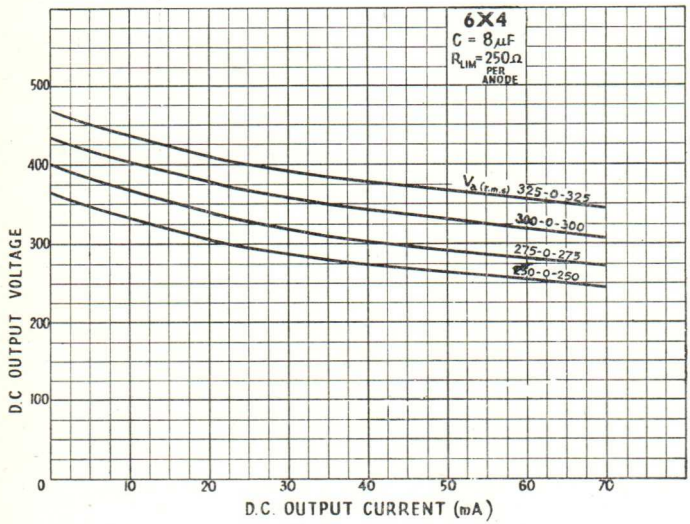
CHOKE INPUT.

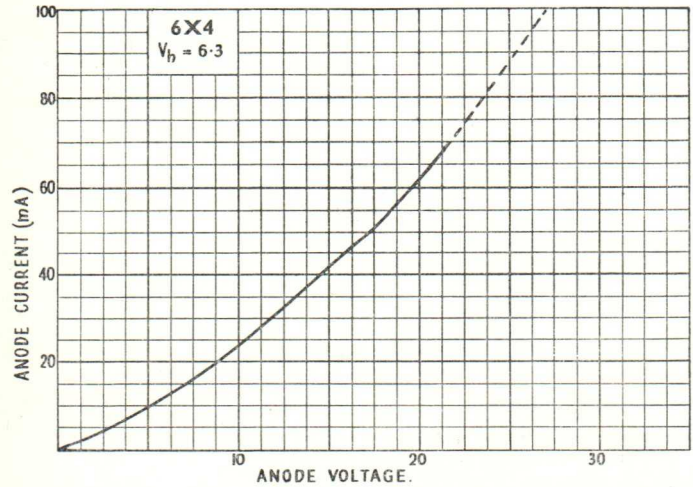
*Input Voltage	450 volts (r.m.s.).
Min. Choke Inductance	10 henries.
Rectified Current	70 mA.
Output Voltage	370 volts.

All dimensions shown are in millimetres (max.).

*Each Anode.

Issue 2
Dec.,1957


6X4
C = 8 μF
R_LIM = 250Ω PER ANODE
V_a(r.m.s) 325-0-325
300-0-300
275-0-275
250-0-250
D.C. OUTPUT VOLTAGE
D.C. OUTPUT CURRENT (mA)
0
100
200
300
400
500
10
20
30
40
50
60
70

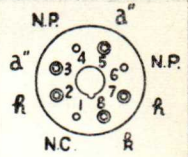

6X4
V_h = 6·3
ANODE CURRENT (mA)
ANODE VOLTAGE.
20
40
60
80
100
10
20
30

FERRANTI

FULL WAVE RECTIFIER

6X5GT

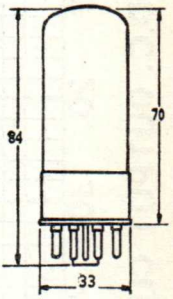
An indirectly heated, high vacuum, full wave rectifier. The cathode is connected to a separate pin.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Bulb	Clear.
Max. Overall Length	84 mm. ($3\frac{5}{16}$in.).
Max. Diameter (Base)	33 mm. ($1\frac{5}{16}$in.).
Max. Seated Height	70 mm. ($2\frac{3}{4}$in.).
Mounting Position	Any.



BASE CONNECTIONS.

Pin 1—No Connection.	Pin 5—Anode 1.
Pin 2—Heater.	Pin 6—No Pin.
Pin 3—Anode 2.	Pin 7—Heater.
Pin 4—No Pin.	Pin 8—Cathode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·6 amp.

RATINGS.

Max. Peak Inverse Voltage ...	1250 volts.
*Max. Peak Anode Current ...	210 mA.
*Max. R.M.S. Anode Voltage ...	325 volts.
Max. Rectified Current ...	70 mA.
*Min. Limiting Resistance ...	150 ohms.
Max. V_{h-k}	450 volts.

All Dimensions shown are in millimetres (max.).

TYPICAL OPERATION.

CONDENSER INPUT.

*R.M.S. Input Voltage	325 volts.
Rectified Current	70 mA.
*Min. Supply Impedance	150 ohms.
Max. Reservoir Condenser ...	32 μF.

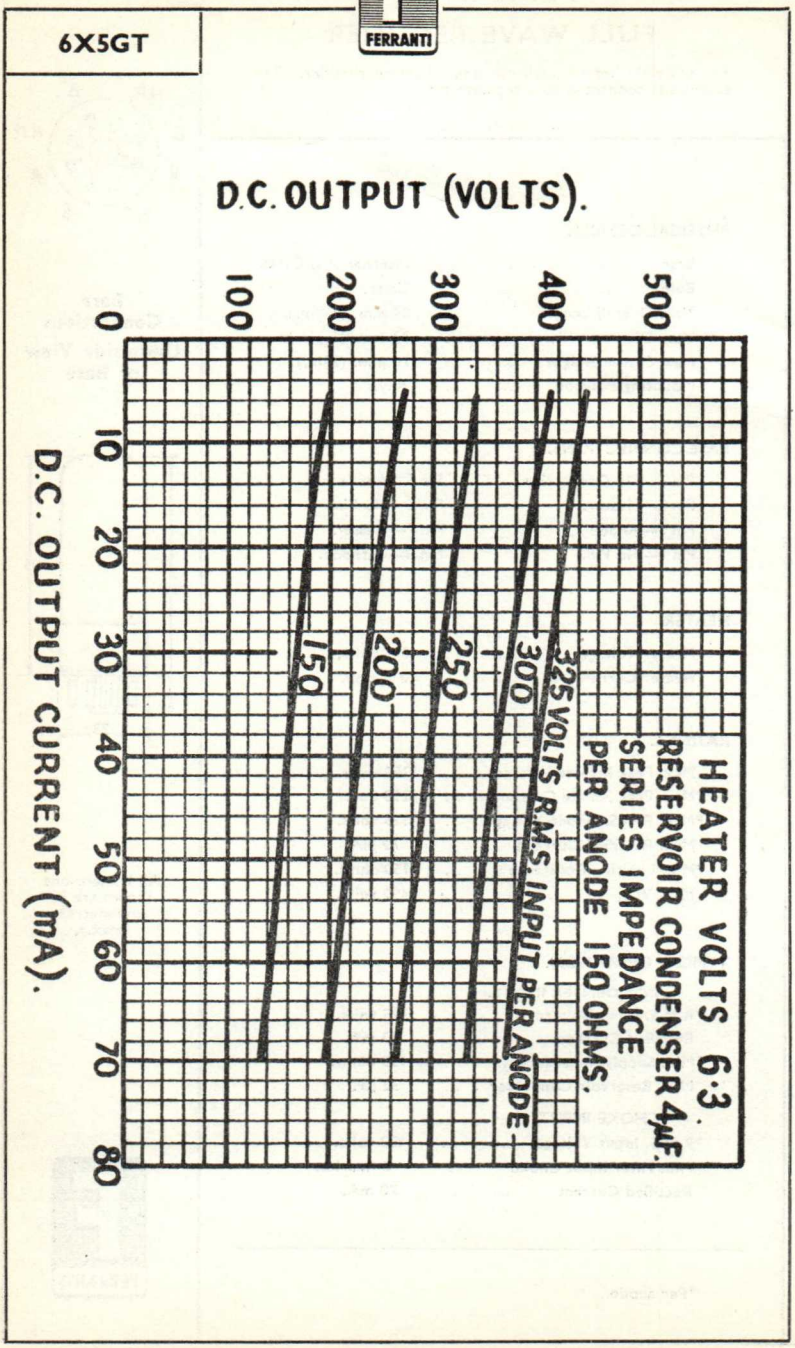
CHOKE INPUT.

*R.M.S. Input Voltage	450 volts.
Min. Filter Input Choke ...	8 henries.
Rectified Current	70 mA.

*Per anode.

Issue 2
Sept., 1953

6X5GT

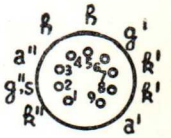

D.C. OUTPUT (VOLTS).
0
100
200
300
400
500
HEATER VOLTS 6·3.
RESERVOIR CONDENSER 4μF.
SERIES IMPEDANCE
PER ANODE 150 OHMS.
325 VOLTS R.M.S. INPUT PER ANODE
300
250
200
150
0
10
20
30
40
50
60
70
80
D.C. OUTPUT CURRENT (mA).

FERRANTI

DOUBLE TRIODE

7AN7

A double triode with separate cathodes, primarily designed for use as a cascode R.F. Amplifier in Television Receivers. Suitable for operation at frequencies up to 220 Mc/s.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode Triode 2.	Pin 5—Heater.
Pin 2—Grid Triode 2, Shield.	Pin 6—Grid Triode 1.
	Pin 7—Cathode Triode 1 (in).
Pin 3—Anode Triode 2.	Pin 8—Cathode Triode 1 (out).
Pin 4—Heater.	Pin 9—Anode Triode 1.

The triode on Pins 6, 7, 8 and 9 should have grounded-cathode connection and that on pins 1, 2 and 3 should have grounded-grid connection.

HEATER.*

Heater Current	0·3 amp.
Heater Voltage	7·0 volts.

RATINGS.†

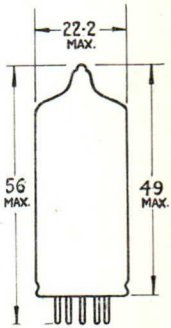
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	180 volts.
Max. Anode Dissipation ...	2 watts.
Max. Cathode Current ...	18 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. $V_{h-k'}$	90 volts.
Max. $V_{h-k''}$ (heater positive)	90 volts.
**Max. $V_{h-k''}$ (pk) (heater negative)	250 volts.
Max. $R_{g'-k'}$	1·0 MΩ
Max. $R_{g''-k''}$	0·5 MΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.†

Anode Voltage	90 volts.
Grid Voltage	−1·5 volts.
Anode Current	12 mA.
Amplification Factor	24
Mutual Conductance	6 mA/V.
§Input Impedance	2 kΩ

CAPACITANCES.‡

$C_{g'-k'}$	2·1 pF.
$C_{a'-k'}$	0·45 pF.
$C_{g'-h}$	<0·25 pF.
$C_{a'-g'}$	1·2 pF.
$C_{a''-g''}$	2·3 pF.
$C_{a''-k''}$	0·16 pF.
$C_{k''-g''+h}$	4·7 pF.
$C_{a''-g''+h}$	2·5 pF.
$C_{g'-a''}$	<0·006 pF.
$C_{a'-a''}$	<0·035 pF.
$C_{a'-k'+h+g''}$	1·2 pF.
$C_{h-k''}$	2·7 pF.



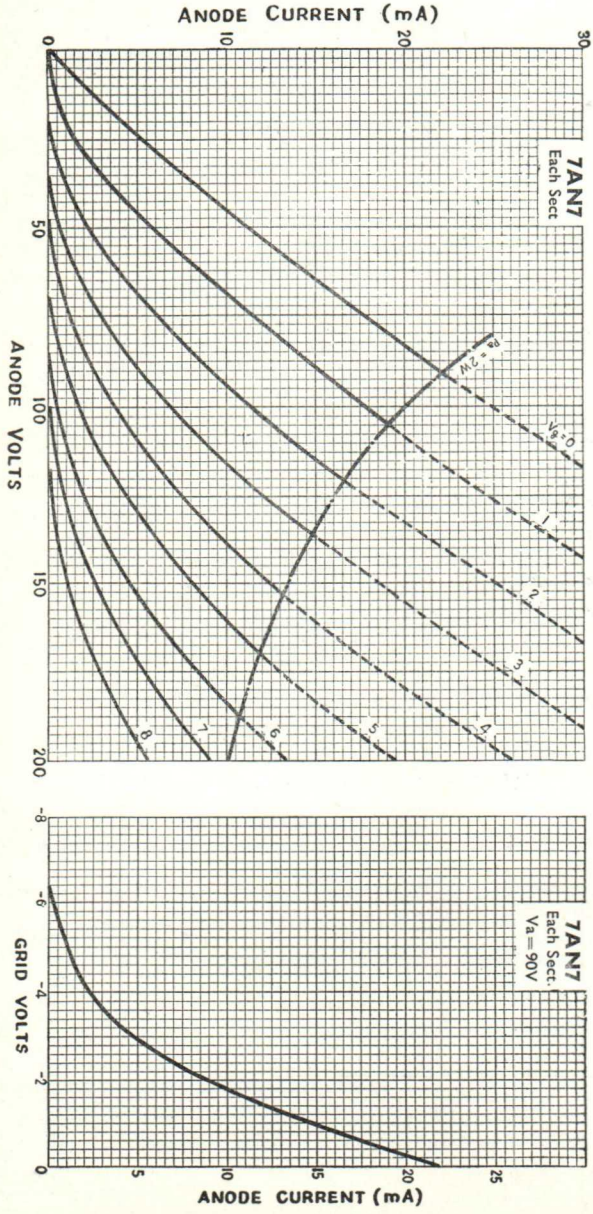
All dimensions shown are in millimetres (max.).

*Suitable for series operation only, a.c. or d.c.
†Each section, unless otherwise indicated.
‡Measured without external shield.
§Measured at a frequency of 200 Mc/s. with cathode connections pins 7 and 8 strapped.
**Max. d.c. component 180 volts.

Issue 2
Dec., 1957

7AN7

FERRANTI

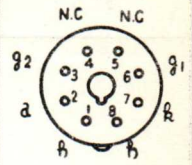


FERRANTI

BEAM TETRODE

7C5

An indirectly heated beam tetrode of all glass construction designed for use in the output stages of radio receivers and audio amplifiers.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B8G (Loctal).
Max. Overall Length	80 mm. ($3\frac{5}{32}$in.).
Max. Seated Height	67 mm. ($2\frac{5}{8}$in.).
Max. Diameter	30 mm. ($1\frac{3}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 5—No Connection.
Pin 2—Anode.	Pin 6—Control Grid.
Pin 3—Screen Grid.	Pin 7—Cathode.
Pin 4—No Connection.	Pin 8—Heater.

HEATER.

*Heater Voltage	6·3 volts.
†Heater Current	0·45 amp.

RATINGS.

Max. Anode Voltage	315 volts.
Max. Screen Voltage	285 volts.
Max. Anode Dissipation	12 watts.
Max. Screen Dissipation	2 watts.
Max. Heater-Cathode Voltage	100 volts DC.

TYPICAL OPERATION.

Single Valve Class A_1 Amplifier.

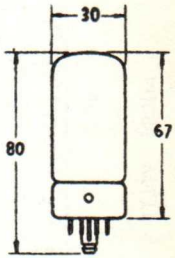
Anode Voltage	250	315	volts.
Screen Voltage	250	225	volts.
Control Grid Voltage	−12·5	−13	volts.
Anode Current (Zero Signal)	45	34	mA.
Anode Current (Max. Signal)	47	35	mA.
Screen Current (Zero Signal)	4·5	2·2	mA.
Screen Current (Max. Signal)	7·0	6·0	mA.
Anode Impedance (approx.)	52000	77000	ohms.
Mutual Conductance	4·1	3·75	mA/V.
Auto Bias Resistor	240	320	ohms.
Anode Load	5000	8500	ohms.
Power Output	4·5	5·5	watts.
Total Harmonic Distortion	6	12	%

Two Valves Push Pull Class AB_1 Amplifier.

Anode Voltage	250	285	volts.
Screen Voltage	250	285	volts.
Control Grid Voltage	−15	−19	volts.
Auto Bias Resistor	200	260	ohms.
Peak Input Voltage (Grid to Grid)	30	38	volts.
Anode Current (Zero Signal)	70	70	mA.
Anode Current (Max. Signal)	79	92	mA.
Screen Current (Zero Signal)	5	4	mA.
Screen Current (Max. Signal)	13	13·5	mA.
Anode Impedance	60000	65000	ohms.
Mutual Conductance	3·7	3·6	mA/V.
Optimum Load Resistance (Anode to Anode)	10000	8000	ohms.
Power Output	10	14	watts.
Total Harmonic Distortion	5	3·5	%

CAPACITANCES‡

C_{in}	8·5 pF.
C_{out}	7·5 pF.
C_{a-g}	0·45 pF.

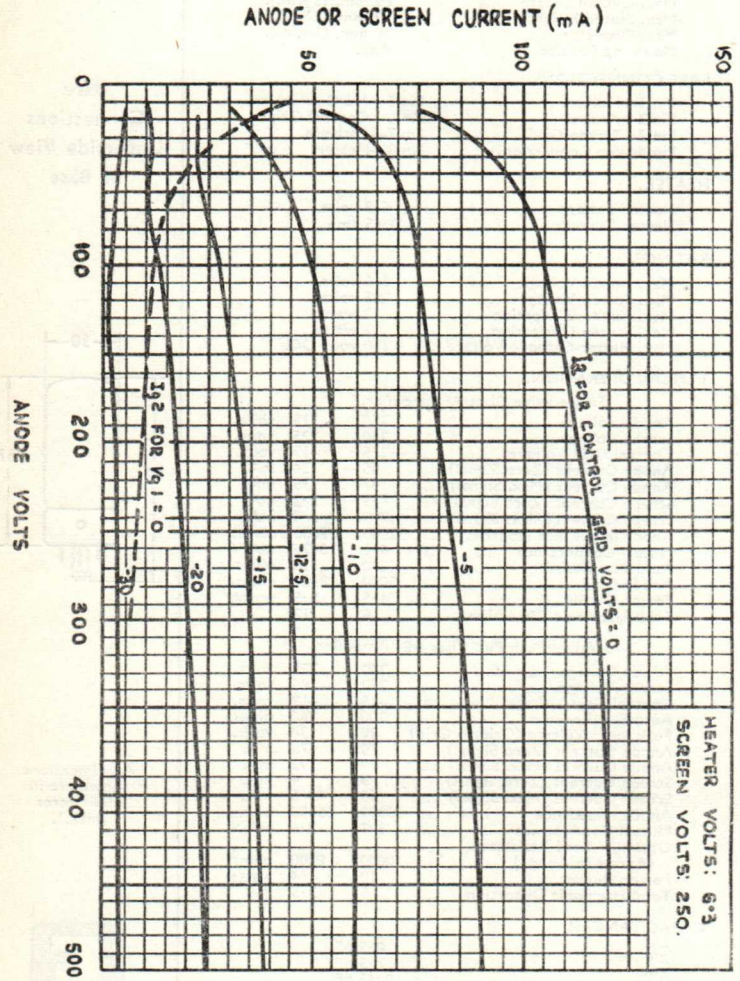


All dimensions shown are in millimetres (max.).

*The Nominal Heater Voltage is 7·0 volts.
†The Nominal Heater Current is 0·48 amp.
‡Measured without external shield.

Issue 1
Feb.,1954

7C5


ANODE OR SCREEN CURRENT (mA)
0
50
100
150
ANODE VOLTS
100
200
300
400
500
I_{g2} FOR V_{g1} = 0
I_{g2} FOR CONTROL GRID VOLTS = 0
-5
-10
-12·5
-15
-20
-30
HEATER VOLTS: 6·3
SCREEN VOLTS: 250.

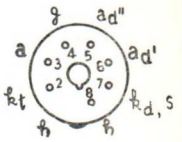
FERRANTI

DOUBLE DIODE TRIODE

Type 7K7 is an indirectly heated double diode triode with separate cathodes for the diode and triode sections.

PHYSICAL DETAILS.

Base	B8G (Loctal).
Bulb	Clear.
Max. Overall Length	71 mm. ($2\frac{53}{64}$in.).
Max. Seated Height	58 mm. ($2\frac{9}{32}$in.).
Max. Diameter	30 mm. ($1\frac{3}{16}$in.).
Mounting Position	Any.



Base Connections Underside View of Base

BASE CONNECTIONS.

