TECHNICAL HANDBOOK

VALVES AND CATHODE RAY TUBES

Ferranti

TECHNICAL HANDBOOK

VALVES
AND
CATHODE RAY TUBES

Issue 4
Oct., 1963

GENERAL.

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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-g1}
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	$c_{g1-k(w)}$

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_{g1-k}	R_{g1-k}
Total effective load resistance	—	R_L
Cathode Bias Resistor	—	R_k

Power.

Anode dissipation	P_a	—
Grid 2 dissipation	P_{g2}	—
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

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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.

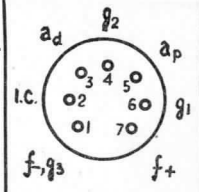
FERRANTI

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

FILAMENT.

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

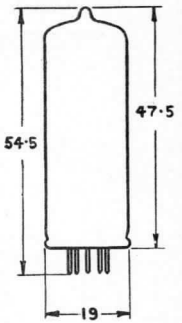
RATINGS.

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.
*Rg_1–f max.	3 MΩ
‡Vg_1 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.



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 (μg_1–g_2)	13·5	13·5	

Diode Section.

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

All dimensions shown are in millimetres (max.).

†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.
*Rg_1–f may be increased up to 22 MΩ if grid current biasing is employed.
‡For grid current of 0·3μA

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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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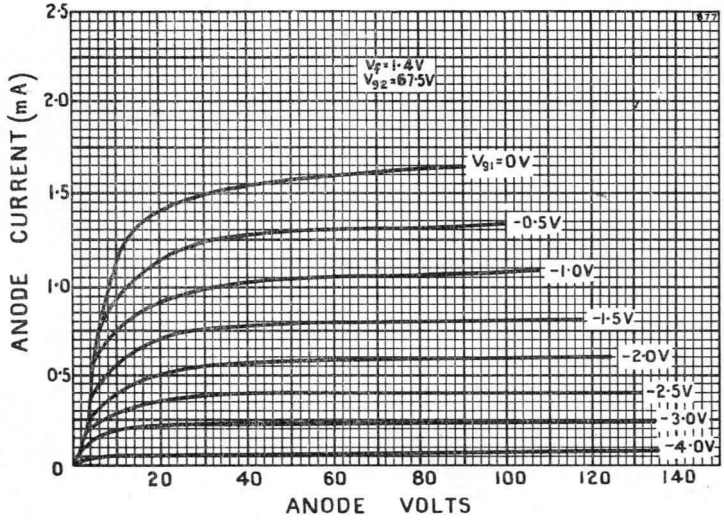

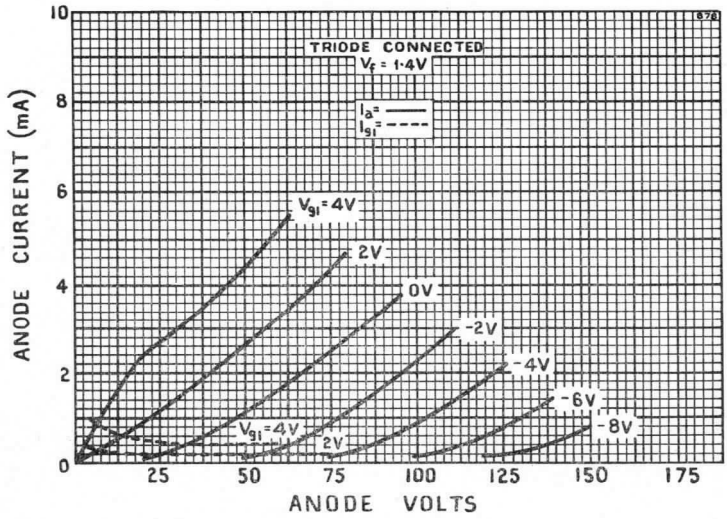

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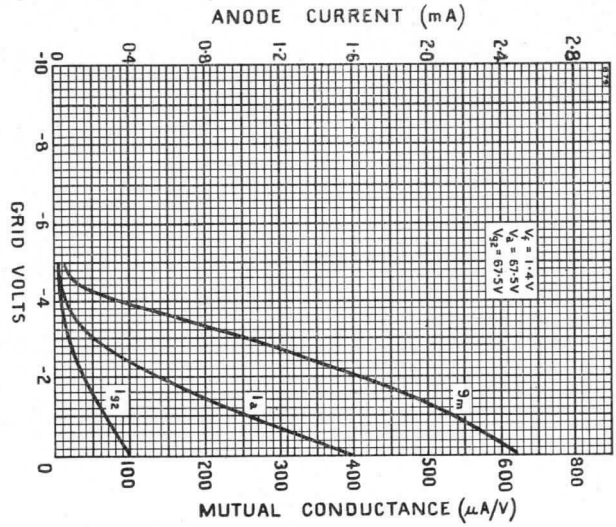
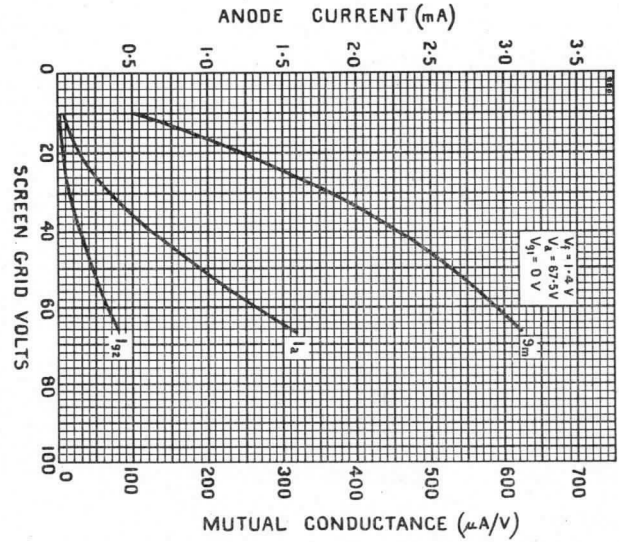

ANODE CURRENT (mA)
0·4
0·8
1·2
1·6
2·0
2·4
2·8
GRID VOLTS
-10
-8
-6
-4
-2
0
100
200
300
400
500
600
800
MUTUAL CONDUCTANCE (μA/V)
V_f = 1·4V
V_a = 67·5V
V_{g2} = 67·5V
I_{g2}
I_a
g_m


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

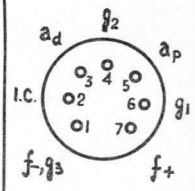
FERRANTI

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

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Pin 4—Screen Grid (g_2).
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.

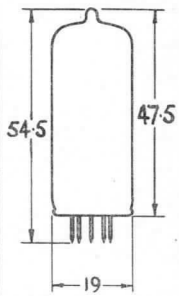
RATINGS.

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_{g1-f} (I_k <0·25 mA) ...	3 MΩ
V_{g1} max. (I_{g1} = +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_{g1-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

DAF96

1AH5

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_{g_1-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_{g_1-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.†

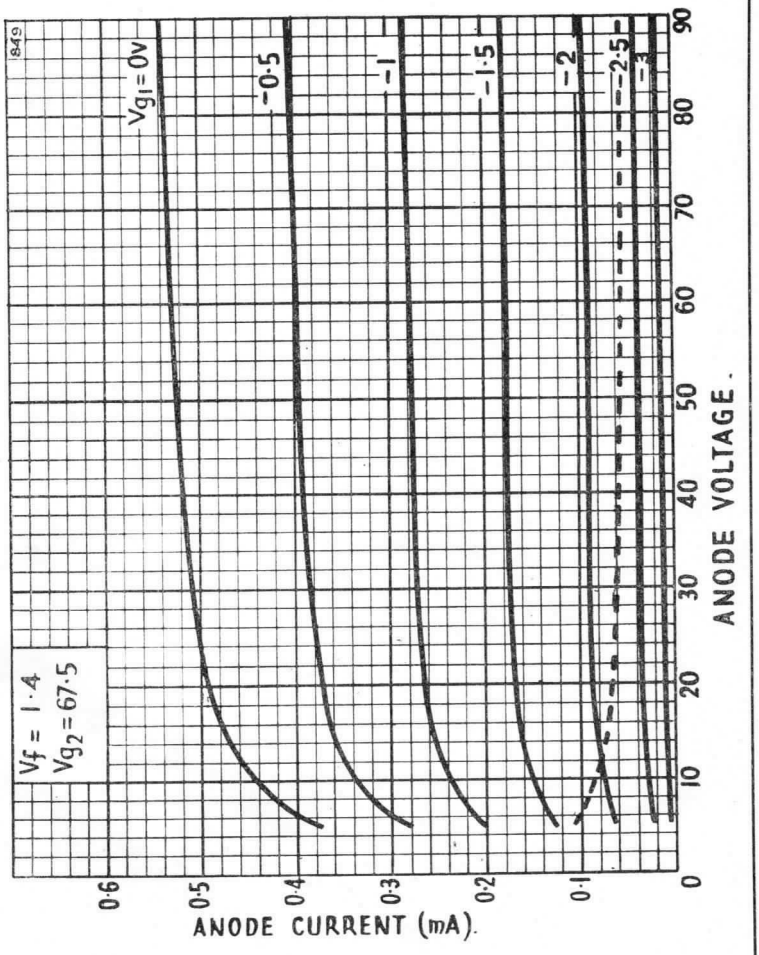
C_{in}	1·8 pF.
C_{out}	2·7 pF.
C_{a-g_1}	<0·3 pF.
$C_{a_d-g_1}$	0·03 pF.
$C_{a_d-a_p}$	<0·9 pF.
C_{ad-all}	1·1 pF.

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

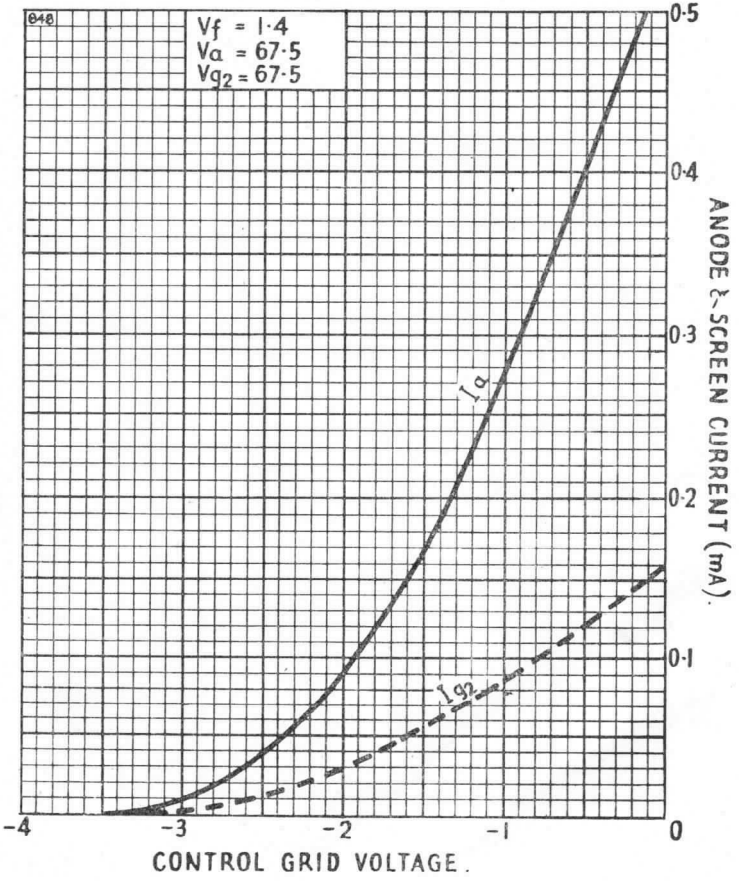
‡By-passed to earth by 0·47 μF capacitor.

†Measured without external shield.

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



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



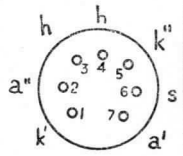
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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.

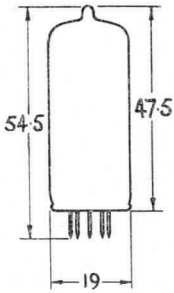
Pin 1—Cathode 1. Pin 4—Heater.
Pin 2—Anode 2. Pin 5—Cathode 2.
Pin 3—Heater. Pin 6—Internal Shield.
Pin 7—Anode 1.

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.

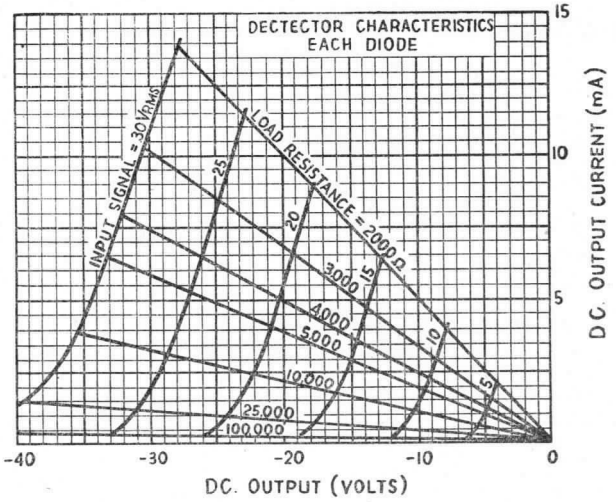
‡‡$C_{a'-a''}$	<0·026 pF.
†$C_{a'-k'+h+s}$	3·0 pF.
‡$C_{a''-k''+h+s}$	3·0 pF.
§$C_{k'-a'+h+s}$	3·4 pF.
††$C_{k''-a''+h+s}$	3·4 pF.

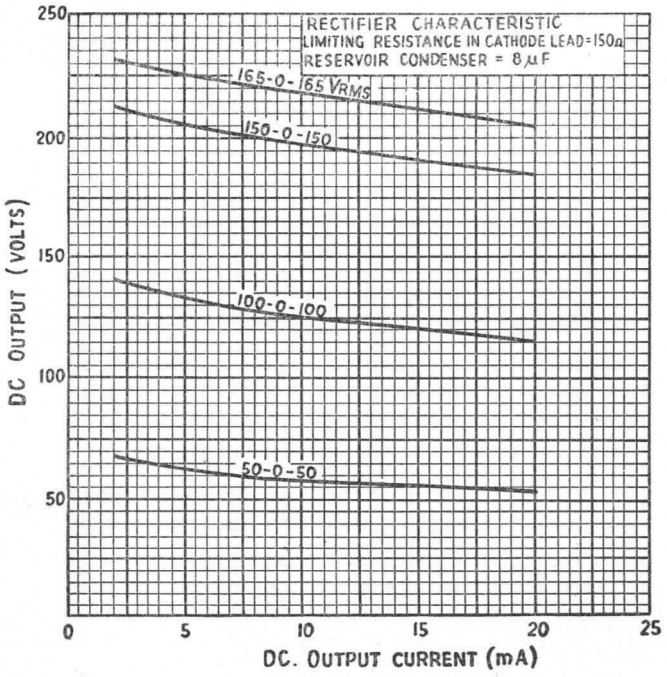
All dimensions shown are in millimetres (max.).

*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.

Issue 4
Aug.,1957

DD6


DECTECTOR CHARACTERISTICS
EACH DIODE
INPUT SIGNAL = 30 VRMS
25
20
LOAD RESISTANCE = 2000 Ω
3000
4000
5000
10,000
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)

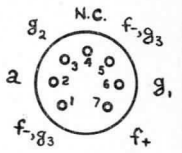
FERRANTI

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.



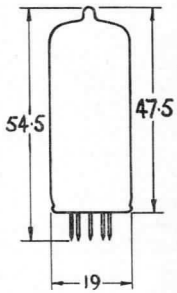
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. (2 5/32 in.).
Max. Seated Height	47·5 mm. (1 7/8 in.).
Max. Diameter	19·0 mm. (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.).

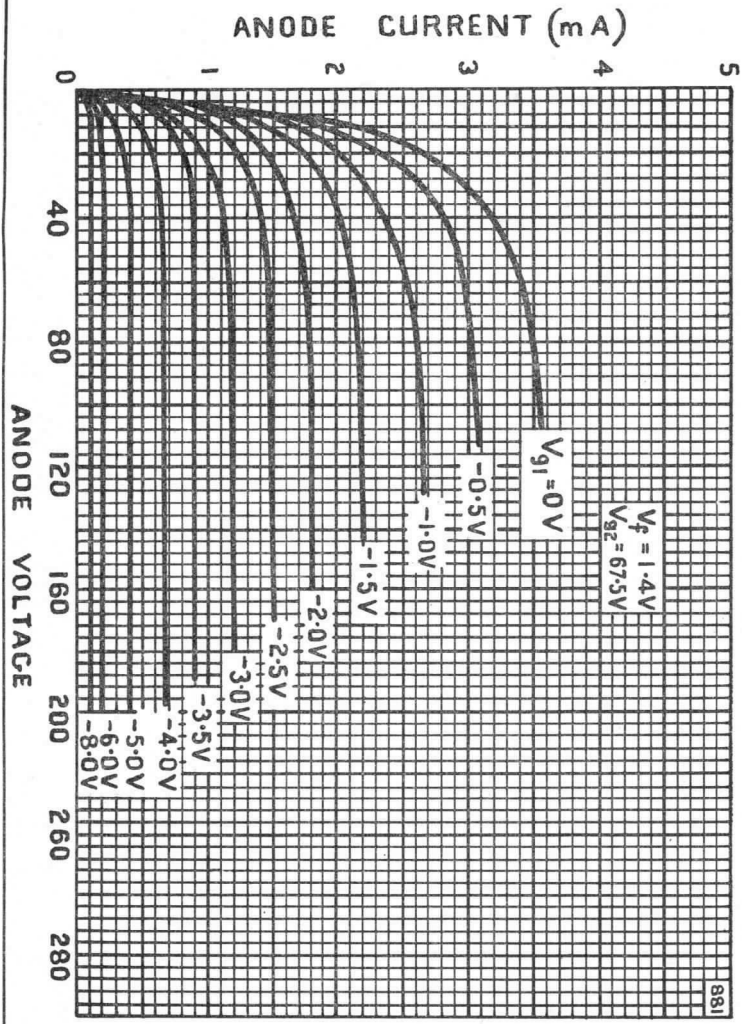
CAPACITANCES.

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
240
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
1188

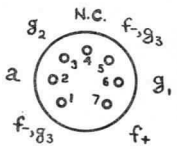
FERRANTI

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.

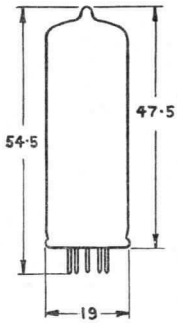
Pin 1—Filament (–), and Suppressor Grid (g_3).
Pin 2—Anode.
Pin 3—Screen Grid (g_2).
Pin 4—No Connection.
Pin 5—Filament (–), and Suppressor Grid (g_3).
Pin 6—Control Grid (g_1).
Pin 7—Filament (+).

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	

All dimensions shown are in millimetres (max.).

CAPACITANCES*

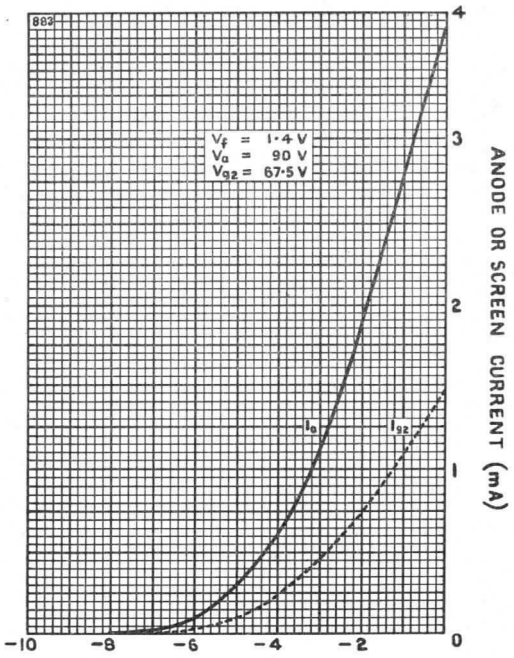
C_{in}	... ...	3·6 pF.
C_{out}	... ...	7·5 pF.
C_{a-g1}	... ...	<0·01 pF.

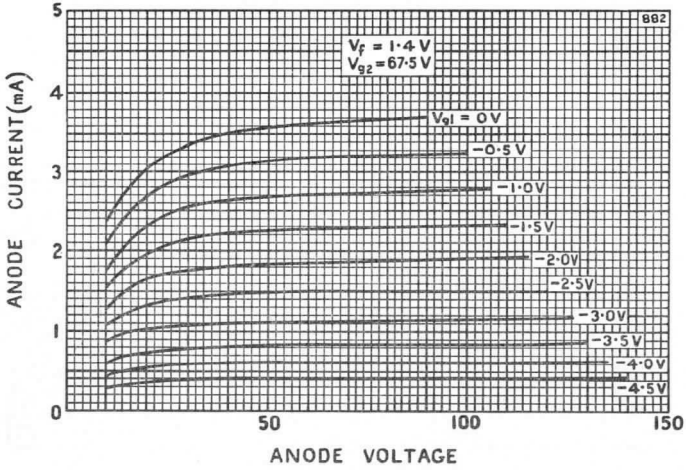
*Measured without external shield.

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
0
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

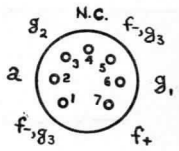
FERRANTI

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

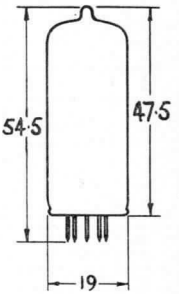
Underside View of Base

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. (2 5/32 in.).
Max. Seated Height	47·5 mm. (1 7/8 in.).
Max. Diameter	19·0 mm. (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_{g1-k}	3·0 MΩ
Max. V_{g1} ($I_{g1} = +0·3\ \mu A$) ...	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 (μ_{g1-g2})	18	18	
V_{g1} (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.

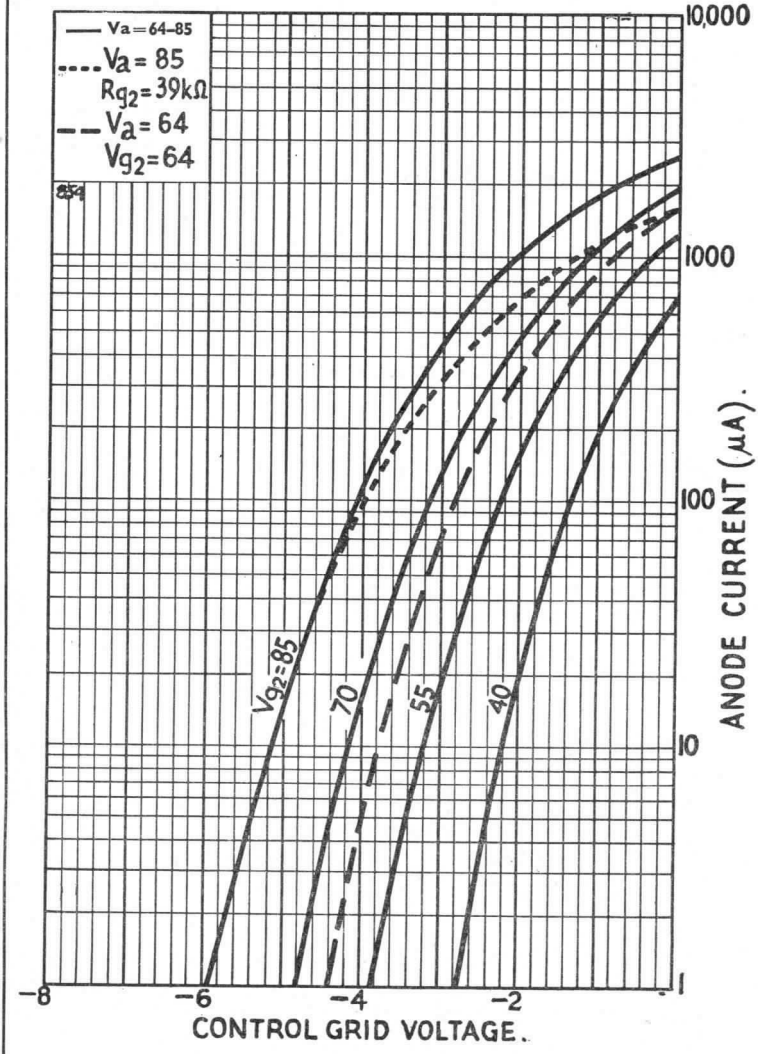
C_{in}	3·3 pF.
C_{out}	7·8 pF.
C_{a-g1}	<0·01 pF.

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

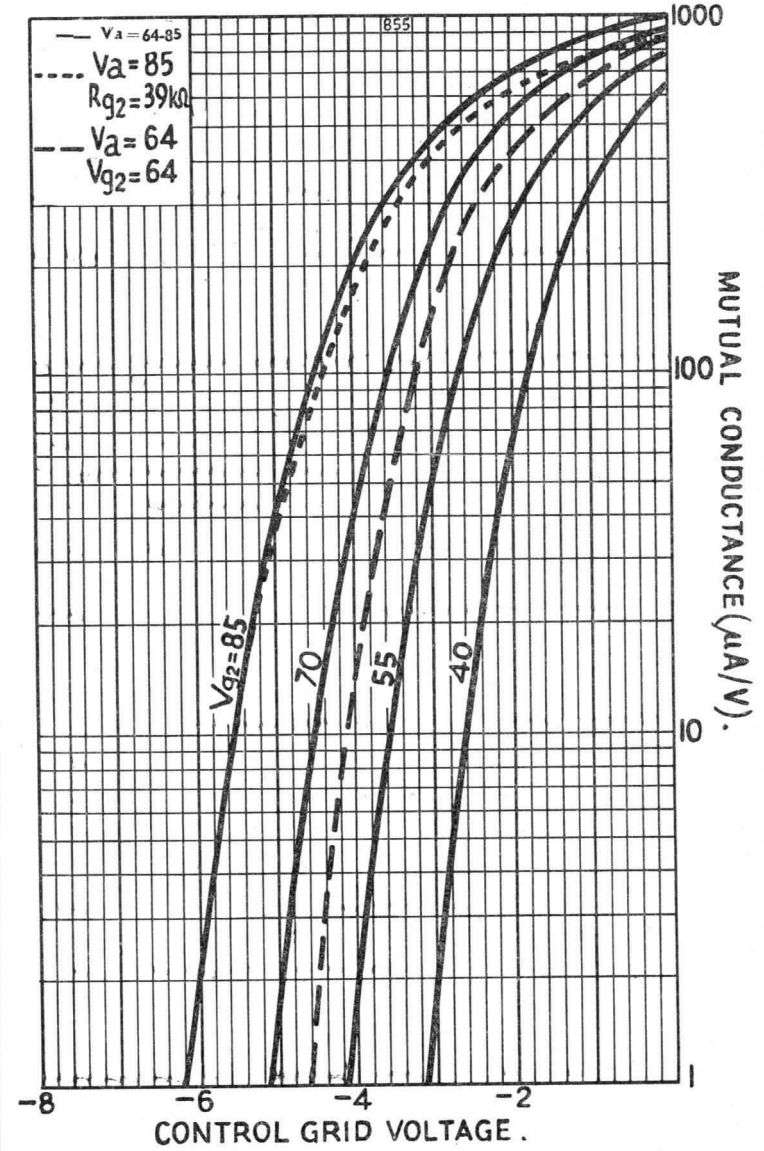
Issue 2
Dec., 1957

DF96

IAJ4



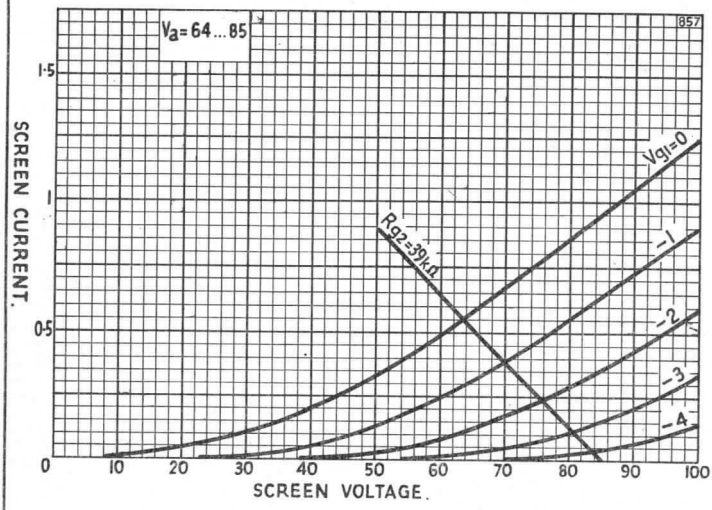
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

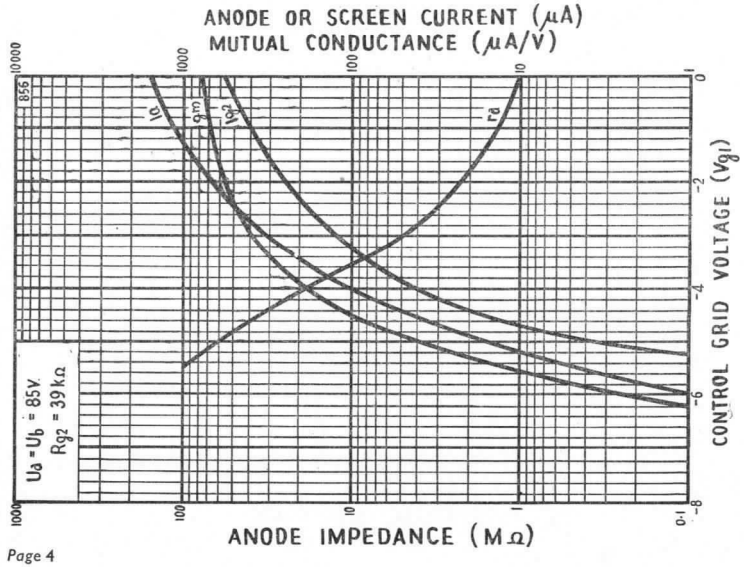


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

DF96

IAJ4





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

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.

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 (μg_1-g_2) ...	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.

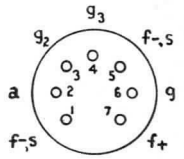
As Self-oscillating Mixer (triode connection);

†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

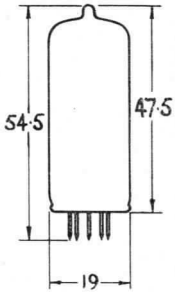
CAPACITANCES.

	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.



Base Connections Underside View of Base



All dimensions shown are in millimetres (max.).

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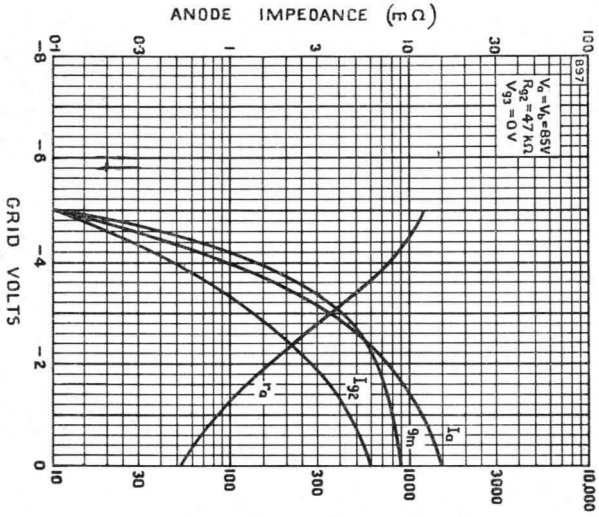
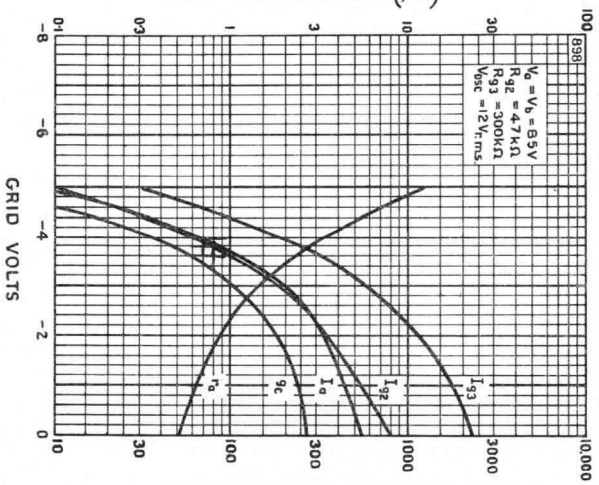
DF97



ANODE OR SCREEN CURRENT (μA)
MUTUAL CONDUCTANCE (μA/V)



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.

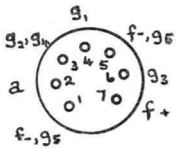
PHYSICAL DETAILS.

Base	B7G.
Max. Overall Length	54·5 mm. (2 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—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(+).



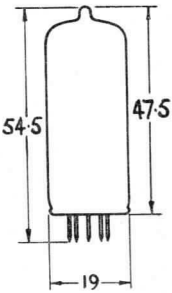
Base Connections Underside View of Base

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
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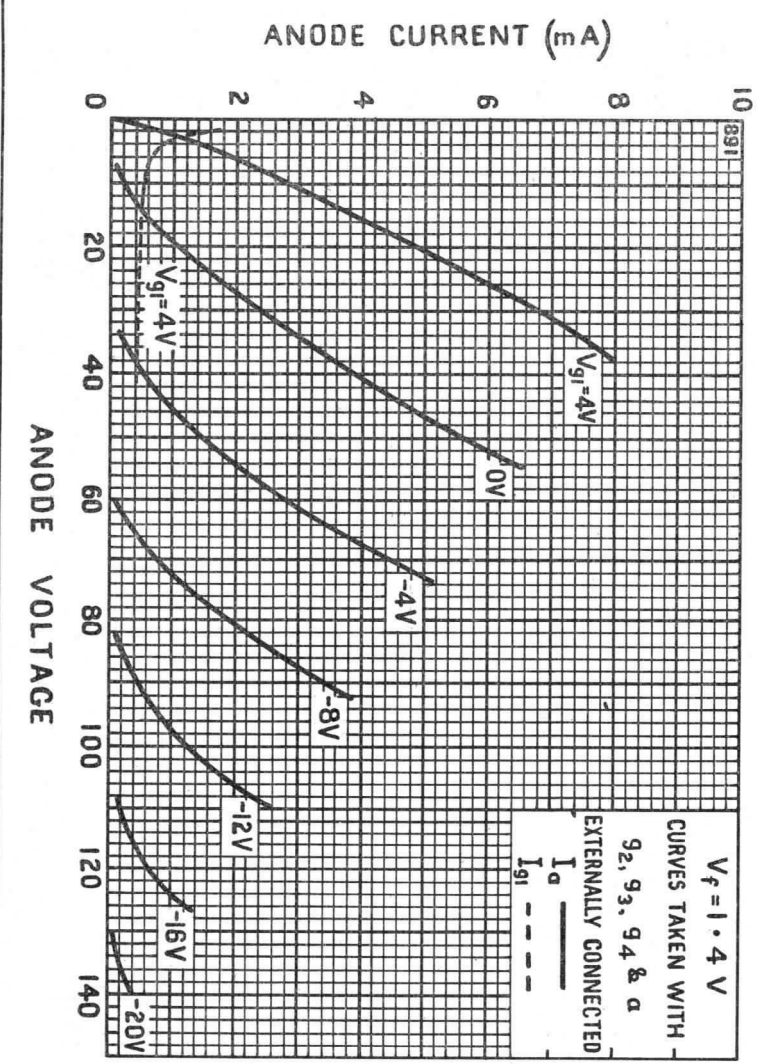
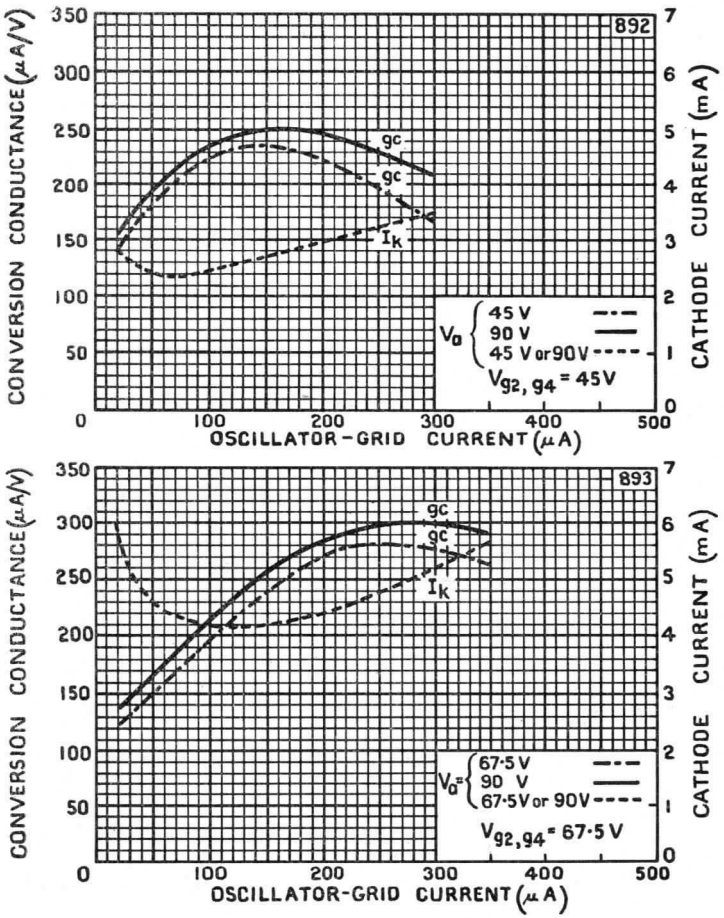

ANODE CURRENT (mA)
0
2
4
6
8
10
8911
20
40
60
80
100
120
140
ANODE VOLTAGE
V_{g1}=4V
0V
-4V
-8V
-12V
-16V
-20V
V_f=1·4 V
CURVES TAKEN WITH
g_2, g_3, g_4 & a
EXTERNALLY CONNECTED
I_a ——
I_{g1} - - - -



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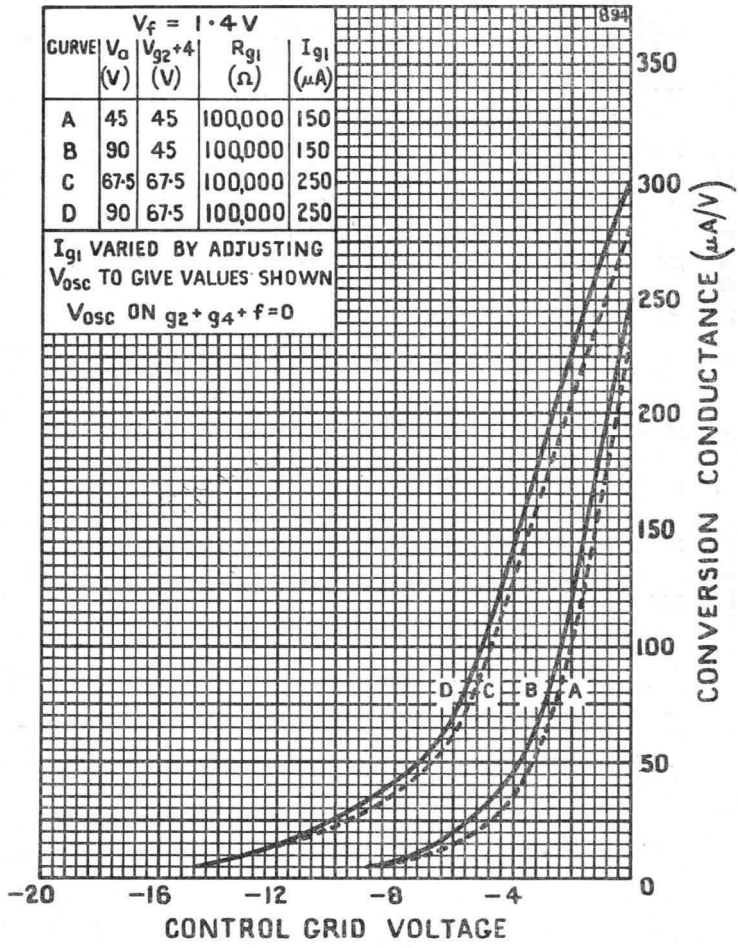


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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.

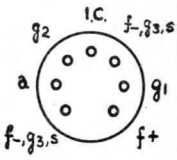
PHYSICAL DETAILS.

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).



Base Connections

Underside View of Base

FILAMENT.

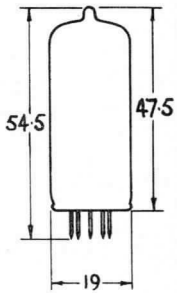
Filament Voltage	1·4 volts.
Filament Current	50 mA.

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. R_{g3-f}	3 MΩ
Max. R_{g1-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.



All dimensions shown are in millimetres (max.).

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_{g1-all} ...	4 pF.	C_{a-g3} ...	<0·4 pF.
C_{g2-all} ...	5 pF.	C_{g1-g2} ...	3·0 pF.
C_{g3-all} ...	7·5 pF.	C_{g1-g3} ...	<0·2 pF.
C_{a-all} ...	8·5 pF.	C_{g2-g3} ...	1·6 pF.

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

†Optimum value. In a typical circuit I_{g1} will be between 50μA and 250μA.

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

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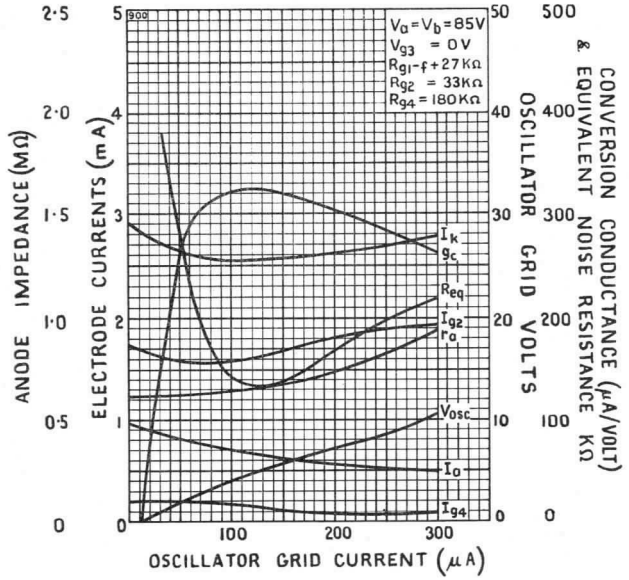
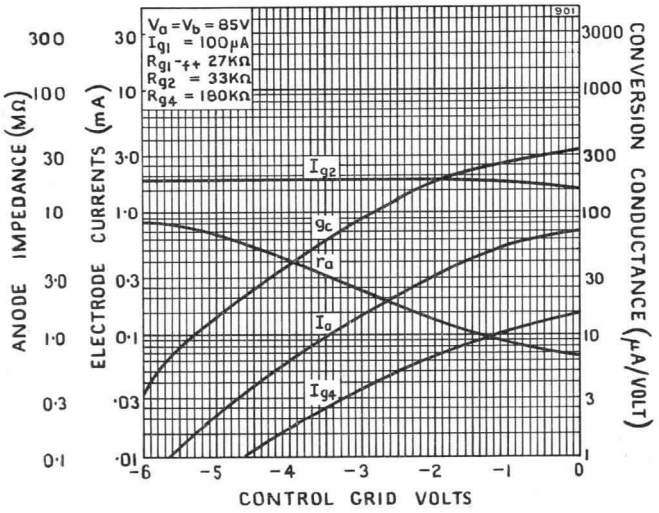
DK92

IAC6


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


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

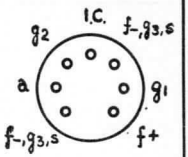
PHYSICAL DETAILS.

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—OscillatorAnode (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).



Base Connections

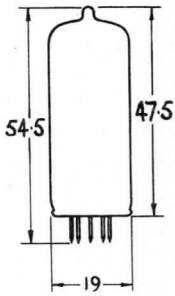
Underside View of Base

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} ($I_{g3}=+0·3\ \mu A$) ...	+1·0 volt.
Max. V_{g1} ($I_{g1}=+0·3\ \mu A$) ...	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	

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.

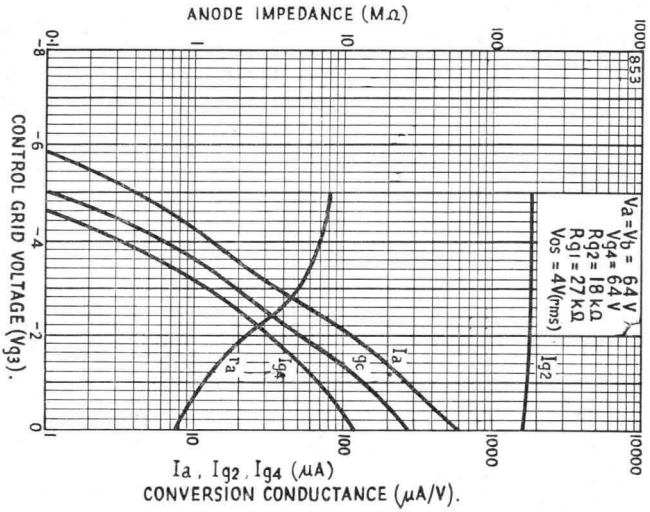
All dimensions shown are in millimetres (max.).

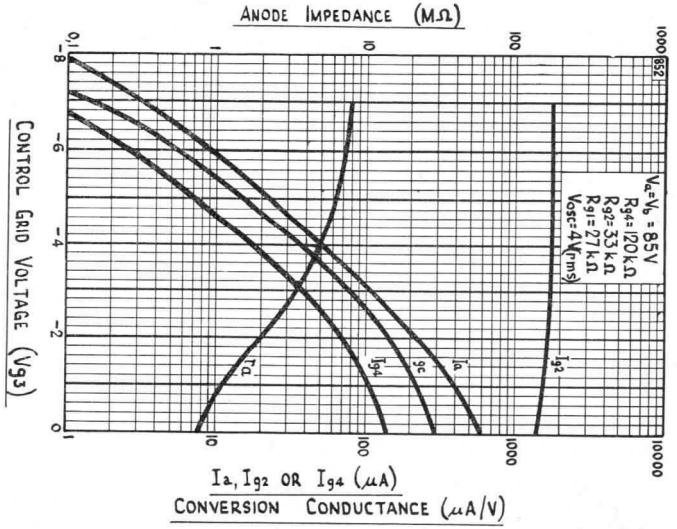
*Based on supply voltages of 67·5V and 90V decreased by the negative bias for the output valve.
†With Oscillator Grid (g_1) connected to filament (+).

Issue 2
Dec., 1957

DK96

IAB6





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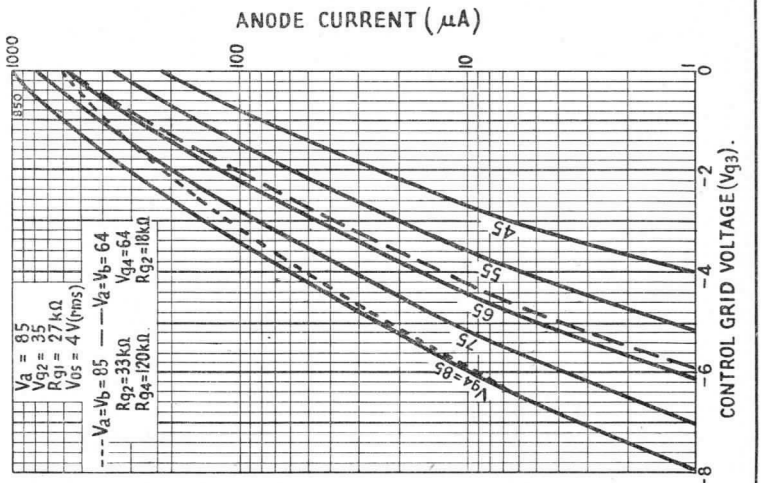
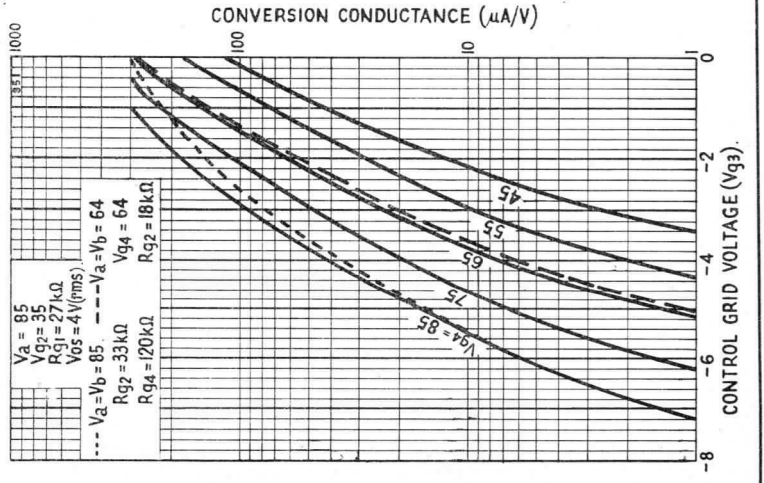
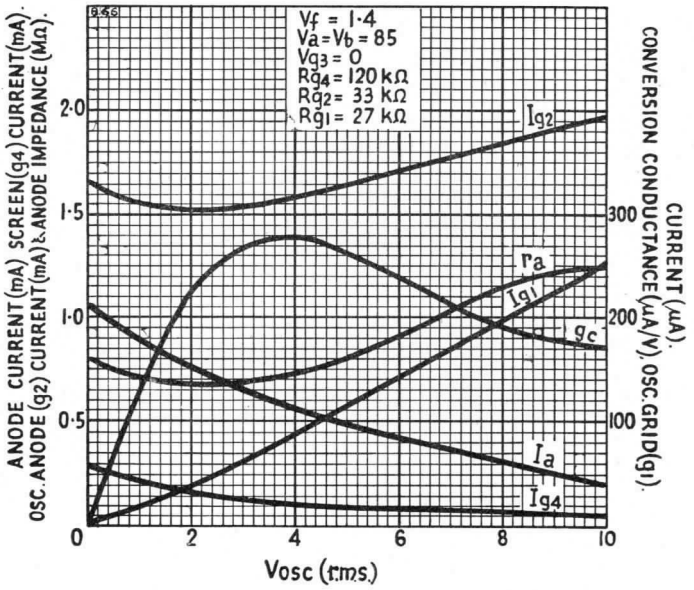
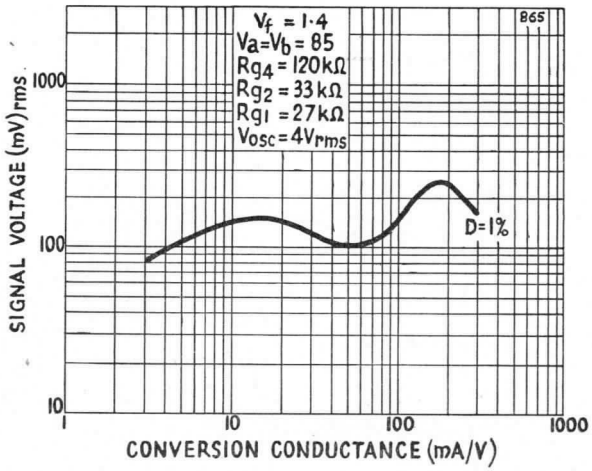

ANODE CURRENT (μA)
1000
100
10
1
0
-2
-4
-6
-8
CONTROL GRID VOLTAGE (Vg3).
850
Va = 85
Vg2 = 35
Rg1 = 27kΩ
Vos = 4 V(rms)
--- Va=Vb=85 —— Va=Vb=64
Rg2=33kΩ Vg4=64
Rg4=120kΩ Rg2=18kΩ
45
55
65
75
Vg4=85


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).
CURRENT (μA).
CONVERSION CONDUCTANCE(μA/V), OSC.GRID(g1).
2·0
1·5
1·0
0·5
0
2
4
6
8
10
300
200
100
Vosc (r.m.s.)


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

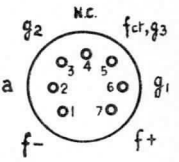
A directly heated miniature Pentode with a centre-tapped filament designed for use in the output stage of Battery Operated Receivers. The low drain filament is suitable only for DC. operation but the sections may be connected either in series or parallel.

PHYSICAL DETAILS.

Base	B7G—All Glass.
Max. Overall Length	54·5 mm. ($2\frac{5}{32}$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 (–). Pin 5—Filament centre tap and Suppressor Grid (g_3).
Pin 2—Anode. Pin 6—Control Grid (g_1).
Pin 3—Screen Grid (g_2). Pin 7—Filament (+).
Pin 4—No Connection.



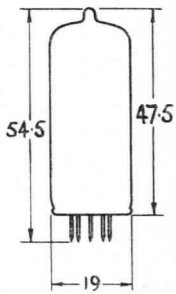
Base Connections Underside View of Base

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.



All dimensions shown are in millimetres (max.).

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 (μ_{g1-g2})	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	%

*†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
$V_{in\ (g1-g1)}$ ...	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
$V_{in\ (g1-g1)}$ ...	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.

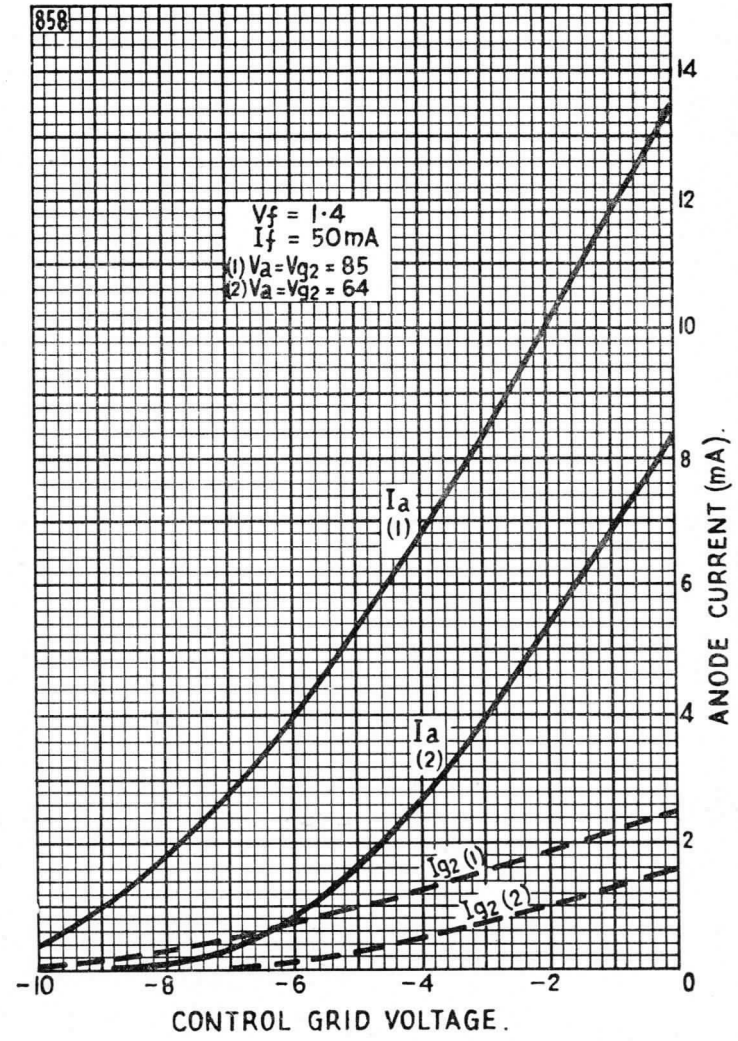
Parallel Filament Connection: V_f applied between pin 5 and pins 1 and 7 connected together. V_{g1} referred to pin 5.

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.



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

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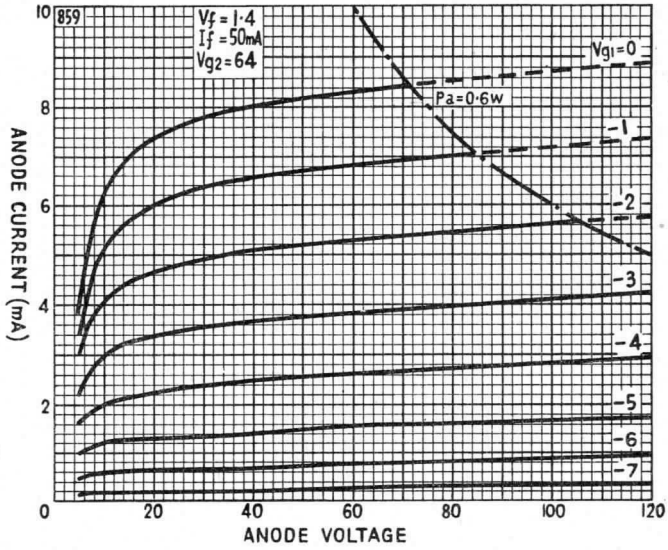
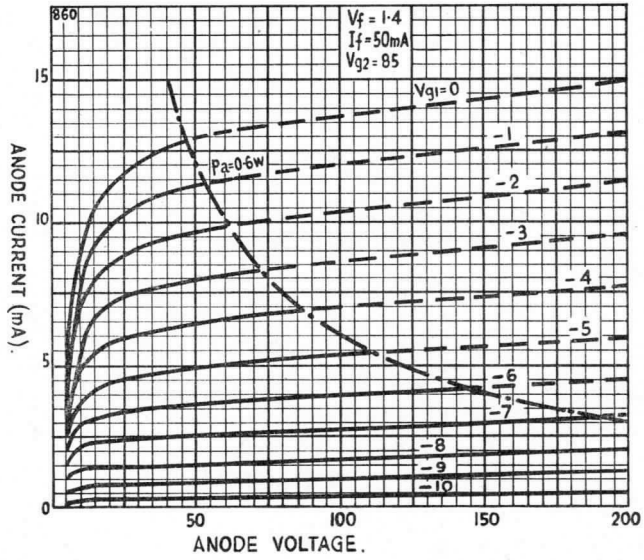
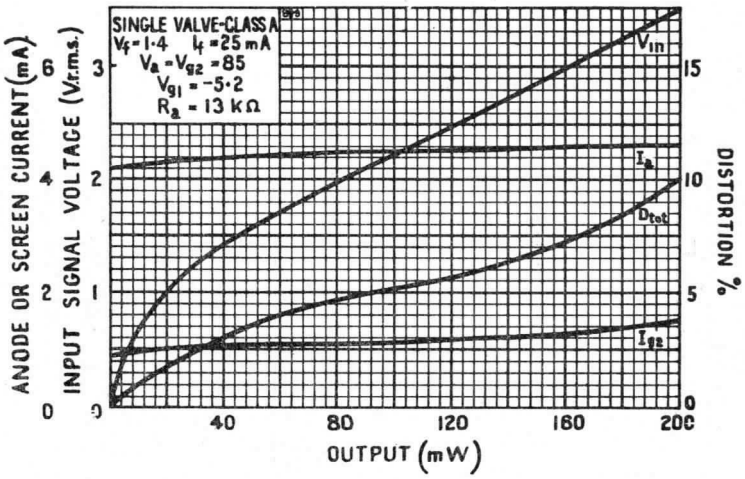
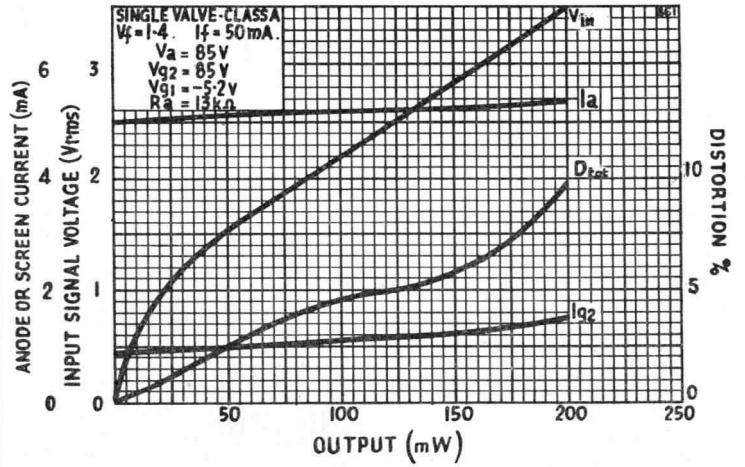
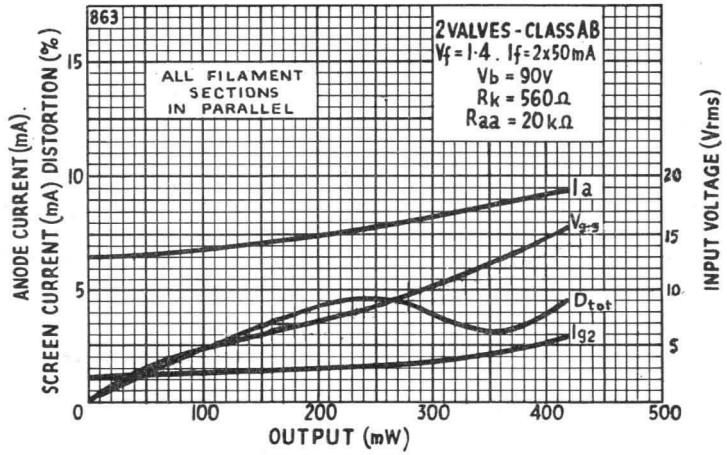


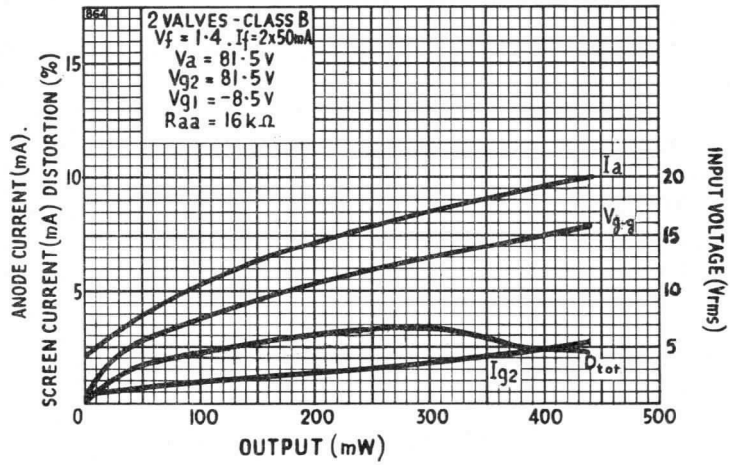


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.


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
0
1
2
3
4
5
6
0
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
0
1
2
3
4
5
6
0
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
OUTPUT (mW)
0
100
200
300
400
500
5
10
15
20


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
OUTPUT (mW)
0
100
200
300
400
500
5
10
15
20

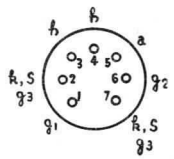
DP61

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.



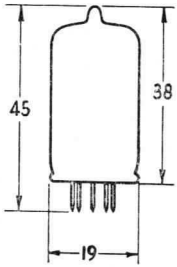
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B7G.
Max. Overall Length	... ...	45 mm. (1¾in.).
Max. Seated Height	... ...	38 mm. (1½in.).
Max. Diameter	... ...	19 mm. (¾in.).
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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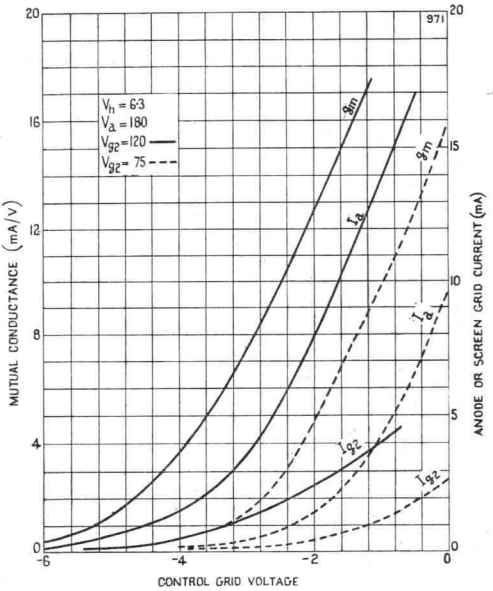
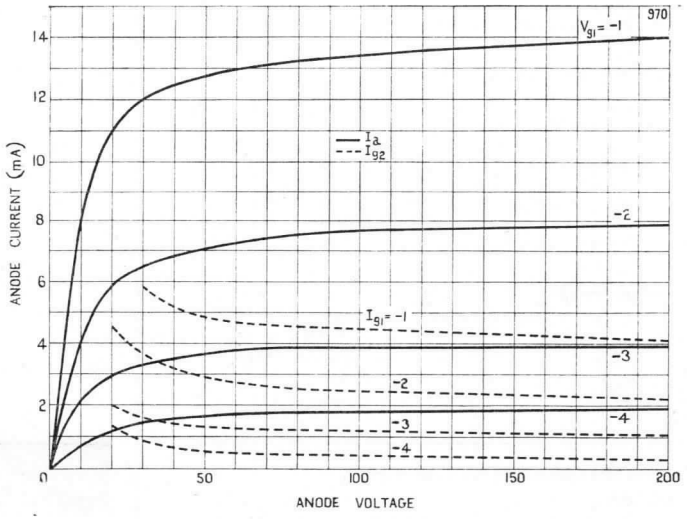
DP61

6AK5

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.

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

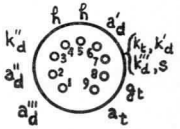
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

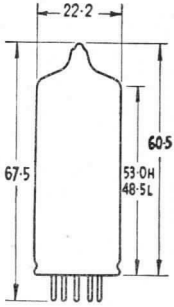
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	0·8	mA.
Stage Gain	51	53	47	55	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (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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EABC80

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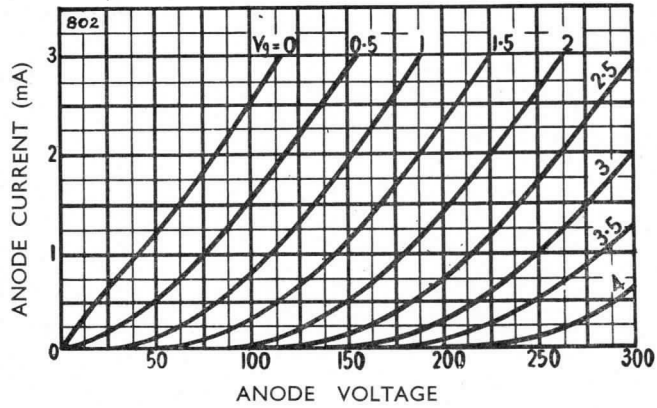
CAPACITANCES. TRIODE SECTION.

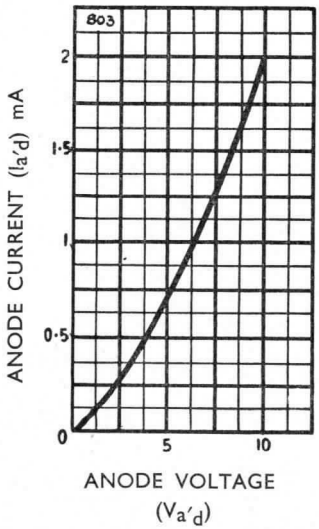
C_{in}	... ...	1.9 pF.
C_{out}	... ...	1.4 pF.
C_{a-g}	... ...	2.0 pF.
C_{g-h}	... ...	<0.04 pF.

DIODE SECTION.

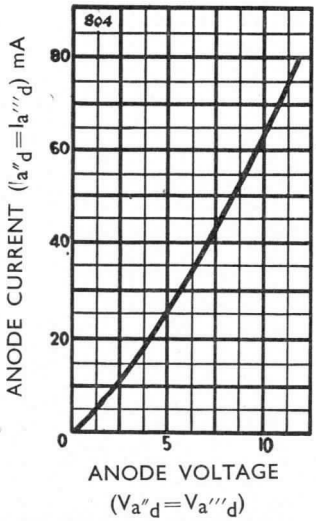
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$	...	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$		4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k'''d,\ s)}$	...	4.8 pF.
$C_{k''d-all}$		4.9 pF.
$C_{a'd-h}$		<0.25 pF.
$C_{a'''d-h}$		<0.2 pF.
$C_{k''d-h}$		2.5 pF.



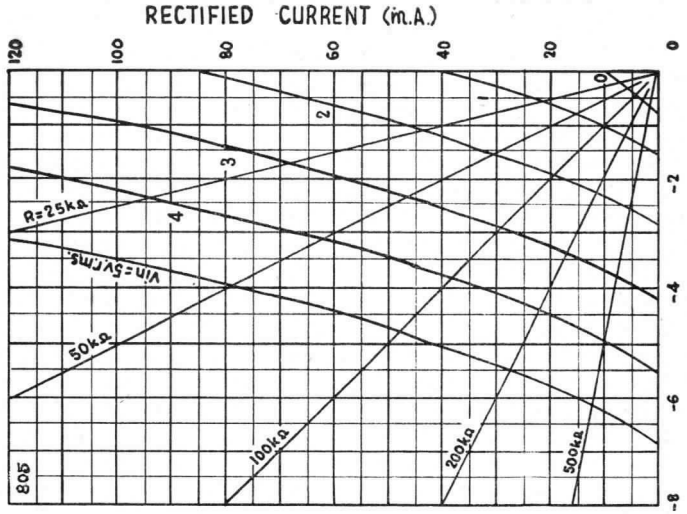
DIODE I

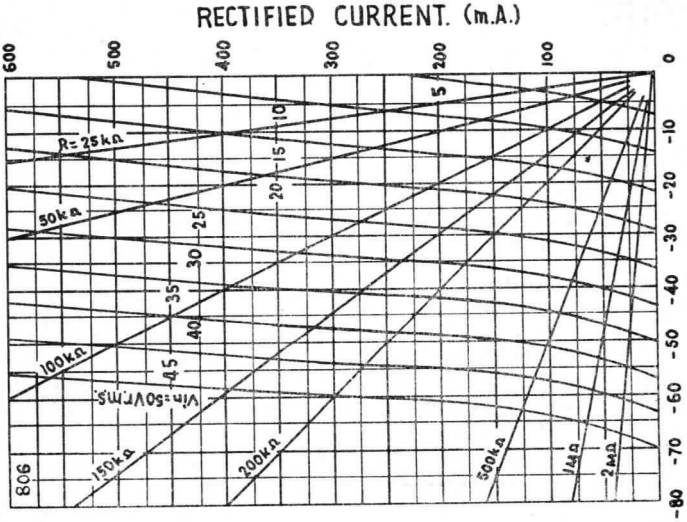


DIODE II - DIODE III



AVERAGE CHARACTERISTICS FOR DIODE I





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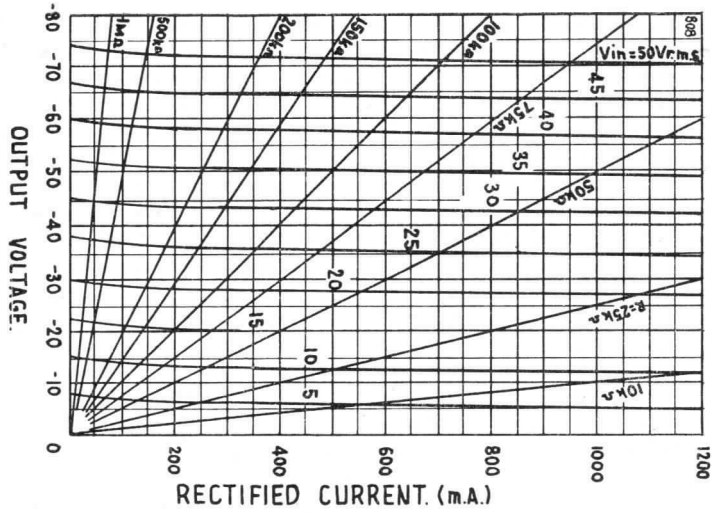
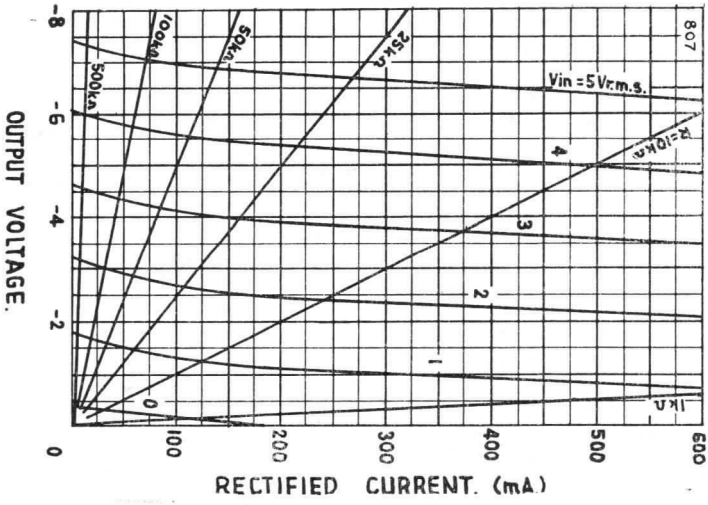
AVERAGE CHARACTERISTICS DIODE II AND DIODE III



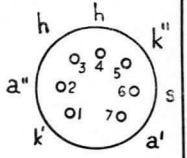


FERRANTI

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 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.

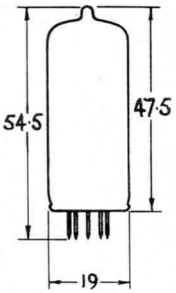
Max. Peak Inverse Voltage	...	420 volts.
Max. R.M.S. Input Voltage	...	150 volts.
*Max. Peak Anode Current	...	54 mA.
*Max. Rectified Current	...	9 mA.
*Max. Resonant Frequency	...	700 M/cs.
Max. V_{h-k}	... ...	330 volts DC.

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.



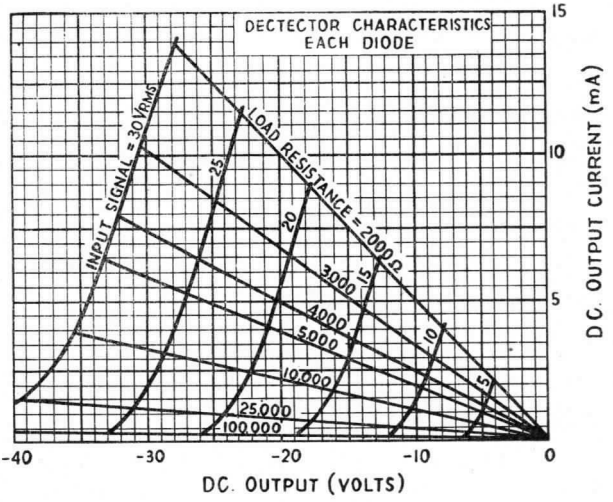
All dimensions shown are in millimetres (max.).

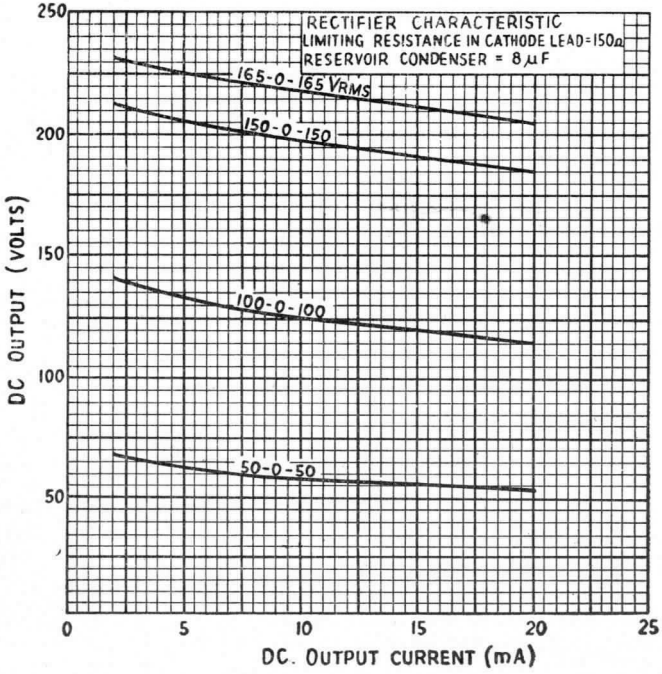
*Each Section.
‡‡With close-fitting external shield connected to Cathode No. 1
†With close-fitting external shield connected to Cathode No.2
‡With close-fitting external shield connected to Anode No. 1
§With close-fitting external shield connected to Anode No. 2
††With close-fitting external shield connected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

FERRANTI

Issue 4
Aug., 1957

EB91





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

FERRANTI

DOUBLE DIODE PENTODE

EBF80

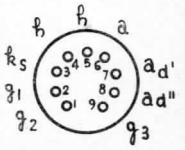
An indirectly heated double diode variable-mu pentode designed for use as detector, A.V.C. diode and R.F., I.F., or A.F. Amplifier.

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$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 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).



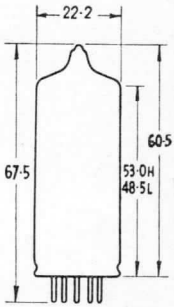
Base Connections Underside View of Base

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	100	volts.
Anode Load Resistor ...	220	220	100	47	kΩ
Screen Feed Resistor ...	820	100	470	100	kΩ
Auto Bias Resistor ...	1·8	0	0	0	kΩ
Grid Resistor	0	10	10	10	MΩ
Peak Output Voltage ...	19	19	19	19	volts.
Stage Gain	110	160	110	110	
Grid Resistor for following Valve	680	680	330	100	kΩ
Total Distortion	5	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.

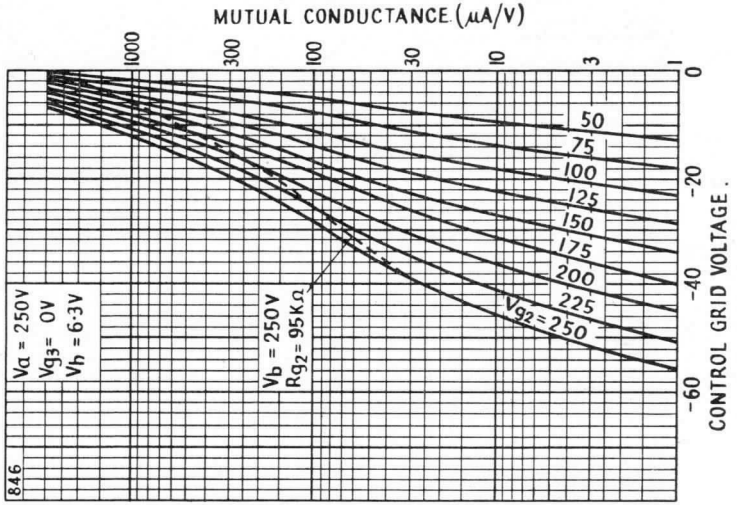
All dimensions shown are in millimetres (max.).

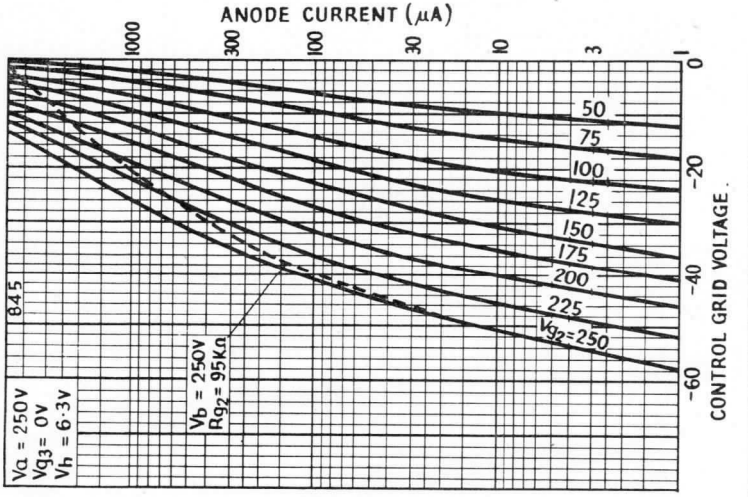
*If grid current biasing is employed R_{g1-k} may be increased up to 22 MΩ

Issue 1.
Jan., 1957

EBF80

FERRANTI



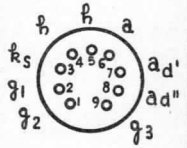


Ferranti

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.

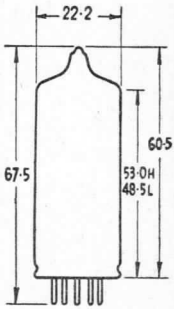
Max. H.T. Supply Voltage	...	550 volts
Max. Anode Voltage	... ...	300 volts
Max. Screen Voltage (I_a<4 mA.)		300 volts
Max. Screen Voltage (I_a>8 mA.)		125 volts
Max. Anode Dissipation	... ...	2·25 watts
Max. Screen Grid Dissipation	...	0·45 watts
Max. Control Grid Voltage (I_{g_1}=+0·3μA.)	... ...	−1·3 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	kΩ
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

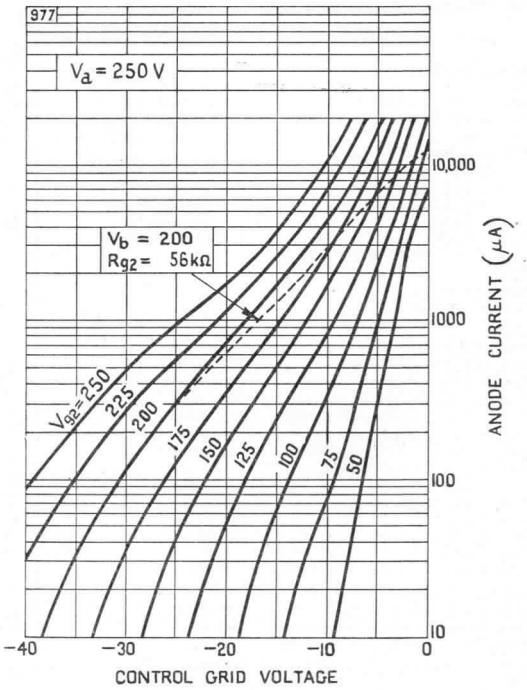
†This bias voltage is produced by the grid current through the grid resistor and the diode current. If attenuation occurs due to the high resistance of the grid cathode path, the negative bias should be increased to approx −1·5 volts for V_a=200 or to −2 volts if V_a=250.

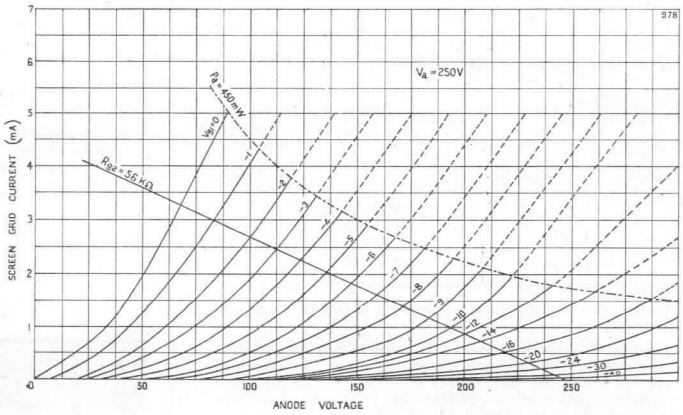
Issue 2.
May, 1962.

Ferranti

Ferranti

EBF89



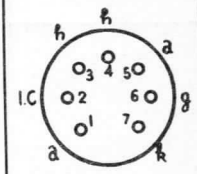


FERRANTI

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.

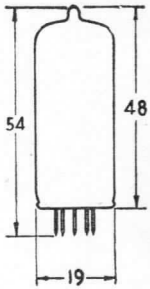
Base	B7G.
Max. Overall Length	54 mm. (2⅛in.).
Max. Seated Height	48 mm. (1⅞in.).
Max. Diameter	19 mm. (¾in.).
Mounting Position	Any.

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.

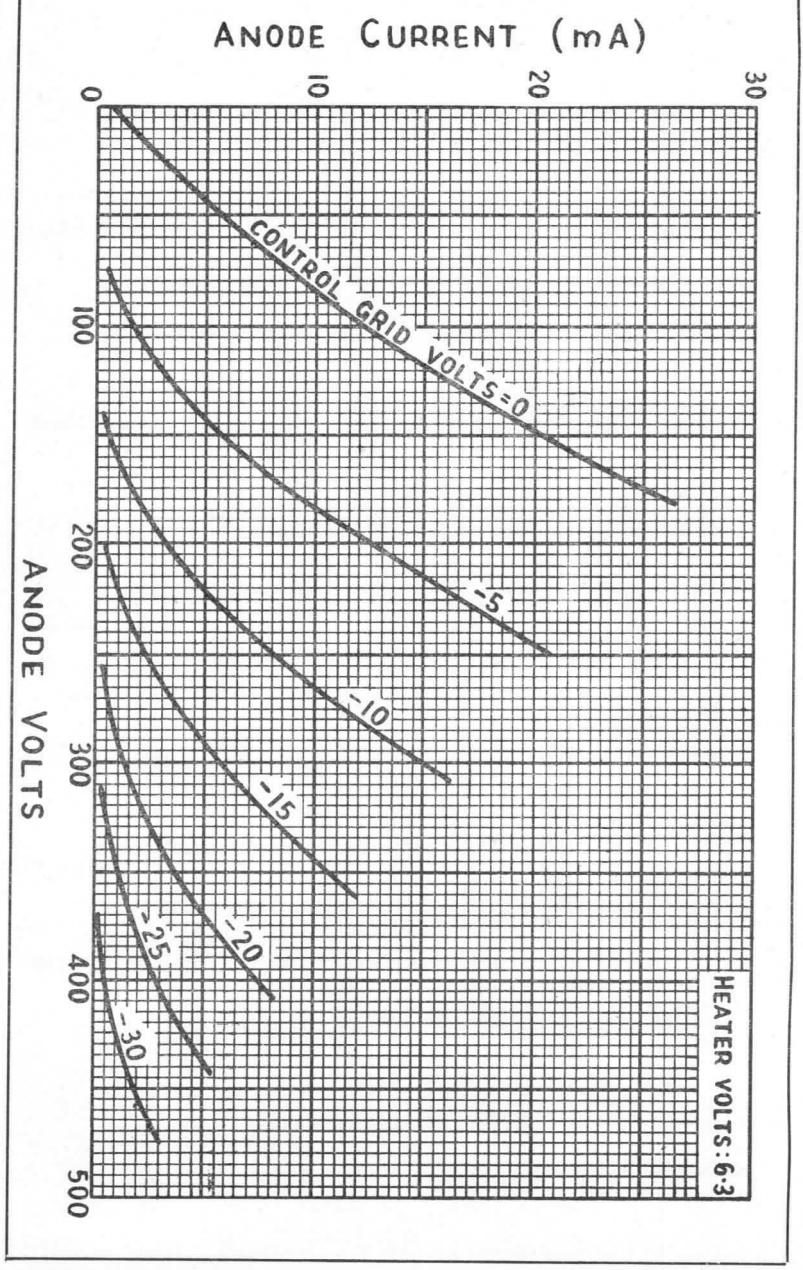
*At moderate frequencies.

†At 150 Mc/s. with R_{g-k} = 10kΩ

Issue 1.
June, 1956

EC90

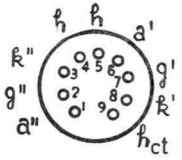
FERRANTI



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. ($1\frac{13}{16}$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.

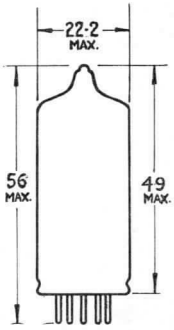
HEATER.

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.

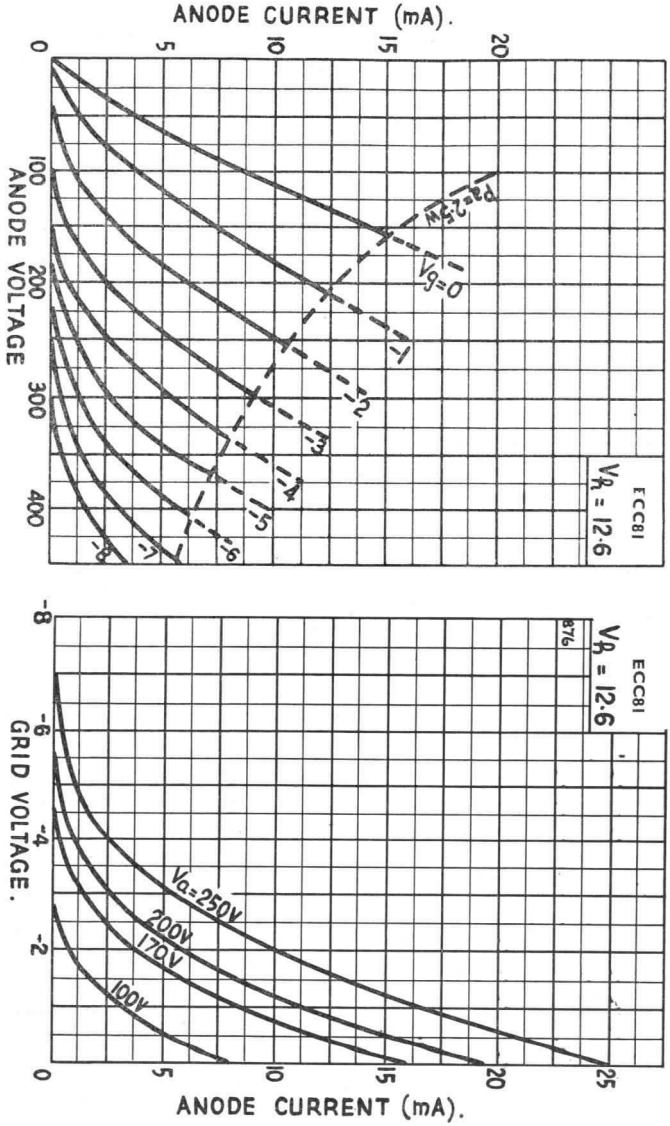
All dimensions shown are in millimetres (max.).

*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

ECC81

FERRANTI

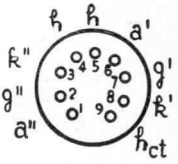


FERRANTI

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.



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. ($1\frac{15}{16}$in.).
Max. Diameter (Base)	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

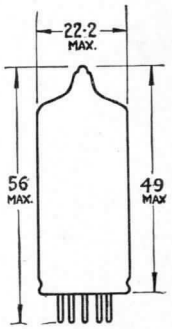
Pin 1—Anode Triode 2.	Pin 5—Heater.
Pin 2—Grid Triode 2.	Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2.	Pin 7—Grid Triode 1.
Pin 4—Heater.	Pin 8—Cathode Triode 1.

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.

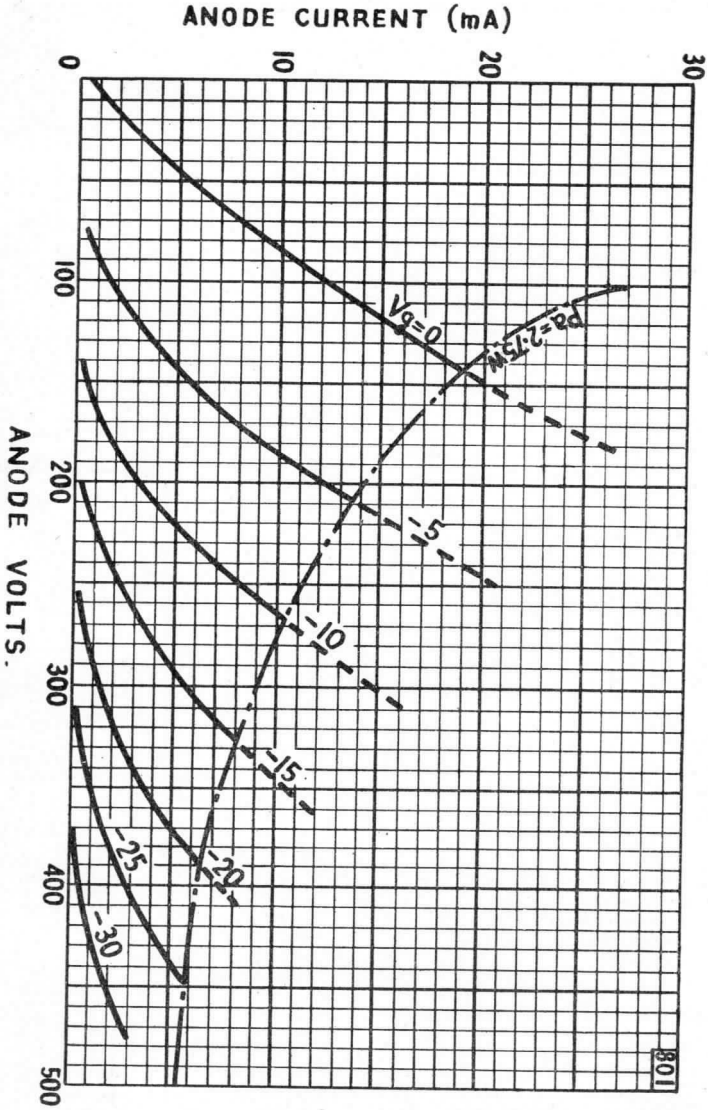
‡Vh applied between pin 9 and pins 4 and 5 connected together.

**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

ECC82

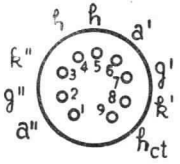

ANODE CURRENT (mA)
0
10
20
30
ANODE VOLTS.
100
200
300
400
500
Vg=0
Pa=2.75W
-5
-10
-15
-20
-25
-30
8011

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.



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. ($1\frac{15}{16}$in.).
Max. Diameter (Base)	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

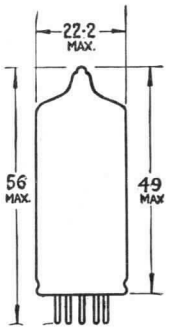
Pin 1—Anode Triode 2.	Pin 5—Heater.
Pin 2—Grid Triode 2.	Pin 6—Anode Triode 1.
Pin 3—Cathode Triode 2.	Pin 7—Grid Triode 1.
Pin 4—Heater.	Pin 8—Cathode Triode 1.

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	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

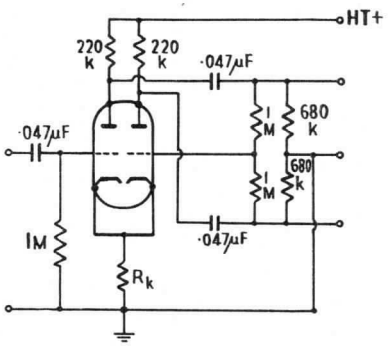
1. Cathode Bias.

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**

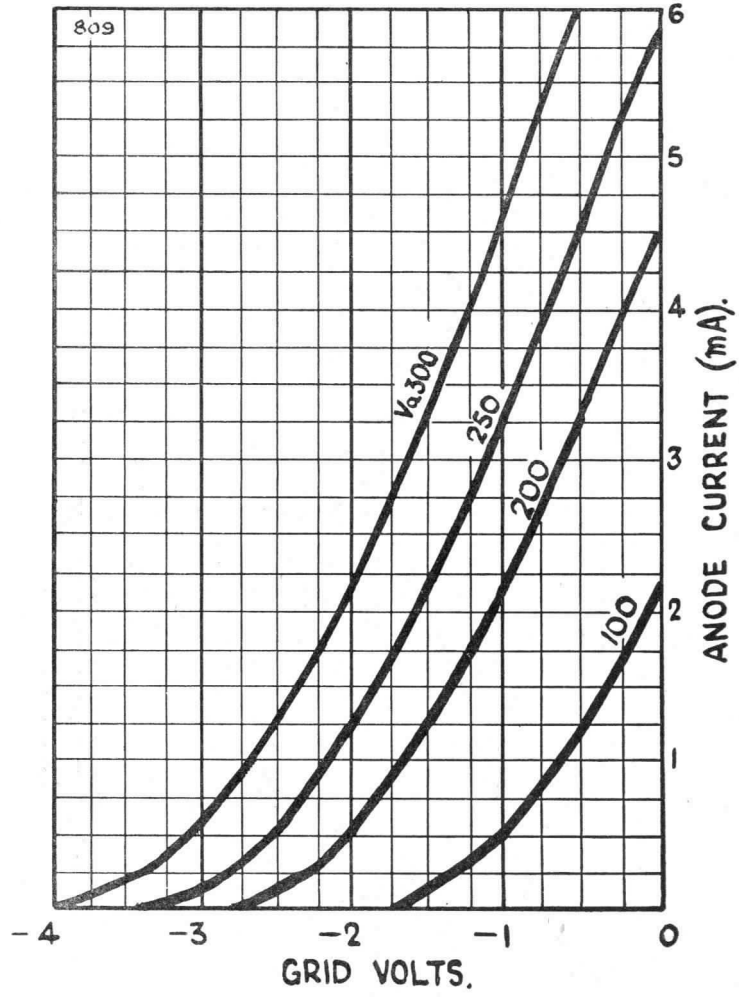
Anode Supply Voltage	200	250	250	300	300	350	350	400	volts.
Grid Resistance ...	10	10	10	10	10	10	10	10	MΩ
Anode Load Resistance	100	100	220	100	220	100	220	220	kΩ
Cathode Current ...	0·7	1·0	0·56	1·3	0·74	1·6	0·88	1·09	mA.
Grid Resistor of following valve ...	330	330	680	330	680	330	680	680	kΩ
Stage 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.



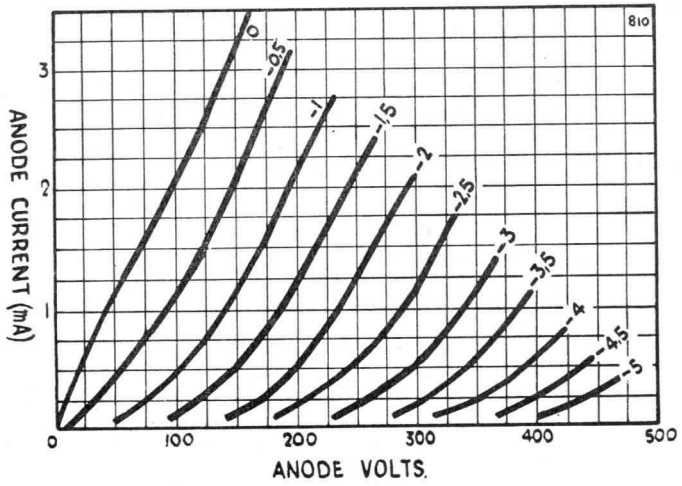
Anode Supply Voltage ...	250		350		volts.
Cathode Resistor	1·2		0·82		kΩ
Cathode Current	1·08		1·7		mA.
Stage Gain	58		62		
*Output Voltage ...	35	7	45	9	V.r.m.s.
Total Distortion ...	5·5	1·1	3·5	0·7	%

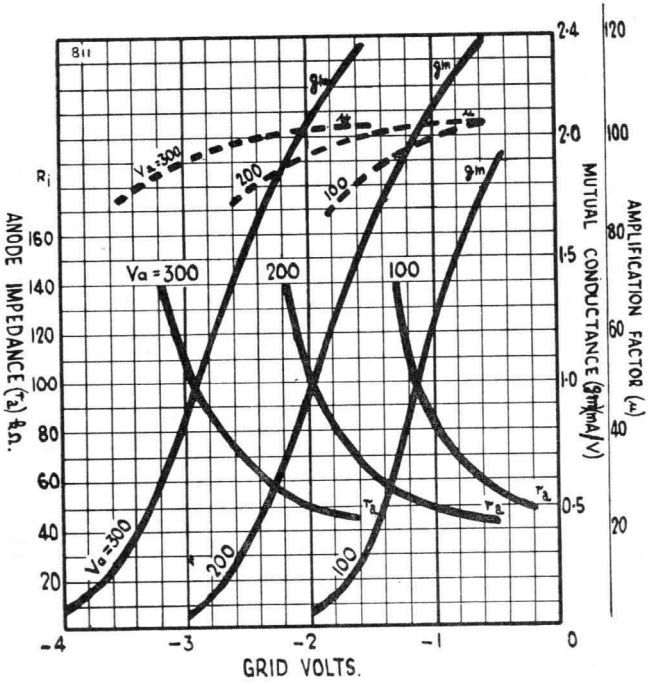
*At start of positive grid current. At lower output voltages distortion is approximately proportionate to output voltage.
**Measured with a signal source impedance of 100 Ω



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

FERRANTI

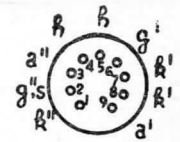

810
ANODE CURRENT (mA)
3
2
1
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
0
100
200
300
400
500
ANODE VOLTS.


811
ANODE IMPEDANCE (rₐ) & Rᵢ
MUTUAL CONDUCTANCE (gm mA/V)
AMPLIFICATION FACTOR (μ)
Va = 300
200
100
Va=300
200
100
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
GRID VOLTS.

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

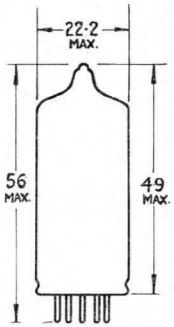
PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$ in.).
Max. Seated Height	49 mm. ($1\frac{11}{16}$ 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 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.‡

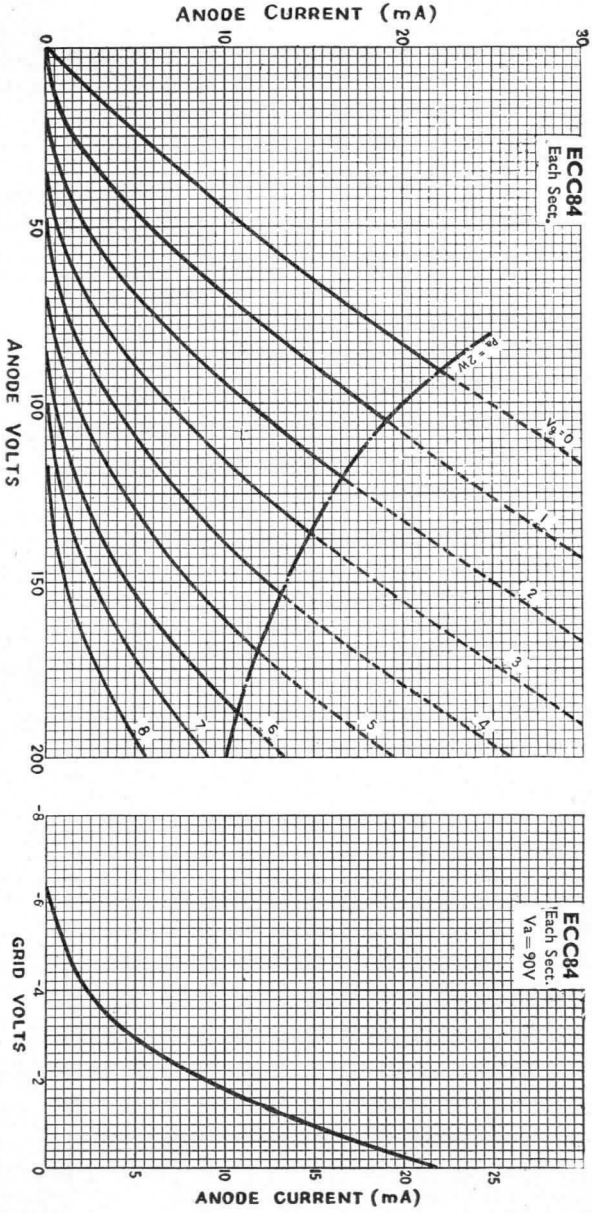
$C_{g'-k'}$	2·1 pF.
$C_{a'-k'}$	0·45 pF.
$C_{g'-h}$	<0·25 pF.
$C_{a'-g'}$	1·2 pF.
$C_{a''-g''}$	2·3 pF.
$C_{a''-k''}$	0·16 pF.
$C_{k''-g''+h}$	4·7 pF.
$C_{a''-g''+h}$	2·5 pF.
$C_{g'-a''}$	<0·006 pF.
$C_{a'-a''}$	<0·035 pF.
$C_{a'-k'+h+g''}$	1·2 pF.
$C_{h-k''}$	2·7 pF.

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.
Pa = 2W
Vg = 0
-1
-2
-3
-4
-5
-6
-7
-8
50
100
150
200
ANODE VOLTS
-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

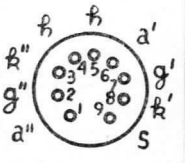
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{5}{8}$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.	



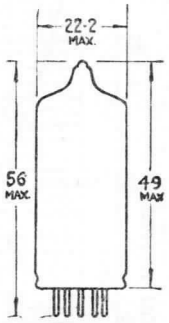
Base Connections Underside View of Base

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.

Ferranti

issue 2
June, 1960

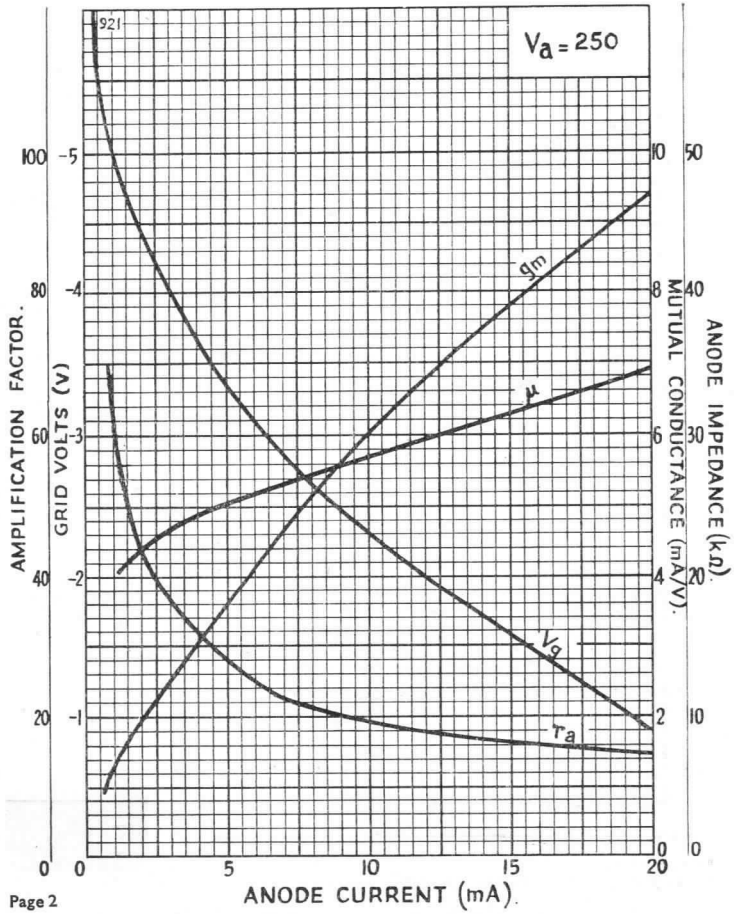
Ferranti

ECC85
6AQ8

CAPACITANCES (measured without external shield).

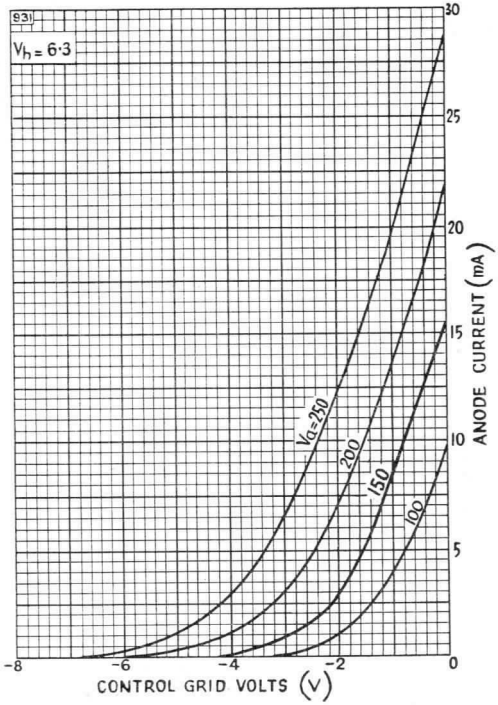
*C_{in}	3·0 pF.
*C_{out}	1·2 pF.
†*C_{out}	1·9 pF.
*C_{a-k}	0·18 pF.
*C_{a-g}	1·6 pF.
$C_{a'-a''}$	<0·04 pF.
†$C_{a'-a''}$	<0·008 pF.
$C_{g'-g''}$	<0·003 pF.
$C_{a'-g''} = C_{a''-g'}$	<0·008 pF.
$C_{a'-k''} = C_{a''-k'}$	<0·008 pF.
$C_{g'-k''} = C_{g''-k'}$	<0·003 pF.

*Each Section.
†Measured with external shield.

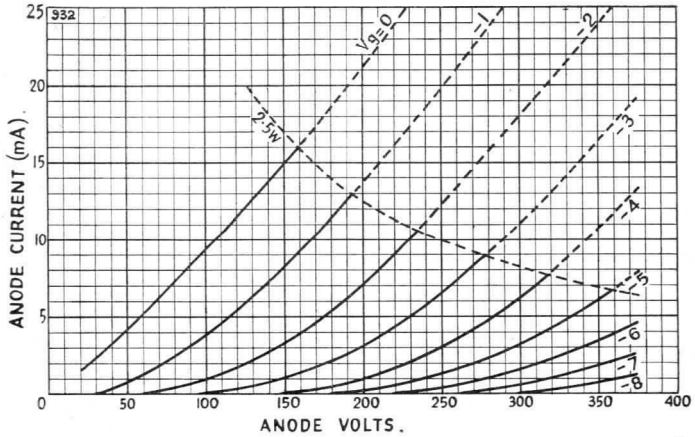


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical I_a/V_g Characteristics.

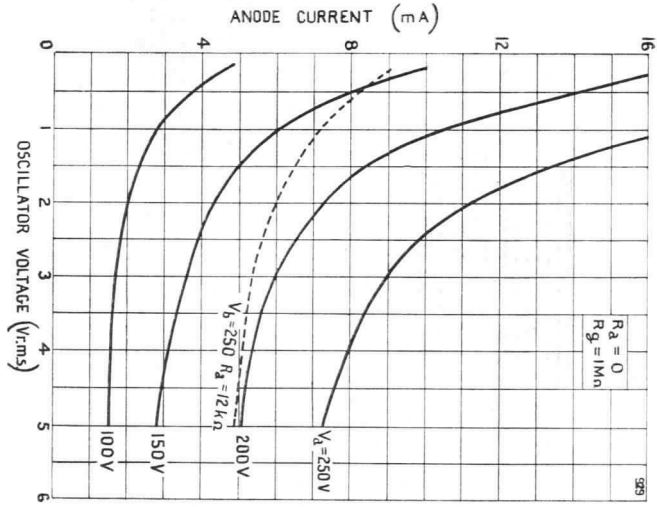


Typical I_a/V_a Characteristics.

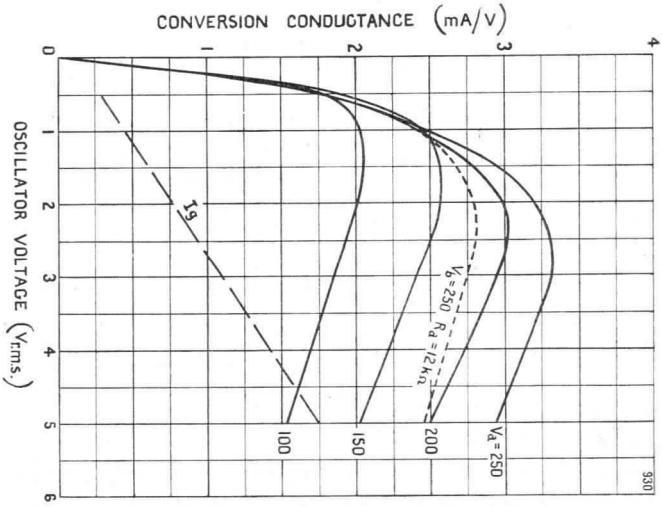


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical I_a/V_{osc} Characteristics.



Typical g_c/V_{osc} Characteristics.



R875

FERRANTI

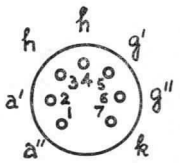
V.H.F. DOUBLE TRIODE

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. ($2\frac{5}{32}$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
Underside View of Base

BASE CONNECTIONS.

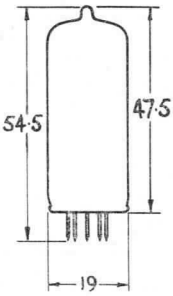
Pin 1—Anode Triode 2. Pin 4—Heater.
Pin 2—Anode Triode 1. Pin 5—Grid Triode 1.
Pin 3—Heater. Pin 6—Grid Triode 2.
Pin 7—Cathode.

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.§

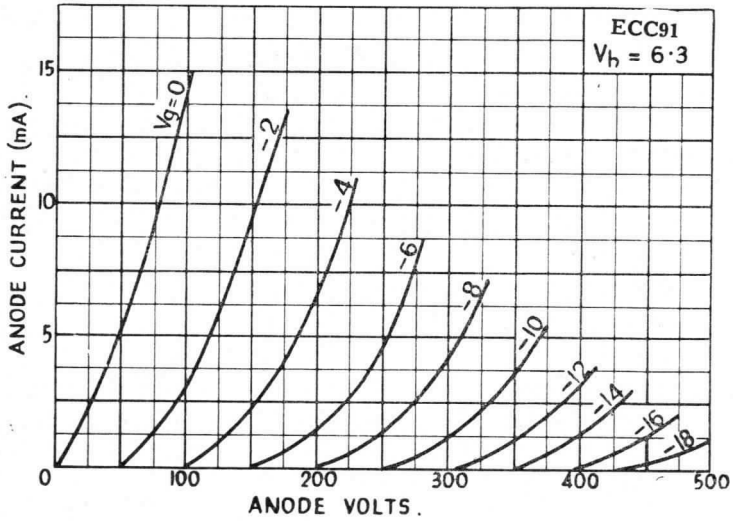
C_{in}	2·2 pF.
C_{out}	0·4 pF.
C_{a-g}	1·6 pF.

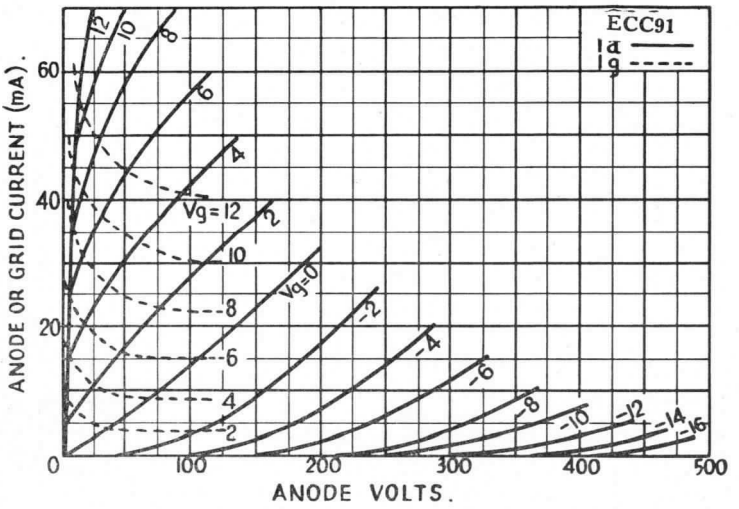
All dimensions shown are in millimetres.

§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.

Issue 1.
Dec., 1955

ECC91


ECC91
V_h = 6·3
ANODE CURRENT (mA).
15
10
5
0
Vg=0
-2
-4
-6
-8
-10
-12
-14
-15
-18
100
200
300
400
500
ANODE VOLTS.

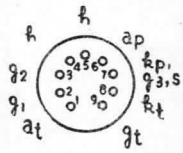

ECC91
Ia
Ig
ANODE OR GRID CURRENT (mA).
60
40
20
0
12
10
8
6
4
Vg=12
2
10
8
6
4
2
Vg=0
-2
-4
-6
-8
-10
-12
-14
-16
100
200
300
400
500
ANODE VOLTS.

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. ($1\frac{15}{16}$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 Voltage	6·3 volts.
Heater Current	0·43 amp.

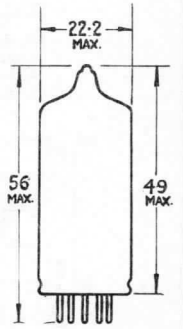
RATINGS.

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.



All dimensions shown are in millimetres.

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

*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.

Ferranti

Issue 1.
May, 1960

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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.

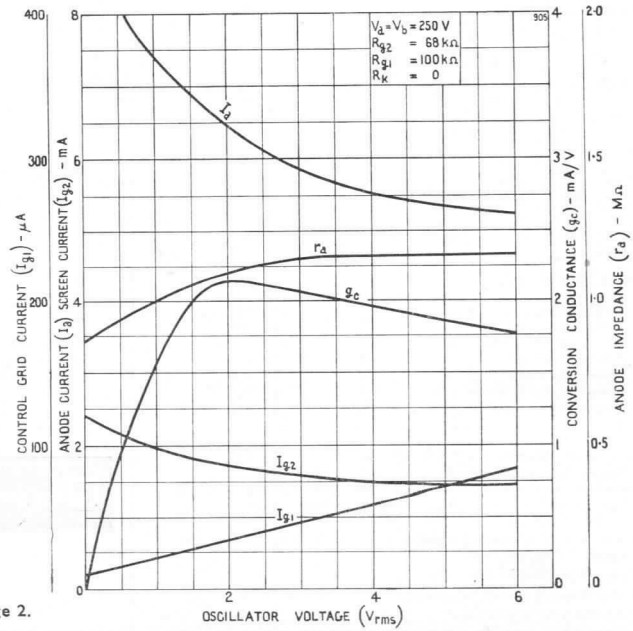
C_n	5·3 pF.
C_{out}	3·6 pF.
C_{a-g_1}	<0·025 pF.

Triode Section.

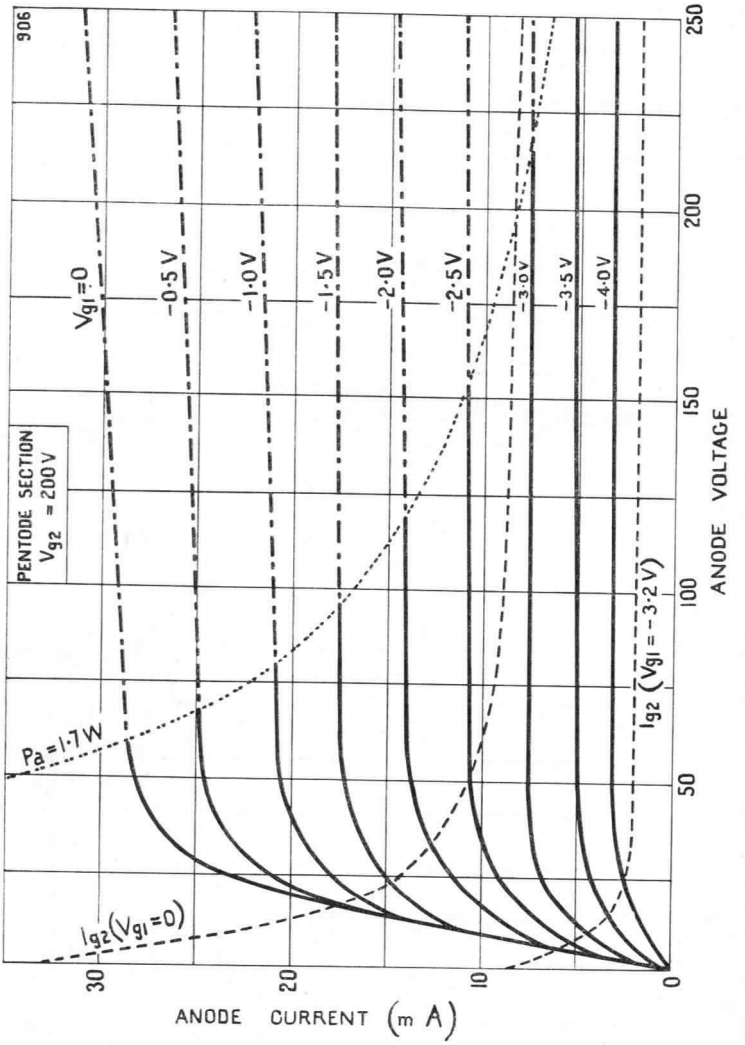
C_{g-k+h}	2·5 pF.
C_{a-k+h}	1·8 pF.
C_{a-g}	1·5 pF.

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.

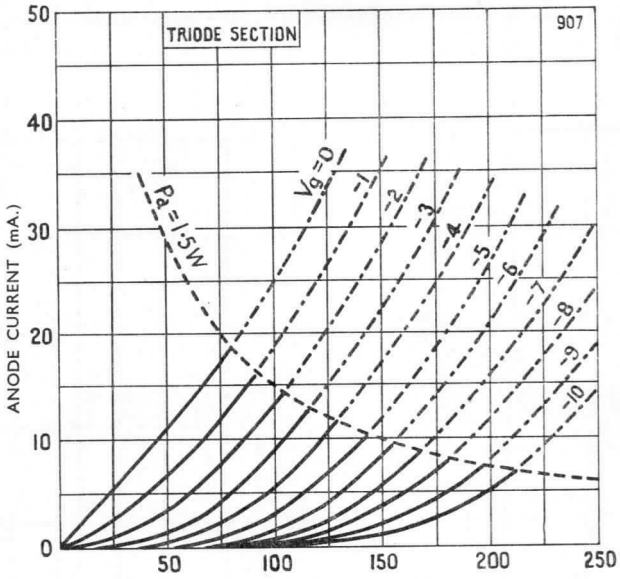


Anode Current/Anode Voltage Characteristics—Pentode Section.

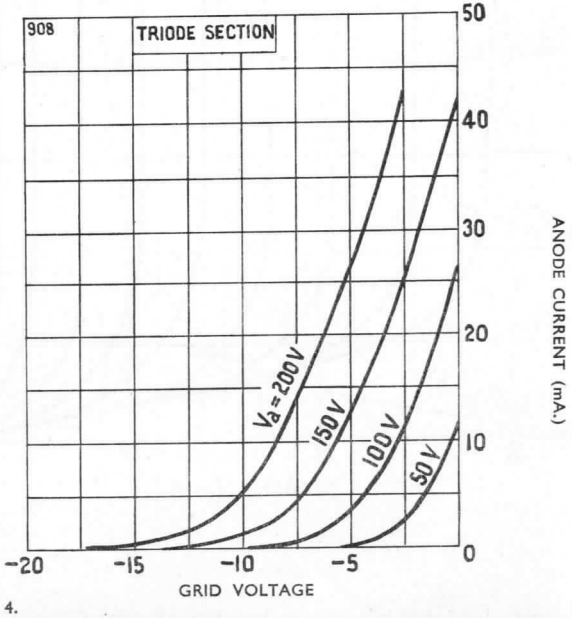


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Anode Current/Anode Voltage Characteristic—Triode Section.



Anode Current/Grid Voltage Characteristics—Triode Section.



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

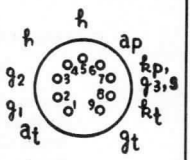
Ferranti

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.

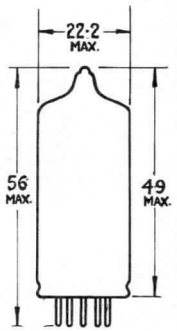
RATINGS.

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_{g_1-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_{g_1} for cut-off	−10 volts.

Issue 2
Nov. 1960

Ferranti

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_{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	5·0	5·0	5·2	mA.
Screen Current ...	I_{g2}	2·0	2·0	2·0	mA.
Grid Current ...	I_{g1}	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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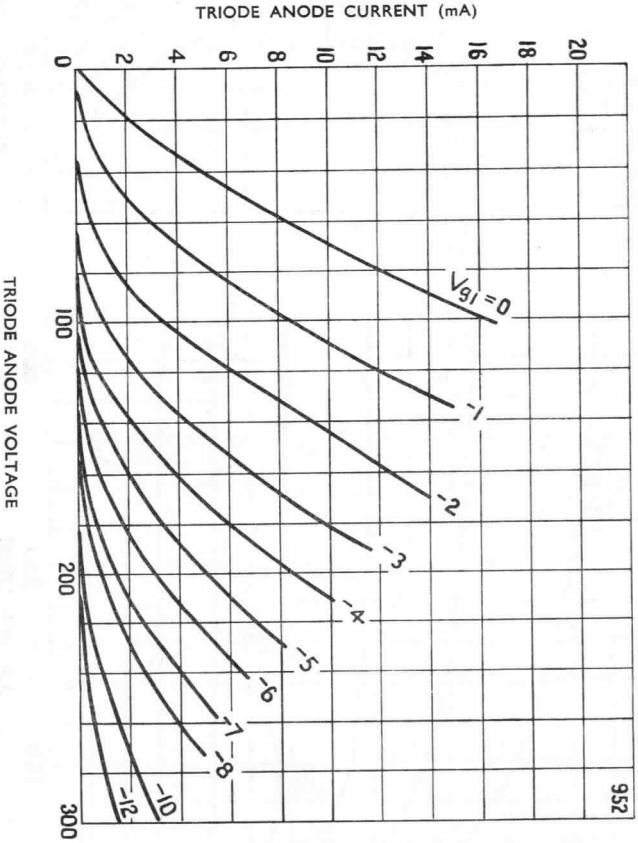
Typical Characteristics – TRIODE Section.



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

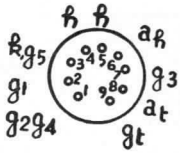
Ferranti

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

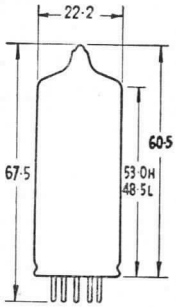
Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
Max. Overall Length	... ...	67·5 mm. ($2\frac{11}{32}$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.

*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.

Dimensions in millimetres.

Issue 2.
June, 1960

Ferranti

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.	$\mu g_1 - g_2g_4$	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).

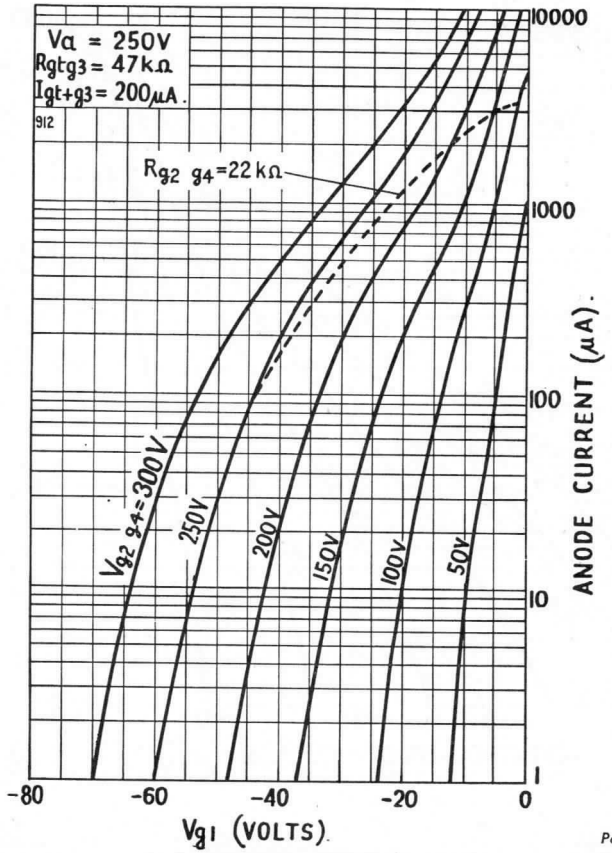
Supply Voltage	V_b	250 volts.
Anode Load Resistor	R_{at}	33 kΩ
Grid Resistor	R_{gt}	47 kΩ
Grid Current	Ig_t	200 μA.
Anode Current	I_{a_t}	4·5 mA.
Mutual Conductance	g_m (eff)	650 μA/V.

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

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_{g1-g3}		<0·3 pF.
C_{g3-h}		<0·06 pF.
C_{ah-at}	0·20 pF.	
C_{ah-gt}	<0·09 pF.	
$C_{ah-g3gt}$	<0·35 pF.	
C_{g1-gt}	<0·06 pF.	
$C_{g1-g3gt}$	<0·17 pF.	
$C_{g1-g3gt}$	<0·45 pF.	

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

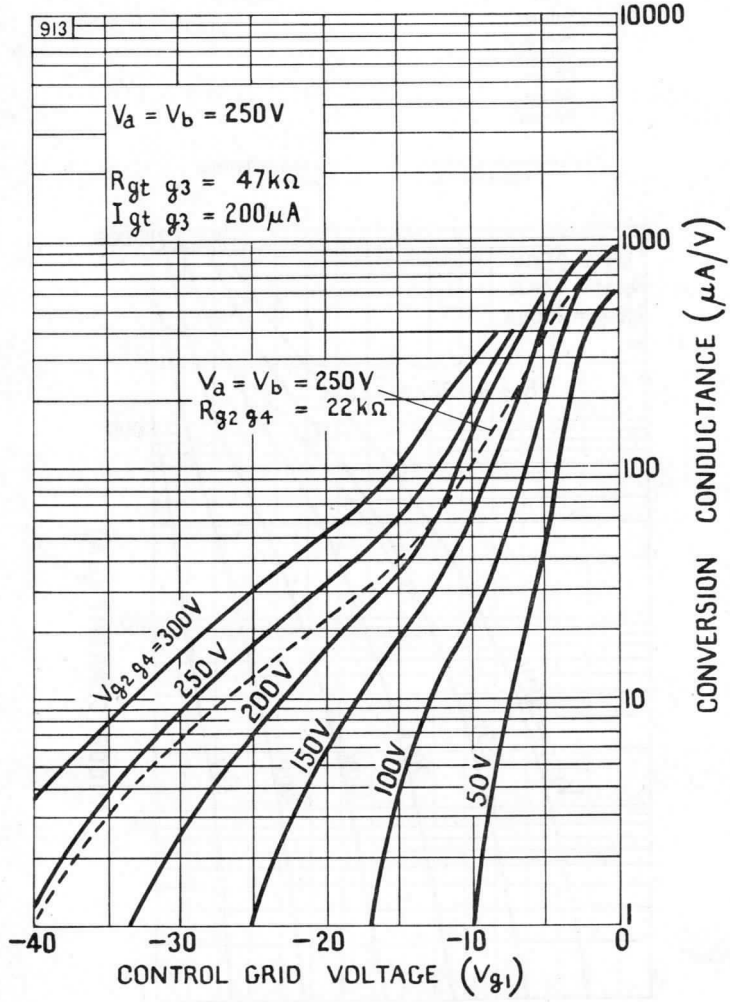


Issue 2.
June, 1960

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

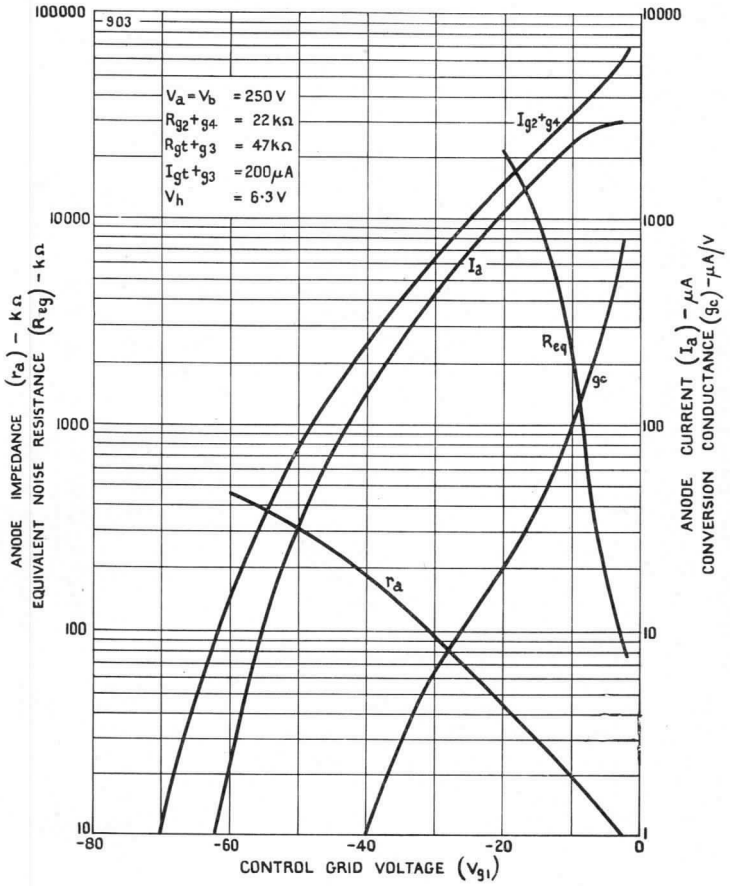
Ferranti

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



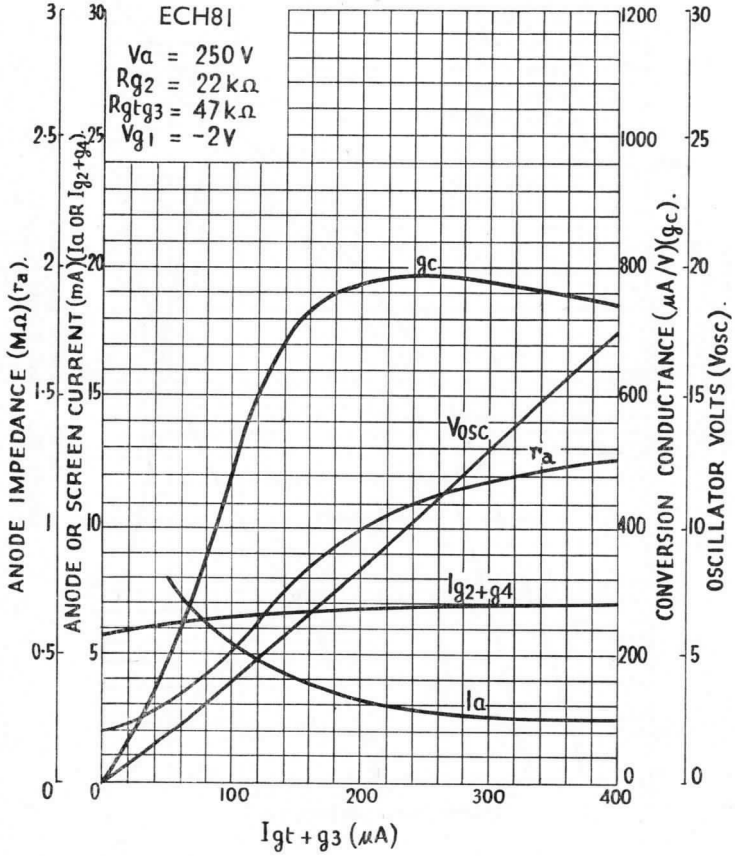
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Characteristics as Frequency Changer.



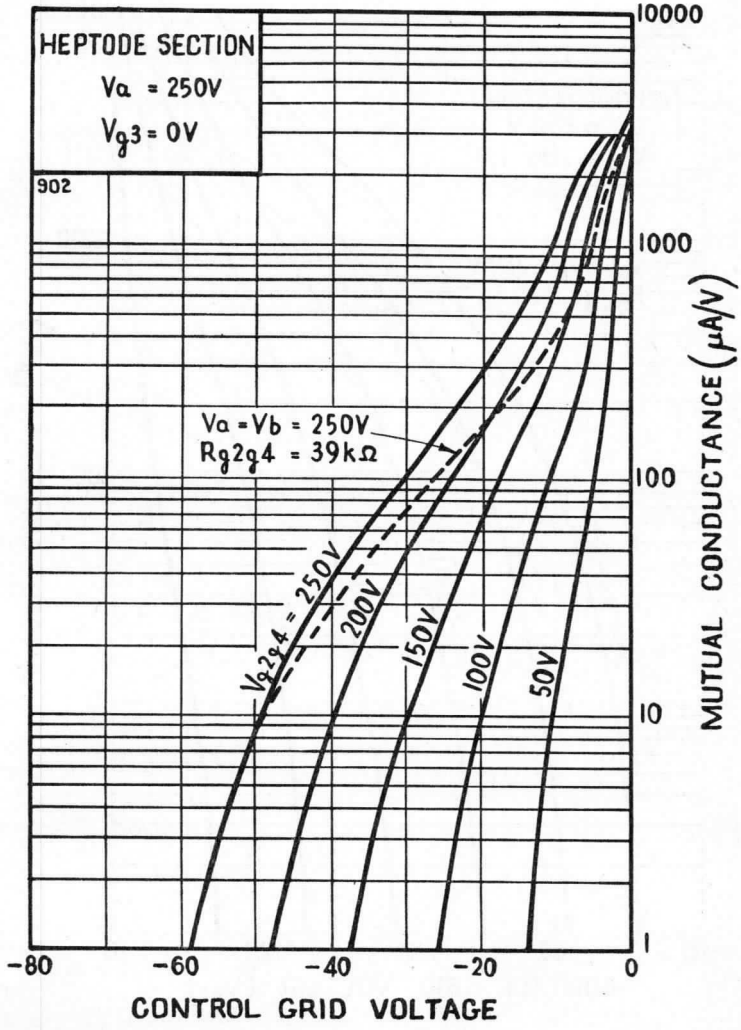
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Characteristics as Frequency Changer.



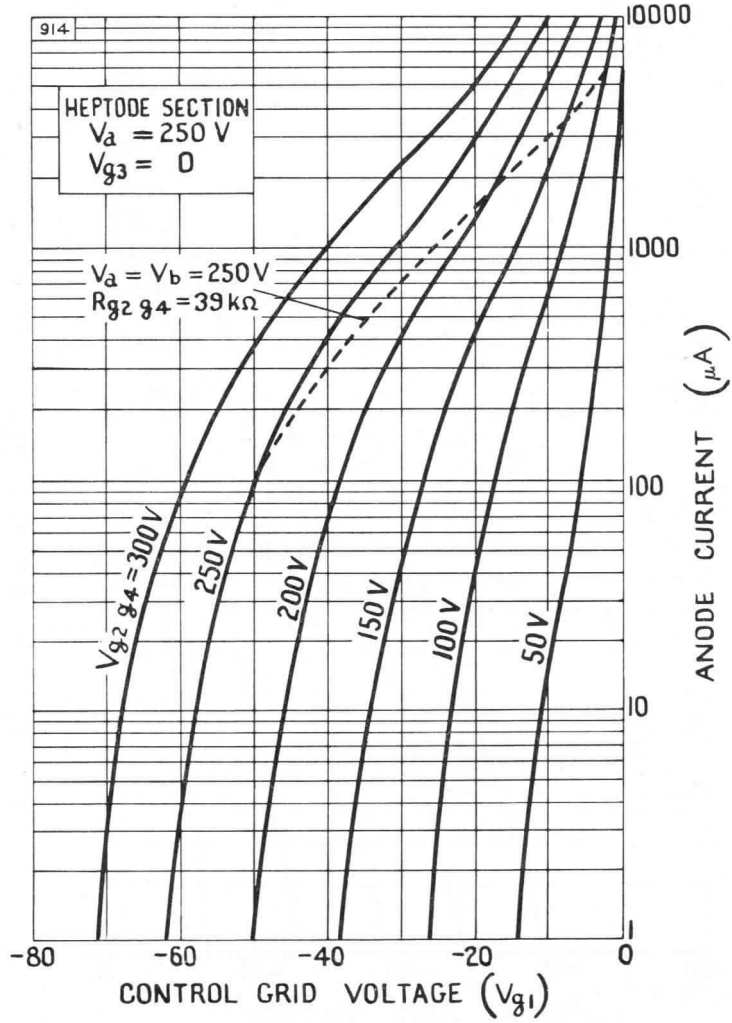
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Mutual Conductance/Grid Voltage Characteristics—Heptode Section.



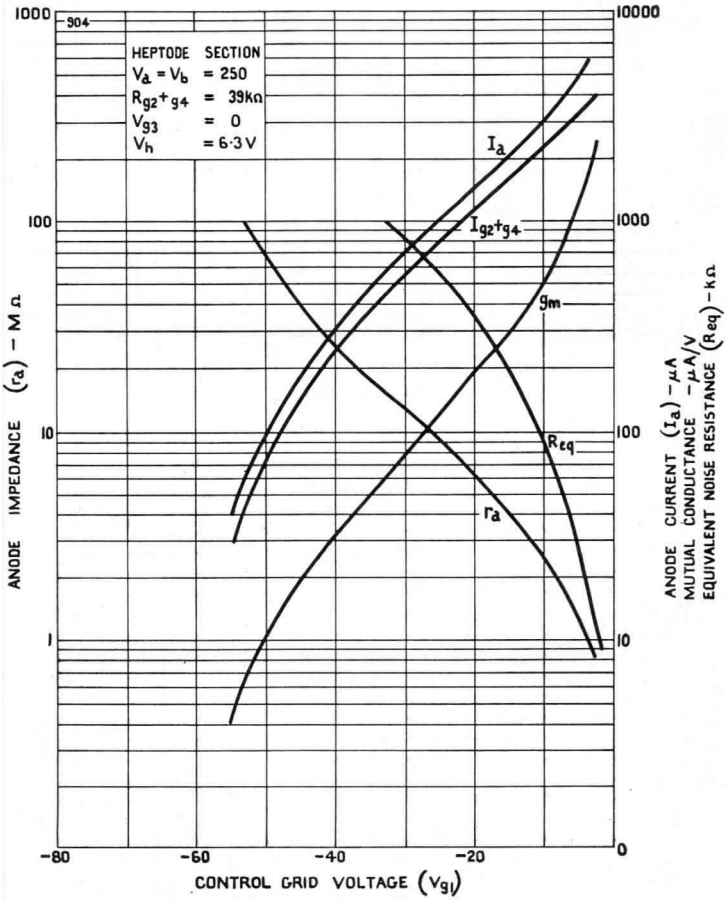
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Anode Current/Grid Voltage Characteristics—Heptode Section.



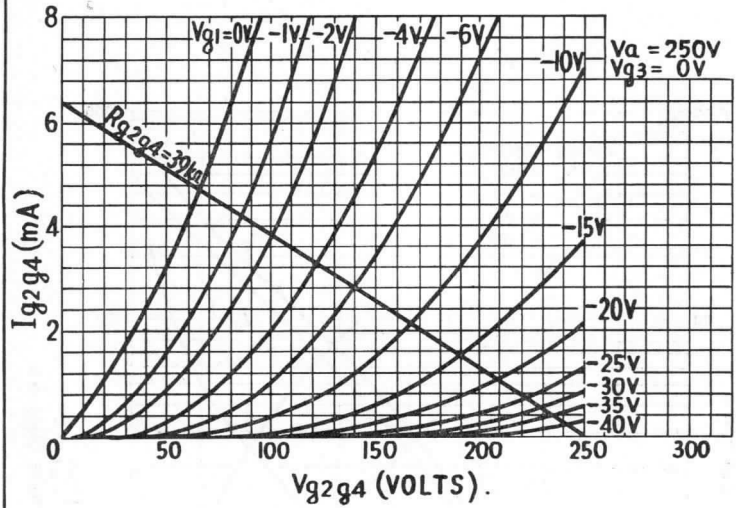
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Characteristics—Heptode Section.

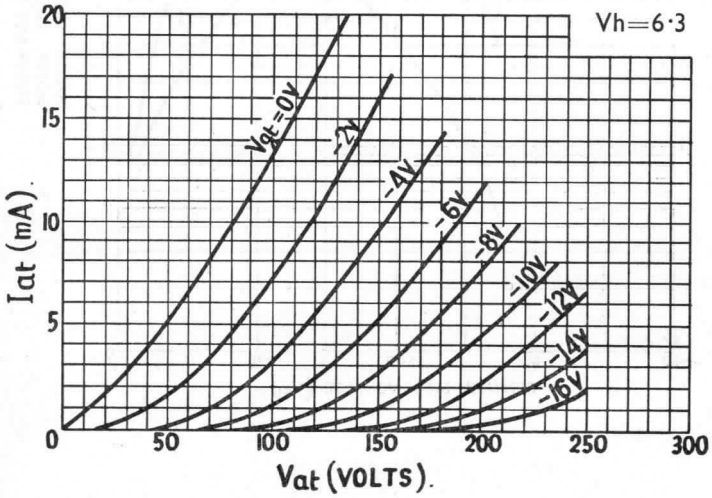


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Typical Screen Grid Characteristics.
Heptode Section.



Typical Anode Current/Anode Voltage Characteristics.
Triode Section.

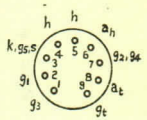


Ferranti

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.



Base Connections Underside View of Base

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

HEATER.

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

RATINGS.

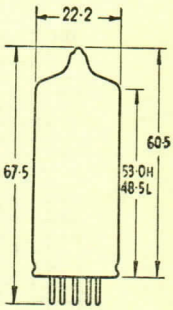
HEPTODE SECTION

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

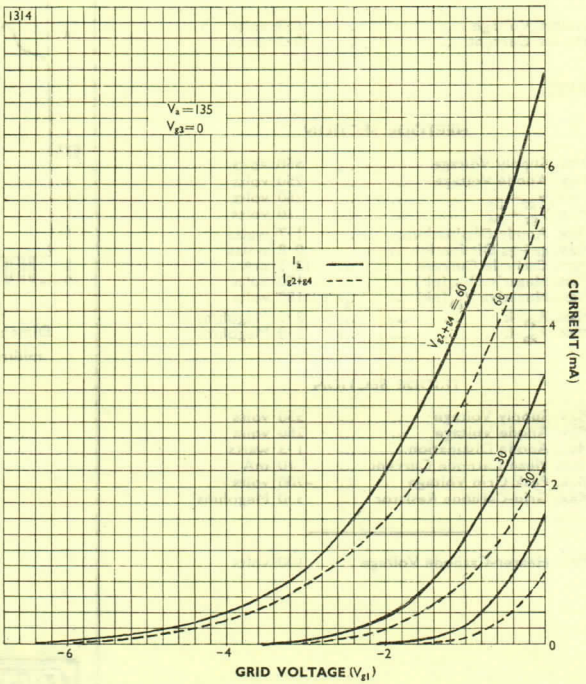
ECH84

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

TRIODE PENTODE

ECL80

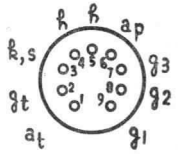
An indirectly heated triode pentode for use with series or parallel heater connection on a.c. or d.c. mains. Primarily designed for use with the triode as a frame blocking oscillator and the pentode as a frame output valve. The triode section may also be used as a line blocking oscillator or audio voltage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

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.



Base Connections Underside View of Base

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

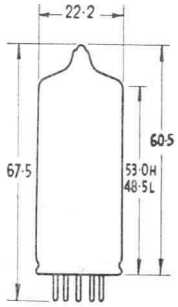
TRIODE SECTION.**

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.

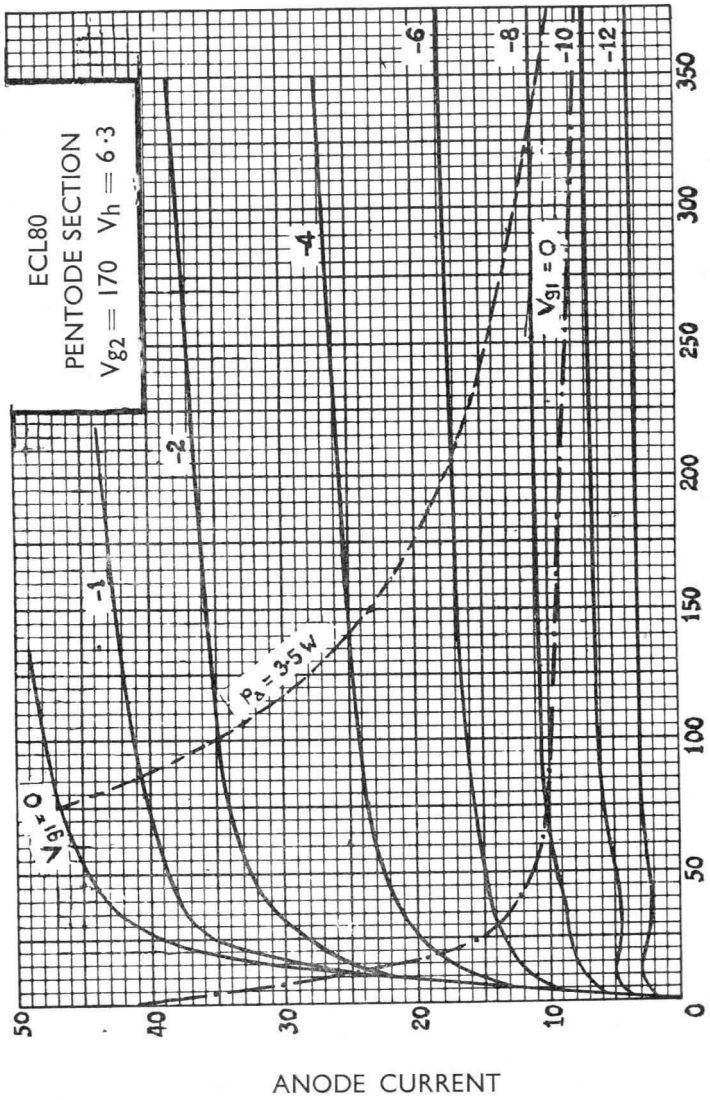
(as A.F. Amplifier).

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	%

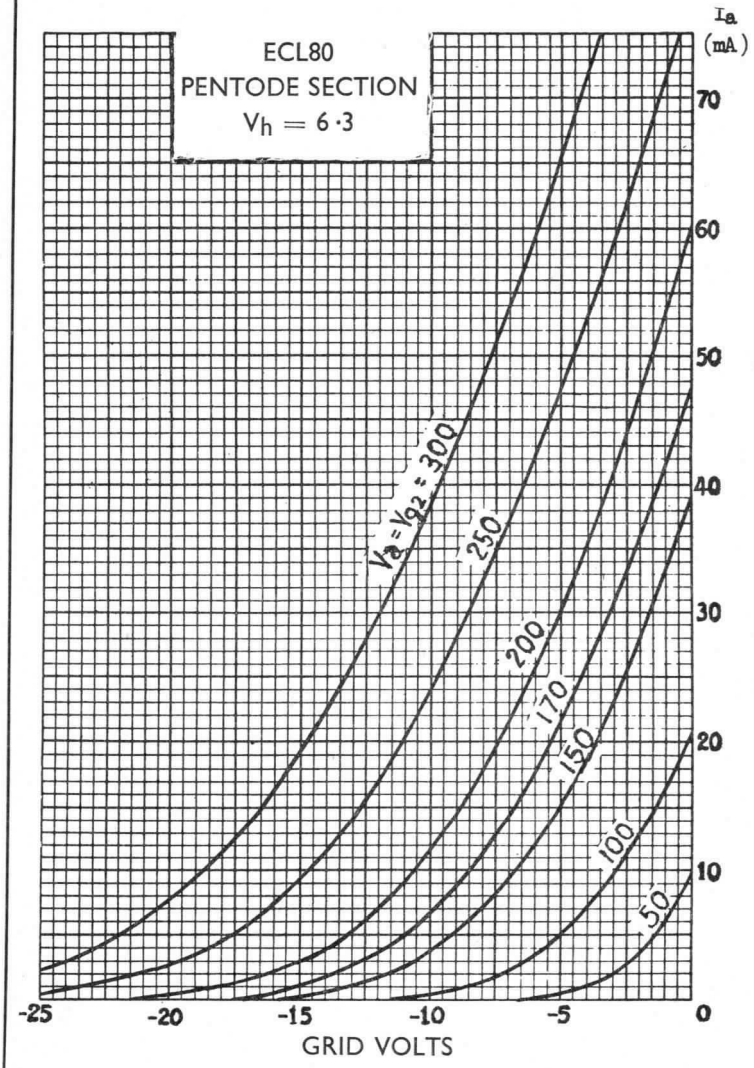
CAPACITANCES.

	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.



Issue 2.
Aug., 1957



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

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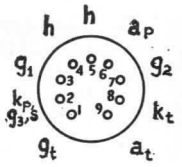
ECL82

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 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_{g_1-k} (fixed bias)	1·0 MΩ
Max. R_{g_1-k} (cathode bias)	2·0 MΩ
Max. R_{h-k}	20 kΩ

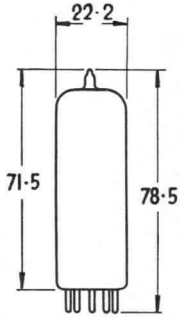
TRIODE SECTION.

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.

Issue 2.
June, 1960

Ferranti

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 (rms.
Optimum Load (Anode to Anode)	5	10	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.

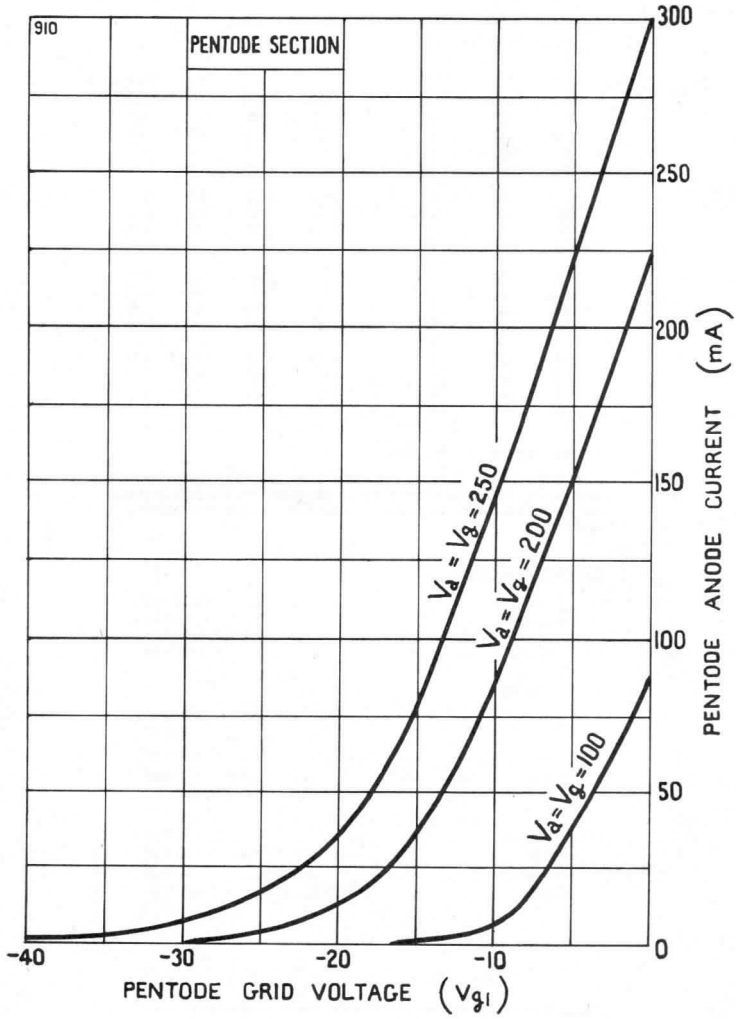
*Grid Resistor of the following valve.

†Measured with an input of 100 mV.

‡Measured at V_{out}= 10 volts.

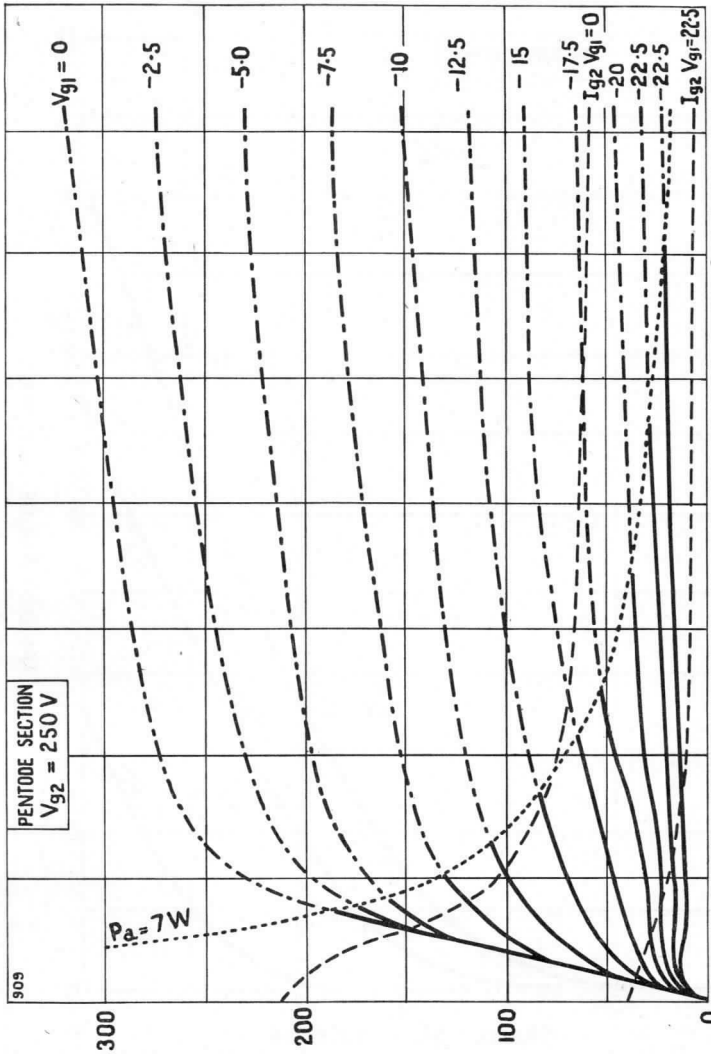
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS
PENTODE SECTION

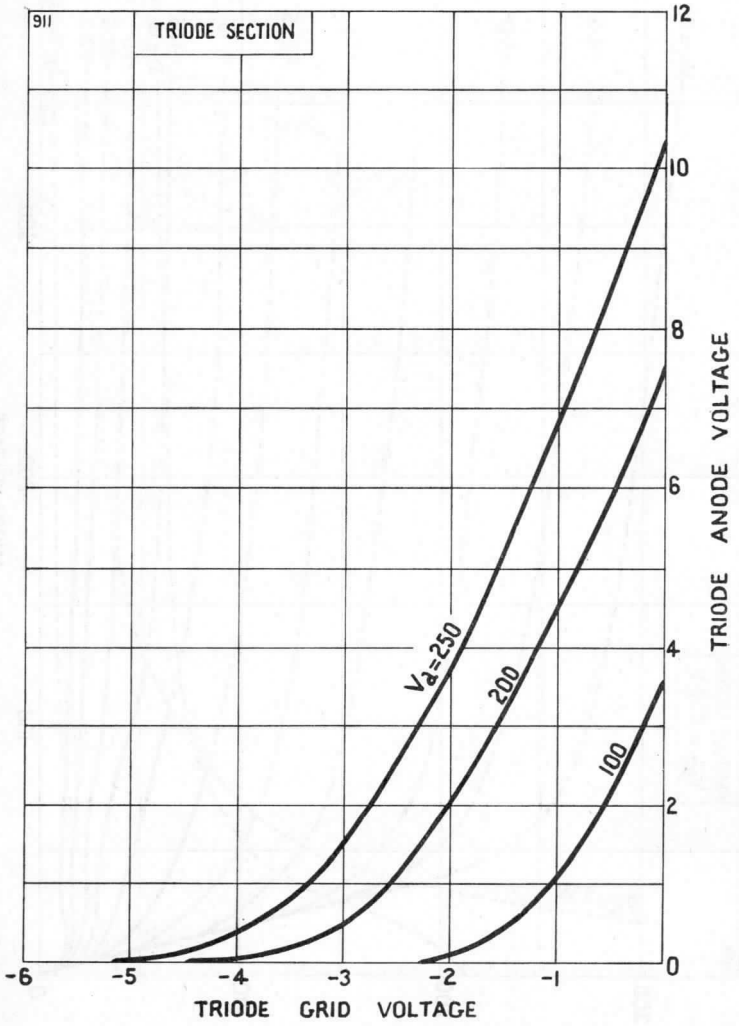


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

TYPICAL ANODE & SCREEN CURRENT/ANODE VOLTAGE CHARACTERISTICS
PENTODE SECTION



TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS
TRIODE SECTION



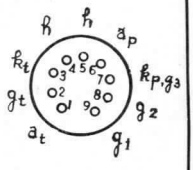
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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. ($1\frac{15}{16}$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—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.

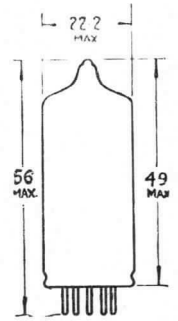
RATINGS.

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_{g1-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	

Ferranti

Issue 2
July, 1961

Ferranti

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.

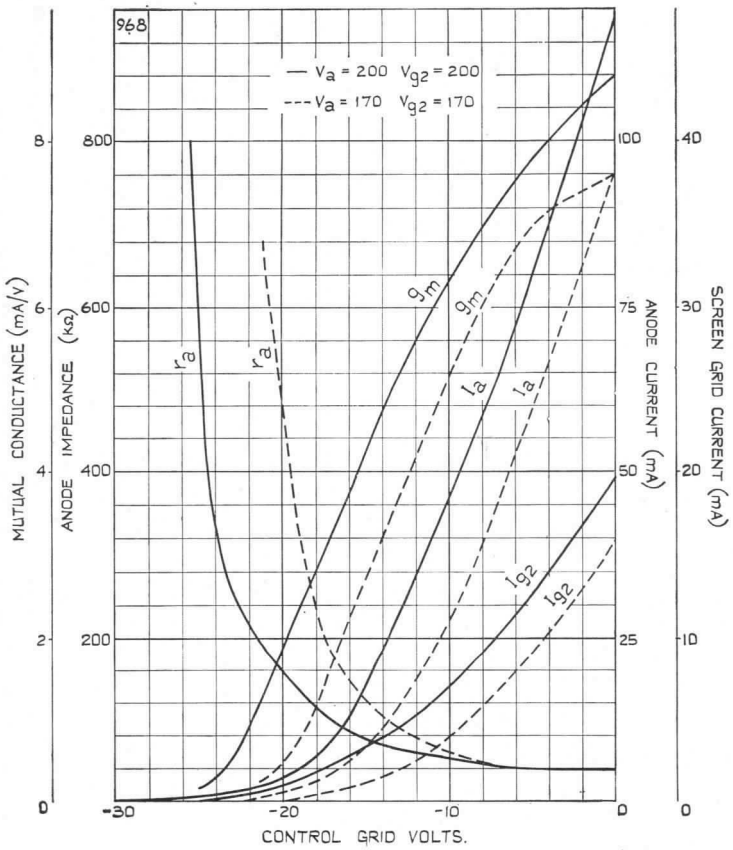
‡Output Voltage measured for total harmonic distortion of 5%.

Typical Anode/Screen Grid Current and Anode Voltage Characteristics

Issue 2
July, 1961

Ferranti

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



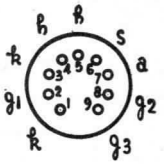
Ferranti

EF80

6BX6

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.



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.

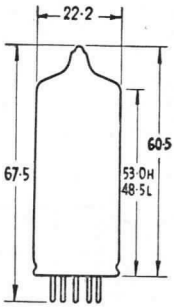
Pin 1—Cathode. Pin 5—Heater.
Pin 2—Control Grid (g_1). Pin 6—Shield.
Pin 3—Cathode. Pin 7—Anode.
Pin 4—Heater. Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

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

All dimensions shown are in millimetres

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.

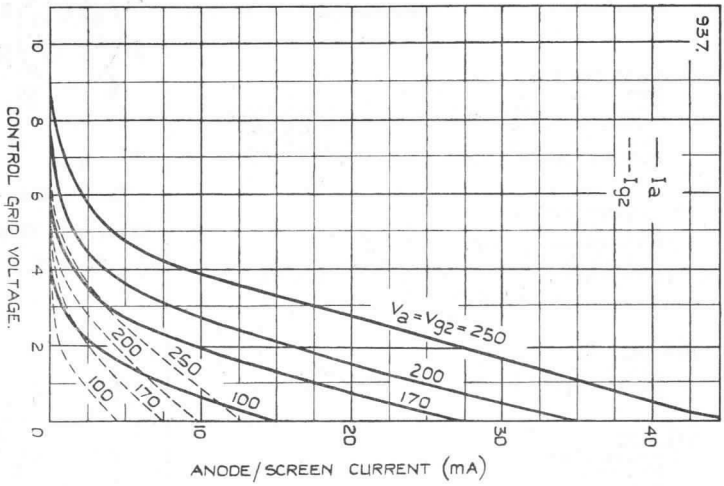
*For grid current of +0·3 μA.

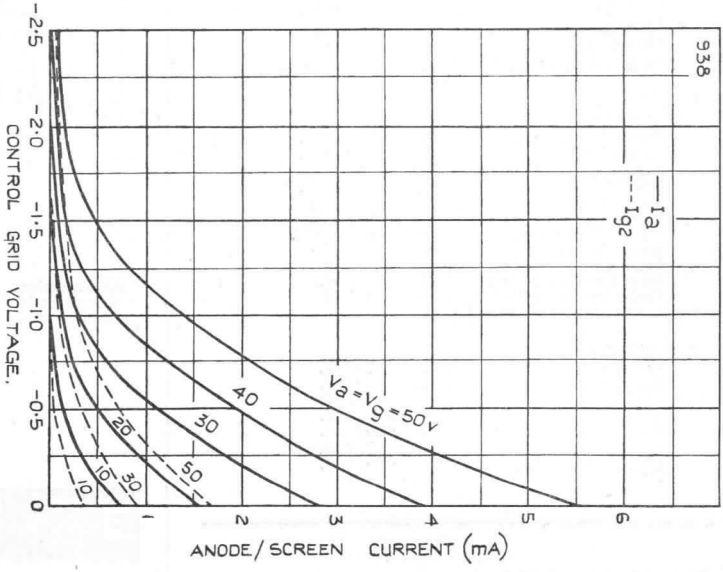
Issue 2
Oct. 1960

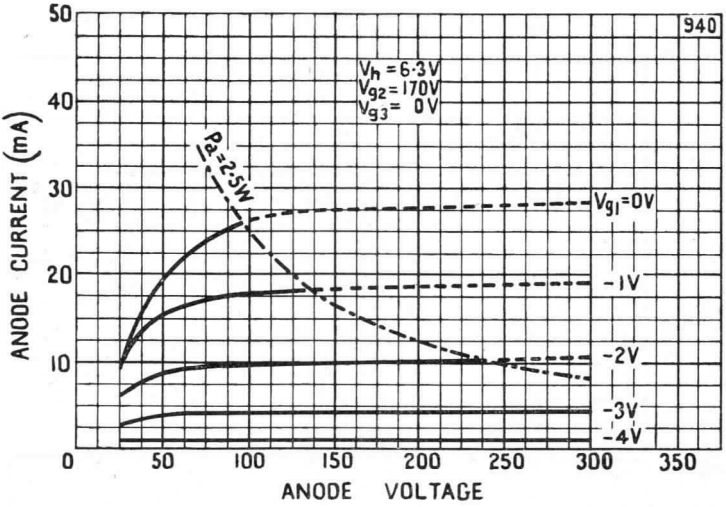
Ferranti

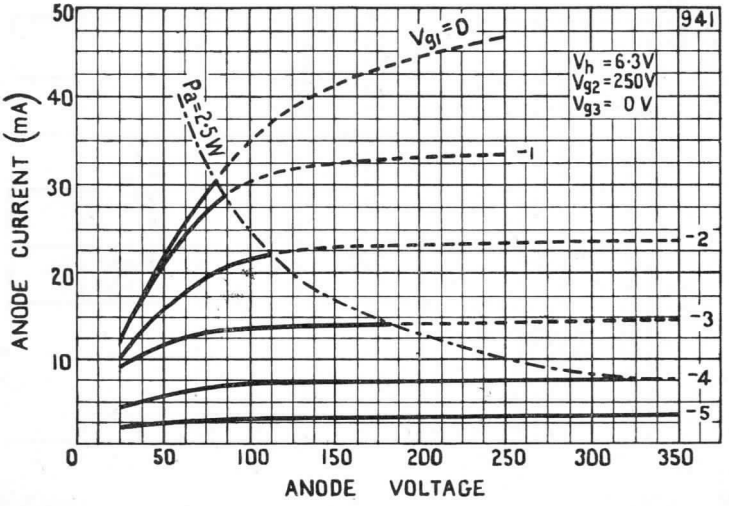
EF80

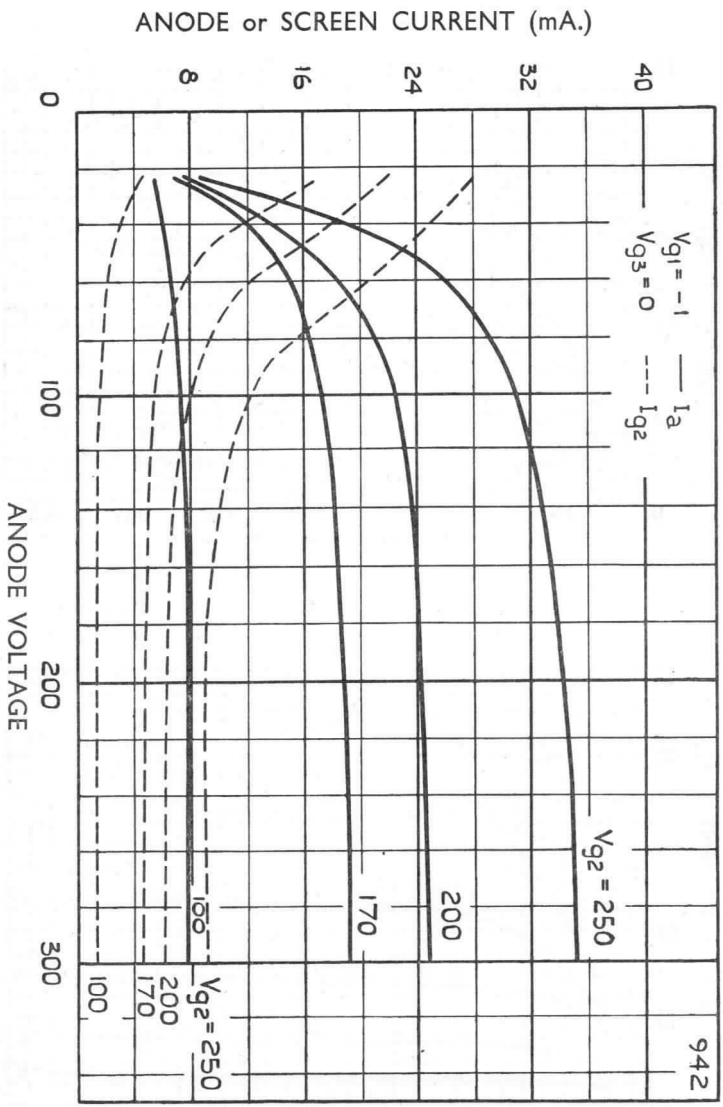
6BX6

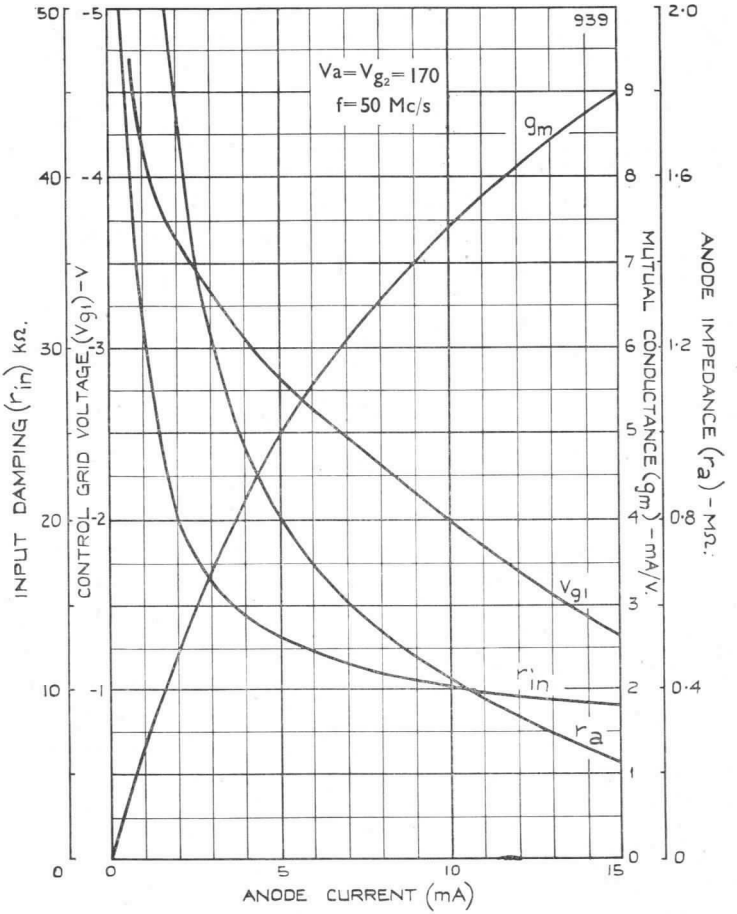





940
V_h = 6·3V
V_{g2} = 170V
V_{g3} = 0V
Pa=2·5W
V_{g1}=0V
-1V
-2V
-3V
-4V
ANODE CURRENT (mA)
ANODE VOLTAGE
0
10
20
30
40
50
50
100
150
200
250
300
350


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
ANODE VOLTAGE
0
100
200
300
Vg1 = -1
Vg3 = 0
Ia
Ig2
Vg2 = 250
200
170
150
100
942

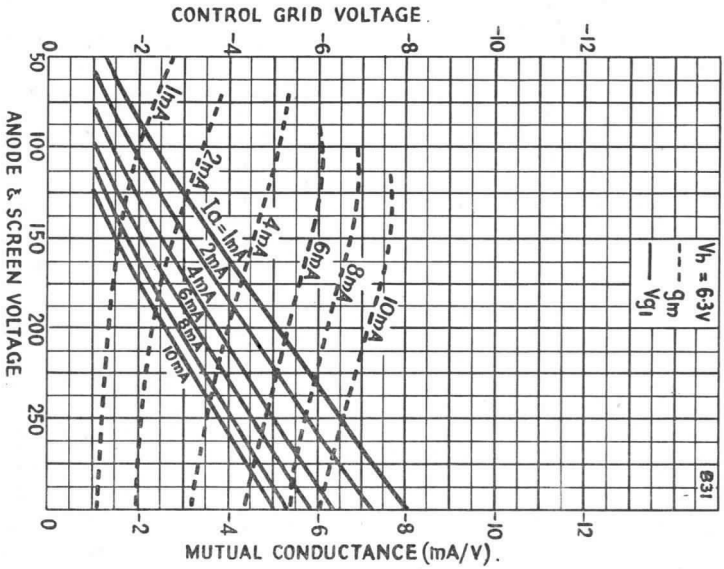


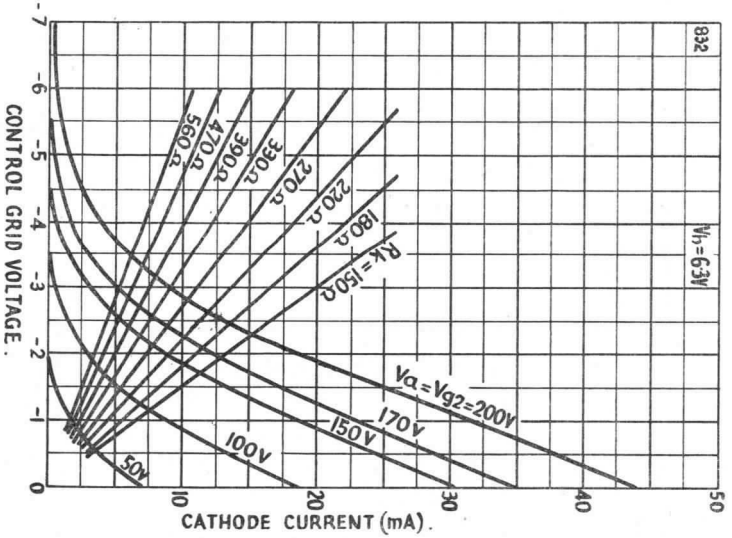
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

EF80

6BX6





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

R0359

FERRANTI

VARIABLE-MU R.F. PENTODE

EF85

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

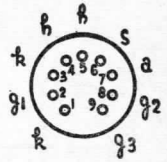
PHYSICAL DETAILS.

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).



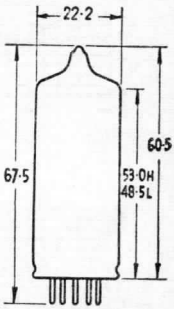
Base Connections
Underside View of Base

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	250 volts.
Max. Anode Dissipation ...	2·5 watts.
Max. Screen Dissipation ...	0·65 watts.
Max. Control Grid Voltage ($I_{g1}=+0·3\mu A$) ...	−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.

Dimensions shown are in millimetres

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.).

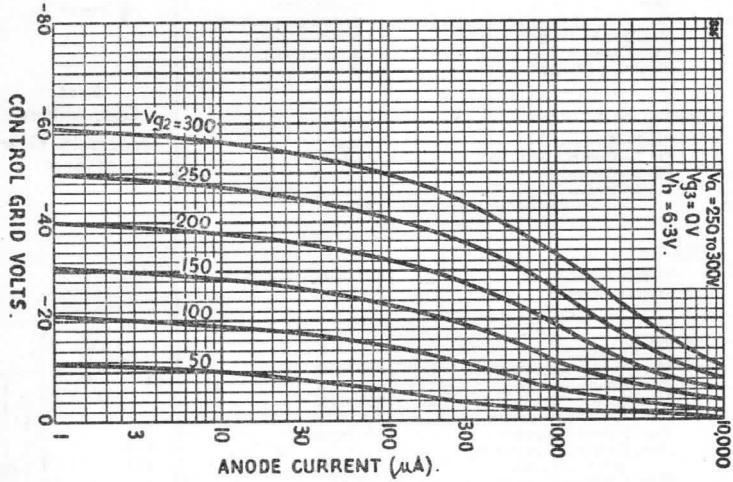
*Common screen resistor with ECH81 used as a frequency changer. Total current through resistor is 8·5 mA.

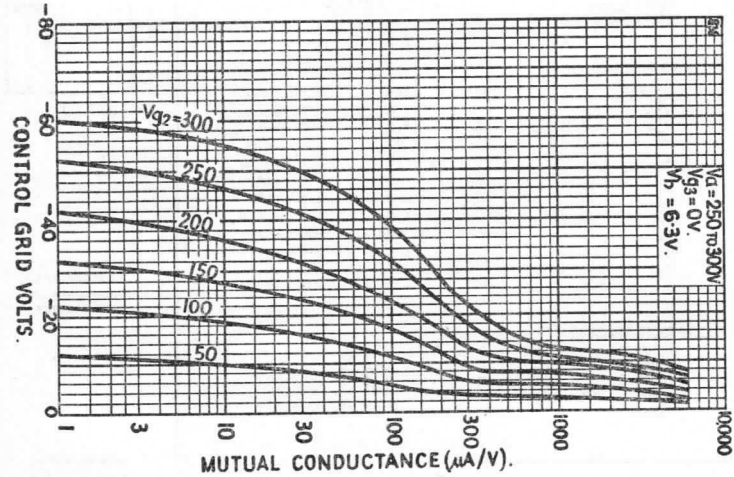
†Common screen resistor with ECH81 used as I.F. or R.F. Amplifier. Total current through resistor is 6·7 mA.

‡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).

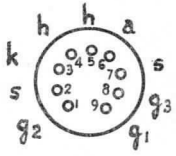

CONTROL GRID VOLTS.
-80
-60
-40
-20
0
V_{g2}=300
250
200
150
100
50
V_a=250 to 300V
V_{g3}=0V
V_h=6·3V.
1
3
10
30
100
300
1000
10000
MUTUAL CONDUCTANCE (μA/V).

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. ($1\frac{25}{32}$in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

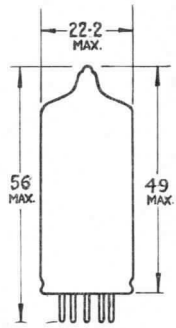
Pin 1—Screen Grid (g_2). Pin 5—Heater.
Pin 2—Shield. Pin 6—Anode.
Pin 3—Cathode. Pin 7—Shield.
Pin 4—Heater. Pin 8—Suppressor Grid (g_3).
Pin 9—Control Grid (g_1).

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_{g1-k}	... ...	3 MΩ
Max. R_{g3-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 (μg_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_{g1-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

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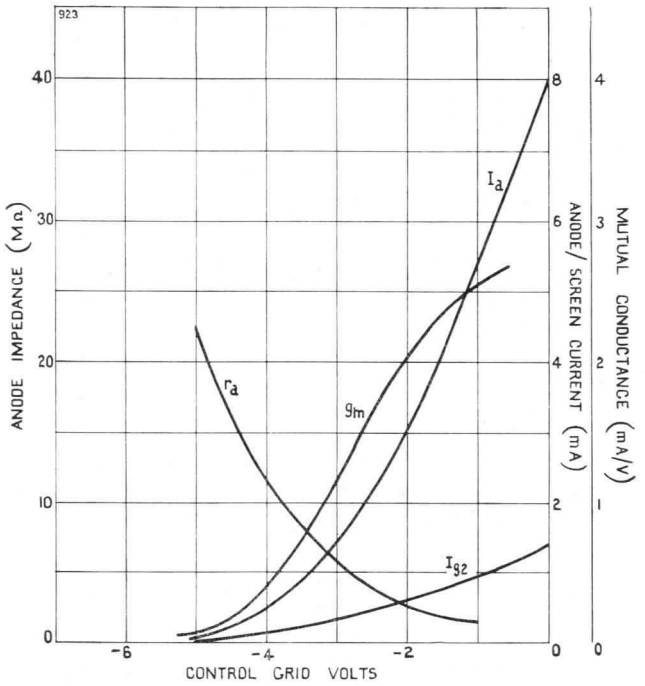
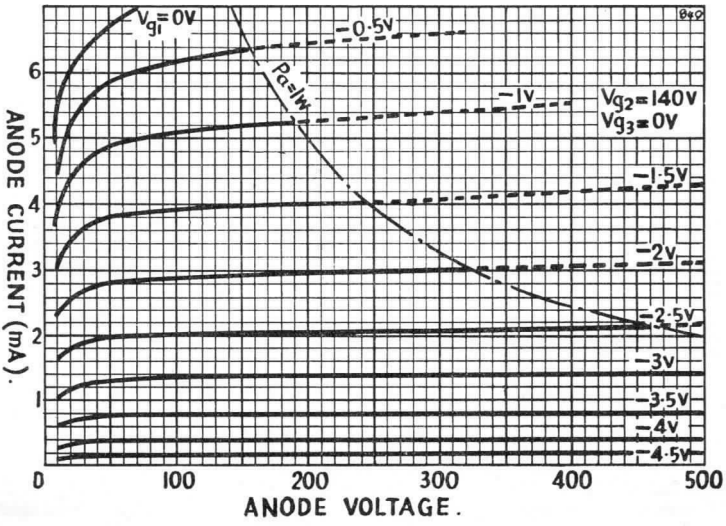
*Figures quoted are typical figures at the start of positive grid current. For lower output voltages the distortion is approximately proportional to the voltage.

†Measured without external shield.

