Mullard technical handbook

Book two
Valves and tubes

Part four
Transmitting and industrial heating tubes
Microwave tubes

July 1975

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TRANSMITTING, INDUSTRIAL HEATING AND MICROWAVE TUBES

CONTENTS

Book 2 comprises the following parts—

Part 1 Receiving valves, cathode ray tubes, gas filled tubes.
Part 2 Camera tubes, image intensifiers, radiation detectors.
Part 3 Discontinued – see Part 1.
Part 4 Transmitting, industrial heating and microwave tubes.
Part 5 Discontinued – tubes transferred to Part 4
– components to Book 1 Part 8.

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BOOK 2 (Part 4)

VALVES AND TUBES

Transmitting and industrial heating tubes

Microwave tubes

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DATA HANDBOOK SYSTEM

The Mullard data handbook system is made up of three sets of books, each comprising several parts.

The three sets of books, easily identifiable by the colours of their covers, are as follows:

Book 1	(blue)	Semiconductor devices and integrated circuits
Book 2	(orange)	Valves and tubes
Book 3	(green)	Passive components, materials, and assemblies.

New editions will be issued at approximately yearly intervals.

The data contained in these books are as accurate and up to date as it is reasonably possible to make them at the time of going to press. It must however be understood that no guarantee can be given here regarding the availability of the various devices or that their specifications may not be changed before the next edition is published.

The devices on which full data are given in these books are those around which we would recommend equipment to be designed. Where appropriate, other types no longer recommended for new equipment designs, but generally available for equipment production are listed separately with abridged data. Data sheets for these types may be obtained on request. Older devices on which data may still be obtained on request are also included in the index of the appropriate part of each book.

Requests for information on the data handbook system and for individual data sheets should be made to

Central Technical Services
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Surrey CR4 4XY.

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Information regarding price and availability of devices must be obtained from our authorised agents or from our representatives.

SELECTION GUIDE—BOOK 2, PART 4

Section B—TRIODES

Triodes for industrial heating

Approx. Output at Full Ratings (kW)	Max. Frequency at Full Ratings (MHz)	Max. Frequency at Reduced Ratings (MHz)	Max. Anode Dissipation (kW)	Max. Anode Voltage (kV)	Cooling	Type No.
CERAMIC-METAL TYPES						
2·7	250	250	1·5	5·5	Forced-air Forced-air Flanged fixing	YD1240 YD1244
4·5	160	220	2·5	7·2	Forced-air Water (helix)	YD1150 YD1152
8·8	120	220	5·0	7·2	Forced-air Water jacket Water (helix)	YD1160 YD1161 YD1162
13·2	50	—	10	12	Forced-air	YD1173
15·4	120	—	10	7·2	Forced-air Water jacket Water (helix)	YD1170 YD1171 YD1172
26·5	120	—	10	12	Forced-air	YD1175
26·5	120	—	15	12	Water (helix)	YD1177
31·6	100	—	15	9·0	Forced-air	YD1180
31·6	100	—	20	9·0	Integral jacket	YD1182
50	100	—	15	14·4	Forced-air	YD1185
50	100	—	20	14·4	Integral jacket	YD1187
60	30	—	40	9·6	Integral jacket Vapour	YD1192 YD1193
90	100	—	30	14·4	Forced-air	YD1195
90	100	—	40	14·4	Integral jacket	YD1197
120	30	—	80	14	Integral jacket Vapour	YD1202 YD1203
240	30	—	120	16·8	Integral jacket Vapour	YD1212 YD1213
480	30	—	240	19·2	Integral jacket Vapour	YD1342 YD1343
Note: All above types have high efficiency external anodes and coaxial connections.						
NON-CERAMIC TYPES						
1·5	50	—	0·5	5·0	—	TY5-500
1·69	100	120	0·45	4·0	—	TY4-500
2·7	50	—	0·8	6·0	—	TY6-800
8·25	55	85	6·0	7·2	Forced-air Water jacket Water (helix)	TY7-6000A TY7-6000W TY7-6000H

Section B—TRIODES (cont.)

Triodes for television translator service

Typical Power Output (W)	Typical Frequency (MHz)	Max. Anode Dissipation (W)	Max. Anode Voltage (kV)	Max. Anode Current (mA)	Inter-modulation Product (dB)	Type No.
35	780	300	1·8	200	−52	YD1300
55	780	325	2·0	250	−54	YD1302
100	860	900	3·5	550	−56	YD1333
220	860	1800	3·5	700	−52	YD1330
220	860	1800	3·5	550	−53	YD1336

Telecommunications power triodes

Approx. Output at Full Ratings (kW)	Max. Frequency at Full Ratings (MHz)	Max. Frequency at Reduced Ratings (MHz)	Max. Anode Dissipation (kW)	Max. Anode Voltage (kV)	Cooling	Type No.
1·69	100	120	0·45	4·0	—	TY4-500
6·9	75	220	5·0	6·0	Forced-air	TY6-5000A
			6·0		Water jacket	TY6-5000W
			6·0		Water (helix)	TY6-5000H
10	30	—	6·0	7·2	Forced-air	TY7-6000A
					Water jacket	TY7-6000W
					Water (helix)	TY7-6000H

Audio power triodes

Power Output two valves in Push-pull (kW)	Max. Anode Dissipation (kW)	Max. Anode Voltage (kV)	Cooling	Type No.
2·44	0·45	4·0	—	TY4-500
9·0	2·5	7·0	Forced-air	YD1150
			Water (helix)	YD1152
13·3	5·0	6·0	Forced-air	TY6-5000A
	6·0		Water jacket	TY6-5000W
	6·0		Water (helix)	TY6-5000H
18	5·0	7·0	Forced-air	YD1160
			Water jacket	YD1161
			Water (helix)	YD1162
20	6·0	7·2	Forced-air	TY7-6000A
			Water jacket	TY7-6000W
			Water (helix)	TY7-6000H
33	10	7·2	Forced-air	YD1170
			Water jacket	YD1171
			Water (helix)	YD1172

Section C—TETRODES

Telecommunications power tetrodes

Approx. Output at Full Ratings (W)	Max. Frequency at Full Ratings (MHz)	Max. Frequency at Reduced Ratings (MHz)	Max. Anode Dissipation (W)	Heater or Filament Voltage (V)	Cooling	Type No.
375	120	200	125	5·0	—	QY3-125
800	400	1 215	700	6·3	Forced-air	YL1110
930	110	220	500	5·0	Forced-air	QY4-500A
1 000	75	120	250	5·0	Forced-air	QY4-250
1 100	110	—	400	5·0	Forced-air	QY4-400
1 760	75	110	500	10	—	QY5-500
2 200	250	—	1 500	4·2	Forced-air	YL1440
4 100	75	220	3 000	6·3	Forced-air Water-jacket	QY5-3000A QY5-3000W
6 300	250	—	6 000	6·3	Forced-air	YL1420
10 500	110	—	6 000	6·8	Forced-air	YL1470
13 000	250	—	12 000	8·0	Forced-air	YL1430
27 500	250	—	18 000	11·5	Forced-air	YL1520

Single sideband tetrodes

P.E.P. Output (W)	Max. Frequency (MHz)	Anode Voltage (V)	Grid 2 Voltage (V)	Heater or Filament Voltage (V)	Cooling	Type No.
510	120	4 000	550	5·0	Forced-air	QY4-250
650	110	4 000	705	5·0	Forced-air	QY4-400
680	1 215	2 500	450	6·3	Forced-air	YL1110
900	75	5 000	700	10·0	—	QY5-500
1 380	200	5 000	1 000	6·3	Forced-air Water jacket	QY5-3000A QY5-3000W

Section D—TRAVELLING WAVE TUBES

Radar travelling wave tubes

Frequency (GHz)	Minimum saturated power output (W)	Type No.
2·7 to 3·3 7·0 to 11·5	250 (pulsed) 0·004	LB3–250B LA9–3B

Communications travelling wave tubes

Frequency (GHz)	Minimum saturated power output (W)	Type No.
3·4 to 4·2	25	YH1090
5·8 to 8·5	22	YH1170
5·9 to 6·5	10	LB6–10
5·9 to 6·5	25	LB6–25
6·4 to 7·2	20	LB6–25A
7·0 to 8·5	22	YH1172

Television transposer travelling wave tube

Frequency (MHz)	Minimum saturated power output (W)	Type No.
470 to 860	220	YH1210

Section E—VACUUM PRODUCTS

Ionisation gauge heads

Description	Tubulation*	Pressure Range (torr)	Gauge Factor	Type No.
Double filament ionisation gauge head	K	10^{-3} to 10^{-10}	12	IOG–22
Ionisation gauge head	—	10^{-1} to 10^{-7}	5·5	IOG–39
Ionisation gauge head	W	10^{-3} to 5×10^{-8}	20	IOG–71

* K = "Kovar" type sealing glass
W = Tungsten sealing glass

GENERAL SECTION A

A

These symbols are based on British Standard Specification No. 1409 : 1950, " Letter Symbols for Electronic Valves ".

1. SYMBOLS FOR ELECTRODES

Anode	a	Fluorescent Screen or Target...	t
Cathode	k	External Metallisation	M
Grid	g	Internal Metallisation	m
Heater	h	Deflector Electrodes	x or y
Filament	f	Internal Shield	s
Beam Plates	bp	Resonator	Res

NOTE 1. In valves having more than one grid, the grids are distinguished by numbers—g_1, g_2, etc., g_1 being the grid nearest the cathode.

NOTE 2. In multiple valves, electrodes of the different sections may be distinguished by adding one of the following letters:

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

Thus, the grid of the triode section of a triode-hexode is denoted by g_t.

NOTE 3. Two or more similar electrodes which cannot be distinguished by any of the above means may be denoted by adding one or more primes to indicate to which electrode system the electrode forms a part.
Thus, the anode of the first diode in a double diode valve is denoted a′.