Pin 1—Heater.	Pin 5—Diode Anode 2.
Pin 2—Triode Cathode.	Pin 6—Diode Anode 1.
Pin 3—Triode Anode.	Pin 7—Diode Cathode, screen
Pin 4—Triode Grid.	Pin 8—Heater.

HEATER.

*Heater Voltage	6·3 volts.
†Heater Current	0·3 amp.

RATINGS.

Max. Anode Voltage (Triode) ...	250 volts.
Max. Anode Dissipation ...	1 watt.
Max. Heater-Cathode Voltage	90 volts DC.
Min. Grid Voltage	0 volts.

TYPICAL OPERATING CONDITIONS.

TRIODE SECTION.

As Class A1 Amplifier.

Heater Voltage	6·3 volts.
Anode Voltage	250 volts.
Grid Voltage	−2·0 volts.
Anode Current	2·3 mA.
Mutual Conductance	1·6 mA/V.
Anode Impedance	44 kΩ
Amplification Factor	70

As Resistance Coupled Amplifier.

Heater Voltage ...	6·3	6·3 volts.
Anode Voltage ...	100	250 volts.
Anode Load Resistor	0·27	0·47 MΩ
Grid Resistor ...	0·47	1·0 MΩ
Auto Bias Resistor	5·6	5·6 kΩ
Peak Output Voltage	8·6	48·5 volts.
Stage Gain ...	41	54

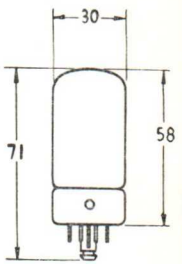
DIODE SECTION.

Refer to curves for type 6SQ7GT.

CAPACITANCES.

(With close fitting shield connected to Cathode).

C_{in}	2·4 pF.
C_{out}	2·0 pF.
C_{a-g}	1·7 pF.
$C_{g-a_{d'}}$, $C_{g-a_{d''}}$	0·25 pF. max.



All dimensions shown are in millimetres. (max.)

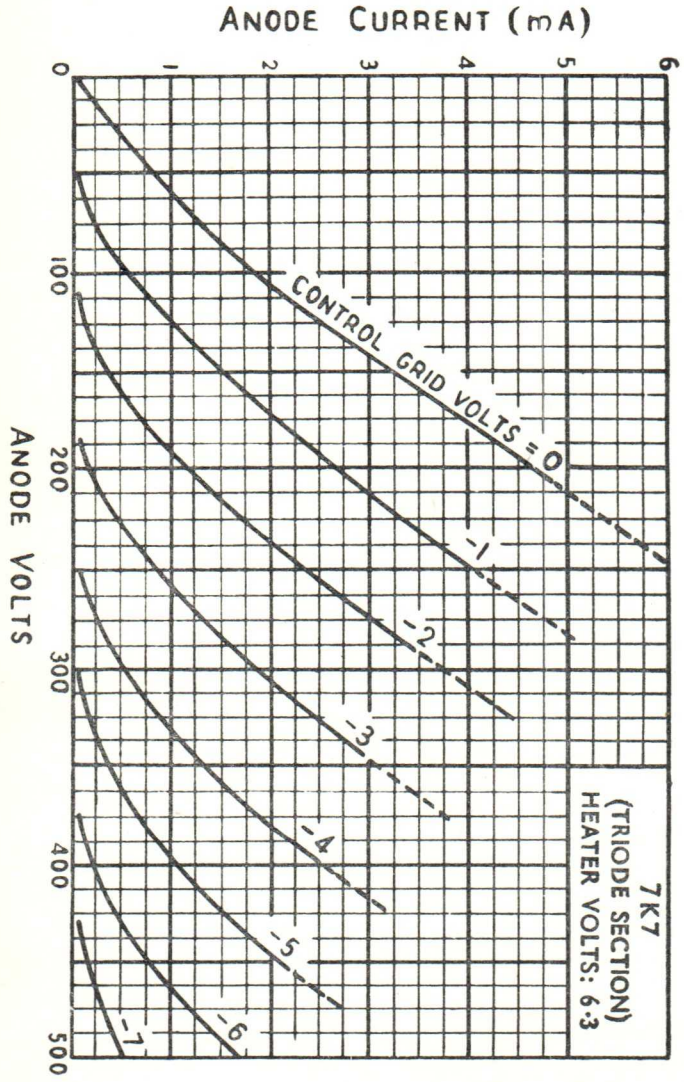
* The Nominal Heater Voltage is 7·0 volts.

† The Nominal Heater Current is 0·32 amps.

Issue 2. Jan., 1955

7K7

FERRANTI

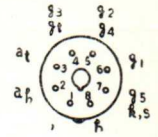


FERRANTI

TRIODE HEPTODE FREQUENCY CHANGER

7S7

An indirectly heated triode heptode of all glass construction designed for use as a frequency changer in radio receivers. The triode section serves as the oscillator, being internally coupled to the heptode, which serves as the tuner, this type of construction providing the minimum frequency drift.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

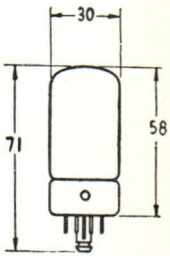
Base	B8G—Loctal.
Max. Overall Length	71 mm. ($2\frac{13}{16}$in.).
Max. Seated Height	58 mm. ($2\frac{5}{16}$in.).
Max. Diameter	30 mm. ($1\frac{3}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Heptode Anode.
Pin 3—Triode Anode.
Pin 4—Triode Grid, and Heptode Grid g_3.
Pin 5—Heptode Grids g_2 and g_4.
Pin 6—Heptode Grid g_1.
Pin 7—Cathode, Internal Shield. Heptode Grid g_5.
Pin 8—Heater.

HEATER.

*Heater Voltage	6·3 volts.
†Heater Current	0·3 amp.



RATINGS.

Max. Heptode Anode Voltage	300 volts.
‡Max. Heptode Screen Voltage ...	100 volts.
Max. Heptode Anode Dissipation	0·6 watt.
‡Max. Heptode Screen Dissipation	0·4 watt.
Max. Triode Anode Voltage ...	175 volts.
Max. Triode Anode Dissipation	1·0 watt.
Max. Total Cathode Current ...	14 mA.
Max. V_{h-k}	100 volts.

CHARACTERISTICS.

TRIODE SECTION.

Anode Voltage	100 volts.
Grid Voltage	0 volt.
Anode Current	6·5 mA.
Anode Impedance	11 kΩ.
Mutual Conductance	1·65 mA/V.
Amplification Factor	18

TYPICAL OPERATION.

Heptode Anode Voltage ...	100	250 volts.
‡Heptode Screen Voltage ...	100	100 volts.
Heptode Control Grid Voltage (g_1)	−2	−2 volts.
Triode Anode Voltage ...	100	250 volts.
Triode Anode Resistor ...	–	20 kΩ.
Auto Bias Resistor	240	195 ohms.
Triode Grid and Heptode Grid (g_3) Resistor	0·05	0·05 MΩ
Heptode Anode Current ...	1·9	1·8 mA.
‡Heptode Screen Current ...	3·0	3·0 mA.
Triode Anode Current ...	3·0	5·0 mA.
Triode Grid and Heptode Grid (g_3) Current...	0·3	0·4 mA.
Heptode Anode Impedance ...	0·5	1·25 MΩ
Conversion Conductance ...	500	525 μA/V.
Total Cathode Current	8·2	10·2 mA.

All dimensions shown are in millimetres (max.).

*The Nominal Heater Voltage is 7·0 volts.
†The Nominal Heater Current is 0·32 amp.
‡Heptode Grids g_2 and g_4.

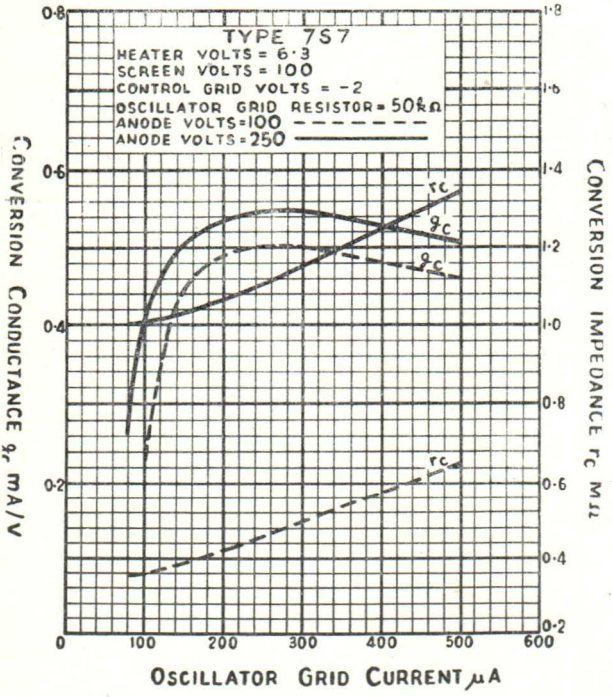
Issue 1
Dec., 1955

FERRANTI

CAPACITANCES.**

C_{in}	(Triode)	7·3 pF.
C_{out}	(Triode)	3·5 pF.
C_{in}	(Heptode)	5·0 pF.
C_{out}	(Heptode)	8·0 pF.
C_{a-g}	(Triode)	1·0 pF.
C_{a-g}	(Heptode)	0·03 pF. (max.).
C_{at-gh}	... ...	0·10 pF. (max.).
$C_{g1h-gtg3h}$	... ...	0·35 pF. (max.).

**With close fitting external shield connected to Cathode.

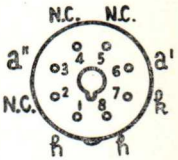


FERRANTI

FULL WAVE RECTIFIER

7Y4

Type 7Y4 is an indirectly heated, high vacuum, full wave rectifier. The cathode is connected to a separate pin.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

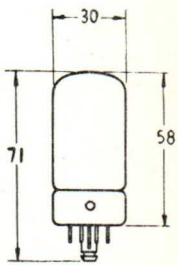
Base	B8G—Loctal.
Bulb	Clear.
Max. Overall Length	71 mm. ($2\frac{25}{32}$in.).
Max. Seated Height	58 mm. ($2\frac{9}{32}$in.).
Max. Diameter	30 mm. ($1\frac{3}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 5—No Connection.
Pin 2—No Connection.	Pin 6—Anode 1.
Pin 3—Anode 2.	Pin 7—Cathode.
Pin 4—No Connection.	Pin 8—Heater.

HEATER

*Heater Voltage	6.3 volts.
†Heater Current	0.5 amp.



RATINGS.

Max. Peak Inverse Voltage ...	1250 volts.
Max. Peak Anode Current ...	200 mA.§
Max. R.M.S. Anode Voltage ...	450 volts§
Max. Rectified Current	70 mA.
Min. Limiting Resistance ...	150 ohms§
Max. V_{h-k}	450 volts.

TYPICAL OPERATING CONDITIONS.

CAPACITOR INPUT.

§R.M.S. Input Voltage	325 volts.
Rectified Current	70 mA.
§Min. Supply Impedance ...	150 ohms.
Max. Reservoir Capacitor ...	32 μF.

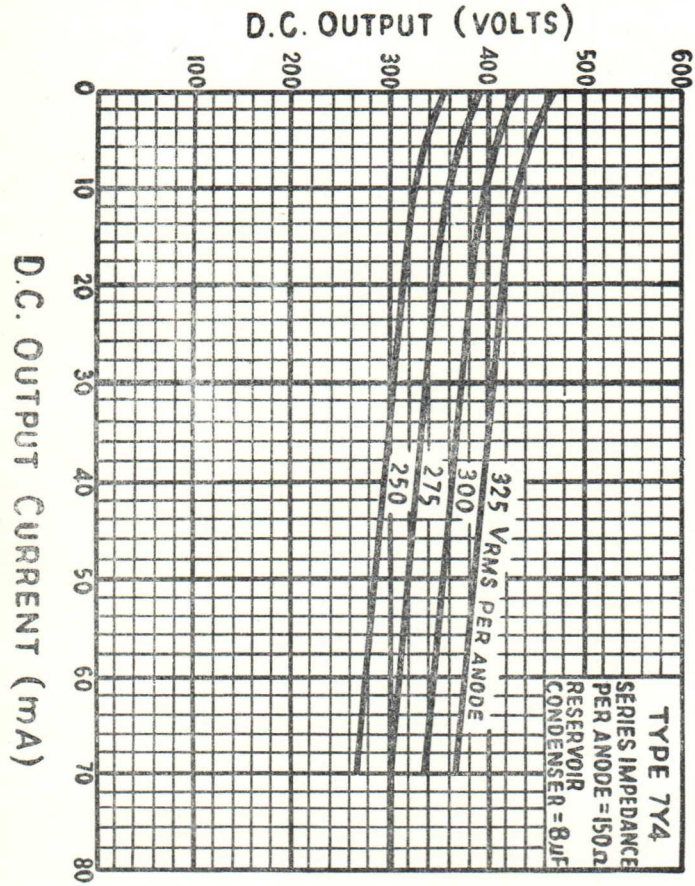
CHOKE INPUT.

§R.M.S. Input Voltage	450 volts.
Rectified Current	70 mA.
Min. Input Choke Inductance ...	10 henries.

All Dimensions shown are in millimetres (max.).

*The Nominal Heater Voltage is 7.0 volts.
†The Nominal Heater Current is 0.53 amps.
§Each anode

Issue 2
March, 1954

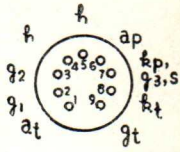

D.C. OUTPUT (VOLTS)
0
100
200
300
400
500
600
D.C. OUTPUT CURRENT (mA)
0
10
20
30
40
50
60
70
80
325 VRMS PER ANODE
300
275
250
TYPE 7Y4
SERIES IMPEDANCE PER ANODE = 150Ω
RESERVOIR CONDENSER = 8μF

FERRANTI

TRIODE PENTODE

9A8

Combined triode and high slope pentode with separate cathodes designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 Mc/s. It is suitable for series connected heater operation, a.c. or d.c.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode.	Pin 6—Pentode Anode.
Pin 2—Pentode g_1	Pin 7—Pentode Cathode, g_3 and shield.
Pin 3—Pentode g_2	
Pin 4—Heater.	Pin 8—Triode Cathode.
Pin 5—Heater.	Pin 9—Triode Grid.

HEATER.

Heater Current	0.3 amp.
Heater Voltage	9.0 volts.

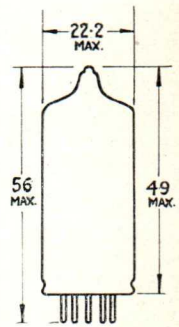
RATINGS.

PENTODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	175 volts.*
Max. Anode Dissipation ...	1.7 watts.
Max. Screen Dissipation ...	0.5 watts.†
Max. Cathode Current ...	17 mA.
**Min. Negative Grid Voltage ...	1.3 volts.
Max. V_{h-k} (heater positive) ...	100 volts.
‡Max. V_{h-k} (heater negative)	225 volts.
Max. R_{g1-k} (auto bias)	1.0 MΩ
Max. R_{g1-k} (fixed bias) ...	0.5 MΩ

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	1.7 watts.
Max. Cathode Current ...	17 mA.
§Max. Peak Instantaneous Cathode Current	200 mA.
Max. R_{g-k}	0.5 MΩ
**Min. Negative Grid Voltage ...	1.3 volts.
Max. Peak Instantaneous Negative Grid Voltage	350 volts.
‡Max. V_{h-k} (heater negative)	225 volts.
Max. V_{h-k} (heater positive) ...	100 volts.



All dimensions shown are in millimetres.

CHARACTERISTICS.

	Pentode Sect.	Triode Section	
Anode Voltage	170	100	volts.
Screen Voltage	170	–	volts.
Grid Bias Voltage ...	–2	–2	volts.
Anode Current ...	10	14	mA.
Screen Current	2.8	–	mA.
Mutual Conductance ...	6.2	5.0	mA/V.
Anode Impedance ...	400	4	kΩ
μ	–	20	
Inner μ	47	–	
Input Impedance (f=50 Mc/s.)	10	–	kΩ
Equivalent Noise Resistance	1.5	–	kΩ

*May be increased to 200 volts with cathode current not exceeding 10 mA.
†May be increased to 0.75 volts with anode dissipation not exceeding 1.2 watts.
‡Max. d.c. component 150 volts.
§Max. duration of pulse 200 μsecs.
**At grid current of 0.3 μA.

Issue 2
Aug.,1957

FERRANTI

TYPICAL OPERATION (as Frequency Changer)*

Anode Voltage	V_a	170	170	volts.
Screen Voltage ...	V_{g2}	170	170	volts.
Grid Resistor	R_{g1}	0·1	0·1	MΩ
Auto Bias Resistor ...	R_k	820	0	ohms.
Anode Current ...	I_a	5·2	6·3	mA.
Screen Current ...	I_{g2}	1·5	2·5	mA.
Oscillator Voltage ...	Vosc.	3·5	4·0	volts (r.m.s.)
Conversion Conductance	gc	2·1	2·05	mA/V.
Anode Impedance ...	r_a	0·87	0·72	MΩ
Grid Current	I_{g1}	0	53	μA.

CAPACITANCES.†

$C_{a_p-a_t}$	<0·06 pF.
$C_{a_p-g_t}$	<0·02 pF.
$C_{g_p-a_t}$	<0·16 pF.
$C_{g_p-g_t}$	<0·02 pF.

Pentode Section.

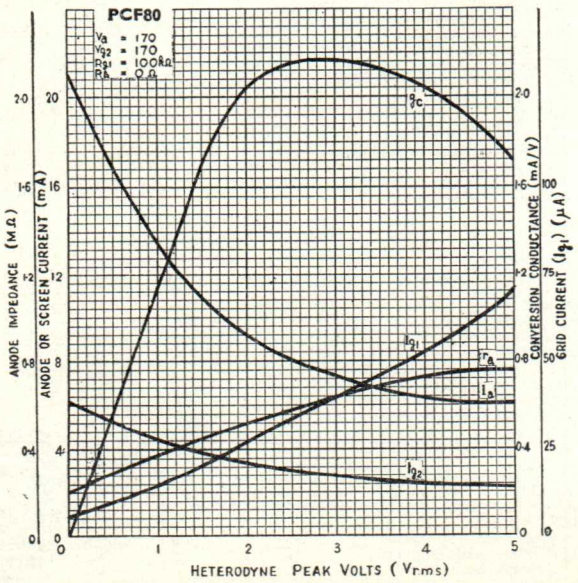
C_{in}	5·5 pF.
C_{out}	3·8 pF.
C_{a-g_1}	<0·025 pF.

Triode Section.

C_{g-k+h}	2·5 pF.
C_{a-k+h}	1·8 pF.
C_{a-g}	1·5 pF.

*Variations in heater-cathode capacitance may render this valve unsuitable for use in Hartley oscillator circuits, particularly in F.M. receivers ; it is recommended that a Colpitts type of circuit be employed.
†Measured without external shield.

AVERAGE CHARACTERISTIC CURVES AS FREQUENCY CHANGER.



FERRANTI

TRIPLE DIODE TRIODE

9AK8

An indirectly heated triple diode triode. One diode has a separate cathode. Primarily designed for use as A.F. amplifier and demodulator in FM/AM Receivers.

PHYSICAL DETAILS.

Base	B9A Noval
Max. Overall Length	67·5 mm. (2$\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. (2$\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Diode 3 Anode. Pin 6—Diode 1 Anode.
Pin 2—Diode 2 Anode. Pin 7—Triode Cathode.
Pin 3—Diode 2 Cathode. Diode 1 Cathode.
Pin 4—Heater. Diode 3 Cathode, Shield.
Pin 5—Heater. Pin 8—Triode Grid.
Pin 9—Triode Anode.

HEATER.

Heater Current	0·3 amp.
Heater Voltage	9·5 volts.

RATINGS.

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	1 watt.
Max. Cathode Current ...	5 mA.
*Max. R_{g-k}	3 MΩ
Max. R_{h-k}	20 kΩ
§Max. V_{h-k}	150 volts.
†Min. Negative Grid Voltage ...	1·3 volts.

DIODE SECTIONS.

Max. P.I.V. (Each Diode) ...	350 volts.
Max. Peak Current Diode 1 ...	6 mA.
Max. Peak Current Diode 2 ...	75 mA.
Max. Peak Current Diode 3 ...	75 mA.
Max. Current Diode 1	1 mA.
Max. Current Diode 2	10 mA.
Max. Current Diode 3	10 mA.