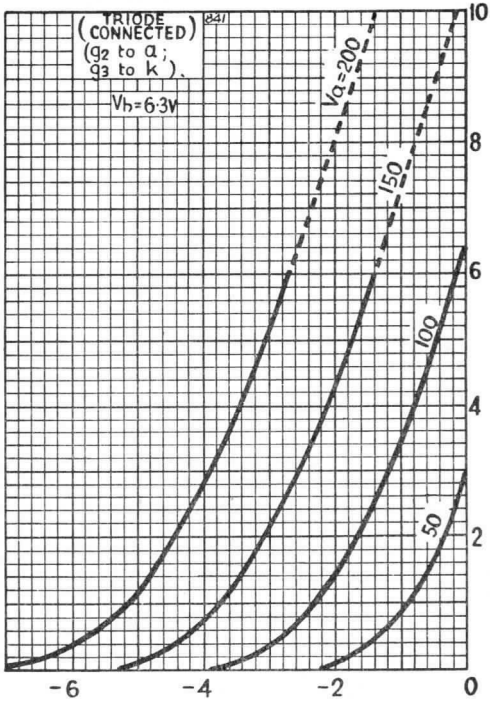
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

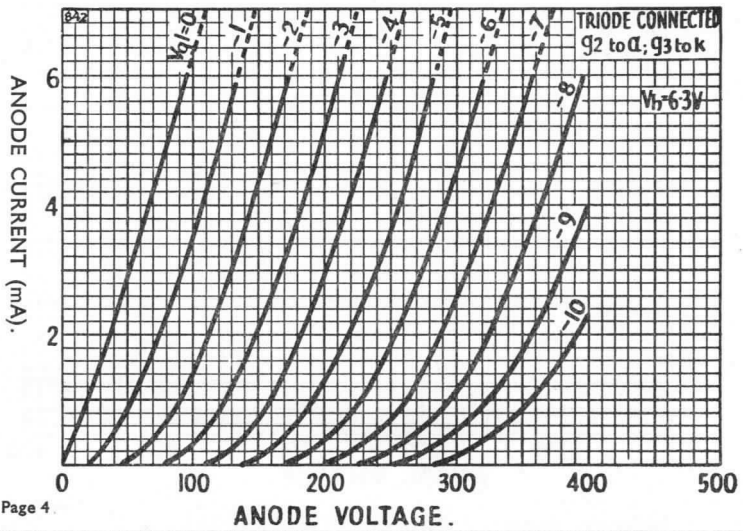
TYPICAL CHARACTERISTICS





TYPICAL CHARACTERISTICS - CONNECTED AS TRIODE





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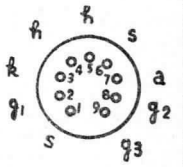
Ferranti

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.



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_{g1-k}	3 MΩ
Max. R_{g3-k}	10 kΩ
Max. R_{h-k}	20 kΩ.

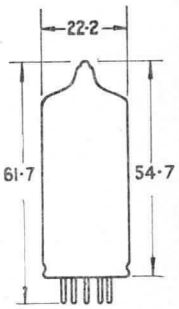
CHARACTERISTICS.

Anode Voltage ...	250	250	250 volts.
Suppressor Grid Voltage	0	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 (μg_1-g_2) ...	19	—	
Anode Impedance	>0·8	1·0	MΩ

$V_a=V_b$ ...	200	250	250	250	volts.
V_{g3} ...	0	0	0	0	volts.
R_{g2} ...	24	51	*18	*22	kΩ
V_{g1} ...	−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_{g2} ...	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 $V_{g1}=-20$	0·16	0·24	0·23	0·23	mA/V.

CAPACITANCES.

C_{in}	5·5 pF.
C_{out}	5·1 pF.
C_{a-g1}	0·002 pF. (max.).
C_{g1-g2}	2·1 pF.
C_{g1-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 $V_{g1}=-20$ and 9·3 mA. at $V_{g1}=-0·5$.

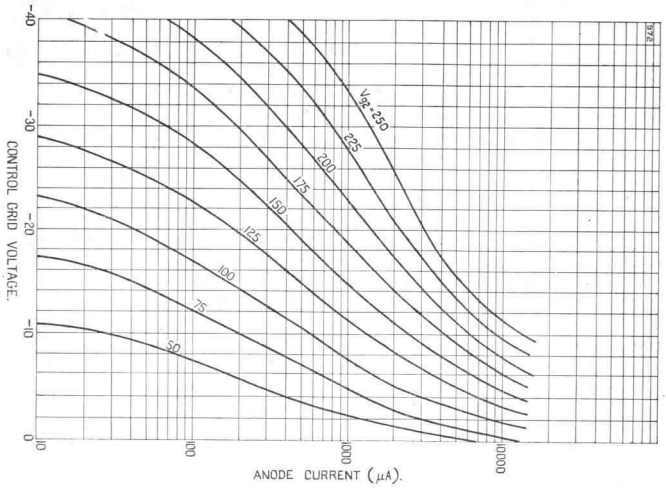
†For grid current bias operation with $R_{g1}=10M\Omega$. If this condition is not acceptable the negative grid bias should be increased to −2 volts.

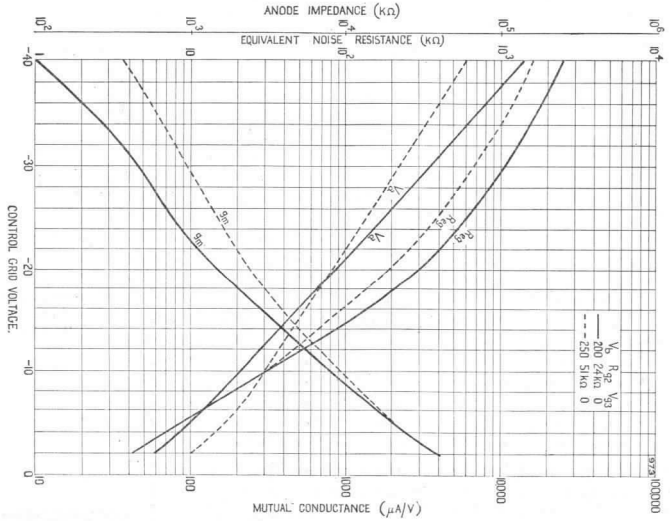
Ferranti

Issue 2.
Nov., 1961.

Ferranti

TYPICAL CHARACTERISTICS





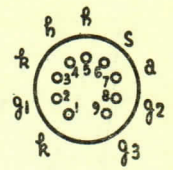
Ferranti

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.

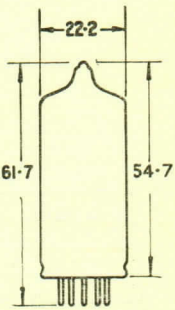
Anode Voltage	170	200	230	volts.
Screen Grid Voltage	90	90	90	volts.
Suppressor Grid Voltage	0	0	0	volts.
Grid Voltage	−1·8	−2·0	−2·1	volts.
Anode Current	14	12	10·5	mA.
Screen Grid Current	5·3	4·5	3·6	mA.
Mutual Conductance	14	12·5	10·6	mA/V.
Anode Impedance	350	500	640	kΩ
Input Damping (at 50 Mc/s.)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

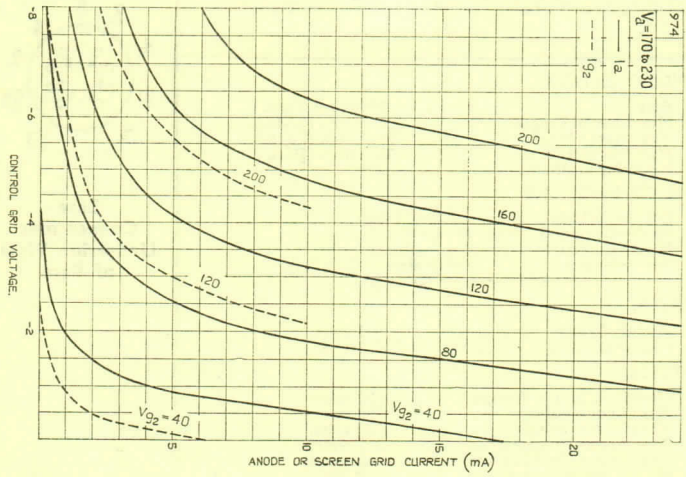
Ferranti

Ferranti

EF183

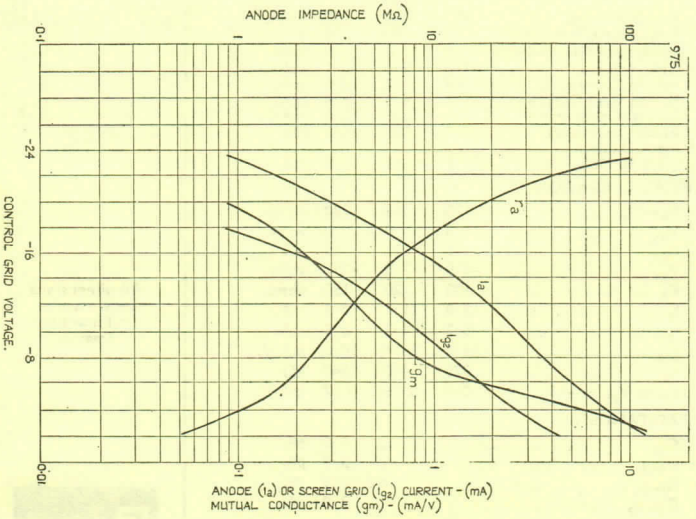
6EH7

TYPICAL I_a and I_{g2} CHARACTERISTICS.



TYPICAL CHARACTERISTICS.

at $V_a = V_{g2} = 200V. - R_{g2} = 24 k\Omega.$

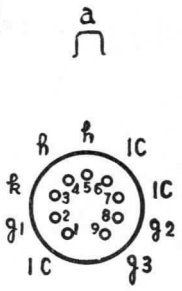


Ferranti

EL81

OUTPUT PENTODE

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



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
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.).
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

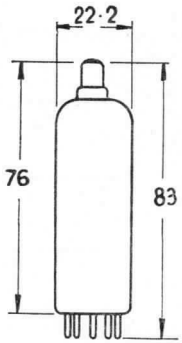
CAPACITANCES (Measured without external shield).

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.



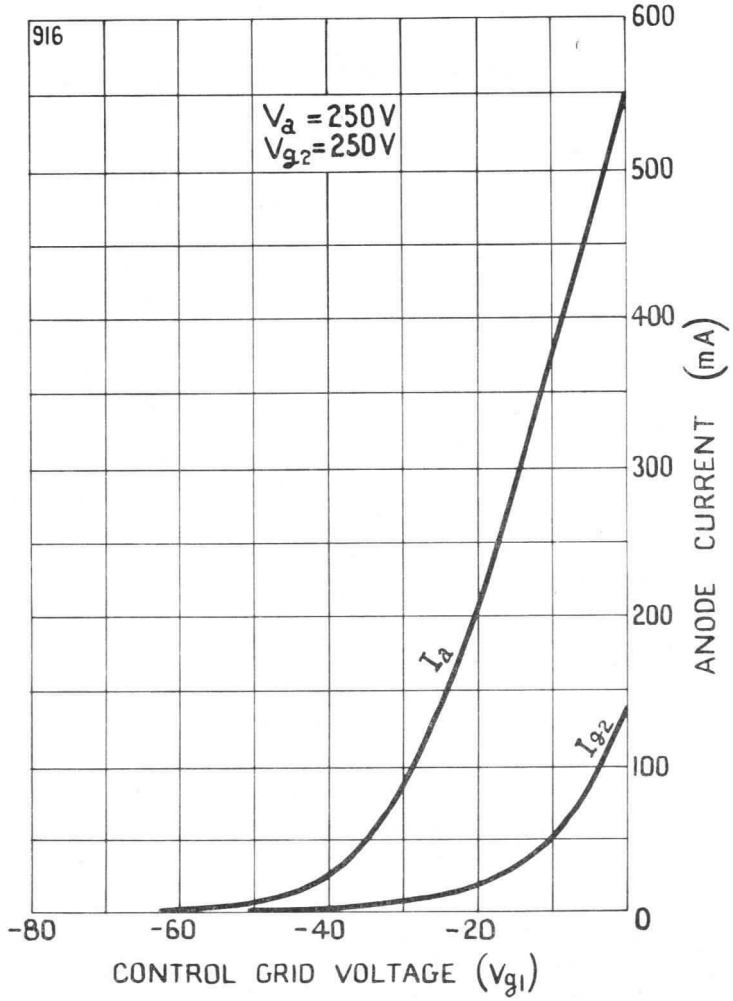
All Dimensions shown are in millimetres (max.).

*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

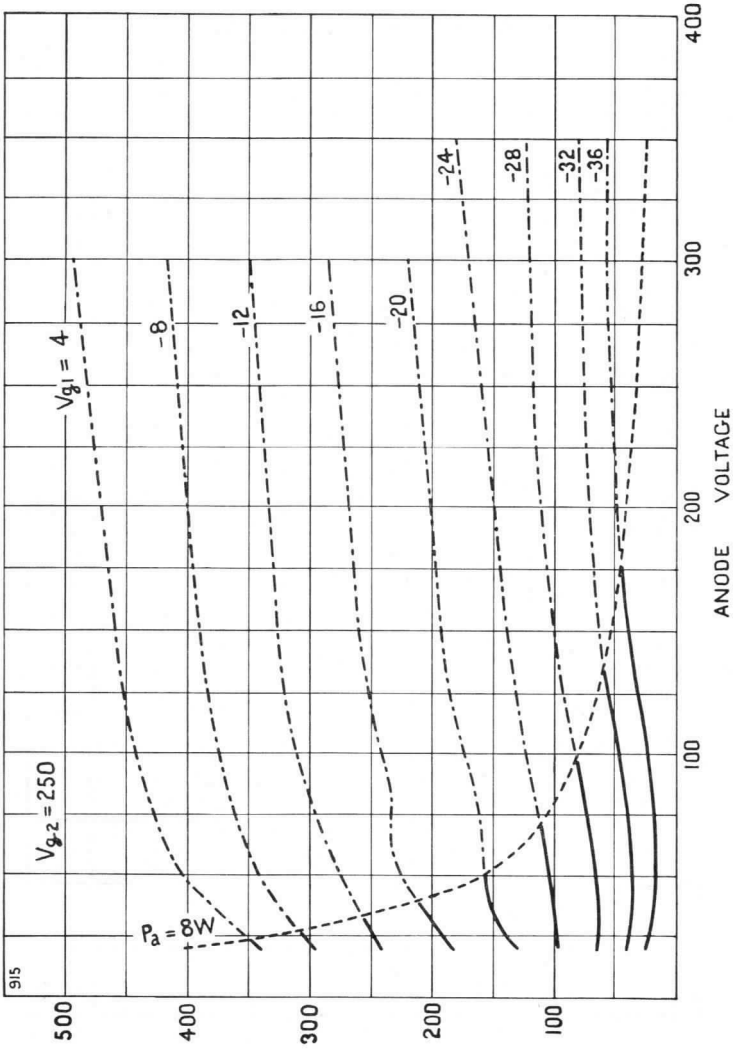
Issue 2
Feb., 1960

Ferranti

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS.

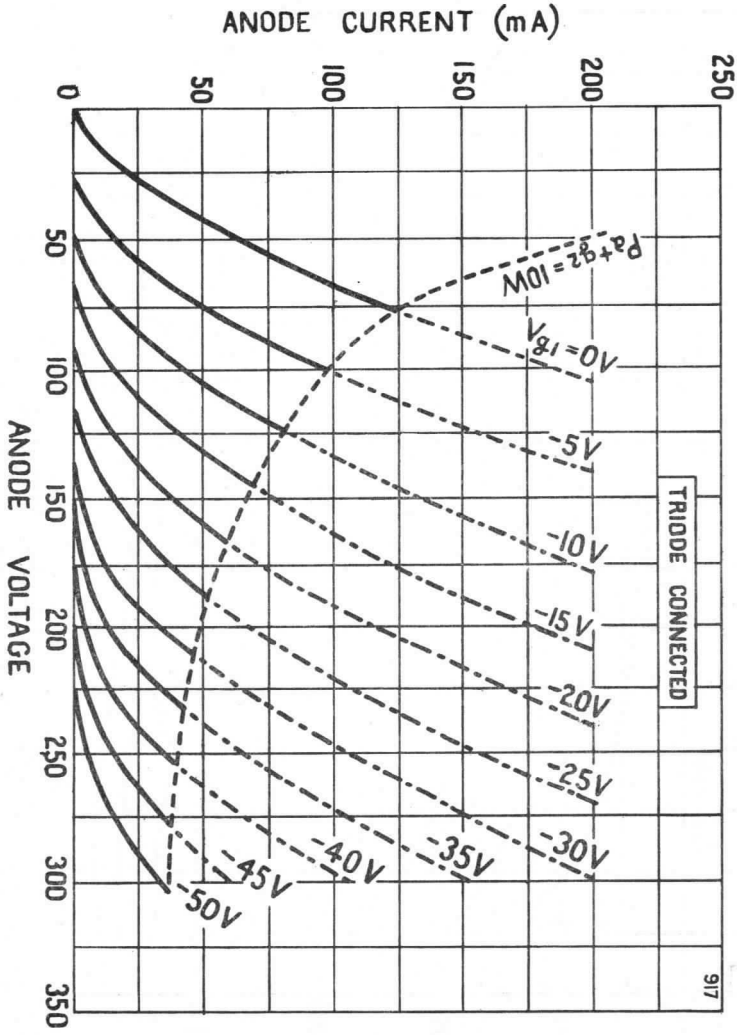


TYPICAL ANODE CURRENT/ANODE VOLTAGE CHARACTERISTICS.



Ferranti

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



Ferranti

OUTPUT PENTODE

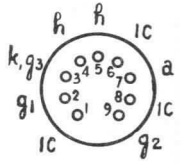
EL84

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.

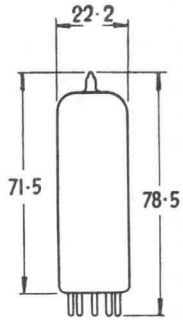
Pin 1—Internal Connection.
Pin 2—Control Grid.
Pin 3—Cathode.
Suppressor Grid.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Internal Connection.
Pin 7—Anode.
Pin 8—Internal Connection.
Pin 9—Screen Grid.

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 %

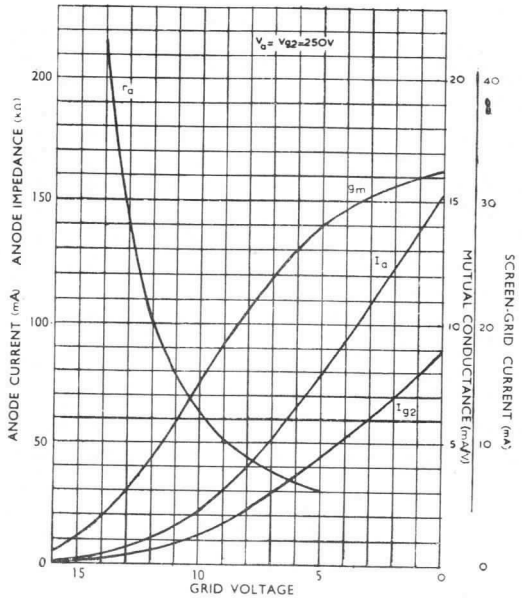
As Audio Amplifier (2 valves in Class AB push pull).

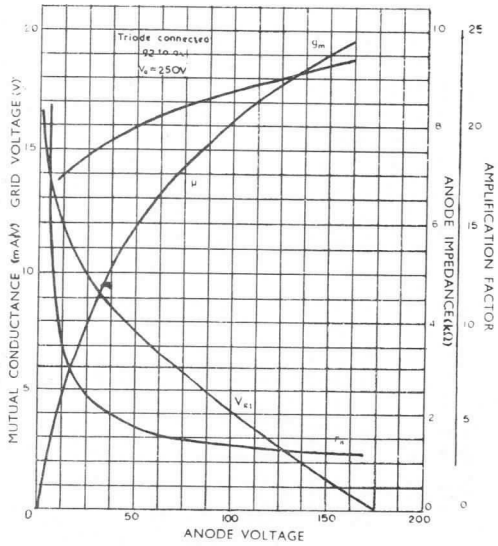
Pentode Connection.

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.





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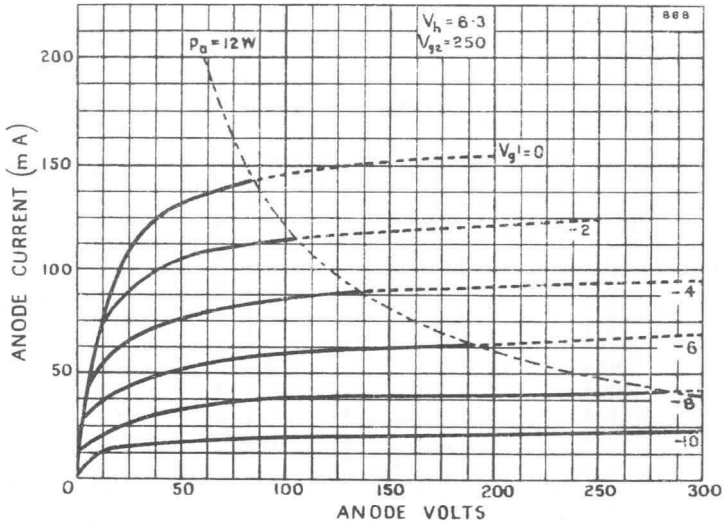
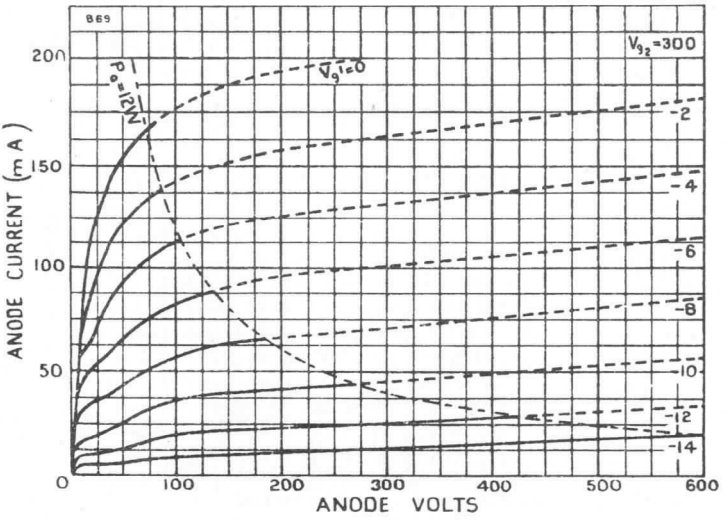
Ferranti

EL84

6BQ5





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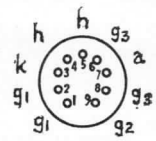
Ferranti

EL85

OUTPUT PENTODE

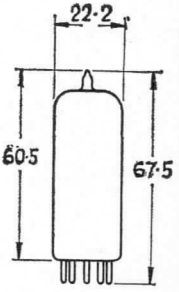
An indirectly heated pentode rated for an anode dissipation of 6 watts. Designed for use as an RF Amplifier up to 120 Mc/s or as an AF output valve.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base		B9A Glass
Max. Overall Length		67·5 mm. ($2\frac{1}{32}$")
Max. Seated Height		60·5 mm. ($2\frac{3}{8}$")
Max. Diameter		22·2 mm. ($\frac{7}{8}$")



All dimensions shown are in millimetres (max.)

BASE CONNECTIONS.

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

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_{g2}	200	250	volts
*R_k	310	310	Ω
$I_{a(o)}$	2×16	2×20	mA
$I_{g2(o)}$	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_{g1-g1}	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_{g2}	250	250	volts
V_{g1}	−17·5	−23	volts
$I_{a(o)}$	2×5·0	2×5·0	mA
$I_{g2(o)}$	2×0·8	2×0·9	mA
I_a (Max. Sig.)	2×15	2×19	mA
I_{g2} (Max. Sig.)	2×5	2×7·3	mA
R_{a-a}	16	16	kΩ
Vg_{1-g1} (r.m.s.)	24·4	32	volts
P_{out}	3·9	6·8	watts
D_{tot}	3·5	4·3	%

CAPACITANCES.

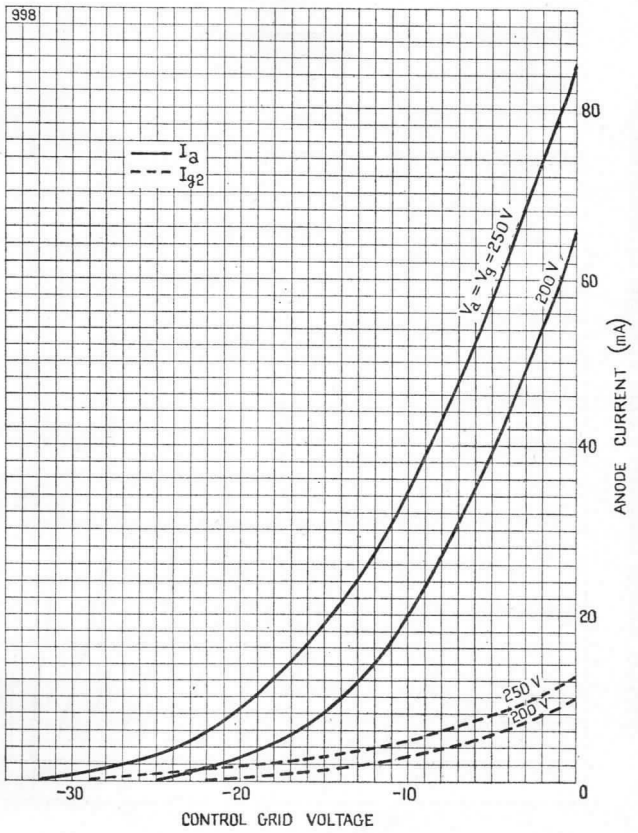
C_{in}	4·3	pF
C_{out}	5·1	pF
C_{a-g1}	<0·2	pF

*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.

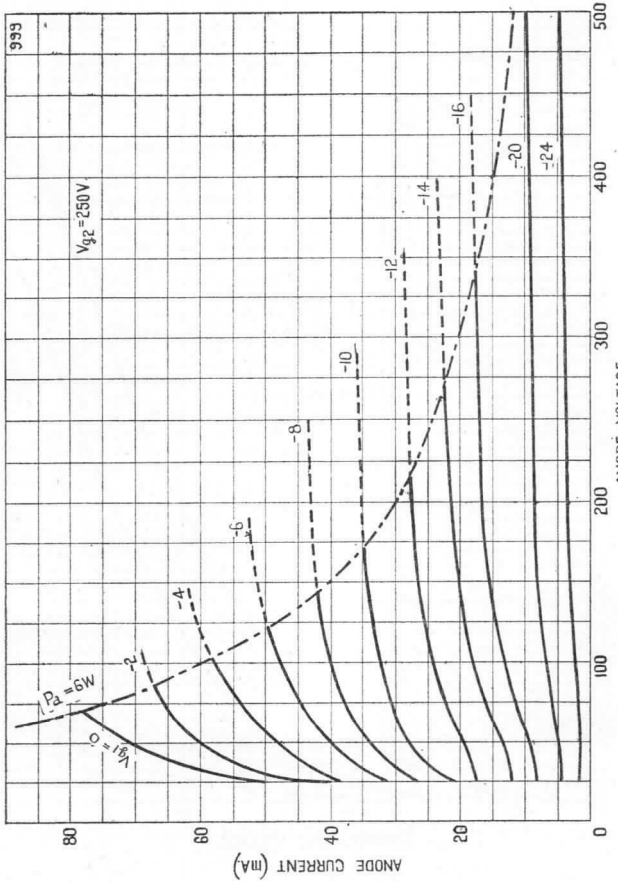
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

TYPICAL ANODE CURRENT v GRID VOLTAGE CHARACTERISTICS



EL85

TYPICAL ANODE CURRENT v GRID VOLTAGE CHARACTERISTICS

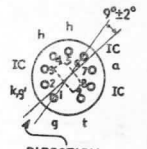


R859

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.



DIRECTION OF VIEWING.

PHYSICAL DETAILS.

Base		B9A (Noval).
Max. Overall Length		67·5 mm. ($2\frac{7}{32}$in.).
Max. Seated Height		60·5 mm. ($2\frac{25}{32}$in.).
Max. Diameter		22·2 mm. ($\frac{7}{8}$in.).
Mounting Position		Any.

For dimensions and location of display area see outline drawing.

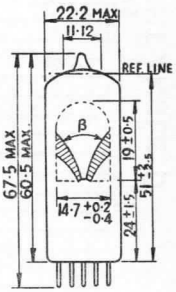
Base Connections Underside View of Base

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 ...	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.

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 β	5	50	degrees.
Anode Current	370	10	μA.
Target Current	2·0	2·3	mA.

All dimensions shown are in millimetres.

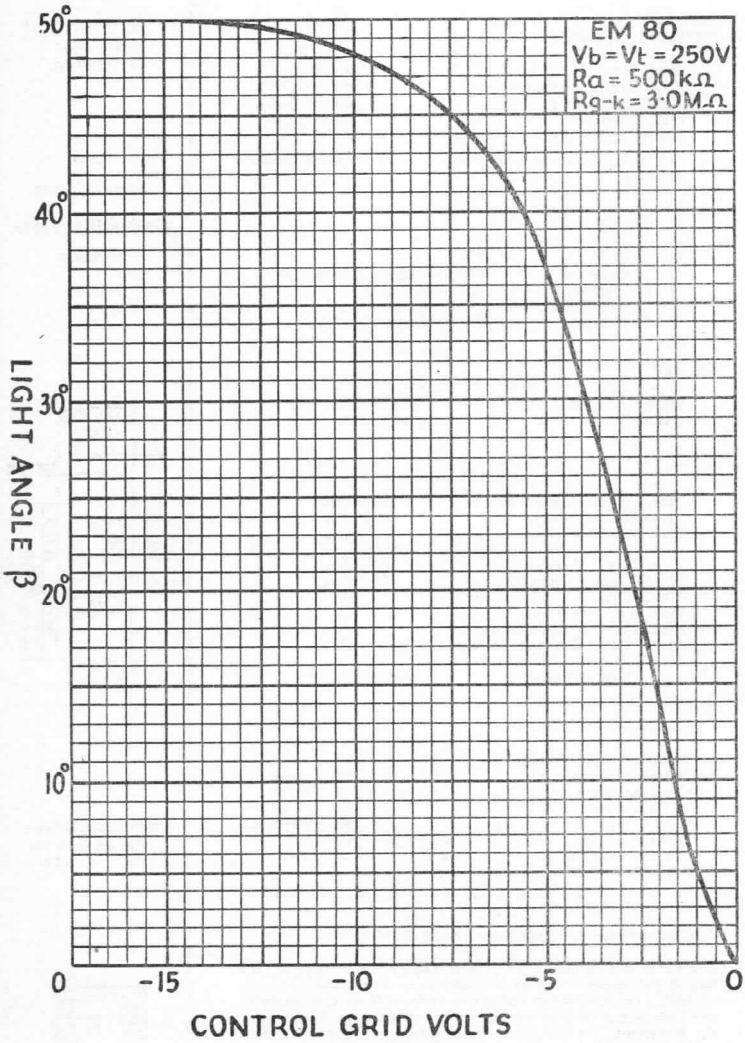
*Applied through an anode resistor of 0·56 MΩ

†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

EM80

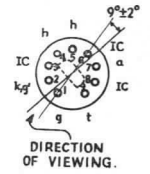

EM 80
Vb = Vt = 250V
Ra = 500kΩ
Rg-k = 3·0MΩ
50°
40°
30°
20°
10°
0
LIGHT ANGLE β
0
-15
-10
-5
0
CONTROL GRID VOLTS

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.

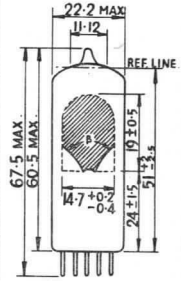


Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	B9A (Noval).
Max. Overall Length	... ...	67·5 mm. ($2\frac{27}{32}$in.)
Max. Seated Height	... ...	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	... ...	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	... ...	Any.

For dimensions and location of display area see outline drawing.



BASE CONNECTIONS.

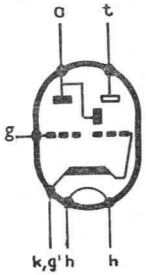
Pin 1—Grid.	Pin 5—Heater.
Pin 2—Cathode.	Pin 6—Internal Connection.
Pin 3—Internal Connection.	Pin 7—Anode.
Pin 4—Heater.	Pin 8—Internal Connection.
	Pin 9—Target.

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

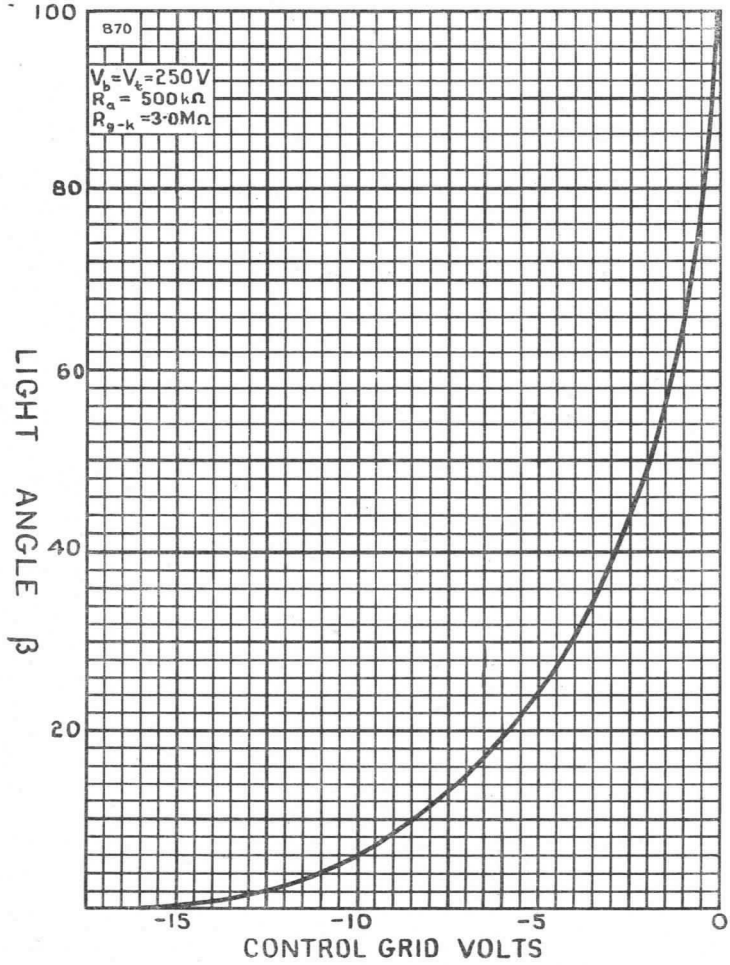
*Anode Supply Voltage	...	250	250	volts.
Target Voltage	... ...	250	250	volts.
Grid Resistor	... ...	3·0	3·0	MΩ
Grid Voltage	... ...	−1	−10·5	volts.
†Light Angle ß	... ...	65	5	degrees.
Anode Current	... ...	370	20	μA.
Target Current	... ...	2·0	2·3	mA.

*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

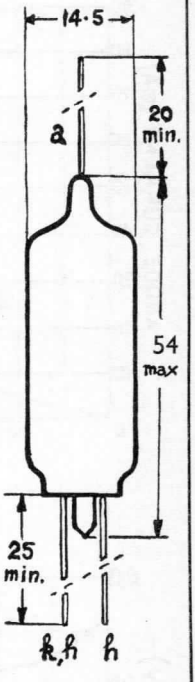

100
80
60
40
20
870
$V_b = V_c = 250V$
$R_a = 500k\Omega$
$R_{g-k} = 3{\cdot}0M\Omega$
LIGHT ANGLE β
-15
-10
-5
0
CONTROL GRID VOLTS

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.

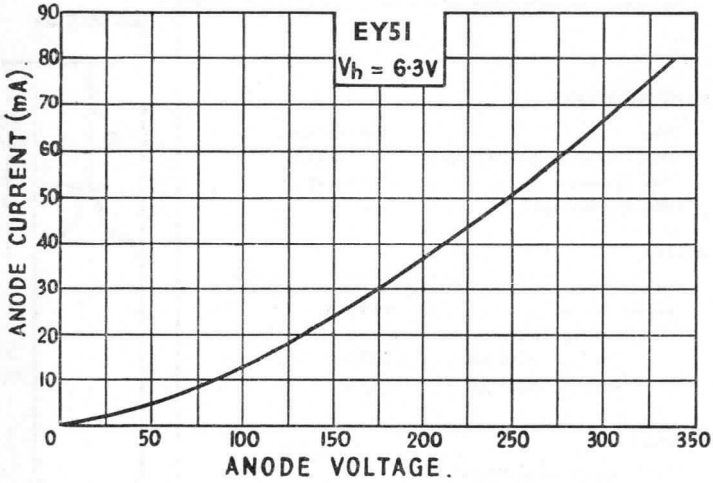
*Connections should not be soldered to the leads at any point less than 10 mm. from the seal, nor should the leads be bent near to the seal.

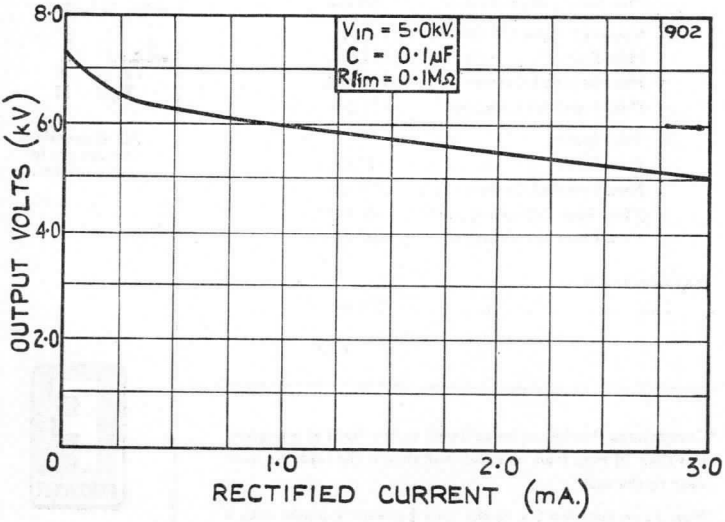
†Max. pulse duration 5% of the time between 2 pulses with a maximum duration of 5 μsecs.

Issue 2
Mar.,1959

EY51

TYPICAL CHARACTERISTICS





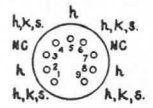
Ferranti

EY86

6S2

HIGH VOLTAGE RECTIFIER

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

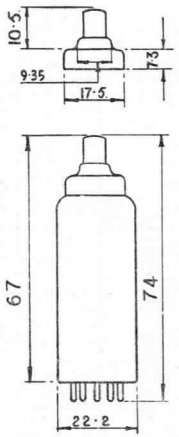
Underside View of Base

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.

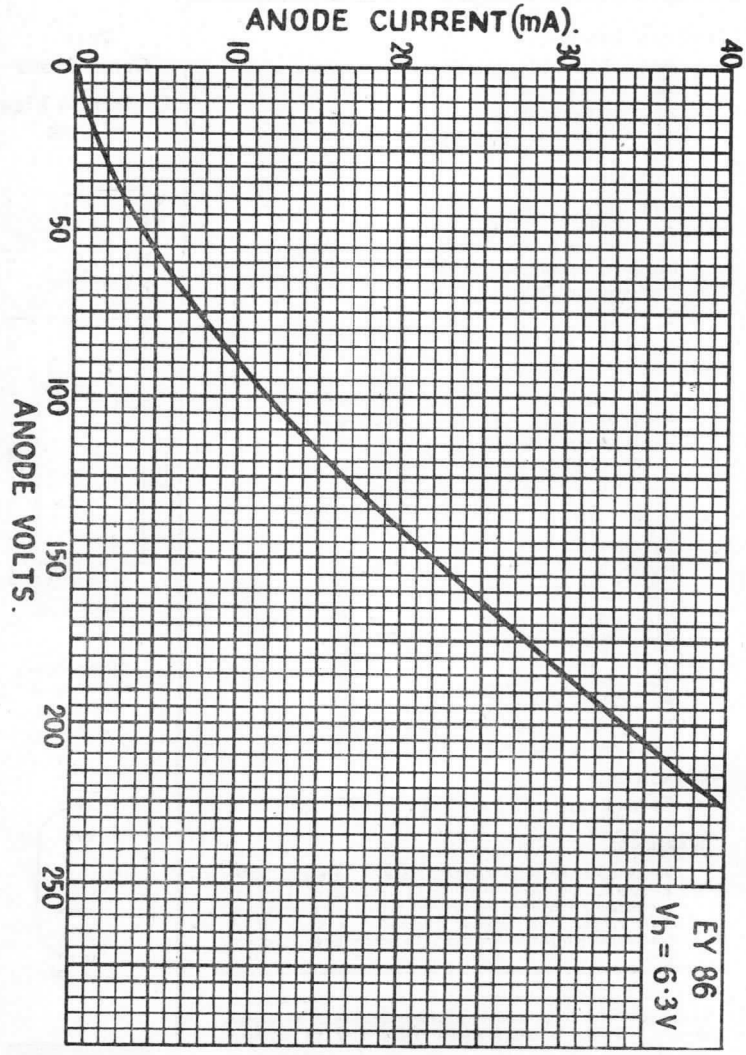
Issue 2.
June, 1962

Ferranti

Ferranti

EY86

6S2



FERRANTI

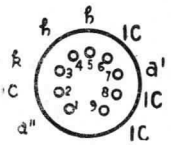
FULL WAVE RECTIFIER

EZ80

An indirectly heated, full wave rectifier.

PHYSICAL DETAILS.

Base	B9A—Noval.
Bulb	Clear.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$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

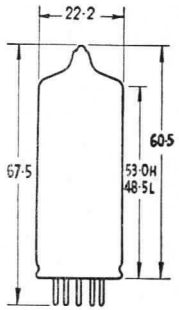
Underside View of Base

BASE CONNECTIONS.

Pin 1—Anode 2.	Pin 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.

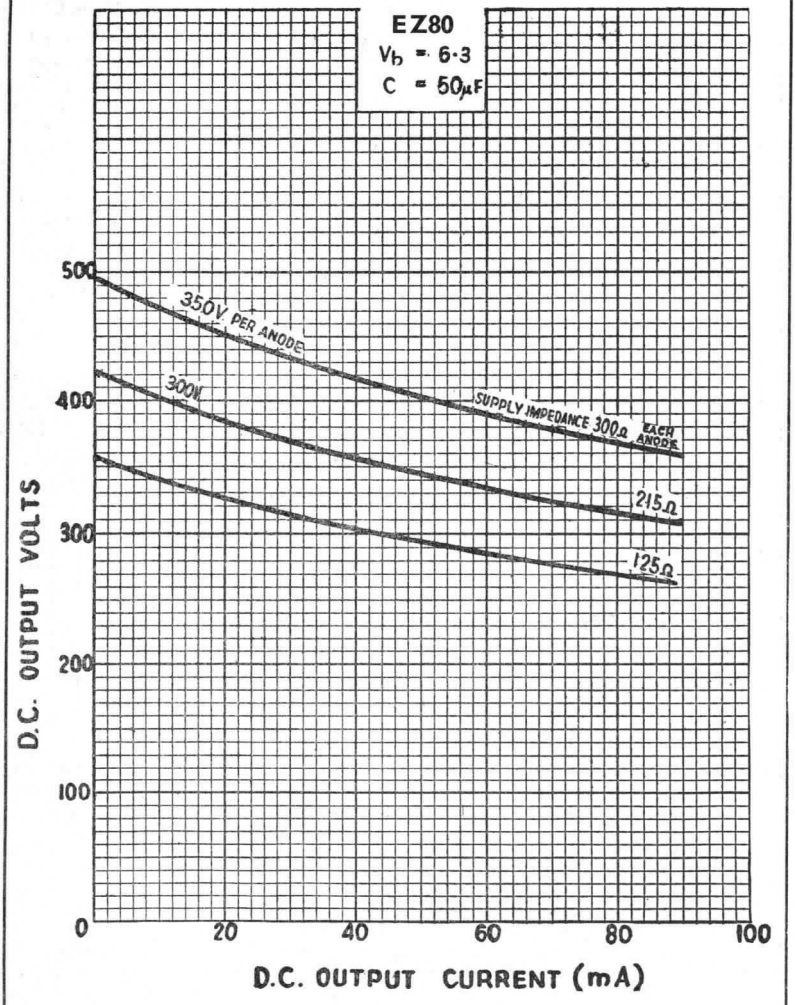
*R.M.S. Input Voltage	250	275	300	350	volts.
Rectified Current	90	90	90	90	mA.
*Min. Supply Impedance	125	175	215	300	ohms.
Max. Reservoir Capacitor	50	50	50	50	μF.
DC. Output Voltage	265	285	310	360	volts.

All dimensions shown are in millimetres.

*Each Anode.

Issue 2
(Tentative)
Dec., 1957

EZ80

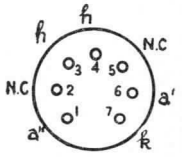

EZ80
V_b = 6·3
C = 50μF
350V PER ANODE
300V
SUPPLY IMPEDANCE 300Ω EACH ANODE
215Ω
125Ω
D.C. OUTPUT VOLTS
500
400
300
200
100
0
20
40
60
80
100
D.C. OUTPUT CURRENT (mA)

FERRANTI

FULL WAVE RECTIFIER

EZ90

A miniature indirectly heated, full wave rectifier.



Base Connections

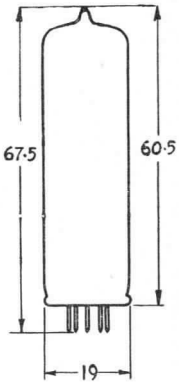
Underside View of Base

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.

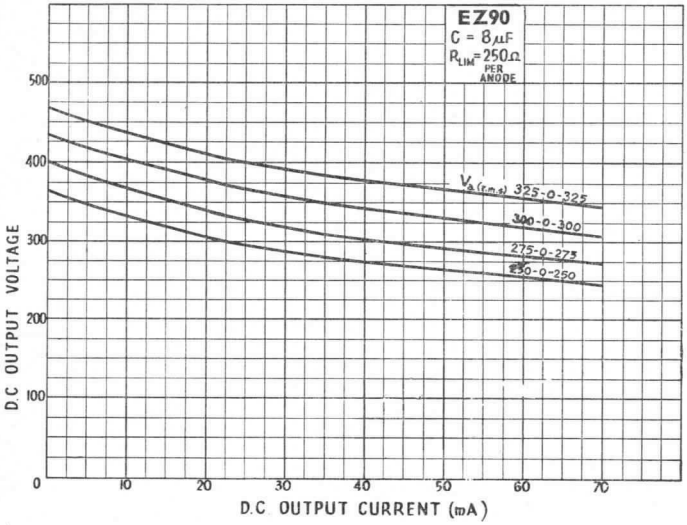
*Input Voltage	450 volts (r.m.s.).
Min. Choke Inductance	10 henries.
Rectified Current	70 mA.
Output Voltage	370 volts.

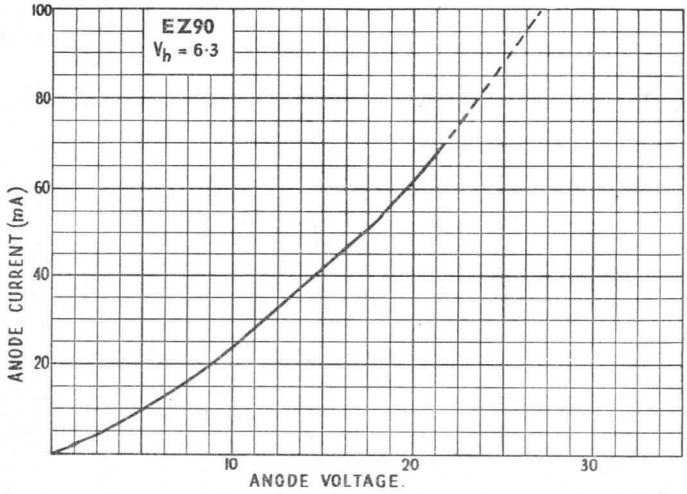
All dimensions shown are in millimetres (max.).

*Each Anode.

Issue 2
Dec.,1957

EZ90


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
500
400
300
200
100
0
10
20
30
40
50
60
70
D.C OUTPUT CURRENT (mA)


EZ90
V_h = 6·3
ANODE CURRENT (mA)
100
80
60
40
20
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$\frac{3}{4}$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

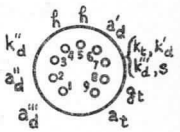
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

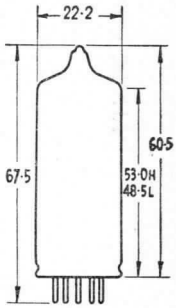
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	·76	mA.
Stage Gain	51	53	47	54	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion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

PABC80

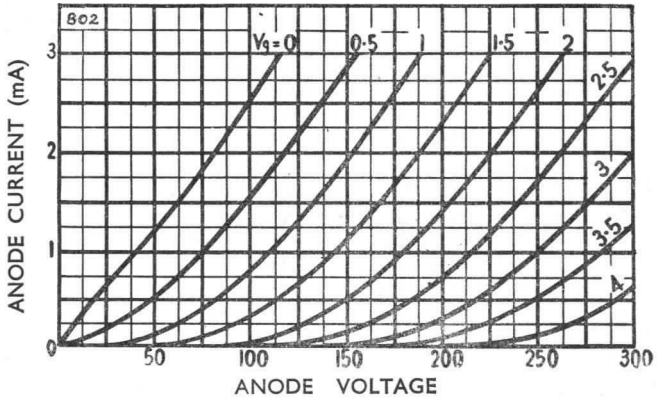
FERRANTI

CAPACITANCES. TRIODE SECTION.

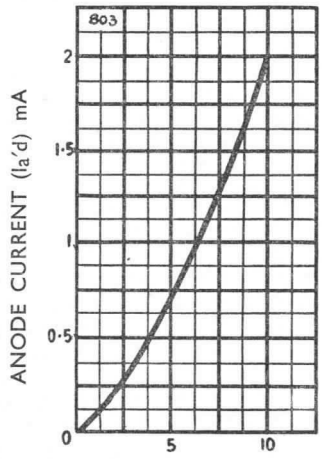
C_{in}	...	...	...	...	1.9 pF.
C_{out}	...	...	...	...	1.4 pF.
C_{a-g}	...	...	...	...	2.0 pF.
C_{g-h}	...	...	...	...	<0.04 pF.

DIODE SECTION.

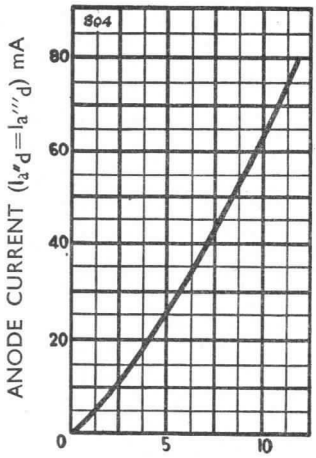
$C_{a'd-(h+kt, k'd, k''d, s)}$				...	0.8 pF.
$C_{a''d-(h+k''d+kt, k'd, k'''d, s)}$					4.8 pF.
$C_{a'''d-(h+kt, k'd, k''d, s)}$				...	4.8 pF.
$C_{k''d-all}$	...	...	...	...	5.0 pF.
$C_{a'd-h}$	...	...	...	...	<0.25 pF.
$C_{a'''d-h}$	...	...	...	...	<0.2 pF.
$C_{k''d-h}$	...	...	...	...	2.5 pF.



DIODE I



DIODE II - DIODE III

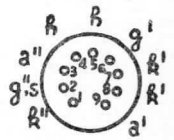


FERRANTI

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. ($1\frac{15}{16}$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	0·3 amp.
Heater Voltage	7·0 volts.

RATINGS.†

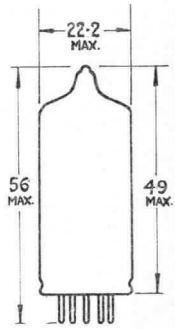
Max. Anode Supply Voltage	550 volts.
Max. Anode Voltage	180 volts.
Max. Anode Dissipation	2 watts.
Max. Cathode Current	18 mA.
Max. Neg. Grid Voltage	50 volts.
Max. $V_{h-k'}$	90 volts.
Max. $V_{h-k''}$ (heater positive)	90 volts.
**Max. $V_{h-k''}$ (pk) (heater negative)	250 volts.
Max. $R_{g'-k'}$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

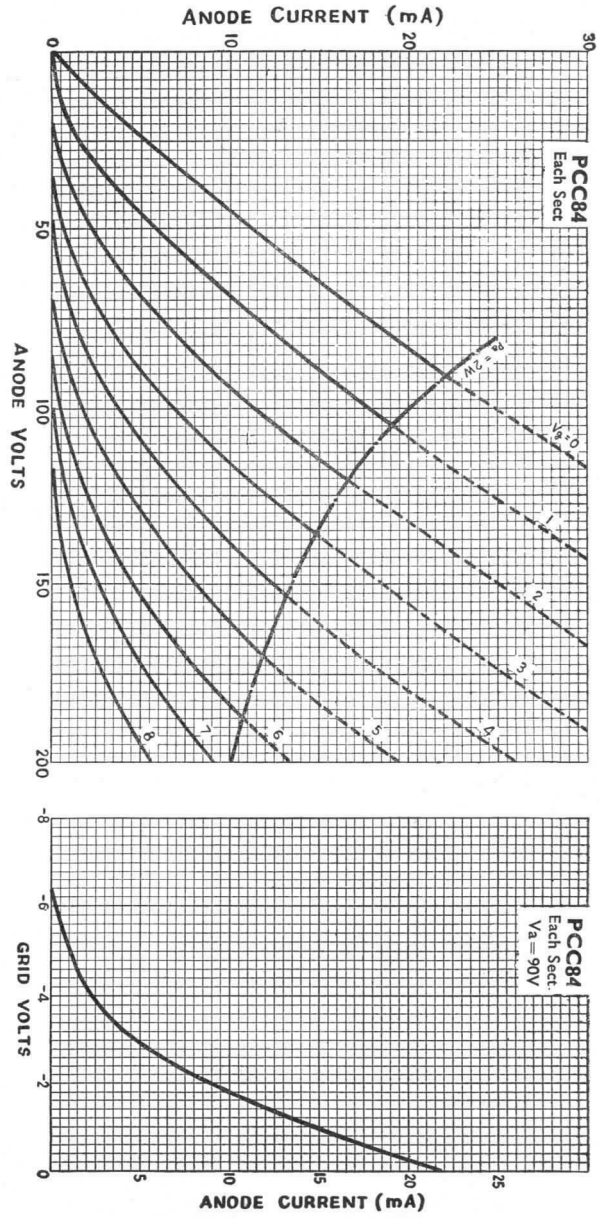
‡Measured without external shield.

§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

PCC84


ANODE CURRENT (mA)
0
10
20
30
50
100
150
200
ANODE VOLTS
PCC84
Each Sect
Va = 250V
Vg = 0
-1
-2
-3
-4
-5
-6
-7
-8
-8
-6
-4
-2
0
5
10
15
20
25
GRID VOLTS
ANODE CURRENT (mA)
PCC84
Each Sect.
Va = 90V

FERRANTI

DOUBLE TRIODE

PCC85

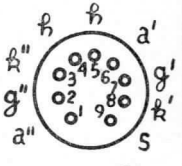
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

PHYSICAL DETAILS.

Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{1}{2}$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.

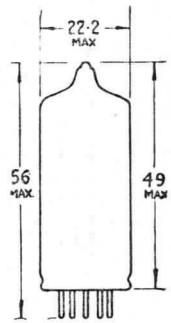
TYPICAL OPERATION.

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.

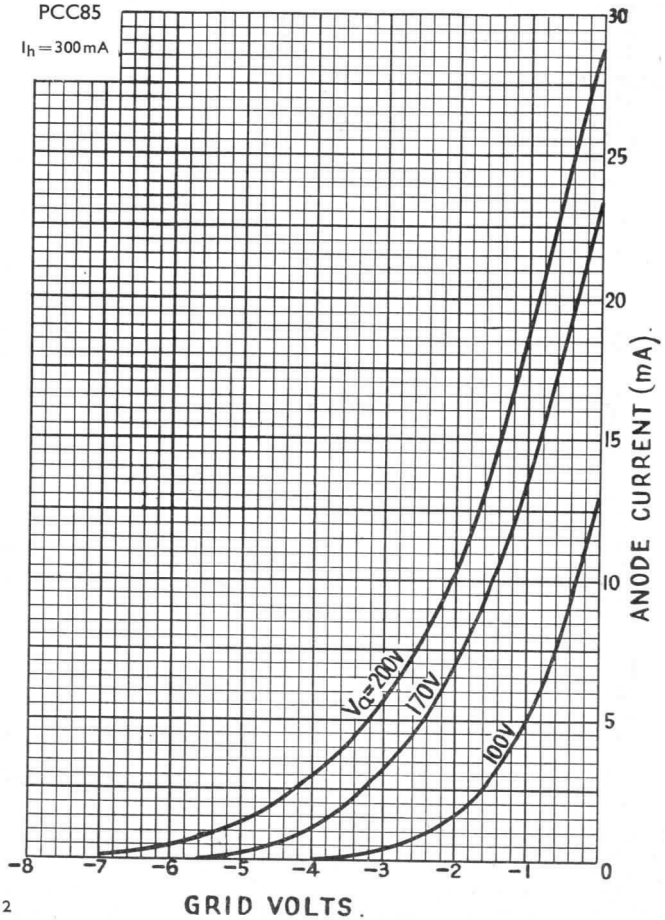
Issue 2
(Tentative)
Dec., 1957

FERRANTI

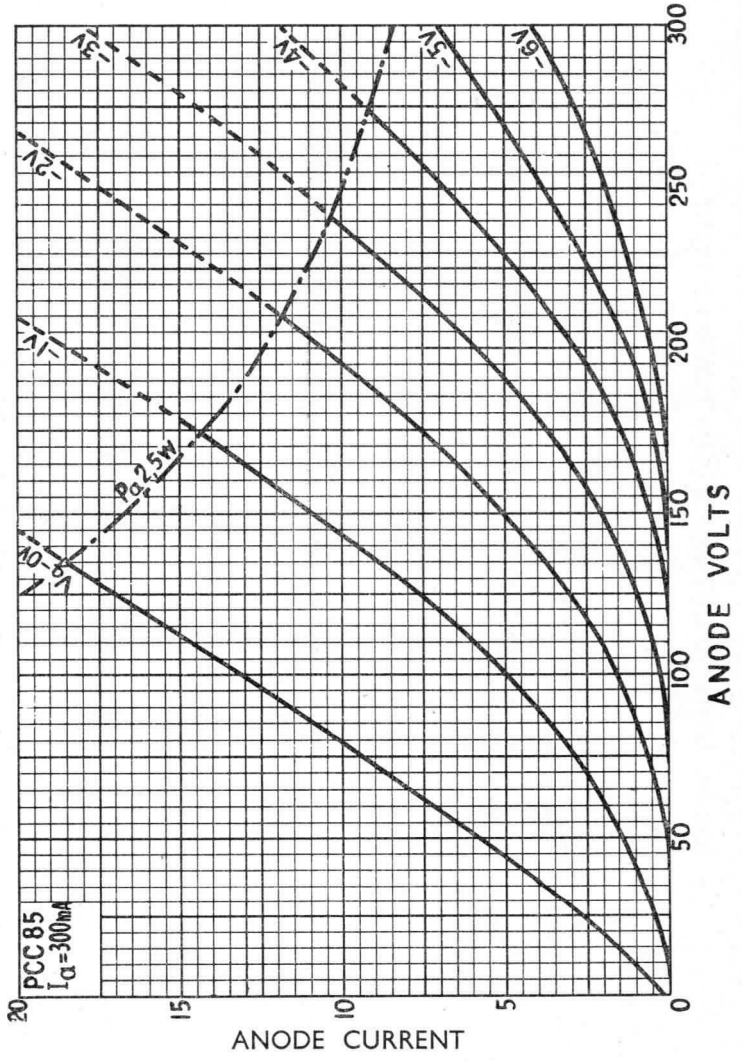
CAPACITANCES.

*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.

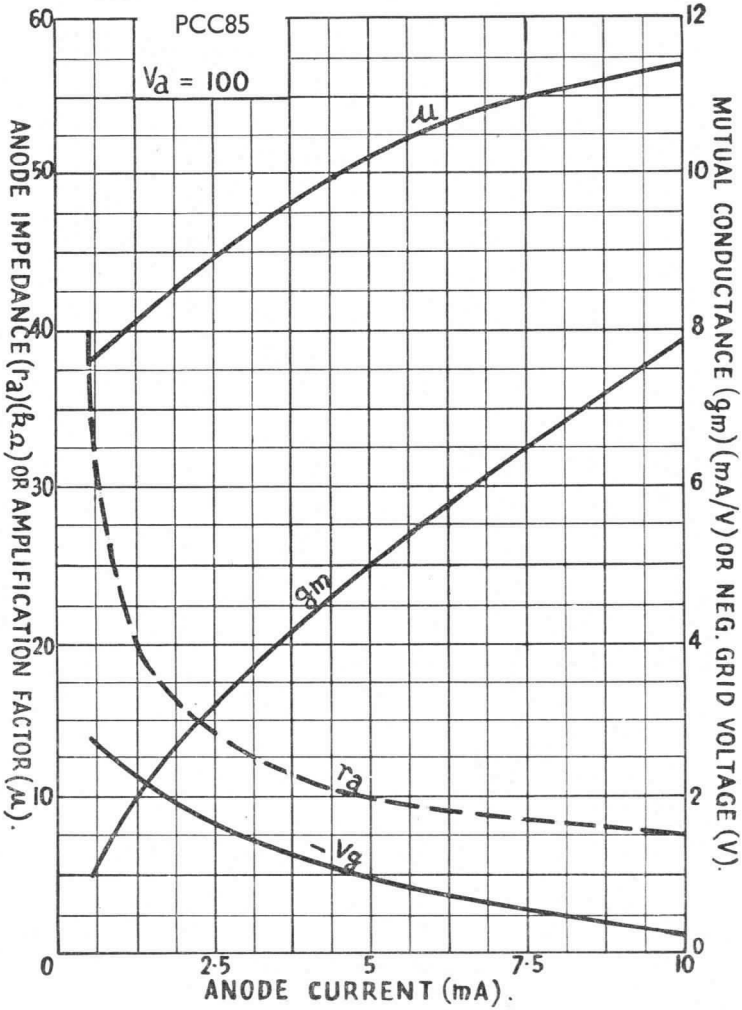
*Each Section.
†Measured with external shield.



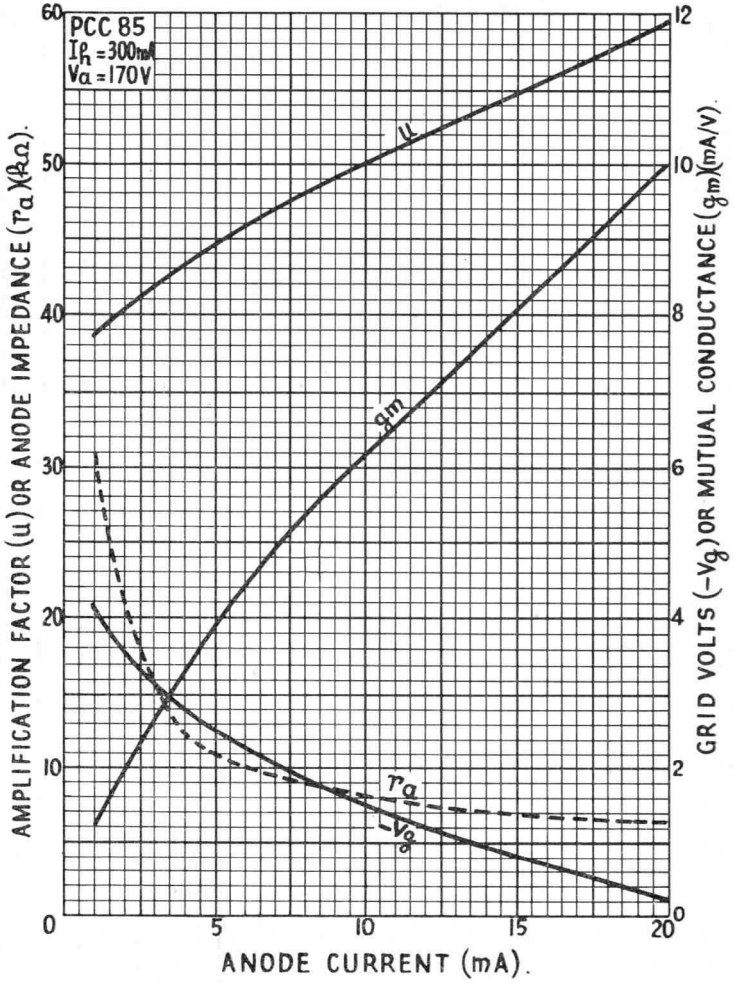
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.



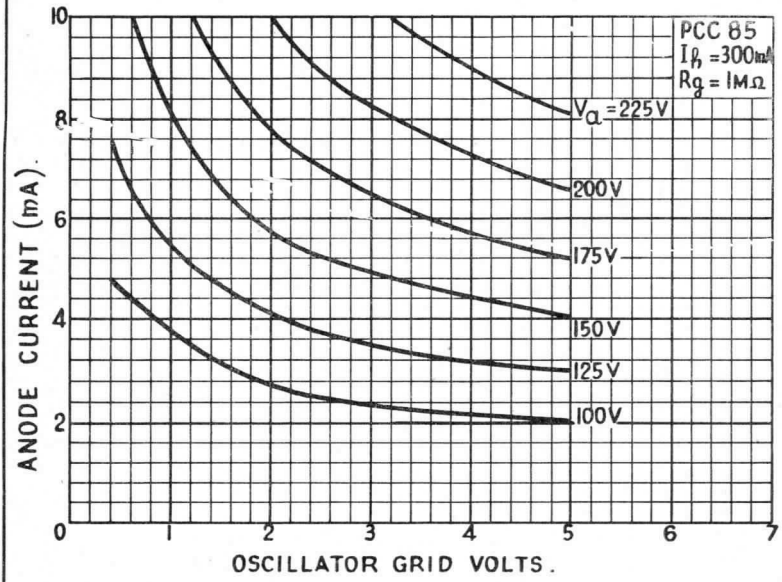
Issue 2
(Tentative)
Dec., 1957

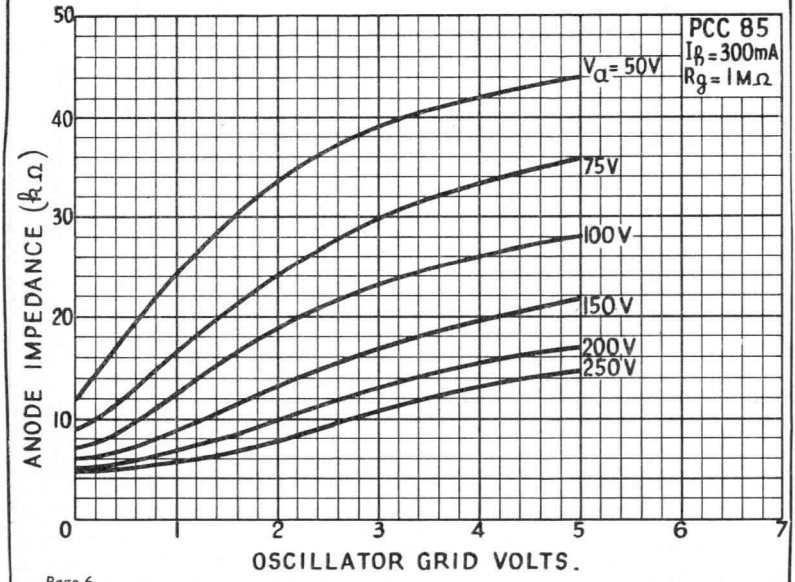


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.



Issue 2
(Tentative)
Dec., 1957





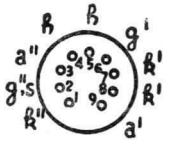
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

R.F. DOUBLE TRIODE

PCC89

A double triode with separate cathodes, primarily designed for use as a Cascade 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. ($1\frac{15}{16}$ 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.
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.†

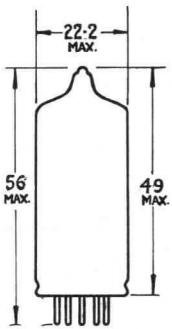
$C_{g'-a''}$	< ·005 pF.
$C_{a'-a''}$	< ·015 pF.

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.

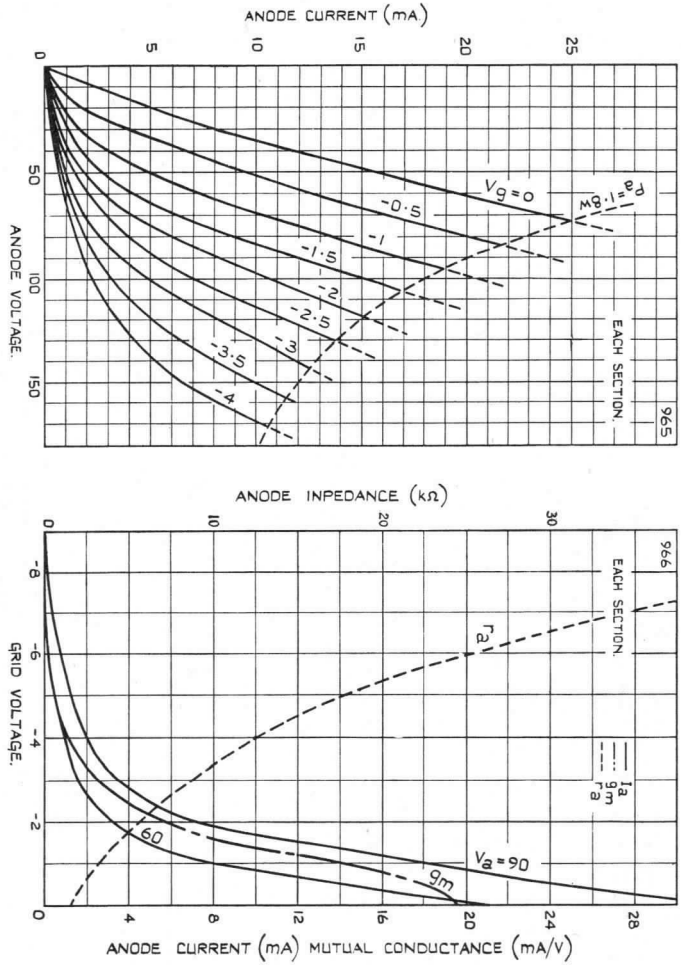
Issue 1.
Oct. 1961.

Ferranti

Ferranti

PCC89

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.

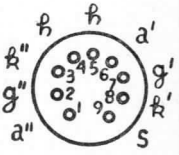
PHYSICAL DETAILS.

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



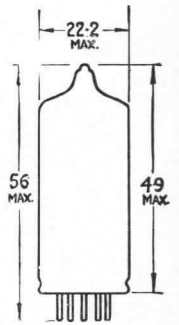
Base Connections Underside View of Base

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

*Each section, unless otherwise indicated.

Dimensions shown are in millimetres

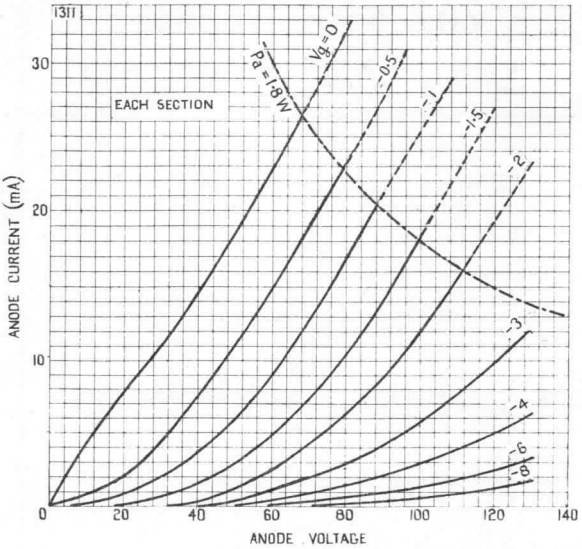
Ferranti

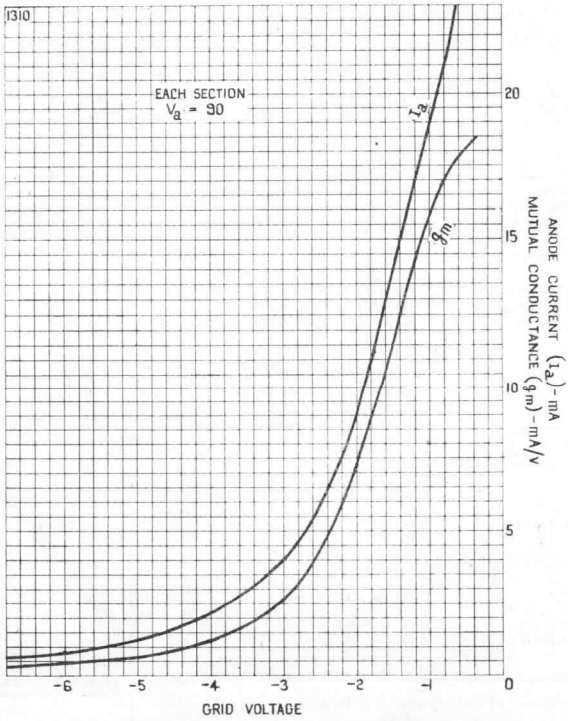
Issue 1
May, 1963

Ferranti

PCC189

TYPICAL CHARACTERISTICS

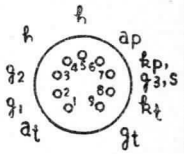




FERRANTI
TRIODE PENTODE

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. ($1\frac{25}{32}$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.

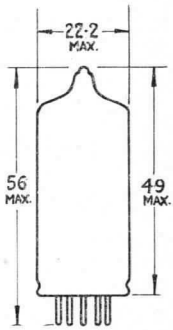
RATINGS.

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.



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.†

$C_{a_p-a_t}$	<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.

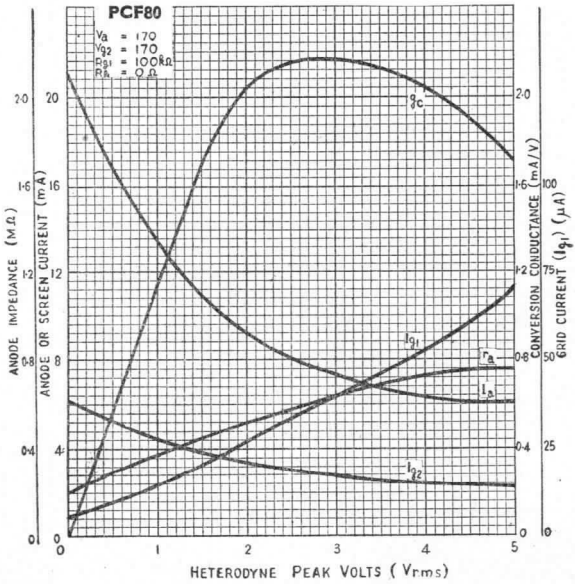
Triode Section.

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.



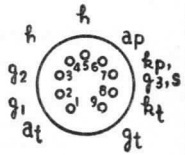
Ferranti

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.)

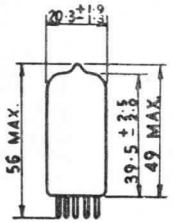
RATINGS.

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.

Ferranti

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.

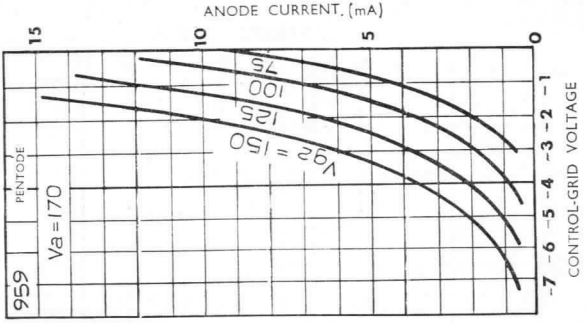
C_{in}	5·0 pF.
C_{out}	2·6 pF.
C_{a-g_1}	<0·01 pF.

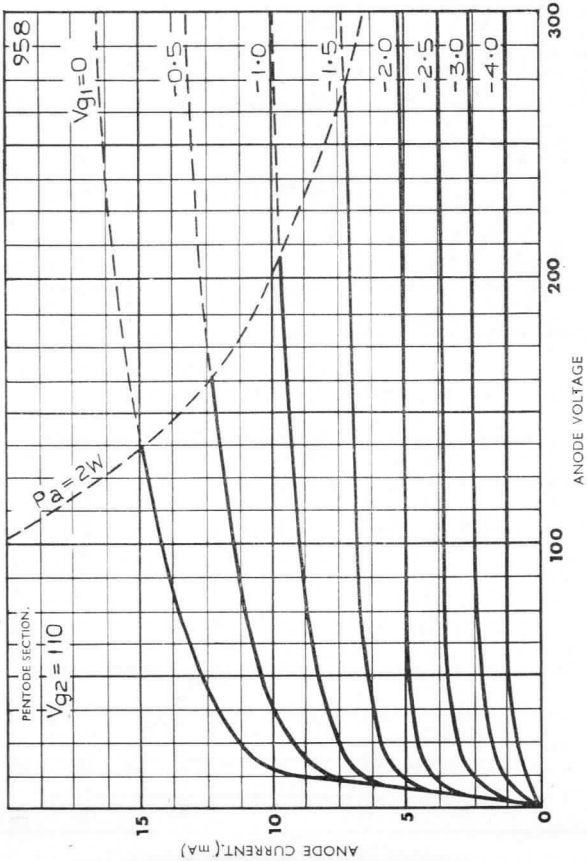
Triode Section.

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.).

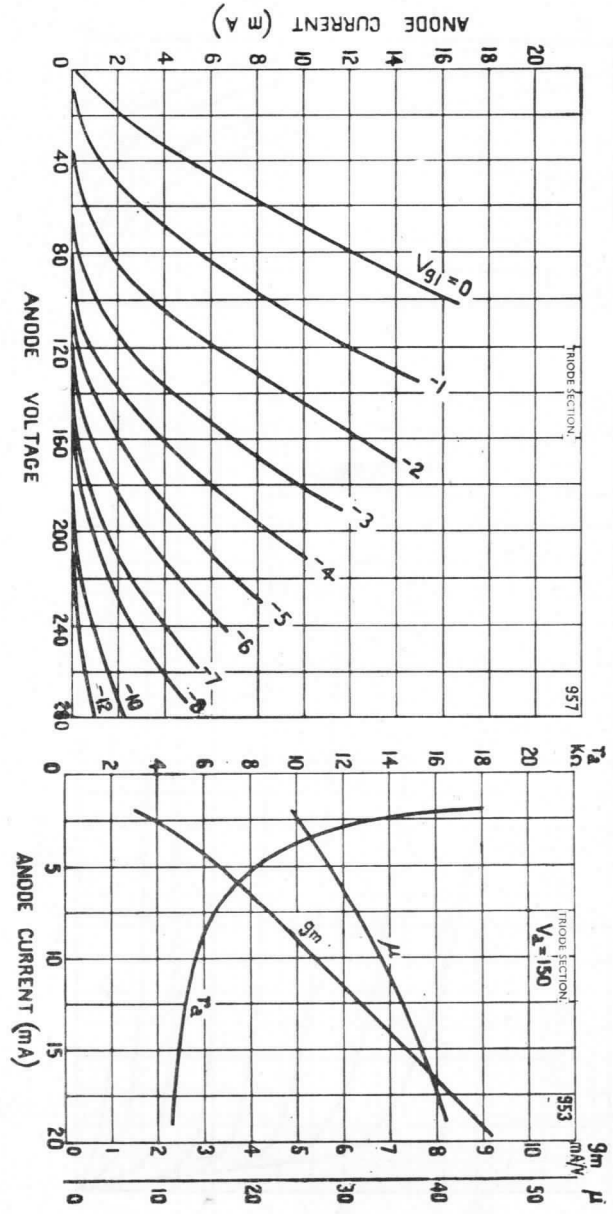
TYPICAL CHARACTERISTICS OF PENTODE SECTION.



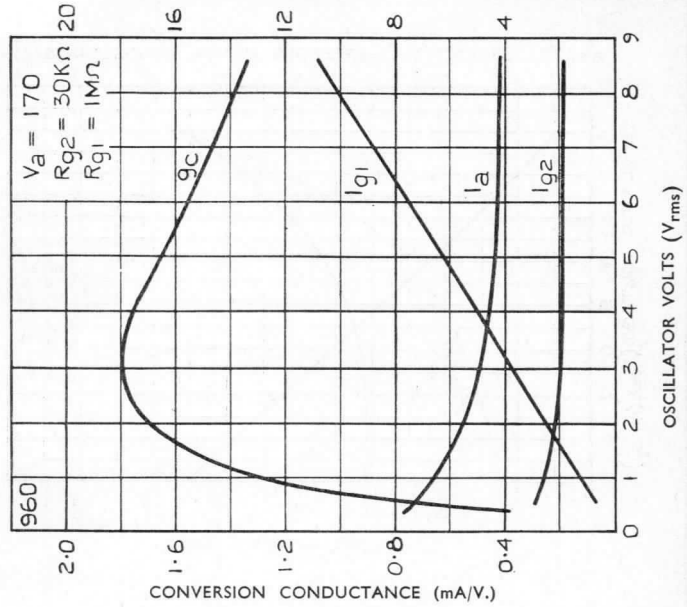


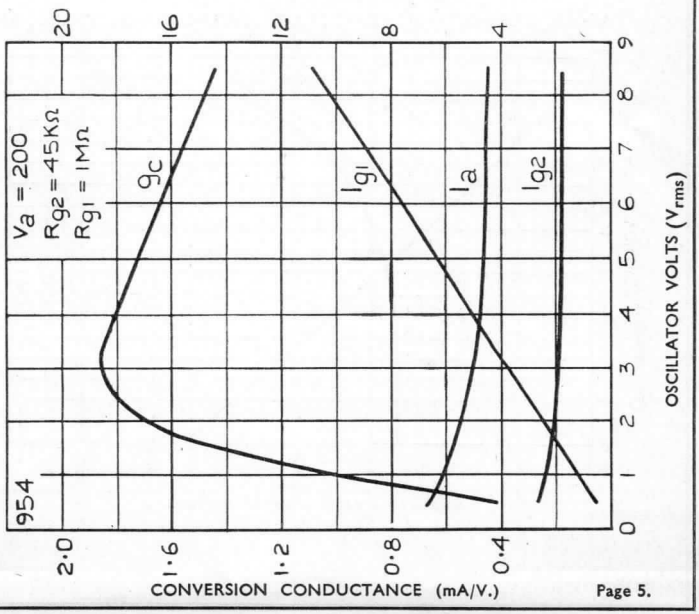
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM. LANCS.

TYPICAL CHARACTERISTICS OF TRIODE SECTION.

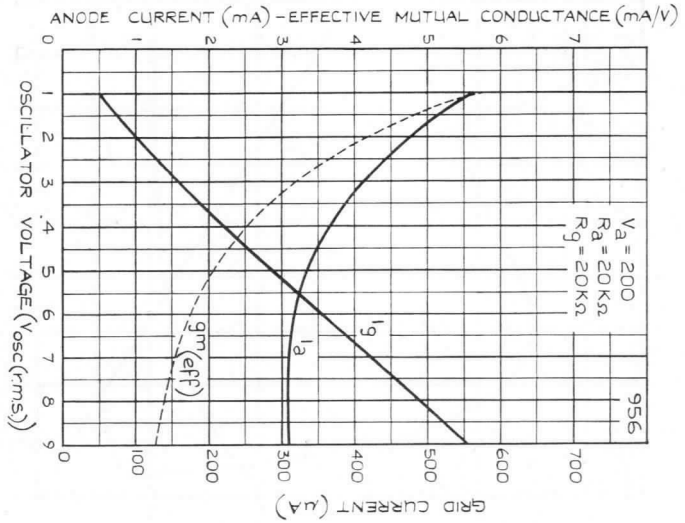


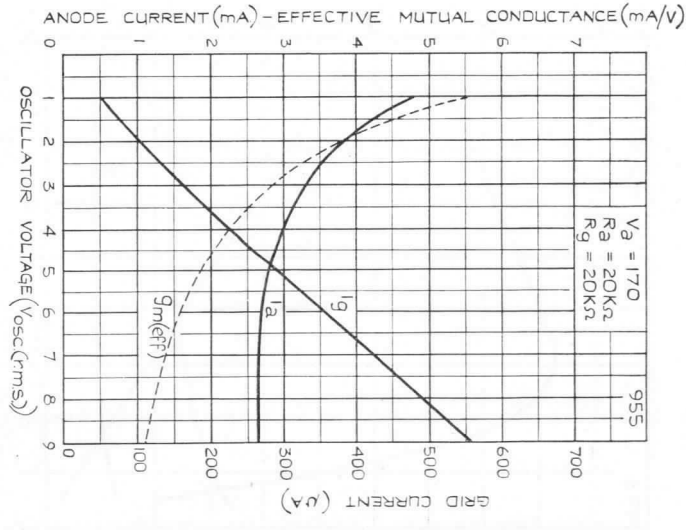
TYPICAL CHARACTERISTICS OF PENTODE SECTION AS MIXER.





TYPICAL CHARACTERISTICS OF TRIODE SECTION AS OSCILLATOR.



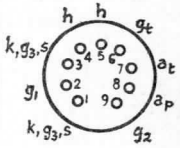


Ferranti

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. ($1\frac{15}{16}$")
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

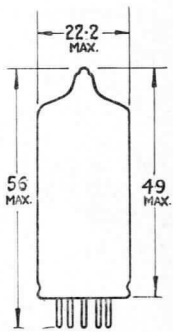
CHARACTERISTICS.

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

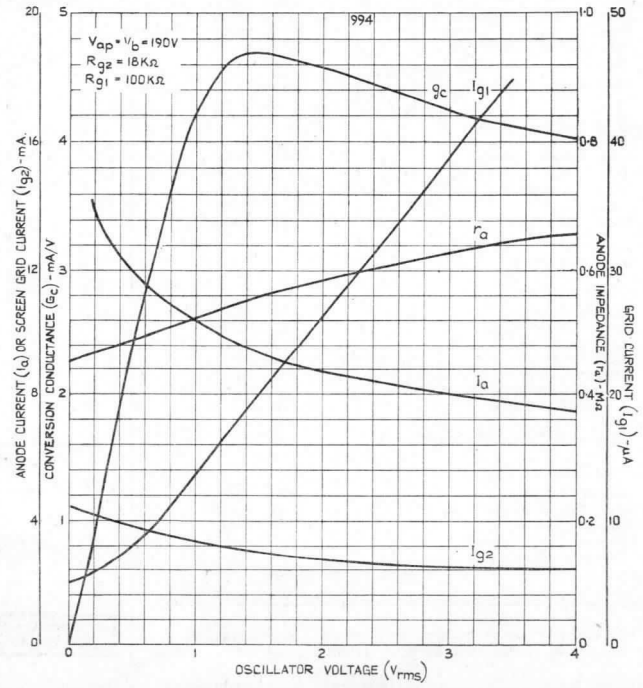
Pentode Section.

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

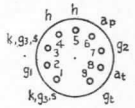


Ferranti

TRIODE PENTODE

PCF806

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

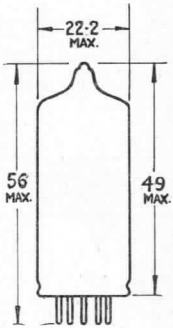
CHARACTERISTICS.

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

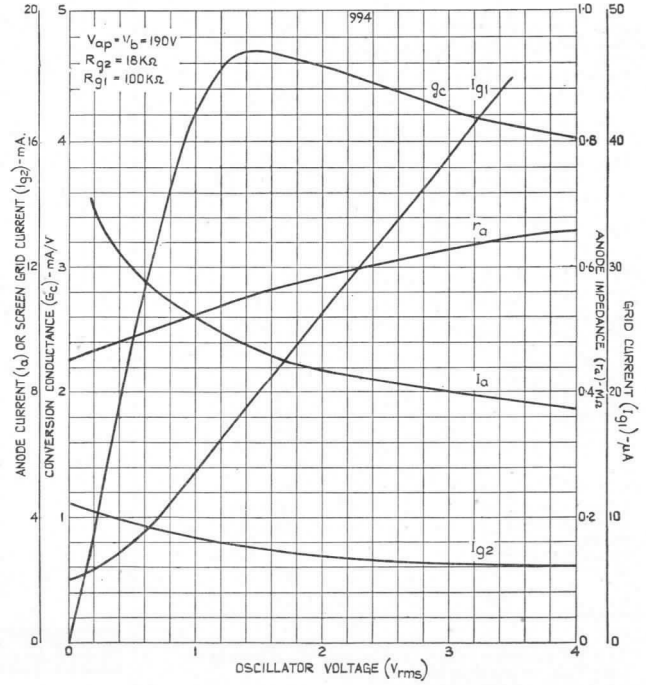
Pentode Section

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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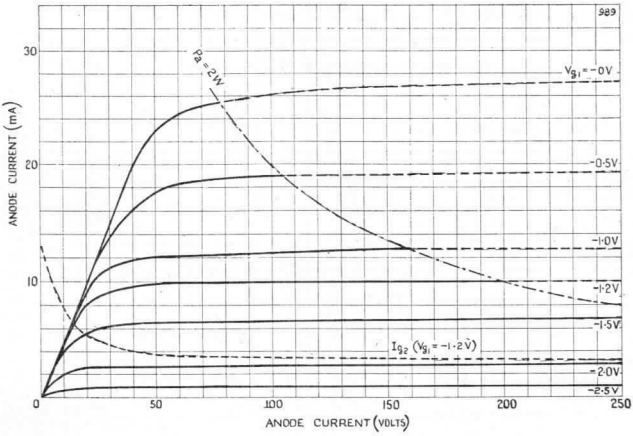
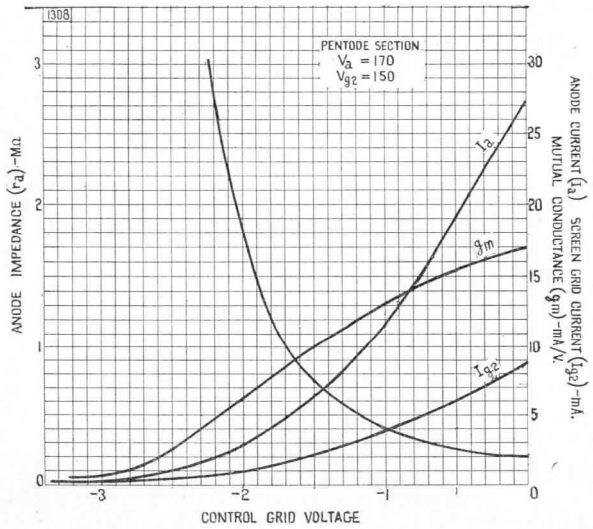
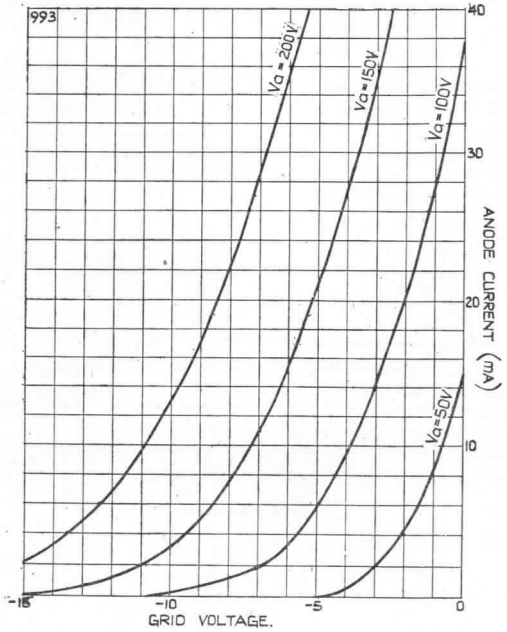
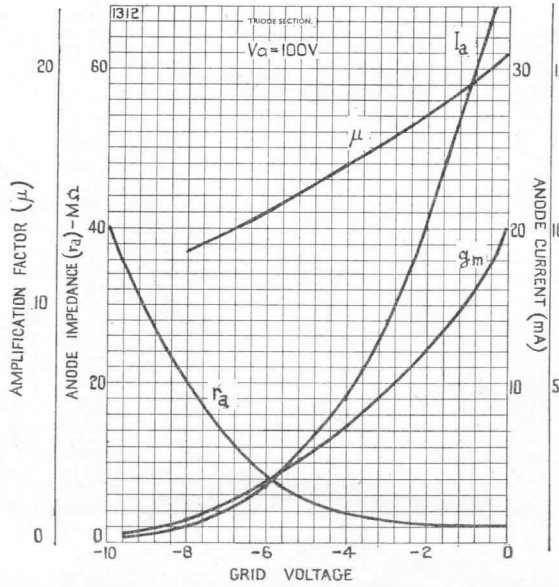
TYPICAL PENTODE CHARACTERISTICS





TYPICAL TRIODE CHARACTERISTICS



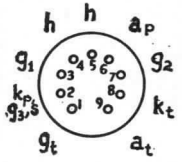


Ferranti

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. ($3\frac{9}{32}$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 5—Heater.
Pin 2—Pentode Cathode, g_3 and Shield.	Pin 6—Pentode Anode. Pin 7—Pentode Screen Grid (g_2).
Pin 3—Pentode Grid (g_1).	Pin 8—Triode Cathode.
Pin 4—Heater.	Pin 9—Triode Anode.

HEATER.

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

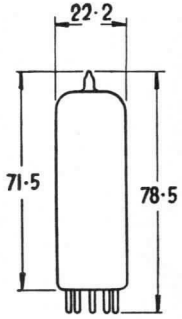
RATINGS.

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_{g_1-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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Issue 2.
Nov. 1960

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.

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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.

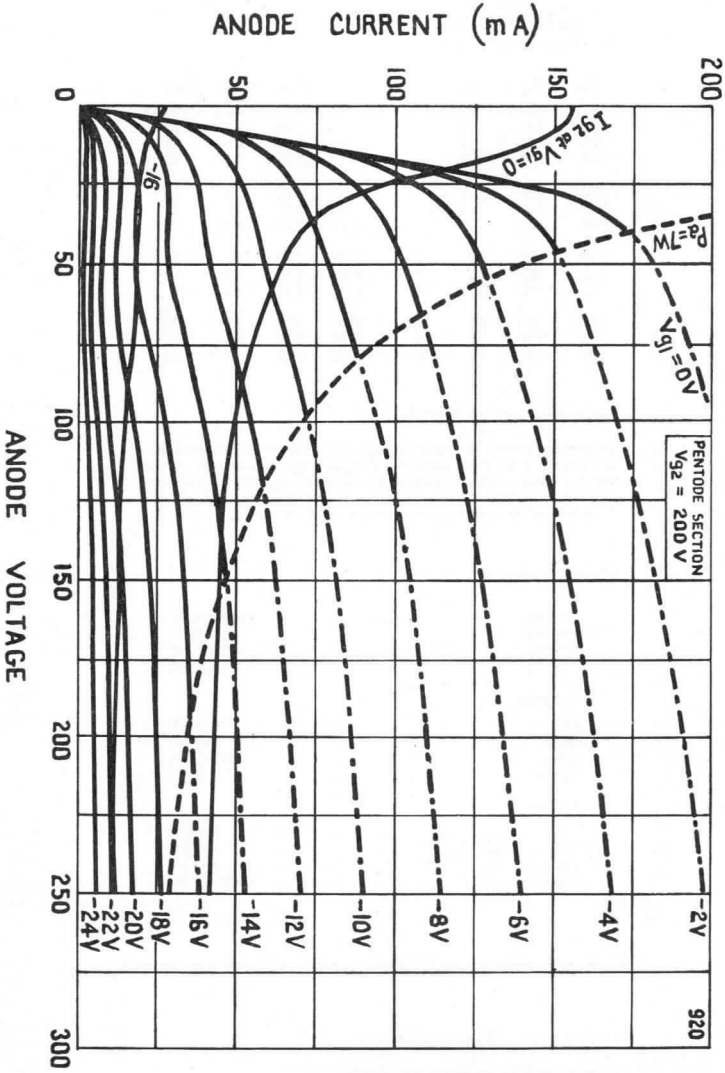
†Measured with an input of 100 mV.

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

PCL82

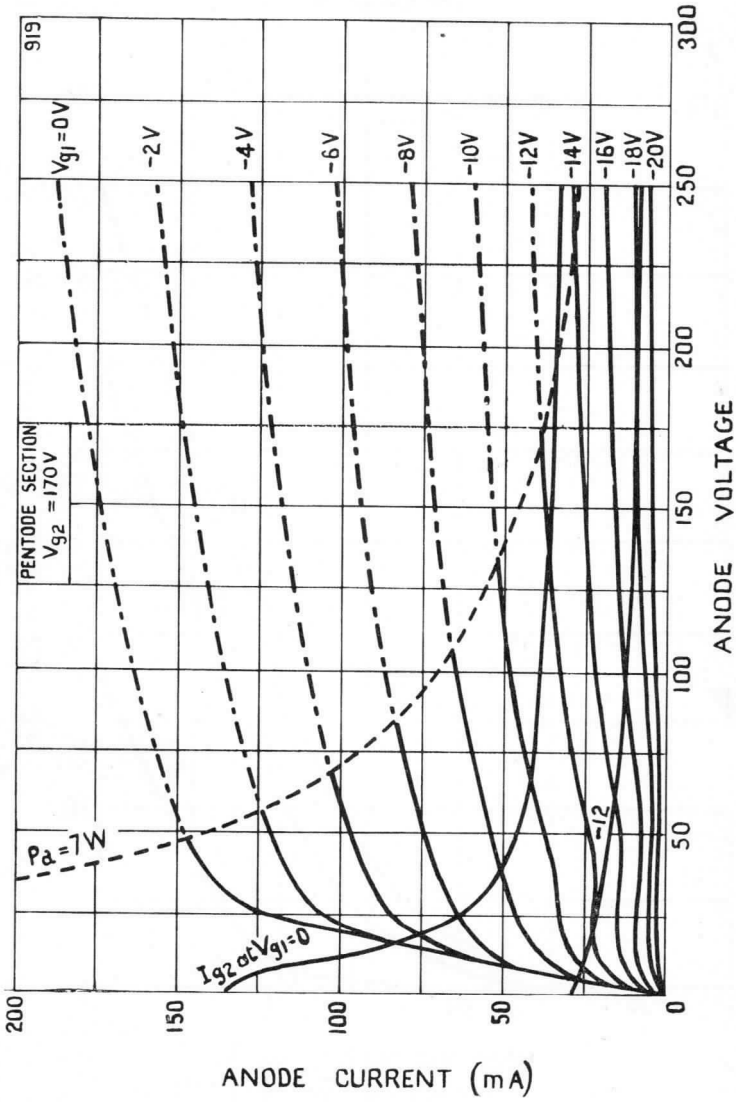
TYPICAL ANODE & SCREEN CURRENT/ANODE VOLTAGE CHARACTERISTICS

PENTODE SECTION



TYPICAL ANODE & SCREEN CURRENT/ANODE VOLTAGE CHARACTERISTICS

PENTODE SECTION



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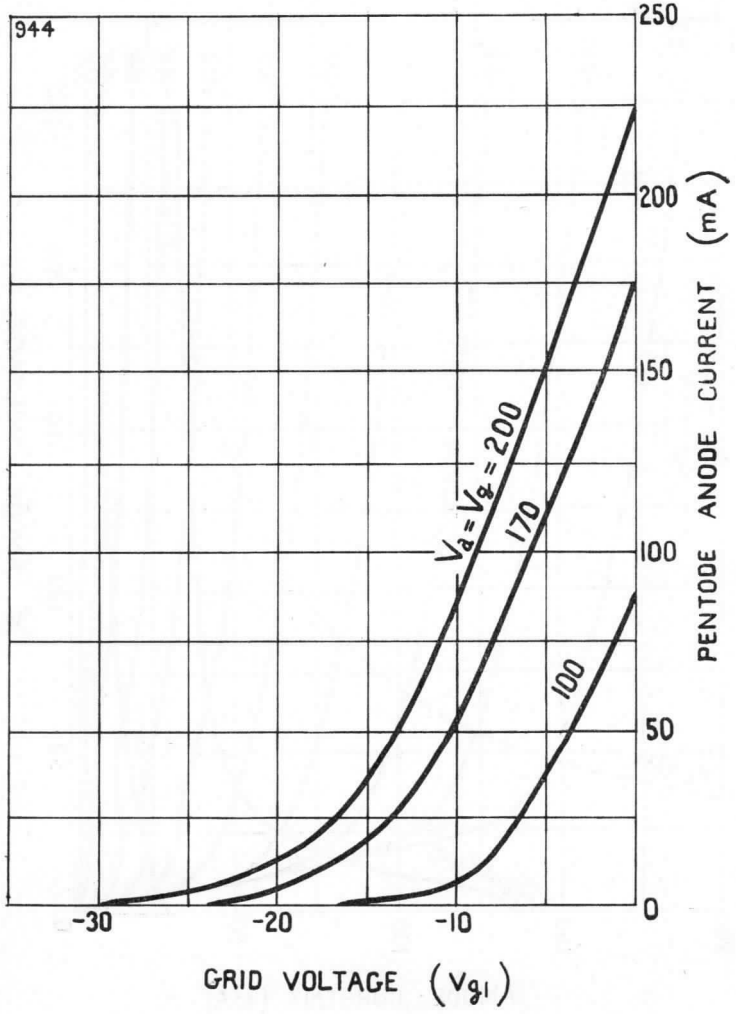
TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS

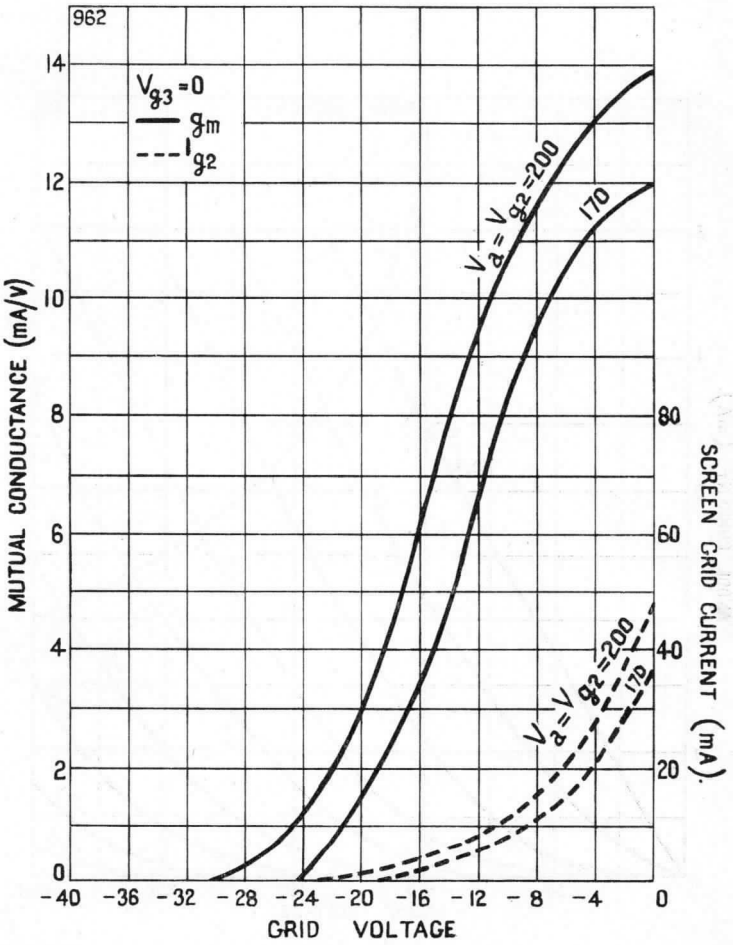
PENTODE SECTION



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

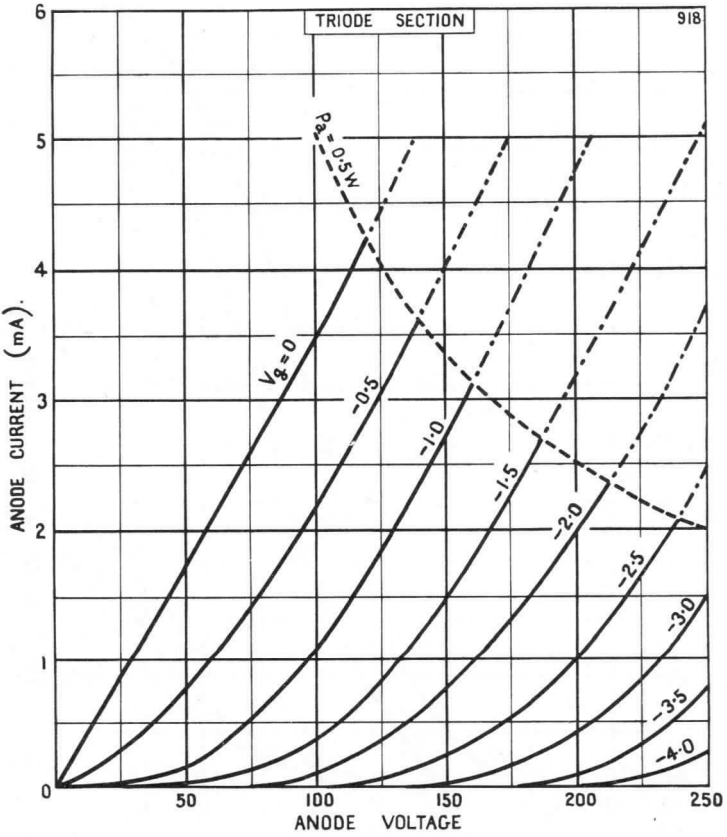
TYPICAL MUTUAL CONDUCTANCE & SCREEN GRID CURRENT CHARACTERISTICS

PENTODE SECTION



TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS

TRIODE SECTION

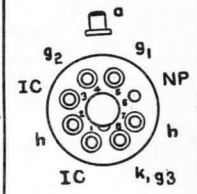


Ferranti

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.

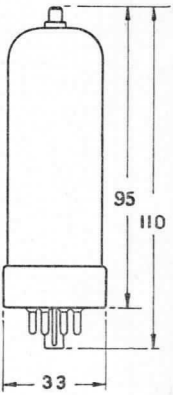
As Line Timebase Output Valve.

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.

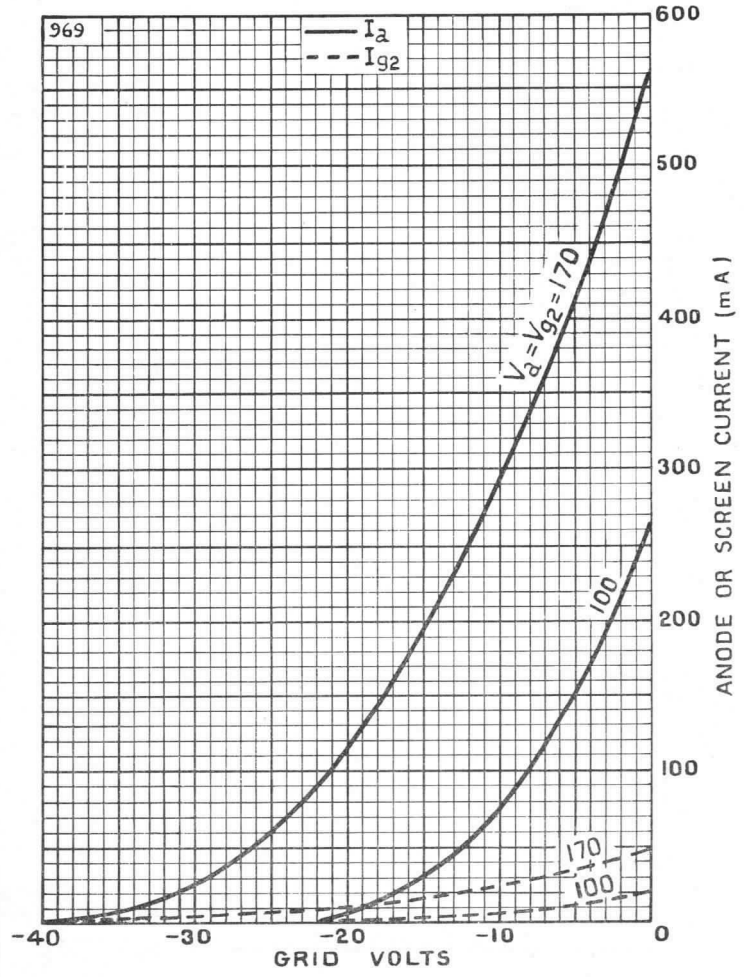
Issue 2.
July, 1961

Ferranti

CAPACITANCES.

C_{in}	...	...	...	...	18 pF.
C_{out}	...	...	...	...	9 pF.
C_{a-g1}	...	...	...	...	<1·1 pF.

TYPICAL ANODE CURRENT / GRID VOLTAGE CHARACTERISTIC



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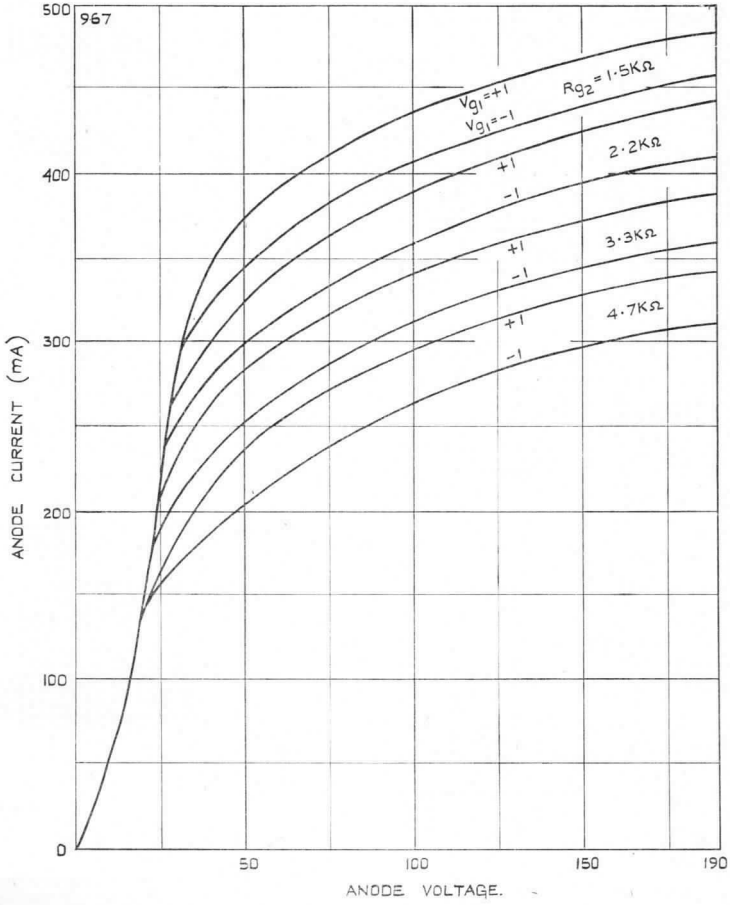
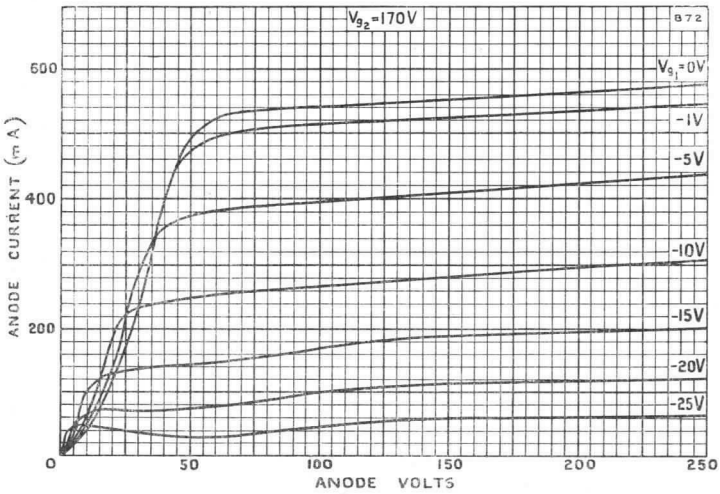
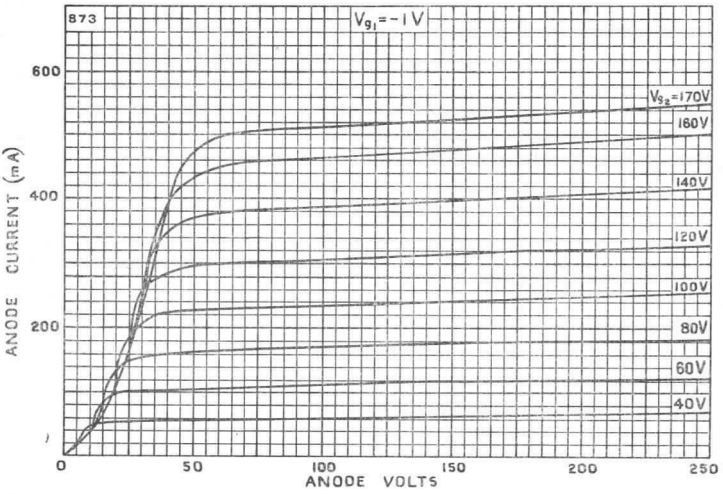
TYPICAL ANODE CURRENT / ANODE VOLTAGE WITH SCREEN GRID FEED RESISTOR AS PARAMETER. (Supply Voltage 190 Volts)



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. ($3\frac{9}{32}$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.

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 (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.

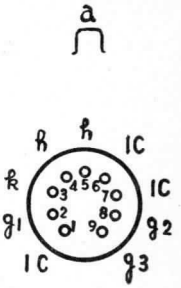
The above figures are for an average new valve. To allow for manufacturing spread of characteristics, and to cover change during life, the output circuit should be designed around the following values :—

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

As Audio Amplifier (2 valves in push pull).

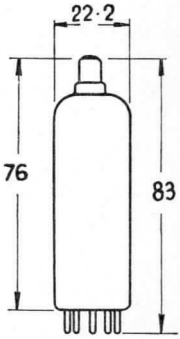
Anode Voltage	170	200	volts.
Suppressor Grid Voltage	0	0	volts.
Screen Grid Voltage	170	200	volts.
Control Grid Voltage	–27	–31·5	volts.
Screen Feed Resistor	1	1	kΩ
Anode Current (Zero signal)	2 x 20	2 x 25	mA.
Anode Current (Max. signal)	2 x 73	2 x 87	mA.
Screen Current (Zero signal)	2 x 1·5	2 x 2	mA.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



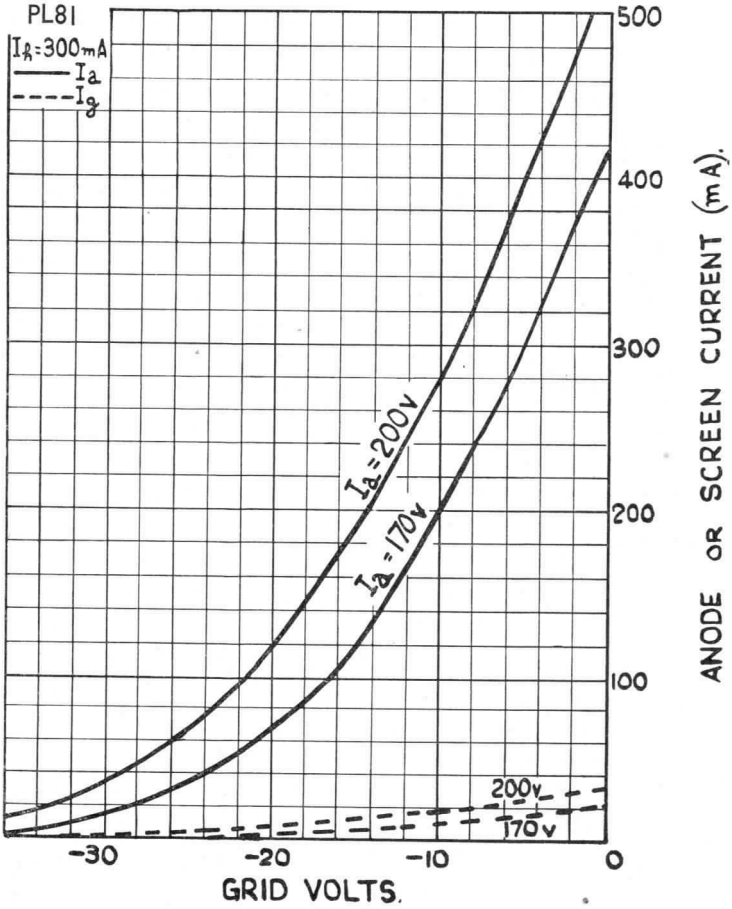
All Dimensions shown are in millimetres (max.).

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.



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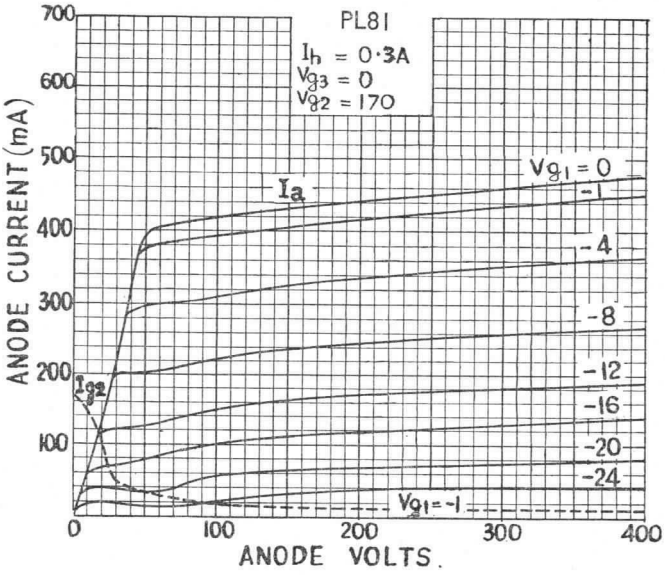
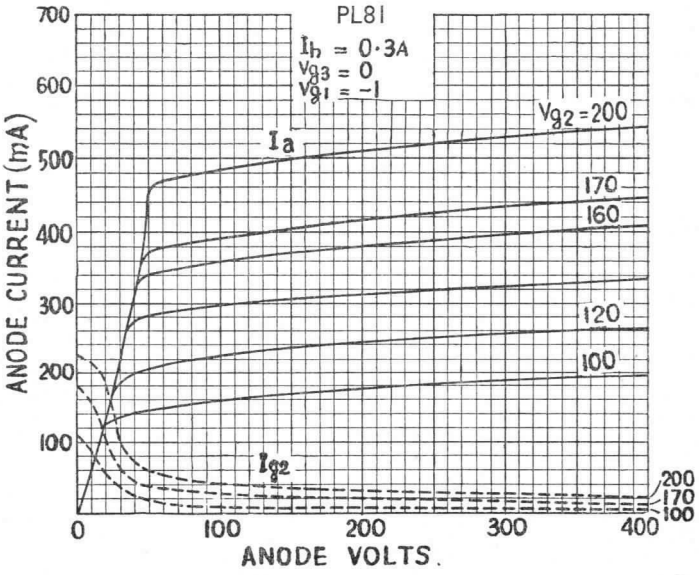
FERRANTI

PL81





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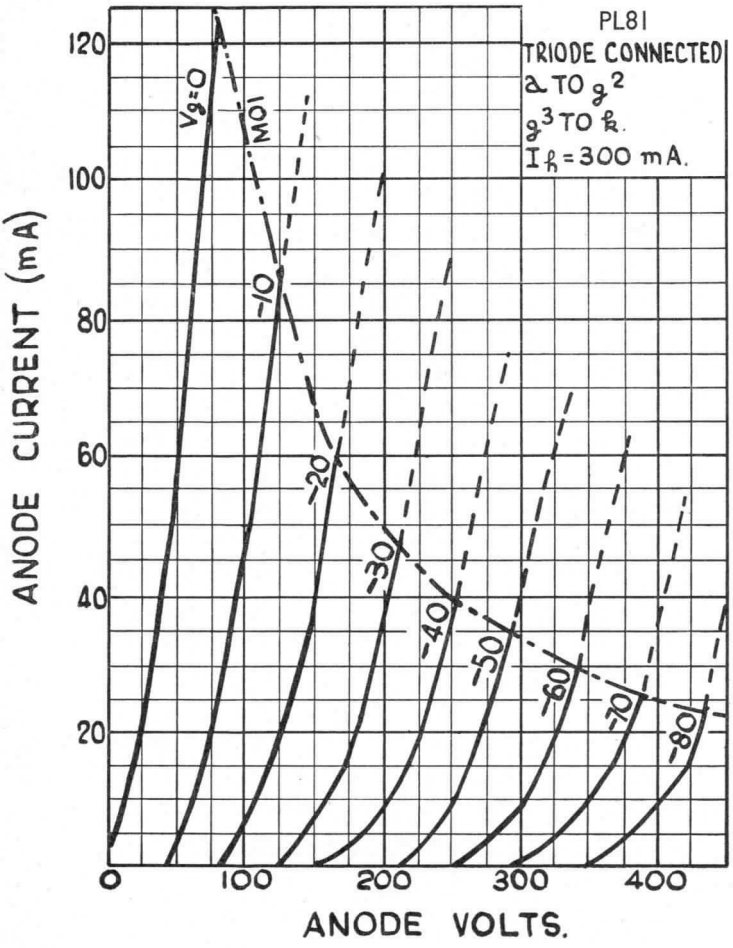
Dec., 1955



FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS

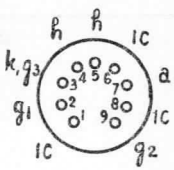
R0359

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. ($3\frac{9}{32}$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

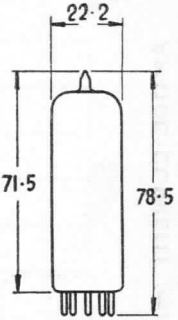
Anode Voltage	50	60	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage ...	−1	−1	volt.
Anode Current	140	175	mA.

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

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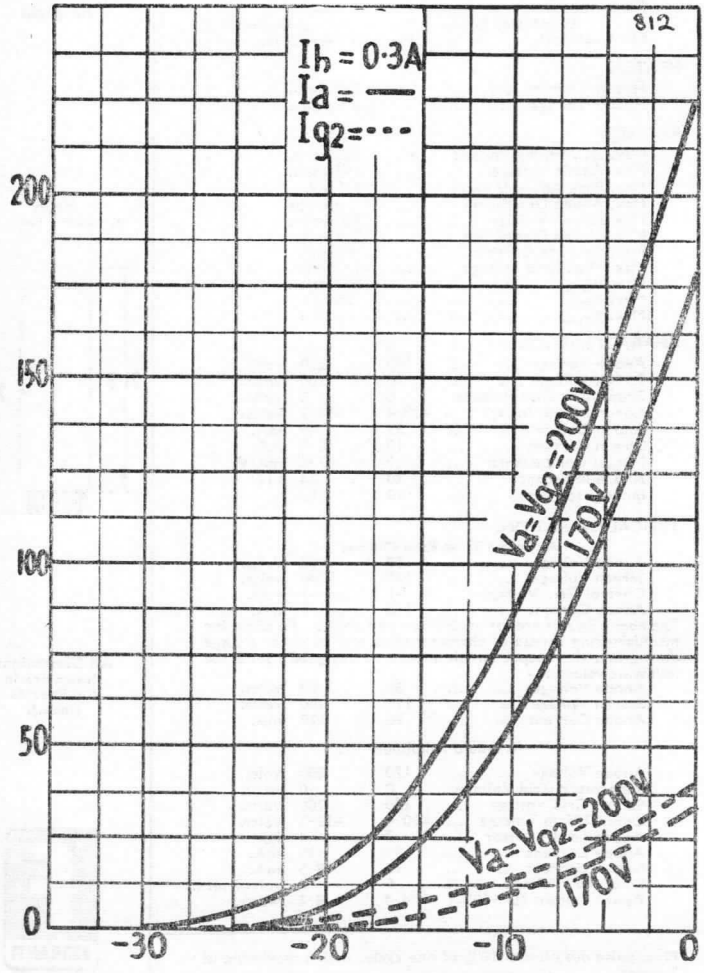
TYPICAL OPERATION (cont.)
As Audio Amplifier (2 valves in push pull).

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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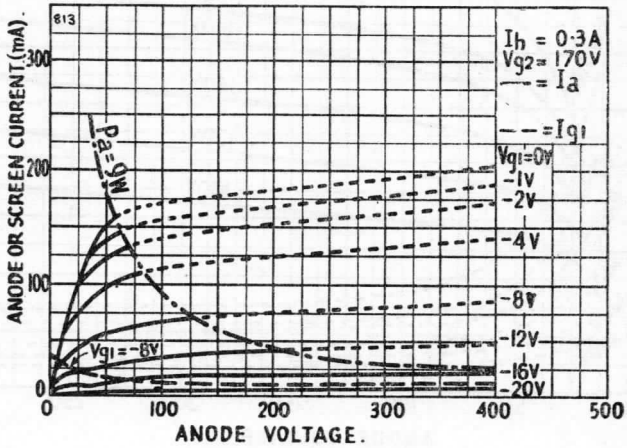

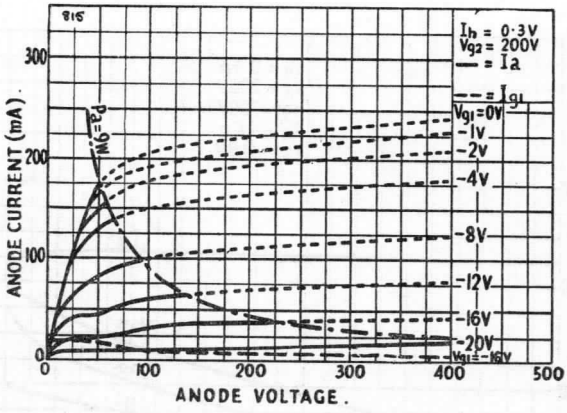

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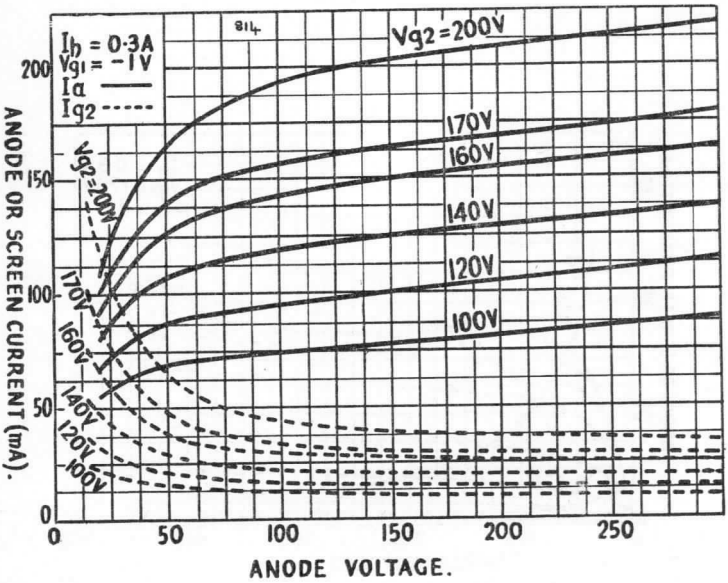

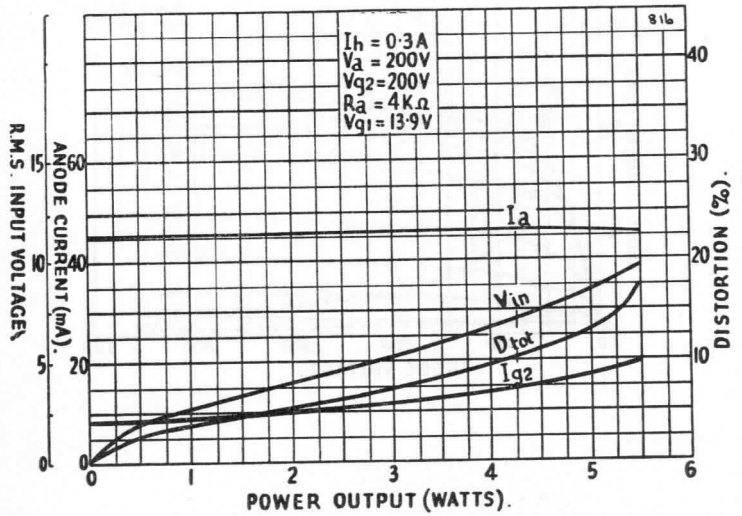

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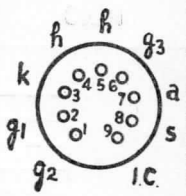
VIDEO OUTPUT PENTODE

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.

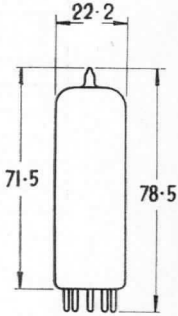
Pin 1—Screen Grid.
Pin 2—Control Grid.
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Suppressor Grid.
Pin 7—Anode.
Pin 8—Shield.
Pin 9—Internal Connection.

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 ($I_{g_1} = +0·3\mu A$)	−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	

All Dimensions shown are in Millimetres. (Max.)

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.

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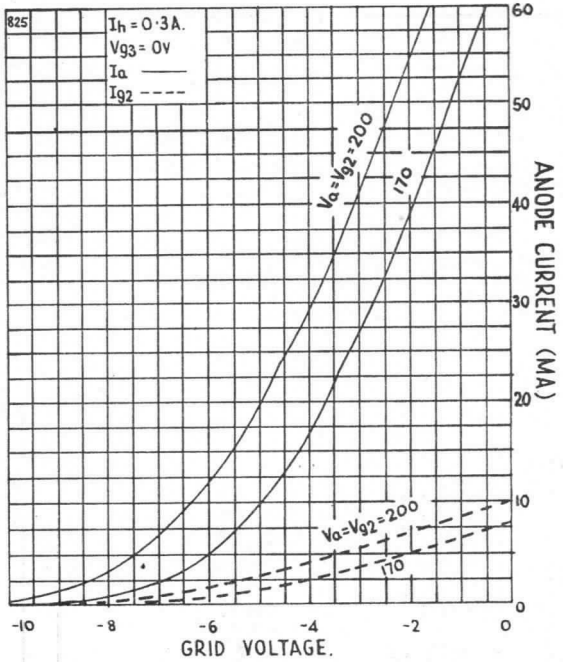

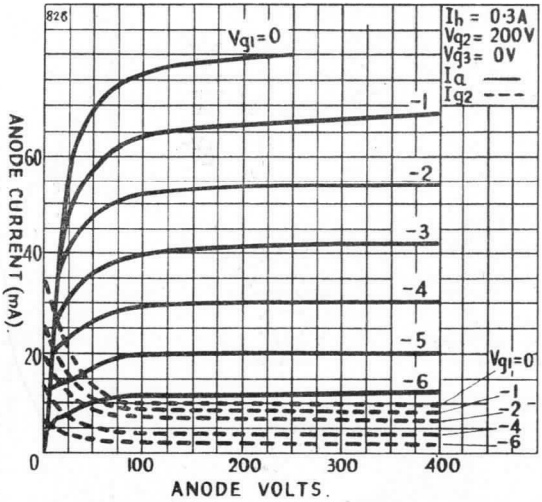

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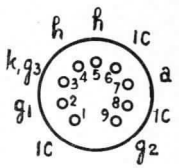
PL84

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.

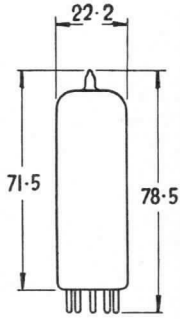
As Frame Time Base Output.

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

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Issue 2.
Mar., 1961

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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.

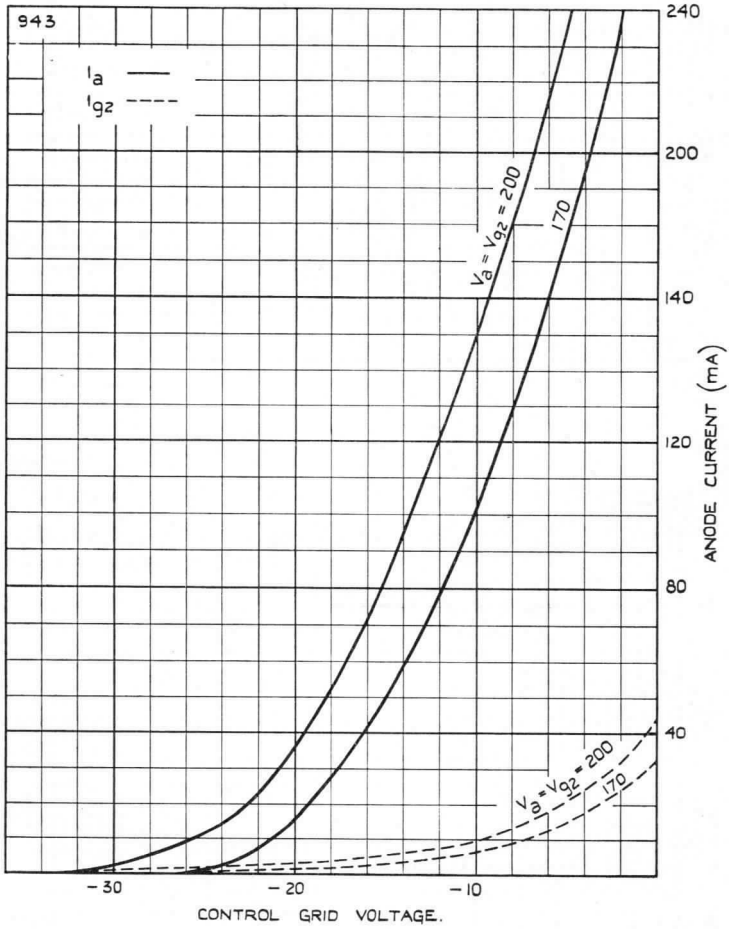
C_{in}	12 pF.
C_{out}	6 pF.
C_{a-g_1}	<0·6 pF.
C_{g_1-h}	<0·25 pF.

*Common Bias Resistor.

†Total Distortion 5%.

‡Total Distortion of 10%.

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS



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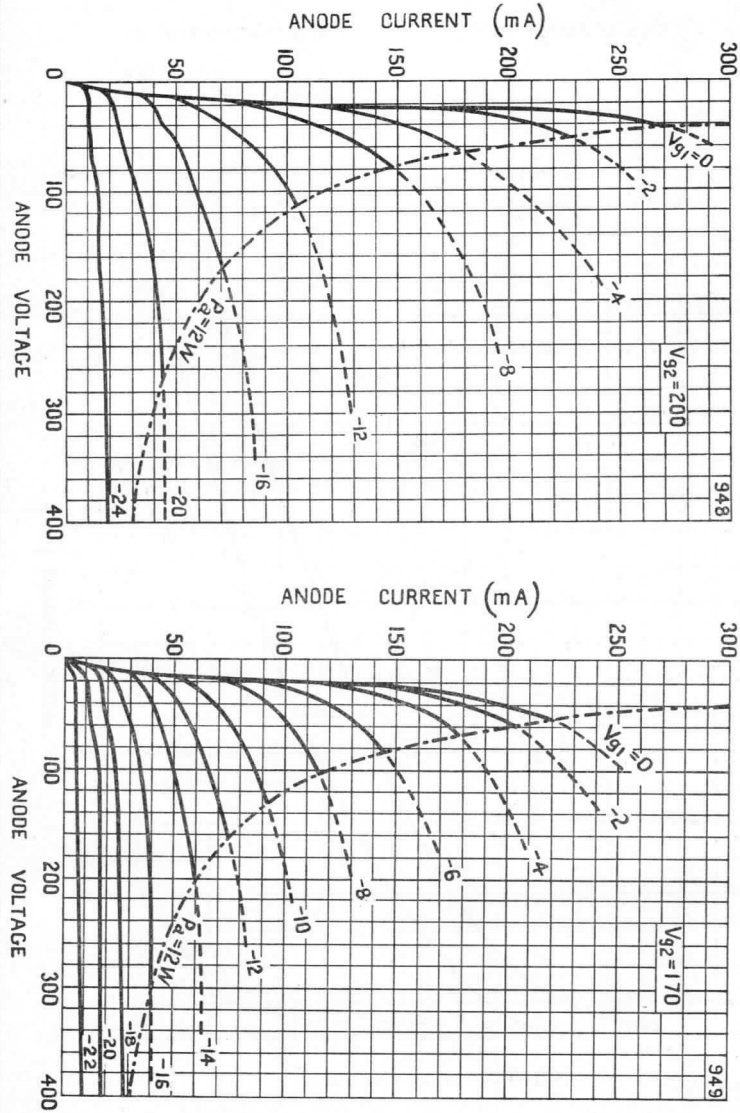
TYPICAL ANODE CURRENT/ANODE VOLTAGE CHARACTERISTICS

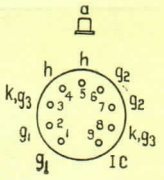


Ferranti

PL500

LINE OUTPUT PENTODE

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 ($4\frac{3}{16}$")
Max. Seated Height	95·5 mm ($3\frac{3}{4}$")
Max. Diameter	30·2 mm ($1\frac{3}{16}$")

BASE CONNECTIONS.

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

HEATER.

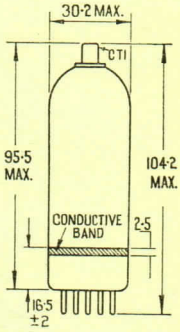
Heater Current	0·3 amp
Heater Voltage	27 volts

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



Dimensions in millimetres

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.

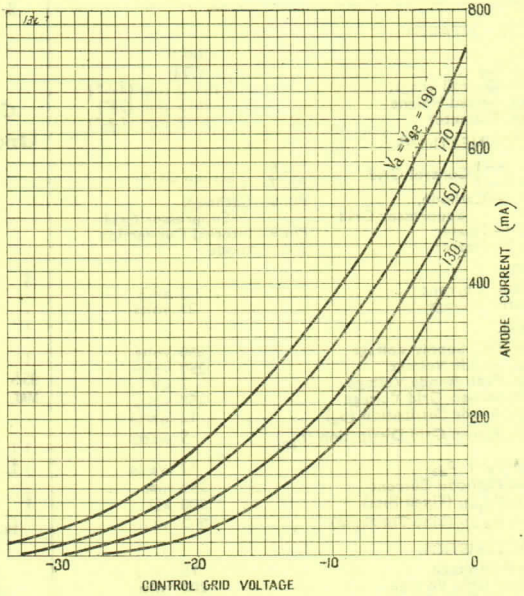
†This is the minimum value of R_{g_2} necessary to prevent excessive screen grid dissipation during warm up.

‡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.

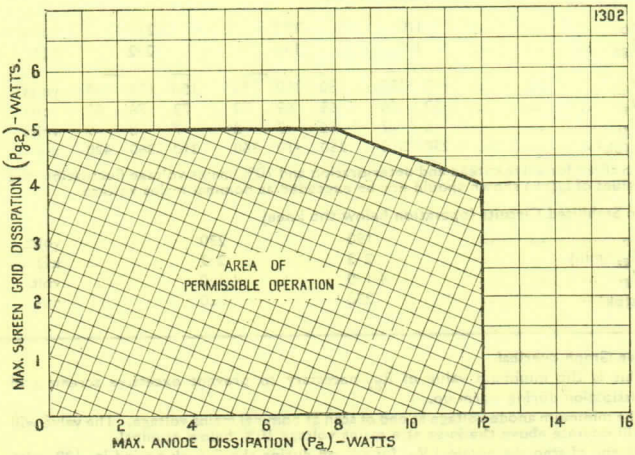
§At end of scan the nominal V_{g_1} for cut off during the flyback period is −120 volts.

Tentative Issue 1. April, 1963

TYPICAL i_a/V_g CHARACTERISTICS



ANODE AND SCREEN GRID DISSIPATION RATINGS



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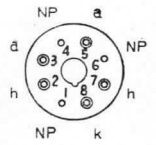
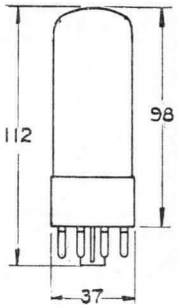
PY33

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

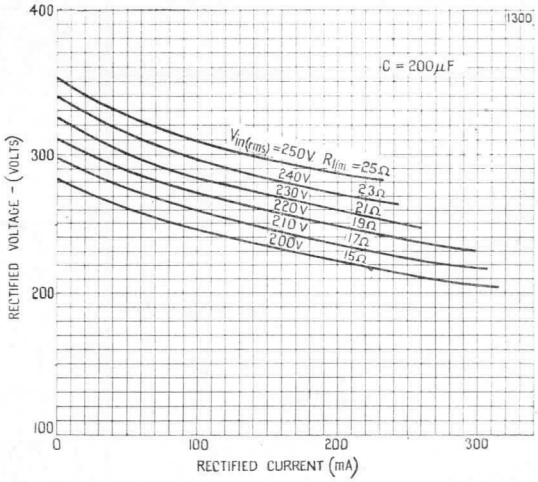
To choose the required value of limiting resistor when a constant output voltage is required at different input voltages, as in Television Receivers, the graph overleaf should be consulted.

*Mains voltage of not more than 250V. r.m.s., plus a maximum DC. component of 275 volts.

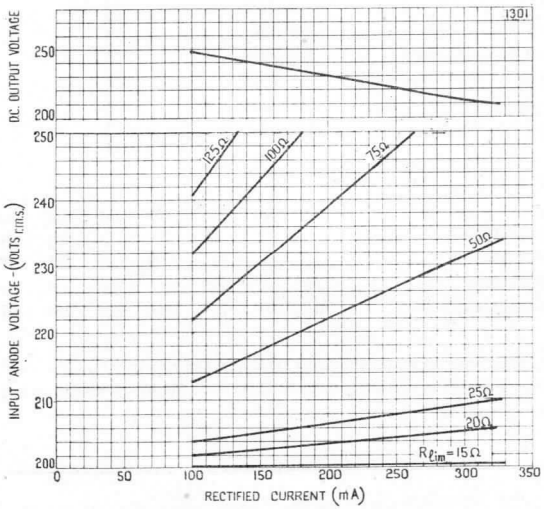
Issue 2.
Feb., 1963.

Ferranti

REGULATION CURVES



TO DETERMINE THE VALUE OF LIMITING RESISTOR WHEN A CONSTANT OUTPUT VOLTAGE IS REQUIRED.



Ferranti

BOOSTER DIODE

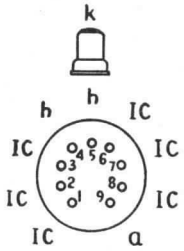
PY81

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

Underside View of Base

BASE CONNECTIONS.

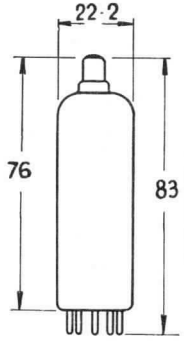
Pin 1—Internal Connection.	Pin 6—Internal Connection.
Pin 2—Internal Connection.	Pin 7—Internal Connection.
Pin 3—Internal Connection.	Pin 8—Internal Connection.
Pin 4—Heater.	Pin 9—Anode.
Pin 5—Heater.	T.C.—Cathode.

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.)



Dimensions shown are in millimetres (max)

CAPACITANCES.

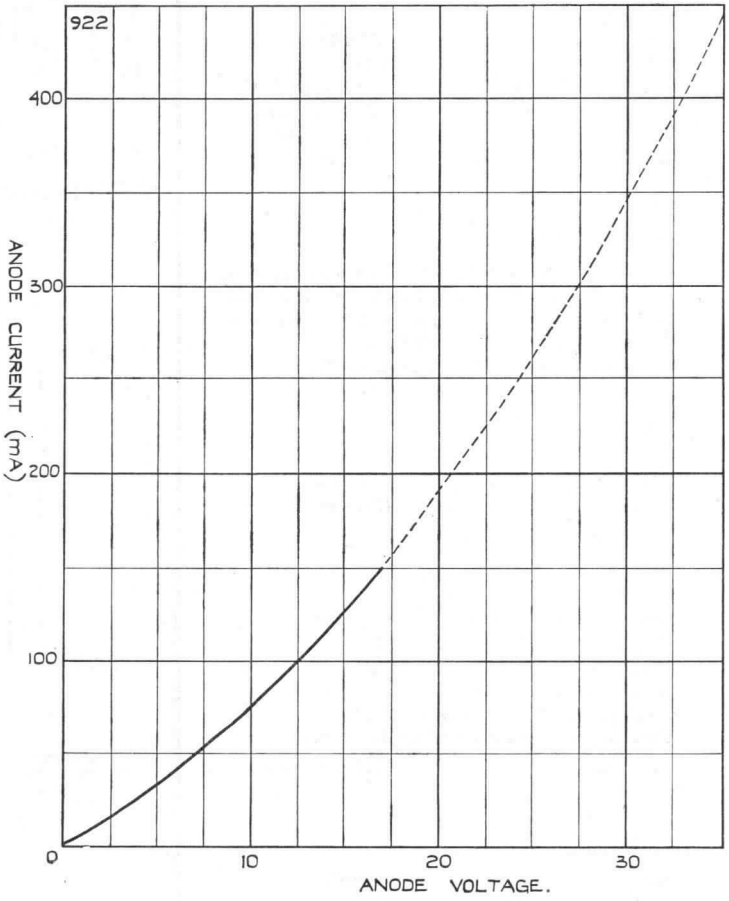
C_{a-k}	6·4 pF.
C_{h-k}	2·8 pF.

*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



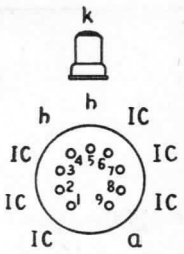
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

BOOSTER DIODE

PY83

An indirectly heated booster diode. The high heater-cathode insulation permits operation in transformerless AC/DC Television Receivers.



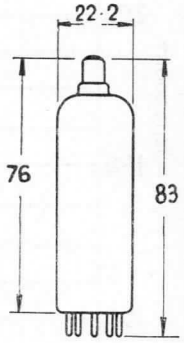
Base Connections
Underside View of Base

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.

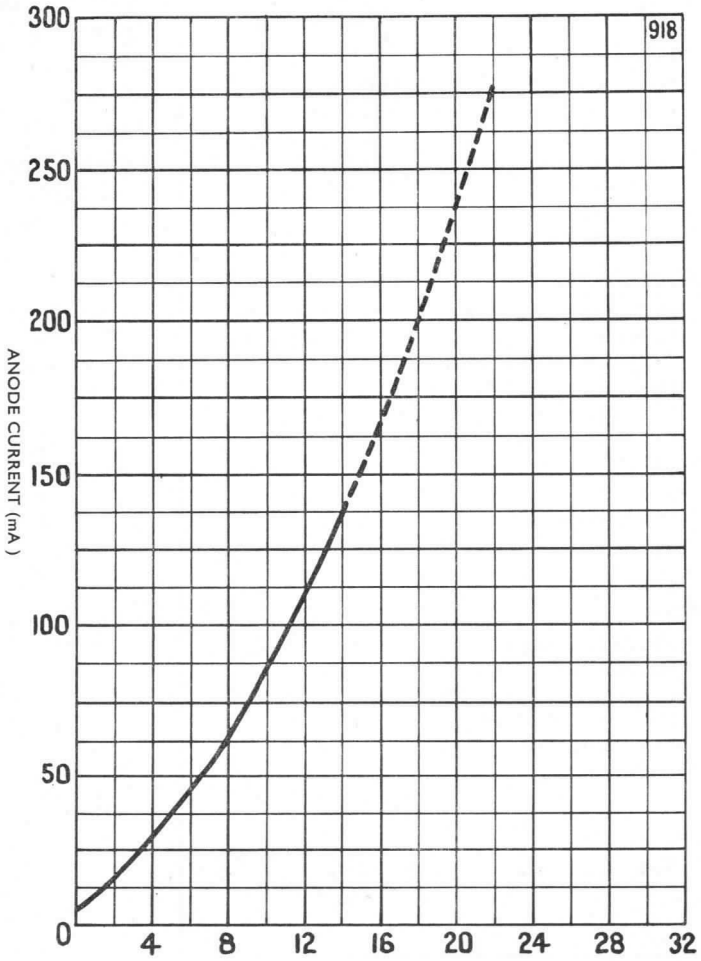
*Max. pulse duration of 22% of one cycle with a maximum of 18 μsecs.

Issue 1
May, 1960

Ferranti

Ferranti

Typical Anode Current/Anode Voltage Characteristic

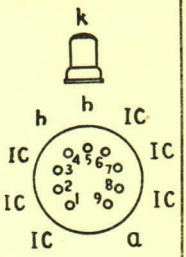


Ferranti

BOOSTER DIODE

PY88

An indirectly heated booster diode. Designed for use with 110° deflection Cathode Ray Tubes in Television Receivers with series heater chains.



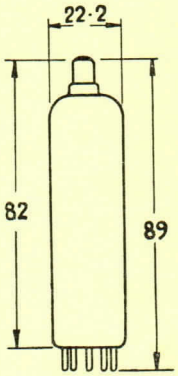
Base Connections
Underside View of Base

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.

Tentative
Issue 1
Oct., 1960

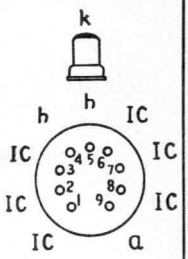
Ferranti

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.



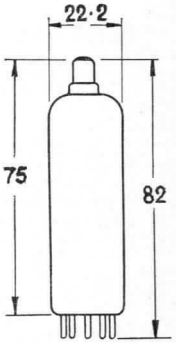
Base Connections Underside View of Base

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.

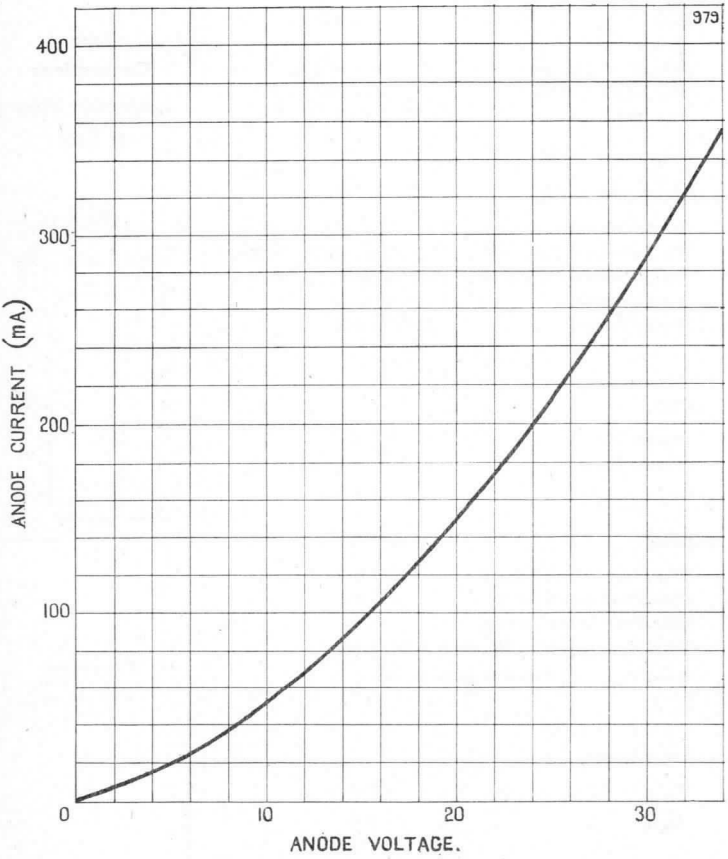
C_{a-k}	4·7 pF
C_{k-h}	1·9 pF

*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



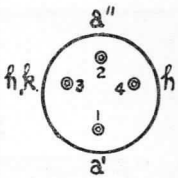
R0558/2

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

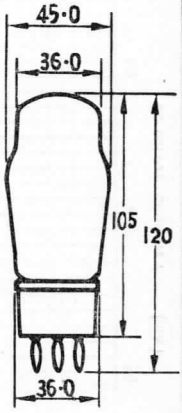
Underside View of Base

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.

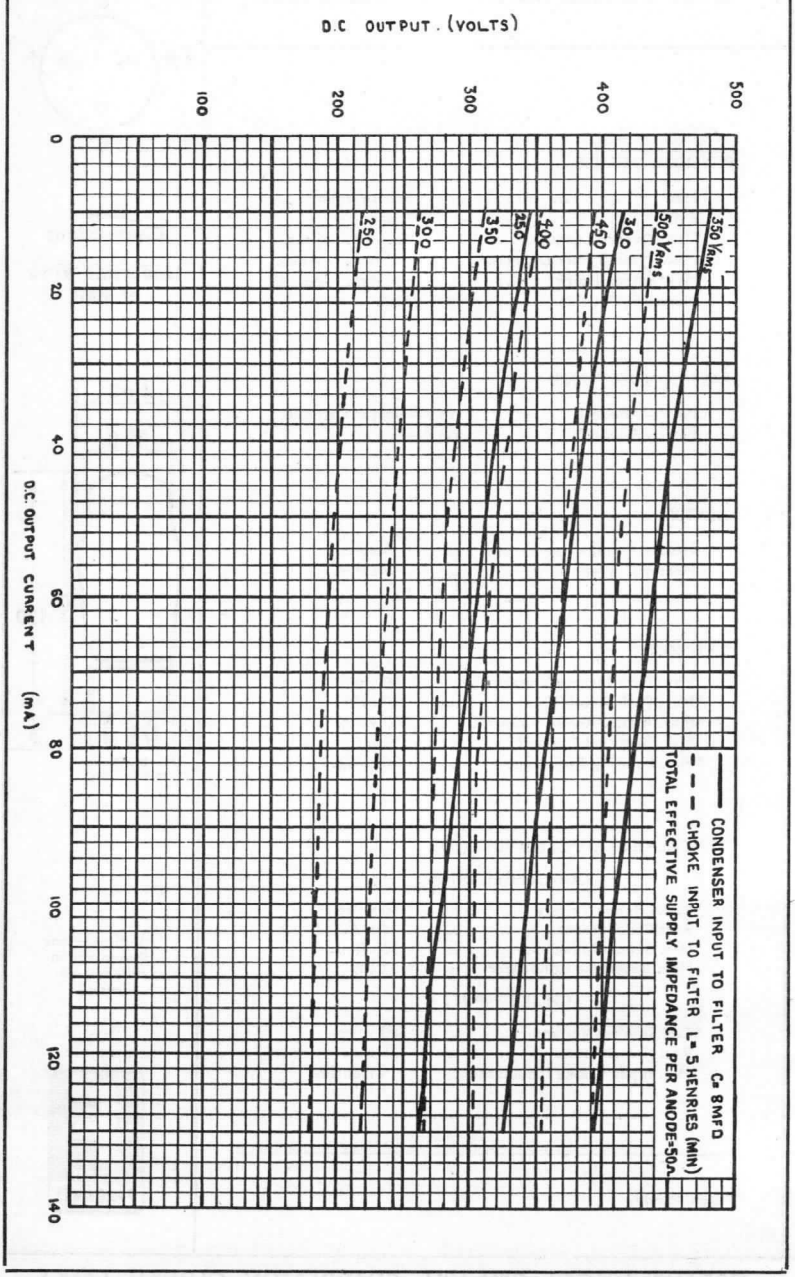
*R.M.S. Input Voltage	500 volts.
Rectified Current	125 mA.
Min. Input Choke Inductance ...	4 Henries.

All dimensions shown are in millimetres. (max.).

*Each Anode.

Issue 2
Sept.,1952

R42


D.C OUTPUT. (VOLTS)
100
200
300
400
500
0
20
40
60
80
100
120
140
D.C. OUTPUT CURRENT (mA.)
350 V RMS
300
250
500 V RMS
450
400
350
300
250
CONDENSER INPUT TO FILTER C= 8 MFD
CHOKE INPUT TO FILTER L= 5 HENRIES (MIN)
TOTAL EFFECTIVE SUPPLY IMPEDANCE PER ANODE=500Ω

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.

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

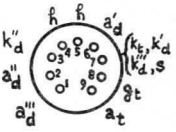
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

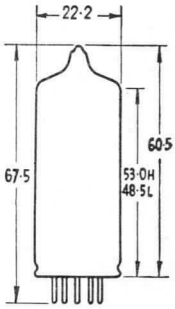
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	·76	mA.
Stage Gain	51	53	47	54	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion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

*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$V_{r.m.s.}$)



Base Connections

Underside View of Base



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

Issue 2
Dec.,1957

UABC80

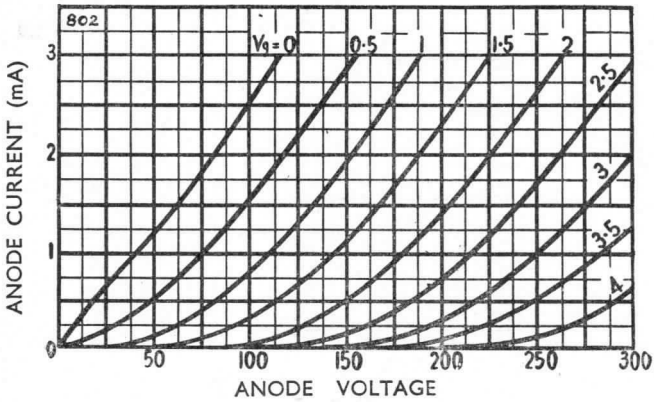
FERRANTI

CAPACITANCES. TRIODE SECTION.

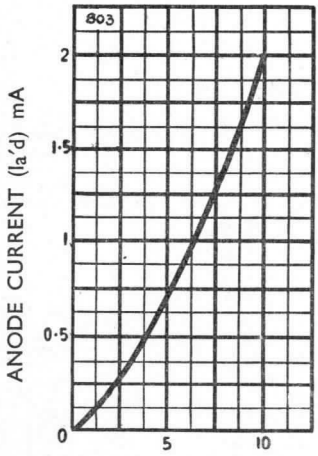
C_{in}	... ...	1.9 pF.
C_{out}	... ...	1.4 pF.
C_{a-g}	... ...	2.0 pF.
C_{g-h}	... ...	<0.04 pF.

DIODE SECTION.

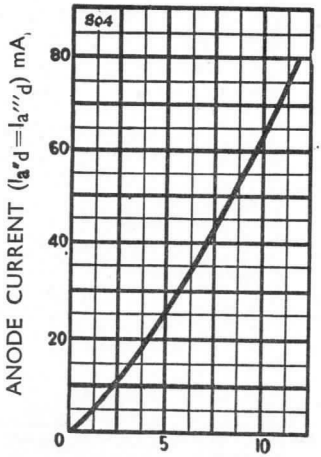
$C_{a'd-(h+kt, k'd, k'''d, s)}$	...	0.8 pF.
$C_{a''d-(h+k''d+kt, k'd, k'''d, s)}$		4.8 pF.
$C_{a'''d-(h+kt, k'd, k'''d, s)}$	...	4.8 pF.
$C_{k''d-all}$		5.0 pF.
$C_{a'd-h}$		<0.25 pF.
$C_{a'''d-h}$		<0.2 pF.
$C_{k''d-h}$		2.5 pF.



DIODE I



DIODE II - DIODE III



UBF89

Ferranti

DOUBLE DIODE PENTODE

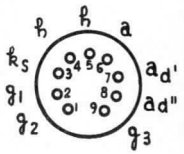
An indirectly heated double diode variable-mu pentode designed for use as detector, A.V.C. diode and R.F., I.F., or A.F. Amplifier in equipments with series heater chains. The diode sections are only suitable for A.M. detection.

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 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 Current	0·1 Amp.
Heater Voltage	19·0 Volts.

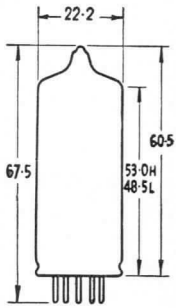
RATINGS.

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

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.

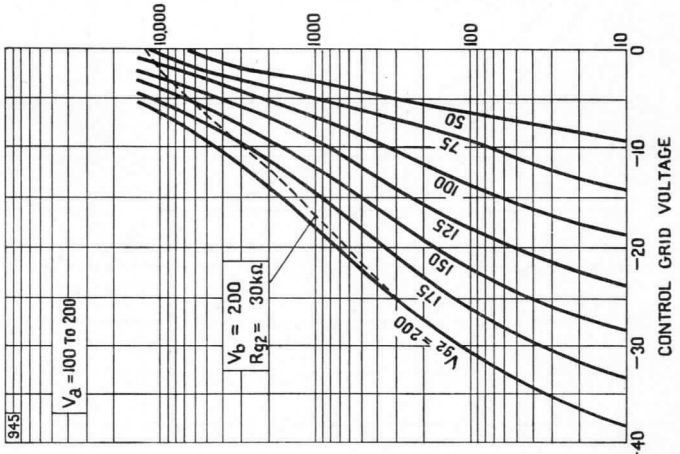
Diode Sections.

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

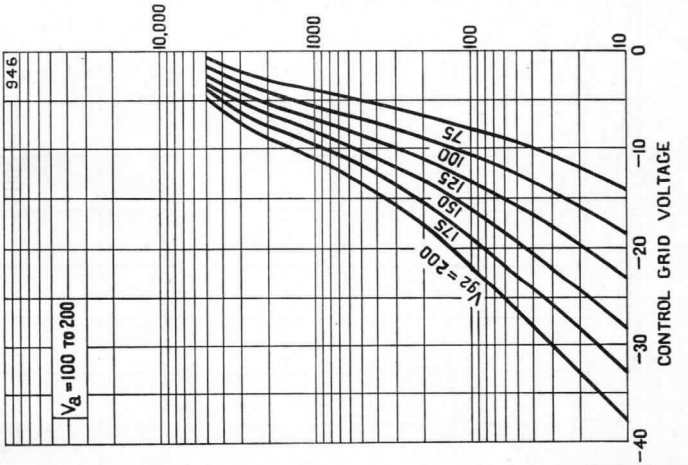
$C_{ad'-g1}$	<0·0025	pF.
$C_{ad''-g1}$	<0·001	pF.
$C_{ad'-ap}$	<0·15	pF.
$C_{ad'-ap}$	<0·025	pF.

†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.

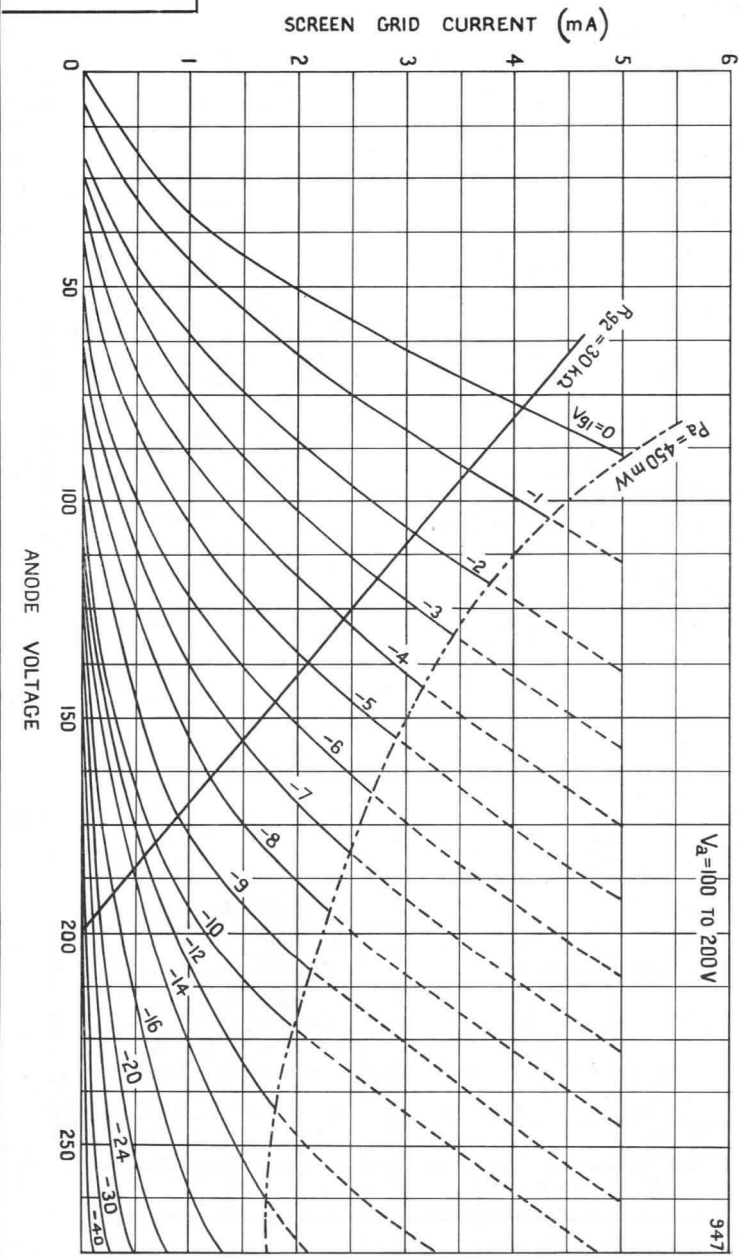
ANODE CURRENT (μA)



MUTUAL CONDUCTANCE (μA/V)



UBF89



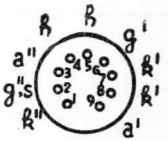
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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. ($1\frac{5}{16}$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 3—Anode Triode 2.	Pin 7—Cathode Triode 1 (in).
Pin 4—Heater.	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	100 μA
Heater Voltage	21 volts.

RATINGS.†

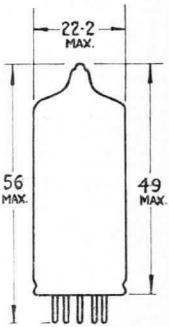
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	180 volts.
Max. Anode Dissipation ...	2 watts.
Max. Cathode Current ...	18 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. $V_{h-k'}$	90 volts.
Max. $V_{h-k''}$ (heater positive)	90 volts.
**Max. $V_{h-k''}$ (pk) (heater negative)	250 volts.
Max.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

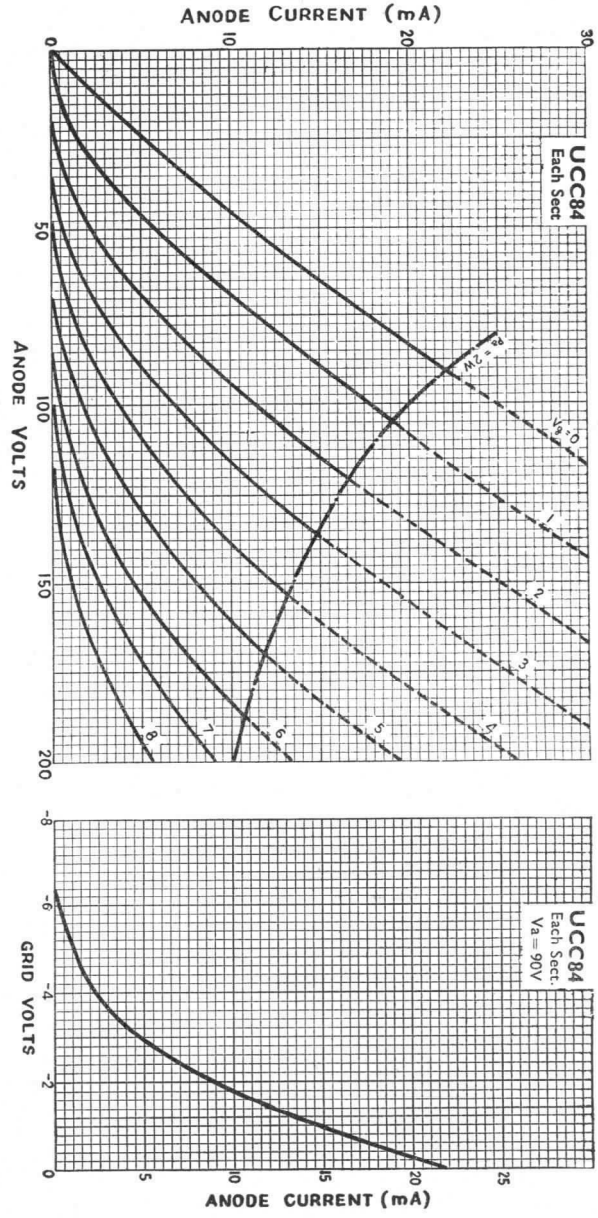
‡Measured without external shield.

§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
Ra = 2M
Vg = 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

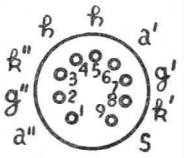
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

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 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—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.

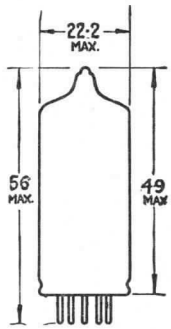
TYPICAL OPERATION.

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.

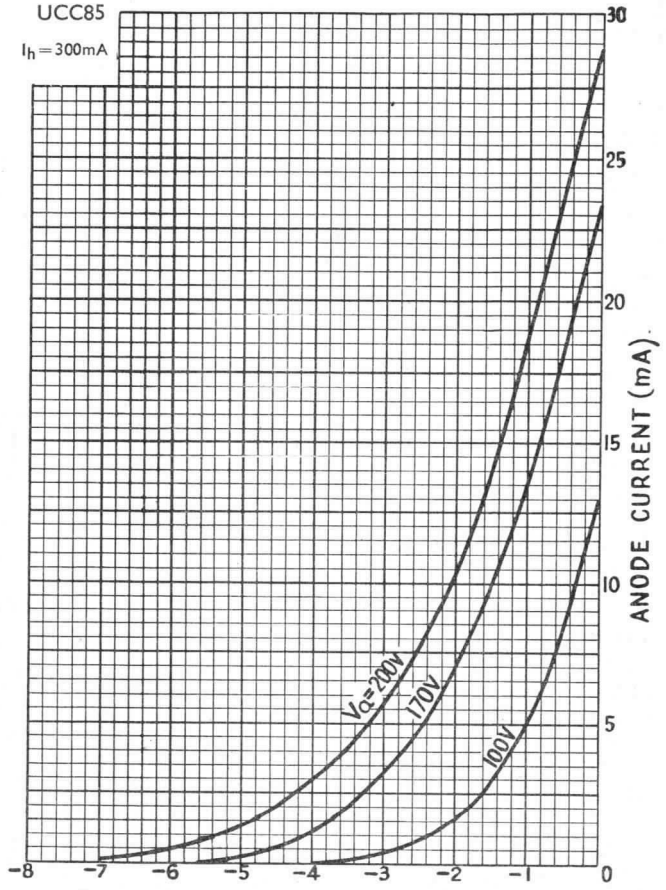
Issue 2
(Tentative)
Dec., 1957

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

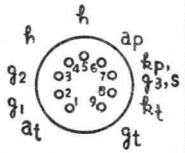
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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. ($2\frac{3}{16}$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.

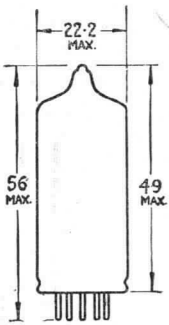
RATINGS.

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	Va	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.†

$C_{a_p-a_t}$	<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.

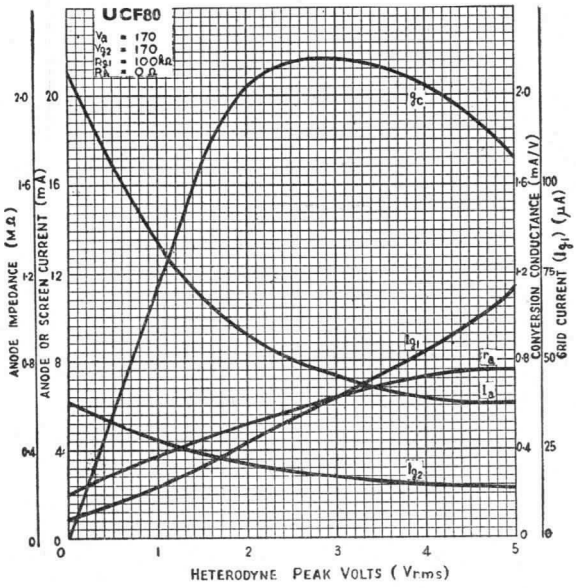
Triode Section.

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.



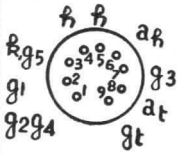
Ferranti

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. ($2\frac{21}{32}$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 Current	0·1 amps
Heater Voltage	19·0 volts.

RATINGS.

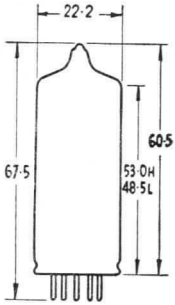
HEPTODE SECTION.

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_{g_1} = +0·3 μA.)	−1·3 volts.
*Max. Grid No. 3 Voltage ...	
(I_{g_3} = +0·3 μA.)	−1·3 volts.
Max. R_{g_1-k}	3·0 Megohms.
Max. R_{g_3-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.



Dimensions in millimetres.

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.

*The maximum value of R_{g_3-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 1
June, 1960

Ferranti

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.

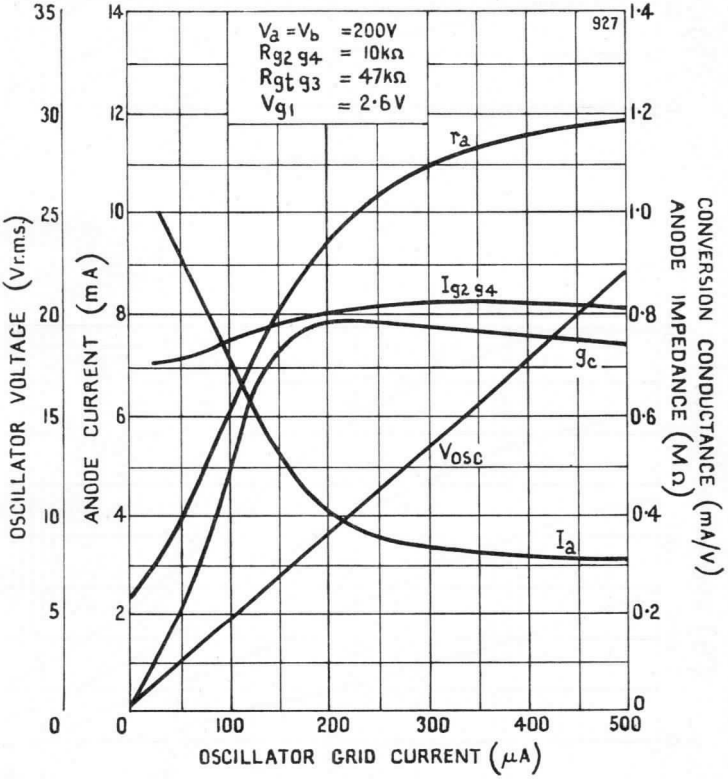
Microphony.

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.

FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS

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_{g1-g3}		<0·3 pF.
C_{g3-h}		<0·06 pF.
C_{ah-at}	0·20 pF.	
C_{ah-gt}	<0·09 pF.	
$C_{ah-g3gt}$	<0·35 pF.	
C_{g1-gt}	<0·06 pF.	
C_{g1-gt}	<0·17 pF.	
$C_{g1-g3gt}$	<0·45 pF.	



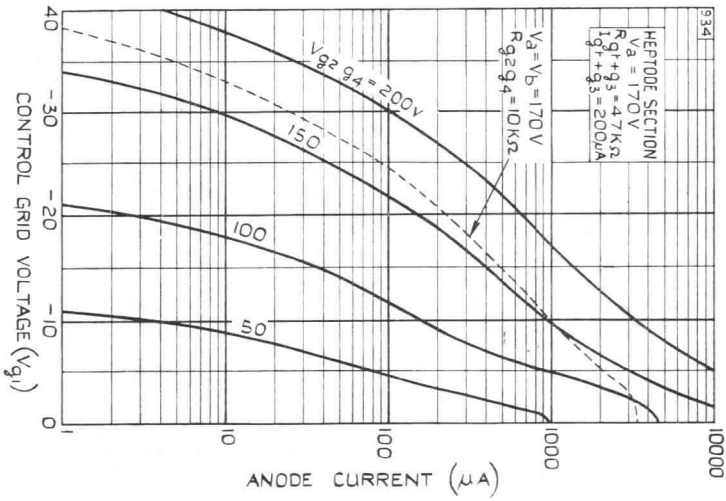
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

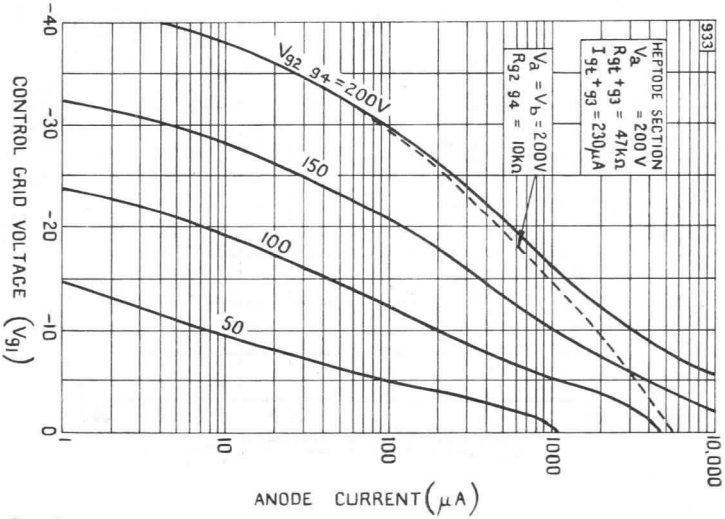
Ferranti

UCH81

19D8

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





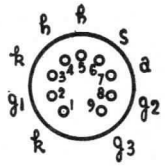
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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.



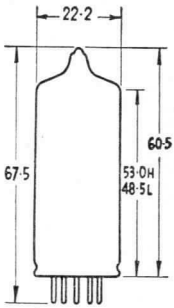
Base Connections
Underside View of Base

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.

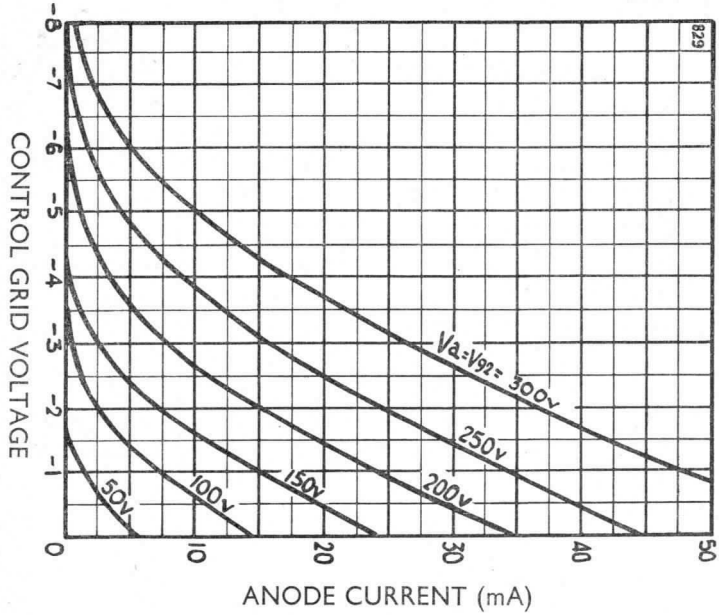
C_{in} (g_1)	... ...	7·5 pF.
C_{in} (g_1)	... ...	5·4 pF.
C_{out}	... ...	3·3 pF.
C_{a-g_1}	... ...	<0·007 pF.
C_{a-k}	... ...	<0·01 pF.
C_{g2-g1}	... ...	2·6 pF.
C_{g1-h}	... ...	<0·15 pF.

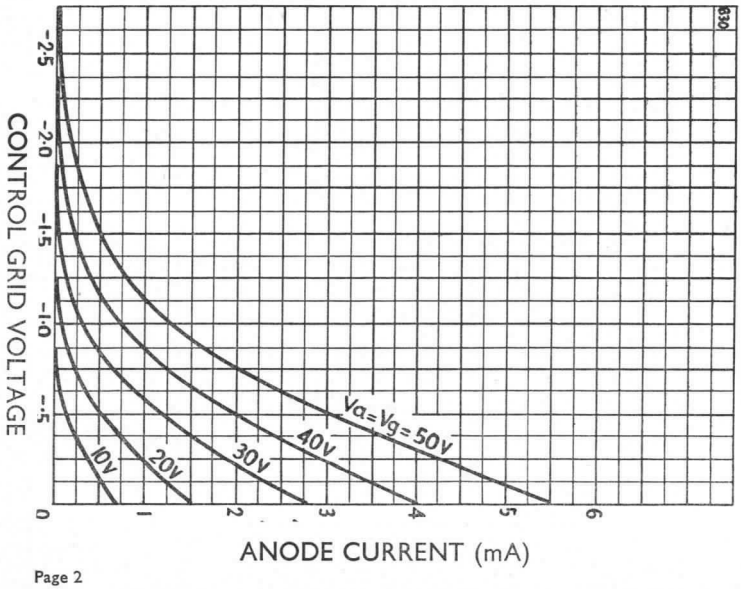
All dimensions shown are in millimetres (max.).

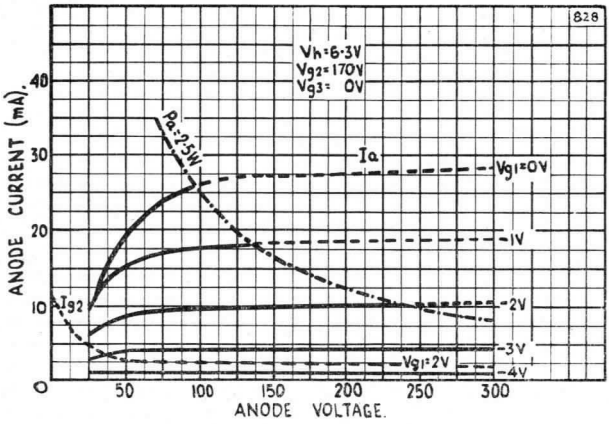
*For grid current of 0.3 μA.