2. SYMBOLS FOR ELECTRIC MAGNITUDES

Voltages		Current	
Direct Voltage	V	Direct Current	I
Alternating Voltage (r.m.s.)	$V_{r.m.s.}$	Alternating Current (r.m.s.)	$I_{r.m.s.}$
Alternating Voltage (mean)	V_{av}	Alternating Current (mean)	I_{av}
Alternating Voltage (peak)	v_{pk}	Alternating Current (peak)	i_{pk}
Peak Inverse Voltage ...	P.I.V.	No Signal Current	I_0

Miscellaneous

Frequency	f	Anode Efficiency	η
Amplification Factor ...	μ	Sensitivity	S
Mutual Conductance ...	g_m	Brightness	B
Conversion Conductance...	g_c	Temperature	T
Distortion	D	Time	t

	Inside Valve	Outside Valve
Resistance	r	R
Reactance	x	X
Impedance	z	Z
Admittance	y	Y
Mutual Inductance	m	M
Capacitance	c	C
Capacitance at Working Temperature	c_w	
Power	p	P

3. AUXILIARY SYMBOLS

Battery or other source of supply	b
Inverse (Voltage or Current)	inv
Ignition (Voltage)	ign
Extinction (Voltage)	ext
No Signal	o
Input	in
Output	out
Total	tot
Centre Tap	ct

4. COMPLEX SYMBOLS

Symbols in Sections 1 and 3 above may be used as subscripts to symbols in Section 2, to denote such magnitudes as Anode Current, Grid Volts, etc., e.g.:—

Anode Voltage ...	V_a	Anode Current (A.C. r.m.s.)	$I_{a(r.m.s.)}$
Control-Grid Voltage	V_{g1}	No Signal Anode Current ...	$I_{a(o)}$
Anode Supply Voltage	$V_{a(b)}$	Control-Grid Current ...	I_{g1}
Filament Voltage ...	V_f	Total Distortion	D_{tot}
Heater Voltage ...	V_h	3rd Harmonic Distortion ...	D_3
Anode Dissipation ...	p_a	Equivalent Noise Resistance	R_{eq}
Output Power ...	P_{out}	Limiting Resistor	R_{lim}
Drive Power	P_{drive}	Cathode Bias Resistor	R_k
Anode Current (D.C.)	I_a		

	Internal	External
Anode Resistance	r_a	R_a
Insulation Resistance (heater to cathode)	r_{h-k}	
Resistance between Control-Grid and Cathode ...	r_{g1-k}	R_{g1-k}
Capacitance (cold)—		
Anode to all other electrodes		c_{a-all}
Anode to control-grid		c_{a-g1}
Control-grid to cathode at working temperature		$c_{g1-k(w)}$
Control-grid to all other electrodes except anode (Input Capacitance)		c_{in}
Anode to all other electrodes except control-grid (Output Capacitance)		c_{out}
Inner Amplification Factor		μ_{g1-g2}

A new comprehensive type nomenclature system for transmitting and industrial valves and tubes has recently been introduced. In general, new Mullard devices will have type numbers in the 'new system', earlier devices will retain numbers in one of the 'old systems'.

NEW SYSTEM

The type number for valves or tubes used primarily in 'professional' applications (e.g. transmitters, navigation or communication equipment, industrial applications) consists of two letters followed by four figures. This system does not apply to receiving-type valves.

The first letter indicates a fundamental characteristic of the device:

X—photosensitive tube
Y—vacuum valve or tube (except photodevices)
Z—gasfilled valve or tube (except photodevices)

The second letter indicates the construction or application of the device :

A—diode
C—trigger tube
D—triode or double triode
G—miscellaneous
H—travelling wave tube
J—magnetron
K—klystron
L—tetrode, pentode, double tetrode or double pentode
M—cold cathode indicator or counter tube
P—photomultiplier tube or radiation counter tube
Q—camera tube
T—thyratron
X—ignitron, image intensifier or image converter
Y—rectifier
Z—voltage stabiliser or reference tube

The group of four figures is a serial number. The last figure is 0 for basic types; variants of the basic type are indicated by the figures 1 to 9.

Example

YL1030 Transmitting double tetrode

Receiving-type valves

The type number of receiving valves used primarily in 'professional' applications is similar to that for normal receiving valves except that there are four figures instead of two or three. The letters and first figure have the same significance as in the receiving valve type numbering system.

Example

EC1000 Triode for professional applications, special base, 6.3V heater

OLD SYSTEMS

Transmitting and large industrial valves and tubes
The type number generally consists of two or more letters followed by two sets of figures. These symbols provide information concerning the principal uses and ratings of the valves according to the following code.

The first letter indicates the general functional class of valve:

B—backward wave tube
J—magnetron
K—klystron
L—travelling wave tube
M—l.f. amplifying or modulator triode
P—r.f. power pentode
Q—r.f. power tetrode
R—power rectifier
T—r.f. power triode
X—large thyratron. (All hydrogen thyratrons and other thyratrons having max. mean anode current of 500mA or more.)

Note.—For valves having dual electrode systems, the code letters for both systems are used, e.g. 'QQ' for a double tetrode.

The second letter indicates some structural property in each class of valve:

(a) For transmitting valves and vacuum rectifiers, the type of cathode.
(b) For thyratrons and gasfilled rectifiers, the type of gas present.
(c) For microwave devices, a basic structural feature.

A—outputs up to 1W, B—outputs of 1W and over: In backward wave and travelling wave tubes
D—disc-seal construction
G—mercury-vapour filled
H—hydrogen-filled
N—external magnet required (in magnetrons)
P—packaged construction (in magnetrons)
R—inert-gas filled
S—reflex (single resonator) construction (in klystrons)
T—multiple resonator construction (in klystrons)
V—indirectly heated oxide-coated cathode
X—directly heated tungsten filament
Y—directly heated thoriated-tungsten filament
Z—directly heated oxide-coated filament

The third letter

Transmitting valves with a silica envelope have a third letter 'S'.
Thyratrons with a shield grid (tetrode construction) have a third letter 'Q'.
Microwave devices that are tunable have a third letter 'T'.

The first group of figures, immediately following the letters, indicates:

(a) The approximate anode voltage in kV for transmitting valves and rectifiers:

Thus 05 represents 0.5kV = 500V
2 represents 2kV = 2000V

For valves intended for pulse operation this figure is the peak anode voltage in kV.

(b) The approximate peak inverse voltage in kV for thyratrons.

(c) The approximate frequency of operation in Gc/s for magnetrons, klystrons, backward wave tubes and travelling wave tubes:

Thus 9 represents 9Gc/s = 9000Mc/s.

The second group of figures indicates:

(a) For transmitting valves, the maximum permissible anode dissipation in W. For dissipations of 10kW or more the dissipation in kW is given.

(b) For transmitting valves primarily intended for pulse operation this group is prefixed by the letter 'P' and the figures indicate the maximum peak current in amps.

(c) For backward wave and travelling wave tubes, the output power in mW or W depending on the second letter ('A' or 'B').

(d) For magnetrons, the pulse power output in kW.

(e) For klystrons, the power output in mW.

(f) For rectifiers, the approximate rectifier output current in mA.

(g) For thyratrons, the approximate maximum permissible mean anode current in mA. This group consists of at least three digits, the first one being 0 if the current is between 10 and 100mA. For currents of 10A or more the current in amps is given.

Thus 045 represents 45mA
6400 represents 6400mA = 6.4A
12 represents 12A

A final letter occasionally follows the second group of figures. This is usually a serial letter to denote a particular design or development. Types designed for water cooling are indicated by the letter 'W' and if these types also have a forced air-cooled version this is indicated by the letter 'A'.

Examples

JP9-7	Magnetron with packaged construction for operation at a frequency of approximately 9000Mc/s with pulse power output of 7kW.
KS9-20	Klystron of reflex construction for operation at a frequency of approximately 9000Mc/s with a power output of 20mW.
LA4-250	Travelling wave tube for operation at a frequency of approximately 4000Mc/s with an output of 250mW.

QQV03-10	Double beam tetrode with indirectly heated oxide-coated cathode. Rated to work at 300V and to dissipate 10W continuously (5W at each anode).
QV20-P18	R.F. power tetrode with indirectly heated oxide-coated cathode. Designed for pulse operation with maximum peak anode voltage of 20kV and maximum peak anode current of 18A.
RG3-250	Mercury-vapour rectifier rated to work at 3kV and to give a maximum rectified output of 250mA.
XG5-500	Mercury-vapour thyratron having a rated peak inverse voltage of approximately 5kV and a maximum permissible mean anode current of approximately 500mA.

Cold cathode tubes

The type number for cold cathode tubes (excluding photocells and stabilisers) consists of one letter followed by a group of three figures which are followed by a second letter.

The first letter is always Z, indicating a cold cathode gasfilled tube.

The first figure indicates the type of base, the significance of the figure being the same as for Mullard receiving valves.

The second and third figures are serial numbers indicating a particular design or development.

The second letter indicates the function of the tube:

A—amplifier tube (continuous operation)
B—binary counter of switching tube
C—multistage counter tube
E—electrometer trigger or amplifier tube
G—gating tube
M—indicator (metering) tube
S—multistage switching tube
T—3-electrode trigger tube
U—4-electrode trigger tube
W—5-electrode trigger tube

Example

Z803U 4-electrode cold cathode trigger tube with B9A base.

The characteristics and curves published in this Handbook are based upon the average of readings taken on a number of valves, and the performance figures given under "Typical Operating Data" are values to be expected when average valves are used under appropriate conditions. The conditions selected are those under which the power delivered and the efficiency are as high as possible compatible with good valve life.