CHARACTERISTICS.

TRIODE SECTIONS.

Anode Voltage	170	200	volts.
Grid Voltage	−1·85	−2·3	volts.
Anode Current	1	1	mA.
Mutual Conductance	1·45	1·4	mA/V.
Amplification Factor	70	70	
Anode Impedance	48	50	kΩ

DIODE SECTIONS.

Diode 1 Impedance ($V_{a'd}$ = 10v)	5 kΩ
Diode 2 Impedance ($V_{a''d}$ = 5v)	200 Ω
Diode 3 Impedance ($V_{a'''d}$ = 5v)	200 Ω
$r_{a''d}/r_{a'''d}$	0·65 to 1·5

MICROPHONY

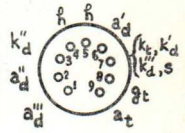
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

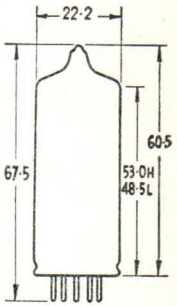
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	·76	mA.
Stage Gain	51	53	47	54	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (for V_{out} = 8v r.m.s.)	1·1	0·9	0·8	0·6	%
Grid Resistor for following valve	680	680	330	680	kΩ

*For operation with grid current biasing R_{g-k} may be increased to 22 MΩ max.
†For grid current of 0.3 μA.



Base Connections

Underside View of Base



All dimensions shown are in millimetres (max. unless otherwise stated).

Issue 2
Dec.,1957

9AK8

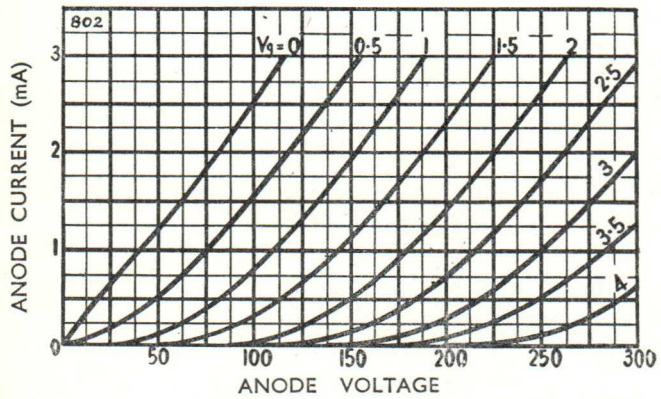
FERRANTI

CAPACITANCES. TRIODE SECTION.

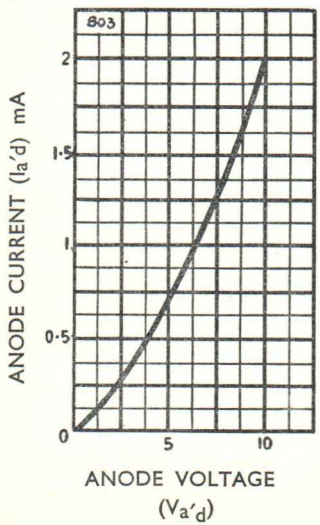
C_{in}	1.9 pF.
C_{out}	1.4 pF.
C_{a-g}	2.0 pF.
C_{g-h}	<0.04 pF.

DIODE SECTION.

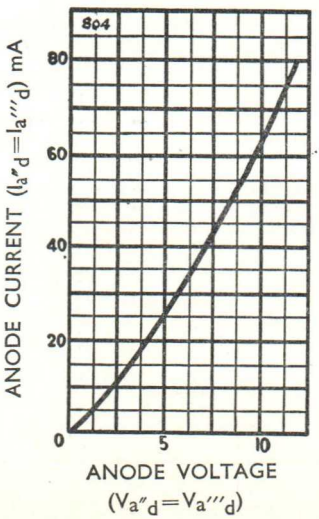
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$	4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k''d,\ s)}$	4.8 pF.
$C_{k''d-all}$	5.0 pF.
$C_{a'd-h}$	<0.25 pF.
$C_{a'''d-h}$	<0.2 pF.
$C_{k''d-h}$	2.5 pF.



DIODE I



DIODE II - DIODE III

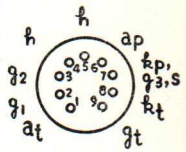


FERRANTI

TRIODE PENTODE

9U8

Combined triode and pentode with separate cathodes designed primarily for use as a frequency changer in Television Receivers operating at frequencies up to 220 M/cs. It is suitable for series connected heater operation, AC. or DC.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Triode Anode.	Pin 6—Pentode Anode.
Pin 2—Pentode g_1	Pin 7—Pentode cathode, pentode g_3 and internal shield.
Pin 3—Pentode g_2	
Pin 4—Heater.	Pin 8—Triode Cathode.
Pin 5—Heater.	Pin 9—Triode Grid.

HEATER.

Heater Current	0.3 amp.
Heater Voltage	9.5 volts (approx.).

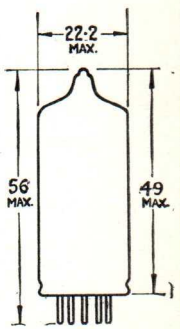
RATINGS.

PENTODE SECTION.

Max. H.T. Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Screen Voltage	300 volts.
Max. Anode Dissipation ...	2.8 watts.
Max. Screen Dissipation ...	0.5 watts.
Max. Cathode Current ...	20 mA.
Max. V_{h-k} (heater positive) ...	90 volts.
Max. V_{h-k} (heater negative) ...	220 volts.
Max. R_{g_1-k} (auto bias)	1.0 MΩ
Max. R_{g_1-k} (fixed bias) ...	0.5 MΩ

TRIODE SECTION.

Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	2.7 watts.
Max. Cathode Current ...	20 mA.
Max. V_{h-k} (heater positive) ...	90 volts.
Max. V_{h-k} (heater negative) ...	220 volts.



CHARACTERISTICS.

	Pentode Section.	Triode Section.
Anode Voltage ...	170–250	150 volts.
Screen Voltage ...	110	– volts.
Grid Bias Voltage ...	–0.9	–1 volt.
Anode Current ...	10	18 mA.
Screen Current ...	3.5	– mA.
Mutual Conductance	5.2	8.5 mA/V.
Anode Impedance ...	400	5 kΩ
μ	–	40
Inner μ	35	–
V_{g_1} for cut-off ...	–10	– volts.

All dimensions shown are in millimetres.

Issue 1
Jan.,1955

FERRANTI

TYPICAL OPERATION (as Frequency Changer).

TRIODE as Oscillator.

Anode Supply Voltage	$V_{a(b)}$	170	200	250 volts.
Anode Resistor ...	R_a	20	20	20 kΩ
Grid Resistor	R_g	20	20	20 kΩ
Oscillator Voltage (r.m.s.)	$V_{osc.}$	3	3	3 volts.
Anode Current ...	I_a	3.3	4.1	5.7 mA.
Grid Current	I_g	160	160	160 μA.
Mutual Conductance	$_{gn}$	2.8	3.2	4·0 mA/V.

PENTODE as Mixer.

Anode Voltage ...	V_a	170	200	250 volts.
Screen Feed Resistor ...	R_{g2}	30	45	70 kΩ
Grid Resistor	R_{g1}	1	1	1 MΩ
Grid Voltage	V_{g1}	0	0	0 Volts.
Anode Current ...	I_a	4·7	4·9	5·2 mA.
Screen Current ...	I_{g2}	2	1·9	1·9 mA.
Grid Current	I_{g1}	3·7	3·7	3·7 μA.
Conversion Conductance	$_{gc}$	1·65	1·8	1·9 mA/V.

CAPACITANCES*

$C_{a_p-a_t}$	<0·07 pF.

Pentode Section.

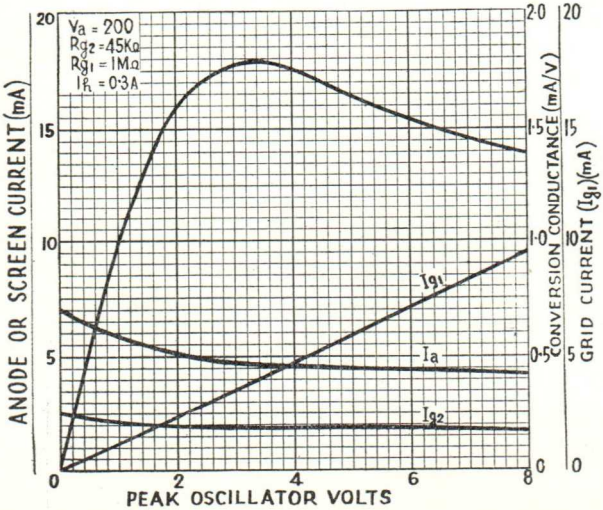
C_{in}	5·0 pF.
C_{out}	2·6 pF.
C_{a-g_1}	<0·01 pF.

Triode Section.

C_{in}	2·5 pF.
C_{out}	0·4 pF.
C_{a-g}	1·8 pF.

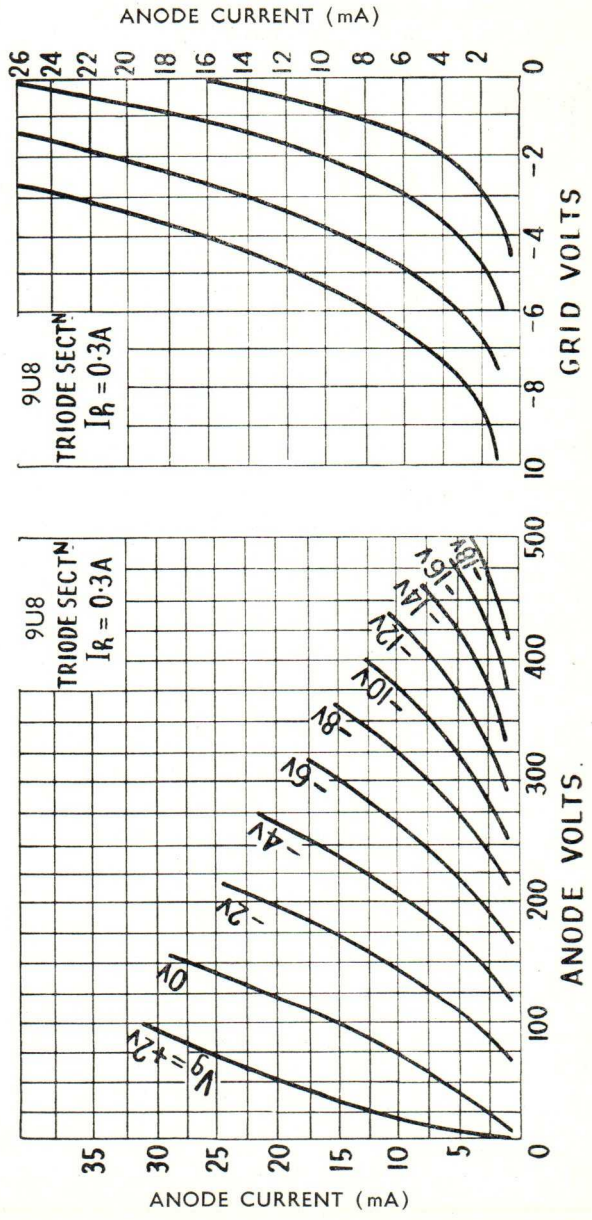
*Measured without external shield.

AVERAGE PERFORMANCE CURVES AS FREQUENCY CHANGER



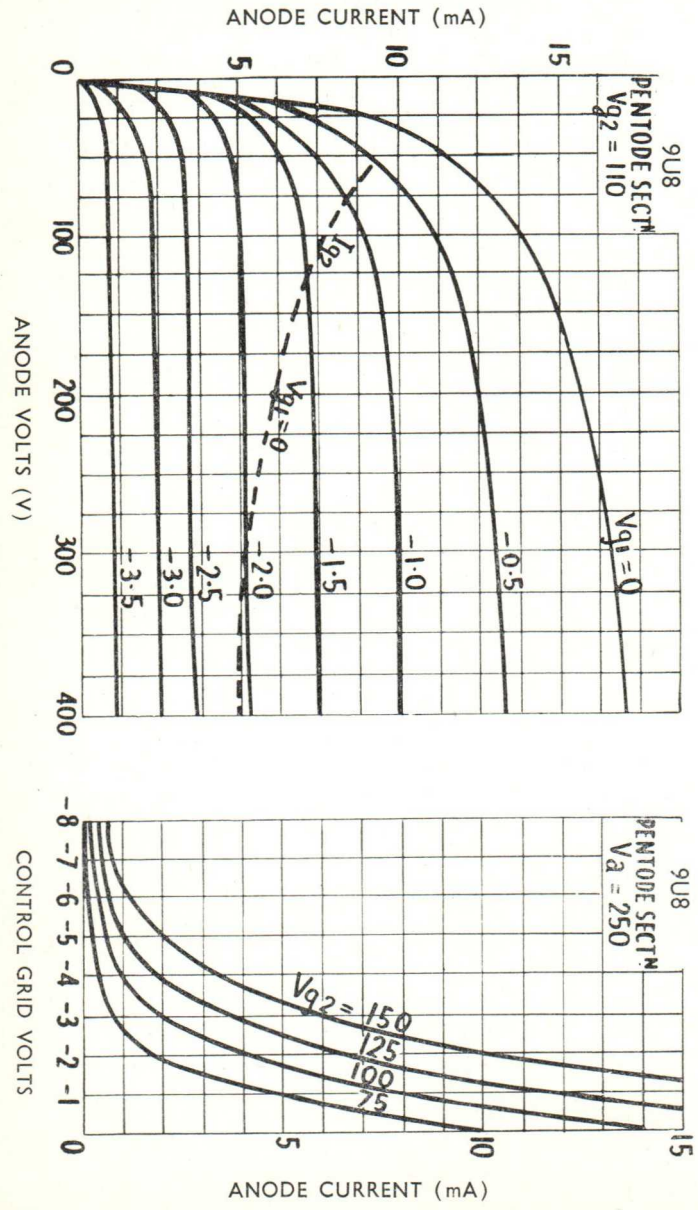
FERRANTI

9U8



Issue 1.
Jan., 1955

FERRANTI

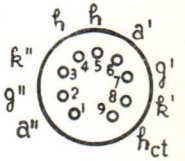

ANODE CURRENT (mA)
0
5
10
15
9U8
PENTODE SECTN
Vg2 = 110
Ig2
Vg1=0
-0·5
-1·0
-1·5
-2·0
-2·5
-3·0
-3·5
ANODE VOLTS (V)
100
200
300
400
9U8
PENTODE SECTN
Va = 250
Vg2 = 150
125
100
75
-8 -7 -6 -5 -4 -3 -2 -1 0
CONTROL GRID VOLTS
ANODE CURRENT (mA)

FERRANTI

DOUBLE TRIODE

12AT7

An indirectly heated double triode valve with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as a frequency changer or R.F. Amplifier at frequencies up to 300 Mc/s.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A (Noval).
Bulb	Clear.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter (Base)	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Heater Centre Tap.

HEATER.¶

The heater is centre tapped and the two halves may be operated either in series or in parallel with one other.

	Series.†	Parallel.‡	
Heater Voltage	12·6	6·3	volts.
Heater Current	0·15	0·3	Amp.

RATINGS.*

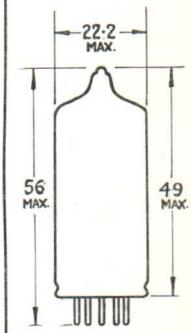
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage (working)	300 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Cathode Current ...	15 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. V_{h-k}	150 volts.
Max. R_{g-k} (Cathode Bias) ...	1·0 MΩ
Max. R_{h-k}	20 kΩ

CHARACTERISTICS.*

Anode Voltage	100	170	200	250	volts.
Grid Voltage	−1	−1	−1	−2	volts.
Anode Current	3·0	8·5	11·5	10	mA.
Mutual Conduc.	3·75	5·9	6·7	5·5	mA/V.
Amplificat. Factor	62	66	70	60	
Anode Imped.	16·5	11	10·5	11	kΩ

CAPACITANCES.

*C_{in}	2·3 pF.
$C_{a'-k'+h}$	0·45 pF.
$C_{a''-k''+h}$	0·35 pF.
*C_{a-g}	1·6 pF.
*C_{a-k}	0·2 pF.
*C_{h-k}	2·5 pF.
*C_{k-g+h}	4·7 pF.
$C_{a'-a''}$	<0·4 pF.
$C_{g'-g''}$	<0·005 pF.
$C_{a'-g'+h}$	1·9 pF.
$C_{a''-g''+h}$	1·8 pF.
C_{g-h}	<0·17 pF.
$C_{a'-g''}$	<0·07 pF.
$C_{a''-g'}$	<0·04 pF.



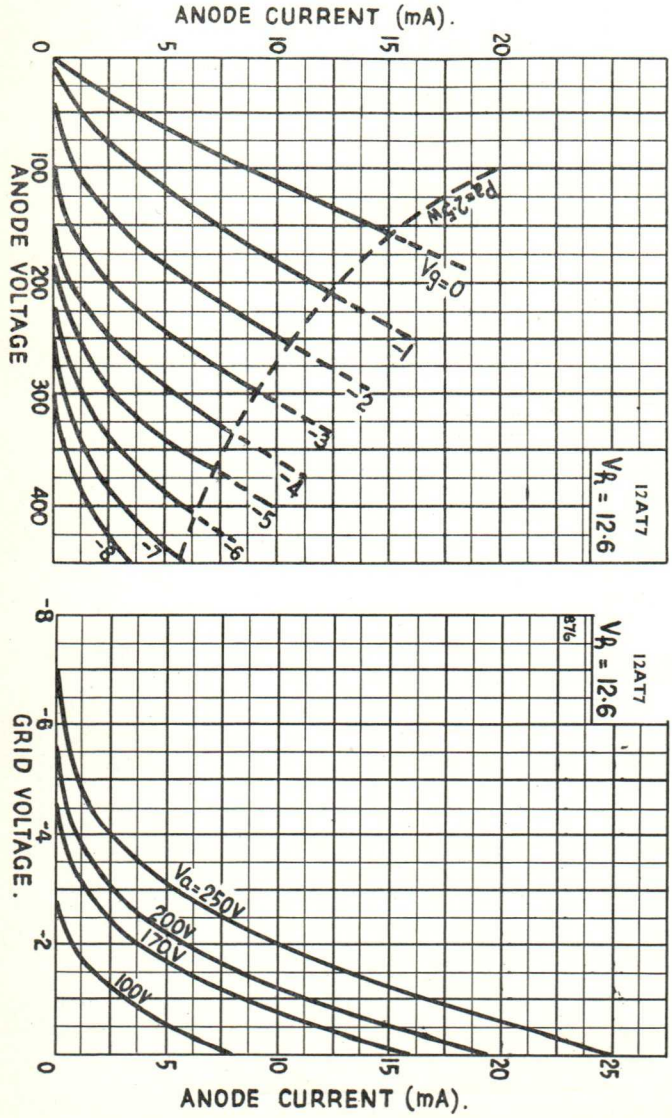
All dimensions shown are in millimetres (max.).

*Each Section.
†Vh applied between pins 4 and 5.
‡Vh applied between pins 9 and pins 4 and 5 connected together.

Issue 3
Aug.,1957

12AT7

FERRANTI

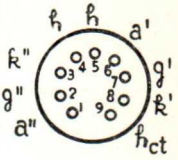


FERRANTI

HIGH IMPEDANCE DOUBLE TRIODE

12AU7

An indirectly heated double triode valve with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as an amplifier or phase inverter in AC/DC radio receivers, or in oscillator or multivibrator circuits for industrial applications.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B9A Noval.
Bulb	Clear.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter (Base)	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2. Pin 5—Heater.
Pin 2—Grid Triode 2. Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2. Pin 7—Grid Triode 1.
Pin 4—Heater. Pin 8—Cathode Triode 1.
Pin 9—Heater Centre Tap.

HEATER.

The heater is centre tapped and the two halves may be operated either in series or in parallel with one another.

	Series.†	Parallel.‡
Heater Voltage	12·6	6·3 volts.
Heater Current	0·15	0·3 Amp.