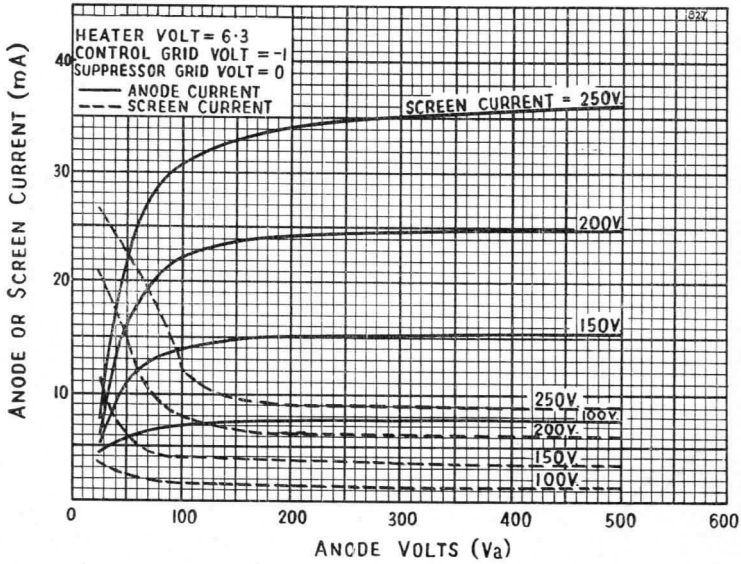
Issue 1
Aug., 1957

FERRANTI


8529
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)


6930
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)

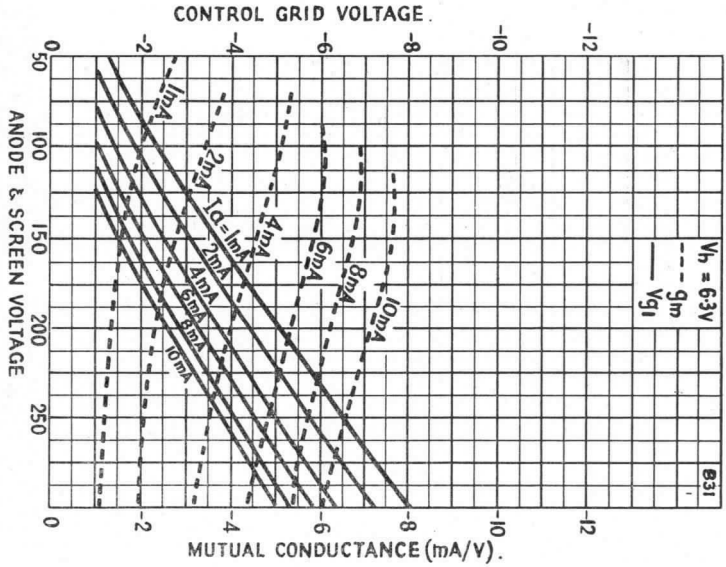


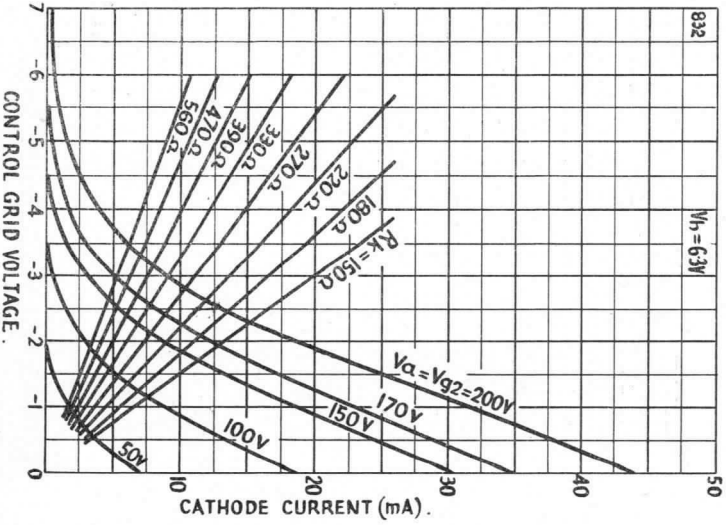


FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

UF80

FERRANTI





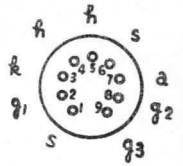
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

UF89

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.



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 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 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_{g_1-k}	3 MΩ
Max. R_{g_3-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	—	

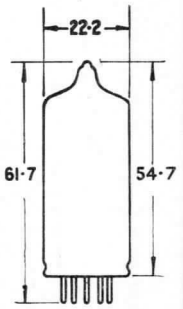
TYPICAL OPERATION.

As R.F. or I.F. Amplifier with Cathode bias.

$V_a=V_b$	100	170	200	volts.
V_{g_3}	0	0	0	volts.
R_{g_2}	15	15	24	kΩ
R_k	130	130	130	ohms.
V_{g_1}	−1·05	−2	−2	volts.
I_a	6	11	11·1	mA.
I_{g_2}	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_{g_1}=−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_{g_3}	0	0	0	volts.
R_{g_2}	22	22	33	kΩ
R_k	0	0	0	Ω
R_{g_1}	10	10	10	MΩ
I_a	6·1	11·8	11·3	mA.
I_{g_2}	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_{g_1}=−20)	—	110	150	μA/V.



All dimensions shown are in millimetres (max.).

*With grid current bias, this resistance may be increased up to 22 MΩ max.

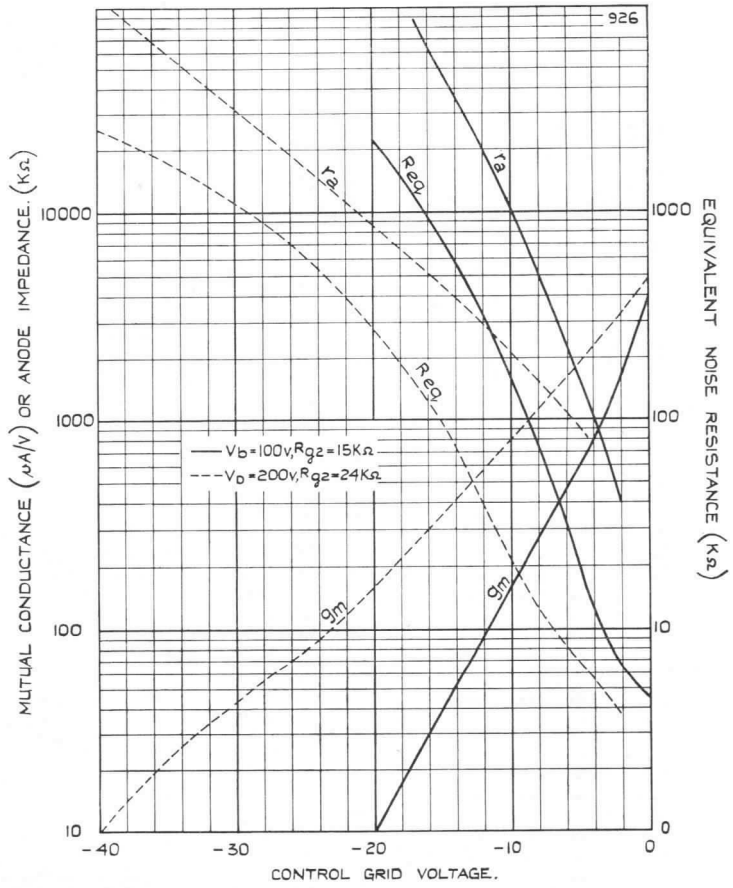
†Grid current may occur at this voltage. If this condition is not acceptable the negative grid bias should be increased to −2 volts.

Issue 1.
May, 1960

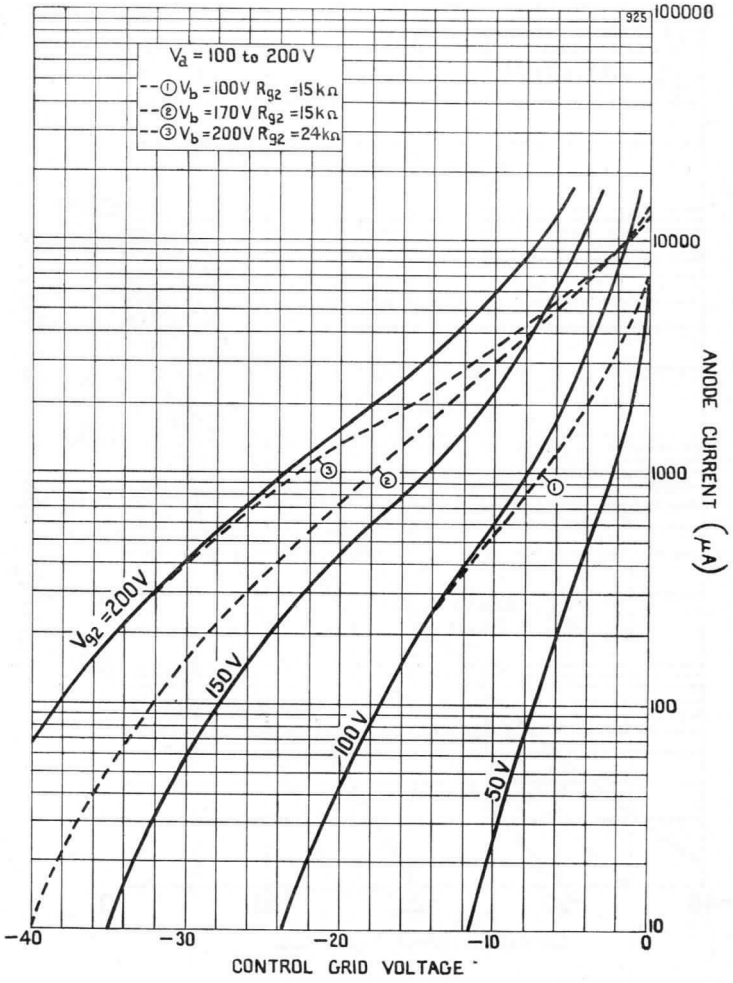
Ferranti

CAPACITANCES

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

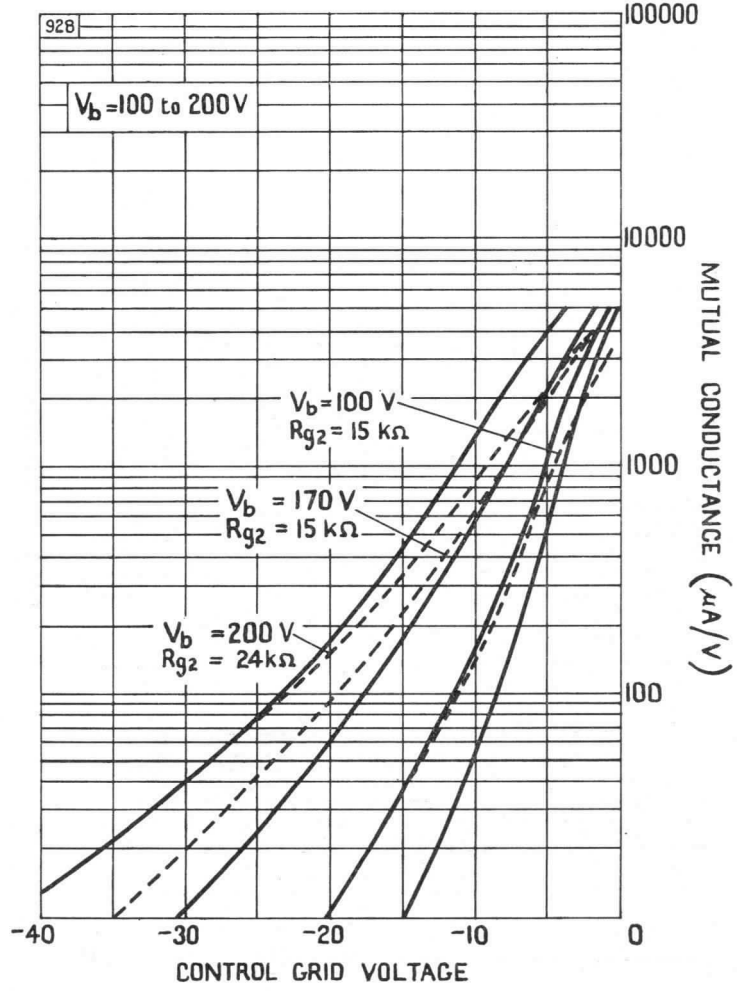


TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTICS



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

TYPICAL MUTUAL CONDUCTANCE/GRID VOLTAGE CHARACTERISTICS



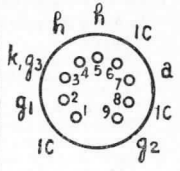
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM. LANCS.

Ferranti

UL84

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 4—Heater.	Pin 8—Internal Connection.
	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

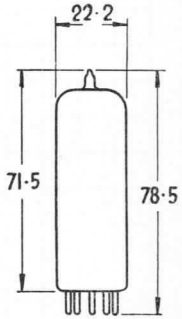
CHARACTERISTICS.

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.



All Dimensions shown are in millimetres (max.).

*Screen Grid Supply Voltage=200. R_{g2}=470 ohms, not decoupled.

Issue 2.
June, 1962

Ferranti

TYPICAL OPERATION (cont.)

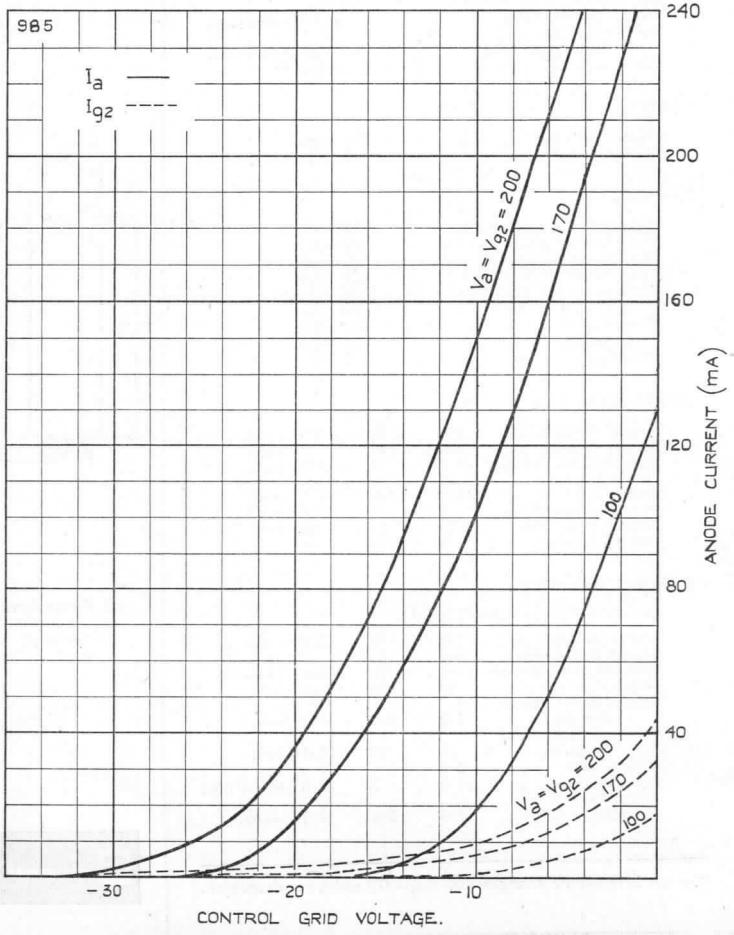
As Audio Amplifier (2 valves in push pull).

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

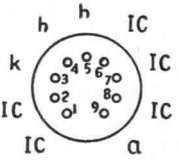
UY85

HALF WAVE RECTIFIER

An indirectly heated, half wave rectifier, for use in equipments with series heater chains.

PHYSICAL DETAILS.

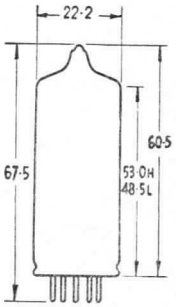
Base	B9A—Noval.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$in.).
Max. Seated Height	60·5 mm. ($2\frac{3}{8}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.



Base Connections Underside View of Base

BASE CONNECTIONS.

Pin 1—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	0·1 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.

All dimensions shown are in millimetres.

TYPICAL OPERATING CONDITIONS.

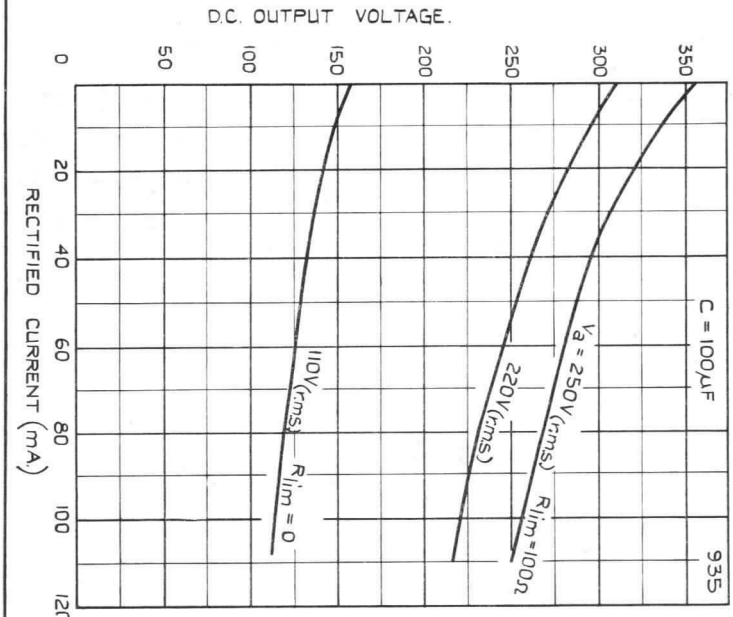
	Capacitor Input.			
R.M.S. Input Voltage ...	110	220	250	volts.
Rectified Current ...	110	110	110	mA.
Min. Supply Impedance ...	0	90	100	ohms.
Max. Reservoir Capacitor	100	100	100	μF.
DC. Output Voltage ...	112	215	245	volts.

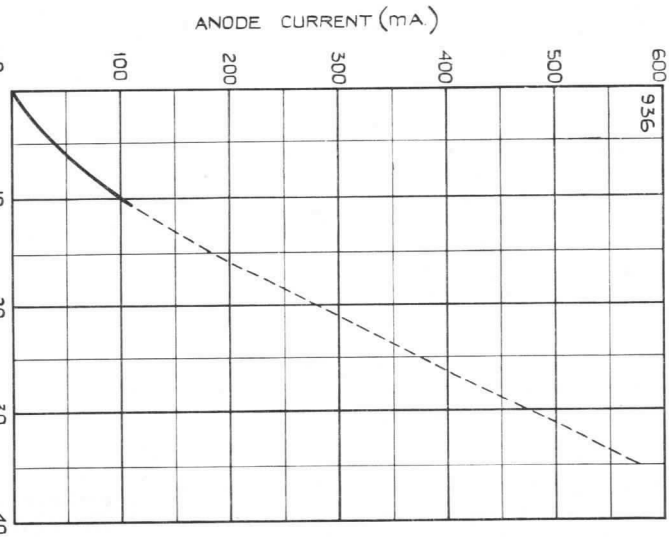
Ferranti

Issue 2
Sept, 1960

Ferranti

UY85





FERRANTI

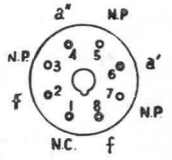
FULL WAVE RECTIFIER

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

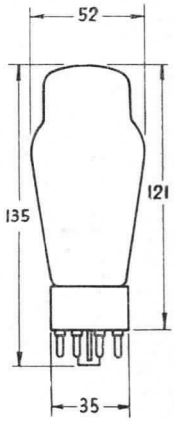
Pin 1.—No connection.	Pin 5.—No Pin.
Pin 2.—Filament.	Pin 6.—Anode 1.
Pin 3.—No Pin.	Pin 7.—No Pin.
Pin 4.—Anode 2.	Pin 8.—Filament.

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 Current of { 112·5 mA.	510	—	volts
{ 78 mA.	—	660	volts
At Full-Load Current of { 225 mA.	430	—	volts
{ 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.

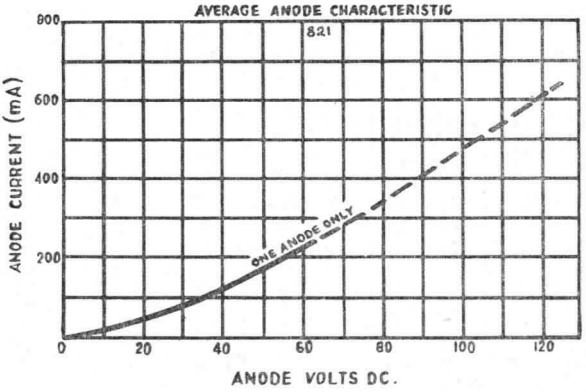
‡When a filter input capacitor greater than 10μF. is used, it may be necessary to increase the effective supply impedance to avoid exceeding the hot-switching transient anode current.

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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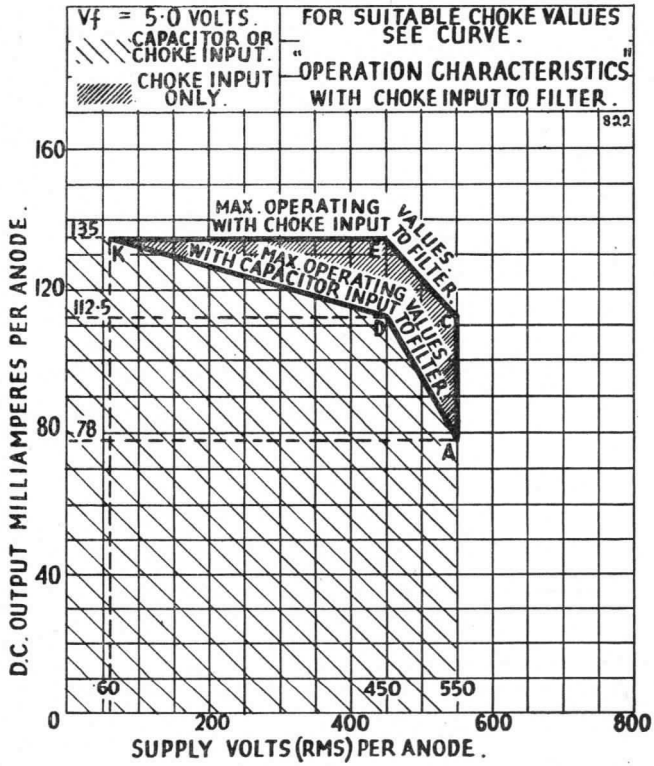
FERRANTI

RATING CHART



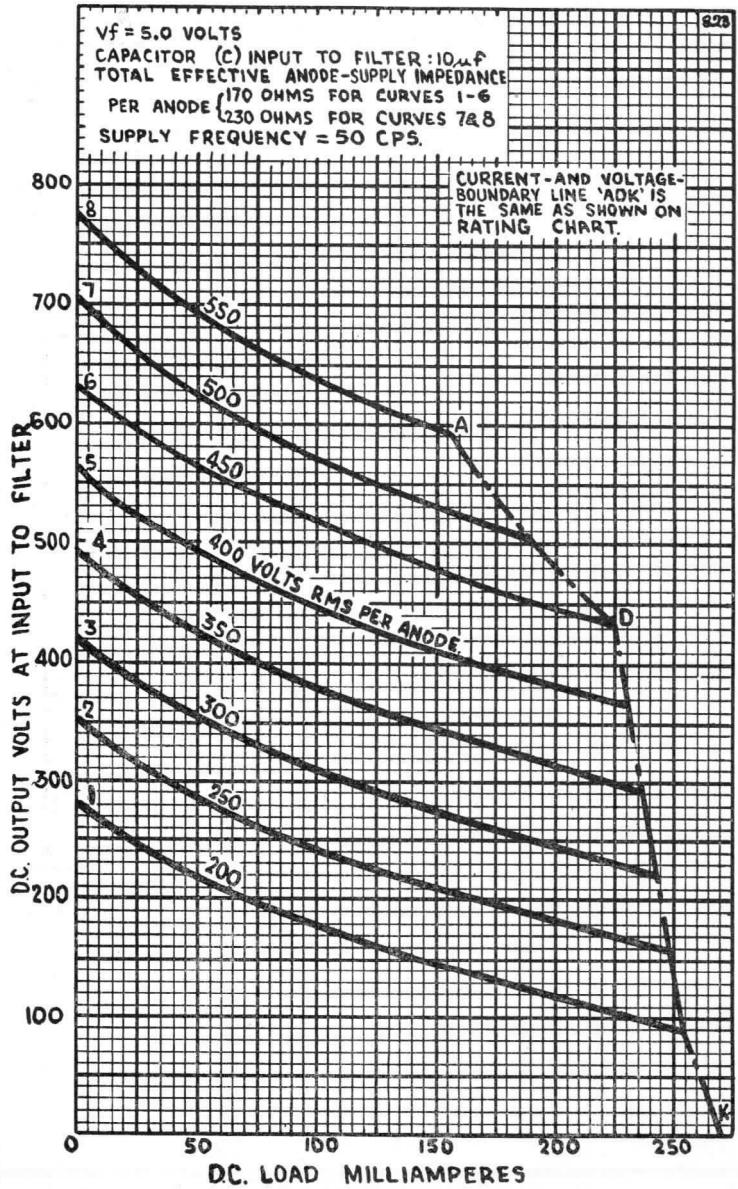
SEE NOTE ON PAGE 3

FERRANTI

5U4G

OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CAPACITOR-INPUT FILTER



SEE NOTE ON PAGE 3

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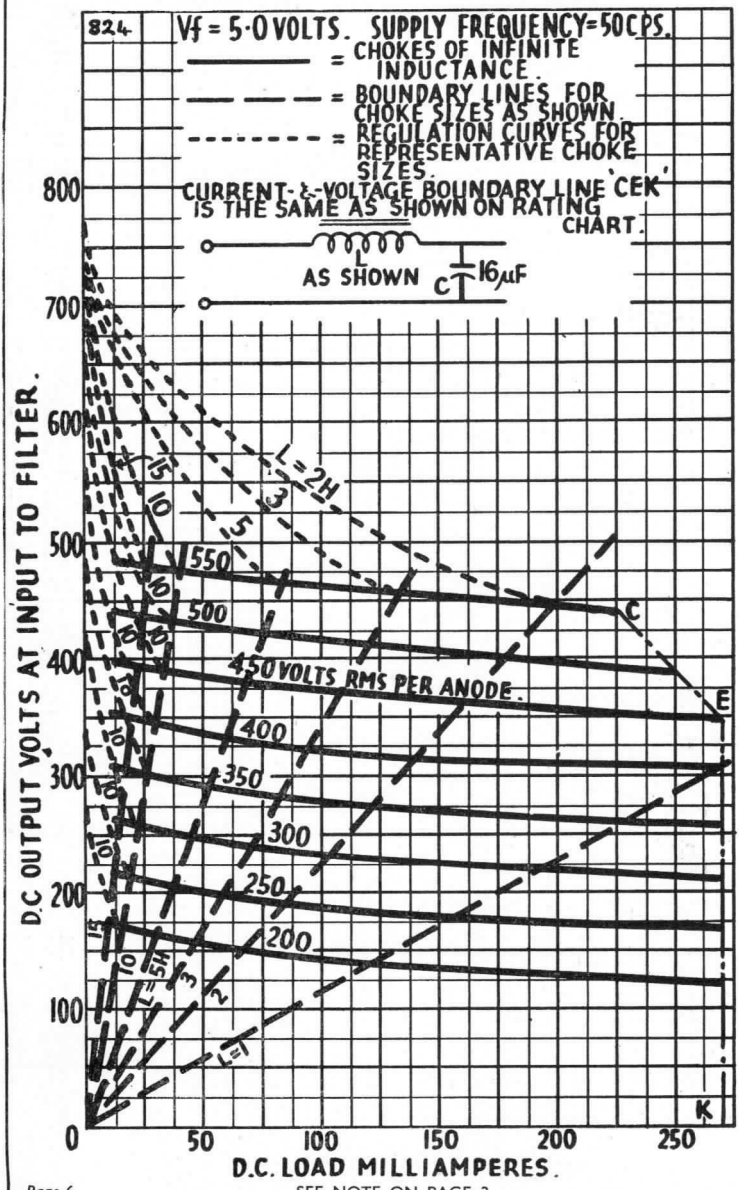
OPERATION CHARACTERISTICS

FULL-WAVE CIRCUIT, CHOKE-INPUT FILTER



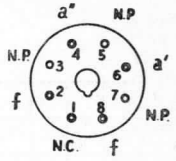
SEE NOTE ON PAGE 3

Ferranti

5Y3GT

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	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.

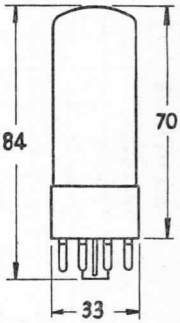
Pin 1—No Connection.	Pin 5—No Pin.
Pin 2—Filament.	Pin 6—Anode 1.
Pin 3—No Pin.	Pin 7—No Pin.
Pin 4—Anode 2.	Pin 8—Filament.

FILAMENT.

Filament Voltage	5·0 volts.
Filament Current	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.

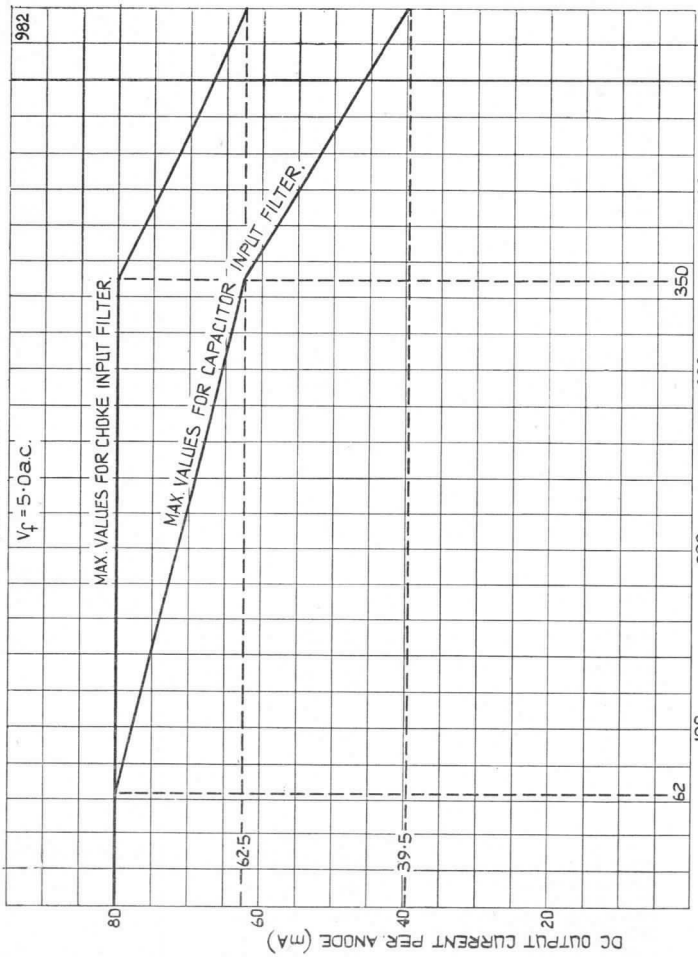
†Each Anode.

§For maximum duration of 0·2 sec.

Issue 4.
Sept., 1962

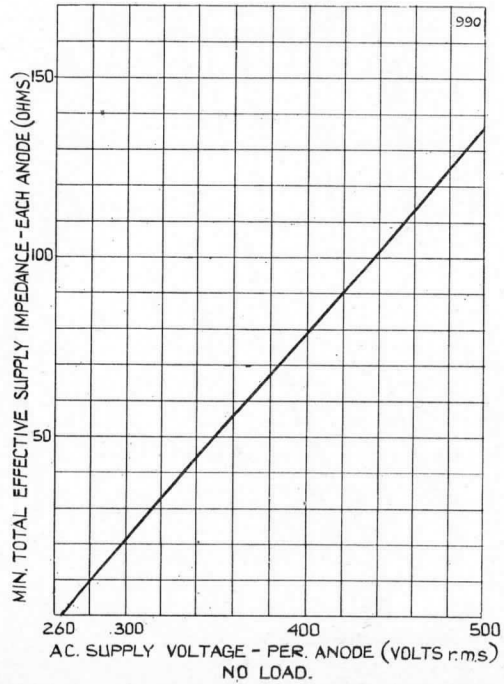
Ferranti

5Y3GT

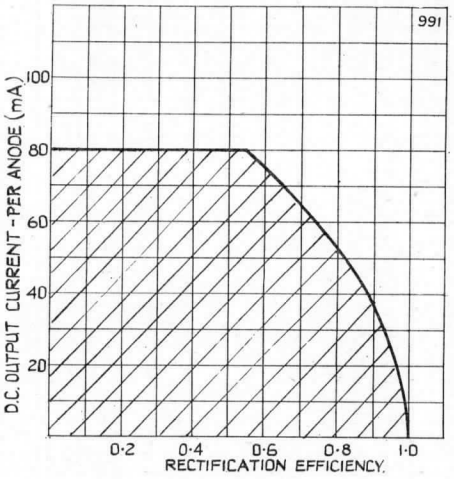

RATINGS
V_f = 5·0a.c.
982
MAX. VALUES FOR CHOKE INPUT FILTER.
MAX. VALUES FOR CAPACITOR INPUT FILTER.
80
60
40
20
62·5
39·5
62
100
200
300
350
400
500
AC SUPPLY VOLTAGE PER ANODE (V rms.) - NO LOAD.
DC OUTPUT CURRENT PER ANODE (mA)

RATINGS (with Capacitor-Input Filter)

Max. transient peak anode current = 2·5A



Max. Steady static peak anode current = 440mA



$$\text{Rectification Efficiency} = \frac{V_{out}}{\sqrt{2}\, V_{in\ (rms)}}$$

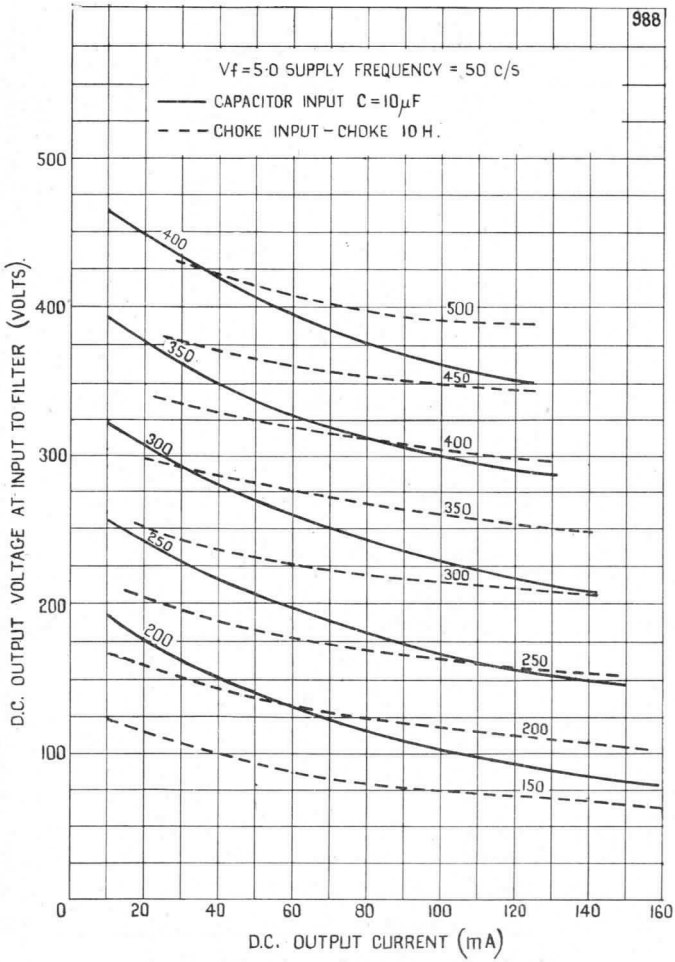
where

V_{out} = DC output (at input to filter)

$V_{in\ (rms)}$ = AC supply volts (rms) per anode

Ferranti

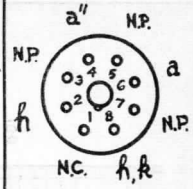
TYPICAL OPERATING CHARACTERISTICS



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

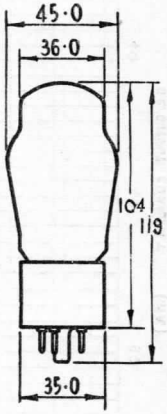
Underside View of Base

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

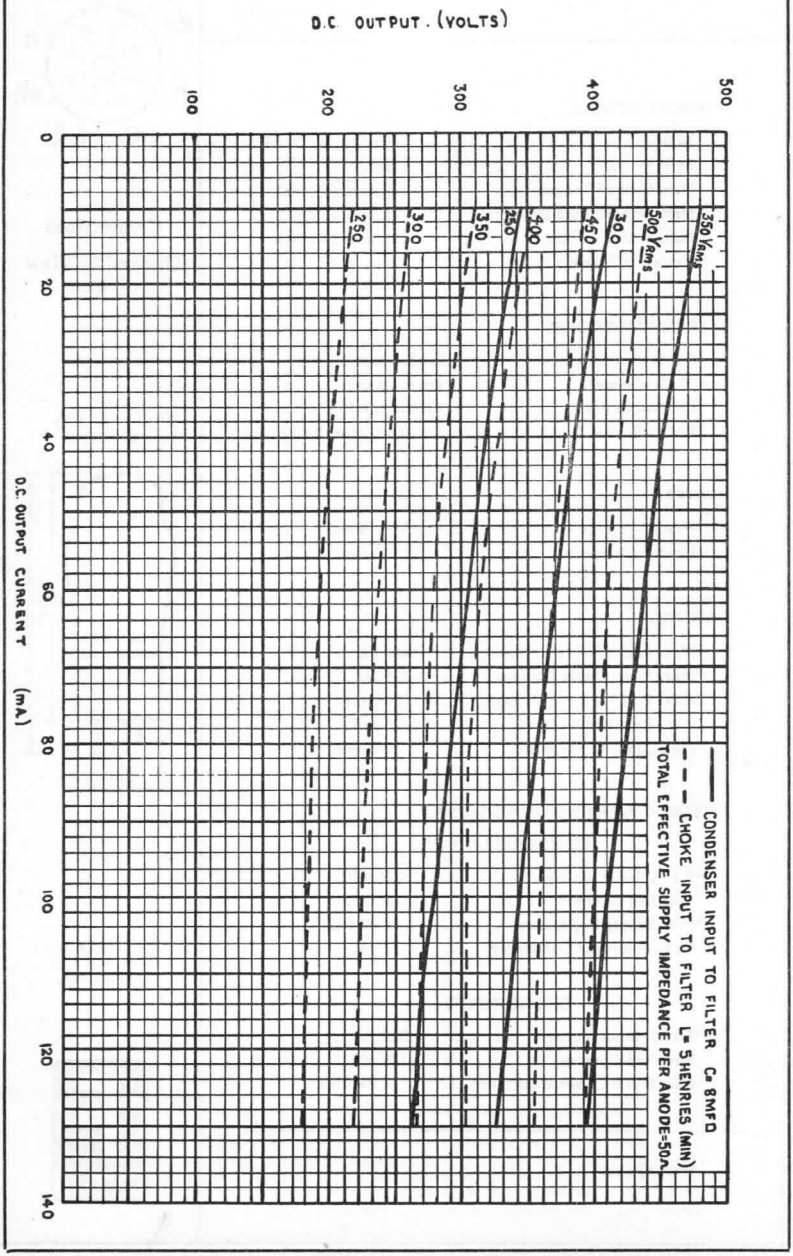
*R.M.S. Input Voltage	500 volts.
Rectified Current	125 mA.
Min. Input Choke Inductance ...	4 henries.

All dimensions shown are in millimetres.

*Per Anode

Issue 2
June, 1953

5Z4G

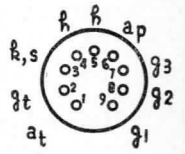

D.C. OUTPUT. (VOLTS)
100
200
300
400
500
0
20
40
60
80
100
120
140
D.C. OUTPUT CURRENT (mA.)
350 Vrms
500 Vrms
300
450
250
400
250
350
300
250
CONDENSER INPUT TO FILTER C= 8MFD
CHOKE INPUT TO FILTER L= 5 HENRIES (MIN)
TOTAL EFFECTIVE SUPPLY IMPEDANCE PER ANODE=50Ω.

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.

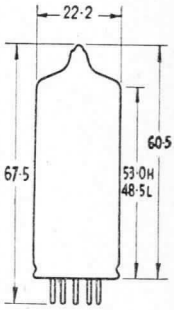
RATINGS.

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



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	−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	

*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.

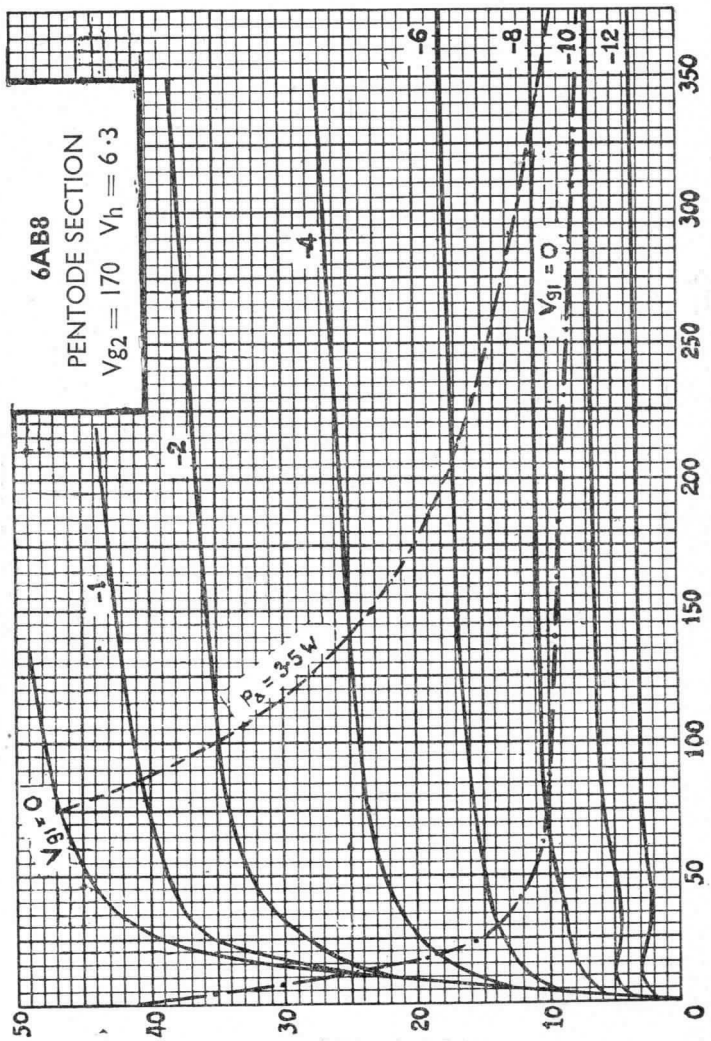
(as A.F. Amplifier).

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.



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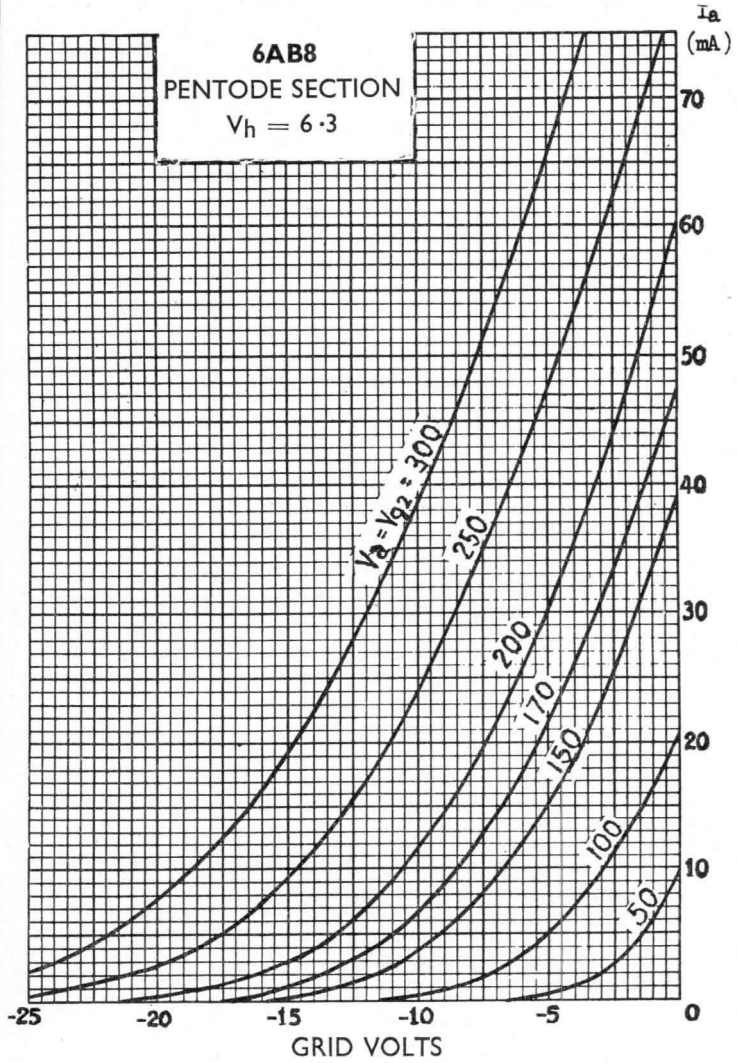

6AB8
PENTODE SECTION
Vh = 6·3
Ia
(mA)
70
60
50
40
30
20
10
0
ANODE CURRENT
Va = Vg2 = 300
250
200
170
150
100
50
-25
-20
-15
-10
-5
0
GRID VOLTS

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

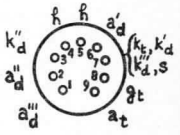
This valve can be used without special precautions against microphony in circuits in which the input voltage is not less than 10 mV. for an output of 50 mW. from the output stage at 800 c/s. and higher frequencies.

TYPICAL OPERATION.

Triode as AF Amplifier with grid current bias.

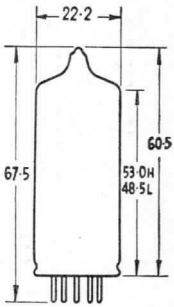
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	0·8	mA.
Stage Gain	51	53	47	55	
Total Distortion (for V_{out}=3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion (for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

Issue 2
Dec., 1957

6AK8

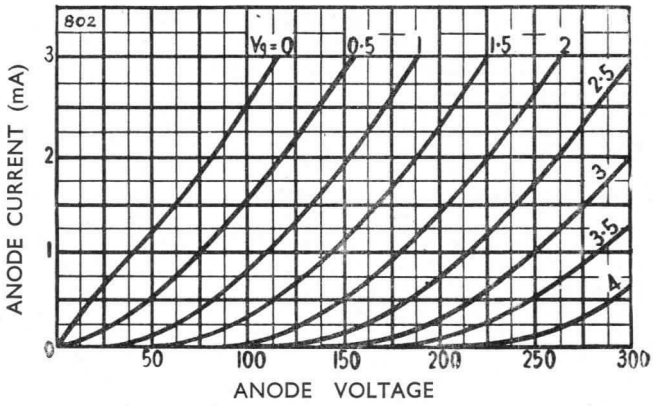
FERRANTI

CAPACITANCES. TRIODE SECTION.

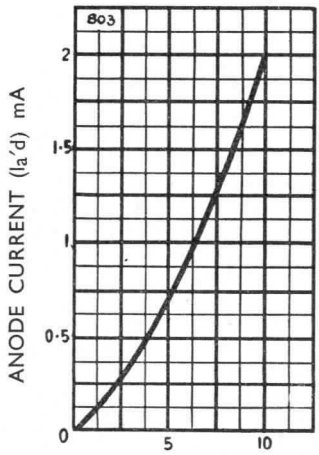
C_{in}	1.9 pF.
C_{out}	1.4 pF.
C_{a-g}	2.0 pF.
C_{g-h}	<0.04 pF.

DIODE SECTION.

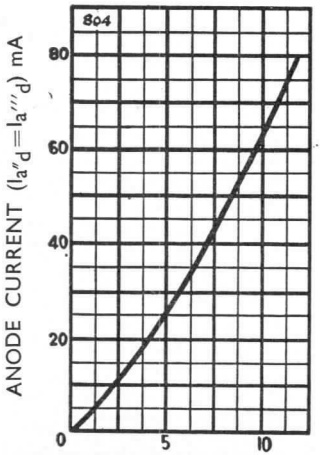
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$	4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k''d,\ s)}$	4.8 pF.
$C_{k''d-all}$	4.9 pF.
$C_{a'd-h}$	<0.25 pF.
$C_{a'''d-h}$	<0.2 pF.
$C_{k''d-h}$	2.5 pF.



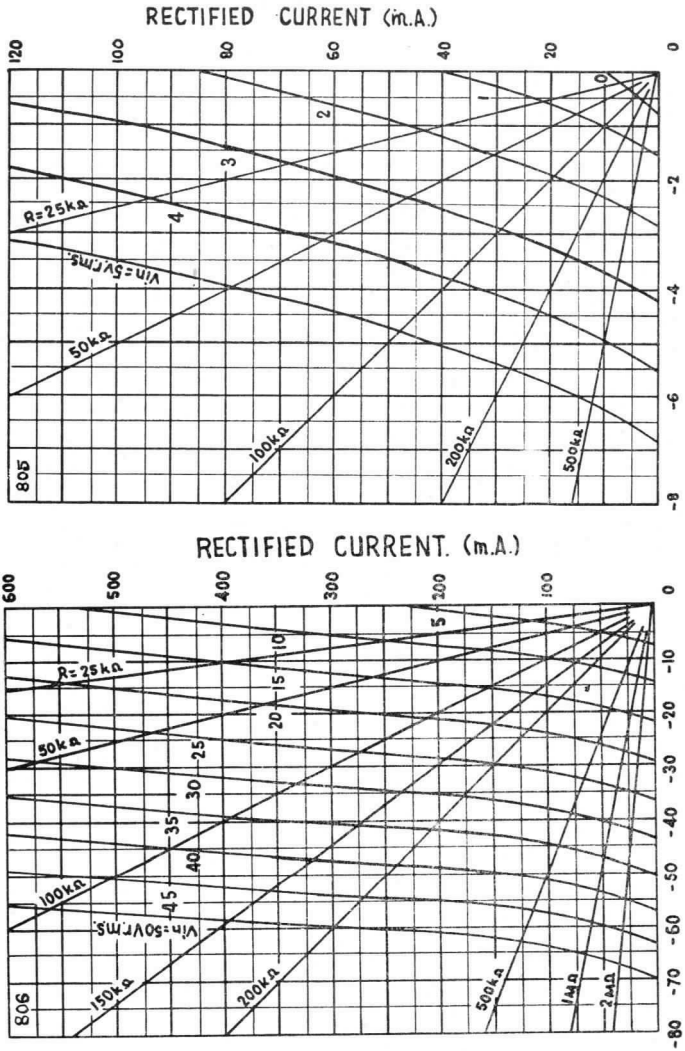
DIODE I



DIODE II - DIODE III



AVERAGE CHARACTERISTICS FOR DIODE I

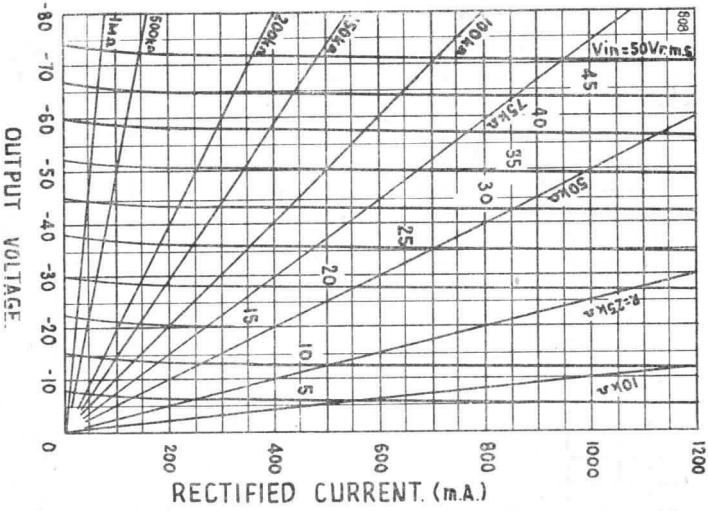


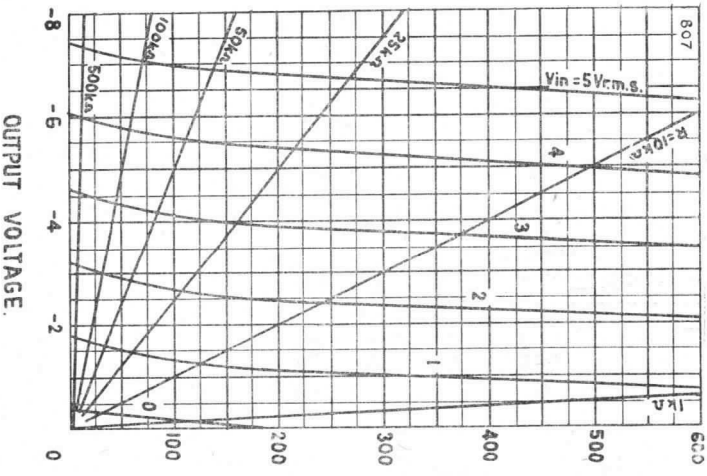
Issue 2
Dec., 1957

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

FERRANTI

AVERAGE CHARACTERISTICS DIODE II AND DIODE III



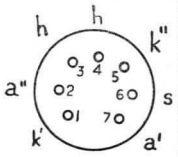


FERRANTI

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.

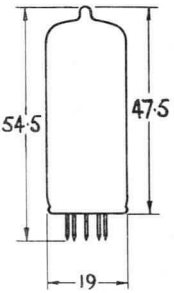
Base	... ...	B7G.
Max. Overall Length	... ...	54·5 mm. ($2\frac{5}{32}$in.).
Max. Seated Height	... ...	47·5 mm. ($1\frac{7}{8}$in.).
Max. Diameter	... ...	19 mm. ($\frac{3}{4}$in.).
Mounting Position	... ...	Any.

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.

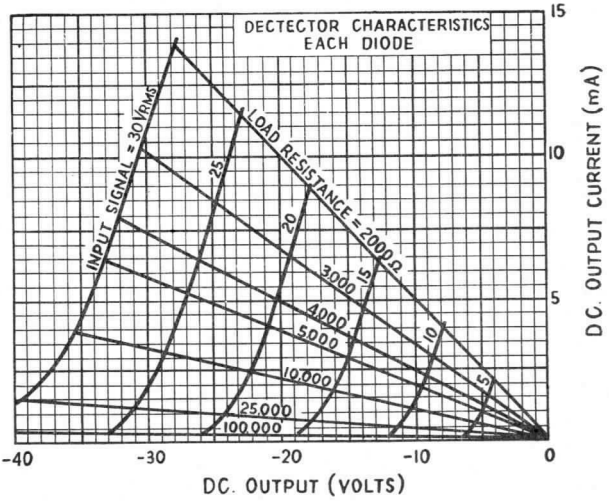
‡‡$C_{a'-a''}$	... ... <0·026 pF.
†$C_{a'-k'+h+s}$	... ... 3·0 pF.
‡$C_{a''-k''+h+s}$	... ... 3·0 pF.
§$C_{k'-a'+h+s}$	... ... 3·4 pF.
††$C_{k''-a''+h+s}$	... ... 3·4 pF.

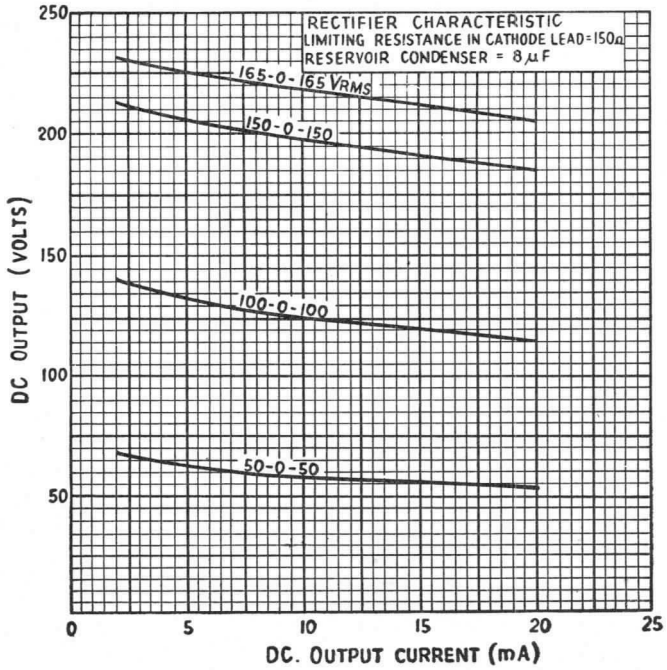
*Each Section.
‡‡With close-fitting external shield connected to Cathode No. 1
†With close-fitting external shield connected to Cathode No.2
‡With close-fitting external shield connected to Anode No. 1
§With close-fitting external shield connected to Anode No. 2
††With close-fitting external shield connected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

FERRANTI

Issue 4
Aug.,1957

6AL5





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

FERRANTI

DOUBLE TRIODE

6AQ8

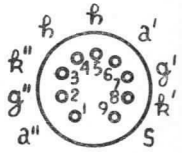
A double triode with separate cathodes. Designed for use as an R.F. Amplifier or self oscillating Mixer in F.M. and A.M. receivers.

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.



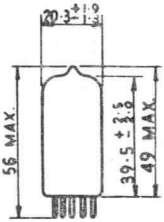
Base Connections Underside View of Base

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.

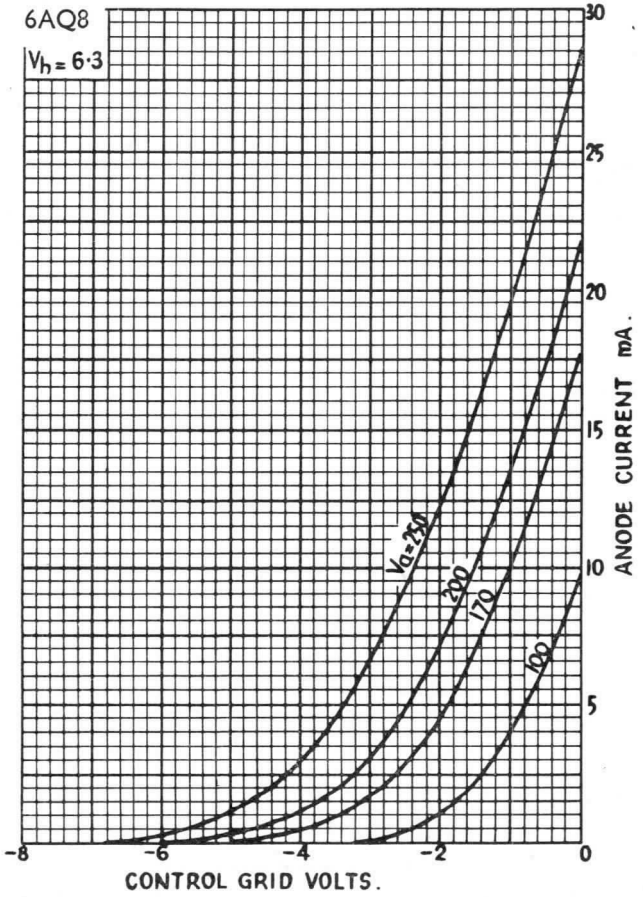
Issue 1.
(Tentative)
Dec., 1955

FERRANTI

CAPACITANCES (without external shield).

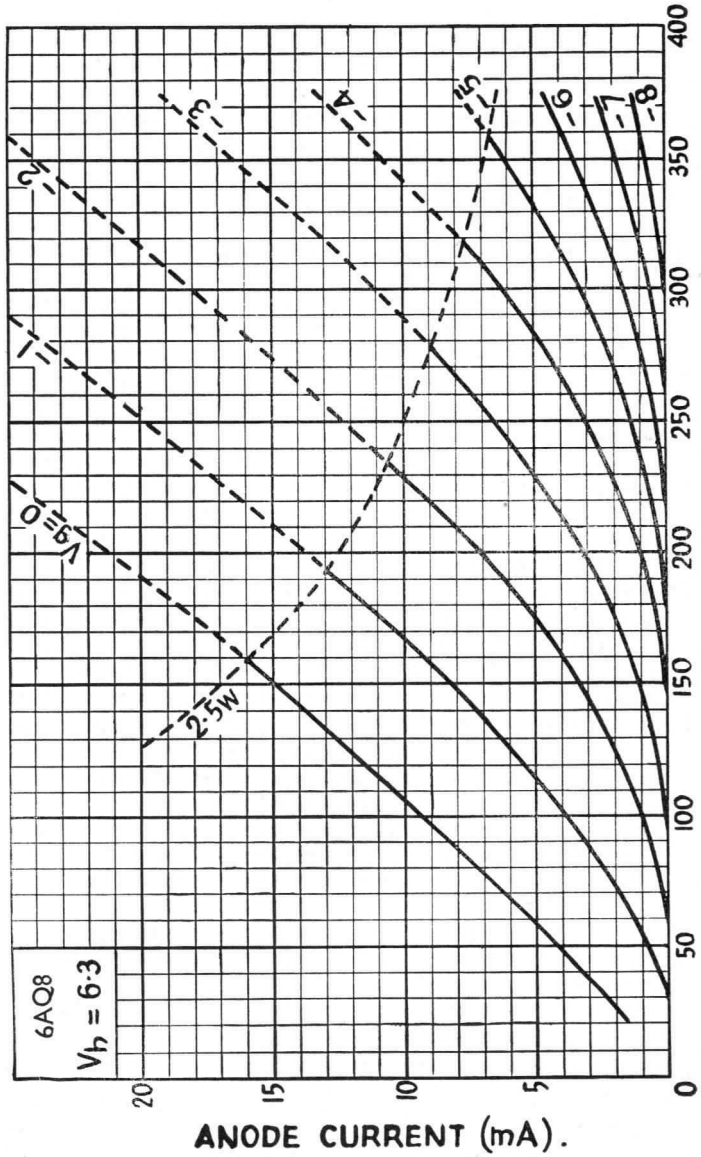
*C_{in}	3·0 pF.
*C_{out}	1·2 pF.
†*C_{out}	1·9 pF.
*C_{a-k}	0·18 pF.
*C_{a-g}	1·5 pF.
$C_{a'-a''}$	<0·04 pF.
†$C_{a'-a''}$	<0·008 pF.
$C_{g'-g''}$	<0·003 pF.
$C_{a'-g''} = C_{a''-g'}$	<0·008 pF.
$C_{a'-k''} = C_{a''-k'}$	<0·008 pF.
$C_{g'-k''} = C_{g''-k'}$	<0·003 pF.

*Each Unit.
†With external shield.



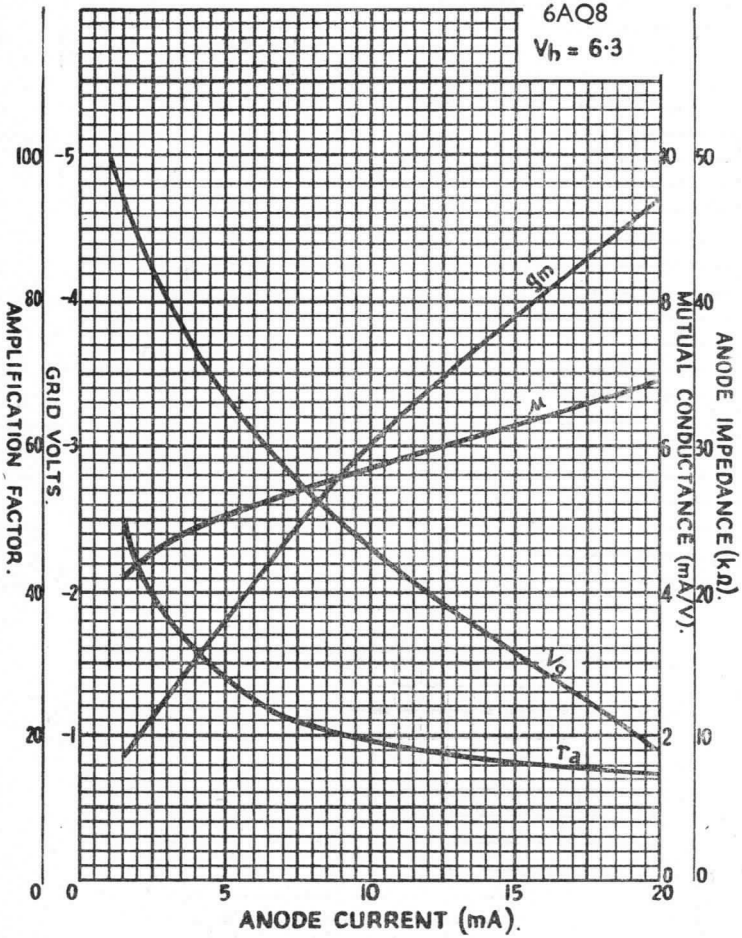
FERRANTI

6AQ8



Issue 1
(Tentative)
Dec.,1955

FERRANTI



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

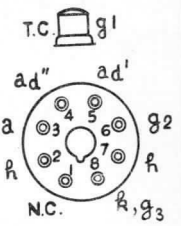
R1255

FERRANTI

DOUBLE DIODE PENTODE

6B8G

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.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Top Cap	Skirted Miniature(CTI)
Max. Overall Length	114 mm. (4½in.).
Max. Seated Height	99 mm. (3$\frac{29}{32}$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).

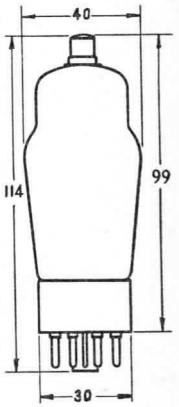
Top Cap—Control Grid (g_1).

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.



All Dimensions shown are in millimetres (max.).

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.

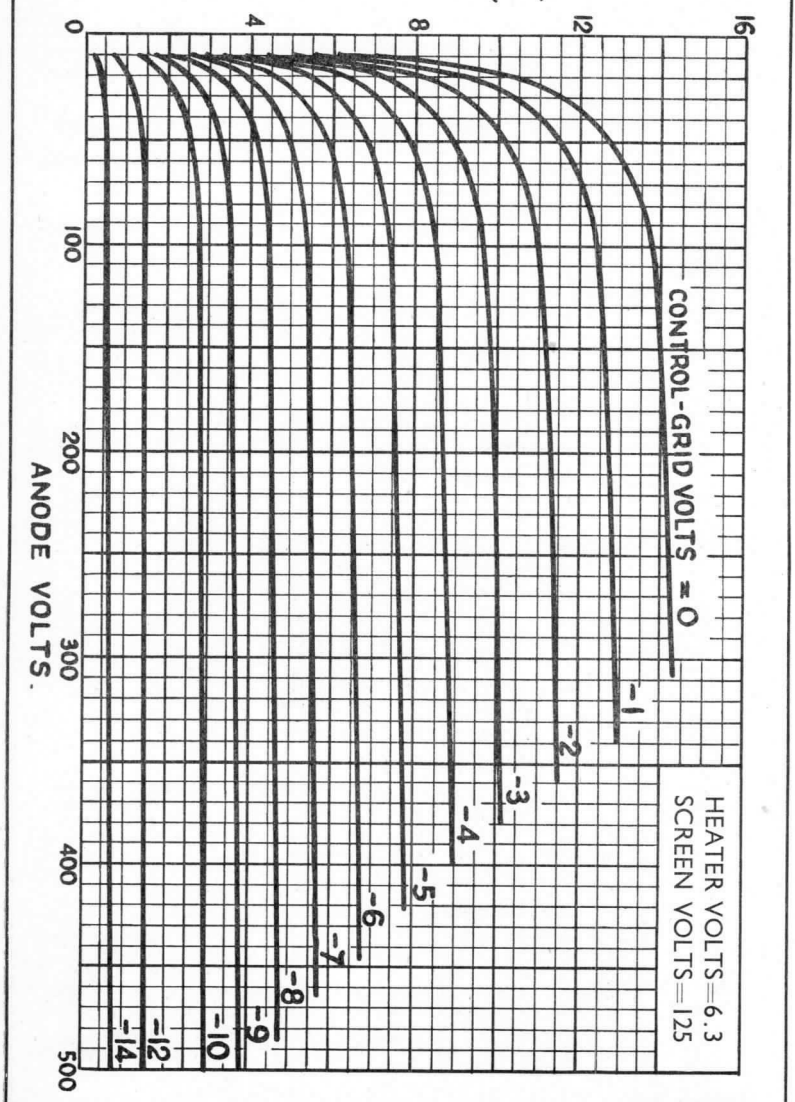
*Pentode Section.

Issue 2.
Oct., 1952

6B8G

FERRANTI

AVERAGE CHARACTERISTICS PENTODE SECTION



R.857

FERRANTI

R.F. PENTODE

6BX6

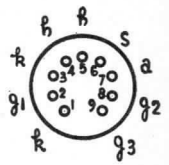
An indirectly heated R.F. Pentode for use with series or parallel heater connection on a.c. or d.c. mains. Primarily designed for use as an R.F. or I.F. Amplifier in Television Receivers, it is also suitable for use as a video amplifier, mixer or synch. separator.

PHYSICAL DETAILS.

Base	... ...	B9A—Noval.
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.

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).



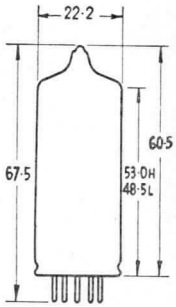
Base Connections
Underside View of Base

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	... ...	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

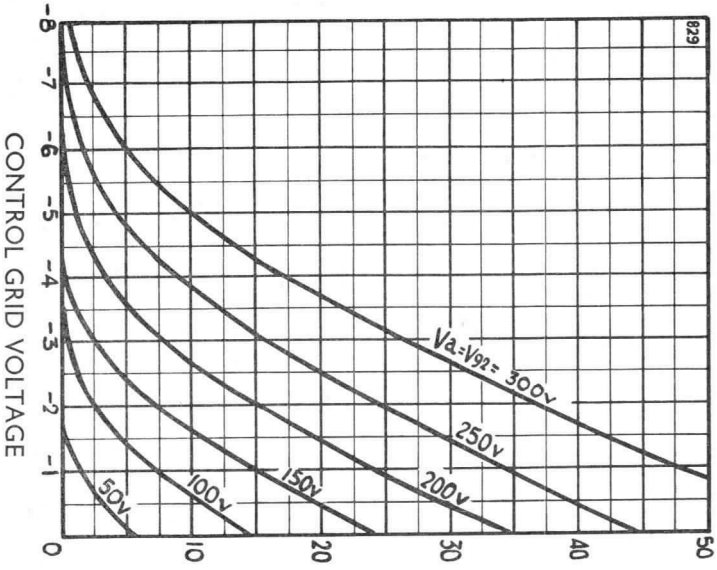
All dimensions shown are in millimetres (max.).

CAPACITANCES.

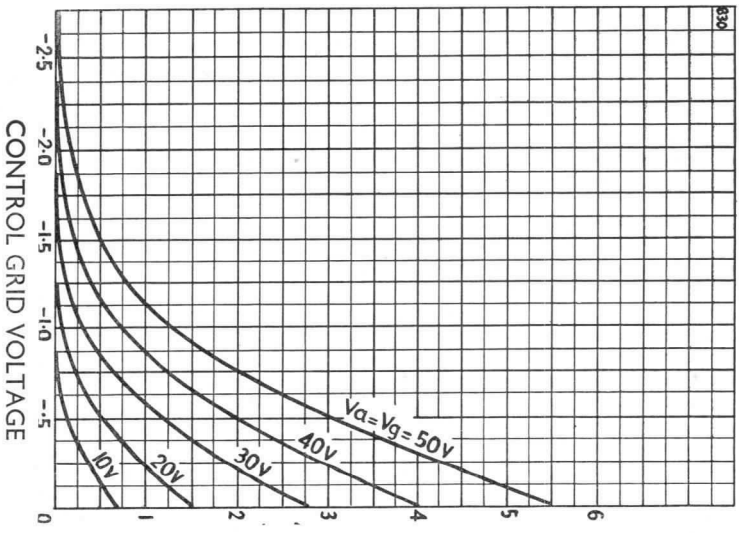
C_{in} (g_1)	... ...	7·5 pF.
C_{in} (g_1)	... ...	5·4 pF.
C_{out}	... ...	3·3 pF.
C_{a-g1}	... ...	<0·007 pF.
C_{a-k}	... ...	<0·01 pF.
C_{g2-g1}	... ...	2·6 pF.
C_{g1-h}	... ...	<0·15 pF.

*For grid current of 0.3 μA.

Issue 1
Mar., 1956

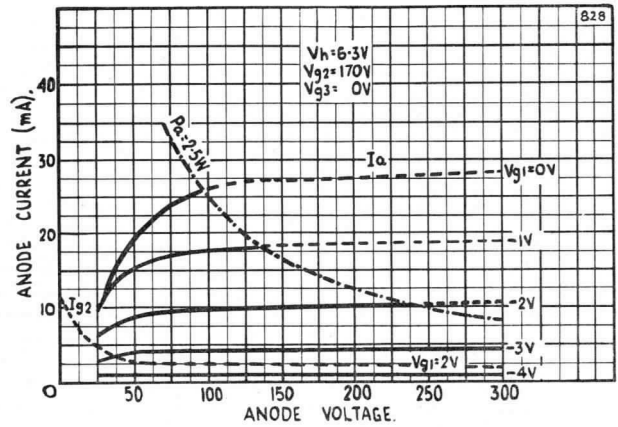


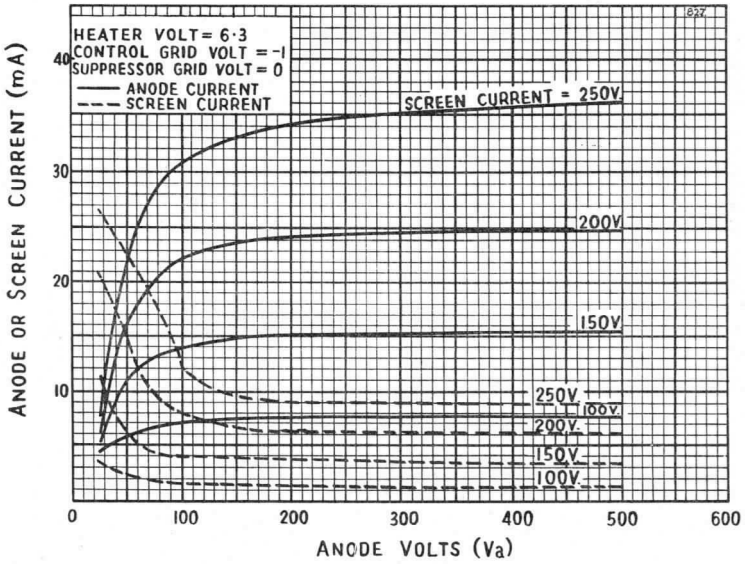
ANODE CURRENT (mA)



ANODE CURRENT (mA)

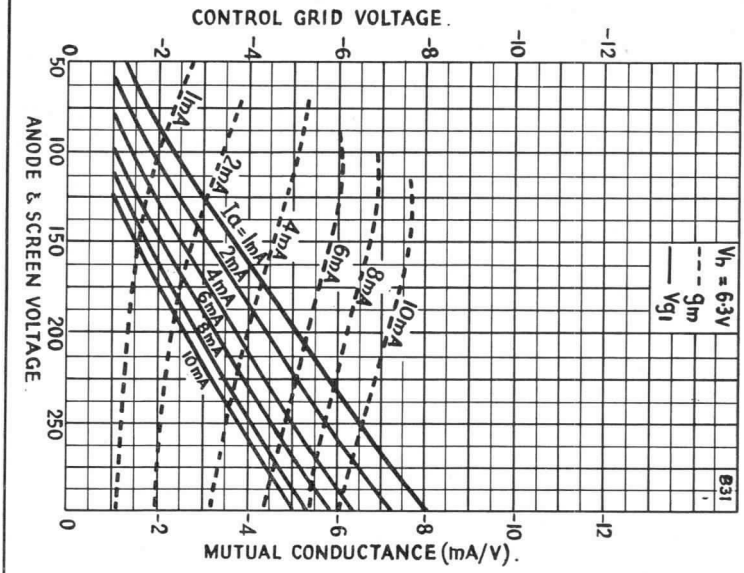
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

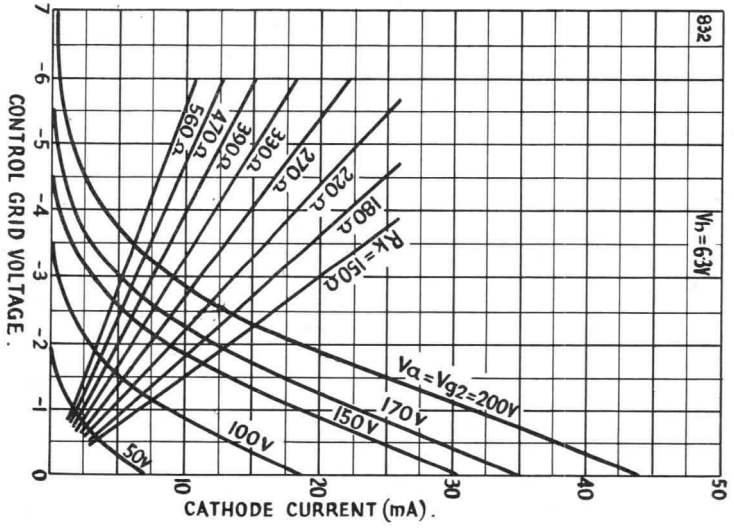




FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

FERRANTI


CONTROL GRID VOLTAGE.
ANODE & SCREEN VOLTAGE.
MUTUAL CONDUCTANCE (mA/V).
Vh = 6·3v
gm
Vg1
831
Ia=1mA
2mA
4mA
6mA
8mA
10mA

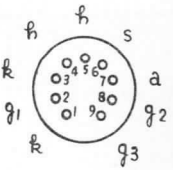

CONTROL GRID VOLTAGE.
CATHODE CURRENT (mA).
832
Vh=6·3V
Rk=150Ω
180Ω
220Ω
270Ω
330Ω
390Ω
470Ω
560Ω
Va=Vg2=200V
170V
150V
100V
50V

FERRANTI

VARIABLE-MU. R.F. PENTODE

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$\frac{11}{16}$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.

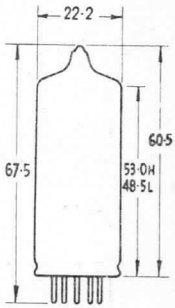
Pin 1—Cathode.
Pin 2—Control Grid (g_1)
Pin 3—Cathode.
Pin 4—Heater.
Pin 5—Heater.
Pin 6—Shield.
Pin 7—Anode.
Pin 8—Screen Grid (g_2).
Pin 9—Suppressor Grid (g_3).

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



All dimensions shown are in millimetres (max.).

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.).

*Common screen resistor with 6AJ8 used as a frequency changer. Total current through resistor is 8·5 mA.

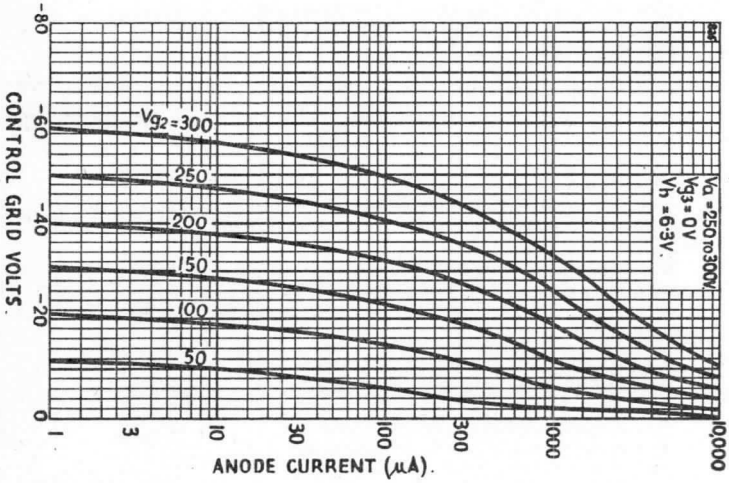
†Common screen resistor with 6AJ8 used as I.F. or R.F. Amplifier. Total current through resistor is 6·7 mA.

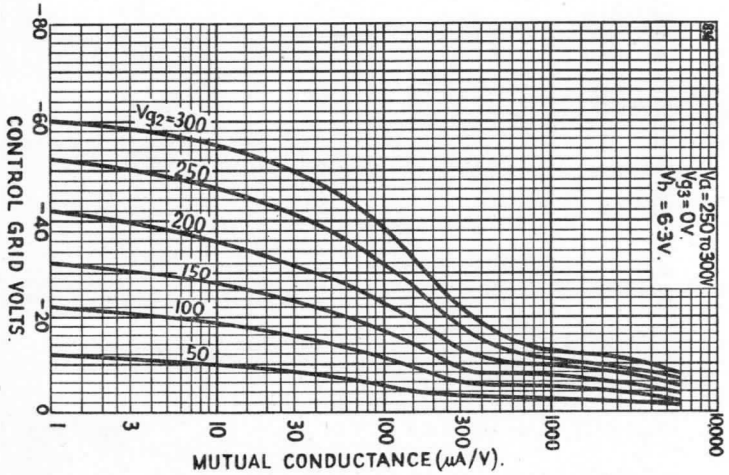
‡Measured without external shield.

Issue 1.
Mar., 1956

6BY7

FERRANTI

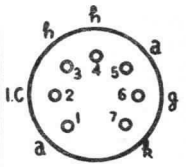




FERRANTI
TRIODE

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.

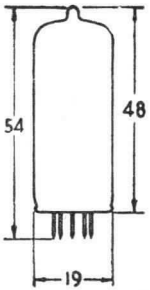
Base	B7G.
Max. Overall Length	54 mm. ($2\frac{1}{8}$in.).
Max. Seated Height	48 mm. ($1\frac{7}{8}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

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).

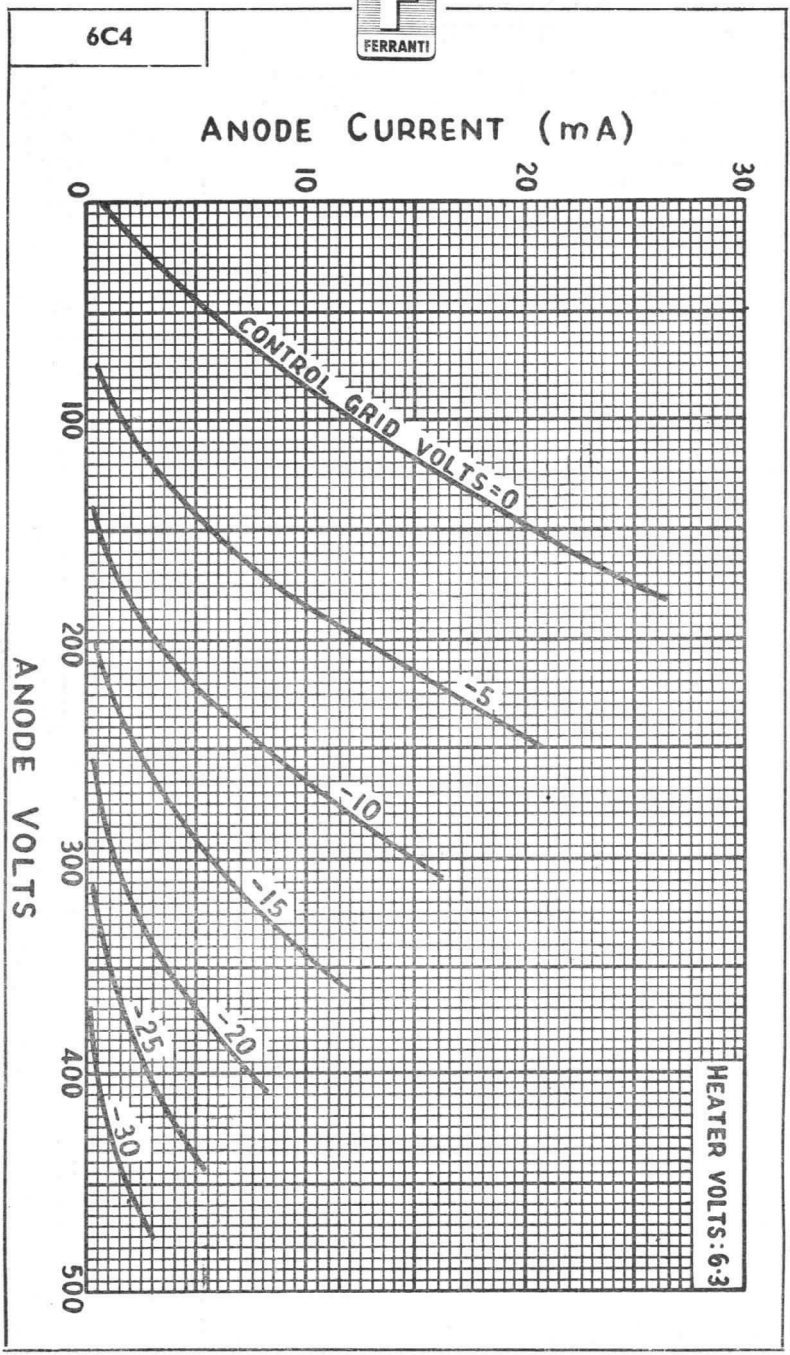
C_{in}	1·8 pF.
C_{out}	3·0 pF.
C_{a-g}	1·6 pF.

All dimensions shown are in Millimetres (max.)

*At moderate frequencies.
†At 150 Mc/s.

Issue 3.
Feb., 1953

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

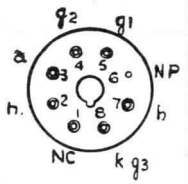
R1255

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. ($1\frac{25}{32}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Heater.
Pin 3—Anode.
Pin 4—Screen Grid (g_2).
Pin 5—Control Grid (g_1).
Pin 6—No Pin.
Pin 7—Heater.
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.

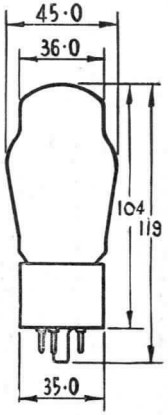
Anode Voltage	250	285	volts.
Screen Voltage	250	285	volts.
Control Grid Voltage ...	−16·5	−20	volts.
Anode Current (Zero Signal)	34	38	mA.
Anode Current (Max. Signal)	36	40	mA.
Screen Current (Zero Signal)	6·5	7	mA.
Screen Current (Max. Signal)	10·5	12	mA.
Anode Impedance (Approx.)	80000	78000	ohms.
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.



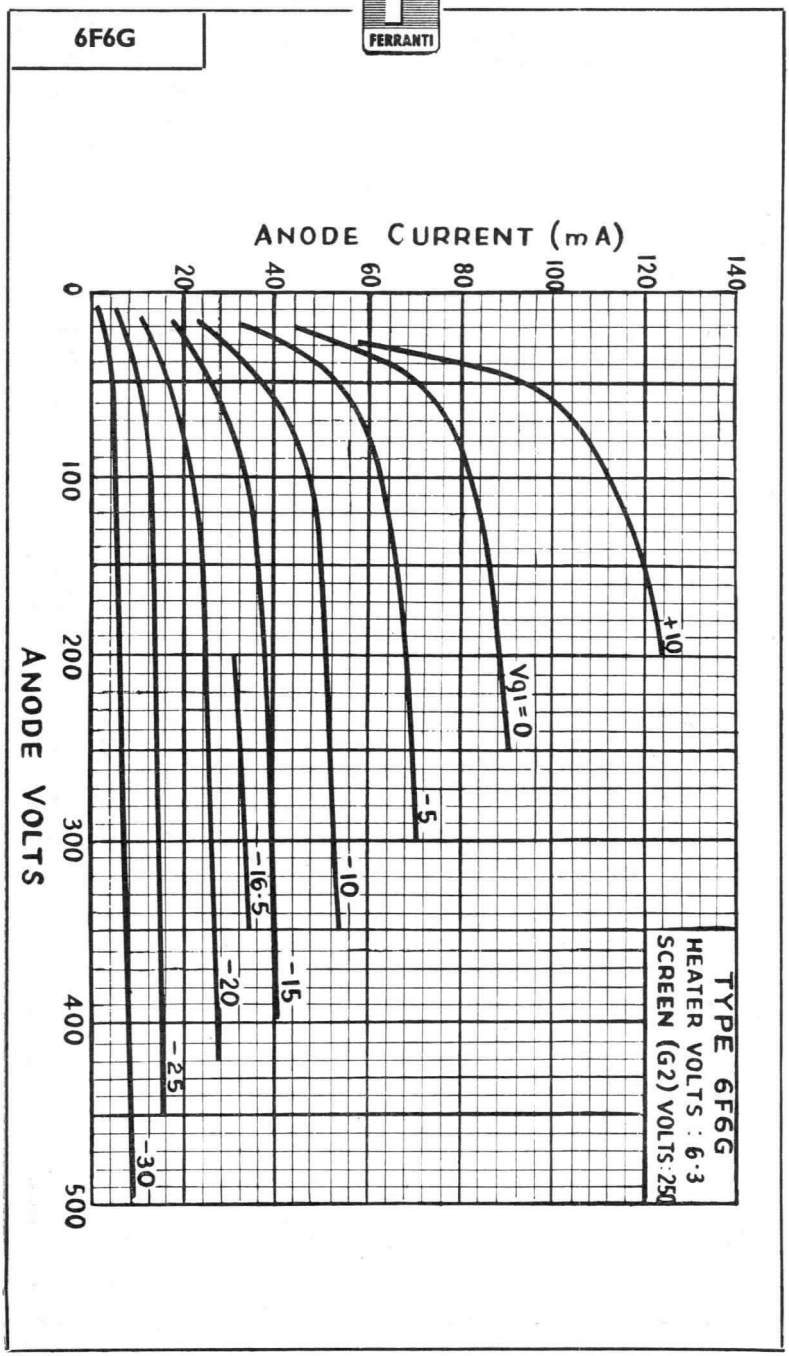
All Dimensions shown are in millimetres (max.).

FERRANTI

Issue 3
Feb., 1953

6F6G

FERRANTI



FERRANTI

V.H.F. DOUBLE TRIODE

6J6

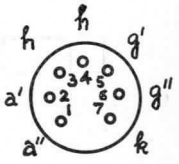
A double triode, with common cathode, designed for use as an R.F. power amplifier or oscillator.

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.

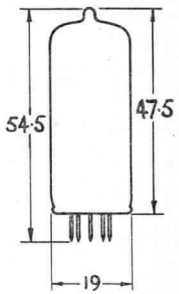
Anode Voltage	100 volts.
Anode Current	8·5 mA.
*Auto-bias Resistor	50 ohms†
Mutual Conductance	5·3 mA/V.
Amplification Factor	38
Anode Impedance	7100 ohms.

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.).

CAPACITANCES.§

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

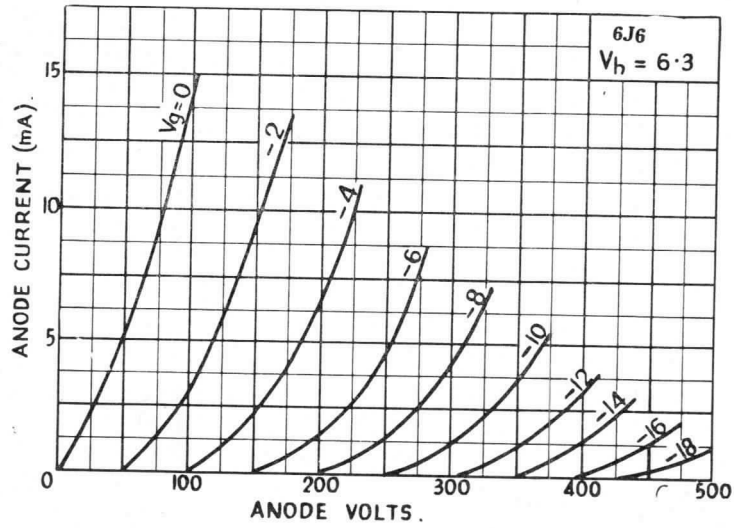


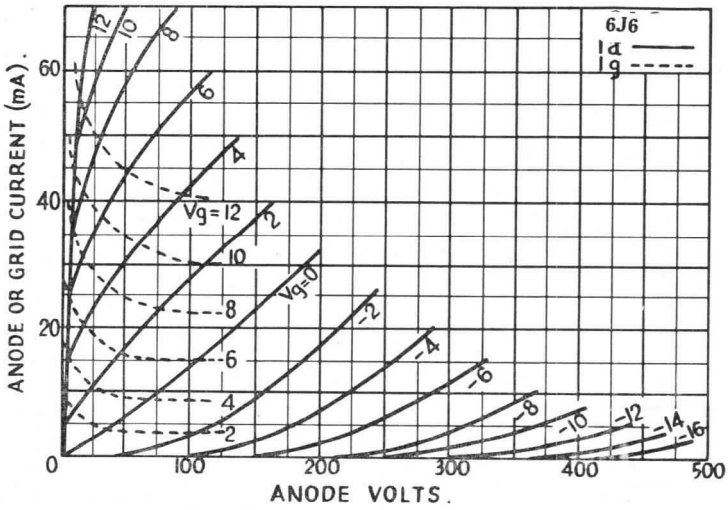
All dimensions shown are in millimetres.

§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.

Issue 1.
Dec., 1955

FERRANTI


6J6
V_h = 6·3
ANODE CURRENT (mA).
15
10
5
0
Vg=0
-2
-4
-6
-8
-10
-12
-14
-16
-18
100
200
300
400
500
ANODE VOLTS.

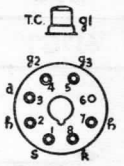

6J6
Ia
Ig
ANODE OR GRID CURRENT (mA).
60
40
20
0
12
10
8
6
4
Vg=12
2
10
8
6
4
2
Vg=0
-2
-4
-6
-8
-10
-12
-14
-16
100
200
300
400
500
ANODE VOLTS.

FERRANTI
R.F. PENTODES

Indirectly heated pentodes designed for use in High-gain Amplifiers or Anode Bend Detectors in AC. or AC/DC. equipments.

6J7G

6J7GT



Base Connections
Underside View of Base

	6J7G	6J7GT
PHYSICAL DETAILS.		
Base		International Octal.
Top Cap		Skirted Miniature.
Max. Overall Length	114 mm. (4½in.)	84 mm. (3 5/16in.).
Max. Seated Height	99 mm. (3 7/8in.)	70 mm. (2¾in.).
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

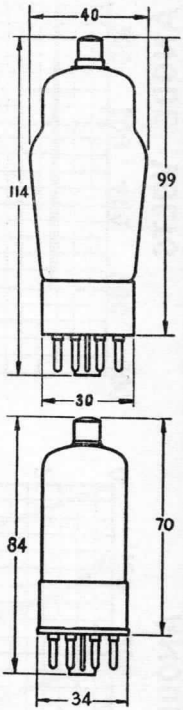
TYPICAL OPERATION.

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.

	6J7G	6J7GT	
PENTODE CONNECTION§			
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.



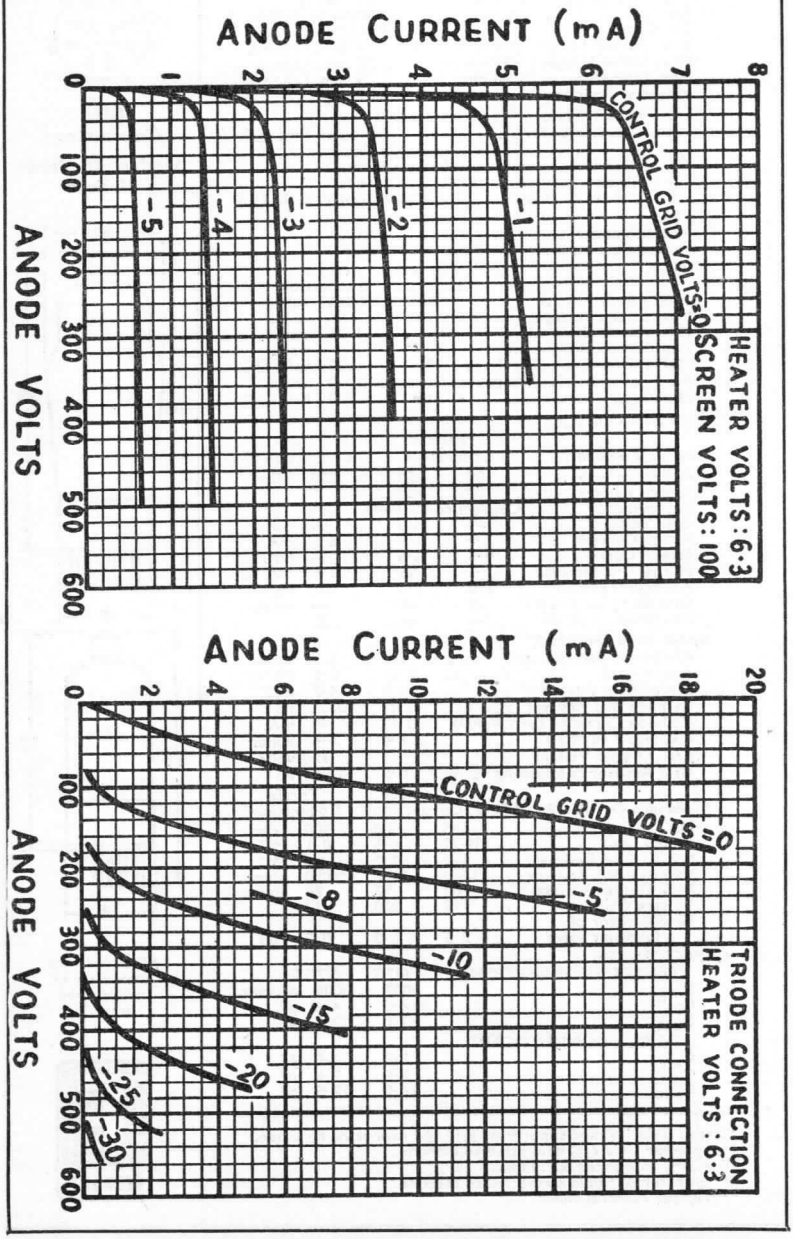
All dimensions shown are in millimetres (max.).

*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.

Issue 2
Feb., 1953

6J7G

6J7GT



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

R1055

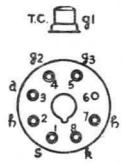
FERRANTI

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.



Base Connections Underside View of Base

PHYSICAL DETAILS.

	6K7G.	6K7GT.
Base	International Octal.	International Octal (Small Wafer-metal Sleeve).
Top Cap	Skirted Miniature.	Skirted Miniature.
Max. Overall Length	114 mm. (4½in.).	84 mm. (3⅜in.).
Max. Seated Height	100 mm. (3 13/16in.).	70 mm. (2¾in.).
Max. Diameter (Bulb)	40 mm. (1 9/16in.).	34 mm. (1 5/16in.).
Mounting Position	Any.	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.

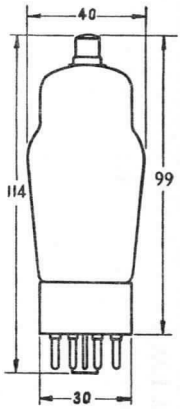
Max. Anode Voltage	300 volts.
Max. Screen Voltage	125 volts.
Min. Grid Voltage	0 volts.
Max. Anode Dissipation	2·75 watts.
Max. Screen Dissipation	0·35 watt.
Max. Heater-Cathode Voltage	100 volts DC.

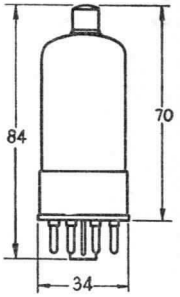
TYPICAL OPERATION.

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.



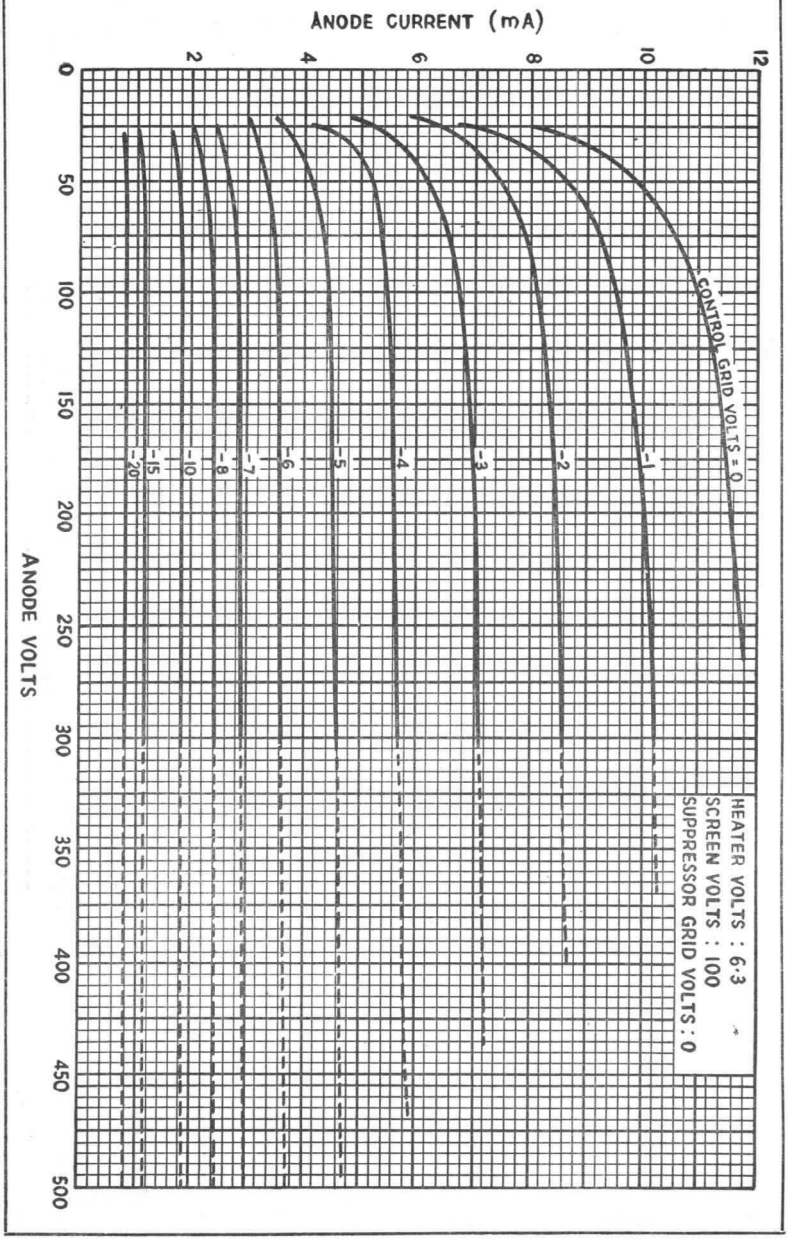


All dimensions shown are in Millimetres (Max.).

Issue 4.
Mar., 1954

6K7G

6K7GT


ANODE CURRENT (mA)
0
2
4
6
8
10
12
ANODE VOLTS
0
50
100
150
200
250
300
350
400
450
500
CONTROL GRID VOLTS = 0
-1
-2
-3
-4
-5
-6
-7
-8
-10
-15
-20
HEATER VOLTS : 6·3
SCREEN VOLTS : 100
SUPPRESSOR GRID VOLTS : 0

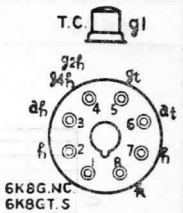
FERRANTI

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. ($3\frac{1}{2}$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. Top Cap—Hexode Control Grid.
Pin 5—Triode Grid, and Hexode Grid 1.
Pin 6—Triode Anode.
Pin 7—Heater.
Pin 8—Cathode.

HEATER.

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

RATINGS.

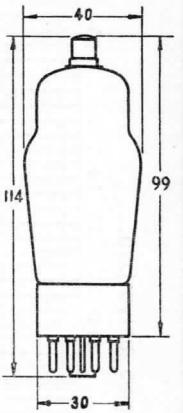
Max. Hexode Anode Voltage	300 volts.
Max. Hexode Screen Voltage (Grids 2, 4)	150 volts.
Min. Hexode Control Grid Voltage (Grid 3)	0 volts.
Max. Hexode Anode Dissipation	0·75 watt.
Max. Hexode Screen Dissipation	0·7 watt.
Max. Triode Anode Voltage ...	125 volts.
Max. Triode Anode Dissipation	0·75 watt.
Max. Total Cathode Current ...	16 mA.
Max. Heater-Cathode Voltage ...	100 volts DC.

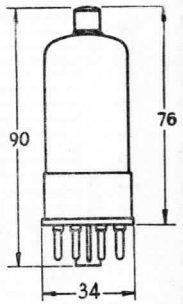
TYPICAL OPERATION.

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.	





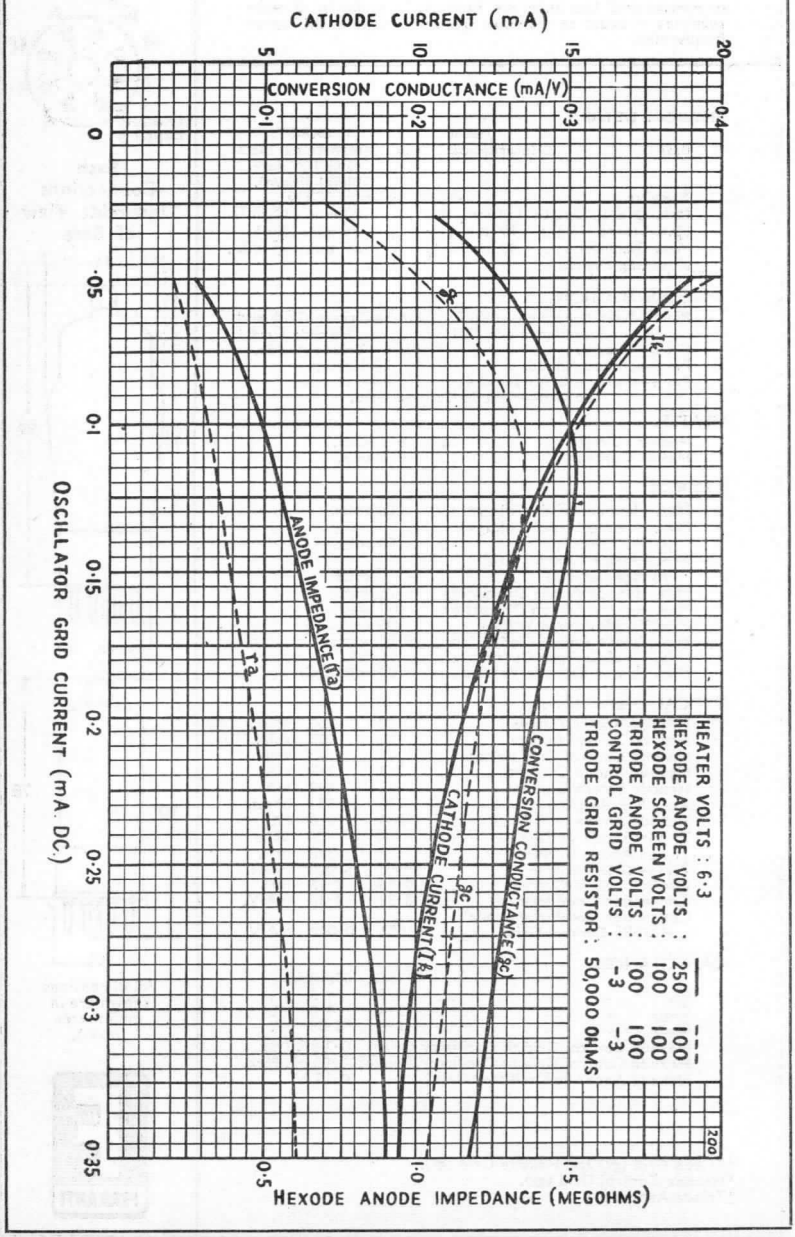
All dimensions shown are in millimetres (max.).

†Triode Grid (gt) and Hexode Grid (g_1).
*Hexode Control Grid (g_3).
‡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.)
ANODE IMPEDANCE (ra)
CONVERSION CONDUCTANCE (gc)
CATHODE CURRENT (Ik)
gc
Ik
ra
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
0·5
1·0
1·5
HEXODE ANODE IMPEDANCE (MEGOHMS)
200

FERRANTI

DOUBLE DIODE PENTODE

6N8

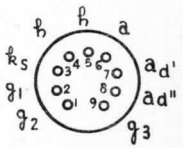
An indirectly heated double diode variable-mu pentode designed for use as detector, A.V.C. diode and R.F., I.F., or A.F. Amplifier.

PHYSICAL DETAILS.

Base	B9A—All Glass.
Max. Overall Length	67·5 mm. (2$\frac{21}{32}$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 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).



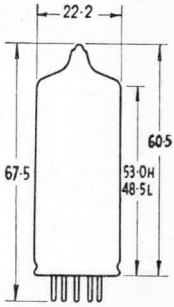
Base Connections
Underside View of Base

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

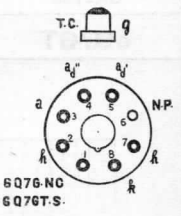
FERRANTI

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



Base Connections Underside View of Base

PHYSICAL DETAILS.

	6Q7G.	6Q7GT.
Base	International Octal.	International Octal. (Small Wafer-metal Sleeve).
Top Cap	Skirted Miniature CT1	Skirted Miniature.
Max. Overall Length	114 mm. ($4\frac{1}{2}$in.).	84 mm. ($3\frac{5}{16}$in.).
Max. Seated Height	99 mm. ($3\frac{15}{16}$in.).	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter (Bulb)	40 mm. ($1\frac{9}{16}$in.).	34 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.	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.

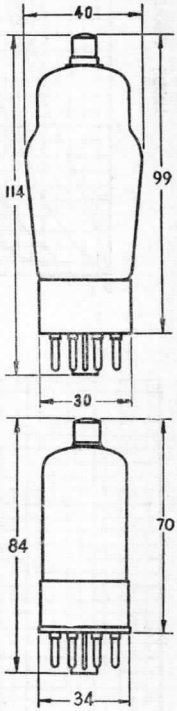
Anode Voltage	100	250	volts.
Anode Load Resistor	0·25	0·47	MΩ
Grid Resistor	1·0	1·0	MΩ
Auto Bias Resistor	5600	6800	ohms.
Peak Output Voltage	12	49	volts.
Stage Gain	45	56	
Total Harmonic Distortion	4·5	5	%

DIODE SECTION.

Refer to curves.

CAPACITANCES.

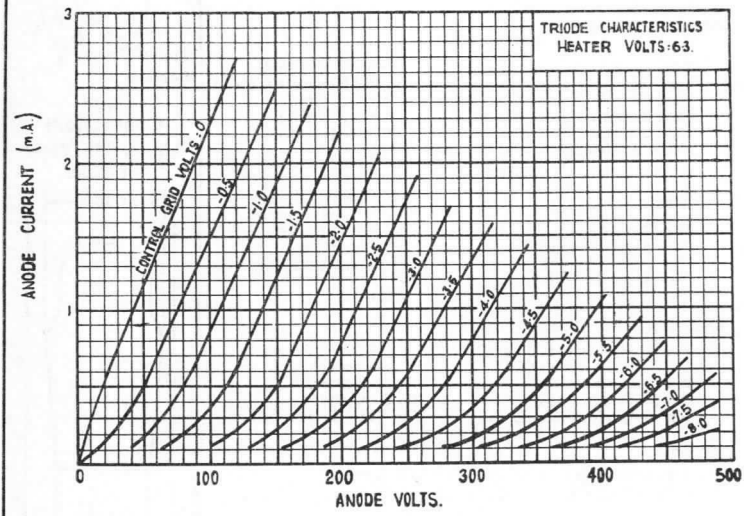
	6Q7G	6Q7GT	
C_{in}	2·0	1·8	pF.
C_{out}	4·0	3·4	pF.
C_{a-g}	2·0	1·8	pF.
$C_{a_d'-kC=a_d''-k}$	2·5	2·8	pF.

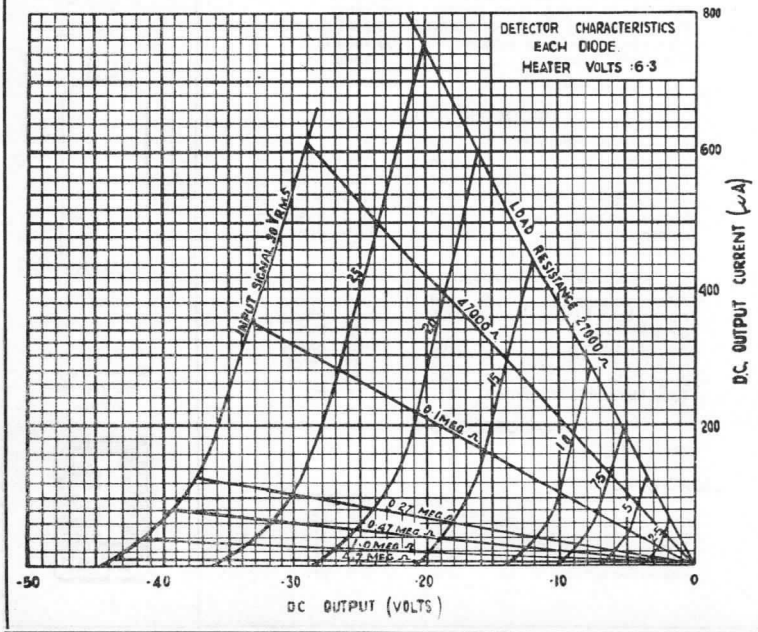


All dimensions shown are in millimetres (max.).

Issue 3
Sept., 1952

6Q7G
6Q7GT


TRIODE CHARACTERISTICS
HEATER VOLTS: 6.3.
ANODE CURRENT (mA.)
ANODE VOLTS.
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
1
2
3


DETECTOR CHARACTERISTICS
EACH DIODE.
HEATER VOLTS: 6.3
D.C. OUTPUT CURRENT (μA)
D.C. OUTPUT (VOLTS)
INPUT SIGNAL 30 VRMS
LOAD RESISTANCE 27000 Ω
47000 Ω
0.1 MEG Ω
0.47 MEG Ω
1.0 MEG Ω
4.7 MEG Ω
-50
-40
-30
-20
-10
0
200
400
600
800

FERRANTI

R.F. PENTODE

6SJ7GT

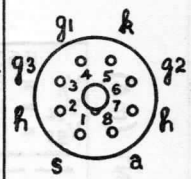
An indirectly heated, single ended R.F. Pentode designed for use in High-gain Amplifiers or as Anode Bend Detector in AC. or AC./DC. equipments. The internal screening, connected to the cathode, will provide sufficient shielding except in the case of very high gain circuits.

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.

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



Base Connections

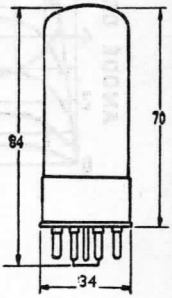
Underside View of Base

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_{g1-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.

All dimensions shown are in millimetres (max.).

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.

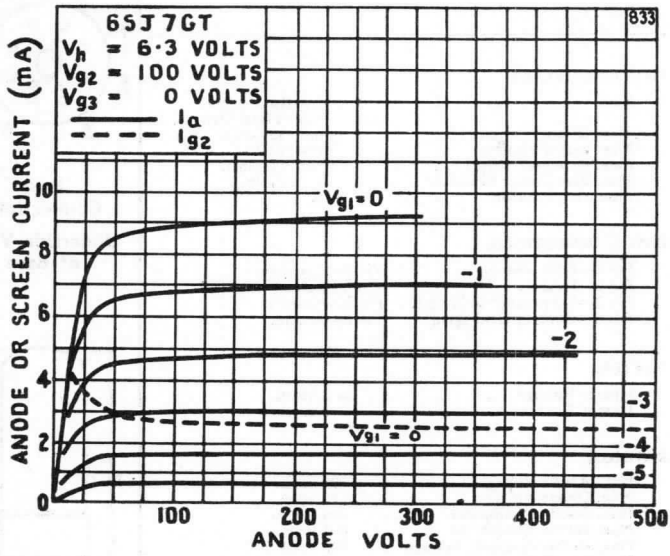
†g_2 and g_3 connected to anode.

Issue 3
Oct., 1952

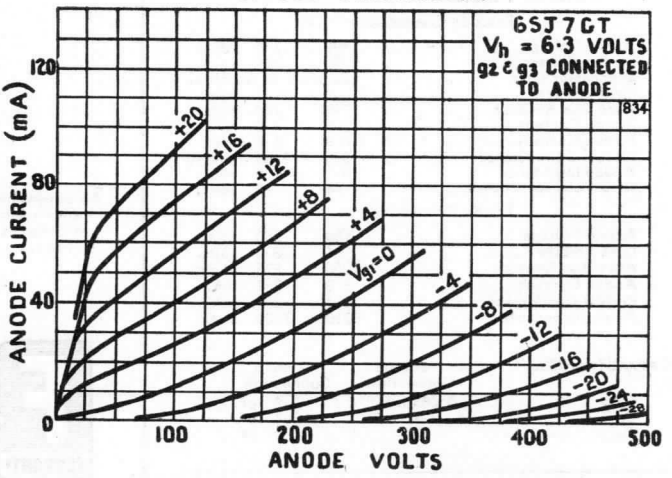
6SJ7GT

FERRANTI

PENTODE CONNECTION



TRIODE CONNECTION

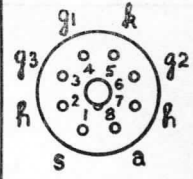


FERRANTI

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.



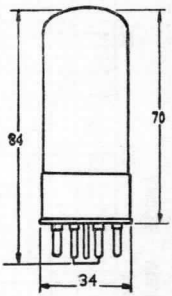
Base Connections
Underside View of Base

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.

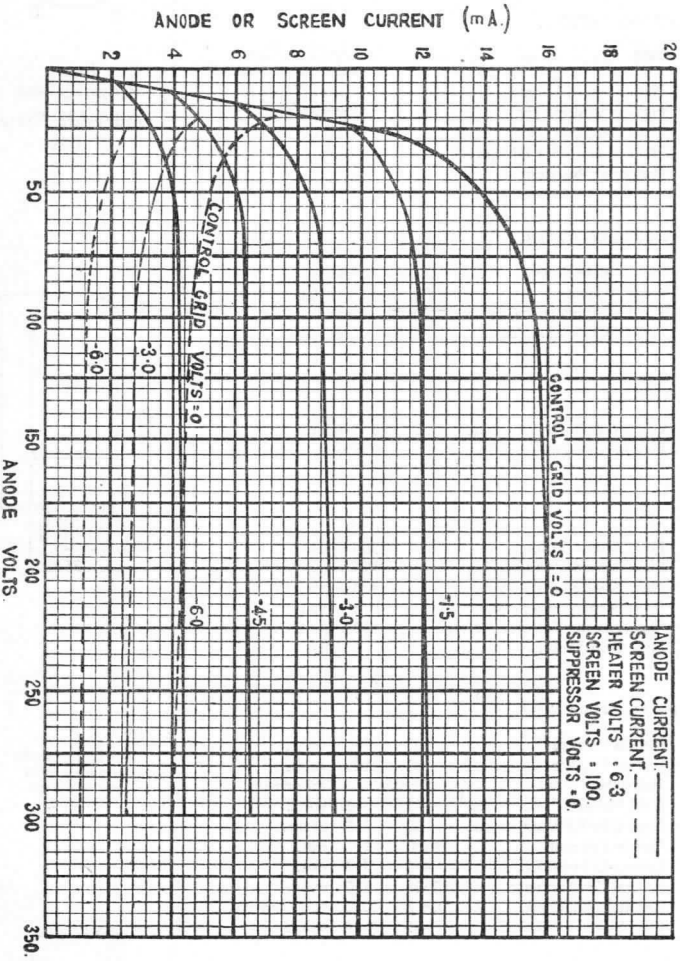
All Dimensions shown are in millimetres (Max.).

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
CONTROL GRID VOLTS = 0
-6·0
-3·0
-6·0
-4·5
-3·0
-1·5
ANODE CURRENT ——
SCREEN CURRENT - - - -
HEATER VOLTS = 6·3.
SCREEN VOLTS = 100.
SUPPRESSOR VOLTS = 0.

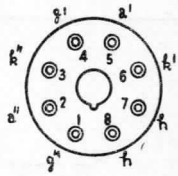
R0558

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 A1 Amplifier.

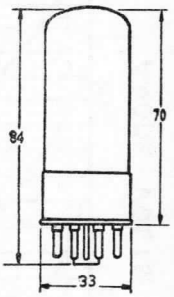
Anode Voltage	250 volts.
Grid Voltage	−2 volts.
Anode Current	2·3 mA.
Amplification Factor	70
Anode Impedance	44000 ohms.
Mutual Conductance	1·6 mA/V.

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.



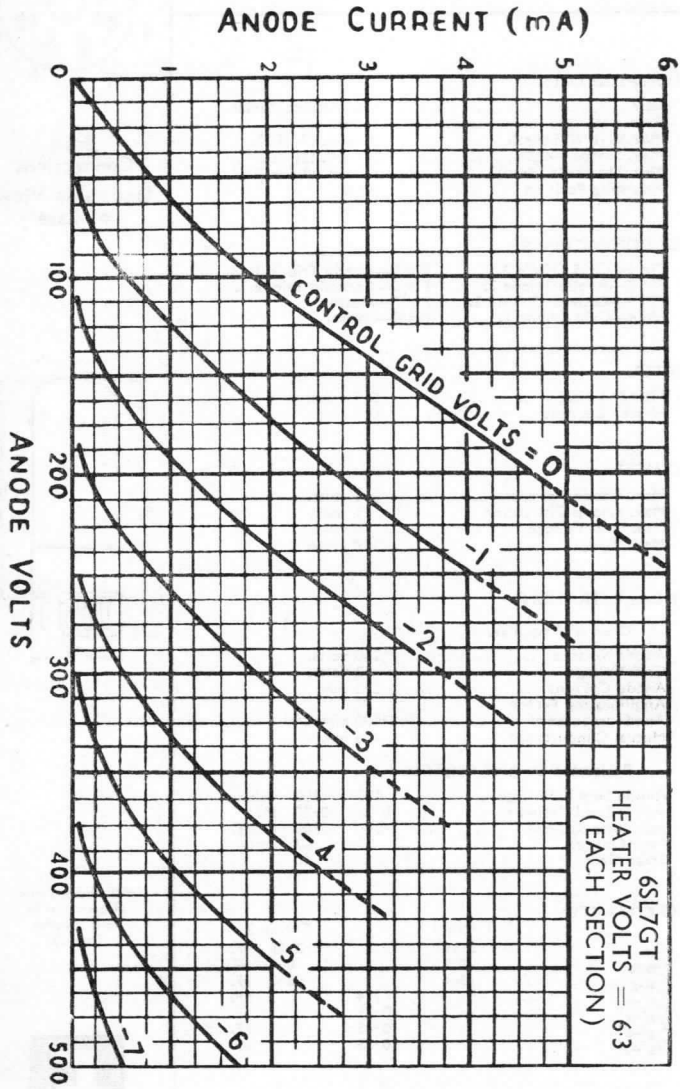
All dimensions shown are in millimetres (max.).

*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)

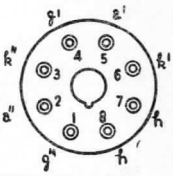
R0359

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.

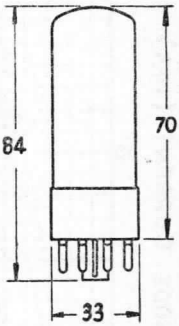
Pin 1—Grid Triode 2.	Pin 5—Anode Triode 1.
Pin 2—Anode Triode 2.	Pin 6—Cathode Triode 1.
Pin 3—Cathode Triode 2.	Pin 7—Heater.
Pin 4—Grid Triode 1.	Pin 8—Heater.

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.



Dimensions shown are in millimetres (max.).

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†

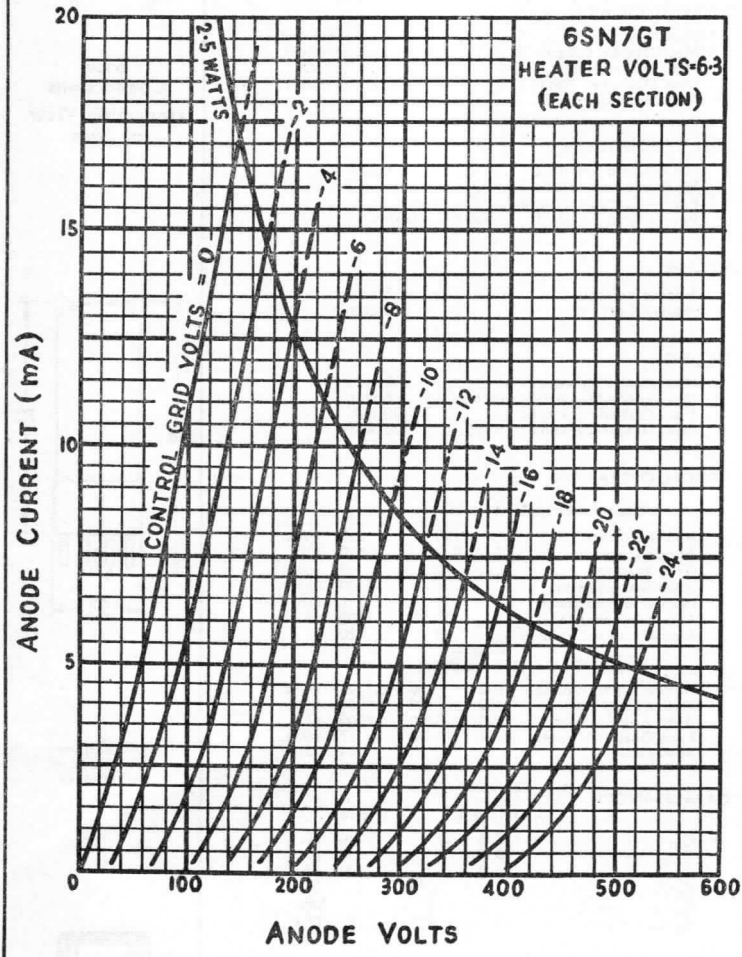
	Triode 1.		Triode 2.	
C_{in}	2·6		2·6	pF.
C_{out}	0·8		0·8	pF.
C_{a-g}	4·0		4·1	pF.
$C_{a'-a''}$		0·5		pF.
$C_{g'-g''}$		0·1		pF.
$C_{g'-a''} = C_{g''-a'}$ ...		0·2		pF.

*Each section.

†Without external shield.

Issue 1.
Feb., 1954

6SN7GT

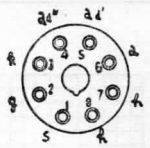

6SN7GT
HEATER VOLTS-6·3
(EACH SECTION)
2·5 WATTS
CONTROL GRID VOLTS = 0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
ANODE CURRENT (mA)
0
5
10
15
20
0
100
200
300
400
500
600
ANODE VOLTS

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. ($3\frac{5}{16}$in.).
Max. Seated Height	... ...	70 mm. ($2\frac{3}{4}$in.).
Max. Diameter	... ...	34 mm. ($1\frac{5}{16}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

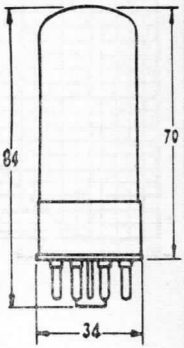
Pin 1—Base Sleeve.
Pin 2—Triode Grid.
Pin 3—Cathode.
Pin 4—Diode Anode 2.
Pin 5—Diode Anode 1.
Pin 6—Triode Anode.
Pin 7—Heater.
Pin 8—Heater.

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.

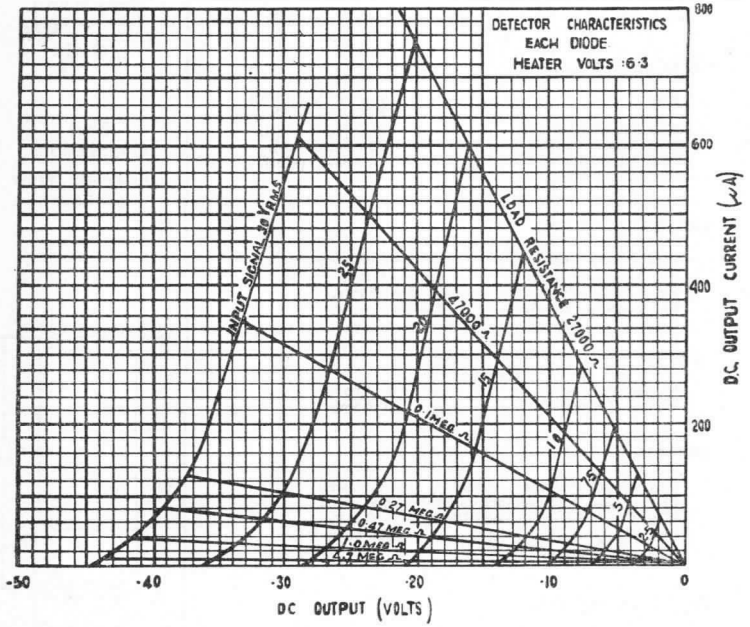
C_{in}	3·0 pF.
C_{out}	2·4 pF.
$C_{a_t-g_t}$	1·6 pF.
$C_{a_d'-g_t}$	0·01 pF.
$C_{a_d''-g_t}$	0·04 pF.

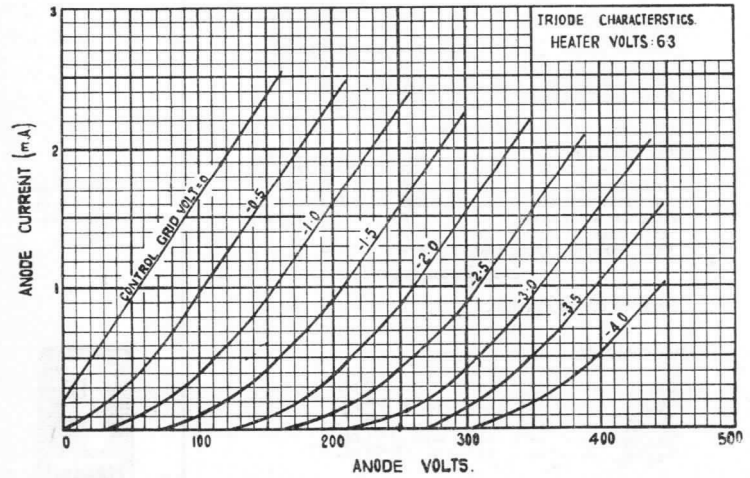
All dimensions shown are in millimetres (max.)

Issue 3
Oct., 1952

6SQ7GT

FERRANTI





FERRANTI

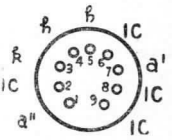
FULL WAVE RECTIFIER

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

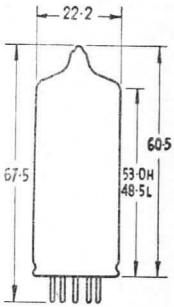
Underside View of Base

BASE CONNECTIONS.

Pin 1—Anode 2.	Pin 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.

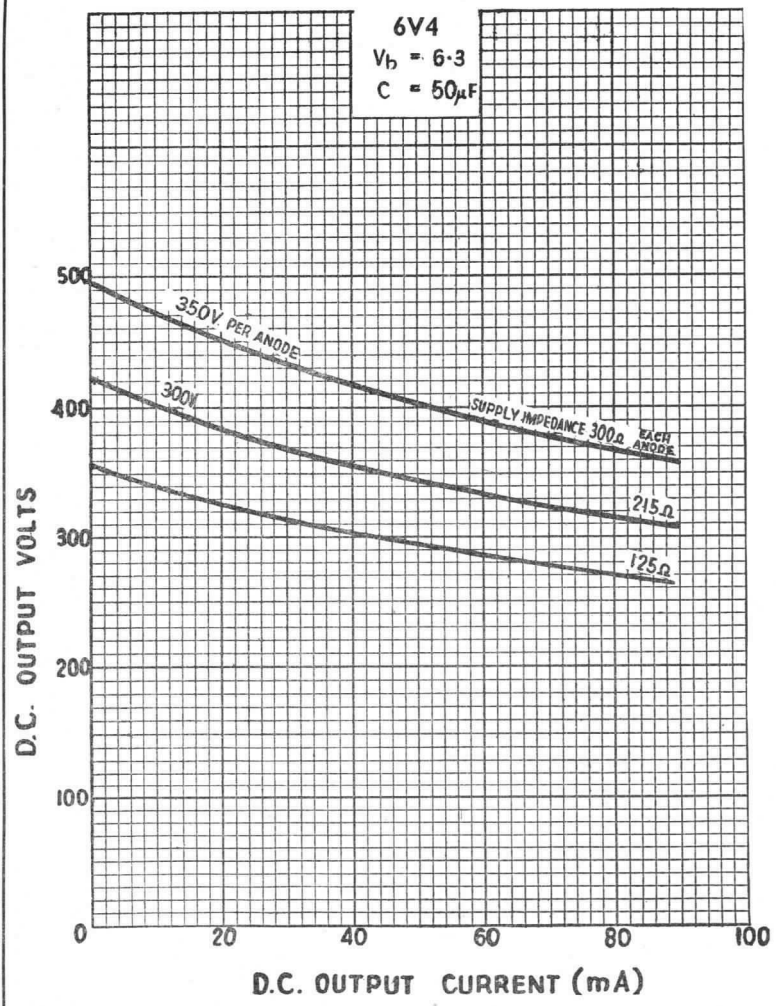
*R.M.S. Input Voltage	250	275	300	350	volts.
Rectified Current	90	90	90	90	mA.
*Min. Supply Impedance	125	175	215	300	ohms.
Max. Reservoir Capacitor	50	50	50	50	μF.
DC. Output Voltage	265	285	310	360	volts.

All dimensions shown are in millimetres.

*Each Anode.

Issue 2
(Tentative)
Dec., 1957

FERRANTI


6V4
Vb = 6·3
C = 50μF
350V PER ANODE
300V
SUPPLY IMPEDANCE 300Ω EACH ANODE
215Ω
125Ω
D.C. OUTPUT VOLTS
500
400
300
200
100
0
20
40
60
80
100
D.C. OUTPUT CURRENT (mA)

R0559

FERRANTI

OUTPUT BEAM TETRODES

6V6 G

6V6 GT

Indirectly heated beam tetrodes designed for use in the output stages of radio receivers and audio amplifiers.

PHYSICAL DETAILS.

	6V6G.	6V6GT.
Base	International Octal.	International Octal.
Max. Overall Length	119 mm. (4 11/16 in.).	84 mm. (3 5/16 in.).
Max. Seated Height	104 mm. (4 3/32 in.).	70 mm. (2 3/4 in.).
Max. Diameter (Bulb)	45 mm. (1 25/32 in.).	33 mm. (1 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 %

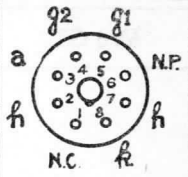
2 Valves Push Pull Class AB_1 Amplifier.

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 %

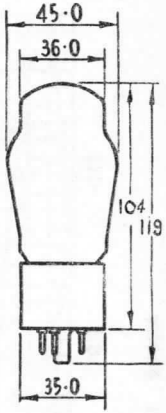
CAPACITANCES (approx.)*

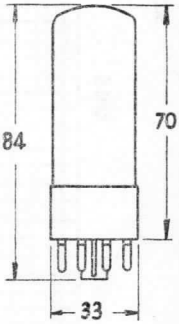
	6V6G	6V6GT
C_{in}	10·0	9·5 pF.
C_{out}	8·0	9·1 pF.
C_{a-g}	1·0	1·0 pF.
C_{h-k}	6·0	6·0 pF.

*Measured without external shield.



Base Connections Underside View of Base





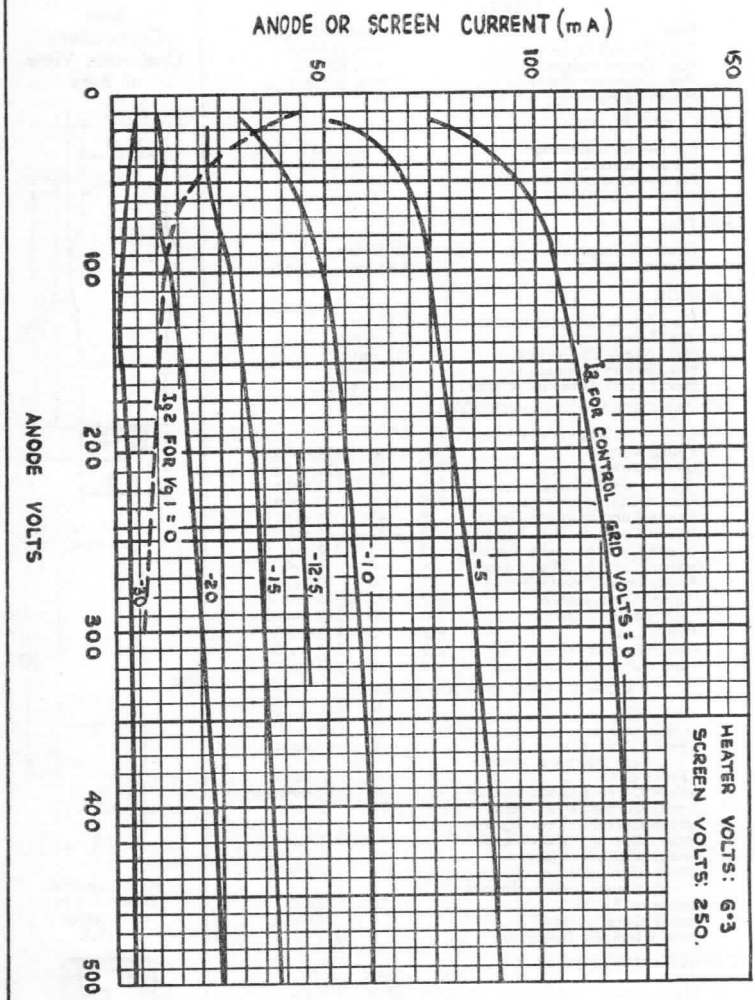
All dimensions shown are in millimetres (max.).

FERRANTI

Issue 5
Dec., 1955

6V6 G

6V6 GT

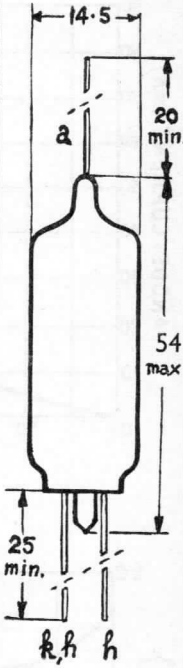

ANODE OR SCREEN CURRENT (mA)
0
50
100
150
ANODE VOLTS
100
200
300
400
500
Ig2 FOR Vg1 = 0
-20
-15
-12·5
-10
-5
Ia FOR CONTROL GRID VOLTS = 0
HEATER VOLTS: 6·3
SCREEN VOLTS: 250.

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.

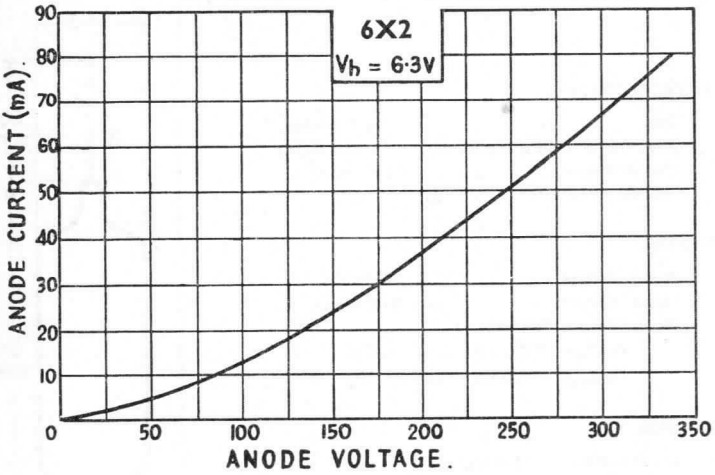
C_{a-k}	0·8 pF.

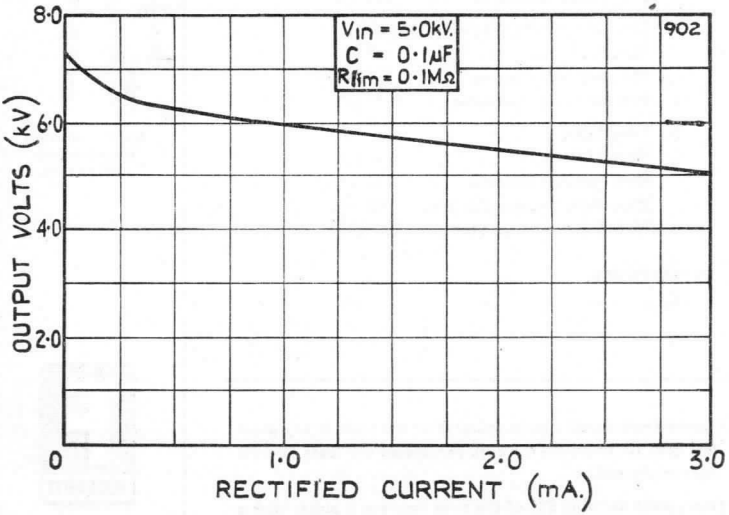
*Connections should not be soldered to the leads at any point less than 10 mm. from the seal, nor should the leads be bent near to the seal.

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

Issue 2
Mar., 1959

TYPICAL CHARACTERISTICS



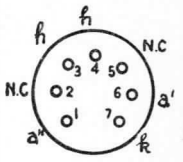


FERRANTI

FULL WAVE RECTIFIER

6X4

A miniature indirectly heated, full wave rectifier.



Base Connections

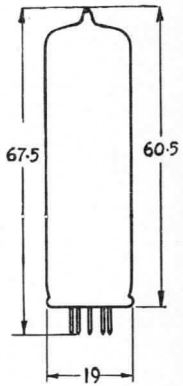
Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Bulb	Clear.
Max. Overall Length	67·5 mm. ($2\frac{21}{32}$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.

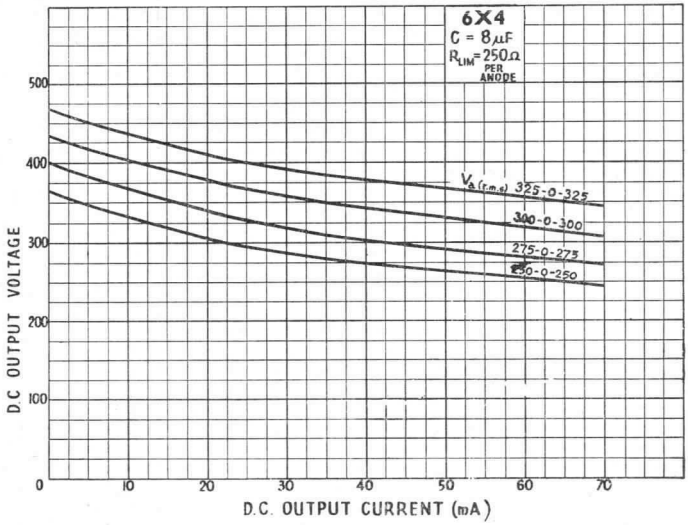
CHOKE INPUT.

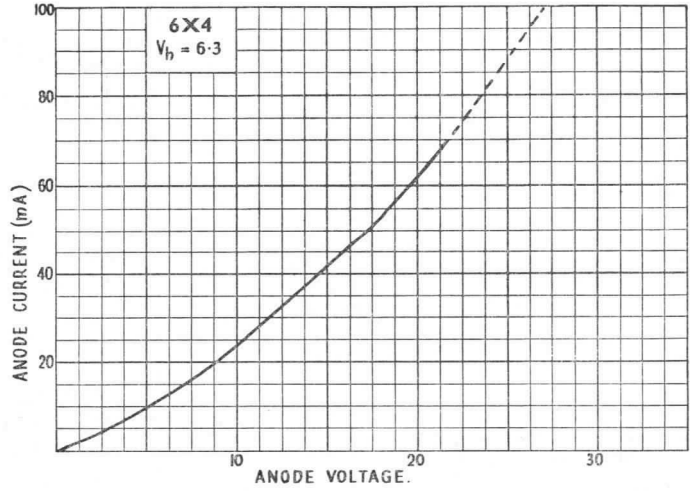
*Input Voltage	450 volts (r.m.s.).
Min. Choke Inductance	10 henries.
Rectified Current	70 mA.
Output Voltage	370 volts.

All dimensions shown are in millimetres (max.).

*Each Anode.

Issue 2
Dec.,1957


6X4
C = 8 μF
R_{LIM} = 250 Ω PER ANODE
$V_{a(r.m.s)}$ 325-0-325
300-0-300
275-0-275
250-0-250
D.C OUTPUT VOLTAGE
500
400
300
200
100
0
10
20
30
40
50
60
70
D.C. OUTPUT CURRENT (mA)

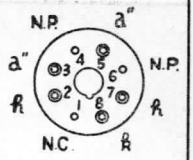

6X4
V_h = 6·3
ANODE CURRENT (mA)
100
80
60
40
20
10
20
30
ANODE VOLTAGE.

FERRANTI

FULL WAVE RECTIFIER

6X5GT

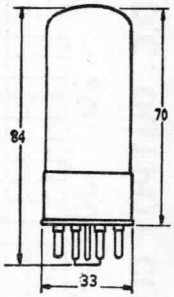
An indirectly heated, high vacuum, full wave rectifier. The cathode is connected to a separate pin.



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.

All Dimensions shown are in millimetres (max.).

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.

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.

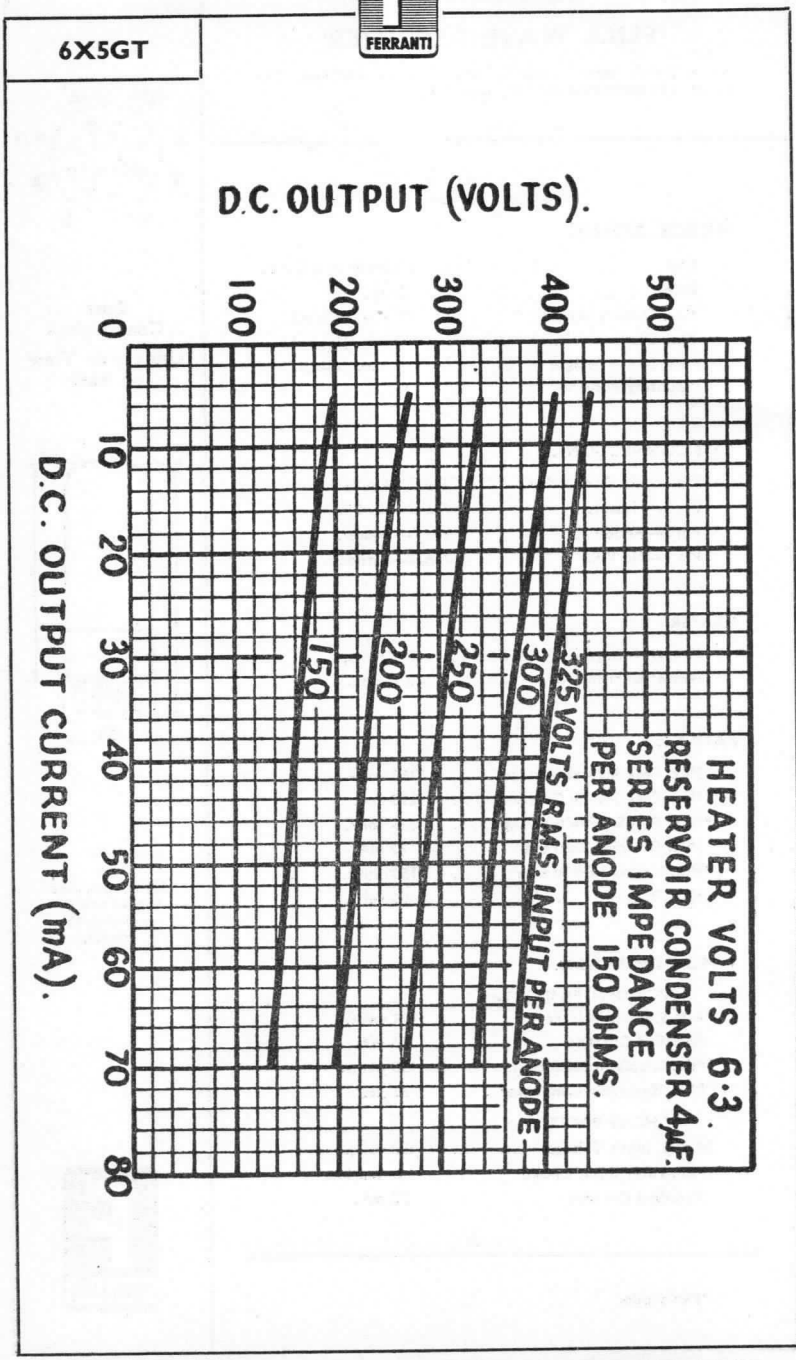
CHOKE INPUT.

*R.M.S. Input Voltage	... ...	450 volts.
Min. Filter Input Choke	...	8 henries.
Rectified Current	... ...	70 mA.

*Per anode.

Issue 2
Sept., 1953

6X5GT

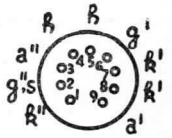

D.C. OUTPUT (VOLTS).
0
100
200
300
400
500
D.C. OUTPUT CURRENT (mA).
0
10
20
30
40
50
60
70
80
HEATER VOLTS 6·3.
RESERVOIR CONDENSER 4μF.
SERIES IMPEDANCE
PER ANODE 150 OHMS.
325 VOLTS R.M.S. INPUT PER ANODE
300
250
200
150

FERRANTI

DOUBLE TRIODE

7AN7

A double triode with separate cathodes, primarily designed for use as a cascade 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 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.†

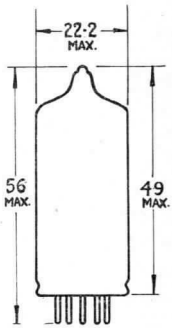
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	180 volts.
Max. Anode Dissipation ...	2 watts.
Max. Cathode Current ...	18 mA.
Max. Neg. Grid Voltage ...	50 volts.
Max. $V_{h-k'}$	90 volts.
Max. $V_{h-k''}$ (heater positive)	90 volts.
**Max. $V_{h-k''}$ (pk) (heater negative)	250 volts.
Max.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

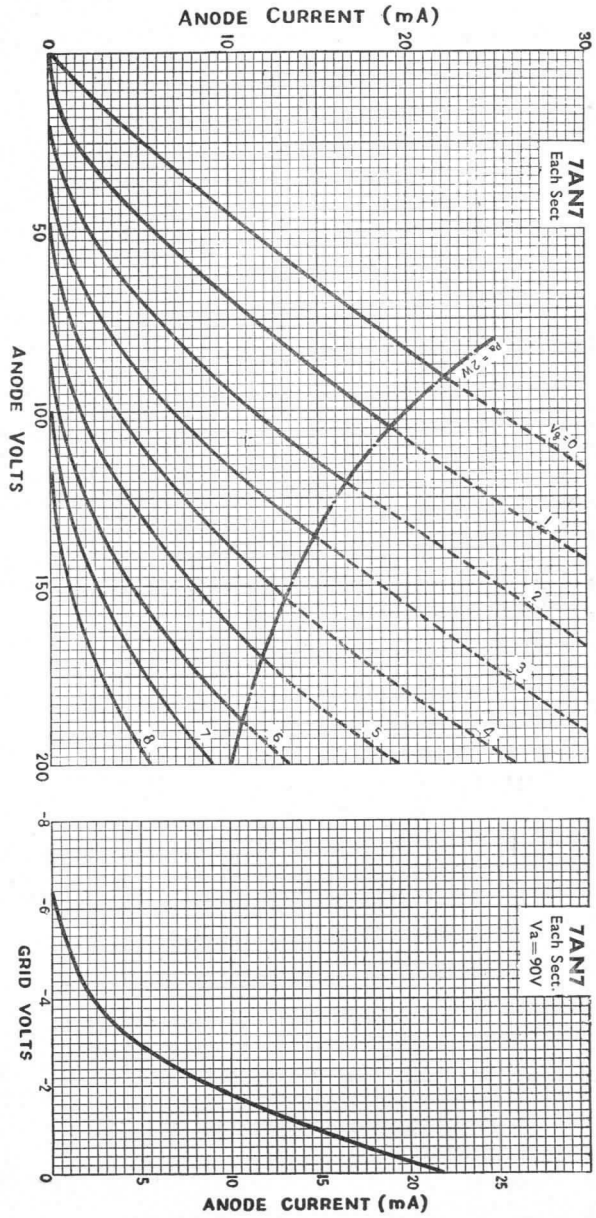


All dimensions shown are in millimetres (max.).

*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.

Issue 2
Dec., 1957

7AN7

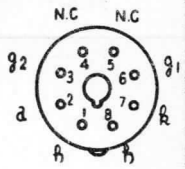

ANODE CURRENT (mA)
0
10
20
30
50
100
150
200
ANODE VOLTS
7AN7
Each Sect
Pa = 2W
Vg = 0
1
2
3
4
5
6
7
8
-8
-6
-4
-2
0
5
10
15
20
25
GRID VOLTS
7AN7
Each Sect.
Va = 90V
ANODE CURRENT (mA)

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.

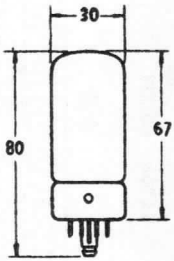
Anode Voltage	250	315	volts.
Screen Voltage	250	225	volts.
Control Grid Voltage	−12·5	−13	volts.
Anode Current (Zero Signal) ...	45	34	mA.
Anode Current (Max. Signal) ...	47	35	mA.
Screen Current (Zero Signal)	4·5	2·2	mA.
Screen Current (Max. Signal) ...	7·0	6·0	mA.
Anode Impedance (approx.) ...	52000	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.

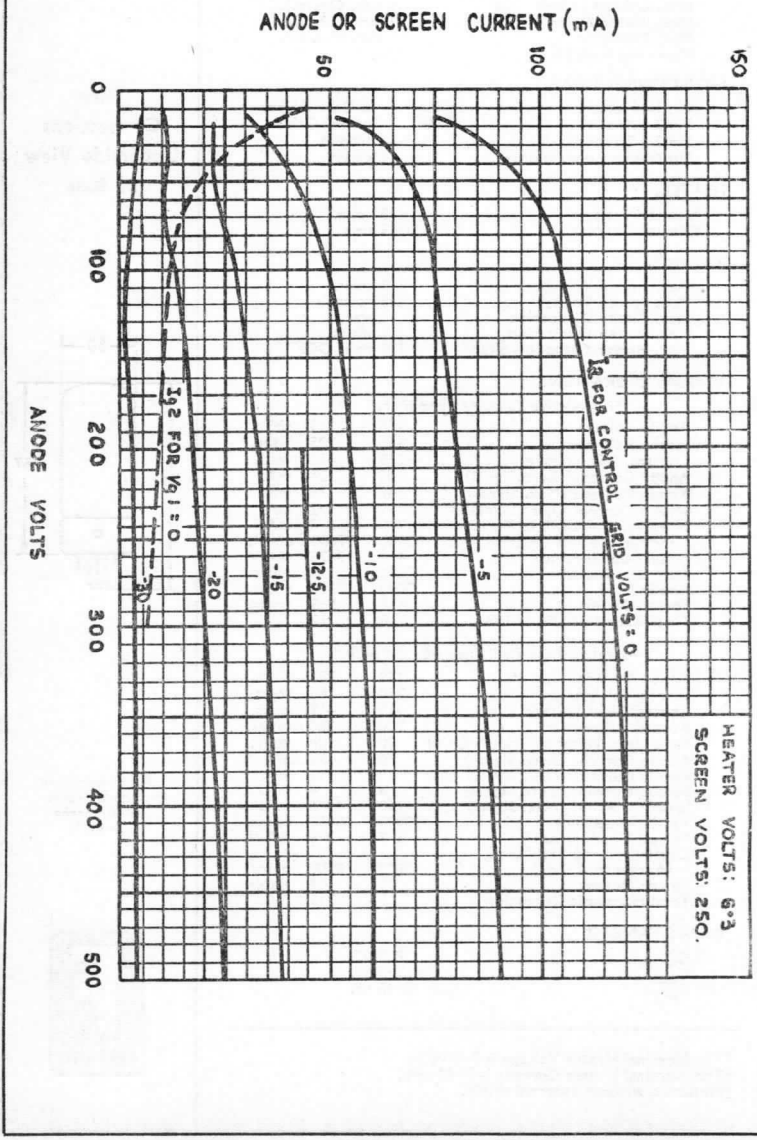


All dimensions shown are in millimetres (max.).

*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
0
100
200
300
400
500
I_{g2} FOR V_{g1} = 0
I_a FOR CONTROL GRID VOLTS = 0
-5
-10
-12·5
-15
-20
-30
HEATER VOLTS: 6·3
SCREEN VOLTS: 250.

FERRANTI

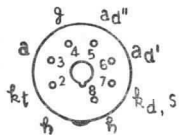
DOUBLE DIODE TRIODE

7K7

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. ($2\frac{23}{32}$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 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.

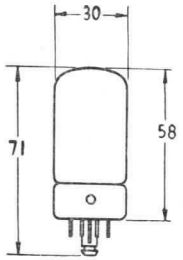
TRIODE SECTION.

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



All dimensions shown are in millimetres. (max.)

DIODE SECTION.

Refer to curves for type 6SQ7GT.

CAPACITANCES.

(With close fitting shield connected to Cathode).

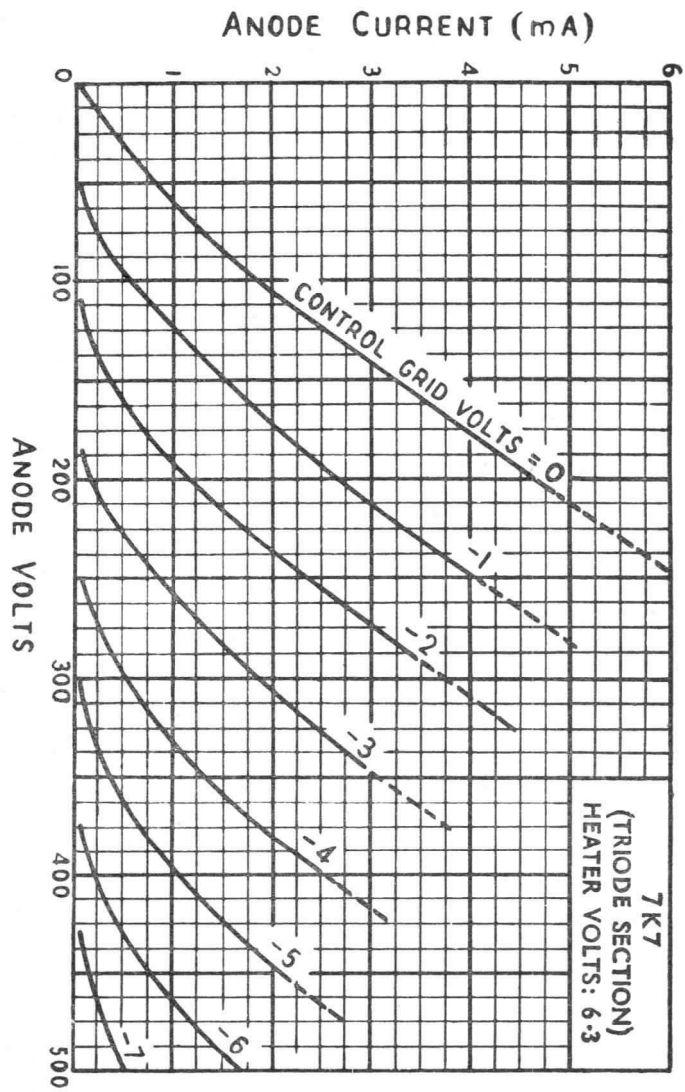
C_{in}	2·4 pF.
C_{out}	2·0 pF.
C_{a-g}	1·7 pF.
$C_{g-a_{d'}}$, $C_{g-a_{d''}}$	0·25 pF. max.

* The Nominal Heater Voltage is 7·0 volts.

† The Nominal Heater Current is 0·32 amps.

Issue 2.
Jan., 1955

7K7


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
7K7
(TRIODE SECTION)
HEATER VOLTS: 6·3

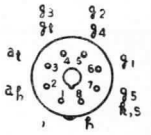
R.857

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.

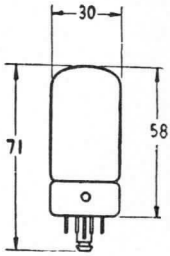
Base	B8G—Loctal.
Max. Overall Length	71 mm. ($2\frac{23}{32}$in.).
Max. Seated Height	58 mm. ($2\frac{9}{32}$in.).
Max. Diameter	30 mm. ($1\frac{5}{16}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 5—Heptode Grids g_2 and g_4.
Pin 2—Heptode Anode.	Pin 6—Heptode Grid g_1.
Pin 3—Triode Anode.	Pin 7—Cathode, Internal Shield.
Pin 4—Triode Grid, and Heptode Grid g_3.	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.

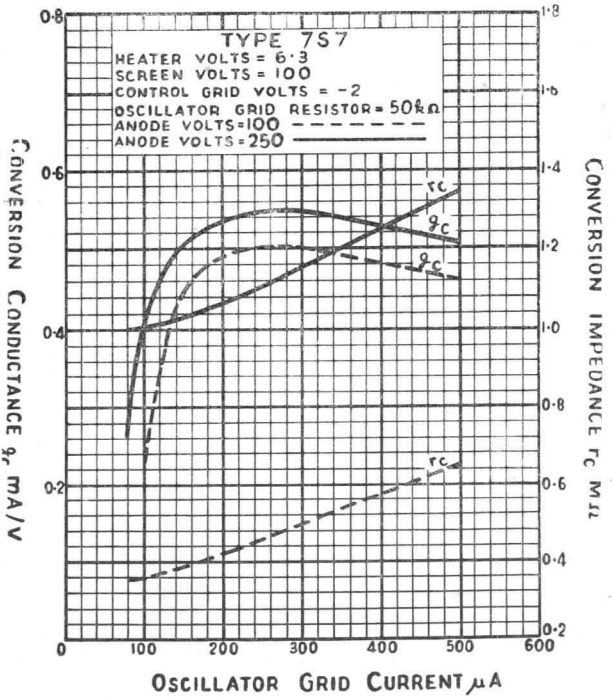
Issue 1
Dec., 1955

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.).

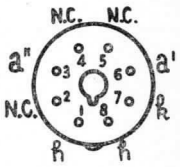
**With close fitting external shield connected to Cathode.



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.

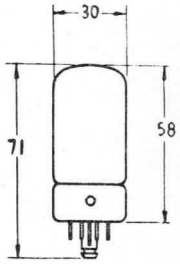
Base	B8G—Loctal.
Bulb	Clear.
Max. Overall Length	71 mm. ($2\frac{25}{32}$in.).
Max. Seated Height	58 mm. ($2\frac{9}{32}$in.).
Max. Diameter	30 mm. ($1\frac{3}{16}$in.).
Mounting Position	Any.

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.

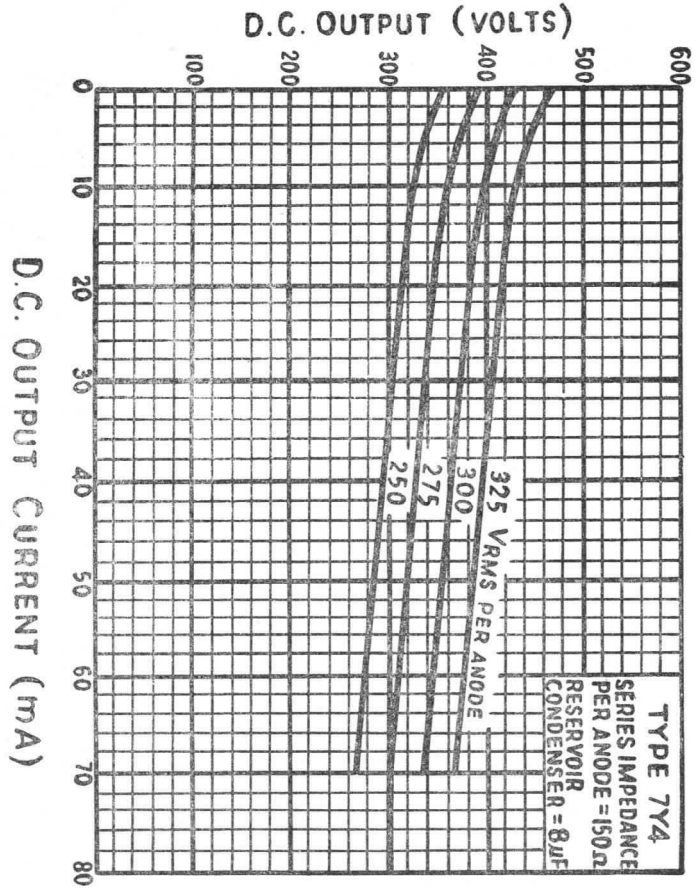
§R.M.S. Input Voltage	450 volts.
Rectified Current	70 mA.
Min. Input Choke Inductance ...	10 henries.

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

7Y4

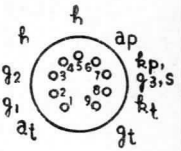

D.C. OUTPUT (VOLTS)
100
200
300
400
500
600
0
10
20
30
40
50
60
70
80
D.C. OUTPUT CURRENT (mA)
325 VRMS PER ANODE
300
275
250
TYPE 7Y4
SERIES IMPEDANCE PER ANODE = 150Ω
RESERVOIR CONDENSER = 8μF

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.

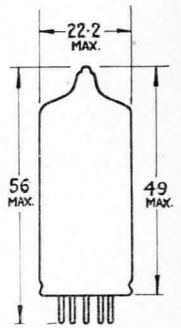
Max. Anode Supply Voltage ...	550 volts.
Max. Anode Voltage	250 volts.
Max. Screen Voltage	175 volts.*
Max. Anode Dissipation ...	1.7 watts.
Max. Screen Dissipation ...	0.5 watts.†
Max. Cathode Current ...	17 mA.
**Min. Negative Grid Voltage ...	1.3 volts.
Max. V_{h-k} (heater positive) ...	100 volts.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

FERRANTI

TYPICAL OPERATION (as Frequency Changer)*

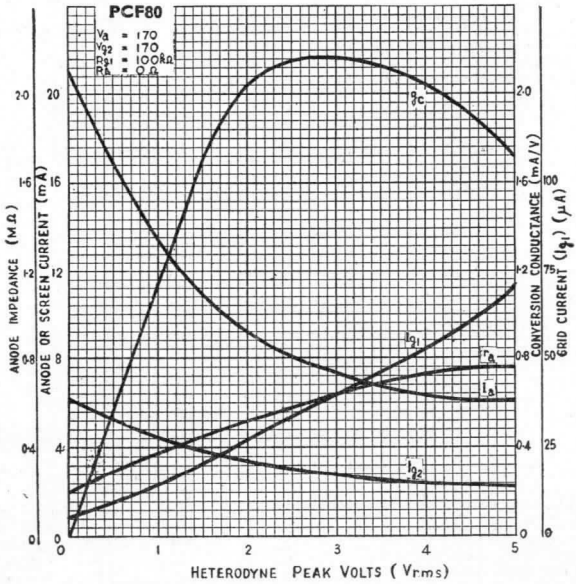
Anode Voltage	Va	170	170	volts.
Screen Voltage ...	V_{g2}	170	170	volts.
Grid Resistor	R_{g1}	0·1	0·1	MΩ
Auto Bias Resistor ...	Rk	820	0	ohms.
Anode Current ...	Ia	5·2	6·3	mA.
Screen Current ...	I_{g2}	1·5	2·5	mA.
Oscillator Voltage ...	Vosc.	3·5	4·0	volts (r.m.s.)
Conversion Conductance	gc	2·1	2·05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

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.

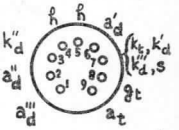
Triode as AF Amplifier with grid current bias.

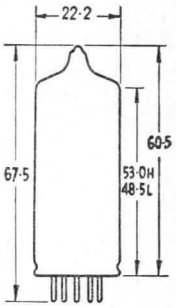
Anode Supply Voltage	170	200	250	250	volts.
Anode Load Resistor ...	220	220	100	220	kΩ
Grid Resistor (R_{g-k})	10	10	10	10	MΩ
Cathode Resistor (R_k)	0	0	0	0	
Anode Current ...	0·46	0·56	1·4	·76	mA.
Stage Gain	51	53	47	54	
Total Distortion (for V_{out} = 3v r.m.s.)	0·4	0·3	0·25	0·2	%
Total Distortion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

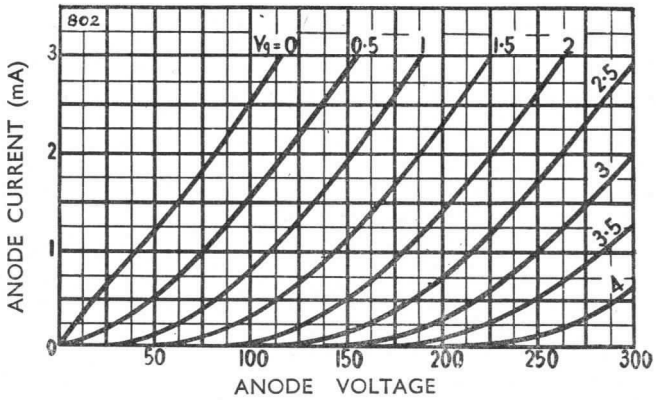
FERRANTI

CAPACITANCES. TRIODE SECTION.

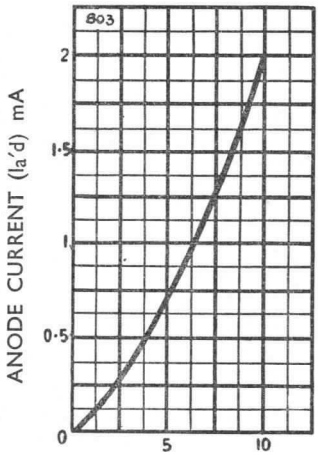
C_{in}	... ...	1.9 pF.
C_{out}	... ...	1.4 pF.
C_{a-g}	... ...	2.0 pF.
C_{g-h}	... ...	<0.04 pF.

DIODE SECTION.

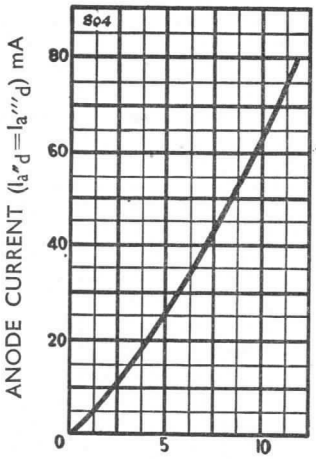
$C_{a'd-(h+kt,\ k'd,\ k'''d,\ s)}$	...	0.8 pF.
$C_{a''d-(h+k''d+kt,\ k'd,\ k'''d,\ s)}$		4.8 pF.
$C_{a'''d-(h+kt,\ k'd,\ k''d,\ s)}$	...	4.8 pF.
$C_{k''d-all}$	...	5.0 pF.
$C_{a'd-h}$	...	<0.25 pF.
$C_{a'''d-h}$	...	<0.2 pF.
$C_{k''d-h}$	...	2.5 pF.



DIODE I



DIODE II - DIODE III

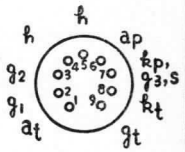


FERRANTI

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.

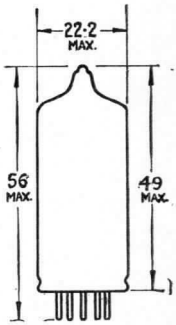
Base	B9A—Noval.
Max. Overall Length	56 mm. ($2\frac{7}{32}$in.).
Max. Seated Height	49 mm. ($1\frac{15}{16}$in.).
Max. Diameter	22.2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.

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_{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	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_{g1} for cut-off ...	–10	– volts.

All dimensions shown are in millimetres.

FERRANTI

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	g_n	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	g_c	1·65	1·8	1·9	mA/V.

CAPACITANCES*

$C_{a_p-a_t}$	<0·07 pF.

Pentode Section.

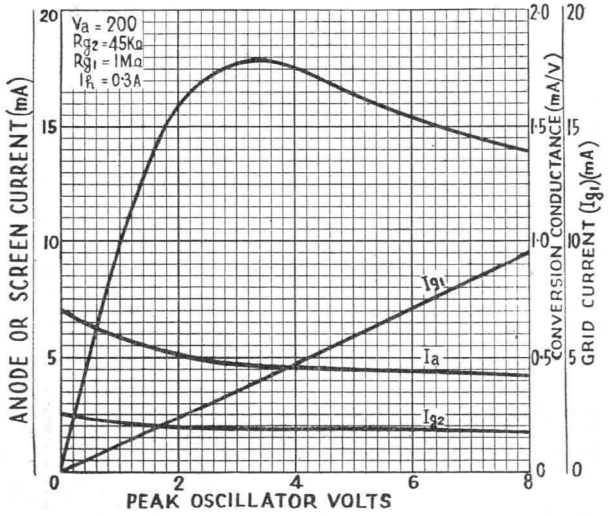
C_{in}	5·0 pF.
C_{out}	2·6 pF.
C_{a-g_1}	<0·01 pF.

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

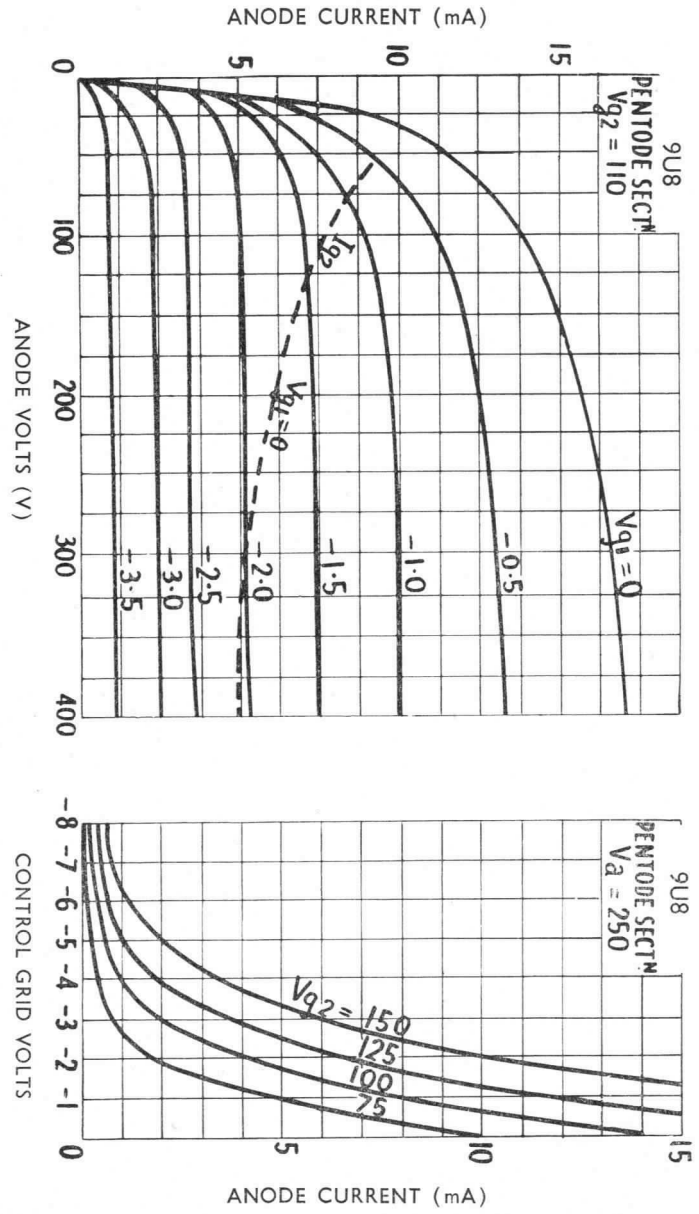


FERRANTI

9U8
TRIODE SECTN
IR = 0·3A
ANODE CURRENT (mA)
GRID VOLTS
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
10

9U8
TRIODE SECTN
IR = 0·3A
ANODE CURRENT (mA)
ANODE VOLTS
35
30
25
20
15
10
5
0
100
200
300
400
500
Vg = +2V
0V
-2V
-4V
-6V
-8V
-10V
-12V
-14V
-16V
-18V

FERRANTI



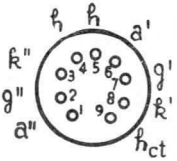
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

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.

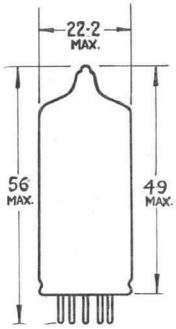
HEATER.

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.

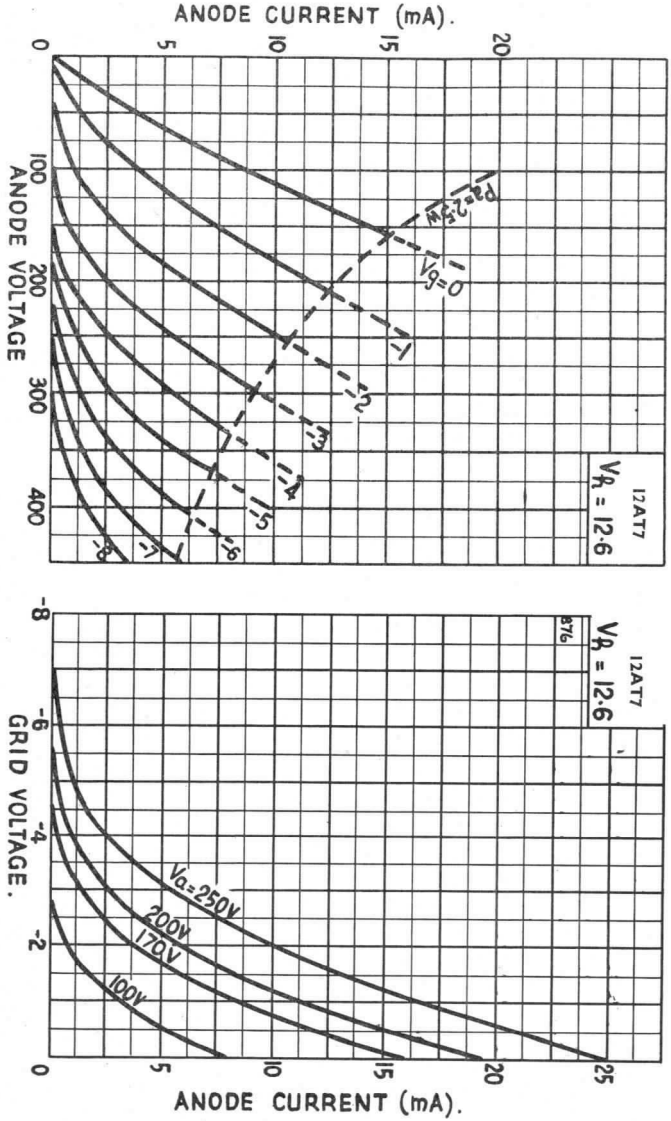
All dimensions shown are in millimetres (max.).

*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

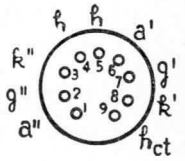
HIGH IMPEDANCE DOUBLE TRIODE

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.

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 Underside View of Base

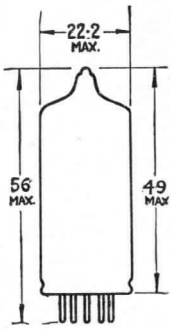
BASE CONNECTIONS.

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.

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.

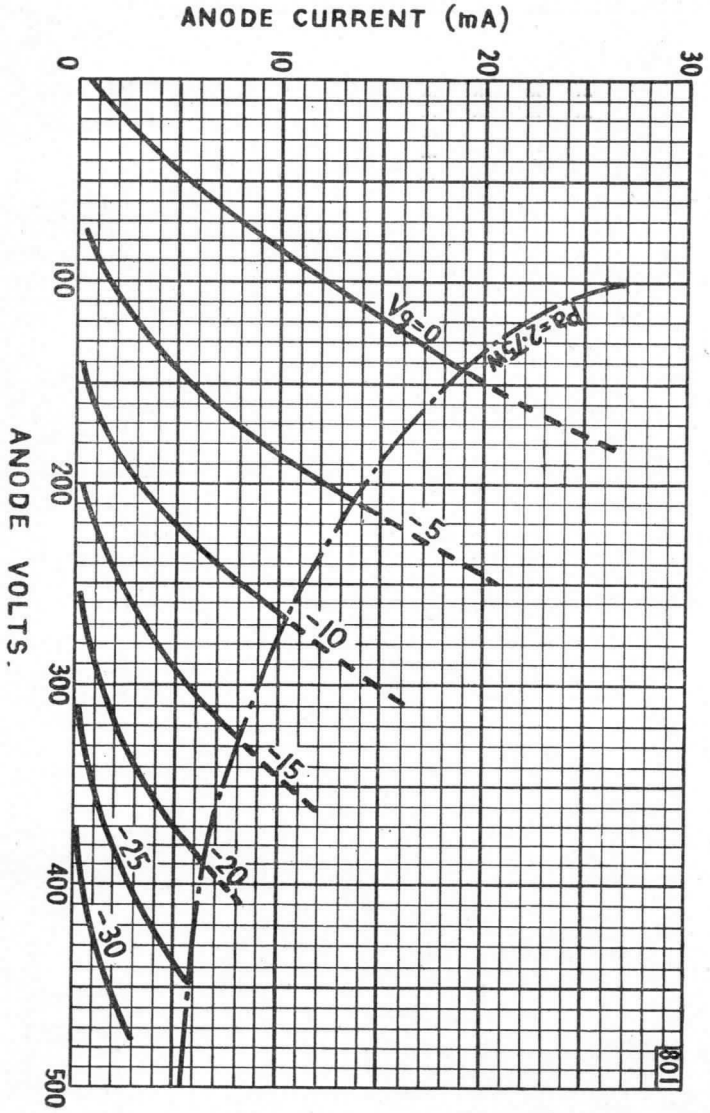
All dimensions shown are in millimetres (max.).

*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

FERRANTI



FERRANTI

DOUBLE TRIODE

12AX7

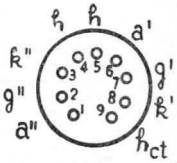
An indirectly heated high μ double triode with centre tapped heater. Except for the common heater each triode unit is independent of the other. It is suitable for use as a Resistance coupled A.F. amplifier or phase inverter.

PHYSICAL DETAILS.

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

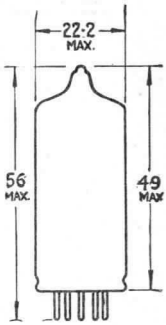
HEATER.

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
Aug., 1957

FERRANTI

TYPICAL OPERATION as Resistance Coupled A.F. Amplifier

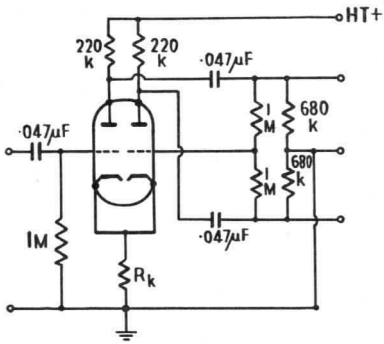
1. Cathode Bias.