Amplification Factor

The amplification factors quoted for pentodes and tetrodes are those of g_1 with respect to g_2.

Drive Power

The value given is the power actually absorbed at the grid of the driven valve. The previous stage should be capable of delivering from twice to three times this power to allow for circuit losses.

Input Voltage

The value quoted is the peak value (v_{pk}) unless otherwise stated. For push-pull stages the grid-to-grid value is given.

Output Power

The value given is the total output delivered by the valve. The useful power will be somewhat less, dependent upon circuit losses.

RATING SYSTEMS

The following recommendations should be interpreted in conjunction with British Standard Code of Practice No. CP1005: (1962), 'The Use of Electronic Valves', upon which these notes have, in part, been based.

RATING SYSTEMS (in accordance with I.E.C. Publication 134)
Note: Limiting conditions may be either maxima or minima.

Absolute maximum rating system

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.
The equipment manufacturer should design so that, initially and throughout life, no absolute-maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

Design-maximum rating system

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.
The equipment manufacturer should design so that, initially and throughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

Design-centre rating system

Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.
The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply-voltage.

GENERAL OPERATIONAL RECOMMENDATIONS

The following recommendations should be interpreted in conjunction with British Standard Code of Practice No. CP1005: Part 7: 1954, 'The Use of Electronic Valves', upon which these notes have, in part, been based.

GENERAL

The published characteristics and curves are based upon the average of readings taken on a number of valves and the operating conditions given are those which result in optimum power output and efficiency without over-running the valve. Failure to observe the various recommendations may seriously reduce the life of the valve and in some instances result in catastrophic failure.

LIMITING VALUES

The limiting values are absolute. It is important that none of these limits are ever exceeded and such variations as mains fluctuations, component tolerances and switching surges, must be taken into account in deciding the nominal valve operating conditions.

In some instances, such as pulse operation or intermittent service, it may be permitted to exceed the absolute values but, to ensure the validity of the guarantee, the desired operating conditions must be agreed with Mullard Limited, (Industrial Technical Service Department).

TYPICAL OPERATING CONDITIONS

Typical operating conditions are shown for various modes of operation, e.g. 'r.f. power amplifier class C telegraphy' or 'telephony', etc. Some of the typical operating conditions for a particular mode of operation may incorporate one or more of the absolute ratings; in such cases the designer should take precautionary steps to ensure that these ratings are never exceeded.

FILAMENT OR HEATER SUPPLY

Either a.c. or d.c. supply may be used for filament heating. The published negative grid bias voltages are based upon a.c. heating. When d.c. heating is employed for directly heated valves the grid bias should be reduced by one-half of the filament voltage and when the anode current is greater than 5% of the filament current the h.t. return should be taken to a centre point resistor or to a reversing switch. When a.c. is employed the h.t. return should be taken to the centre tap of the filament transformer.

Measurements of the filament or heater voltage should always be made after the valve and supply transformer have attained their working temperature, and should be taken at the valve pins or terminals.

(*a*) *Oxide-coated Filaments and Cathodes*

To obtain maximum life the filament or heater voltage must be within ±2.5% of the nominal value and temporary fluctuations should not exceed ±10%.

With valves specially designed for use in mobile transmitters, emergency operation of the filament or heater down to the specified voltage is allowed.

(*b*) *Thoriated Tungsten Filaments*

To obtain maximum life the filament voltage must be within ±1% of the nominal value and temporary fluctuations should not exceed ±5%.

(*c*) *Pure Tungsten Filaments*

It is essential, when using valves with pure tungsten filaments, that the recommended filament operating conditions are never exceeded. The filament voltage marked on such valves is that which provides the rated total emission (i.e. 90% of the saturation emission) when the valve is new. In order to maintain this emission over the whole life of the valve, the filament voltage must be increased progressively to a total maximum of 105%. When less than the rated total emission is required for a particular application, the life can be extended by operating the filament at a reduced voltage.

(*d*) *Filament Switching*

It may be necessary with some valves to limit the filament current when switching on the supply. Information on this will generally be included on individual data sheets but in cases of doubt Mullard Limited, (Industrial Technical Service Department) should be consulted.

COOLING

(*a*) *General*

With radiation-cooled valves the maximum base, seal and envelope temperatures are given in the published data. To avoid exceeding these it may sometimes be necessary to provide artificial cooling.

In the development stage of an equipment the various temperatures should be measured with due regard to the ultimate environmental conditions. Special paints and lacquers are available for this purpose but any other suitable method can be used.

In some cases the filament and grid seals of water-cooled, forced-air-cooled and silica valves require cooling and guidance is given on individual data sheets.

Where additional cooling is necessary for safe operation precautionary steps must be taken to switch off all supply voltages in the event of failure or reduction of the cooling medium.

(*b*) *Water-Cooling*

A water-cooled valve should always be used with the recommended type of water jacket. The circulating cooling water should be as free as possible from all solid matter and the dissolved oxygen content should be low. Whenever possible a closed water system using distilled or demineralised water should be employed. In general, the resistivity of the cooling water should not be less than 3.3kΩ/c.c and the inorganic solid content should not exceed 3 parts in 10^5, but for some applications and some types of valves it may be desirable for the resistivity to be considerably higher and the solid content to be less. If desired, Mullard Limited, (Industrial Technical Service Department) will undertake to analyse the available water supply.

The temperature limits given in the individual data sheets should in no circumstances be exceeded and it is essential to insert an automatic device in the water outlet to switch off the supply voltages in the event of the failure or reduction of the water supply.

(*c*) *Forced-Air Cooling*

The temperature limits laid down in the data sheets should in no circumstance be exceeded and precautions should be taken to switch off all supply voltages in the event of a fault in the air circulating system.

The use of an inlet filter in the air supply is recommended particularly in dusty or dirty locations to avoid clogging the radiator air ducts.

(*d*) *Auxiliary Air and Water-Cooling*

Where auxiliary cooling is specified, e.g. for grid seals, precautionary steps must be taken to switch off all supply voltages in the event of the failure or reduction of these auxiliaries.

VALVES IN R.F. HEATING APPLICATIONS

The service conditions associated with r.f. heating, i.e. induction heating, dielectric-loss heating and short wave diathermy, can be more severe than those associated with communication service.

These severe conditions are mainly due to the wide variations in load impedance usually encountered which, in turn, produce large variations in grid current, anode current, grid dissipation and anode dissipation. The risk of exceeding the valve ratings is, therefore, increased.

For valves recommended for r.f. heating applications, the data sheets include ratings and typical operating conditions calculated to provide margins of safety against variations of load and supply voltage. Since it is not possible to anticipate the degree of protection which a designer may wish to incorporate, these data generally give two sets of operating conditions:

(*a*) for the valve fed from an unsmoothed d.c. supply and where no protection is incorporated in the equipment against valve overload, under-drive or inefficient operation, and:

(*b*) for the valve fully protected; this offers a performance only slightly less than that allowed for maximum 'class C telegraphy.'

The designer may choose an operating condition between these extremes depending upon the degree of protection which he decides to incorporate in the equipment. However, no limiting values may be exceeded during the work cycle.

It may sometimes be desired to use a valve for which no industrial ratings are given. The following table considers five methods of operation of triodes and indicates the factors by which the maximum 'class C telegraphy' should be multiplied in order to arrive at a safe rating, and designers are strongly recommended to give due consideration to these factors:

Method 1. Equipments fitted with effective automatic mains voltage stabilisation and effective automatic protection against valve over-load and over-drive and in which the power supply is derived from a filtered source containing not more than 5% ripple. (Three-phase full-wave and six-phase half or full-wave rectifier systems whether filtered or unfiltered, may be taken as meeting this requirement.)

Method 2. D.C. smoothed but unprotected.

Method 3. Equipment supplied by unsmoothed full-wave biphase rectifier but not fitted with automatic regulation or over-load protection.

Method 4. Self-rectifying equipment half-wave operation.

Method 5. Self-rectifying equipment full-wave operation without smoothing choke.

FACTORS APPLICABLE TO EACH VALVE

Method	1	2	3	4	5
Anode voltage r.m.s.	—	—	—	0.8	0.8
Anode voltage d.c.	0.95	0.8	0.7	—	—
Anode current	0.95	0.8	0.7	0.4	0.4
Power input	0.9	0.65	0.6	0.3	0.3
Anode dissipation	0.95	0.6	0.6	0.6	0.6
Control-grid current	0.9	0.8	0.7	0.4	0.4
Control-grid dissipation	0.9	0.7	0.7	0.7	0.7

Should it be desired to use tetrodes for r.f. heating applications Mullard Limited, (Industrial Technical Service Department) should be consulted.

To avoid damage to the valve in the event of an overload it is recommended that the minimum protection incorporated in industrial heating equipment should include a rapid action device to cut off the h.t. when the anode or grid current exceeds the maximum rating. If the anode dissipation at zero grid bias exceeds the limiting value, then grid under-current protection is also recommended in case oscillation ceases while the h.t. is applied. Further, where water or forced-air cooling of the valve is used, protection against failure of the cooling system is necessary.

MOUNTING

It is strongly recommended that all valves be mounted vertically. It is, however, permissible to mount some of the smaller valves horizontally provided that, for directly heated valves, the plane of the filament is vertical or, for indirectly heated valves, the plane of the major axis of the first grid is vertical. Recommendations on mounting are given on the data sheets when necessary.

Leads having sufficient flexibility to allow for thermal expansion and other movements should be employed for the external connections to those valves whose construction is such that stress might otherwise be set up in the seals.

When designing a mounting for an r.f. valve, it is important to avoid closed circuits of conducting material in regions of strong r.f. fields, otherwise considerable loss of output may result. It is always preferable to keep the quantity of any material in the r.f. field to a minimum.