RATINGS.§

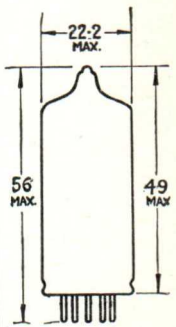
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation ...	2·75 watts.
Max. Cathode Current	20 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. Pos. Grid Voltage	0 volts.
Max. V_{h-k} (Heater negative) ...	180 volts.
Max. V_{h-k} (Heater positive) ...	180 volts.
Max. R_{g-k} (Cathode Bias) ...	1·0 MΩ
Max. R_{g-k} (Fixed Bias)	0·25 MΩ
**Max. R_{h-k}	20 kΩ

CAPACITANCES.*

§C_{in}	... ...	1·6 pF.
C_{out}	Triode No. 1	0·5 pF.
	Triode No. 2	0·35 pF.
§C_{a-g}	... ...	1·5 pF.

CHARACTERISTICS.§

Anode Voltage	100	250	volts.
Anode Current	12	10·5	mA.
Grid Voltage	0	−8·5	volts.
Amplification Factor	19	17	
Anode Impedance	6200	7700	Ω
Mutual Conductance	3·1	2·2	mA/V.

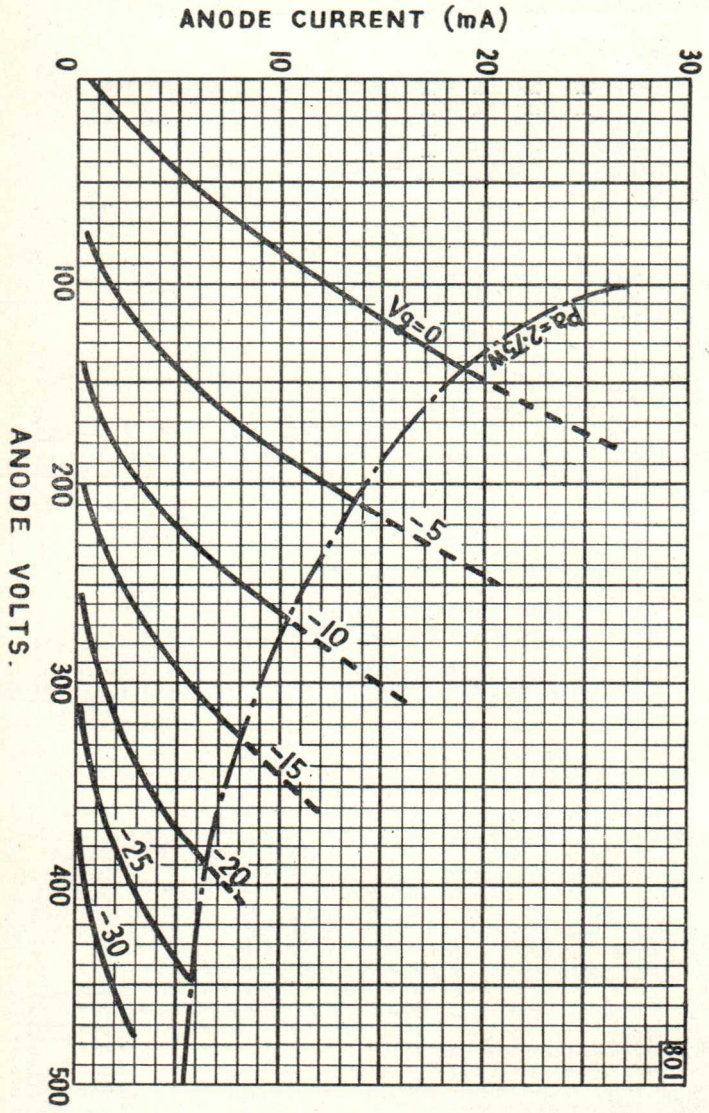


All dimensions shown are in millimetres (max.).

*Measured without external shield.
†Vh applied between pins 4 and 5.
‡Vh applied between pin 9 and pins 4 and 5 connected together.
**When used as a phase inverter immediately preceding the output stage R_{h-k} max. may be 120 kΩ
§Each Section, unless otherwise indicated.

Issue 2
Aug., 1957

12AU7


ANODE CURRENT (mA)
0
10
20
30
ANODE VOLTS.
100
200
300
400
500
Vg=0
Pa=2·75W
-5
-10
-15
-20
-25
-30
1081

FERRANTI

DOUBLE TRIODE

12AX7

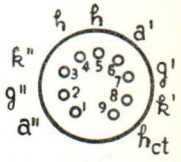
An indirectly heated high μ double triode with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as a Resistance coupled A.F. amplifier or phase inverter.

PHYSICAL DETAILS.

Base	B9A Noval.
Bulb	Clear.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{13}{16}$in.).
Max. Diameter (Base)	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Anode Triode 2.
Pin 2—Grid Triode 2.
Pin 3—Cathode Triode 2.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Anode Triode 1.
Pin 7—Grid Triode 1.
Pin 8—Cathode Triode 1.
Pin 9—Heater Centre Tap.



Base Connections Underside View of Base

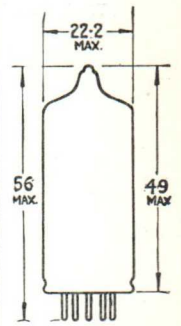
HEATER.

The heater is centre tapped and the two halves may be operated either in series or in parallel with one other.

	Series†	Parallel‡	
Heater Voltage	12.6	6.3	volts.
Heater Current	0.15	0.3	Amp.

RATINGS.*

Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation	1.0 watts.
Max. Cathode Current	8 mA.
Max. Neg. Grid Voltage	50 volts.
Max. Pos. Grid Voltage	0 volts.
Max. V_{h-k}	180 volts.
§Max. R_{g-k} (Fixed Bias)	0.5 MΩ
Max. R_{g-k} (Cathode Bias)	1.0 MΩ
Max. R_{g-k} (Cathode Bias) (Ia<1mA)	2.2 MΩ
**Max. R_{h-k}	20 kΩ



CHARACTERISTICS.*

Anode Voltage	100	250 volts.
Grid Voltage	−1.0	−2.0 volts.
Anode Current	0.5	1.2 mA.
Amplification Factor	100	100
Anode Impedance	80	62.5 kΩ
Mutual Conductance	1.25	1.6 mA/V.

CAPACITANCES.

*C_{in}	1·6 pF.
$C_{a'-k'}$	0·46 pF.
$C_{a''-k''}$	0·34 pF.
*C_{a-g}	1·7 pF.
*C_{g-h}	<0·15 pF.
$C_{a'-a''}$	<1·2 pF.
$C_{g'-g''}$	<0·01 pF.
$C_{a''-g'} = C_{a'-g''}$	<0·1 pF.

All dimensions shown are in millimetres.

*Each Section.
**Max. R_{h-k} may be 120 kΩ when the valve is used as a phase inverter immediately preceding the output stage.
†V_h applied between pins 4 and 5.
‡V_h applied between pin 9 and pins 4 and 5 connected together.
§With grid current biasing Max. Rg-k = 22MΩ

Issue 2
Aug., 1957

FERRANTI

TYPICAL OPERATION as Resitance Coupled A.F. Amplifier

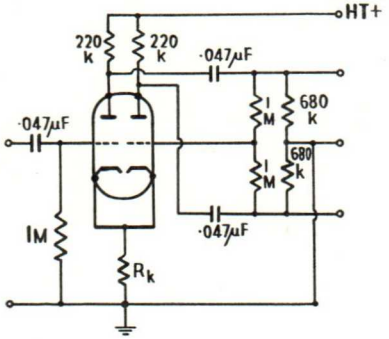
1. Cathode Bias.

Anode Supply Voltage	200	250	250	300	300	350	350	400	volts.
Anode Load Resistance	100	100	220	100	220	100	220	220	kΩ
Cathode Current ...	0·65	0·86	0·48	1·11	0·63	1·4	0·85	1·02	mA.
Cathode Bias Resistor ...	1·8	1·5	2·7	1·2	2·2	1·0	1·5	1·2	kΩ
Grid Resistor of following valve ...	330	330	680	330	680	330	680	680	kΩ
Stage Gain	50	54·5	66·5	57	72	61	75·5	76·5	
*Output Voltage ...	20	26	28	30	36	36	37	38	volts (r.m.s.)
*Total Distortion ...	4·8	3·9	3·4	2·7	2·6	2·2	1·6	1·1	%

2. Grid Current Bias**

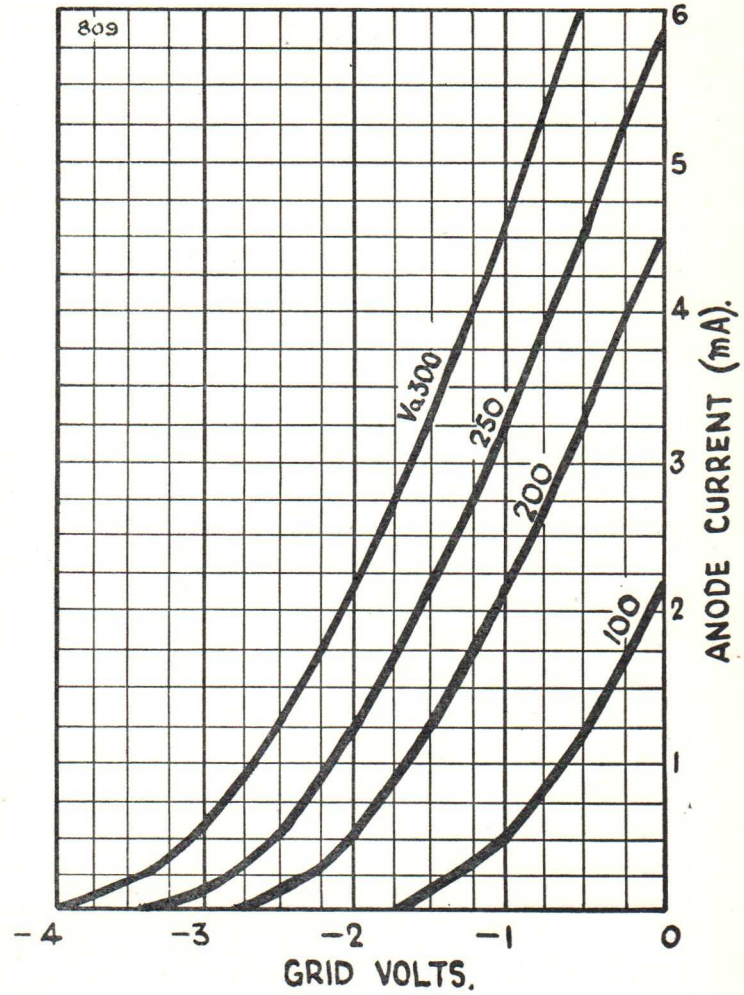
Anode Supply Voltage	200	250	250	300	300	350	350	400	volts.
Grid Resistance ...	10	10	10	10	10	10	10	10	MΩ
Anode Load Resistance	100	100	220	100	220	100	220	220	kΩ
Cathode Current ...	0·7	1·0	0·56	1·3	0·74	1·6	0·88	1·09	mA.
Grid Resistor of following valve ...	330	330	680	330	680	330	680	680	kΩ
Stage Gain	50	51	62	54	66	56	67	68	
Output Voltage ...	20	26	28	30	36	36	37	38	volts (r.m.s.)
Total Distortion ...	3·9	2·6	2·7	2·2	2·2	1·8	1·7	1·4	%

TYPICAL OPERATION AS PHASE INVERTER.



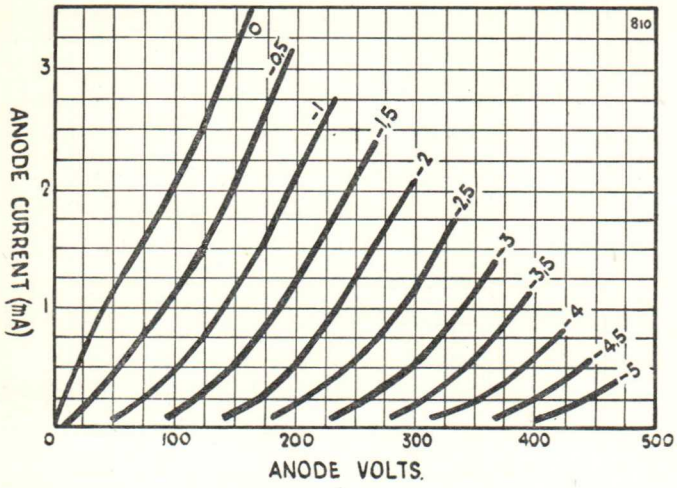
Anode Supply Voltage ...	250		350	volts.
Cathode Resistor	1·2		0·82	kΩ
Cathode Current	1·08		1·7	mA.
Stage Gain	58		62	
*Output Voltage ...	35	7	45	9 V.r.m.s.
Total Distortion ...	5·5	1·1	3·5	0·7 %

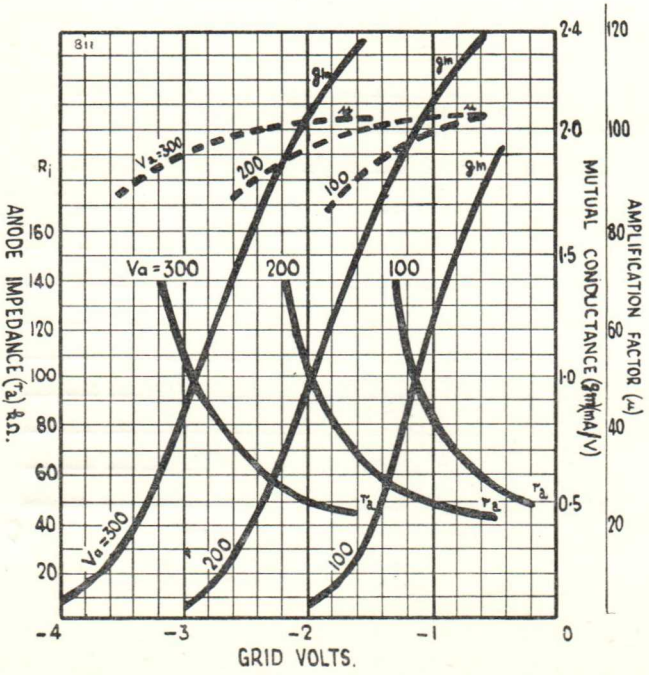
*At start of positive grid current. At lower output voltages distortion is approximately proportionate to output voltage.
**Measured with a signal source impedance of 100 Ω



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

FERRANTI


810
ANODE CURRENT (mA)
ANODE VOLTS.
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
0
100
200
300
400
500
1
2
3


811
ANODE IMPEDANCE (ra) Ω.
MUTUAL CONDUCTANCE (gm mA/V)
AMPLIFICATION FACTOR (μ)
GRID VOLTS.
Va=300
200
100
Ri
gm
μ
ra
160
140
120
100
80
60
40
20
2·4
2·0
1·5
1·0
0·5
120
100
80
60
40
20
-4
-3
-2
-1
0

FERRANTI

DOUBLE DIODE PENTODE

12C8GT

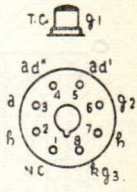
Type 12C8GT is an indirectly heated double diode pentode designed for use as detector, A.V.C. and L.F. amplifier in radio receivers.

PHYSICAL DETAILS.

Base	International Octal.
Top Cap	Skirted Miniature.
Max. Overall Length	90 mm. ($3\frac{9}{16}$in.).
Max. Seated Height	76 mm. (3in.).
Max. Diameter (Base)	34 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.

BASE CONNECTION.

Pin 1—Base Sleeve.
Pin 2—Heater.
Pin 3—Triode Anode.
Pin 4—Diode Anode 2.
Pin 5—Diode Anode 1.
Pin 6—Screen Grid.
Pin 7—Heater.
Pin 8—Cathode, Suppressor Grid.
Top Cap—Control Grid.



Base Connections

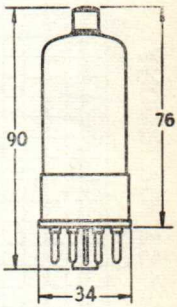
Underside View of Base

HEATER.

Heater Current	0·15 amp.
Heater Voltage	12·6 volts.

RATINGS.

Max. Anode Voltage	300 volts.
Max. Screen Voltage	125 volts.
Max. Anode Dissipation ...	2·25 watts.
Max. Heater-Cathode voltage	100 volts.
Max. Screen Dissipation ...	0·3 watts.
Max. Diode Current (each Diode)	1·0 mA.
Min. Grid Voltage	0 volts.



TYPICAL OPERATION.

PENTODE SECTION.

Class A_1 Amplifier.

Anode Voltage ...	100	250	250	volts.
Screen Voltage ...	100	100	125	volts.
Grid Voltage ...	−3	−3	−3	volts.
Anode Current ...	5·8	6·0	9·0	mA.
Screen Current ...	1·7	1·5	2·3	mA.
Grid Volts for Cut off	−17	−17	−21	volts.
Mutual Conductance	0·95	1·0	1·12	mA/volt.
Anode Impedance	0·3	0·8	0·6	MΩ

Resistance Coupled Amplifier.

Supply Voltage		90	300	volts.
Anode Load Resistor ...		0·25	0·25	MΩ
Screen Feed Resistor ...		1·2	1·5	MΩ
Auto Bias Resistor ...		3500	1800	ohms.
Peak Output Voltage ...		33	95	volts.
Stage Gain		55	100	
Grid Resistor for following valve ...		0·5	1·0	MΩ

DIODE SECTION.

Refer to curves for Type 6Q7G.

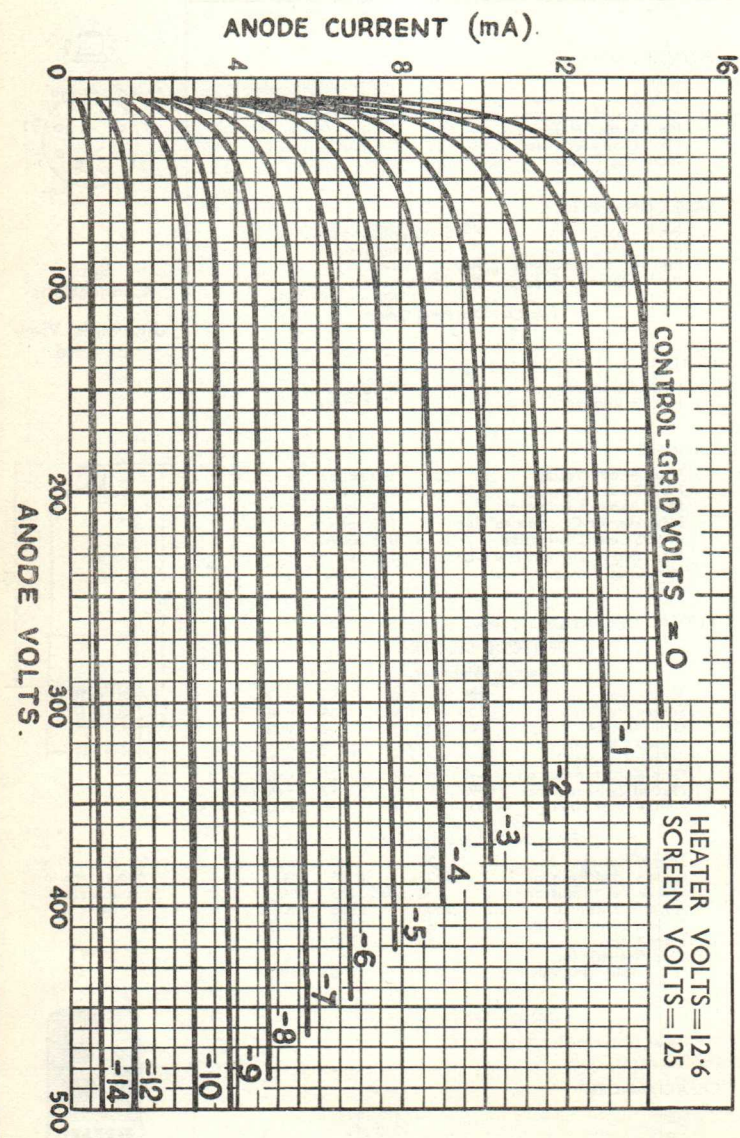
CAPACITANCES.

C_{in}	4·5 pF.
C_{out}	10·0 pF.
C_{a-g}	0·005 pF. (max.).

All dimensions shown are in millimetres (max.).