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**

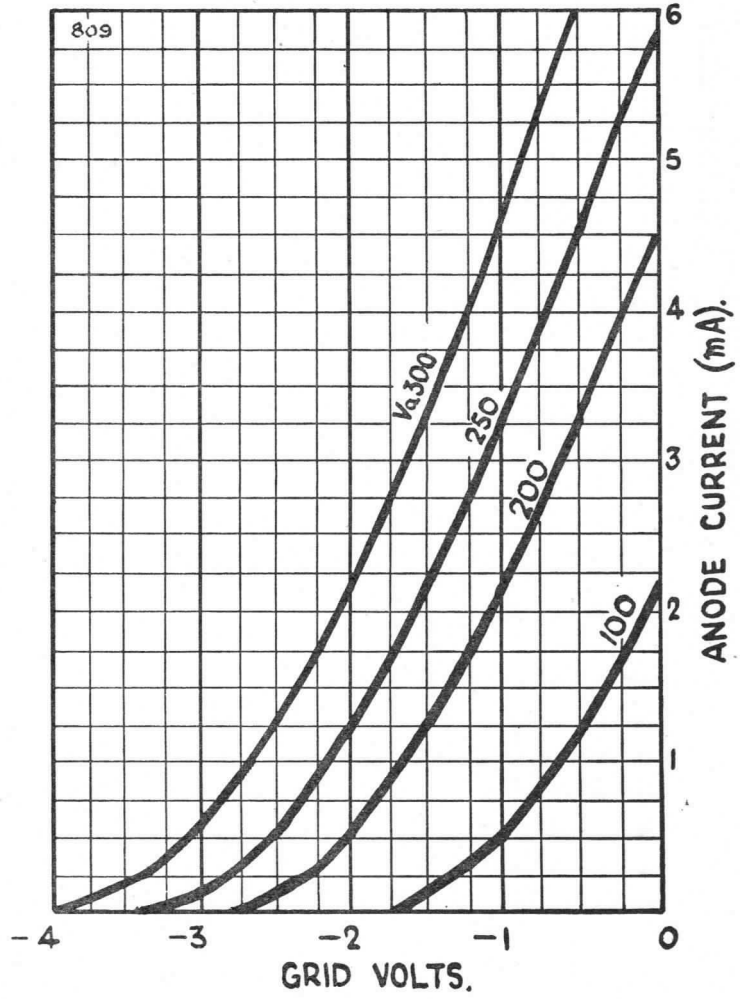
Anode Supply Voltage	200	250	250	300	300	350	350	400	volts.
Grid Resistance ...	10	10	10	10	10	10	10	10	MΩ
Anode Load Resistance	100	100	220	100	220	100	220	220	kΩ
Cathode Current ...	0·7	1·0	0·56	1·3	0·74	1·6	0·88	1·09	mA.
Grid Resistor of following valve ...	330	330	680	330	680	330	680	680	kΩ
Stage 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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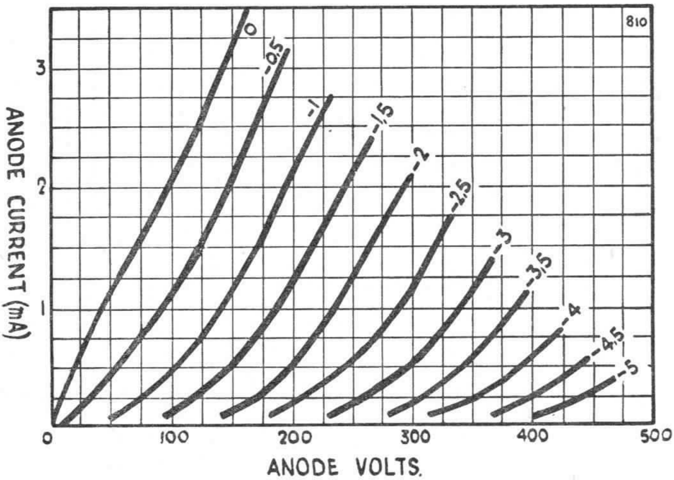
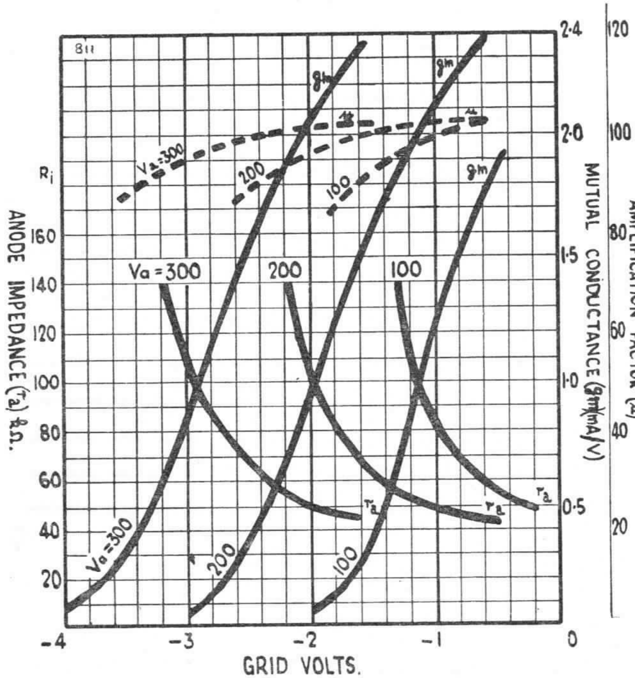

810
ANODE CURRENT (mA)
ANODE VOLTS.
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
0
100
200
300
400
500
1
2
3


811
GRID VOLTS.
ANODE IMPEDANCE (r_a) kΩ.
MUTUAL CONDUCTANCE (gm)(mA/V)
AMPLIFICATION FACTOR (μ)
Va=300
200
100
Va = 300
Va=300
gm
r_a
μ
Ri
-4
-3
-2
-1
0
20
40
60
80
100
120
140
160
0.5
1.0
1.5
2.0
2.4
20
40
60
80
100
120

FERRANTI

DOUBLE DIODE PENTODE

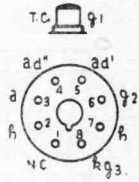
Type 12C8GT is an indirectly heated double diode pentode designed for use as detector, A.V.C. and L.F. amplifier in radio receivers.

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.

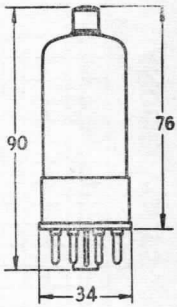
Supply Voltage	90		300	volts.
Anode Load Resistor ...	0·25		0·25	MΩ
Screen Feed Resistor ...	1·2		1·5	MΩ
Auto Bias Resistor ...	3500		1800	ohms.
Peak Output Voltage ...	33		95	volts.
Stage Gain	55		100	
Grid Resistor for following valve ...	0·5		1·0	MΩ

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.).

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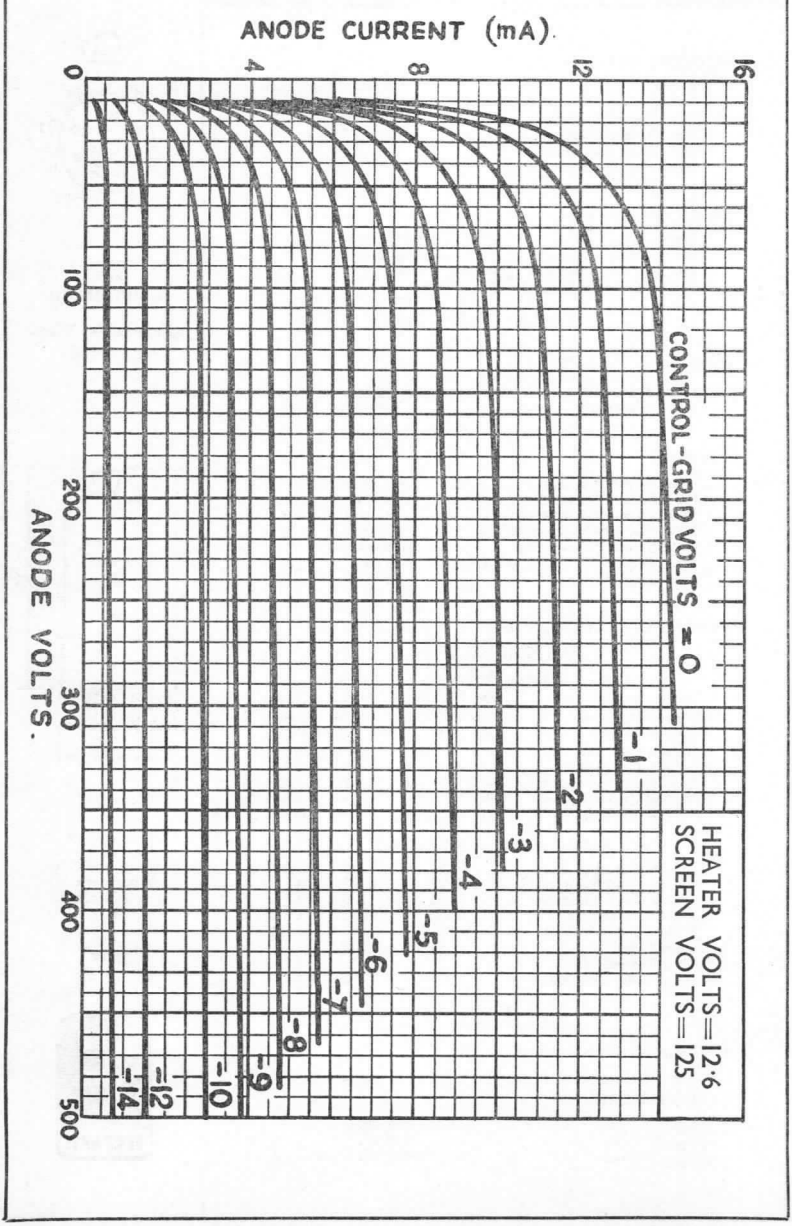
Issue 1
Feb.,1954

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

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

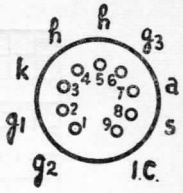
R0359

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.



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.

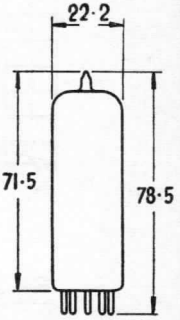
Pin 9—Internal Connection.

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 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.

Dimensions shown are in millimetres (max.).

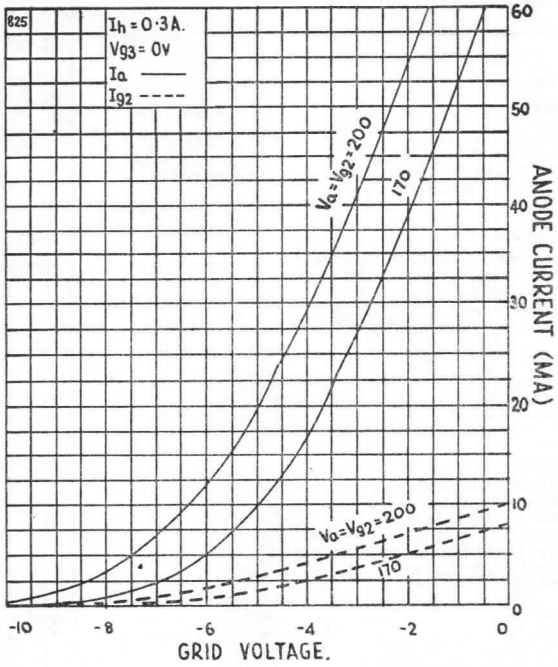
CAPACITANCES.

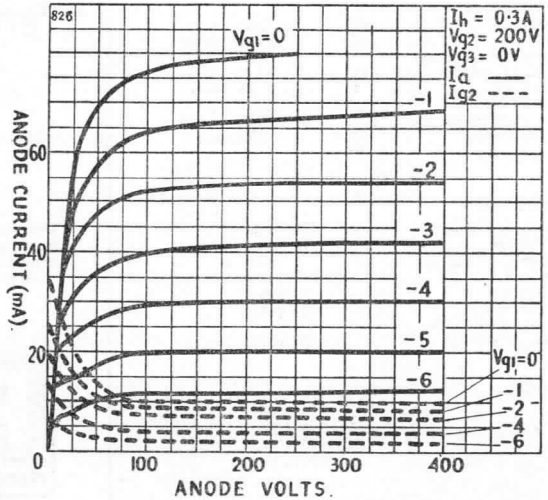
C_{in}	10·4 pF.
C_{out}	6·6 pF.
C_{a-g1}	<0·1 pF.
C_{g1-h}	<0·15 pF.

FERRANTI

Issue 1.
Mar.,1956

15A6





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

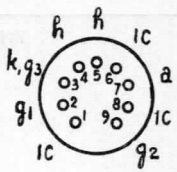
R0359

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

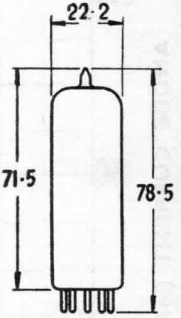
Anode Voltage	50	60	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage ...	−1	−1	volt.
Anode Current	140	175	mA.

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

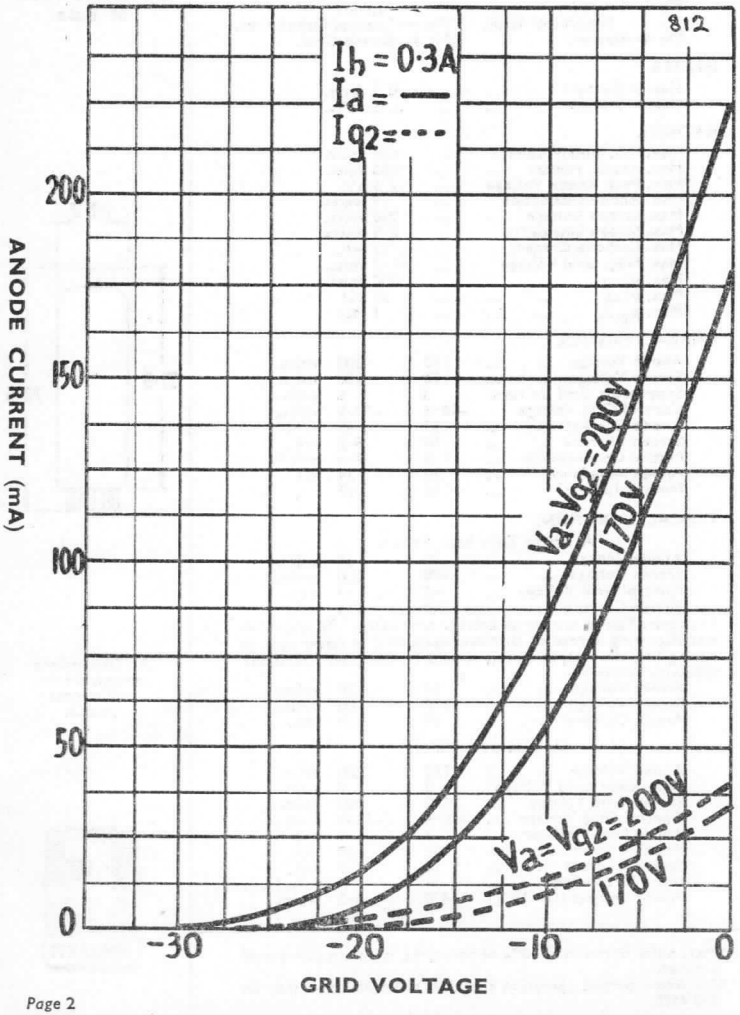
TYPICAL OPERATION (cont.)

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.



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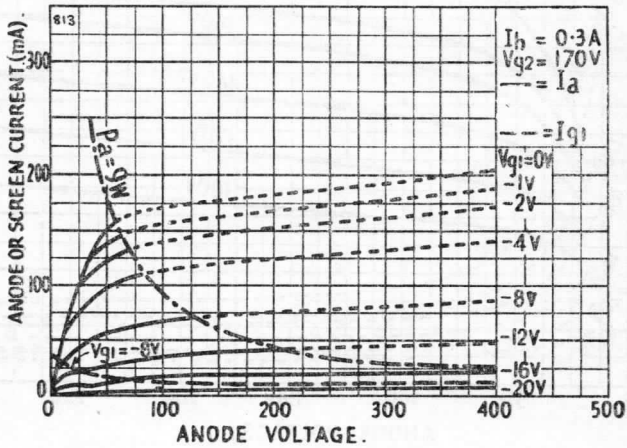
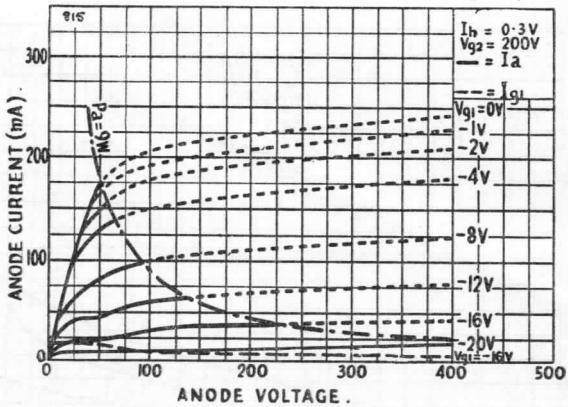
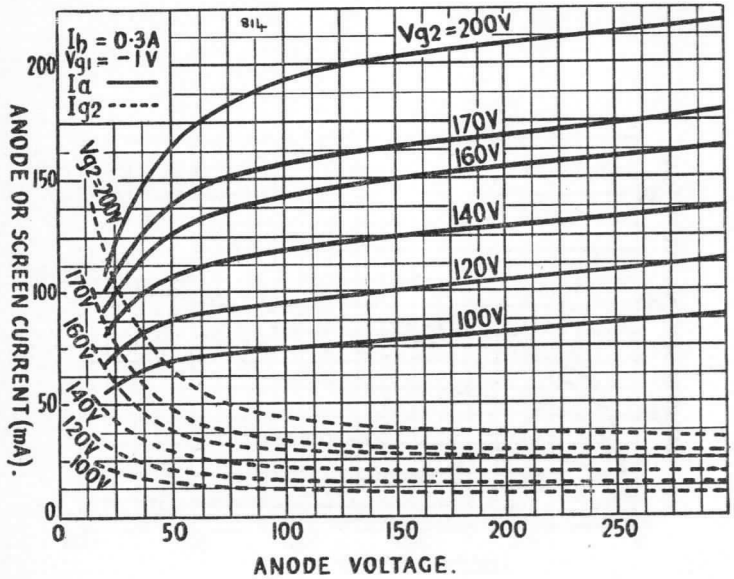
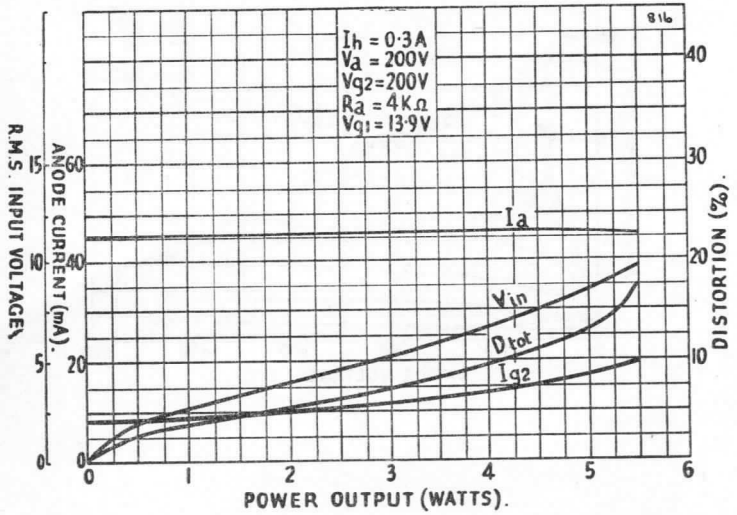

813
ANODE OR SCREEN CURRENT (mA).
300
200
100
0
Pa=9W
Vg1=-8V
Ih = 0·3A
Vg2= 170V
—— = Ia
– – – = Ig1
Vg1=0V
-1V
-2V
-4V
-8V
-12V
-16V
-20V
0
100
200
300
400
500
ANODE VOLTAGE.


815
ANODE CURRENT (mA).
300
200
100
0
Pa=9W
Ih = 0·3V
Vg2 = 200V
—— = Ia
– – – = Ig1
Vg1=0V
-1v
-2v
-4v
-8V
-12V
-16V
-20V
Vg1=-16V
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

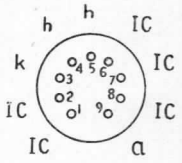
An indirectly heated half wave rectifier with a 0·3 amp. heater designed for series connected heater operation.

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.

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



Base Connections

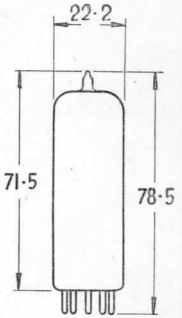
Underside View of Base

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.

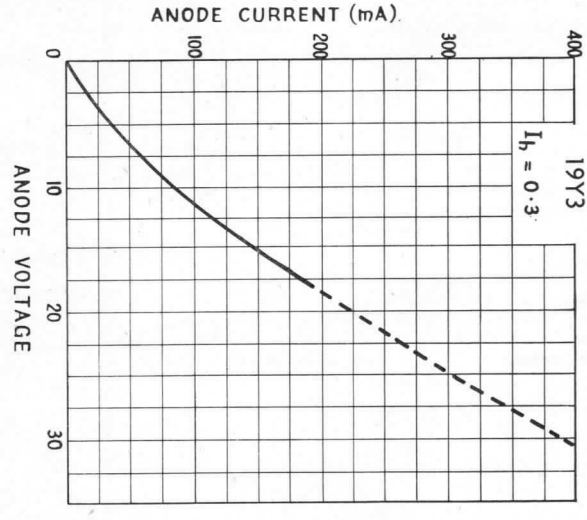
All dimensions shown are in millimetres.

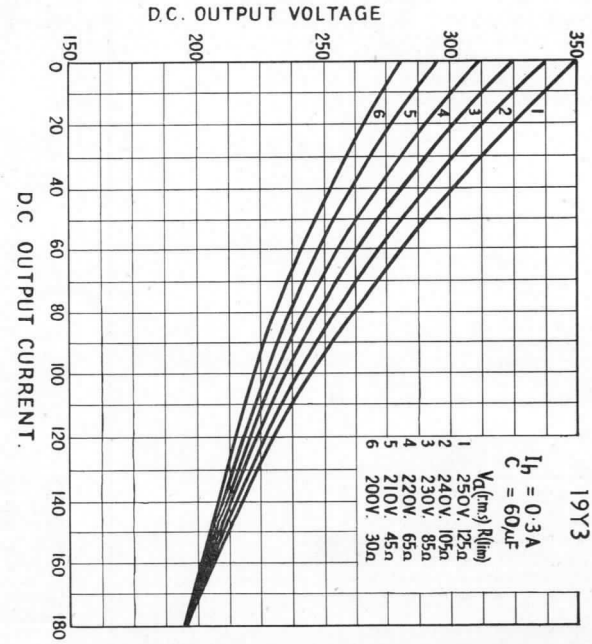
*Mains voltage of not more than 220 V. r.m.s., plus a maximum DC. component of 250 volts.

†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





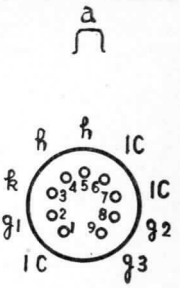
FERRANTI LIMITED, Electronics Dept., Gem Mill, Chadderton, Oldham, Lancs.

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.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	B9A—Noval.
Top Cap	CT1.
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.).
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.

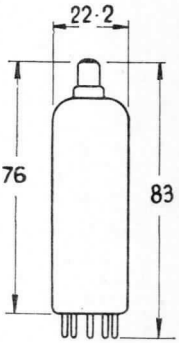
Anode Voltage	70	70	volts.
Screen Voltage	170	200	volts.
Control Grid Voltage	–1	–1	volt.
Anode Current	380	470	mA.

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 × 20	2 × 25	mA.
Anode Current (Max. signal)	2 × 73	2 × 87	mA.
Screen Current (Zero signal)	2 × 1·5	2 × 2	mA.
Screen Current (Max. signal)	2 × 10	2x12·5	mA.
Optimum Load (Anode to Anode)	2·5	2·5	kΩ



All Dimensions shown are in millimetres (max.).

*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

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Dec.,1955

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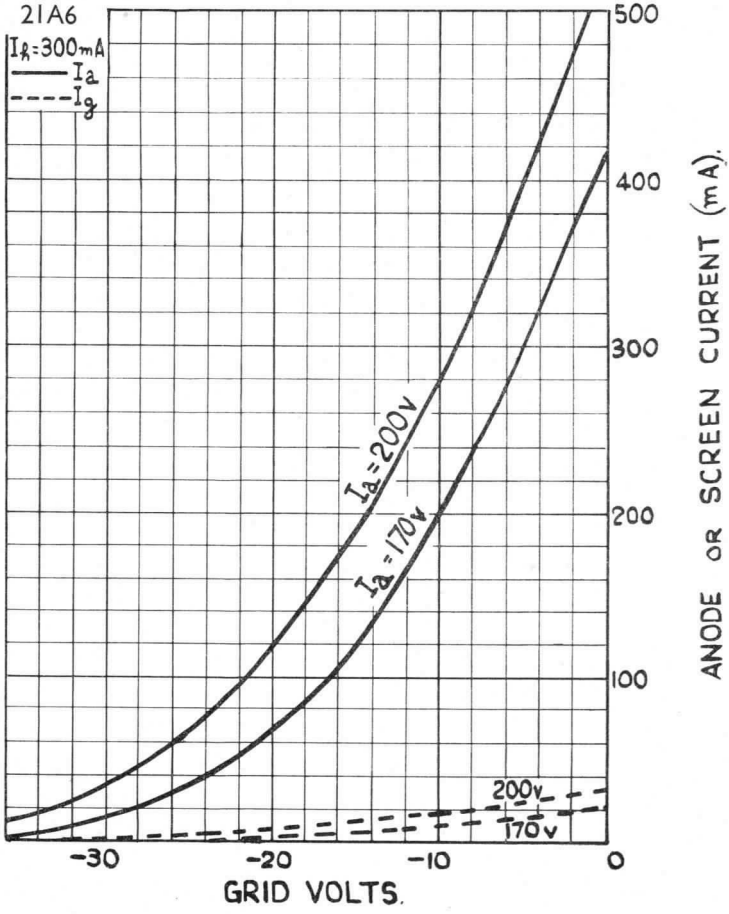
CAPACITANCES.

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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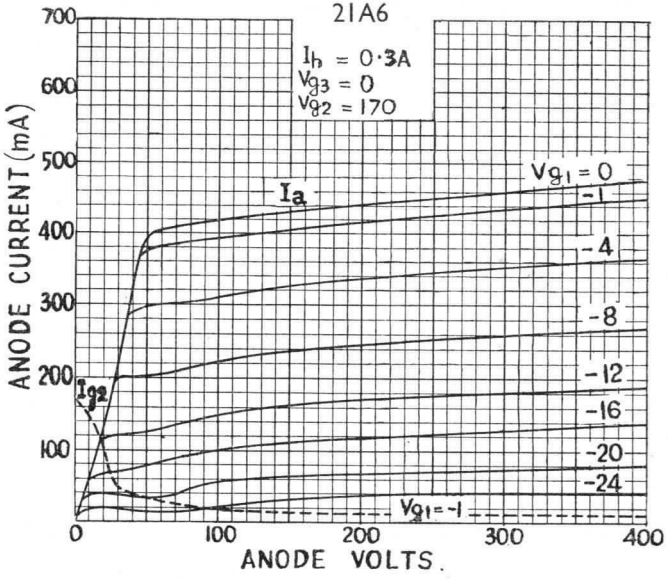
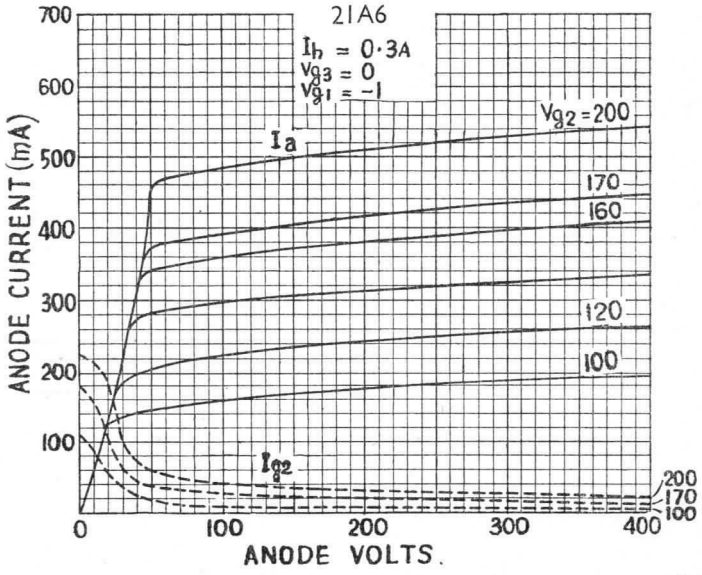
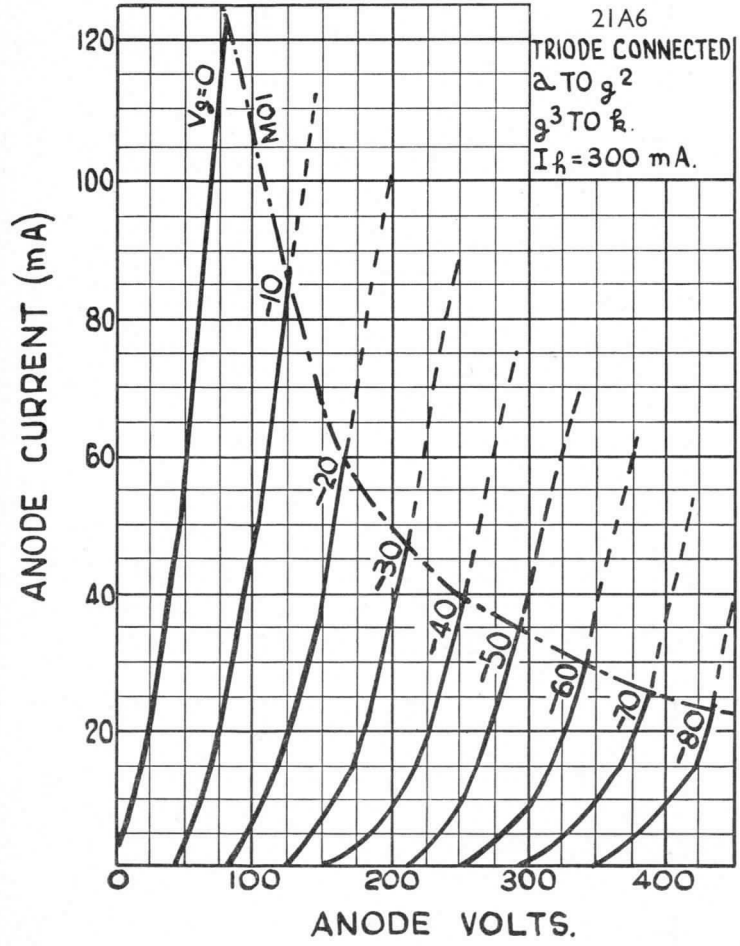

21A6
I_h = 0·3A
V_{g3} = 0
V_{g2} = 170
V_{g1} = 0
-1
-4
-8
-12
-16
-20
-24
I_a
I_{g2}
V_{g1} = -1
ANODE CURRENT (mA)
ANODE VOLTS.
700
600
500
400
300
200
100
0
100
200
300
400


21A6
I_h = 0·3A
V_{g3} = 0
V_{g1} = -1
V_{g2} = 200
170
160
120
100
I_a
I_{g2}
200
170
100
ANODE CURRENT (mA)
ANODE VOLTS.
700
600
500
400
300
200
100
0
100
200
300
400

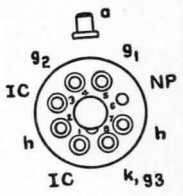

21A6
TRIODE CONNECTED
a TO g2
g3 TO k.
Ik = 300 mA.
ANODE CURRENT (mA)
120
100
80
60
40
20
0
100
200
300
400
ANODE VOLTS.
Vg=0
+01
-10
-20
-30
-40
-50
-60
-70
-80

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.

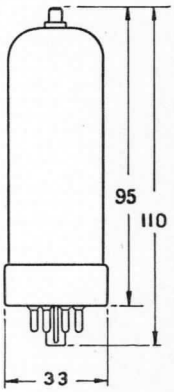
Pin 1—Internal Connection. Pin 5—Control Grid.
Pin 2—Heater. Pin 6—No Pin.
Pin 3—Internal Connection. Pin 7—Heater.
Pin 4—Screen Grid. Pin 8—Cathode and Top Cap—Anode. Suppressor Grid.

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.

All dimensions shown are in millimetres (max.)

CAPACITANCES.

C_{in}	18 pF.
C_{out}	8 pF.
C_{a-g_1}	<1·1 pF.

*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.

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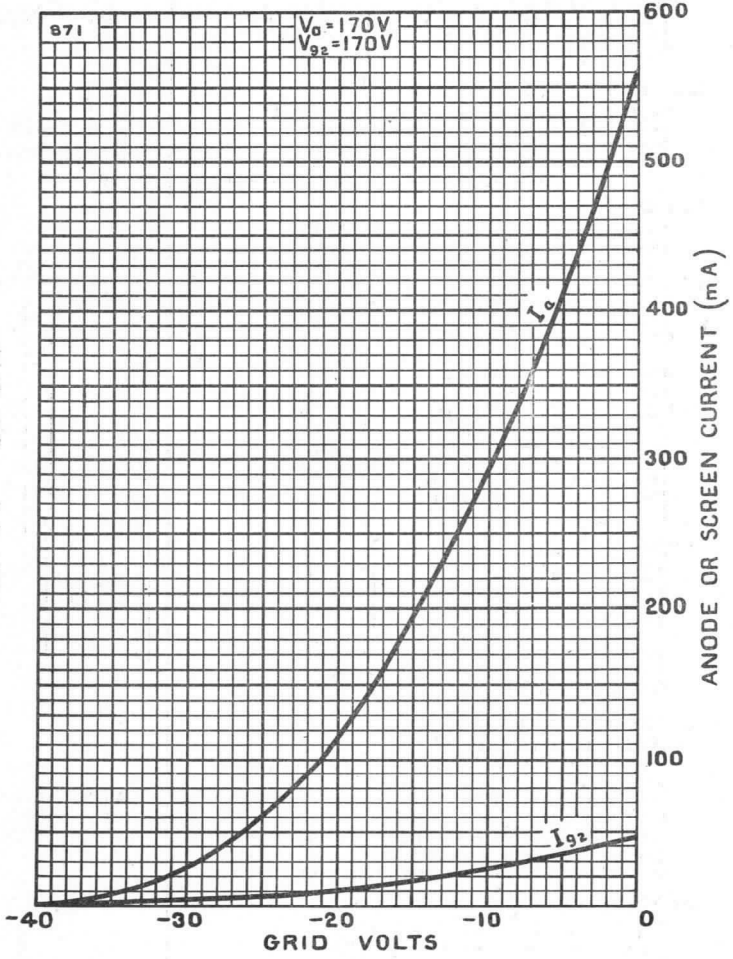
Feb., 1957

FERRANTI



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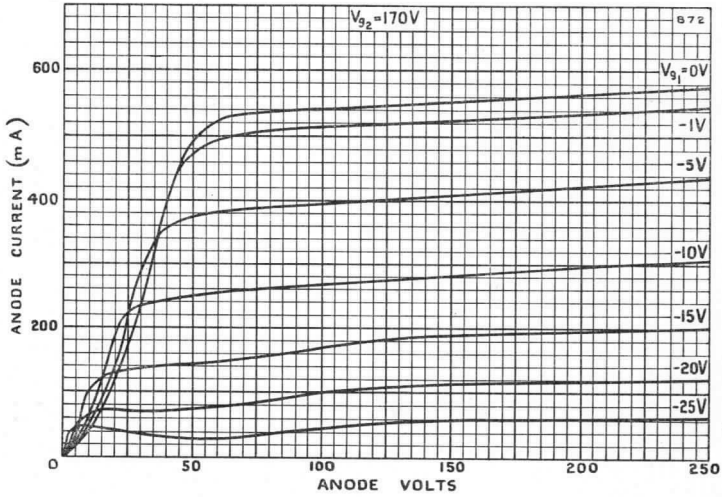
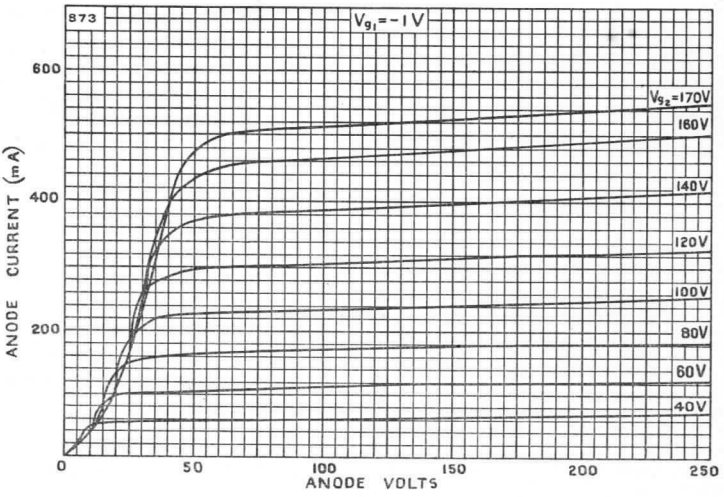
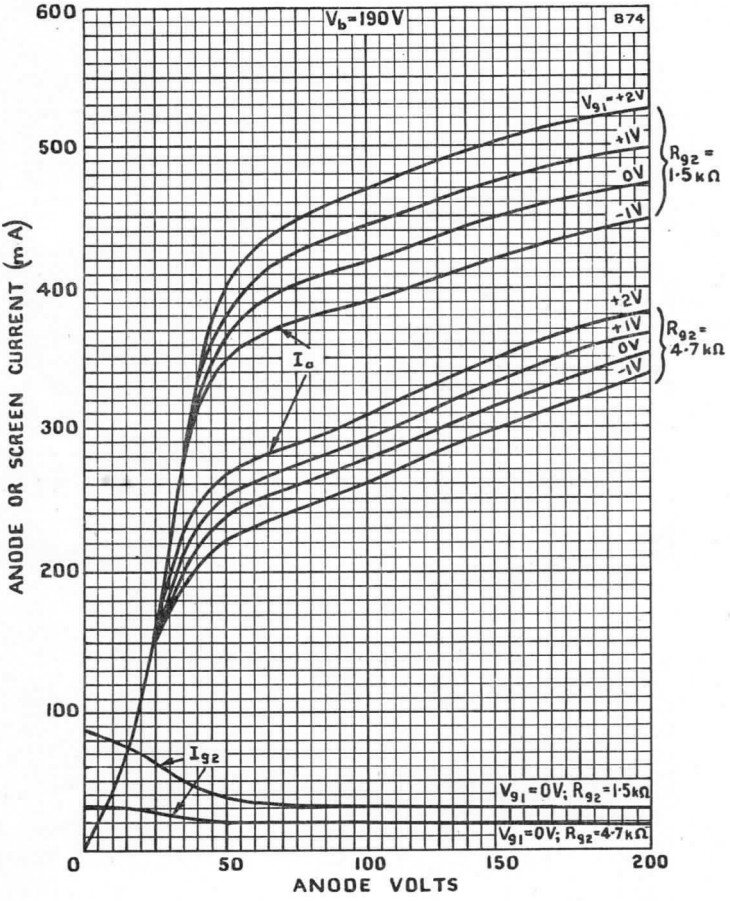

V_{g_2}=170V
672
V_{g_1}=0V
-1V
-5V
-10V
-15V
-20V
-25V
600
400
200
0
50
100
150
200
250
ANODE CURRENT (mA)
ANODE VOLTS


673
V_{g_1}=-1V
V_{g_2}=170V
160V
140V
120V
100V
80V
60V
40V
600
400
200
0
50
100
150
200
250
ANODE CURRENT (mA)
ANODE VOLTS



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R1255

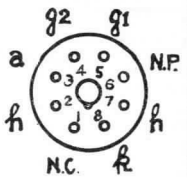
FERRANTI

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

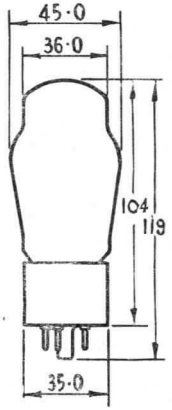
PHYSICAL DETAILS.

35L6G.

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.

35L6GT.

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.

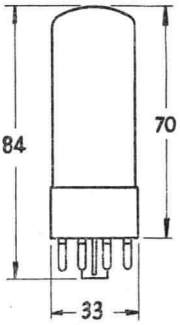
Pin 1—No Connection.	Pin 5—Control Grid (g_1).
Pin 2—Heater.	Pin 6—No Pin.
Pin 3—Anode.	Pin 7—Heater.
Pin 4—Screen Grid (g_2).	Pin 8—Cathode.

HEATER.

Heater Current	0·15 amp.
Heater 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	%

All dimensions shown are in millimetres (max.).

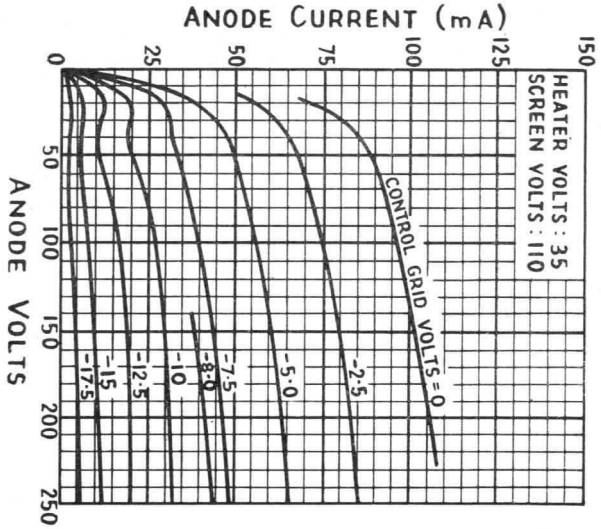
CAPACITANCES.

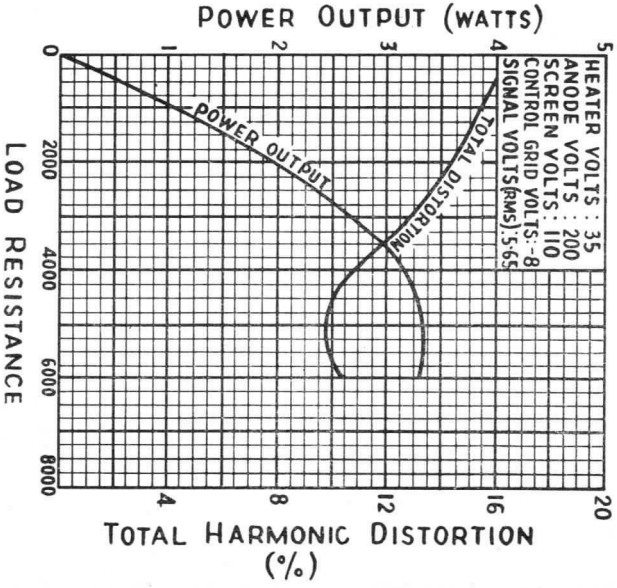
	35L6G	35L6GT	
C_{in}	13·5	13·0	pF.
C_{out}	8·0	9·0	pF.
C_{a-g}	1·0	1·0	pF.

Issue 3.
Jan., 1953

35L6G

35L6GT





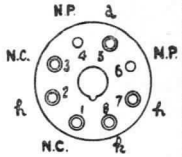
R1055

FERRANTI

HALF WAVE RECTIFIER

Valve type 35Z4GT is an indirectly heated, high vacuum. half wave rectifier designed for use in AC/DC equipment,

35Z4GT



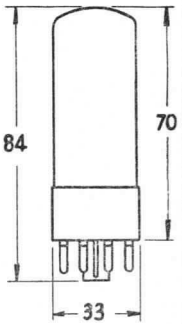
Base Connections Underside View of Base

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.



All dimensions shown are in millimetres. (max.).

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.

TYPICAL OPERATION.

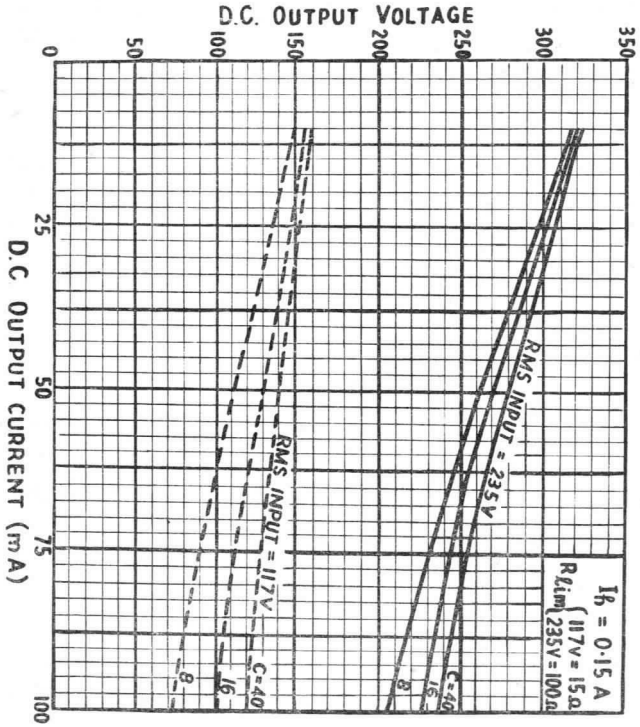
CAPACITOR INPUT.

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

FERRANTI



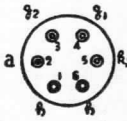
FERRANTI

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 Underside View of Base

BASE CONNECTIONS.

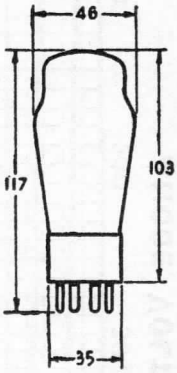
Pin 1—Heater.	Pin 4—Control Grid.
Pin 2—Anode.	Pin 5—Cathode, Suppressor Grid.
Pin 3—Screen Grid.	Pin 6—Heater.

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.

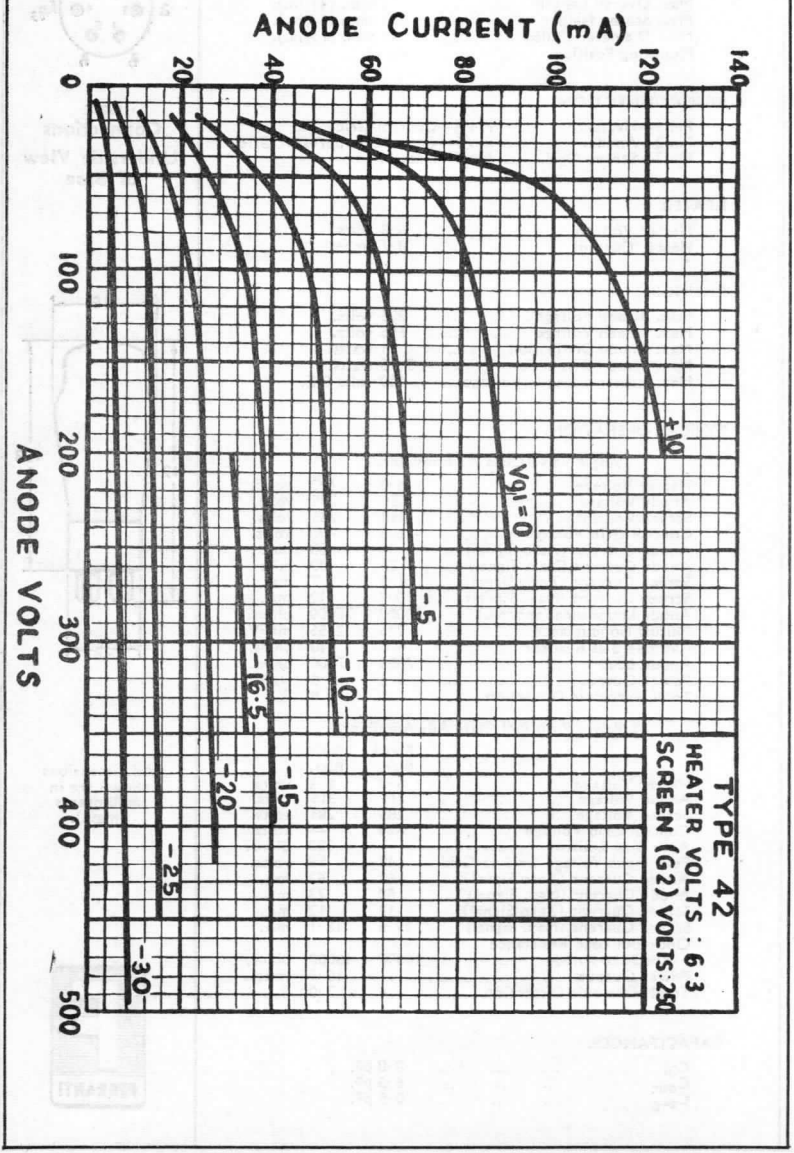
	Fixed Bias.	Auto Bias.	
Heater Voltage	6·3	6·3	volts.
Anode Voltage	315	315	volts.
Screen Voltage	285	285	volts.
Control Grid Voltage	−24	—	volts.
Auto Bias Resistor	—	320	ohms.
Peak Input Voltage Grid to Grid	48	58	volts.
Anode Current (Zero Signal)	62	62	mA.
Anode Current (Max. Signal) ...	80	73	mA.
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	%

All dimensions shown are in millimetres (max.).

CAPACITANCES.

C_{in}	8·0 pF.
C_{out}	6·5 pF.
C_{a-g}	0·5 pF.

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
-16·5
-15
-20
-25
-30
TYPE 42
HEATER VOLTS : 6·3
SCREEN (G2) VOLTS: 250

R1255

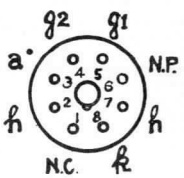
FERRANTI

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.

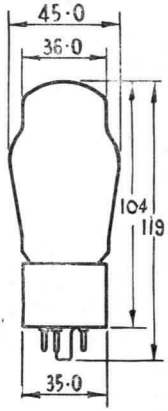
50L6G

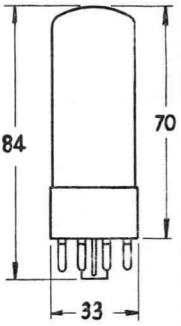
50L6GT



Base Connections

Underside View of Base





All dimensions shown are in millimetres (max.).

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	%

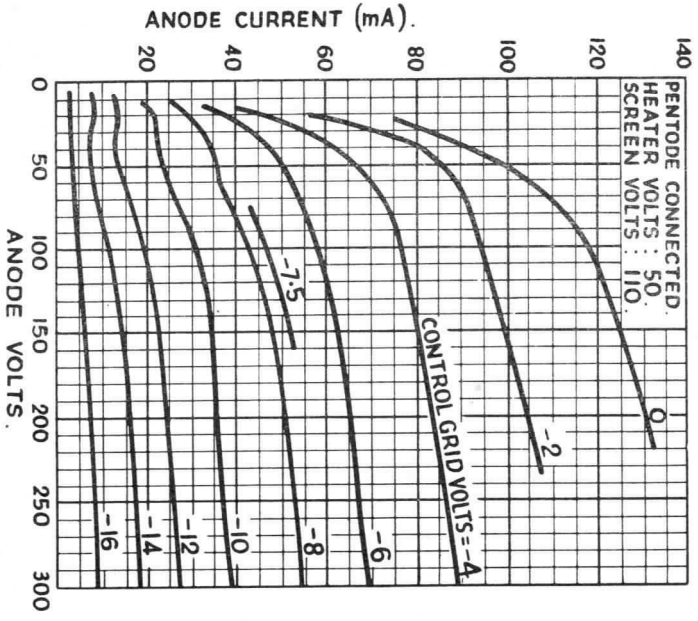
CAPACITANCES.

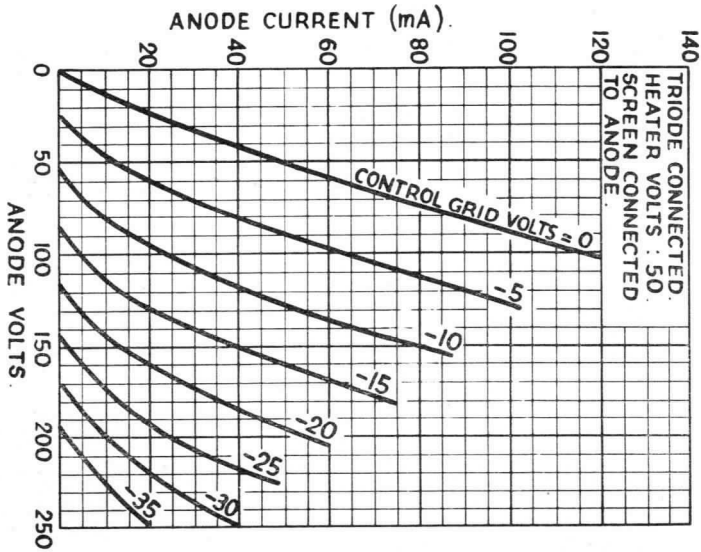
	50L6G	50L6GT	
C_{in}	12·5	12·0	pF.
C_{out}	8·0	9·5	pF.
C_{a-g}	1·0	1·0	pF.

Issue 2.
April, 1953

50L6G

50L6GT

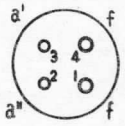




FERRANTI

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 1/16 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 2—Anode 2.
Pin 3—Anode 1.
Pin 4—Filament.

FILAMENT.

Filament Voltage	5·0 volts.
Filament Current	2·0 amps.

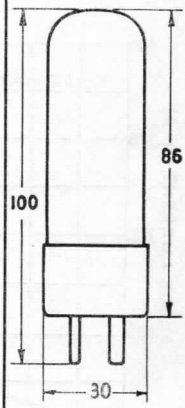
RATINGS*

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 { 62·5 mA.	390	—	volts.
Current of { 42 mA.	—	610	volts.
At Full-Load { 125 mA.	350	—	volts.
Current of { 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.

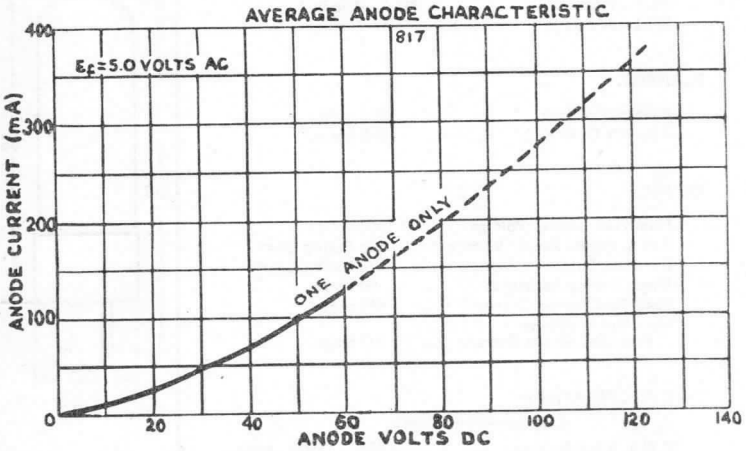
†For maximum duration of 0·2 sec.

Issue 3
Mar., 1956

FERRANTI

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.	270	—	volts.
{ 62·5mA.	—	405	volts.
At Full-Load Current of { 150 mA.	245	—	volts.
{ 125 mA.	—	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.

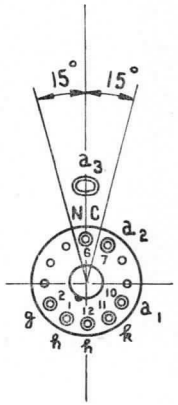
Side Contact—3rd Anode.

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 ...	$-\frac{V_{a_1}}{5}$ 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.

Issue 1.
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.

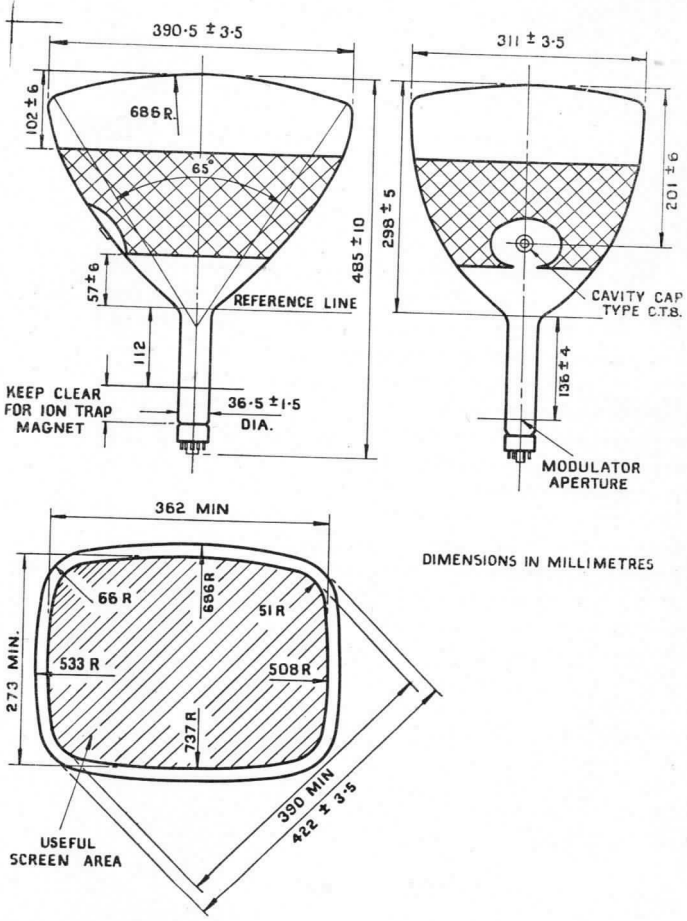
Adjustment of the Ion Trap Magnet should be carried out in accordance with the procedure outlined under "Notes on Operation (Cathode Ray Tubes)" preceding this section of the handbook.

§§ Ion Trap Magnet field strength 59–67 gauss.

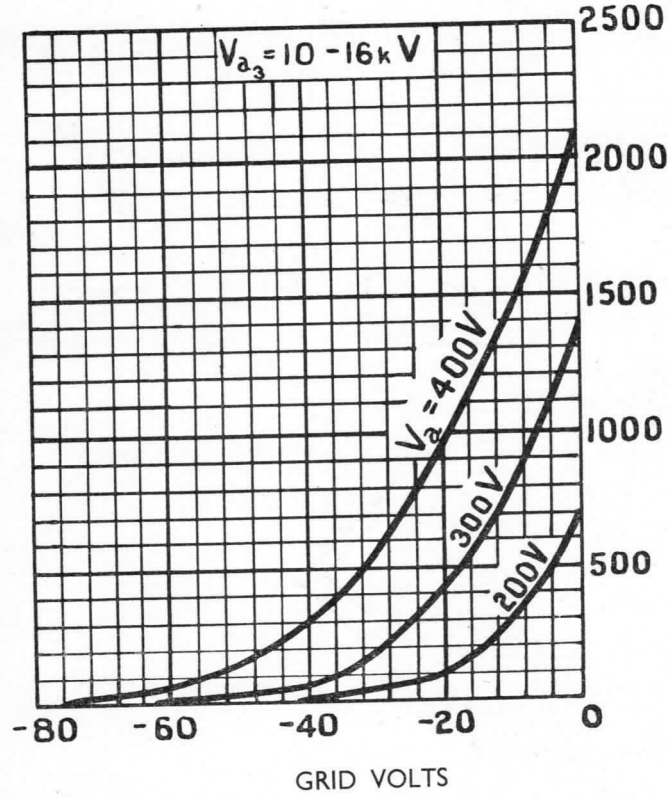
CAPACITANCES.

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
2500
2000
1500
1000
500
V_a = 400V
300V
200V
-80
-60
-40
-20
0
GRID VOLTS
FINAL ANODE CURRENT (μA)

FERRANTI

TELEVISION TUBE

T12/72U

Cathode Ray Tube type T12/72U is a Triode Tube, designed for series operation in AC/DC Television Receivers.

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^{+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.

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.

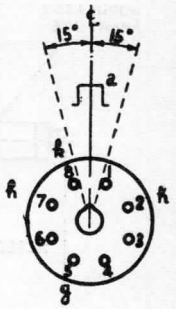
Anode Voltage	... ...	9·0 kV.
V_g for visual cut off	... ...	−60 volts.
Av. Mod. Drive for 150 μA Beam Current	...	32 volts.
†Focus Coil	... ...	800 ampere turns (approx.).

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.



Base Connections
Underside View of Base

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.

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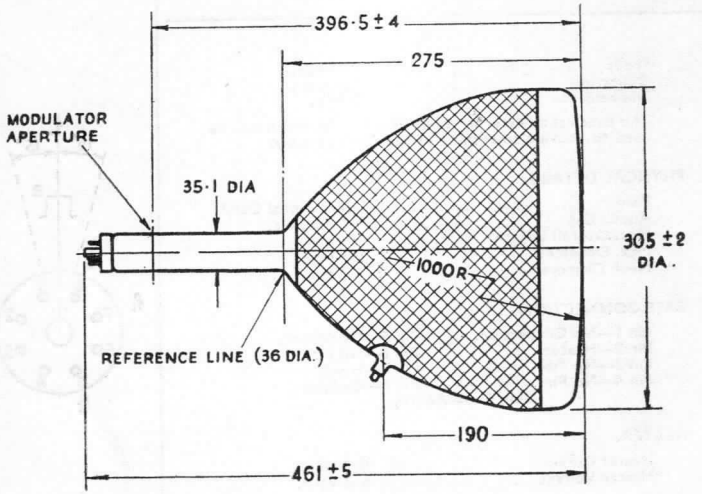
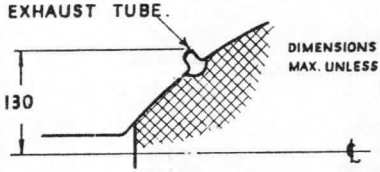
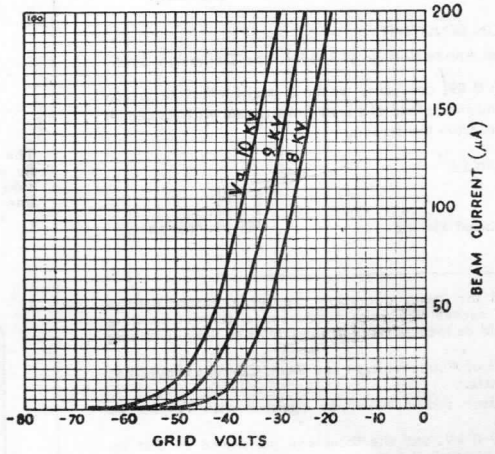
Dec., 1955

T12/72U





DIMENSIONS IN MILLIMETRES. MAX. UNLESS OTHERWISE STATED.



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

Both vols checked Oct. 61

TPD

Prefaces ✓

INDUSTRIAL VALVES.

FERRANTI

ARC DISCHARGE VALVE

AD30

A Cold Cathode gas filled arc discharge Diode which is capable of passing high peak currents of short duration ; suitable for use with magneto-striction oscillators, etc.

PHYSICAL DETAILS.

Max. Overall Length	249 mm. (9⅞in.).
Max. Overall diameter	31 mm. (1¼in.).
Max. Dia. of glass tube ...	28·5 mm. (1⅛in.).
End Caps	CT3.
Mounting Position	Any.

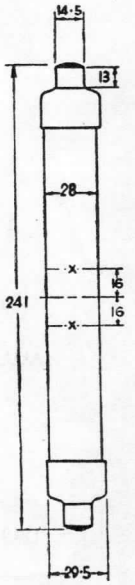
RATINGS (Max. Ratings are "Absolute.")

Max. Anode Voltage	1800 volts.
Max. Mean Anode Current ...	100 mA.
Max. Operating Frequency ...	4 pps.
Max. Discharge Capacitor ...	10 μF.

TYPICAL OPERATION and CHARACTERISTICS.

Anode Voltage	1650 volts.
Discharge Capacitor	4 μF.
*Trigger Voltage	20000 volts.
Load Resistance	4 Ω
Operating Frequency	4 pps.
†Peak Anode Current ...	(approx.) 250 Amps.
‡Anode Current Duration	(approx.) 25 μsecs.
Delay Time	50 μsecs.

Typical circuits for operation are shown overleaf. These circuits employ a Ferranti Cold Cathode Tetrode Type NSP2 to discharge high peak current pulses through the primary of a Pulse Transformer or Ignition Coil to provide the high voltage trigger pulses for the AD30.



All dimensions shown are in millimetres. (max.).

*The trigger voltage may be supplied from an ignition coil giving a secondary voltage between 20 and 30 kilovolts. This voltage should be applied to the valve by means of a clip, or a few turns of bare wire wrapped round the envelope. The trigger clip should be located near the mid point of the tube in the area enclosed by lines X X on the outline drawing. The trigger pulses can be applied to the primary of the ignition coil by electronic or mechanical means.

†The peak anode current with zero discharge resistance is of the order of 550 Amps. when a 4 μF. capacitor is employed. Higher values of capacitor result in higher peak currents.

‡The duration of the current pulses varies with voltage, discharge capacitor and discharge circuit resistance. With Va=1650, C=4 μF. typical times are as follows :—

Circuit Resistance.	Current Duration.
0 ohms	10 μsecs.
4 ohms	25 μsecs.
10 ohms	70 μsecs.

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AD30

FERRANTI

OPERATION CONTROLLED BY FREE RUNNING OSCILLATOR.

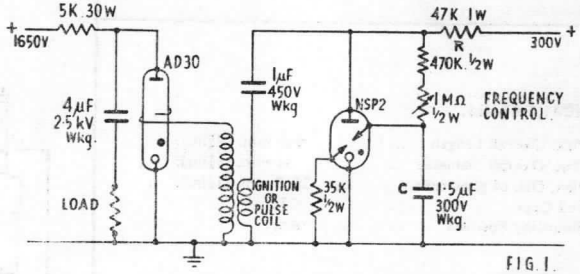


FIG. 1.

The frequency of operation is controlled by the values of R and C. The values shown in the diagram are suitable for a repetition rate of 4 pps.

ELECTRONICALLY SYNCHRONISED OPERATION.

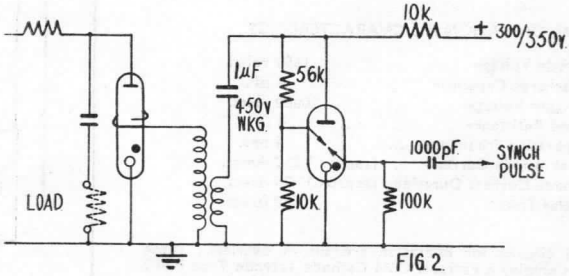


FIG. 2.

Greater frequency stability can be attained if the NSP2 is triggered from a controlled frequency source as indicated in the above diagram. The synchronising pulses must be negative going and of about 150 volts minimum height.

MECHANICALLY SYNCHRONISED OPERATION.

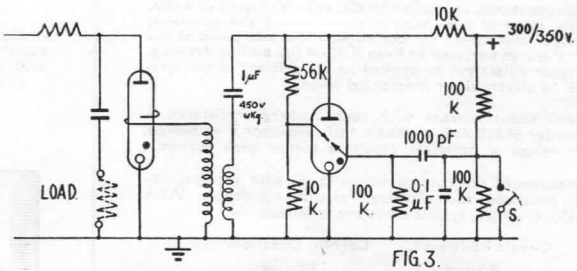


FIG. 3.

Closing the switch S causes a single discharge. The switch may be operated by a motor or other mechanical means.

Further information regarding operation of the NSP2 as a trigger valve may be obtained from the Data Sheet for NSP2.

FERRANTI

COLD CATHODE TETRODE

ASP2

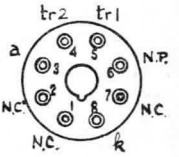
Ferranti "Argostron" Type ASP2 is an argon filled cold cathode tetrode valve. It is intended for use as a Stroboscopic Light Source in applications employing photographic recording. For visual observations Type NSP2 is recommended.

PHYSICAL SPECIFICATION.

Base	International Octal.
Max. Seated Height	89 mm. (3½in.).
Max. Overall Length	103 mm. (4 1/16 in.).
Max. Base Diameter	32 mm. (1¼in.).
Length of Arc	24 mm. (15/16 in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No Connection.	Pin 5—Trigger Electrode 1.
Pin 2—No Connection.	Pin 6—No Pin.
Pin 3—Anode.	Pin 7—No Connection.
Pin 4—Trigger Electrode 2.	Pin 8—Cathode.



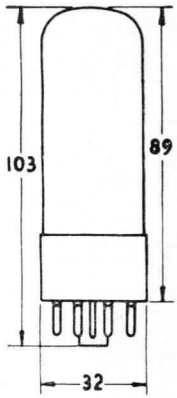
Base Connections
Underside View Base

RATINGS (Absolute).

Max. Anode Voltage (working)	380 volts.
Min. Anode Voltage (working)	270 volts.
Max. Peak Inverse Anode Voltage	350 volts.
†Max. Average Anode Current ...	80 μF.
Max. Discharge Capacitance ...	16 mA.
Max. Average Trigger Current	10 mA.
Min. Series Discharge Resistance	0·3 ohms.

CHARACTERISTICS.

*Static Striking Voltage (tr_2 to tr_1)	75-120 volts.
Max. Flashing Frequency ...	250 per sec.
Min. Trigger Current required at V_a 380	100 μA.
Min. Trigger Current required at V_a 270	200 μA.
Peak Luminous Intensity / Flash Duration	The discharge of a 2 μF capacitor charged to 350V. gives a Peak Luminous Intensity of approx. 80 candelas with a flash duration of 20 microseconds at half the peak light output.
Delay Time	From 50 microseconds down to a few microseconds dependent on circuit conditions. Minimum delay times are achieved by using high values of trigger pulse energy and anode voltage.



All dimensions shown are in millimetres.

TYPICAL OPERATION as Stroboscopic Light Source :

DC. Supply Voltage	350 volts.
‡Vtr_2 at Triggering Instant ...	70 volts.
§Trigger Pulse Amplitude (Vtr_1)	150 volts min.
Series Discharge Resistance ...	0·5 ohms.
Charging Resistor	3000 ohms.
Discharge Capacitor for Operation at :—	
6–35 c.p.s.	4 μF.
30–50 c.p.s.	3 μF.
45–80 c.p.s.	2 μF.
80–150 c.p.s.	1 μF.
140–250 c.p.s.	0·5 μF.

For typical circuits and further information refer to "Notes on Operation" on NSP2 Data Sheets.

†A minimum peak current of 5 amp. is recommended. This ensures the formation of an arc discharge with an anode-cathode volt drop of approx. 20 volts. If the peak current is less than 5 amps. a glow discharge is likely to form with a volt drop of 75 volts which may result in permanent damage to the valve.

*The limits quoted refer to the trigger voltage for a low rate of change of electrode voltages with tr_1 negative to tr_2. For pulse operation a higher trigger voltage is generally necessary. See under "Typical Operation."

‡Positive with respect to cathode.

§Negative with respect to cathode.

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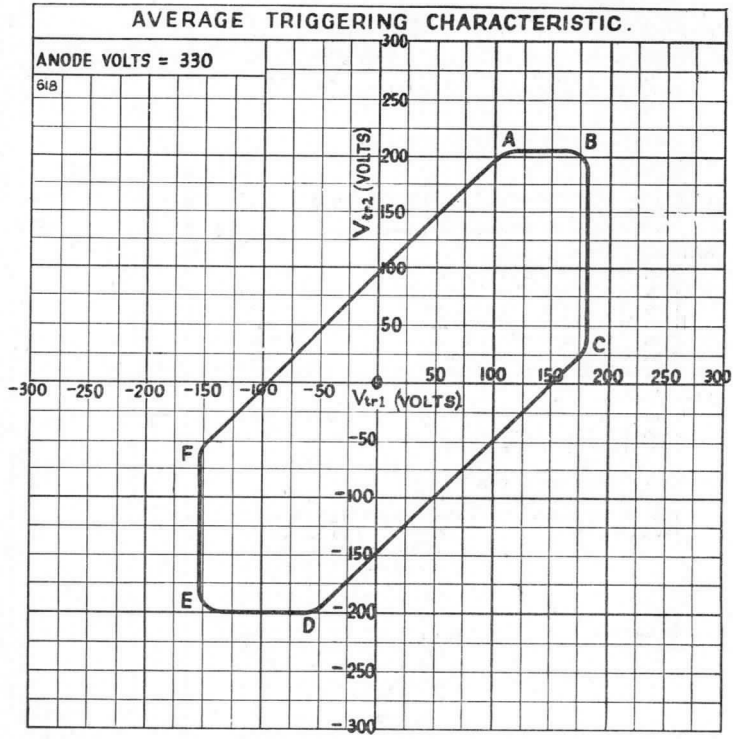
Jan., 1958

ASP2

FERRANTI



AVERAGE STATIC TRIGGERING CHARACTERISTIC

The area enclosed by the loops is an area of non-conduction. If the vector sum of the voltages on two electrodes lies within the loop the valve will not fire. Any change of either or both of these voltages which cause the vector sum to fall outside the loop will trigger the valve.

For pulse operation it is usually necessary to ensure that the pulse has a sufficient excess voltage (See "Typical Operation.")

As the triggering impulse carries the vector sum of the applied voltages outside the loop the point at which it crosses the loop indicates the manner in which the valve is triggered as follows :—

Between AB Trigger Electrode 2 to Cathode.
BC Trigger Electrode 1 to Cathode.
CD Trigger Electrode 1 to Trigger Electrode 2.
DE Cathode to Trigger Electrode 2.
EF Cathode to Trigger Electrode 1.
FA Trigger Electrode 2 to Trigger Electrode 1.

The most reliable operation is ensured by triggering between tr_2 and tr_1, i.e., between F and A.

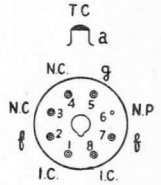
FERRANTI

LOW VOLTAGE X-RAY TUBE

B110

A low power X-ray tube with copper target, suitable for radiographic work on materials which are appreciably transparent to low voltage X-rays, e.g., plastics and thin metals. The electrical characteristics and focus properties of the tube may be varied by the application of suitable potentials to a control electrode which is positioned around the directly heated tungsten filament.

The B110 is not designed as a micro-focus type tube but is primarily intended for use in applications employing comparatively low power and where a fairly fine focus is required, and where the cost of a conventional high power X-ray tube is not justified.



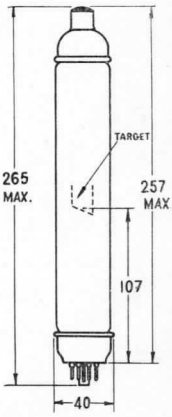
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Max. Overall Length	265 mm.
Max. Diameter	40 mm.
Top Cap	CT3.
Mounting Position	Any.
Target	Copper.

PIN CONNECTIONS.

*Pin 1 } —Filament.
*Pin 2 }
Pin 3—No Connection.
Pin 4—No Connection.
Pin 5—Grid.
Pin 6—No Pin.
*Pin 7 } —Filament.
*Pin 8 }
T.C.—Target.



RATINGS.

Max. Target Voltage	50 kV. D.C. 25 kV. A.C.
Max. Target Dissipation (continuous)	25 watts.
†Max. Target Dissipation (intermittent)	500 watts.
Max. Negative Grid Voltage ...	1400 volts.
Max. Filament Current	6 amps.

CHARACTERISTICS OF TYPICAL TUBE.

Filament Current ...	5·8	5·8	5·8	amps.
Target Voltage (D.C.) ...	15	35	35	kV.
Grid Bias	−150	−550	−650	volts.
Target Current	1·2	0·8	0·05	mA.

TYPICAL OPERATION (1). D.C. operation with Grid Bias.

Filament Current	5·5 amps.
Filament Voltage	3·6 volts (approx.).
Target Voltage	40 kV. D.C.
Grid Voltage	0 to −1400 volts.
‡Spot Size	0·8 mm.

TYPICAL OPERATION (2). D.C. operation with Auto Bias.

Filament Current	5·8 amps.
Filament Voltage	3·9 volts. (approx.).
Target Voltage	15 kV. D.C.
Auto Bias Resistor	100 kΩ
Target Current (mean) ...	1·5 mA.

All dimensions shown are in millimetres. (max.)

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TYPICAL OPERATION (3). A.C. operation with Auto Bias.

Filament Current	...	...	5·8 amps.
Filament Voltage	...	...	3·9 volts (approx.).
Target Voltage ...	...	...	15 kV. A.C.
Auto Bias Resistor	...	...	100 kΩ
Target Current (mean)		...	0·7 mA.

MODE OF OPERATION.

Adjust the filament current to 5·5 amps. and connect the grid to one side of the filament. Raise the target voltage steadily to the required figure, and as the target voltage is increasing adjust the filament current so that the target dissipation does not exceed 25 watts. If it is desired to operate with a smaller focal spot, it may be necessary to apply a negative potential of 400—900 volts to the grid and then increase the filament current slightly until sufficient beam current is available.

The tube may be operated at constant filament current, and target current adjusted by changing the grid bias voltage.

The target current may be compensated for variations of mains input voltage and tube characteristics by feedback circuits which adjust either the filament current or the grid bias voltage.

The target voltage should be increased gradually from zero to the required operating potential.

The filament current should be kept as low as possible, consistent with obtaining the required target current.

Care must be taken during transport and handling to avoid mechanical shocks to the tube.

Suitable shielding should be provided to protect the operator from radiation when the tube is working.

NOTES.

*One filament lead should be connected to both pins 1 and 2, and the other lead to both pins 7 and 8.

†The tube should never be operated at the maximum intermittent target dissipation for periods of more than 20 seconds. Between two periods of intermittent operation the target must be allowed to cool completely. If the tube has been operated at the maximum rating, the cooling time will be approximately 15 minutes.

‡At Target Voltage 40 kV. D.C. Target Current 100 microamperes.

FERRANTI

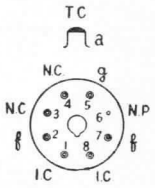
LOW VOLTAGE X-RAY TUBE

B120

A low power X-ray tube with copper target, suitable for radiographic work on materials which are appreciably transparent to low voltage X-rays, e.g., plastics and thin metals. The radiation is emitted through a thin glass window to reduce absorption of the softer rays.

The electrical characteristics and focus properties of the tube may be varied by the application of suitable potentials to a control electrode which is positioned around the directly heated tungsten filament.

Type B120 is not designed as a micro-focus type tube but is primarily intended for use in applications employing comparatively low power and where a fairly fine focus is required, and where the cost of a conventional high power X-ray tube is not justified.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Max. Overall Length	265 mm.
Max. Diameter	60 mm.
Top Cap	CT3.
Mounting Position	Any.
Target	Copper.

PIN CONNECTIONS.

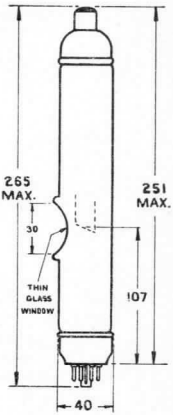
*Pin 1 } Filament.	Pin 5—Grid.
*Pin 2 }	Pin 6.—No Pin.
Pin 3.—No Connection.	*Pin 7 } Filament.
Pin 4.—No Connection.	*Pin 8 }

RATINGS.

Max. Target Voltage	25 kV. DC. 25 kV. AC. 50 c/s.
Max. Target Dissipation (cont.)	25 watts.
†Max. Target Dissipation (intermittent)	150 watts.
Max. Negative Grid Voltage ...	−1400 volts.
Max. Filament Current ...	6 amps.

CHARACTERISTICS.

Filament Current	5·8 amps.
Target Voltage (DC.)	15 kV.
Grid Bias	−150 volts.
Target Current	1·2 mA.



All dimensions shown are in millimetres. (max.)

NOTES.

*One filament lead should be connected to both pins 1 and 2, and the other lead to both pins 7 and 8.

†The tube should never be operated at the maximum intermittent target dissipation for periods of more than 20 seconds. Between two periods of intermittent operation the target must be allowed to cool completely. If the tube has been operated at the maximum rating, the cooling time will be approximately 15 minutes.

Tentative.
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TYPICAL OPERATION.

DC. Operation with Grid Bias.

Filament Current	5·5 amps.
Filament Voltage	3·6 volts (approx.).
Target Voltage	20 kV. DC.
Grid Voltage	–250

DC. Operation with Auto Bias.

Filament Current	5·8 amps.
Filament Voltage	3·9 volts (approx.).
Target Voltage	15 kV. DC.
Auto Bias Resistor ...	100 kΩ
Target Current (mean) ...	1·5 mA.

AC. Operation with Auto Bias.

Filament Current	5·8 amps.
Filament Voltage	3·9 volts (approx.).
Target Voltage (50 c/s.) ...	15 kV. AC.
Auto Bias Resistor	100 kΩ
Target Current (mean) ...	0·7 mA.

NOTES ON OPERATION.

Adjust the filament current to 5·5 amps and connect the grid to one side of the filament. Raise the target voltage steadily to the required figure, and as the target voltage is increasing adjust the filament current so that the target dissipation does not exceed 25 watts. If it is desired to operate with a smaller focal spot, it may be necessary to apply a negative potential of 400–900 volts to the grid and then increase the filament current slightly until sufficient beam current is available.

The tube may be operated at constant filament current, and target current adjusted by changing the grid bias voltage.

The target current may be compensated for variations of mains input voltage and tube characteristics by feedback circuits which adjust either the filament current or the grid bias voltage.

The target voltage should be increased gradually from zero to the required operating potential.

The filament current should be kept as low as possible, consistent with obtaining the required target current.

The thin window opposite the target should not be handled as the glass in this area is very thin and easily fractured.

Suitable shielding should be provided to protect the operator from radiation when the tube is in operation.

Care must be taken during transport and handling to avoid mechanical shocks to the tube.

FERRANTI

DEMOUNTABLE LOW VOLTAGE X-RAY TUBE

A demountable X-Ray Tube with provision for rapid replacement of the filament.

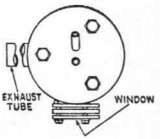
The tube has an inclined target which is water cooled and can be operated up to 10mA beam current at a target voltage of 40kV.

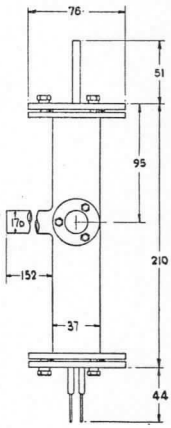
A special feature is the polythene window which can also be easily replaced if necessary.

As this polythene window is very transparent to soft X-Rays a very high intensity of X radiation can be obtained with target voltages as low as 5kV. The tube can therefore be operated under conditions which produce an X-Ray output which provides a much higher ratio of characteristic radiation to "white" radiation than is normally obtainable from conventional types of X-Ray tubes.

The electrical characteristics and focus of the tube can be controlled by application of suitable potentials to a screen which is positioned round the directly heated tungsten filament.

The tube is not of the micro-focus type but is primarily intended for use in applications requiring fairly fine focus at comparatively high power.





All dimensions shown are in millimetres.

PHYSICAL DETAILS.

Max. Overall Length	305 mm.
Max. Overall Diameter (excl. exhaust tube) ...	78 mm.
Max. Tube Diameter	38 mm.
For other dimensions see drawing.	
Mounting Position	Any.
Target	Copper.

RATINGS.

Max. Target Voltage	40 kV.
Max. Target Dissipation ...	400 watts.
Max. Negative Screen Voltage	1400 volts.
Max. Filament Current ...	3·5 Amps.

TYPICAL OPERATION.

Filament Current	2·0 Amps.
Filament Voltage	6·0 Volts approx.
Target Voltage	40 kV.
Screen Voltage	0 to −1400 Volts.
Spot Size (approx.) at 500 μA.	0·5 mm.
Spot Size (approx.) at 10 mA. ...	1·0 mm.

MODE OF OPERATION.

Adjust the filament current to 1·5 amps and set the screen voltage at −800V. Increase the E.H.T. supply to the Target continuously from zero to the required operating potential. Adjust the screen voltage to bring the beam to a sharp focus on the target (as indicated by the usual photographic methods). Adjust the filament supply to give the required beam current. Repeat the last two adjustments in order to obtain optimum focus. In general it is desirable to operate the tube with the highest negative screen potential which will give sufficient beam current.

Issue 2
Aug., 1957

FERRANTI

TETRODE ELECTROMETER VALVE

BM10

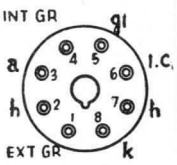
A single tetrode electrometer valve, with an indirectly heated oxide-coated cathode, suitable for battery or mains operation. Internal and external guard rings are fitted and the envelope is silicone coated to render it moisture repellent.

PHYSICAL DETAILS.

Base	International Octal.
Top Cap	Type CT2.
Max. Overall Length	140 mm. (5½in.).
Max. Seated Height	125 mm. (5in.).
Max. Diameter	45 mm. (1¾in.).
Mounting Position	Any.
Envelope	Clear glass, silicone coated.

BASE CONNECTIONS.

Pin 1—Ext. Guard Ring. Pin 5—Screen (g_1).
Pin 2—Heater (h) Pin 6—Internal Connection.
Pin 3—Anode (a) Pin 7—Heater (h)
Pin 4—Int. Guard Ring Pin 8—Cathode (k)
Top Cap—Control Grid (g_2)



Base Connections
Underside View of Base

HEATER.

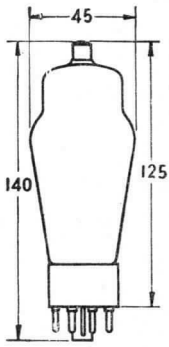
Heater Voltage	4·0 volts.
Heater Current	0·25 amp.

RATINGS.

Max. Anode Voltage	8·0 volts.
Max. Screen Voltage	6·0 volts.

CAPACITANCES.

C_{in}	2·9 pF.
C_{out}	6·9 pF.
C_{a-g_2}	5·0 pF.
C_{a-g_1} (screen)	1·9 pF.



TYPICAL OPERATION.

Anode Voltage (Va) ...	4·6	6·0	4·0	volts.
Screen Voltage (V_{g_1}) ...	6·0	4·0	3·0	volts.
Control Grid Voltage (V_{g_2})	−3·0	−3·0	−2·0	volts.
Anode Current (Ia) ...	275	190	100	μA.
Screen Current (I_{g_1}) ...	430	240	160	μA.
Mutual Conductance (gm)	160	100	90	μA/V.
Amplification Factor (μ)	2·0	1·8	2·0	
Control Grid Current (I_{g_2})	$<30\times10^{-14}$	$<20\times10^{-14}$	$<2\times10^{-14}$	amp.
Control Grid Insulation (r_{g_2})	$>10^{13}$	$>3\times10^{13}$	$>10^{14}$	ohms.

In order to achieve maximum stability and to reduce the control grid current to a minimum :—

1. Keep the glass envelope dry and free from contamination by fingerprints, etc.
2. Operate the valve in total darkness with adequate electrical and magnetic screening.
3. Ensure that the potential at any point of the heater is positive relative to that of the cathode.

e.g.—In DC. operation connect the heater negative terminal to the cathode or to a source of constant potential which is positive relative to the cathode.
In AC. operation maintain the centre-tap of the 4-volt heater supply 4 volts positive relative to the cathode.

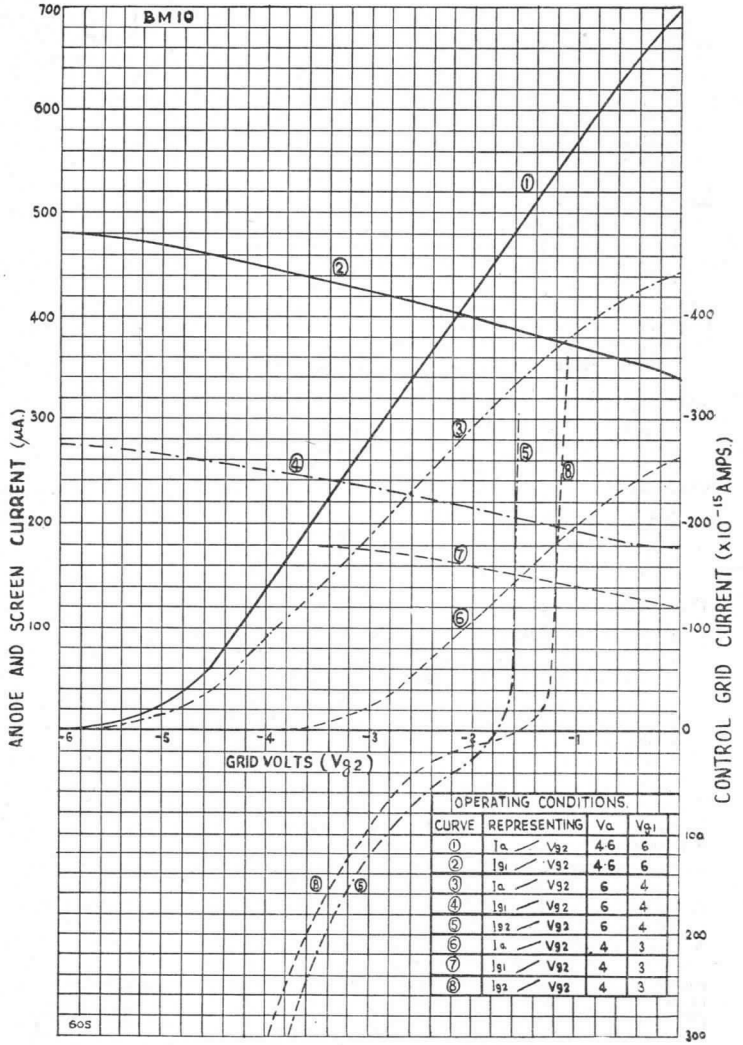
4. The guard rings should be at a fixed potential equal to the mean operating potential of the control grid.

A steady operating condition of the valve will be more rapidly achieved if the heater voltage is applied at least 45 seconds before the anode and screen potentials.

All dimensions shown are in millimetres (max.).

Issue 1
Dec., 1955
(Tentative)

BM10



OPERATING CONDITIONS.

CURVE	REPRESENTING	Va	Vg1
①	Ia / Vg2	4·6	6
②	Ig1 / Vg2	4·6	6
③	Ia / Vg2	6	4
④	Ig1 / Vg2	6	4
⑤	Ig2 / Vg2	6	4
⑥	Ia / Vg2	4	3
⑦	Ig1 / Vg2	4	3
⑧	Ig2 / Vg2	4	3

Ferranti

FLASH TUBE

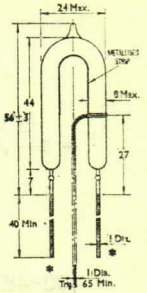
CD10
CD11

Xenon filled flash tubes designed for use in Electronic Flash Equipment for Photographic or similar applications to operate from low voltages which can be supplied from a small power pack.

PHYSICAL DETAILS.

CD10

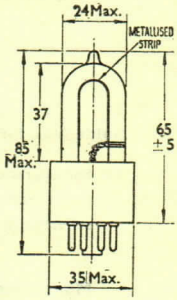
Max. Length (excluding leads and pins)	60 mm. (2·36")
Max. Diameter of Glass ...	8 mm. (·325")
Max. Overall Width	24 mm. (·955")
Electrode Connections	Flexible Leads
Mounting Position	Any

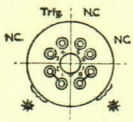


Type CD10

CD11

Max. Seated Height	70 mm. (2·75")
Max. Diameter of Glass ...	8 mm. (0·32")
Max. Overall Width	35 mm. (1·38")
Electrode Connections	Octal Base
Mounting Position	Any





Type CD11

Dimensions in millimetres

ELECTRODE CONNECTIONS.

Type **CD10** has flexible leads. The twin twisted lead is the trigger lead. The device is non-polarised.

Type **CD11** is fitted on an Octal Base—see diagram in margin for connections.

The devices are non-polarised, the charging voltage and discharge capacitor may therefore be connected across the leads marked * in the marginal diagrams without regard to polarity.

RATINGS. (Both types)

Max. Discharge Energy	50 Joules
Max. Operating Voltage... ...	500 Volts
Min. Operating Voltage ...	180 Volts
*Min. Interval between Flashes ...	10 Secs
Max. Discharge Capacitor ...	600 μF

TYPICAL OPERATION. (Both Types)

Operating Voltage	410 Volts
†Trigger Voltage	2 to 3 kV
Discharge Capacitor	600 μF
Charging Resistor	3·3 kΩ (6 watt)
Flash Duration	·002 Sec Approx.

A typical circuit is shown overleaf

*At maximum dissipation.

†Ferranti Miniature Pulse Transformer Type PT56 is recommended.

Tentative
Issue 3.
Nov., 1963

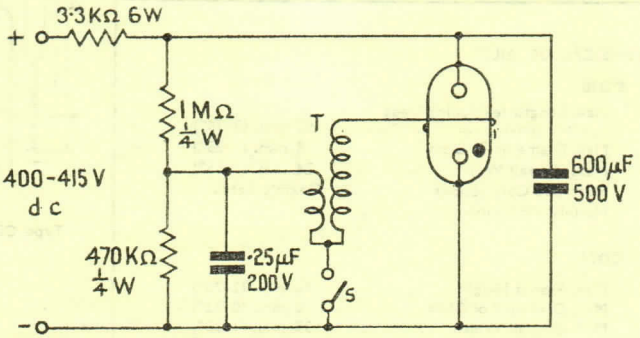
Ferranti

Ferranti

CD10

CD11

CIRCUIT DIAGRAM



Guide Nos. for Flash Photography

For operation in a circuit similar to the above, i.e. with a discharge energy of 50 joules with the CD10 or CD11 mounted in a 3¾" diameter satin finish parabolic reflector the following guide numbers may be used.

Monochrome Film

Film Speed A.S.A.	Guide No.
25— 32	50
40— 50	65
64— 80	85
110—125	105
160—200	125
250—320	150

Reversal Colour Film

Film Speed A.S.A.	
25	30
50	40

The above figures are approximate and are intended to be used only as a guide for correct exposure.

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

Ferranti

FLASH TUBE

A Xenon filled flash tube with integral reflector and pulse transformer designed for use in Electronic Flash Equipment for Photographic or similar applications operating at low voltage.

PHYSICAL DETAILS

Base	International Octal
Seated Height	86 mm. (3⅜ in.)
Overall Length	102 mm. (4 in.)
Diameter of Reflector	105 mm. (4⅛ in.)
Diameter of Base	35 mm. (1⅜ in.)
*Mounting Position	Any

See outline drawing overleaf.

PIN CONNECTIONS

Pin 1—Not connected.	Pin 5—Trigger Input.
Pin 2—**	Pin 6—Not Connected.
Pin 3—Not Connected.	Pin 7—**
Pin 4—Trigger Earth.	Pin 8—Not Connected.

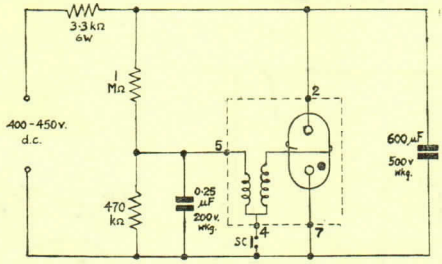
**The device is non-polarised, the charging voltage and discharge capacitor may therefore be connected across the pins 2 and 7 without regard to polarity.

RATINGS

Max. Discharge Energy	50 Joules
Max. Operating Voltage ...	500 Volts
Min. Operating Voltage ...	180 Volts
†Min. Interval between Flashes ...	10 Secs
Max. Discharge Capacitor ...	600 μF

TYPICAL OPERATION

Operating Voltage	420 Volts
Trigger Pulse at Pin 5	See Note ‡
Discharge Capacitor	600 μF
Charging Resistor	3·3 kΩ (6 watt)
Flash Duration	·002 Sec (approx)



The figures outside the broken line indicate the pins in the CD 14 base. SC denotes the camera shutter contacts or other appropriate switch.

*The recommended method of mounting is by support at the flange of the reflector.

†At maximum dissipation.

‡A suitable trigger voltage may be obtained from the discharge of a Capacitor between pins 5 and 4 as indicated in the circuit diagram.

Max. values are :

Capacitor	0·25 μF
Charge	350 volts.

Tentative
Issue 2.
Feb., 1964

Ferranti

GUIDE NOS. FOR FLASH PHOTOGRAPHY

For operation in a circuit similar to that shown overleaf, i.e. with a discharge energy of 50 joules the following guide numbers may be used.

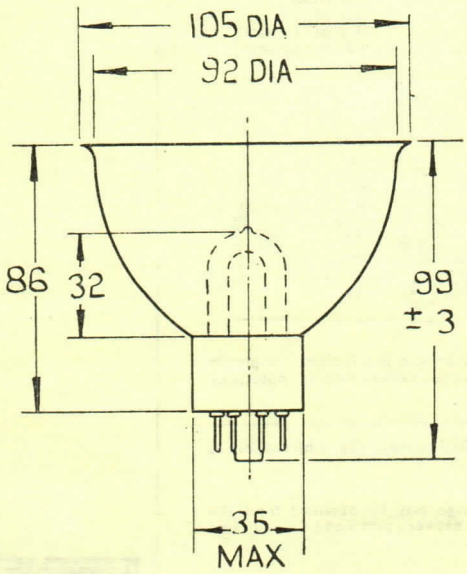
Monochrome Film

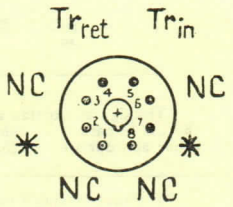
Film Speed A.S.A.	Guide No.
25— 32	50
40— 50	65
64— 80	85
110—125	105
160—200	125
250—320	150

Reversal Colour Film

Film Speed A.S.A.	
25	30
50	40

The above figures are approximate and are intended to be used only as a guide to correct exposure.





*—The tube is not polarised. The discharge capacitor is connected across these pins without regard to polarity.

R.857

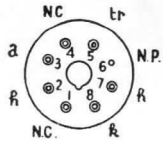
FERRANTI

LINEAR LIGHT SOURCES

Mercury-Argon filled light sources in which the light output is proportional to the anode current. The many uses include phototelegraphic picture recording, sound film recording, time interval marking and stroboscopic applications.

CL40

CL41

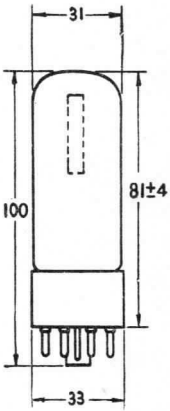


Base Connections Underside View of Base

Light Apertures

CL40

CL41



All dimensions shown are in millimetres.

PHYSICAL DETAILS.

Base	International Octal.
Max. Overall Diameter	33 mm. ($\frac{1.3}{1.6}$in.).
Max. Seated Height	85 mm. ($3\frac{11}{32}$in.).
Max. Overall Length	100 mm. ($3\frac{15}{16}$in.).
Mounting Position	Should not be declined more than 45° below horizontal.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Heater.
Pin 3—Anode.
Pin 4—No Connection.
Pin 5—Trigger.
Pin 6—No Pin.
Pin 7—Heater.
Pin 8—Cathode.

RATINGS.

Heater Voltage	6·3 volts.
Heater Current	1·2 amp.
Max. Anode Voltage	600 volts.
*Min. Trigger Supply Voltage ...	350 volts.
Min. Cathode Current to maintain glow	5 mA.
Volt Drop Across Tube (During Operation) ...	30 (approx.).
Max. Modulation Frequency ...	20 kc/s.
Max. Cathode Current ...	100 mA.

Heating Time ... (see "Notes on Operation" overleaf).

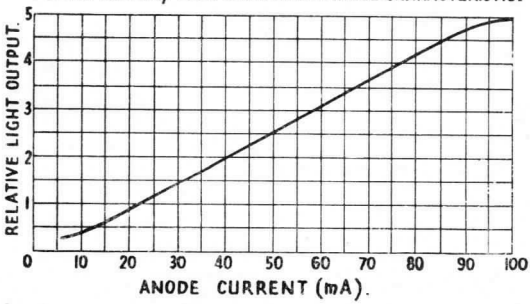
LIGHT SOURCE.

CL40. The End aperture is circular and approx. 3·2 mm. diameter.
CL41. The End aperture is in the form of a slit of length 3·0 mm. and width 0·5 mm.
On both types the column of light viewed broadside presents an area approximately 24 × 5 mm.

TYPICAL OPERATING CONDITIONS.

Heater Voltage	6·3
†Anode and Trigger Supply Voltage	400
Mean Anode Current	50 mA.
Current Modulation	50 %

LIGHT OUTPUT/TUBE CURRENT. AVERAGE CHARACTERISTIC.



*See "Notes on Operation" overleaf.

†It is recommended that the Trigger is connected to the anode by an external resistance of 22,000 ohms.

Issue 1
Jan., 1955

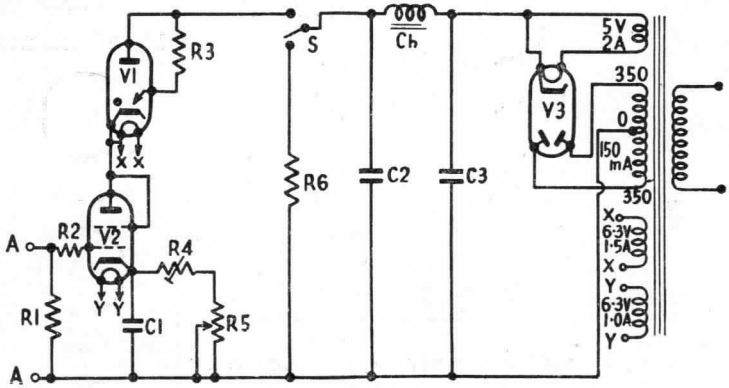
CL40
CL41

FERRANTI

NOTES ON OPERATION.

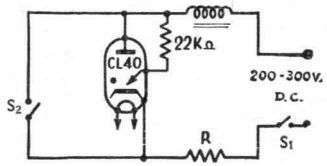
A recommended method of operation is to connect the CL40 in series with a hard valve which is capable of passing sufficient current to provide the required maximum modulation of the CL40.

The modulating signal is applied to the grid of this series valve at A.A. and the resultant changes in anode current of this valve produce corresponding variations in the CL40 anode current. In the typical circuit shewn below, the potentiometer R4 should be preset to limit the 807 cathode current to 100 mA. when R5 is at minimum resistance. R5 should then be adjusted so that the CL40 is operating at the required mean current.



R1	220kΩ	R5	2kΩ Pot. 3W.	C3	8μF. 500V Wkg.
R2	10kΩ	R6	47kΩ 5W.	V1	Ferranti CL40/1
R3	22kΩ	Ch	20 Henries.	V2	Ferranti 807.
R4	300Ω Preset 3W.	C1	50μF. 50V. Wkg.	V3	Ferranti R52.
		C2	16μF. 500V. Wkg.		

Under circumstances where only a limited DC. voltage is available it is possible to run the CL40 by utilising surge voltage to trigger the valve in a manner indicated in the following circuit diagram. The choke is not critical, a normal radio smoothing choke would be suitable but the resistor R should be chosen to limit the valve current to 100mA. Triggering is achieved by opening switch S_2.



IMPORTANT.

When the lamp is first installed or after a long period of rest, the heater should be operated at 6·3 volts for at least 5 mins. without the application of anode and striker voltages. Anode and striker potentials should then be applied and the lamp given a preliminary operating run for 15 mins. with anode current not greater than 50 mA.

On subsequent occasions before the lamp is put to normal use, it should have an initial run for 2 mins. at a heater voltage of 6·3 volts without the application of anode voltage, followed by a further period of 5 mins. during which the anode current is limited to 50 mA.

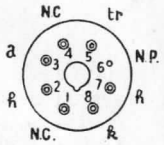
For applications where optimum stability of light output is required this second period should be extended to 10–15 mins.

Ferranti

CL42

LINEAR LIGHT SOURCE

A Helium filled, end viewing, light source in which the light output is proportional to the anode current. The low noise content of this light source makes it particularly suitable for use in sound-on film recording, interferometers and many other applications.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	International Octal
Max. Overall Diameter	... ...	29·5 mm. (1·16″)
Max. Seated Height	... ...	75 mm. (2·95″)
Max. Overall Length	... ...	90 mm. (3.55″)
Mounting Position	... ...	Any

BASE CONNECTIONS.

Pin 1—No Connection	Pin 5—Trigger
Pin 2—Heater	Pin 6—No Pin
Pin 3—Anode	Pin 7—Heater
Pin 4—No Connection	Pin 8—Cathode

LIGHT SOURCE.

The tube is designed for end viewing applications.
The end aperture is circular and approx. 4·0 mm. diameter

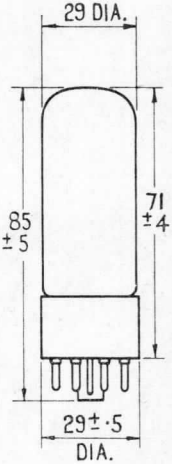
HEATER.

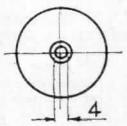
Suitable parallel operation only, a.c. or d.c.

Heater Voltage	... ...	6·3 volts
Heater Current	... ...	1·2 amps

RATINGS & CHARACTERISTICS.

*Max. Trigger Voltage	... ...	500 volts (d.c.)
Max. Mean Anode Current	...	40 mA
Max. Peak Anode Current	...	90 mA.
‡Min. Cathode Current	... ...	10 mA
Max. Anode/Cathode Volt Drop		110 volts
§Min. Cathode Heating Time	...	60 secs





Light Aperture

Dimensions are in millimetres

NOTES ON OPERATION.

(1). The trigger electrode should be connected to anode via a resistor—22 kΩ is the recommended value.

(2). Before the application of anode or trigger voltages, the tubes must be run with heater volts only applied for a period of at least one minute before application of H.T. voltage, followed by an unmodulated stabilising period of 5 minutes during which time the anode current should be near 40 mA.

(3). For optimum stability the anode supply should be derived from a stabilised D.C. power pack and the stabilising period mentioned in (2) increased to say 15 minutes.

*With trigger electrode connected to anode via a 22 kΩ resistor. If the supply voltage is below this value the valve may not trigger unless special circuitry is used as indicated on page 2.

‡In a circuit similar to that shown overleaf this is the lowest value of current to maintain the discharge. Operation at lower values can be achieved with special circuitry.

§Before application of the H.T. supply to anode or trigger. See 'Notes on Operation.

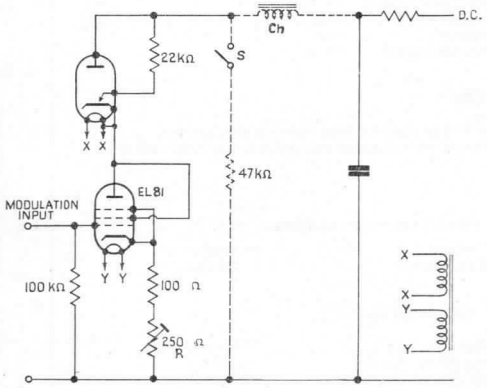
Issue 2.
May, 1962.

TYPICAL OPERATION.

A recommended simple method of operation is to connect the CL42 in series with a hard valve which is capable of passing sufficient current to provide the required maximum modulation.

The modulating signal is applied to the grid of this series valve and the resultant changes in anode current of this valve produce corresponding variations in the CL42 cathode current.

A diagram of a typical circuit of this type is shown below.



In the circuit above the cathode current of the EL81 is limited to the maximum rated peak current of the CL42 (i.e. 90 mA) by the pre-set resistance (R) in the cathode circuit.

This circuit is designed to operate from a supply voltage which is lower than the necessary trigger voltage. The method of operation is as follows:—

After the CL42 and EL81 have had the appropriate filament voltage applied for the necessary warm up time, (see 'Notes on Operation' below), the H.T. should be switched on with the switch 'S' closed.

Switch 'S' is then opened and the resultant surge will trigger the CL42.

If the DC supply voltage is higher than the trigger voltage, the choke switch and resistor shown dotted may be omitted from the circuit.

Ferranti

CL44

LINEAR LIGHT SOURCE

A Neon filled, end viewing, light source which can be modulated. The light output is proportional to the anode current.

PHYSICAL DETAILS.

Base	International Octal
Max. Overall Diameter	29·5 mm. (1·16")
Max. Seated Height	75 mm. (2·95")
Max. Overall Length	90 mm. (3·55")
Mounting Position	Any

BASE CONNECTIONS.

Pin 1—No Connection	Pin 5—Trigger
Pin 2—Heater	Pin 6—No Pin
Pin 3—Anode	Pin 7—Heater
Pin 4—No Connection	Pin 8—Cathode

LIGHT SOURCE.

The end aperture is circular and approx. 4·0 mm. diameter. The tube is designed for end viewing applications, but the light may be viewed broadside if desired.

HEATER.

Suitable parallel operation only, AC. or DC.

Heater Voltage	6·3 volts
Heater Current	1·5 amps

RATINGS.

*Min. Supply Voltage	400 volts (d.c.)
Max. Mean Anode Current ...	40 mA
Max. Peak Anode Current ...	90 mA
§Min. Cathode Heating Time ...	60 secs

CHARACTERISTICS.

†Max. Trigger Voltage	400 volts (d.c.)
‡Min. Cathode Current	10 mA
Max. Modulation Frequency ...	15 Kc/s
Max. Anode/Cathode Volt Drop	55 volts

NOTES ON OPERATION.

(1) The trigger electrode should be connected to anode via a resistor—20 kΩ is the minimum value.

(2) Before the application of anode or trigger voltages, the tubes must be run with heater volts only applied for a period of at least one minute before application of H.T. voltage. For use as a modulated light source this period should be followed by an unmodulated stabilising period of 5 minutes during which time the anode current should be near 40 mA.

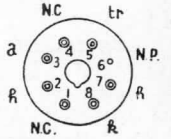
(3) For optimum stability the anode supply should be derived from a stabilised DC. power pack and the stabilising period mentioned in (2) increased to say 15 minutes.

*If the supply voltage is below this value the valve may not trigger unless special circuitry is used as indicated on the circuit diagram on Page 2.

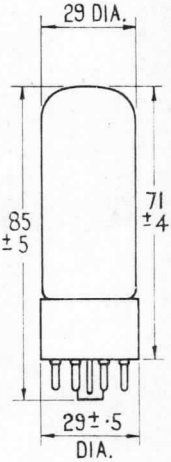
§Before application of the H.T. supply to anode or trigger. See 'Notes on Operation (2)'

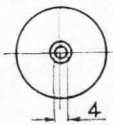
†With trigger electrode connected to anode via a 22 kΩ resistor.

‡In a circuit similar to that shown overleaf this is the lowest value of current to maintain the discharge. Operation at lower values can be achieved with special circuitry.



Base Connections Underside View of Base





Light Aperture

Dimensions are in millimetres

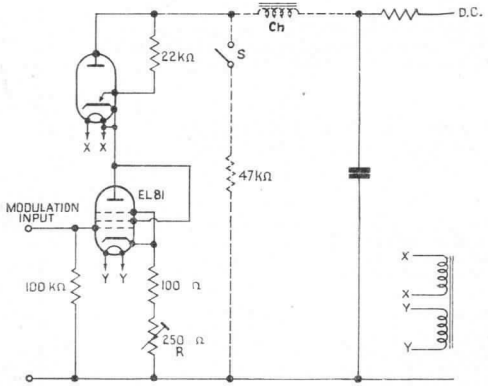
Issue 2. Nov. 1962

TYPICAL OPERATION.

A recommended simple method of operation as a modulated light source is to connect the CL44 in series with a hard valve which is capable of passing sufficient current to provide the required maximum modulation.

The modulating signal is applied to the grid of this series valve and the resultant changes in anode current of this valve produce corresponding variations in the CL44 cathode current.

A typical circuit of this type is shown below.



In this circuit the resistance (R) in the cathode circuit of the EL81 is pre-set to limit the cathode current of the EL81 to the maximum rated peak current of the CL44 (i.e. 90 mA).

This circuit is designed to operate from a d.c. supply voltage which is lower than the necessary trigger voltage. The method of operation is as follows:—

After the CL44 and EL81 have had the appropriate filament voltage applied for the necessary warm up time, (see 'Notes on Operation'), the H.T. should be switched on with the switch 'S' closed.

Switch 'S' is then opened and the resultant surge will trigger the CL44.

If the DC. supply voltage is higher than the trigger voltage, the choke, switch and resistor shown dotted may be omitted from the circuit.

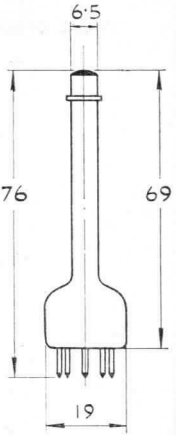
Ferranti

LINEAR LIGHT SOURCES

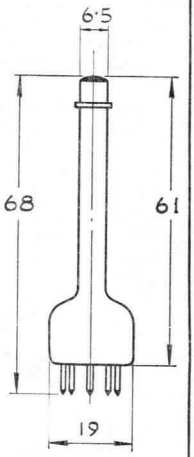
Gas filled light sources in which the light output is proportional to the anode current. Used for phototelegraphic picture recording, sound film recording, time interval marking and stroboscopic and many other applications.

CL50

CL52



CL50



CL52

Dimensions are in millimetres (max.)

PHYSICAL DETAILS.

		CL50	CL52
Max. Overall Length	...	68	76 mm.
Max. Seated Height	...	61	69 mm.
Base (both types)	...	B7G.	
Top Cap (both types)	...	CT1.	

GAS FILLING.

CL50	... ...	Mercury/Argon.
CL52	... ...	Helium.

BASE CONNECTIONS.

CL50.

Pin 1—I.C.
Pin 2—Cathode.
Pin 3 } Heater. *
Pin 4 }
Pin 5—Trigger.
Pin 6 } Heater. *
Pin 7 }
Top Cap—Anode

CL52.

Pin 1—Trigger.
Pin 2—Cathode.
Pin 3—Heater.
Pin 4—Heater.
Pin 5—Trigger.
Pin 6—No connection.
Pin 7—Cathode.
Top Cap—Anode.

See diagrams overleaf.

LIGHT SOURCE.

The source of light is cylindrical and extends downwards from the top cap. The effective broadside dimensions are approximately :—

CL50	... ...	5×35 mm.
CL52	... ...	5×26 mm.

HEATER.

		CL50	CL52	
Heater Voltage	... ...	6·3	6·3	volts.
Heater Current	... ...	1·25	1·5	amps.

RATINGS & CHARACTERISTICS.

Type No.		CL50	CL52	
Gas		Hg/A	He	
†Min. Supply Voltage	... ...	375	500	volts(d.c.).
Max. Mean Anode Current	...	50	40	mA.
Max. Peak Cathode Current	...	100	90	mA.
‡Min. Cathode Current	... ...	8	10	mA.
Anode/Cathode Volt Drop	...	35	95	volts (apx).

§Min. Cathode Heating Time—See Notes on Operation.

TYPICAL OPERATION.

A recommended simple method of operation is to connect the CL50/52 in series with a hard valve which is capable of passing sufficient current to provide the required maximum modulation of the CL50/52.

The modulating signal is applied to the grid of this series valve and the resultant changes in anode current of this valve produce corresponding variations in the CL50/52 cathode current.

A diagram of a typical circuit of this type is shown overleaf.

---

*Pins 3 & 4 are connected to one end of the heater and the other end is connected to both pins 6 & 7. (see diagrams overleaf).

†This is the maximum voltage required to trigger the lamp.

‡In a circuit as shown overleaf this is the lowest value of current to maintain the discharge. Operation at lower values can be achieved with special circuitry.

§Before application of the HT supply to anode or trigger.

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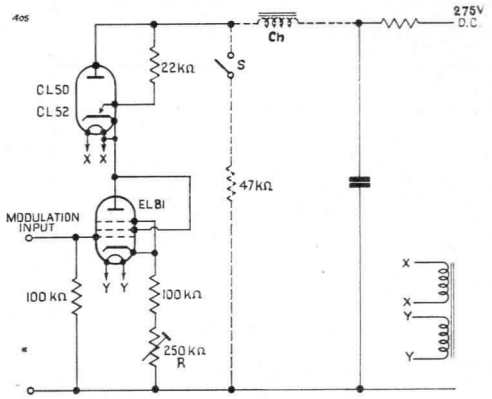
Aug. 1961

Ferranti

TYPICAL OPERATION (cont'd).



In the circuit above the cathode current of the EL81 is limited to 100 mA for CL50 or 90 mA for CL52 by the pre-set resistance (R) in the cathode circuit.

This circuit is designed to operate either tube from a supply voltage which is lower than the necessary trigger voltage. The method of operation is as follows:-

After the CL50 or CL52 and EL81 have had the appropriate filament voltage applied for the necessary warm up time, (see notes on operation (2) below), the H.T. should be switched on with the switch S closed.

Switch S is then opened and the resultant surge will trigger the CL50 or CL52.

If the DC supply voltage is higher than the appropriate trigger voltage, the choke switch and resistor shown dotted may be omitted from the circuit.

NOTES on OPERATION.

(1). The trigger electrode should be connected to anode via a resistor - 22Kohms is the recommended value.

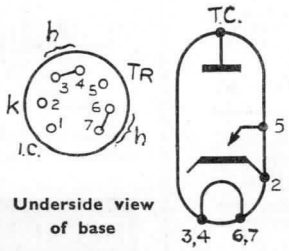
(2). Before the application of anode or trigger voltages, the tubes must be run with heater volts only applied as indicated below.

(a). Type CL50 - When first installed or after long inoperative periods the heater should be run at full voltage for at least 5 minutes - followed by a stabilising period after application of anode voltage of say 10 minutes without modulation and anode current not exceeding 50 mA.

On subsequent occasions the heater warm up time can be reduced to 2 minutes and the stabilising period to say 5 minutes.

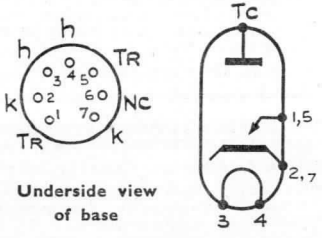
(b). Type CL52 - On all occasions the heater voltage should be applied at least one minute before H.T. voltage followed by an unmodulated stabilising period of 5 minutes during which time the anode current should be near 40 mA.

(3). For optimum stability the anode supply should be derived from a stabilised D.C. power pack and the stabilising period mentioned in (2) increased to say 15 minutes.



Underside view of base

CL50



Underside view of base

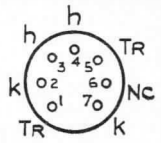
CL52

CL 55
CL 56
CL 57
CL 58

Ferranti

SPECTRAL LIGHT SOURCES

Light Sources filled with spectrally pure gas. These spectral sources can be used in cases where a known line spectrum is required and the form of construction makes them particularly suitable for uses requiring a compact source or where a close approach to the actual source is necessary.
The light output is roughly proportional to the anode current.



Underside view of base

PHYSICAL DETAILS.

Base	B7G
Max. Overall Length	68 mm.
Max. Seated Height	61 mm.
Top Cap	CT1.

GAS FILLING.

CL55	Helium.
CL56	Krypton.
CL57	Neon.
CL58	Xenon.

LIGHT SOURCE.

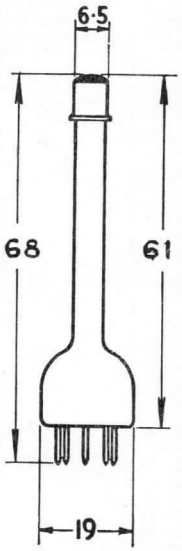
The source of light is cylindrical with an effective broadside dimension of 5×32 mm. approx. and extends downwards from the top cap.

BASE CONNECTIONS.

Pin 1—Trigger.	Pin 5—Trigger.
Pin 2—Cathode.	Pin 6—No connection.
Pin 3—Heater.	Pin 7—Cathode.
Pin 4—Heater.	Top Cap—Anode.

HEATER.

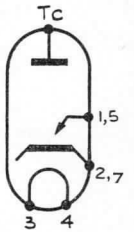
	CL55	CL56	CL57	CL58	
Heater Voltage ...	6·3	6·3	6·3	6·3	volts.
Heater Current ...	1·5	1·5	1·3	1·5	amps.



Dimensions are in millimetres (max.)

RATINGS & CHARACTERISTICS.

Type No. / Gas	CL55 He.	CL56 Kr.	CL57 Ne.	CL58 Xe.	
*Min. Supply Voltage	500	375	400	375	volts(d.c.).
Max. Mean Anode Current ...	40	50	40	50	mA.
Min. Cathode Current	See Note * below.				
Max. Peak Cathode Current ...	90	90	90	90	mA.
Anode/Cathode Volt Drop ...	95	15	55	12	volts.(Apx)
†Min. Cathode Heating Delay (all types)		— 60 —			sec.



*It is recommended that the trigger electrode is connected to the anode through a 22,000 ohm resistor. Under these conditions the minimum anode current to maintain the discharge is less than 10 mA.
*This is the maximum voltage required to trigger the lamp.
†Before application of the HT supply to anode or trigger.

Ferranti

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Apr., 1961

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CL 55
CL 56
CL 57
CL 58

TYPICAL OPERATION

For most applications in which a light source of predetermined and relatively constant brightness is required the circuit of Fig. 1 is suitable. If it is desired to operate the lamp at various levels of brightness the series resistor R should be variable. The value of R should be chosen to limit the current to within the specified rating.

The lamp should first be allowed to stabilise at near maximum mean current for a few minutes after which the series resistance can be increased to reduce the current through the lamp.

If it is required to have a light source that can be continuously controlled, the circuit of Fig. 2 should be used. The control signal is applied to the pentode control grid at A.

When greater stability is required in either of the above circuits the HT supply to the lamp (and pentode) should be derived from a stabilised DC power pack.

In circumstances where the available DC voltage is limited and lower than the specified minimum supply voltage, it is possible to start the lamp by utilising a surge voltage in the manner indicated in Fig. 3. Triggering is achieved by opening S2 with S1 closed. The value of the choke is not critical but the resistance at R must limit the current through the lamp to 40 mA.

In all cases provision should be made for the cathode heating delay before application of HT voltage.

Fig. 1.

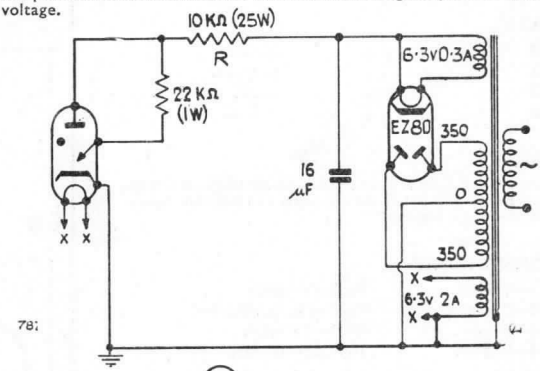


Fig. 2.

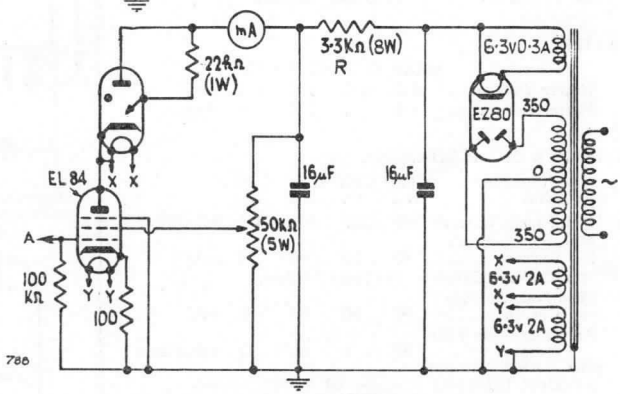
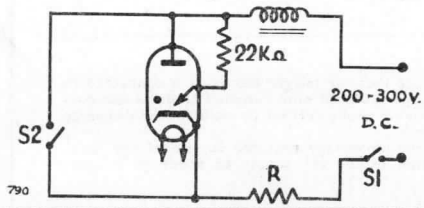


Fig. 3.



FERRANTI

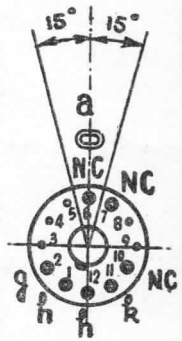
VACUUM LIGHT SOURCES — HIGH SPEED STROBOSCOPIC LIGHT SOURCES

CL60
CL61
CL62
CL63
CL64
CL65
CL66

Small grid controlled Triode Tubes designed to produce single light flashes or trains of light flashes of high luminous intensity ; they are also suitable for continuous stroboscopic working at high repetition rates. The seven types differ only in the type of screen phosphor employed.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Side Contact	CT8 Cavity Type.
Max. Overall Length	221 mm. (8¾in.).
Max. Diameter	95mm. (3¾in.).
Nom. Neck Diameter	35 mm.
Mounting Position	Any.



SCREEN FLUORESCENCE.

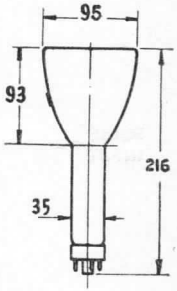
Type	*Phosphor*	*Luminescence*	*Decay Time**
CL60	A type	Green	<1μsec.
CL61	P type	Blue	5μsecs. approx.
CL62	Q type	Ultra-Violet	0·1μsec. approx.
CL63	C type	Yellow-Green	6μsecs. approx.
CL64	V type	Yellow	5μsecs. approx.
CL65	R type	Red	2μsecs. approx.
CL66	T type	White	5μsecs. approx.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Grid.
Pin 3—No pn.
Pin 4—No pin.
Pin 5—No pin.
Pin 6—No connection.
Pin 7—No connection.
Pin 8—No pin.
Pin 9—No pin.
Pin 10—No connection.
Pin 11—Cathode.
Pin 12—Heater.
Side Contact—Anode.

HEATER.

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



RATINGS AND CHARACTERISTICS.

‡Max. Anode Voltage	20 kV.
Max. Anode Current (Pulsed) ...	100 mA.
**Max. Mean Anode Current ...	200 μA.
Grid Volts for Cut off ...	−30 to −80 volts.
Grid drive for Max. Anode Current	150 volts max.

LIGHT OUTPUT (V_a=20 kV—100 mA peak beam current, using eye corrected photometer).

CL60	10,000 candelas approx.
CL61	16,000 candelas approx.
CL62	240 candelas approx.††
CL63	24,000 candelas approx.
CL64	12,000 candelas approx.
CL65	14,000 candelas approx.
CL66	12,000 candelas approx.

†See Phosphor Characteristic Curves on pages 2 and 3.
*To 1/e level.
‡The anode voltage may be raised to 25 kV. in applications where the presence of constant 'background illumination' of a low level can be tolerated. Alternatively the anode may be pulsed up to 35 kV. for applications where greatest light output is required for single flashes of short duration trains of flashes.
**Averaged over a period 1 min. For shorter periods mean anode currents of up to 400 μA. may be used. For periods of not more than 1 sec. mean currents up to 3 mA. may be used.
††Most of the output of the Q phosphor is in the extreme violet.

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Aug, 1958

CL60
CL61
CL62
CL63
CL64
CL65
CL66

LUMINOUS AREA.

The unfocused luminous area is 5 cm. dia. minimum. The fluorescent area may be reduced to approx. $\frac{1}{4}$in. diameter by means of a suitable focus coil : under this condition care must be taken to avoid damaging the phosphor by overloading.

FLASH DURATION.

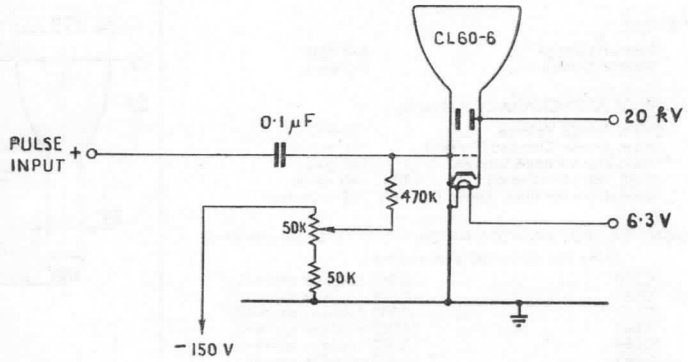
The minimum duration of the flash depends on the duration of the grid pulse and on the screen phosphor. With CL60 and CL62 the flash duration can be reduced to less than 1 microsecond.

FLASH FREQUENCY.

Any repetition rate can be employed within the characteristics of the particular screen phosphor provided the maximum mean current rating is not exceeded.

TYPICAL OPERATION.

The usual method of operation of these Flash Tubes is to apply positive going pulses to the negatively biased control grid. A typical circuit is shewn on the following diagram :—

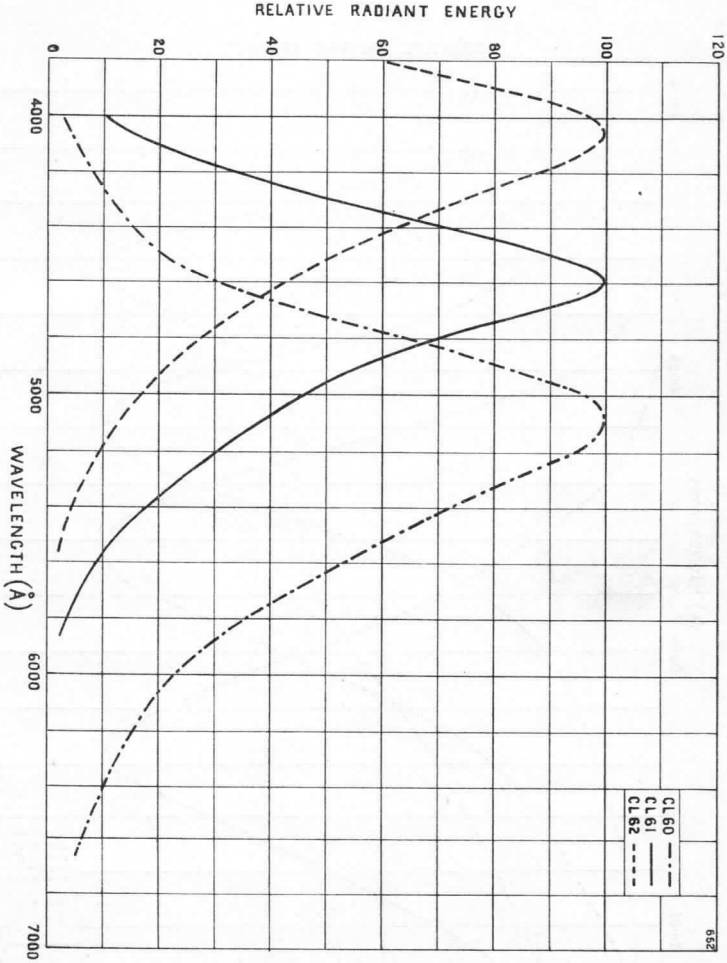


The negative bias on the control grid is set by means of the potentiometer so that when H.T. is applied to the anode there is no anode current flowing or that there is no illumination of the screen. When the positive pulses are applied to the grid the anode current flows and the screen fluoresces. The brightness duration and frequency of the flash are respectively controlled by the amplitude, duration and P.R.F. of the pulses as applied to the grid. These pulses should be derived from a low impedance source and should not have an amplitude in excess of 200 volts but the maximum anode current of the CL60-66 should not exceed 100 mA. in any case.

CL60
CL61
CL62
CL63
CL64
CL65
CL66

TYPICAL PHOSPHOR CHARACTERISTICS IN THE VISIBLE SPECTRUM

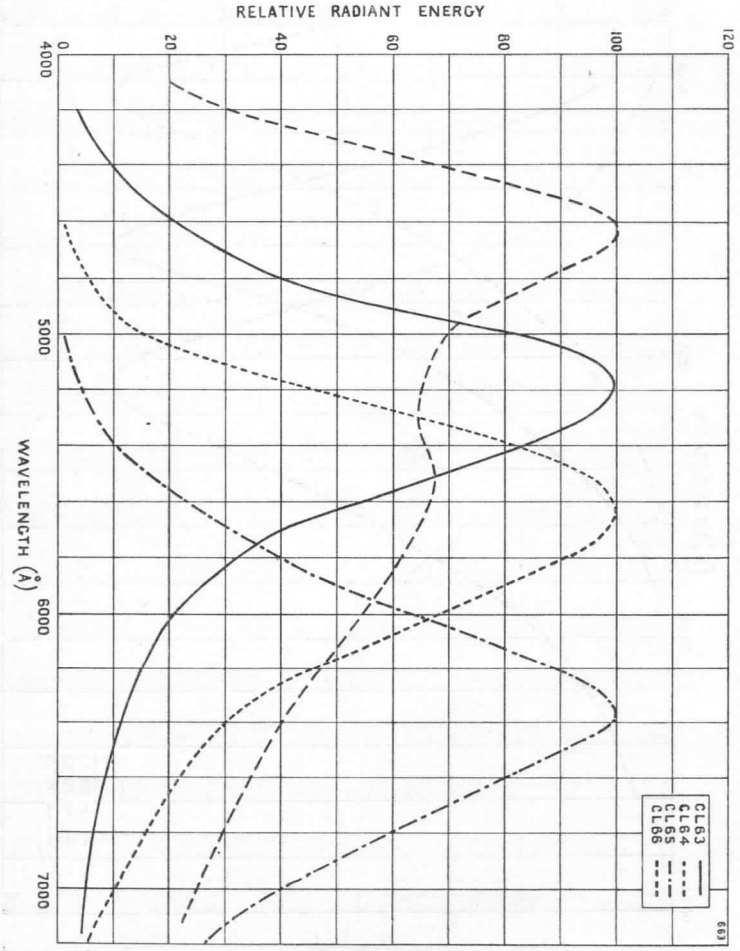
(NOTE—The curves are not relative to each other)



CL60
CL61
CL62
CL63
CL64
CL65
CL66

TYPICAL PHOSPHOR CHARACTERISTICS IN THE VISIBLE SPECTRUM

(NOTE—The curves are not relative to each other)



Ferranti

ED20

STROBOSCOPIC LIGHT SOURCE

A Xenon filled arc discharge lamp intended primarily for use as a Stroboscopic Light Source for low repetition frequencies up to 30 per second. The reflector is an integral part of the design and the trigger pulse transformer is incorporated in the base.

PHYSICAL DETAILS.

Base	UX6.
Max. Seated Height	86 mm. ($3\frac{3}{8}$in.).
Overall Length	102mm. ($4\frac{1}{64}$in.).
Diameter of Reflector	105mm. ($4\frac{1}{8}$in.).
Diameter of base	35mm. ($1\frac{3}{8}$in.).
*Mounting Position	Any.

PIN CONNECTIONS.

Pin 1—Cathode.
Pin 2—Trigger earth.
Pin 3—Trigger input.
Pin 4—Anode.
Pin 5—I.C.
Pin 6—I.C.

RATINGS.

Max. A.C. Supply Voltage ...	240 volts (r.m.s.).
Max. Anode Voltage (Static) ...	300 volts d.c.
Max. Anode Voltage (Working)	240 volts d.c.
Min. Anode Voltage (Working)	180 volts d.c.
Max. Dissipation	12 watts.
Max. Energy per Flash	1 joule.
Max. Discharge Capacitor ...	16 μF.
Min. Value of Charging Resistor	500 ohms.

CHARACTERISTICS.

Max. Flashing Frequency ...	30 per second.
Trigger Voltage	see Note 1 overleaf.

TYPICAL OPERATION.

as Stroboscopic Light Source.

Anode Voltage	230 volts.
Charging Resistor :	
1—15 c/s.	500 ohms.
16—30 c/s.	1000 ohms.
Discharge Capacitor	
1—15 c/s.	16 μF.
16—30 c/s.	4 μF.

A simple circuit for operation from a.c. mains is shown overleaf.

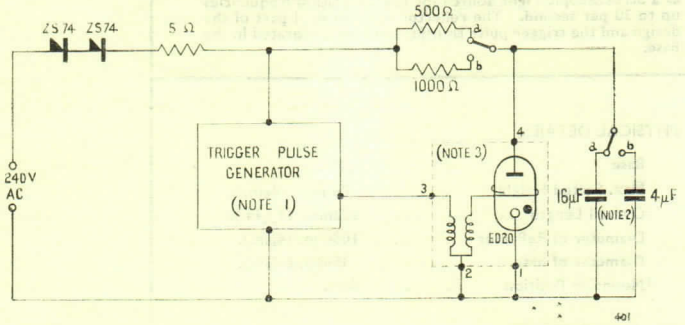
*The recommended method of mounting is by support at the flange of the reflector.

Tentative
Issue 1
Mar., 1961

Ferranti

TYPICAL OPERATION (Cont.).

Circuit diagram for operation as a Stroboscopic Light Source from A.C. supplies with silicon rectifiers and 2 range frequency switching.



Note 1.

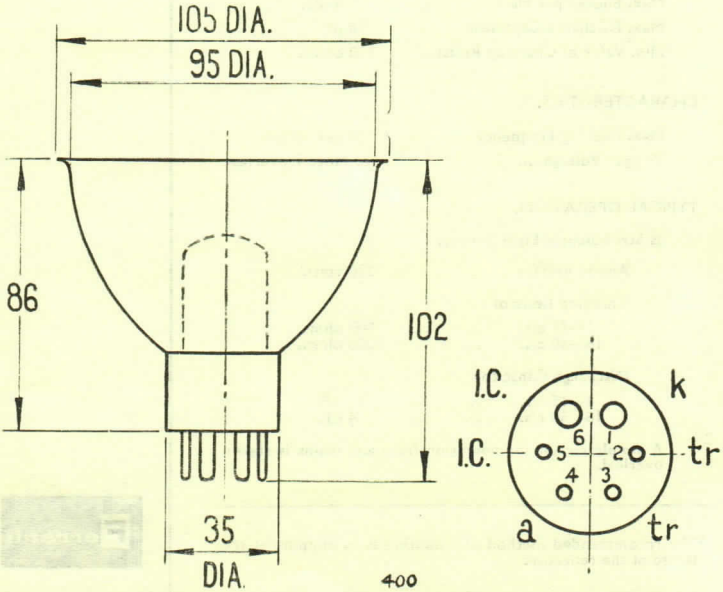
The trigger pulse generator circuit may use either valve or semi-conductor devices. It can conveniently consist of a means of controlling the frequency of a discharge through the primary of the built in transformer. A suitable discharge may be obtained from a capacitor of approx. 0·1 μF charged to 150 volts.

Note 2.

The capacitors should be good quality paper type—electrolytic capacitors are unsuitable.

Note 3.

The figures refer to the valve pin connections.

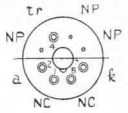


ED25

Ferranti

STROBOSCOPIC LIGHT SOURCE

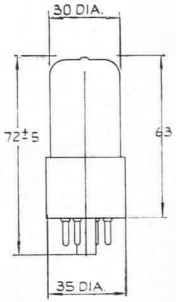
A gas filled cold cathode arc discharge tube designed for use in stroboscopic applications at frequencies up to 150 flashes per second. It emits a white light.



Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Max. Seated Height	63 mm. (2·48″)
Max. Overall Length	77 mm. (2·86″)
Max. Diameter	35 mm. (1·38″)
Mounting Position	Any (Vertical-base down preferred)



PIN CONNECTIONS.

Pin 1—Anode	Pin 5—Blank
Pin 2—Anode	Pin 6—Blank
Pin 3—Blank	Pin 7—Cathode
Pin 4—Trigger	Pin 8—Cathode

RATINGS.

Max. Anode Voltage	500 volts
Max. Flash repetition rate ...	150 per sec.
Max. Discharge Capacitor ...	8 μF

TYPICAL OPERATION.

D.C. Supply Voltage	450 volts
*Trigger Voltage	2 to 4 kV
Discharge Capacitor	0·5 μF
Charging Resistance	8000 ohms
Flash Repetition Rate	150 per sec.

Dimensions in Millimetres

See overleaf for a typical stroboscope circuit with suitable component values.

*A suitable trigger pulse transformer is Ferranti Type PT56.

Ferranti

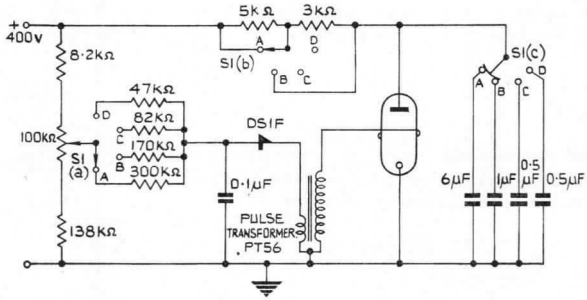
Issue 2.
Aug. 1962.

TYPICAL OPERATION (Continued).

The circuit of a Stroboscope offering repetition rates up to 150 flashes per second in 4 ranges is shown below.

The approximate frequency of the four ranges is as follows.

Switch in position	A ...	100–150 c/s (6000–9000 r.p.m.)
	B ...	30–100 c/s (1800–6000 r.p.m.)
	C ...	15– 30 c/s (900–1800 r.p.m.)
	D ...	1– 15 c/s (60– 900 r.p.m.)



The resistors R1 or R2 should be of the vitreous type with a dissipation rating of 14 watts.

The above range coverage is only applicable with an input voltage of 400 V D.C. and with resistors of close tolerance (5%).

Ferranti

STROBOSCOPIC LIGHT SOURCE

A Xenon filled stroboscopic Flash Tube designed for low voltage operation for use in applications at frequencies up to 250 flashes per second. It emits a white light.

PHYSICAL DETAILS.

Electrode Connections ...	Flexible Leads
Max. Overall Length (excl. leads)	45 mm. (1·772")
Max. Width	20 mm. (·787")
Max. Diameter of Glass Tube	7 mm. (·276")

ELECTRODE CONNECTIONS.

The anode lead is marked red.

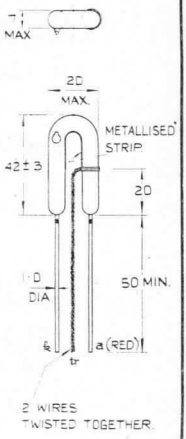
RATINGS.

Max. Anode Voltage (Static)	600 volts
Max. Anode Voltage (Working)	500 volts
Min. Anode Voltage (Working)	350 volts
Max. Flash repetition rate ...	250 per sec
Max. Dissipation	6 watts
Min. Charging Resistor ...	7·5 kΩ

TYPICAL OPERATION.

DC. Supply Voltage	450 volts
*Trigger Voltage	4 to 6 kV
Charging Resistance	7·5 kΩ
Discharge Capacitor:—	
0—25 f.p.s.	2·0 μF
25— 50 f.p.s.	1·0 μF
50—150 f.p.s.	0·5 μF
150—250 f.p.s.	0·25 μF

See overleaf for a typical stroboscope circuit with suitable component values.



Dimensions in Millmetres

*A suitable trigger pulse transformer is Ferranti Type PT.56.

Issue 2.
Sept., 1962

Ferranti

TYPICAL OPERATION (Continued).

The circuit of a Stroboscope providing repetition rates up to 250 flashes per second in 4 ranges is shown below.

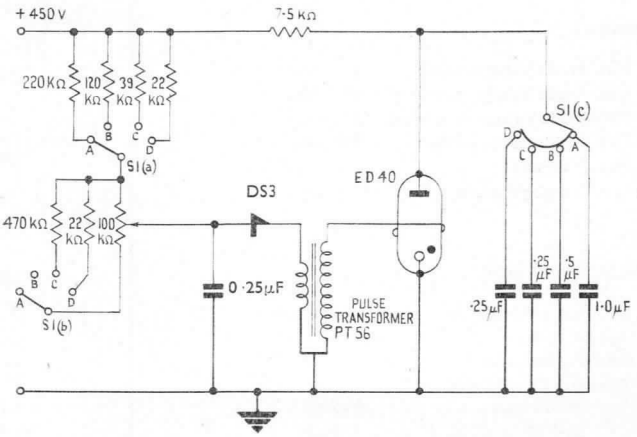
In this equipment a silicon p-n-p-n switch (Ferranti type DS.3) is used to provide a simplified trigger circuit.

The repetition rate is controlled by the 100kΩ potentiometer which may be calibrated.

Switches S1(a), S1(b) and S1(c) are ganged.

The approximate flashing frequency of the four ranges is as follows:

Switch in position A ... 15— 25 f.p.s. (900—1500 r.p.m.)
B ... 25— 50 f.p.s. (1500—3000 r.p.m.)
C ... 50—140 f.p.s. (3000—8000 r.p.m.)
D ... 140—250 f.p.s. (8400—15000 r.p.m.)



The 7·5 kΩ charging resistor should be preferably of the vitreous type with a dissipation rating of 14 watts.

As the frequency of operation of the p-n-p-n switch is dependent on voltage, the above range coverage is only applicable with an input voltage of 450 V D.C. and with resistors of close tolerance (5%).

Other types of controlled trigger circuits to produce the necessary triggering pulse for the ED.40 may of course be used.

ED50

Ferranti

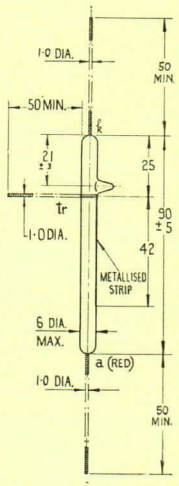
STROBOSCOPIC LIGHT SOURCE

A Xenon filled stroboscopic Flash Tube designed for low voltage operation in applications requiring a linear source at low repetition rates. It emits a white light.

PHYSICAL DETAILS.

Electrode Connections	Flexible Leads
Max. Overall Length (excl. leads)	95 mm. (3·7")
Min. Lead Length	50 mm. (1·9")
Max. Diameter of Glass Tube ...	8 mm. (0·3")
Effective Flash Length	40 mm. (1·6")

For other dimensions see outline drawing.



Dimensions in Millmetres

ELECTRODE CONNECTIONS.

The anode lead is marked red.

RATINGS.

Max. Anode Voltage (Static)	600 volts
Max. Anode Voltage (Working) ...	550 volts
Min. Anode Voltage (Working) ...	350 volts
Max. Flash repetition rate	10 per sec
Max. Dissipation	10 watts
Min. Charging Resistor	7·5 kΩ

TYPICAL OPERATION.

DC. Supply Voltage	350	500 volts
*Trigger Voltage	4 to 6	4 to 6 kV
Charging Resistor	7·5	7·5 kΩ
Discharge Capacitor:—		
0—10 f.p.s.	32	8·0 μF

*A suitable trigger pulse transformer is Ferranti Type PT.56.

Tentative
Issue 2.
Nov., 1962

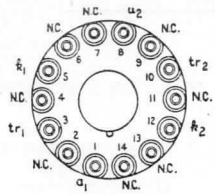
Ferranti

Ferranti

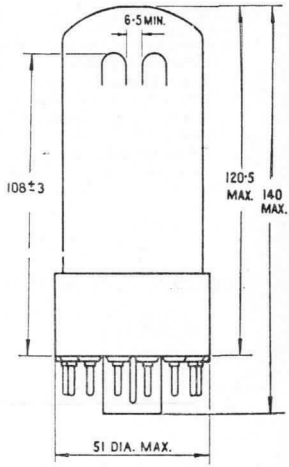
EDN10

STROBOSCOPIC LIGHT SOURCE

A xenon filled cold cathode arc discharge tube incorporating two independent EN55 assemblies. The tube is designed for stroboscopic operation with interlaced trigger circuits to provide flash rates of up to 800 per second. (The tube can be operated at flash rates of 1000 per second in specially designed circuits.) It emits a white light.



Base Connections
Underside View of Base



All dimensions shown are in millimetres

PHYSICAL DETAILS.

Base	B14A (Diheptal)
Max. Seated Height	120·5 mm. (4·74")
Max. Overall Length	140 mm. (5·51")
Max. Dia. (over base)	51 mm. (2·08")
Mounting Position...	Any

BASE CONNECTIONS.

Pin 1—Anode 1
Pin 2—No Connection
Pin 3—Trigger 1
Pin 4—No Connection
Pin 5—Cathode 1
Pin 6—No Connection
Pin 7—No Connection
Pin 8—Anode 2
Pin 9—No Connection
Pin 10—Trigger 2
Pin 11—No Connection
Pin 12—Cathode 2
Pin 13—No Connection
Pin 14—No Connection

RATINGS. (Each section)

(All maximum ratings are 'absolute')

Max. Anode Voltage (DC. Static)	...	1000 volts
Max. Anode Voltage (working)	...	900 volts
Min. Anode Voltage (working)	...	700 volts
*Max. Dissipation	...	20 watts
Max. Discharge Capacitor	...	6 μF
†Min. Charging Resistor (12–150 c/s)	...	8 kΩ
(150–400 c/s)	...	11 kΩ
Max. Operating Frequency ...	...	400 c/s

CHARACTERISTICS.

‡*Trigger Voltage	...	2–4 kV
§Typical Peak Luminous Intensity	...	140,000 Candelas
§Typical Flash Duration at ½ peak	...	25–30 μSec

*See Notes on Operation—Page 2.
†For stroboscopic operation these resistors should be rated for 25W dissipation.
‡Peak pulse voltage.
§V_a=900 C=6μF.

Issue 2.
Nov., 1963

NOTES ON OPERATION.

Discharge Capacitor. Should be a good quality type with sufficient working voltage continuous rating, preferably non-inductive and designed for high current pulse operation.

Discharge Energy. It is important to ensure that the energy dissipated in the tube does not exceed the maximum rating given on Page 1. Over-running the tube even for very short periods may cause permanent damage, resulting in erratic operation particularly at the higher frequencies and/or shortened life.

Trigger Voltage. The trigger voltage is the peak pulse voltage.

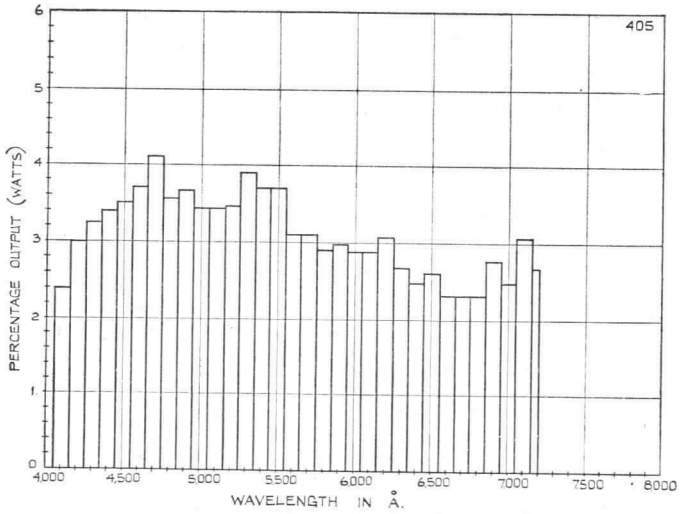
Connecting Leads. Because of the very high peak current of the discharge all the leads in the discharge path connecting the capacitor with anode and cathode should be of heavy gauge and as short as possible in order to ensure the maximum discharge energy.

Flash Duration. The duration of the light flash with a 4 μF. capacitor charged to 800 volts is approximately 15–20 microseconds at $\frac{1}{3}$ of the peak luminous intensity. Higher energy discharges will lengthen the duration of the discharge and lower energy discharges are shorter.

WARNING. The use of high voltages and capacitances constitutes a hazard and care should be taken in operating or repairing any equipment incorporating these tubes.

SPECTRAL CHARACTERISTICS.

DISTRIBUTION OF RATE OF EMISSION OF ENERGY OVER THE VISIBLE SPECTRUM.

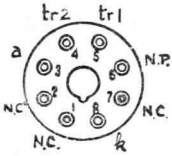


Ferranti

EN10

"NEOSTRON"
STROBOSCOPIC LIGHT SOURCE

Designed for use in Stroboscopic applications, the Ferranti 'Neostron' is a cold cathode tetrode gas discharge tube emitting a reddish light. Operating frequency can be controlled by low voltage, low energy pulses. Also suitable for operation as a relay valve providing high peak current pulses.



Base Connections

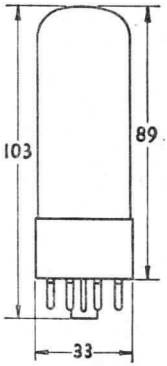
Underside View of Base

PHYSICAL SPECIFICATION.

Base	International Octal.
Max. Seated Height	89 mm. ($3\frac{1}{2}$in.).
Max. Overall Length	103 mm. ($4\frac{1}{16}$in.).
Max. Base Diameter	32 mm. ($1\frac{1}{4}$in.).
Length of Arc	24 mm. ($\frac{15}{16}$in.).
Mounting Position	Any.

PIN CONNECTIONS.

Pin 1—No Connection.	Pin 5—Trigger Electrode 1.
Pin 2—No Connection.	Pin 6—No Pin.
Pin 3—Anode.	Pin 7—No Connection.
Pin 4—Trigger Electrode 2.	Pin 8—Cathode.



RATINGS (Maximum Ratings are 'Absolute' ratings).

Max. Anode Voltage (static)	440 volts.
Max. Anode Voltage (working) ...	380 volts.
Min. Anode Voltage (working) ...	240 volts.
Max. Peak Inverse Anode Voltage ...	350 volts.
Max. Average Anode Current	100 mA.
Max. Discharge Capacitance	16 μF.
Max. Average Trigger Current... ...	10 mA.

CHARACTERISTICS.

*Static striking voltage (tr_2 to tr_1) ...	80–130 volts.
Max. flashing frequency	250 per sec.
Min. trigger current required at V_a 380	50 μA.
Min. trigger current required at V_a 240	300 μA.
†Peak Luminous Intensity	700 candelas.
†Flash Duration at $\frac{1}{3}$peak	15 μSec.
†Peak Anode Current	400 amps.
§Triggering delay	< 40 μSec.

TYPICAL OPERATION as Stroboscopic Light Source:—

DC. supply voltage	300–330 volts.
Vtr_2 at triggering instant	70 volts.
Trigger pulse amplitude (Vtr_1) ...	−150 volts(min.).
Charging resistor	3000 ohms.
Discharge Capacitor for Operation at:—	
6–35 f.p.s. ...	4 μF.
Up to 50 f.p.s. ...	3 μF.
to 80 f.p.s. ...	2 μF.
to 150 f.p.s. ...	1 μF.
to 250 f.p.s. ...	0·5 μF.

The voltage applied to tr_2 should be positive with respect to the cathode and the trigger pulse applied to tr_1 should be negative.
The discharge capacitor should be a good quality type suitable for heavy current pulse operation.

All dimensions shown are in millimetres.

*tr_1 negative to tr_2 This range of trigger voltage quoted is for single flash operation or for operation with long intervals between flashes. For repetitive flash operation as in stroboscopic applications a higher trigger voltage is necessary.

†Va = 380 volts. C = 4 μF.

§See 'Notes on Operation'.

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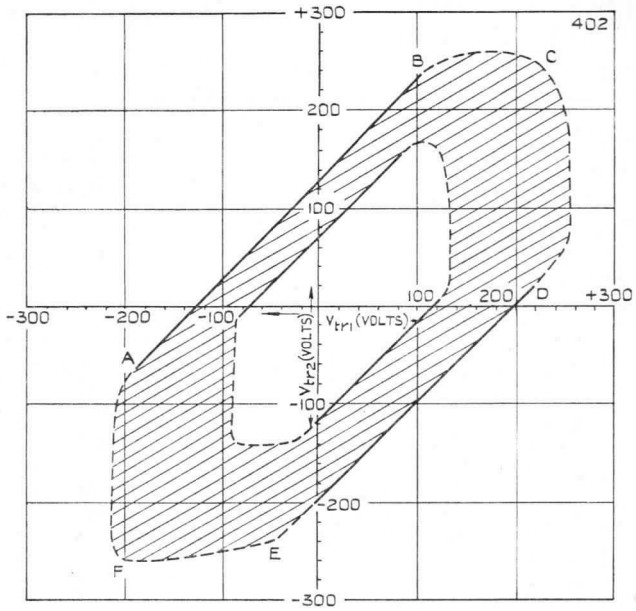
AVERAGE STATIC TRIGGERING CHARACTERISTICS.



The unshaded area enclosed by the loops is an area of non-conduction. If the vector sum of the voltages on two trigger electrodes lies within the loop the valve will not fire. Any change of either or both of these voltages which causes the vector sum to fall outside the loop will trigger the valve.

The inner loop is applicable to tubes with trigger voltage at the lower limit and the outer loop applies to tubes on the upper trigger voltage limit.

To ensure reliable operation and interchangeability with any tube, the vector sum of the two trigger electrodes must fall outside the outer loop.

For repetitive pulse operation it is usually necessary to ensure that the pulse has a sufficient excess voltage (See 'Notes on Operation').

As the triggering impulse carries the vector sum of the applied voltages outside the loop the point at which it crosses the loop indicates the manner in which the valve is triggered as follows:—

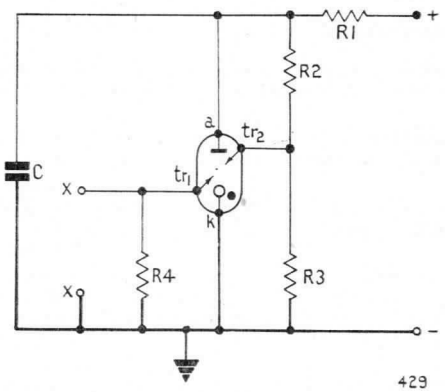
Between BC Trigger Electrode 2 to Cathode.
CD Trigger Electrode 1 to Cathode.
DE Trigger Electrode 1 to Trigger Electrode 2.
EF Cathode to Trigger Electrode 2.
FA Cathode to Trigger Electrode 1.
FB Trigger Electrode 2 to Trigger Electrode 1.

The portion of the loops shown broken indicate regions in which triggering is erratic and the limits are ill defined.

The most reliable operation is ensured by triggering between tr_2 and tr_1 with tr_1 negative to tr_2 i.e. between A and B on the diagram.

NOTES ON OPERATION.

Method of Operation.



Operation of this type of flash tube is as follows:—

The capacitor C (Discharge capacitor), connected between anode and cathode is charged through a resistor R1 (Charging resistor). A voltage of sufficient amplitude applied between the two trigger electrodes tr_1 and tr_2 will initiate a glow discharge between these electrodes. This discharge will in turn cause breakdown of the main gap between anode and cathode, discharging the capacitor C and producing a bright flash of light. Operating with maximum rated anode voltage and a 4 μF capacitor the duration of the current discharge is approx. 4 to 5 microseconds at one third of peak light output. The light duration is longer, approx. 20 microseconds.

When the trigger voltage between tr_1 and tr_2 is obtained from a controlled pulse the frequency of flashing will be determined by the trigger pulse frequency.

Trigger Pulse. As noted on Page 2, the tube may be triggered in a variety of ways, some of these are however likely to prove erratic and unreliable. The recommended method of triggering is to apply a positive voltage to Trigger electrode No. 2 (tr_2) and a negative pulse to Trigger electrode No. 1 (tr_1).

The voltage applied to tr_1 is conveniently obtained by means of the potentiometer chain R2, R3, shown in the diagram above, but must always be lower than the minimum trigger voltage and should have a maximum value of about 70 volts.

To ensure reliable operation at all frequencies, the negative trigger pulse amplitude (applied to Trigger Electrode 1) should be at least 150 volts, with a width of 30 to 100 microseconds at half amplitude. A suitable pulse may be derived by differentiation of a pulse from a multivibrator. If a square pulse is used, the pulse width may be slightly less (down to 20 microseconds).

The minimum values of trigger current quoted on Page 1 are for pulses of long duration. For very short pulses high values of current may be necessary.

The duration of the trigger pulse is not critical, subject to the minimum quoted above. However, the duration of the pulse must not exceed the time required for the anode discharge capacitor to recharge to about 80 volts as, during deionization time, pulses of greater length are liable to cause a second discharge when the anode reaches 80 volts. This second spurious discharge may cause loss of control and the tube will flash at a repetition rate quite independent of the trigger pulse or the discharge may be a glow discharge in the main gap with consequent serious deterioration of the cathode (A glow discharge is characterised by a more diffused appearance and a less intense colour than the required arc discharge).

Trigger Delay. In conventional circuits the delay in triggering the main gap after the application of the trigger pulse is less than 40 microseconds. It is however dependent on circuit conditions and low energy trigger pulses may lengthen the delay time, whilst high energy pulses with normal circuitry can considerably reduce the delay time.

Ferranti

Notes on Operation (Cont.)

Charging Resistor. The minimum value of charging resistor should be approx. 3,000 ohms, and must be rated for at least 8 watts dissipation.

Discharge Capacitor. This capacitor should be a good quality foil type, preferably non-inductive. Electrolytic types are quite unsuitable.

The Discharge Capacitor value should be chosen in accordance with the recommendation on Page 1, dependent on the frequency range required.

In equipments required to operate over a wide frequency band, the complete range is preferably covered in steps by switching different capacitor values in accordance with the recommendations regarding the charging time in the last paragraph under the heading 'Trigger Pulse' and in the

For maximum light output, the time constant of the discharge capacitor and its charging resistance, must be such as to ensure a nearly complete recharge between flashes. This requires that the time constant is not greater than about one third of the flash interval (for a 96% recharge). At higher frequencies it may not be possible to ensure such a complete recharge as, if the charging rate is faster than the valve recovery (deionization) rate, a spurious discharge will occur. As noted under 'Trigger Pulse' this discharge may initiate a series of uncontrolled flashes quite independent of the trigger pulse and at a higher repetition rate.

Anode Voltage. The operating anode voltage should be preferably in the range 300—340 volts. In frequency controlled operation when it is required to operate over a wide range, a low impedance power supply is desirable to avoid large fluctuations of the anode voltage and the voltage applied to tr_1 if this is obtained from a potentiometer across the anode supply voltage.

Peak Anode Current. The peak anode current must be sufficient to ensure the formation of an arc discharge which gives an anode-cathode volt drop of approximately 20 volts. If the peak anode current is low a glow discharge is probable and the volt drop will then be around 70 volts which will result in permanent damage and serious deterioration. A recommended minimum value of peak anode current is 2 amperes.

Mean Anode Current. The mean anode current may be calculated as follows:—

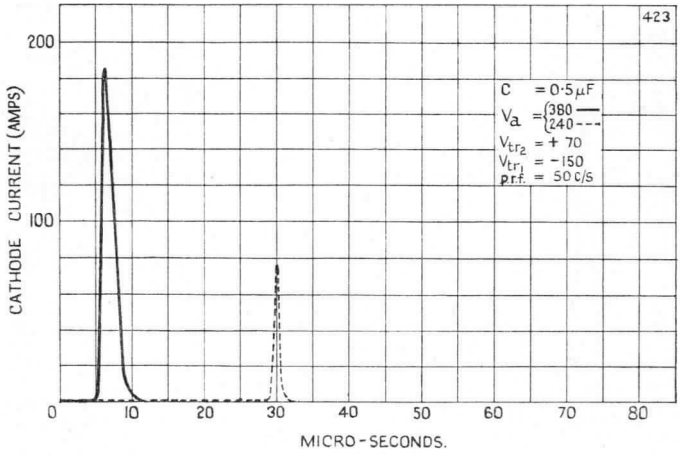
$$I_a(\text{mean}) = \frac{CVf}{1000} \quad \text{mA.}$$

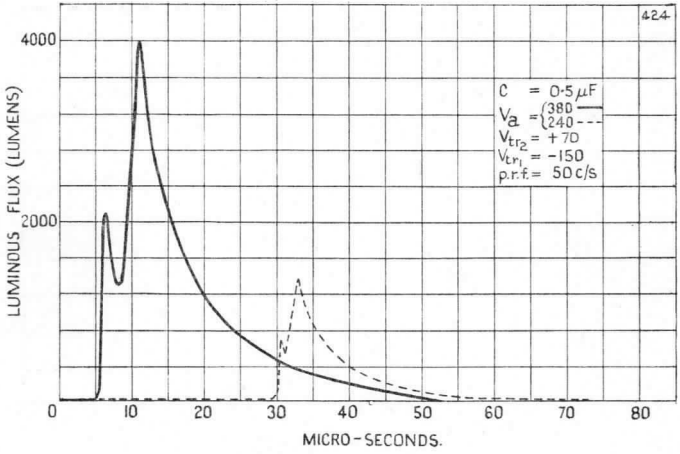
where C = discharge capacitor in μF.
V = voltage to which capacitor is charged at instant of triggering.
f = flash frequency per second.

Trigger Electrode/Cathode Connections. The tube must not be operated without a DC. connection between each trigger electrode and cathode.

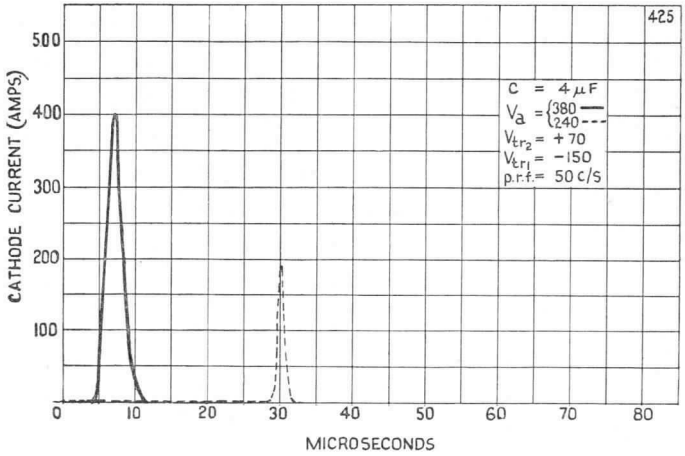
The circuit resistance between cathode and tr_1 and between cathode and tr_2 must have a value of at least 1000 ohms in each instance. A resistance of the order of 100,000 ohms is recommended.

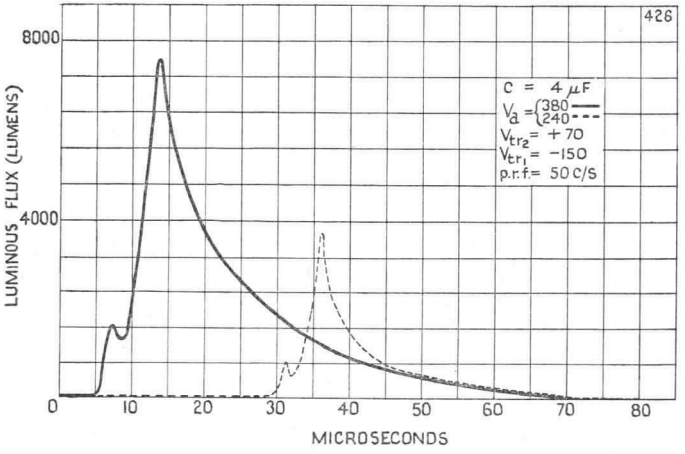
TYPICAL DISCHARGE CHARACTERISTICS



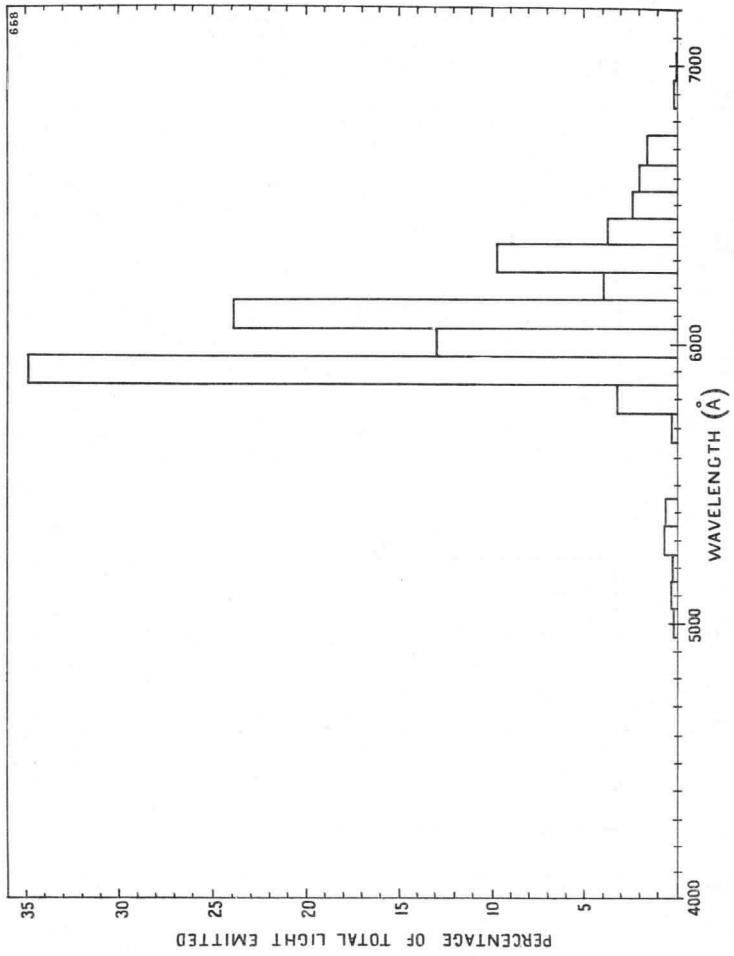


TYPICAL DISCHARGE CHARACTERISTICS



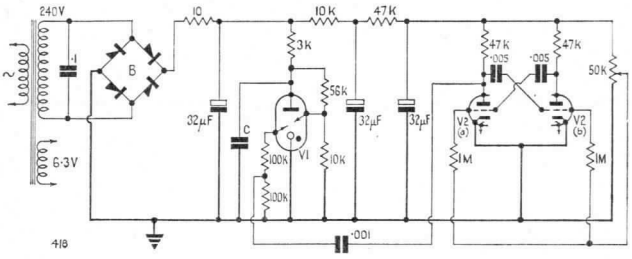


SPECTRAL DISTRIBUTION OF VISIBLE LIGHT



NOTES ON OPERATION—RECOMMENDED CIRCUITS

STROBOSCOPE.



C — Discharge Capacitor (see pages 1 and 4)

B — Single Phase Bridge (4 Ferranti Silicon Rectifiers ZS74)

V1 — Ferranti EN 10

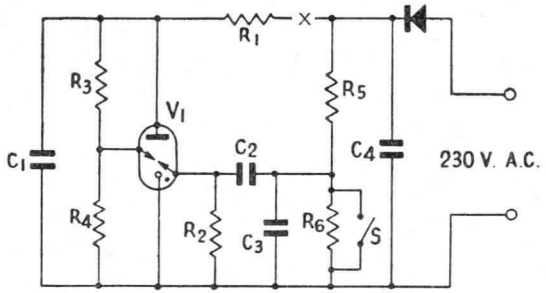
V2(a), V2(b) — Ferranti ECC 81

A typical circuit using a multivibrator as frequency control is shown above The frequency of operation is determined by the suitable choice of component values as indicated. The square pulses are differentiated by using a 1000 pF. capacitor with 100,000 ohm resistor.

The above circuit may require slight modification in practice to allow for such variations as impedance of power supply, tolerances of components, etc. High impedance power supplies result in large variations of the HT. line voltage as the frequency is varied, and consequent variations in tr_2 voltage and pulse height at tr_1.

The HT. voltage line during operation should preferably be in the range 300–330 volts.

RELAY CIRCUIT.



R1	3300 ohms.	C1	3 μF.
R2	100K ohms.	C2	1000 pF.
R3	56K ohms.	C3	0·1 μF.
R4	10K ohms.	C4	8 μF.
R5	100K ohms.	S	External switch.
R6	100K ohms.	V1	EN10

The above circuit is for operation of an electro-magnetic relay in which triggering is effected by closure of external contacts.

Closing of switch S causes a single flash, and operates an electro-magnetic relay which should be inserted at the point 'X'.

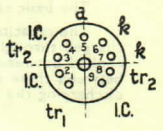
FERRANTI LIMITED, GEM MILL, CHADDERTON, OLDHAM, LANCS.

Ferranti

STROBOSCOPIC LIGHT SOURCE

EN15

A neon filled cold cathode tetrode discharge tube designed for use as a Stroboscopic Light Source. Operating frequency is controlled by low voltage, low energy pulses. For some applications it may be operated as a free running oscillator with simple Resistance/Capacity control of frequency.



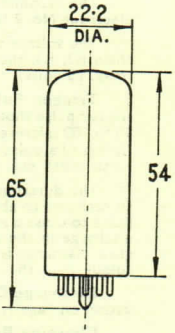
Base Connections
Underside View of Base

PHYSICAL SPECIFICATION.

Base	B9A/D.
Max. Seated Height	54 mm. ($2\frac{1}{16}$in.).
Max. Overall Length	65 mm. ($2\frac{9}{16}$in.).
Max. Diameter	22·2 mm. ($\frac{7}{8}$in.).
Mounting Position	Any.*

PIN CONNECTIONS.

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



RATINGS (Absolute).

Max. Anode Voltage (Static)	440 volts.
Max. Anode Voltage (Operating) ...	375 volts.
Min. Anode Voltage (Operating) ...	230 volts.
‡Max. Trigger Electrode No. 2 voltage	75 volts.
Max. Average Anode Current	80 mA.
Max. Discharge Capacitor	8 μF.
Min. $R_{trig.\ 1-k}$	1000 ohms.
Min. $R_{trig.\ 2-k}$	1000 ohms.

CHARACTERISTICS.

§Trigger Voltage ($V_{trig.\ 1-trig.\ 2}$) ... (Single Flashes)	80 to 130 volts.
†Trigger Electrode No. 1 Voltage (Stroboscopic Operation) ...	−150 volts (min.).
Max. Flashing frequency	250 per sec.

TYPICAL OPERATION (As Stroboscopic Light Source).

DC supply Voltage	300 volts.
†Trigger Pulse amplitude ($V_{trig.\ 1}$) ...	−150 volts.
‡Trigger Electrode No. 2 voltage ($V_{trig.\ 2}$)	70 volts.
**Charging Resistor	3000 ohms.

Discharge Capacitor.

6—40 f.p.s.	4 μF.
40—50 f.p.s.	3 μF.
50—75 f.p.s.	2 μF.
75—140 f.p.s.	1 μF.
140—200 f.p.s.	0·75 μF.
200—250 f.p.s.	0·5 μF.

*A position between horizontal or vertically base up is preferred.

‡Positive to Cathode.

§Trigger Electrode No. 1 negative to Trigger Electrode No. 2.

†Negative to Cathode.

**Of suitable wattage. For most applications a readily available small vitreous enamel type rated at 14 watts is satisfactory.

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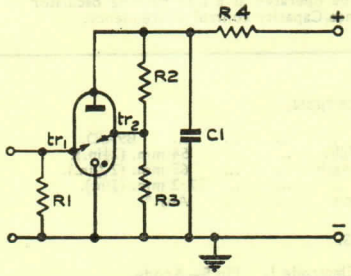
NOTES ON OPERATION.

The basic circuit for operation of this tube is shown in the diagram below.

The capacitor C1 (Discharge capacitor), connected between anode and cathode is charged through a resistor R4 (Charging resistor). A voltage of sufficient amplitude applied between the two trigger electrodes tr_1 and tr_2 will initiate a glow discharge between these electrodes, which will cause breakdown between anode and cathode, discharging the capacitor C1 and producing a bright flash of light.



The recommended method of triggering is to apply a positive voltage to trigger electrode No. 2 (tr_2) and a negative pulse to trigger electrode No. 1 (tr_1).

The voltage applied to tr_2 is conveniently obtained by means of the potentiometer chain R2, R3, shown in the diagram above, and should have a value of about 70 volts. (max. 75 volts).

Trigger Pulse. To ensure reliable operation at all frequencies, the negative trigger pulse should be steep fronted with amplitude of at least 150 volts, and a width of 30 to 100 microseconds at half amplitude. A suitable pulse may be derived by differentiation of a pulse from a multivibrator or Miller circuit. If a square pulse is used, the pulse width may be slightly less.

The duration of the pulse must be limited to the time required for the capacitor to recharge to about 80 volts, as during deionization time, pulses of greater length are liable to cause a second discharge when the anode reaches 80 volts, or to initiate a glow discharge in the main gap with consequent serious deterioration of the cathode. (A glow discharge is characterised by a more diffused appearance and is of a less intense colour than the required arc discharge).

Discharge Capacitor. This should be chosen in accordance with the recommendation on Page 1, dependent on the frequency range required.

Charging Resistor. The minimum value of charging resistor should be approx. 3,000 ohms, and must be rated for the appropriate dissipation. For maximum light output it is essential-to ensure a nearly compiete recharge of the capacitor between flashes The time constant should be not greater than about one third of the flash interval (for a 96% recharge). At the higher operating frequencies it may not be possible to ensure such a complete recharge, as a spurious discharge will ocucr as the charging rate is faster than the valve de-ionisation time. This discharge may in turn initiate a series of uncontrolled flashes, quite independent of the trigger pulse and at a higher repetition rate. Suitable values of discharge capacitor and charging resistance are given on Page 1 of this data sheet.

Anode Voltage. The operating anode voltage should be preferably in the range 300—330 volts. A low impedance power supply is desirable to avoid large fluctuations of the anode voltage and tr_2 voltage over the frequency range.

Mean Anode Current. The mean anode current may be calculated as follows:—

$$I_a\ (\text{mean}) = \frac{CVf}{1000}\ \text{mA.}$$

where C = discharge capacitor in μF.

V = voltage on discharge capacitor at instant of triggering.

f = flash frequency per second.

Trigger Electrode/Cathode Connections. The tube must not be operated without a D.C. connection between each trigger electrode and cathode. The circuit resistance between cathode and tr_1 and between cathode and tr_2 must have a value of at least 1000 ohms in each instance. A resistance of the order of 100,000 ohms is recommended.

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

FERRANTI
COLD CATHODE TETRODE

EN30

A miniature cold cathode gas filled tetrode. It is an arc discharge valve. The cathode is designed for pulse operation and is capable of passing up to 250 amperes peak. It is equally suitable as a stroboscopic light source or for relay applications where high peak current, short duration, pulses are required.

PHYSICAL SPECIFICATION.

Base	B7G.
Max. Seated Height	70 mm.
Max. Overall Length	77 mm.
Max. Diameter	19 mm.
Length of arc	22 mm. (approx.)
Mounting Position	Any.*

PIN CONNECTIONS.

Pin 1—Trigger Electrode 1.	Pin 5—Cathode†
Pin 2—I.C.	Pin 6—I.C.
Pin 3—I.C.	Pin 7—Trigger Electrode 2.
Pin 4—Cathode†	Top Cap—Anode.

RATINGS.

Maximum Anode Voltage (Static) ...	440 volts.
Maximum Anode Voltage (working) ...	400 volts.
Minimum Anode Voltage (working) ...	250 volts.
Peak Inverse Anode Voltage	350 volts.
Max. Mean Anode Current	50 mA.
Maximum Average Current	10 mA.
Minimum R_{tr_1-k}	1000 ohms.
Minimum R_{tr_2-k}	1000 ohms.

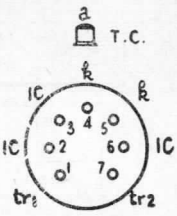
CHARACTERISTICS.

‡Static Trigger Voltage (tr_2 to tr_1)	80–130 volts.‡
Max. Repetition Frequency	250 per sec.
Min. Trigger Current required at V_a 400	50 μA.
Min. Trigger Current required at V_a 250	300 μA.
§Peak Anode Current, Peak Luminous Intensity, Flash Duration ...	The discharge of a 1μF capacitor charged to 330V. gives a peak anode current of approx. 150 amp. and a Peak Luminous Intensity of approx. 270 candelas with a flash duration of 15 microseconds at half the peak light output.
Delay Time	Less than 40 microseconds, dependent on circuit conditions. With higher energy pulses the delay time can be considerably reduced

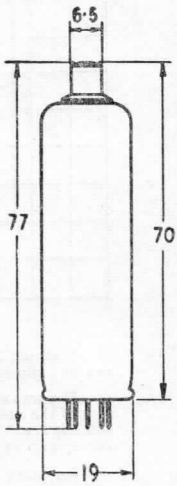
TYPICAL OPERATION as Stroboscopic Light Source :

Anode Supply Voltage	300–330 volts DC.
**Trigger Electrode No. 2 Voltage	70 volts.
††Trigger Pulse Amplitude (V_{tr_1})	150 volts min.
Charging Resistor	6000 ohms.
Discharge Capacitor for operation	
at 6–35 c.p.s. ...	2 μF.
30–50 c.p.s. ...	1·5 μF.
45–80 c.p.s. ...	1 μF.
80–150 c.p.s. ...	0·5 μF.
140–250 c.p.s. ...	0·3 μF.

For basic circuit and further information refer to "Notes on Operation" on Pages 3 and 4.



Base Connections Underside View of Base



All dimensions shown are in millimetres (max.).

*Vertically base up or horizontally is preferred.

†The cathode circuit should be connected to both pins 4 and 5.

‡The limits quoted are to cover production variations, and refer to the triggering voltage for a low rate of change of electrode voltages, with tr_1 negative to tr_2. For pulse operation a higher trigger voltage is generally necessary. See under "Typical Operation."

§A minimum peak current of 5 amp. is recommended. This ensures the formation of an arc discharge with an anode-cathode volt drop of approx. 20 volts. If the peak current is less than 5 amps. a glow discharge is likely to form with a volt drop of 70 volts which may result in permanent damage to the valve.

**At instant of triggering.

††V_{tr_1} negative with respect to cathode.

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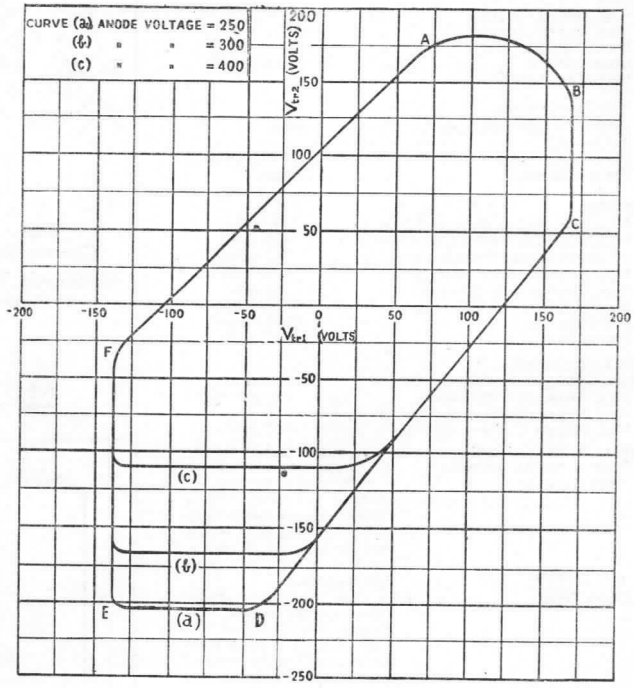
FERRANTI

AVERAGE STATIC TRIGGER CHARACTERISTICS



It should be noted that the above quadrant diagram is for an average EN30 and due allowance should be made for trigger voltage tolerance (see page 1).

The area enclosed by the loops is an area of non-conduction. If the vector sum of the voltages on the two trigger electrodes lies within the loop the valve will not fire. Any change of either or both of these voltages which causes the vector sum to fall outside the loop will trigger the valve.

For pulse operation it is usually necessary to ensure that the pulse has a sufficient excess voltage (See under "Trigger Pulse" on page 3.)

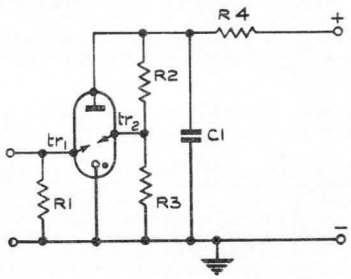
As the triggering impulse carries the vector sum of the applied voltages outside the loop the point at which it crosses the loop indicates the manner in which the valve is triggered as follows :—

Between AB Trigger Electrode 2 to Cathode Breakdown.
BC Trigger Electrode 1 to Cathode Breakdown.
CD Trigger Electrode 1 to Trigger Electrode 2. Breakdown.
DE Cathode to Trigger Electrode 2 Breakdown.
EF Cathode to Trigger Electrode 1 Breakdown.
FA Trigger Electrode 2 to Trigger Electrode 1 Breakdown.

The most reliable operation is ensured by triggering between tr_2 and tr_1, i.e., between F and A.

NOTES ON OPERATION.

The basic circuit for operation of this tube is shown below :—



The capacitor C1 (Discharge capacitor), connected between anode and cathode is charged through a resistor R4 (Charging resistor). A voltage of sufficient amplitude applied between the two trigger electrodes tr_1 and tr_2 will initiate a glow discharge between these electrodes, which will cause breakdown between anode and cathode, discharging the capacitor C1 and producing a bright flash of light. The current duration of this discharge is of the order of 5 microseconds, with a peak current up to 250 amperes. The light duration is longer, approximately 20 microseconds at half peak light output, operating with maximum anode voltage.

When the trigger voltage between tr_1 and tr_2 is obtained from a controlled pulse the frequency of flashing will be determined by the trigger pulse frequency.

The following points should be noted in designing equipment incorporating EN30.

Trigger Pulse. Whilst as noted on page 2, the tube may be triggered in a variety of ways some of these are likely to be erratic and unreliable. The recommended method of triggering is to apply a positive voltage to trigger electrode No. 2 (tr_2) and a negative pulse to trigger electrode No. 1 (tr_1).

The voltage applied to tr_2 is conveniently obtained by means of the potentiometer chain R2, R3, shown in the diagram above, but must always be lower than the minimum trigger voltage and should have a maximum value of about 70 volts.