Where a valve with an internal anode (e.g. silica valve TYS5-3000) is mounted in a clamp, any large metal parts of the clamp which are located in the region of the anode should be connected to anode terminal. This will prevent heating of the glass or silica which would otherwise result from the r.f. potential gradient between the anode and the clamp.

Clamps used for supporting silica valves should be designed in such a way as to accommodate the usual envelope tolerances and thus avoid undue pressure being applied to the envelope.

DRIVE POWER

The value of grid current stated on the data sheets is intended only as a guide, and in making adjustments to the circuit the important factor to note is the grid driving voltage. Either over-driving or under-driving will result in a reduction in efficiency.

At low radio frequencies the drive power required for 'class C' operation can be calculated from the expression

$$P_{drive} = 0.9 \times v_{in(pk)} \times I_{g1} \text{ (d.c.)}$$

at higher frequencies more drive power is required due to input damping. The value given for the symbol $P_{load(driver)}$ is the power which must be available from the driver stage to provide for valve drive, input damping and circuit losses. It may be necessary to allow more for a circuit designed for a wide tuning range.

POWER OUTPUT

The valve output figures (P_{out}), represent the power which the valve will deliver to the circuit and load; a figure of load power (P_{load}) allowing for a typical circuit transfer efficiency for the type of service under consideration is stated.

When it is desired to operate power valves at frequencies so high that the efficiency is falling the input must be reduced.

REDUCED OPERATING LEVELS

(*a*) When it is desired to operate valves at reduced power levels at h.f. the valve conversion efficiency can be kept at the maximum by decreasing the input current rather than the voltage.

(*b*) When operating above about 100Mc/s however, circuit loses are higher and it is preferable to keep the input current high and reduce the voltage, thus minimising the circuit loss and obtaining a better load power.

(*c*) When the frequency of operation is so high that the efficiency is decreased the input power must be reduced in order to avoid excessive electrode dissipations. This should be achieved by reducing the anode voltage, see frequency/voltage characteristic in the individual data sheets.

POWER DISSIPATED IN VALVE ELECTRODES

Dissipation in the screen-grid is given by the product of d.c. voltage and current

$$P_{g2} = V_{g2} \times I_{g2}$$

Power in the control-grid for 'class C' operation at low radio frequencies can be closely approximated from the peak positive value of drive voltage and the d.c. grid current. (The peak positive voltage is the drive voltage less the magnitude of the bias voltage.)

$$p_{g1} = I_{g1} \left[0.9\ v_{in(pk)} - |V_{g1}|\right]$$

At higher radio frequencies the grid dissipation will be somewhat higher due to the increased capacitive current in the electrode.

In many radiation-cooled types the anode becomes visibly hot when near full dissipation and the temperature can be measured by a pyrometer. The temperature for full rated dissipation is usually given in the data sheets but any other loading may be checked by making comparative measurements with d.c. power, under non-oscillatory conditions.

For valves whose anodes are cooled by circulated water or by forced-air, the anode dissipation can be assessed by measuring the rise of temperature and flow of the cooling medium.

Radiation-cooled valves which do not colour may be assessed by covering with an insulating hood, vented to produce a reasonable equilibrium temperature and provided with some form of thermometer. The measured temperature under normal operating conditions may then be checked by making comparative measurements with d.c. power, under non-oscillatory conditions.

CLASS 'B' LOW FREQUENCY APPLICATIONS

The performance shown on the data sheets is based on an ideal circuit with no transformer losses, a resistive load, constant supply voltages and a sinusoidal input voltage. Allowances should be made for these factors in assessing the actual useful output power.

To reduce distortion due to the flow of grid current the impedance of the circuit supplying the input to the valve must be low. The use of a cathode follower driver stage is recommended, but an input transformer with a low output impedance or with a low damping resistance may be used.

The type of driver valve chosen must be able to deliver sufficient power to overcome the circuit losses in addition to providing the actual valve drive power.

STORAGE AND INSTALLATION

(*a*) *Mounting*

All large valves should be mounted with the filament vertical. The recommendation contained in individual data sheets as to the accuracy of the mounting should be complied with, otherwise the filament may sag towards the grid under its own weight.

In mobile or portable equipment, and in fixed installations subject to vibration, care should be exercised to ensure that the valve supports or chassis are suitably designed to protect the valve from mechanical shock and vibration.

(*b*) *Corona Effects*

Metal parts (particularly sharp points or edges), which might cause intense electrostatic fields, should not be located in the vicinity of valves operating at high voltages, since corona discharge may occur and cause damage to the valve. On installation, filament and other flexible leads should be kept well clear of the bulb and adjacent conductors.

(*c*) *Storage and Transit*

Valves not installed in equipment should be stored in their original packing or in racks. Any rack employed should be designed to protect the valve from excessive shaking or vibration and be so constructed that no stresses are imposed on the seals or the envelope.

Normal good storage conditions should be provided to prevent deterioration, such as corrosion of contacts or impairment of electrical insulation.

Valves should always be transported in the original packing designed for the purpose.

CONDITIONING

After transit or a period of storage it is recommended that power valves should be operated for not less than 15 minutes with the filaments only energised before being put into full service. In addition, with valves having anode voltages in excess of 5kV, the anode voltage and input power should be increased gradually or in several steps for a further period of 15 minutes, or longer, until normal operation is achieved. This treatment will clean-up traces of gases which may be present and which could cause premature failure of the valve.

Where valves are being held in store for an indefinite period it is recommended that periodic conditioning and testing is carried out as a safeguard against deterioration of vacuum. The interval of testing will, of course, depend upon the size and type of valve, and users are invited to contact Mullard Limited, (Industrial Technical Service Department) for details of treatment of individual valves.

PRESENTATION OF VALVE DATA

The symbols component and base references incorporated in the data are in accordance with the following British Standards:—

1409: 1950	Letter symbols for electronic valves.
1991: Part 1: 1954	Letter symbols, signs and abbreviations.
530: 1948 (with supplements)	Graphical symbols for telecommunications.
448: 1953	Electronic valve bases, caps and holders.

TRIODES

B

B

V.H.F. POWER TRIODE

TY4-500

QUICK REFERENCE DATA

Radiation cooled triode intended for use as r.f. amplifier or oscillator or a.f. amplifier.

	Class 'C' telegraphy	Class 'C' industrial oscillator	Class 'B' A.F.	
f max.	120	100	—	Mc/s
V_a max.	4.0	4.0	4.0	kV
p_a max.	450	450	450	W
Performance				
f	100	100	—	Mc/s
P_{out}	1.69	1.14	2.44	kW

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES which precede this section of the handbook.

FILAMENT Thoriated tungsten

V_f	10	V
I_f	9.9	A

MOUNTING POSITION Vertical only, base up or down

CAPACITANCES

c_{a-g}	7.0	pF
c_{g-f}	8.0	pF
c_{a-f}	170	mpF

CHARACTERISTICS

g_m ($I_a = 125$mA)	4.5	mA/V
μ	28	

COOLING

Max. temperature of base pins	180	°C
Max. temperature of anode seal	220	°C

In order to keep within the temperature limits it may be necessary to direct a low velocity flow of air on to the anode seal and the base of the valve when operated at maximum ratings at frequencies above 50Mc/s. The air stream on to the base should be directed so that it also passes over the envelope. Below 50Mc/s, radiation cooling from the envelope is sufficient but an anode terminal connector of large surface area is necessary in order to keep the anode seal cool.

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Absolute maximum ratings

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A

Typical operating conditions, grounded cathode

f	100	100	100	100	Mc/s
V_a	2.5	3.0	3.5	4.0	kV
V_g	−200	−250	−300	−350	V
I_a	535	535	535	535	mA
I_g	115	115	115	115	mA
$v_{in(pk)}$	405	460	520	580	V
P_{drive}	42	48	54	60	W
p_a	390	425	450	450	W
P_{out}	950	1175	1430	1690	W
P_{load}	760	940	1144	1350	W
η_a	71	73.5	76	79	%

Typical operating conditions, grounded grid (two valves)

f	100	100	100	100	Mc/s
V_a	2.5	3.0	3.5	4.0	kV
V_g	−200	−250	−300	−350	V
I_a	2×535	2×535	2×535	2×535	mA
I_g	2×115	2×115	2×115	2×115	mA
$v_{in(g-g)\ pk}$	810	920	1040	1160	V
P_{drive}	2×212	2×248	2×274	2×320	W
p_a	2×390	2×425	2×450	2×450	W
*P_{out}	1900+340	2350+400	2860+440	3380+520	W
P_{load}	1.79	2.2	2.64	3.12	kW
η_a	71	73.5	76	79	%

*Includes power transferred from driver stage.