Issue 1
Feb., 1954

12C8GT


ANODE CURRENT (mA).
0
4
8
12
16
100
200
300
400
500
ANODE VOLTS.
CONTROL-GRID VOLTS = 0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-12
-14
HEATER VOLTS = 12·6
SCREEN VOLTS = 125

FERRANTI

12J7GT
R.F. PENTODE

International Octal Based Glass Valve for use as an Amplifier or Anode Bend Detector in equipment designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6J7GT, except for the Heater Rating.

12K7GT
VARI-MU R.F. PENTODE

International Octal Based Glass Valve for use as an R.F. or I.F. amplifier in radio receivers designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6K7GT, except for the Heater Rating.

12K8GT
TRIODE-HEXODE

International Octal Based Glass Valve for use as a Frequency Changer in superheterodyne radio receivers designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6K8GT, except for the Heater Rating.

12Q7GT
DOUBLE DIODE TRIODE

International Octal Based Glass Valve for use as detector, A.V.C., and L.F. amplifier in radio receivers designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6Q7GT, except for the Heater Rating.

Issue 3
April, 1956

FERRANTI

12SJ7GT

12SK7GT

12SL7GT

12SQ7GT

FERRANTI

12SJ7GT
R.F. PENTODE

International Octal Based Glass Valve of single-ended construction for use as an Amplifier or Anode Bend Detector in equipment designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6SJ7GT, except for the Heater Rating.

12SK7GT
VARI-MU R.F. PENTODE

International Octal Based Glass Valve of single-ended construction for use as an R.F. or I.F. amplifier in radio receivers designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6SK7GT, except for the Heater Rating.

12SL7GT
HIGH IMPEDANCE DOUBLE TRIODE

International Octal Based Glass Valve of single-ended construction for use as an amplifier or phase inverter in AC/DC equipments. Except for the common heater each triode is independent of the other.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6SL7GT, except for the Heater Rating.

12SQ7GT
DOUBLE DIODE TRIODE

International Octal Based Glass Valve of single-ended construction for use as detector, A.V.C., and L.F. amplifier in radio receivers designed for AC/DC operation.

Heater Current	...	...	0·15 amps.
Heater Voltage	...	...	12·6 volts.

The Ratings, Characteristics and Dimensions of this valve are identical to those of type 6SQ7GT, except for the Heater Rating.

FERRANTI

R0359

FERRANTI

VIDEO OUTPUT PENTODE

15A6

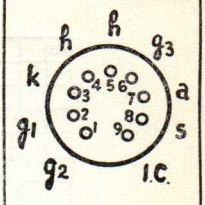
An indirectly heated output pentode designed for use as a Video Output Valve in Television Receivers with series heater chains.

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
Max. Overall Length	78·5 mm. ($3\frac{3}{32}$in.).
Max. Seated Height	71·5 mm. ($2\frac{13}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Screen Grid. Pin 5—Heater.
Pin 2—Control Grid. Pin 6—Suppressor Grid.
Pin 3—Cathode. Pin 7—Anode.
Pin 4—Heater. Pin 8—Shield.
Pin 9—Internal Connection.



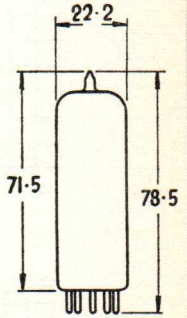
Base Connections
Underside View of Base

HEATER.

Heater Current	0·3 amp.
Heater Voltage	15·0 volts.

RATINGS.

Max. DC. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Anode Dissipation ...	9 watts.
Max. Screen Voltage	250 volts.
Max. Screen Dissipation ...	2 watts.
Max. Cathode Current ...	70 mA.
Max. Neg. Grid Voltage ($I_{g1}=+0·3\mu A$)	−1·3 volts.
Max. V_{h-k}	150 volts.
Max. R_{h-k}	20 kΩ.
Max. R_{g1-k} Fixed Bias ...	500 kΩ
Max. R_{g1-k} Auto Bias ...	1·0 MΩ



CHARACTERISTICS.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage ...	−2·3	−3·5	volts.
Anode Current	36	36	mA.
Screen Current	5	5	mA.
Mutual Conductance ...	10·5	10·5	mA/V.
Anode Impedance ...	100	100	kΩ
Inner μ (μ_{g1-g2}) ...	25	25	

TYPICAL OPERATION.

Anode Supply Voltage	170 volts.
Screen Voltage	170 volts.
Suppressor Grid Voltage ...	0 volts.
Control Grid Voltage	−6·7 volts.
Anode Current	4 mA.
Screen Current	0·25 mA.
Anode Load Resistance	2·2 kΩ
Peak Output Voltage	>70 volts.

CAPACITANCES.

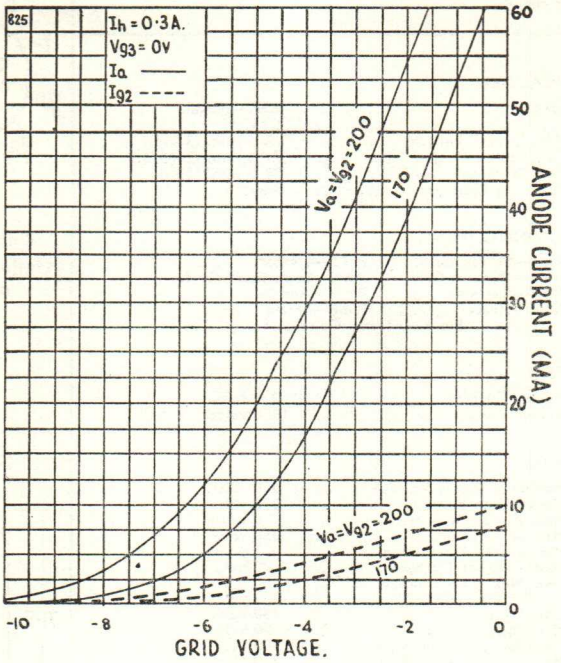
C_{in}	10·4 pF.
C_{out}	6·6 pF.
C_{a-g1}	<0·1 pF.
C_{g1-h}	<0·15 pF.

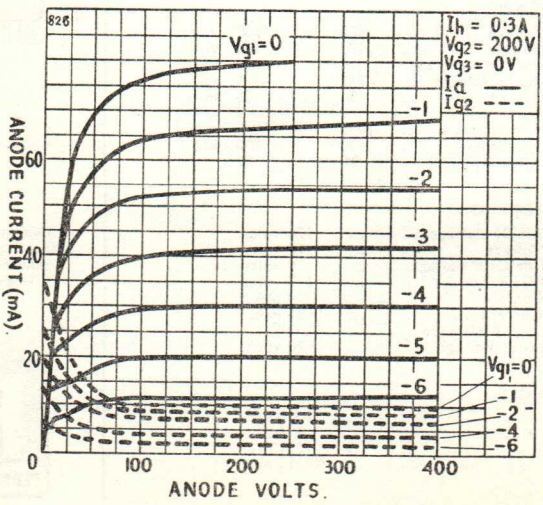
Dimensions shown are in millimetres (max.).

FERRANTI

Issue 1.
Mar.,1956

FERRANTI


825
I_h = 0·3A.
V_{g3} = 0V
Ia
I_{g2}
V_a=V_{g2}=200
170
V_a=V_{g2}=200
170
ANODE CURRENT (MA)
60
50
40
30
20
10
0
-10
-8
-6
-4
-2
0
GRID VOLTAGE.


826
V_{g1}=0
-1
-2
-3
-4
-5
-6
I_h = 0·3A
V_{g2} = 200V
V_{g3} = 0V
Ia
I_{g2}
V_{g1}=0
-1
-2
-4
-6
ANODE CURRENT (mA).
60
40
20
0
100
200
300
400
ANODE VOLTS.

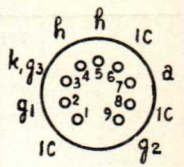
R0359

FERRANTI

OUTPUT PENTODE

16A5

An indirectly heated output pentode. It is suitable for use in Television Receivers as a Frame Time Base Output Valve, or an Audio Output Valve. It is intended for use in series heater chains.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	78·5 mm. ($3\frac{9}{32}$in.).
Max. Seated Height	71·5 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 5—Heater.
Pin 2—Control Grid.	Pin 6—Internal Connection.
Pin 3—Cathode, Suppressor Grid.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Screen Grid.

HEATER.

Heater Current	0·3 Amp.
Heater Voltage	16·5 volts.

RATINGS.

Max. DC. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
*Max. Peak Anode Voltage ...	2·5 kV.
Max. Anode Dissipation ...	9 watts.
Max. Screen Voltage	250 volts.
Max. Screen Dissipation ...	2·5 watts.
Max. Cathode Current ...	75 mA.
Max. Neg. Grid Voltage ...	−1·3 volts.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	20 kΩ
§Max. R_{g1-k}	1 MΩ

CHARACTERISTICS.

Anode Voltage	170	200 volts.
Screen Voltage	170	200 volts.
Suppressor Grid Voltage	0	0 volts.
Control Grid Voltage	−10·4	−14·2 volts.
Anode Current	53	45 mA.
Screen Current	10	8·5 mA.
Mutual Conductance ...	9	7·6 mA/V.
Anode Impedance ...	20	24 kΩ
Inner μ (μ_{g1-g1}) ...	10	10

TYPICAL OPERATION.

As Frame Time Base Output

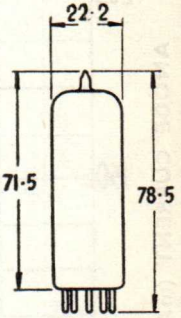
Anode Voltage	50	60 volts.
Screen Voltage	170	200 volts.
Control Grid Voltage ...	−1	−1 volt.
Anode Current	140	175 mA.

The above figures are for an average new valve. To allow for manufacturing spread of characteristics, and to cover change during life, the output circuit should be designed round the following values :—

Anode Voltage	50	60 volts.
Screen Voltage	170	200 volts.
Anode Current	90	120 mA.

As Audio Amplifier.

Anode Voltage	170	200 volts.
Suppressor Grid Voltage	0	0 volts.
Screen Grid Voltage ...	170	200 volts.
Control Grid Voltage ...	−10·4	−13·2 volts.
Anode Load Resistor ...	3	4 kΩ
Anode Current	53	45 mA.
Screen Current	10	8·5 mA.
Input A.F. Voltage ...	6	7 volts (r.m.s.)
Power Output (D=10%)	4·0	4·2 watts.



All Dimensions shown are in millimetres (max.).

*Max. pulse duration of 10% of one cycle, with a maximum of 2 m/sec.
§For frame output operation the max. value of R_{g1-k} may be 2·2 MΩ

Issue 1
Mar.,1956

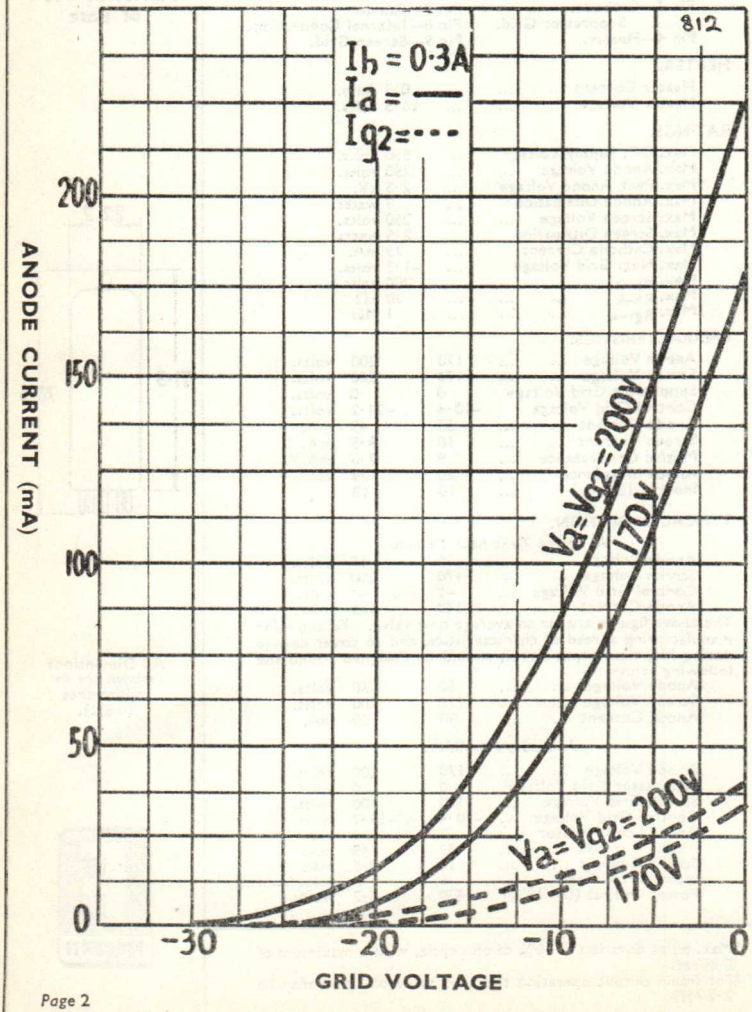
FERRANTI

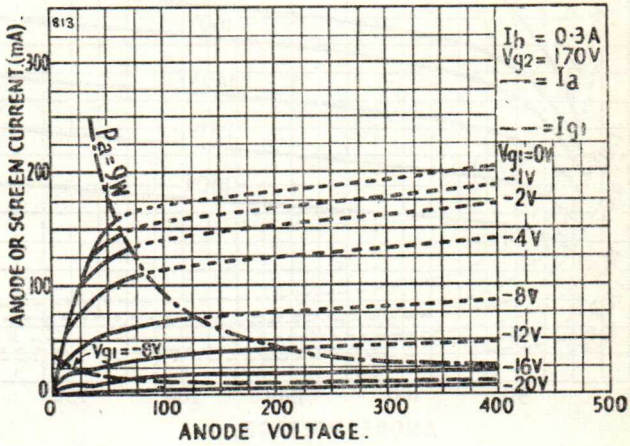
TYPICAL OPERATION (cont.)
As Audio Amplifier (2 valves in push pull).

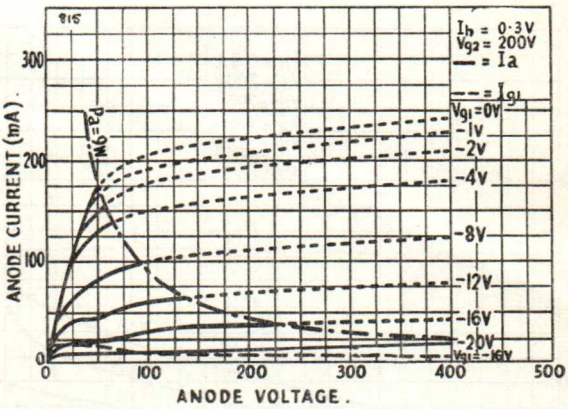
Anode Voltage	200 volts.
Screen Voltage	200 volts.
Auto Bias Resistor (Rk) ...	135 ohms.
Optimum Load Resistance (Anode to Anode)	4 kΩ
Input A.F. Voltage	13·5 volts (r.m.s.).
Power Output (D=5%) ...	12 watts.

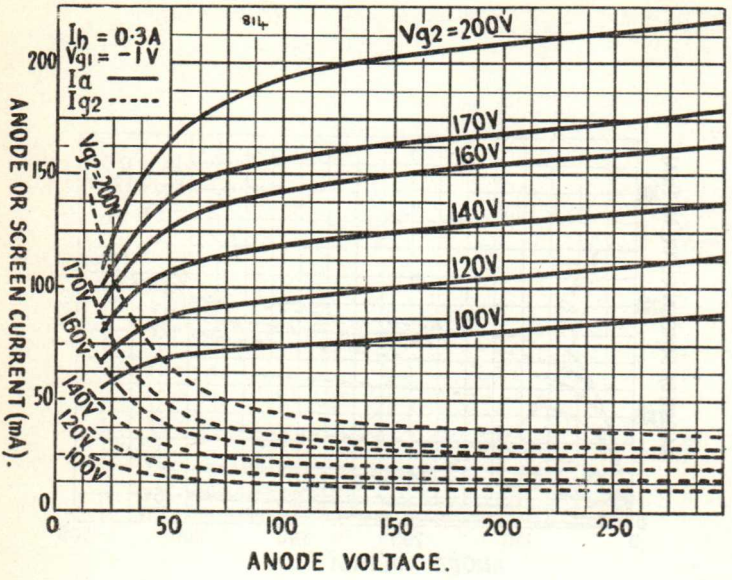
CAPACITANCES.

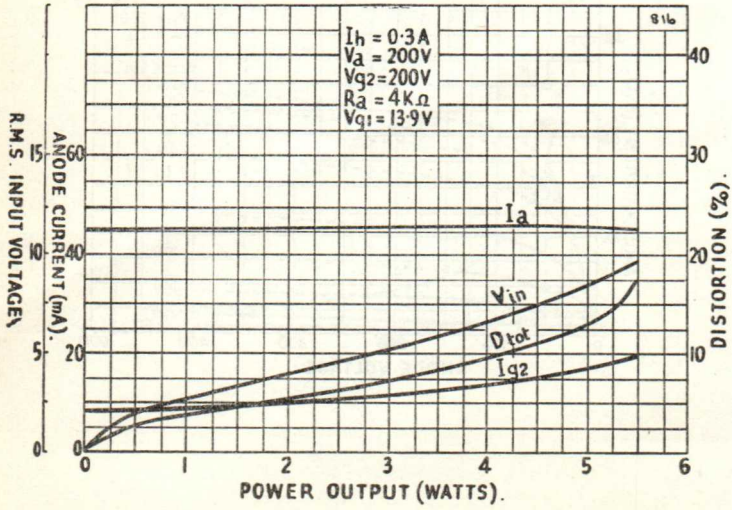
C_{in}	11·0 pF.
C_{out}	6·2 pF.
C_{a-g1}	<1·0 pF.
C_{g1-h}	<0·15 pF.




813
Ih = 0·3A
Vg2 = 170V
—— = Ia
– – – = Ig1
Vg1=0V
-1V
-2V
-4V
-8V
-12V
-16V
-20V
Pa=9W
Vg1=-8V
ANODE OR SCREEN CURRENT (mA).
300
200
100
0
0
100
200
300
400
500
ANODE VOLTAGE.


815
Ih = 0·3V
Vg2 = 200V
—— = Ia
– – – = Ig1
Vg1=0V
-1V
-2V
-4V
-8V
-12V
-16V
-20V
Vg1=-16V
Pa=9W
ANODE CURRENT (mA).
300
200
100
0
0
100
200
300
400
500
ANODE VOLTAGE.


814
Ih = 0·3A
Vg1 = −1V
Ia ——
Ig2 -----
Vg2=200V
170V
160V
140V
120V
100V
ANODE OR SCREEN CURRENT (mA).
ANODE VOLTAGE.
0
50
100
150
200
250


816
Ih = 0·3A
Va = 200V
Vg2=200V
Ra = 4KΩ
Vg1 = 13·9V
Ia
Vin
Dtot
Ig2
R.M.S. INPUT VOLTAGE.
ANODE CURRENT (mA).
DISTORTION (%).
POWER OUTPUT (WATTS).

FERRANTI

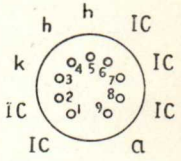
FULL WAVE RECTIFIER

19Y3

An indirectly heated half wave rectifier with a 0·3 amp. heater designed for series connected heater operation.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length ...	78·5 mm. ($3\frac{3}{32}$ins.).
Max. Seated Height ...	71·5 mm. ($2\frac{13}{16}$ins.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.



Base Connections

Underside View of Base

BASE CONNECTIONS.

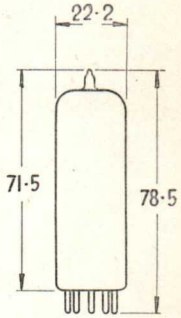
Pin 1—Internal Connection.	Pin 5—Heater.
Pin 2—Internal Connection.	Pin 6—Internal Connection.
Pin 3—Cathode.	Pin 7—Internal Connection.
Pin 4—Heater.	Pin 8—Internal Connection.
Pin 9—Anode.	

HEATER.

Heater Current	0·3 amps.
Heater Voltage	19 volts.

RATINGS.

Max. Peak Inverse Voltage ...	700 volts.
Max. R.M.S. Anode Voltage ...	250 volts.
Max. Rectified Current	180 mA.
*Max. $V_{h-k\ (pk)}$ (Heater negative)	550 volts.
†Max. Reservoir Capacitor ...	60 μF.
Min. Limiting Resistance :—	
V_a (r.m.s.) = 250 ...	100 ohms.
= 240 ...	80 ohms.
= 230 ...	60 ohms.
= 220 ...	40 ohms.
= 200 ...	30 ohms.