To ensure reliable operation at all frequencies, the trigger pulse amplitude should be at least 150 volts, with a width of 30 to 100 microseconds at half amplitude ; a suitable pulse may be derived by differentiation of a square pulse from a multivibrator. If a square pulse is used, the pulse width may be slightly less (down to 20 microseconds).

The minimum values of trigger current quoted on page 1 are for pulses of long duration. For short pulses higher values of current are necessary.

The duration of the triggering pulse is not critical, subject to the minimum quoted above, but certain factors should be noted. The duration of the pulse must be limited to the time required for the anode discharge capacitor to recharge to about 80 volts as, during deionization time. pulses of greater length are liable to cause a second discharge when the anode reaches 80 volts, or to initiate a glow discharge in the main gap with consequent serious deterioration of the cathode. (A glow discharge is characterised by a more diffused appearance and is of a less intense colour than the required arc discharge).

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Discharge capacitor, This should be chosen in accordance with the recommendation on Page 1, dependent on the frequency range required.

In equipments required to operate over a wide frequency band, the whole range of frequency is preferably covered in steps by switching different capacitor values.

Charging resistor. The minimum value of charging resistor should be approx. 6,000 ohms, and must be rated for 8 watts minimum dissipation.

For maximum light output, the time constant of the discharge capacitor and its charging resistance, must be such as to ensure a nearly complete recharge between flashes. This requires that the time constant is not greater than about one third of the flash interval (for a 96% recharge). At higher frequencies it may not be possible to ensure such a complete recharge as, if the charging rate is faster than the valve recovery rate, a spurious discharge will occur. This discharge may in turn initiate a series of uncontrolled flashes, quite independent of the trigger pulse and at a higher repetition rate. Suitable values of discharge capacitor and charging resistance are given on Page 1 of this data sheet.

Anode voltage. The operating anode voltage should be preferably in the range 300—330 volts. In frequency controlled operation when it is required to operate over a wide frequency range, a low impedance power supply is desirable to avoid large fluctuations of the anode voltage and also of course the tr_2 voltage in conventional circuit.

Mean anode current. The mean anode current may be calculated as follows :—

$$I_a \text{ (mean)} = \frac{CVf}{1000} \text{ mA}$$

where C = discharge capacitor in μF.
V = voltage on discharge capacitor at instant of triggering.
f = flash frequency per second.

Trigger Electrode/Cathode Connections. The tube must not be operated without a D.C. connection between each trigger electrode and cathode.

The circuit resistance between cathode and tr_1 and between cathode and tr_2 must have a value of at least 1000 ohms in each instance. A resistance of the order of 100,000 ohms is recommended.

Additional circuits shown on NSP2 data sheets may be adapted to EN30 operation by modification of circuit values in accordance with the foregoing notes.

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FERRANTI

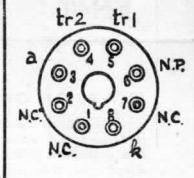
COLD CATHODE TETRODE

EN40

Type EN40 is a cold cathode tetrode gas discharge valve intended for use as a stroboscopic light source, particularly in applications employing photographic recording.

The light emitted is "whitish" in colour and of high actinic value.

Operation can be controlled by pulses of low energy.



Base Connections
Underside View of Base

PHYSICAL SPECIFICATION.

Base	International Octal.
Max. Seated Height	89 mm. ($3\frac{1}{2}$in.).
Max. Overall Length	103 mm. ($4\frac{1}{16}$in.).
Max. Diameter Base	32 mm. ($1\frac{1}{4}$in.).
Length of Arc	24 mm. ($\frac{15}{16}$in.).
Mounting Position	Any.*

PIN CONNECTIONS.

Pin 1—No connection.	Pin 5—Trigger No. 1.
Pin 2—No connection.	Pin 6—No Pin.
Pin 3—Anode.	Pin 7—No connection.
Pin 4—Trigger No. 2.	Pin 8—Cathode.

RATINGS.

Maximum Anode Voltage (Static)	440 volts.
Maximum Anode Voltage (working)	350 volts.
Minimum Anode Voltage (working)	250 volts.
Peak Inverse Anode Voltage ...	300 volts.
Maximum Mean Anode Current	100 mA.
Maximum Average Grid Current	10 mA.

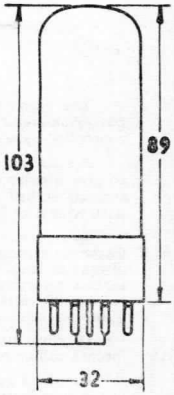
CHARACTERISTICS.

††Static Trigger Voltage (tr_2 to tr_1)	70–120 volts.
Maximum Flashing Frequency	150 per sec.
†Peak Anode Current	250 amps.
Minimum Trigger Current required :—	
V_a = 350	50 μA.
V_a = 250	300 μA.

TYPICAL OPERATION.

DC Supply Voltage	300–330 volts.
‡Trigger Electrode No. 2 Voltage (V_{tr_2})	50 volts.
§Trigger Pulse Amplitude (V_{tr_1})	150 volts.
Charging Resistor	3500 ohms.
Discharge Capacitor for operation	
at 6–35 c.p.s.	4 μF.
30–50 c.p.s.	3 μF.
45–80 c.p.s.	2 μF.
80–150 c.p.s.	1 μF.

For further information refer to "Notes on Operation" overleaf.



Dimensions shown are in millimetres (max.)

*Vertically base up or horizontally preferred.

†A minimum peak current of 5 amps. is recommended. This ensures the formation of an arc discharge with an anode-cathode volt drop of approx. 20 volts. If the peak current is less than 5 amps. a glow discharge is likely to form with a volt drop of 70 volts which may result in permanent damage to the valve.

††tr_1 negative with respect to tr_2. The limits quoted refer to operation with a trigger voltage having a low rate of change. For pulse operation a higher trigger voltage is generally necessary.

‡At instant of triggering.

§V_{tr_1} negative with respect to cathode.

Issue 3
Mar., 1958

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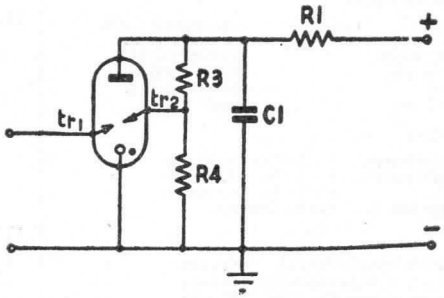
NOTES ON OPERATION.

The basic circuit for the operation of this valve is shown below. A capacitor C1 is connected across anode and cathode and charged through a series resistance R1. If a sufficient voltage is now applied between electrodes tr_1 and tr_2 to initiate a glow discharge, this will cause breakdown of the main anode to cathode gap. The capacitor C1 discharges within a few microseconds, and the valve emits a bright flash of light of similar duration.



The recommended triggering method is to apply a positive voltage from the potentiometer R3–R4 to tr_2, and a negative pulse to tr_1, the flashing frequency being controlled by the pulses on tr_1.

A suitable triggering pulse for tr_1 may be derived by differentiating a square pulse to give a pulse of 150 volts or higher, with a width of approximately 30–100 microseconds at half amplitude. Alternatively, square pulses of approximately 200 volts, with widths of 20–400 microseconds may be used.

The duration of the pulse must be limited to the time required for the anode discharge capacitor to recharge to about 80 volts as, during de-ionization time, pulses of greater length are liable to cause a glow discharge in the main gap with consequent serious deterioration of the cathode, or to initiate a second discharge when the anode reaches 80 volts. This discharge may in turn initiate a series of uncontrolled flashes quite independent of the trigger pulse and at a higher repetition rate.

(A glow discharge is characterised by a more diffused appearance and is of a less intense colour than the required arc discharge.)

For short pulses, higher values of initiating currents are required than those quoted in the specification.

For maximum light output, the time constant of the discharge capacitor and its charging resistance must be such as to ensure a nearly complete recharge between flashes. This requires that the time constant is not greater than about one third of the flash interval (for a 96% recharge). At higher frequencies it may not be possible to ensure such a complete recharge as, if the charging rate is faster than the valve recovery rate, a spurious discharge will occur as indicated above.

Suitable values of discharge capacitor and charging resistance are given under "Typical Operation" overleaf.

The mean anode current may be calculated as follows :—

$$I_{a\ (mean)} = \frac{CVf}{1000}\ mA.$$

where C = discharge capacitor in μF.

V = voltage on discharge capacitor at instant of triggering.

f = flash frequency per second.

In equipments which operate over a wide frequency band, the whole range of frequency is preferably covered in steps by switching different capacitor values in accordance with the recommendations regarding charging time.

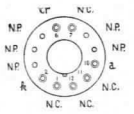
The circuit resistance connected between cathode and tr_1 and cathode and tr_2 must have a value of at least 1000 ohms.

Ferranti

EN55

STROBOSCOPIC LIGHT SOURCE

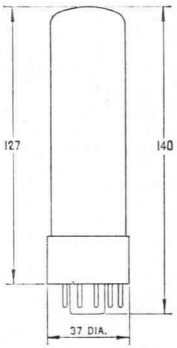
A xenon filled cold cathode arc discharge tube designed for use in stroboscopic applications at frequencies up to 400 c/s. It emits a white light.



Underside View of base

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Max. Seated Height	127 mm. (5 in.).
Max. Overall Length	140 mm. (5½ in.).
Max. Diameter (over base) ...	37 mm. (1 $\frac{29}{32}$ in.).
Mounting Position	Any.



BASE CONNECTIONS.

Pin 1—No Connection.	Pin 7—No Connection.
Pin 2—Cathode.	Pin 8—No Pin.
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—Anode.
Pin 5—No Pin.	Pin 11—No Connection.
Pin 6—Trigger.	Pin 12—No Connection.

RATINGS.

(All maximum ratings are 'absolute').

Max. Anode Voltage (D.C. Static) ...	1000 volts.
Max. Anode Voltage (working) ...	900 volts.
Min. Anode Voltage (working) ...	700 volts.
*Max. Dissipation	20 watts.
Max. Discharge Capacitor	6 μF.
†Min. Charging Resistor (12–150 c/s) ...	8 kΩ
(150–400 c/s) ...	11 kΩ
Max. Operating Frequency	400 c/s.

CHARACTERISTICS.

‡*Trigger Voltage	... 2 to 4 kV.
§Typical Peak Luminous Intensity	... 140,000 Candelas.
§Typical Flash Duration at ⅓ peak	... 25 to 30 μsec.

For Peak Luminous Intensity and Flash Duration for other operating conditions see graphs on Pages 4 and 5.

*See Notes on Operation—Page 6.

†For stroboscopic operation these resistors should be rated for 25W. dissipation.

‡Peak pulse voltage.

§Va = 900 C = 6μF.

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Jan., 1962.

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TYPICAL OPERATION.

For repetitive flashing operation the following circuits are suitable for use in conjunction with a variable frequency pulse generator to control the flash frequency.

For stroboscopic equipment the initiating controlled frequency pulse applied to the trigger of the EN10 or fed to the control grid of the EL81 in the circuits below may be derived from a multivibrator circuit (as described in the EN10 data sheet) or other hard valve pulse generator circuit.

(1) For operation at frequencies from 5 to 250 c/s. The trigger pulse voltage may be satisfactorily derived from a trigger circuit using a 'NEOSTRON' type tube (EN10) as illustrated in Fig. 1. The controlled frequency pulse which is applied to the trigger electrode of the EN10 determines the flash frequency of the EN55. Further information on the operation of this circuit is contained in the EN10 data sheets.

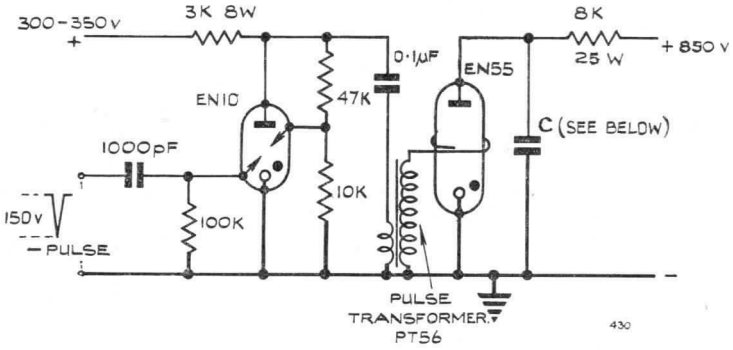


Fig. 1

Recommended values of C:—

5–25 c/s	3 μF.
25–50 c/s...	1·5 μF.
50–150 c/s	0·75 μF.
150–250 c/s	0·5 μF.

(2) For frequencies above 250 c/s it is desirable to use a hard value trigger circuit. A suitable circuit is shown below (Fig. 2).

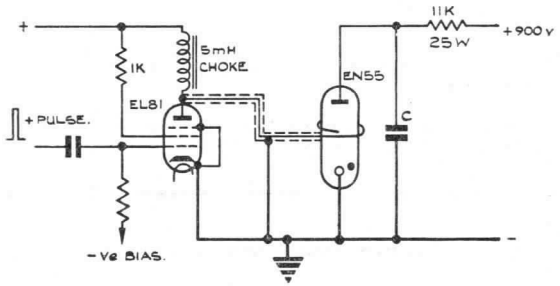


Fig. 2

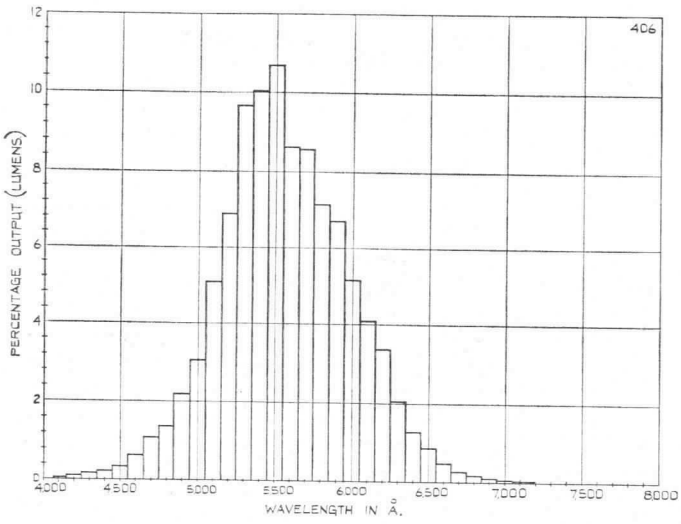
Recommended values of C —

250–400 c/s ... ... 0·25 μF.

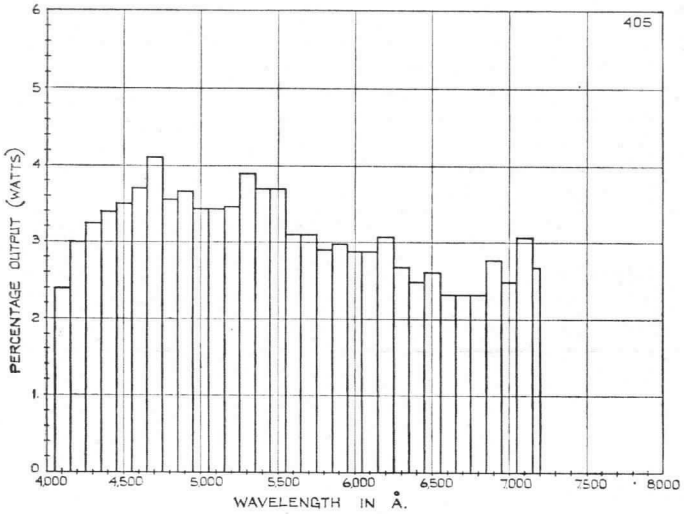
A simple air cored or "ferrox" cored choke with an inductance of approximately 5 mH and adequate insulation will be suitable.

SPECTRAL CHARACTERISTICS

DISTRIBUTION OF LIGHT OUTPUT OVER THE VISIBLE SPECTRUM



DISTRIBUTION OF RATE OF EMISSION OF ENERGY OVER THE VISIBLE SPECTRUM



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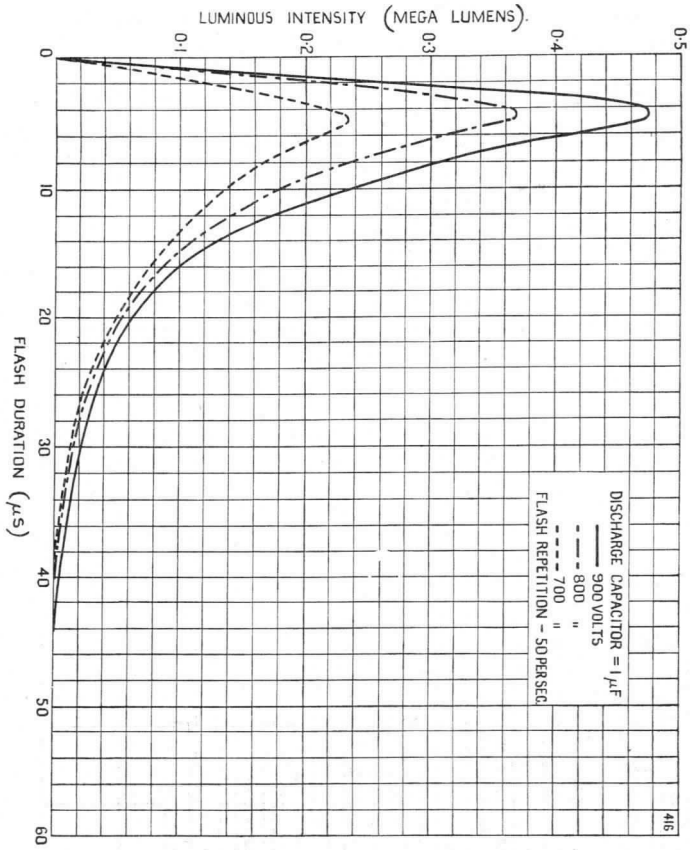
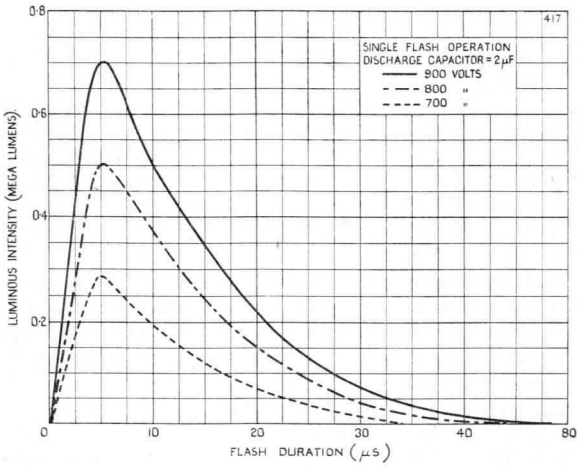
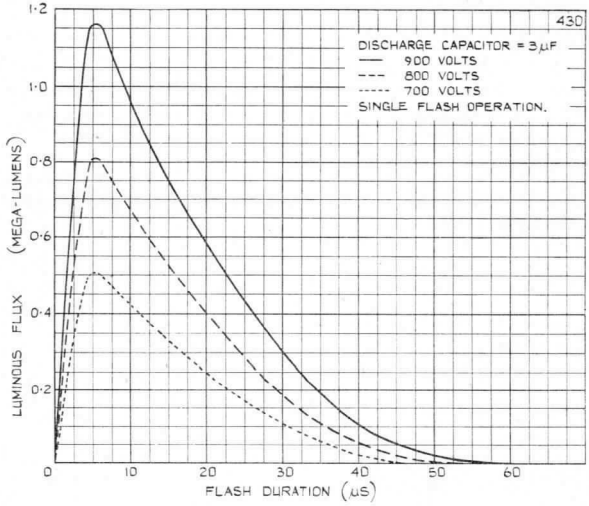
TYPICAL FLASH CHARACTERISTICS
at 50 flashes per sec.



TYPICAL FLASH CHARACTERISTICS
Single Flash Operation





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NOTES ON OPERATION.

Discharge Capacitor. Should be a good quality paper type with sufficient working voltage continuous rating preferably non-inductive and designed for high current pulse operation.

Discharge Energy. It is important to ensure that the energy dissipated in the tube does not exceed the maximum rating given on page 1. Over-running the tube even for very short periods may cause permanent damage, resulting in erratic operation particularly at the higher frequencies, and/or shortened life.

Trigger Voltage. The trigger voltage is the peak pulse voltage.

Connecting Leads. Because of the very high peak current of the discharge all the leads in the discharge path connecting the capacitor with anode and cathode should be of heavy gauge and as short as possible in order to ensure the maximum discharge energy.

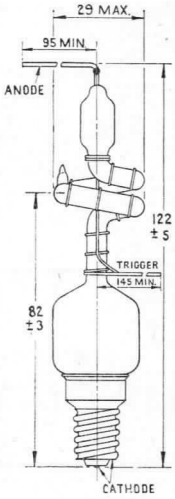
Flash Duration. The duration of the light flash with a 4 μF. capacitor charged to 800 volts is approximately 15-20 microseconds at $\frac{1}{3}$ of the peak luminous intensity. Higher energy discharges will lengthen the duration of the discharge and lower energy discharges are shorter. (See graphs on Pages 4 and 5).

WARNING. The use of high voltages and capacitances constitutes a hazard and care should be taken in operating or repairing any equipment incorporating these tubes.

Ferranti

STROBOSCOPIC LIGHT SOURCE

A gas filled cold cathode arc discharge lamp intended primarily for use as a stroboscopic light source for frequencies of up to 250 c/s. It emits a white light.



All dimensions shown are in Millimetres (max.).

PHYSICAL DETAILS.

Base	... ...	Small Edison Screw Type.
Max. Overall Height	...	127 mm. (5 ins.).
Max. Diameter	... ...	29 mm. ($1\frac{5}{32}$ ins.).
Mounting Position	...	Any.

RATINGS (Absolute).

Max. Anode Voltage	... ...	900 volts.
Min. Anode Voltage	... ...	650 volts.
*Max. Dissipation	... ...	25 watts.
Min. Charging Resistor	... ...	3 kΩ
Max. Discharge Capacitor	...	10 μF.
Max. Flashing Frequency	...	250 c/s.

CHARACTERISTICS.

†Trigger Voltage	2 to 4 kV.
Peak Luminous Intensity	The discharge of a 10μF. capacitor charged to 800 volts produces a flash with peak luminous flux of approx. 900,000 lumens.

TYPICAL OPERATION.

D.C. Supply Voltage	... ...	750 volts.
Charging Resistor:—		
Up to 150 c/s.	... ...	3·3 kΩ
150 to 250 c/s.	... ...	5·0 kΩ
Discharge Capacitor:—		
0—25 c/s.	... ...	6·0 μ.F
25—50 c/s.	... ...	3·0 μ.F
50—150 c/s.	... ...	1·5 μ.F
150—250 c/s.	... ...	0·5 μ.F

A typical circuit of a Stroboscope for operation up to 250 c/s in four ranges is shown overleaf.

*See Notes on Operation overleaf.

†The Peak Pulse Voltage. A suitable Pulse Transformer is Ferranti type PT56.

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Jan., 1962.

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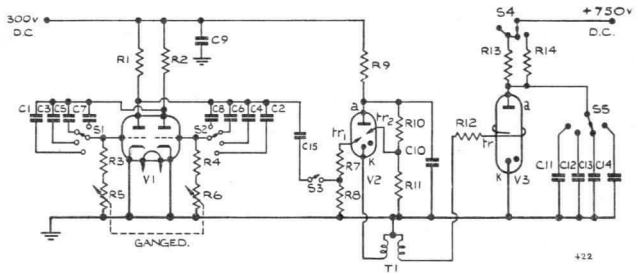
Typical Operation (Cont.)

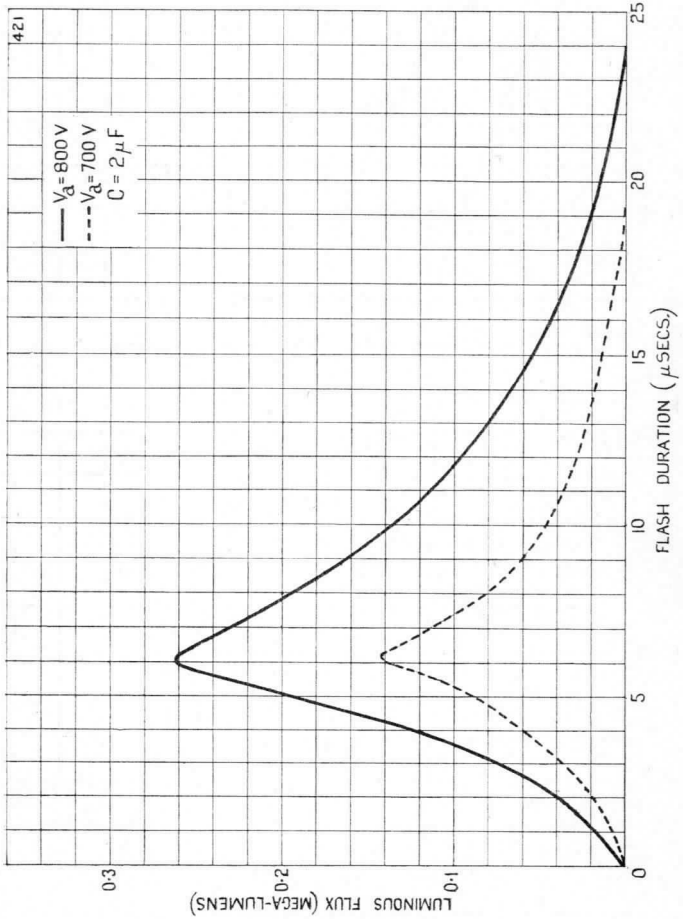
FOUR RANGE STROBOSCOPE.

The circuit below is for a Stroboscope covering frequencies from approx. 8 c/s. to 250 c/s in four ranges. Switches S1, S2, S4 and S5 are preferably ganged. Switch S3 is included to switch off the flash unit whilst keeping the multivibrator synchronising pulse generator running in order to avoid frequency drift during warming up periods.



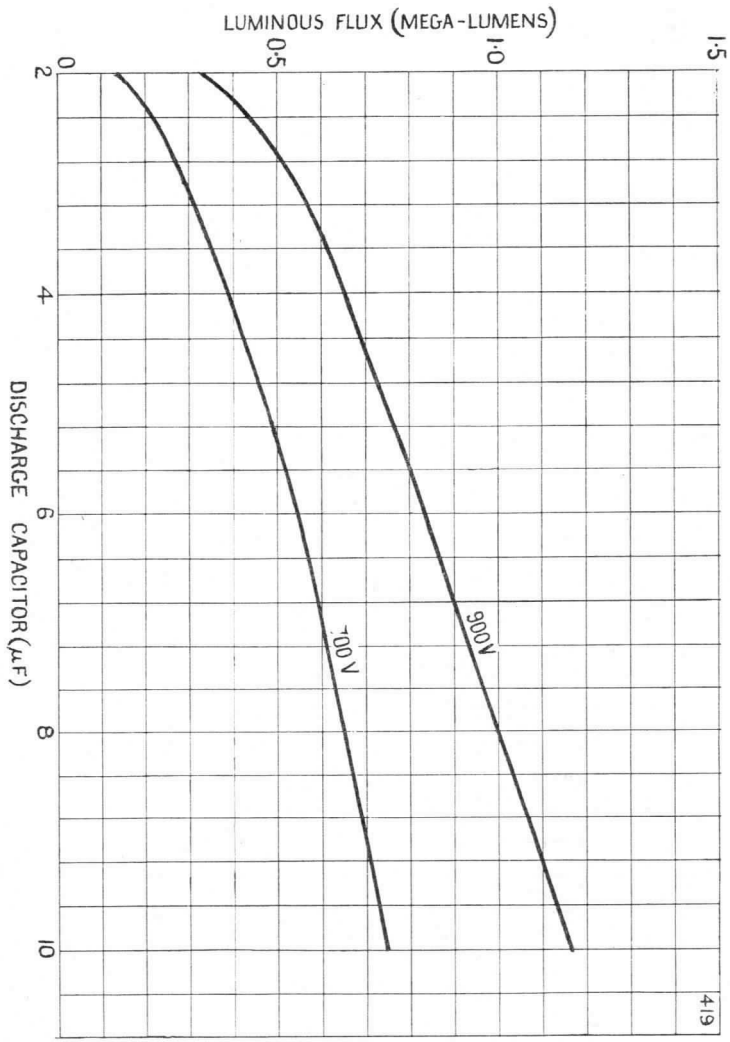
V1	Ferranti Valve Type ECC81.
V2	Ferranti Valve Type EN10.
V3	Ferranti Valve Type EN60.
T1	Ferranti Pulse Transformer Type PT56.
R1	47 kΩ
R2	47 kΩ
R3	50 kΩ
R4	50 kΩ
R5, R6	2 × 100 kΩ—Ganged
R7	100 kΩ
R8	100 kΩ
R9	5 kΩ 8W.
R10	56 kΩ 5W.
R11	10 kΩ 5W.
R12	100 kΩ
R13	3·3 kΩ 25W.
R14	5·0 kΩ 25W.
C1	·25 μF.
C2	·25 μF.
C3	·1 μF.
C4	·1 μF.
C5	·03 μF.
C6	·03 μF.
C7	·01 μF.
C8	·01 μF.
C9	8 μF.
C10	2 μF.
C11	6 μF.
C12	3 μF.
C13	1·5 μF.
C14	0·5 μF.
C15	1000 pF.

TYPICAL FLASH CHARACTERISTIC



Ferranti

TYPICAL PEAK LUMINOUS FLUX

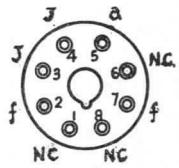


FERRANTI

SATURATED EMISSION DIODE

GE10

A directly heated tungsten filament diode, intended for operation with temperature limited emission. The large change in anode current resulting from a small change in filament voltage, and the stability of the valve, make it suitable for use as a control in stabiliser circuits.



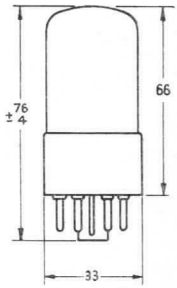
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Max. Overall Length	81 mm. ($3\frac{3}{16}$ in.).
Max. Seated Height	65 mm. ($2\frac{9}{16}$ in.).
Max. Diameter	33 mm. ($1\frac{5}{16}$ in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Not connected.	Pin 5—Anode.
Pin 2—Filament.	Pin 6—Not connected.
*Pin 3—Jumper.	Pin 7—Filament.
*Pin 4—Jumper.	Pin 8—Not connected.



RATINGS.

Max. Filament Voltage	1·8 volts.
Max. Anode Voltage	500 volts.
Min. Anode Voltage to ensure saturation	100 volts.

CHARACTERISTICS.

Filament Current (at 1·8 volts)	330 mA.
Anode Current (at V_f = 1·8, V_a = 500) ...	0·65 mA.

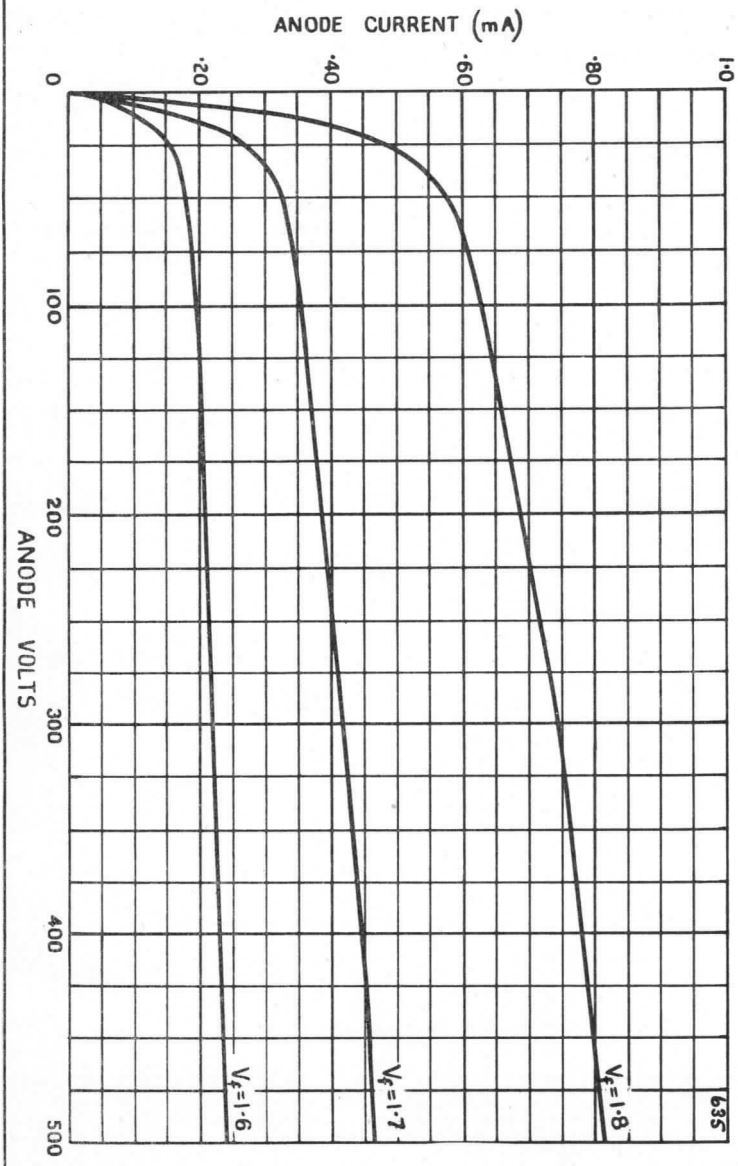
TYPICAL OPERATION.

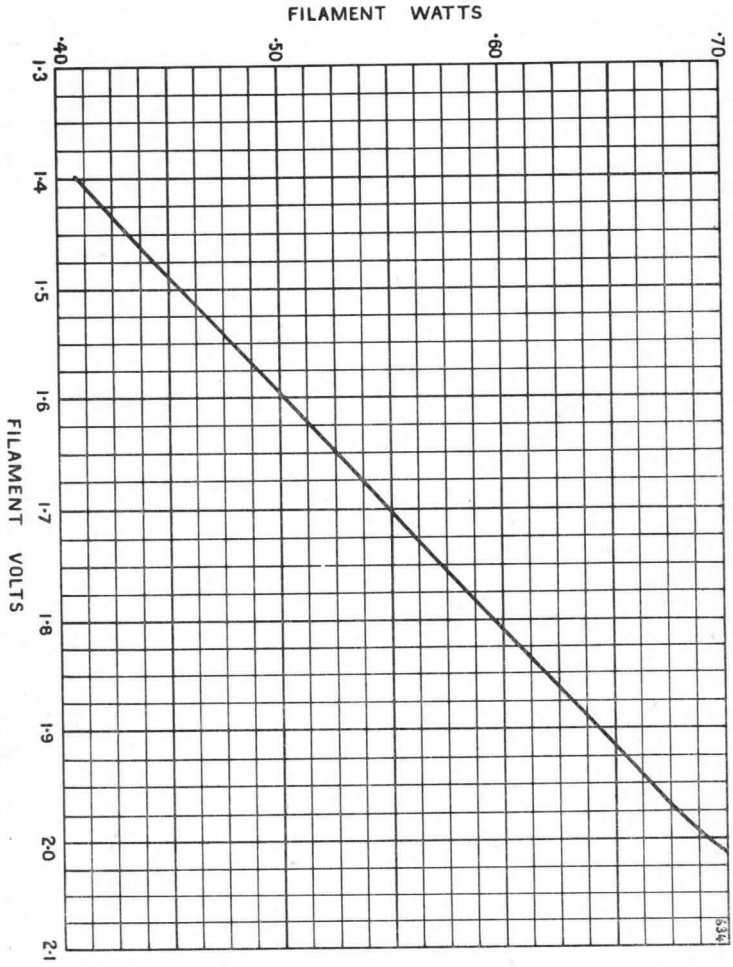
Anode Current (saturated) ...	0·3 mA.
Filament Voltage	1·65 volts (approx.).
Filament Current	320 mA. (approx.).
Minimum anode voltage ...	100 volts.
Maximum anode voltage ...	500 volts.

All dimensions shown are in millimetres (max.)

*The "jumper" link in the base is a short circuit between pins 3 and 4 and with suitable circuit connections operates as a switch to render the equipment inoperative when the valve is removed from its holder.

Issue 2.
Mar., 1957


ANODE CURRENT (mA)
0
·20
·40
·60
·80
1·0
ANODE VOLTS
100
200
300
400
500
V_f=1·6
V_f=1·7
V_f=1·8
1935

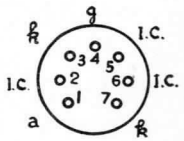

FILAMENT WATTS
·40
·50
·60
·70
1·3
1·4
1·5
1·6
1·7
1·8
1·9
2·0
2·1
FILAMENT VOLTS
634

FERRANTI

COLD CATHODE TRIODE

GK10

A gas-filled cold cathode Triode of miniature dimensions, designed for use as a Relay Valve.



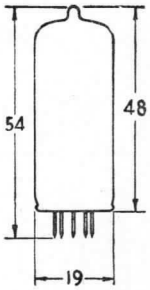
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Max. diameter (glass envelope)	19 mm. ($\frac{3}{4}$in.).
Max. seated height	48 mm. ($1\frac{7}{8}$in.).
Max. overall length	54 mm. ($2\frac{1}{8}$in.).
Mounting position	Any.

BASE CONNECTIONS.

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



CHARACTERISTICS.

Nominal Trigger Voltage ...	80 volts.
Anode-Cathode Gap Volt Drop	75 volts (approx.).
Trigger-Cathode Gap Volt Drop	70 volts (approx.).
‡§Min. Transfer Current	10 μA.
Recovery Time	800 μSecs. (approx.).

RATINGS.

Max. Anode Voltage	150 volts DC.
Max. Peak Anode Current ...	30 mA.
Max. Mean Anode Current ...	7·5 mA.
Max. Trigger Current	500 μA.

TYPICAL OPERATING CONDITIONS.

*Anode Voltage	135 volts DC.
†Static Bias (positive)	55 volts DC.
Transfer Current	4 μA.
†Trigger Pulse Amplitude ...	50 volts.

All dimensions shown are in millimetres (max.).

‡At $V_a = 135$.

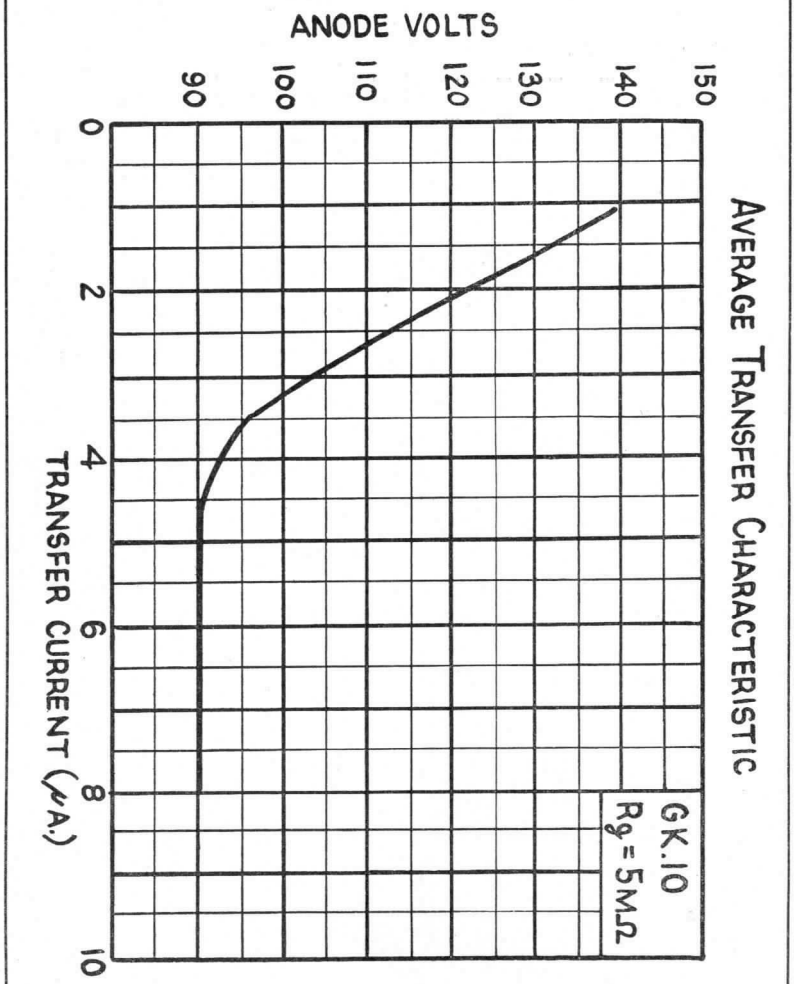
§10 microamperes is the minimum current to ensure interchangeability and reliable operation during life, but transfer currents on individual valves may be considerably lower.

*The anode supply switch should be shunted by a resistor of approximately 30 megohms to prevent surge effects which would cause the valve to fire on switching.

Issue 2
July, 1955

GK10

FERRANTI



AVERAGE TRANSFER CHARACTERISTIC

R.857

FERRANTI

COLD CATHODE TRIODES

GK32

GK33

Gas filled valves of miniature dimensions designed for use as Relay Tubes. These valves are intended for pulse operation with a low duty cycle.

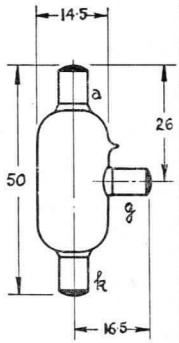
PHYSICAL DETAILS.

	GK32	GK33
Base	None.	
Max. Diameter (glass envelope)	15·5 mm.	15·5 mm.
Max. Overall Diameter ...	25·5 mm.	21·5 mm.
Max. Overall Length ...	51·5 mm.	42 mm.
Mounting Position	Any.	

On Type GK32 the electrodes are brought out to CT.1 caps in order to permit mounting in standard clips.

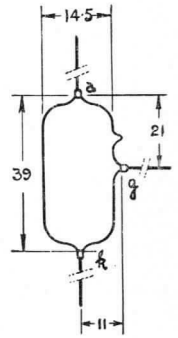
Type GK33 is fitted with flexible leads and is intended to be wired in to the equipment.

On both types the grid is brought out to a side connection and the anode is indicated by a red band.



RATINGS.

Max. Anode Voltage	140 volts DC.
Max. Peak Anode Current ...	20 mA.
Max. Grid Current	500 μA.



CHARACTERISTICS.

*Trigger Voltage	85–98 volts DC.
**Min. Transfer Current	10 μA.
Average Recovery Time ...	1 millisec.

TYPICAL OPERATION.

†Anode Voltage	135 volts DC.
‡Static Bias (positive)	80 volts DC.
Transfer Current	2·2 μA.
Volt Drop across Valve	80 volts (approx.).
§Trigger Pulse Amplitude ...	≮20 volts.

CAPACITANCES.

C_{g-k}	0·6 pF.
C_{a-k}	0·12 pF.
C_{a-g}	0·1 pF.

*At Va = 135.

**10 microamperes is the minimum current to ensure interchangeability and reliable operation, but transfer currents on individual valves may be considerably lower.

†The anode supply switch should be shunted by a resistor of approximately 30 megohms to prevent surge effects which would cause the valve to fire on switching.

‡Alternatively the static bias may be obtained by connecting the grid to the anode supply voltage through a high resistance of the order of 1000 megohms. Under these conditions the valve will respond to trigger signals of very low amplitude and consistent operation by the same signal can be ensured from valve to valve.

§For operation by pulses of very short duration it is usually necessary to increase the pulse amplitude.

These valves were formerly designated K32 and K33.

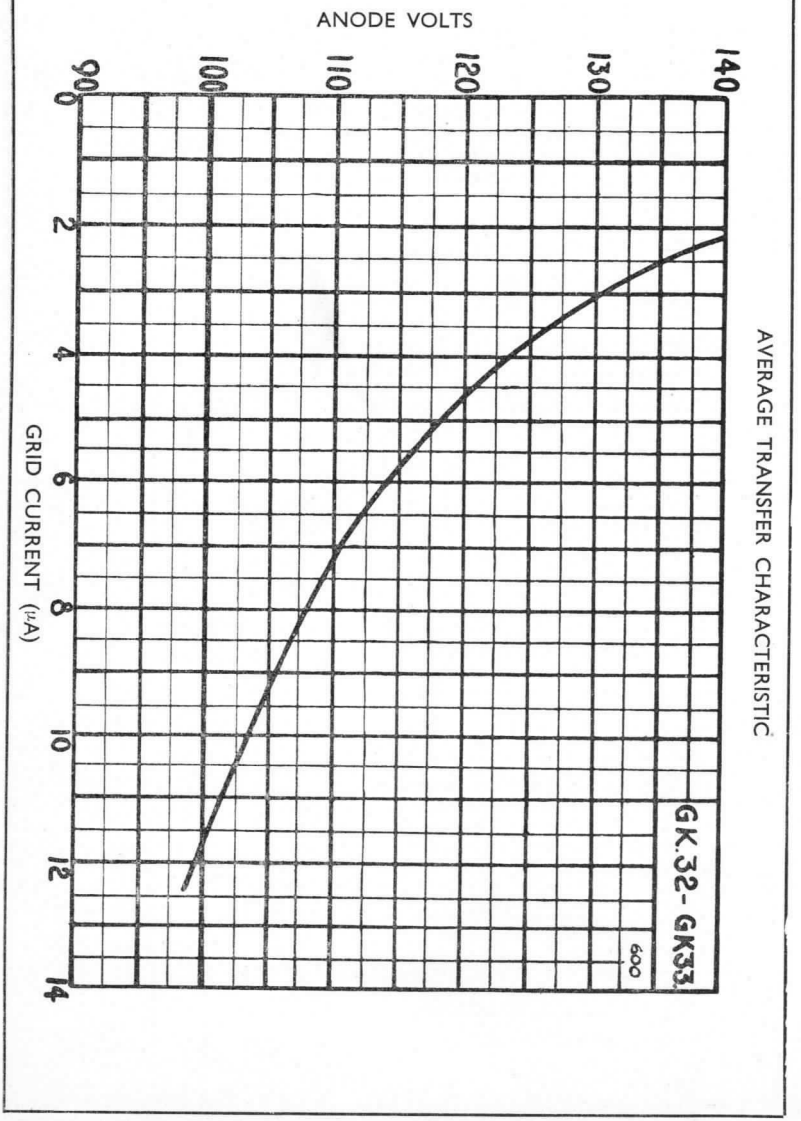
All dimensions shown are in millimetres (nom.).

FERRANTI

Issue 3
Dec., 1955

GK32

GK33



AVERAGE TRANSFER CHARACTERISTIC

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

R657

FERRANTI

COLD CATHODE TRIODES

GK40

GK41

Gas filled valves of miniature dimensions designed for use as Relay Tubes.

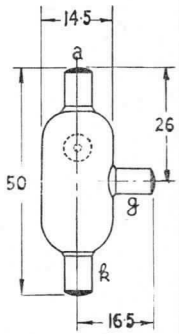
PHYSICAL DETAILS.

	GK40	GK41
Base	None.	
Max. diameter (glass envelope)	15·5 mm.	15·5 mm.
Max. overall width ...	25·5 mm.	21·5 mm.
Max. overall length ...	52 mm.	42 mm.
Mounting position ...	Any.	

On Type GK40 the electrodes are brought out to caps in order to permit mounting in standard clips.

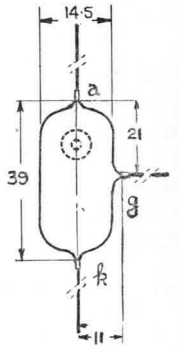
Type GK41 is fitted with flexible leads and is intended to be wired in to the equipment.

On both types the grid is brought out to a side connection and the anode is indicated by a red band.



RATINGS.

Max. Anode Voltage	140 volts DC.
Max. Peak Anode Current ...	20 mA.
Max. Grid Current	500 μa.



CHARACTERISTICS.

*Trigger Voltage	79–85 volts DC.
**Min. Transfer Current	4μa.
Average Recovery Time ...	1·5 milliseconds.

TYPICAL OPERATION.

†Anode Voltage	135 volts DC.
‡Static Bias (positive)	70 volts DC.
Transfer Current	1 μA.
Volt Drop across Valve ...	73 volts approx.
§Trigger Pulse Amplitude ...	≮20 volts.

CAPACITANCES.

C_{g-k}	0·7 pF.
C_{a-k}	0·12 pF.
C_{a-g}	0·1 pF.

*At $V_a = 135$.

**4 microamperes is the minimum current to ensure interchangeability and reliable operation, but transfer currents on individual valves may be considerably lower.

†The anode supply switch should be shunted by a resistor of approximately 30 megohms to prevent surge effects which would cause the valve to fire on switching.

‡Alternatively the static bias may be obtained by connecting the grid to the anode supply voltage through a high resistance of the order of 1000 megohms. Under these conditions the valve will respond to trigger signals of very low amplitude and consistent operation by the same signal can be ensured from valve to valve.

§For operation by pulses of very short duration it is usually necessary to increase the pulse amplitude.

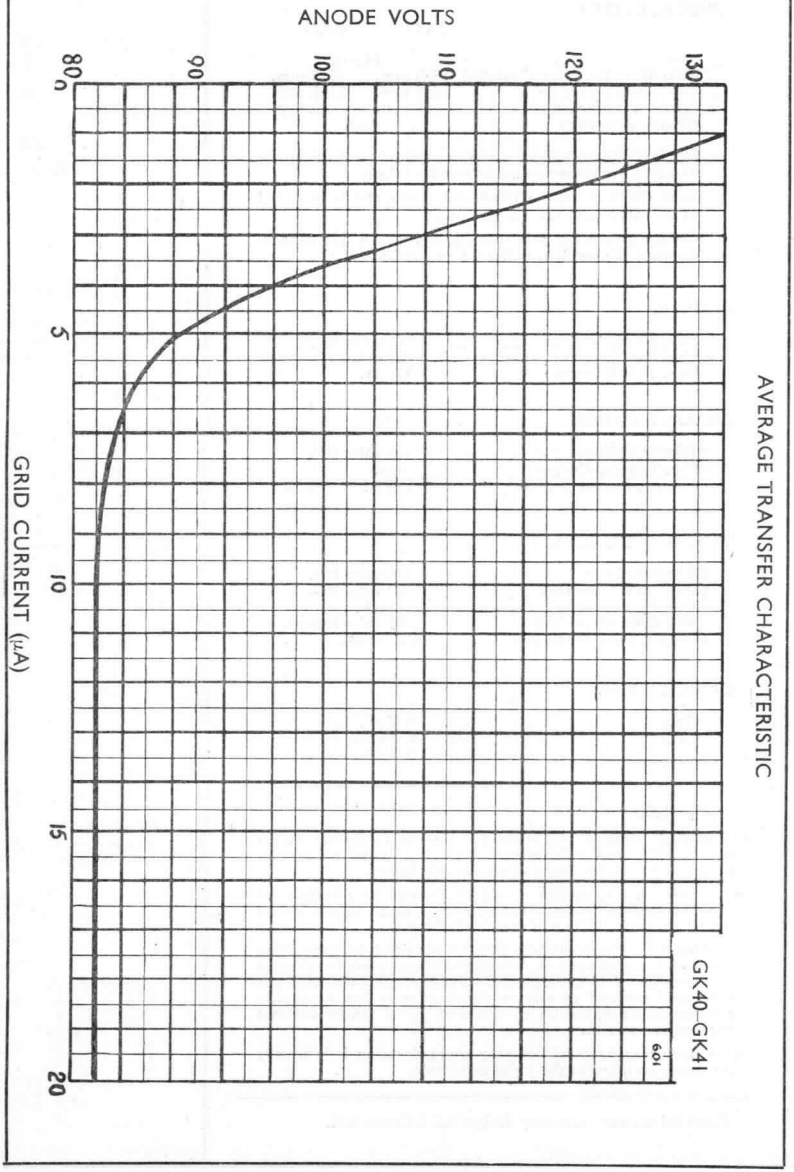
All dimensions shown are in millimetres

These valves were formerly designated K40 and K41.

Issue 3
Dec., 1955

GK40

GK41

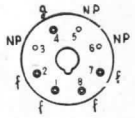

ANODE VOLTS
80
90
100
110
120
130
GRID CURRENT (μA)
0
5
10
15
20
AVERAGE TRANSFER CHARACTERISTIC
GK40-GK41
601

FERRANTI
TRIODE THYRATRON

GL1

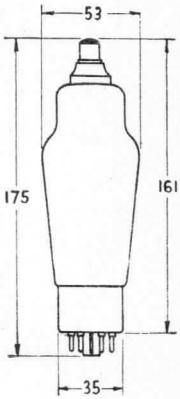
Type GL1 is a Mercury-Argon Triode Thyratron with a directly heated oxide coated cathode.

TC



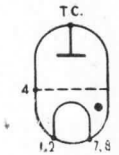
PHYSICAL DETAILS.

Base	... ...	International Octal.
Top Cap	... ...	Type CT2 with ceramic collar.
Max. Overall Length	... ...	175 mm. ($6\frac{29}{32}$ins.).
Max. Seated Height	... ...	161 mm. ($6\frac{11}{32}$ins.).
Max. Bulb Diameter	... ...	53·0 mm. ($2\frac{3}{32}$ins.).
Mounting Position	... ...	Vertical Base Down.



BASE CONNECTIONS.

Pin 1 } Filament*
Pin 2 }
Pin 3—No Pin.
Pin 4—Control Grid.
Pin 5—No Pin.
Pin 6—No Pin.
Pin 7 } Filament*
Pin 8 }
Top Cap—Anode.



RATINGS—Absolute Ratings.

Filament Voltage	... ...		2·5 volts.
Filament Current	... ...		7·0 amps.
Max. Peak Anode Voltage :			
	Forward	...	1250 volts.
	Inverse	...	1250 volts.
Max. Peak Anode Current	...		6·0 amps.
Max. Mean Anode Current	...		1·5 amps.
Max. Instantaneous Grid Current			50 mA.
Min. Heating Time	... ...		15 secs.
Max. Power Supply Frequency			400 c/s.
Temperature Range	... ...		−55°C to +80°C.
Max. Negative Control Grid Voltage :			
	Before Conduction	...	500 volts.
	After Conduction	...	12 volts.

ELECTRICAL CHARACTERISTICS.

Peak Voltage Drop	... ...			16 volts.
Control Characteristics :				
	DC Anode Voltage	26	500	1250 volts.
	DC Grid Voltage	0	−4·0	−6·8 volts.
Min. Grid Circuit Resistance	...			1000 ohms.

INTERELECTRODE CAPACITANCES :

Grid to Anode	... ...	1·8 pF.
Grid to Filament	...	5·8 pF.

All dimensions shown are in millimetres. (max.)

*It is essential to connect one side of the filament supply to both pins 1 and 2, and the other side to both pins 7 and 8.

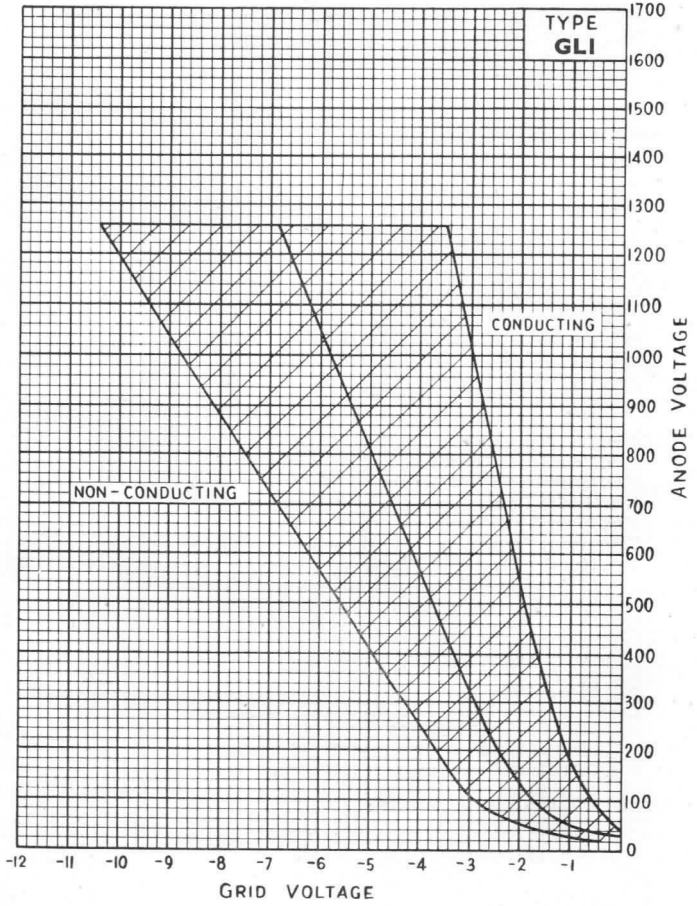
Issue 4.
Sept.,1955

FERRANTI LIMITED, Electronics Dept., Gem Mill, Chadderton, Oldham, Lancs.

GLI

FERRANTI

CRITICAL CONTROL GRID VOLTAGE CHARACTERISTIC



FERRANTI LIMITED, Electronics Dept., Gem Mill, Chadderton, Oldham, Lancs.

FERRANTI

COLD CATHODE TETRODE

GN10

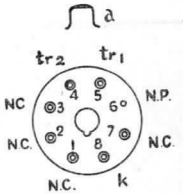
A gas-filled cold cathode arc discharge valve, designed for pulse operation. It is capable of passing a discharge current of the order of 250 Amperes peak, and is particularly suitable for Electronic Relays and Controls when short duration high peak current pulses are required.

PHYSICAL SPECIFICATION.

Base	International Octal.
Max. Seated Height	100 mm. (3$\frac{15}{16}$in.).
Max. Overall Length	114 mm. (4$\frac{1}{2}$in.).
Max. Base Diameter	33 mm. (1$\frac{5}{16}$in.).
Top Cap	Type CT1 ($\frac{1}{4}$in. dia.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No connection.
Pin 2—No connection.
Pin 3—No connection.
Pin 4—Trigger Electrode No. 2.
Pin 5—Trigger Electrode No. 1.
Pin 6—No Pin.
Pin 7—No connection.
Pin 8—Cathode.
Top Cap—Anode.



Base Connections

Underside View of Base

RATINGS.

Maximum Anode Voltage (Static) ...	550 volts.
Maximum Anode Voltage (working) ...	450 volts.
Minimum Anode Voltage (working) ...	320 volts.
Peak Inverse Anode Voltage	500 volts.
Max. Mean Anode Current	90 mA.
Maximum Average Grid Current ...	10 mA.
Max. Discharge Capacity	16 μF.

CHARACTERISTICS.

*Static Striking Voltage (tr_2 to tr_1)	90–140	volts.
Max. Repetition Frequency ...	250	per sec.
Min. Trigger Current required at V_a 450	50	μA.
Min. Trigger Current required at V_a 320	100	μA.

†Peak Anode Limits
Anode Current
Duration
A peak anode current of approx. 300 amps. results from the discharge of a 2 μFd. capacitor charged to 450 V.
The discharge time is 5 μ secs. approx.

Luminous Intensity — Under discharge conditions noted above the peak luminous intensity is approx. 530 candelas.

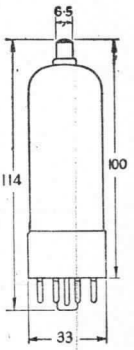
TYPICAL OPERATION.

DC. Supply Voltage	420 volts.
Trigger Electrode No. 2 Voltage (V_{tr2})	60 volts.
§Trigger Pulse Amplitude (V_{tr1})	160 volts.
Charging Resistor	3000 ohms.
Discharge Capacitor for operation at :—	
50 c.p.s.	2 μF.
250 c.p.s.	0·5 μF.

For further information on operation please refer to data sheet for NSP2 under "Notes on Operation." However, because of the increased supply voltage used with GN10, the circuits shown on the NSP2 Sheet will require some modification of component valves to provide the correct trigger electrode voltages.

DELAY TIME.

From 50 microseconds down to a few microseconds dependent on circuit conditions. In normal operation shortest delay times are ensured by using high values of Anode Voltage and trigger pulse energy.



All dimensions shown are in millimetres.

*The limits quoted are to cover production variations, and refer to the triggering voltage for a low rate of change of electrode voltages, with tr_1 negative to tr_2. For pulse operation a higher trigger voltage is generally necessary. See under "Typical Operation" and "Notes on Operation."

†A minimum of 5 amps. is necessary for the formation of an arc discharge with a tube drop of approx. 20 volts. If the main gap current is less than 5 amps. peak, a glow discharge is likely to form with a 70 volt drop and results in excessive cathode dissipation.

‡At instant of triggering.

§Negative in respect to cathode.

Issue 3
Jan., 1958

GN10

NOTES ON OPERATION.

On the quadrant diagram shown below the area enclosed by the loops is an area of non-conduction. If the vector sum of the voltages on two electrodes lies within the loop the valve will not fire. Any change of either or both of these voltages which causes the vector sum to fall outside the loop will trigger the valve by producing a glow discharge between one of the trigger electrodes and cathode or between the two trigger electrodes. This discharge will then initiate the arc discharge in the main anode—cathode gap. However to ensure reliable triggering and interchangeability, the valve should be triggered by a discharge between the two Trigger Electrodes, with a positive voltage on tr_2 and a negative going voltage on tr_1.

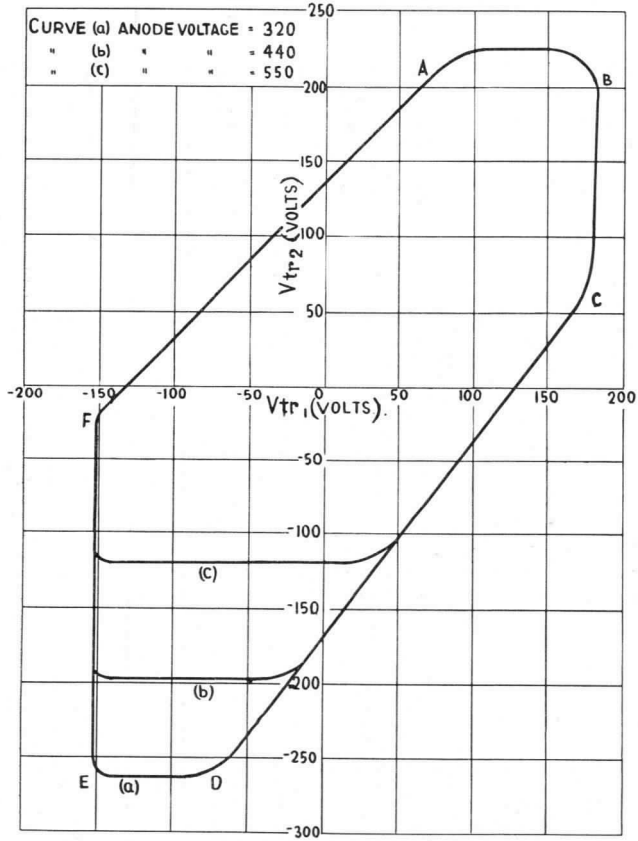
As the triggering impulse carries the vector sum of the applied voltages outside the loop, the point at which it crosses the loop indicates the manner in which the valve is triggered as follows :—

A—B Trigger Elec. 2 to Cathode.
B—C Trigger Elec. 1 to Cathode.
C—D Trigger Elec. 1 to Trigger Elec. 2.
D—E Cathode to Trigger Elec. 2.
E—F Cathode to Trigger Elec. 2.
F—A Trigger Elec. 2 to Trigger Elec. 1.

As noted above the most reliable operation is ensured by triggering between F and A, i.e., between tr_2 and tr_1.

For pulse operation it is necessary to apply a negative pulse of sufficient height and width, to trigger Electrode No. 1. A suitable trigger pulse is one about 150—200 volts which has a width of 30—100 microseconds at half the pulse amplitude.

The voltage on Trigger Electrode 2 should be approximately 60 volts positive at the instant of triggering.



AVERAGE STATIC TRIGGERING CHARACTERISTIC

FERRANTI

COLD CATHODE TETRODE

GN20

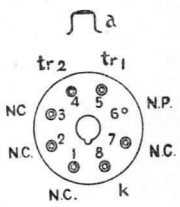
Type GN20 is a gas-filled cold cathode arc discharge valve. It is designed for pulse operation, and is particularly suitable for such applications as Electronic Relays where short duration pulses of up to 250 Amperes peak are required. The gas filling is argon.

PHYSICAL SPECIFICATION.

Base	International Octal.
Max. Seated Height	100 mm. (3 15/16 in.).
Max. Overall Length	114 mm. (4 1/2 in.).
Max. Base Diameter	33 mm. (1 5/16 in.).
Top Cap	Type CTI (1/4 in. dia.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—No connection.
Pin 2—No connection.
Pin 3—No connection.
Pin 4—Trigger Electrode No. 2
Pin 5—Trigger Electrode No. 1
Pin 6—No Pin.
Pin 7—No connection.
Pin 8—Cathode.
Top Cap—Anode.



Base Connections

Underside View of Base

RATINGS.

Maximum Anode Voltage ...	420 volts DC.
Minimum Anode Voltage ...	350 volts DC.
Peak Inverse Anode Voltage ...	400 volts.
*Maximum Mean Anode Current	80 mA.
Maximum Average Trigger Current	10 mA.
Minimum Series Discharge Resistance	0·3 ohms.

CHARACTERISTICS.

†Static Trigger Voltage (tr_1 to tr_2)	75 to 125 volts.
Max. Repetition Frequency ...	250 per sec.
Min. Trigger Current :—	
Va = 420	50 μA.
Va = 350	100 μA.

TYPICAL OPERATION.

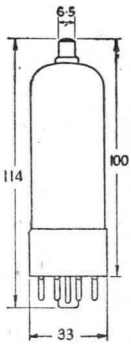
DC. Supply Voltage	360 volts.
Trigger Electrode No. 2 Voltage (V_{tr_2})	60 volts.
§Trigger Pulse Amplitude (V_{tr_1})	150 volts.
Charging Resistor	4000 ohms.
Discharge Capacitor for operation at :—	
50 c.p.s.	2 μF.
250 c.p.s.	0·5 μF.

For pulse operation to ensure interchangeability and reliable triggering it is necessary to employ a pulse of sufficient height and width. A suitable pulse may be derived by differentiating a square pulse of about 150—200 volts (e.g., from a multivibrator circuit) to produce a pulse which has a width of 30—100 microseconds at half the pulse height. The voltage on Trigger Electrode No. 2 should be approx. 60 volts at the instant of triggering.

For further information on operation please refer to data sheet for NSP2 under "Notes on Operation."

DELAY TIME.

From 50 microseconds down to a few microseconds dependent on circuit conditions. Minimum delay times can be achieved by using high values of trigger pulse energy and anode voltage.



All dimensions shown are in millimetres.

*A minimum of 5 amps. is recommended. This ensures the formation of an arc discharge with a tube drop of approx. 20 volts. If the peak current is less than 5 amps. a glow discharge is likely to form with a 75 volt drop.

†The limits quoted are to cover production variation and refer to the trigger voltage for single triggering with tr_1 negative to tr_2. For pulse operation a higher trigger voltage is generally necessary. See under "Typical Operation."

§Negative with respect to cathode.

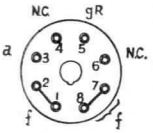
Issue 1
Aug.,1955

Ferranti

GRD7

GUARD RING DIODE

Type GRD7 is a directly heated diode with cylindrical co-axial electrodes and a tungsten filament. The guard rings ensure a homogeneous anode-cathode field and eliminate 'fringe' effect.
Although primarily designed for educational deomnstration purposes it is equally suitable in applicatons requiring a saturated diode of high stability, such as in stabilised AC. supply circuits.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

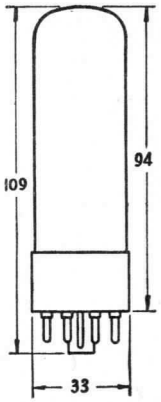
Base	International Octal.
Max. Overall Length	109 mm. (4$\frac{1}{2}$in.).
Max. Seated Height	94 mm. (3$\frac{11}{16}$in.).
Max. Diameter	33 mm. (1$\frac{5}{16}$in.).
Mounting Position	Vertical, base down.

The Anode and Guard Rings are of non-magnetic material.

A hole in the anode alows the filament to be sighted for the approximate assessment of temperature by optical method.*

BASE CONNECTIONS.

†Pin 1 } Filament.
†Pin 2 }
Pin 3—Anode.
Pin 4—No connection.
Pin 5—Guard Rings.
Pin 6—No connection.
†Pin 7 } Filament.
†Pin 8 }



Dimensions shown are in millimetres (max.).

RATINGS.

Continuous Operation:

Max. Filament Voltage	6 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation... ...	2 watts.

‡Intermittent Operation:

Max. Filament Voltage	7 volts.
Max. Anode Voltage	300 volts.
Max. Anode Dissipation... ...	5 watts.

CHARACTERISTICS.

Electrical.

Filament Voltage (for I_f=2·2 amps.) ...	6·3 volts approx.
Filament Current	Variable. (See I_f/Temp. graph on Page 3).

Physical.

Anode Length	14·5 mm.
Anode Internal Diameter ...	6·5 mm.
Filament Diameter	0·125 mm.
Effective Filament Length ...	14·5 mm.

*Due allowance should be made for transmission losses due to the glass envelope. There may also be losses due to film deposited on the glass.

†It is advisable that one filament lead shall be connected to both Pins 1 and 2 and the other lead to both Pins 7 and 8.

‡Short period operation, for example, as required for demonstration purposes.

Issue 4.
Oct., 1961.

Ferranti

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BRIEF NOTES
ON EDUCATIONAL DEMONSTRATIONS

Richardson's Law.

Total Electron Emission $= aAT^2 \exp.(-11600\phi/T.)$

Where a is the effective area of electron emission

T is the absolute temperature of the Electron emitting surface of the cathode.

A and ϕ are thermionic constants determined by the chemical nature of the cathode.

The GRD7 cathode is a tungsten filament with diameter (d) = 0·125 mm. and an effective length (l) = 14·5 mm.

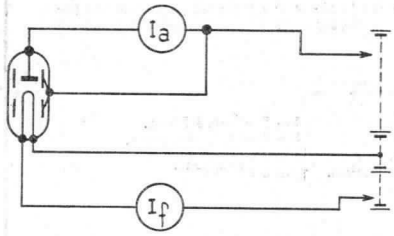
For Tungsten the generally accepted value of A is approximately 600 and the value of ϕ is 4·52.

The expression above therefore becomes

$= \pi dl \times 600 \times T^2$ Exp. $(-11600 \times 4{\cdot}52/T)$.

$= 3400 \times T^2$ Exp. $(-52500/T)$ approximately.

A typical circuit for demonstration is shown below:



410

Child-Langmuir Three-halves Power Law.

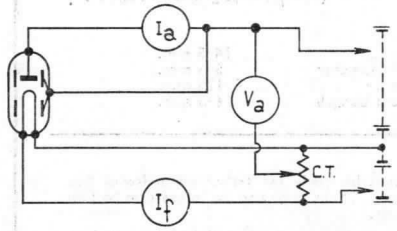
For a vacuum diode:—

$I_a\,(mA) = 14{\cdot}65 \frac{l}{R} 10^{-3}\, V_a 1{\cdot}5$

Where l is the length of the anode

R is the inside radius of the anode.

A circuit for experimental verification:—



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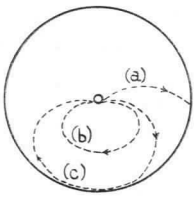
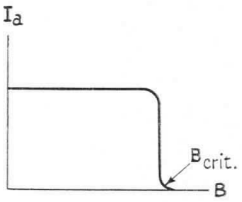
Hull's Law (Basic Magnetron Effect).

Experimental verification of this law can be effected by surrounding the GRD7 with a solenoid to produce a homogeneous magnetic field parallel to the electrode axis.

It is useful only as a device to conveniently demonstrate the principle of current cut-off in a vacuum diode.

The magnetic field affects the electron path as illustrated below. At a low value of flux density (B) the electrons reach the anode along a slightly curved path (a) whilst at a high value of flux density the curvature of the electron path (b) is such that the electrons return to the cathode. Therefore by varying the flux density it is possible to let anode current (I) pass, or to cut it off. The point at which I is cut off is B_{crit}, a condition corresponding to the electron path (c). The cut off is somewhat gradual because the initial electron velocity is non-uniform and for other reasons.





For a vacuum diode:—

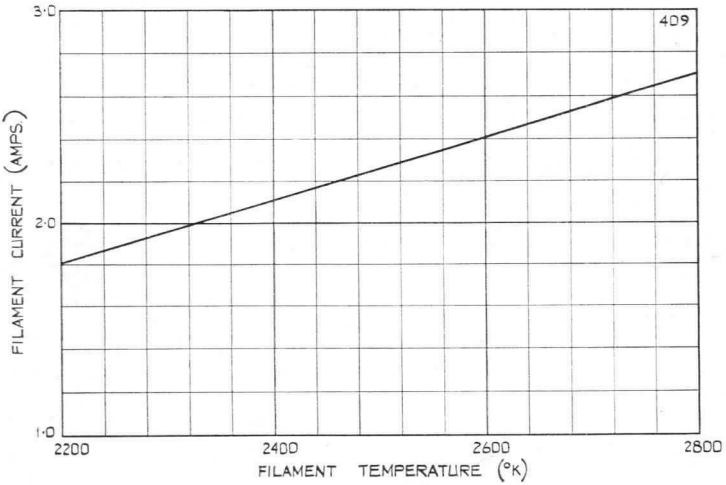
$B_{crit} = k\sqrt{V_a}$

where Bcrit = the flux density of the magnetic field for current cut-off.

V_a = Anode Voltage.

k = a constant with a value dependent on the dimensions of the diode and the configuration of the magnetic field.

FILAMENT TEMPERATURE/FILAMENT CURRENT



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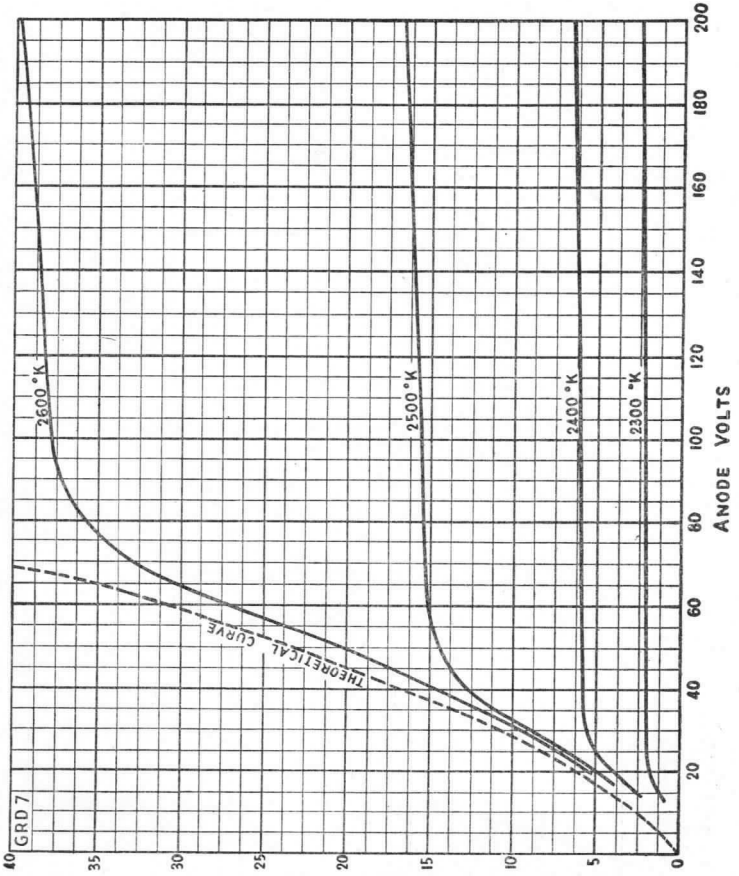
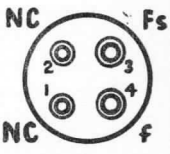

GRD 7
2600 °K
2500 °K
2400 °K
2300 °K
THEORETICAL CURVE
ANODE VOLTS
0
20
40
60
80
100
120
140
160
180
200
40
35
30
25
20
15
10
5
0
ANODE CURRENT mA)

FERRANTI

MERCURY VAPOUR RECTIFIER

A Mercury Vapour Rectifier with an oxide coated filament.

HG25



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	UX—4-pin (Bayonet).
Max. Overall Length	170 mm. (6$\frac{11}{16}$in.).
Max. Seated Height	155 mm. (6$\frac{1}{8}$in.)
Max. Bulb Diameter	66 mm. (2$\frac{37}{32}$in.).
Anode Cap	Type CT3.
Mounting Position	Vertical—Base down.

CATHODE.

Fil. Voltage	2·5 volts.
Fil. Current	5·0 amps.

RATINGS. (Maximum ratings are "absolute" values.)

Natural Ventilation Forced Ventilation	20°C—40°C 20°C—60°C	25°C—55°C 25°C—65°C
Max. P.I.V. ... ... (See Note 2 below)	5kV—10kV	up to 5kV

Max. Peak Anode Current ...	1·0	Amp.
Max. Av. Anode Current ...	0·25	Amp.
Ambient Temperature Range :		
Natural Ventilation ...	20°—55°C.	
Forced Ventilation	20°—65°C.	
Min. Cathode Heating Delay ... (See Note 1 below.)	30	secs.

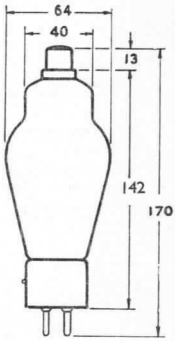
The above ratings apply to operation in circuits using a choke input filter and a supply frequency of 50 c/s.

TYPICAL OPERATION.

*CIRCUIT.	D.C. Output Kilovolts.	Amps.
No. 1. Bi-Phase Half Wave (2 valves) ...	3·2	0·5
No. 2. 3-Phase Half Wave (3 valves) ...	4·5	0·75
No. 3. Single Phase Full Wave (4 valves) ...	6·5	0·5
No. 4. 3-Phase Full Wave (6 valves) ...	9·5	0·75
No. 5. 3-Phase Half Wave Double Y (6 valves)	4·5	1·5

INSTALLATION NOTES.

1. When first installed or after a long period of rest the valve should be run for at least 5 minutes before the application of any anode voltage.
2. The rated value of P.I.V. is applicable only over the temperature ranges noted above. Care should be taken in selecting a suitable position in the layout to ensure free circulation of air around the bulb.
3. Valves should be shielded from radio frequency fields.
4. Surges due to H.T. switching or other causes should be avoided.
5. This rectifier is directly heated and it is therefore recommended that the output circuit should be returned to the mid point of the filament transformer secondary.
6. If valves are used in parallel to increase current output balancing inductances must be placed in the anode leads.



All dimensions shown are in millimetres (max.)

*For Circuit Diagrams see overleaf.

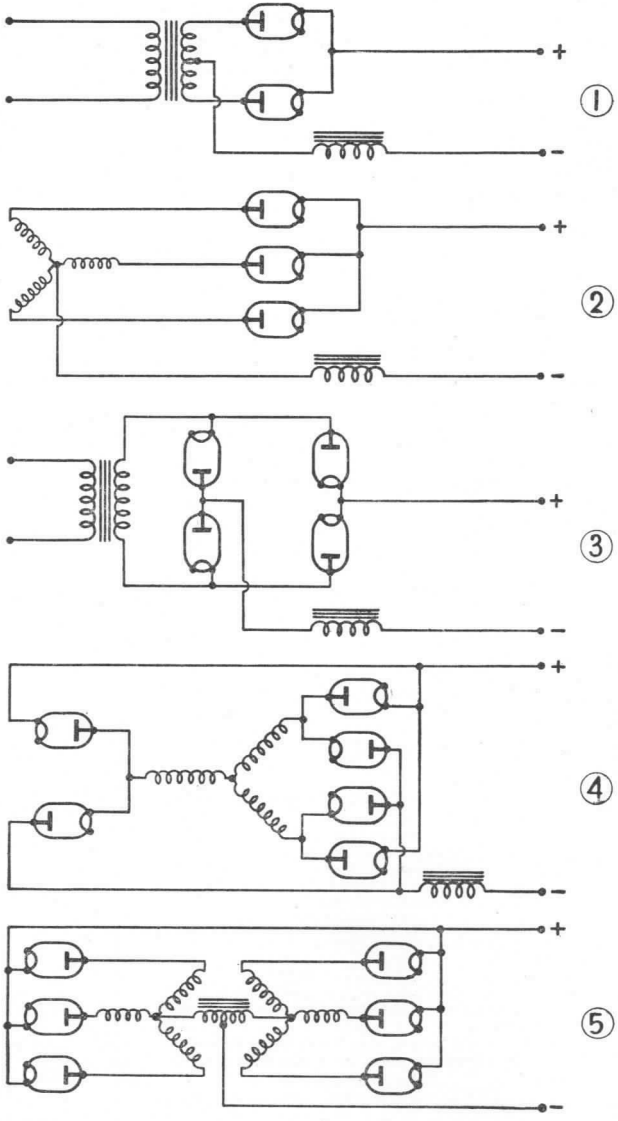
This Valve is a direct equivalent to U.S.A. type 866A.

Issue 1.
Mar., 1957

FERRANTI

HG25

Circuits referred to under "TYPICAL OPERATION" overleaf.



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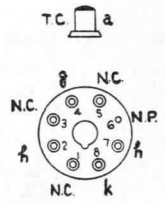
HL10

HIGH VOLTAGE VACUUM TRIODE

A high voltage vacuum triode with an indirectly heated oxide coated cathode. Applications include its use as a control valve or regulator for high voltage d.c. power supplies and as a variable resistor for use at high d.c. voltages.



Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	International Octal.
Top Cap	Skirted Medium CT3. (14.5 mm. dia.)
Max. Overall Length	234 mm.
Max. Seated Height	220 mm.
Max. Diameter	64 mm.
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Not connected. Pin 5—Not connected.
Pin 2—Heater. Pin 6—No Pin.
Pin 3—Not connected. Pin 7—Heater.
Pin 4—Grid. Pin 8—Cathode.
Top Cap—Anode.

HEATER.

Heater Voltage	4·0 volts.
Heater Current	1·5 amps.

RATINGS (Absolute).

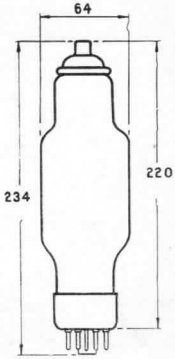
Max. Anode Voltage	20 kV.
Max. Peak Anode Current ...	30 mA.
Max. Mean Anode Dissipation ...	30 watts.
Max. Mean Anode Current ...	10 mA.
Max. Negative Grid Voltage ...	−250 volts.
Max. Grid Circuit Resistance ...	2 megohms.
*Max. Peak Heater/Cathode Voltage	150 volts.
Min. Cathode Heating Period prior to application of anode potential	30 secs.

CHARACTERISTICS.

D.C. Anode Voltage	5	10	15	20	kV.
→ D.C. Grid Volts for cut off ...	−24	−40	−59	−80	volts.
→ D.C. Grid Volts for I_a = 100μA	−18	−35	−52	−73	volts.
→ Amplification Factor	300	300	300	300	(approx.)

→ CAPACITANCES.

C_{g-k} (input)	4·0 pF.
C_{a-g} (output)	2·0 pF.



All dimensions shown are in millimetres (max.).

*Heater negative with respect to cathode.

WARNING.

Operation of the HL10 at high anode voltage may result in the production of X-rays which could cause possible injury from prolonged exposure at close range unless adequate shielding is provided. Relatively simple shielding should prove adequate.

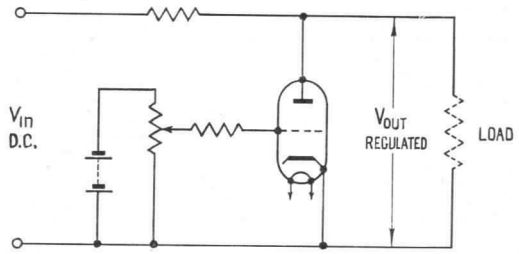
The high voltages normally applied to this valve can be very dangerous and particular care should be taken when making any circuit adjustments. It is recommended that before any part of the circuit is touched the supply voltage should be switched off and the terminals of any capacitor grounded.

Issue 3
Mar., 1961

Ferranti

Ferranti

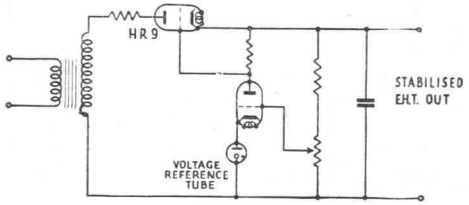
As a Shunt Regulator.



(*Fig* 1)

Fig. (1) shows a simple circuit using the HL10 as a shunt regulator.

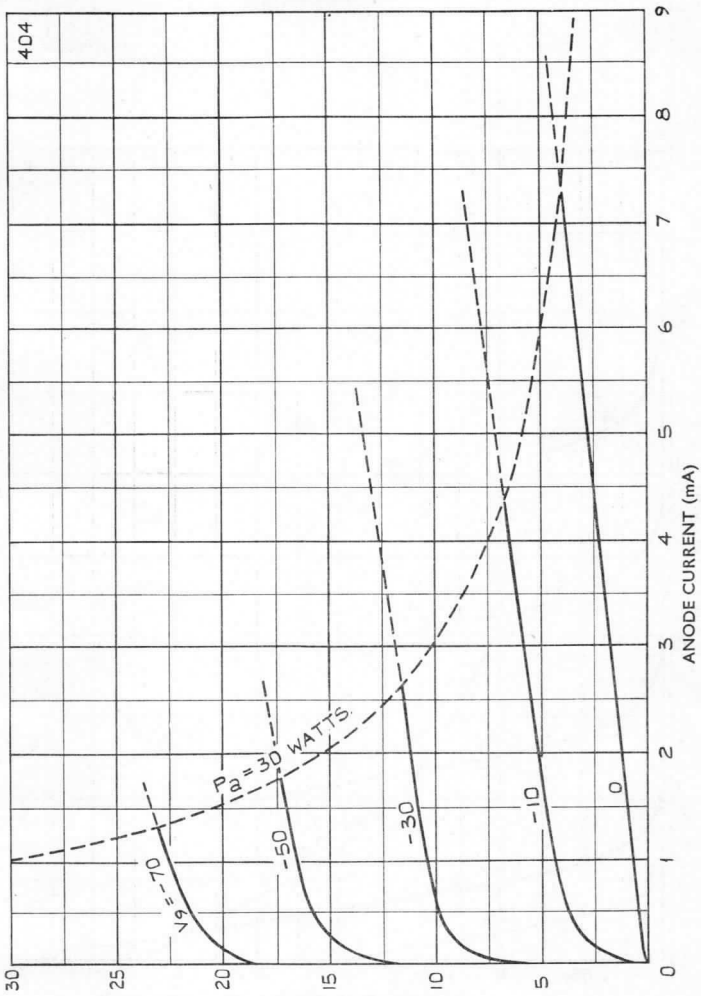
As a Voltage Controller in a Grid Controlled Rectifier Circuit with Automatic Stabilisation.



(*Fig*. 2)

In this application the HL10 is used in conjunction with a gas filled cold cathode diode type KD21. The function of the KD21 is to provide a stabilised cathode bias, and the HL10 supplies automatic grid control to the Rectifier HR9. The resultant stabilised E.H.T. output voltage can be varied by adjustment of the HL10 grid potentiometer.

Typical Anode Voltage/Anode Current Characteristics



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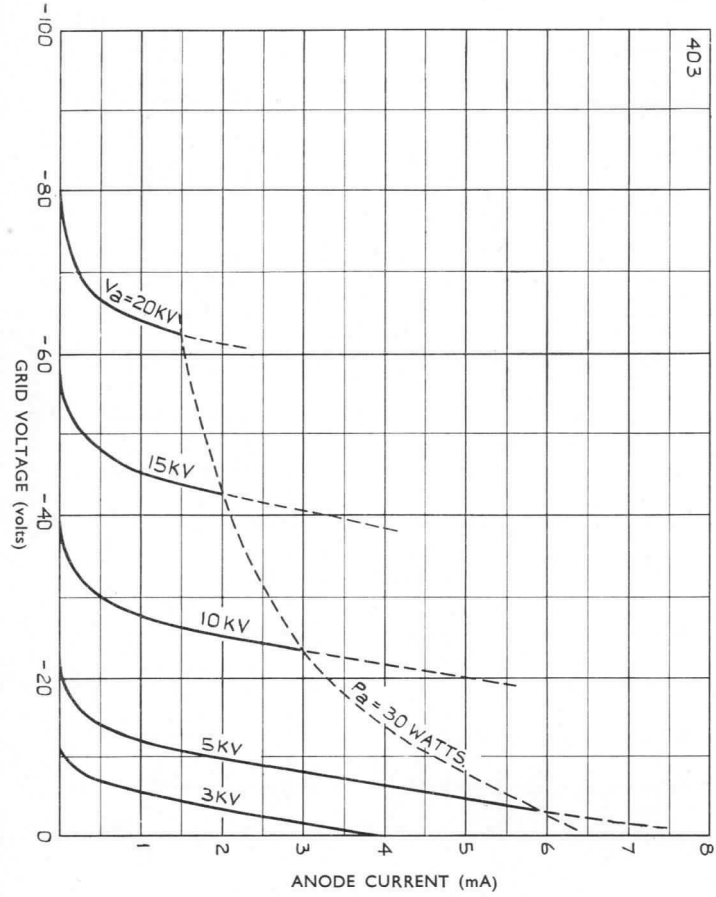
Typical Anode Current/Grid Voltage Characteristics



R657

FERRANTI

HIGH VOLTAGE REGULAR CONTROL TRIODE

HL22

A low current triode with an indirectly heated cathode. It has been specially designed for use as a control valve in voltage regulators for high voltage, low current, DC. power supplies. The envelope is silicone coated to render it moisture repellent.

PHYSICAL DETAILS.

Base	International Octal.
Top Cap	Skirted Miniature.
Max. Overall Length	129 mm.
Max. Seated Height	115 mm.
Max. Diameter	33 mm.
Mounting Position	Any.
Envelope	Silicone coated clear glass.

HEATER.

Heater Voltage	4·0 volts.
Heater Current	0·9 amp.

RATINGS (Absolute).

Max. Anode Voltage	25 kV.
Max. Peak Anode Current ...	5 mA.
Max. Mean Anode Dissipation ...	4 watts.
Max. Anode Direct Current ...	0·75 mA.
*Max. Peak Heater Cathode Voltage	150 volts.
Max. Negative Grid Voltage ...	200 volts.
Max. Grid Circuit Resistance ...	10 megohms.
Minimum Cathode Heating Time	45 secs.

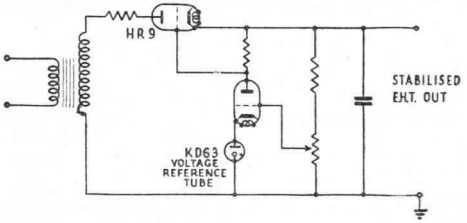
CHARACTERISTICS.

Control Characteristics :

DC. Anode Voltage (kV)	15	20	25
DC. Grid Voltage for cut off (Volts) ...	–26	–34	–42
DC. Grid Voltage for Ia=5μA	–21·5	–29	–36
Amplification Factor ...	900	900	900

TYPICAL OPERATION.

The valve is usually employed in a High Voltage Stabiliser Circuit. A typical circuit incorporating a type HR9 grid controlled rectifier is shown below. In this arrangement the HL22 is used as a control valve in association with a voltage reference tube type KD63.

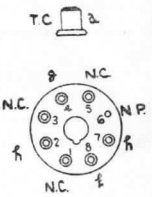


The high voltages normally applied to this valve can be very dangerous and particular care should be taken when making any circuit adjustments. It is recommended that before any part of the circuit is touched the supply should be switched off and the terminals of any capacitor grounded.
Operation of the HL22 at high anode voltage may result in the production of X-rays which could cause possible injury from prolonged exposure at close range unless adequate shielding is provided. Relatively simple shielding should prove adequate.

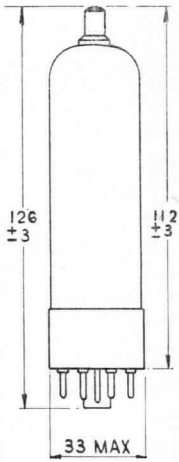
CAPACITANCES.

C_{a-k}	<0·1 pF.
C_{g-k}	1·0 pF.
C_{a-g}	0·6 pF.

*The heater may be either positive or negative with respect to cathode.



Base Connections Underside View of Base



All dimensions shown are in millimetres (max.)

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Tentative Issue 1 April, 1956

HL22

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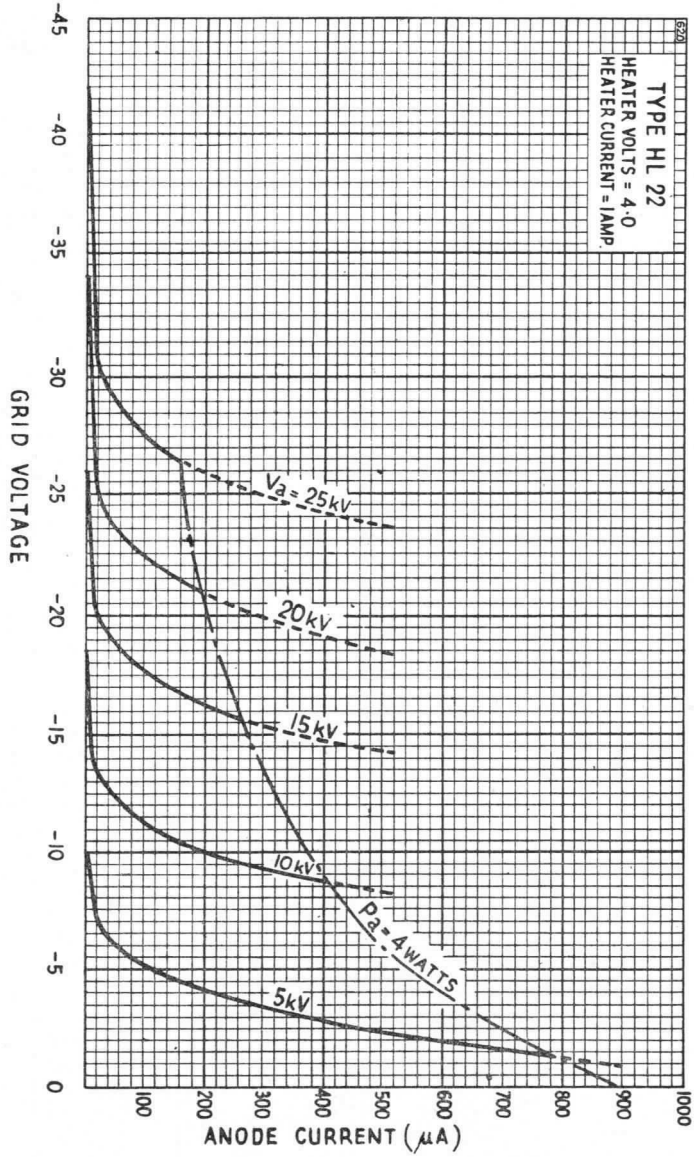


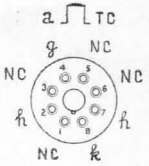
AVERAGE Ia/Vg CHARACTERISTIC.

Ferranti

HL25

HIGH VOLTAGE CONTROL TRIODE

A triode with an indirectly heated cathode designed for use as a control valve in voltage regulators in high voltage, low current, DC. power supplies.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	International Octal
Top Cap	TC. 1 (flanged)
Max. Overall Length ...	132 mm
Max. Seated Height ...	118 mm
Max. Diameter	33 mm
Mounting Position ...	Any
Envelope	Silicone coated clear glass

HEATER.

Heater Voltage	4·0 volts
Heater Current	1·0 amp

RATINGS (Absolute).

Max. Anode Voltage	15 kV
Max. Mean Anode Current	1·0 mA
Max. Peak Anode Current	5 mA
Max. Mean Anode Dissipation	4 watts
*Max. Peak Heater Cathode Voltage ...	150 volts
Max. Negative Grid Voltage	150 volts
Max. Grid Circuit Resistance	5 megohms
Minimum Cathode Heating Time ...	45 secs

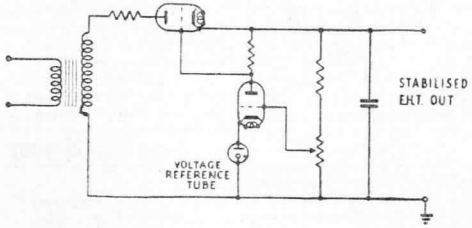
CHARACTERISTICS.

Control Characteristics:

Anode Voltage	15 kV
Grid Voltage for cut-off...	−32 volts
Grid Voltage for Ia=5μA	−25 volts
Amplification Factor	800

TYPICAL OPERATION.

A typical circuit for a stabilised High Voltage Supply is shown below.



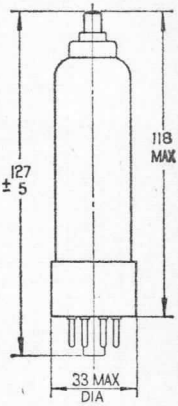
The voltage reference tube supplies stabilised bias to the HL25 which provides automatic control of the grid controlled rectifier. Variation of the stabilised output voltage is achieved by adjustment of the HL25 grid supply.

CAPACITANCES.

C_{a-k}	<0·1 pF
C_{g-k}	1·0 pF
C_{a-g}	0·6 pF

WARNING

The high voltages normally applied to this valve can be very dangerous and particular care should be taken when making any circuit adjustments. It is recommended that before any part of the circuit is touched the supply should be switched off and the terminals of any capacitor grounded



All dimensions shown are in millimetres

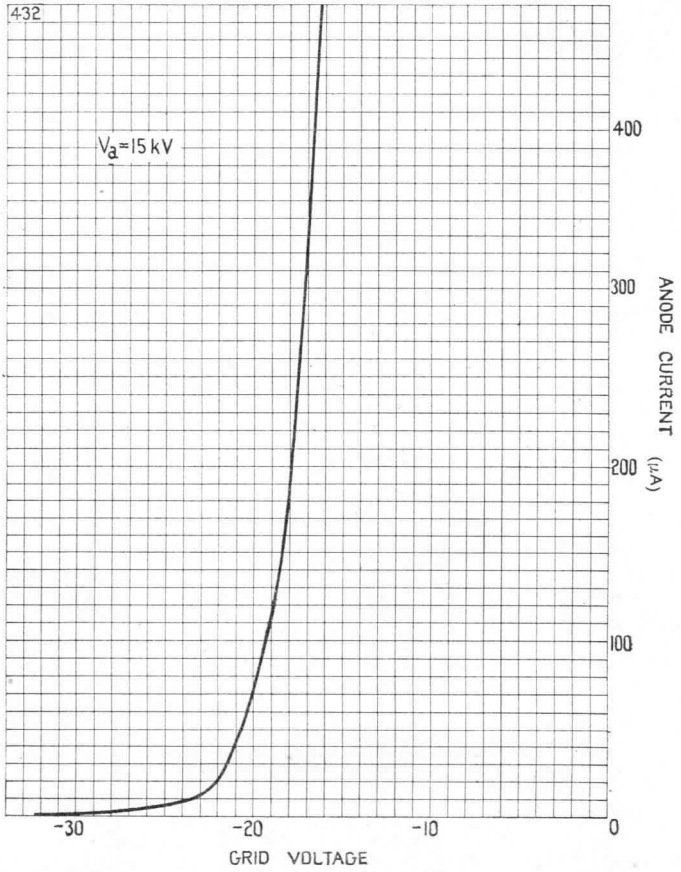
*The heater may be either positive or negative with respect to cathode.

Issue 1
April, 1963

Ferranti

Ferranti

AVERAGE Ia/Vg CHARACTERISTIC

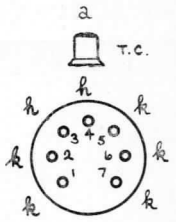


FERRANTI

VACUUM HIGH VOLTAGE RECTIFIER

HR2

A miniature indirectly heated Half-Wave High Voltage Rectifier, suitable for use for E.H.T. supplies for Oscilloscopes, Television Receivers, etc.



Base Connections
Underside View of Base

PHYSICAL DETAILS

Base	B7G
Top Cap...	Skirted Miniature
Max. Overall Length ...	60 mm. ($2\frac{5}{16}$")
Max. Seated Height ...	53 mm. ($2\frac{1}{16}$")
Max. Diameter	19 mm. ($\frac{3}{4}$")
Mounting Position ...	Any

BASE CONNECTIONS

Pin 1.—Cathode.	Pin 5.—Cathode.
Pin 2.—Cathode.	Pin 6.—Cathode.
Pin 3.—Heater.	Pin 7.—Cathode.
Pin 4.—Heater.	Top Cap—Anode.

HEATER

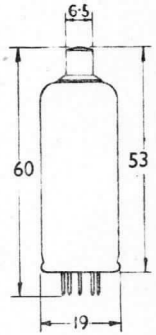
Heater Voltage	4·0 volts.
Heater Current	0·5 Amp.

RATINGS

The following Ratings are "Absolute" and apply to operation at 50 c/s with a capacitor input filter and delayed switching.

Max. P.I.V. (no load) ...	15·5 kV.
Max. P.I.V. (working) ...	13·0 kV.
Max. R.M.S. Input Voltage ...	5·5 kV.
Max. Peak Anode Current ...	40 mA.
Max. Rectified Current ...	5 mA.
Max. Reservoir Condenser ...	0·25 μF.
Min. Supply Impedance ...	50,000 ohms.
Min. delay for H.T. switching	30 secs.
Max. Operating Frequency ...	100 kc/s.

This valve may be used with simultaneous switching providing the RMS input voltage is not more than 3·5 kV and the rectified current does not exceed 1·5 mA.

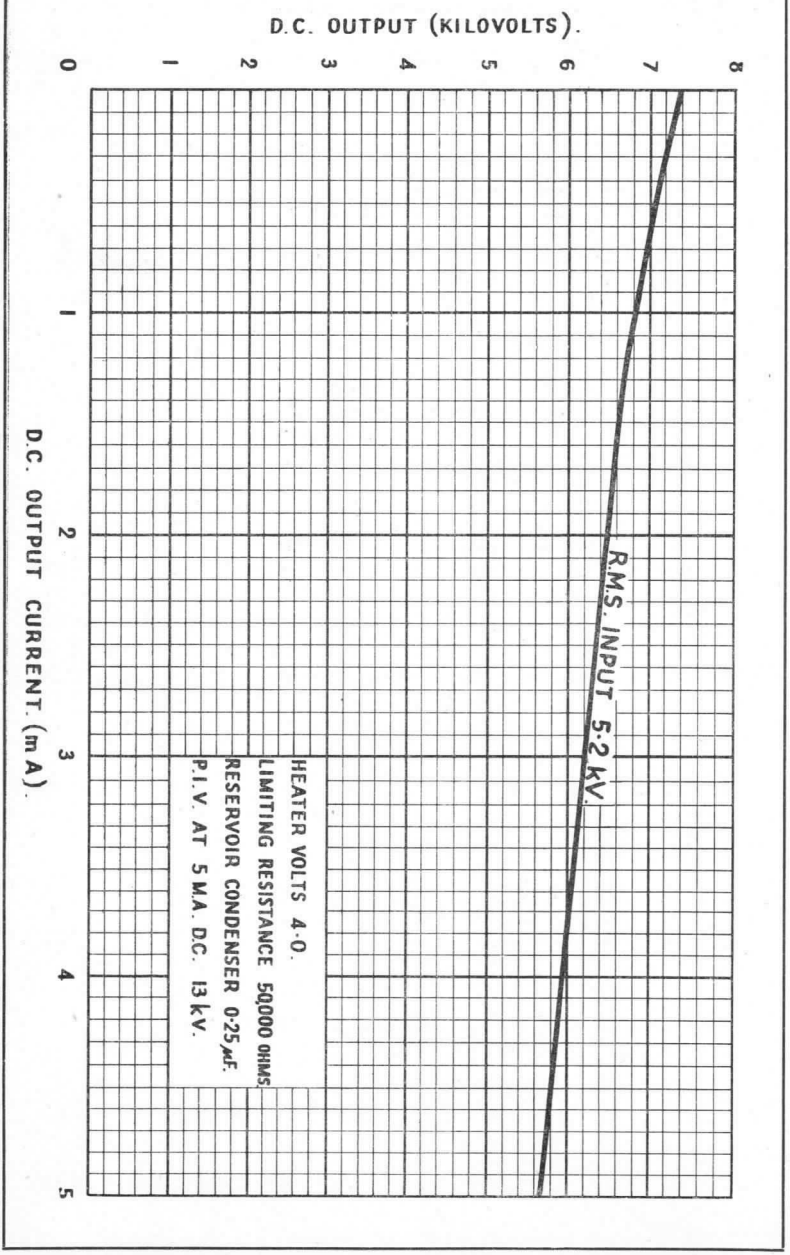


All dimensions shown are in millimetres. (max.)

FERRANTI

Issue 3
Feb., 1954

HR2

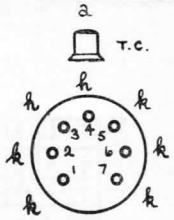

D.C. OUTPUT (KILOVOLTS).
0
1
2
3
4
5
6
7
8
D.C. OUTPUT CURRENT (mA).
0
1
2
3
4
5
R.M.S. INPUT 5·2 kV.
HEATER VOLTS 4·0.
LIMITING RESISTANCE 50,000 OHMS
RESERVOIR CONDENSER 0·25 μF.
P.I.V. AT 5 MA. D.C. 13 kV.

FERRANTI

VACUUM HIGH VOLTAGE RECTIFIER

HR3

A miniature indirectly heated Half-Wave High Voltage Rectifier.



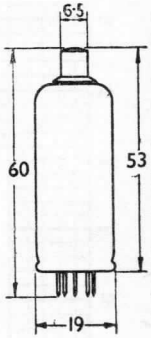
Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	B7G.
Top Cap	Skirted Miniature.
Max. Overall Length	60 mm. ($2\frac{5}{16}$in.).
Max. Seated Height	53 mm. ($2\frac{1}{16}$in.).
Max. Diameter	19 mm. ($\frac{3}{4}$in.).
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Cathode.	Pin 5—Cathode.
Pin 2—Cathode.	Pin 6—Cathode.
Pin 3—Heater.	Pin 7—Cathode.
Pin 4—Heater.	Top Cap—Anode.



HEATER.

Heater Voltage	4·0 volts.
Heater Current	0·5 amp.

RATINGS*

Max. P.I.V. (no load)	14·0 kV.
Max. P.I.V. (working)	11·5 kV.
Max. R.M.S. Input Voltage ...	5·0 kV.
Max. Peak Anode Current ...	80 mA.
Max. Rectified Current ...	15 mA.
Max. Reservoir Condenser ...	1·0 μF.
Min. Supply Impedance	30,000 ohms.
†Min. Delay for H.T. switching ...	30 secs.
Max. Operating Frequency ...	100 kc/s.

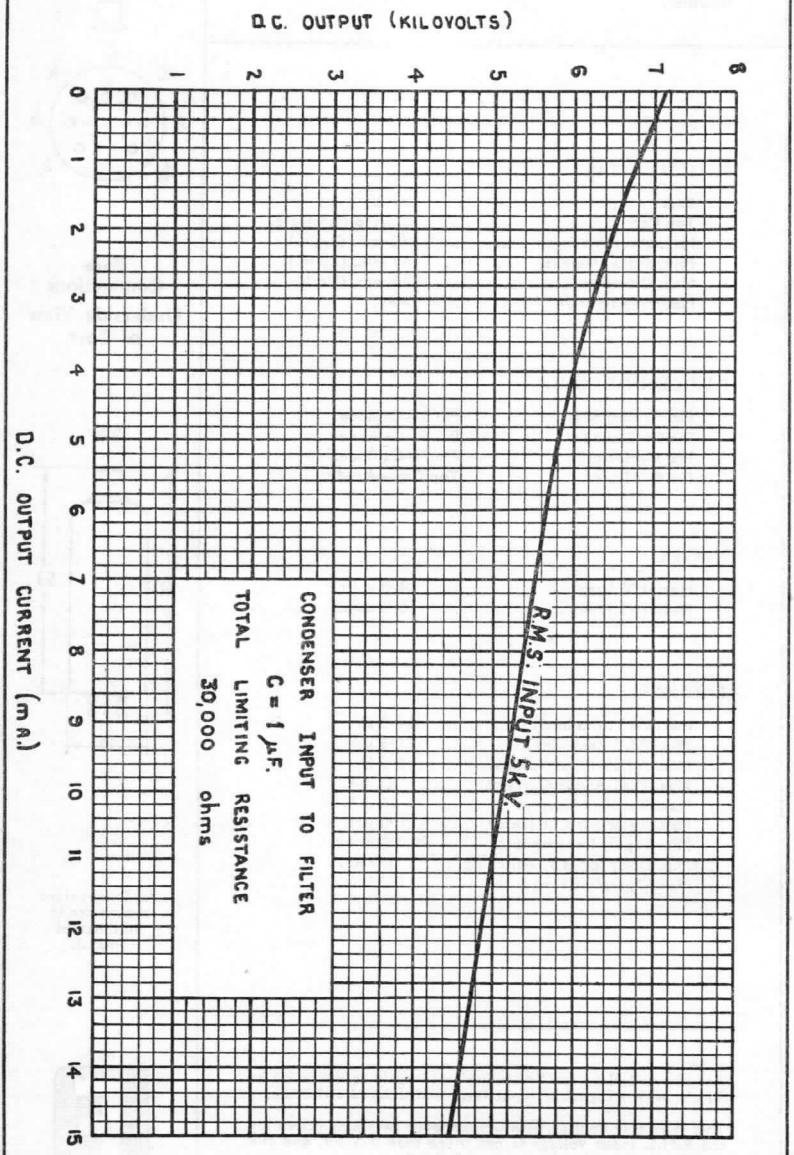
All Dimensions shown are in millimetres (max.).

*The above Ratings are "Absolute" and apply to operation at 50 c/s. with a capacitor input filter and delayed switching.

†This valve may be used with simultaneous switching providing the R.M.S. input voltage is not more than 3·5 kV. and the rectified current does not exceed 3·0 mA.

Issue 3
Feb., 1954

HR3


D.C. OUTPUT (KILOVOLTS)
1
2
3
4
5
6
7
8
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
D.C. OUTPUT CURRENT (m.a.)
R.M.S. INPUT 5 K.V.
CONDENSER INPUT TO FILTER
C = 1 μF.
TOTAL LIMITING RESISTANCE
30,000 ohms

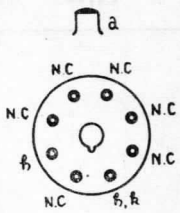
R0558.

FERRANTI

VACUUM HIGH VOLTAGE RECTIFIER

HR6

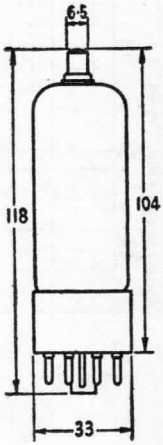
An indirectly heated Half-Wave High Voltage Rectifier.



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	... ...	International Octal.
Top Cap	... ...	Skirted Miniature—CT1
Max. Overall Length	...	118 mm. ($4\frac{21}{32}$in.).
Max. Seated Height	...	104 mm. ($4\frac{3}{32}$in.).
Max. Diameter (Base)	...	33 mm. ($1\frac{5}{16}$in.).
Mounting Position	...	Any.



BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Heater.
Pin 3—No Connection.
Pin 4—No Connection.
Pin 5—No Connection.
Pin 6—No Connection.
Pin 7—No Connection.
Pin 8—Heater, Cathode.
Top Cap—Anode.

HEATER.

Heater Voltage	... ...	4·0 volts.
Heater Current	... ...	1·25 amp.

RATINGS*

Max. P.I.V. (no load)	... ...	13·0 kV.
Max. P.I.V. (working)	... ...	11·5 kV.
Max. R.M.S. Input Voltage	...	4·5 kV.
Max. Peak Anode Current	...	280 mA.
Max. Rectified Current	...	40 mA.
Max. Reservoir Capacitor	...	1·0 μF.
Min. Supply Impedance	... ...	4500 ohms.
Min. Switching Delay Time	...	60 secs.

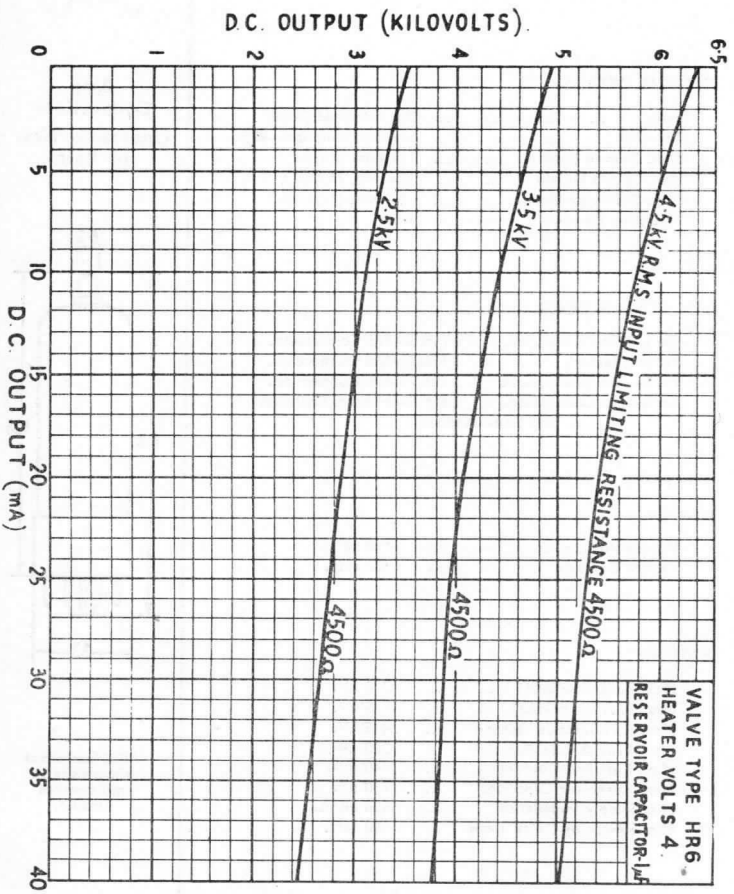
All Dimensions shown are in millimetres (max.).

*The above ratings are "Absolute" and apply to operation at 50 c/s. with a capacitor input and delayed switching.

FERRANTI

Issue 3
Dec.,1955

HR6


D.C. OUTPUT (KILOVOLTS)
0
1
2
3
4
5
6
6·5
D.C. OUTPUT (mA)
0
5
10
15
20
25
30
35
40
4·5 kV R.M.S. INPUT LIMITING RESISTANCE 4500Ω
3·5 kV
2·5 kV
4500Ω
4500Ω
4500Ω
VALVE TYPE HR6
HEATER VOLTS 4
RESERVOIR CAPACITOR 1μF

R0256

FERRANTI

VACUUM HIGH VOLTAGE RECTIFIER

HR8

An indirectly heated Half-Wave High Voltage Rectifier.

PHYSICAL DETAILS

Base	International Octal.
Top Cap	Skirted Miniature.
Max. Overall Length...	118 mm. ($4\frac{21}{32}$")
Max. Seated Height ...	104 mm. ($4\frac{3}{32}$")
Max. Diameter (Base)	33 mm. ($1\frac{5}{16}$")
Mounting Position ...	Any.

BASE CONNECTIONS

Pin 1.—No Connection. Pin 5.—No Connection.
Pin 2.—Heater. Pin 6.—No Connection.
Pin 3.—No Connection. Pin 7.—No Connection.
Pin 4.—No Connection. Pin 8.—Heater,cathode.
Top Cap—Anode.

HEATER

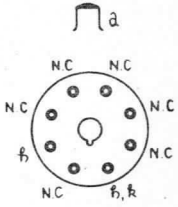
Heater Voltage	4·0 volts.
Heater Current	1·25 amps.

RATINGS

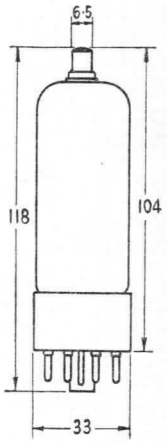
The following ratings are "Absolute" and apply to operation at 50 c/s with a capacitor input and delayed switching.

Max. P.I.V. (no load)	14·0 kV.
*Max. P.I.V. (working) ...	12·5 kV.
Max. R.M.S. Input Voltage ...	5·0 kV.
Max. Peak Anode Current ...	350 mA.
Max. Rectified Current ...	50 mA.
Max. Reservoir Capacitor ...	1·0 μF.
Min. Supply Impedance ...	4000 ohms
Min. Switching Delay Time ...	60 secs.

*The Valve may be operated at a P.I.V. (working) of 15 kV. [P.I.V. (no load) 16·5 kV.] provided that the maximum Rectified Current load is reduced to 40 mA., and the maximum Peak Anode Current is restricted to 300 mA. Under these conditions the supply impedance should be increased to a minimum of 5000 ohms.



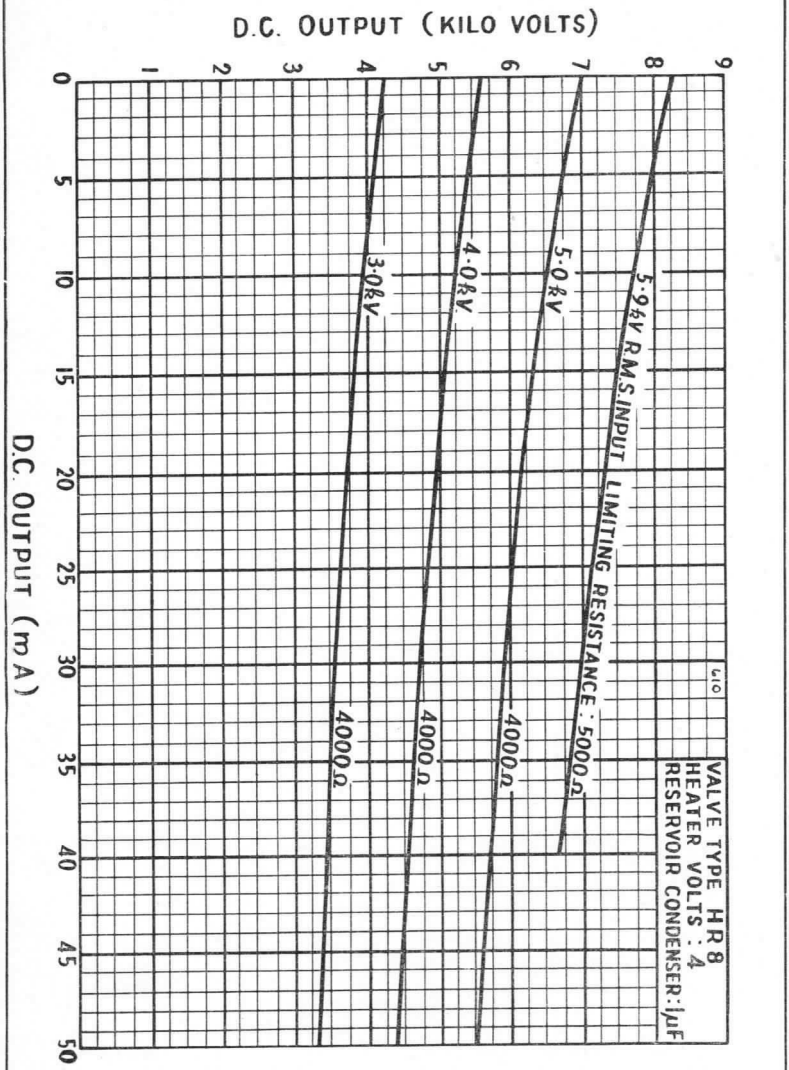
Base Connections Underside View of Base



All dimensions shown are in millimetres. (max.).

Issue 1.
Feb., 1954

HR8

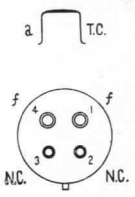

D.C. OUTPUT (KILO VOLTS)
0
1
2
3
4
5
6
7
8
9
D.C. OUTPUT (mA)
0
5
10
15
20
25
30
35
40
45
50
5·9kV R.M.S. INPUT LIMITING RESISTANCE : 5000Ω
5·0kV
4·0kV
3·0kV
4000Ω
4000Ω
4000Ω
4000Ω
VALVE TYPE HR8
HEATER VOLTS : 4
RESERVOIR CONDENSER : μF

Ferranti

VACUUM HIGH VOLTAGE RECTIFIER

HR12

A directly heated Half-Wave High Voltage Rectifier, with thoriated tungsten filament.



Base Connections

Underside View of Base

PHYSICAL DETAILS.

Base	... ...	Medium UX–4.
Top Cap	... ...	Skirted Medium CT3.
Max. Overall Length	...	154 mm. ($6\frac{1}{16}$in.).
Max. Seated Height	...	140 mm. ($5\frac{1}{2}$in.).
Max. Diameter	... ...	45 mm. ($1\frac{3}{4}$in.).
Mounting Position	...	Any.

BASE CONNECTIONS.

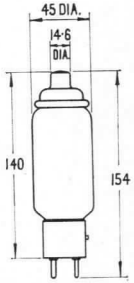
Pin 1.—Filament. Pin 3.—No Connection.
Pin 2.—No Connection. Pin 4.—Filament.
TC.—Anode.

HEATER.

Heater Voltage	... ...	2·5 volts.
Heater Current	... ...	5·0 amp.

RATINGS* (Absolute).

Max. P.I.V. (no load)	... ...	40 kV.
Max. P.I.V. (working)	... ...	36 kV.
Max. R.M.S. Input Voltage	... ...	15 kV.
Max. Peak Anode Current	... ...	175 mA.
Max. Peak Rectified Current	... ...	25 mA.
Max. Reservoir Capacitor	... ...	0·1 μF.
Min. Supply Impedance	... ...	27 kΩ
Min. Switching Delay Time	... ...	5 secs.



All Dimensions shown are in millimetres (max.).

OPERATING NOTES.

It is advisable to clean the bulb at regular intervals as accumulation of dust or dirt on the bulb may cause leakage paths and lead to failure of the valve.

X-RAY WARNING.

Operation at high anode voltage may result in the production of X-rays which could cause possible injury from prolonged exposure at close range unless adequate shielding is provided. Relatively simple shielding should prove adequate.

*The above ratings are "Absolute Maximum Ratings" and apply to operation at 50 c/s. with a capacitor input and delayed switching.

Issue 1
Nov. 1960

Ferranti

FERRANTI

VOLTAGE STABILISERS

Types KD21 (VR75/30), KD24 (VR105/30) and KD25 (VR150/30) are cold cathode glow discharge voltage stabiliser valves.

KD21 (VR 75/30)

KD24 (VR 105/30)

KD25 (VR 150/30)

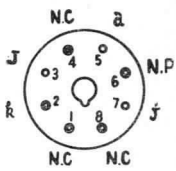
PHYSICAL DETAILS.

Base	... ...	International Octal.
Bulb	... ...	Clear.
Max. Overall Length	... ...	105 mm. ($4\frac{1}{8}$in.).
Max. Seated Height	... ...	91 mm. ($3\frac{9}{16}$in.).
Max. Diameter (Bulb)	... ...	40 mm. ($1\frac{9}{16}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—Cathode.
Pin 3—Jumper*
Pin 4—No Connection.
Pin 5—Anode.
Pin 6—No Pin.
Pin 7—Jumper*
Pin 8—No Connection.

*With suitable circuit connections the 'jumper' link in the base operates as a switch to render the equipment inoperative when the stabiliser valve is removed from its holder. A suggested arrangement is shown overleaf.



Base Connections Underside View of Base

RATINGS AND CHARACTERISTICS.

KD21

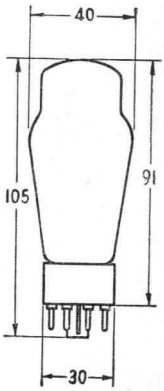
†Min. Anode Supply Voltage	...	105 volts DC.
Nom. Striking Voltage ...	...	100 volts DC.
Nom. Operating Voltage	...	75 volts DC.
Max. Operating Current	...	40 mA.
Min. Operating Current	...	5 mA.
‡Max. Peak Current ...	...	100 mA.
Regulation (5 to 40 mA.)	...	6 volts.

KD24

†Min. Anode Supply Voltage	...	135 volts DC.
Nom. Striking Voltage ...	...	115 volts DC.
Nom. Operating Voltage	...	105 volts DC.
Max. Operating Current	...	40 mA.
Min. Operating Current	...	5 mA.
‡Max. Peak Current ...	...	100 mA.
Regulation (5 to 40 mA.)	...	4 volts.

KD25

†Min. Anode Supply Voltage	...	180 volts DC.
Nom. Striking Voltage ...	...	160 volts DC.
Nom. Operating Voltage	...	150 volts DC.
Max. Operating Current	...	40 mA.
Min. Operating Current	...	5 mA.
‡Max. Peak Current ...	...	100 mA.
Regulation (5 to 40 mA.)	...	5·5 volts.



All dimensions shown are in millimetres. (max.).

†See note overleaf.

‡See note overleaf.

Issue 1.
Feb., 1954

KD21
(VR 75/30)

KD24
(VR 105/30)

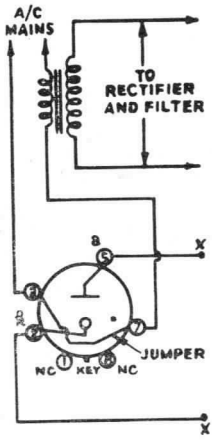
KD25
(VR 150/30)

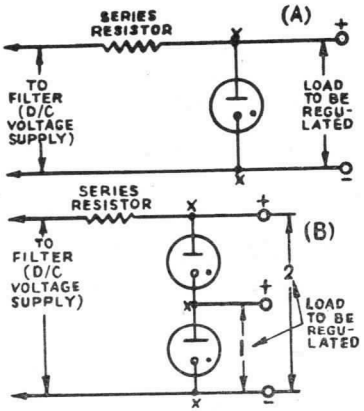
NOTES.

†To ensure 'striking' throughout life.

‡Sufficient resistance must always be included in series with these valves to limit the current through the valve to 40 milliamperes under steady operating conditions. However during the warming up period of approximately 10 seconds, before the valves in the associated equipment draw anode current, the maximum current can be permitted to rise to 100 mA providing that each such starting period is followed by at least several minutes of operation under normal conditions. Unless this precaution is observed the performance of the stabiliser will be impaired.

TYPICAL CIRCUIT CONNECTIONS.





VALVE TYPE	REGULATED SUPPLY VOLTAGE TO LOAD (APPROX. VOLTS)		
	CIRCUIT A	CIRCUIT B	
		1	2
VR75/30	75	75	150
VR105/30	105	105	210
VR150/30	150	150	300

FERRANTI

VOLTAGE STABILISERS

KD60

KD61

Small sized neon filled Cold-cathode Diodes, designed to fulfil the requirement of a high order of stability of running voltage at low currents. The valves are constructed in such a manner that they can also be used as visual indicators.

PHYSICAL DETAILS.

	KD60	KD61
Base	None	Flexible leads.
Max. Overall Length ...	51	44 mm.
Max. Width	23	19·5 mm.
Max. Dia. of glass envelope	12·5	12·5 mm.
End Caps	Skirted Miniature	—

The anode is indicated by a red band.

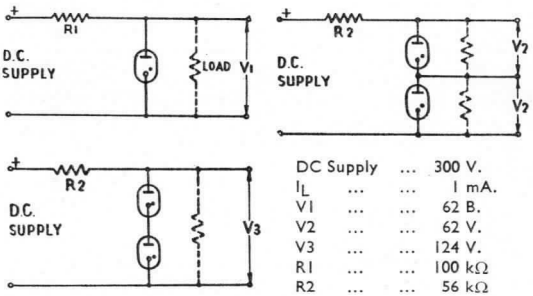
RATINGS.

Max. Ignition Voltage (DC) ... 85 volts.
Max. Operating Current ... 2·5 mA.
Min. Current to maintain Ionisation 20 μA.

CHARACTERISTICS.

Max. Voltage Drop across tube over operating range ... 64 volts.
Min. Voltage Drop across tube over operating range ... ... 60 volts.
†Regulation 1·0 mA to 1·2 mA ±0·15 volts.
0·5 mA to 1·0 mA ± 0·2 volts.
125 μA to 2·5 mA ± 0·4 volts.
*Min. operating current ... ... 125 μA.
Preferred operating current ... 1·0 mA.

TYPICAL OPERATION.



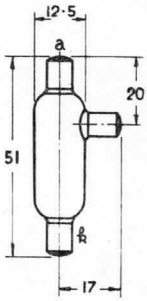
DC Supply ...	300 V.
I_L	1 mA.
V1	62 B.
V2	62 V.
V3	124 V.
R1	100 kΩ
R2	56 kΩ

For other operating conditions refer to chart overleaf.

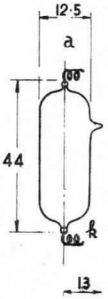
†The initial drift is very small but for maximum stability the valve should be given a preliminary run of 15 minutes.

*At current below 125 μA the potential drop across the tube rises.

KD 60



KD 61



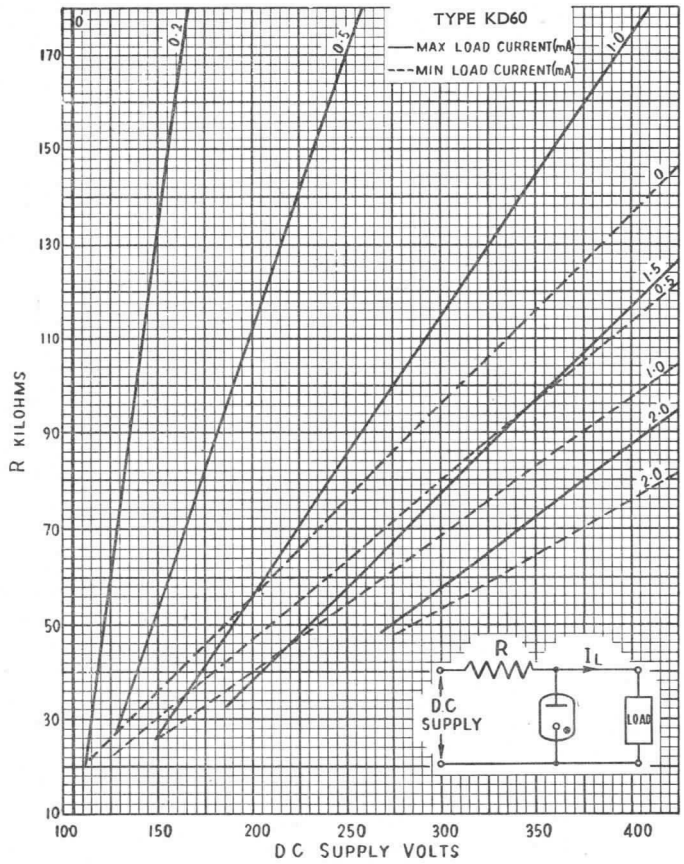
All Dimensions shown are in Millimetres (max.)

FERRANTI

Issue 5
Mar., 1956

KD60

KD61



This graph facilitates the determination of the permissible values of supply voltage and series resistance for operation with various loads permanently connected in parallel with the Stabiliser Valve.

On this graph Load current (I_L) refers to the DC. current flowing through the load at 62v.

The operating point of the valves must lie—

(a) below and to the right of the full line corresponding to the maximum load current.

(b) above and to the left of the dotted line corresponding to the minimum load current.

To determine the value of series resistor required in applications which employ several valves in series in order to get a higher stabilised voltage (e.g., R_2 overleaf) the method is as follows :—

For a circuit employing n valves in series the value of Series Resistor (Rs) is determined from the formula

$$R_s = R \times n$$

R is the value of resistor on the graph appropriate to a supply Voltage $\frac{V}{n}$ when V is the actual supply Voltage.

The largest convenient value of Resistor should be employed to obtain the best stability and longest life.

Due allowance should be made for the tolerance of the resistor and variation of the DC. supply voltage.

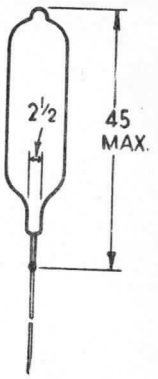
If the load is removed, or its resistance increased at the instant of switching on the supply voltage, much lower supply voltages and higher load currents may be employed.

FERRANTI

VOLTAGE REFERENCE TUBE

KD63

A subminiature neon filled Cold-cathode Diode. The running voltage is of a high order of stability and the valve is suitable for use as a Voltage Reference Tube. It is of rugged design suitable for use under conditions where shock or vibration is encountered.



PHYSICAL DETAILS.

Base	B3B/A—Flexible Leads.
Max. Overall Length (excluding leads)	45 mm. (1$\frac{25}{32}$in.).
Max. Length of glass bulb ...	38 mm. (1$\frac{1}{2}$in.).
Max. Diam. of glass envelope	10·16 mm. ($\frac{25}{32}$in.).

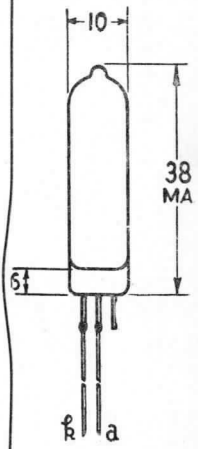
The anode lead is indicated by a red spot.

RATINGS.

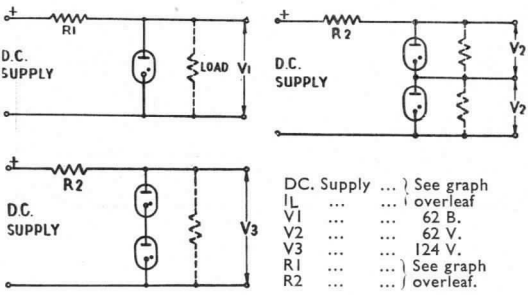
Max. Operating Current ...	2·5 mA.
*Min. Operating Current ...	200 μA.

CHARACTERISTICS.

Min. Voltage to ensure ignition	105 volts.
Max. Voltage Drop across tube over operating range ...	64 volts.
Min. Voltage Drop across tube over operating range	60 volts.
†Regulation 1·0 mA to 1·2 mA ±	0·1 volts.
0·5 mA to 2·2 mA ±	0·4 volts.
200 μA to 2·5 mA ±	0·75 volts.
*Min. current to maintain ionisation	20 μA.
Preferred operating current range	1·0 to 1·2 volts.



TYPICAL OPERATION.



DC. Supply ...	) See graph
IL	) overleaf
V1	62 B.
V2	62 V.
V3	124 V.
R1	) See graph
R2	) overleaf.

Because of the constancy of ignition voltage this valve can readily be employed in voltage overload protection devices for instruments, etc.

Dimensions shown are in millimetres (nominal) unless otherwise stated.

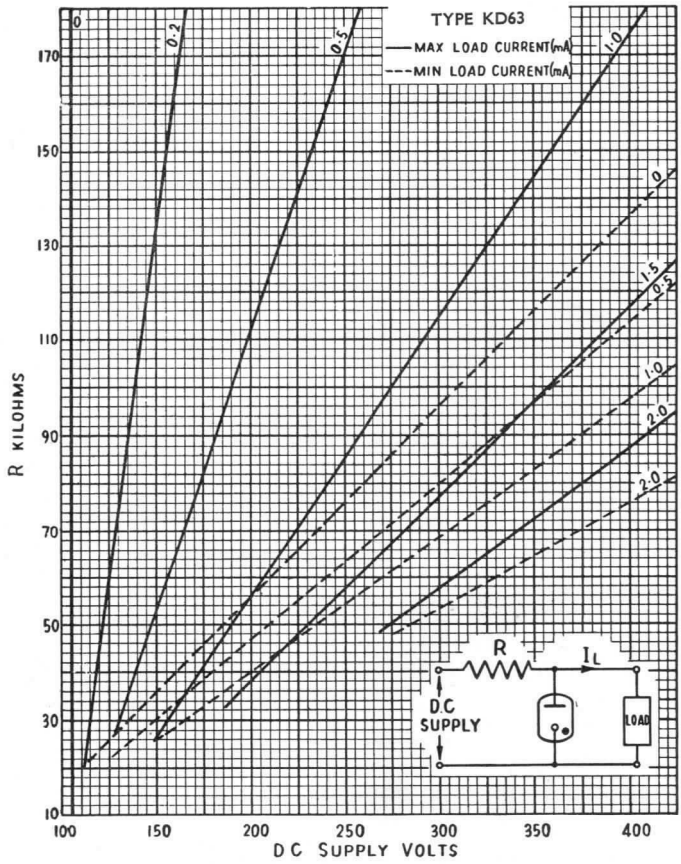
*At current below 200 μA the potential drop across the tube rises and performance may be erratic.

†This stabiliser will operate immediately an adequate ignition voltage is applied but for maximum stability the valve should be given a preliminary run of 15 minutes. The initial drift of Type KD63 is very small.

‡Regulation approximating to that quoted for the range 1·0–1·2 mA. can be obtained by limiting the operation to any similar narrow current range within the limits 0·5–2·2 mA.

Issue 4
July, 1957

KD63



This graph facilitates the determination of the permissible values of supply voltage and series resistance for operation with various loads permanently connected in parallel with the KD63.

On this graph Load current (I_L) refers to the DC. current flowing through the load at 62v.

The operating point of the KD63 must lie- ~

(a) below and to the right of the full line corresponding to the maximum load current.
(b) above and to the left of the dotted line corresponding to the minimum load current.

In applications which employ several valves in series in order to get a higher stabilised voltage, the method to determine the value of series resistor required (i.e., R_2 overleaf), is as follows :—

For a circuit employing n valves in series the value of Series Resistor (R_s) is determined from the formula

$$R_s = R \times n$$

R is the value of resistor on the graph appropriate to a supply Voltage $\frac{V}{n}$ when V is the actual supply Voltage.

The largest convenient value of Resistor should be employed to obtain the best stability and longest life.

Due allowance should be made for the tolerance of the resistor and variation of the DC. supply voltage.

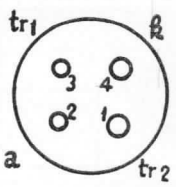
If the load is removed, or its resistance increased at the instant of switching on the supply voltage, much lower supply voltages and higher load currents may be employed.

FERRANTI

COLD CATHODE TETRODE

NSP1

The Ferranti "Neostron" type NSP1 is a cold cathode tetrode gas discharge valve. Developed primarily as a stroboscopic light source emitting a neon-red light, it is equally suitable for other uses where pulses of very high peak current are required.



Base Connections
Underside View of Base

PHYSICAL SPECIFICATION.

Base	... ...	UX 4 pin.
Max. Seated Height	... ...	96 mm. ($3\frac{3}{4}$in.).
Max. Overall Length	... ...	110 mm. ($4\frac{11}{32}$in.).
Max. Base Diameter	... ...	33 mm. ($1\frac{5}{16}$in.).
Length of arc	... ...	24 mm ($\frac{15}{16}$in.).
Mounting Position	... ...	Any.

BASE CONNECTIONS.

Pin 1—Trigger Electrode 2. Pin 3—Trigger Electrode 1.
Pin 2—Anode. Pin 4—Cathode.

RATINGS (Absolute).

Max. Anode Voltage (static)	... ...	440 volts.
Max. Anode Voltage (working)	... ...	380 volts.
Min. Anode Voltage (working)	... ...	220 volts.
Max. Peak Inverse Anode Voltage	... ...	350 volts.
Max. Average Anode Current	... ...	100 mA.
Max. Discharge Capacitance	... ...	16 μF.
Max. Average Trigger Current	... ...	10 mA.

CHARACTERISTICS.

*Static striking voltage (tr_2 to tr_1)	...	80–130 volts.
Max. flashing frequency	... ...	250 per sec.
Min. trigger current required at V_a 380		50 μA.
Min. trigger current required at V_a 220		300 μA.

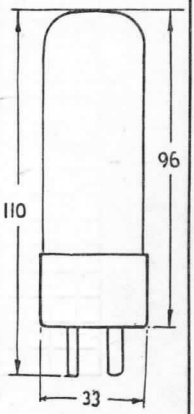
†Peak Anode Current
Peak Luminous Intensity
Flash Duration
} The discharge of a 2 μF capacitor charged to 380V. gives a peak anode current of approx. 230 amps. and a Peak Luminous Intensity of approx. 460 candelas with a flash duration of 10 microseconds at half the peak light output.

Delay Time ... ... Less than 40 microseconds, dependent on circuit conditions. With higher energy pulses the delay time can be considerably reduced.

TYPICAL OPERATION as Stroboscopic Light Source :

DC. supply voltage	... ...	300–330 volts.
‡Vtr_2 at triggering instant	...	... 70 volts.
§Trigger pulse amplitude (Vtr_1)		... 150 volts min.
Charging resistor	... ...	... 3000 ohms.
Discharge Capacitor for Operation at:—		
6–35 c.p.s.	... ...	4 μF.
30–50 c.p.s.	... ...	3 μF.
45–80 c.p.s.	... ...	2 μF.
80–150 c.p.s.	... ...	1 μF.
140–250 c.p.s.	... ...	0·5 μF.

For typical circuits and further information refer to NSP2 Data Sheet under "Notes on Operation."



All dimensions shown are in millimetres.

*tr_1 negative to tr_2.
†A minimum peak current of 5 amps. is recommended. This ensures the formation of an arc discharge with an anode–cathode volt drop of approx. 20 volts. If the peak current is less than 5 amps. a glow discharge is likely to form with a volt drop of 70 volts which may result in permanent damage to the valve.
‡Positive with respect to cathode.
§Negative with respect to cathode.

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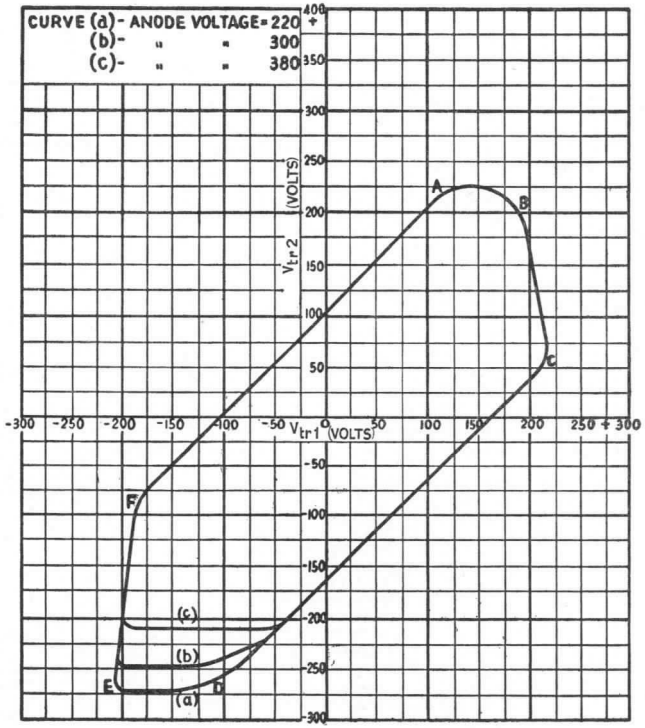
July, 1957



AVERAGE STATIC TRIGGERING CHARACTERISTICS

The area enclosed by the loops is an area of non-conduction. If the vector sum of the voltages on two electrodes lies within the loop the valve will not fire. Any change of either or both of these voltages which causes the vector sum to fall outside the loop will trigger the valve.

For pulse operation it is usually necessary to ensure that the pulse has a sufficient excess voltage (see "Notes on Operation" on NSP2 data sheet).

As the triggering impulse carries the vector sum of the applied voltages outside the loop the point at which it crosses the loop indicates the manner in which the valve is triggered as follows :—

Between AB Trigger Electrode 2 to Cathode Breakdown.
BC Trigger Electrode 1 to Cathode Breakdown.
CD Trigger Electrode 1 to Trigger Electrode 2 Breakdown.
DE Cathode to Trigger Electrode 2 Breakdown.
EF Cathode to Trigger Electrode 1 Breakdown.
FA Trigger Electrode 2 to Trigger Electrode 1 Breakdown.

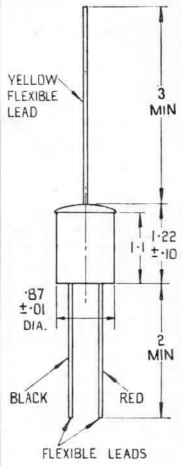
The most reliable operation is ensured by triggering between Tr_2 and Tr_1, i.e., between F and A on the diagram.

Ferranti

PULSE TRANSFORMER

PT56

A compact, resin encapsulated pulse transformer designed to supply the trigger voltage for photographic and stroboscopic flash tubes.



Dimensions in inches

PHYSICAL DETAILS.

Max. Overall Length	1·32" (33·5 mm.)
Diameter	0·87" (22·1 mm.)
Length of Flexible Leads	
Output Lead (Yellow) ...	3·0" (76·2 mm.)
Other Leads...	2·0" (50·8 mm.)

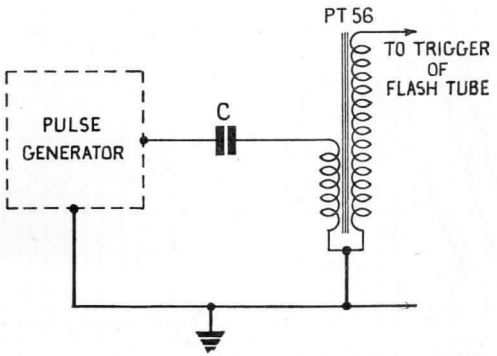
LEAD CONNECTIONS.

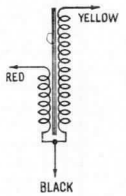
Pulse Input	Red
Pulse Output	Yellow
Common Negative	Black

RATINGS & CHARACTERISTICS.

Max. Input Pulse Voltage ...	350 volts
Max. Input Discharge Capacitor	0·25 μF
Output Voltage	See graph overleaf

TYPICAL OPERATION.





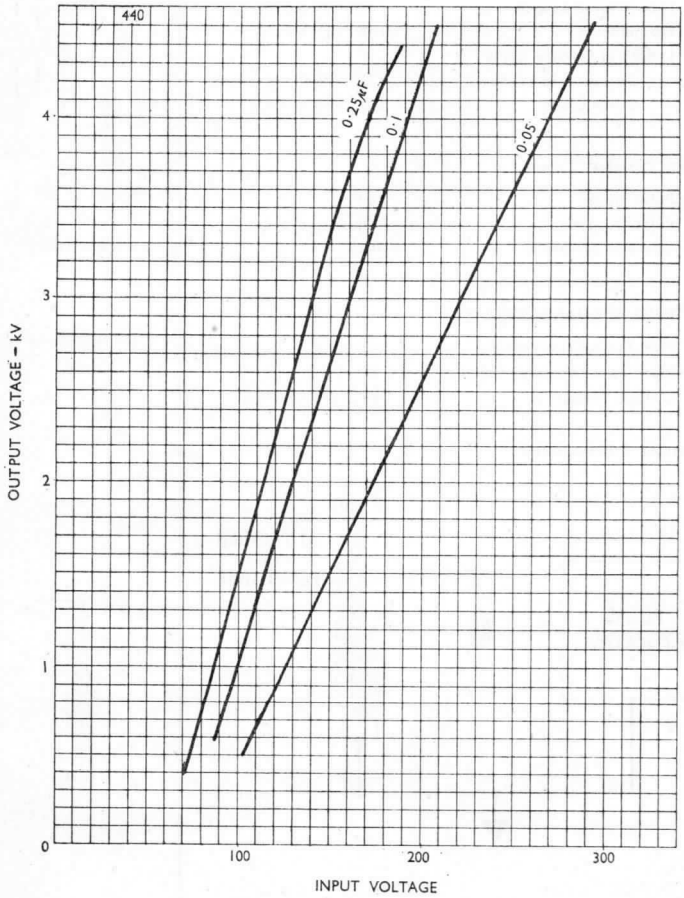
The discharge voltage pulse from the capacitor C must have a quick rate of current change.

Connections to the red (primary) lead and black (earth) lead should be as short as possible.

Ferranti

Issue 2
Aug., 1963

TYPICAL INPUT/OUTPUT CHARACTERISTICS

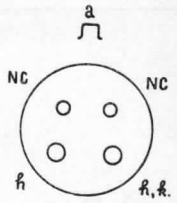


FERRANTI

HALF WAVE RECTIFIER

2X2A

An indirectly heated, high vacuum half wave rectifier. It is designed for use in applications where shock and vibration are encountered.



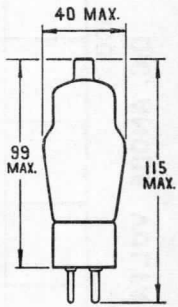
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	UX–4 Pin.
Bulb	Clear.
Max. Overall Length	115 mm. ($4\frac{17}{32}$in.).
Max. Seated Height	99 mm. ($3\frac{29}{32}$in.).
Max. Diameter (Bulb)	40 mm. ($1\frac{9}{16}$in.).
Anode Cap	CT_2.
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater. Pin 3—No Connection
Pin 2—No Connection Pin 4—Heater, Cathode.
Top Cap—Anode.



All dimensions shown are in millimetres (max.).

HEATER.

Heater Voltage	2·5 volts.
Heater Current	1·75 amps.

RATINGS.

Max. P.I.V.	12·5 kV.
Max. Peak Anode Current ...	60 mA.
Max. Rectified Current	7·5 mA.
†Max. Hot Switching Transient Current	100 mA.
Max. Ambient Temperature ...	70 °C.

TYPICAL OPERATION.

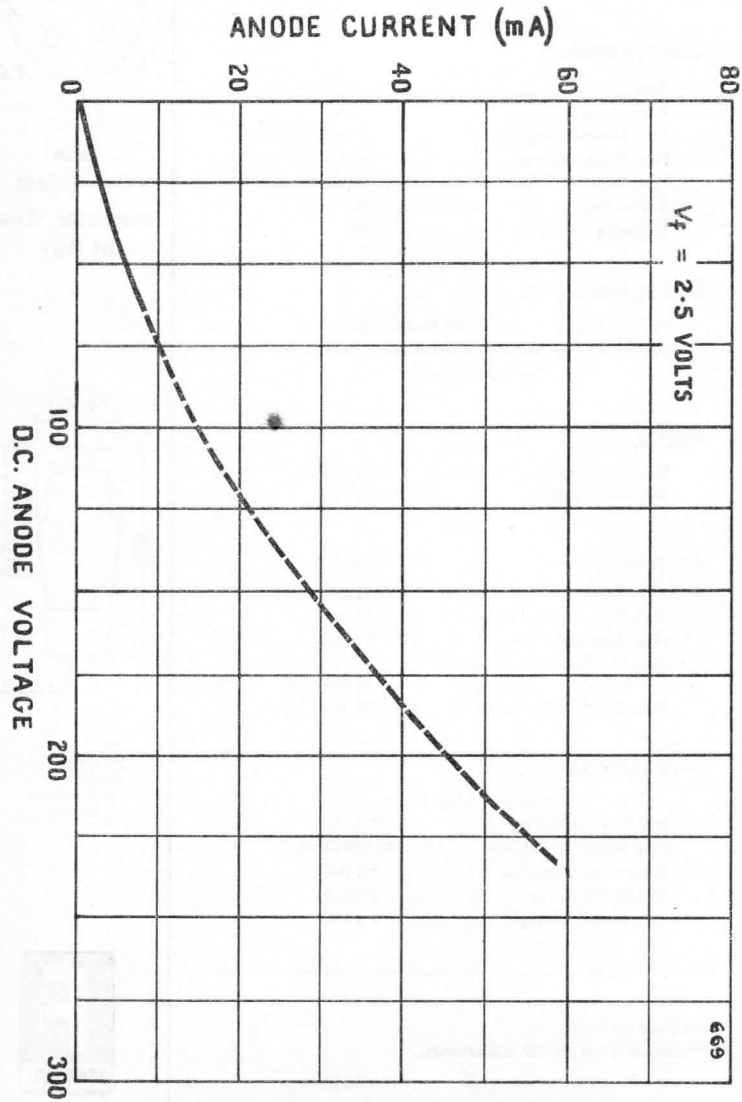
Capacitor Input Filter.

R.M.S. Input Voltage	5·5 kV.
Min. Supply Impedance	300,000 ohms.
Filter Input Capacitor	0·1 μF.
Rectified Current	2·0 mA.
*DC. Output Voltage	4·5 kV.

*At input to filter.
†Maximum duration 200 milliseconds.

Issue 1
Tentative
July, 1958

2X2A

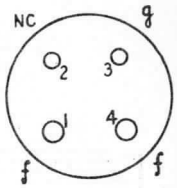

ANODE CURRENT (mA)
0
20
40
60
80
D.C. ANODE VOLTAGE
100
200
300
V_f = 2·5 VOLTS
669

R.0158

FERRANTI
THYRATRON

A gas and mercury vapour triode thyratron with a directly heated oxide coated cathode.

3C23



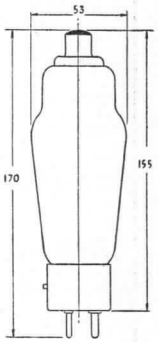
Base Connections
Underside View of Base

PHYSICAL DETAILS.

Base	Medium UX 4-pin Bayonet.
Top Cap	CT3.
Max. Overall Length	170 mm. ($6\frac{11}{16}$in.).
Max. Seated Height	155 mm. ($6\frac{3}{32}$in.).
Max. Diameter (Bulb)	53 mm. ($2\frac{3}{32}$in.).
Mounting Position	Vertical, base down.

BASE CONNECTIONS.

Pin 1—Filament. Pin 3—Grid.
Pin 2—No Connection.... Pin 4—Filament.
Top Cap—Anode.



FILAMENT.

Filament Voltage	2·5 volts.
Filament Current (nominal)	7·0 amps.
Min. Filament Heating Time	15 seconds.

RATINGS (Absolute).

Max. Peak Anode Voltage :	
Forward	1250 volts.
Inverse	1250 volts.
Max. Peak Anode Current :	
Below 25 c/s.	3 amps.
25 c/s. and higher	6 amps.
Max. Mean Anode Current :	
Below 210 c/s.	1·5 amps.
210 to 400 c/s.	1·0 amp.
Max. Peak Grid Current	50 mA.
*Max. Mean Grid Current	10 mA.
Max. Negative Control Grid Voltage :	
Before Conduction	500 volts.
During Conduction	10 volts.
Max. Power Supply Frequency	400 c/s.
**Condensed Mercury Temperature Range	−40 to +80°C.
Min. Grid Circuit Resistance	1000 ohms.

ELECTRICAL CHARACTERISTICS.

Peak Voltage Drop			16	volts.
Approximate Control Characteristics :				
DC. Anode Voltage	25	500	1250	volts.
DC. Grid Voltage	0	−4	−6·5	volts.
Ionisation Time (approx.)		10		μsecs.
De-ionisation Time (approx.)		1000		μsecs.

CAPACITANCES.

Grid to Anode	1·8 pF. (approx.)
Grid to Filament	5·8 pF. (approx.)

All dimensions shown are in millimetres. (max.).

*Averaged over 5 seconds.

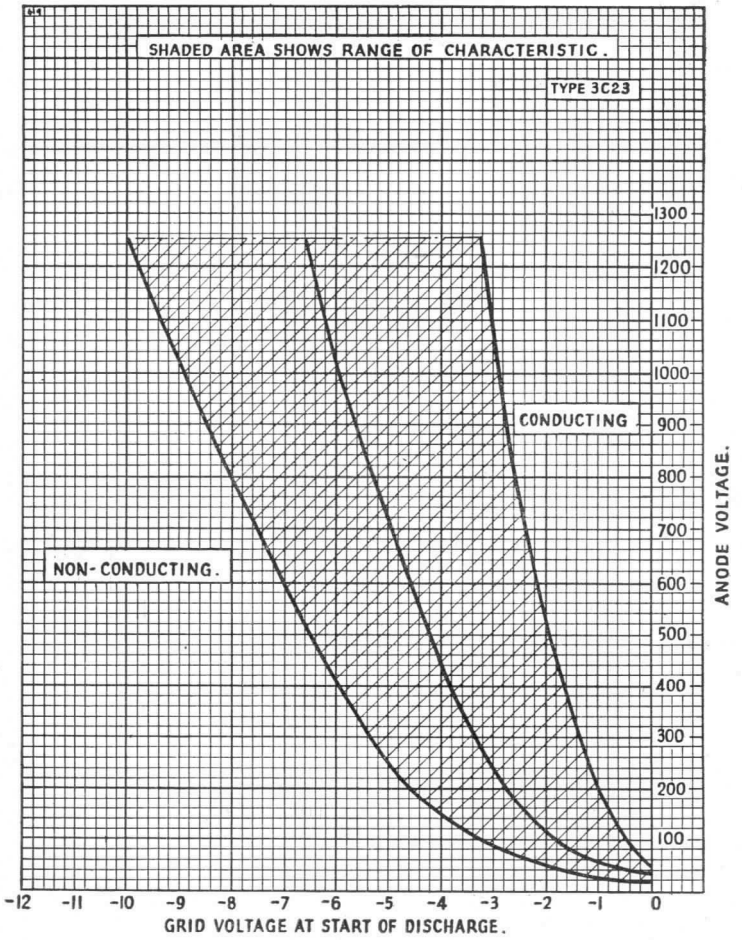
**Recommended condensed mercury temperature = 40°C.

Issue 1
April, 1956

3C23

FERRANTI

CONTROL CHARACTERISTIC



R0256

FERRANTI

FULL WAVE RECTIFIER

5R4GY

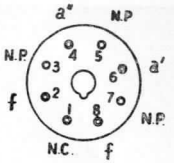
A directly heated, high vacuum full wave rectifier, designed for use in equipments where a large output is required.

PHYSICAL DETAILS.

Base	International Octal.
Bulb	Clear.
Max. Overall Length	135 mm. (5⅜in.)
Max. Seated Height	121 mm. (4¾in.)
Max. Diameter (Bulb)	52 mm. (2 1/16in.)
Mounting Position	Vertical, base down ; or horizontal with pins 1 and 4 in vertical plane.

BASE CONNECTIONS.

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.



Base Connections Underside View of Base

FILAMENT.

Filament Voltage ...	5·0 volts.
Filament Current ...	2·0 amps.

RATINGS.

Max. Peak Anode Current per anode			650	mA.
Max. P.I.V. (no load) ...	2100	2400	2800	volts.
Max. Rectified Current (Capacitor Input) ...	250	175	150	mA.
Max. Rectified Current (Choke Input) ...	250	250	175	mA.
Min. Choke Inductance ...	5	5	10	Henries
Delay for H.T. Switching		see Note *		

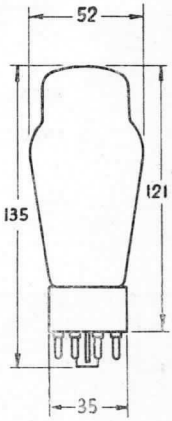
TYPICAL OPERATION.

CAPACITOR INPUT.

‡R.M.S. Input voltage ...	750	850	1000	volts.
††Min. Supply Impedance ...	250	500	575	ohms.
Rectified Current ...	250	150	150	mA.
Reservoir Capacitor ...	4	4	4	μF.

CHOKE INPUT.

‡R.M.S. Input Voltage ...	850	1000	volts.
Rectified Current ...	250	175	mA.
Min. Input Choke Inductance	5	10	Henries



All Dimensions shown are in Millimetres (max.).

*Under certain operating conditions which are shown on the graph overleaf it is necessary to delay application of the Anode Voltage until the filament has reached the required temperature. Neglect of this precaution will lead to early failure.

†If an input capacitor larger than 4 μF is employed the anode supply impedance should be increased to limit the peak anode current to the maximum specified under "Ratings."

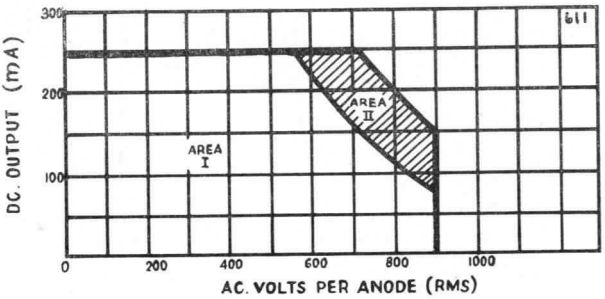
‡Each Anode.

Issue 1.
Feb., 1954.

FERRANTI

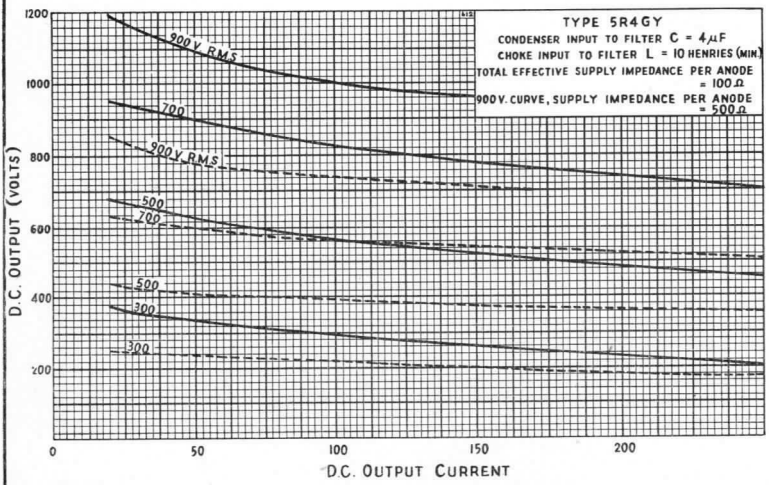
OPERATION CHARACTERISTICS

CAPACITOR INPUT TO FILTER



AREA I: FILAMENT & ANODE VOLTAGE MAY BE APPLIEED SIMULTANEOUSLY.

AREA II: FILAMENT SHOULD BE ALLOWED TO REACH OPERATING TEMPERATURE BEFORE ANODE VOLTAGE IS APPLIED, FOR AVERAGE CONDITIONS, THE DELAY IS APPROXIMATELY 10 SECONDS.



FERRANTI

OUTPUT BEAM TETRODE

807

Indirectly heated beam tetrode designed for use as a Low Frequency Amplifier or Modulator, or as a Radio Frequency Power Amplifier or Oscillator.

PHYSICAL DETAILS.

Base	UX–5 pin bayonet.
Max. Overall Length	147 mm.
Max. Seated Height	130 mm.
Max. Diameter (Bulb)	53 mm.
Mounting Position	Any.

BASE CONNECTIONS.

Pin 1—Heater. Pin 4—Cathode, Beam Plates.
Pin 2—Screen Grid Pin 5—Heater.
Pin 3—Control Grid. Top Cap—Anode.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·9 amp.

RATINGS.

Max. Anode Voltage	600	volts.
Max. Peak Anode Voltage	2000	volts.
Max. Screen Grid Voltage	300	volts.
Max. Negative Control Grid Voltage	200	volts.
Max. Cathode Current	150	mA.
Max. Peak Cathode Current	400	mA.
Max. Screen Grid Current	10	mA.
Max. Control Grid Current	5	mA.
Max. Peak Control Grid Current	25	mA.
Max. Anode Dissipation	25	watts.
Max. Screen Grid Dissipation	3·5	watts.
Max. V_{h-k}	100	volts.
Max. R_{g-k}	25	kΩ

TYPICAL OPERATION.

Single Valve Class A Amplifier.

Anode Voltage	300	500	volts.
Screen Voltage	250	200	volts.
Control Grid Voltage	−12·5	−14·5	volts.
Anode Current	83	50	mA.
Screen Current	8·0	1·6	mA.
Anode Impedance	24	39	kΩ
Mutual Conductance	6·5	5·7	mA/volts.
Cathode Bias Resistor	140	280	ohms.
Anode Load	3	6	kΩ
Power Output	6·4	11·5	watts.
Total Harmonic Distortion	6	12	%

2 Valves Push Pull Amplifier.

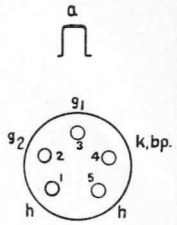
	Class AB1		Class AB2†	
Anode Voltage	500	600	600	volts.
Screen Voltage	300	300	300	volts.
Control Grid Voltage	–	−27·5	−30	volts.
Cathode Bias Resistor	270	–	–	ohms.
Peak AF. Input Voltag. Grid to Grid	72	59	78	volts.
Anode Current (Zero Signal)	100	80	60	mA.
Anode Current (Max. Signal)	119	150	200	mA.
Screen Current (Zero Signal)	2·5	1·5	1·5	mA.
Screen Current (Max. Signal)	16·5	17·5	21	mA.
Optimum Load Resistance Anode to Anode	9	10	6·4	kΩ
Power Output	32·5	47·5	80	watts.
Total Harmonic Distortion	2·7	2·2	3·5	%

CAPACITANCES.

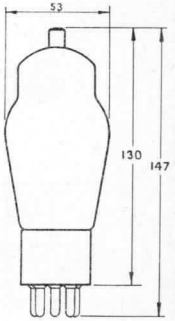
C_{in}	11 pF.
*C_{out}	7 pF.
C_{a-g1}	<0·2 pF.

*Measured with external shield.

†Anode and Screen supply voltages must not vary by more than 5% and grid bias voltage by not more than 3% between no signal and peak signal conditions to obtain the maximum output at low distortion.



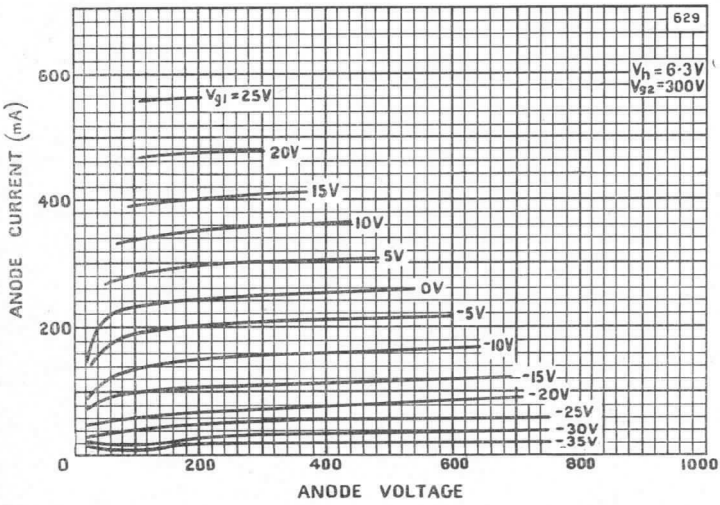
Base Connections Underside View of Base

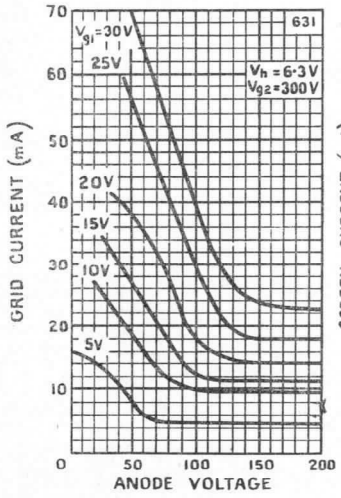


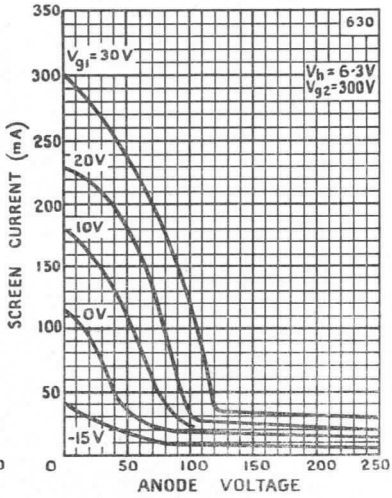
All dimensions shown are in millimetres (max.).

Issue 1
Aug., 1957

FERRANTI


629
V_h = 6·3V
V_{g2} = 300V
V_{g1} = 25V
20V
15V
10V
5V
0V
-5V
-10V
-15V
-20V
-25V
-30V
-35V
ANODE CURRENT (mA)
600
400
200
0
200
400
600
800
1000
ANODE VOLTAGE


631
V_{g1} = 30V
25V
V_h = 6·3V
V_{g2} = 300V
20V
15V
10V
5V
GRID CURRENT (mA)
70
60
50
40
30
20
10
0
50
100
150
200
ANODE VOLTAGE

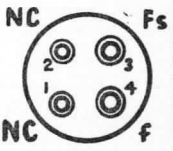

630
V_{g1} = 30V
V_h = 6·3V
V_{g2} = 300V
20V
10V
0V
-15V
SCREEN CURRENT (mA)
350
300
250
200
150
100
50
0
50
100
150
200
250
ANODE VOLTAGE

FERRANTI

MERCURY VAPOUR RECTIFIER

A Mercury Vapour Rectifier with an oxide coated filament.

866A



Base Connections Underside View of Base

PHYSICAL DETAILS.

Base	UX—4-pin (Bayonet).
Max. Overall Length	170 mm. (6 1/16 in.).
Max. Seated Height	155 mm. (6 1/8 in.)
Max. Bulb Diameter	66 mm. (2 3/32 in.).
Anode Cap	Type CT3.
Mounting Position	Vertical—Base down.

CATHODE.

Fil. Voltage	2·5 volts.
Fil. Current	5·0 amps.

RATINGS. (Maximum ratings are "absolute" values.)

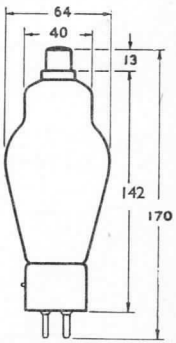
Natural Ventilation Forced Ventilation	20°C—40°C 20°C—60°C	25°C—55°C 25°C—65°C
Max. P.I.V. ... ... (See Note 2 below)	5kV—10kV	up to 5kV

Max. Peak Anode Current ...	1·0	Amp.
Max. Av. Anode Current ...	0·25	Amp.
Ambient Temperature Range :		
Natural Ventilation ...	20°—55°C.	
Forced Ventilation	20°—65°C.	
Min. Cathode Heating Delay ... (See Note 1 below.)	30	secs.

The above ratings apply to operation in circuits using a choke input filter and a supply frequency of 50 c/s.

TYPICAL OPERATION.

*CIRCUIT.	D.C. Output Kilovolts.	Amps.
No. 1. Bi-Phase Half Wave (2 valves) ...	3·2	0·5
No. 2. 3-Phase Half Wave (3 valves) ...	4·5	0·75
No. 3. Single Phase Full Wave (4 valves) ...	6·5	0·5
No. 4. 3-Phase Full Wave (6 valves) ...	9·5	0·75
No. 5. 3-Phase Half Wave Double Y (6 valves)	4·5	1·5



All dimensions shown are in millimetres (max.)

INSTALLATION NOTES.

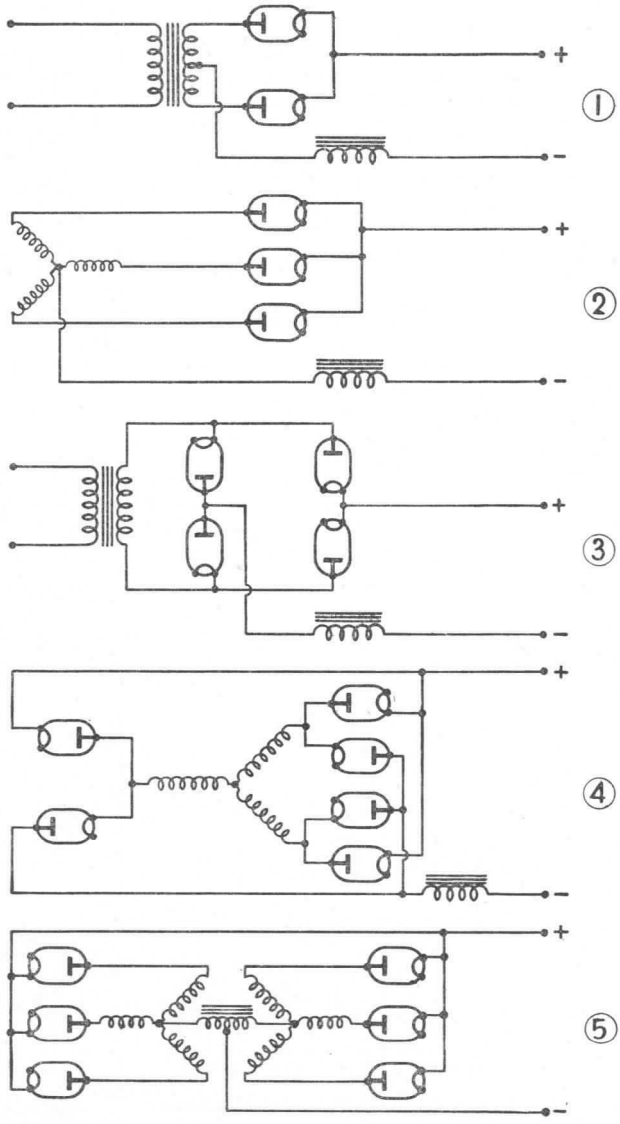
1. When first installed or after a long period of rest the valve should be run for at least 5 minutes before the application of any anode voltage.
2. The rated value of P.I.V. is applicable only over the temperature ranges noted above. Care should be taken in selecting a suitable position in the layout to ensure free circulation of air around the bulb.
3. Valves should be shielded from radio frequency fields.
4. Surges due to H.T. switching or other causes should be avoided.
5. This rectifier is directly heated and it is therefore recommended that the output circuit should be returned to the mid point of the filament transformer secondary.
6. If valves are used in parallel to increase current output balancing inductances must be placed in the anode leads.

*For Circuit Diagrams see overleaf.

Issue 1.
Mar., 1957

FERRANTI

Circuits referred to under "TYPICAL OPERATION" overleaf.



MICROWAVE DEVICES.

Ferranti

T. R. CELL

A broad band passive protection cell normally used in conjunction with pulsed attenuators or in radar systems where protection against random signals is not available.

The cell should be mounted in the receiver arm, between rectangular flanges for W.G.16.

PHYSICAL DATA.

Dimensions	See outline drawing overleaf.
Waveguide	W.G.16 (0·4″ × 0·9″).
Primer Terminal ...	CT.1.
Mounting Position ...	Any.

FREQUENCY RANGE ... 8950 to 9600 Mc/s.

RATINGS.

Max. Line Power level	10 kW.
*Max. Primer Supply Voltage ...	−1500 volts.
Min. Primer Supply Voltage ...	−950 volts.
*Max. Primer Current	150 μA.
*Min. Primer Current	100 μA.
Ambient Temperature Range (non-operating) ...	−40 to + 100 °C.

CHARACTERISTICS.

	Average.	Limit.	
Low Power Level.			
Insertion Loss :— 8950 to 9600 Mc/s. ...	0·6	1·0	dB.
V.S.W.R.	1·15	1·25	dB.
High Power Level.			
Breakdown Power	120	200	mW.
Leakage at 40kW. peak :—			
Total Leakage Power ...	12	20	mW.
Spike Leakage Energy ...	0·12	0·2	ergs/pulse.
†Recovery Time (to 6dB. loss) ...	—	50	μSec.
Primer Characteristics.			
Primer Operating Voltage ...	200	180 to 280	volts.

*A suitable resistor should be connected in series with the electrode to limit the current to between 100 and 150 micro-amperes. At least 1 megohm should be connected directly to the primer electrode terminal.

†Measured at 10 kW.

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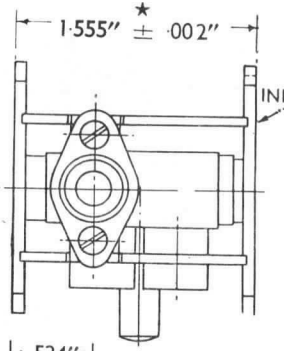
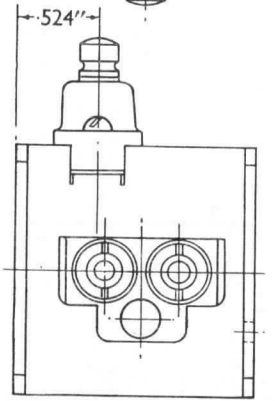
Issue 2.
Sept., 1960

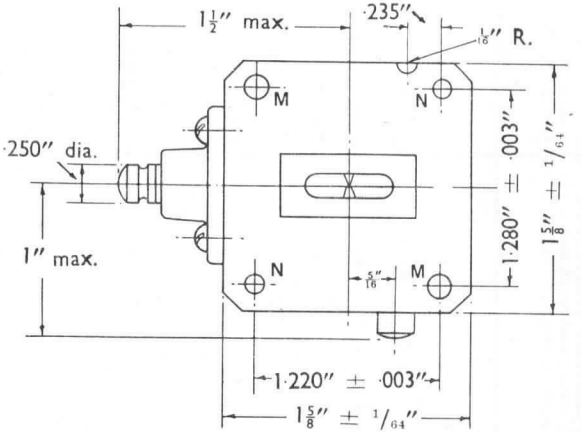
Ferranti

NF40



★ Flanges are flat and parallel within these limits





M—2 holes in each flange:— ·170″ dia. ±·002″ coaxial to each other
N—2 holes in each flange:— ·150″ dia. ±·002″ coaxial to each other
The holes are positioned as shown and are on a 1·768″ ±·004″ P.C.D.

1011

FERRANTI LTD., KINGS CROSS ROAD, DUNDEE.

Ferranti

T. R. CELL

A very broad band power limiting cell for use in Radar systems as a unit to provide protection for crystals against random signals.

PHYSICAL DATA.

Dimensions	...	See outline drawing overleaf.
Waveguide	...	W.G.16 (0·4″ × 0·9″).
Primer Terminal	...	CT.1.
Mounting Position	...	Any.

FREQUENCY RANGE ... 7000 to 11500 Mc/s.

RATINGS.

Max. Line Power level	...	100 watts.
*Max. Primer Supply Voltage	...	−1500 volts.
Min. Primer Supply Voltage	...	−950 volts.
*Max. Primer Current	...	150 μA.
*Min. Primer Current	...	100 μA.
Ambient Temperature Range (non-operating)	...	−40 to + 100 °C.

CHARACTERISTICS.

		Average.	Limit.	
Low Power Level.				
Insertion Loss :—				
7400– 7900 Mc/s.	...	0·6	1·2	dB.
8000– 9900 Mc/s.	...	0·4	0·9	dB.
10000–10600 Mc/s.	...	0·3	0·8	dB.
7000–11500 Mc/s.	...	—	4	dB.
High Power Level.				
Breakdown Power	...	150	300	mW.
Leakage at 40kW. peak :—				
Total Leakage Power	...	60	—	mW.
Spike Leakage Energy	...	0·13	—	ergs/pulse.
†Recovery Time (to 6dB. loss)	...	—	50	μSec.
Primer Characteristics.				
Primer Operating Voltage	...	190	170 to 240	volts.

*A suitable resistor should be connected in series with the electrode to limit the current to between 100 and 150 micro-amperes. At least 1 megohm should be connected directly to the primer electrode terminal.

†Measured at 10 watts.

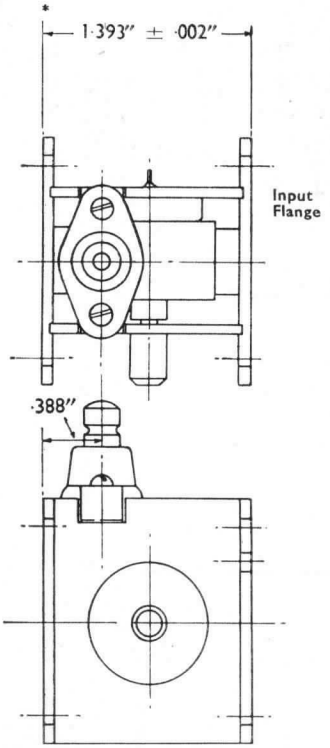
Ferranti

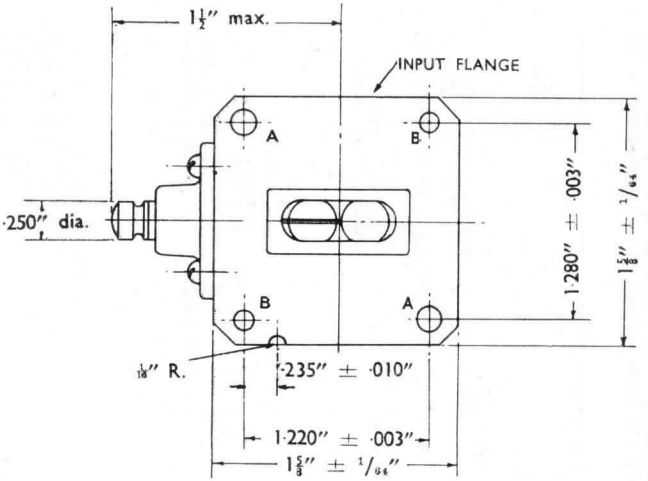
Issue 2.
May, 1960

Ferranti

NF41

*Flanges are flat and parallel within these limits





A —2 holes in each flange: ·170″ dia. ±·002″ coaxial to each other
B—2 holes in each flange: ·150″ dia. ±·002″ coaxial to each other
The holes are positioned as shown and are on a 1·768″ ±·004″ P.C.D.

FERRANTI LTD., KINGS CROSS ROAD, DUNDEE.

Ferranti

T. R. CELL

A separate cavity T.R. Cell designed for use in 'L' Band.
It is equivalent to the American Type 1B23.

PHYSICAL DATA.

Max. overall length	3" (76 mm.).
Max. dia. over diaphragm flange	$1\frac{8}{64}$" (29 mm.).

For other dimensions see drawing overleaf.

FREQUENCY RANGE	400 to 1500 Mc/s. Dependent on the cavity design.*

RATINGS.

Max. Transmitter Power ...	20 kW.
Max. Primer Supply Voltage ...	–1500 volts.
Min. Primer Supply Voltage ...	–800 volts.
Max. Primer Current	200 μA.
Min. Primer Current	100 μA.

CHARACTERISTICS.

Low Power Level

†Insertion Loss	1·6 dB max.
Interaction Loss	0·2 dB max.

Primer Electrode Characteristic

Primer Operating Voltage ...	375 to 525 volts.

OPERATING NOTES.

(1) The performance of this T.R. Cell is to a large extent determined by the cavity into which the tube is fitted. It will work satisfactorily over a large portion of the 'L' Band depending on the cavity design.

(2) The primer electrode should be supplied from a negative potential DC source of at least 800 volts. Suitable resistors should be used to limit the primer electrode current to between 100 and 200 micro-amperes.

*When tested in a cavity as drawing 162-JAN the valves will tune in the range 949 to 951 Mc/s.

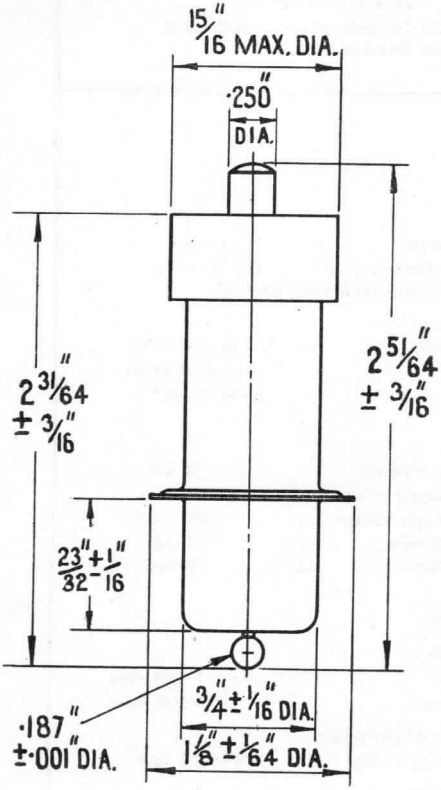
†In test cavity as drawing 162-JAN.