CLASS 'C' ANODE MODULATION

Absolute maximum ratings (carrier condition for a modulation factor of 1)

V_a max.	3.0	kV
p_a max.	300	W
p_g max.	50	W
I_g max.	115	mA
I_k max.	550	mA
$i_{k(pk)}$ max.	5.0	A

Typical operating conditions at f $\leqslant$ 100Mc/s

V_a	3.0	kV
V_g	−375	V
I_a	450	mA
I_g	85	mA
$v_{in(pk)}$	580	V
P_{drive}	42	W
p_a	300	W
P_{out}	1.05	kW
P_{load}	840	W
η_a	78	%
For 100% modulation		
P_{mod}	675	W

CONTINUOUS INDUSTRIAL OPERATION AS CLASS 'C' OSCILLATOR

Absolute maximum ratings

f max.	100	Mc/s
V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_k max.	650	mA
$i_{k(pk)}$ max.	5.0	A
I_g (loaded) max.	115	mA
I_g (unloaded) max.	150	mA

Typical operating conditions

Supply	F.W. rectification unsmoothed	
f	100	Mc/s
$V_{tr(r.m.s.)}$	3.5-0-3.5	kV
V_a	3.15	kV
I_a	415	mA
I_g	120	mA
R_{g-f}	3.0	kΩ
R_a	1.4	kΩ
Feedback ratio $\frac{v_{in(pk)}}{v_{a(pk)}}$	0.2	
P_{drive}	60	W
p_a	420	W
P_{out} (less P_{drive})	1.14	kW
η_a	74	%
P_{load}	950	W

INTERMITTENT OPERATION FOR DIELECTRIC WELDING

Absolute maximum ratings

f max.	100	Mc/s
Duty factor max.	0.5	
Averaging time max.	10	s
V_a max.	4.0	kV
p_a max.	700	W
p_g max.	72	W
I_g (loaded) max.	160	mA
I_k max.	900	mA
$i_{k(pk)}$ max.	5.0	A

Typical operating conditions

Supply	Smoothed d.c.	F.W. rectification unsmoothed	
f	100	100	Mc/s
Duty factor	0.5	0.5	
Averaging time	10	10	s
$V_{tr(r.m.s.)}$	—	3.5-0-3.5	kV
V_a	3.5	3.15	kV
I_a	750	675	mA
I_g (loaded)	140	125	mA
R_{g-f}	2.2	2.2	kΩ
R_a	2.2	2.2	kΩ
Feedback ratio $\frac{v_{in(pk)}}{v_{a(pk)}}$	0.2	0.2	
P_{drive}	75	75	W
P_{out} (less P_{drive})	1.86	1.86	kW
p_a	690	690	W
η_a	74	74	%
P_{load}	1.5	1.5	kW

CLASS 'B' A.F.

Limiting values

V_a max.	4.0	kV
p_a max.	450	W
p_g max.	50	W
I_g max.	140	mA
I_k max.	700	mA
$i_{k(pk)}$ max.	2.2	A

Typical operating conditions

V_a	2.5	3.0	3.5	4.0	kV
V_g	−75	−94	−114	−135	V
$I_{a(o)}$	2× 70	2× 70	2× 70	2× 70	mA
I_a (max. sig.)	2×555	2×500	2×442	2×368	mA
I_g	2×127	2×130	2×115	2× 93	mA
$V_{in(g-g)\ (r.m.s.)}$	378	400	402	404	V
p_a	2×375	2×380	2×330	2×329	W
R_{a-a}	5.2	7.5	10.2	14.5	kΩ
P_{out}	2.0	2.31	2.44	2.21	kW
η_a	72	77	78.8	77.5	%
D_{tot}	3.5	5.0	5.0	5.0	%

WEIGHT

Valve only	14.8	oz
	420	g
Valve plus carton	3.1	lb
	1.4	kg

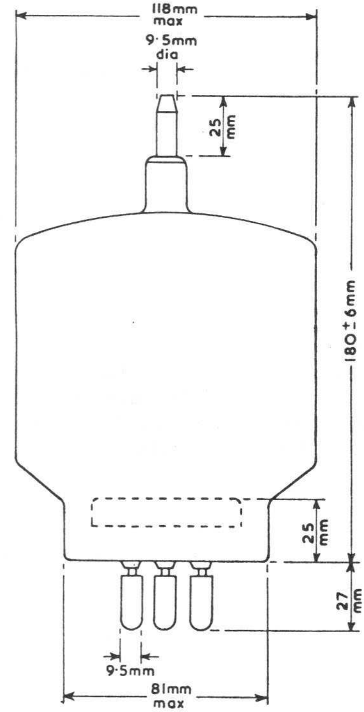
CIRCUIT NOTES

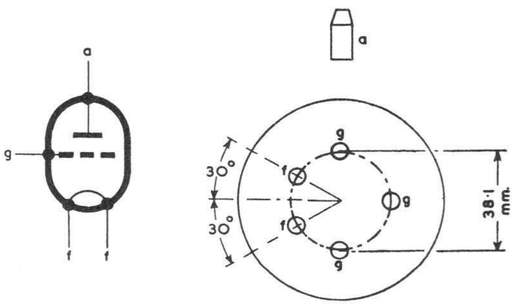
To ensure equal distribution of the currents through the seals the grid leads should be strapped together at the valve holder and the circuit connections joined to the midpoint of the strap. This should not be allowed to impair the free flotation of individual contacts.