TYPICAL OPERATING CONDITIONS.

R.M.S. Input Voltage per Anode ...	200	220	240	250 volts.
Rectified Current ...	180	180	180	180 mA.
Supply Impedance per Anode ...	30	65	105	125 ohms.
Reservoir Capacitor	60	60	60	60 μF.
DC. Output Voltage	195	195	195	195 volts.

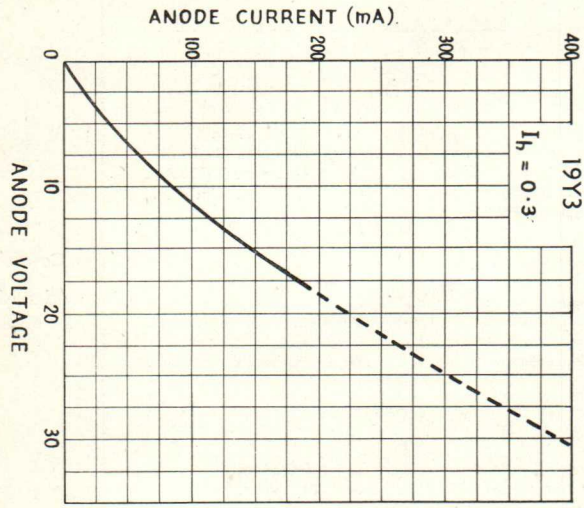
All dimensions shown are in millimetres.

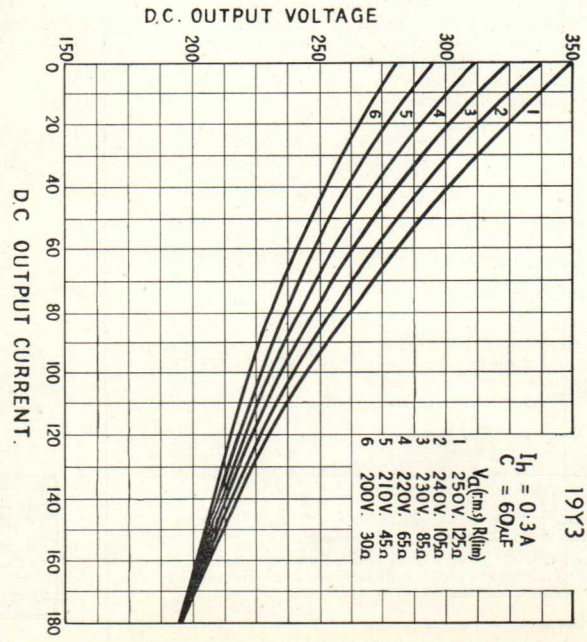
*Mains voltage of not more than 220 V. r.m.s., plus a maximum DC. component of 250 volts.

†For two PY82 in parallel the max. Reservoir Capacitor is 100 μF., but each anode must have the minimum specified limiting resistance.

Issue 1
(Tentative)
Aug., 1955

19Y3


ANODE CURRENT (mA).
0
100
200
300
400
ANODE VOLTAGE
0
10
20
30
19Y3
I_h = 0·3·


D.C. OUTPUT VOLTAGE
150
200
250
300
350
D.C OUTPUT CURRENT.
0
20
40
60
80
100
120
140
160
180
1
2
3
4
5
6
19Y3
I_h = 0·3A
C = 60μF
Va(rms) R(lim)
1 250V. 125Ω
2 240V. 105Ω
3 230V. 85Ω
4 220V. 65Ω
5 210V. 45Ω
6 200V. 30Ω

R1257

FERRANTI
LINE OUTPUT PENTODE

21A6

An indirectly heated output pentode designed for use in Television Receivers as a Line Time Base Output Valve. It is intended for use in a.c. or d.c. series heater chains.

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
Max. Overall Length	83 mm. ($3\frac{5}{32}$in.).
Max. Seated Height	76 mm. (3in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Control Grid.	Pin 7—Internal Connection.
Pin 3—Cathode.	Pin 8—Screen Grid.
Pin 4—Heater.	Pin 9—Suppressor Grid.
Pin 5—Heater.	Top Cap—Anode.

HEATER.

Heater Current	0·3 amp.
Heater Voltage	21·5 volts.

RATINGS.

Max. DC. Supply Voltage	550 volts.
Max. Anode Voltage	250 volts.
*Max. Peak Anode Voltage	7 kV.
†Max. Anode Dissipation	8 watts.
Max. Screen Voltage	250 volts.
‡†Max. Screen Dissipation	4·5 watts.
Max. Cathode Current	180 mA.
**Min. Neg. Grid Voltage	1·3 volts.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	20 kΩ
§Max. R_{g1-k}	500 kΩ
Max. Bulb Temperature	185 °C.

CHARACTERISTICS.

Anode Voltage	170	200	volts.
Screen Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Control Grid Voltage	−22	−28	volts.
Anode Current	45	40	mA.
Screen Current	3	2·8	mA.
Mutual Conductance	6·2	6·0	mA/V.
Anode Impedance	10	11	kΩ
Inner μ (μ_{g1-g2})	5·5	5·5	

TYPICAL OPERATION.

As Line Output Pentode.

Anode Voltage	70	70	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage	−1	−1	volt.
Anode Current	380	470	mA.

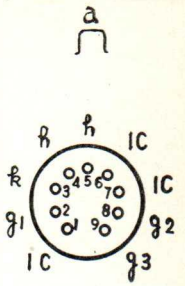
The above figures are for an average new valve. To allow for manufacturing spread of characteristics, and to cover change during life, the output circuit should be designed around the following values :—

Anode Voltage	70	70	volts.
Screen Voltage	170	200	volts.
Anode Current	<250	<310	mA.

As Audio Amplifier (2 valves in push pull).

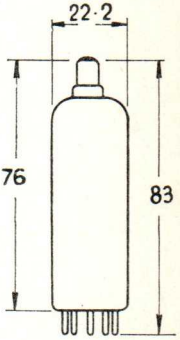
Anode Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Screen Grid Voltage	170	200	volts.
Control Grid Voltage	−27	−31·5	volts.
Screen Feed Resistor	1	1	kΩ
Anode Current (Zero signal)	2 x 20	2 x 25	mA.
Anode Current (Max. signal)	2 x 73	2 x 87	mA.
Screen Current (Zero signal)	2 x 1·5	2 x 2	mA.
Screen Current (Max. signal)	2 x 10	2x12·5	mA.
Optimum Load (Anode to Anode)	2·5	2·5	kΩ

*Max. pulse duration of 18% of one cycle, with a maximum of 18 μsecs.
†$p_a + p_{g2}$ should not exceed 10 watts.
‡Max. average p_{g2} is 6 watts for the period between the start of screen current and the instant when the anode current attains one half of its normal operating value.
**For grid current of 0·3 μA.
§For line output operation the max. value of R_{g1-k} may be 3·3 MΩ



Base Connections

Underside View of Base



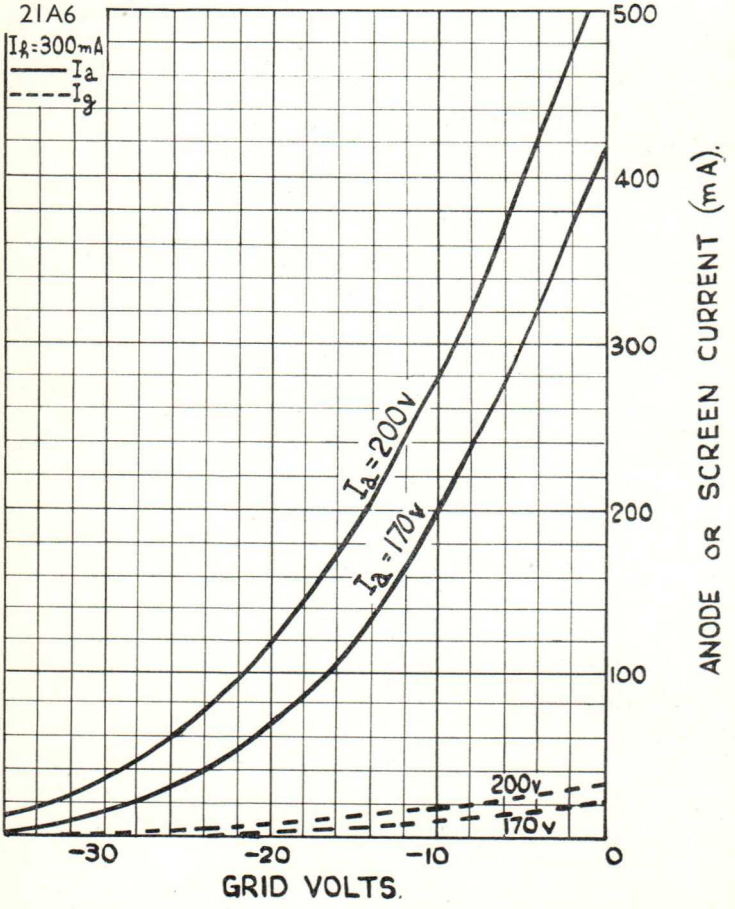
All Dimensions shown are in millimetres (max.).

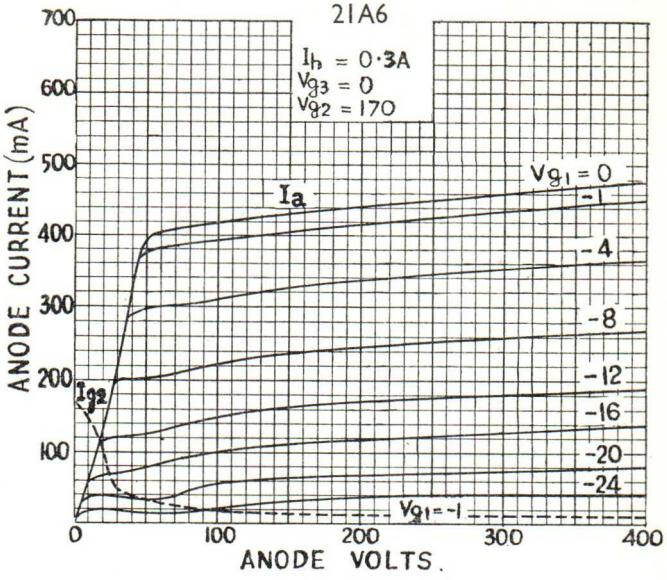
Issue 1
Dec., 1955

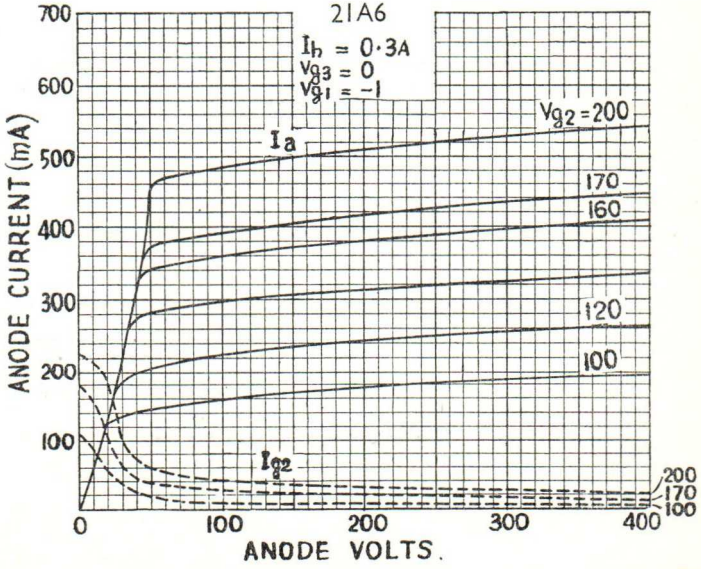
FERRANTI

CAPACITANCES.

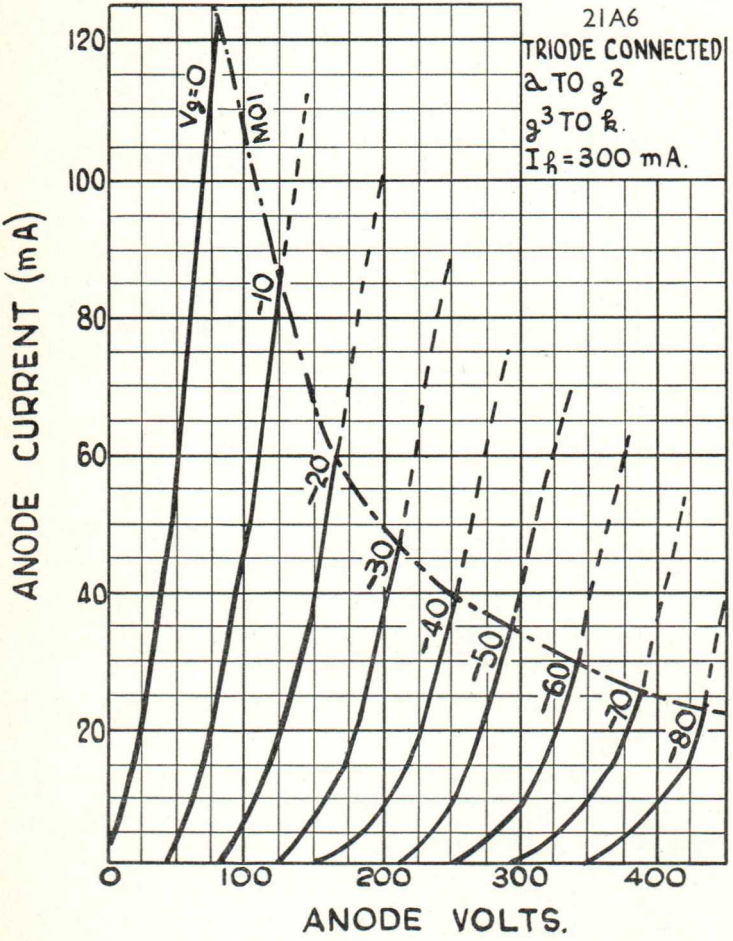
C_{in}	...	...	...	...	14·7 pF.
C_{out}	...	...	...	...	6·4 pF.
C_{a-g1}	...	...	...	...	<0·8 pF.
C_{a-k}	...	...	...	...	<0·1 pF.
C_{g1-h}	...	...	...	...	<0·2 pF.







FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

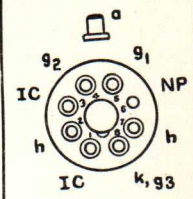

21A6
TRIODE CONNECTED
a TO g2
g3 TO k.
Ik = 300 mA.
ANODE CURRENT (mA)
120
100
80
60
40
20
0
100
200
300
400
ANODE VOLTS.
Vg=0
-01
-10
-20
-30
-40
-50
-60
-70
-80

FERRANTI

LINE OUTPUT PENTODE

25E5

An indirectly heated output pentode. It is designed for use as a Line Time Base Output Valve in Television Receivers employing television tubes with 90° scanning angles; and is intended for use in series heater chains.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	Octal.
Top Cap	CTI.
Max. Overall Length	110 mm. ($4\frac{11}{32}$")
Max. Seated Height	95 mm. ($3\frac{3}{4}$")
Max. Diameter	33 mm. ($1\frac{5}{16}$")
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Internal Connection. Pin 5—Control Grid.
Pin 2—Heater. Pin 6—No Pin.
Pin 3—Internal Connection. Pin 7—Heater.
Pin 4—Screen Grid. Pin 8—Cathode and Suppressor Grid.
Top Cap—Anode.

HEATER.

Heater Current	0·3 Amp.
Heater Voltage	25 volts.

RATINGS.

Max. D.C. Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
*Max. Peak Anode Voltage (Positive)	7 kV.
Max. Peak Anode Voltage (Negative)	1·5 kV.
Max. Anode Dissipation (p_a) ...	10 watts.
Max. Screen Voltage	250 volts.
†Max. Screen Dissipation (p_{g_2})	5 watts.
Max. $p_a + p_{g_2}$	13 watts.
Max. Cathode Current ...	200 mA.
Max. Peak Neg. Grid Voltage ...	−1·0 kV.
Max. V_{h-k} (Cathode Negative)	200 volts.
Max. V_{h-k} (Cathode Positive)	250 volts.
Max. R_{g_1-k}	500 kΩ

CHARACTERISTICS.

Anode Voltage	170 volts.
Screen Voltage	170 volts.
Control Grid Voltage	−21 volts.
Anode Current	100 mA.
Screen Current	8 mA.
Mutual Conductance	11 mA/V.
Anode Impedance	5·5 kΩ
Inner μ ($\mu_{g_1-g_2}$)	5·5

TYPICAL OPERATION.

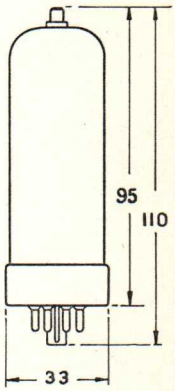
As Line Output Pentode.

Curves of anode current against anode voltage for a range of control grid voltages and screen grid resistors are shown on page 4 of the data, these apply for an average new valve.

To allow for valve spread and deterioration during life the line output circuit should be designed around a current 25% lower than the value shown on the curves.

CAPACITANCES.

C_{in}	18 pF.
C_{out}	8 pF.
C_{a-g_1}	<1·1 pF.

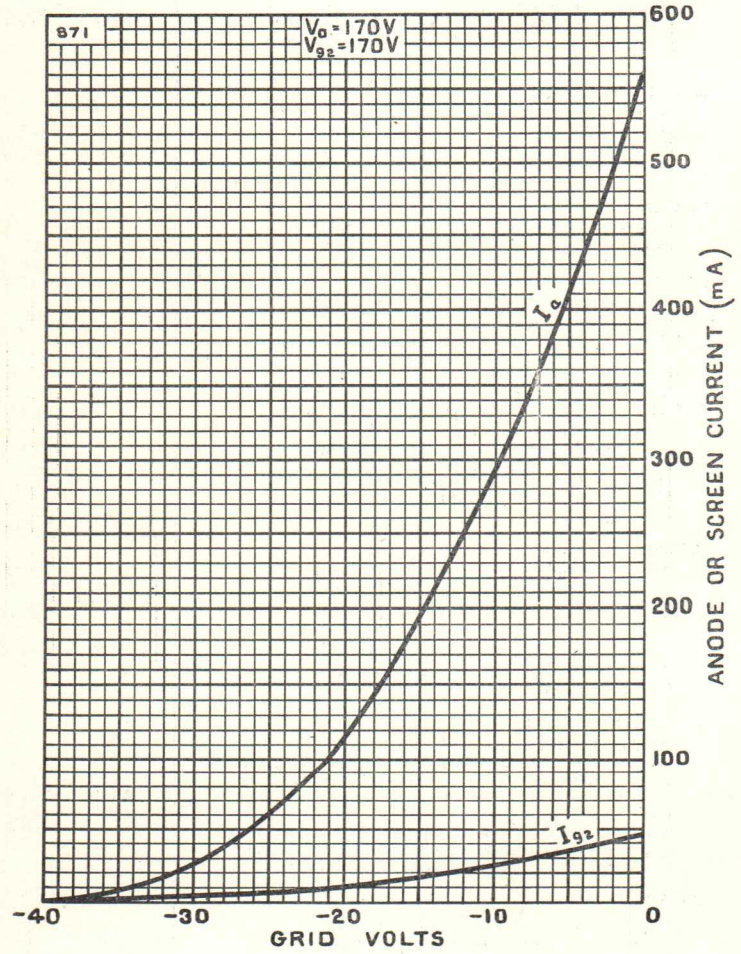


All dimensions shown are in millimetres (max.)

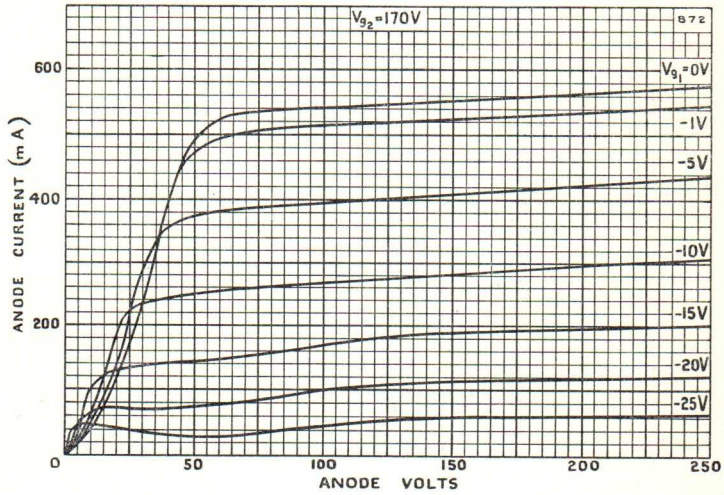
*Max. pulse duration of 18% of one cycle, with a maximum of 18 μsecs.