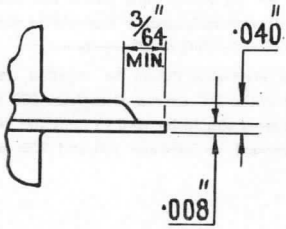
Issue 2.
Nov. 1959

Ferranti

Ferranti

QF10





ENLARGED VIEW OF
DIAPHRAGM FLANGE

Ferranti

T. R. CELL

A separate cavity T.R. Cell designed for use in 'L' Band.

PHYSICAL DATA.

Max. overall length	3" (76 mm.).
Max. dia. over diaphragm flange	$1\frac{9}{64}$" (29 mm.).

For other dimensions see drawing overleaf.

*FREQUENCY RANGE	400 to 1500 Mc/s. Dependent on the cavity design.

RATINGS.

Max. Transmitter Power ...	20 kW.
Max. Primer Supply Voltage ...	−1500 volts.
Min. Primer Supply Voltage ...	−800 volts.
Max. Primer Current	200 μA.
Min. Primer Current	100 μA.

CHARACTERISTICS.

Low Power Level	
†Insertion Loss	1·6 dB max.
Interaction Loss	0·2 dB max.
Primer Electrode Characteristic	
Primer Operating Voltage ...	300 to 425 volts.

OPERATING NOTES.

(1) The performance of this T.R. Cell is to a large extent determined by the cavity into which the tube is fitted. It will work satisfactorily over a large portion of the 'L' Band depending on the cavity design.

(2) The primer electrode should be supplied from a negative potential DC source of at least 800 volts. Suitable resistors should be used to limit the primer electrode current to between 100 and 200 micro-amperes.

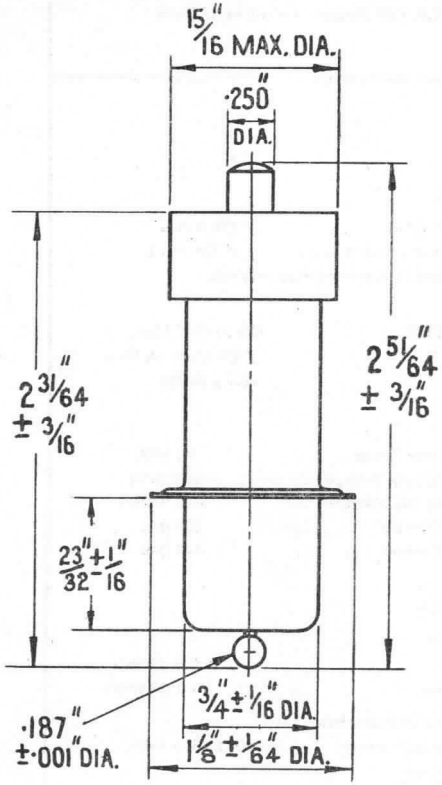
*When tested in a cavity as drawing 162-JAN the valves will tune in the range 949 to 951 Mc/s.

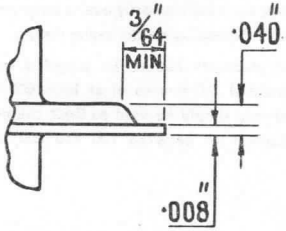
†In test cavity as drawing 162-JAN.

Ferranti

Issue 2.
Nov. 1959

Ferranti





ENLARGED VIEW OF
DIAPHRAGM FLANGE

FERRANTI

T.R. CELL

QF40

Type QF40 is an integral cavity, high 'Q', T-R Cell for operation in the 3 cm. band. It is designed for coupling to $\frac{1}{2}$in. I.D. circular waveguide.

PHYSICAL DIMENSIONS.

Max. overall height	3$\frac{1}{32}$ins. (100 mm.)
Max. overall width	2·065ins. (52·4 mm.)

For other dimensions see drawings in margin and overleaf.
The Keep-alive electrode is connected to a 5 BA terminal at the top of the cell.

RATINGS.

Max. Transmitter Power level	50 kW. Peak.
Tuning Range	9,500 Mc/s. ± 5%
Voltage Standing Wave Ratio	2·0
Max. Insertion loss	1·5 db.
*Max. Leakage at 40 kW. Peak— spike	0·04 ergs/pulse.
flat	15 mW.
†Min. Breakdown Power ...	>100 mW.
‡Effective R.F. short circuit	(a) 0·72in. ±0·03in.
	(b) 0·67in. ±0·03in.
Max. Recovery time (to 6 db. loss)	4 μsecs.
Max. Keep-alive Breakdown voltage	1000 volts.

TYPICAL PERFORMANCE DATA.

Low Level Characteristics.

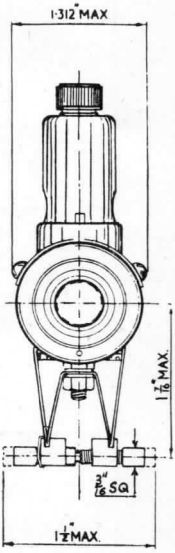
Q_L	400 (approx.)
Voltage Standing Wave Ratio	1·4 approx.
Insertion Loss	1·2 db.

High Power Characteristics.

*Leakage at 40 kW.— spike	0·02 ergs/pulse.
— flat ...	10 mW.
†Breakdown Power	40 mW.
Recovery time (to 6 db. loss)	2·5 μsecs.

Keep Alive Characteristics.

Breakdown Voltage	700 volts.
Potential Drop	350 volts.



All dimensions shewn are in inches.

* 1 μsec. pulses.

† For protection from external transmitters.

‡ The position of the R.F. short has two alternative values depending on whether a window discharge occurs or not, but in either case the crystal protection is not affected.

(a) At peak powers below approximately 15 kW. or with 0·1 μsec. pulse lengths at all power levels, discharge is confined to the cones, and the effective short is at 0·72in. ±0·03in.

(b) At peak powers above approximately 15 kW. with pulse lengths greater than 0·1 μsec., a window discharge occurs as well and the effective short is at 0·67in. ±0·03in.

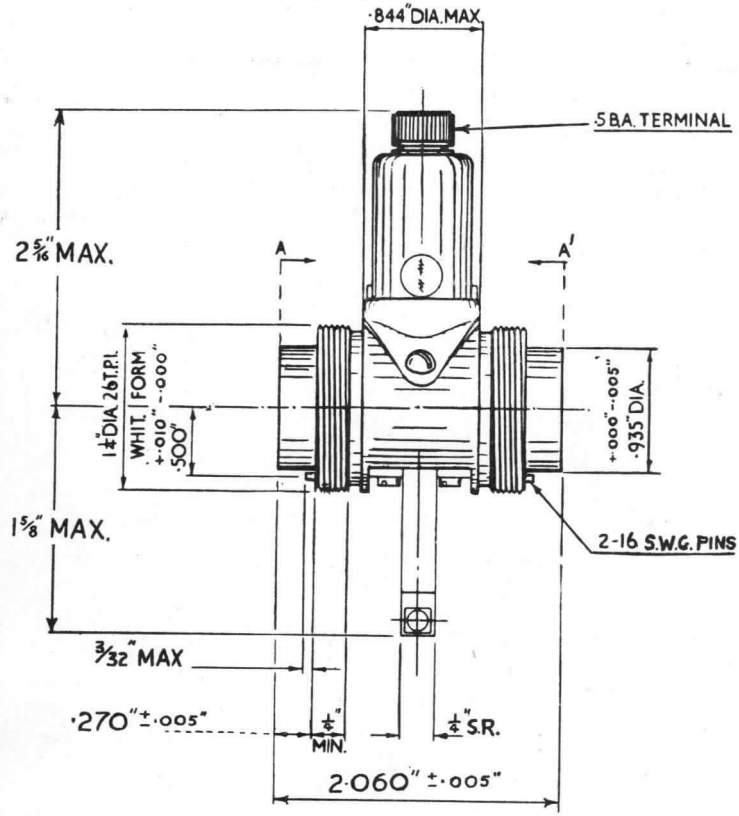
These distances are measured from the input edge of the cell, i.e., from either of the positions indicated by the broken lines A or A¹ on the drawing.

Formerly known as Type TTR31.

Issue 3.
Jan., 1955.

FERRANTI LIMITED, Crewe Toll, Ferry Road, EDINBURGH, 5.

QF40



OPERATING NOTES.

This T.R. Cell in a simple duplexer, gives complete protection to all types of crystals both from the local and neighbouring transmitters, with an appreciable margin of safety and long life.

To ensure rapid breakdown a negative voltage of 1000V. D.C. should be applied to the keep-alive electrode. The keep-alive current should be restricted to between 100 μA and 150 μA by means of a suitable limiting resistance. Some of this resistance may be located in the power supply but at least 1 megohm should be connected directly on to the keep-alive terminal to prevent relaxation oscillations at the keep-alive. It is advisable to arrange that the keep-alive current is passing for a few seconds before the transmitter begins to operate.

The cell is provided with a tuner free from backlash which gives a sensitive adjustment of frequency over the specified tuning ranges.

To give protection from neighbouring transmitters when the set is not operating and the keep-alive unenergised a suitable gate or crystal shutter must be fitted.

FERRANTI

T.R. CELL

QF41

Type QF41 is a tuneable T-R Cell for operation in the 3 cm. band. It is designed for coupling to rectangular waveguide 0·9in. x 0·4in. internal dimensions (Waveguide No. 16 in RCL351) and is fitted with an engraved tuner. It is similar to Type QF40 but its effective bandwidth when tuned has been increased to about 25 M/cs. for a V.S.W.R. of 2·0, or 15 M/cs. if the limit of V.S.W.R. is 1·5.

PHYSICAL DIMENSIONS.

Max. overall height	3 1/8 ins. (94 mm.)
Max. overall width	1·0in. (25·4 mm.)

For other dimensions see drawings in margin and overleaf.
The Keep-alive electrode is connected to a 5 BA terminal at the top of the cell.

RATINGS.

Max. Transmitter Power level	50 kW. peak.
*Tuning Range	9,500 Mc/s. ± 5%
Preset Tuning Range ...	Centre Frequency ± 100 Mc/s.
V.S.W.R.	1·4.
Max. Insertion Loss at Resonant Frequency ...	1·2 db.
Max. Insertion Loss at ± 15 Mc/s. off Resonant Frequency	1·5 db.
†Max. Leakage at 40 kW. Peak— spike	0·10 ergs/pulse.
flat	30 mW.
‡Min. Breakdown Power ...	250 mW.
§Effective R.F. short circuit	(a) 0·25 ± 0·03 inches.
	(b) 0·20 ± 0·03 inches.
Max. Recovery Time (to 6 db. loss) at 40 kW.	4 μsecs.
Max. Keep-alive Breakdown voltage	1000 volts.

TYPICAL PERFORMANCE DATA.

Low Level Characteristics.

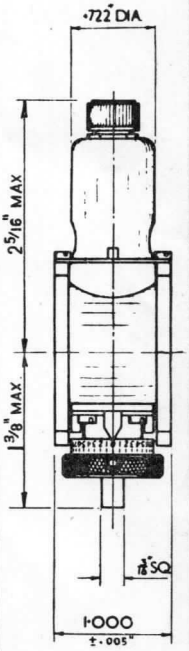
Q_L	130 approx.
V.S.W.R. at Resonance ...	1·1 approx.
Insertion Loss at Resonance ...	0·8 db.

High Power Characteristics.

Leakage at 40 kW.— spike	0·06 ergs/pulse.
—flat ...	20 mW.
Breakdown Power	100 mW.
Recovery Time (to 6 db. loss)	1·5 μsec.

Keep-Alive Characteristics.

Breakdown Voltage	700 volts.
Potential Drop at 150 μA. ...	350 volts.



All dimensions shewn are in inches.

* The engraved tuner provides a covergae of ± 100 Mc/s. about the centre frequency. Each division of the tuner scale corresponds to an alteration in frequency of approx. 10 Mc/s. The cell is normally supplied with the tuner centred on 9375 Mc/s. but on request it may be set at other points within the range 9075 Mc/s. to 9925 Mc/s.

† 1 μsec. pulses.

‡ For protection against external transmitters.

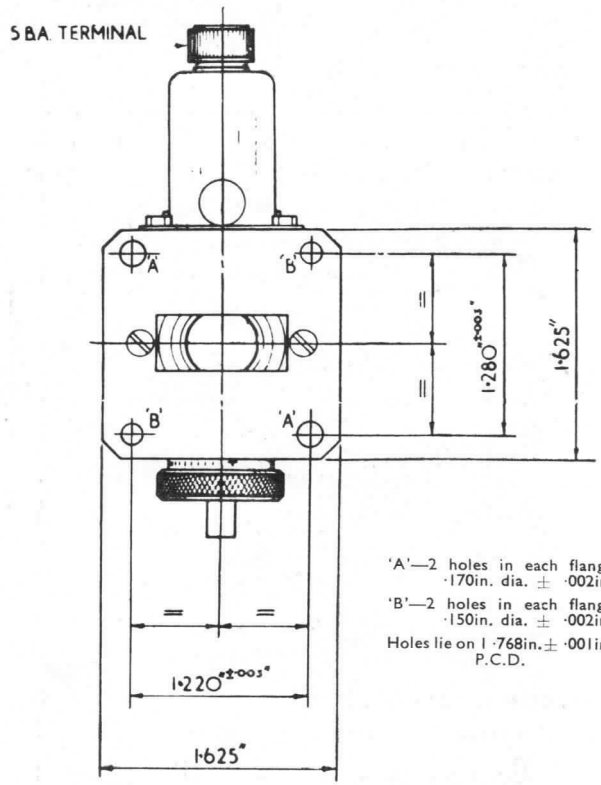
§ See note overleaf.

Formerly known as Type TTR31MR.

Issue 4.
Jan., 1955

QF41

FERRANTI



'A'—2 holes in each flange ·170in. dia. ± ·002in.

'B'—2 holes in each flange ·150in. dia. ± ·002in.

Holes lie on 1·768in. ± ·001in. P.C.D.

OPERATING NOTES.

This T.R. Cell in a simple duplexer, gives complete protection to all types of crystals both from the local and neighbouring transmitters, with an appreciable margin of safety and long life.

To ensure rapid breakdown a negative voltage of 1000V. D.C. should be applied to the keep-alive electrode. The keep-alive current should be restricted to between 100 μA and 150 μA by means of a suitable limiting resistance. Some of this resistance may be located in the power supply but at least 1 megohm should be connected directly on to the keep-alive terminal to prevent relaxation oscillations at the keep-alive. It is advisable to arrange that the keep-alive current is passing for a few seconds before the transmitter begins to operate.

To give protection from neighbouring transmitters when the set is not operating and the keep-alive unenergised a suitable gate or crystal shutter must be fitted.

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* The position of the R.F. short has two alternative values, depending on whether a window discharge occurs or not, but in either case the crystal protection is not affected.

(a) At peak powers below approximately 15 kW. or with 0·1 μsec. pulse lengths at all power levels, discharge is confined to the cones, and the effective short is at 0·25in. ± 0·03in.

(b) At peak powers above approximately 15 kW. with pulse lengths greater than 0·1 μsec., a window discharge occurs as well and the effective short is at 0·20in. ± 0·03in.

These distances are measured from the face of the input flange of the cell.

Ferranti

T.R. CELL

QF41A to QF41K

The QF41 series are tuneable integral cavity T-R cells for operation in the 'X' (3 cm.) band. These cells are designed for use in branched duplexers in WG16 (Rectangular 0·9"×0·4" internal dimensions).

PHYSICAL DIMENSIONS.

Max. overall height	3⅝ins. (95·3 mm.)
Max. width between flanges	1·0in. (25·4 mm.)
Top Cap (Primer electrode)	CT6 (5BA thread).
Mounting Position	Any.
Waveguide	WG16.

For other dimensions see drawings overleaf.

FREQUENCY RANGE.

The preset tuner provides tuning over a range of approx. ±75 Mc/s.

The operating centre frequency and actual range is indicated by the suffix letter:—

QF41A	9005 to 9155 Mc/s.
QF41B	9100 to 9250 Mc/s.
QF41C	9200 to 9350 Mc/s.
QF41D	9300 to 9450 Mc/s.
QF41E	9400 to 9550 Mc/s.
QF41F	9500 to 9650 Mc/s.
QF41G	9600 to 9750 Mc/s.
QF41H	9700 to 9850 Mc/s.
QF41J	9800 to 9950 Mc/s.
QF41K	9900 to 10050 Mc/s.

RATINGS.

Max. Transmitter Power level	... 50 kW. Peak.
*Max. Primer Supply Voltage	... –1500 volts.
*Min. Primer Supply Voltage	... –700 volts.
*Max. Primer Current ...	... 200 μA.
*Min. Primer Current ...	... 100 μA.

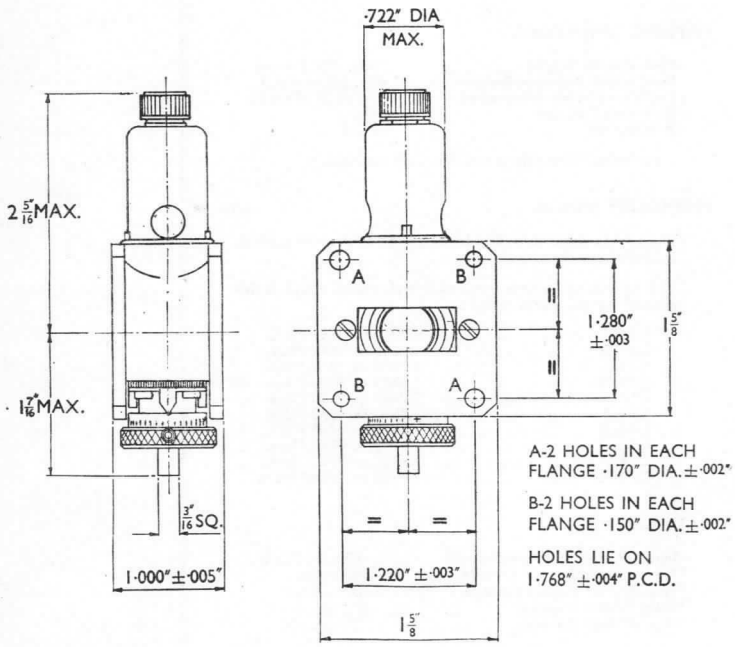
CHARACTERISTICS.

	Average.	Limit.
Low Power Level		
Q_L	130	125 to 160
V.S.W.R. (at Resonance) ...	1·1	1·4
†Insertion Loss	0·8	1·2 dB.
High Power Level.		
‡Leakage at 40 kW.:—		
Flat Leakage Power ...	20	30 mW.
Spike Leakage Energy ...	0·06	0·1 ergs/pulse
Breakdown Power	100	250 mW.
Recovery Time (to –6dB.)...	1·5	4 μSec.
§Position of V.S.W. minimum:—		
Gap discharge	0·24"±0·02".	
Window discharge ...	0·22"±0·02".	
Primer Operating Voltage ...	350	250 to 450 volts.

*See note (4) under 'Operating Notes' overleaf.
†Primer energised.
‡1μsec. pulses.
§Measured from the input flange.
See note (5) under 'Operating Notes' overleaf.

Issue 5.
Nov., 1959.

QF41A to QF41K



OPERATING NOTES.

(1) This T.R. Cell in a simple duplexer, gives complete protection to all types of crystals both from the local and neighbouring transmitters, with an appreciable margin of safety and long life.

(2) A balanced mixer is an advantage.

(3) To give protection from neighbouring transmitters when the set is not operating and the primer unenergised a suitable gate or crystal shutter must be fitted.

(4) To ensure rapid breakdown a negative voltage of 1000V. D.C. should be applied to the primer electrode. The primer current should be restricted to between 100 μA and 200 μA by means of a suitable limiting resistance. Some of this resistance may be located in the power supply but at least 1 megohm should be connected directly on to the primer terminal to prevent relaxation oscillations. It is advisable to arrange that the keep-alive current is passing for a few seconds before the transmitter begins to operate.

(5) The position of the V.S.W. minimum has two alternative values, depending on whether a window discharge occurs or not, but in either case the crystal protection is not affected. Transition of the V.S.W. minimum from the cones to the window takes place under the following conditions:—

At 8·7 kW. approx. with a pulse width of 1 μsec. and a P.R.F. of 1000.
At 10·4 kW. approx. with a pulse width of 1 μsec. and a P.R.F. of 500.
At 17 kW. approx with a pulse width of 0·1 μsec. and a P.R.F. of 1000.

Ferranti

T.R. CELL

QF42A to QF42K

A series of medium 'Q', integral cavity T.R. cells for operation in the 'X'-Band. They are designed for coupling to $\frac{7}{8}$" i.d. circular waveguide and a preset tuner is incorporated.

PHYSICAL DIMENSIONS.

Max. overall height	3·675ins. (93·35 mm.)
Max. width	2·065in. (52·4 mm.)
Top Cap (Primer electrode)	CT6 (5BA thread).
Mounting Position	Any.
Waveguide	Circular $\frac{7}{8}$" i.d.

For other dimensions see drawings overleaf.

FREQUENCY RANGE.

The preset tuner provides tuning over a range of approx. ±75 Mc/s.

The operating centre frequency and range is indicated by the suffix letter:—

QF41A	9005 to 9155 Mc/s.
QF41B	9100 to 9250 Mc/s.
QF41C	9200 to 9350 Mc/s.
QF41D	9300 to 9450 Mc/s.
QF41E	9400 to 9550 Mc/s.
QF41F	9500 to 9650 Mc/s.
QF41G	9600 to 9750 Mc/s.
QF41H	9700 to 9850 Mc/s.
QF41J	9800 to 9950 Mc/s.
QF41K	9900 to 10050 Mc/s.

RATINGS.

Max. Transmitter Power level	... 50 kW. Peak.
*Max. Primer Supply Voltage	... −1500 volts.
*Min. Primer Supply Voltage	... −700 volts.
*Max. Primer Current ...	... 200 μA.
*Min. Primer Current ...	... 100 μA.

CHARACTERISTICS.

	Average.	Limit.
Low Power Level		
Q_L		160 approx.
V.S.W.R. (at Resonance) ...	1·1	1·4
†Insertion Loss	0·8	1·2 dB.
High Power Level.		
‡Leakage at 40 kW.:—		
Flat Leakage Power ...	20	30 mW.
Spike Leakage Energy ...	0·06	0·1 ergs/pulse
Breakdown Power	100	250 mW.
Recovery Time (to −6dB.)...	1·5	4 μSec.
§Position of V.S.W. minimum:—		
Gap discharge	0·69"±0·03".	
Window discharge ...	0·67"±0·03".	
Primer Operating Voltage ...	350	250 to 450 volts.

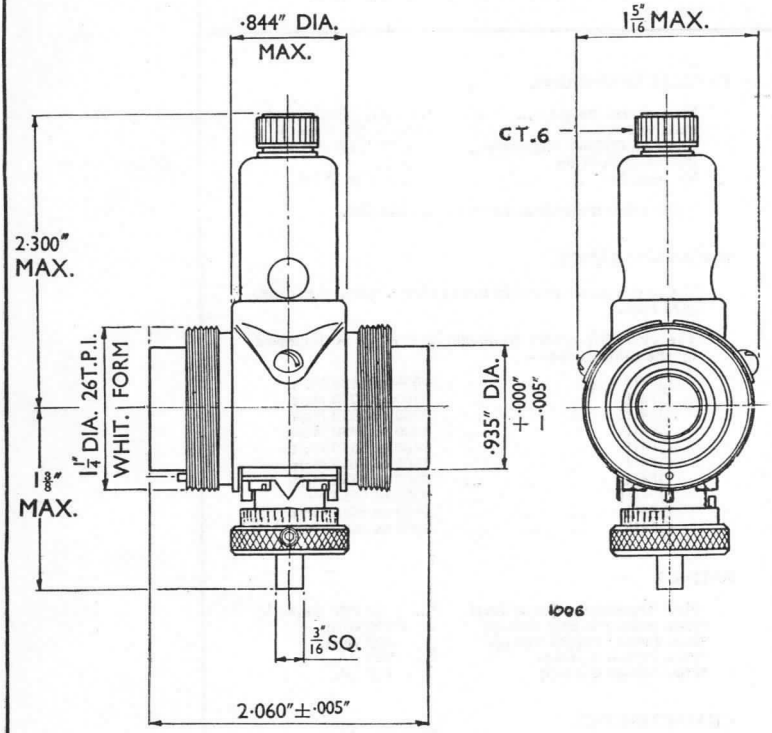
*See note (4) under 'Operating Notes' overleaf.
†Primer energised.
‡1 μsec. pulses.
§Measured from the input edge of the cell.
See note (5) under 'Operating Notes' overleaf.

Issue 5.
Nov., 1959.

Ferranti

Ferranti

QF42A to QF42K



OPERATING NOTES.

(1) This T.R. Cell in a simple duplexer, gives complete protection to all types of crystals both from the local and neighbouring transmitters, with an appreciable margin of safety and long life.

(2) A balanced mixer is an advantage.

(3) To give protection from neighbouring transmitters when the set is not operating and the primer unenergised a suitable gate or crystal shutter must be fitted.

(4) To ensure rapid breakdown a negative voltage of 1000V. D.C. should be applied to the primer electrode. The primer current should be restricted to between 100 μA and 200 μA by means of a suitable limiting resistance. Some of this resistance may be located in the power supply but at least 1 megohm should be connected directly on to the primer terminal to prevent relaxation oscillations. It is advisable to arrange that the keep-alive current is passing for a few seconds before the transmitter begins to operate.

(5) The position of the V.S.W. minimum has two alternative values, depending on whether a window discharge occurs or not, but in either case the crystal protection is not affected. Transition of the V.S.W. minimum from the cones to the window takes place under the following conditions:—

At 8·7 kW. approx. with a pulse width of 1 μsec. and a P.R.F. of 1000.
At 10·4 kW. approx. with a pulse width of 1 μsec. and a P.R.F. of 500.
At 17 kW. approx with a pulse width of 0·1 μsec. and a P.R.F. of 1000.

FERRANTI

T.R. CELL

QF50

Type QF50 is a tuneable T-R Cell for operation in the Q band.

PHYSICAL DIMENSIONS.

Max. Overall Height ...	...	92 mm. (3·625in.).
Max. Width over Tuner	...	31 mm. (1·220in.).
Primer Connection Caps	...	Type C.T.1. (0.25in. dia.).

For other dimensions see drawings overleaf.

CHARACTERISTICS.

Low Level Characteristics.

Loaded 'Q'	150 max.
V.S.W.R.	2 max.
Tuning Range	8·4 to 8·8 mm.
Insertion Loss	2 db. max.

High Power Characteristics.

Nominal Peak Power	20 kW.
Nominal Mean Power	8 watts.
Leakage { Spike	0·045 e/p. max.
Leakage { Flat	25 mW. max.
Recovery Time to 3 db.	2 μsecs. max*
Recovery Time to 1 db.	4 μsecs. max.

Primer Characteristics.

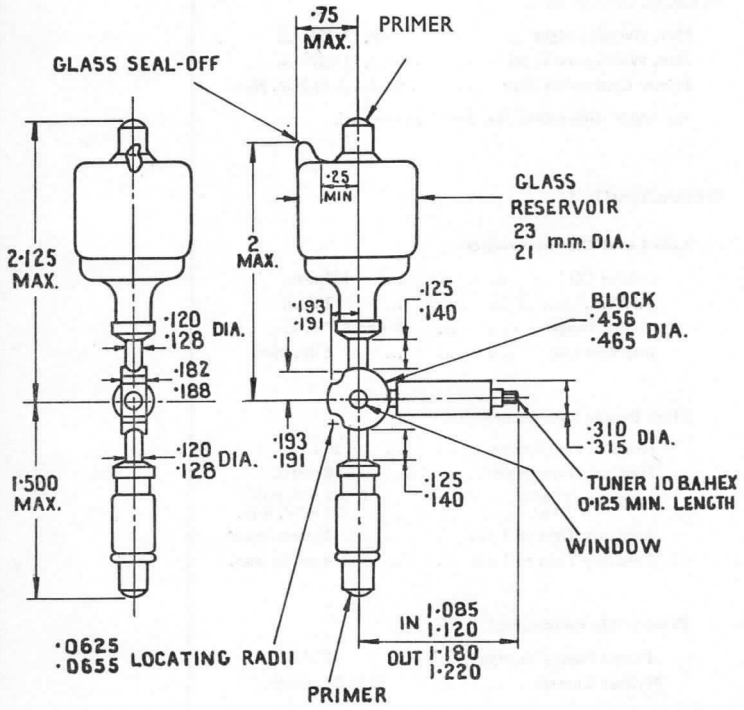
Primer Supply Voltage	−2 kV.
*Primer Current	50 to 75 μamps.

*The primer electrodes should be fed from a source maintained at a negative potential of 2,000 volts DC. The primer current should be restricted to a value between 50 and 75 μA. by employing suitable limiting resistors. Some of this resistance may be located in the power supply but at least 2 megohms must be connected directly on to each primer terminal to prevent relaxation oscillations.

Issue 2
Dec. 1958

FERRANTI

QF50



Note:

Maximum displacement of tuning mechanism is 2° with cell held against either face and held on locating radii.

Ferranti

KLYSTRON

A High Power Amplifier Klystron designed for CW operation in the 3 cm. waveband.

PHYSICAL DETAILS.

Electrode Connections	See Drawing.
Overall Length	296 mm. ($11\frac{43}{64}$in.).
For other dimensions see outline drawing on Page 3.	
Output Waveguide ...	Rect. 1in. × $\frac{1}{2}$in. I.D.
Input Waveguide ...	Rect. 1in. × $\frac{1}{2}$in. I.D.
Water Connections :	
Block	To B.S.S. 659 for $\frac{1}{4}$" bore.
Collector	To B.S.S. 659 for $\frac{1}{8}$" bore.
Mounting Position ...	Vertical with Cathode uppermost.

HEATER.

Heater Voltage	4·5 to 6·0 volts.
Heater Current	10 to 10·5 Amps.
*Minimum Heating Delay Time ...	5 minutes.

RATINGS.

Max. Beam Voltage	14 kV.
Max. Beam Current	850 mA.
†Min. Power Output	1800 watts.

FREQUENCY.

‡Operating Frequency ...	8700 – 10,000 Mc/s.
Tuning Range	45 Mc/s. ± 10 Mc/s.

WATER COOLING for operation at :—

	1 kw.	2 kw.	
Minimum Water flow through Block at 20°C.	1·0	2·0	litres/min.
Pressure drop through Block at above flow	0·6	1·2	lbs./sq.in.
Minimum Water flow through Collector at 20°C. ...	2·5	5·0	litres/min.
Pressure Drop through Collector at above flow	0·1	0·4	lbs./sq.in.

§AIR COOLING of Output Window

Min. Air Flow at 20°C. ...	0·5	1·0 litres/sec.

TYPICAL OPERATION AND CHARACTERISTICS.

Beam Voltage	9·4 to 10·6	12·8 to 13·6	kV.
Beam Current	450 to 550	720 to 790	mA.
Focus Voltage	–200 to –450	–300 to –700	volts.
Focus Current	<0·5	<0·5	mA.
Output Power	1000	2000	watts.
Efficiency	19 to 22	19 to 22	%
R.F. Gain :			
High Level	10·5 to 12·5	12 to 14	dB.
Low Level	12 to 14	17 to 18·5	dB.
Phase Variation of Output with Beam Voltage	1·3	1·5	radians/kV.
Loss Current :			
No. R.F.	⩾10	⩾10	% of beam current.
Optimum R.F. Drive	<150	<200	mA.

*See Notes on Operation (2) overleaf.

†At Beam Voltage = 14 kV.

‡Valves can be supplied tuned to any frequency within this range.

§Drawings of the necessary wave guide cooling section will be supplied on request.

Ferranti

Issue 2.
May, 1960

Ferranti

NOTES ON OPERATION.

1. The heater voltage should be gradually increased until a steady current within the specified range is obtained.

2. The valve has no getter and therefore when first installed or after more than two or three weeks shelf life it is advisable to run the heater for about half an hour before applying H.T. which should then be raised slowly (approx. 4 kV/min.) checking that reasonable focus is obtained. On other occasions when this procedure is unnecessary the warm up time from switching on of heaters to full power is about 5 minutes. During this heating period the heater current should not exceed 13 Amps.

3. The cavity block and collector are insulated from each other, therefore current taken by the block can be measured separately. This current should not exceed 200 mA. and an H.T. trip set to operate at 200mA. is a useful safeguard against H.T. flashover.

4. It is recommended that a pressure type water flow relay should be fitted in the collector drain pipe, in order to break the H.T. supply in the event of cooling water supply failure, otherwise the beam will rapidly puncture the collector if such a failure occurs.

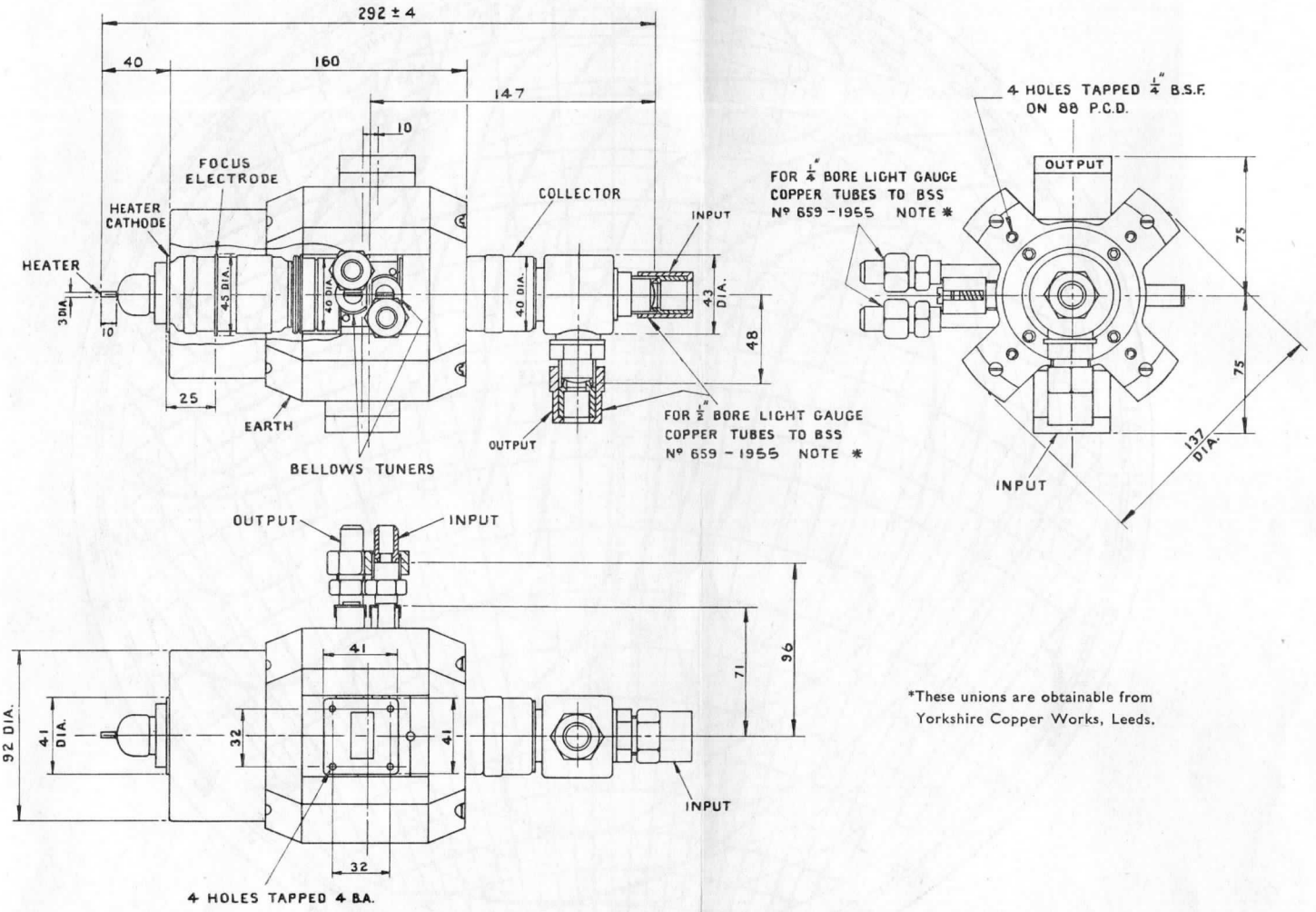
5. Care should be taken not to exceed 2 : 1 V.S.W.R. in the output circuit, otherwise the output window may puncture.

6. The following precautions should be taken to avoid internal damage to the cathode or focus electrode in the event of flashover when the valve is first run :—

   (a) Connect a resistor of not less than 75 ohms in series with the mains H.T. feed to the cathode.

   (b) Limit the focus electrode to cathode potential in the event of breakdown to less than 1000 volts. This can be readily achieved by series connected neon discharge tubes across the focus electrode supply.

   (c) It is also advisable to connect a series resistor (approx. 10kΩ) between the focus electrode and its supply potentiometer and to decouple the latter to cathode with a capacitor of 1μF.



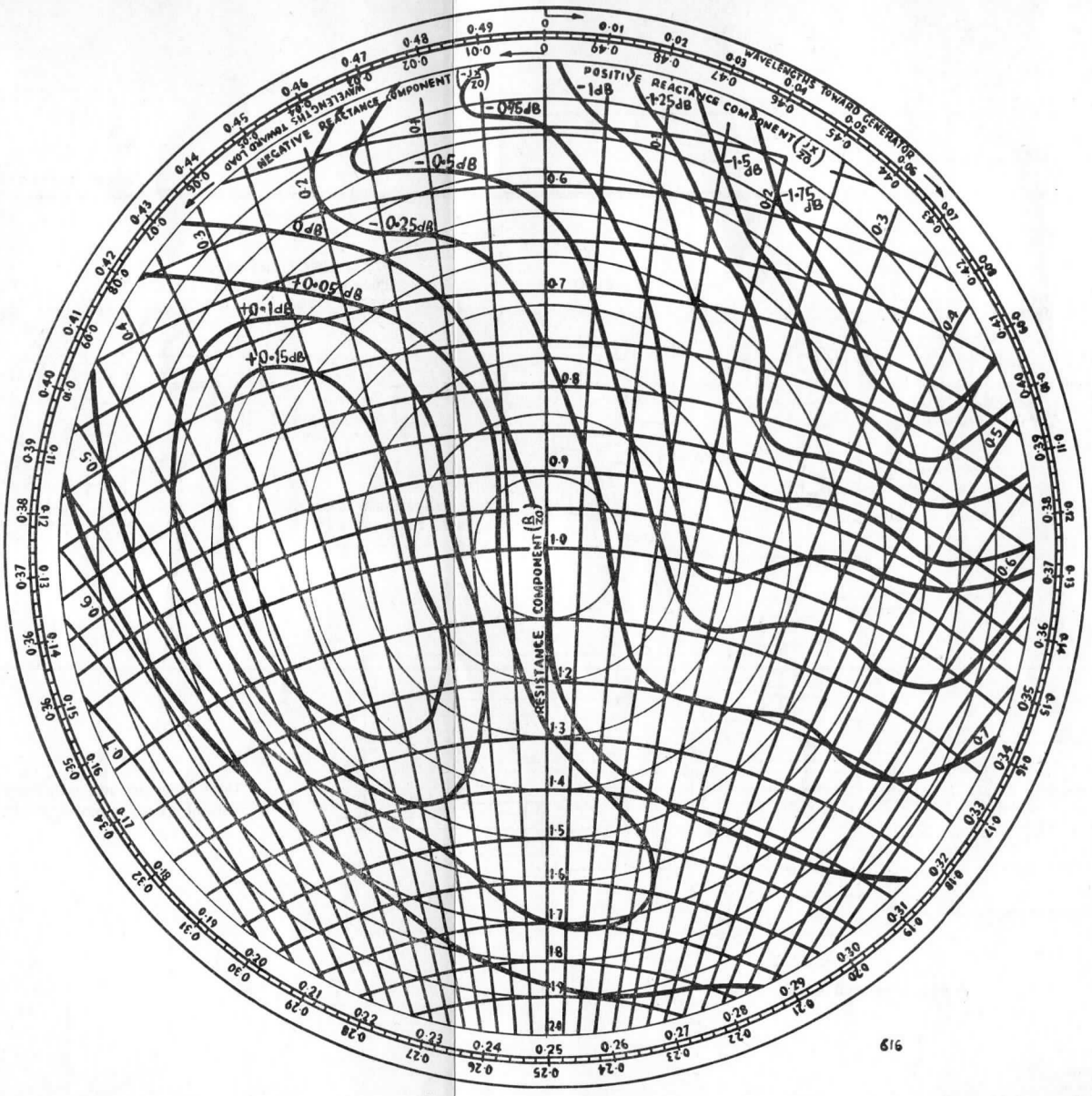
*These unions are obtainable from Yorkshire Copper Works, Leeds.

Dimensions shown are in millimetres

Issue 2,
May, 1960

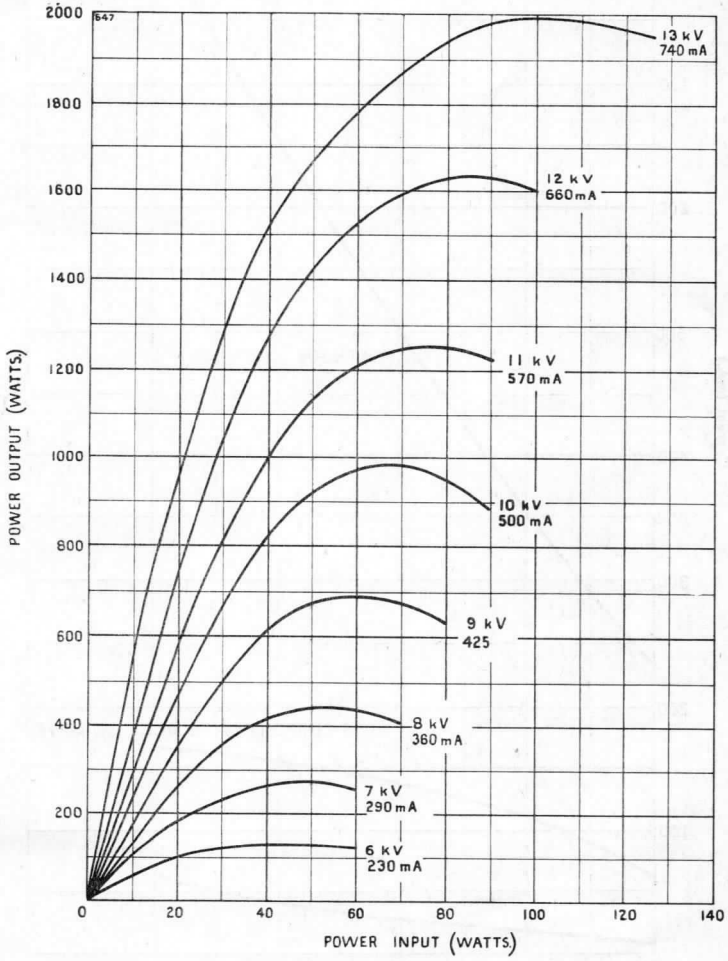
Ferranti

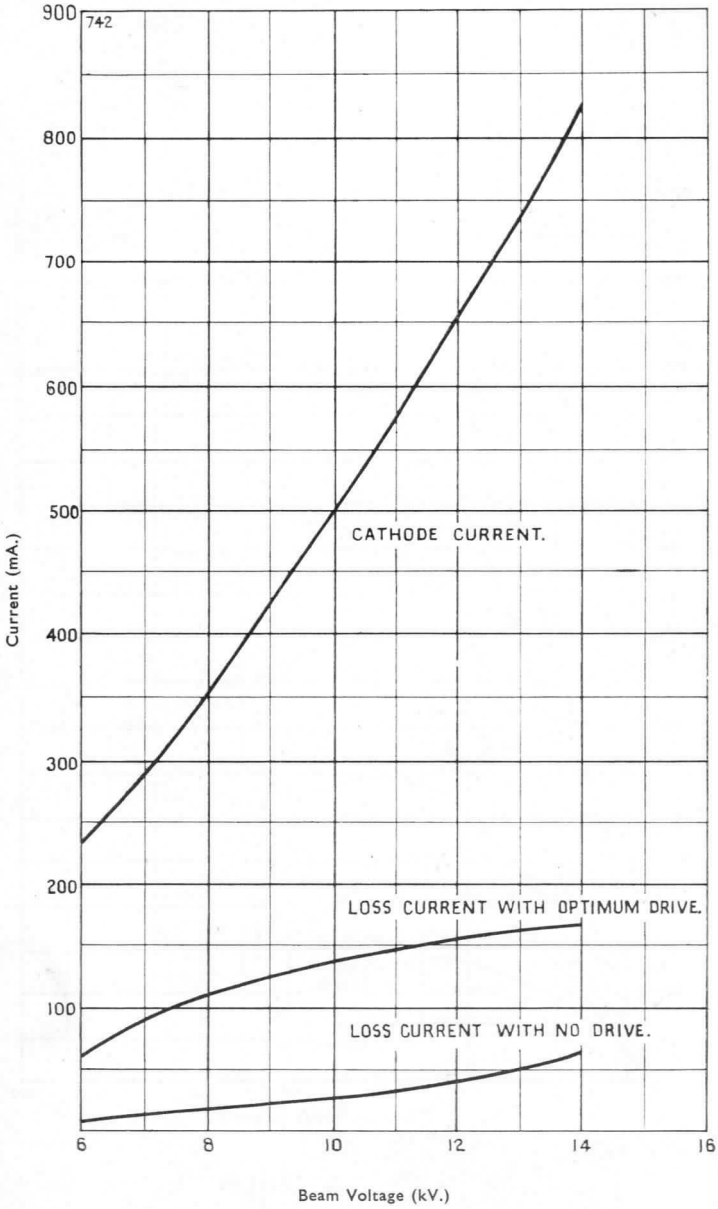
RIEKE DIAGRAM



Beam Voltage = 10kV
Beam Current = 500mA
OdB = 1kW

Ferranti


647
2000
1800
1600
1400
1200
1000
800
600
400
200
0
20
40
60
80
100
120
140
POWER OUTPUT (WATTS)
POWER INPUT (WATTS)
13 kV
740 mA
12 kV
660 mA
11 kV
570 mA
10 kV
500 mA
9 kV
425
8 kV
360 mA
7 kV
290 mA
6 kV
230 mA


742
900
800
700
600
500
400
300
200
100
Current (mA.)
CATHODE CURRENT.
LOSS CURRENT WITH OPTIMUM DRIVE.
LOSS CURRENT WITH NO DRIVE.
6
8
10
12
14
16
Beam Voltage (kV.)

FERRANTI
KLYSTRON

SY30

A water-cooled two resonator low noise rugged Klystron Power Amplifier with a gain of 10dB intended for C.W. operation. It is designed to be driven by an oscillator type SZ21, under which condition the power output will be in the range 150-200W. The valve has rugged tuners capable of ± 20 Mc/s. tuning range which are intended to be used for tuning the cavities up to any one SZ21.

Tentative Data.

PHYSICAL DETAILS.

Overall Length		185 mm. (11¾in.).
For other dimensions see outline drawing.		
Output Waveguide		{ WG16 coupling to
Input Waveguide		{ I.S.S. choke flanges.
Water Connections		⅛in. gas thread.

HEATER.

Heater Voltage	5 to 7·0 volts.
Heater Wattage	19–21 watts.

RATINGS.

Max. Beam Voltage	10·0 kV.
Max. Beam Current	260 mA.
Max. Focus Voltage	50 volts.

FREQUENCY.

*Operating Frequency	9500 Mc/s.
Tuning Range	±20 Mc/s.

WATER COOLING.

†Minimum Water flow at 20°C.	1·0 Litre/min.

TYPICAL OPERATION AND CHARACTERISTICS.

Beam Voltage		8		kV.
Beam Current		150		mA.
Focus Voltage		–25		volts.
Efficiency		17		%
R.F. Gain ...	High Level ...	10		dB.
	Low Level ...	14		dB.
Input Power		15	25	watts.
‡Output Power		175	200	watts.

NOTES ON OPERATION.

1. The heater voltage should be gradually increased until a steady current within the specified range is obtained.
2. It is recommended that a pressure type water flow relay should be fitted in the drain pipe, in order to break the H.T. supply in the event of cooling water supply failure, otherwise the beam will rapidly puncture the colletor if such a failure occurs.
3. Care should be taken not to exceed 2 : 1 V.S.W.R. in the output circuit, otherwise the output window may puncture.
4. The following precautions should be taken to avoid internal damage to the cathode or focus electrode in the event of flashover when the valve is first run : the focus electrode to cathode potentials should be limited in the event of breakdown to less than 500 volts. This can be readily achieved by series connected neon discharge tubes across the focus electrode supply.

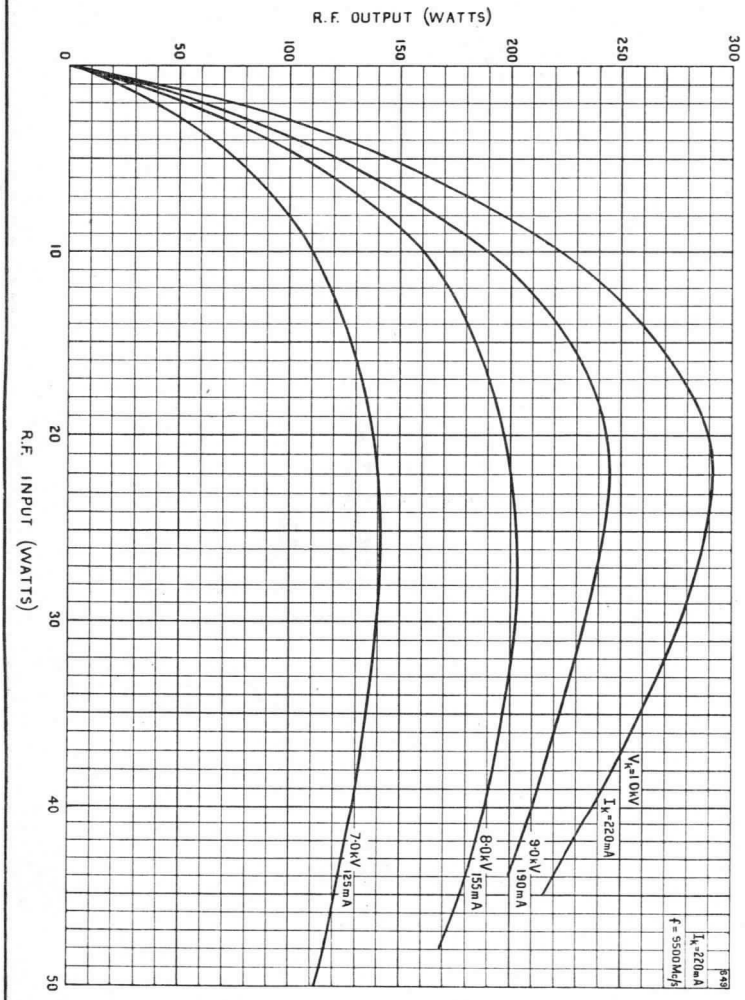
*Valves can be supplied tuned to any "X" band frequency by arrangement.

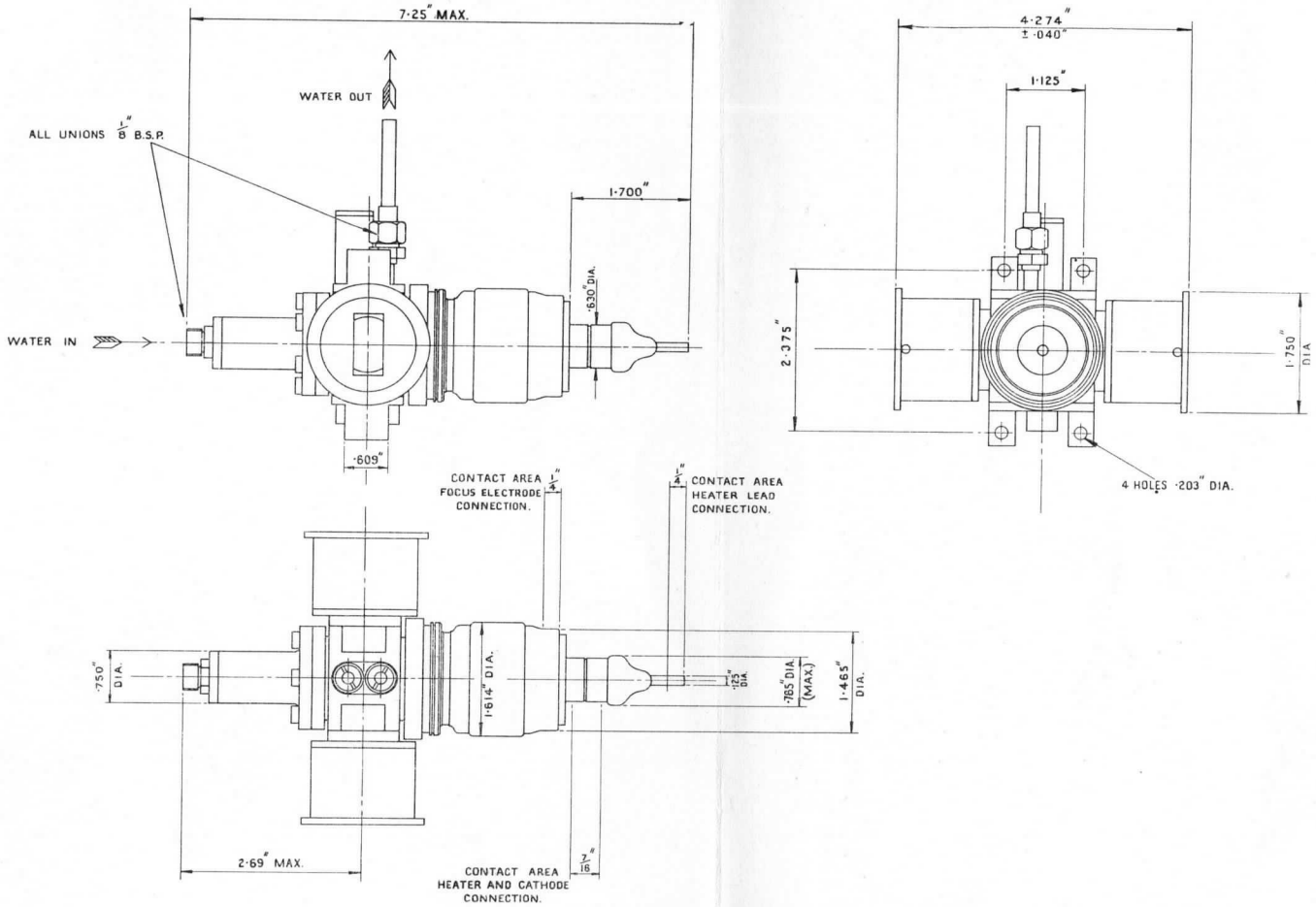
†Water input must be to collector end union.

‡At 9500 Mc/s.—F.
Bandwidth : to 3 dB points—18·5 Mc/s.
to 1 dB points— 10 Mc/s.

Issue 1
Dec., 1957
(Tentative)

FERRANTI


R.F. OUTPUT (WATTS)
0
50
100
150
200
250
300
R.F. INPUT (WATTS)
10
20
30
40
50
7·0kV 125mA
8·0kV 155mA
9·0kV 190mA
V_a=10kV
I_k=220mA
I_k=220mA
f = 9550Mc/s
549

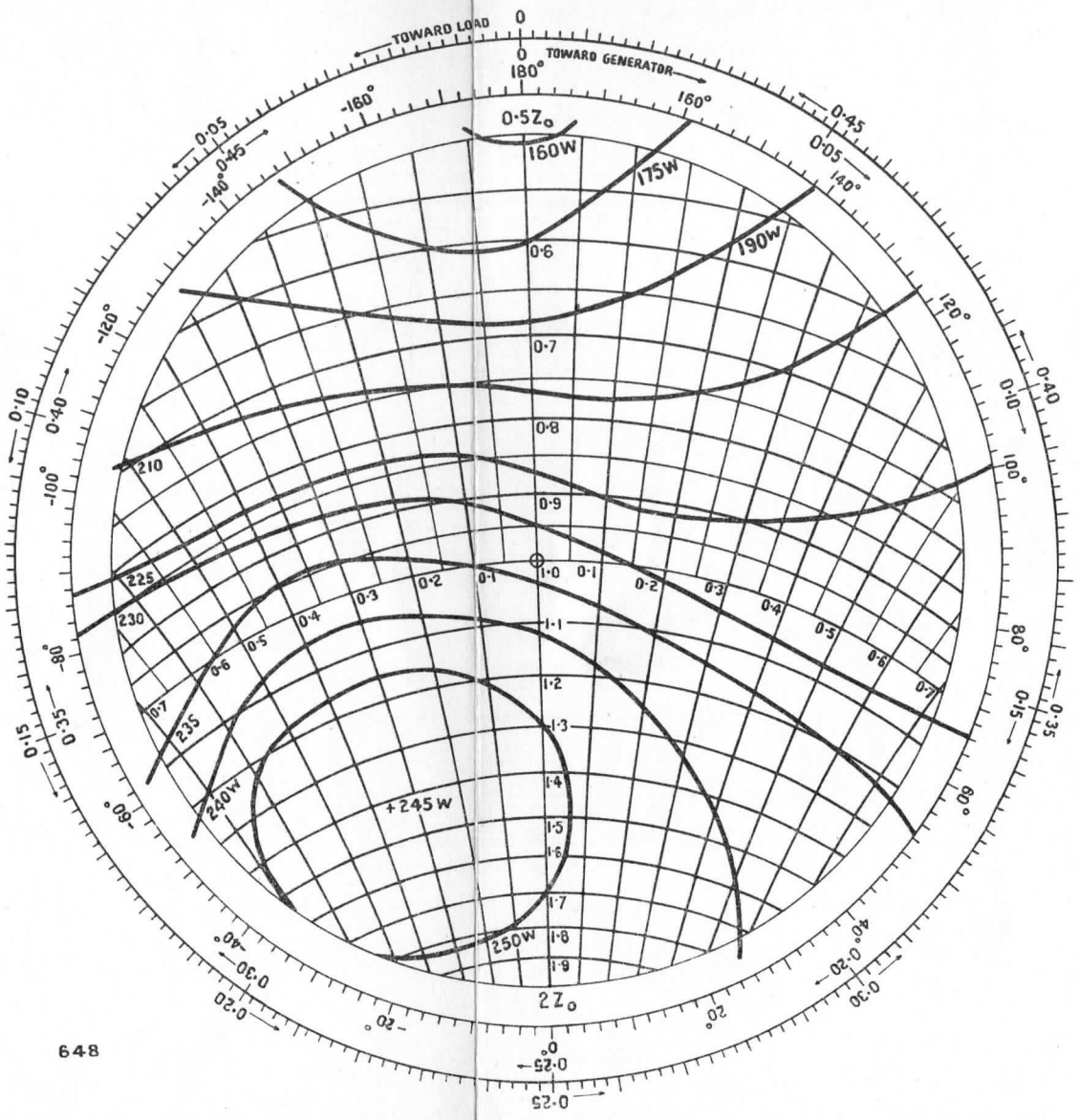


All dimensions shown are in millimetres (max.).

FERRANTI

Issue 1
Dec., 1957
(Tentative)

RIEKE DIAGRAM



648

Beam Voltage = 8 kV.
Beam Current 150 mA.
Drive Power for max. power output in matched conditions.
180° corresponds to the plane of output flange.

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

Ferranti

KLYSTRON

A water-cooled two resonator low noise rugged Klystron Power Amplifier with a gain of 10dB intended for C.W. operation. It is designed to be driven by an oscillator type SZ22, under which condition the power output will be in the range 150-200 W. The valve has rugged tuners with a ±20 Mc/s. tuning range which is intended to be used for tuning the cavities to match any SZ22.

PHYSICAL DETAILS.

Max. Overall Length	7·25″ (184·5 mm.).
Max. Overall Width	4·314″ (109·5 mm.).

For other dimensions see outline drawing on Page 3.

Output Waveguide	WG16 coupling to
Input Waveguide	I.S.S. choke flanges
Water Connections	⅛″ B.S.P. Unions.

HEATER.

Heater Power	20 to 27 Watts.
Heater Resistance at 23·5 watts.	...2·35 to 2·65 Ohms.
Cold Heater Resistance ...	0·2 Ohms.
Max. switch-on surge current ...	9 Amps.

RATINGS.

Max. Beam Voltage	10·0 kV.
Max. Beam Current	260 mA.
Max. Focus Voltage	50 volts.

FREQUENCY.

†Operating Frequency	9500 Mc/s.
Tuning Range	±20 Mc/s.

WATER COOLING.

‡Minimum Water flow at 20°C....	1·0 Litre/min.

TYPICAL OPERATION AND CHARACTERISTICS.

Beam Voltage		8	kV.
Beam Current		150	mA.
Focus Voltage		−25	volts.
Efficiency		17	%
R.F. Gain ...	High Level ...	10	dB.
	Low level ...	14	dB.
Input Power	15	25	watts.
§Output Power	175	200	watts.

NOTES ON OPERATION.

1. It is recommended that a pressure type water flow relay should be fitted in the drain pipe, in order to break the H.T. supply in the event of cooling water supply failure, otherwise the beam will rapidly puncture the collector if such a failure occurs.
2. Care should be taken not to exceed 2:1 V.S.W.R. in the output circuit, otherwise the output window may puncture.
3. To avoid internal damage to the cathode or focus electrode in the event of flashover when the valve is first run, the focus electrode to cathode potential should be limited in the event of breakdown to less than 500 volts. This can be readily achieved by series connected neon discharge tubes across the focus electrode supply.

*Over the operating heater power range the heater resistance R series with the heater power W according to the law $R \propto \sqrt{W}$.

†Valves can be supplied tuned to any "X" band frequency by arrangement.

‡Water input must be to collector end union.

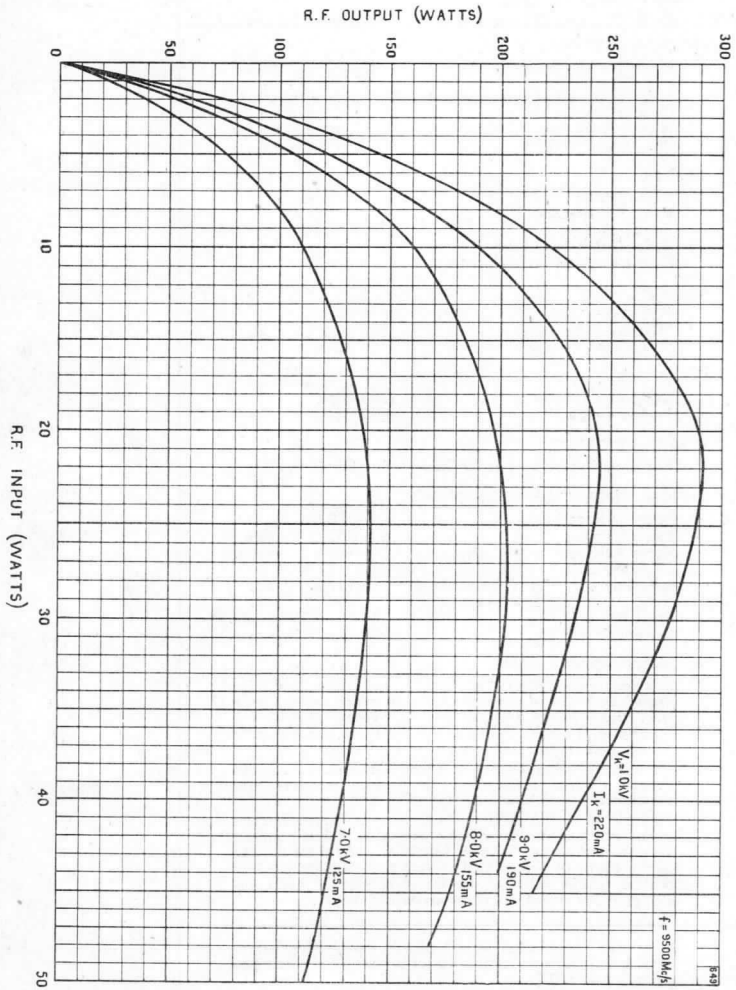
§At 9500 Mc/s.
Bandwidth: to 3 dB points—18·5 Mc/s.
to 1 dB points—10 Mc/s.

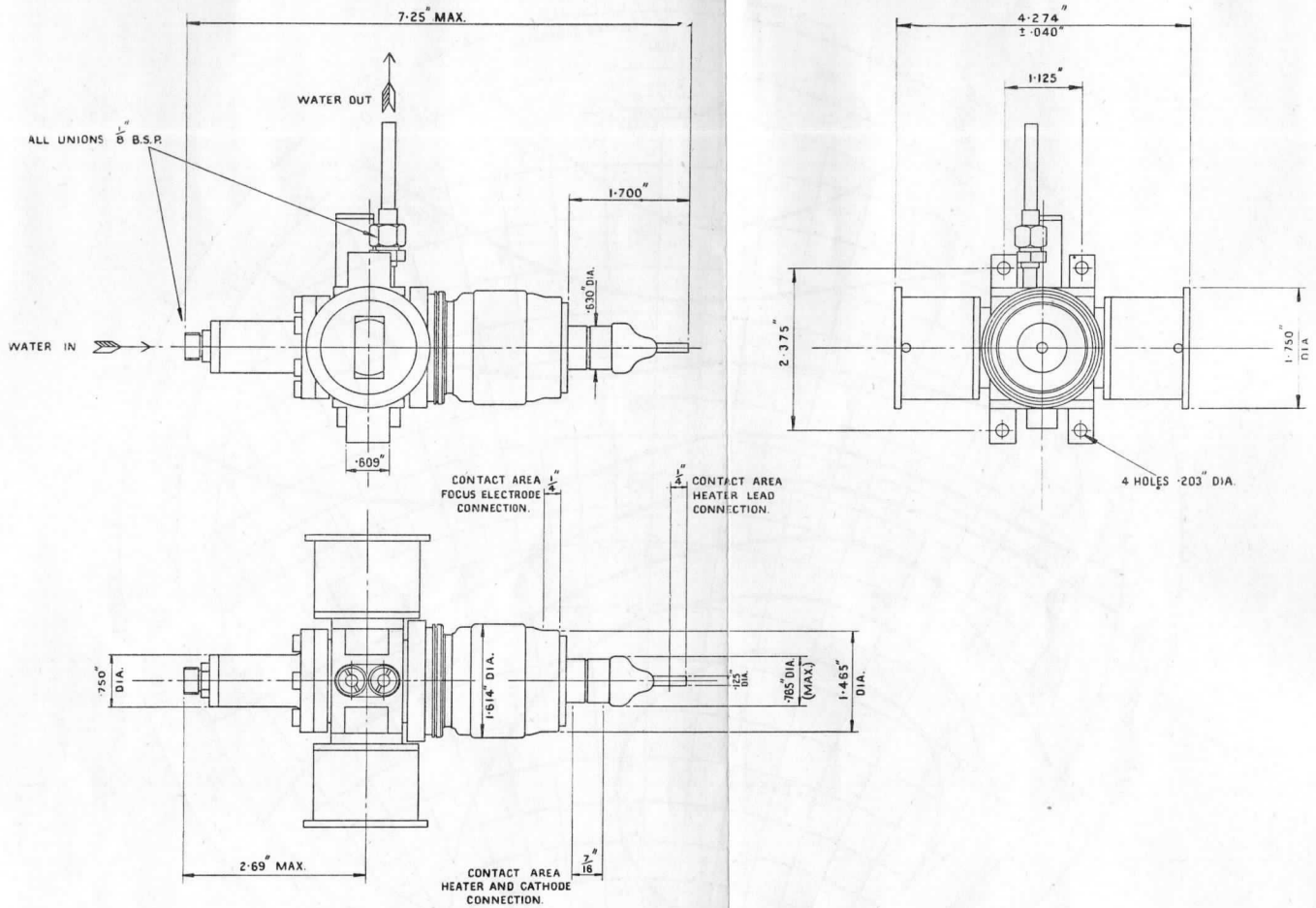
Issue 1.
Mar., 1962

Ferranti

Ferranti

TYPICAL RF INPUT/OUTPUT CHARACTERISTICS.



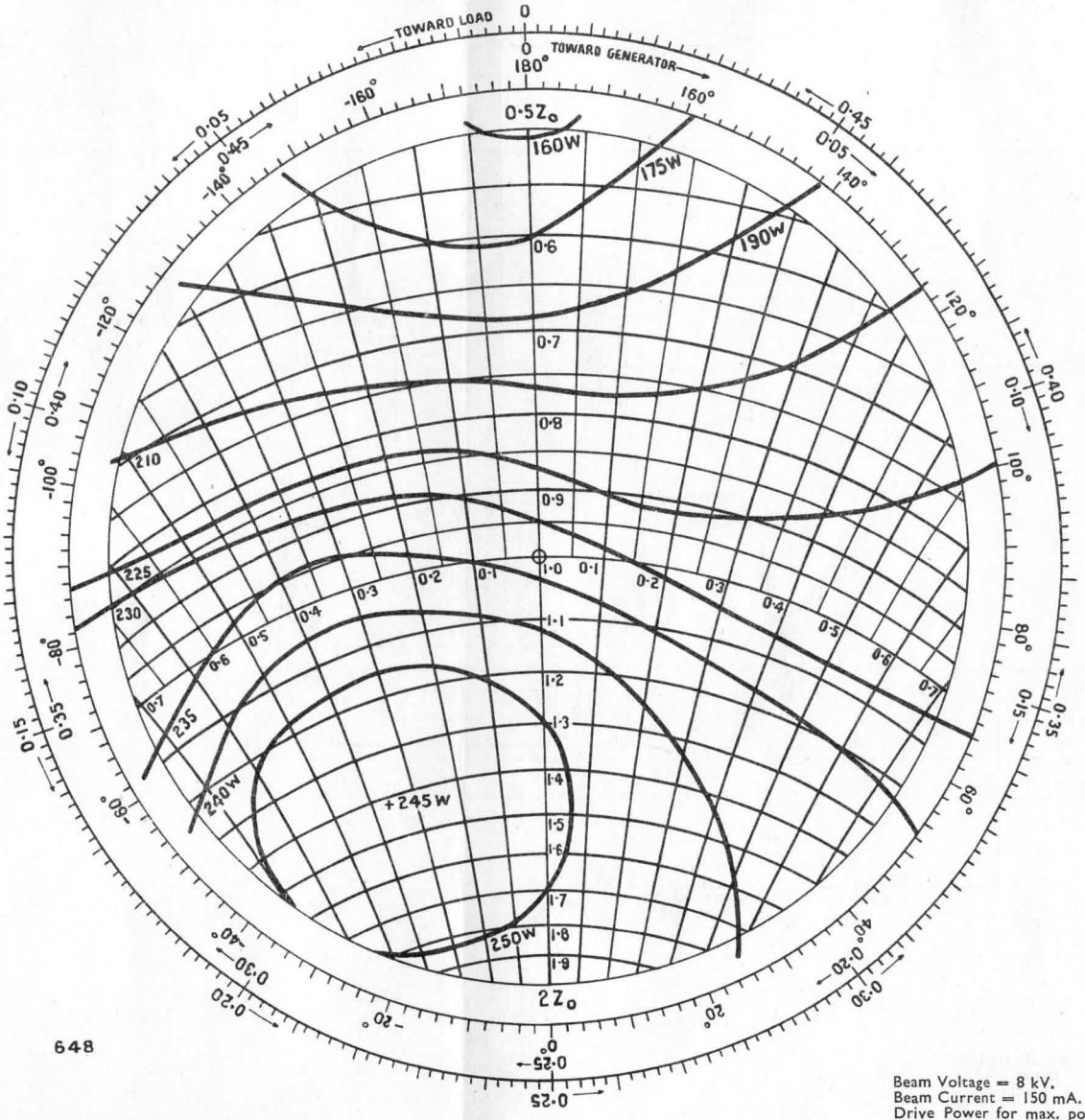


All dimensions shown are in inches

Ferranti

Issue 1.
Mar. 1962.

RIEKE DIAGRAM



648

Beam Voltage = 8 kV.
Beam Current = 150 mA.
Drive Power for max. power output in matched conditions.
180° corresponds to the plane of the output flange.

Ferranti

KLYSTRON

A High Power 4 Cavity Broad Band Amplifier Klystron for CW operation at 'X' Band frequency.

PHYSICAL DETAILS.

Base	None.
Overall Length (valve) ...	14" (356 mm.)
Overall Length (Magnet Assembly)	17⅜" (442 mm.)
*Output Waveguide... ...	Rect. 1·122"×0·497" I.D.
*Input Waveguide	Rect. 1·122"×0·497" I.D.
For other dimensions see drawing on Page 3.	
Water Connections ...	⅛ B.S.P. Unions.
Mounting Position	Vertical—Cathode end down
Weight (in permanent magnet assembly)	90 lbs.

HEATER.

Heater Power ...	27·6 to 37·2 Watts
Heater Resistance at 32 watts ...	3·1 to 3·4 Ohms
Cold Heater resistance ...	0·2 Ohms
†Max. switch-on surge current	9 Amps
‡Min. heating delay time ...	3 Mins

RATINGS.

Maximum Beam Volts ...	13 kV
Maximum Beam Current ...	700 mA
Maximum Power Output ...	3 kW

FREQUENCY.

**Operating Frequency	8000—9000 Mc/s
††Valve Bandwidth	16 Mc/s

WATER COOLING.

Minimum water flow through block at 20°C.	1·5 litre/min
Minimum water flow through collector at 20°C. ...	6 litres/min
Pressure drop through block at 1·5 litre/min. ...	0·5 lbs./sq. in.
Pressure drop through collector at 6 litres/min....	4 lbs./sq. in.

Note: The block and collector may be run in series with a 6 litres/min. water flow. The water must enter the block first.

Pressure drop through block at 6 litres/min.... ...	4 lbs./sq. in.

TYPICAL OPERATION.

Beam Voltage	13 kV
Beam Current ...	530 to 600 mA
§Magnetic Field ...	1500 to 1700 Gauss.
Output Power ...	... ≮2000 watts
Efficiency	33 to 38 %
R.F. Gain	32 to 47 dB
Loss current:	
No R.F. at 13 kV. ...	≯3% of beam current.
2 kW. at 13 kV. ...	≯100 mA

*Pressure joint to dowelled plate-further details will be sent on request.

†See 'Notes on Operation' (1) overleaf.

‡The time which must elapse after application of full heater volts before the E.H.T. can be run up.

**Valves can be supplied tuned to any frequency in this band.

††See graph on page 4.

§This field can either be supplied by a permanent magnet system or by electromagnet. Details of the electromagnet can be supplied on request.

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NOTES ON OPERATION.

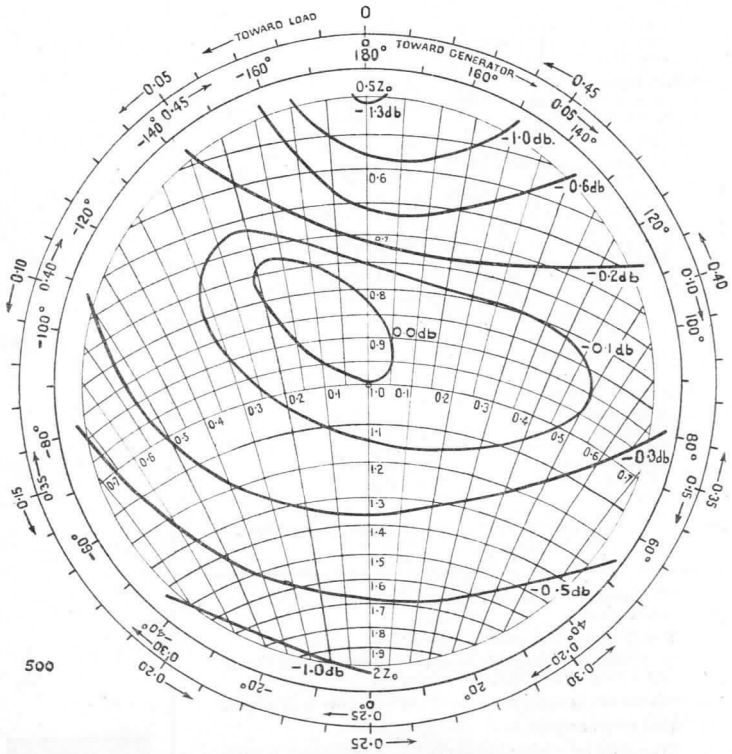
(1) The heater should either be increased slowly from zero to satisfy the surge current specification, or a resistance should be inserted in series with the supply voltage so that application of this voltage will not produce a surge current greater than the specified figure.

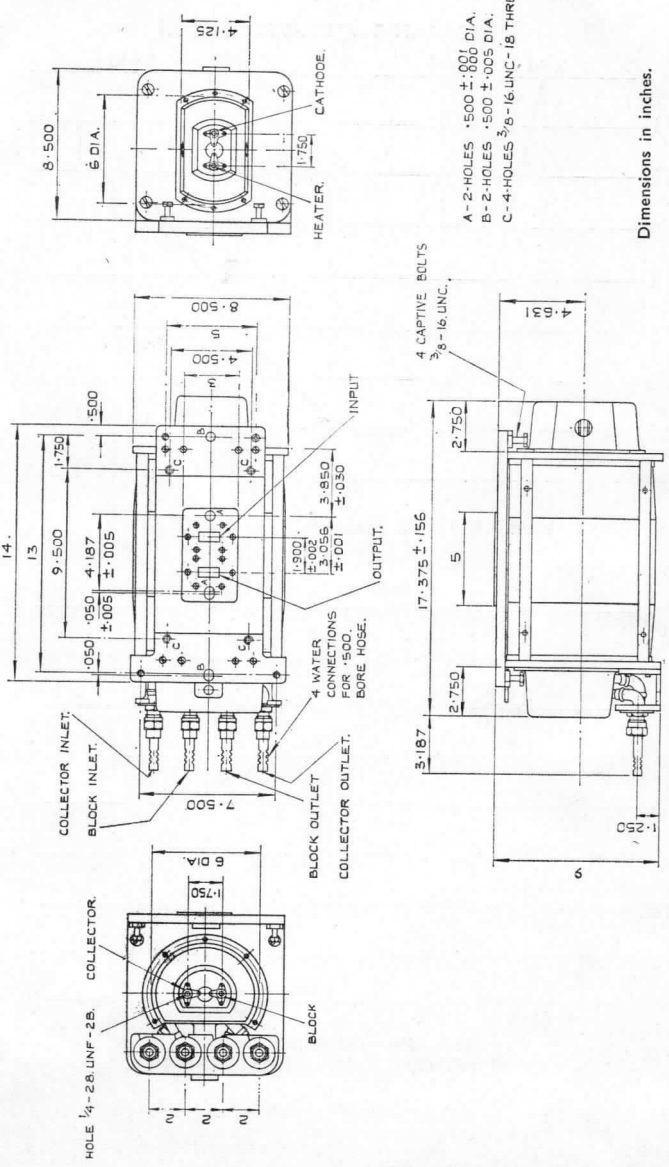
(2) The cavity block and collector are insulated from each other, and, current taken by the block can be therefore measured separately. This current should not exceed 200 mA. An H.T. trip set to operate at 200 mA. is a safeguard against H.T. Flash-over.

(3) Care should be taken not to exceed 2:1 VSWR in the output circuit, otherwise the output window may puncture. A VSWR higher than 2:1 may also make it impossible to obtain the stated output.

(4) A 200 ohms resistor of suitable wattage should be connected in series with the cathode H.T. supply to limit the current drawn in the event of flash-over.

RIEKE DIAGRAM.





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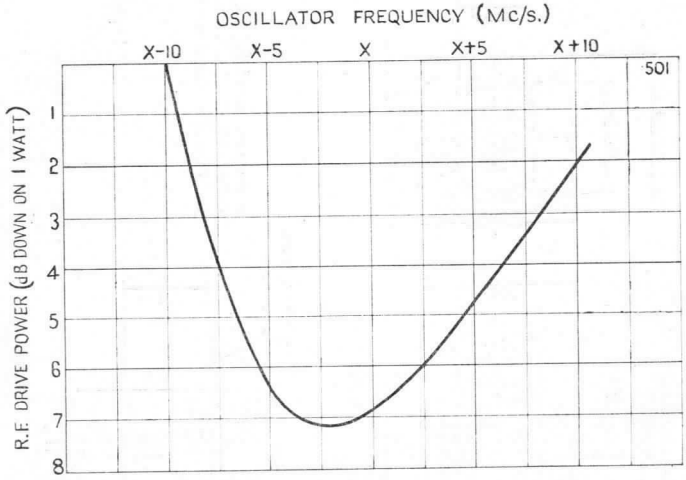
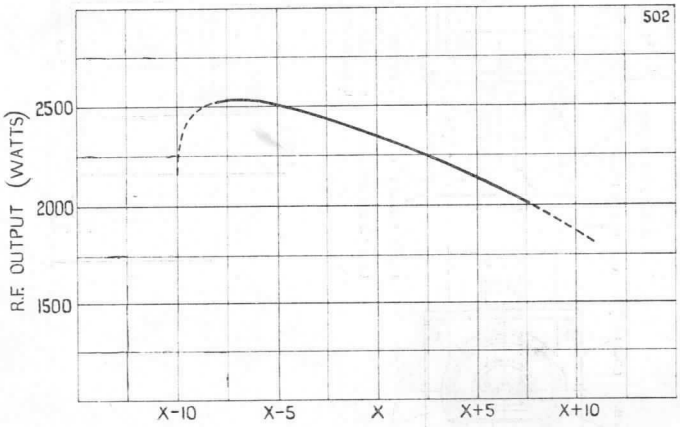


'X' IS THE TUNED FREQUENCY OF THE SY 41



'X' IS THE SET FREQUENCY OF THE SY41 IN Mc/s.

Ferranti

KLYSTRON

A two cavity fixed Tuned Klystron Oscillator for Transmitter operation in the 'X' Band. This valve is designed to minimise the effects of vibration and to withstand heavy acceleration.

PHYSICAL DETAILS.

Overall Length	170 mm.
For other dimensions see outline drawings on Page 3.	
*Output Waveguide	W.G. 16–American Type UG39/U.
Water Connections	$\frac{1}{8}$in. B.S.P.
Mounting Position (Preferred)	Vertical with Cathode down.
Weight	1 lb. 10 ozs. 0·73 kg.

HEATER.

Heater Voltage	7 to 8·5 volts.
Heater Input Power	15·5 to 21 watts.
Heater Resistance at 18w. Input Power	1·9 to 2·1 ohms.
Cold Heater Resistance ...	0·2 ohms.
Max. Heater Switching Surge ...	8 amps.

RATINGS.

Max. Beam Voltage	8·0 kV.
Max. Beam Current	40 mA.

FREQUENCY.

†Operating Frequency	9500±25 Mc/s.
Tuning Range	Fixed Tuned.

WATER COOLING.

The valve is provided with water cooling circuits on both block and collector. With these connected in series a flow of not less than 0·5 litre/min. of water at 25°C. is necessary.

TYPICAL OPERATION AND CHARACTERISTICS.

Beam Voltage	7·2 to 7·8 kV.
Beam Current	30—40 mA.
Output Power	10—20 watts.
Beam Voltage at low end of mode	5·6 to 6·2 kV.
§Electronic Tuning Range ...	2 Mc/s. for 600 volts. ±100 volts.
**Frequency Pushing with Beam Voltage	4·2 kc/s/V.
Frequency Pushing with Heater Current	150 c/s/Amp.
††Frequency Pulling	1·1 Mc/s.
§§Frequency Drift	<2 kc/s/hour.
Temp. Coefficient Frequency ...	150 kc/s/°C.
Microphony	Less than 500 c/s/g. up to 10g. in the range 20—5000 c/s.
Shock	Shocks up to 150g of 7 milliseconds duration produce no detectable frequency variation.

*Bolts to UG 40A/U. Choke Flange.
†This is the frequency to which these Klystrons are normally tuned.
†Tubes for operation at other frequencies in the range 8500 to 10,000 Mc/s. can be supplied to special order.
§For a power variation of less than 1dB.
**At optimum power output.
††All phases of V.S.W.R. 1·5:1.
§§At constant temperature.

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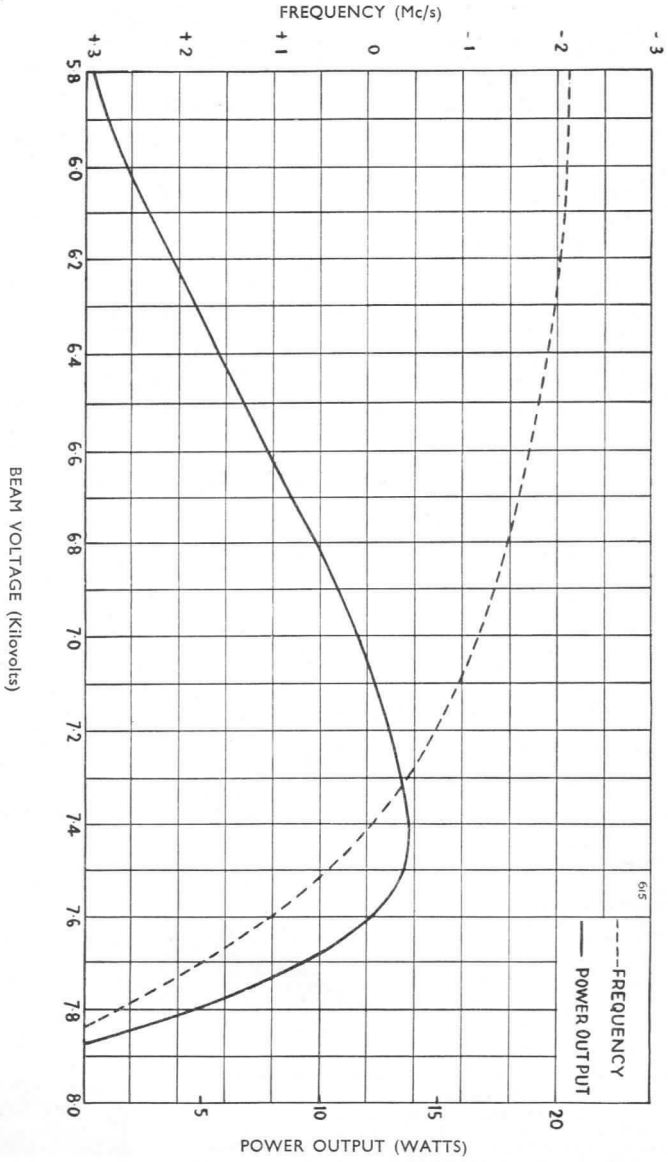
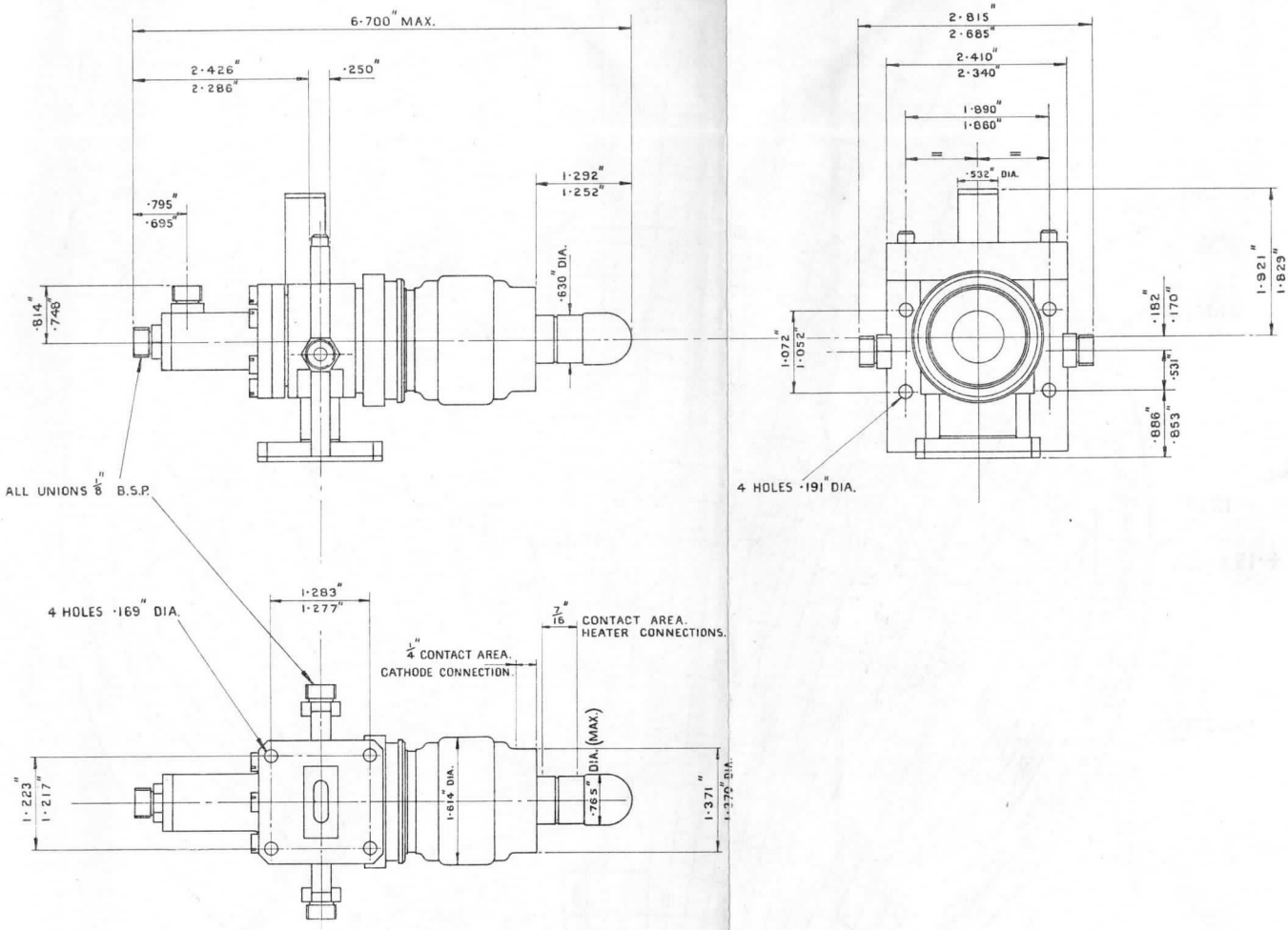

FREQUENCY (Mc/s)
+3
+2
+1
0
-1
-2
-3
58
60
62
64
66
68
70
72
74
76
78
80
BEAM VOLTAGE (Kilovolts)
5
10
15
20
POWER OUTPUT (WATTS)
FREQUENCY
POWER OUTPUT
615


6·700" MAX.
2·426"
2·286"
·250"
1·292"
1·252"
·795"
·695"
·814"
·748"
·630" DIA.
ALL UNIONS 1/8" B.S.P.
2·815"
2·685"
2·410"
2·340"
1·890"
1·860"
·532" DIA.
1·921"
1·829"
·182"
·170"
1·072"
1·052"
·531"
·886"
·853"
4 HOLES ·191" DIA.
4 HOLES ·169" DIA.
1·283"
1·277"
7/16" CONTACT AREA.
HEATER CONNECTIONS.
1/4" CONTACT AREA.
CATHODE CONNECTION.
·765" DIA. (MAX.)
1·614" DIA.
1·223"
1·217"
1·371"
1·370" DIA.

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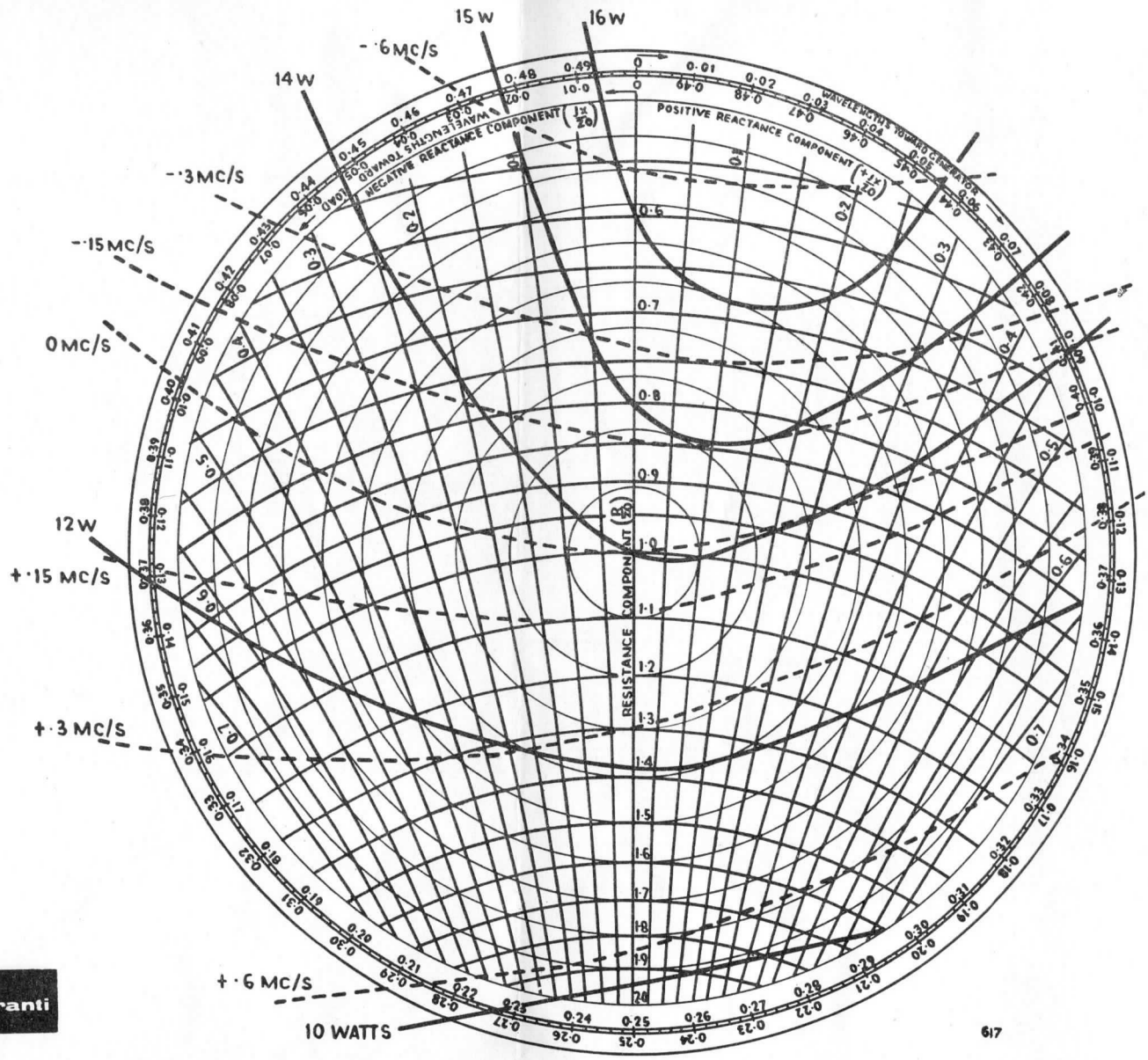
RIEKE DIAGRAM



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KLYSTRON

A two cavity Tunable Klystron Oscillator for Transmitter operation in the 'X' Band. This valve is designed to minimise the effects of vibration and to withstand heavy acceleration.

PHYSICAL DETAILS.

Max. Overall length	8·48ins. (216 mm.)
For other dimensions, see outline drawing on page 3.	
*Output waveguide	W.G. 15
Water connections thread ...	No. 10–32U.N.F.–2A
Mounting position	Any.
Weight	1·66 Kg. (3lb. 10oz.)

HEATER.

Heater Voltage	7 to 8·5 volts.
Heater Input Power	15·5 to 21 watts.
Heater Resistance at 18w. Input Power	1·9 to 2·1 ohms.
Cold Heater Resistance	0·2 ohms.
Max. Heater Switching Surge ...	8 amps.

RATINGS.

Max. Beam Voltage...	8·0 kV.
Max. Beam Current	40 mA.

FREQUENCY.

‡Operating frequency Range ...	8000—9000 Mc/s.
Tuning Range	± 20 Mc/s.

WATER COOLING.

Minimum water flow	0·3 litre/min.
§Maximum water flow	3·0 litre/min.
Maximum temperature of coolant	50 °C.
Coolant pressure drop at 0·6 litres/min. flow at 10°C.	0·1 lb./sq. in.

TYPICAL OPERATION AND CHARACTERISTICS.

Beam Voltage	6·8—7·4 kV.
Beam Current	28—30 mA.
Output Power	10—20 watts.
Electronic tuning range	
Frequency pushing with Beam volts	3 kc/s./V.
Frequency pushing with heater current	200 c/s./A.
Frequency pulling	4·5 Mc/s.
Temperature coefficient of frequency	150 kc/s./°C.
Microphony	less than 4000 c/s/g up to 10g in the range 20—200 cycles
Shock	Up to 150g of 7 millisecs. duration produces no detectable frequency variation.

*Bolts to UG40A/U Choke flange.
‡The operating frequency required should be specified when ordering.
§To avoid microphony due to turbulence in water channels.

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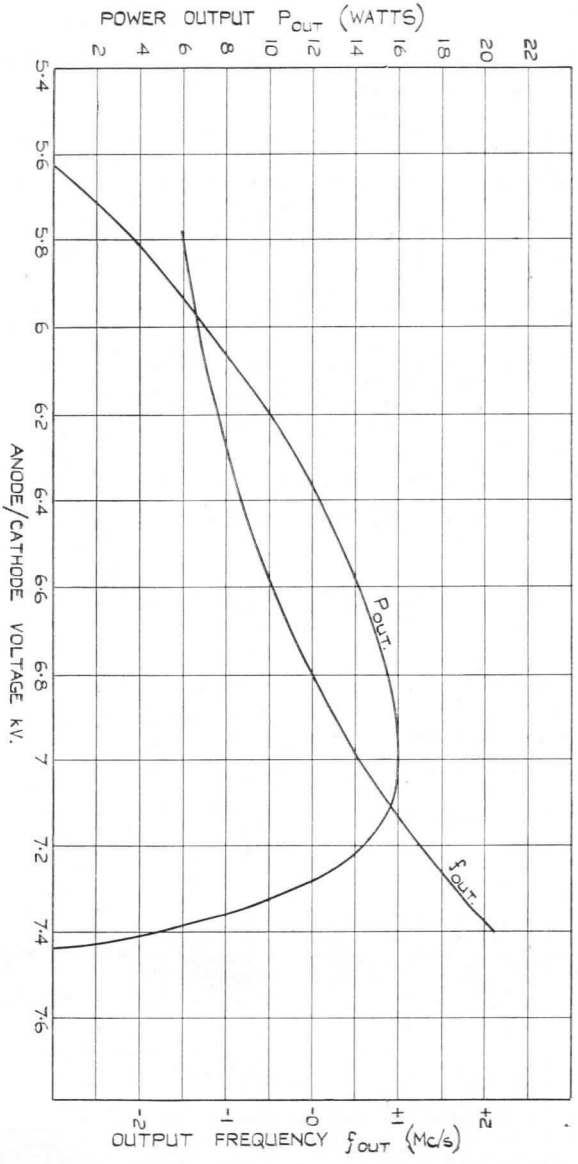
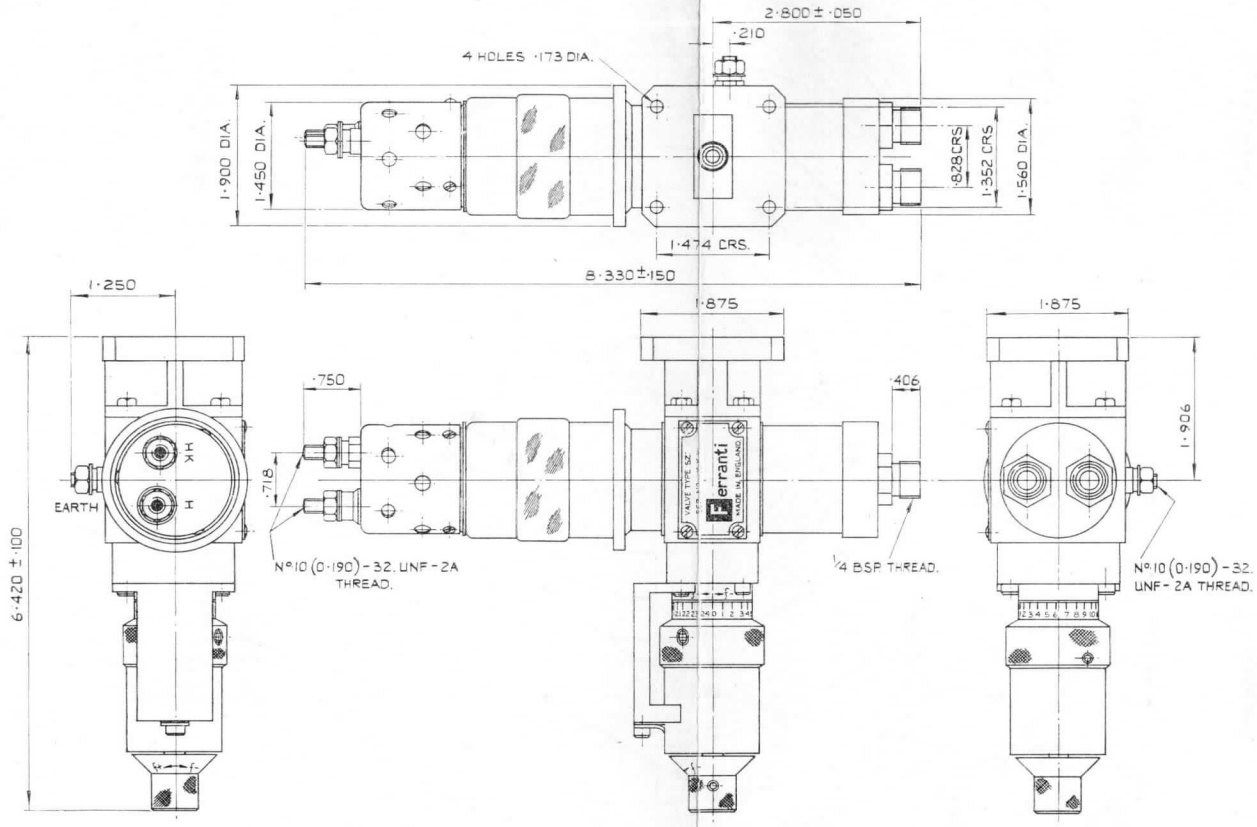
Sept.,1961

Typical Power Output and Frequency/Anode Voltage Characteristics.



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



Dimensions in inches.
(Nominal unless otherwise stated.)

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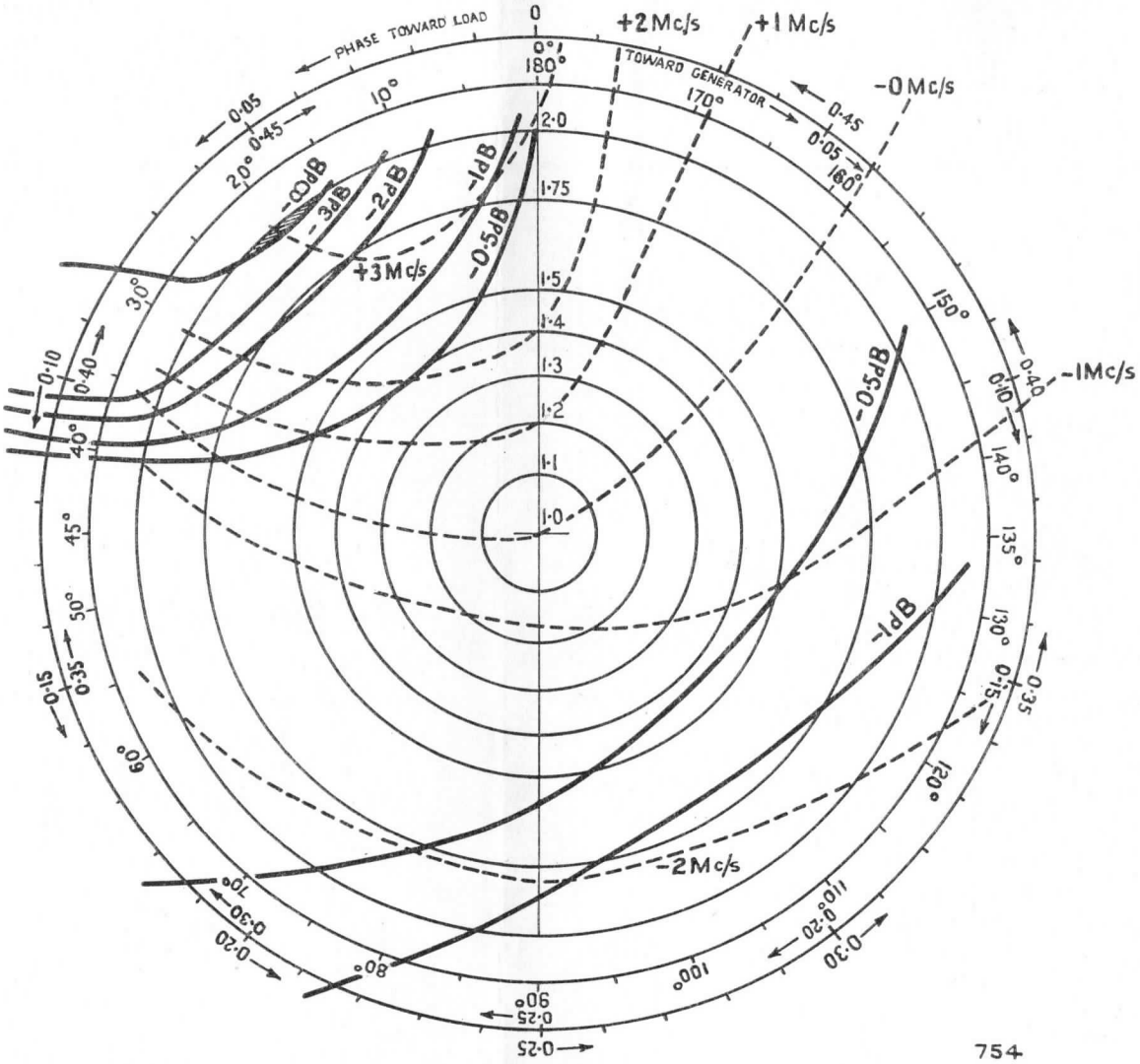
RIEKE DIAGRAM



754

Ferranti

Ferranti

SZ50

KLYSTRON

A very rugged Reflex Klystron for use as a Local Oscillator. It has been designed to provide extreme stability and reliability in operation under the most severe environmental conditions. It is intended for convection cooling with free air circulation.

PHYSICAL DATA.

Dimensions	See Drawings on Page 3.
Output Connection	Bolts to UG-39/U flange or UG-40A/U choke for W.G.16
Mounting Position	Any
Weight	6 oz. (180 gm.) approx.
Electrode Connections	Moulded flying leads.

FREQUENCY.

Operating Range	9300±300 Mc/s

TUNING.

A single screw tuner covers the tuning frequency range in approximately 2¼ turns. For tuner screw settings see the graph on page 5. The average tuner torque is 35 in./oz. (max. 50 in./oz.).

HEATER.

Heater Voltage	6·3 volts
Heater Current	1·2±10% amps

RATINGS. (All ratings are 'Absolute')

Max. Heater Voltage	6·9 volts
Min. Heater Voltage	5·7 volts
Max. Resonator Voltage	350 volts
Max. Resonator Current	60 mA
Max. Neg. Reflector Voltage	500 volts
Max. Vibration	20 g
Max. Shock (short duration)	150 g
Max. Altitude for operation	60,000 ft
*Max. Body Temperature	200 °C
Max. V_{h-k}	55 volts

CHARACTERISTICS AND TYPICAL OPERATION.

Frequency Range	9300±300		Mc/s
Heater Voltage	6·3		volts
Load	Matched-V.S.W.R. <1·1		
Resonator Voltage	250		volts
	Min.	Max.	
†Reflector Voltage	−75	−120	volts
Resonator Current	20	40	mA
Reflector Current	–	5	μA
Power Output	29	66	mW
‡Electronic Tuning Range	±15	–	Mc/s
Electronic Tuning Tracking Error	–	5	Mc/s
§Electronic Tuning Rate	1·3	4·3	Mc/s / volt
Temperature Coefficient	+50	−100	kc/s / °C
Warm-up Frequency Drift	–	10	Mc/s
Heater Voltage Coefficient	–	1·5	Mc/s / volt
Hysteresis	–	50	%

*Reliability will be seriously impaired if this temperature is exceeded.

†See Graph on Page 4.

‡Measured at half power point.

§At mode peak.

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CHARACTERISTICS AND TYPICAL OPERATION (cont.)

*Tuner Resetting Accuracy (max. ΔF.)	...	...	...	...	2 Mc/s
†Pressure Coefficient (Max. ΔF.)	...	...	...	...	±½ Mc/s

Vibration.

The max. peak to peak frequency variation from vibration of 100 c/s to 4 kc/s at 10g peak to peak is 0·2 Mc/s. ‡

Shock.

The maximum frequency deviation due to shock of 100g. is 2·0 Mc/s.

NOTES ON OPERATION.

Mounting.

The klystron should be securely bolted to the mating waveguide flange. Normally the anode (tube body) is operated at earth potential; when operated with the anode above earth potential suitable insulation should be provided between the tube and waveguide flanges. §

Installation.

It is important that the circuit in which a new klystron is being installed is thoroughly checked before the application of any voltages.

Applied Voltages.

The applied voltages should not exceed the maximum published ratings under any circumstances. All quoted voltages are relative to the cathode.

Tuning.

Anti-clockwise rotation of the tuner screw increases frequency.

Heater Voltage.

Life and reliability are directly related to the deviation of the heater voltage from its centre rated frequency. Under no circumstances should it deviate by more than ±10%.

Reflector Voltage.

The Reflector must always be operated at a potential which is negative with respect to that of the cathode, and its power supply should not be disconnected during the time the resonator voltage is applied. When the reflector voltage is modulated, the magnitude of the modulating voltage must be limited to the extent necessary to prevent positive excursions of the reflector voltage. When there is any possibility of the reflector voltage becoming equal to or more positive than the cathode a protective diode should be connected between the reflector and cathode. The performance of this diode should be checked regularly as it will normally be operated at zero current drain, an operating condition which materially reduces the life.

Load.

For correct functioning over the specified frequency band and also from 8500 Mc/s. to 9000 Mc/s., the load should present a V.S.W.R. of not more than 1·2 to the valve. Outside the range 8500 to 9600 Mc/s but within the frequency range of 7800 to 10500 Mc/s the load should present a V.S.W.R. of less than 1·5.

Life.

The guaranteed life under normal operating conditions is 500 hours. An average life of 1000 hours is a 95% expectancy. The life expectancy will be appreciably reduced if the valve is operated under conditions where specified maximum ratings are exceeded. See also the note on 'Heater Voltage' above.

---

*Resetting accuracy defines the frequency deviation which can result from turning the tuner screw through approximately half a turn in either direction, then returning it to its original position.

†The frequency deviation measured when the atmosphere pressure surrounding the valve and inside the set and cavity is increased from 1/10th atmosphere to 1 atmosphere in 1 minute (max.).

‡The valve is design tested to 20g.

§To facilitate insulated mounting the eyelets in the fixing bolt holes are removable.

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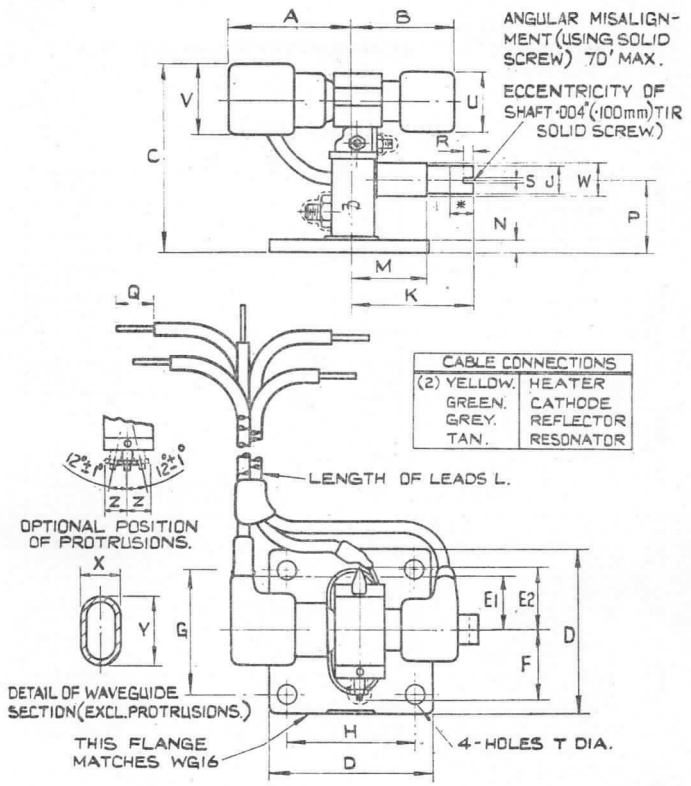
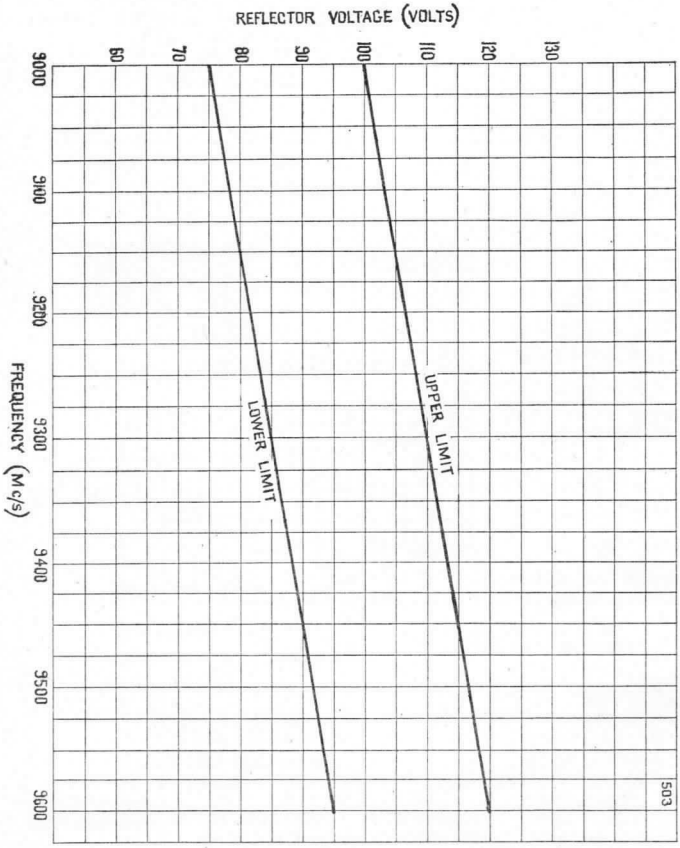
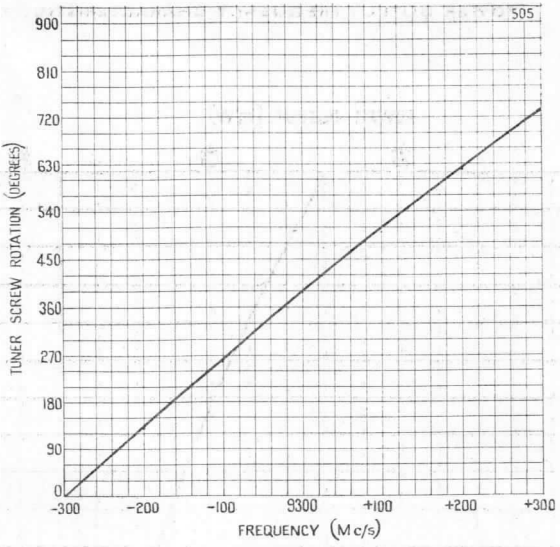


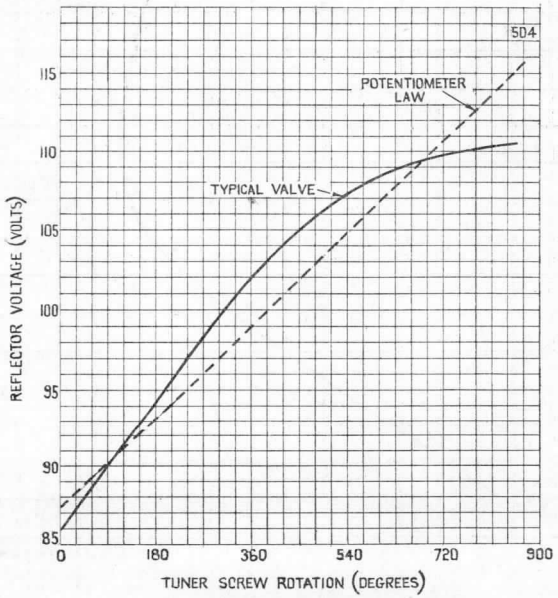
DIM	INCHES	m.m.	NOTES.	DIM	INCHES	m.m.	NOTES.
A	1·260 MAX.	32		N	·125 +·025 −·020	3·17 +·63 −·50	
B	1·026 MAX.	25·56		P	·720±·002	18·29±·05	
C	1·900 MAX.	48·25		Q	·375±·125	9·52±3·18	
D	1·625±·015	41·25±·40		R	·100	2·54	
E1	·680 MAX.	17·27		S	·040	1·02	
E2	·725	18·42	MAX. BODY WIDTH	T	·219±·003	5·55±·08	EXCLUDING ·195 INSERTS.
F	·625 MAX.	15·87	EXCL. GROUND TAG	U	·600 MAX.	15·25	
G	1·220±·004	31 ±·10		V	·750 MAX.	19·05	
H	1·280±·004	32·51±·10		W	·360 MAX.	9·13	
J	·281 +·002 −·002	7·14 +·00 −·05	* DIA. OVER ·200" (5mm) LENGTH	X	·435 MAX.	11·06	
K	1·240±·060	31·50±1·52	AT 9·6 G a/s (32-34 TPI)	Y	1·100 MAX.	27·94	
L	18	457		Z	·240 MAX.	6·10	
M	·812	20·64					

REFLECTOR VOLTAGE/FREQUENCY CHARACTERISTIC

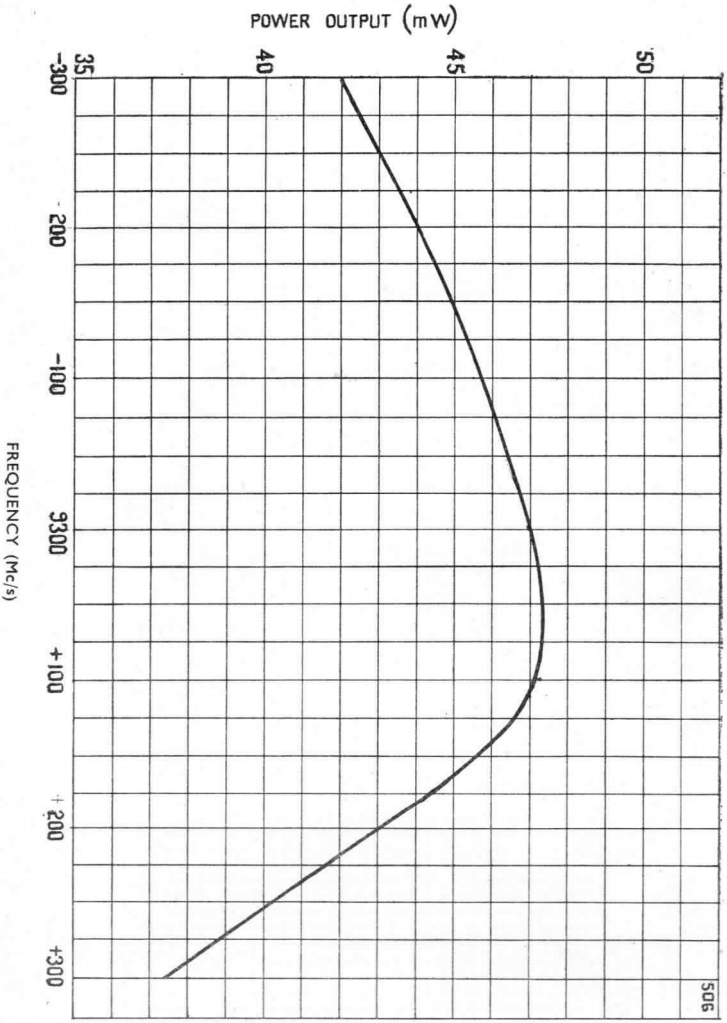


TUNER SCREW SETTING





POWER OUTPUT/FREQUENCY CHARACTERISTIC



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SZ51

SZ51A

KLYSTRONS

Reflex Klystrons of rugged construction for use as a local oscillator. They have been designed for use in the most severe environmental conditions where extreme frequency stability and reliability are required. The two types are identical except for Tuner Screw turns to cover the tuning range.

PHYSICAL DATA.

Dimensions	See Drawings on Page 3.
Output Connection ...	Bolts to UG-39/U flange or UG-40A/U choke for 1in. x 0·5in. x 0·05in. waveguide.
Mounting Position ...	Any.
Weight	6 oz. (180gm.) approx.
Base	Moulded with flying leads.
Top Cap	Moulded with flying lead.

FREQUENCY.

Operating Range	8450±400 Mc/s.

TUNING.

A single screw tuner covers the tuning frequency range in approximately 1⅜in. turns. For tuner screw settings see the graphs on page 7 (SZ51) & page 8 (SZ51A). The average tuner torque is 30 in./oz. (max. 35in./oz.).

HEATER.

Heater Voltage	6·3 volts.
Heater Current	1·2 ±10% amps.

RATINGS.

Max. Heater Voltage	6·9 volts.
Min. Heater Voltage	5·7 volts.
Max. Resonator Voltage	350 volts.
Max. Resonator Current	60 mA.
Max. V_{h-k}	45 volts.
Max. Body Temperature	200 °C.
Reflector Voltage (negative)	0–500 volts.

COOLING.

Designed for cooling by conduction and free air circulation. Forced air cooling is not usually required but the Klystron body temperature should not be allowed to exceed 200°C.

CHARACTERISTICS AND TYPICAL OPERATION

Frequency Range ...		8450±400			Mc/s.
Heater Voltage		6·3			volts.
Load		Matched			
Resonator Voltage ...		350			volts.
		Min.	Av.	Max.	
*Reflector Voltage ...		−90	—	−185	volts.
Resonator Current ...		—	50	60	mA.
Reflector Current ...		—	—	10	μA.
Power Output		40	120	—	mW.
Electronic Tuning Range ...		30	—	80	Mc/s.
Modulation Sensitivity ...		0·6	—	2·7	Mc/s / volt.
Temperature Coefficient		−100	−30	+50	kc/s / °C.
Heater Voltage Coefficient ...		—	—	1·5	Mc/s / volt.

*See Graph on page 5

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May, 1960

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CHARACTERISTICS AND TYPICAL OPERATION. (cont.)

†Noise	$<3 \times 10^{-14}$ W/ Mc/s/ mW
‡Tuner Resetting Accuracy (max. ΔF.)	1 Mc/s.
§Tuner Side Thrust (max. ΔF.)	0·5 Mc/s.
¶Pressure Coefficient (Max. ΔF).	2 Mc/s.

Vibration.

The max. peak to peak frequency variation from vibration of 40 c/s to 4 kc/s at 10g peak to peak is 0.2 Mc/s.

Shock.

The maximum frequency deviation due to shock of 150g. is 1·5 Mc/s.

NOTES ON OPERATION.

Mounting.

The klystron should be securely bolted to the mating waveguide flange. Normally the anode (tube body) is operated at earth potential ; when operated with the anode above earth potential suitable insulation should be provided between the tube and waveguide flanges.**

Application of Voltages.

It is important that the circuit in which a new klystron is being installed is thoroughly checked before the application of any voltages. The applied voltages should not exceed the maximum published ratings under any circumstances.

Reflector Voltage.

The Reflector must never be operated at a potential positive with respect to that of the cathode, nor should its power supply be disconnected during the time the resonator voltage is applied. When the reflector voltage is modulated the magnitude of the modulating voltage must be limited to the extent necessary to prevent positive excursions of the reflector voltage. A protective diode connected directly between the reflector and the cathode can be used to prevent the reflector from becoming positive. The performance of this diode should be checked regularly as it will normally be operated at zero current drain, an operating condition which materially reduces the life.

Load.

For correct functioning the load should present a VSWR of less than 1·4 to the tube at the operating frequency.

---

†The R.F. noise is the sum of the R.F. noise power in two channels 40 Mc/s. above and below the frequency of oscillation, compared to normal noise at 290°K. in the same channels.
The noise standard used in these measurements is a CV1881 discharge tube. The noise power is expressed as Watts per Mc/s. of I.F. band width per milliwatt of R.F. output power.

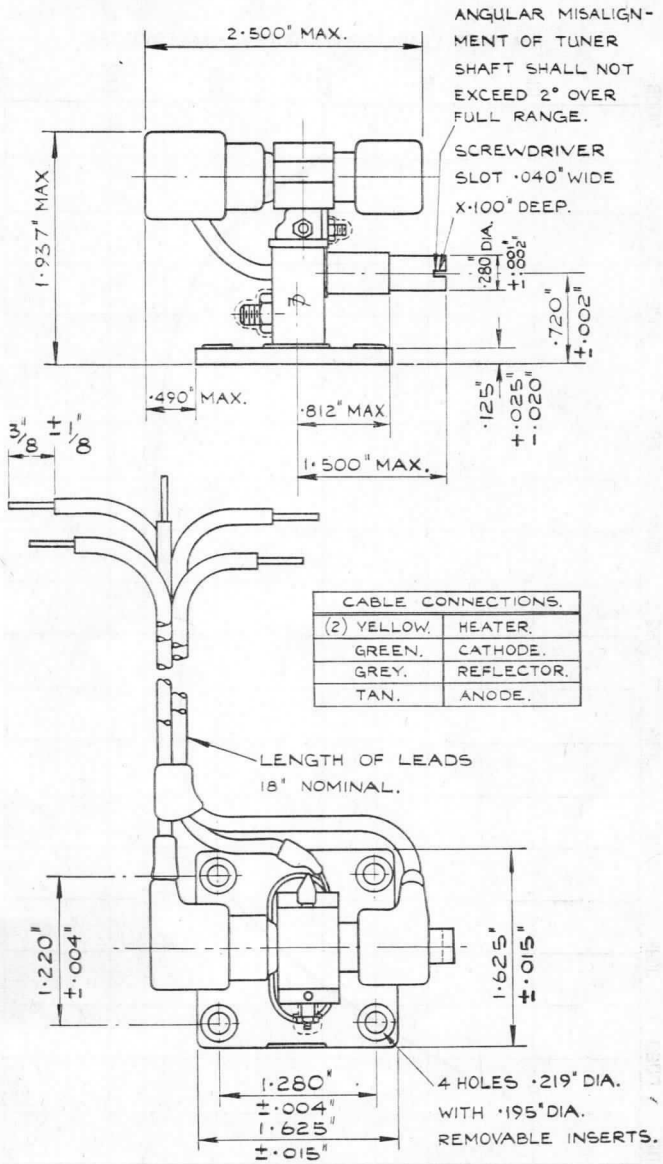
‡Resetting accuracy defines the frequency deviation which can result from turning the tuner screw through approximately half a turn in either direction, then returning it to its original position.

§The frequency deviation, caused by side thrust due to the application a ¼lb. weight to the top of the tuner spindle in each of two mutually perpendicular axes both of which are perpendicular to the spindle axis.

¶The frequency deviation measured when the atmosphere pressure surrounding the valve and inside the set and cavity is increased from 1/10th atmosphere to 1 atmosphere in 1 minute (max.).

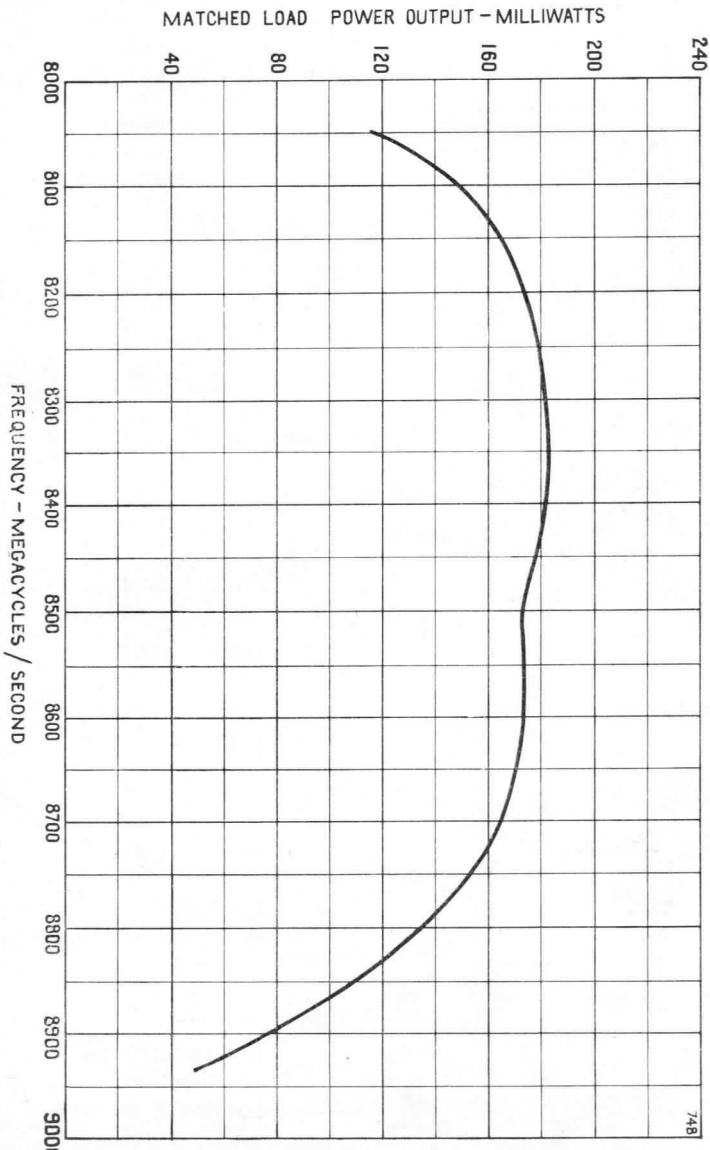
**To facilitate insulated mounting the eyelets in the fixing bolt holes are removable

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



Issue 1.
May, 1960

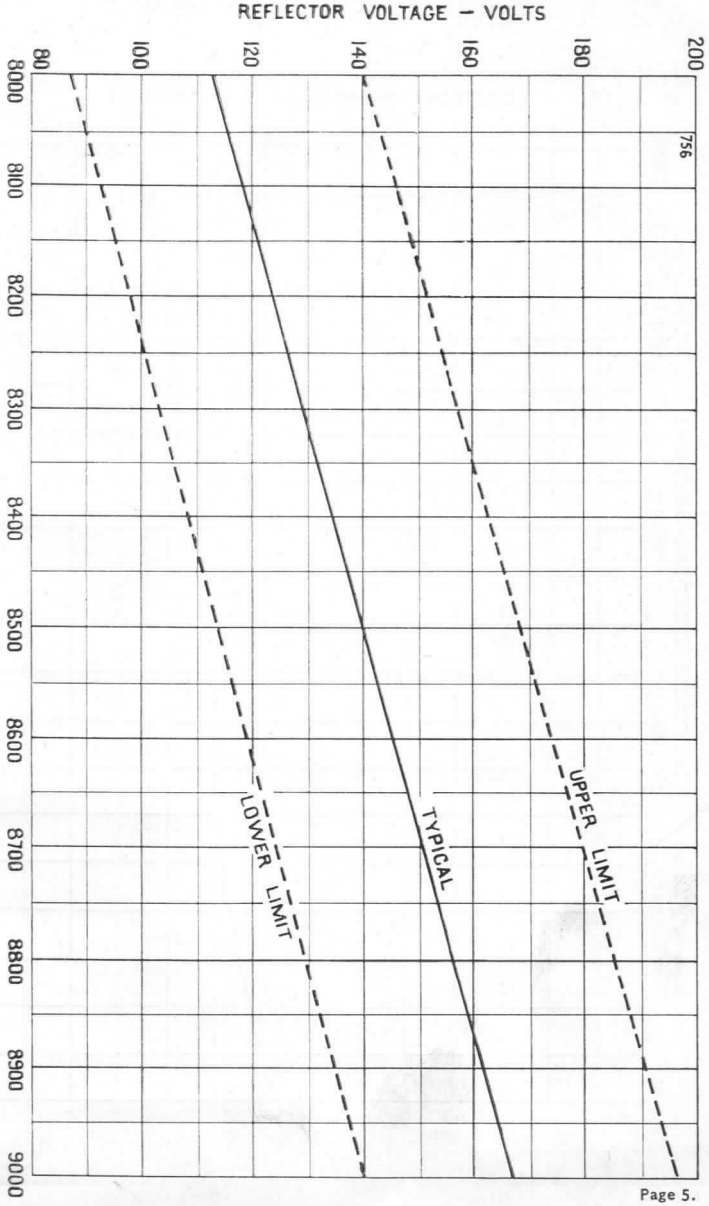
POWER OUTPUT/FREQUENCY CHARACTERISTIC



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

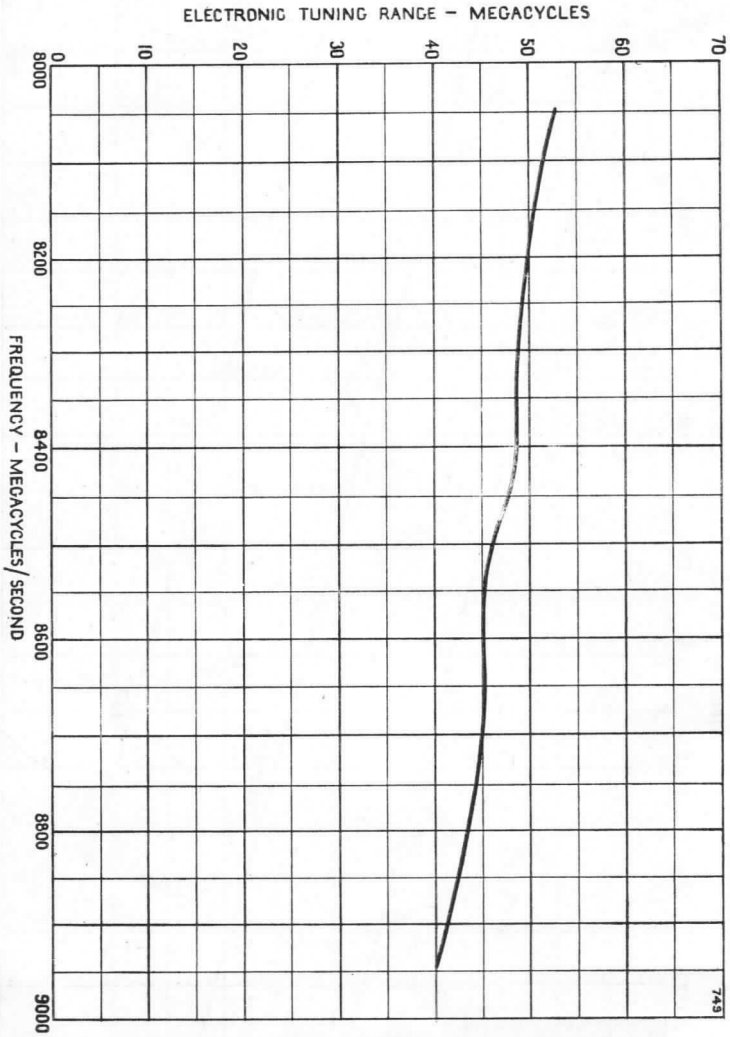
REFLECTOR VOLTS/FREQUENCY CHARACTERISTICS.

Reflector Voltage at Maximum Power Point.



Ferranti

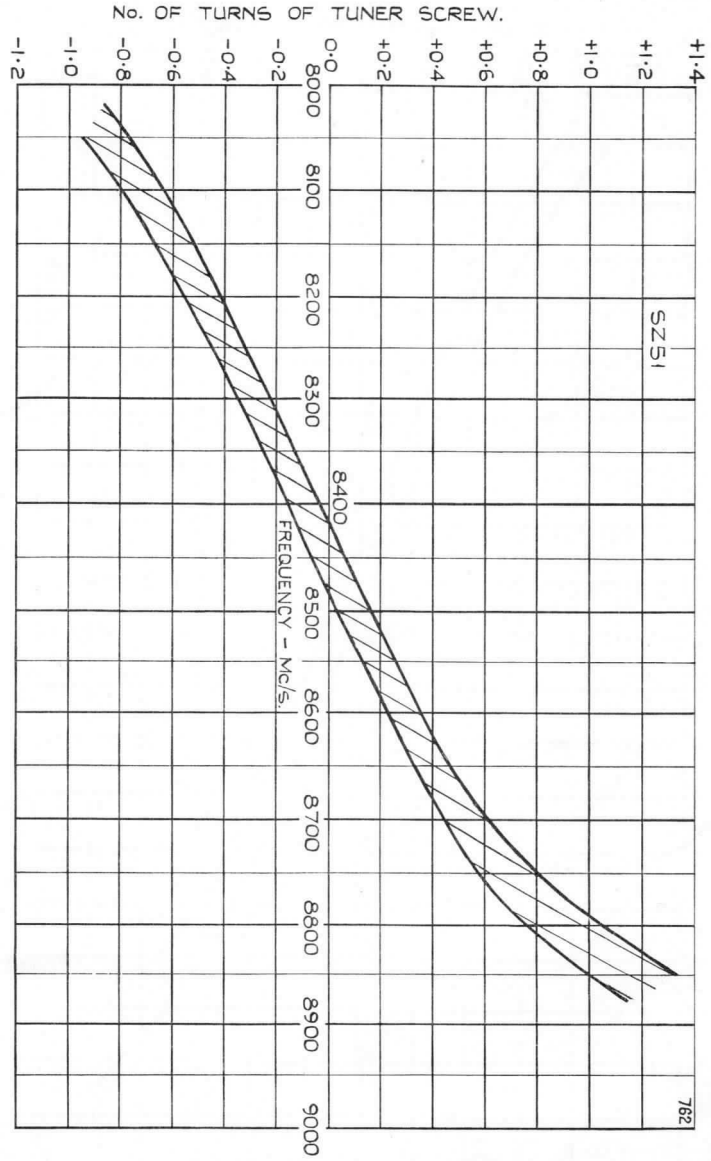
ELECTRONIC TUNING RANGE



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

TUNER SCREW SETTING.

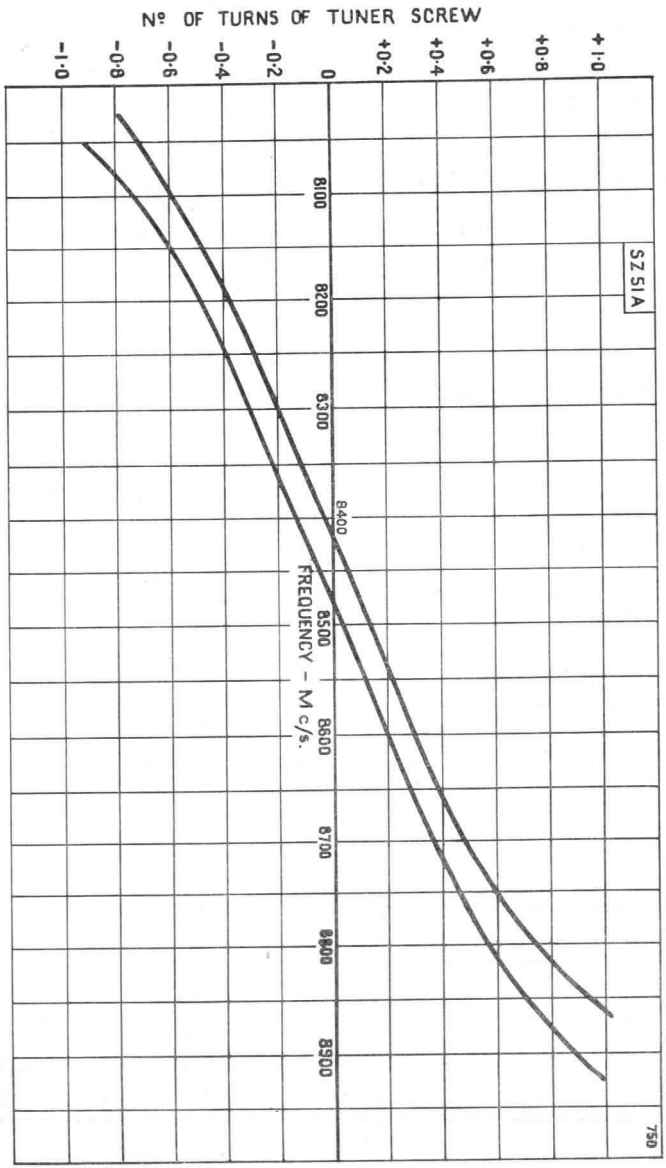
(The tuner screw setting for any frequency should lie within the area enclosed by the two lines,)



Ferranti

TUNER SCREW SETTING

(The tuner screw setting for any frequency should lie within the area enclosed by the two lines.)



Ferranti

KLYSTRON

A rugged wide band Reflex Klystron for use as a Local Oscillator Designed for low voltage operation and to provide extreme stability and reliability under the most severe environmental conditions. Other features are low noise and small 'warm up' frequency drift. Intended for convection cooling with free air circulation. It is a direct replacement for American Type VA201B

PHYSICAL DATA.

Dimensions	See Drawings on Page 3.
Output Connection	Bolts to UG-39/U flange or UG-40A/U choke for W.G.16
Mounting Position	Any
Weight	6 oz. (170 gm.) approx.
Electrode Connections	Moulded flying leads.

FREQUENCY RANGE.

Mechanical Tuning Range ... 8500–9655 Mc/s

A single screw tuner covers the tuning frequency range in approximately 4½ turns. For tuner screw settings see the graph on Page 6. The average tuner torque is 30 oz./in. (max. 50 oz./in.).
Clockwise rotation reduces the frequency.

HEATER.

Heater Voltage	6·3 volts
Heater Current	1·2±10% amps

RATINGS. (All ratings are 'Absolute')

Max. Heater Voltage	6·9 volts
Min. Heater Voltage	5·7 volts
Max. Resonator Voltage	350 volts
Max. Resonator Current	60 mA
Max. Neg. Reflector Voltage	–500 volts
Max. Reflector Current	10 μA
Max. V_{h-k}	45 volts
Max. Vibration	20 g
Max. Shock (short duration)	150 g
Max. Altitude for operation	60,000 ft
*Max. Body Temperature	200 °C

CHARACTERISTICS AND TYPICAL OPERATION.

Frequency Range		8500–9655				Mc/s
Heater Voltage		6·3				volts
Load		Matched				
Resonator Voltage		250		300		volts
Mode		6¾		5¾		
		Min.	Max.	Min.	Max.	
†Reflector Voltage		–40	–120	–80	–200	volts
Resonator Current		—	45	—	60	mA
Reflector Current		—	10	—	10	μA
Power Output		12	66	40	120	mW
‡Electronic Tuning Range		30	—	20	—	Mc/s
§Electronic Tuning Rate		1·0	—	·5	—	Mc/s / volt
Temperature Coefficient		–100	+50	–100	+50	kc/s / °C
Heater Voltage Coefficient		—	1·5	—	1·5	Mc/s / volt

*Reliability will be seriously impaired if this temperature is exceeded.
†See Graph on Page 4.
‡Measured at half power point.
§At mode peak.

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Nov., 1963

CHARACTERISTICS AND TYPICAL OPERATION (Cont.)

*Noise	$<3 \times 10^{-14}$ W / Mc/s / mW
†Tuner Resetting Accuracy (max. ΔF.)	1 Mc/s
‡Tuner Side Thrust (max. ΔF.)	0·5 Mc/s

Vibration.

The max. peak to peak frequency variation from vibration of 20–1000 c.p.s. at 10g. is 0·2 Mc/s.

Shock.

The maximum frequency deviation due to shock of 150g. is 1·5 Mc/s.

NOTES ON OPERATION.

Mounting.

The klystron should be securely bolted to the mating waveguide flange. Normally the resonator (tube body) is operated at earth potential; when operated with the resonator above earth potential suitable insulation should be provided between the tube and waveguide flanges.

Applied Voltages.

It is important that the circuit in which a new klystron is being installed is thoroughly checked before the application of any voltages.

All quoted voltages are relative to the cathode.

The applied voltages should not exceed the maximum published ratings under any circumstances.

Voltage surges due to switching must be limited within the maximum ratings.

Heater Voltage.

Life and reliability are directly related to the deviation of the heater voltage from its centre rated voltage. Under no circumstances should it deviate by more than ±10%.

Reflector Voltage.

The Reflector must always be operated at a potential which is negative with respect to that of the cathode, and its power supply should not be disconnected during the time the resonator voltage is applied. When the reflector voltage is modulated, the magnitude of the modulating voltage must be limited to the extent necessary to prevent positive excursions of the reflector voltage. When there is any possibility of the reflector voltage becoming equal to or more positive than the cathode a protective diode should be connected between the reflector and cathode. The performance of this diode should be checked regularly.

Load.

For correct functioning of the tube the load should meet the following conditions:

(a)† Over the specified operating frequency range the load should present a VSWR of less than 1·2 to the tube.

(b) Over the frequency ranges: 7,800 to 8,500 Mc. and 9,655 to 10,500 Mc. the load should present a VSWR of less than 1·5 to the tube.
Failure to meet condition (b) may result in the occurrence of spurious modes.

Life.

The guaranteed life under normal operating conditions is 500 hours. An average life of 1000 hours is a 95% expectancy. The life expectancy will be appreciably reduced if the valve is operated under conditions where specified maximum ratings are exceeded. See also the note on 'Heater Voltage' above.

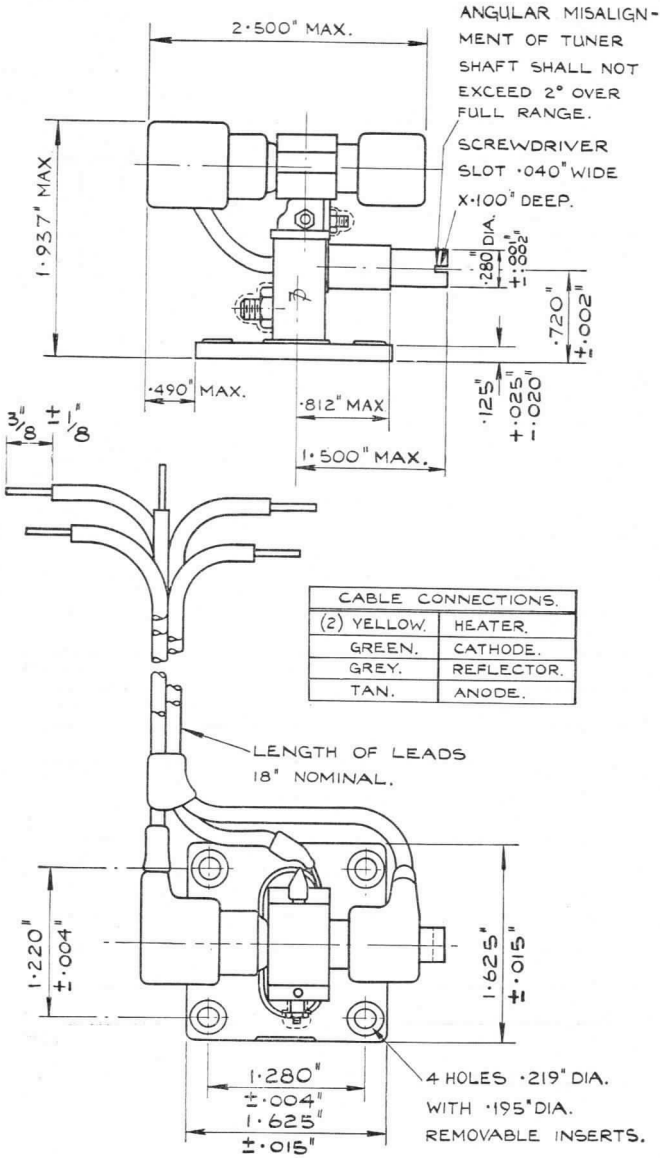
---

*The R.F. noise is the sum of the R.F. noise power in two channels 40 Mc/s. above and below the frequency of oscillation, compared to normal noise at 290°K. in the same channels.
The noise standard used in these measurements is a CV1881 discharge tube. The noise power is expressed as Watts per Mc/s. of I.F. band width per milliwatt of R.F. output power.

†Resetting accuracy defines the frequency deviation which can result from turning the tuner screw through approximately half a turn in either direction, then returning it to its original position.

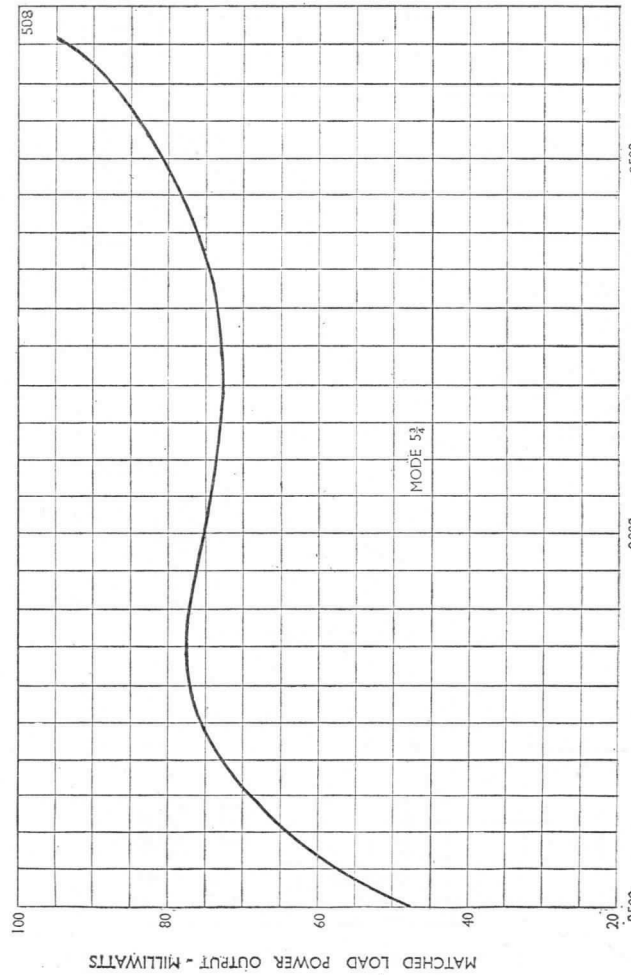
‡The frequency deviation, caused by side thrust due to the application of a ¼lb. weight to the top of the tuner spindle in each of two mutually perpendicular axes both of which are perpendicular to the spindle axis.

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


2·500" MAX.
ANGULAR MISALIGNMENT OF TUNER SHAFT SHALL NOT EXCEED 2° OVER FULL RANGE.
SCREWDRIVER SLOT ·040" WIDE X·100" DEEP.
1·937" MAX
·280" DIA. +·001" −·002"
·720" ±·002"
·490" MAX.
·812" MAX
·125" +·025" −·020"
3/8" ± 1/8"
1·500" MAX.
CABLE CONNECTIONS.
(2) YELLOW. HEATER.
GREEN. CATHODE.
GREY. REFLECTOR.
TAN. ANODE.
LENGTH OF LEADS 18" NOMINAL.
1·220" ±·004"
1·625" ±·015"
1·280" ±·004"
1·625" ±·015"
4 HOLES ·219" DIA. WITH ·195" DIA. REMOVABLE INSERTS.

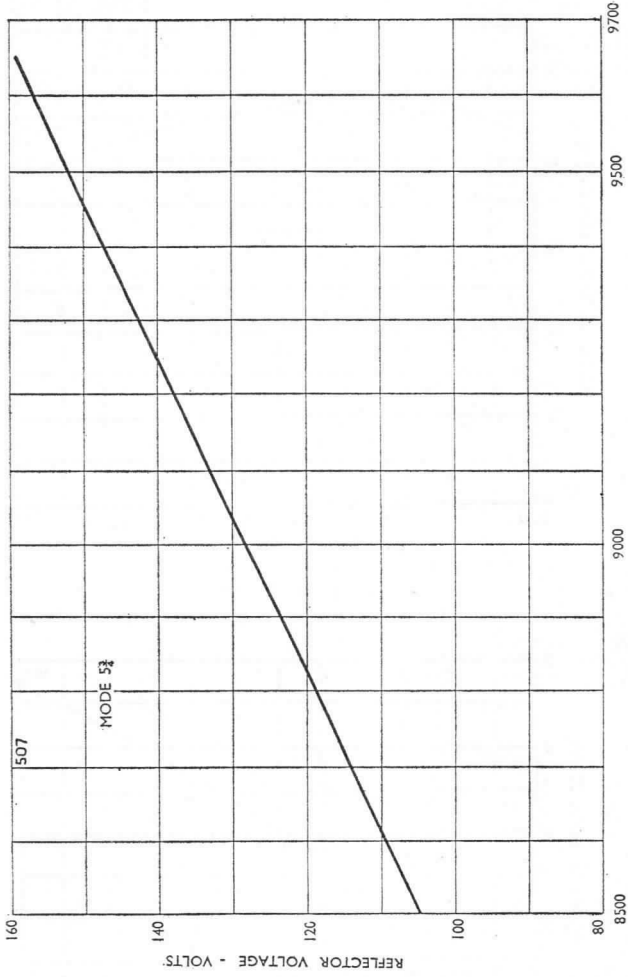
Ferranti

TYPICAL POWER OUTPUT/FREQUENCY CHARACTERISTIC

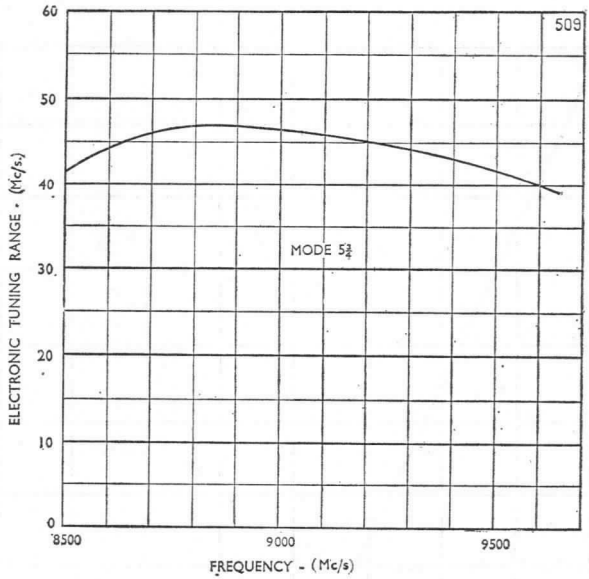


TYPICAL REFLECTOR VOLTS/FREQUENCY CHARACTERISTICS

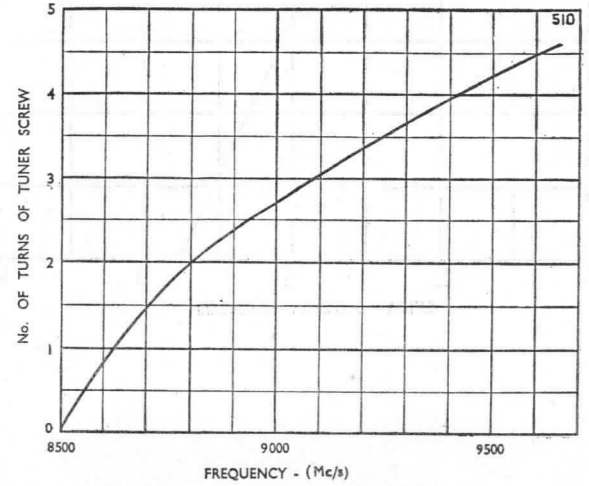
Reflector Voltage at Maximum Power Point.



TYPICAL ELECTRONIC TUNING RANGE



TUNER SCREW SETTING



FERRANTI

"X" BAND NOISE TUBE

TE10

A tube specifically designed for noise measurement at "X" Band frequencies. The small size and low current drain, coupled with stable noise output make this tube particularly suitable for applications where a built in noise monitoring facility is required.

PHYSICAL DETAILS.

The tube is normally supplied in a waveguide mount. The dimensions of this mount and of the tube are shown on the drawing overleaf. The tube can be supplied without the mount if desired.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	0·95 amp. (nom.)

RATINGS AND CHARACTERISTICS.

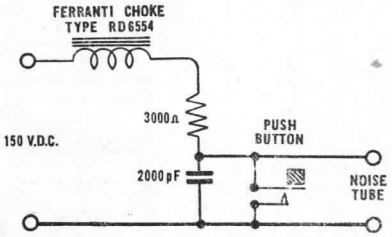
Striking Voltage	1150 volts.
*Normal Operating Voltage	50 volts.
Normal Operating Current	35 mA.
Max. Operating Current	50 mA.
Min. Series Resistance	3000 ohms.
†Available Noise Power	15·25±0·25 dB.
‡V.S.W.R. over band 9·375±350 Mc/s.	<1·25
Insertion loss of 'unstruck' tube on mount	<0·2 dB.

§Bandwidth : The wave guide mount is normally fitted with a three screw matching section which is tuned and locked to a centre frequency of 9375 Mc/s. at a V.S.W.R. of 1·01.

Waveguide Mount : The mount can be supplied with or without a built in dummy load as required.

OPERATION.

The striking voltage is 1,150 and the diagram below gives details of a circuit which enables the high striking voltage to be obtained from a low voltage supply. The push button which is normally open is depressed for a second or two and then released and the resulting high voltage transient is sufficient to strike the tube.



The noise output remains stable over long periods, but to ensure stability a resistor having a value of at least 3,000 ohms must be connected in series with the tube.

*at Ia=35 mA.

†The available noise power is referred to thermal noise at 17°C and does not include the image frequency contribution.

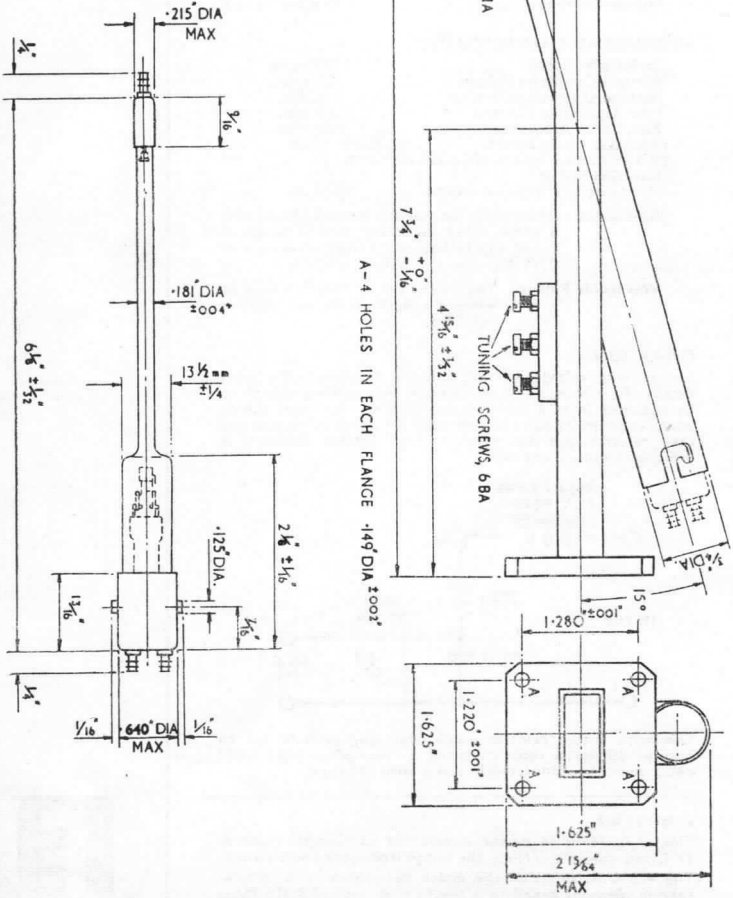
‡The V.S.W.R. refers to the match obtained with a 'struck' tube in a mount tuned to a centre frequency of 9,375 Mc/s. with the waveguide terminated by a matched load. At 9,375 Mc/s. the V.S.W.R. is 1·01.

§On request the waveguidemount can be supplied with unlocked tuning screws, so that the user can tune the mount to any desired centre frequency in the band 8,500 to 10,500 Mc/s.

Issue 2
July, 1958

FERRANTI

TE10



FERRANTI LIMITED, KINGS CROSS ROAD, DUNDEE.

Ferranti

KLYSTRON

A reflex Klystron designed for use as local oscillator in airborne applications. The very rugged construction and extreme frequency stability ensure reliability under the most severe environmental conditions.

PHYSICAL DATA.

Dimensions	See Drawings on Page 2.
Output Connection ...	Bolts to UG-39/U flange or UG4OA/U chokes for 1in. x 0·5in. x 0·05in. waveguide.
Mounting Position ...	Any.
Weight	6 oz. (180gm.) approx.
Base	Moulded with flying leads.
Top Cap	Moulded with flying lead.

COOLING.

Designed for cooling by conduction and free air circulation. Forced air cooling is not usually required but the Klystron body temperature should not be allowed to exceed 200°C.

HEATER.

Heater Voltage	6·3 volts.
Heater Current	1·2 ±10% amps.

FREQUENCY.

Operating Range	8500–9600 Mc/s.

TUNING.

The single screw tuner covers the frequency range in approximately 4½ turns. Clockwise rotation reduces the frequency. The average tuner torque is 35in./oz. (maximum –50in./oz.).

RATINGS.

Max. Heater Voltage	6·9 volts.
Min. Heater Voltage	5·7 volts.
Max. Resonator Voltage	350 volts.
Max. Resonator Current	55 mA.
Max. V_{h-k}	45 volts.
Max. Body Temperature	200°C.
Reflector Voltage (negative)	0–500 volts.

Issue 2.
Oct., 1959

Ferranti

Ferranti

CHARACTERISTICS AND TYPICAL OPERATION.

Frequency Range			8500–9600				Mc/s.
Heater Voltage			6·3				volts.
Load			Matched				
Resonator Voltage		250			300		volts.
Mode		$6\frac{3}{4}$			$5\frac{3}{4}$		
	Min.	Av.	Max.	Min.	Av.	Max.	
Reflector Voltage	−40	—	−120	−80	—	−200	volts.
Resonator Current	—	33	—	—	41	45	mA.
Reflector Current	—	—	5	—	—	5	μA.
Power Output ...	12	30	66	40	90	120	mW.
Electronic Tuning Range ...	30	45	—	20	40	—	Mc/s.
Modulation Sensitivity ...	1·0	3·0	—	·5	2·0	—	Mc/s / volt.
Temperature Coefficient	−100	−30	+50	−100	−30	+50	kc/s / °C.
Heater Voltage Coefficient ...	—	—	1·5	—	—	1·5	Mc/s / volt.
*Noise						$<3\times10^{-14}$	W / Mc/s / mW
†Tuner Resetting Accuracy (max. Δ F.)						1	Mc/s.
‡Tuner Side Thrust (max. Δ F.)						0·5	Mc/s.

Vibration.

The max. peak to peak frequency variation from vibration of 20–1000 c.p.s. at 10g is 0.2 Mc/s.

Shock.

The maximum frequency deviation due to shock of 150g. is 1·5 Mc/s.

NOTES ON OPERATION.

Mounting.

The klystron should be securely bolted to the mating waveguide flange. Normally the anode (tube body) is operated at earth potential ; when operated with the anode above earth potential suitable insulation should be provided between the tube and waveguide flanges.**

Application of Voltages.

It is important that the circuit in which a new klystron is being installed be thoroughly checked before the application of any voltages. Under no circumstances should the applied voltages exceed the maximum published ratings.

Reflector Voltage.

The Reflector must never be operated at a potential positive with respect to that of the cathode nor should its power supply be disconnected during the time the resonator voltage is applied. When the reflector voltage is modulated the magnitude of the modulating voltage must be limited to the extent necessary to prevent positive excursions of the reflector voltage. A protective diode connected directly between the reflector and the cathode can be used to prevent the reflector from becoming positive. The performance of this diode should be checked regularly as it will normally be operated at zero current drain, an operating condition which materially reduces the life.

Load.

For correct functioning of the tube the load should meet the following conditions.

(a) At the frequency of operation the load should present a VSWR of less than 1·2 to the tube.

(b) Over the frequency ranges : 7,800 to 8,500 Mc. and 9,600 to 10,500 Mc. the load should present a VSWR of less than 1·5 to the tube. Failure to meet condition (b) may result in the occurrence of spurious modes.

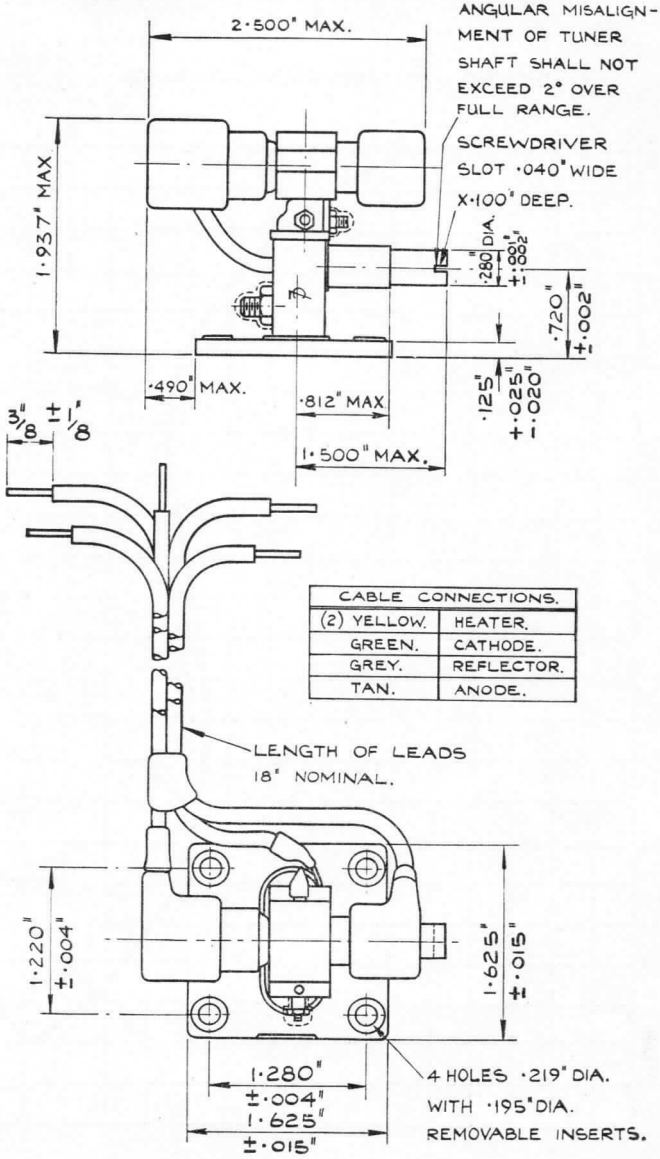
---

*The R.F. noise is the sum of the R.F. noise power in two channels 40 Mc/s. above and below the frequency of oscillation, compared to normal noise at 290°K. in the same channels.
The noise standard used in these measurements is a CV1881 discharge tube. The noise power is expressed as Watts per Mc/s. of I.F. band width per milliwatt of R.F. output power.

†Resetting accuracy defines the frequency deviation which can result from turning the tuner screw through approximately half a turn in either direction, then returning it to its original position.

‡The frequency deviation, caused by side thrust due to the application a ¼lb. weight to the top of the tuner spindle in each of two mutually perpendicular axes both of which are perpendicular to the spindle axis.

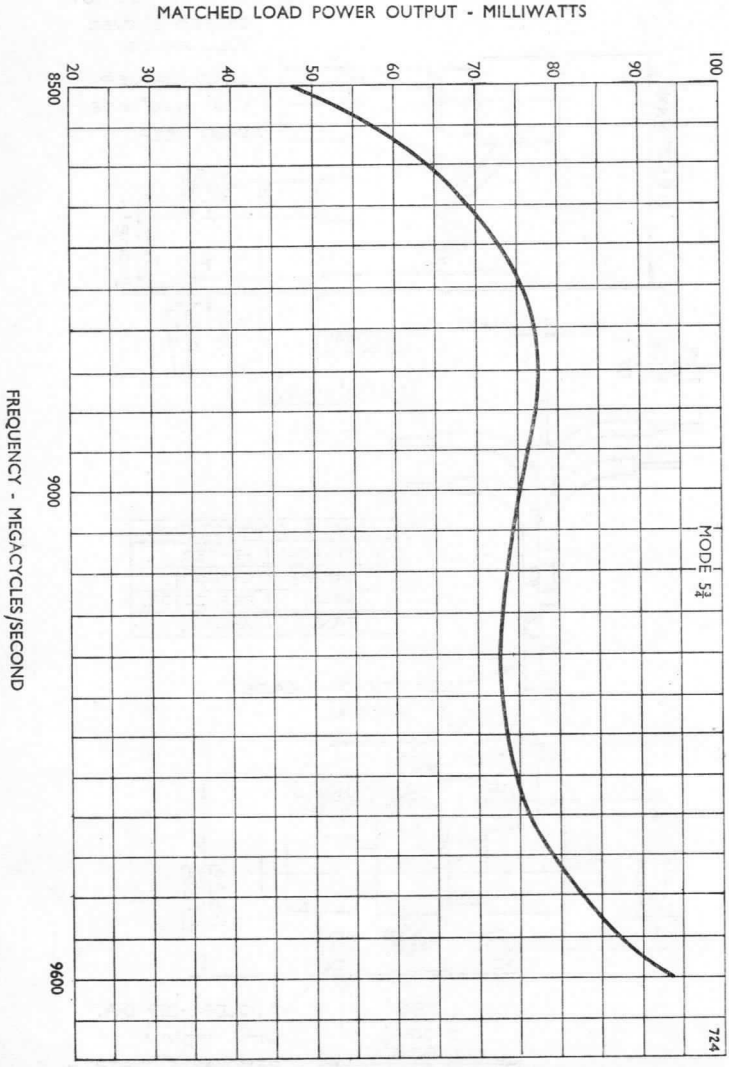
**To facilitate this the eyelets in the fixing bolt holes are removable.



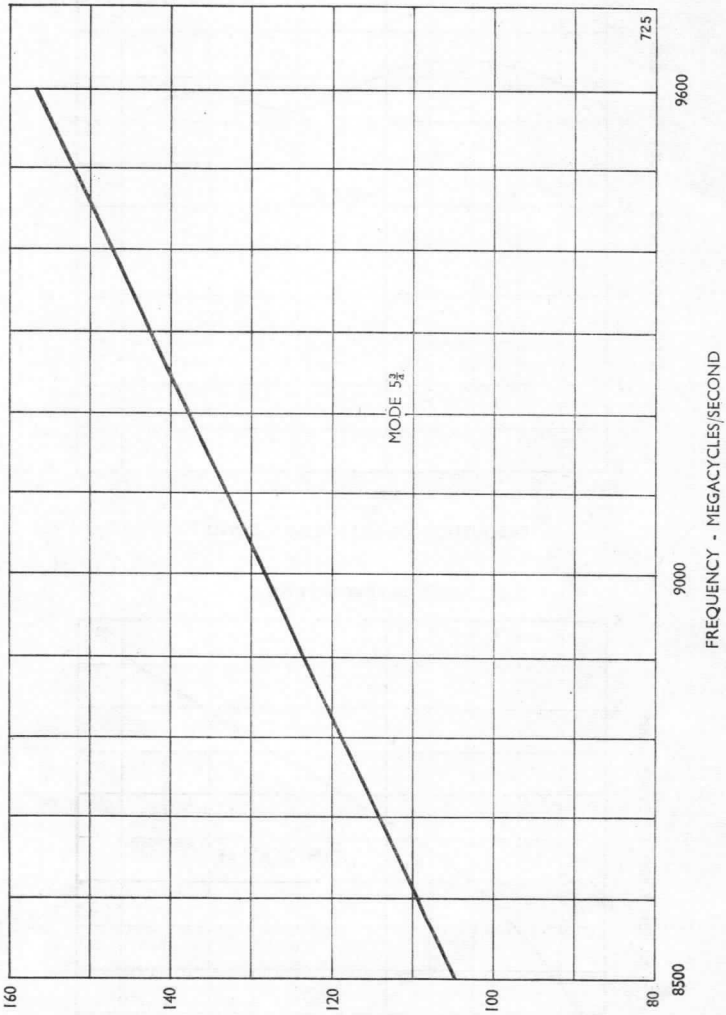
CABLE CONNECTIONS.	
(2) YELLOW.	HEATER.
GREEN.	CATHODE.
GREY.	REFLECTOR.
TAN.	ANODE.

Ferranti

POWER OUTPUT/FREQUENCY CHARACTERISTIC

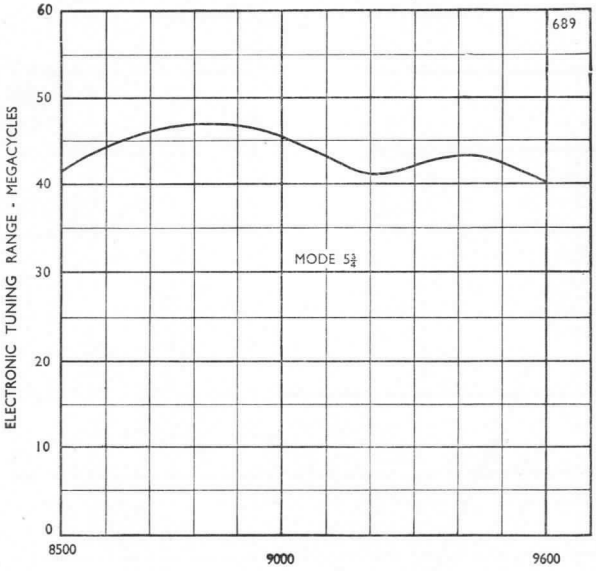


REFLECTOR VOLTS/FREQUENCY CHARACTERISTICS.
Reflector Voltage at Maximum Power Point.

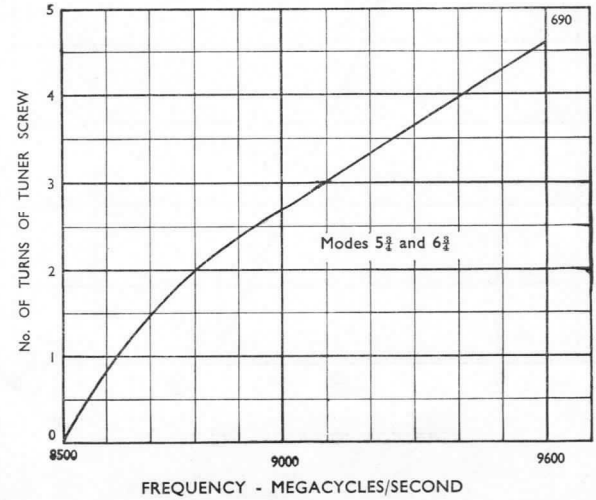


Ferranti

ELECTRONIC TUNING RANGES.



TUNER SCREW SETTING.



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

Ferranti

T.R. CELL

A broad band T.R. for operation in the frequency range 9180 Mc/s. to 10,000 Mc/s. May be used in branched duplexer or balanced duplexer systems. Specially developed for high reliability and long life.

PHYSICAL DATA.

Dimensions	See outline drawing overleaf.
Waveguide	W.G.16 (0·4" × 0·9").
Primer Terminals ...	CT1.
Mounting Position ...	Any.
Max. Waveguide Pressure	30 lbs./Sq. in.

FREQUENCY RANGE ... ... 9180 to 10,000 Mc/s.

RATINGS.

Max. Transmitter Line Power ...	200 kW.
Min. Transmitter Line Power	4 kW.
*Max. Primer Supply Voltage (Main & Aux.)	–1500 volts.
*Min Primer Supply Voltage (Main & Aux.)	–950 volts.
†Max. Main Primer Current	185 μA.
†Min. Main Primer Current	100 μA.
†Max. Aux. Primer Current	80 μA.
†Min. Aux. Primer Current	50 μA.
Ambient Temperature Range (Storage) ...	–40 to + 100°C.

CHARACTERISTICS.

	Average	Limit.	
Low Power Level.			
V.S.W.R. (9400–9800 Mc/s.)	1·14	1·2	
V.S.W.R. (9100–10,000 Mc/s.)	1·2	1·3	
‡Insertion Loss	0·5	0·8	dB.
High Power Level.			
Leakage at 200 kW. Peak:–			
Total Leakage Power ...	45	100	mW.
Spike Leakage Energy	0·16	0·3	ergs/pulse.
Primer Breakdown Power	150	250	mW.
Recovery Time (to –6dB Loss)	1	3	μSec
Arc Loss (at 4 kW.) ...		0·8	dB.
§Position of Min. V.S.W.	0·020	0·014 to 0·028	inches
Primer Characteristics.			
Primer Operating Voltage	210	180 to 280	volts.

OPERATING NOTES.

(1) For operation at a line power above 50 kW. a pre T.R. cell is recommended.

(2) A balanced mixer should be used wherever possible.

(3) To ensure rapid primer breakdown, the primer electrodes should be supplied from a negative voltage of at least 1,000 volts D.C.

(4) Suitable resistors should be connected in series with the electrodes to limit the current to between 100 and 185 microamperes for the main primer electrode and between 50 and 80 microamperes for the aux. primer. At least 1 megohm should be connected directly to each primer electrode terminal to prevent relaxation oscillations at the "keep alive".

(5) The maximum difference in electrical length between cells is 40 degrees.

*See "Operating Notes" (3).
†See "Operating Notes" (4).
‡With primer energised.
§Measured from input flange face.

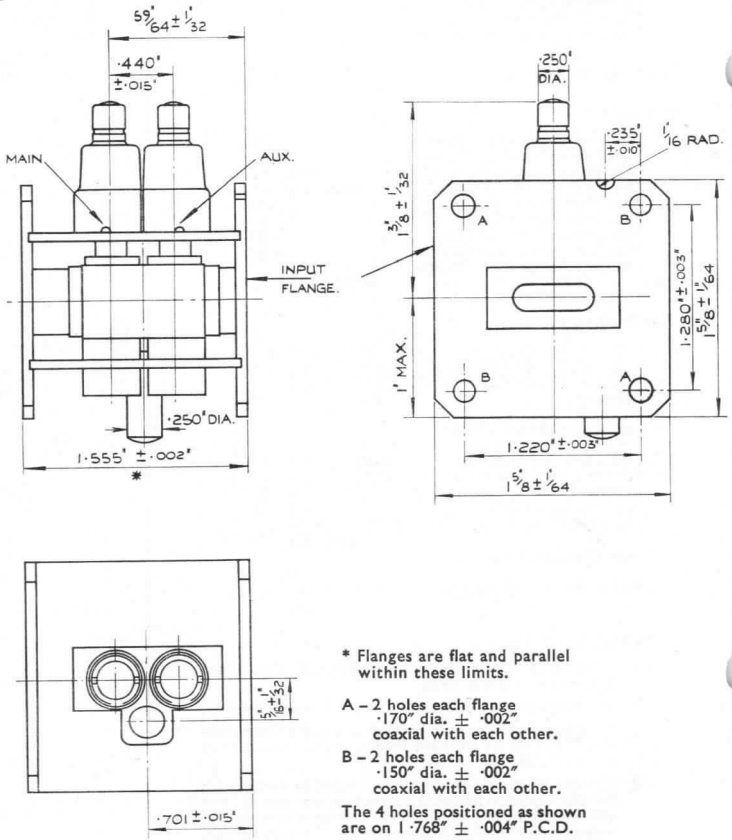
Issue 2.
June, 1960

Ferranti

WF42

Ferranti

1012



* Flanges are flat and parallel within these limits.

A – 2 holes each flange ·170" dia. ± ·002" coaxial with each other.

B – 2 holes each flange ·150" dia. ± ·002" coaxial with each other.

The 4 holes positioned as shown are on 1·768" ± ·004" P.C.D.

Ferranti

TR. CELL

A broad band T. R. Cell specially developed for high reliability and long life. Suitable for use in branched or balanced duplexer systems.

PHYSICAL DATA.

Dimensions	See outline drawing overleaf
Waveguide	W.G.16 (0·4″×0·9″).
Mounting Position ...	Any.
Max. Waveguide Pressure	30 lbs./sq. in.

FREQUENCY RANGE ... ... 8500 to 9300 Mc/s.

RATINGS.

Max. Transmitter Line Power ...	200 kW.
Min. Transmitter Line Power	4 kW.
*Max. Primer Supply Voltage (Main & Aux.)	−1500 volts.
*Min. Primer Supply Voltage (Main & Aux.)	−950 volts.
Max. Main Primer Current	185 μA.
Min. Main Primer Current	100 μA.
Max. Aux. Primer Current	80 μA.
Min. Aux. Primer Current	50 μA.
Ambient Temperature Range (Storage)	−40 to + 100°C.

CHARACTERISTICS.

	Average	Limit.	
†Low Power Level.			
V.S.W.R. (8500–9300 Mc/s.)	1·2	1·3	
‡Insertion Loss	0·5	0·8	dB.
§High Power Level.			
Leakage at 200 kW. Peak :–			
Total Leakage Power ...	45	100	mW.
Spike Leakage Energy ...	0·16	0·3	ergs/pulse
Primer Breakdown Power	150	250	mW.
Recovery Time (to –6dB loss)	1	3	μS.
Arc Loss (at 4 kW.) ...	—	0·8	dB.
**Position of Min. V.S.W.	0·020	0·021 ± ·007	ins.
Primer Operating Voltage...	210	180 to 280	volts.

OPERATING NOTES.

(1) For operation at a line power above 50 kW. a pre-TR. cell is recommended.

(2) A balanced mixer should be used wherever possible.

(3) The maximum difference in electrical length between cells is 40 degrees.

(4) To ensure rapid primer breakdown, the primer electrodes should be supplied from a negative voltage of 1000 volts D.C. Suitable resistors should be connected in series with the electrodes to limit the current to between 100 and 185 microamperes for the main primer electrode and between 50 and 80 microamperes for the aux. primer. At least 1 megohm should be connected directly to each primer electrode terminal to prevent relaxation oscillations at the "keep alive".

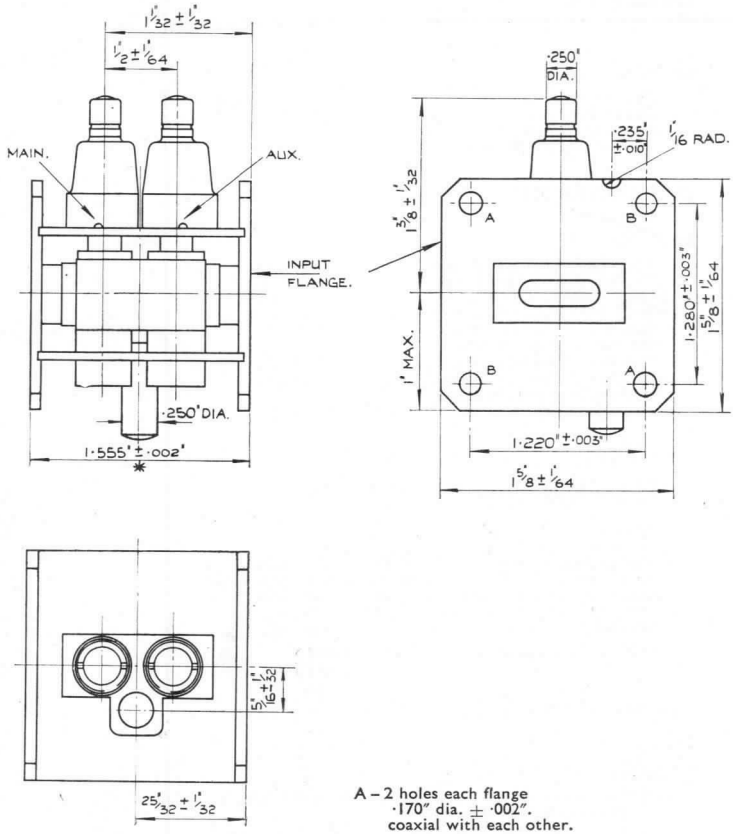
*See note (4) under "Operating Notes".
†Unfired Characteristics.
‡With primer energised.
§Fired Characteristics.
**Measured from input flange face.