ACCESSORIES

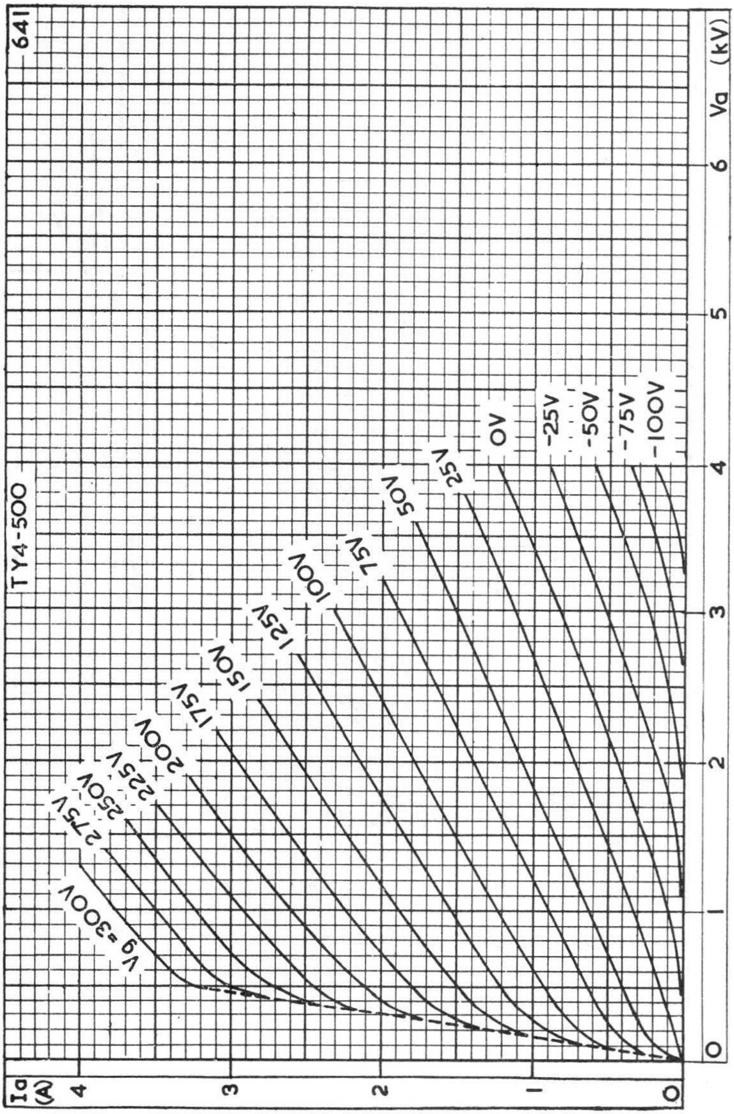
Socket	40216
Anode clip	40626

1608

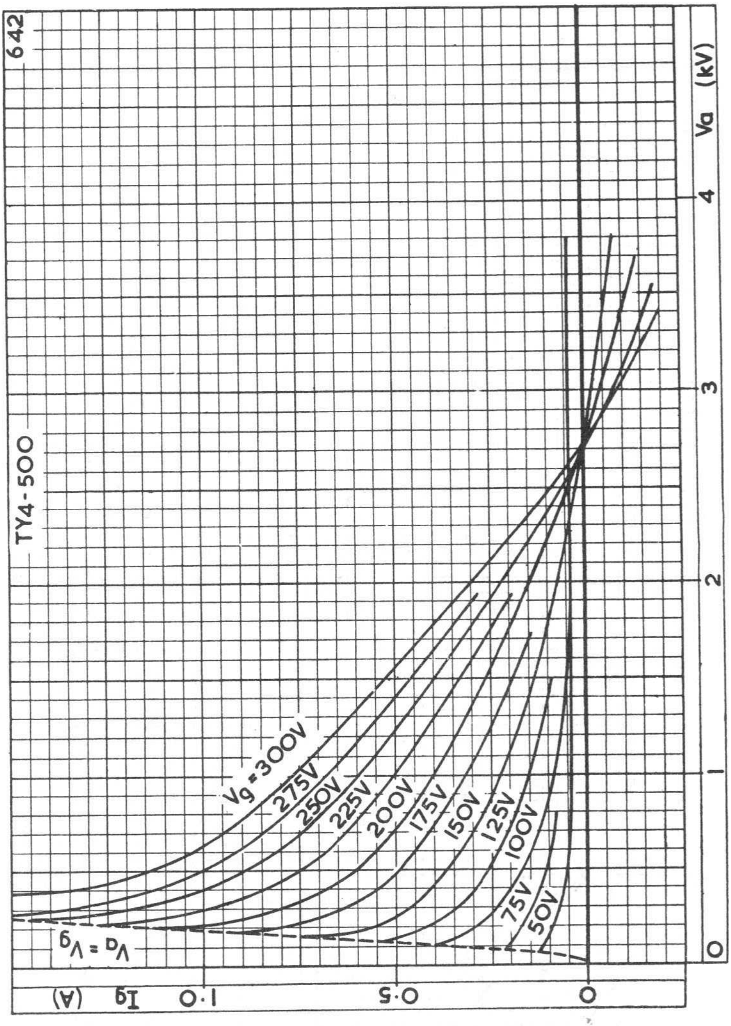




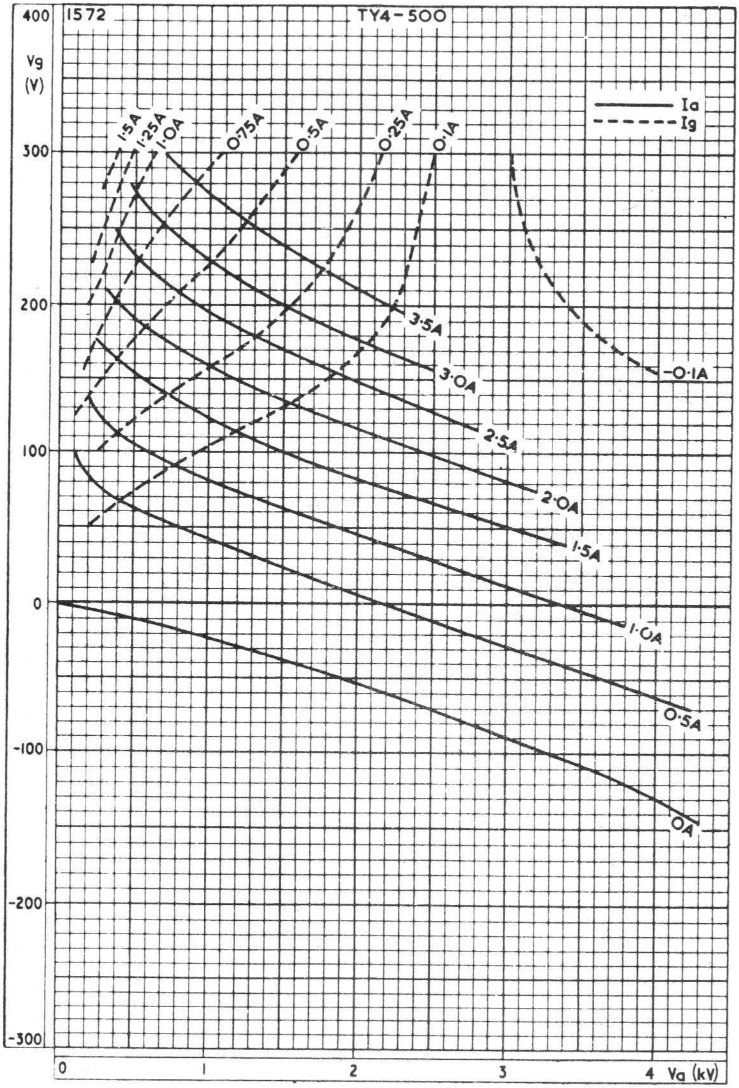
B5K Base



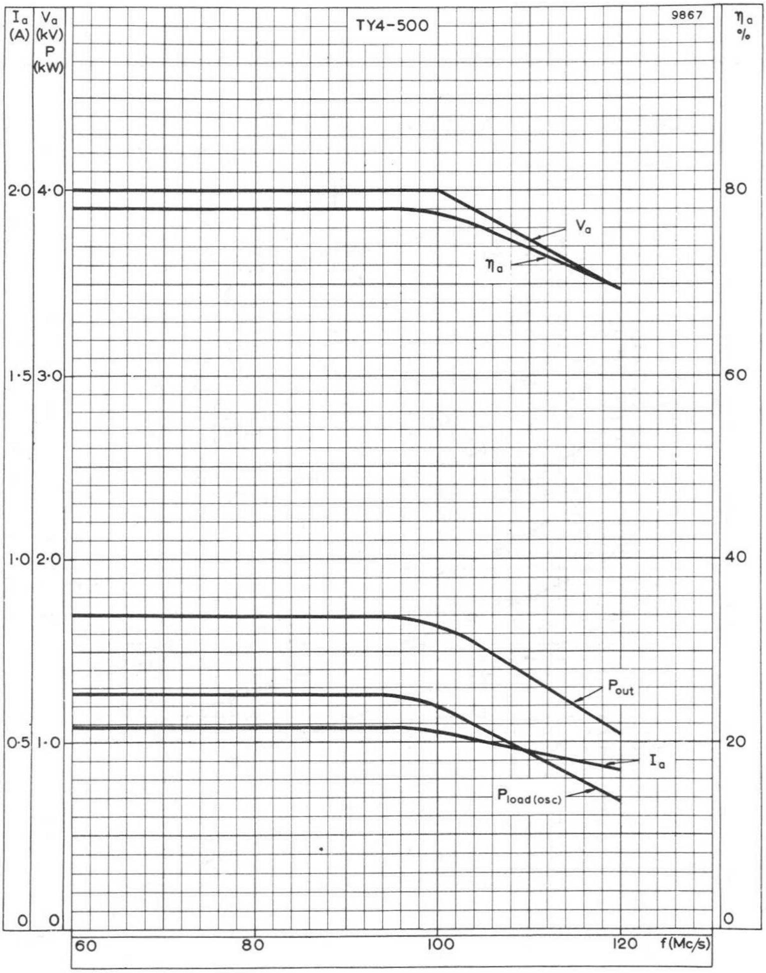
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE



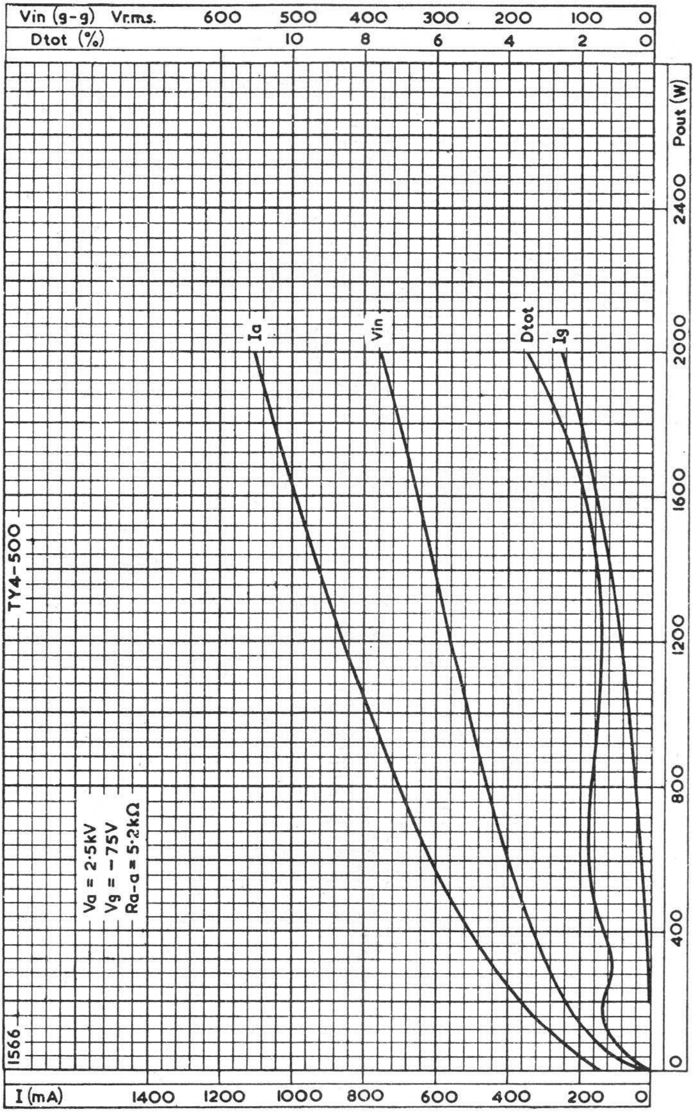
GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE