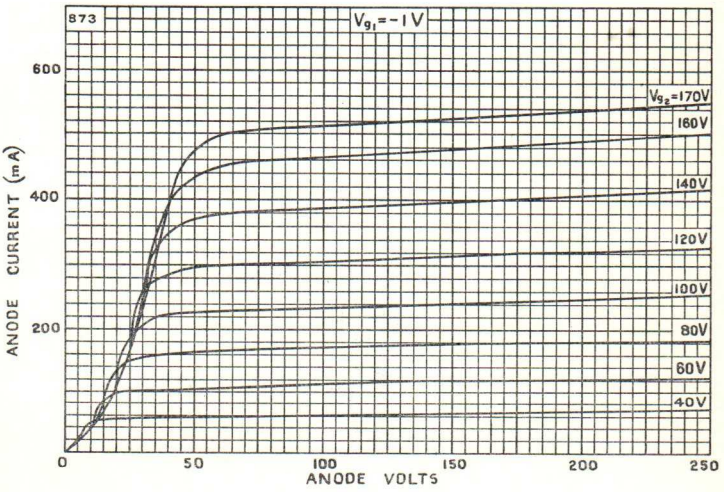
†Max. average p_{g_2} is 7 watts for the period between the start of screen current and the instant when the anode current attains one half of its normal operating value.

Issue 1.
Feb., 1957

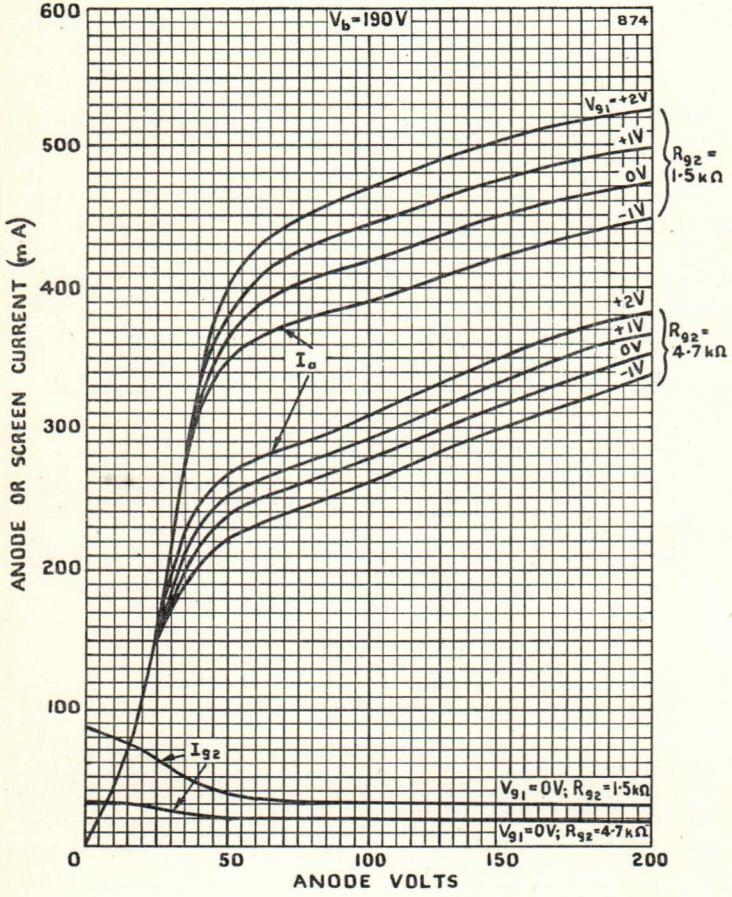


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.





FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

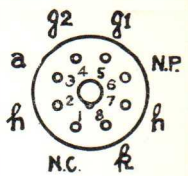
FERRANTI

BEAM TETRODES

35L6G

35L6GT

Types 35L6G and 35L6GT are indirectly heated beam tetrodes for use in the output stages of equipments designed for AC/DC operation. These valves are capable of giving relatively high power outputs at the low voltages available in such equipments.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

	35L6G.	35L6GT.
Base	International Octal.	International Octal.
Max. Overall Length	119 mm. ($4\frac{11}{16}$in.).	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	104 mm. ($4\frac{3}{32}$in.).	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Bulb)	45 mm. ($1\frac{25}{32}$in.).	33 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.	Any.

BASE CONNECTIONS.

Pin 1—No Connection. Pin 5—Control Grid (g_1).
Pin 2—Heater. Pin 6—No Pin.
Pin 3—Anode. Pin 7—Heater.
Pin 4—Screen Grid (g_2). Pin 8—Cathode.

HEATER.

Heater Current	0·15 amp.
Heater Voltage	35·0 volts.

RATINGS.

Max. Anode Voltage	200 volts.
Max. Screen Voltage	110 volts.
Max. Anode Dissipation	8·5 watts.
Max. Screen Dissipation	1·0 watt.
Max. Heater-Cathode Voltage	100 volts DC.

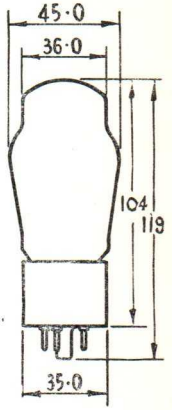
TYPICAL OPERATION.

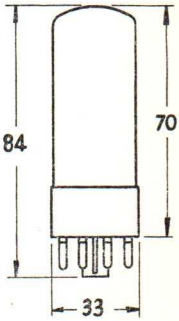
Single Valve Class A_1 Amplifier.

Anode Voltage	110	200	volts.
Screen Voltage	110	110	volts.
Control Grid Voltage	−7·5	−8·0	volts.
Anode Current (Zero Signal)	40	41	mA.
Anode Current (Max. Signal)	41	44	mA.
Screen Current (Zero Signal)	3	2	mA.
Screen Current (Max. Signal)	7	7	mA.
Anode Impedance (Approx.)	14000	40000	ohms.
Mutual Conductance	5·8	5·9	mA/V.
Cathode Bias Resistor	170	185	ohms.
Anode Load	2500	4500	ohms.
Power Output	1·5	3·3	watts.
Total Harmonic Distortion	10	10	%

CAPACITANCES.

	35L6G	35L6GT	
C_{in}	13·5	13·0	pF.
C_{out}	8·0	9·0	pF.
C_{a-g}	1·0	1·0	pF.



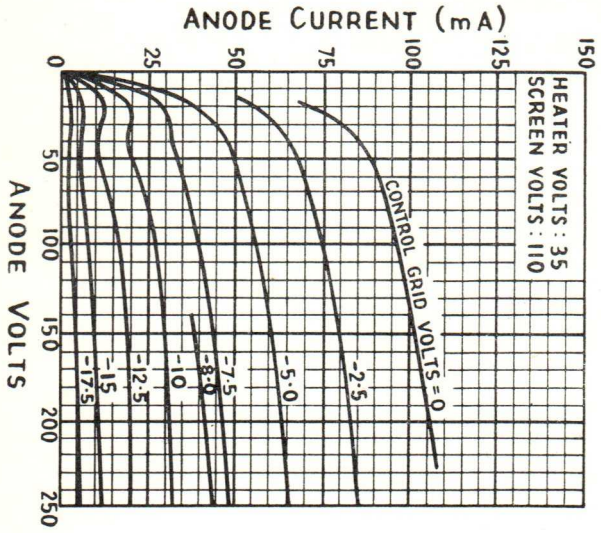


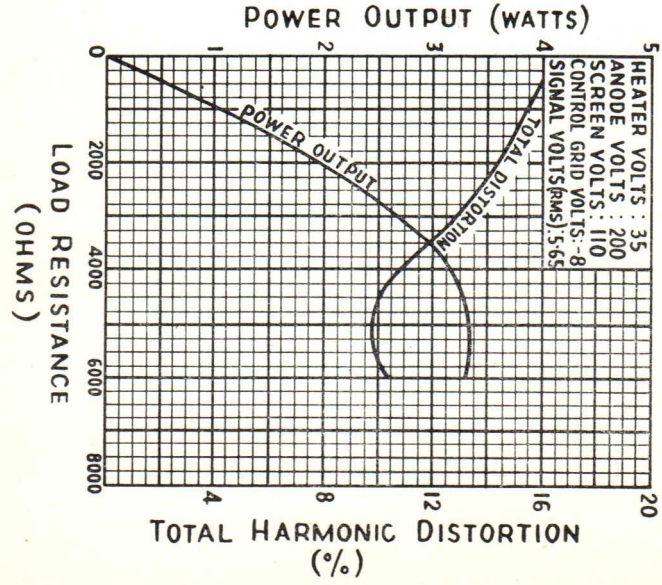
All dimensions shown are in millimetres (max.).

Issue 3.
Jan., 1953

35L6G

35L6GT



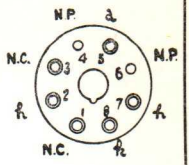


FERRANTI

HALF WAVE RECTIFIER

Valve type 35Z4GT is an indirectly heated, high vacuum, half wave rectifier designed for use in AC/DC equipment,

35Z4GT



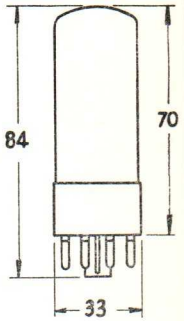
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Bulb	Clear.
Max. Overall Length	84 mm. ($3\frac{5}{16}$in.).
Max. Diameter	33 mm. ($1\frac{5}{16}$in.).
Max. Seated Height	70 mm. ($2\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No Connection.	Pin 5—Anode.
Pin 2—Heater.	Pin 6—No Pin.
Pin 3—No Connection.	Pin 7—Heater.
Pin 4—No Pin.	Pin 8—Cathode.



HEATER.

Heater Current	0·15 amp.
Heater Voltage	35 volts.

RATINGS.

Max. Peak Inverse Voltage ...	700 volts.
Max. Peak Anode Current ...	600 mA.
Max. R.M.S. Anode Voltage ...	250 volts.
Max. Rectified Current ...	100 mA.
Max. V_{h-k}	350 volts.

All dimensions shown are in millimetres. (max.).

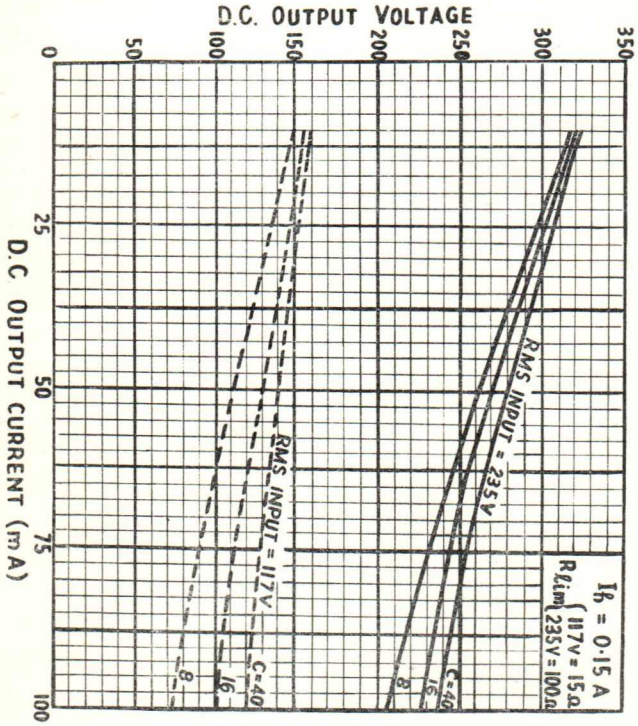
TYPICAL OPERATION.

CAPACITOR INPUT.

R.M.S. Input Voltage per Anode	117	250	volts.
Rectified Current	100	100	mA.
Min. Supply Impedance	15	100	ohms.
Max. Reservoir Condenser ...	40	40	μF.

Issue 2.
Dec., 1952

35Z4GT


D.C. OUTPUT VOLTAGE
0
50
100
150
200
250
300
350
D.C OUTPUT CURRENT (mA)
25
50
75
100
RMS INPUT = 117V
RMS INPUT = 235V
C=40
16
8
I_H = 0·15 A
R(lim) 117V = 15Ω
235V = 100Ω

FERRANTI

OUTPUT PENTODE

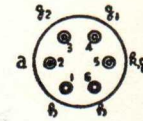
Type 42 is an indirectly heated pentode designed for use in the output stage of AC. radio receivers and audio amplifiers.

PHYSICAL DETAILS.

Base	UX—6 pin.
Max. Overall Length	117 mm. ($4\frac{39}{64}$in.).
Max. Seated Height	103 mm. ($4\frac{1}{16}$in.).
Max. D ameter (Bulb)	46 mm. ($1\frac{13}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 4—Control Grid.
Pin 2—Anode.	Pin 5—Cathode, Suppressor Grid.
Pin 3—Screen Grid.	Pin 6—Heater.



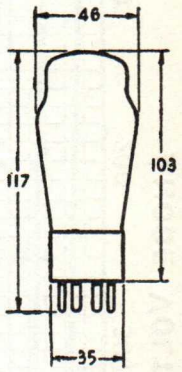
Base Connections Underside View of Base

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·7 amps.

RATINGS.

Max. Anode Voltage	375 volts.
Max. Screen Voltage	285 volts.
Max. Anode Dissipation ...	11 watts.
Max. Screen Dissipation ...	3·75 watts.
Max. Heater-Cathode Voltage ...	100 volts DC.



TYPICAL OPERATION.

Single Valve Class A_1 Amplifier.

Heater Voltage	6·3	6·3	volts.
Anode Voltage	250	285	volts.
Screen Voltage	250	285	volts.
Control Grid Voltage	−16·5	−20	volts.
Anode Current (Zero Signal) ...	34	38	mA.
Anode Current (Max. Signal) ...	36	40	mA.
Screen Current (Zero Signal) ...	6·5	7	mA.
Screen Current (Max. Signal) ...	10·5	12	mA.
Anode Impedance (approx.) ...	80000	78000	ohms.
Mutual Conductance	2·5	2·55	mA/V.
Cathode Bias Resistor	410	440	ohms.
Anode Load	7000	7000	ohms.
Power Output	3·2	4·8	watts.
Total Harmonic Distortion ...	8	9	%

2 Valves Push Pull Class AB_1 Amplifier.

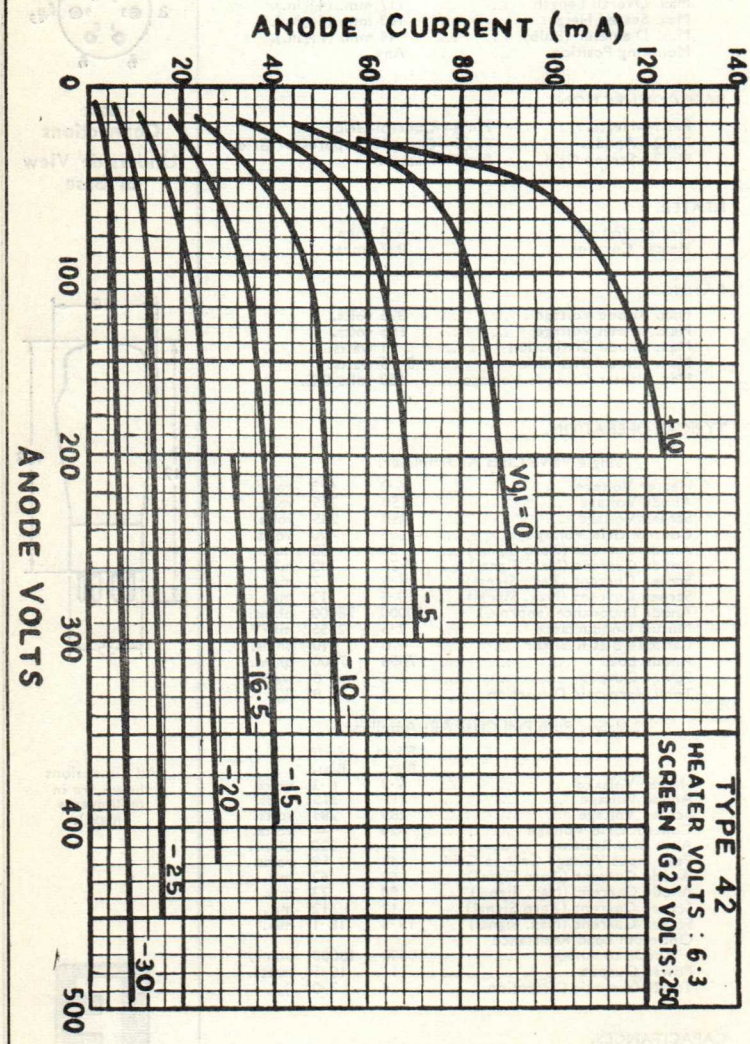
	Fixed Bias.	Auto Bias.	
Heater Voltage	6·3	6·3	volts.
Anode Voltage	315	315	volts.
Screen Voltage	285	285	volts.
Control Grid Voltage	−24	—	volts.
Auto Bias Resistor	—	320	ohms.
Peak Input Voltage Grid to Grid	48	58	volts.
Anode Current (Zero Signal)	62	62	mA.
Anode Current (Max. Signal) ...	80	73	mA.
Screen Current (Zero Signal)	12	12	mA.
Screen Current (Max. Signal)	19·5	18·1	mA.
Optimum Load Resistance Anode to Anode	10000	10000	ohms.
Power Output	11	10·5	watts.
Total Harmonic Distortion ...	4	3·0	%

CAPACITANCES.

C_{in}	8·0 pF.
C_{out}	6·5 pF.
C_{a-g}	0·5 pF.

All dimensions shown are in millimetres (max.).

Issue 2
Feb., 1954

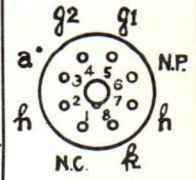

ANODE CURRENT (mA)
0
20
40
60
80
100
120
140
ANODE VOLTS
100
200
300
400
500
+10
Vg1=0
-5
-10
-15
-16·5
-20
-25
-30
TYPE 42
HEATER VOLTS : 6·3
SCREEN (G2) VOLTS: 250

FERRANTI
BEAM TETRODES

Types 50L6G and 50L6GT are indirectly heated beam tetrodes for use in the output stages of equipments designed for AC/DC operation. These valves are capable of giving relatively high power outputs at the low voltages available in such equipments.

50L6G

50L6GT



Base Connections

Underside View of Base

PHYSICAL DETAILS.

50L6G.

Base	... ...	International Octal.
Max. Overall Length	... ...	119 mm. ($4\frac{11}{16}$in.).
Max. Seated Height	... ...	104 mm. ($4\frac{3}{32}$in.).
Max. Diameter (Bulb)	... ...	45 mm. ($1\frac{25}{32}$in.).
Mounting Position	... ...	Any.

50L6GT.

Base	... ...	International Octal.
Max. Overall Length	... ...	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	... ...	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Base)	... ...	33 mm. ($1\frac{5}{16}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—No Connection. Pin 5—Control Grid (g_1).
Pin 2—Heater. Pin 6—No Pin.
Pin 3—Anode. Pin 7—Heater.
Pin 4—Screen Grid (g_2). Pin 8—Cathode.

HEATER.

Heater Current	... ...	0·15 amp.
Heater	... ...	50·0 volts.

RATINGS.

Max. Anode Voltage	... ...	200 volts.
Max. Screen Voltage	... ...	110 volts.
Max. Anode Dissipation	...	10 watts.
Max. Screen Dissipation	...	1·25 watts.
Max. Heater-Cathode Voltage	...	100 volts DC.

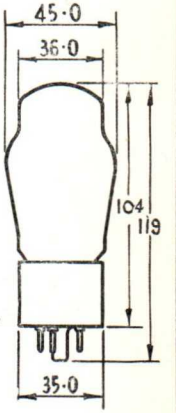
TYPICAL OPERATION.