Ferranti

Issue 3
Jan., 1961

WF43

1013



A – 2 holes each flange
·170″ dia. ± ·002″.
coaxial with each other.

B – 2 holes each flange
·150″ dia. ± ·002″
coaxial with each other.

The 4 holes positioned as shown
are on 1·768″ ± ·004″ P.C.D.

Ferranti

T.R. CELL

A broad band T.R. Cell with two keep-alive electrodes and suitable for pre-pulsing. May be used in branched duplexer or balanced duplexer systems.

PHYSICAL DATA.

Dimensions	See outline drawing overleaf
Waveguide	W.G.16 (0·4" × 0·9").
Primer Terminals ...	C.T.I.
Mounting Position ...	Any.
Max. Waveguide Pressure	30 lbs./Sq. in.

FREQUENCY RANGE ... ... 8500 to 10000 Mc/s.

RATINGS.

Max. Transmitter Line Power ...	200 kW.
Min. Transmitter Line Power	4 kW.
*Max. D.C. Primer Supply Voltage ...	−1500 volts.
*Min. D.C. Primer Supply Voltage ...	−950 volts.
*Max. D.C. Primer Current	185 μA.
*Min. D.C. Primer Current	100 μA.
†Max. Peak P.P. Primer Supply Voltage	−650 volts ± 10%.
†Max. P.P. Primer Current	10 mA.
Ambient Temperature Range (not operating)	−40 to + 100°C.

CHARACTERISTICS.

	Limit.
Low Power Level	
V.S.W.R. (8500–8850 Mc/s.)	1·4
V.S.W.R. (8850–9850 Mc/s.)	1·25
V.S.W.R. (9850–10000 Mc/s.) ...	1·3
§Insertion Loss	1·0 dB.
High Power Level.	
Leakage at 200 kW. peak :–	
Total Leakage Power (unpulsed) ...	100 mW.
Spike Leakage Energy (unpulsed) ...	0·3 ergs/pulse.
Spike Leakage Energy (pulsed) ...	0·1 ergs/pulse.
Primer Breakdown Power	250 mW.
Recovery Time (to −6dB)	3 μsec.
Arc Loss (at 4 kW.)	0·8 dB.
‡Position of Min. V.S.W.	... 0·014 to 0·028 ins.
Primer Characteristics.	
D.C. Primer Operating Voltage	180 to 280 volts.

OPERATING NOTES.

(1) For operation at a line power above 50 kW. a pre T.R. cell is recommended.

(2) A balanced mixer should be used wherever possible.

(3) There are two primer electrodes, one of which is designed to operate as a pulsed electrode and is marked P.P. The other is D.C. primed and is marked D.C.

(4) The leading edge of the pre-pulse must precede the main R.F. pulse by 0·2/μsecs. and should be applied to the pre-pulse electrode through a 50 KΩ resistor which must be immediately adjacent to the pre-pulse terminal.
Pre-pulse Characteristics.
Peak amplitude : 650 V. ± 10%. Duration : 2/μsecs.

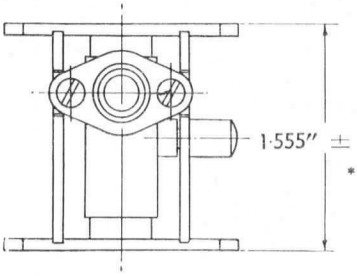
(5) The D.C. Primer Electrode should be supplied from a negative potential Source of 1000 volts D.C. minimum. Suitable resistors should be used to limit the electrode current to between 100 and 185 microamperes At least one megohm must be placed immediately adjacent to the electrode terminal to prevent relaxation oscillations.

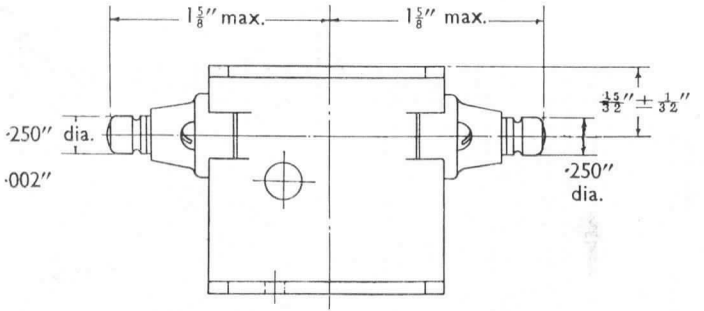
(6) The maximum difference in electrical length between cells is 40°.

*See "Operating Notes" (3) and (5).
†See "Operating Notes" (3) and (4).
§With Primer energised.
‡Measured from input flange face.

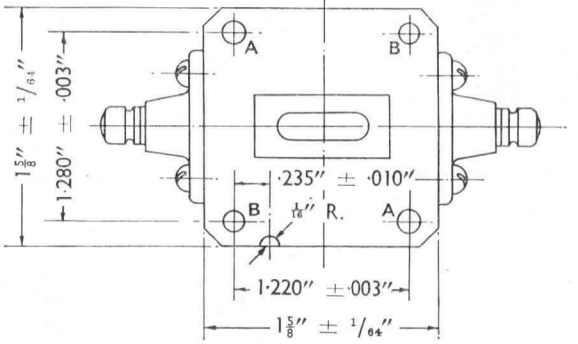
Issue 2
June, 1960

Ferranti





A. 2 holes in each flange: ·170″ dia. ± ·002″ coaxial to each other
B. 2 holes in each flange: ·150″ dia. ± ·002″ coaxial to each other
are positioned as shown and are on 1·768″ ± ·004 P.C.D.



* Flanges are flat and parallel within these limits

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WF44

FERRANTI LTD., KINGS CROSS ROAD, DUNDEE.

Ferranti

T.R. CELL

A broad band T.R. self-operating in the frequency range 8490 Mc/s. to 9578 Mc/s. May be used in branched duplexer or balanced duplexer systems.
It is equivalent to the American type 1B63A.

PHYSICAL DATA.

Dimensions	... ...	See outline drawing overleaf.
Waveguide	... ...	W.G.16 (0·4″ × 0·9″).
Mounting Position	...	Any.
Max. Waveguide Pressure		30 lbs./Sq. in.

FREQUENCY RANGE ... 8490 to 9578 Mc/s.

RATINGS.

Max. Transmitter Line Power	...	200 kW.
Min. Transmitter Line Power	... ...	4 kW.
*Max. Primer Supply Voltage	... ...	−1500 volts.
*Min. Primer Supply Voltage	... ...	−650 volts.
†Max. Primer Current	... ...	180 μA.
†Min. Primer Current	... ...	100 μA.
Ambient Temperature Range (Storage)	... ...	−40 to + 100 °C.

‡CHARACTERISTICS.

Low Power Level.

V.S.W.R. (8565–9487 Mc/s.)	... ...	1·4
V.S.W.R. (8490–9578 Mc/s.)	... ...	1·9
§Insertion Loss	... ...	0·9 dB.

High Power Level.

Leakage at 200 kW. peak :–

Total Leakage Power	... ...	70 mW.
Spike Leakage Energy	... ...	0·2 ergs/pulse
Primer Breakdown Power	... ...	250 mW.
Recovery Time (to −6dB. loss)	...	4 μsec.
Arc Loss (at 4 kW.)	... ...	0·8 dB.
**Position of Min. V.S.W.	0·058″ to 0·072″	

Primer Characteristics.

Primer Operating Voltage ... 200 to 375 volts.

OPERATING NOTES.

(1) For operation at a line power above 50 kW. a pre T.R. cell is recommended.

(2) To ensure rapid primer breakdown, the electrode should be supplied from a negative voltage of 1000 volts D.C.

(3) A suitable resistor should be connected in series with the electrode to limit the current to between 100 and 180 microamperes. At least 1 megohm should be connected directly to the primer electrode terminal to prevent relaxation oscillations at the "keep alive".

(4) A balanced mixer should be used wherever possible.

*See "Operating Notes" (above) Note (2).
†See "Operating Notes" (above) Note (3).
‡The figures quoted are "limit" figures.
§With primer energised.
**Measured from input flange face.

Ferranti

Issue 2.
Nov. 1959

Ferranti

WF45

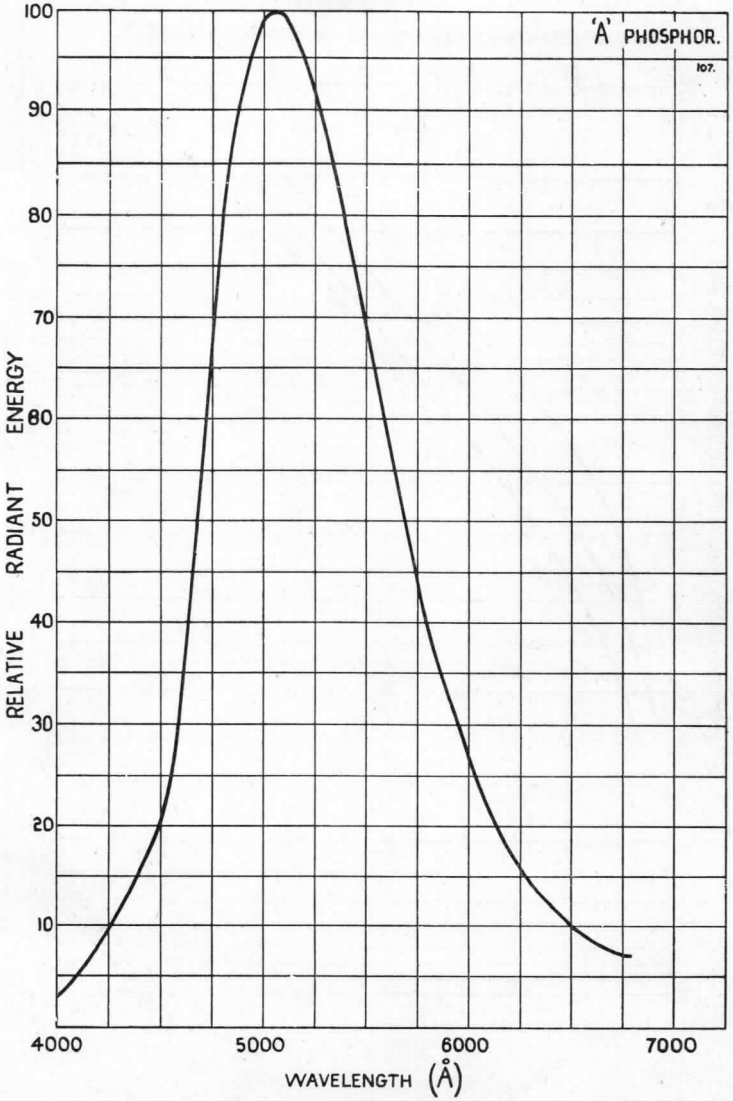
CATHODE RAY TUBES.

Ferranti

CATHODE RAY TUBE

SCREEN TYPE "A"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



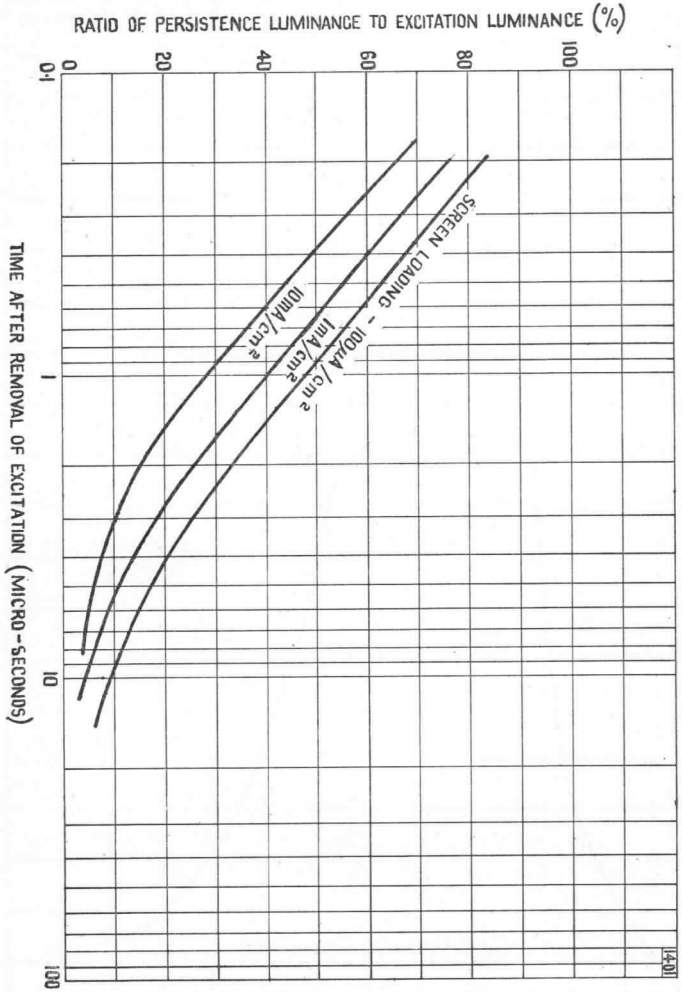
THIS PHOSPHOR IS EQUIVALENT TO U.S.A. PHOSPHOR TYPE P24

Issue 3.
Apr., 1963

Ferranti

SCREEN TYPE "A"

PERSISTENCE CHARACTERISTIC

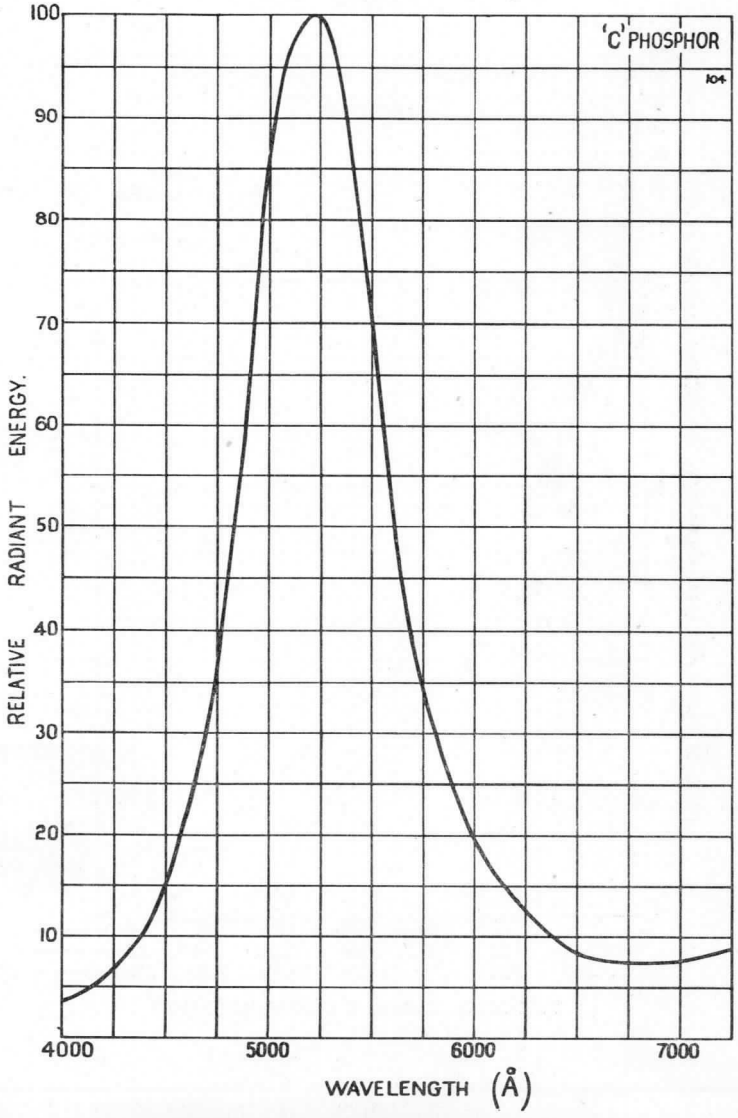


Ferranti

CATHODE RAY TUBE

SCREEN TYPE "C"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC

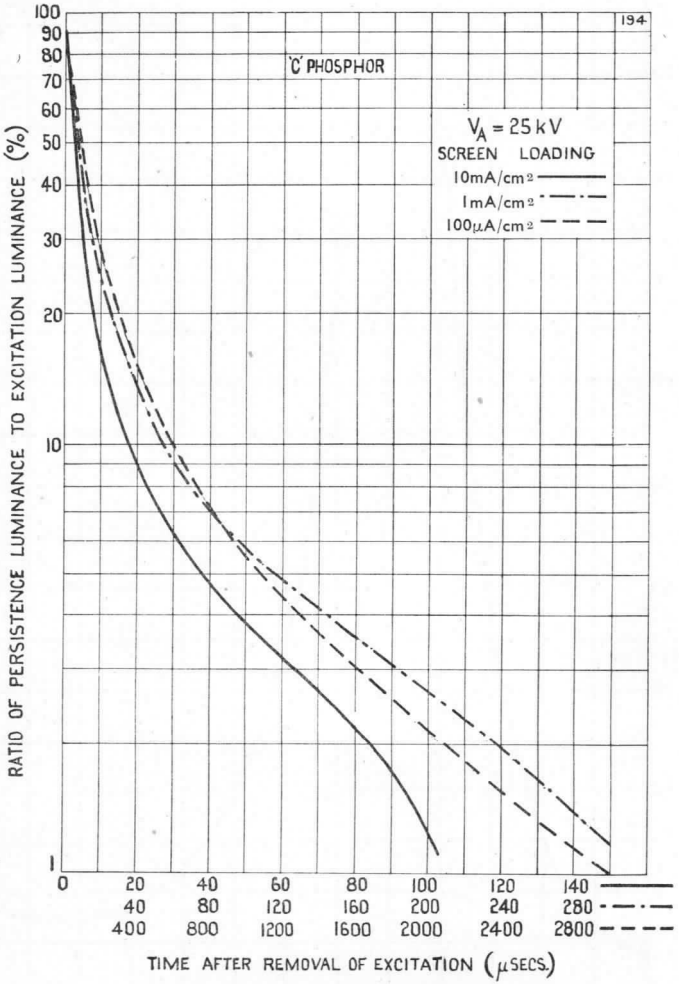


Issue 3.
Aug., 1962

Ferranti

SCREEN TYPE "C"

PERSISTENCE CHARACTERISTIC



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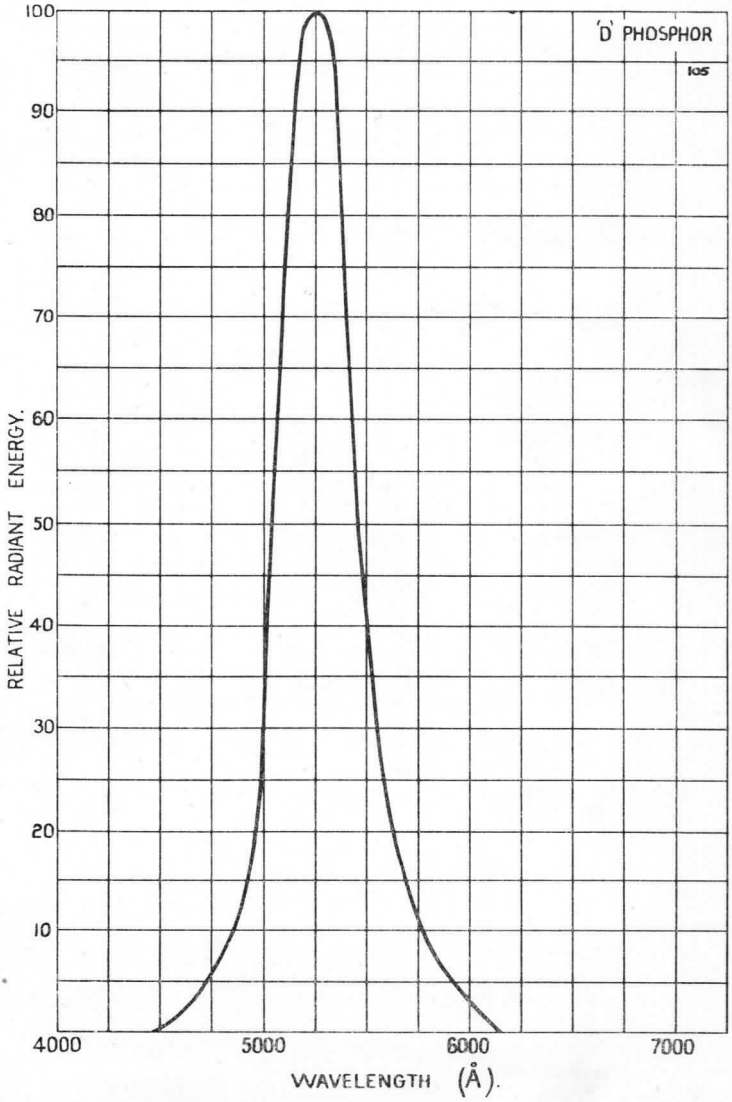
CATHODE RAY TUBE

SCREEN TYPE "D"

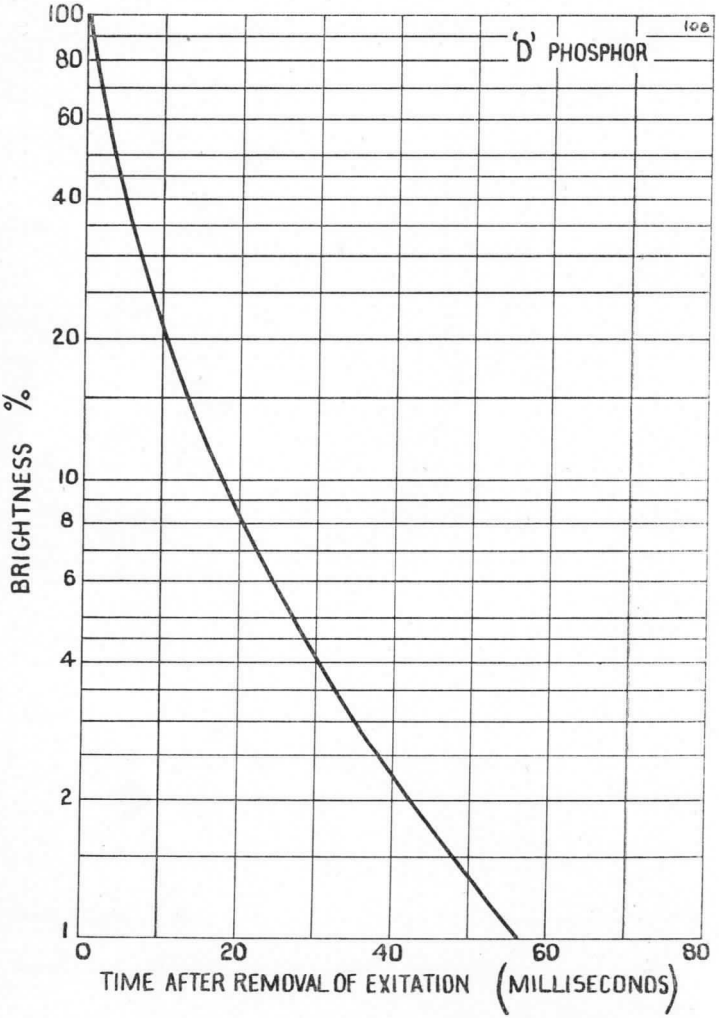
RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



Issue 1
Oct. 1956

SCREEN TYPE "D"

PERSISTENCE CHARACTERISTIC



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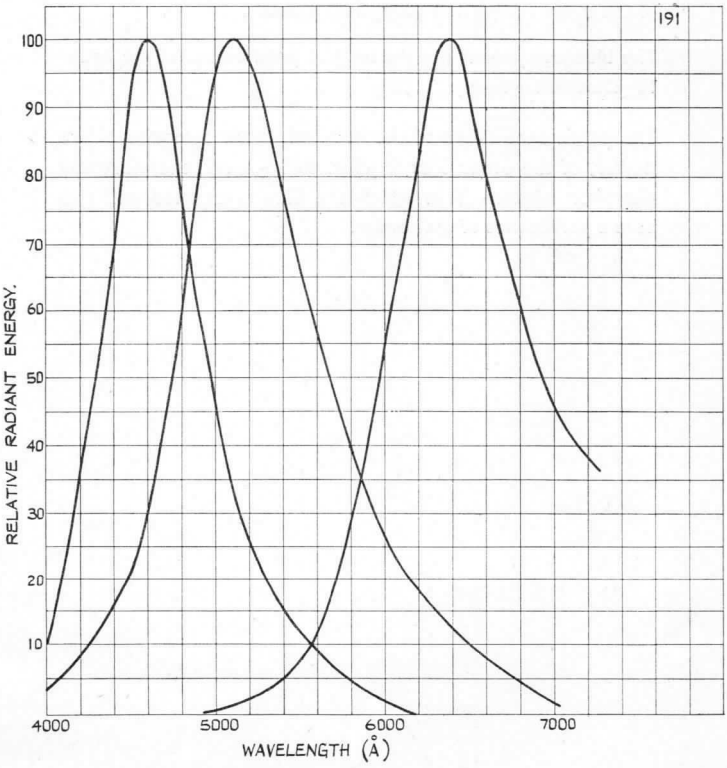
CATHODE RAY TUBES

SCREEN TYPE "E"

SPECTRAL ENERGY EMISSION CHARACTERISTIC

This is a three component screen. The relative spectral emission for each component phosphor is shown. The three curves show the relative radiant energy as a percentage of the total energy for each individual phosphor, but they are not related quantitatively.

The ratios of the three components can be varied to suit customer requirement, (for some applications the blue component can be omitted).



Issue 1.
July, 1962

Ferranti

SCREEN TYPE "E"

PERSISTENCE CHARACTERISTIC

The persistence characteristic depends on the relative amounts of the three component phosphors present.

The blue component has the longest persistence (of the order 10 μSec. to $1/E$ level).

The persistence times of the red and green components are similar, of the order 1 or 2 μSec. to $1/E$ level; therefore any phosphor mixture from which the blue is omitted will also have a persistence of that order.

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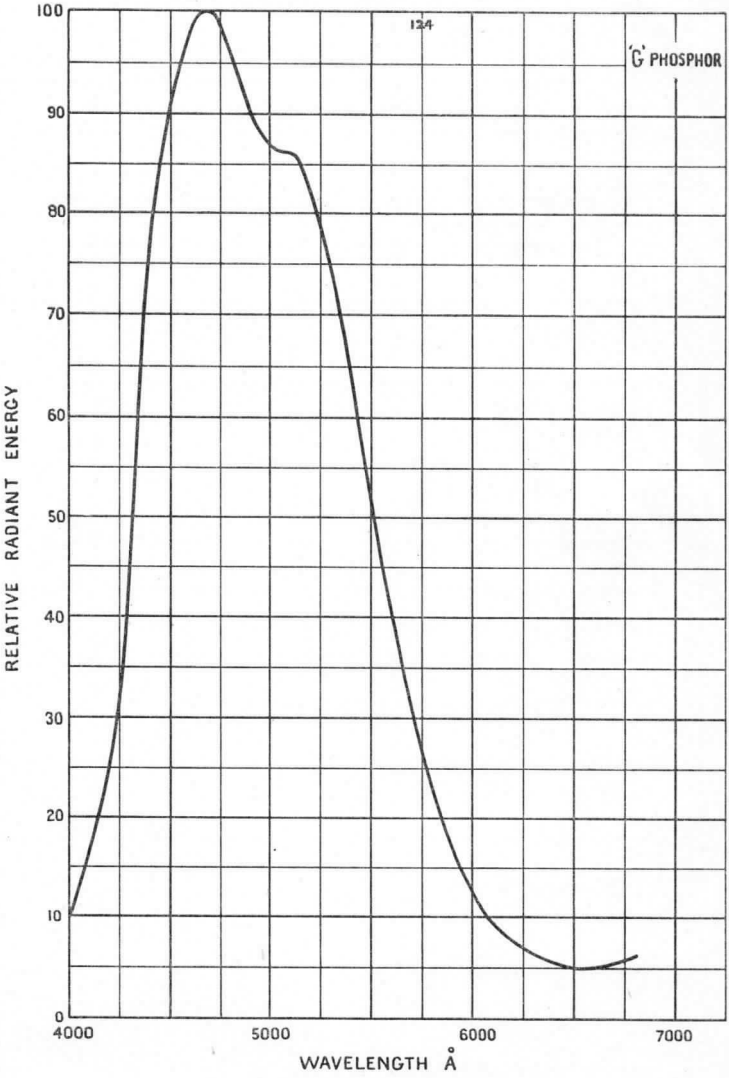
CATHODE RAY TUBE

SCREEN TYPE "G"

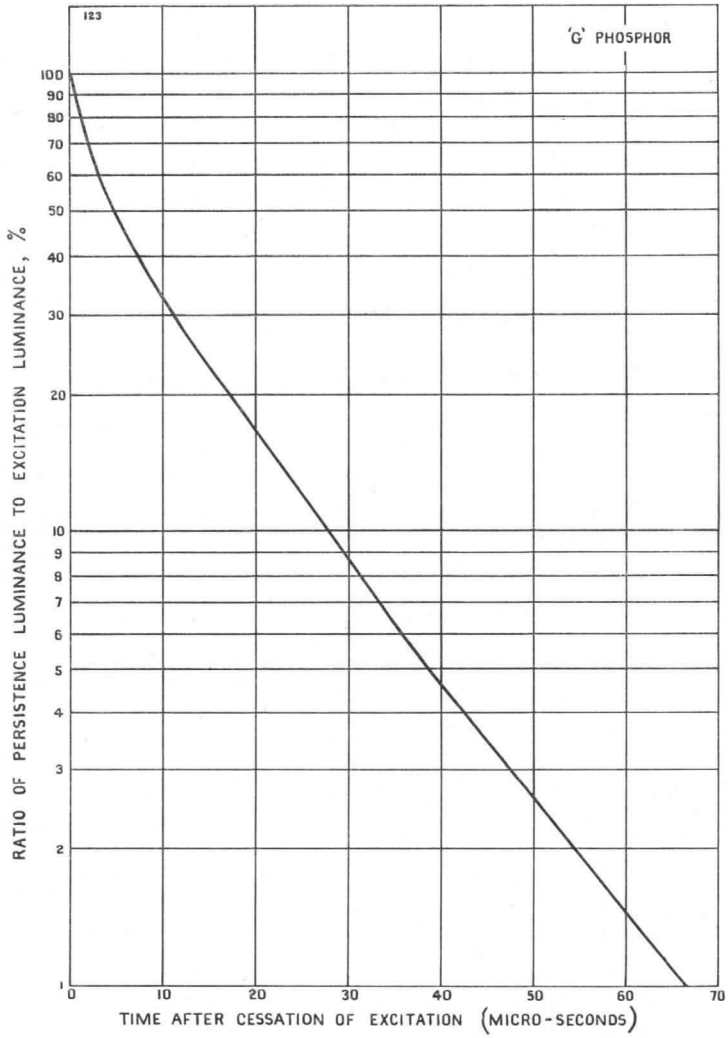
RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



Issue 1.
Aug. 1957

SCREEN TYPE "G"

PERSISTENCE CHARACTERISTIC



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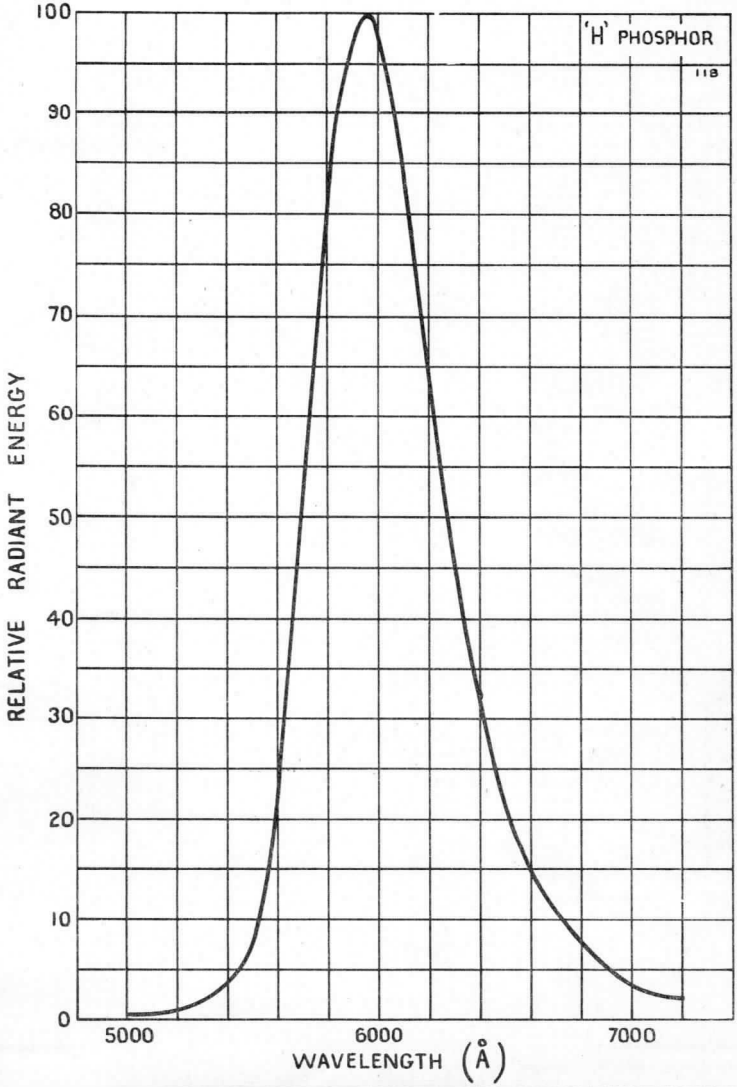
CATHODE RAY TUBE

SCREEN TYPE "H"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



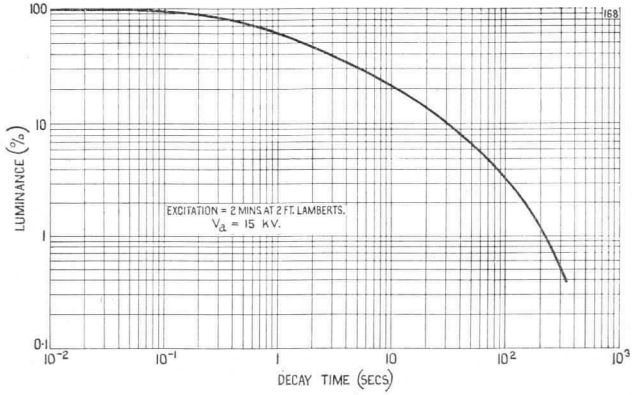
Issue 2
Feb., 1962.

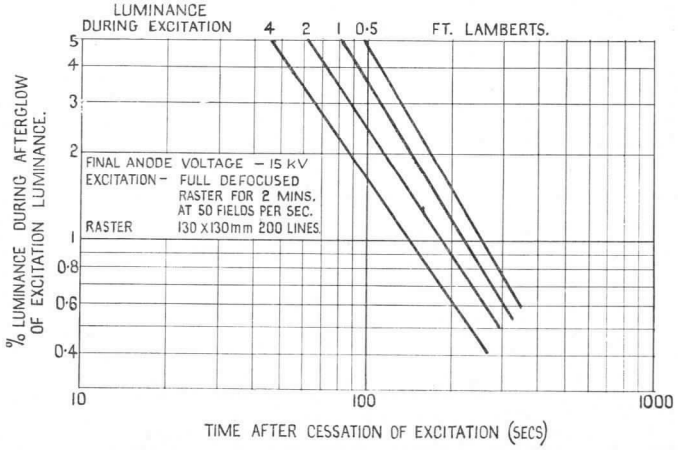
Ferranti

SCREEN TYPE "H"

PERSISTENCE CHARACTERISTIC

AFTERGLOW CHARACTERISTICS OF TYPE H (ALUMINISED) AT 20°C





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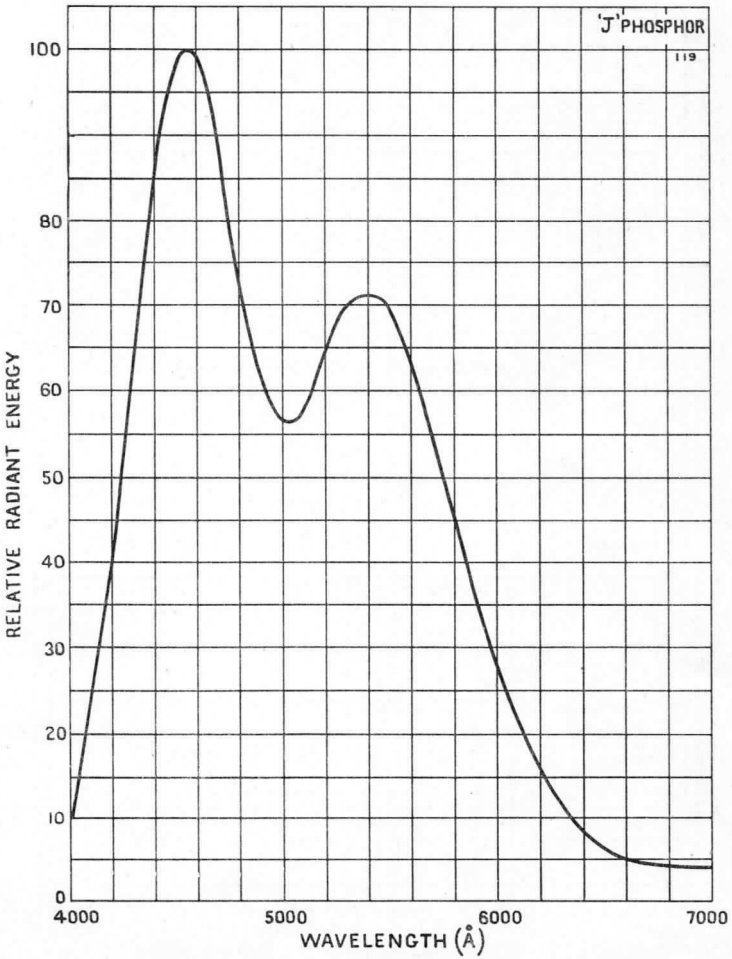
CATHODE RAY TUBE

SCREEN TYPE "J"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

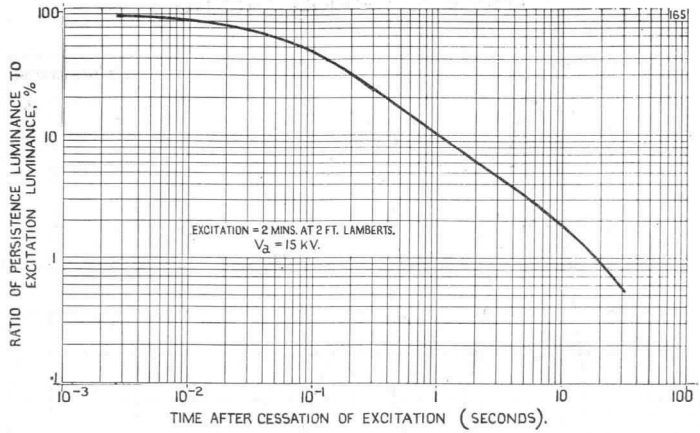


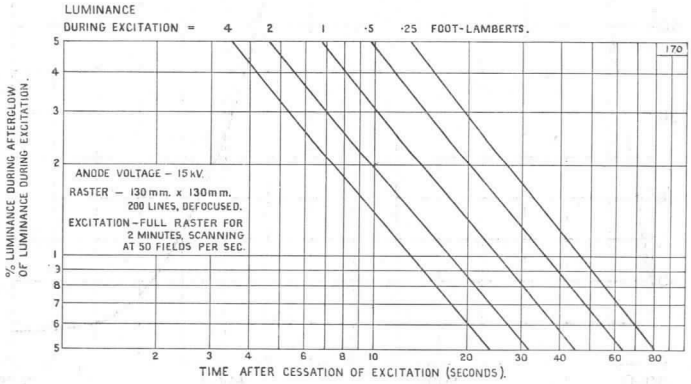
Issue 2
Jan. 1962

Ferranti

SCREEN TYPE "J"

PERSISTENCE CHARACTERISTICS





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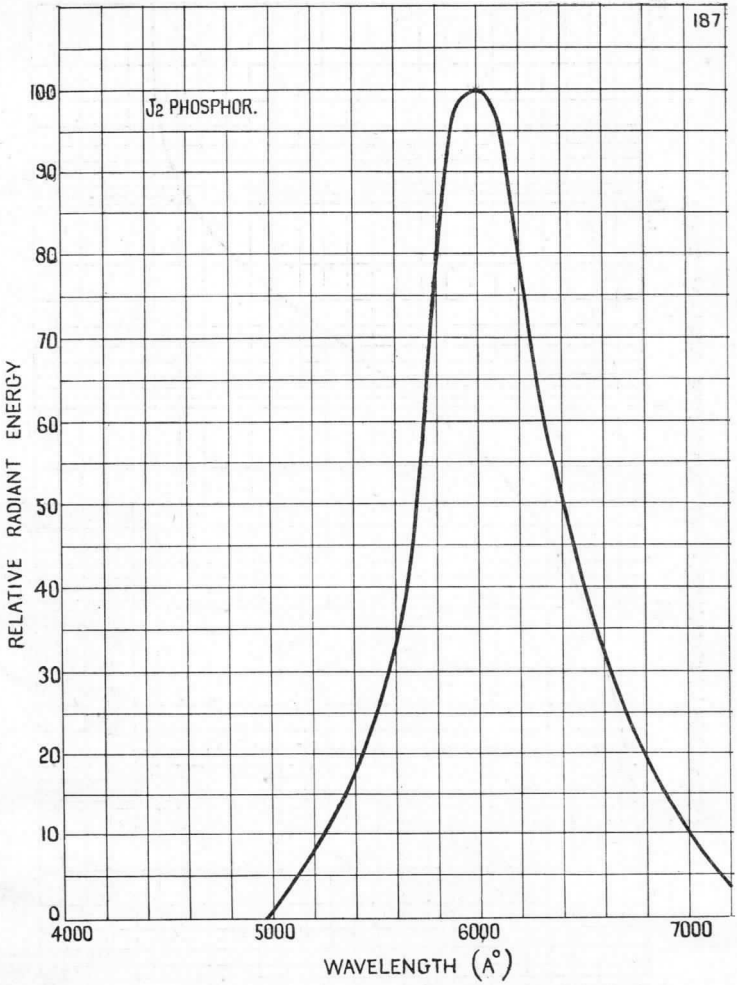
CATHODE RAY TUBES

SCREEN TYPE "J_2"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

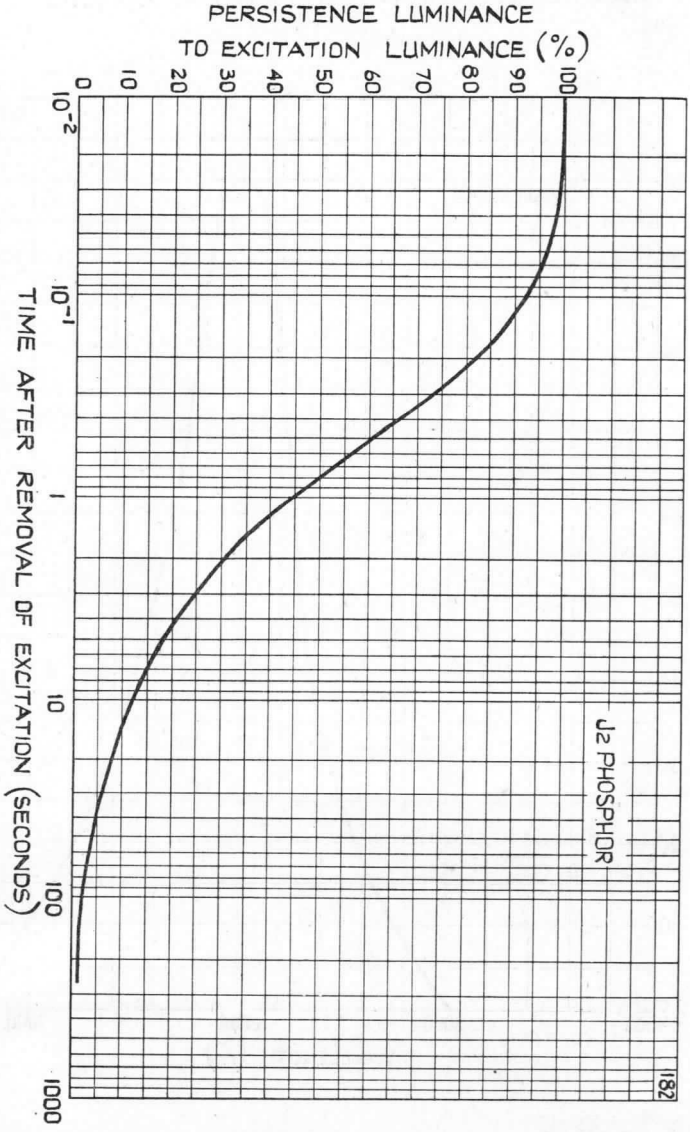


Issue 1
June, 1962

Ferranti

SCREEN TYPE "J_2"

PERSISTENCE CHARACTERISTIC



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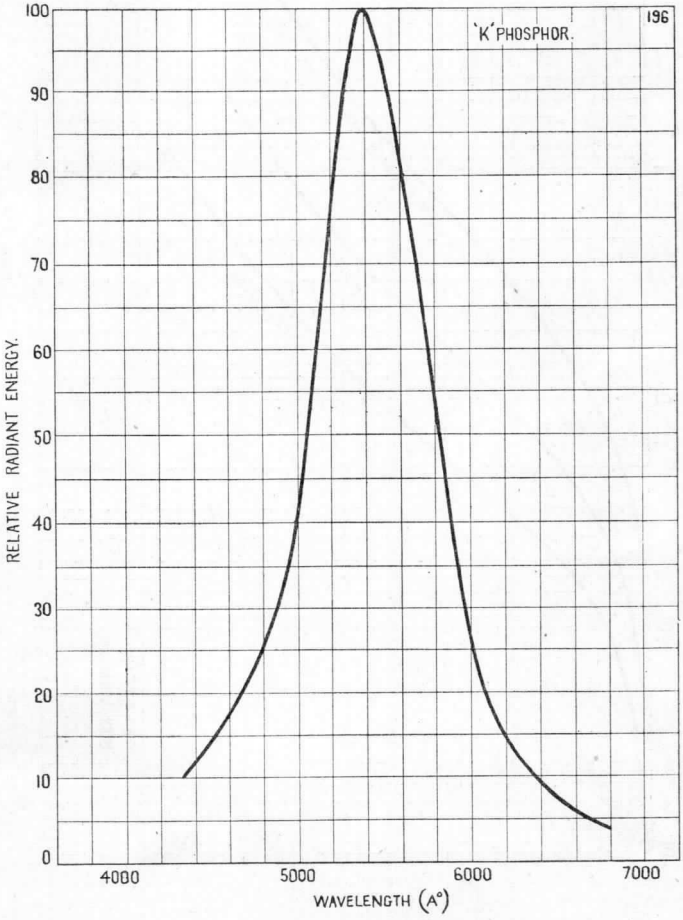
CATHODE RAY TUBE

SCREEN TYPE "K"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

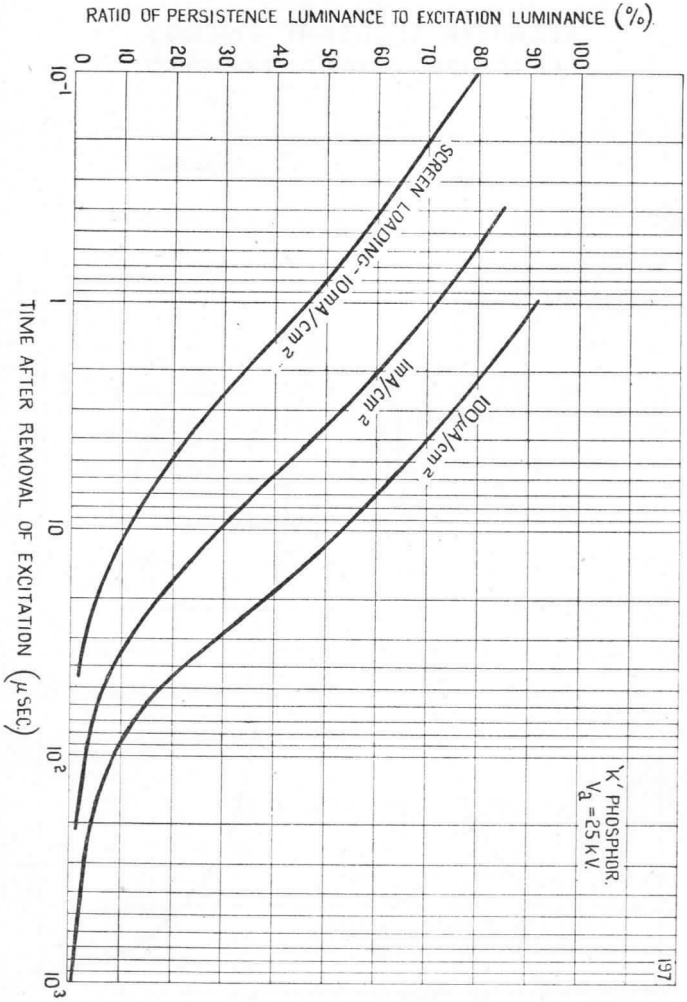


Issue 2.
Feb. 1963

Ferranti

SCREEN TYPE "K"

PERSISTENCE CHARACTERISTIC



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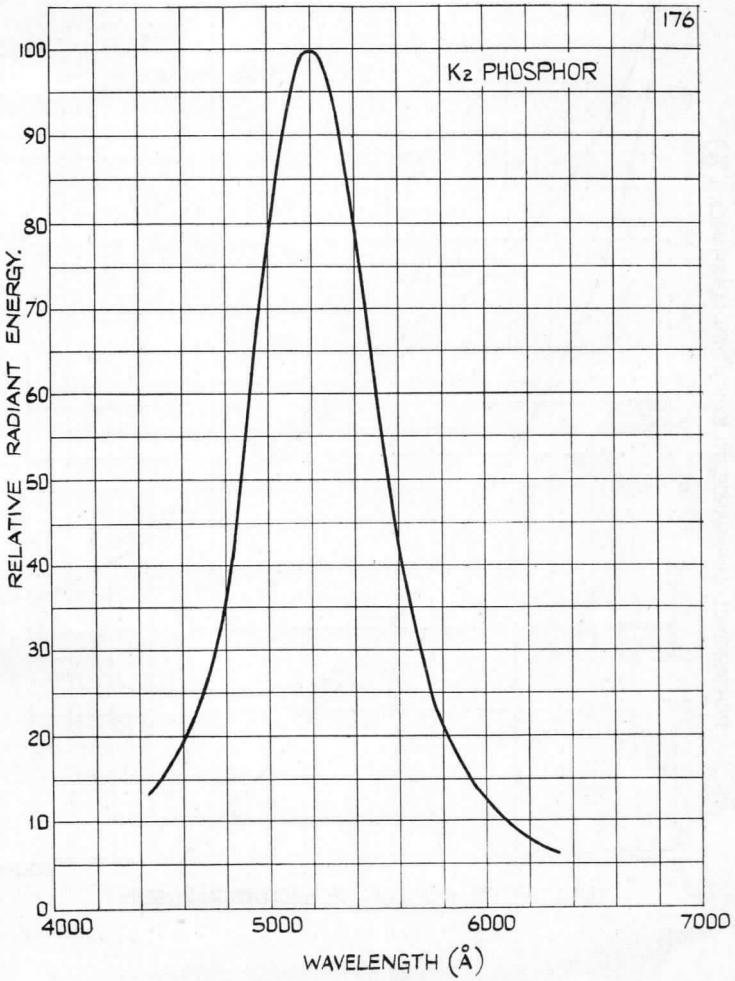
CATHODE RAY TUBE

SCREEN TYPE "K2"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

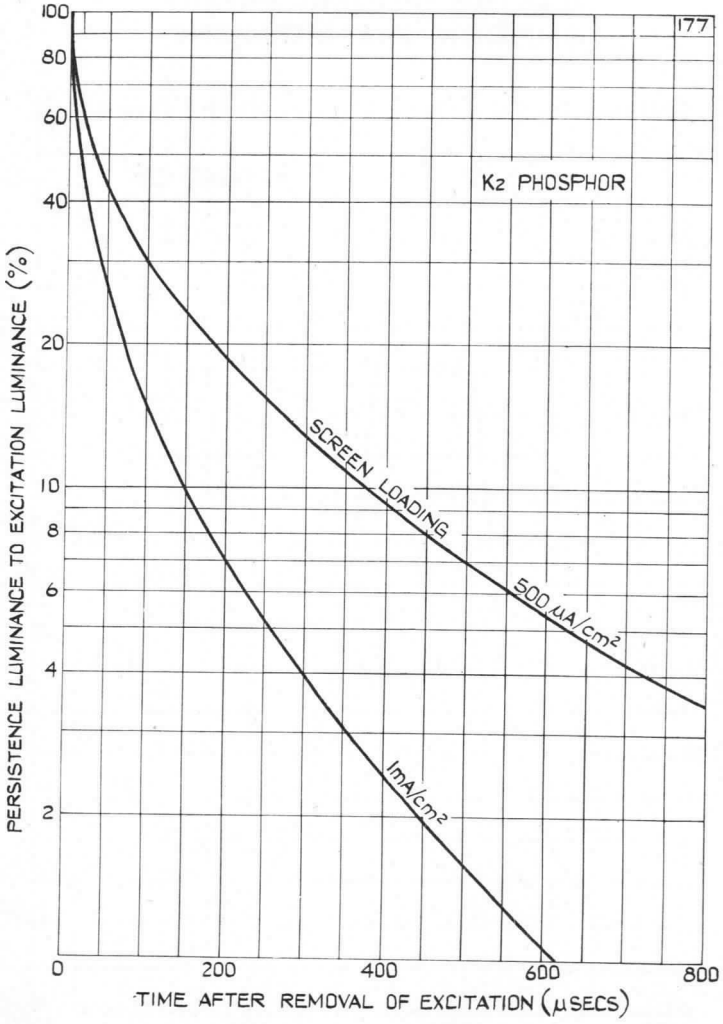


Issue 2
May, 1962

Ferranti

SCREEN TYPE "K2"

PERSISTENCE CHARACTERISTIC



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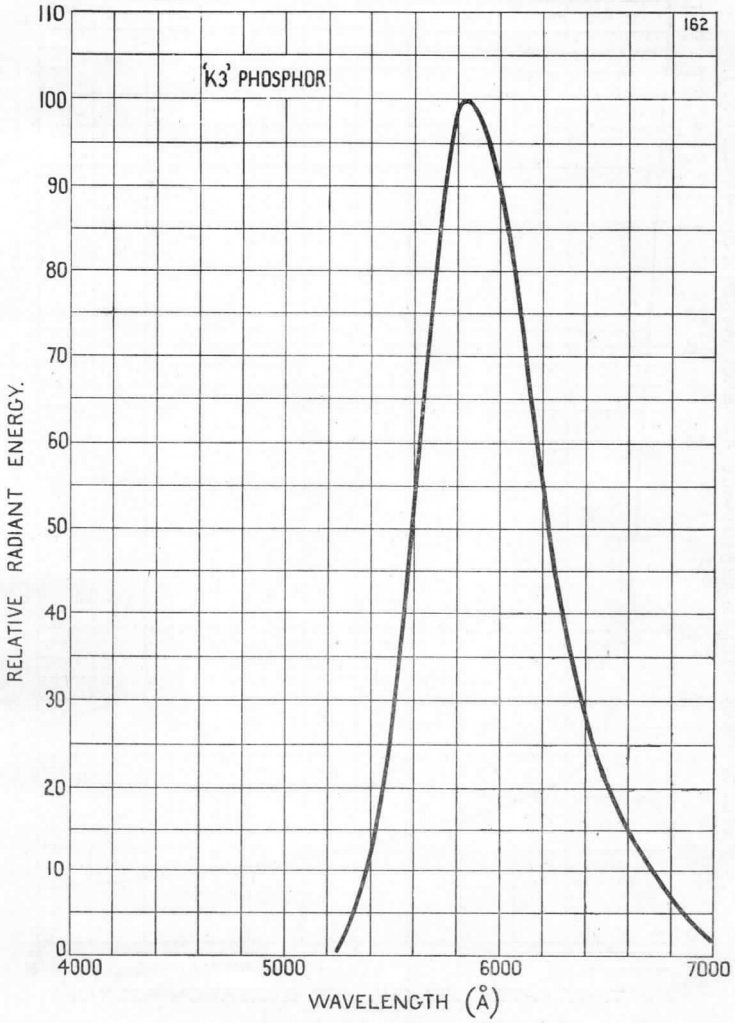
CATHODE RAY TUBE
SCREEN TYPE "K3"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



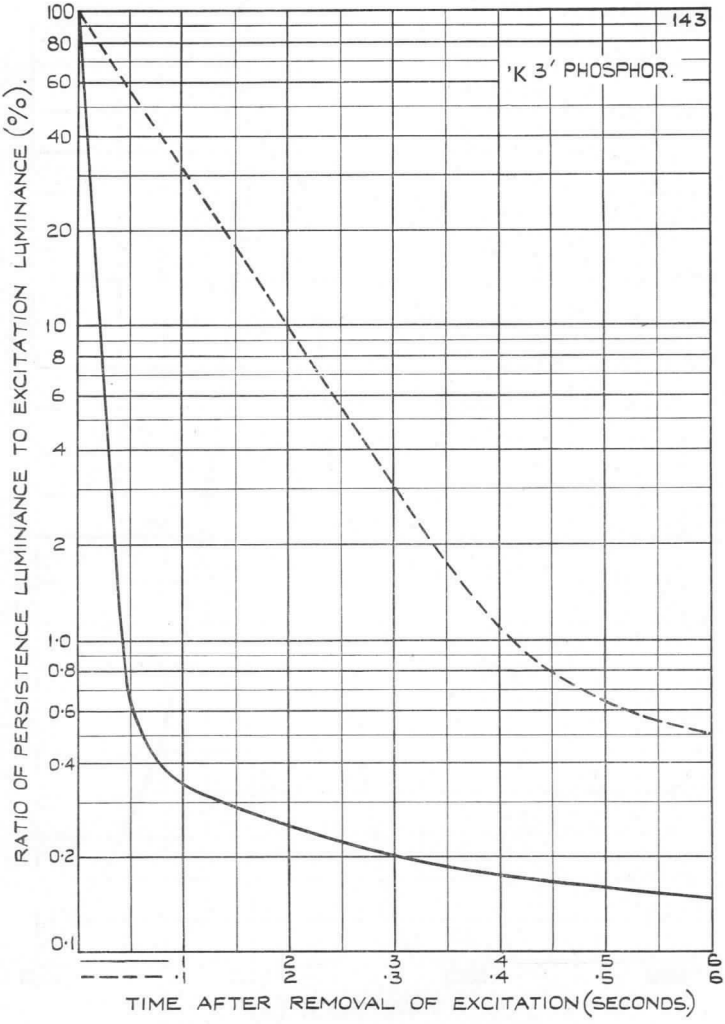
THIS PHOSPHOR IS EQUIVALENT TO U.S.A. PHOSPHOR TYPE P12.

Issue 2
Aug. 1961

Ferranti

SCREEN TYPE "K3"

PERSISTENCE CHARACTERISTIC



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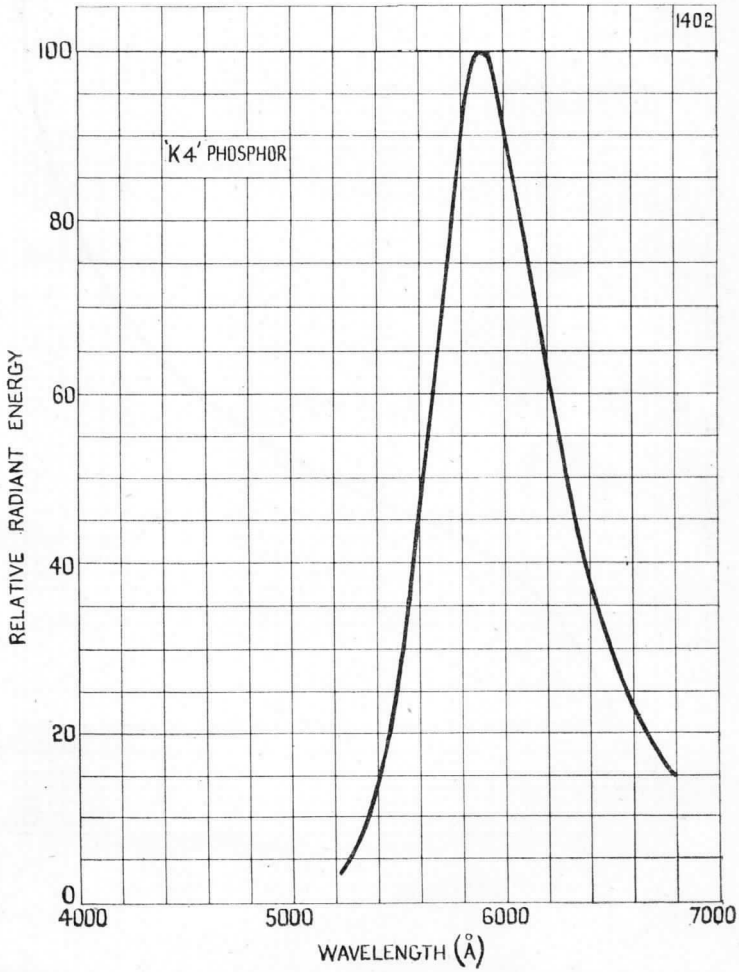
CATHODE RAY TUBE

SCREEN TYPE "K4"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

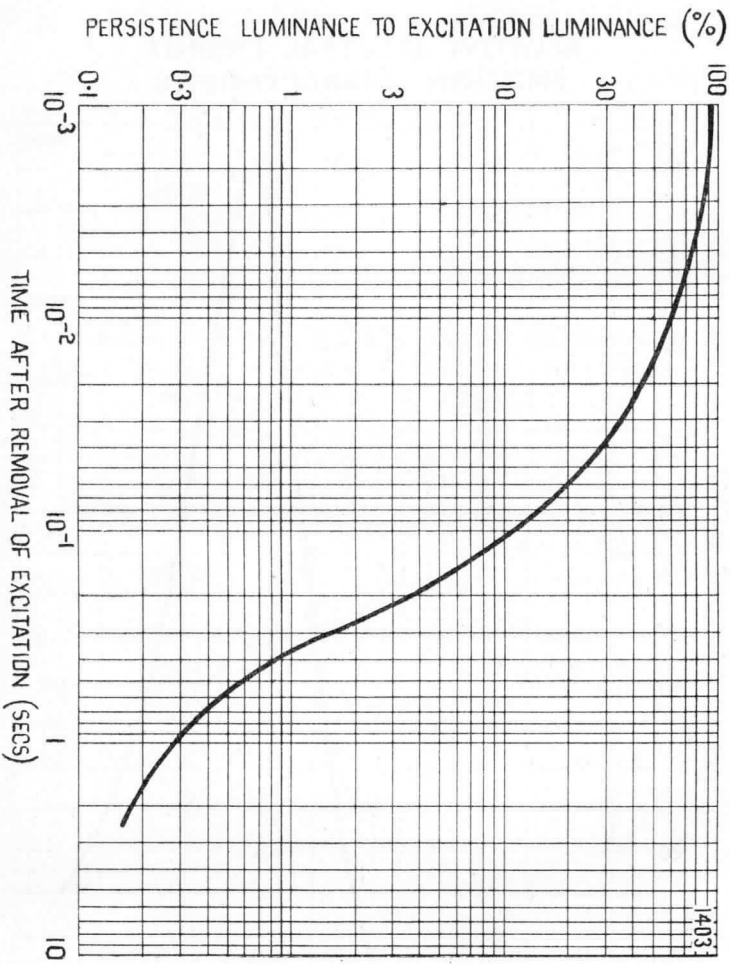


Issue 1.
May, 1963

Ferranti

SCREEN TYPE "K4"

PERSISTENCE CHARACTERISTIC

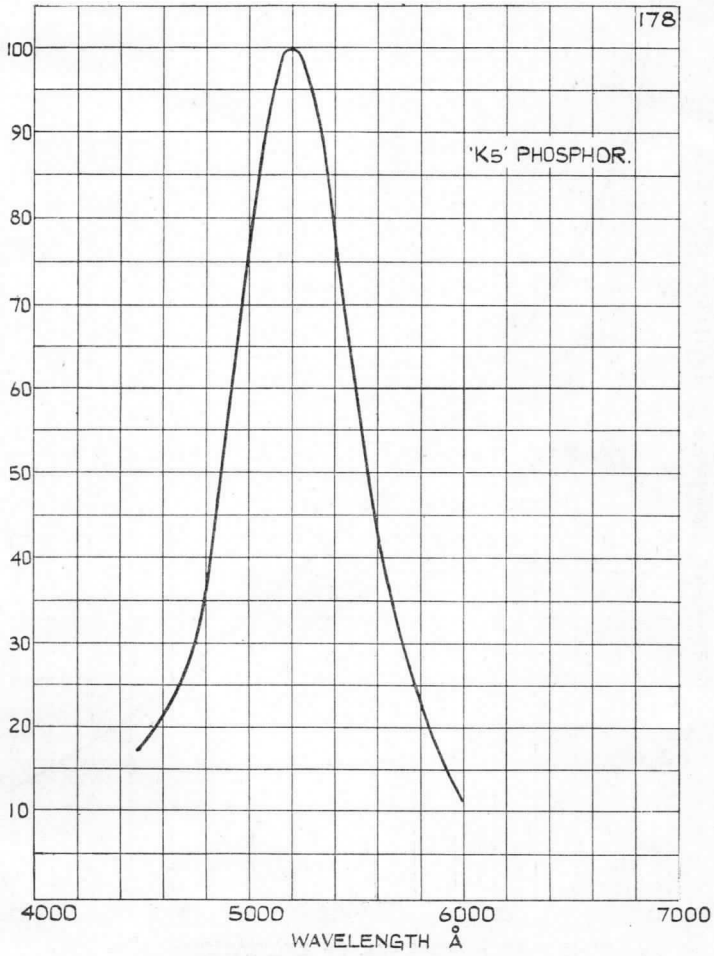


Ferranti

CATHODE RAY TUBE

SCREEN TYPE 'K5'

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

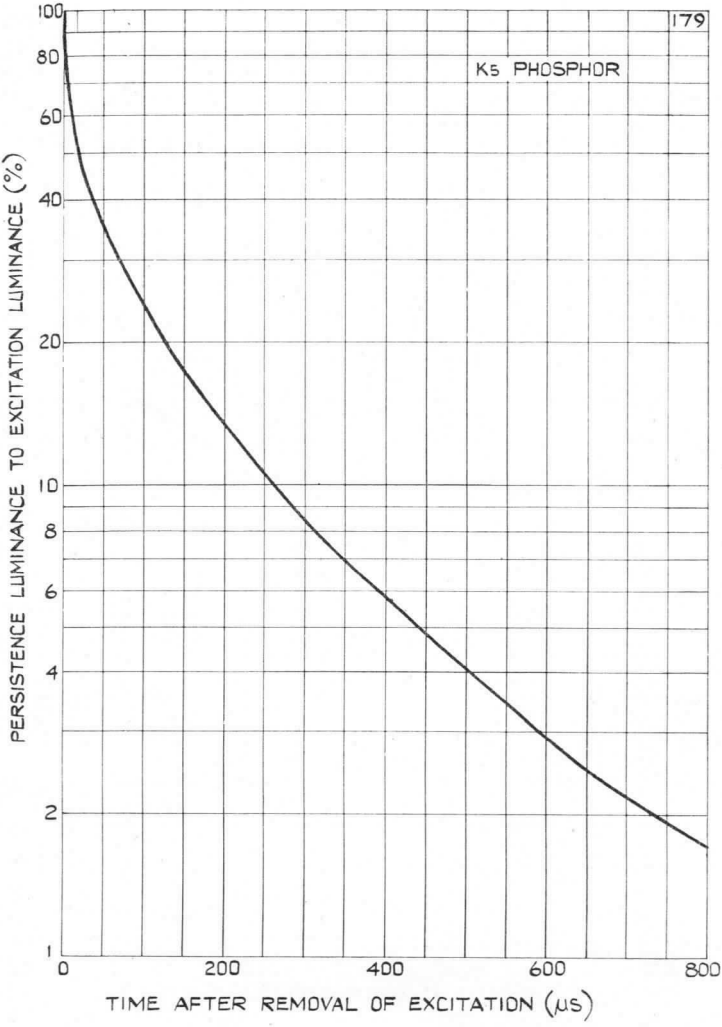


Issue 1
June 1962

Ferranti

SCREEN TYPE 'K5'

PERSISTENCE CHARACTERISTIC

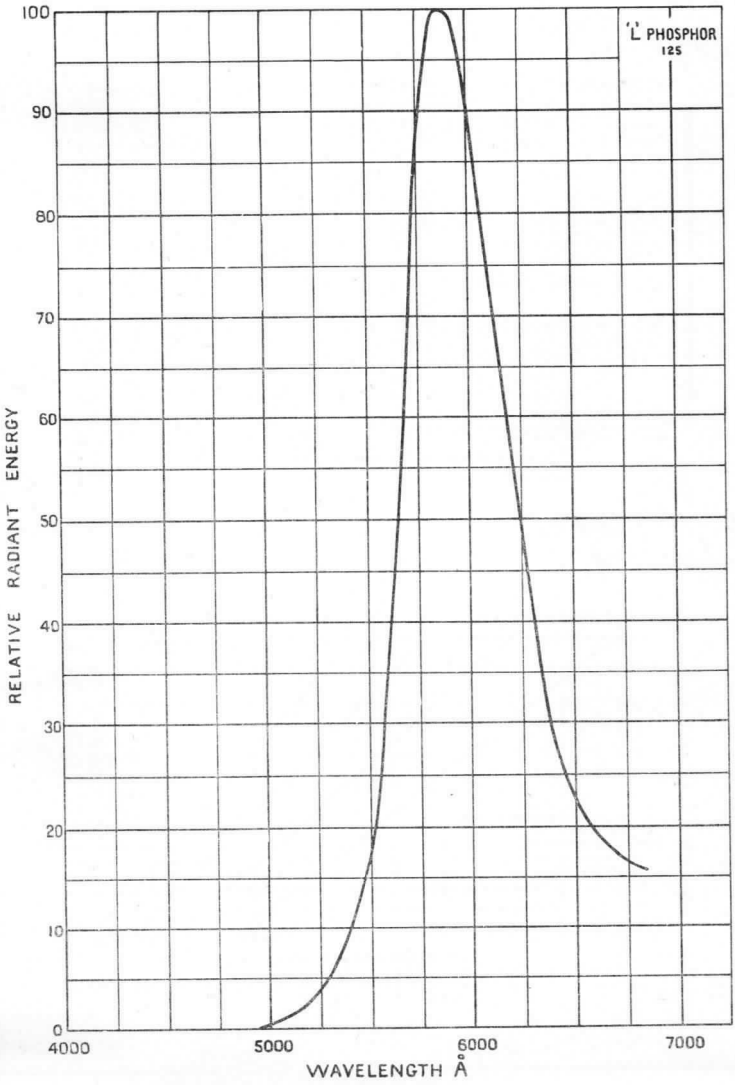


Ferranti

CATHODE RAY TUBE

SCREEN TYPE "L"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC

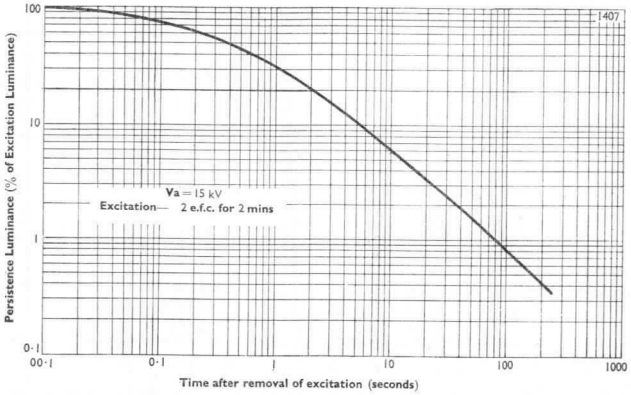


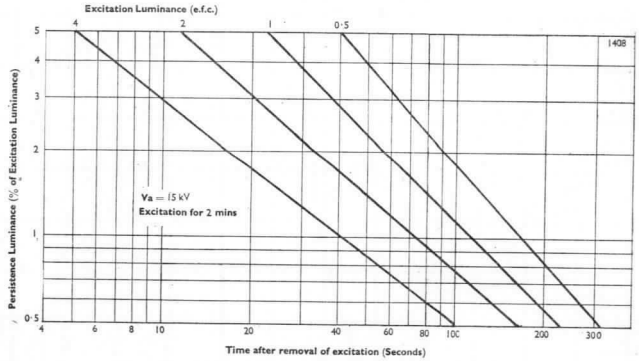
Issue 3.
Aug., 1963

Ferranti

SCREEN TYPE "L"

AFTERGLOW CHARACTERISTICS of TYPE "L" PHOSPHOR AT 20°C





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

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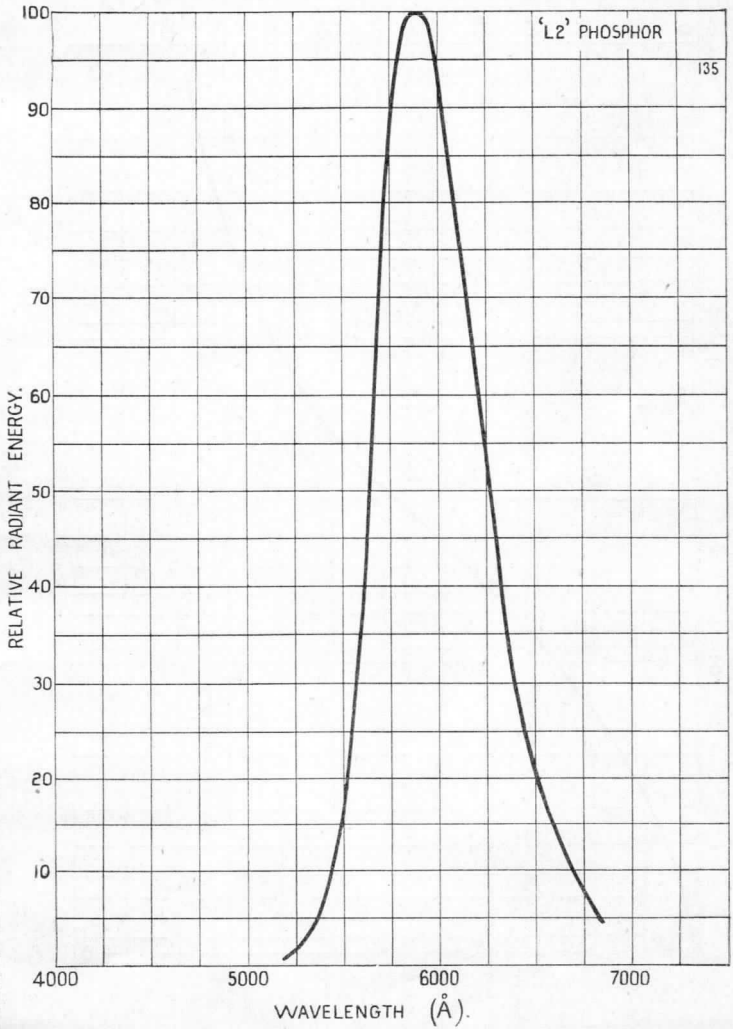
CATHODE RAY TUBES

SCREEN TYPE "L2"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



Issue 2.
Oct., 1962

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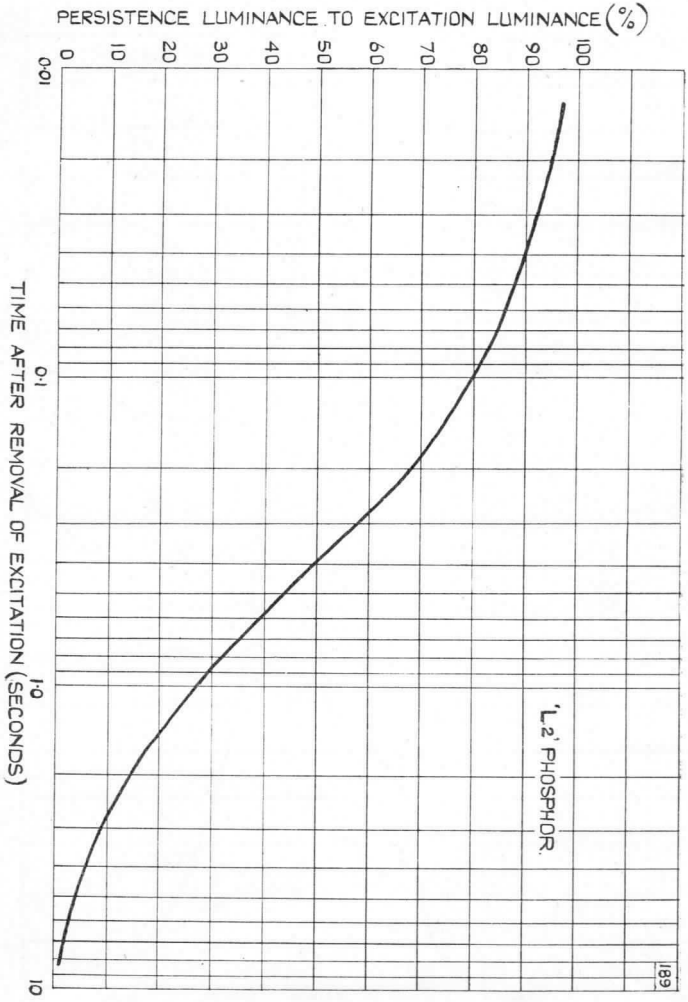
SCREEN TYPE "L2"

PERSISTENCE CHARACTERISTIC



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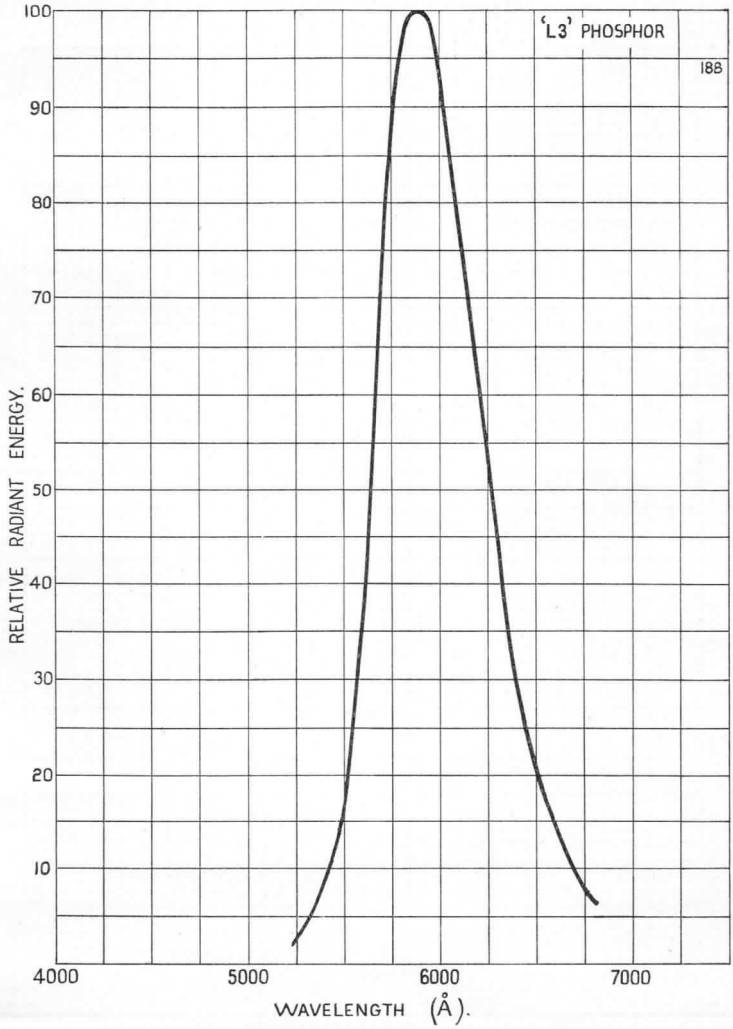
CATHODE RAY TUBES

SCREEN TYPE "L3"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC

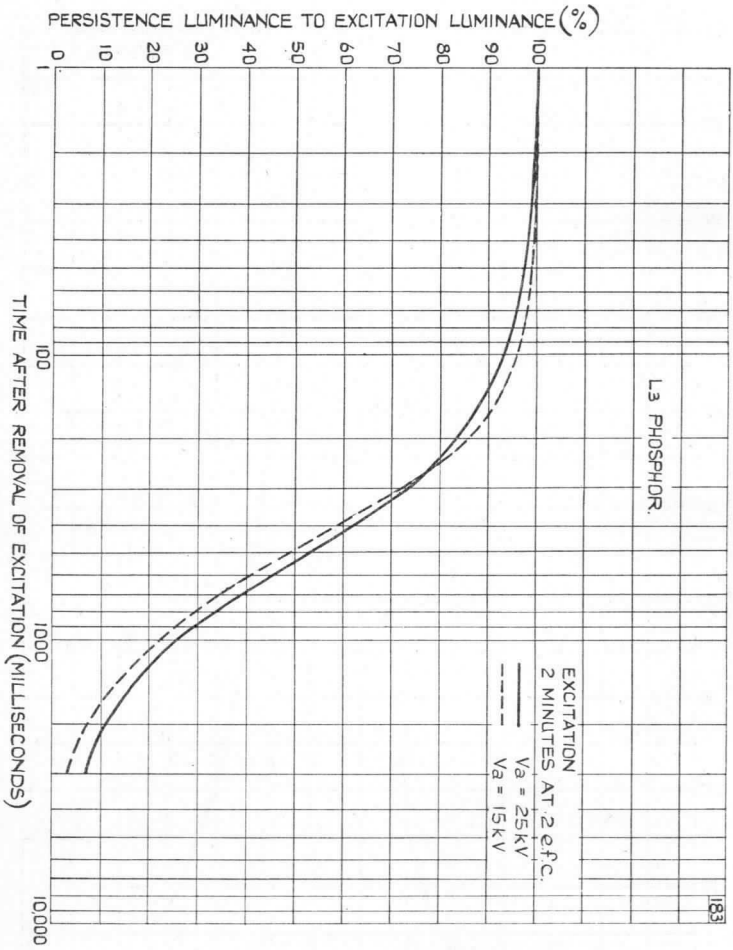


Issue 1.
June, 1962

Ferranti

SCREEN TYPE "L3"

PERSISTENCE CHARACTERISTIC

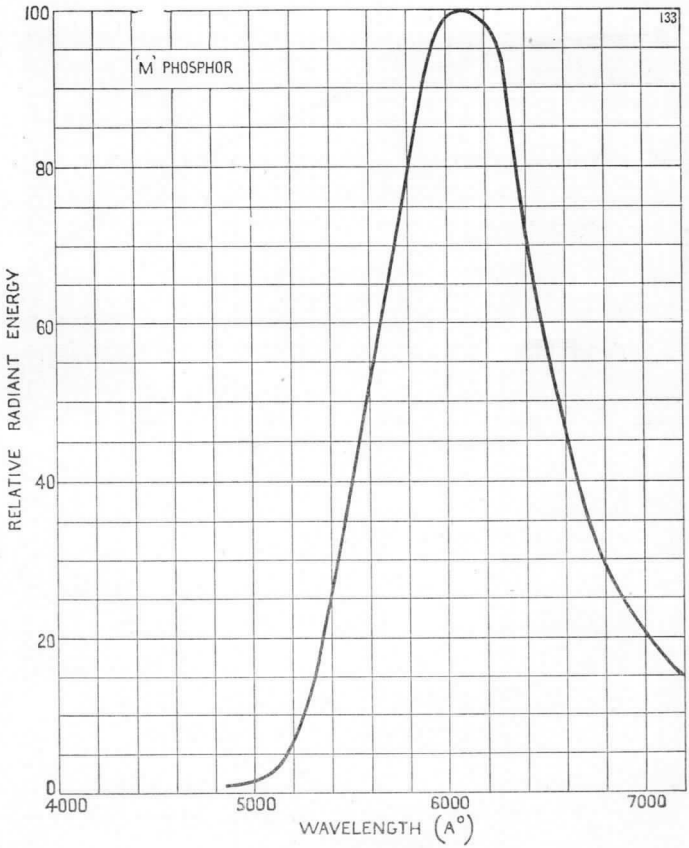


Ferranti

CATHODE RAY TUBES

SCREEN TYPE "M"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

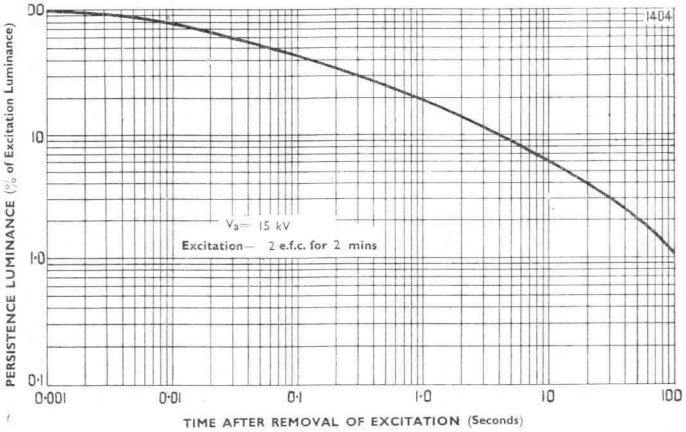


Issue 2.
Sept., 1963

Ferranti

SCREEN TYPE "M"

PERSISTENCE CHARACTERISTIC

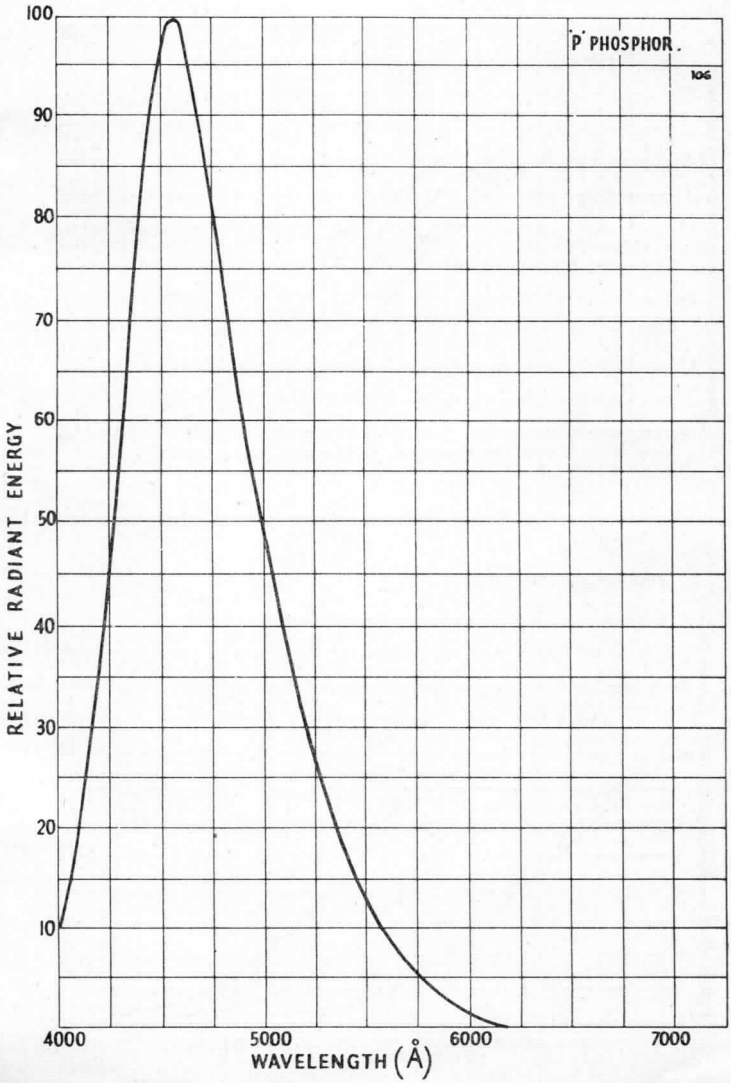


Ferranti

CATHODE RAY TUBE

SCREEN TYPE "P"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC



THE PHOSPHOR IS EQUIVALENT TO U.S.A. PHOSPHOR TYPE P11.

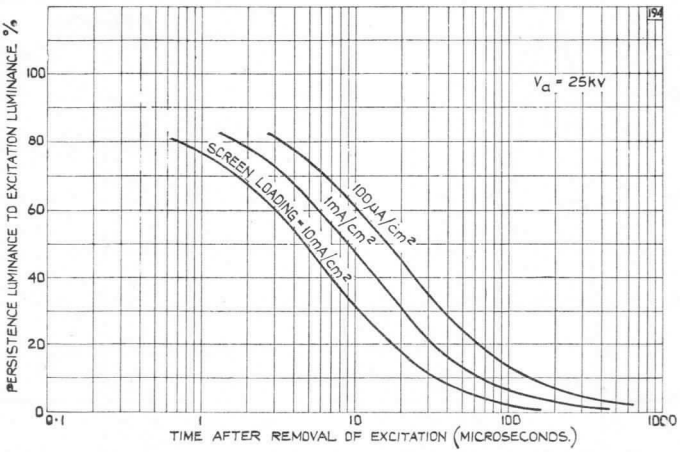
Issue 3.
Dec., 1962

Ferranti

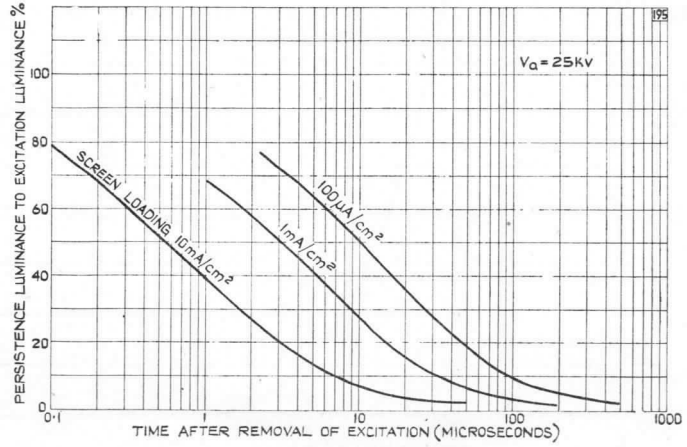
SCREEN TYPE "P"

PERSISTENCE CHARACTERISTIC

NORMAL PHOSPHOR



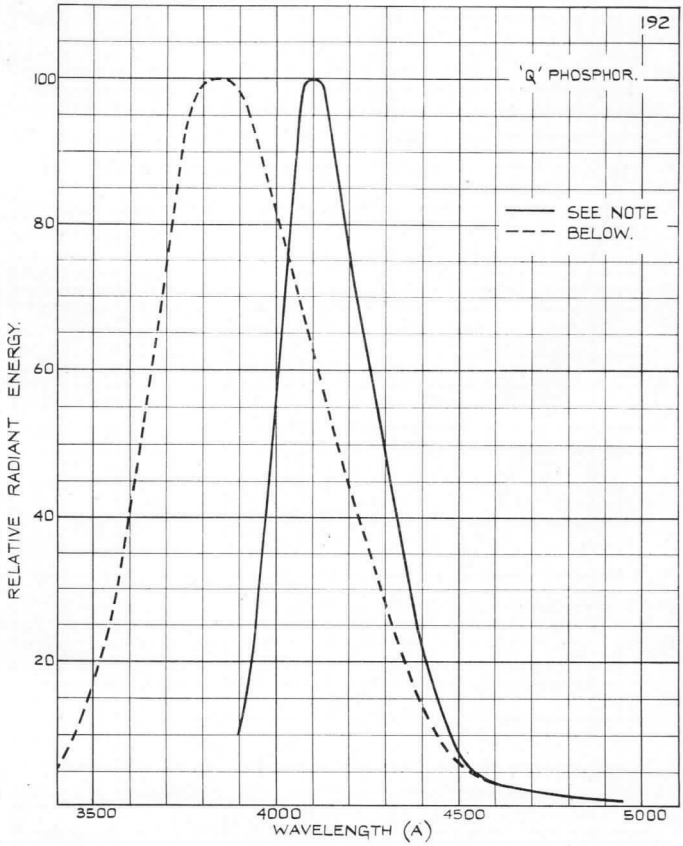
FINE GRAIN PHOSPHOR



Ferranti

CATHODE RAY TUBE
SCREEN TYPE "Q"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC



NOTE:

The actual emission from the screen of a glass faced Cathode Ray Tube screened with 'Q' phosphor is shown by the solid line.

The broken line shows the emission characteristic of the phosphor itself when it is not modified by the glass.

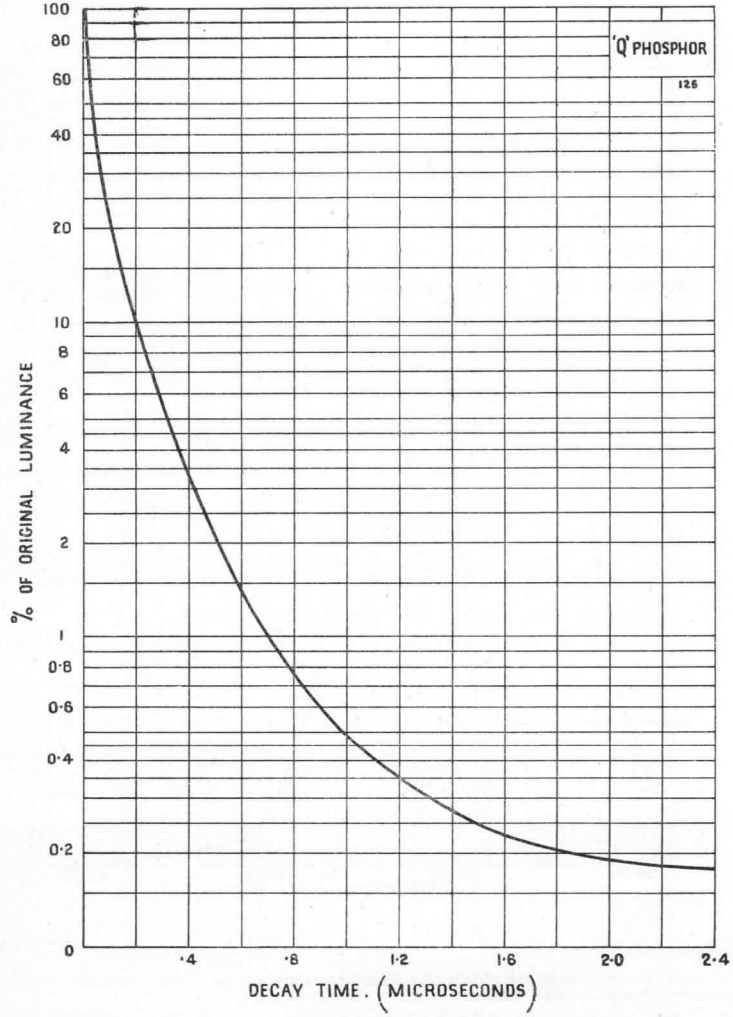
THIS PHOSPHOR IS EQUIVALENT TO U.S.A. PHOSPHOR TYPE P16.

Issue 3
Aug., 1962

Ferranti

SCREEN TYPE "Q"

PERSISTENCE CHARACTERISTIC



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

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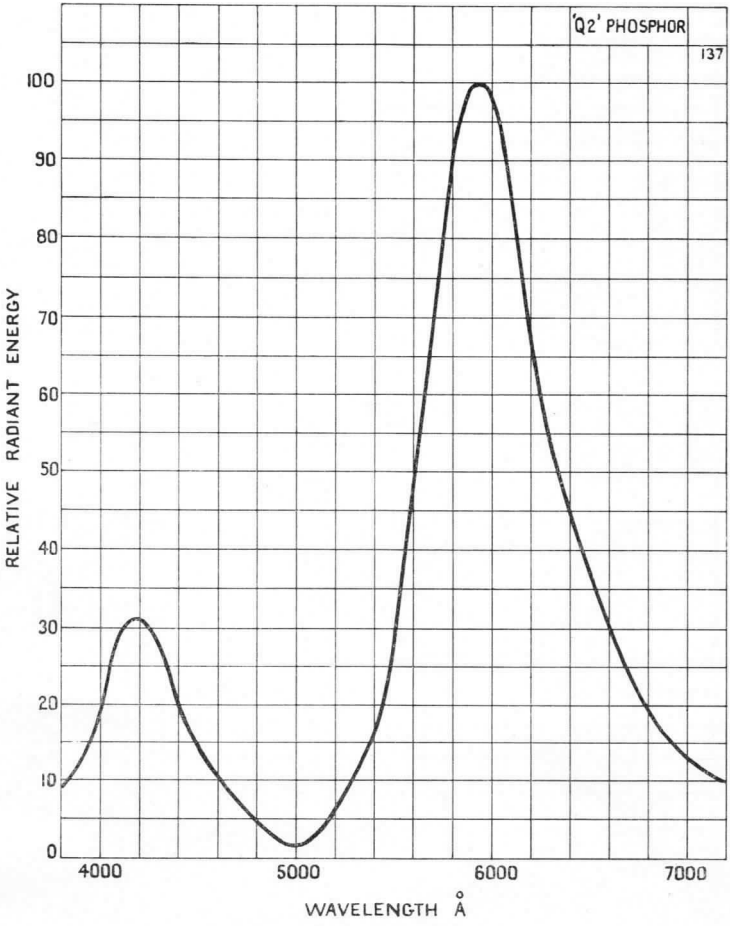
CATHODE RAY TUBE

SCREEN TYPE "Q2"

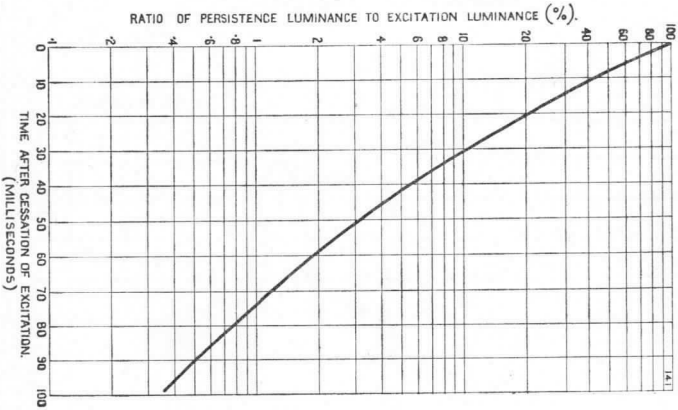
RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



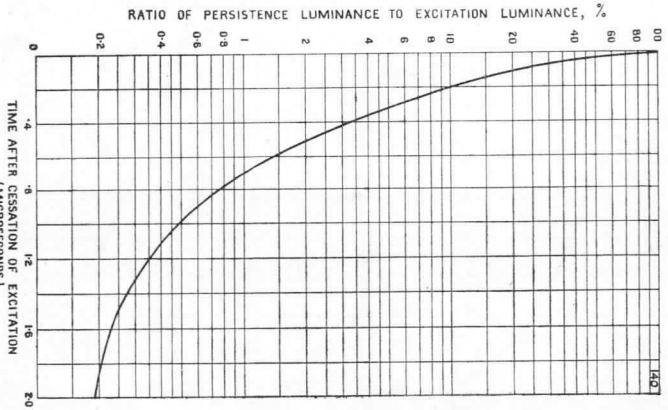
Issue 1
Sept, 1960

SCREEN TYPE "Q2"

PERSISTENCE CHARACTERISTICS



Normal Persistence Characteristic.



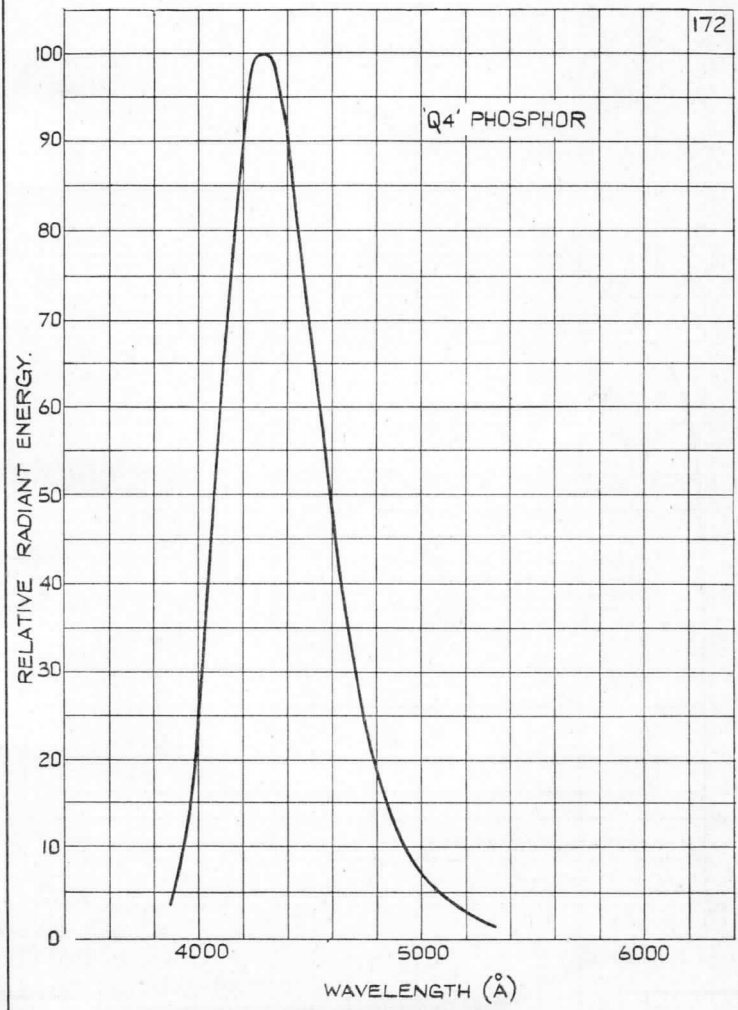
Persistence Characteristic with Chance OB8 (Blue) Filter.

Ferranti

CATHODE RAY TUBE

SCREEN TYPE 'Q4'

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

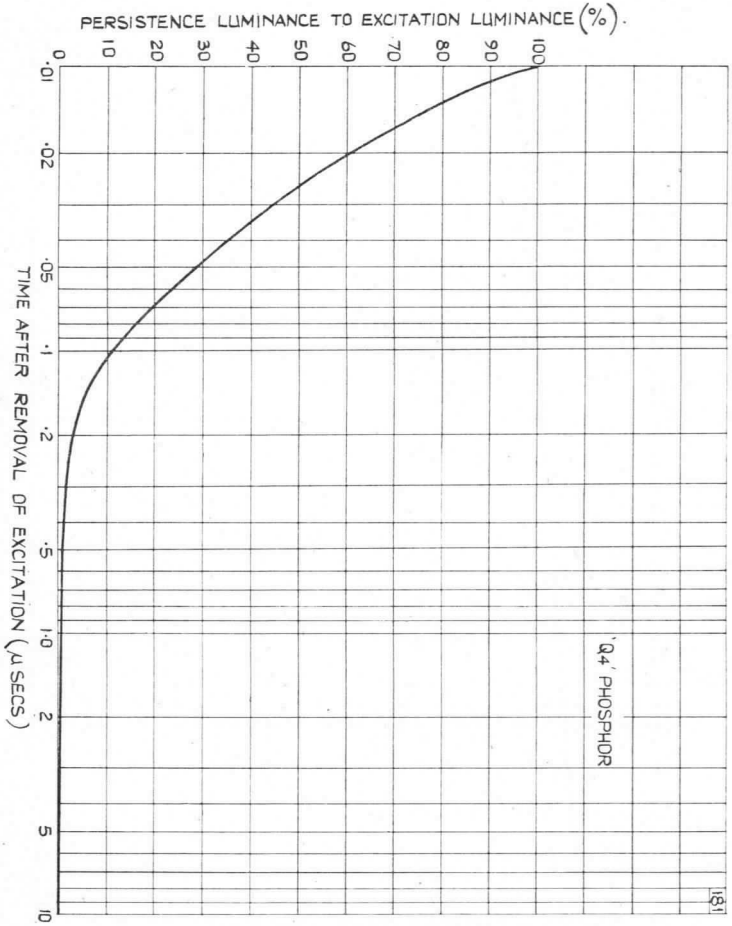


Issue 1
May, 1962.

Ferranti

SCREEN TYPE 'Q4'

PERSISTENCE CHARACTERISTIC

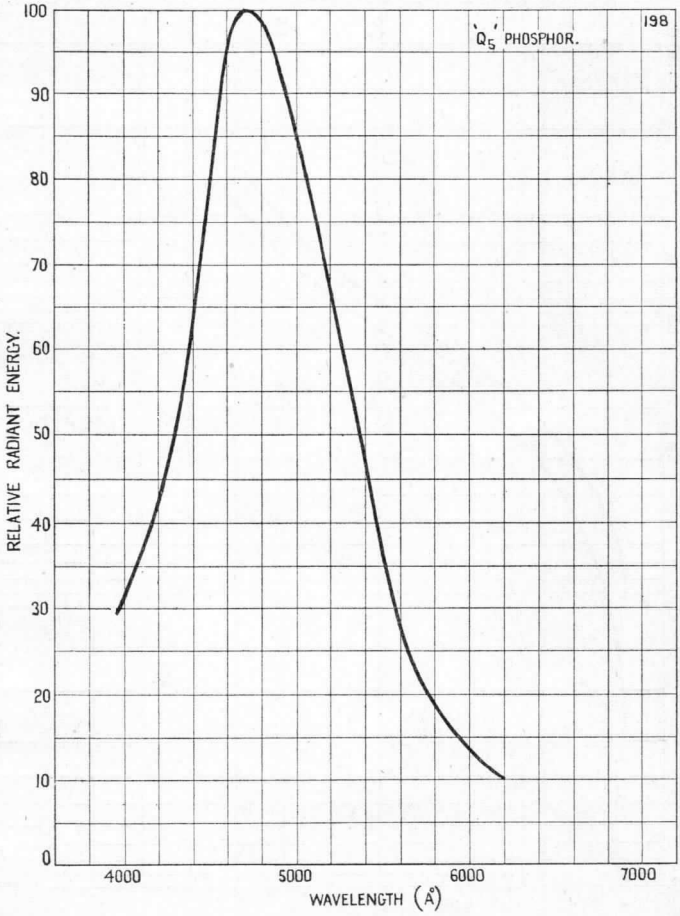


Ferranti

CATHODE RAY TUBE

SCREEN TYPE 'Q5'

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC



Issue 1.
Feb., 1963

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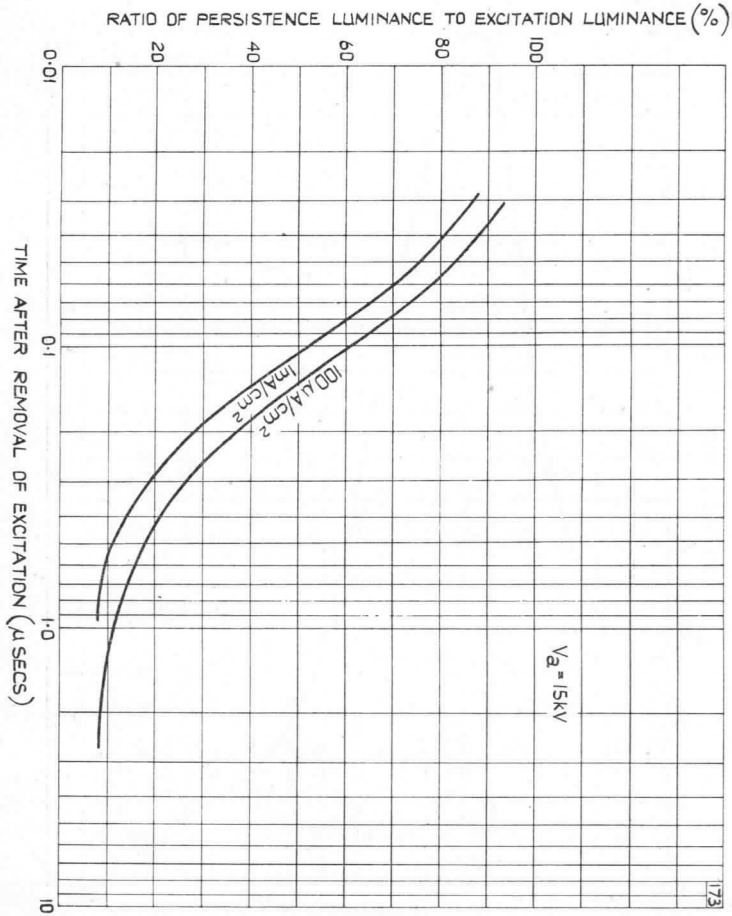
SCREEN TYPE 'Q5'

PERSISTENCE CHARACTERISTIC



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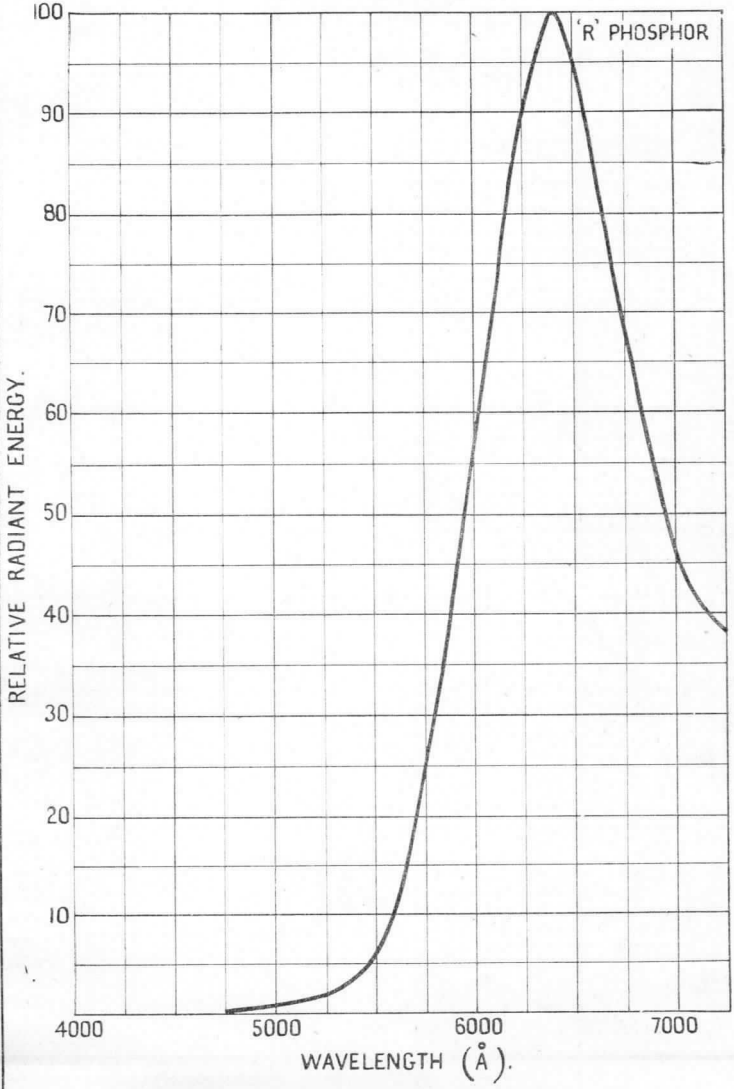
CATHODE RAY TUBE

SCREEN TYPE "R"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC

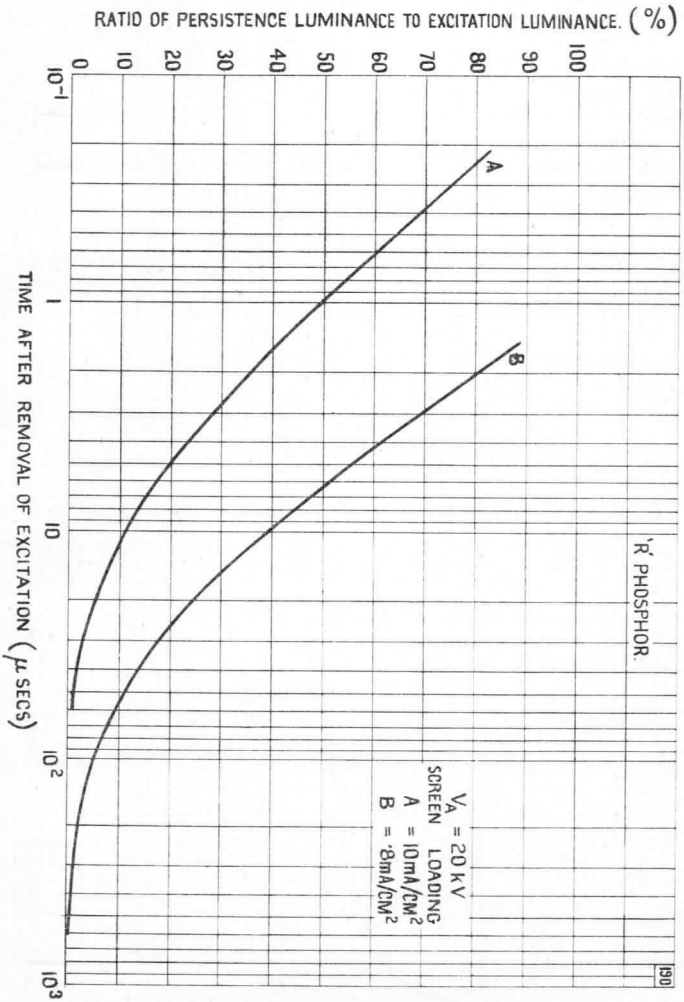


Issue 2.
Oct., 1962

Ferranti

SCREEN TYPE "R"

PERSISTENCE CHARACTERISTIC

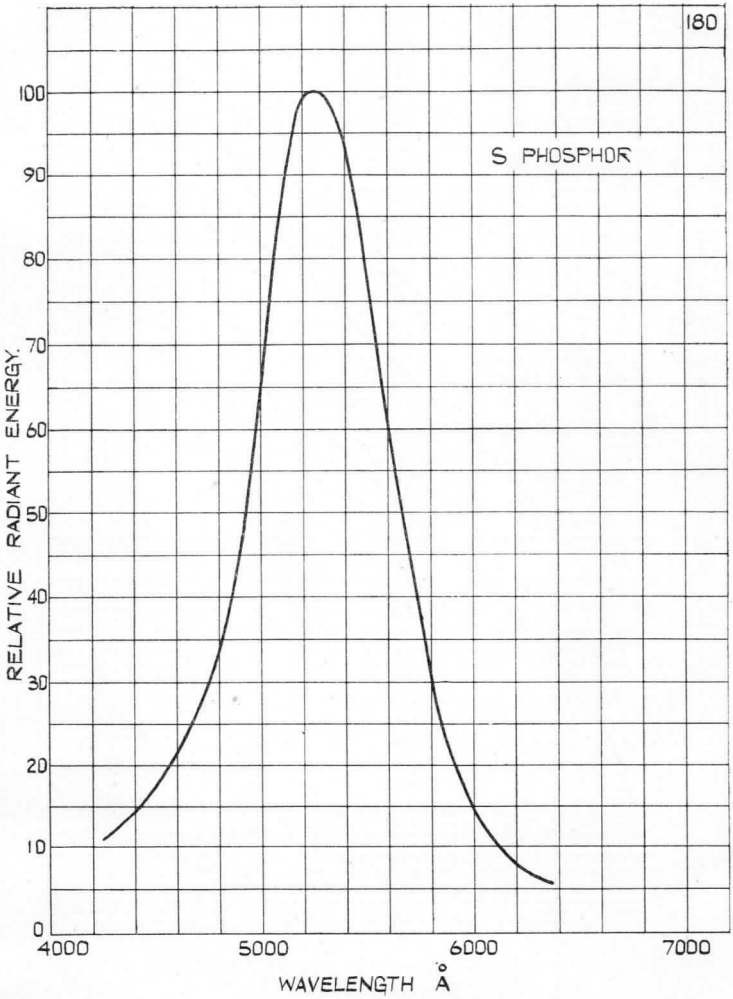


Ferranti

CATHODE RAY TUBE

SCREEN TYPE "S"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

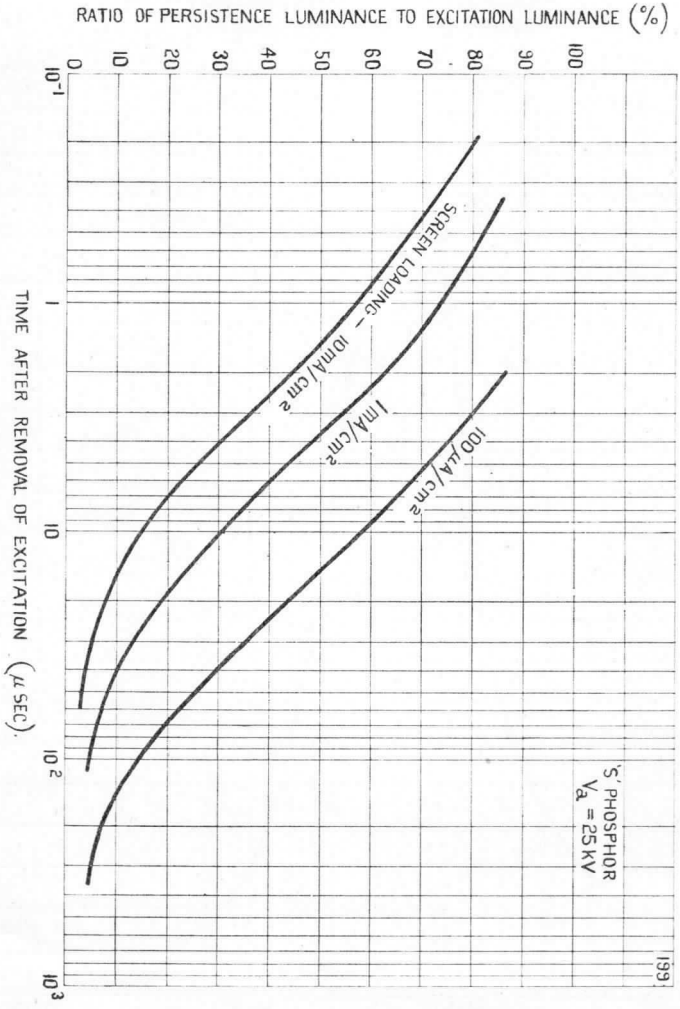


Issue 1.
Dec. 1962

Ferranti

SCREEN TYPE "S"

PERSISTENCE CHARACTERISTIC

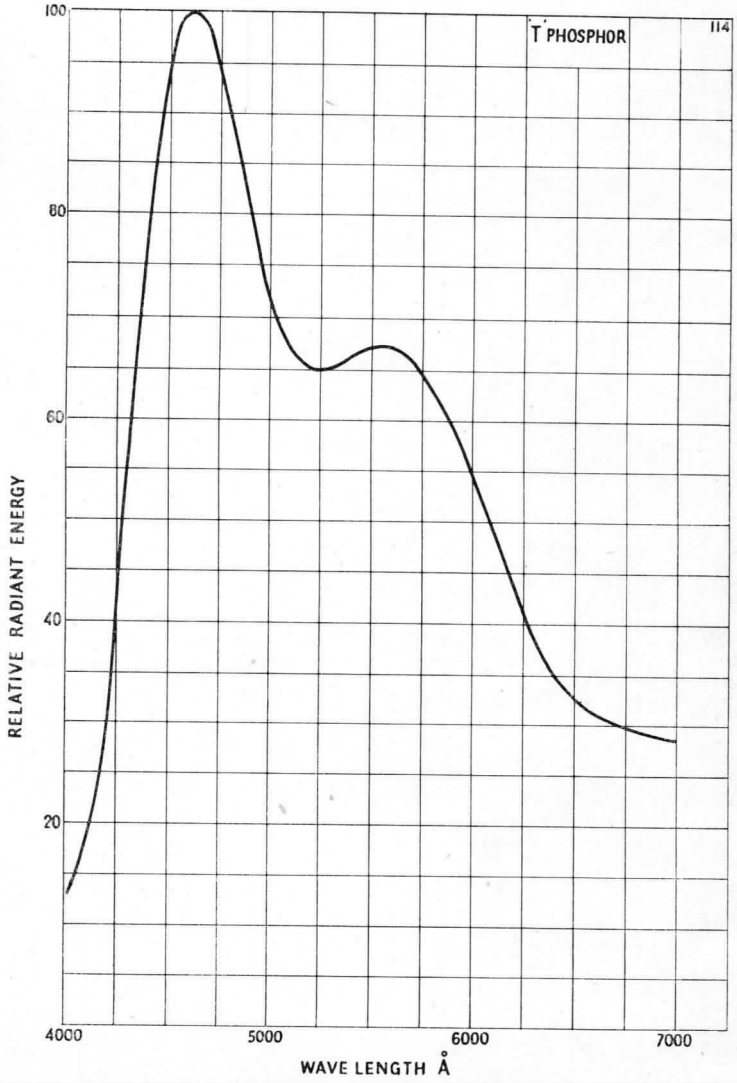


FERRANTI

CATHODE RAY TUBE

SCREEN TYPE "T"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC



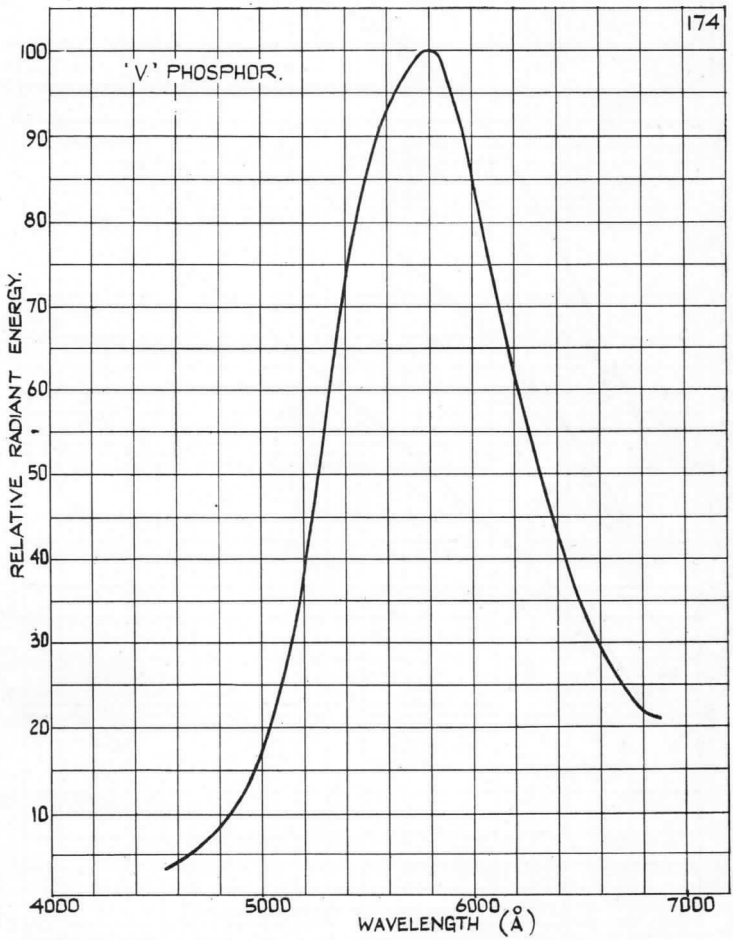
Issue 1.
Mar., 1957

Ferranti

CATHODE RAY TUBE

SCREEN TYPE "V"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC

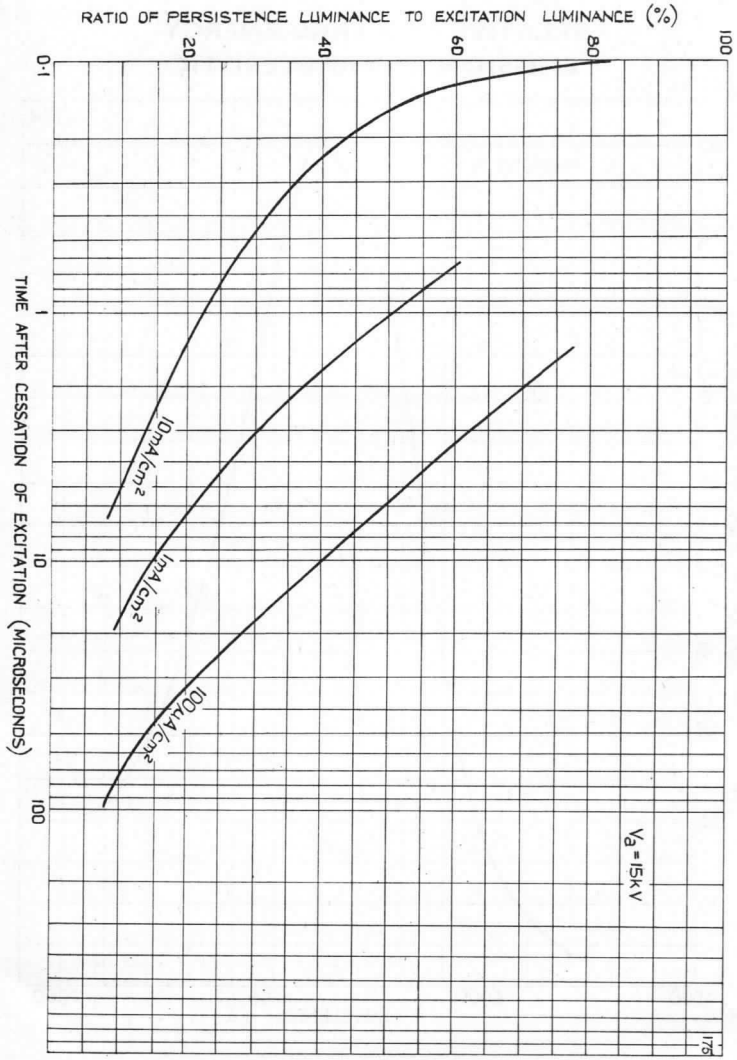


Issue 1
May, 1962.

Ferranti

SCREEN TYPE "V"

PERSISTENCE CHARACTERISTIC

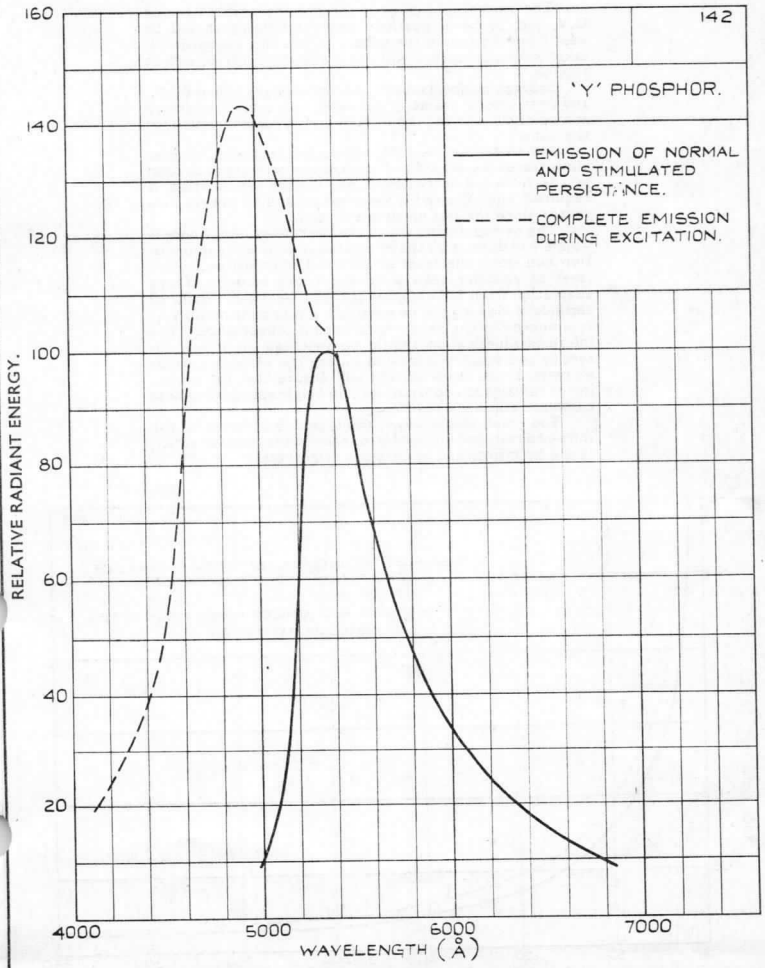


Ferranti

CATHODE RAY TUBES

SCREEN TYPE "Y"

RELATIVE SPECTRAL ENERGY EMISSION CHARACTERISTIC



Issue 1
Oct., 1960

Ferranti

SCREEN TYPE "Y"

VISUAL INFORMATION STORAGE.

The Ferranti 'Y' phosphor is intended to provide visual information storage. The afterglow is under the control of the operator who may delay the revelation of a trace until a time convenient for observation.

Use of the 'Y' phosphor requires provision of an infra-red source (of about 1 micron wavelength) arranged to illuminate the whole screen of the tube uniformly when switched on, and with provision for its intensity to be varied. A convenient method is to use a small car head-lamp, or a number of small filament lamps. Each lamp should be carefully screened by means of a filter to eliminate the visible illumination whilst passing the short and medium infra-red. Gelatine material such as Ilford No. 207 is suitable for this purpose.

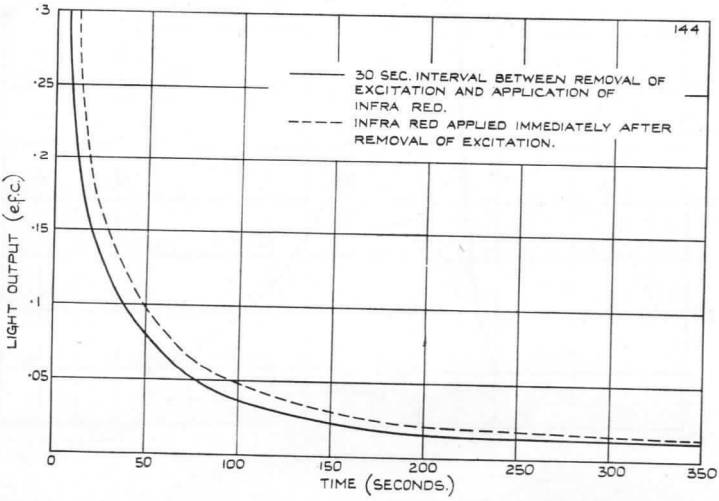
The storage phosphor is sensitive to visible light or U.V. and, as far as possible, ambient lighting should be kept from the face of the tube. Unless this precaution is taken spurious storage will occur and the contrast will be spoiled.

Storage performance is poor at voltages below 8 kV., and best results are achieved when the tube is operated at a point close to the top limit of E.H.T. recommended for the tube.

On switching the infra-red to full intensity, all previous traces are erased and storage can commence as soon as the infra-red is switched off. When observation is required, the infra-red is switched on and all images presented since the last erasure are seen.

The period during which the controlled persistence is visible will depend on the intensities of written-in information and upon the level of infra-red illumination. At a level of visibility seen after about ten seconds of eye adaptation from full external daylight, between 15 and 60 seconds of viewing can be obtained, either continuously or interrupted by the observer to suit his convenience. The infra-red illumination should be switched on at low intensity and steadily increased during the viewing period; increase of the lamp voltage will ensure that the stored image remains at a constant level of brightness until almost complete erasure is reached.

The graph below shows the typical brightness of the infra-red restored image plotted against the time for which it can be maintained at constant brightness.

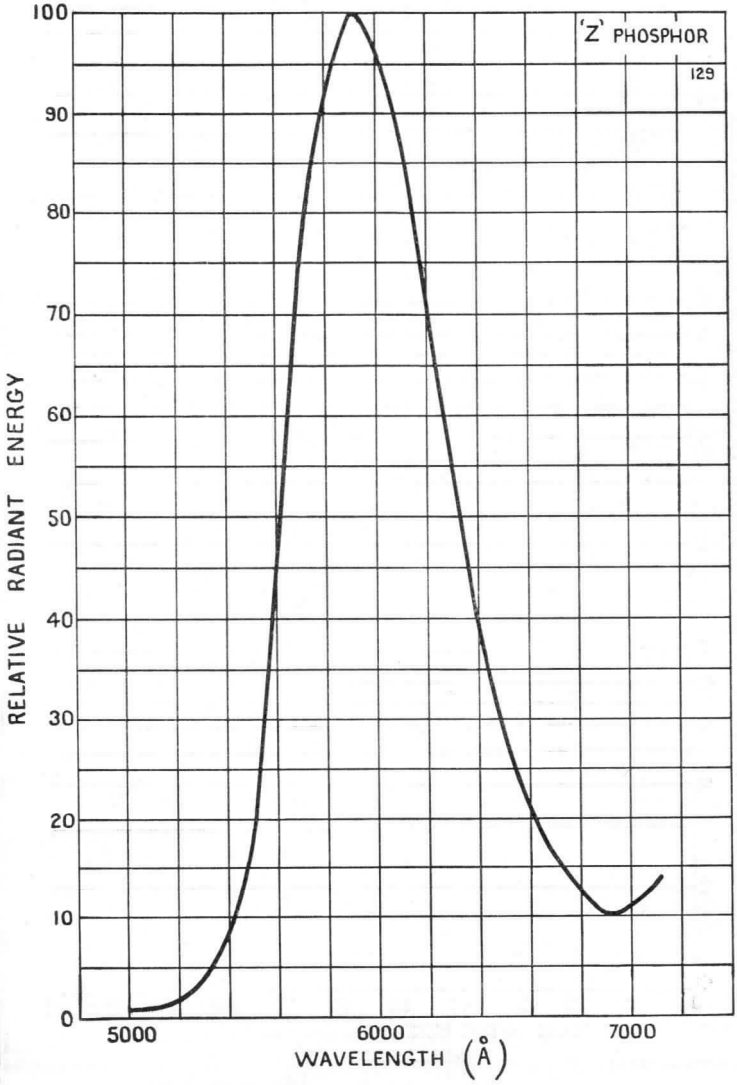


Ferranti

CATHODE RAY TUBES

SCREEN TYPE "Z"

RELATIVE SPECTRAL ENERGY
EMISSION CHARACTERISTIC

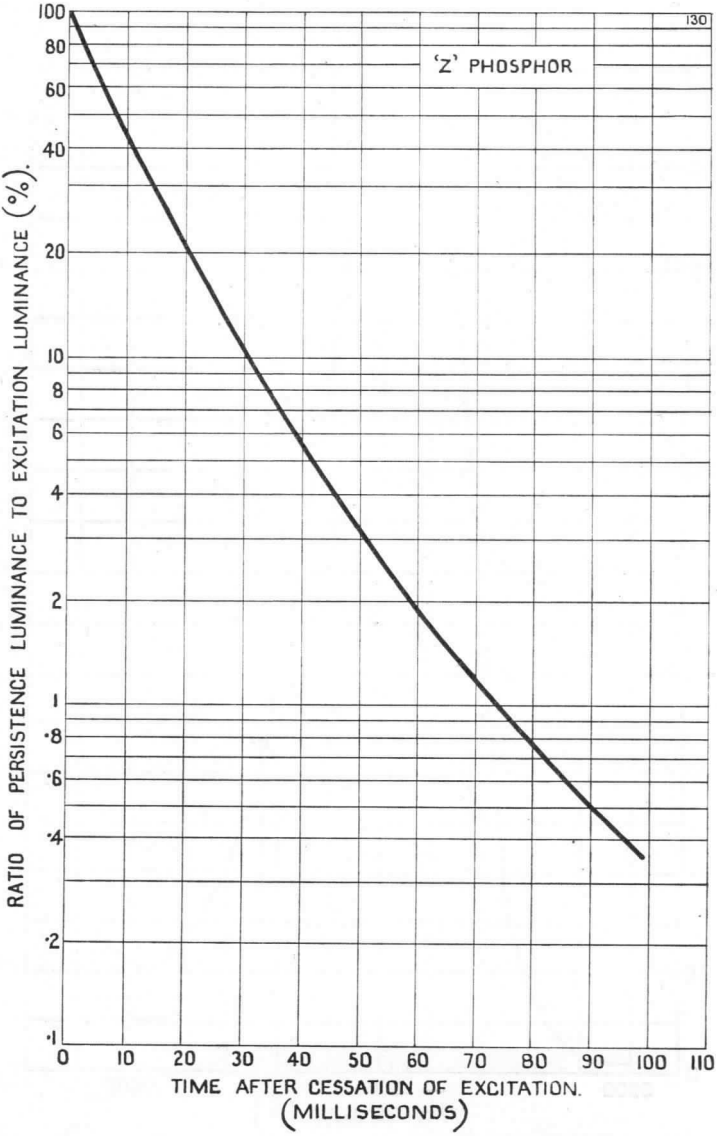


Issue 1
June 1960

Ferranti

SCREEN TYPE "Z"

PERSISTENCE CHARACTERISTIC



3/21 AM
3/21 PM
3/21 QM

Ferranti

HIGH RESOLUTION CATHODE RAY TUBES

3" diameter high resolution triode tubes having optically flat faces with ground internal and external surfaces.

FOCUS ... ... Magnetic

DEFLECTION ... ... Magnetic—Angle 60°

SCREEN	3/21AM	3/21PM	3/21QM
Phosphor Type	'A'	'P'	'Q'
Fluorescence	Green	Blue	Blue/Violet
Persistence	Ultra Short	Ultra Short	Killed

All types have metal-backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS

Base	B12A (Duodecal)
Anode Cap	CT7 (Recessed Ball type) (JEDEC type J1-22)
Max. Overall Length	365 mm.
Max. Diameter	97 mm.
Nom. Neck Diameter	35 mm.
Min. Useful Screen Area ...	85 mm. dia.

For other dimensions see drawing overleaf.

BASE CONNECTIONS

Pin 1—Heater	Pin 7—Not connected
Pin 2—Grid	Pin 8—No pin
Pin 3—No pin	Pin 9—No pin
Pin 4—No pin	Pin 10—Not connected
Pin 5—No pin	Pin 11—Cathode
Pin 6—Not connected	Pin 12—Heater

Side contact—Anode

HEATER

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

RATINGS

Max. Anode Voltage	25 kV.
Nom. V_g for visual cut-off ...	Va/210
Max. V_{hk} (heater negative) ...	200 volts
Max. V_{hk} (heater positive) ...	200 volts
Max. R_{gk}	1·5 MΩ

TYPICAL OPERATION

Heater Voltage	6·3 volts
Anode Voltage	20 kV.
Vg for visual cut-off	–90v.
*Screen resolution	1000 lines per inch.

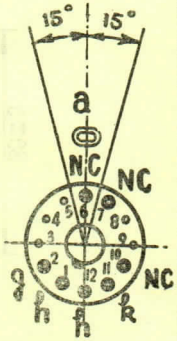
CAPACITANCE

$C_{k\text{-all}}$	<8 pF.
$C_{g\text{-all}}$	<8 pF.

X-RAY WARNING

When operated at an anode voltage in excess of 16kVd. X-ray shielding may be required to give protection against the possible danger of injury from prolonged exposure at close range.

*At screen centre. Measured by shrinking raster method.



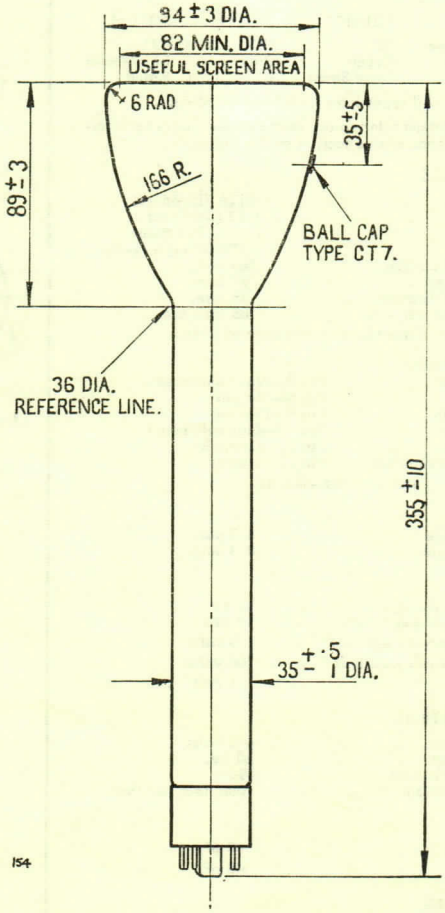
Underside View of Base

Ferranti

Tentative
Issue 2
July 1961

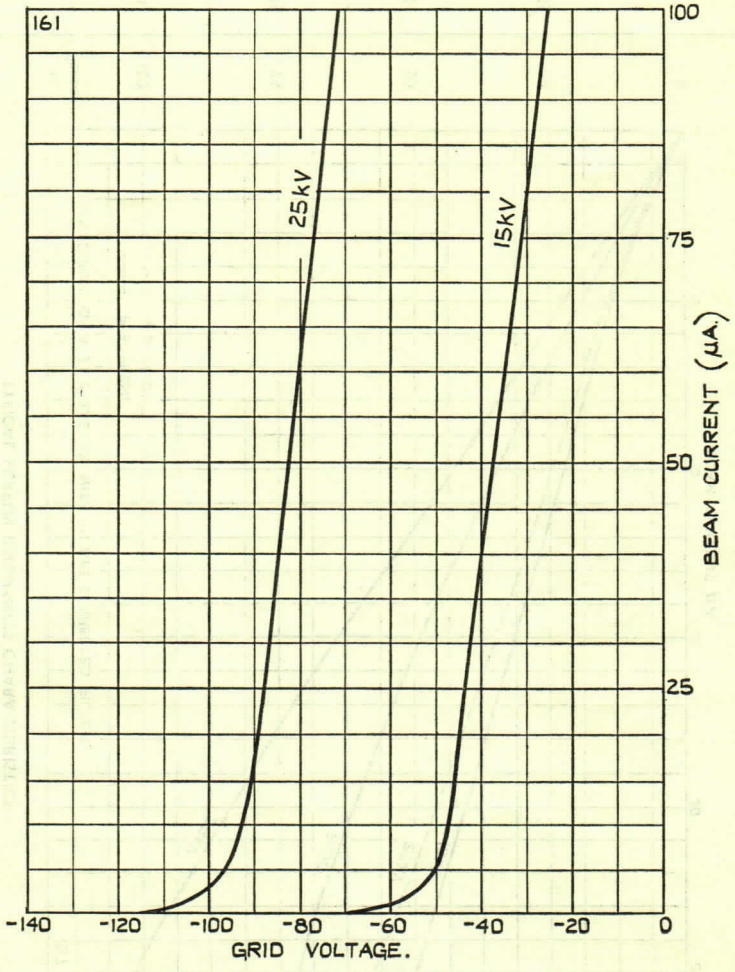
Ferranti

3/21 AM
3/21 PM
3/21 QM



DIMENSIONS ARE IN MILLIMETRES.

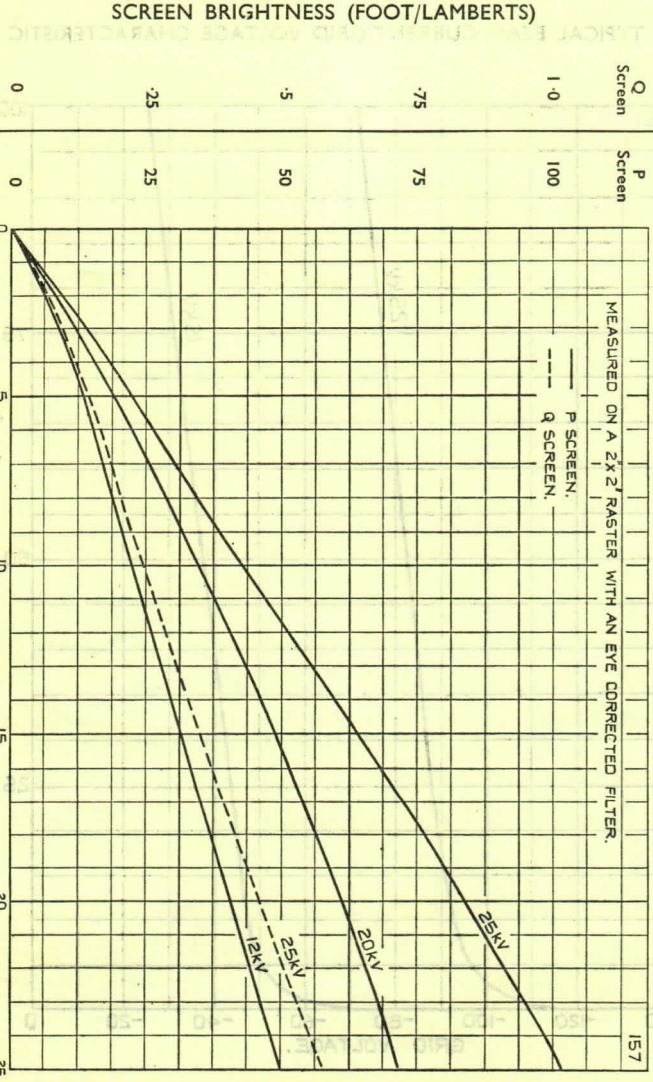
TYPICAL BEAM CURRENT/GRID VOLTAGE CHARACTERISTIC



Ferranti

3/21 AM
3/21 PM
3/21 QM

TYPICAL SCREEN BRIGHTNESS CHARACTERISTICS



Ferranti

RADAR TUBES

5/03 HM
5/03 JM
5/03 LM

5in. diameter Display Tubes with metal backed screens, magnetic deflection and Low Voltage Electrostatic focus, suitable for small radar installations.

FOCUS ... ... Low Voltage Electrostatic

DEFLECTION ... ... Magnetic—Angle 53°

SCREENS

	5/03HM 'H'	5/03JM 'J'	5/03LM 'L'
*Phosphor Type			
Fluorescence	Orange	Blue	Orange
Afterglow	Orange	Yellow	Orange
Persistence	Very long	long	long

All Types have metal backed screens.

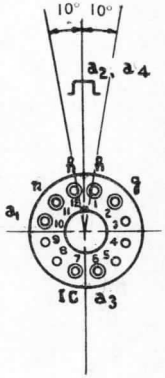
For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT7. Recessed Ball Type.
Max. Overall Length	308 mm.
Min. Useful Screen Area ...	108 mm. dia.
Mounting Position	Any except vertical screen down.

For other dimensions see drawing.

These tubes can also be supplied with an external conductive coating in which case the Type Nos. are respectively 5/03HB, 5/03JB and 5/03LB.



Base Connections

Underside View of Base

BASE CONNECTIONS.

Pin 1—Heater	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.

Side Conatct—2nd Anode, 4th Anode.

HEATER.

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

RATINGS.

Max. A_1 Voltage	500 volts.
Min. A_1 Voltage	200 volts.
Max. $A_2 + A_4$ voltage	15 kV.
Min. $A_2 + A_4$ Voltage	8 kV.
Max. Pos. A_3 Voltage	+500 volts.
Max. Neg. A_3 Voltage...	—500 volts.
Max. $V_{h\text{-}k}$ (Heater positive)	200 volts.
Max. $V_{h\text{-}k}$ (Heater negative)...	200 volts.
Max. $R_{g\text{-}k}$	1·5 MΩ
Max. $R_{h\text{-}k}$	1·0 MΩ

TYPICAL OPERATION

1st Anode Voltage	300 volts.
2nd + 4th Anode Voltage	12 kV.
†3rd Anode Voltage for focus...	—300 to + 300 volts.
§Vg for visual cut off	... —30 to —70 volts.

CAPACITANCES.

$C_{k\text{-all}}$	<8 pF.
$C_{g\text{-all}}$	<8 pF.

*Phosphors Type 'H' and 'L' are liable to burn if operated with a stationary or slow moving spot, even at low values of beam current.

†Optimum focus lies between these values.

§The grid 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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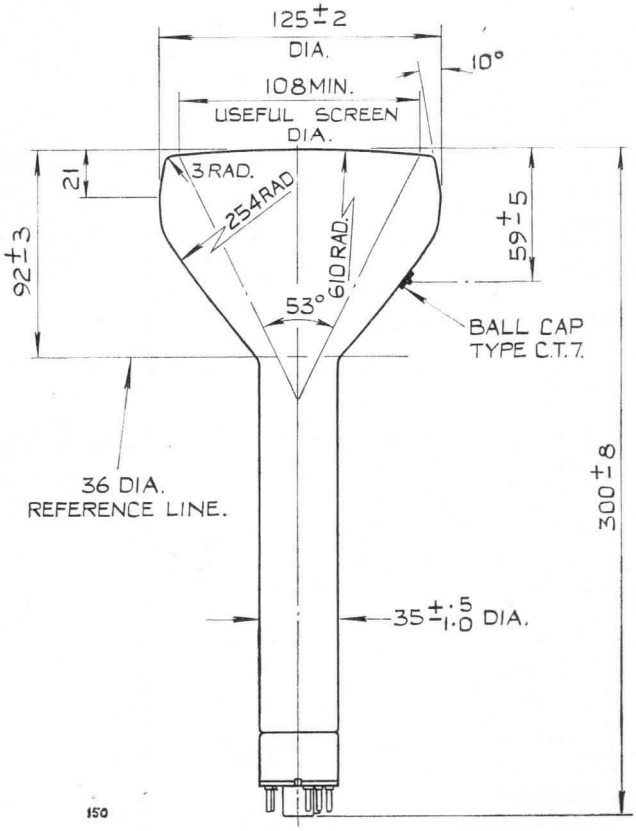
5/03 HM
5/03 JM
5/03 LM



Dimensions are in millimetres

Ferranti

TELEVISION MONITOR TUBE

A 5 inch diameter tube with metal backed screen having good resolution. Designed as a camera viewfinder tube.

FOCUS	Magnetic.
DEFLECTION	Magnetic.

SCREEN.

Phosphor	Type 'T' (Metal backed).
Fluorescence	White.
Persistence	Short.

PHYSICAL DETAILS.

Base	International Octal.
Anode Cap	CT7 (Recessed Ball Type).
Max. Overall Length	287 mm.
Max. Diameter	127 mm.
Neck Diameter	35^{+0}_{-1} mm.
Min. Useful Screen Diameter ...	108 mm.
Weight (Tube alone)	500 gms. (1lb. 2oz.).

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—No Connection.	Pin 5—Grid.
Pin 2—Heater.	Pin 6—No Connection.
Pin 3—1st Anode.	Pin 7—Cathode.
Pin 4—No Connection.	Pin 8—Heater.
Side Cap—2nd Anode.	

HEATER.

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

RATINGS.

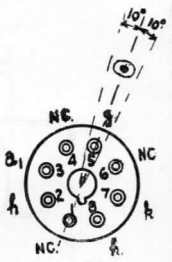
Max. 1st Anode Voltage ...	500 volts.
Max. 2nd Anode Voltage ...	11·0 kV.
Min. 1st Anode Voltage ...	200 volts.
Min. 2nd Anode Voltage ...	5·5 kV.
Max. V_{h-k} (Heater positive) ...	150 volts.
Max. V_{h-k} (Heater negative) ...	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. 1st Anode Supply Impedance	1·5 MΩ

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd Anode Voltage	7·0 kV.
*Vg for visual cutoff ...	−30 to −70 volts.
Av. Mod. Drive for 50 μA. Beam Current ...	20 volts.
†Focus Coil	570 ampere turns (approx.).
Recommended distance of Focus Unit from Ref. Line ...	73 mm.

CAPACITANCES.

C_{k-all}	<10·0 pF.
C_{g-all}	<10·0 pF.



Base Connections

Underside View of Base

*The grid should never be positive with respect to the cathode.

†Positioned so that the gap is 75 mm. from the reference line.

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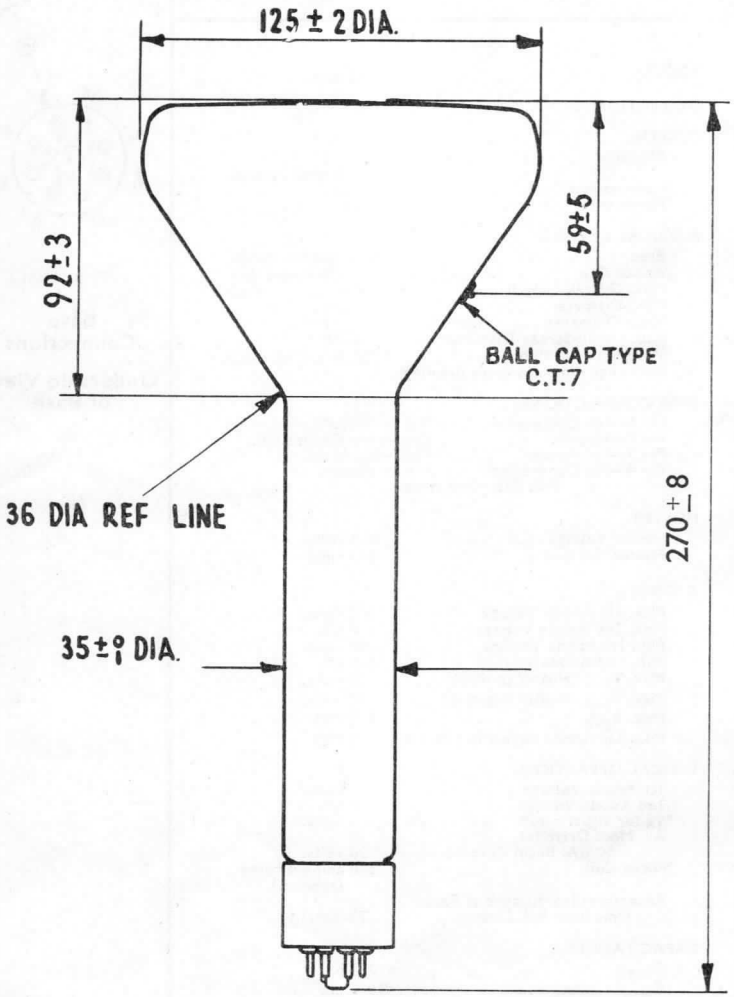
5/04TM



DIMENSIONS IN MILLIMETRES.

Ferranti

HIGH RESOLUTION CATHODE RAY TUBES

5/21 AM

5/21 PM

5/21 QM

5" diameter high resolution triode tubes having optically flat faces with ground internal and external surfaces.

FOCUS	Magnetic
DEFLECTION	Magnetic—Angle 60°

SCREEN	5/21AM	5/21PM	5/21QM
Phosphor Type	'A'	'P'	'Q'
Fluorescence	Green	Blue	Blue/Violet
Persistence	Ultra Short	Ultra Short	Killed

All types have metal-backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS

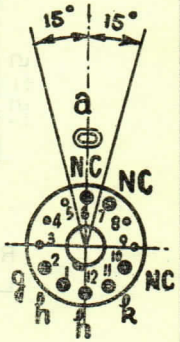
Base	B12A (Duodecal)
Anode Cap	CT8 (Cavity type) (JEDEC type J1-21)
Max. Overall Length	350 mm.
Max. Diameter	128 mm.
Nom. Neck Diameter	37 mm.
Min. Useful Screen Area ...	110 mm.

For other dimensions see drawing overleaf.

BASE CONNECTIONS

Pin 1—Heater	Pin 7—Not connected
Pin 2—Grid	Pin 8—No pin
Pin 3—No pin	Pin 9—No pin
Pin 4—No pin	Pin 10—Not connected
Pin 5—No pin	Pin 11—Cathode
Pin 6—Not connected	Pin 12—Heater

Side contact—Anode



Underside View of Base

HEATER

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

RATINGS

Max. Anode Voltage	25 kV.
Nom. V_g for visual cut-off ...	Va/210
Max. V_{hk} (heater negative) ...	200 volts
Max. V_{hk} (heater positive) ...	200 volts
Max. R_{gk}	1·5 MΩ

TYPICAL OPERATION

Heater Voltage	6·3 volts
Anode Voltage	20 kV.
Vg for visual cut-off	-90v.
*Screen resolution	1000 lines per inch.

CAPACITANCE

$C_{k\text{-all}}$	<8 pF.
$C_{g\text{-all}}$	<8 pF.

X-RAY 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.

*At screen centre. Measured by shrinking raster method.

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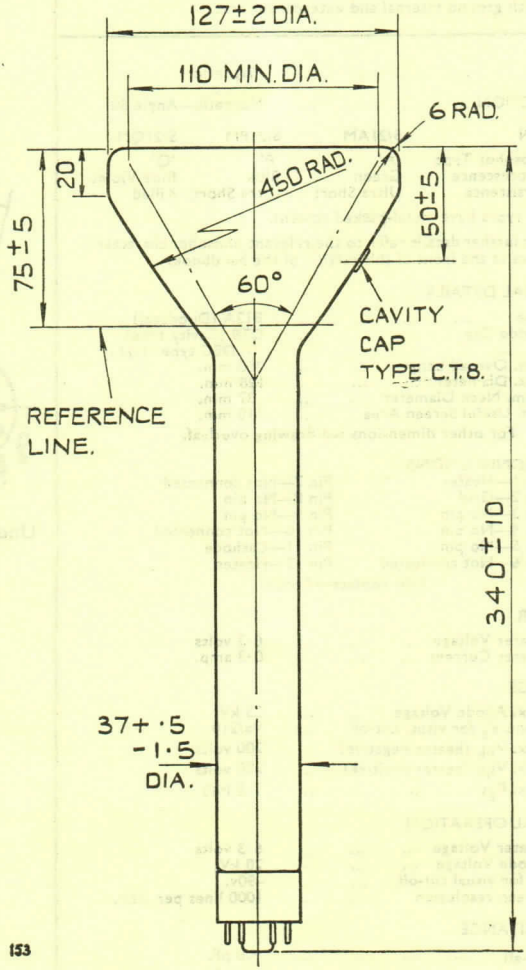
5/21 AM

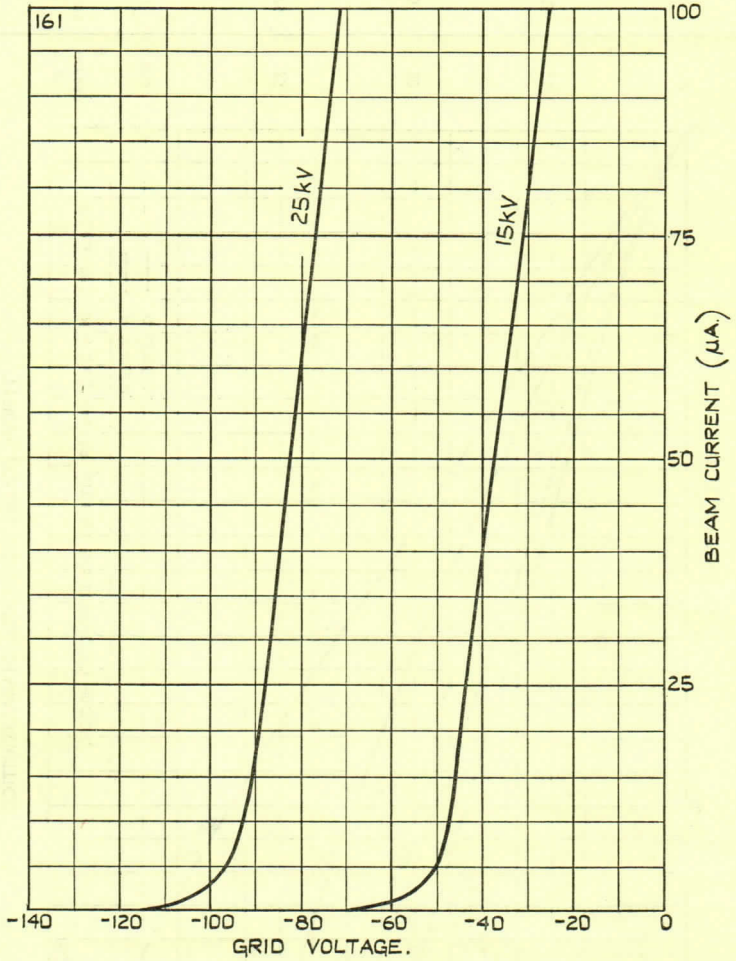
5/21 PM

5/21 QM

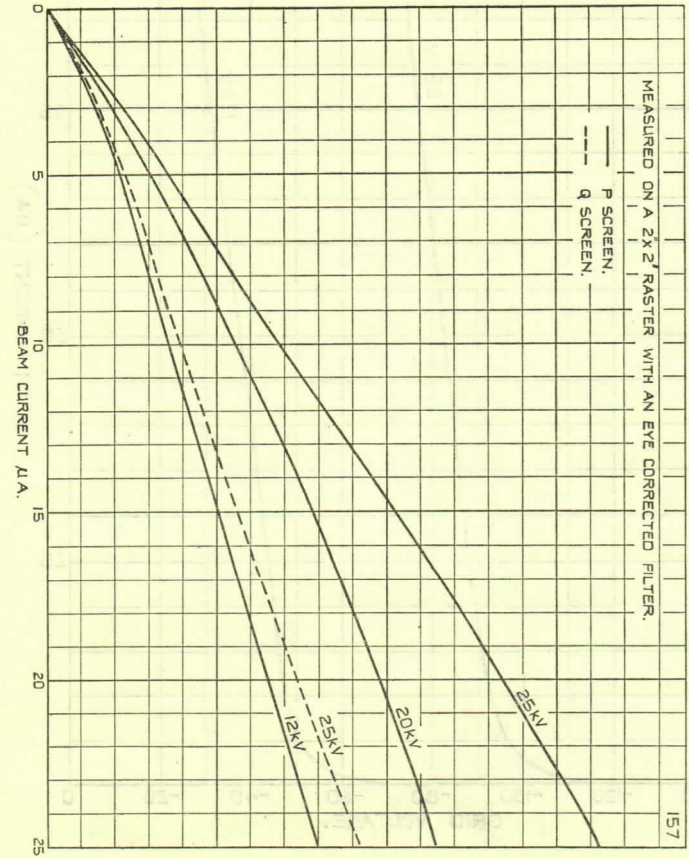


DIMENSIONS ARE IN MILLIMETRES.

TYPICAL BEAM CURRENT/GRID VOLTAGE CHARACTERISTIC



TYPICAL SCREEN BRIGHTNESS CHARACTERISTICS



Ferranti

5/28AM
5/28PM
5/28QM

HIGH RESOLUTION DISPLAY TUBES

A 5 inch diameter Ultra High Resolution Display Tube with an optically flat face with ground internal and external surfaces.

FOCUS. ... ... Magnetic

DEFLECTION. ... ... Magnetic—Angle 60°

SCREEN.

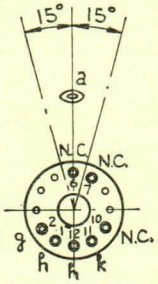
	5/28AM	5/28PM	5/28QM
Phosphor Type	'A'	'P'	'Q'
Fluorescence	Green	Blue	Blue/Violet
Persistence	Ultra Short	Ultra Short	Killed

All types have fine particle size metal-backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal)
Anode Cap	CT8 Cavity Type (JEDEC Type J1-21)
Max. Overall Length	500 mm.
Max. Diameter	129 mm.
Nom. Neck Diameter	37 mm.
*Useful Screen Area Diameter... ...	110 mm. min.



BASE CONNECTIONS.

Pin 1—Heater	Pin 7—Not Connected
Pin 2—Grid.	Pin 8—No Pin
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—Not Connected
Pin 5—No Pin.	Pin 11—Cathode.
Pin 6—Not Connected.	Pin 12—Heater.
Side contact—Anode.	

HEATER.

Heater Voltage	6·3 V.
Heater Current...	0·3 A.

RATINGS.

Max. Anode Voltage	25 kV.
Nom. V_g for visual cut-off	Va/300
Max. $V_{h—k}$ (heater negative) ...	200 V.
Max. $V_{h—k}$ (heater positive) ...	200 V.
Max. $R_{g—k}$	1·5 M Ω

TYPICAL OPERATION.

Heater Voltage	6·3 V.
Anode Voltage	15 kV.
V_g for visual cut-off	—50 V.
†Screen Resolution	2000 lines per inch

CAPACITANCE.

$C_{k—all}$	<8pF.
$C_{g—all}$	<8pF.

X-RAY WARNING: When operated at an anode voltage in excess of 16 kV. shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.

*Minimum diameter of internal ground surface

†At screen centre, measured by shrinking raster method.

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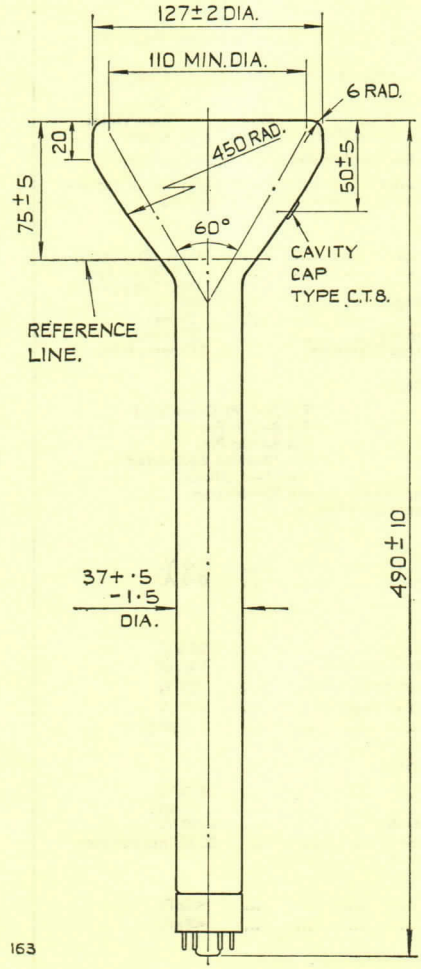
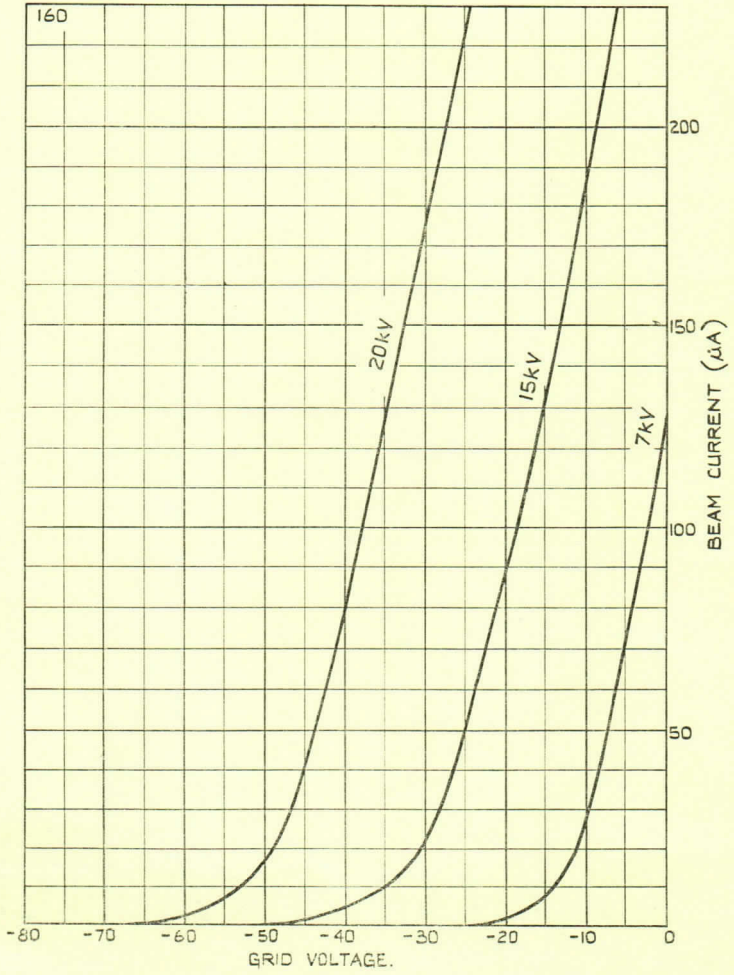


ALL DIMENSIONS IN MILLIMETERS

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTIC



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Issue 2,
Nov. 1961

Ferranti

MICRO SPOT RADAR TUBES

5/71AM
5/71PM
5/71QM

5" diameter optically flat faced Cathode Ray Tubes with a short bulb. The spot size is very small, being less than 0·0005" at the screen centre and the screen can be accurately scanned over an area greater than four inches in diameter.

The high resolution has been made possible in this series of cathode ray tubes by the use of an entirely novel design of electron gun involving two focusing elements, one only of which is electromagnetic and external to the tube in the usual way; the other is electrostatic and of fixed focal length.

FOCUS	Magnetic and Electrostatic
DEFLECTION	Magnetic, 60° angle.
SCREEN	Metal Backed.

*Phosphor	Type 'A'	Type 'P'	Type 'Q'
Fluorescence	Green	Blue	Blue Violet
Persistence to 1/e	1–2 μsecs.	5–10 μsecs.	<0·1 μsecs.

PHYSICAL DETAILS.

Max. Overall Length	470 mm.
Max. Diameter	128 mm
Nom. Neck Diameter	37 mm
Min. Useful Screen Diameter	110 mm

For other dimensions see outline drawing on Page 3.

BASE CONNECTIONS.†

Pin 1—Heater.	Pin 7—No Connection
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 Cap—2nd Anode.

HEATER.

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

RATINGS.

Max. Final Anode Voltage	30 kV
Min. Final Anode Voltage	12 kV
Max. First Anode Voltage	2·5 kV
Min. First Anode Voltage	1 kV
V_g for visual cut-off (at V_{a_1}=2kV)	−80 to −160 volts
Max. V_{h-k} (heater negative)	200 volts
Max. V_{h-k} (heater positive)	200 volts

TYPICAL OPERATION.

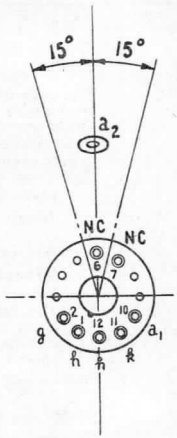
Final Anode Voltage	25 kV
First Anode Voltage	2 kV
Vg for visual cut-off	−120 volts
Resolution	>8000 lines

CAPACITANCES.

C_{k-all}	<8 pF
C_{g-all}	<8 pF

X-RAY 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.



Base Conections

Viewed from spigot end of tube

*Other phosphors available to special order, but resolution may suffer with other type phosphors and our recommendation for specific applications should be sought.

Issue 3.
Sept, 1962

Ferranti

NOTES ON OPERATION

FOCUS COILS.

The tube is intended for use with an air cored electromagnetic focus coil or a suitable astignatism-free coil, supplemented by a dynamic focus coil (focus modulation coil).

Ferranti Focus Coil Assembly Type FC5 has been designed as a thin magnetic lens to provide the highest resolution of which the tube is capable.

This Focus Coil Assembly incorporates:—

Main Focus Coil.

Alignment Coils for electrical alignment—no mechanical adjustment required.

Astigmatism Coils to produce a non astigmatic round spot

Dynamic Focus Coil to ensure highest resolution over whole scan area

This dynamic focus coil is supplied with a signal, the current of which is proportional to the distance of the spot from the screen centre, by this means the focal length of the combined lens decreases as the spot approaches the centre.

Further information regarding this coil will be supplied on request.

SCAN COILS.

The design of deflector coils should be aimed at producing a uniform field consistent with linear angular deflection and with minimum spot size. The best design for scan coils is toroidally wound coils on a ferrite core with the connections for each winding brought out separately to permit push pull or single ended operation. The coils should be wound in segments to keep the self capacity as low as possible. Damping resistors should be provided.

Any pin-cushion distortion which may result from coil design is best corrected by small shaping magnets placed around the tube bulb between the scan coils and face

Suitable scan coils for most applications can be supplied by Ferranti Ltd. Details on request.

BEAM CENTRING MAGNET.

A weak permanent magnet, clamped to the base or neck of the tube a little behind the cathode can be adjusted to provide the correction necessary to allow for reasonable tolerances in the gun design and the presence of a small external field.

EHT AND HT SUPPLIES

The quality of EHT, scanning and focus is very important since multiple effcts due to EHT ripple, imperfect focusing and poor scanning fields can cause such enlargement of the spot that no advantage is apparent when using these tubes.

High Frequency ripple on the EHT supply can cause considerable performance loss in this type of tube. This fault can usually be recognised by a "crawl" visible on the line as seen under a microscope, more commonly observed when the EHT supply is driven by a free-running oscillator. Even locked ripple at a harmonic of the sweep speed may upset both focus and linearity. In decoupling to cure this trouble, excessive smoothing capacity should be avoided to prevent "flashover".

SETTING UP.

The centring magnet should be clipped loosely at the gun end of the neck Bias and H.T. voltages should be applied and a raster obtained. Without applying focus current, the centring magnet should be now adjusted and clamped or exact symmetry of the raster on the face of the tube. The strength of the centring magnet may be adjusted by rotation.

Ferrous metal should not be used in the construction of the mount.

Neither ferrous nor non-ferrous metals should be placed close to the scan coil.

It is essential that the mumetal sleeve provided should be fitted to the neck.

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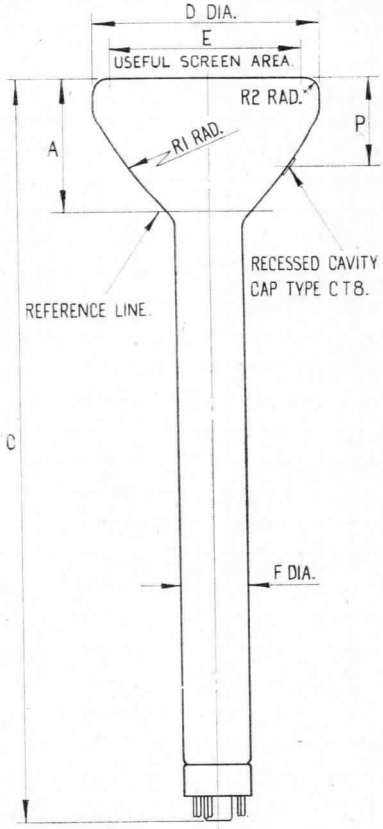
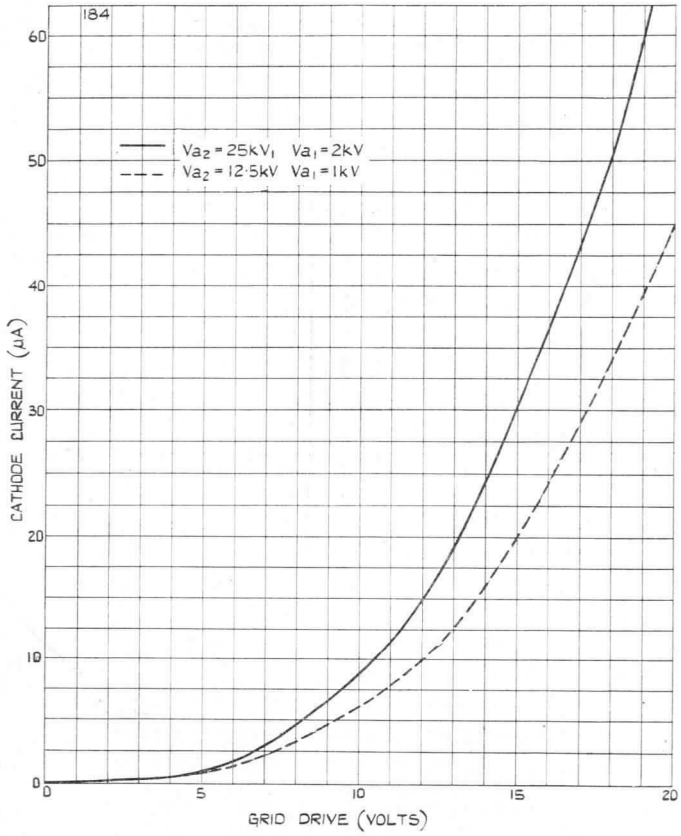


DIM.	INS	m m.	DIM.	INS.	m m.
A	2·953 ± ·118	75 ± 3	F	1·457 $^{+\cdot 020}_{-\cdot 059}$	37 $^{+\ 1}_{-\ 2}$
C	18·307 ± ·197	465 ± 5	P	1·968 ± ·197	50 ± 5
D	4·960 ± ·079	126 ± 2	R1	17·716	450
E	4·330	110 MIN.	R2	·250	6·35

TYPICAL GRID DRIVE CHARACTERISTICS.



Ferranti

MICRO SPOT RADAR TUBES

5/71AP
5/71PP
5/71QP

5″ diameter optically flat faced Cathode Ray Tubes with a short bulb. The spot size is very small, being less than 0·0005″ at the screen centre and the screen can be accurately scanned over an area greater than four inches in diameter.

The high resolution has been made possible in this series of cathode ray tubes by the use of an entirely novel design of electron gun involving two focusing elements, one only of which is electromagnetic and external to the tube in the usual way; the other is electrostatic and of fixed focal length.

FOCUS	Magnetic and Electrostatic
DEFLECTION	Magnetic 60° angle.
SCREEN	Metal Backed.

*Phosphor	Type 'A'	Type 'P'	Type 'Q'
Fluorescence	Green	Blue	Blue Violet
Persistence to 1/e	1–2 μsecs.	5–10 μsecs.	<0·1 μsecs.

PHYSICAL DETAILS.

Max. Overall Length	473 mm.
Max. Diameter	135 mm
Nom. Neck Diameter	37 mm
Min. Useful Screen Diameter	110 mm
For other dimensions see outline drawing on Page 2.	
Electrode Connections	Flying Leads

ELECTRODE CONNECTIONS.

Colour Code:	
Heater	Brown
Cathode	Yellow
Modulator	Green
First Anode	Orange
Final Anode	White

HEATER.

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

RATINGS.

Max. Final Anode Voltage	30 kV
Min. Final Anode Voltage	12 kV
Max. First Anode Voltage	2·5 kV
Min. First Anode Voltage	1 kV
V_g for visual cut-off (at V_{a1} = 2kV)	−80 to −160 volts
Max. V_{h-k} (heater negative)	200 volts
Max. V_{h-k} (heater positive)	200 volts

TYPICAL OPERATION.

Final Anode Voltage	25 kV
First Anode Voltage	2 kV
Vg for visual cut-off	−120 volts
Resolution	> 8000 lines

CAPACITANCES.

C_k–all	<8 pF
C_g–all	<8 pF

X-RAY 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.

*Other phosphors available to special order, but resolution may suffer with other type phosphors and our recommendation for specific applications should be sought.

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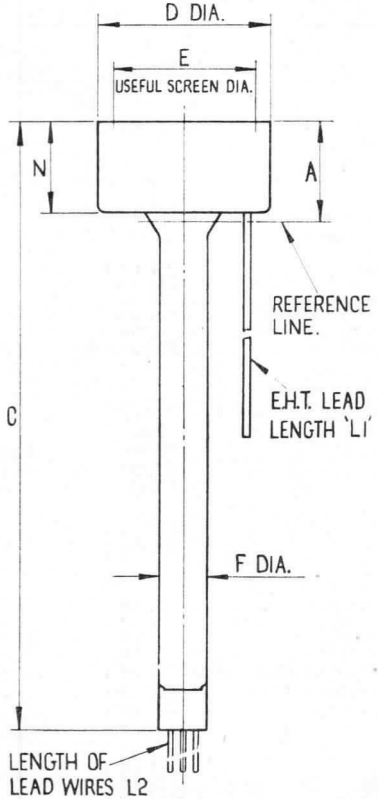
Aug., 1962

Ferranti



DIM.	INS.	m m.	DIM.	INS.	m m.
A	2·953 ± ·118	75 ± 3	F	1·457 $\pm^{\cdot 030}_{\cdot 039}$	37 $\pm^{\cdot 5}_{1 \cdot 5}$
C	18·228 ± ·394	463 ± 10	L1	36	914
D	5·118 ± ·079	130 ± 2	L2	36	914
E	4·330	110 MIN.	N	2·756 ± ·118	70 ± 3

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

NOTES ON OPERATION

SCAN COILS.

The design of deflector coils should be aimed at producing a uniform field consistent with linear angular deflection and with minimum spot size. The best design for scan coils is toroidally wound coils on a ferrite core with the connections for each winding brought out separately to permit push pull or single ended operation. The coils should be wound in segments to keep the self capacity as low as possible. Damping resistors should be provided.

Any pin-cushion distortion which may result from coil design is best corrected by small shaping magnets placed around the tube bulb between the scan coils and face.

FOCUS COILS.

The tube is intended for use with an air cored electromagnetic focus coil or a suitable astignatism-free coil, supplemented by a dynamic focus coil (focus modulation coil).

Ferranti Focus Coil Assembly Type FC5 has been designed as a thin magnetic lens to provide the highest resolution of which the tube is capable.

This Focus Coil Assembly incorporates:—

Main Focus Coil.

Alignment Coils for electrical alignment—no mechanical adjustment required.

Astigmatism Coils to produce a non astigmatic round spot.

Dynamic Focus Coil to ensure highest resolution over whole scan area.

This dynamic focus coil is supplied with a signal, the current of which is proportional to the distance of the spot from the screen centre, by this means the focal length of the combined lens decreases as the spot approaches the centre.

Further information regarding this coil will be supplied on request.

BEAM CENTRING MAGNET.

A weak permanent magnet, clamped to the base or neck of the tube a little behind the cathode can be adjusted to provide the correction necessary to allow for reasonable tolerances in the gun design and the presence of a small external field.

SETTING UP.

The centring magnet should be clipped loosely at the gun end of the neck Bias and H.T. voltages should be applied and a raster obtained. Without applying focus current, the centring magnet should be now adjusted and clamped or exact symmetry of the raster on the face of the tube. The strength of the centring magnet may be adjusted by rotation.

It is advisable to use no ferrous metal in the construction of the mount. Neither ferrous nor non-ferrous metals should be placed close to the scan coil.

It is essential that the mumetal sleeve provided should be fitted to the neck.

GENERAL.

The tube is coated, except over the screen and neck surface, with a thick layer of plastic resin. The final anode lead, insulated with a coating of irradiated polythene emerges from the rear surface of the resin, enabling the tube to be operated under adverse atmospheric conditions without danger of EHT breakdown.

The leads to the gun electrodes are also encapsulated in a manner which does not hinder the easy fitting of the scan and focus coils.

The cylindrical shape of the resin coating facilitates firm clamping of the tube in its mount.

Great care must be taken in considering the quality of EHT, scanning and focus supplies, since multiple effects due to EHT ripple, imperfect focusing and poor scanning fields can cause such enlargement of the spot that no advantage is apparent when using these tubes.

High Frequency ripple on the EHT supply can cause considerable performance loss in this type of tube. This fault can usually be recognised by a "crawl" visible on the line as seen under a microscope, more commonly observed when the EHT supply is driven by a free-running oscillator, Even locked ripple at a harmonic of the sweep speed may upset both focus and linearity. In decoupling to cure this trouble, excessive smoothing capacity should be avoided to prevent "flashover".