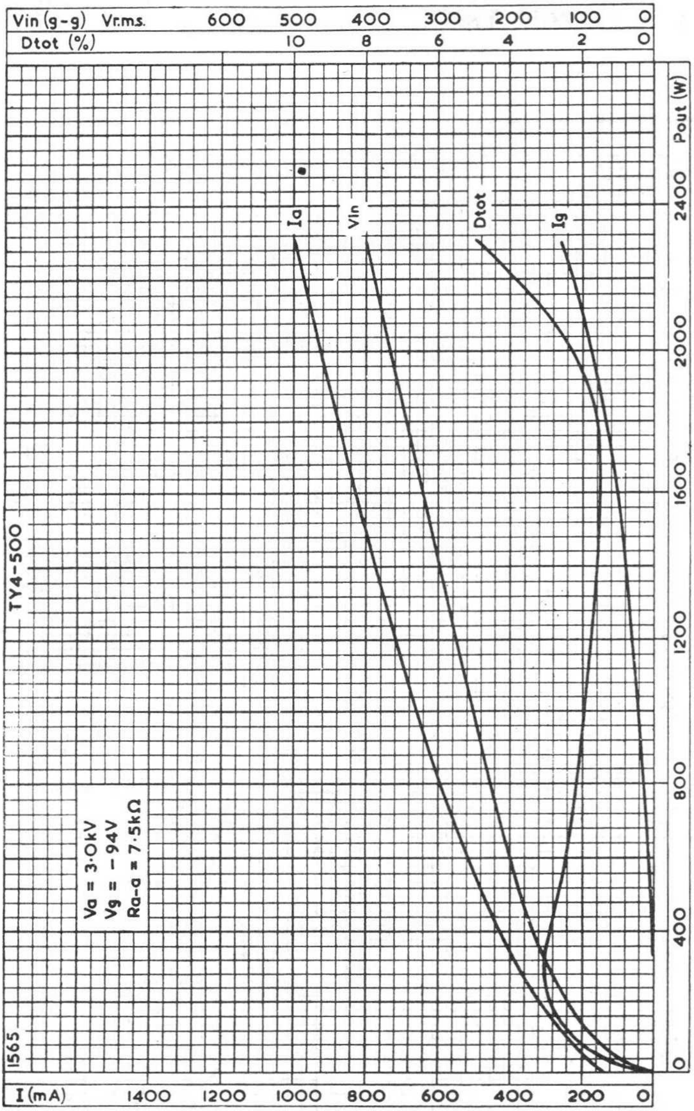
CONSTANT CURRENT CURVES



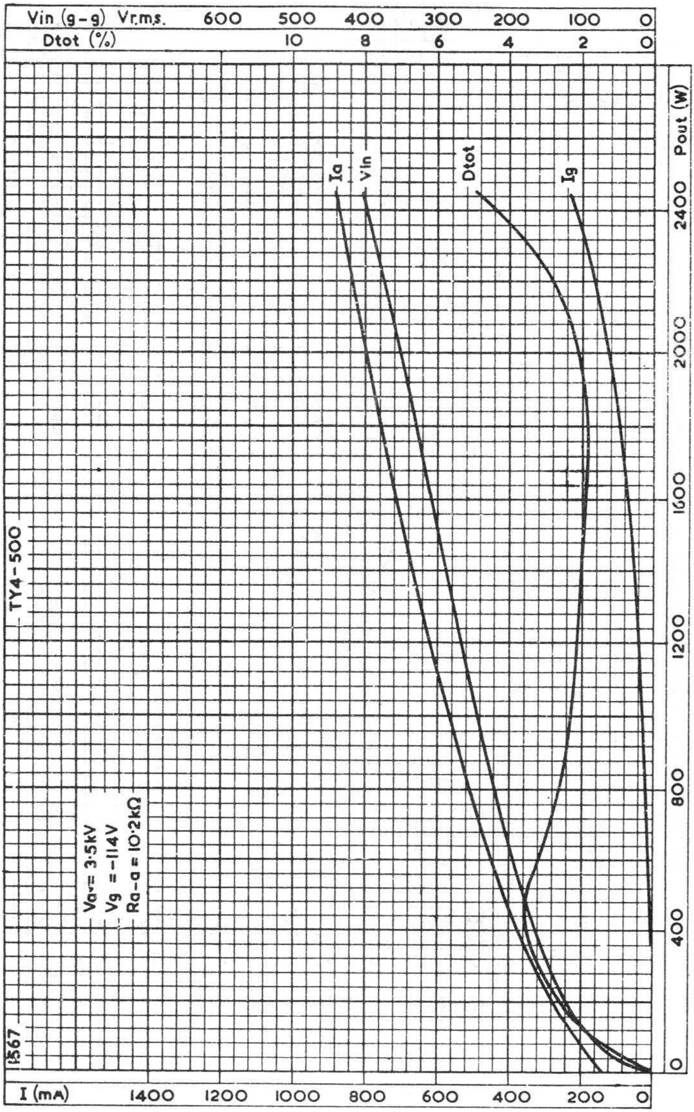
FREQUENCY CHARACTERISTICS, SINGLE VALVE AS CLASS 'C' AMPLIFIER AND OSCILLATOR



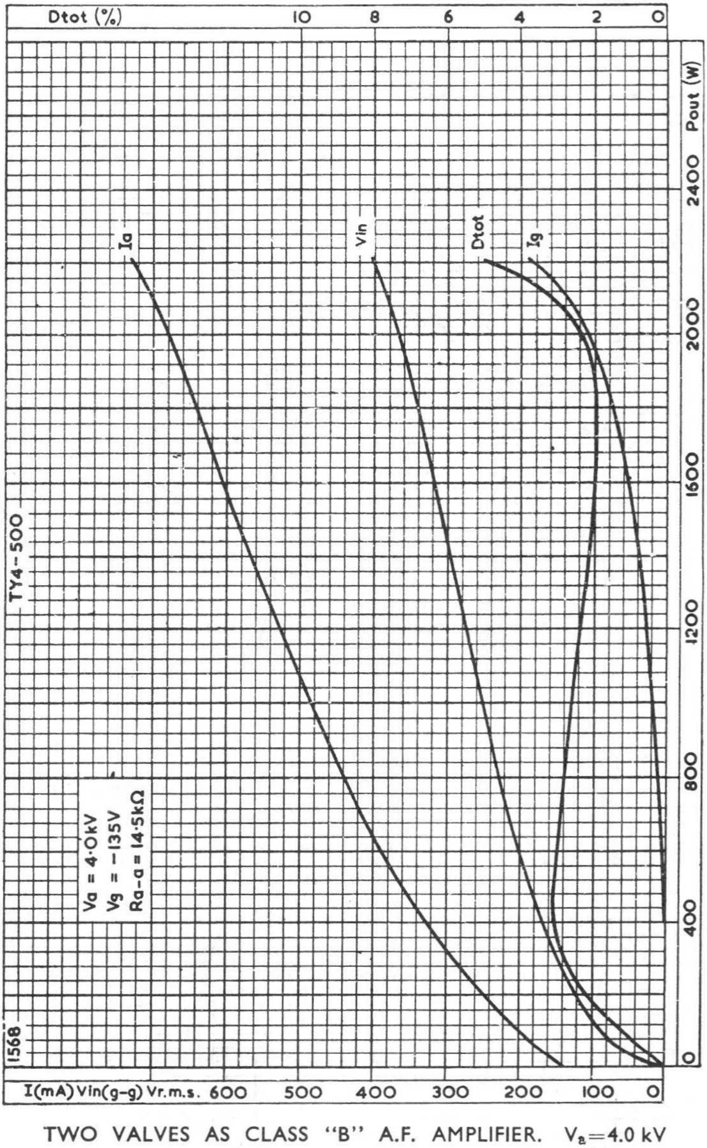
TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=2.5 kV



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. $V_a = 3.0$ kV



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. $V_a = 3.5$ kV



TWO VALVES AS CLASS "B" A.F. AMPLIFIER. V_a=4.0 kV

TRIODE

TY5-500

Application: *R.F. industrial heating.*
Power output: *1.6kW continuous rating.*
Frequency: *50Mc/s at full rating.*
Construction: *Glass; radiation cooled anode.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES preceding this section of the handbook.

FILAMENT Thoriated tungsten

*V_f	5.0	V
I_f	32.5	A

*The filament has been designed to accept temporary fluctuations $^{+5}_{-10}\%$

MOUNTING POSITION Vertical only, base down

CAPACITANCES

c_{a-g}	5.1	pF
c_{g-f}	9.2	pF
c_{a-f}	0.2	pF

CHARACTERISTICS (measured at V_a = 4kV, I_a = 120mA)

g_m	3.3	mA/V
g_m (at V_a = 1.0kV, I_a = 2.3A)	10	mA/V
μ	21	

COOLING

Normally	Low velocity air flow	
*At reduced input or with intermittent ratings	Natural	
T_{seals} max.	220	°C
T_{bulb} max.	350	°C

*See examples in typical data.

ACCESSORIES

Socket	B8.700.51
Anode clip	40626

CLASS 'C' OSCILLATOR

With d.c. anode supply

LIMITING VALUES (absolute ratings)

f max.			50	Mc/s
V_a max.			5.0	kV
V_g max.			−1.25	kV
R_{g-f} max.			15	kΩ
Duty factor max.	1	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	500	700	1000	W
I_a max.	560	780	1100	mA
p_g max.	85	95	110	W
I_g max. (at p_a max.)	210	290	420	mA

OPERATING CONDITIONS

Cooling	Additional	Natural		
f	≦50	≦50	≦50	Mc/s
Duty factor	1	0.5	0.2	
t_{on}	—	5.0	1.0	s
t_{off}	—	5.0	4.0	s
V_a	4.0	4.0	4.0	kV
I_a	490	650	825	mA
I_g	140	190	240	mA
p_a	450	630	900	W
η_a	77	76	73	%
R_{g-f}	2.7	2.0	1.7	kΩ
R_a	4.7	3.4	2.7	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.2	0.22	0.24	
P_{out}	1.5	2.0	2.4	kW
$^*P_{load}$	1.2	1.6	1.9	kW

*0.85 (P_{out}−P_{drive})

CLASS 'C' OSCILLATOR

Anode supply single phase, full wave rectifier without smoothing filter.

LIMITING VALUES (absolute ratings)

f max.			50	Mc/s
V_a max.			4.5	kV
V_g max.			850	V
R_{g-f} max.			15	kΩ
Duty factor max.	1.0	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	500	700	1000	W
I_a max.	450	630	900	mA
p_g max.	85	95	110	W
I_g max. (at p_a max.)	190	195	380	mA

OPERATING CONDITIONS

Cooling	Additional	Natural		
f	≦50	≦50	≦50	Mc/s
Duty factor	1.0	0.5	0.2	
t_{on}	—	5.0	1.0	s
t_{off}	—	5.0	4.0	s
$V_{tr(r.m.s.)}$	4.5	4.5	4.5	kV
V_a	4.05	4.05	4.05	kV
I_a	400	530	675	mA
I_g	125	165	210	mA
p_a	450	630	900	W
η_a	77	76	73	%
R_{g-f}	2.7	2.2	1.7	kΩ
R_a	5.9	4.3	3.5	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.16	0.17	0.18	
P_{out}	1.53	2.0	2.46	kW
$^*P_{load}$	1.25	1.5	2.0	kW

*0.85 ($P_{out} - P_{drive}$)

CLASS 'C' OSCILLATOR

Anode supply from three phase half-wave rectifier.

LIMITING VALUES (absolute ratings)

f max.			50	Mc/s
V_a max.			5.0	kV
V_g max.			−1.25	kV
R_{g-f} max.			15	kΩ
Duty factor max.	1.0	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	500	700	1000	W
I_a max.	560	780	1100	mA
p_g max.	85	95	110	mA
I_g max. (at p_a max.)	210	290	420	mA

OPERATING CONDITIONS

Cooling	Additional	Natural		
f	≦50	≦50	≦50	Mc/s
Duty factor	1	0.5	0.2	
t_{on}	—	5.0	1.0	s
t_{off}	—	5.0	4.0	s
$V_{tr(r.m.s.)}$	3.4	3.4	3.4	kV
V_a	4.0	4.0	4.0	kV
I_a	480	640	820	mA
I_g	140	190	240	mA
p_a	450	630	900	W
η_a	77	76	73	%
R_{g-f}	2.7	2.0	1.7	kΩ
R_a	4.7	3.4	2.7	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.2	0.22	0.24	
P_{out}	1.5	2.0	2.4	kW
*P_{load}	1.2	1.6	1.9	kW

*0.85 (P_{load} − P_{drive})

TRIODE # TY5-500

CLASS 'C' OSCILLATOR

Anode supply from transformer without intermediate rectifier.