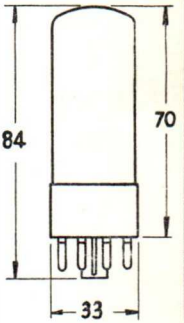
Single Valve Class A_1 Amplifier.

Anode Voltage	... ...	110	200 volts.
Screen Voltage	... ...	110	110 volts.
Control Grid Voltage	...	−7·5	−8 volts.
Anode Current (Zero Signal)		49	50 mA.
Anode Current (Max. Signal)		50	55 mA.
Screen Current (Zero Signal)		4	2 mA.
Screen Current (Max. Signal)		11	7 mA.
Anode Impedance (Approx.)		13000	30000 ohms.
Mutual Conductance	...	9·0	9·5 mA/V.
Cathode Bias Resistor	...	150	160 ohms.
Anode Load	... ...	2000	3000 ohms.
Power Output	... ...	2·1	4·3 watts.
Total Harmonic Distortion		10	10 %

CAPACITANCES.

		50L6G	50L6GT
C_{in}	... ...	12·5	12·0 pF.
C_{out}	... ...	8·0	9·5 pF.
C_{a-g}	... ...	1·0	1·0 pF.





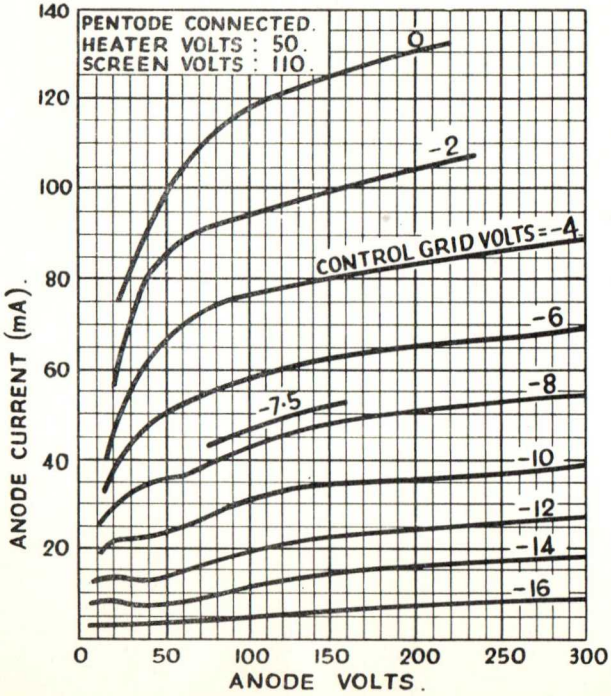
All dimensions shown are in millimetres (max.).

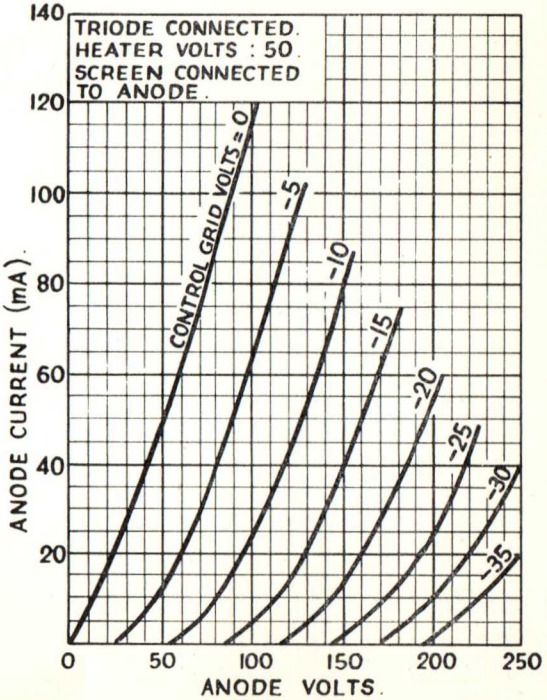
FERRANTI

Issue 2.
April, 1953

FERRANTI

50L6G
50L6GT



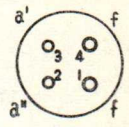


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

FERRANTI

FULL WAVE RECTIFIER

A directly heated, high vacuum full wave rectifier.



Base Connections

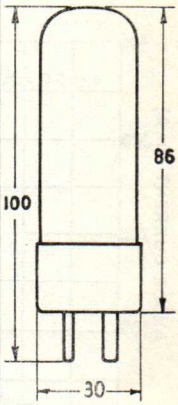
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Bulb	Clear.
Max. Overall Length	100 mm. (3 1/4 in.).
Max. Seated Height	86 mm. (3 3/8 in.).
Max. Diameter (Base)	30 mm. (1 3/16 in.).
Mounting Position	Vertical, base down ; or horizontal with pins 1 and 2 in vertical plane.

BASE CONNECTIONS.

Pin 1—Filament. Pin 3—Anode 1.
Pin 2—Anode 2. Pin 4—Filament.



FILAMENT.

Filament Voltage	5·0 volts.
Filament Current	2·0 amps.

RATINGS*

Max. Peak Inverse Voltage ...	1400 volts.
R.M.S. Anode Supply Voltage ...	See Rating Chart.
Rectified Current	See Rating Chart.
Min. Limiting Resistance ...	50 ohms.
Max. Peak Anode Current ...	400 mA.
†Max. Hot-switching Transient Anode Current ...	2·2 amps.

TYPICAL OPERATION.

Capacitor-Input Filter.

*R.M.S. Input Voltage	350	500	volts.
Filter-Input Capacitor	10	10	μF.
*Min. Supply Impedance	50	140	ohms.
DC. Output Voltage at Input to Filter (approx.) :—			
At Half-Load Current of { 62·5 mA.	390	—	volts.
{ 42 mA.	—	610	volts.
At Full-Load Current of { 125 mA.	350	—	volts.
{ 84 mA.	—	560	volts.
Voltage Regulation, Half-load to Full-load Current (approx.)	40	50	volts.

All dimensions shown are in millimetres (max.).

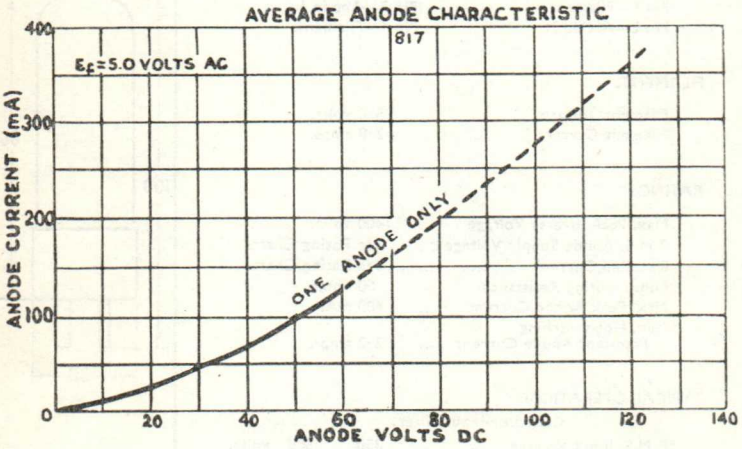
*Each anode.

†For maximum duration of 0·2 sec.

Issue 3
Mar., 1956

TYPICAL OPERATION (cont.)

	Choke-Input Filter.		
Filter-Input Choke	350	500	volts.
R.M.S. Input Voltage per anode	10*	10†	henries.
DC. Output Voltage at Input to Filter (approx.) :—			
At Half-Load Current of { 75 mA. / 62·5mA.	270	—	volts.
	—	405	volts.
At Full-Load Current of { 150 mA. / 125 mA.	245	—	volts.
	—	390	volts.
Voltage Regulation, Half-load to Full-load Current (approx.)	25	15	volts.



*This value is adequate to maintain optimum regulation in the region to the right of line L= 10H on curve Operation Characteristics with Choke-Input Filter, provided the load current is not less than 35 mA. For load currents less than 35 mA., a larger value of inductance is required for optimum regulation.

†This value is adequate to maintain optimum regulation in the region of the right of line L= 10H on curve Operation Characteristics with Choke-Input Filter, provided the load current is not less than 50 mA. For load currents less than 50 mA., a larger value of inductance is required for optimum regulation.

For Rating Chart and Operation Characteristics see type 5Y3GT which is electrically identical.

TELEVISION TUBES.

FERRANTI

TELEVISION TUBE

MW43-69

A 17in. rectangular Television Tube with metal-backed grey glass filter screen and incorporating an ion-trap pentode gun. An external conductive coating provides smoothing for the E.H.T. supply.

Focus	Magnetic.
Deflection	Magnetic.
Screen	Metal-backed
Fluorescence	White.
Light Transmission	66%.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length	495mm.
Mounting Position	Any.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—2nd Anode.
Pin 2—Grid.	Pin 8—No Pin.
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—1st Anode.
Pin 5—No Pin.	Pin 11—Cathode.
Pin 6—No Connection.	Pin 12—Heater.

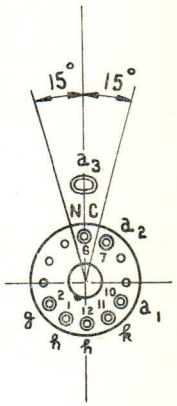
Side Contact—3rd Anode.

HEATER.

*Heater Voltage	6·3 volts.
Heater Current	0·3 amp.

RATINGS.

Max. 1st Anode Voltage	410 volts.
Max. 2nd Anode Voltage	410 volts.
**Max. 3rd Anode Voltage	16 kV.
Min. 1st Anode Voltage	200 volts.
Min. 2nd Anode Voltage	−100 volts.
Min. 3rd Anode Voltage	10 kV.
†Max. V_{h-k} (Heater positive)	125 volts.
†Max. V_{h-k} (Heater negative)	200 volts.
††Max. V_{h-k} (peak) (Heater negative)	410 volts.
Max. R_{g-k}	1·5 MΩ
Max. Z_{g-k} (f=50 c/s.)	0·5 MΩ
Max. R_{h-k}	See note §
Max. 1st Anode supply source Impedance	1·5 MΩ
Max. 2nd Anode supply source Impedance	1·5 MΩ
‡Nom. V_g for visual cut off	$-\frac{V_{a1}}{5}$ volts.



Base Connections

Underside View of Base

*When used for series operation, the surge heater voltage should not exceed 9·5 volts r.m.s. and a current limiting device should be incorporated in the circuit to limit switching surge.

**The product of 3rd Anode Voltage and Beam Current must not exceed 6 watts.

†To avoid excessive hum the A.C. component of V_{h-k} should be as low as possible—in any case not greater than 20 volts (r.m.s.).

††During a warming-up period not exceeding 45 secs.

§When the heater is in a series chain, or earthed, Z_K max. is 0·1 MΩ where Z_k is the 50 c/s. impedance between earth and the cathode. When the heater is supplied from a separate transformer R_{h-k} max. is 1 MΩ

‡The modulator should never be positive with respect to the cathode, except during the period immediately after switching off, when it may be allowed to rise to +1 volt.

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Mar., 1957

FERRANTI

TYPICAL OPERATION.

Heater Voltage ...	... ...	6·3 volts.
1st Anode Voltage	... ...	300 volts.
2nd Anode Voltage	... ...	0 volts.
3rd Anode Voltage	... ...	14 kV.
V_g for visual cut off	... ...	−40 to −86 volts.

PREFOCUSING.

The spot size and uniformity of focus depend upon 2nd Anode Voltage. At 2nd Anode Voltage zero or negative with respect to cathode the spot size at the centre of the screen and the width of the electron beam are such that optimum uniformity of focus is obtained over the whole screen. If the 2nd Anode Voltage is increased, the spot size at the centre of the screen is reduced but the width of the electron beam is increased, resulting in inferior focus at the edges of the screen.

With increased 2nd Anode Voltage the power of the external focusing magnet has to be increased.

ION TRAP.

To accommodate the Ion Trap Magnet the neck of the tube should be kept clear for a distance of 112 mm. from the reference line to the edge of the base. The Ion Trap Magnet should be positioned in such a manner that the south pole is adjacent to the base.

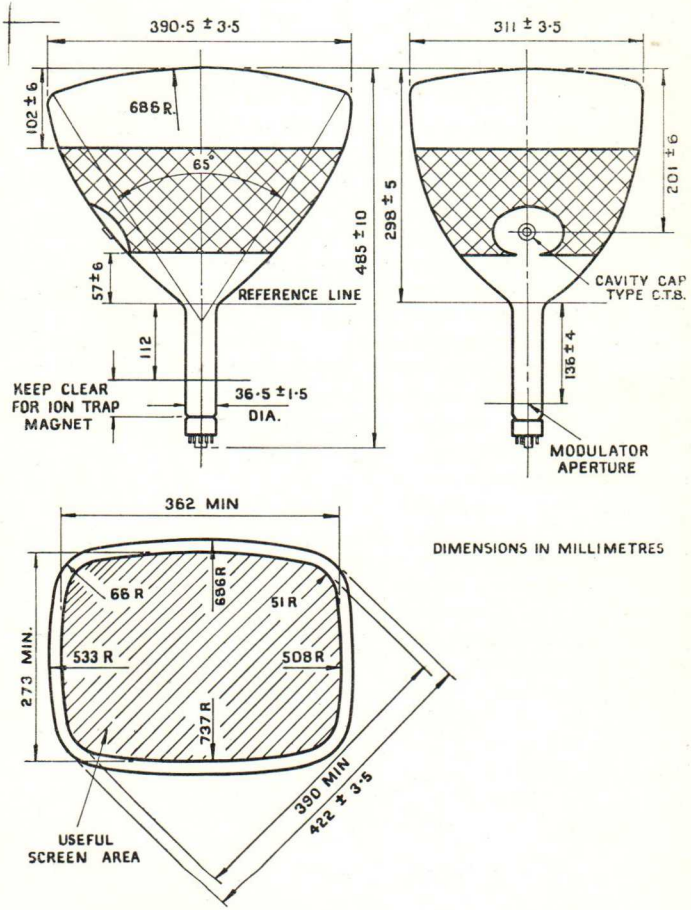
Adjustment of the Ion Trap Magnet should be carried out in accordance with the procedure outlined under "Notes on Operation (Cathode Ray Tubes)" preceding this section of the handbook.

§§ Ion Trap Magnet field strength 59–67 gauss.

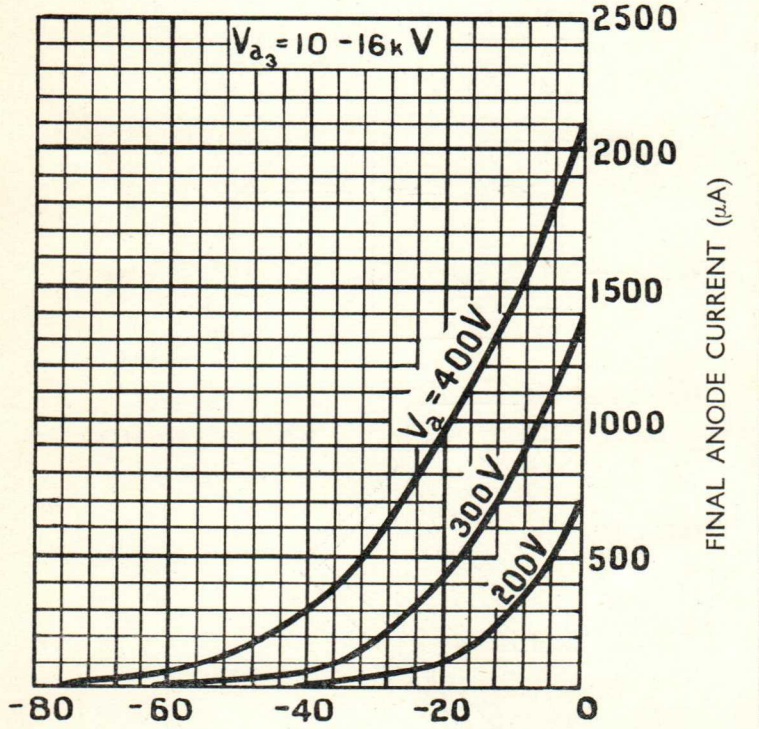
CAPACITANCES.

C_{k-all}	<6·0 pF.
C_{g-all}	<8·0 pF.
C_{k+a_2-all}	< 11 pF.
C_{a_3-M}	1100 pF. approx.

§§ The Ion Trap Magnet assembly should be earthed.



DIMENSIONS IN MILLIMETRES


V_{a_3} = 10 - 16k V
V_a = 400V
300V
200V
2500
2000
1500
1000
500
-80
-60
-40
-20
0
GRID VOLTS
FINAL ANODE CURRENT (μA)

FERRANTI

TELEVISION TUBE

Cathode Ray Tube type T12/72U is a Triode Tube, designed for series operation in AC/DC Television Receivers.

T12/72U

Focus	Magnetic.
Deflection	Magnetic.
Fluorescence	White.

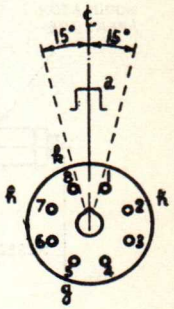
This tube has an external conductive coating which may be used to provide smoothing of the E.H.T. supply.

PHYSICAL DETAILS.

Base	International Octal.
Anode Cap	9·7 mm. dia.
Max. Overall Length	466 mm.
Max. Diameter	307 mm.
Neck Diameter	$35 \pm \frac{0}{1}$ mm.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Heater.
Pin 3—No Pin.
Pin 4—No Pin.
Pin 5—Modulator.
Pin 6—No Pin.
Pin 7—Heater.
Pin 8—Cathode.
Side Cap—Anode.



Base Connections
Underside View of Base

HEATER.

Heater Current	0·3 amp.
‡Heater Voltage	6·3 volts.

RATINGS.

*Max. Anode Voltage	10 kV.
Max. V_{h-k}	200 volts.
**Max. Negative Modulator Voltage for cut-off	Va/100

TYPICAL OPERATION.

Anode Voltage	9·0 kV.
V_g for visual cut off	−60 volts.
Av. Mod. Drive for 150 μA Beam Current ...	32 volts.
†Focus Coil	800 ampere turns (approx.).

DEFLECTION SENSITIVITY.

With an Anode Voltage of 9·0 kV. the Deflection Sensitivity is $0 \cdot 09\ell$ cms/gauss where ℓ is the effective length of the magnetic field of a scan coil situated with its centre 285 mm. from the screen.

CAPACITANCES.

C_{k-all}	6·2 pF.
C_{g-all}	5·0 pF.
$C_{a-external\ coating}$	1500 pF. approx.

The anode cap can lie within 15° either side of the centre line as indicated in the diagram.

‡When used for series operation the surge heater voltage should not exceed 9·5 volts r.m.s. and a current limiting device should be incorporated in the circuit to limit switching surges.

*The product of Anode Voltage and Beam Current should not exceed 7 watts.

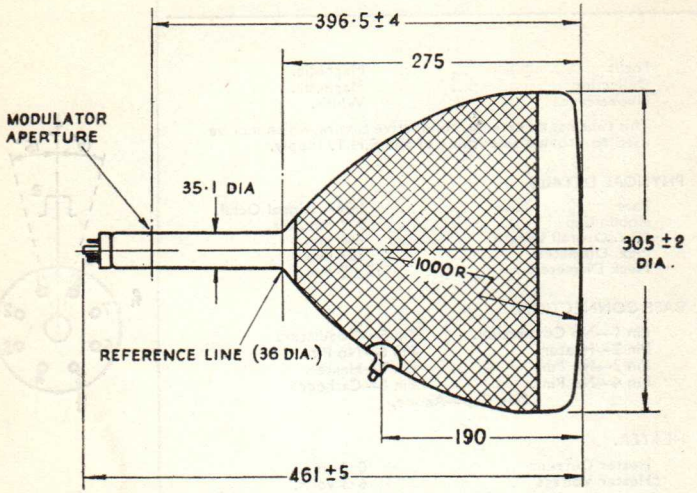
**The modulator should never be positive with respect to cathode.

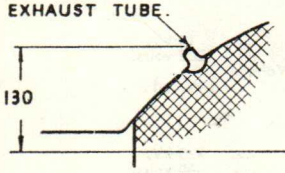
†With Va = 9·0 kV. and the focus coil positioned so that its gap is approximately 2·5 cm. in front of the modulator.

Issue 2
Dec., 1955

T12/72U

FERRANTI





DIMENSIONS IN MILLIMETRES. MAX. UNLESS OTHERWISE STATED.