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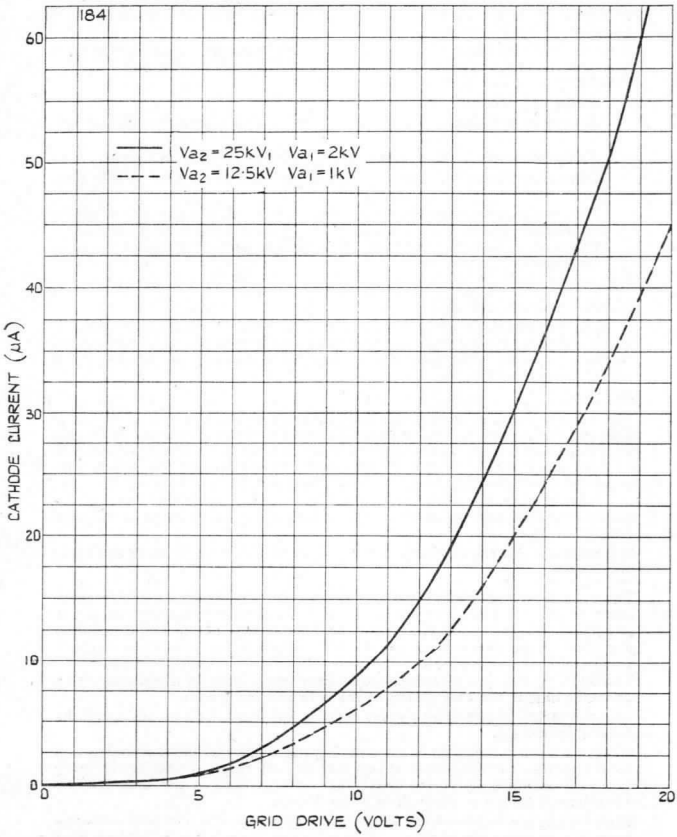
TYPICAL GRID DRIVE CHARACTERISTICS.



Ferranti

MICRO SPOT RADAR TUBES

A very high definition Cathode Ray Tube with a 5in. diameter optically flat face and fine grain metal backed screen. This Tube is designed for use in applications where it is not necessary to have the very high resolution of a Type 5/71 micro-spot tube or for high definition applications requiring a higher light output than that provided by Type 5/71QM.

FOCUS	Magnetic and Electrostatic.
DEFLECTION	Magnetic, 60° angle.
SCREEN	Metal Backed.
*Phosphor	Type 'Q'
Fluorescence	Blue/Violet.
Persistence	Ultra Short.

PHYSICAL DETAILS.

Base	B12A (Duodecal)
Final Anode Connector ...	CT8 (Cavity type).
Max. Overall Length	430 mm.
Max. Diameter	135 mm.
Nom. Neck Diameter	37 mm.
Max. Useful Screen Diameter...	110 mm.

For other dimensions see outline drawing overleaf.

BASE CONNECTIONS.†

Pin 1—Heater.	Pin 7—No Connection.
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 Cap—2nd Anode.

HEATER.

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

RATINGS.

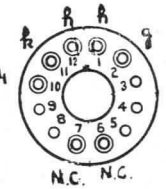
Max. Final Anode Voltage ...	30 kV.
Max. First Anode Voltage ...	2·5 kV.
Min. First Anode Voltage ...	1 kV.
V_g for visual cut-off (at Va_1 = 2kV.)	−80 to −160 volts.
Max. V_{h-k} (heater negative) ...	200 volts.
Max. V_{h-k} (heater positive) ...	200 volts.

TYPICAL OPERATION.

Final Anode Voltage	25 kV.
First Anode Voltage	2 kV.
V_g for visual cut-off	−120 volts.
§Line Width	0·001 ins. (approx.).

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.



Base Connections

View from spigot end of tube

*Other phosphors available to special order.
†This tube can also be supplied with potted anode and flying lead connector—Type 5/74QO
or with both potted anode and base with flying lead connections to all electrodes—Type 5/74QP.
§Measured by microscope at screen centre.

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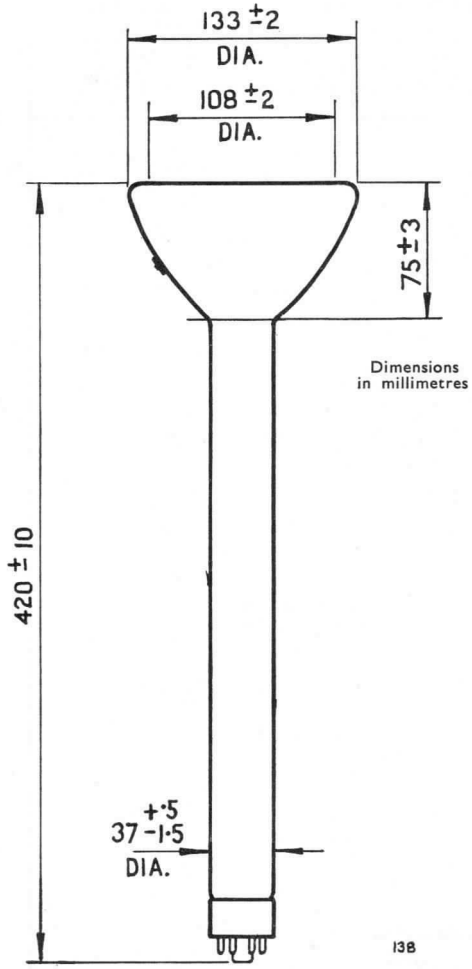
Ferranti



Dimensions in millimetres

Ferranti

5G/14 AJ	5G/14 QJ
5G/14 PJ	5G/14 Q4J

HIGH RESOLUTION DISPLAY TUBES

High Resolution, High Light Output Display Tubes. The 5″ diameter face is optically flat and is of non-browning glass.

FOCUS ..... Magnetic
DEFLECTION ..... Magnetic

SCREENS:

Type No.	Phosphor	Fluorescence	Approx. Persistence
5G/14AJ	A	Green	1 μSec.
5G/14PJ	P	Blue	2 μSec.
5G/14QJ	Q	Blue/Violet	0·1 μSec.
5G/14Q_4J	Q_4	Blue/Violet	0·1 μSec.

Refer to phosphor characteristics at the front of this section of this handbook.

All types have metal backed screens.

PHYSICAL DETAILS:

Base ..... B12A (Duodecal)
Max. overall length..... 458 mm. (18·0 in.)
Min. useful screen area..... 108 mm. (4·25 in.)
Neck diameter ..... 37 mm. nominal
Min. length—Anode lead..... 380 mm. (15·0 in.)

For other dimensions see outline drawing overleaf.

The final anode lead is potted on to the tube and the neck has an external conductive coating.

BASE CONNECTIONS:

Pin 1—Heater	Pin 5—No pin	Pin 9—No pin
Pin 2—Grid	Pin 6—Not connected	Pin 10—Not connected
Pin 3—No pin	Pin 7—1st anode	Pin 11—Cathode
Pin 4—No pin	Pin 8—No pin	Pin 12—Heater

Flying Lead 2nd anode.

HEATER:

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

RATINGS:

Max. 1st Anode voltage ..... 600 volts
Max. 2nd Anode voltage ..... 30 kV
Min. 1st Anode voltage ..... 300 volts
Min. 2nd Anode voltage ..... 15 kV
Max. $V_{h\text{-}k}$ (Heater Positive)..... 250 volts
Max. $V_{h\text{-}k}$ (Heater Negative)..... 150 volts
Max. $R_{h\text{-}k}$..... 1·0 MΩ
Max. $R_{g\text{-}k}$..... 1·5 MΩ

CAPACITANCES:

$C_{k\text{-}all}$..... $<$15·0 pF.
$C_{g\text{-}all}$..... $<$15·0 pF.

TYPICAL OPERATING CONDITIONS:

1st Anode voltage..... 500 volts
2nd Anode voltage..... 25 kV
V_g for visual cut off..... −105 volts

Resolution at Screen Centre:

Microscope Measurement—A and P Phosphors:

Line width measured by microscope to visual extinction (I_B=50μA) 125 microns.

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Resolution at Screen Centre (cont.):

Spatial Frequency Measurement:

A and P Phosphors

95 cycles/cm spatial frequency response at 60% modulation (I_B=1μA). Equivalent to 35 microns. 30 cycles c/m spatial frequency response at 60% modulation (I_B=50 μA). Equivalent to 100 microns.

Q and Q_4 Phosphors

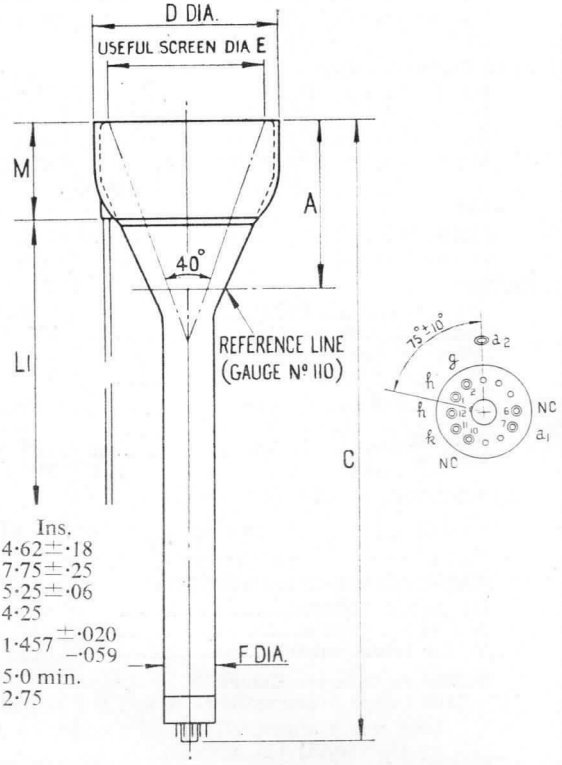
85 cycles/cm spatial frequency response at 60% modulation (I_B=1μA). Equivalent to 37 microns. 25 cycles/cm spatial frequency response at 60% modulation (I_B=50 μA). Equivalent to 130 microns.

The position of the centre of the air gap in the focus-coil should be approximately 210 mm. from the tube face.

X-RAY 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.

This type of tube is also available with the core coated with a thick layer of plastic resin.



Dim.	mm.	Ins.
A	117·5±4·5	4·62±·18
C	451±6·3	17·75±·25
D	133·4±1·5	5·25±·06
E	108 min.	4·25
F	37 $^{+\cdot5}_{-1\cdot5}$	1·457 $^{\pm\cdot020}_{-\cdot059}$
L1	380 min.	15·0 min.
M	70	2·75

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OSCILLOGRAPH TUBE

A miniaturised instrument tube with a rectangular flat face. 'Y' deflection is Electrostatic and 'X' deflection Magnetic.

FOCUS ... ... Low voltage Electrostatic

DEFLECTION ... ... 'X' ... Magnetic.
'Y' ... Electrostatic (single end input)

SCREEN.

Phosphor †	...	...	Type 'D'.
Fluorescence	...	...	Green.
Persistence	...	...	Short.

For further details refer to Type 'D' phosphor characteristics at the front of this section of the handbook.
This tube can be supplied with other screen phosphors.

PHYSICAL DETAILS.

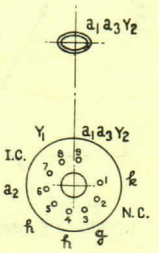
Base	...	...	B9A/D.
Anode Cap	...	...	CT8 Cavity Type.
Max. Overall Length	...	...	275 mm.
Nom. Neck Diameter	...	...	22·5 mm.
Min. 'Y' Deflection	...	...	42 mm.

For other dimensions see outline drawing overleaf.

BASE CONNECTIONS. *

Pin 1—Cathode.	Pin 6—2nd Anode (focus).
Pin 2—No Connection	Pin 7—Internal Connection.
Pin 3—Grid.	Pin 8—'Y_1' Deflector Plate.
Pin 4—Heater.	Pin 9—1st & 3rd Anodes and
Pin 5—Heater.	'Y_2' Deflector Plate.

Side Contact : 1st and 3rd Anodes and 'Y_2' Deflector Plate.



Base Connections

Underside View of Base

HEATER.

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

RATING.

Max. $A_1 + A_3$ voltage	...	...	4 kV.
Min. $A_1 + A_3$ voltage	...	...	1 kV.
Max. V_{h-k}	...	...	200 volts.
Max. R_{g-k}	...	...	0·5 MΩ
Max. R_{h-k}	...	...	1·0 MΩ

TYPICAL OPERATION.

Heater Voltage	...	...	6·3 volts.
1st and 3rd Anode Voltage		...	2 kV.
2nd Anode Voltage for focus	...	...	−50 to +100 volts.
Vg for visual cut-off		...	−20 to −50 volts.
'Y' Plate Sensitivity	...	...	11 v/cm.

†This tube should be fitted with a magnetic shield which must be earthed.

CAPACITANCES.

C_{k-all}	...	...	...	<8 pF.
C_{g-all}	...	...	...	<8 pF.
C_{y_1-all}	...	...	...	2 pF (approx.).

*This Type of Tube can also be supplied with potted base and flying leads—see Data Sheet for Type 5×3/53DE.

†A suitable shield is Type 11467 manufactured by Magnetic and Electrical Alloys Ltd.

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June 1960.

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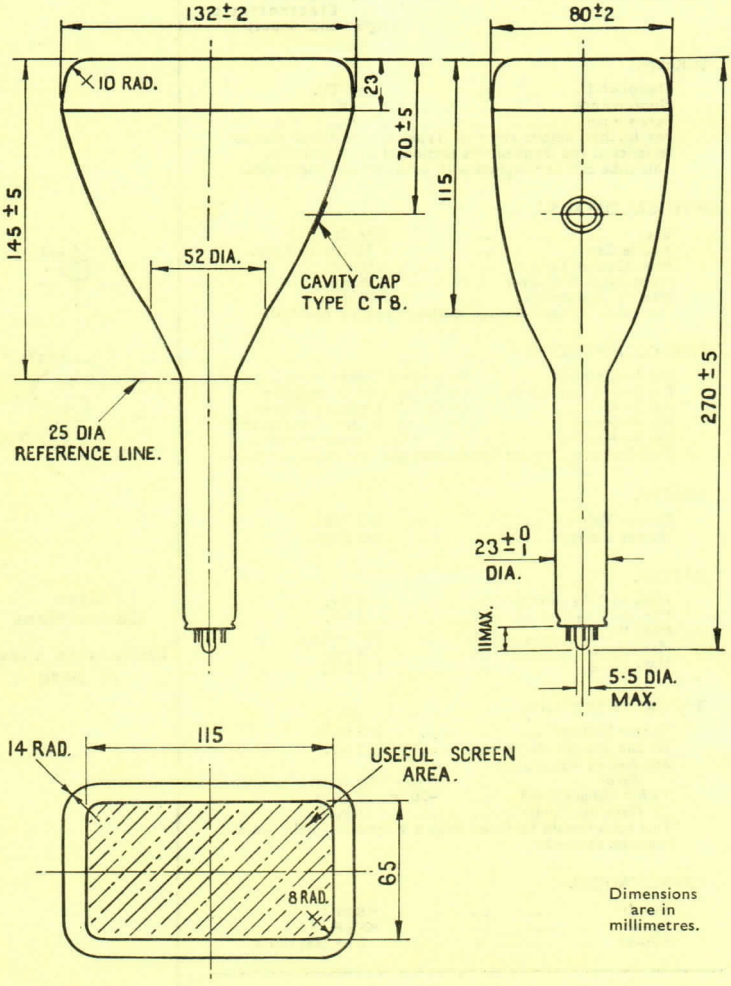
5×3/53D



Dimensions are in millimetres.

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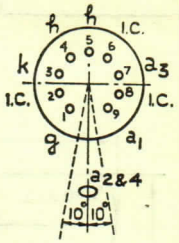
RADAR TUBES

5X3/94LM

5X3/95LM

Miniaturised rectangular faced Display Tube designed for use in airborne radar equipments with transistor circuitry. The narrow neck diameter and narrow scan angle ensure full deflection with low scan power. The high modulation slope and the phospor permit displays of conventional brightness with drive of the order of a few volts. With higher drive voltage, the high slope feature provides displays of high intensity for use in conditions of high ambient lighting.



Underside view of base

FOCUS	Low Voltage Electrostatic.
DEFLECTION	Magnetic.
SCREEN.	
*Phosphor	Type 'L'.
Fluorescence	Orange.
Afterglow	Orange.
Persistence	Long.
PHYSICAL DETAILS.	
Base	B9A/D
Anode Cap	CT8 Cavity Type.
Max. Overall Length	257 mm.
Neck Diameter	23 mm. (nom.)
Mounting Position	Any.

BASE CONNECTION.

Pin 1—Grid	Pin 6—I.C.
Pin 2—I.C.	Pin 7—3rd Anode.
Pin 3—Cathode.	Pin 8—I.C.
Pin 4—Heater.	Pin 9—1st Anode.
Pin 5—Heater.	Side Contact—2nd & 4th Anodes.

HEATER.

	5 x 3/94 LM.	5 x 3/95 LM.
Heater Voltage	6·3	19·0 volts
Heater Current	0·3	0·1 amp,

†RATINGS & CHARACTERISTICS

Max. A_1 voltage	70 volts.
Max. A_2+A_4 voltage	18 kV.
Min. A_2+A_4 voltage	8 kV.
Max. Neg. A_1 voltage	–500 volts.
Max. V_{h-k}	200 volts.
A_3 voltage for focus ...	0 to –300 volts.

†TYPICAL OPERATION.

It is essential to employ cathode modulation, i.e., the grid should be operated at earth or some other fixed potential and all other voltages applied with reference to this point. This type of tube is inefficient under grid modulation conditions unless drive is also applied to A_1 in the same sense as that applied to the grid.

1. Short grid base conditions, where V_k is approx. +10v. for visual cut-off.
   Final Anode Voltage V_{a2+a4} 15 kV.
   V_{A1} ... ... –40 volts.
   V_{A3} for focus ... ... –150 volts.
   Under these conditions the zero bias beam current is approx. 150 microamperes.

2. For high brightness applications with a conventional drive range, where V_k is approximately +60 volts for visual cut off.
   Final Anode Voltage V_{A2+4} 15 kV.
   V_{A1} ... ... 0 volts.
   Under these conditions the beam current at zero bias is approx. 2·5 mA.

Versions with flying leads and encapsulated base and anode contact are also available.

*This phosphor is liable to burn if operated with a spot which is stationary or slow moving, and tubes should not be operated under such conditions, even at low beam current. Alternative phosphors for this application can be supplied on request.

†All potentials are referred to grid.

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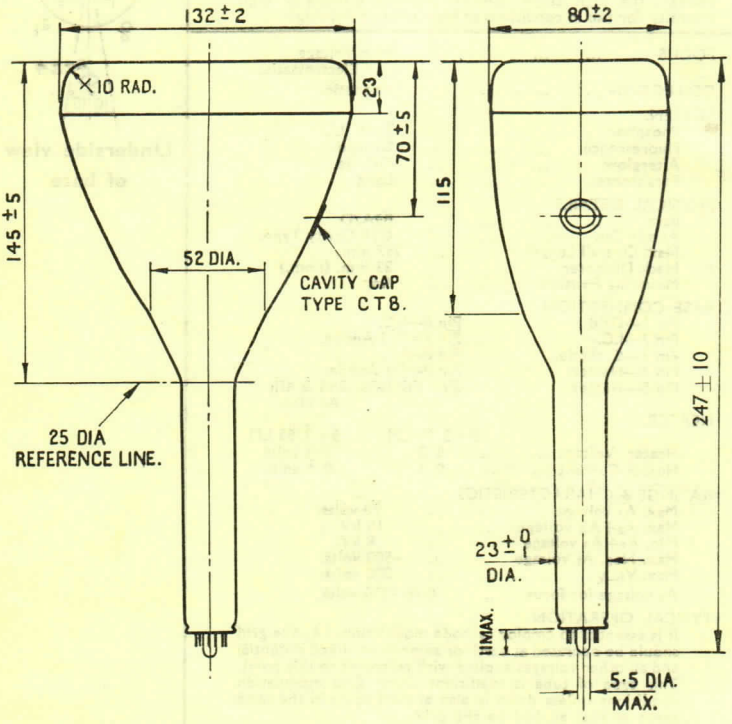
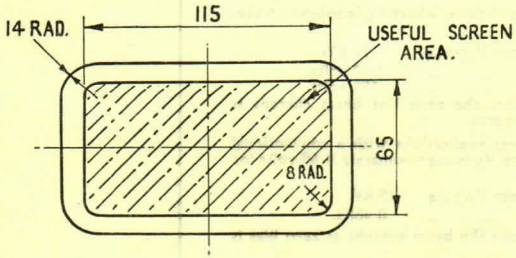
5X3/94LM

5X3/95LM





DIMENSIONS ARE IN MILLIMETRES.

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

Ferranti

CATHODE RAY TUBES

6/22AM
6/22PM
6/22QM

6-inch diameter Triode Tubes for Magnetic deflection and focus.
Types 6/22AM and 6/22QM are designed for use in general Flying Spot Scanner applications.
Type 6/22PM is for use in recording high resolution images on blue sensitive film stock.
All Types have optically flat faces with ground internal and external surfaces.
The tube face is of non-solarising glass.

FOCUS ... ... Magnetic.

DEFLECTION ... ... Magnetic.

SCREENS.

	6/22AM	6/22PM	6/22QM
Phosphor ...	Type 'A'	Type 'P'	Type 'Q'
Fluorescence	Green	Blue	Blue/Violet
Persistence	Ultra-short	Ultra-short	Killed

All types have metal backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT.8 (Cavity Type).
Max. Overall Length	495 mm.
Max. Diameter	163 mm.
Nom. Neck Diameter	37 mm.
Useful Screen Area	127 mm. dia.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—Not connected.
Pin 2—Grid.	Pin 8—No Pin.
Pin 3—No pin.	Pin 9—No pin.
Pin 4—No pin.	Pin 10—Not connected.
Pin 5—No pin.	Pin 11—Cathode.
Pin 6—Not connected.	Pin 12—Heater.

Side Contact—Anode.

HEATER.

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

RATINGS.

*Max. Anode Voltage	30 kV.
†Nom. Vg for visual cut off ...	Va/125
Max. V_{hk} (Heater Negative) ...	200 volts.
Max. V_{hk} (Heater Positive) ...	200 volts.

TYPICAL OPERATION.

Anode Voltage	25 kV.
Vg for visual cut off	−200 volts.
Grid Drive for I_a = 100μA ...	37 volts.
Screen Resolution at 50 f.p.s. ...	1000 lines.
‡Light Output ('P' Screen) ...	300 e.f.c.
§Focus Coil	570 ampere turns (approx.).

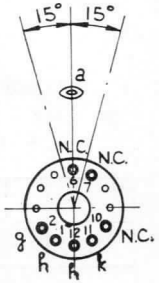
CAPACITANCE.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.

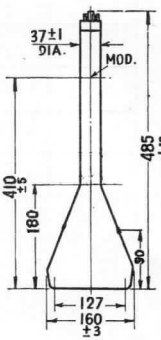
*Recommended operating range—17 to 25 kV.
†The grid should never be positive with respect to the cathode.
‡At Beam Current of 100μA with a 10 x 10 cm. raster.
§A suitable coil is a soleniod of approx. 16,000 turns of 38 s.w.g. wire, positioned with the gap approx. 150 mm. in front of the modulator. Ferranti Type FC.1 (Pt. No. 38/13300) is available.

X-RAY WARNING.

When operated at an anode voltage in excess of 16kV. shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.



Underside View of Base



All dimensions shown are in millimetres.

Ferranti

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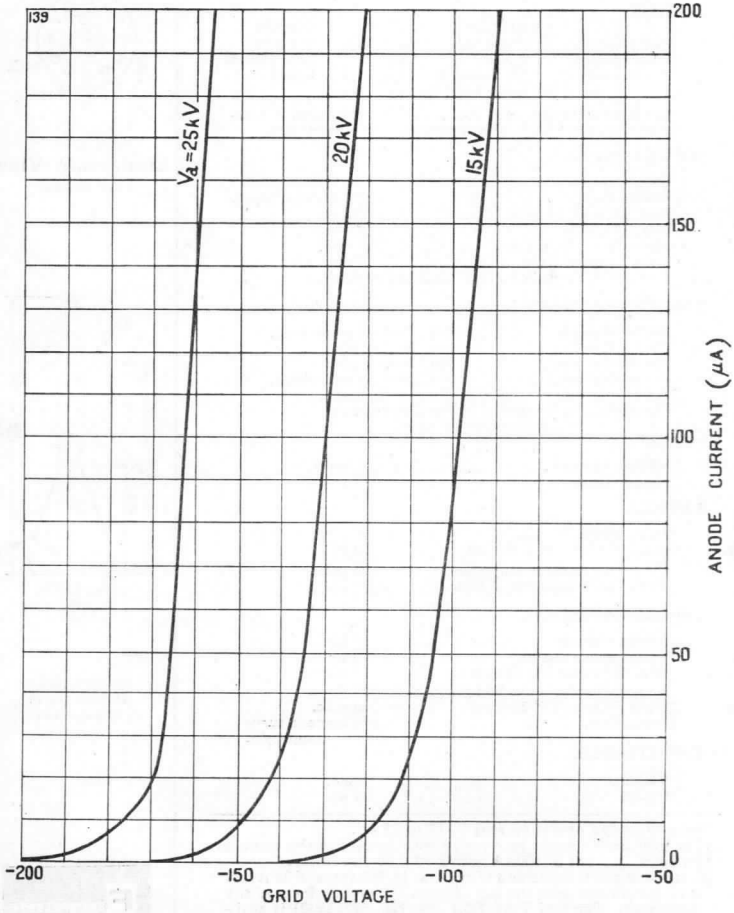
TYPICAL ANODE CURRENT GRID/VOLTAGE CHARACTERISTICS



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FERRANTI

VOLTAGE TRANSIENT OSCILLOGRAPH TUBE

6/32PM

An indirectly heated Triode Tube specially designed for Transient Oscillography. The Fluorescent spot of high actinic value and exceptional brightness makes the tube particularly suitable for photographic recording. The useful screen area is flat and approx. 5 inches in diameter.

FOCUS	Magnetic.
DEFLECTION	Electrostatic.
SCREEN	Metal Backed.
Phosphor	Type 'P'.
Fluorescence	Blue.
Persistence	Ultra Short.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	International Octal.
Anode Cap	Type CT8 (Cavity
Deflector Plate Caps	Type CT2 Type.)
Max. Overall Length	525 mm.
Useful Screen Area	127 mm. dia. (flat face).
Neck Diameter	37 ± 1 mm.
Mounting Position	Any.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—No Connection.	Pin 5—Grid.
Pin 2—Heater.	Pin 6—No Pin.
Pin 3—No Pin.	Pin 7—Heater.
Pin 4—No Pin.	Pin 8—Cathode.

Anode and deflector plates connected to side caps.

HEATER.

Heater Voltage	4.0 volts AC. or DC.
Heater Current	1.0 amp.

RATINGS.

Max. Anode Voltage	25 kV.
Max. V_{h-k}	100 volts.
Max. Pulsed Beam Current	500 μA.

CHARACTERISTICS.

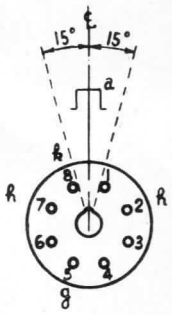
*Nom. Vg for visual cut off	$V_a/120$
Deflection Sensitivity :—	
'Y' plates	$450/V_a$ mm./V.
'X' plates	$500/V_a$ mm./V.

TYPICAL OPERATION.

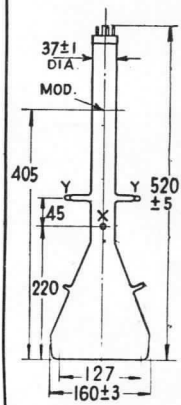
Anode Voltage	20 kV.
Beam Current	75 μA.
Vg for Cut-off	165 volts.
†Focus Coil	900 ampere turns.
Writing Speeds for Single Sweep Photography using Standard X-ray Film :	
Image Ratio	1 : 3.
Lens Aperture	f1.
Writing Speed	> 500,000 spot diameters per microsecond.

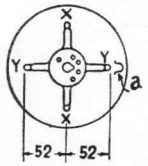
CAPACITANCES.

C_{k-all}	6.0 pF.
C_{g-all}	6.2 pF.
$C_{x_1-x_2}$	1.0 pF.
$C_{y_1-y_2}$	0.9 pF.
C_{x_1-all}	4.8 pF.
C_{x_2-all}	4.8 pF.
C_{y_1-all}	4.3 pF.
C_{y_2-all}	4.3 pF.
$C_{x_1x_2-y_1y_2}$	1.0 pF.



Base Connections Underside View of Base





All dimensions shown are in millimetres.

This tube was formerly designated Type 06/3P.

*The grid should never be allowed to become positive with respect to the Cathode.

†The recommended focus coil is a shrouded solenoid of approx. 16,000 turns of 38 S.W.G. wire. The power unit required for energising this coil should be capable of supplying 40–60 mA. at 150–200 volts.

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FERRANTI

FLYING SPOT SCANNER TUBE

6/33AM

An indirectly heated Triode Tube with a 6in. diameter metal backed screen and electrostatic deflection. This tube is suitable as a replacement for earlier types S6/30A or 6/3A.

FOCUS	Magnetic.
DEFLECTION	Electrostatic.
SCREEN	Metal Backed.
Phosphor	Type 'A'.
Fluorescence	Green.
Persistence	Ultra-short.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.*
Deflector Plate Caps	Type CT2 (9.7 mm. dia.).
Max. Overall Length	495 mm.
Useful Screen Area	127 mm. dia. (flat face).
Neck Diameter	37±1 mm.
Mounting Position	Any.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
Pin 2—Grid.	Pin 8—No Pin.
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—No Connection.
Pin 5—No Pin.	Pin 11—Cathode.
Pin 6—No Connection.	Pin 12—Heater.
Side Contact—Anode.	

HEATER.

Heater Voltage	6.3 volts.
Heater Current	0.3 amp.

RATINGS.

Max. Anode Voltage	25 kV.
Max. V_{h-k}	100 volts.
Max. Beam Current	200 μA.

CHARACTERISTICS.

†Nom. Vg for visual cut off ...	$V_a/120$
Av. Mod. Drive for 50 μA Beam Current	33 volts.
Deflection Sensitivity :—	
'X' plates	$500/V_a$ mm./V.
'Y' plates	$450/V_a$ mm./V.

TYPICAL OPERATION.

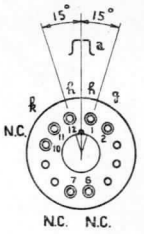
Heater Voltage	6.3 volts.
Anode Voltage	20 kV.
V_g for visual cut off	−170 volts.
‡Focus Coil	900 ampere turns (approx.).
Screen Resolution	> 100 lines per cm.
Normal Peak Beam Current ...	150 μA.

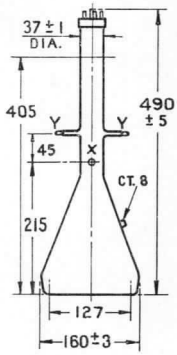
X-RAY WARNING.

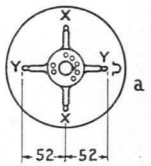
When operated at high anode voltage shielding may be required to protect against harmful X-Ray radiation, which could cause possible injury from prolonged exposure.

CAPACITANCES.

$C_{x\ x_2-y\ y_2}$	1.0 pF.
C_{g-all}	5.8 pF.
$C_{x_1-x_2}$	1.0 pF.
$C_{y_1-y_2}$	0.9 pF.
$C_{x_1-all} = C_{x_2-all}$	4.8 pF.
$C_{y_1-all} = C_{y_2-all}$	4.3 pF.







Dimensions shown are in millimetres.

*A suitable adaptor to CT2 can be supplied where the tube is required to replace an earlier type.
†The grid should never be positive with respect to the cathode.
‡Positioned so that the gap is 100 mm. in front of the modulator.

Issue 1
Aug., 1957

Ferranti

CATHODE RAY TUBES

6/44DM

6/44PM

6-inch diameter Tetrode Tubes having optically flat faces with ground internal and external surfaces.
Type 6/44 DM is designed for use in Telerecording and in Television Transmission Systems Converters.
Type 6/44 PM is for use in recording high resolution images on blue sensitive film stock.

FOCUS ... ... Magnetic.

DEFLECTION ... ... Magnetic.

SCREEN.

	6/44 DM	6/44 PM
Phosphor ...	Type 'D'	Type 'P'
Fluorescence	Green	Blue
Persistence	Short	Ultra-short

Both types have metal backed screens.
For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT.8 (Cavity Type).
Max. Overall Length	495 mm.
Max. Diameter	163 mm.
Nom. Neck Diameter	37 mm.
Useful Screen Area	127 mm. dia.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—2nd Anode.

HEATER.

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

RATINGS.

Max. A_1 Voltage	850 volts.
*Max. A_2 Voltage	30 kV.
†Nom. Vgf or visual cut off ...	$V_{a_1}/7$ volts
Max. V_{hk} (Heater Negative) ...	200 volts.
Max. V_{hk} (Heater Positive) ...	200 volts.

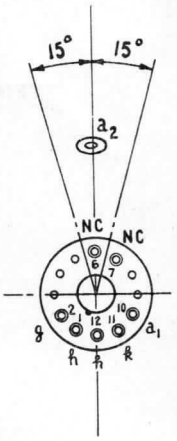
TYPICAL OPERATION.

1st Anode Voltage	600 volts.
2nd Anode Voltage	25 kV.
Vg for visual cut off	–85 volts.
Grid Drive for I_B= 100 μA ...	35 volts.
Screen Resolution at 50 f.p.s. ...	1000 lines.
Focus Coil...	See Note § Below.

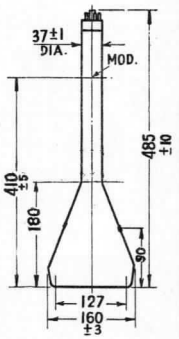
CAPACITANCE.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.

X-RAY WARNING.
When operated at an anode voltage in excess of 16 kV. shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.



Base Connections Underside View of Base



All dimensions shown are in millimetres.

*Recommended operating range—17 to 25 kV.
†The grid should never be positive with respect to the cathode.
§A suitable coil is a solenoid of approx. 16,000 turns of 38 s.w.g. wire, positioned with the gap approx. 150 mm. in front of the modulator.

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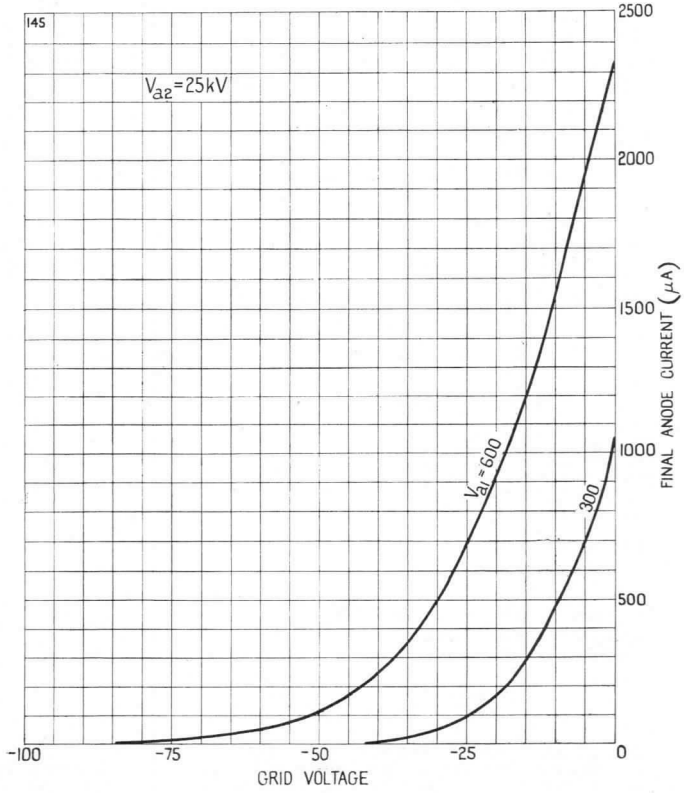
TYPICAL BEAM CURRENT/GRID VOLTAGE CHARACTERISTICS



Ferranti

FLYING SPOT SCANNER TUBES

High Resolution Rectangular Flying Spot Scanner Tubes with Electrostatic Focus.

8/03AM

8/03QM

FOCUS	Low Voltage Electrostatic.	
DEFLECTION	Magnetic—90°	
SCREENS	Metal Backed.	
	8/03AM	8/03QM
Phosphor ...	Type 'A'	Type 'Q'
Fluorescence	Green	Magenta.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

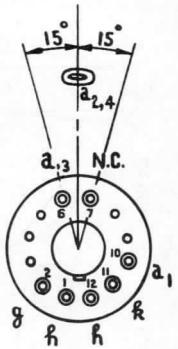
Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length ...	293 mm.
Neck Diameter	37 mm. (nominal).
Mounting Position ...	Any.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
Pin 2—Grid.	Pin 8—No Pin.
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—1st Anode. (A_1).
Pin 5—No Pin.	Pin 11—Cathode.
Pin 6—3rd Anode. (A_3).	Pin 12—Heater.

Side Contact—2nd Anode + 4th Anode. ($A_2 + A_4$).



Base Connections Underside View of Base

HEATER.

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

RATINGS.

Max. A_1 Voltage	500 volts.
Min A_1 voltage	200 volts.
Max. $A_2 + A_4$ voltage ...	15 kV.
Min. $A_2 + A_4$ voltage ...	10 kV.
Max. Pos. A_3 voltage ...	+500 volts.
Max. Neg. A_3 voltage ...	−500 volts.
Max. V_{h-k} (Heater positive)	150 volts.
Max. V_{h-k} (Heater negative)	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION AND CHARACTERISTICS.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd and 4th Anode voltage	12 kV.
3rd Anode voltage for focus ...	−300 to +300 volts.
Vg for visual cut off	−30 to −70 volts.
†Av. Grid Drive for I_a = 100 μA.	25 volts.
Screen Resolution	600 lines.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.

†The grid should never be positive with respect to the cathode.

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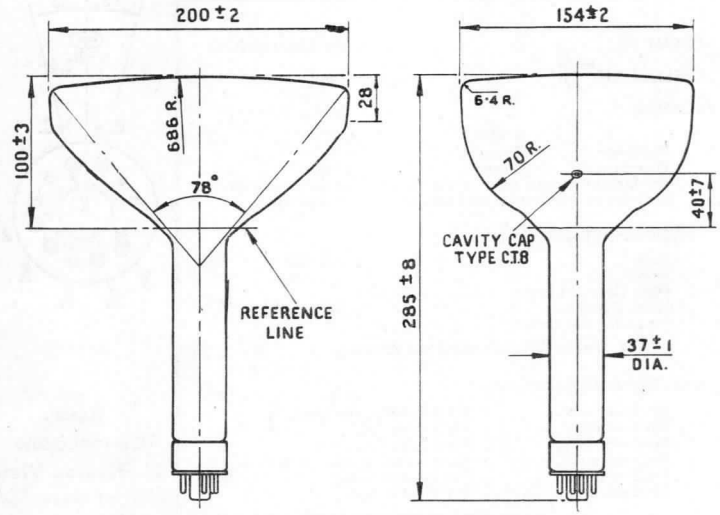
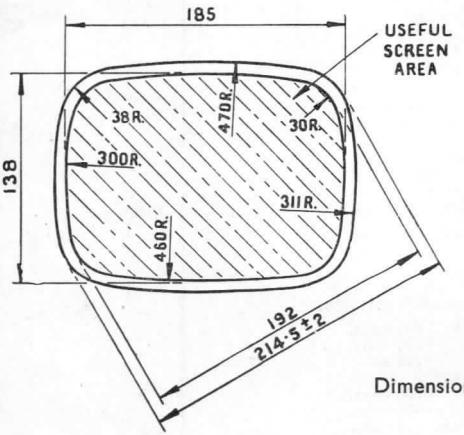
May, 1960

Ferranti

8/03AM

8/03QM





Dimensions in millimetres.

FERRANTI

TELEVISION MONITOR TUBE

8/03TM

A high resolution Television Studio Monitor Tube wth an 8½in. diagonal Rectangular Screen. The screen is metal backed and low voltage electrostatic focus is provided.

FOCUS	Low Voltage Electrostatic.
DEFLECTION	Magnetic—90°
SCREEN	Metal Backed.
Phosphor	Type 'T'.
Fluorescence	White.
Persistence	Short.

For further details, refer to Screen Type 'T' phosphor characteristics at the front of this section of the handbook. This tube can also be supplied with other screen phosphors.

PHYSICAL DETAILS.

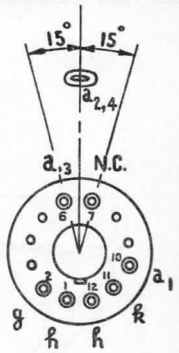
Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length	293 mm.
Neck Diameter	37 mm. (nominal).
Mounting Position	Any.

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.

Side Contact—2nd Anode + 4th Anode.



Base Connections Underside View of Base

HEATER.

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

RATINGS.

Max. A_1 Voltage	500 volts.
Max. A_2+A_4 voltage	15 kV.
Max. Pos. A_3 voltage	+500 volts.
Max. Neg. A_3 voltage	-500 volts.
Min. A_1 voltage	200 volts.
Min. A_2+A_4 voltage	8 kV.
Max. V_{h-k} (Heater positive)	150 volts.
Max. V_{h-k} (Heater negative)	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION AND CHARACTERISTICS.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd and 4th Anode voltage ...	12 kV.
3rd Anode voltage for focus ...	-300 to + 300 volts.
V_g for visual cut off ...	-30 to -70 volts.
†Av. Grid Drive for I_B=100 μA	25 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.

†The grid should never be positive with respect to the cathode.

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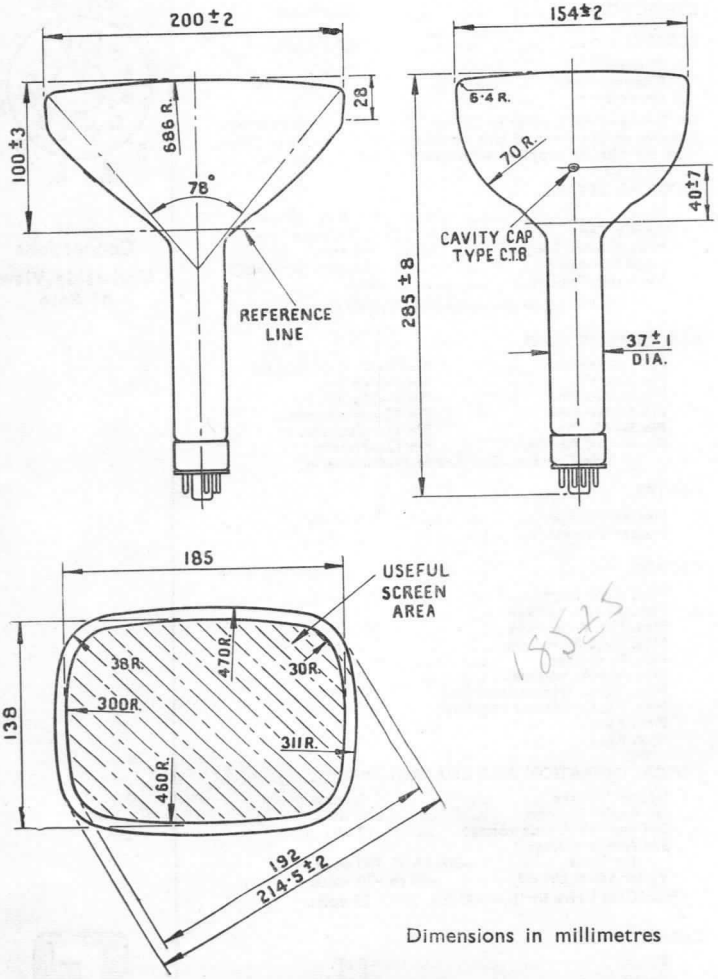
8/03TM



Dimensions in millimetres

FERRANTI

TELEVISION MONITOR TUBE

8/04TM

An 8in. diagonal Rectangular Tube with metal backed screen having very high definition.

FOCUS	Magnetic.
DEFLECTION	Magnetic—90°
SCREEN	Metal Backed.
Phosphor	Type 'T'
Fluorescence	White.
Persistence	Short.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A—Duodecal.
Anode Cap	CT8 (Cavity Type).
Max. Overall Length	308 mm.
Neck Diameter	37 mm. (nominal).

For other dimensions see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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 Cap—2nd Anode.

HEATER.

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

RATINGS.

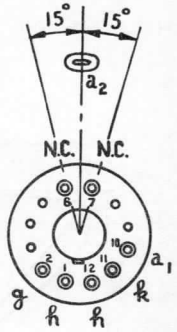
Max. 1st Anode Voltage ...	600 volts.
Max. 2nd Anode Voltage ...	15·0 kV.
Min. 1st Anode Voltage ...	250 volts.
Min. 2nd Anode Voltage ...	8·0 kV.
Max. V_{h-k} Heater Negative ...	200 volts.
Max. V_{h-k} Heater Positive ...	150 volts.
Max. R_{h-k}	1·0 MΩ
Max. R_{g-k}	1·5 MΩ

CAPACITANCES.

C_{k-all}	<8·0 pF.
C_{g-all}	<8·0 pF.

TYPICAL OPERATING CONDITIONS.

1st Anode Voltage	300 volts.
2nd Anode Voltage	12 kV.
Vg for visual cut off ...	–30 to –70 volts.
*Av. Grid Drive for 100μA beam current	25 volts.
Focus Coil Recommended Position:	Magnetic Centre approx. 100 mm. from the reference line.



Base Connections Underside View of Base

*The grid should never be positive with respect to the cathode.

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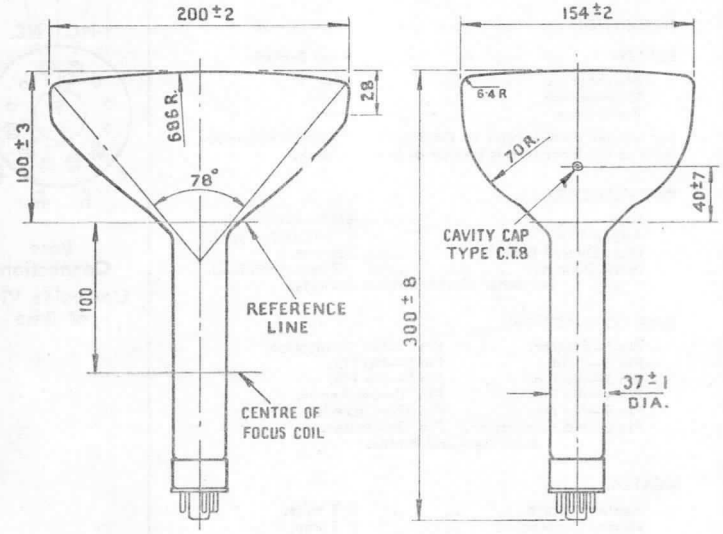
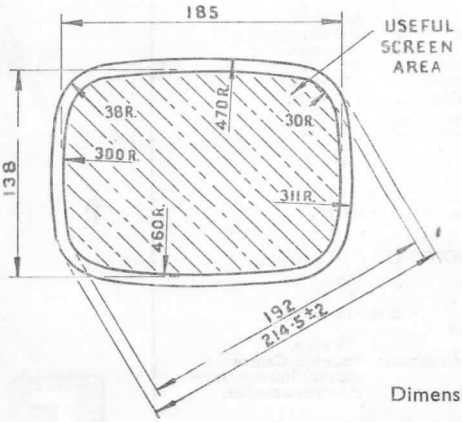
8/04TM





Dimensions in millimetres

FERRANTI

RADAR TUBE

8/52 HM

8/52 LM

A miniaturised Radar Display Tube with a 8½in. diagonal rectangular Screen which is metal backed. The deflection angle is 90° and electrostatic focus is at low voltage.

FOCUS ... ... Low voltage Electrostatic.

DEFLECTION ... ... Magnetic.

SCREEN.

	Type H.	Type L.
Phosphor*		
Fluorescence	Orange.	Orange.
Afterglow	Orange.	Orange.
Persistence	Very long.	Long.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	Noval (B9A)†
Anode Cap	CT8 Cavity Type.
Max. Overall Length	215 mm.
Mounting Position	Any.

For other dimensions see outline drawing overleaf.

BASE CONNECTIONS.

Pin 1—Cathode.	Pin 6—2nd Anode (focus).
Pin 2—N.C.	Pin 7—I.C.
Pin 3—Grid.	Pin 8—N.C.
Pin 4—Heater.	Pin 9—N.C.
Pin 5—Heater.	Side Contact—1st & 3rd Anodes

HEATER.

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

RATING.

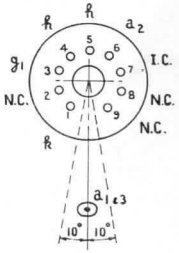
Max. $A_1 + A_3$ voltage	15 kV.
Max. Pos. A_2 voltage	+400 volts.
Max. Neg. A_2 voltage	−200 volts.
Min. $A_1 + A_3$ voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	0·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

Heater Voltage	6·3 volts.
1st and 3rd Anode Voltage ...	12 kV.
2nd anode voltage for focus ...	−100 to +200 volts.
Vg for visual cut-off	−50 to −100.

CAPACITANCE.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.



Base Connections

Underside View of Base

*These phosphors are liable to burn if operated with a spot which is stationary or slow moving. The tube should not be operated under such conditions, even at low beam current. See list of alternative phosphors for this application.

†Note that the centre of the valve holder should be drilled out to ¼inch to accommodate the protruding pumping stem.

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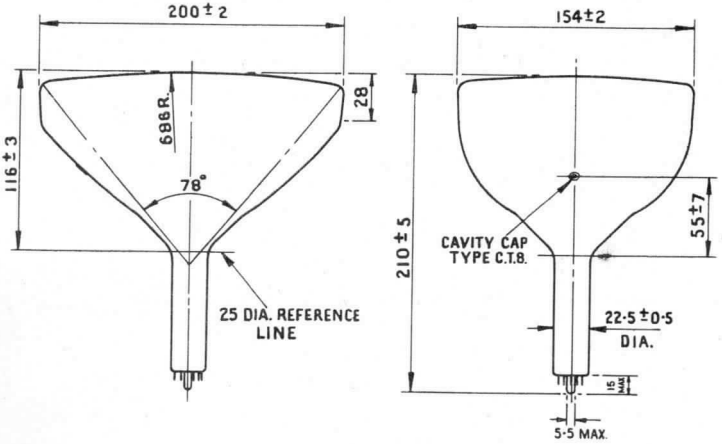
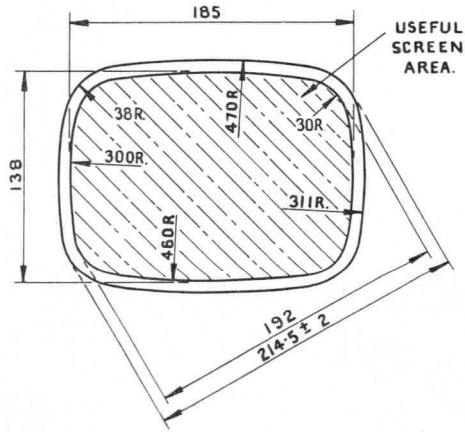
8/52 HM

8/52 LM





Dimensions in mm.

Ferranti

8A/54HM

8A/54LM

RADAR TUBES

Miniaturised 8in. diameter Radar Tubes with narrow neck and small deflection angle. Suitable for use with either Transistor or Valve circuits. Long persistence, metal backed screens.

FOCUS	Magnetic
DEFLECTION	Magnetic—43°.

SCREEN.

*Phosphor	Type 'H'.	Type 'L'.
Fluorescence	Orange.	Orange.
Afterglow	Orange.	Orange.
Persistence	Very Long.	Long.

PHYSICAL DETAILS.

Base	B9A/D.
Anode Cap	CT8 Cavity Type.
Max. Overall Length	426 mm.
Neck Diameter	23 mm. (nom.)
Mounting Position	Any.

For other dimensions see outline drawing overleaf.

BASE CONNECTION

Pin 1—Grid.	Pin 6—I.C.
Pin 2—I.C.	Pin 7—N.C.
Pin 3—Cathode.	Pin 8—I.C.
Pin 4—Heater.	Pin 9—1st Anode.
Pin 5—Heater.	Side Contact—2nd Anode.

HEATER.

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

RATING.

Max. A_1 voltage	600 volts.
Max. A_2 voltage	15 kV.
Min A_2 voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

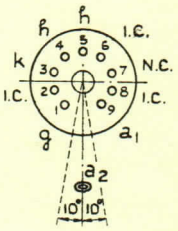
With Valve Drive.

1st Anode voltage	300 volts.
2nd Anode voltage	12 kV.
V_g for visual cut-off	–60 volts.

With Transistor Drive

1st Anode voltage	100 volts.
2nd Anode voltage	12 kV.
V_g for visual cut-off	–25 volts.

Recommended position of focus coil is 60 mm. in front of the grid.



Base Connections Underside View of Base

*These phosphors are liable to burn if operated with a spot which is stationary or slow moving, and tubes should not be operated under such conditions, even at low beam current. Alternative phosphors for this application can be supplied on request.

Tentative Issue 1 Apl., 1961

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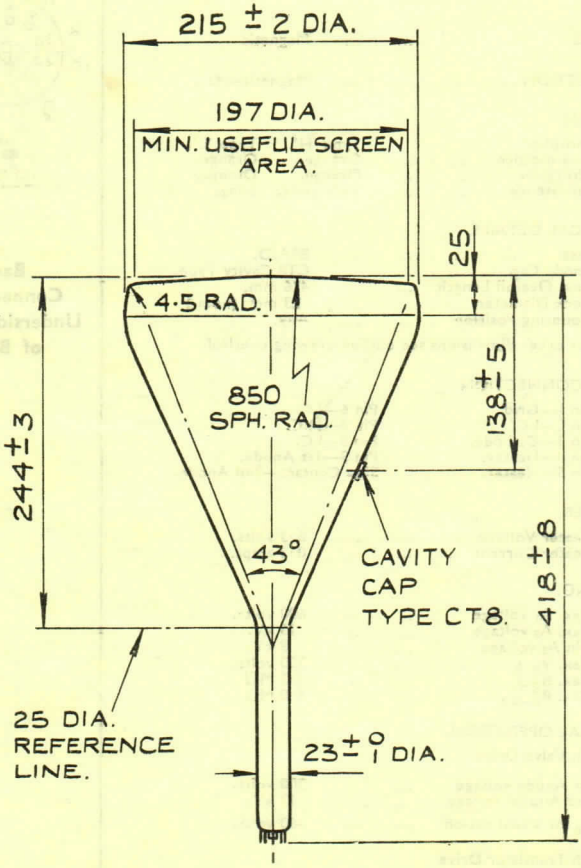
8A/54HM

8A/54LM



DIMENSIONS ARE IN MILLIMETRES.

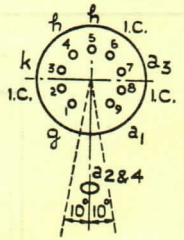
Ferranti

RADAR TUBE

8A/56HM

8A/56LM

Miniaturised Radar Display Tubes with an 8in. diameter screen, narrow angle deflection and low voltage electrostatic focus. Suitable for use with either Valve or Transistor circuits.



Underside view of base

FOCUS	Low Voltage Electrostatic.	
DEFLECTION	Magnetic. 43° angle.	

SCREEN.

*Phosphor	Type 'H'.	Type 'L'.
Fluorescence	Orange.	Orange.
Afterglow	Orange.	Orange.
Persistence	Very Long.	Long.

PHYSICAL DETAILS.

Base	B9A/D
Anode Cap	CT8 Cavity Type.
Max. Overall Length	416 mm.
Neck Diameter	23 mm. (nom.)
Mounting Position	Any.

BASE CONNECTION.

Pin 1—Grid.	Pin 6—I.C.
Pin 2—I.C.	Pin 7—3rd Anode.
Pin 3—Cathode.	Pin 8—I.C.
Pin 4—Heater.	Pin 9—1st Anode.
Pin 5—Heater.	Side Contact—2nd & 4th Anodes.

HEATER.

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

RATING.

Max. A_1 voltage	600 volts.
Max. A_2+A_4 voltage	15 kV.
Min. A_2+A_4 voltage	8 kV.
Max. Pos. A_3 voltage	+500 volts.
Max. Neg. A_3 voltage	−500 volts.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

Valve Drive.

1st Anode voltage	300 volts.
2nd & 4th Anode voltage ...	12 kV.
3rd Anode voltage for focus	−300 to +300 volts.
V_g for visual cut-off	−60 volts.

Transistor Drive.

1st Anode voltage	100 volts.
2nd & 4th Anode voltage ...	12 kV.
V_g for visual cut-off	−25 volts.
3rd Anode voltage for focus	−300 to +300 volts.

*These phosphors are liable to burn if operated with a spot which is stationary or slow moving, and tubes should not be operated under such conditions, even at low beam current. Alternative phosphors for this application can be supplied on request.

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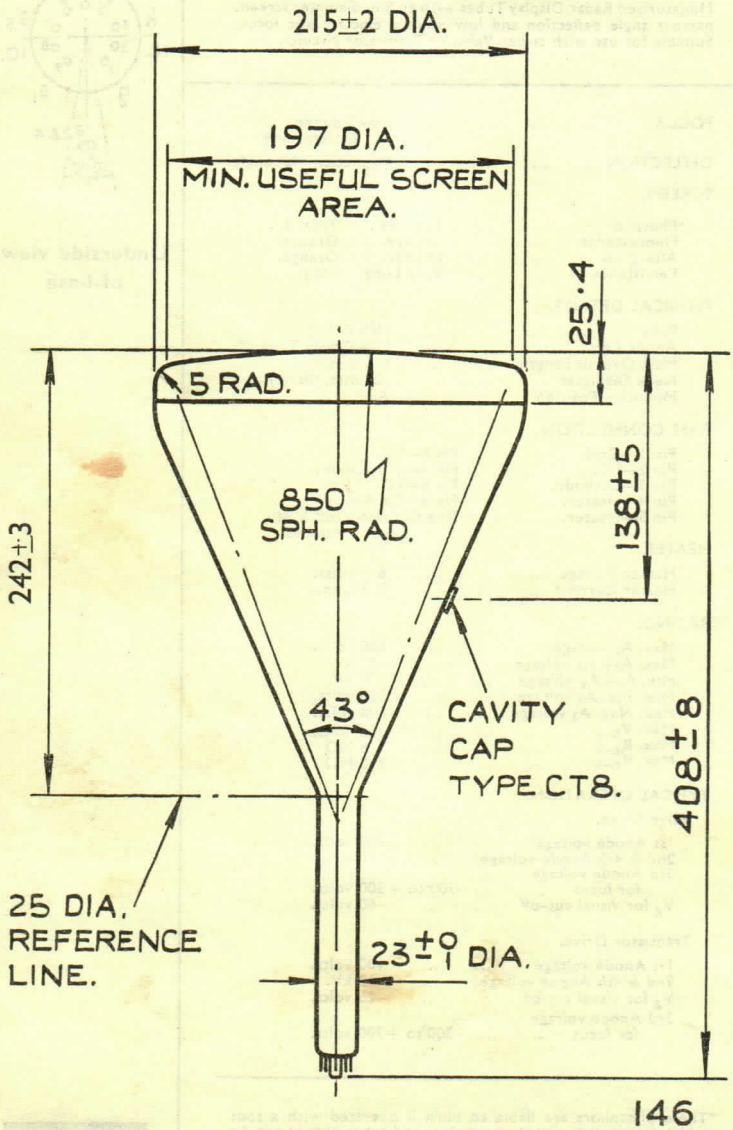
Mar., 1961

Ferranti

Ferranti

8A/56HM

8A/56LM



DIMENSIONS ARE IN MILLIMETRES.

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

8B/08L2B

8B/08VB

8B/08ZB

Ferranti

RADAR TUBES

High Resolution 8½in. Rectangular Radar Display Tubes.

FOCUS	Magnetic.
DEFLECTION	Magnetic.

	8B/08L2B*	8B/08VB	8B/08ZB
Phosphor ...	Orange	Yellow	Orange
Fluorescence ...	Orange	Yellow	Orange
Afterglow ...	Long	Short	Short
Persistence ...			

Refer to phosphor characteristics at the front of this section of the Handbook.

All types have metal backed screens.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT.2 (9.25 mm. dia.).
Max. overall length	588±7 mm.
Neck diameter	35 mm. nominal.

For other dimensions see outline drawing overleaf.

These tubes have an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Grid.
Pin 3—No pin.
Pin 4—No pin.
Pin 5—No pin.
Pin 6—Not connected.
Pin 7—Not Connected.
Pin 8—No pin.
Pin 9—No pin.
Pin 10—1st anode.
Pin 11—Cathode.
Pin 12—Heater.

Side cap—2nd anode.

HEATER.

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

RATINGS.

Max. 1st Anode voltage ...	600 volts.
Max. 2nd Anode voltage ...	15·0 kV.
Min. 1st Anode voltage ...	250 volts.
Min. 2nd Anode voltage ...	9·0 kV.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	1·0 MΩ
Max. R_{g-k}	1·5 MΩ

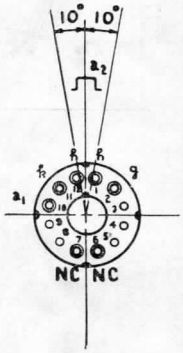
CAPACITANCES.

C_{k-all}	<8·0 pF.
C_{g-all}	<8·0 pF.

TYPICAL OPERATING CONDITIONS.

1st Anode voltage	300 volts.
2nd Anode voltage	15·0 kV.
V_g for visual cut off ...	−30 to −90 volts.
Av. mod. drive for 50 μA. beam current	20 volts.

The position of the centre of the air gap in the focus coil is approximately 70 mm's. from the plane of the modulator face.



Base Connections Underside View of Base

*The screen of this tube is liable to burn if operated with a spot which is stationary or slow moving, even at low values of beam current.

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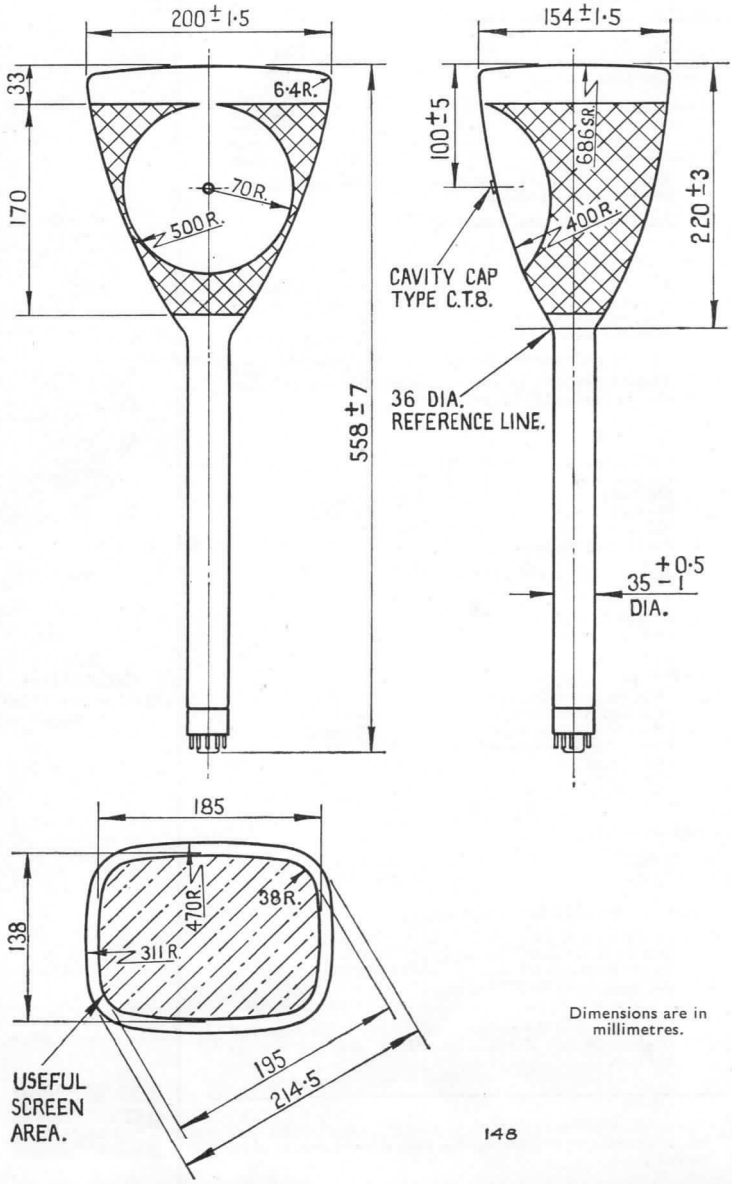
8B/08L2B

8B/08VB

8B/08ZB



Dimensions are in millimetres.

Ferranti

RADAR TUBES

9in. diameter Radar Display Tubes with metal backed screens, magnetic deflection and low voltage electrostatic focus.

9/03HB

9/03JB

9/03LB

FOCUS ... ... Low Voltage Electrostatic.

DEFLECTION ... ... Magnetic.

SCREENS ... ... Metal Backed.

	9/03HB	9/03JB	9/03LB
Phosphor	Type 'H'*	Type 'J'	Type 'L'.*
Fluorescence ...	Orange	Blue	Orange.
Afterglow ...	Orange	Yellow	Orange.
Persistence ...	very long	long	long.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type.)
Max. Overall Length	408 mm.
Nom. neck diameter	35 mm.

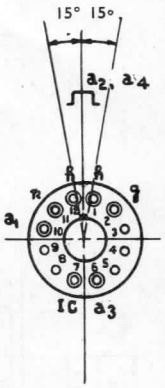
For other dimensions see drawing overleaf.

Mounting Position ... ... Any.

These tubes have an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Grid.
Pin 3—No Pin.
Pin 4—No Pin.
Pin 5—No Pin.
Pin 6—3rd Anode.
Pin 7—No Connection.
Pin 8—No Pin.
Pin 9—No Pin.
Pin 10—1st Anode.
Pin 11—Cathode.
Pin 12—Heater.
Side Contacts—2nd Anode, 4th Anode.



Base Connections View from spigot end of tube

HEATER.

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

RATINGS.

Max. a_1 Voltage	500 volts.
Min. a_1 voltage	200 volts.
Max. a_2+a_4 voltage	15 kV.
Min. a_2+a_4 voltage	8 kV.
Max. Pos. a_3 voltage	+500 volts.
Max. Neg. a_3 voltage	−500 volts.
§Max. Neg. grid voltage	−200 volts.
Max. Z_{g-k}	0·5 MΩ
Max. R_{g-k}	1·5 MΩ
‡Max. R_{h-k}	1·0 MΩ
Max. V_{h-k} (heater negative) ...	200 volts.
(heater positive) ...	150 volts.

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd and 4th Anode voltage ...	12 kV.
**3rd Anode voltage for focus ...	−300 to+ 300 volts.
V_g for visual cut off	−30 to −70 volts.

*These screens are liable to burn if operated with a spot which is stationary or slow moving. The tube should not be operated under such conditions, even at low beam current.

†When used for series operation, a current limiting device should be incorporated in the circuit to ensure that the surge heater voltage does not exceed 9·5 volts r.m.s.

§The grid should never be positive with respect to the cathode.

‡This value of Rh–k is applicable only when the heater has a separate transformer. In series heater chains, the impedance between cathode and earth should not exceed 100kΩ

**The point of optimum focus lies between these values.

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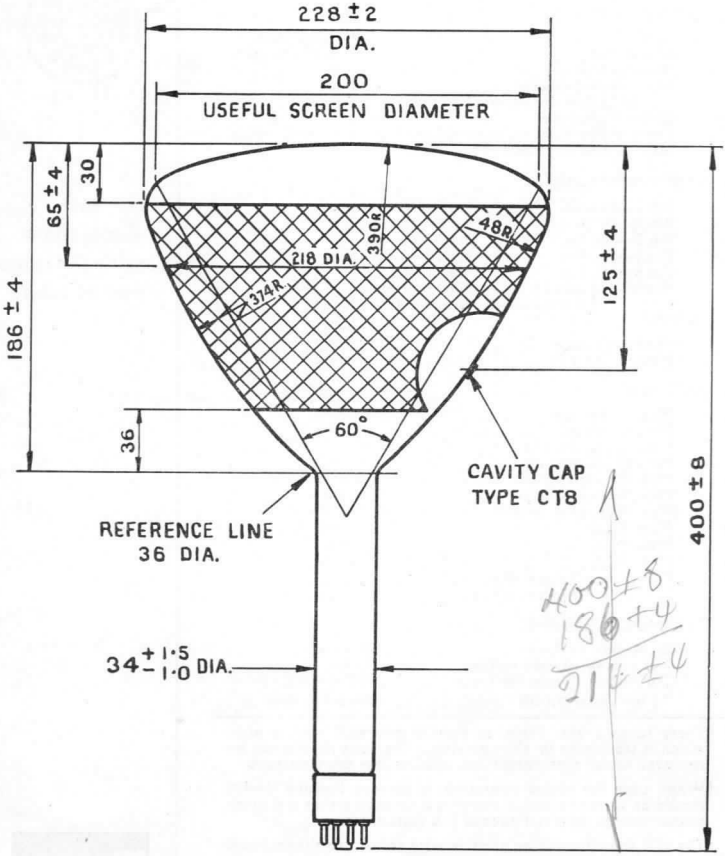
9/03HB
9/03JB
9/03LB

CAPACITANCES.

C_{k-all}	...	...	...	...	<8 pF.
C_{g-all}	...	...	...	...	<8 pF.
C_{a_2-M}	...	...	...	...	750 pF. approx.



400±8
186±4
214±4

9/22AM

9/22PM

9/22QM

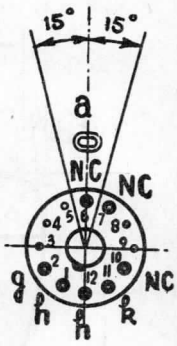
Ferranti

CATHODE RAY TUBES

9-inch diameter Triode Tubes having high quality flat faces with ground internal and external surfaces

Types 9/22AM and 9/22QM are designed for use in Flying Spot Scanner applications

Type 9/22PM is for use in recording high resolution images on blue sensitive film stock



FOCUS	... ...	Magnetic	
DEFLECTION	... ...	Magnetic	
SCREEN	... ...	Metal Backed (All Types)	
	9/22AM	9/22PM	9/22QM
Phosphor	... ... Type 'A'	Type 'P'	Type 'Q'
Fluorescence	... Green	Blue	Blue/Violet
Persistence	... Ultra-short	Ultra-short	Killed

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook

PHYSICAL DETAILS

Base	B12A (Duodecal)
Anode Cap	CT 8 (Cavity Type)
Max. Overall Length	565 mm.
Max. Diameter	236 mm.
Useful Screen Area	200 mm. dia.
Nom. Neck Diameter	37 mm.

For other dimensions see drawing overleaf.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Grid.
Pin 3—No pin.
Pin 4—No pin.
Pin 5—No pin.
Pin 6—Not connected.
Pin 7—Not connected.
Pin 8—No pin.
Pin 9—No pin.
Pin 10—Not connected.
Pin 11—Cathode.
Pin 12—Heater.
Side Contact—Anode.

HEATER.

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

RATINGS.

Max. Anode Voltage	30 kV.
Nom. Vg for visual cut off ...	Va/120
Max. V_{hk} (Heater Negative) ...	200 volts.
Max. V_{hk} (Heater Positive) ...	200 volts.

TYPICAL OPERATION.

Heater Voltage	6·3 volts.
Anode Voltage	25 kV.
Vg for visual cut off	−210 volts.
Grid Drive for $I_B = 100\mu A$. ...	35 volts.
Screen Resolution at 50 f.p.s. ...	1000 lines.
§Focus Coil	570 ampere turns (approx).

CAPACITANCE.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.

*A suitable coil is a solenoid of approx 16,000 turns of 38 s.w.g. wire, positioned with the gap approx 150 mm, in front of the modulator. Ferranti Type 38/13300 is available.

X-RAY WARNING.

When operated at an anode voltage in excess of 16 kV. shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.

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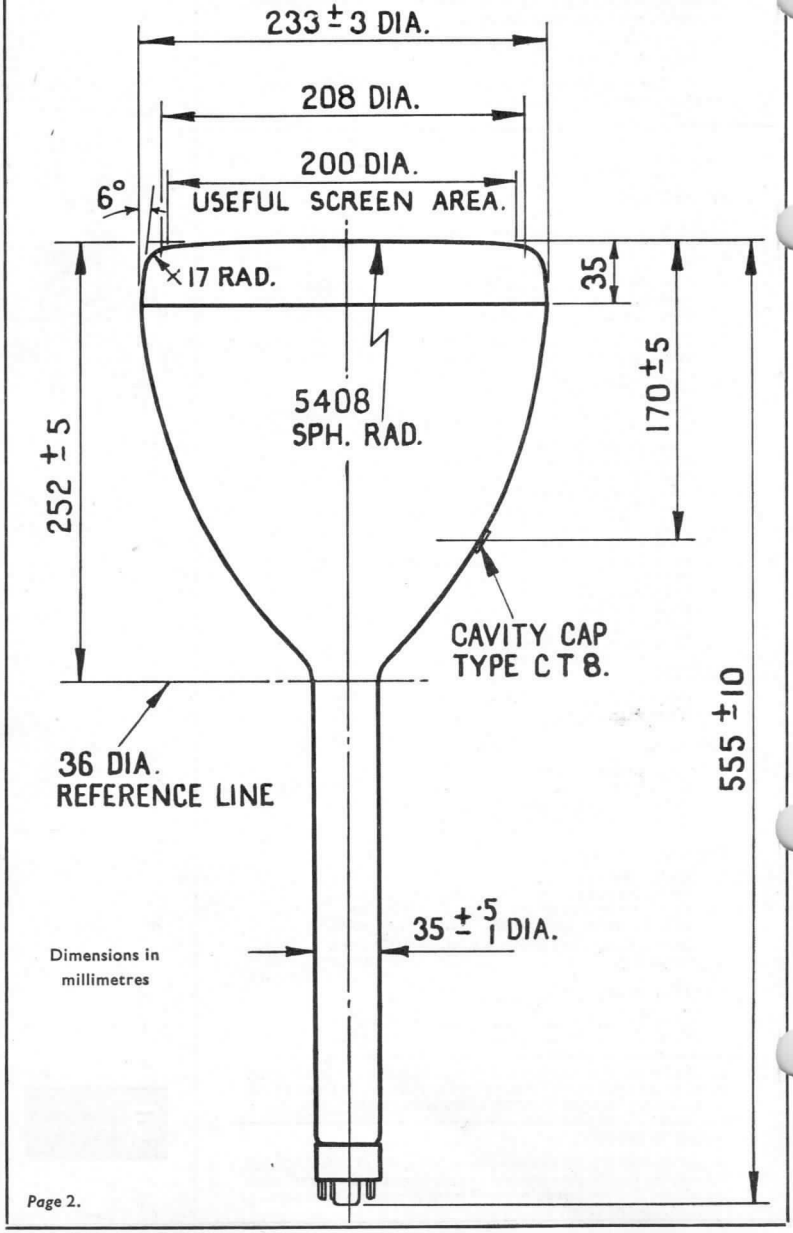
9/22AM
9/22PM
922QM



Dimensions in millimetres

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

Ferranti

CATHODE RAY TUBE

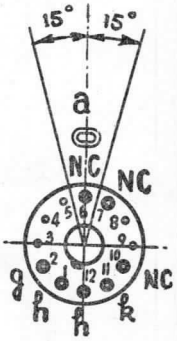
A 9-inch diameter Triode Tube which has a high quality flat face with ground internal and external surfaces.

Primarily designed for use in Telerecording and in Television Transmission Systems Converters.

FOCUS	Magnetic
DEFLECTION	Magneti
SCREEN	Metal Backed
Phosphor	Type 'D'
Fluorescence	Green
Persistence	Short

Other phosphors are available such as Type 'A' (Green) or 'Q' (Violet) for Flying Spot Scanner applications or Type 'P' (Blue) for Photographic Recording.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.



PHYSICAL DETAILS.

Base	B12A (Duodecal)
Anode Cap	CT8 (Cavity Type)
Max. Overall Length	595 mm
Max. Diameter	236 mm
Useful Screen Area	200 mm dia
Nom. Neck Diameter	35 mm

For other dimensions see drawing overleaf.

BASE CONNECTIONS.

Pin 1—Heater	Pin 7—Not connected
Pin 2—Grid	Pin 8—No pin
Pin 3—No pin	Pin 9—No pin
Pin 4—No pin	Pin 10—Not connected
Pin 5—No pin	Pin 11—Cathode
Pin 6—Not connected	Pin 12—Heater

Side Contact—Anode

HEATER.

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

RATINGS.

Max. Anode Voltage	30 kV
Nom. V_g for visual cut-off ...	Va/120
Max. V_{hk} (Heater Negative) ...	200 volts
Max. V_{hk} (Heater Positive) ...	200 volts

TYPICAL OPERATION.

Heater Voltage	6·3 volts
Anode Voltage	25 kV
Vg for visual cut-off	−210 volts
Grid Drive for $I_g = 100\mu A$ ...	35 volts
Screen Resolution at 50 f.p.s. ...	1000 lines
†Focus Coil	570 amp turns (aprox)

X-RAY WARNING.

When operated at an anode voltage in excess of 16 kV shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.

CAPACITANCE.

C_k-all	<8 pF
C_g-all	<8 pF

†Ferranti Focus Coil units Type FC.4 or FC.5 are available.

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Ferranti

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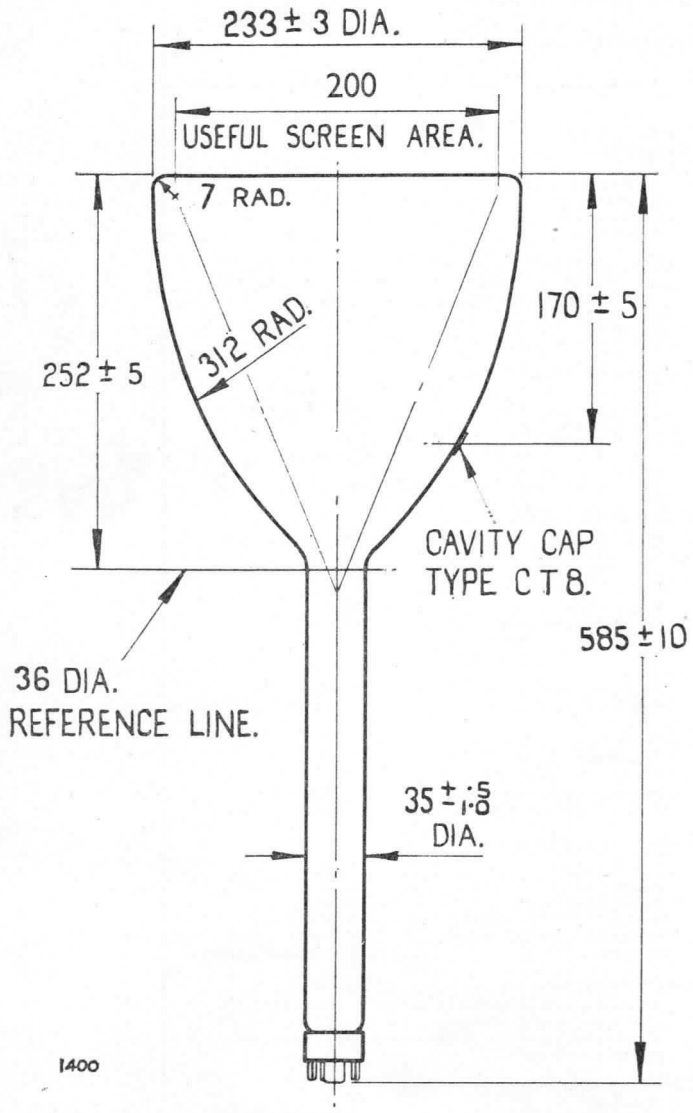


Dimensions in millimetres

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

Ferranti

HIGH RESOLUTION DISPLAY TUBES

9/25AM
9/25PM
9/25QM

9 inch diameter Display Tubes with an optically flat face which has ground internal and external surfaces.

FOCUS. ... ... Magnetic

DEFLECTION. ... ... Magnetic

SCREEN.

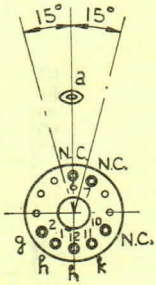
	9/25AM	9/25PM	9/25QM
Phosphor Type	'A'	'P'	'Q'
Fluorescence	Green	Blue	Blue/Violet
Persistence	Ultra Short	Ultra Short	Killed

All types have metal-backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal)
Anode Cap	CT8 Cavity Type (JEDEC Type J1-21)
Max. Overall Length	590 mm.
Max. Diameter	236 mm.
Nom. Neck Diameter	35 mm.
*Useful Screen Area Diameter... ...	210 mm. min.



BASE CONNECTIONS.

Pin 1—Heater	Pin 7—Not Connected
Pin 2—Grid.	Pin 8—No Pin
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—Not Connected
Pin 5—No Pin.	Pin 11—Cathode.
Pin 6—Not Connected.	Pin 12—Heater.
Side contact—Anode.	

HEATER.

Heater Voltage	6·3 V.
Heater Current...	0·3 A.

RATINGS.

Max. Anode Voltage	30 kV.
Nom. V_g for visual cut-off	Va/210
Max. V_{h-k} (heater negative) ...	200 V.
Max. V_{h-k} (heater positive) ...	200 V.
Max. R_{g-k}	1·5 M Ω

TYPICAL OPERATION.

Heater Voltage	6·3 V.
Anode Voltage	20 kV.
V_g for visual cut-off	—90 V.
Line width at screen centre ...	See graph on page 4.

CAPACITANCE.

C_{k-all}	<8pF.
C_{g-all}	<8pF.

X-RAY WARNING: When operated at an anode voltage in excess of 16 kV. shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.

*Minimum diameter of internal ground surface

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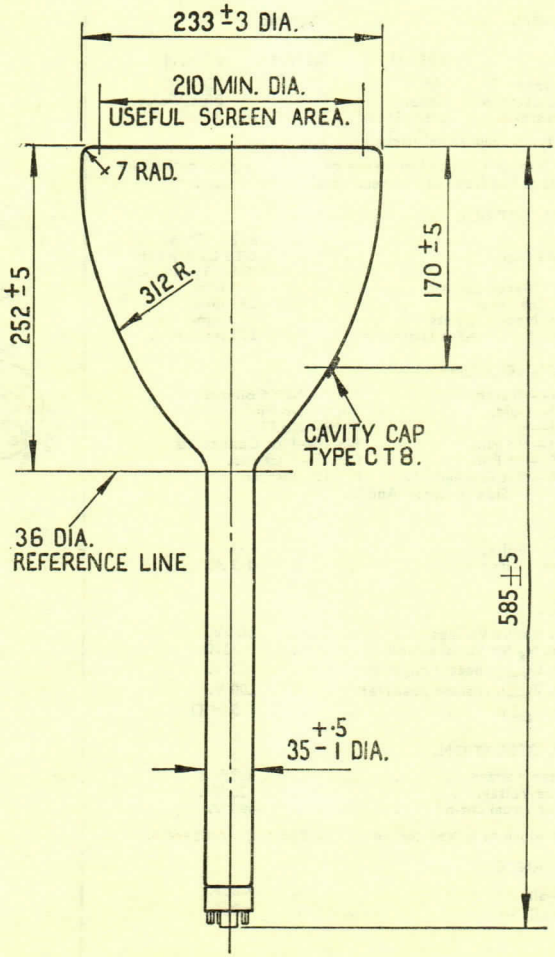
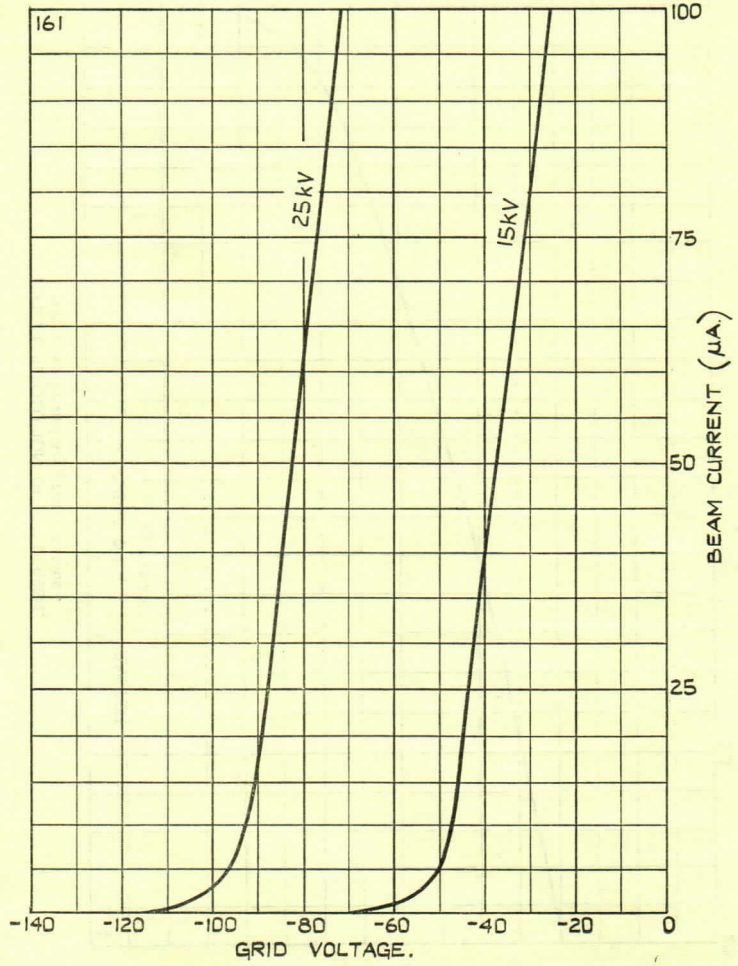
9/25AM
9/25PM
9/25QM



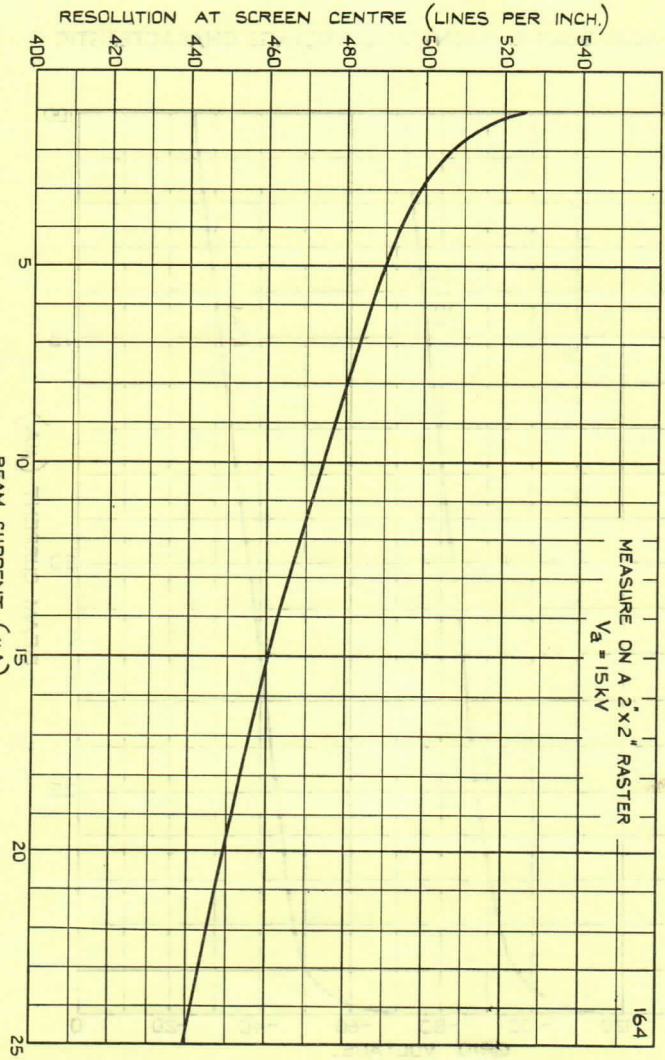
ALL DIMENSIONS IN MILLIMETERS

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

TYPICAL BEAM CURRENT/GRID VOLTAGE CHARACTERISTIC



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



TYPICAL RESOLUTION OF "P" SCREEN.
(Measured by shrinking raster method).

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

Ferranti

HIGH RESOLUTION DISPLAY TUBE

A 9 inch diameter Display Tube with an optically flat face with ground internal and external surfaces.

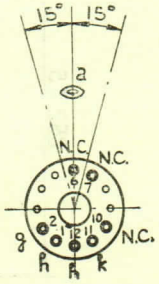
FOCUS. ... ... Magnetic

DEFLECTION. ... ... Magnetic

SCREEN.

Phosphor	... ...	Type 'P' (Fine particle size).
Fluorescence	... ...	Blue.
Persistence	... ...	Ultra short.

For further details refer to Screen Phosphor characteristics at the front of this section of the handbook. This tube can also be supplied with other screen phosphors.



PHYSICAL DETAILS.

Base	... ...	B12A (duodecal)
Anode Cap	... ...	CT8 Cavity Type
Max. Overall Length	... ...	625 mm.
Max. Diameter	... ...	236 mm.
Nom. Neck Diameter	... ...	35 mm.
*Useful Screen Area	... ...	195 mm. min. dia.

BASE CONNECTIONS.

Pin 1—Heater	Pin 7—Not Connected
Pin 2—Grid.	Pin 8—No Pin
Pin 3—No Pin.	Pin 9—No Pin.
Pin 4—No Pin.	Pin 10—Not Connected
Pin 5—No Pin.	Pin 11—Cathode.
Pin 6—Not Connected.	Pin 12—Heater.
Side contact—Anode.	

HEATER.

Heater Voltage	... ...	6·3 v.
Heater Current	... ...	0·3 A.

RATINGS.

Max. Anode Voltage	... ...	30 kV.
Nom. V_g for visual cut-off	... ...	Va/300
Max. $V_{h—k}$ (heater negative)	...	200 v.
Max. $V_{h—k}$ (heater positive)	...	200 v.
Max. $R_{g—k}$	... ...	1·5 M Ω

TYPICAL OPERATION.

Heater Voltage	... ...	6·3 v.
Anode	... ...	15 kV.
V_g for visual cut-off	... ...	—50 v.

Line width at screen centre (see page 4.)

CAPACITANCE.

$C_{k—all}$	... ...	<8pF.
$C_{g—all}$	... ...	<8pF.

X-RAY WARNING: When operated at an anode voltage in excess of 16 kV. shielding may be required to protect against harmful X-ray radiation which could cause possible injury from prolonged exposure.

*Minimum diameter of internal ground surface

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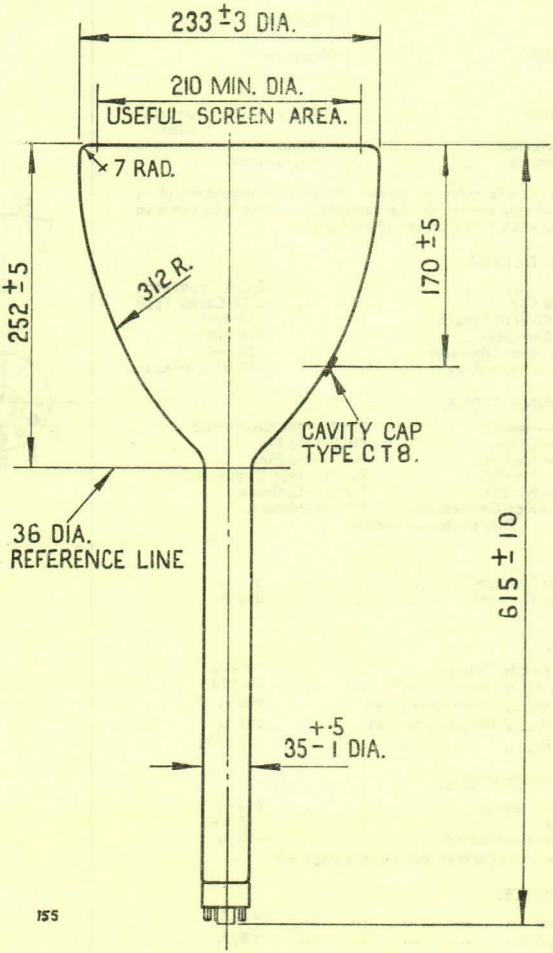
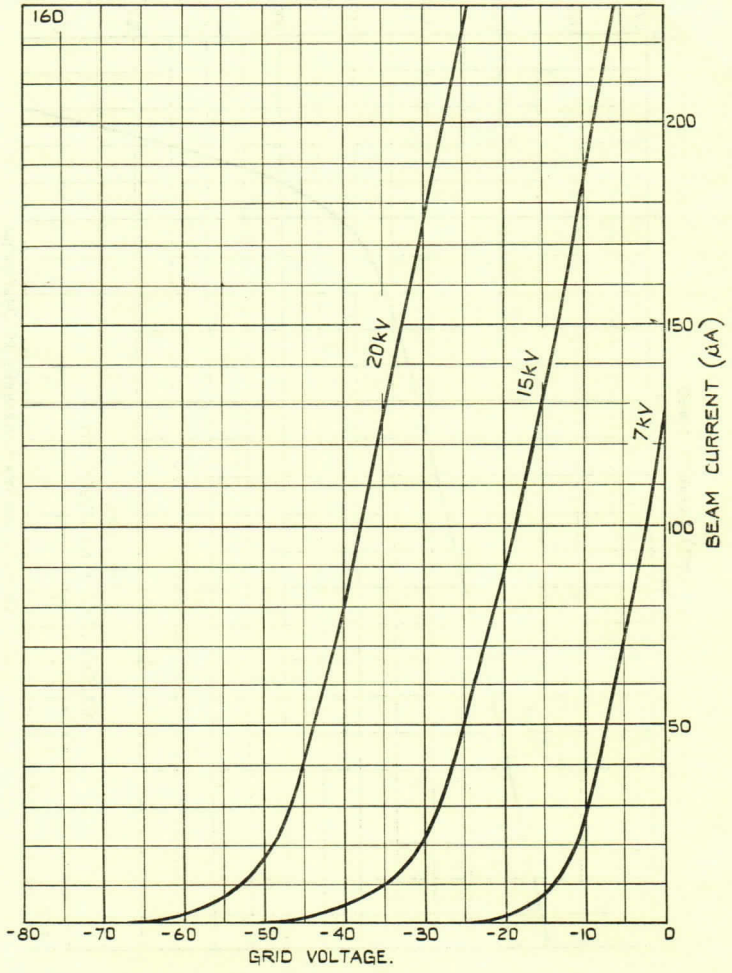


ALL DIMENSIONS IN MILLIMETERS

TYPICAL ANODE CURRENT/GRID VOLTAGE CHARACTERISTIC



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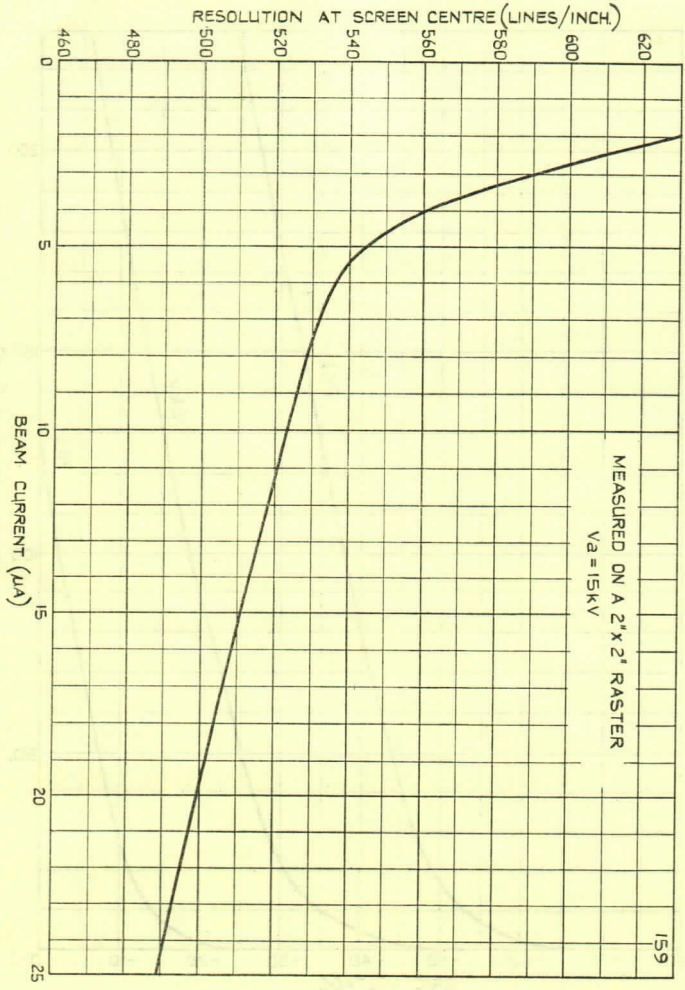


TYPICAL RESOLUTION WITH 'P' SCREEN
MEASURED BY SHRINKING RASTER METHOD

FERRANTI

TELEVISION MONITOR TUBE

10FP4A

A 10in. diameter Tube with a metal backed screen and External conductive coating. Designed for use in Television Monitoring Equipment.

FOCUS	Magnetic.
DEFLECTION	Magnetic.
Deflection Angle	50°.
SCREEN	Metal Backed.
Phosphor	Type 'T'. —Silver activated.
Fluorescence	White.
Persistence	Short.

For further details, refer to Screen Type 'T' phosphor characteristics at the front of this section of the handbook. This tube can also be supplied with other screen phosphors.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type).
Max. Overall Length	456 mm.
Nom. Neck Diameter	37 mm.
For other dimensions see drawing.	
Mounting Position	Any.

This tube has an external conductive coating which may be used for E.H.T. smoothing

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—2nd Anode.	

HEATER.

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

RATINGS.

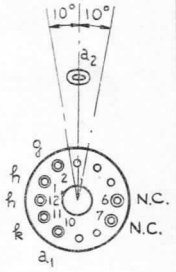
Max. A_1 Voltage	410 volts.
Max. A_2 Voltage	12 kV.
Min. A_1 Voltage	150 volts.
Min. A_2 Voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ
Max. A_1 Supply Impedance ...	1·5 MΩ

TYPICAL OPERATION.

1st Anode Voltage	250 volts.
2nd and 4th Anode Voltage ...	10 kV.
Vg for visual cut off	–27 to –63 volts.
Focus	See Note **

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	2500 pF. max. 500 pF. min.



Base Connections
Underside View of Base

*This Tube is normally supplied with a 6·3 volt 0·3 amp. heater. For direct replacement of Tubes of American origin a Tube with 6·3 volt 0·6 amp. heater should be requested.

**The recommended centre of the magnetic length of the focus unit should be approx. 80 mm. from the Reference Line.

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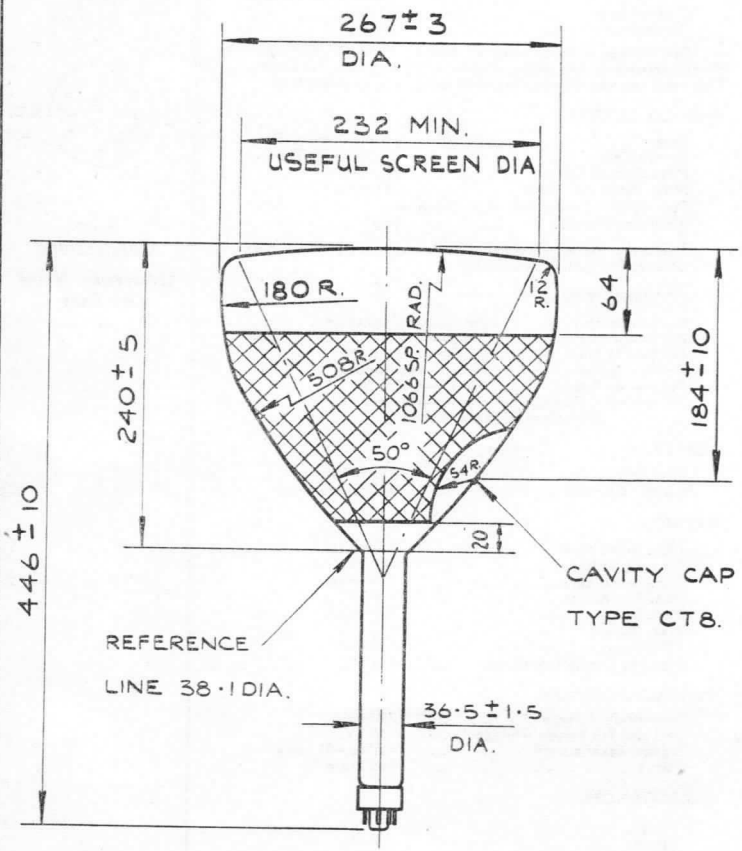
Aug., 1959

10FP4A



DIMENSIONS IN MILLIMETERS

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

FERRANTI

RADAR TUBE

10WP7

A 10in. diameter Radar Display Tube with metal backed screen magnetic deflection, and low voltage electrostatic focus.

FOCUS	Low Voltage Electrostatic	
DEFLECTION	Magnetic	

SCREEN.

Phosphor Type	'J'
Fluorescence	Blue
Afterglow	Yellow
Persistence	Long

For further details, refer to the Type 'J' Phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length ...	440 mm.
Nom. Neck Diameter ...	37mm.
For other dimensions, see drawing.	
Mounting Position ...	Any.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.
Side Contact—2nd Anode, 4th Anode.	

HEATER.

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

RATINGS.

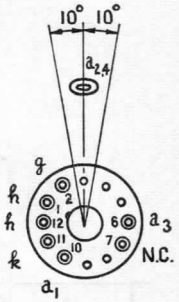
Max. A_1 Voltage	600 volts
Max. A_2 + A_4 Voltage	13·2 kV.
Max. Pos. A_3 Voltage	+1000 volts.
Max. Neg. A_3 Voltage	−500 volts.
Min. A_1 Voltage	200 volts.
Min. A_2 + A_4 Voltage	7 kV.
Max. V_{h-k}	±200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd+4th Anode Voltage	10 kV.
†3rd Anode Voltage for focus	0 to +300 volts.
Vg for visual cut off	−33 to −77 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.



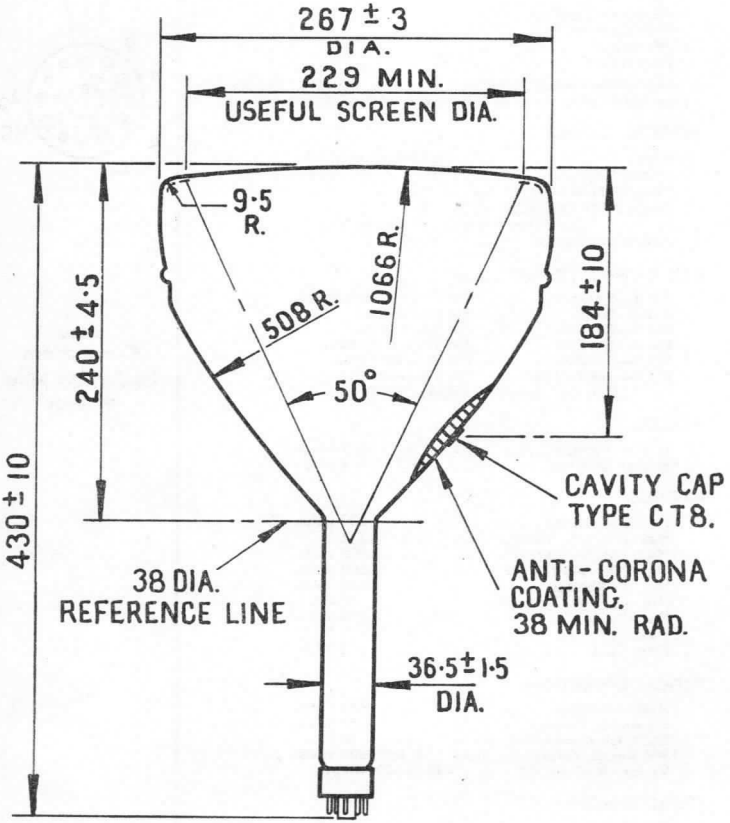
Base Connections
Underside View of Base

*This tube is normally supplied with a 6·3 volt 0·3 amp. heater. On request a tube with a 0·6 amp. heater will be supplied (direct replacement for tubes of American manufacture).

†The point of optimum focus lies between these values.

Issue 1.
Aug., 1959

10WP7



DIMENSIONS IN MILLIMETRES

= CV2162

12/02 HM

FERRANTI
RADAR TUBE

A 12in. diameter flat faced Radar Display Tube with Electrostatic Focus. It has a long persistence fluoride screen which is metal backed.

FOCUS		Electrostatic.
DEFLECTION		Magnetic.
*SCREEN :—	Fluorescence ...	Orange.
	Afterglow ...	Orange.
	Persistence ...	Long.

PHYSICAL DETAILS.

Base	International Octal.
Anode Cap	CT.1.
Max. Overall Length	545 mm.
Max. Diameter	306·5 mm.
Neck Diameter	$35 \pm \frac{0}{1}$ mm.

For other dimensions see drawing overleaf.

BASE CONNECTIONS.

Pin 1—No Connection.
Pin 2—1st Anode.
Pin 3—2nd Anode.
Pin 4—No Connection.
Pin 5—Grid.
Pin 6—Cathode.
Pin 7—Heater.
Pin 8—Heater.
Side Cap—3rd Anode.

HEATER.

Heater Voltage	4·0 volts.
Heater Current	0·9 amp.

RATINGS.

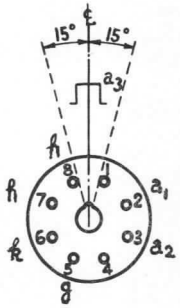
Max. 3rd Anode Voltage ...	13 kV.
Min. 3rd Anode Voltage ...	9 kV.
†Max. 1st Anode Voltage ...	2·2 kV.
†Min. 1st Anode Voltage ...	1·5 kV.
Max. V_{h-k}	150 Volts.

CHARACTERISTICS AND TYPICAL OPERATION.

3rd Anode Voltage	12 kV.
2nd Anode Voltage for focus ...	1·85 to 2·05 kV.
1st Anode Voltage	2·1 kV.
Vg for visual cut-off ...	−70 to −120 Volts.
Av. Grid Drive for $I_b = 50\mu A$.	22 Volts.

CAPACITANCES.

C_{k-all}	< 10·0 pF.
C_{g-k}	< 10·0 pF.



Base Connections
Underside View of Base

The anode cap can lie within 15° either side of the centre line as indicated in the diagram.

*The screen material is liable to burn if operated with a spot which is stationary or slow moving. The tube should not be operated under such conditions even at low beam current.

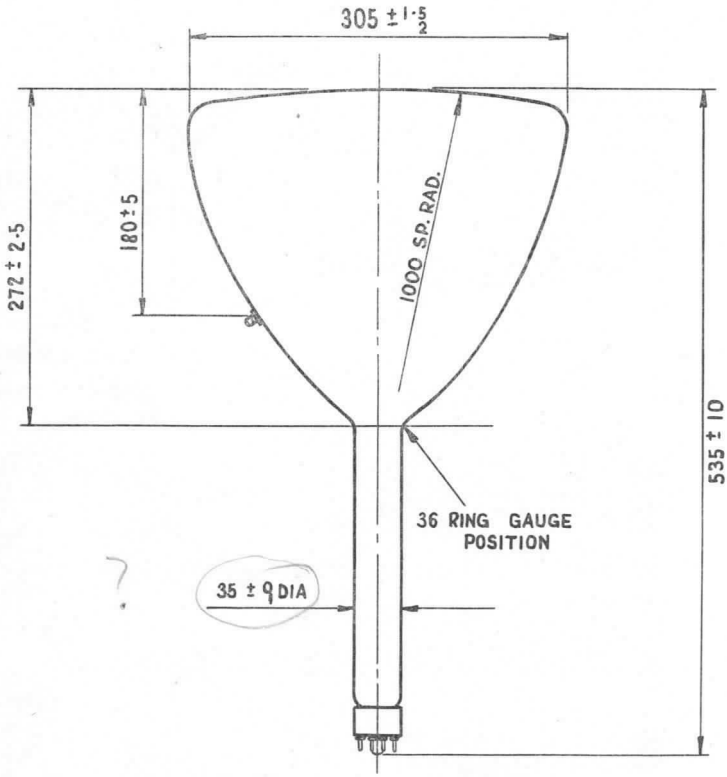
†The voltage applied to a_1 should always be at least 50 volts positive with respect to a_2.

This tube was formerly designated A12/02.

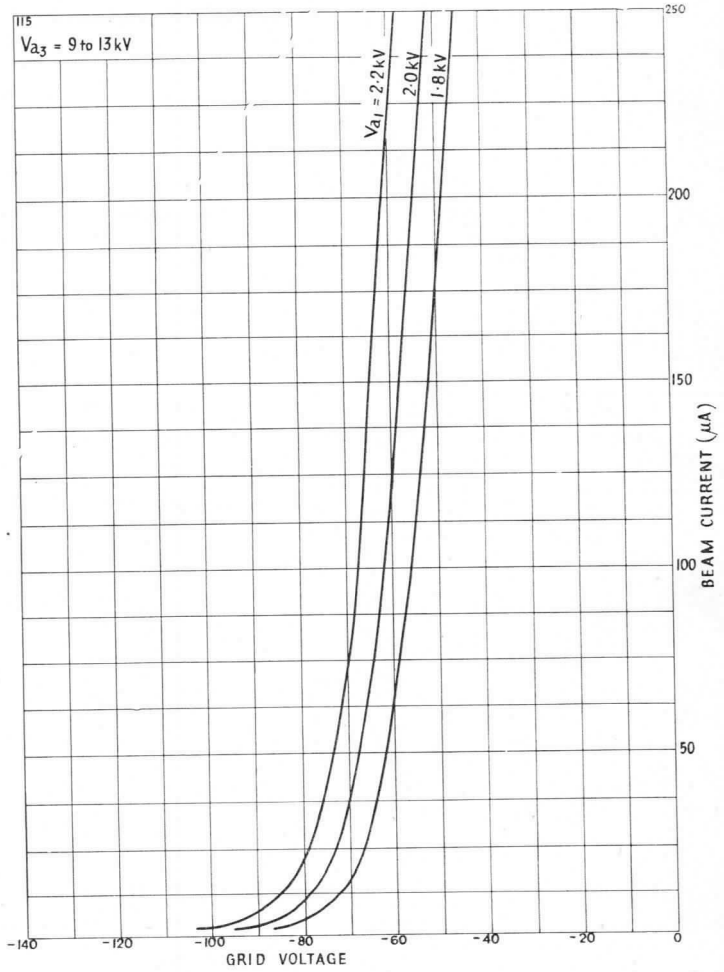
Issue 2
Mar., 1957

12/02 HM

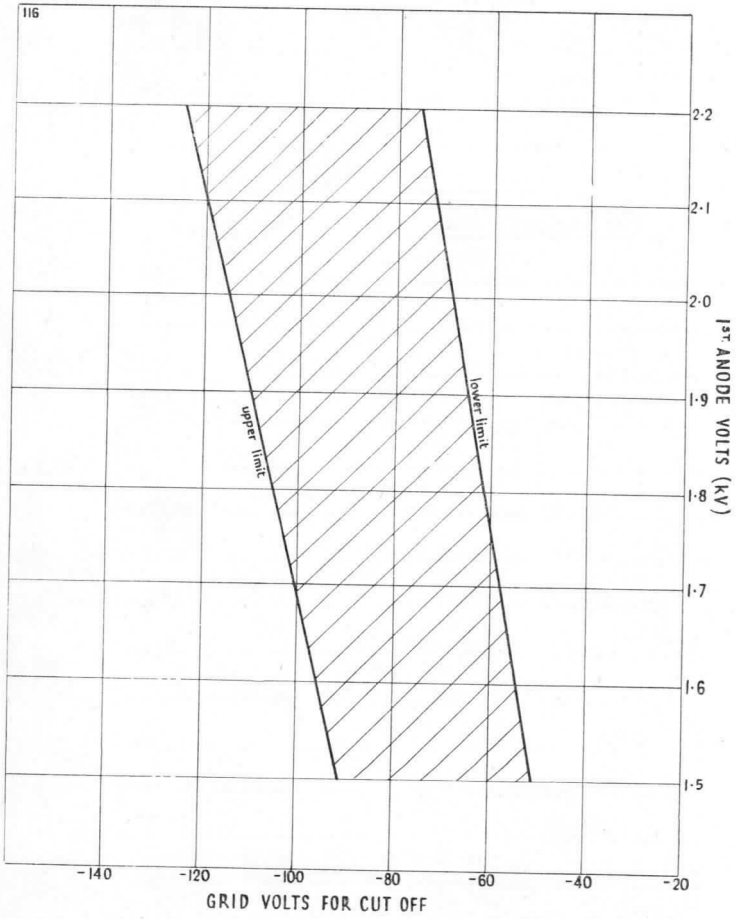
FERRANTI



All dimensions in millimetres.



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


116
2·2
2·1
2·0
1·9
1·8
1·7
1·6
1·5
1ST ANODE VOLTS (kV)
upper limit
lower limit
-140
-120
-100
-80
-60
-40
-20
GRID VOLTS FOR CUT OFF

FERRANTI

RADAR TUBES

12in. diameter Radar Display Tubes with metal backed screens, magnetic deflection and low voltage electrostatic focus.

12/03 HB

12/03 JB

FOCUS	Low Voltage. Electrostatic.
DEFLECTION	Magnetic.

SCREEN.

	12/03HB	12/03JB
Phosphor	‡Type 'H'	Type 'J'
Fluorescence	Orange	Blue
Afterglow	Orange	Yellow
Persistence	very long	long.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

Both Types have metal backed screens.

PHYSICAL DETAILS.

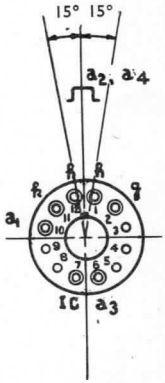
Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length	485 mm.
Mounting Position	Any

For other dimensions see drawing overleaf.

These tubes have an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Grid.
Pin 3—No Pin.
Pin 4—No Pin.
Pin 5—No Pin.
Pin 6—3rd Anode.
Pin 7—No Connection.
Pin 8—No Pin.
Pin 9—No Pin.
Pin 10—1st Anode.
Pin 11—Cathode.
Pin 12—Heater.
Side Contact—2nd Anode, 4th Anode.



Base Connections Underside View of Base

HEATER.

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

RATINGS.

Max. A_1 Voltage	500 volts.
Max. $A_2 + A_4$ voltage	15 kV.
Max. Pos. A_3 Voltage	+500 volts.
Max. Neg. A_3 voltage	–500 volts.
Min. A_1 voltage	200 volts.
Min. $A_2 + A_4$ voltage.	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd and 4th Anode voltage	12 kV.
†3rd Anode voltage for focus	–300 to + 300 volts.
Vg for visual cut off	–30 to –70 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1200 pF. approx.

‡This screen material is liable to burn if operated with a spot which is stationary or slow moving. The tube should not be operated under such conditions, even at low beam current.

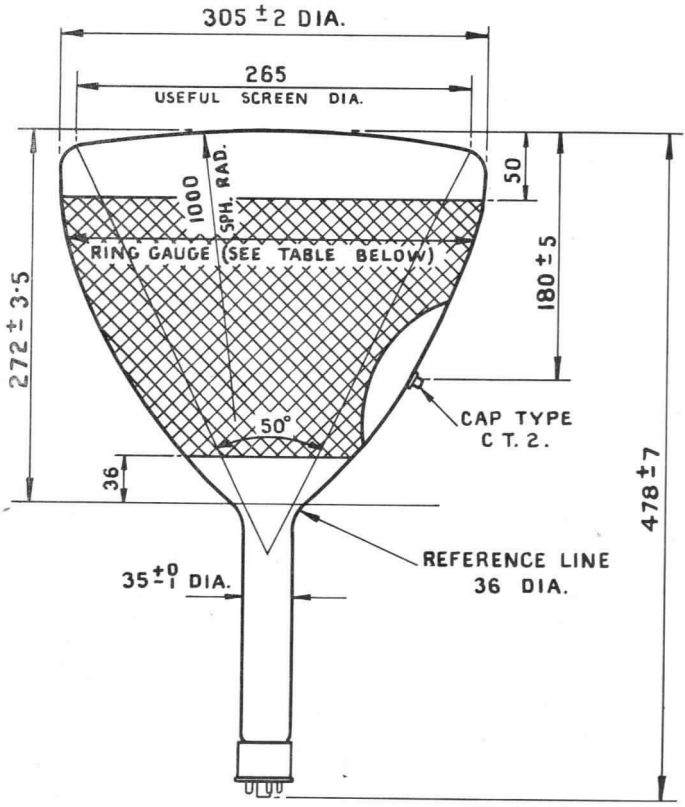
*When used for series operation, the surge heater voltage should not exceed 9·5 volts r.m.s. and a current limiting device should be incorporated in the circuit to limit switching surge.

†The point of optimum focus lies between these values.

Issue 1.
Aug., 1957.

12/03 HB

12/03 JB



RING GAUGE	DISTANCE FROM CENTRE OF SCREEN
280	96 ± 10
230	150 ± 9
180	191 ± 8
130	222 ± 7
80	249 ± 6

FERRANTI
RADAR TUBE

12/04 HM
12/04 JM

12in. diameter flat faced Radar Display Tubes primarily designed for P.P.I. applications.

FOCUS ... ... Magnetic.
DEFLECTION ... ... Magnetic.

SCREEN.

	12/04HM*	12/04JM
Phosphor	Type 'H'	Type 'J'
Fluorescence	Orange	Blue.
Afterglow	Orange	Yellow.
Persistence	long	long.

Both types have metal backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT.2. (9·25mm. dia.)
Max. Overall Length	520mms.
Neck diameter	35mms. nominal

For other dimensions, see drawing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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 Cap—2nd Anode.

HEATER.

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

RATINGS.

Max. 1st Anode Voltage ...	600 volts.
Max. 2nd Anode Voltage ...	15·0 kV.
Min. 1st Anode Voltage ...	250 volts.
Min. 2nd Anode Voltage ...	9·0 kV.
Max. Cathode Current ...	150 μA.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	1·0 MΩ.
Max. R_{g-k}	1·5 MΩ.

CAPACITANCES.

C_{k-all}	<8·0 pF.
C_{g-all}	<8·0 pF.

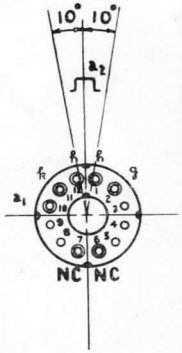
TYPICAL OPERATING CONDITIONS.

1st Anode Voltage	300 volts.
2nd Anode Voltage	15 kV.
Vg for visual cut off	–60 volts.
Av. Mod. Drive for 50μA beam current	20 volts.
‡Focus Coil	640 amp. turns (approx.)

*This tube has a magnesium fluoride screen which is liable to burn even at low values of beam current, if operated with a spot which is stationary or slow moving.

‡Positioned so that the centre of the gap is approx. 120mms. from the reference line (36mm. Ring Gauge Position).

This tube was formerly designated A12/04.



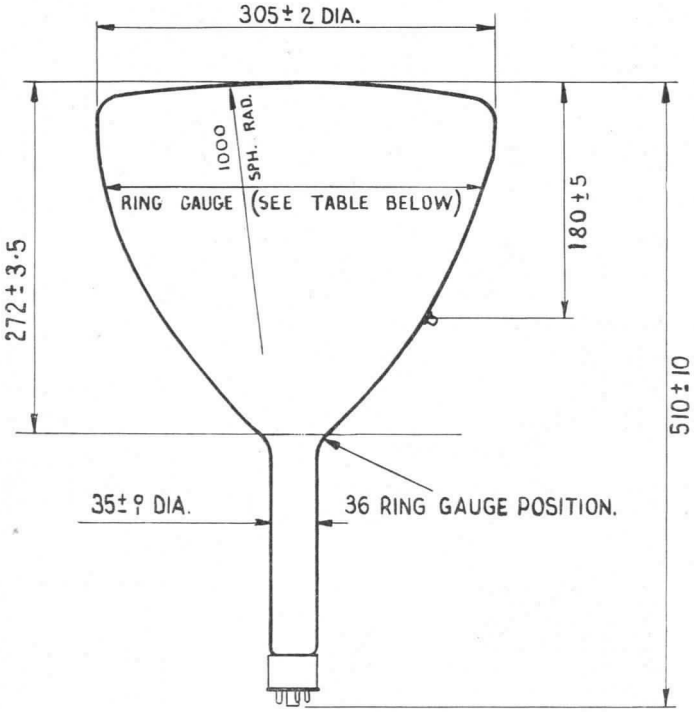
Base Connections Underside View of Base

The anode cap can lie within 15° either side of the centre line as indicated in the diagram.

Issue 1.
Feb., 1957.

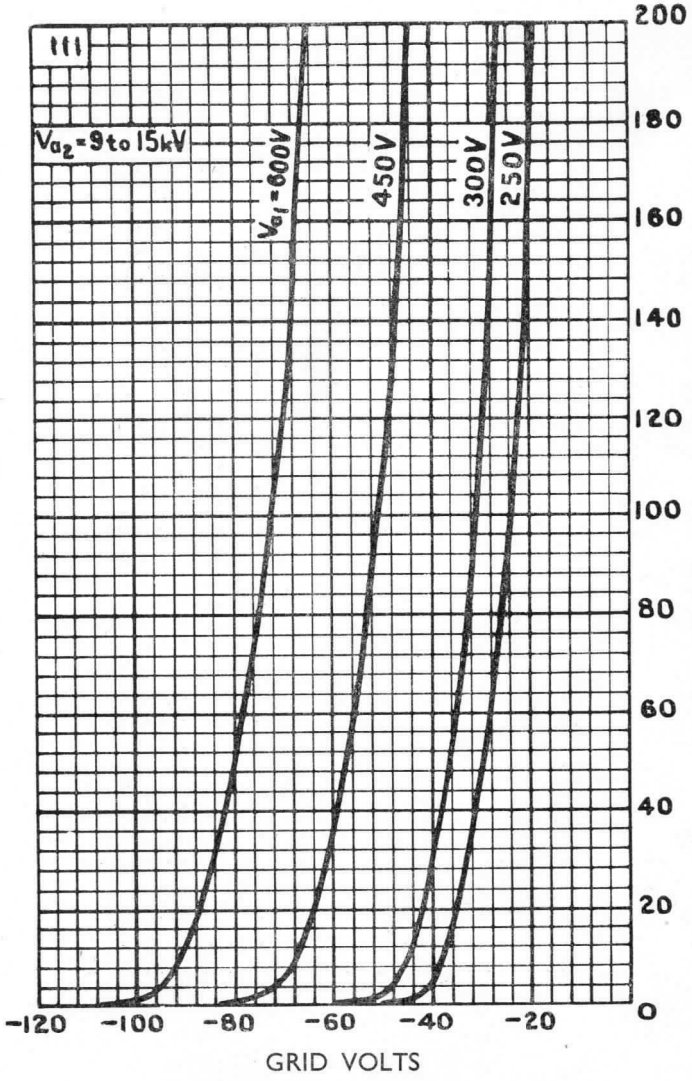
12/04 HM
12/04 JM

FERRANTI

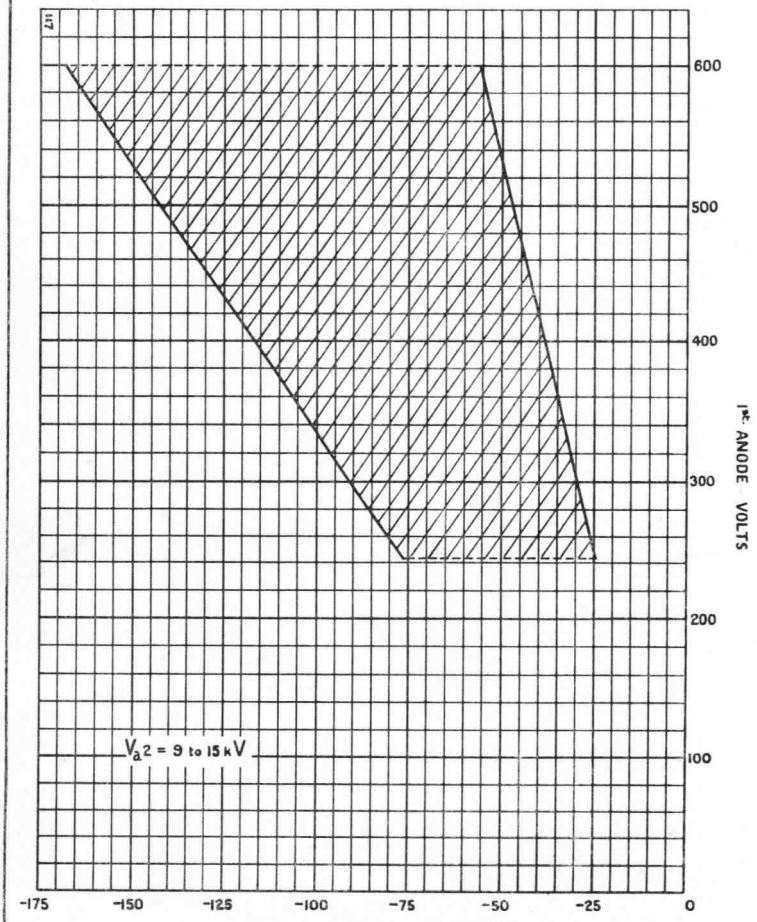


RING GAUGE (mm)	DISTANCE FROM CENTRE OF SCREEN.(mm)
280	96 ± 10
230	150 ± 9
180	191 ± 8
130	222 ± 7
80	249 ± 6
36·1	272 ± 3·5

ALL DIMENSIONS IN MILLIMETRES



Issue 1.
Feb., 1957


600
500
400
300
200
100
1st. ANODE VOLTS
V_a2 = 9 to 15 kV
-175
-150
-125
-100
-75
-50
-25
0
GRID VOLTS

FERRANTI

RADAR TUBE

12/05HM

A 12in. diameter flat faced Radar Display Tube primarily designed for P.P.I. applications. Replacement type.*

FOCUS	Magnetic.
DEFLECTION	Magnetic.

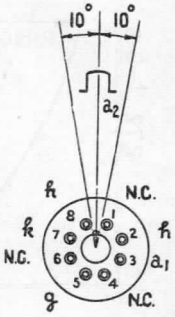
SCREEN.

Phosphor	Type H.
Fluorescence	Orange.
Afterglow	Orange.
Persistence	Very Long.

PHYSICAL DETAILS.

Base	International Octal.
Anode Cap	CT1
Max. Overall Length	495 mm.
Neck Diameter	35 mm. nominal.

For other dimensions see drawing.



All dimensions in millimetres.

BASE CONNECTIONS.

Pin 1—Not Connected.	Pin 5—Grid.
Pin 2—Heater.	Pin 6—Not Connected.
Pin 3—1st Anode.	Pin 7—Cathode.
Pin 4—Not Connected.	Pin 8—Heater.

Side Contact—2nd Anode.

HEATER.

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

RATINGS.

Max. 1st Anode Voltage ...	850 volts.
Max. 2nd Anode Voltage ...	15·0 kV.
Min. 1st Anode Voltage ...	600 volts.
Min. 2nd Anode Voltage ...	10·0 kV.
Max. Cathode Current ...	150 μA.
Max. V_{h-k}	200 volts.
Max. R_{h-k}	1·0 MΩ
Max. R_{g-k}	1·5 MΩ

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.

TYPICAL OPERATING CONDITIONS.

1st Anode Voltage	800 volts.
2nd Anode Voltage	10 kV.
Vg for visual cut off	–80 volts.
Av. Mod. Drive for 50 μA. Beam Current	20 volts
†Focus Coil	640 amp. turns (approx.).

*This tube is equivalent to CV1869 or CV2328.

†Positioned so that the centre of the gap is approx. 98 mms. from the reference line (36mm. Ring Gauge Position).

Issue 3
May 1959

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

12/05HM

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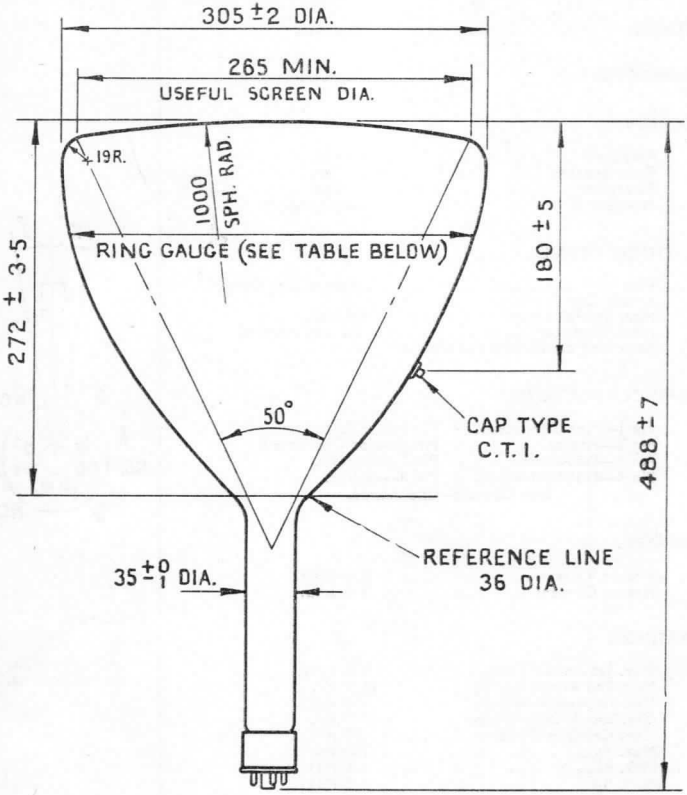


RING GAUGE	DISTANCE FROM CENTRE OF SCREEN		
280	93	±	10
230	150	±	9
180	191	±	8
130	222	±	7
80	249	±	6

12/08 HM

12/08 JM

Ferranti

RADAR TUBES

12in. diameter flat faced Radar Display Tubes primarily designed for P.P.I. applications.

Improved version of CV.429. giving higher resolution.

FOCUS	Magnetic
DEFLECTION	Magnetic

SCREEN.

	12/08HM*	12/08JM
Phosphor	Type 'H'	Type 'J'
Fluorescence	Orange	Blue
Afterglow	Orange	Yellow
Persistence	Long	Long

Both types have metal backed screens

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook

PHYSICAL DETAILS.

Base	B12A (Duodecal)
Anode Cap	CT8. (Cavity Type)
Max. Overall Length	520 mm
Neck Diameter	35 mm nominal

For other dimensions, see drawing

BASE CONNECTIONS.

Pin 1—Heater	Pin 7—No Connection
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 Cap—2nd Anode

HEATER.

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

RATINGS.

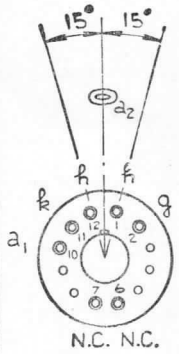
Max. 1st Anode Voltage ...	600 volts
Max. 2nd Anode Voltage ...	15·5 kV
Min. 1st Anode Voltage ...	250 volts
Min 2nd Anode Voltage ...	9·0 kV
Max. Cathode Current ...	150 μA
Max. V_{h-k}	200 volts
Max. R_{h-k}	1·0 MΩ
Max. R_{g-k}	1·5 MΩ

CAPACITANCES.

C_{k-all}	<8·0 pF
C_{g-all}	<8·0 pF

TYPICAL OPERATING CONDITIONS.

1st Anode Voltage	300 volts
2nd Anode Voltage	15 kV
Vg for visual cut-off	–60 volts
Av. Grid Drive for 50μA beam current	20 volts
Line width at I_B=50 μA ...	0·25 mm.
‡Focus Coil	640 amp. turns (approx)



Base Connections

Underside View of Base

*This tube has a magnesium fluoride screen which is liable to burn even at low values of beam current, if operated with a spot which is stationary or slow moving.

‡Positioned so that the centre of the gap is approx. 120 mms. from the reference line (36 mm. Ring Gauge Position).

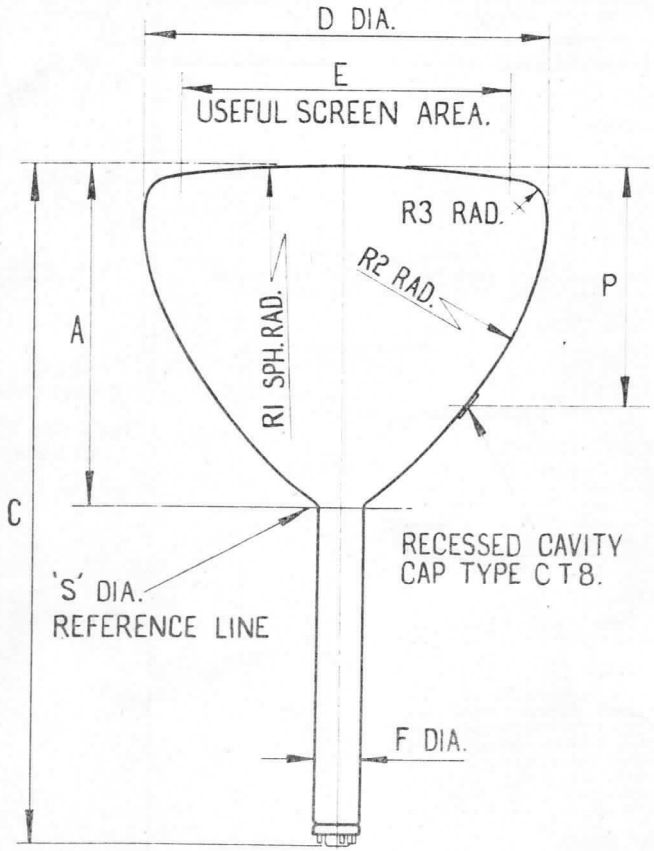
Ferranti

Issue 2
Sept. 1962

Ferranti

12/08 HM

12/08 JM



DIM.	INS.	m m.	DIM.	INS.	m m.
A	10·710 ± ·138	272 ± 3·5	P	7·087 ± ·197	180 ± 5
C	20·197 ± ·276	513 ± 7	R1	39·370	1000
D	12·000 ± ·079	305 ± 2	R2	16·772	426
E	9·842	250 MIN.	R3	·748 ± ·079	19 ± 2
F	1·378 $\pm^{\cdot 020}_{\cdot 039}$	35 $\pm^{\cdot 5}_{1}$	S	1·417	36

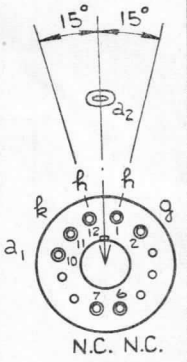
Ferranti

RADAR TUBES

12/48HM

12/48L3M

12in. diameter flat faced Radar Tubes designed for fine symbol presentation, where high resolution is of primary importance. Phosphor Type 'L3' enables flicker free images to be produced at repetition frequencies down to 10 cycles per second, but the persistence of moving targets is curtailed in comparison with Type 'H' or 'L' Phosphor.



Base Connections Underside View of Base

FOCUS	Magnetic
DEFLECTION	Magnetic

SCREEN.

	12/48HM	12/48L3M
Phosphor	*Type 'H'	*Type 'L3'
Fluorescence	Orange	Orange
Afterglow	Orange	Orange
Persistence	very long	long

Both types have metal backed screens.

For further details refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal)
Anode Cap	CT8 (Cavity Type)
Max. Overall Length	640 mm. (25·20")
Min Useful Screen Area ...	250 mm. (9·84") dia.
Nom. Neck diameter ...	35 mm .{i ·378")

For other dimensions, see drawing.

BASE CONNECTIONS.

Pin 1—Heater	Pin 7—No Connection
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 Cap—2nd Anode.

HEATER.

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

RATINGS.

Max. 1st Anode Voltage ...	600 volts
Min 1st Anode Voltage ...	250 volts
Max. 2nd Anode Voltage ...	15·5 kV
Min. 2nd Anode Voltage ...	9·0 kV
Max. Cathode Current ...	150 μA
Max. V_{h-k}	200 volts
Max. R_{h-k}	1·0 MΩ
Max. R_{g-k}	1·5 MΩ

TYPICAL OPERATING CONDITIONS.

1st Anode Voltage	300 volts
2nd Anode Voltage	15 kV
Vg for visual cut-off	−90 volts
Av. Grid Drive for I_B=50 μA.	30 volts
Line width at I_B=50 μA. ...	0·25 mm

The Focus coil should be positioned so that the centre of the gap is approx. 220 mm from the reference line (36 mm Ring Gauge Position).

CAPACITANCES.

C_{k-all}	<8·0 pF
C_{g-all}	<8·0 pF

*This phosphor is liable to burn even at low values of beam current, if operated with a spot which is stationary or slow moving.

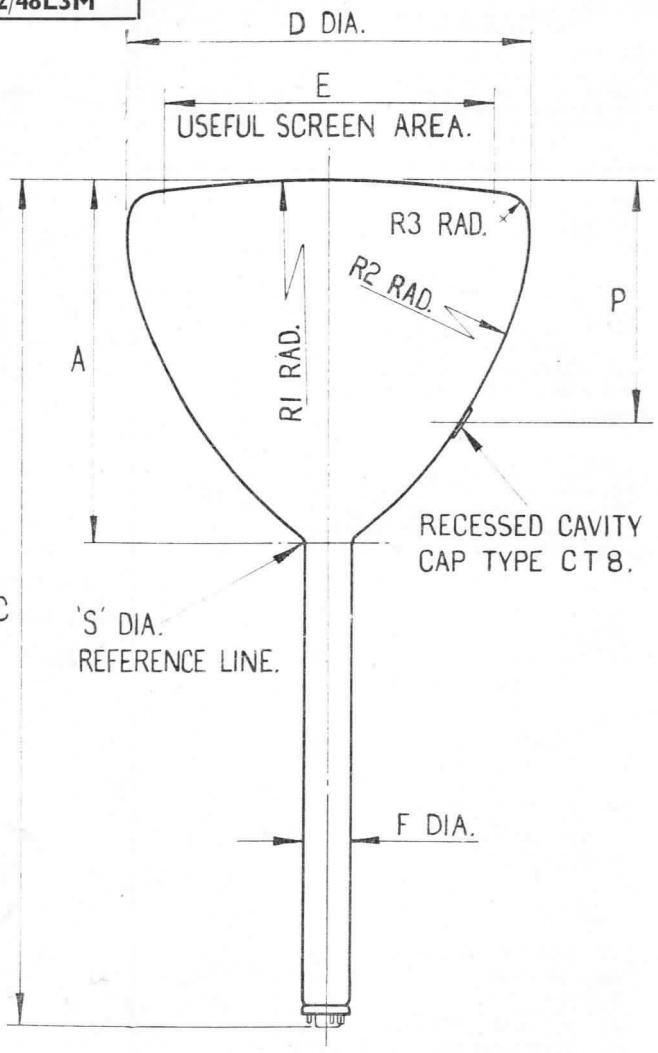
Ferranti

Issue 1.
Sept., 1962

Ferranti

12/48HM

12/48L3M



DIM.	INS.	mm.	DIM.	INS.	mm.
A	10·710±·138	272 ± 3·5	P	7·087±·197	180 ± 5
C	25·040±·157	636 ± 4	R1	39·370	1000
D	12·000±·079	305 ± 2	R2	16·772	426
E	9·842	250 MIN.	R3	·748±·079	19 ±2
F	$1{\cdot}378^{+\cdot020}_{-\cdot039}$	$35^{+5}_{-1\cdot0}$	S	1·417	36

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

Ferranti

FLYING SPOT SCANNER TUBES

14/03AB
14/03QB
14/03Q2B

14in. diagonal Rectangular Tubes with metal backed screen and external conductive coating. Primarily designed for general Flying Spot Scanner applications.

FOCUS ... ... Low Voltage Electrostatic.

DEFLECTION ... ... Magnetic.

SCREEN

Phosphor ...	Type 'A'	Type 'Q'	Type 'Q2'
Fluorescence ...	Green	Blue/Violet	Magenta
Persistence ...	Ultra short	Killed	*

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type).
Max. Overall Length	420 mm.
Nom. neck diameter	37 mm.

For other dimensions see drawing overleaf.

Mounting Position ... ... Any.

These tubes have an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.

Side Contact—2nd Anode, 4th Anode.

HEATER.

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

RATINGS.

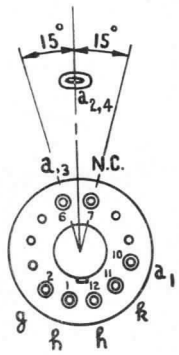
Max. A_1 Voltage	500 volts.
Max. A_2+A_4 voltage	15 kV.
Max. Pos. A_3 voltage	+500 volts.
Max. Neg. A_3 voltage	−500 volts.
Min. A_1 voltage	200 volts
Min. A_2+A_4 voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd and 4th Anode voltage ...	12 kV.
§3rd Anode voltage for focus ...	−300 to +300 volts.
‡V_g for visual cut off	−40 to −80 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1100 pF. (approx.).



Base Connections

Underside View of Base

*A blue filter should be provided for the photocell to separate the two colour peaks which have different persistence times.

†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 point of optimum focus lies between these values.

‡The grid 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.

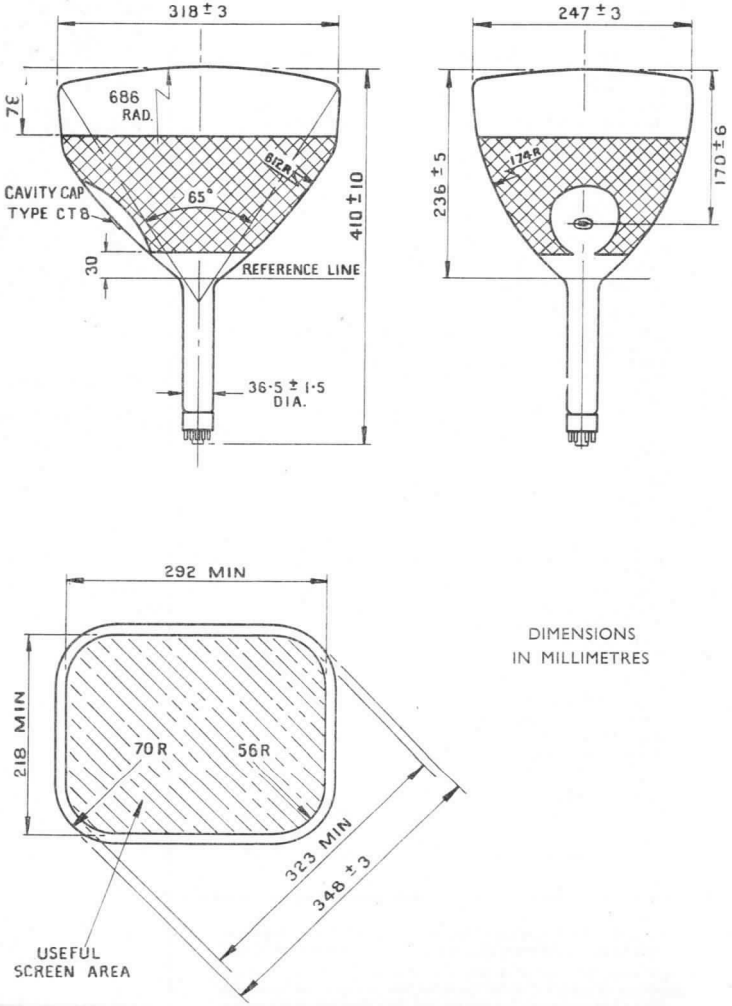
Issue 2
June, 1960

Ferranti

Ferranti

14/03AB
14/03QB
14/03Q2B

THIRD ANGLE PROJECTION



DIMENSIONS IN MILLIMETRES

FERRANTI

MONITOR TUBE

14/03TB

A 14in. diagonal Rectangular Tube with a metal backed screen and external conductive coating. Designed for use in Television Monitoring Equipment.

FOCUS	Low Voltage Electrostatic.	
DEFLECTION	Magnetic.	
SCREEN	Metal backed.	
Phosphor	Type 'T'	
Fluorescence	White.	
Persistence	Short.	

For further details, refer to Screen Type 'T' phosphor characteristics at the front of this section of the handbook. This tube can be supplied with other screen phosphors.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type.)
Max. Overall Length	420 mm.
Nom. neck diameter	37 mm.
For other dimensions see drawing.	
Mounting Position	Any

These tubes have an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.
Side Contact—2nd Anode, 4th Anode.	

HEATER.

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

RATINGS.

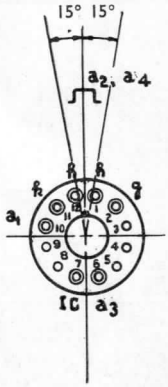
Max. A_1 Voltage	500 volts
Max. A_2+A_4 voltage	15 kV.
Max. Pos. A_3 voltage	+500 volts.
Max. Neg. A_3 voltage	–500 volts.
Min. A_1 voltage	200 volts.
Min. A_2+A_4 voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd and 4th Anode voltage ...	12 kV.
**3rd Anode voltage for focus ...	–300 to +300 volts.
†V_g for visual cut off	–30 to –70 volts.

VAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1100 pF. (approx.).



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 point of optimum focus lies between these values.

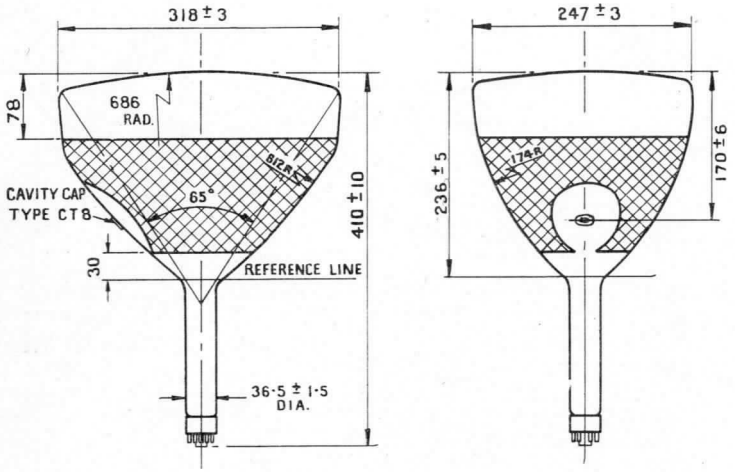
†The grid should never be positive with respect to the cathode, except during the period immediately after switching off, when it may be allowed to rise to + 1 volt.

Issue 1
Aug.,1957

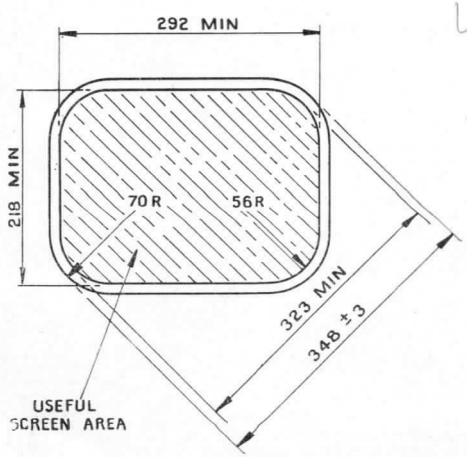
14/03TB

FERRANTI

THIRD ANGLE PROJECTION



410
236
174 ± 5



FERRANTI

TELEVISION MONITOR TUBE

14/04TB

A 14in. diagonal Rectangular Tube with a metal backed screen and external conductive coating. Designed for use in Television Monitoring Equipment.

FOCUS	Magnetic.
DEFLECTION	Magnetic.
SCREEN	Metal Backed.
Phosphor	Type 'T'.
Fluorescence	White.
Persistence	Short.

For further details, refer to Screen Type 'T' phosphor characteristics at the front of this section of the handbook. This tube can also be supplied with other screen phosphors.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type).
Max. Overall Length	457 mm.
Nom. Neck Diameter	37 mm.
For other dimensions see drawing.	
Mounting Position	Any.

This tube has an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—2nd Anode.	

HEATER.

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

RATINGS.

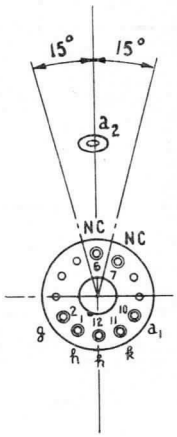
Max. A_1 Voltage	500 volts.
†Max. A_2 Voltage	16 kV.
Min. A_1 Voltage	200 volts.
Min. A_2 Voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
‡Max. R_{h-k}	1·0 MΩ
Max. A_1 Supply Impedance ...	1·5 MΩ

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd and 4th Anode Voltage ...	14 kV.
→ §Vg for visual cut off	−30 to −70 volts.
Focus	See Note ** ←

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1100 pF. (approx.).



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 V_{a2} and I_{a2} must not exceed 6 watts average value for the whole screen.

‡When the heater supply is from a separate transformer. When the heater is in a series chain or earthed the 50 c/s. impedance between earth and cathode (Z_k) is 100kΩ (max).

**The recommended centre of the magnetic length of the focus unit should be approx. 100 mm. from the Reference Line.

§The grid 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.

Issue 1
Jan., 1958

14/04TB

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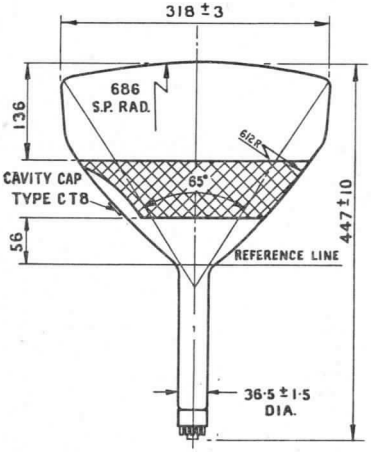
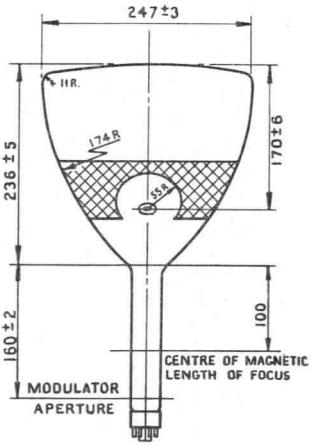
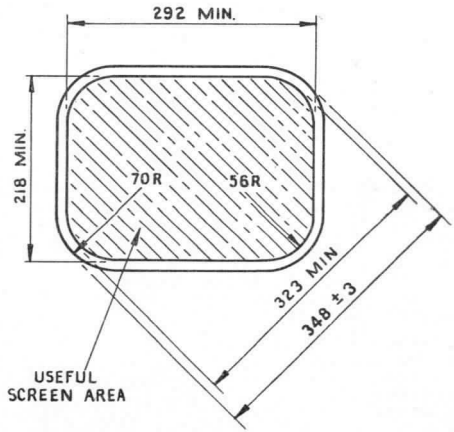






All dimensions are
in millimetres

FERRANTI

RADAR TUBES

15in. diameter Radar Display Tubes with metal backed screens magnetic deflection, and low voltage electrostatic focus.

15/03 HB

15/03 JB

15/03 LB

FOCUS ... ... Low Voltage Electrostatic

DEFLECTION ... ... Magnetic

SCREEN.

	15/03HB	15/03JB	15/03LB
*Phosphor Type	'H'*	'J'	'L'
Fluorescence	Orange	Blue	Orange
Afterglow ...	Orange	Yellow	Orange
Persistence	Very long	Long	Long

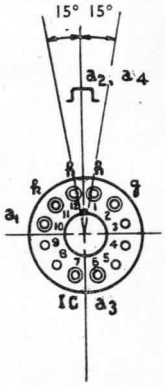
All types have metal backed screens.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base ... ... B12A (Duodecal).
Anode Cap ... ... CT8 Cavity Type.
Max. Overall Length ... 610 mm.
Nom. Neck Diameter ... 37 mm.
For other dimensions, see drawing.
Mounting Position ... Any except vertical screen down.

All types have an external conductive coating which can be used for E.H.T. smoothing.



Base Connections Underside View of Base

A E CONNECTIONS.

Pin 1—Heater
Pin 2—Grid.
Pin 3—No Pin.
Pin 4—No Pin.
Pin 5—No Pin.
Pin 6—3rd Anode.
Pin 7—No Connection.
Pin 8—No Pin.
Pin 9—No Pin.
Pin 10—1st Anode
Pin 11—Cathode.
Pin 12—Heater.
Side Contact—2nd Anode + 4th Anode.

HEATER.

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

RATINGS.

Max. A_1 Voltage ... ... 500 volts.
Max. $A_2 + A_4$ Voltage ... 15 kV.
Max. Pos. A_3 Voltage ... +500 volts.
Max. Neg. A_3 Voltage ... −500 volts.
Min. A_1 Voltage ... ... 200 volts.
Min. $A_2 + A_4$ Voltage ... 8 kV.
Max. V_{h-k} ... ... 200 volts.
Max. R_{g-k} ... ... 1·5 MΩ
Max. R_{h-k} ... ... 1·0 MΩ

TYPICAL OPERATION.

Heater Voltage ... ... 6·3 volts.
1st Anode Voltage ... 300 volts.
2nd+4th Anode Voltage 12 kV.
3rd Anode Voltage for focus −300 to + 300 volts.
†Vg for visual cut off ... −30 to −90 volts.

CAPACITANCES.

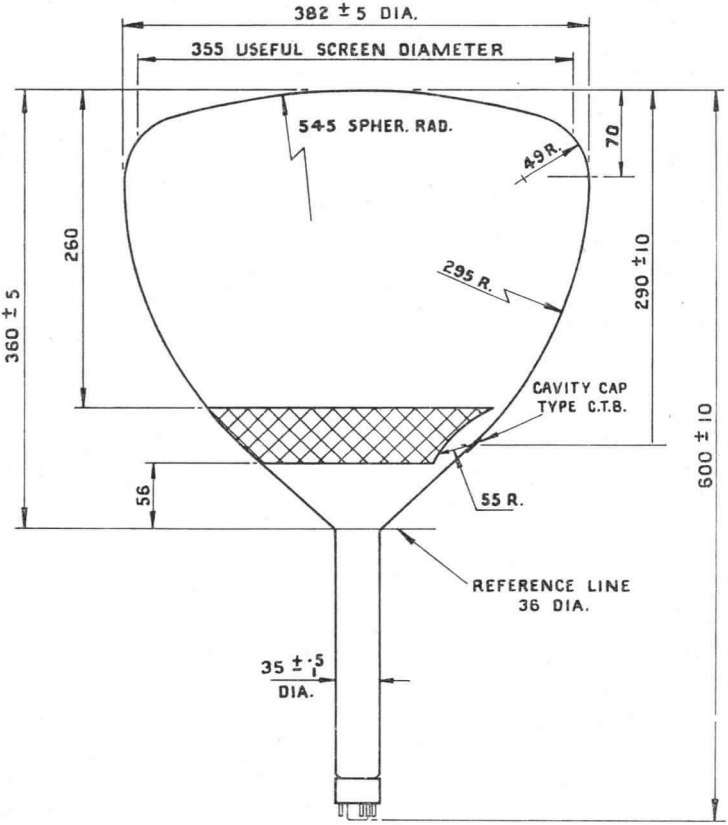
C_k–all ... ... <8 pF.
C_g–all ... ... <8 pF.
C_a–ext. coating ... ... 1500 pF. approx.

*The screen phosphor of Type 15/03HB is liable to burn if operated with a stationary or slow moving spot, even at low values of beam current.

†The modulator should never be positive with respect to the cathode, except during the period immediatly after switching off, when it may be allowed to rise to + 1 volt.

Issue 1.
Dec., 1957

15/03 HB
15/03 JB
15/03 LB



FERRANTI
RADAR TUBES

16/03HB

16/03 JB

16in. diameter Radar Display Tubes with metal backed screens magnetic deflection and Low Voltage Electrostatic focus.

FOCUS	Low Voltage. Electrostatic.
DEFLECTION	Megnetic.

SCREEN.

	16/03HB	16/03JB.
Phosphor	Type 'H'*	Type 'J'
Fluorescence	Orange	Blue.
Afterglow	Orange	Yellow.
Persistence	Very long	long.

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length	485 mm.
For other dimensions, see drawing.	
Mounting Position	Any except vertical screen down.

Both types have an external conductive coating which can be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.
Pin 2—Grid.
Pin 3—No Pin.
Pin 4—No Pin.
Pin 5—No Pin.
Pin 6—3rd Anode.
Pin 7—No Connection.
Pin 8—No Pin.
Pin 9—No Pin.
Pin 10—1st Anode.
Pin 11—Cathode.
Pin 12—Heater.
Side Contact—2nd Anode + 4th Anode.

HEATER.

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

RATINGS.

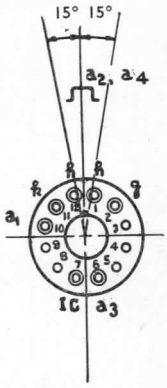
Max. A_1 Voltage	500 volts.
Max. $A_2 + A_4$ Voltage	15 kV.
Max. Pos. A_3 Voltage	+500 volts.
Max. Neg. A_3 Voltage	–500 volts.
Min. A_1 Voltage	200 volts.
Min. $A_2 + A_4$ Voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd + 4th Anode Voltage ...	12 kV.
3rd Anode Voltage for focus ...	–300 to + 300 volts.
†V_g for visual cut off	–30 to –90 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1500 pF. approx.



Base Connections

Underside View of Base

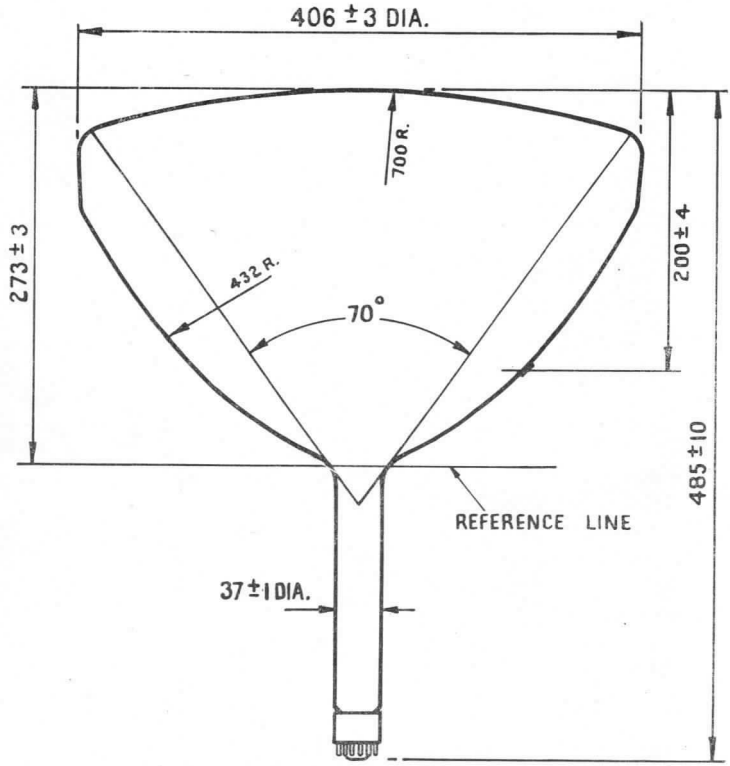
*The screen material of Type 16/03HB is liable to burn if operated with a stationary or slow moving spot, even at low values of beam current.

†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.

Issue 1.
Mar.,1957

16/03HB

16/03 JB



ALL DIMENSIONS ARE IN MILLIMETRES

FERRANTI

MONITOR TUBE

17/03TB

A rectangular Tube with 17in. diagonal screen which is metal backed.
Designed primarily for use in Television Monitoring Epuipment.

FOCUS	... ...	Low Voltage Electrostatic.
DEFLECTION	... ...	Magnetic.
SCREEN....	... ...	Metal backed.
Phosphor	... ...	Type 'T'
Fluorescence	... ...	White

For further details, refer to the relevant phosphor characteristics at the front of this section of the handbook.
This tube can also be supplied with other screen phosphors.

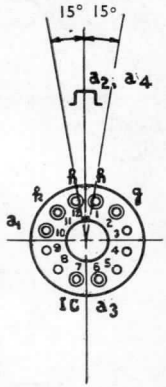
PHYSICAL DETAILS.

Base	... ...	B12A (Duodecal).
Anode Cap	... ...	CT8 Cavity Type.
Max. Overall Length	... ...	490 mm.
Nom. Neck diameter	... ...	37mm.

For other dimensions, see drawing.

Mounting Position	... ...	Any

Both types have an external conductive coating which can be used for E.H.T. smoothing.



Base Connections

Underside View of Base

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.

Side Contact—2nd Anode, 4th Anode.

HEATER.

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

RATINGS.

Max. A_1 Voltage	... ...	500 volts.
Max. $A_2 + A_4$ Voltage	... ...	18 kV.
Max. Pos. A_3 Voltage	... ...	+500 volts.
Max. Neg. A_3 Voltage	... ...	−500 volts.
Min. A_1 Voltage	... ...	200 volts.
Min. $A_2 + A_4$ Voltage	... ...	12 kV.
Max. V_{h-k}	... ...	200 volts.
Max. R_{g-k}	... ...	1·5 MΩ
Max. R_{h-k}	... ...	1·0 MΩ

TYPICAL OPERATION.

Heater Voltage	... ...	6·3 volts.
1st Anode Voltage	... ...	300 volts.
2nd + 4th Anode Voltage	...	15 kV.
‡3rd Anode Voltage for focus	...	−300 to + 300 volts.
†V_g for visual cut off	... ...	−30 to −90 volts.

CAPACITANCES.

C_{k-all}	... ...	<8 pF.
C_{g-all}	... ...	<8 pF.
$C_{a-ext.\ coating}$	... ...	1500 pF. approx.

*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.

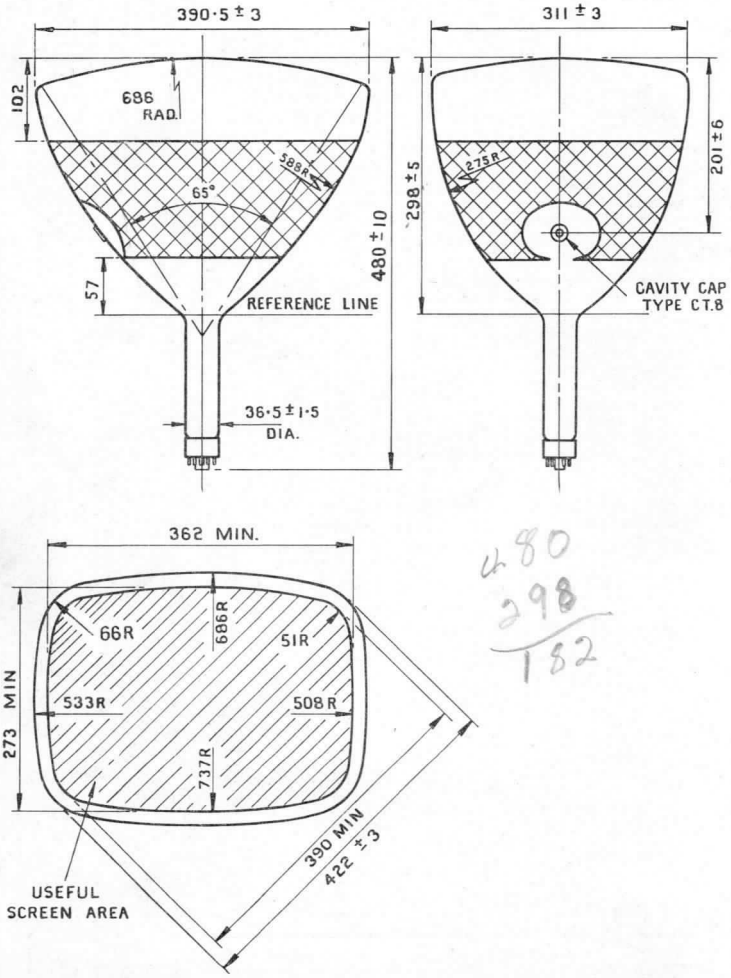
†The modulator should never be positive with respect to the cathode, except during the period immediately after switching off, when it may be allowed to rise to + 1 volt.

‡Optimum focus lies between these values.

Issue 1.
Aug.,1957

17/03TB

FERRANTI



480
298
182

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

FERRANTI
MONITOR TUBE

21/03TB

A 21in. diagonal Rectangular Tube with a metal backed screen and external conductive coating. Designed for use in Television Monitoring Equipment.

FOCUS	Low Voltage Electrostatic.
DEFLECTION	Magnetic.
Deflection Angle	90°.
SCREEN	Metal backed.
Phosphor	Type 'T'—Silver activated.
Fluorescence	White.
Persistence	Short.

For further details, refer to Screen Type 'T' phosphor characteristics at the front of this section of the handbook. This tube can be supplied with other screen phosphors.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type.)
Max. Overall Length	514 mm.
Nom. neck diameter	37 mm.
For other dimensions see drawing.	
Mounting Position	Any

These tubes have an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—3rd Anode.	Pin 12—Heater.

Side Contact—2nd Anode, 4th Anode.

HEATER.

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

RATINGS.

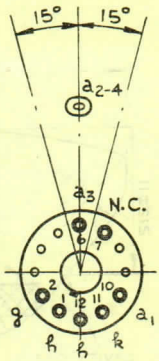
Max. A_1 Voltage	500 volts.
Max. A_2+A_4 voltage	18 kV.
Max. Pos. A_3 voltage	+500 volts.
Max. Neg. A_3 voltage	–500 volts.
Min. A_1 voltage	200 volts.
Min. A_2+A_4 voltage	12 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd and 4th Anode voltage ...	16 kV.
**3rd Anode voltage for focus ...	–200 to+200 volts.
†V_g for visual cut off	–30 to –90 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1500 pF. (approx.).



Base Connections Underside View of Base

**The point of optimum focus lies between these values.

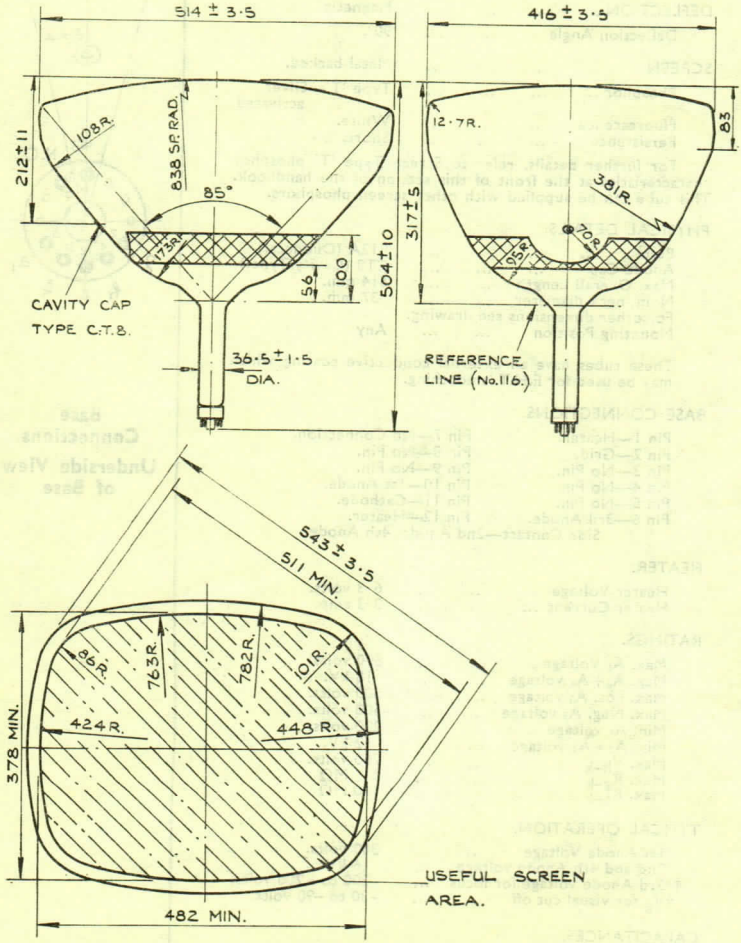
†The grid should never be positive with respect to the cathode, except during the period immediately after switching off, when it may be allowed to rise to + 1 volt.

Tentative Issue 2 May, 1959

FERRANTI

21/03TB

FERRANTI



DIMENSIONS IN MILLIMETRES

FERRANTI
RADAR TUBE

21/04HB

A 21in. diagonal Rectangular Tube with a metal backed screen and external conductive coating. Designed primarily for use as a Radar Display Tube.

FOCUS	Magnetic.
DEFLECTION	Magnetic.
Deflection Angle...	90°.
SCREEN	Metal Backed.
Phosphor	Type 'H'
Fluorescence	Orange.
Afterglow...	Orange.
Persistence	Very Long.

For further details, refer to Screen Type 'T' phosphor characteristics at the front of this section of the handbook. This tube can also be supplied with other screen phosphors.

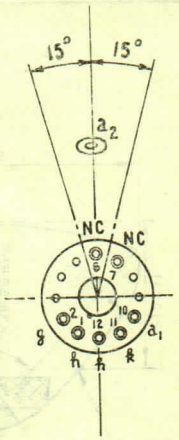
PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 (Cavity Type).
Max. Overall Length	514 mm.
Nom. Neck Diameter	37 mm.
For other dimensions see drawing.	
Mounting Position	Any.

This tube has an external conductive coating which may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No Connection.
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—2nd Anode.	



Base Connections Underside View of Base

HEATER.

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

RATINGS.

Max. A_1 Voltage	500 volts.
Max. A_2 Voltage	18 kV.
Min. A_1 Voltage	200 volts.
Min. A_2 Voltage	12 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ
Max. A_1 Supply Impedance ...	1·5 MΩ

TYPICAL OPERATION.

1st Anode Voltage	300 volts.
2nd and 4th Anode Voltage ...	16 kV.
*Vg for visual cut off	–40 to –80 volts.
Focus	See Note †
An ion trap magnet is not required.	

CAPACITANCES.

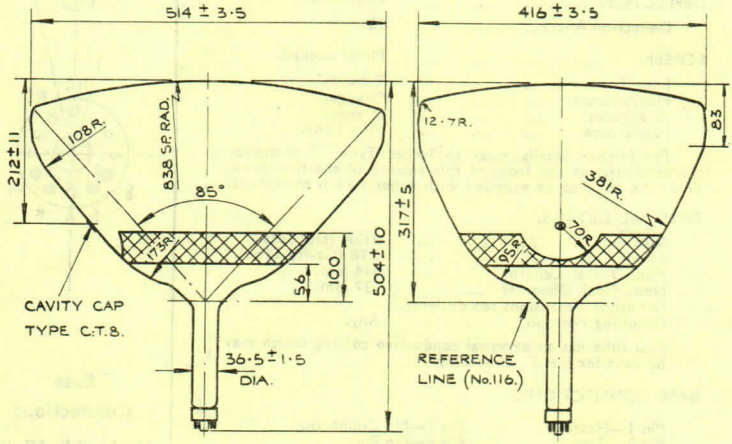
C_{k-all}	<8 pF.
C_{g-all}	<8 pF.
$C_{a-ext.\ coating}$	1500 pF. (approx.).

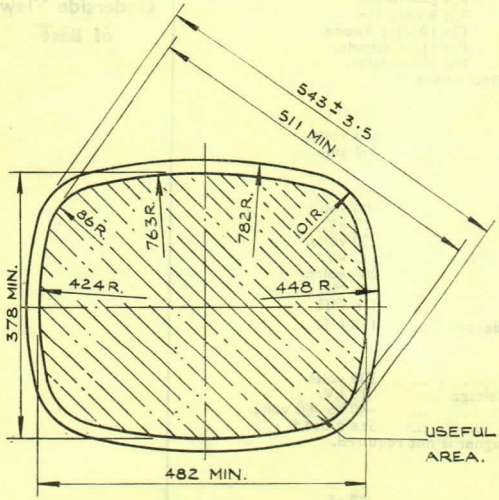
*The grid should never be positive with respect to the cathode, except during the period immediately after switching off, when it may be allowed to rise to + 1 volt.

†The recommended centre of the magnetic length of the focus unit should be approx. 100 mm. from the Reference Line.

Tentative, Issue 1 Aug. 1959.

21/04HB





All dimensions are in millimetres

Ferranti

1240/54HM

1240/54L3M

RADAR TUBES

12in. diameter tubes with narrow neck and small deflection angle. Suitable for use with either Transistor or Valve circuits in Raw or Synthetic Radar and symbol presentation.

FOCUS ... ... Magnetic

DEFLECTION ... ... Magnetic–45°(approx)

SCREEN.

	1240/54HM	1240/54L3M
Phosphor	Type 'H'*	Type 'L3'* †
Fluorescence	Orange	Orange
Afterglow	Orange	Orange
Persistence	Very Long	Long

PHYSICAL DETAILS.

Base	B9A/D
Anode Cap	CT8 Cavity Type
Max. Overall Length	653 mm.
Neck Diameter	23 mm. (nom.)
Mounting Position	Any

For other dimensions see outline drawing overleaf.

BASE CONNECTIONS.

Pin 1—Grid	Pin 6—I.C.
Pin 2—I.C.	Pin 7—N.C.
Pin 3—Cathode	Pin 8—I.C.
Pin 4—Heater	Pin 9—1st Anode
Pin 5—Heater	Side Contact—2nd Anode

HEATER.

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

RATING.

Max. A_1 Voltage	600 volts
Max. A_2 Voltage	15 kV
Min. A_2 Voltage	8 kV
Max. V_{h-k}	200 volts
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

TYPICAL OPERATION.

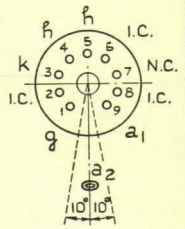
With Valve Drive.

1st Anode Voltage	300 volts
2nd Anode Voltage	12 kV
V_g for visual cut-off ...	–30 to —90 volts

With Transistor Drive.

1st Anode Voltage	100 volts
2nd Anode Voltage	12 kV
V_g for visual cut-off	–25 volts

Recommended position of focus coil is 170 mm in front of the grid.



Base Connections Underside View of Base

*These phosphors are liable to burn if operated with a spot which is stationary or slow moving, and tubes should not be operated under such conditions, even at low beam current. Alternative phosphors for this application can be supplied on request.

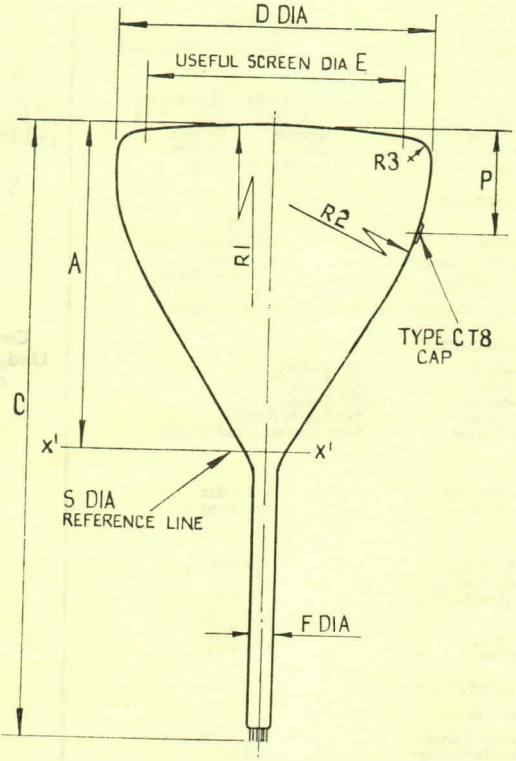
†Phosphor Type L3 is flicker free at 10 c/s.

Tentative Issue 1. Dec., 1963

Ferranti

1240/54HM

1240/54L3M



DIM.	mm.	IN.	DIM.	mm.	IN.
A	322 ± 3	12·67 ±·12	P	90 ± 5	3·54 ±·20
C	645 ± 8	25·39 ±·31	R1	1000	39·37
D	305 ± 2	12·00 ±·08	R2	426	16·77
E	250 MIN.	9·84	R3	19	·75
F	23 ± 1°	·906 +·000 −·039	S	25	·984

ORIGINAL DIMENSIONS IN MILLIMETERS

FERRANTI
RADAR TUBES

1650/03HB

1650/03JB

16in. diameter Radar Display Tube with metal backed screen, magnetic deflection and low voltage electrostatic focus. The deflection angle is approximately 50°.

FOCUS	Low Voltage. Electrostatic.
DEFLECTION	Magnetic.

SCREEN.

	1650/03HB	1650/03JB
Phosphor	*Type "H"	Type "J"
Fluorescence	Orange	Blue
Afterglow	Orange	Yellow
Persistence	Very Long	Long

For further details refer to the revelant phosphor characteristics at the front of this section of the handbook.

PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 Cavity Type.
Max. Overall Length	600 mm.
Deflection Angle	50°

For other dimensions, see drawing.

Mounting Position	Any except vertical screen down.

Both types have an external conductive coating which can be used for E.H.T. smoothing.

CONNECTIONS.

Pin 1—Heater.	Pin 7—No connection.
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—3rd Anode.	Pin 12—Heater.

Side contact—2nd and 4th anodes.

HEATER.

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

RATINGS.

Max. A_1 Voltage	500 volts.
Max. A_2+A_4 Voltage	18 kV.
Max. Pos. A_3 Voltage	+500 volts.
Max. Neg. A_3 Voltage	–500 volts.
Min. A_1 Voltage	200 volts.
Min. A_2+A_4 Voltage	8 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ
Max. R_{h-k}	1·0 MΩ

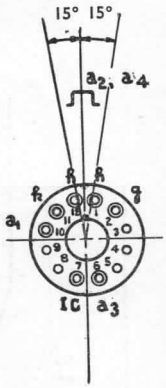
TYPICAL OPERATION.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd and 4th Anode Voltage	15 kV.
3rd Anode Voltage for focus	–300 to +300 volts.
†Vg for visual cut-off	–40 to –100 volts.

NOTE.— When using static shift coils external to the main deflecting system, care must be taken to shield both neck and lens regions of the tube from fringe fields, otherwise deflection defocusing conditions will result.

CAPACITANCES.

C_{k-all}	8 pF.
C_{g-all}	8 pF.
$C_{a-ext.\ coating}$	1500 pF. approx.



Base Connections
Underside View of Base

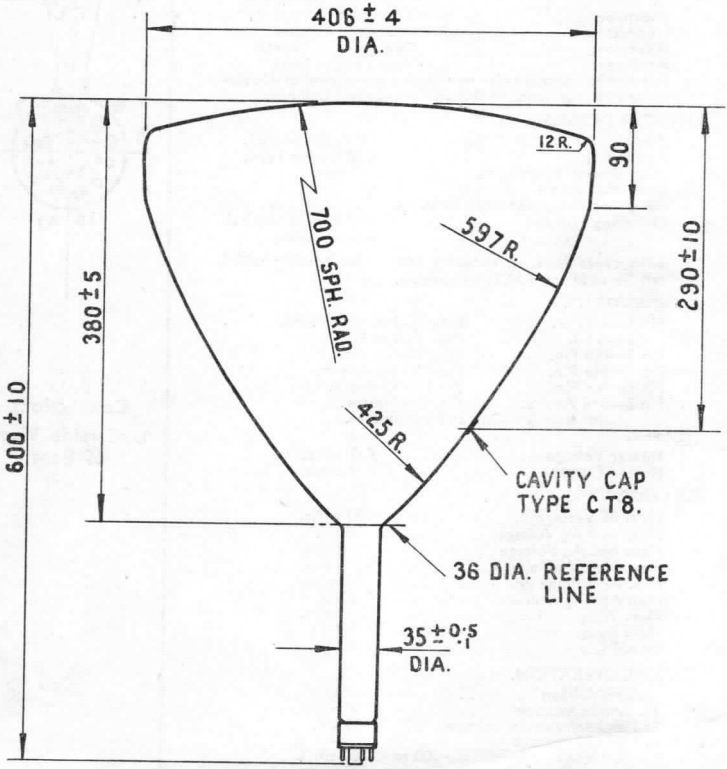
*The screen material of type 1650/03HB is liable to burn if operated with a stationary or slow moving spot, even at low values of beam current.

†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.

Issue 1
Nov., 1958

1650/03HB

1650/03JB



ALL DIMENSIONS ARE IN MM.

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

FERRANTI

PICTURE MONITOR TUBE

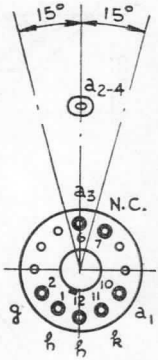
1790/03TB

A rectangular tube with 17″ diagonal screen and 90° deflection angle. Designed primarily for use in Television Monitoring Equipment.

FOCUS	Low Voltage Electrostatic.
DEFLECTION	Magnetic
SCREEN	Metal backed
Phosphor	Type 'T'— Silver Activated.
Fluorescence	White.

This tube can be supplied with other screen phosphors.

For further details refer to the phosphor characteristics at the front of this section of the handbook.



PHYSICAL DETAILS.

Base	B12A (Duodecal).
Anode Cap	CT8 Cavity type.
Max. Overall Length	420 mm.
Nom. Neck diameter	37 mm.
Mounting Position	Any.

For other dimensions see drawing on page 2.
The external conductive coating may be used for E.H.T. smoothing.

BASE CONNECTIONS.

Pin 1—Heater.	Pin 7—No connection.
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—3rd Anode.	Pin 12—Heater.

Side contact—2nd & 4th Anodes.

HEATER.

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

RATINGS.

Max. A_1 voltage	500 volts.
Max. A_2+A_4 voltage	18 kV.
Max. Pos. A_3 voltage	+500 volts.
Max. Neg. A_3 voltage	−500 volts.
Min. A_1 voltage	200 volts.
Min. A_2+A_4 voltage	12 kV.
Max. V_{h-k}	200 volts.
Max. R_{g-k}	1·5 MΩ.
Max. R_{h-k}	1·0 MΩ.

TYPICAL OPERATION.

Heater Voltage	6·3 volts.
1st Anode Voltage	300 volts.
2nd + 4th Anode Voltage ...	15 kV.
*3rd Anode Voltage for focus ...	−300 to +300 volts.
†V_g for visual cut-off	−30 to −90 volts.

CAPACITANCES.

C_{k-all}	<8 pF.
C_{g-all}	<8 pF
$C_{a-ext.\ coating}$	1500 pF approx.

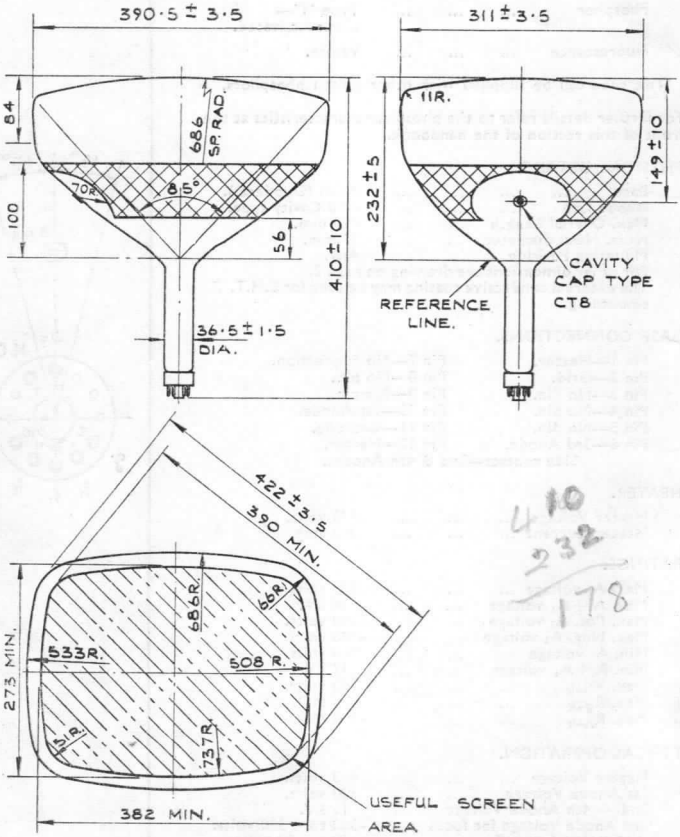
*Optimum focus lies between these values.

†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.

FERRANTI

Issue 1, Apl., 1959

1790/03TB



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232
178

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