LIMITING VALUES (absolute ratings)

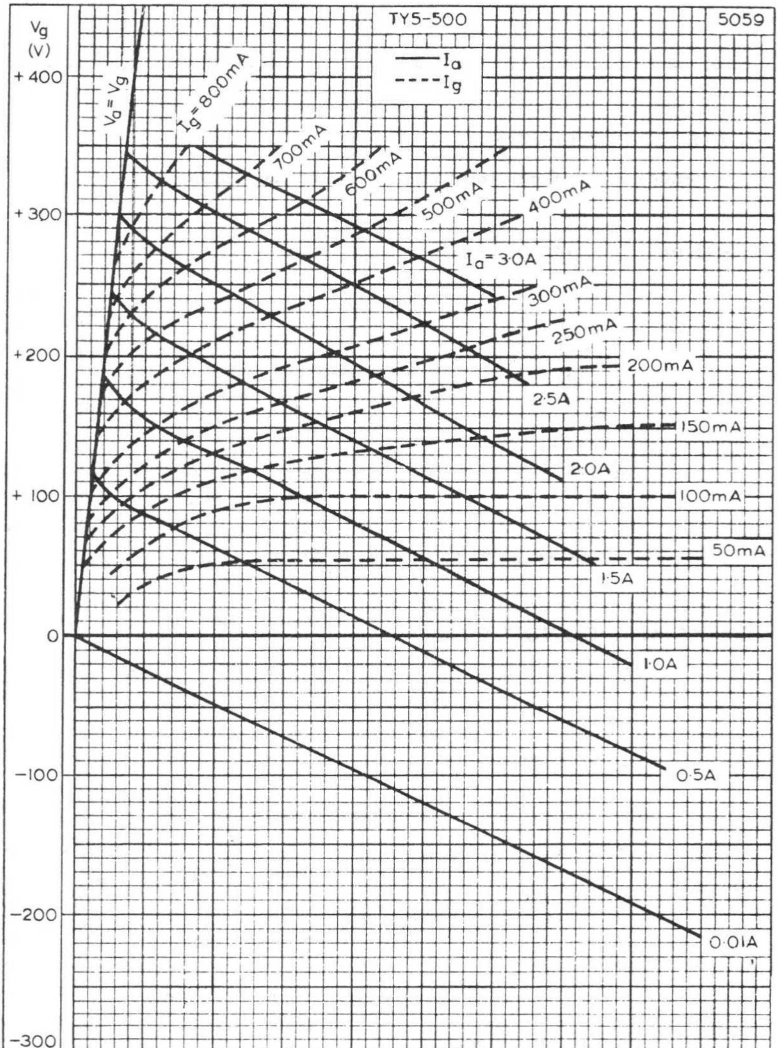
f max.			50	Mc/s
$V_{tr(r.m.s.)}$ max.			5.0	kV
V_g max.			−850	V
R_{g-f} max.			15	kΩ
Duty factor max.	1	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	500	700	1000	W
I_a max.	320	450	640	mA
p_g max.	85	95	110	W
I_g max. (at p_a max.)	110	155	220	mA

OPERATING CONDITIONS

Cooling	Additional	Natural		
f	≦50	≦50	≦50	Mc/s
Duty factor	1.0	0.5	0.2	
t_{on}	—	5.0	1.0	s
t_{off}	—	5.0	4.0	s
$V_{tr(r.m.s.)}$	4.5	4.5	4.5	kV
*I_a	280	420	600	mA
*I_g	80	120	170	mA
p_a	380	500	800	W
η_a	77	76	73	%
R_{g-f}	2.7	1.8	1.3	kΩ
R_a	4.3	2.9	2.0	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.18	0.22	0.25	
P_{out}	1.08	1.6	2.2	kW
**P_{load}	0.9	1.3	1.7	kW

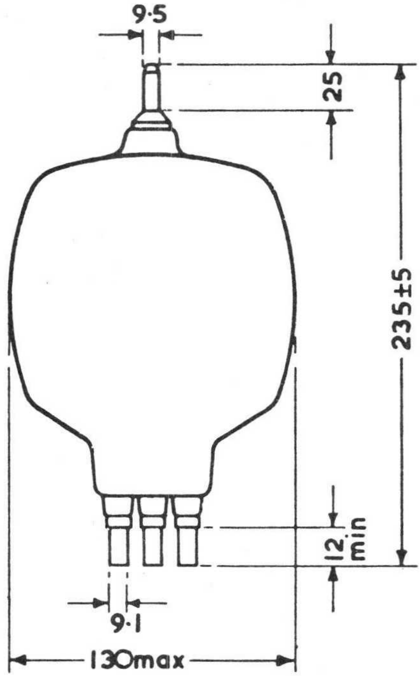
*Averaged over one cycle of supply frequency.

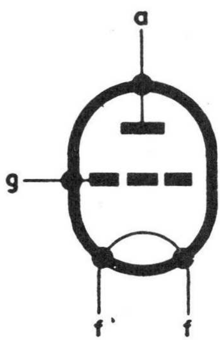
**0.85 ($P_{out} - P_{drive}$)

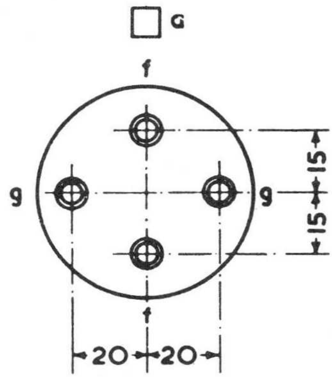


CONSTANT CURRENT CURVES

5082







All dimensions in mm

TRIODE

TY6-800

Application: R.F. Industrial heating.
Power Output: 2.7kW continuous rating.
Frequency: 50Mc/s max. at full ratings.
Construction: Glass, radiation cooled anode.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES preceding this section of the handbook.

FILAMENT Thoriated tungsten

*V_f	6.3	V
I_f	32.5	A

*The filament has been designed to accept temporary fluctuations of $^{+5}_{-10}\%$.

MOUNTING POSITION Vertical only, base down

CAPACITANCES

c_{a-g}	6.2	pF
c_{g-f}	10.5	pF
c_{a-f}	0.25	pF

CHARACTERISTICS (measured at $V_a = 4kV$, $I_a = 190mA$)

g_m	5.1	mA/V
$g_{m'}$ (at $V_a = 1.0kV$, $I_a = 3.0A$)	9.0	mA/V
μ	22	

COOLING

Normally	Low velocity air flow	
*At reduced input or intermittent ratings	Natural	
Maximum temperature of seals	220	°C
Maximum bulb temperature	350	°C

*See examples in typical data.

ACCESSORIES

Socket	B8.700.51
Anode clip	40626

CLASS 'C' POWER OSCILLATOR

With d.c. anode supply.

LIMITING VALUES

f max.			50	Mc/s
V_a max.			6.0	kV
V_g max.			−1.25	kV
R_{g-f} max.			10	kΩ
Duty factor max.	1.0	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	800	1200	1500	W
I_a max.	750	1100	1400	mA
p_g max.	120	150	175	W
I_g max. (at p_a max.)	300	375	400	mA

OPERATING CONDITIONS

Cooling	Additional		Natural		
f	≦50	≦50	≦50	≦50	Mc/s
Duty factor	1.0	1.0	0.2	0.5	
t_{on}	—	—	1	5.0	s
t_{off}	—	—	4	5.0	s
V_a	3.0	5.0	5.0	5.0	kV
I_a	700	700	1200	960	mA
I_g	240	225	310	240	mA
p_a	546	788	1380	1100	W
η_a	74	77.5	77	77	%
R_{g-f}	1.5	2.5	2.0	2.2	kΩ
R_a	2.0	3.8	2.2	2.8	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.3	0.2	0.23	0.22	
P_{out}	1.55	2.7	4.6	3.7	kW
*P_{load}	1.2	2.1	3.6	3.0	kW

*0.85(P_{out}−P_{drive})

TRIODE

TY6-800

CLASS 'C' POWER OSCILLATOR

Anode supply single phase, full wave rectifier without smoothing filter.

LIMITING VALUES

f max.			50	Mc/s
V_a max.			5.4	kV
V_g max.			−1.25	kV
R_{g-f} max.			10	kΩ
Duty factor max.	1.0	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	800	1200	1500	W
I_a max.	670	1000	1250	mA
p_g max.	120	150	175	W
I_g max. (at p_a max.)	270	400	500	mA

OPERATING CONDITIONS

Cooling	Additional		Natural		
f	≦50	≦50	≦50	≦50	Mc/s
Duty factor	1.0	1.0	0.5	0.2	
t_{on}	—	—	5.0	1.0	s
t_{off}	—	—	5.0	4.0	s
V_a	3.15	4.5	4.5	4.5	kV
I_a	600	600	760	870	mA
I_g	180	150	220	240	mA
p_a	620	750	1100	1400	W
η_a	73	77	74	72	%
R_{g-f}	1.5	2.5	1.7	1.6	kΩ
R_a	2.5	3.8	3.3	2.6	kΩ
Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.2	0.17	0.2	0.2	
P_{out}	1.7	2.55	3.13	3.6	kW
*P_{load}	1.4	2.2	2.6	3.0	kW

*$0.85(P_{out} - P_{drive})$

CLASS 'C' POWER OSCILLATOR

Anode supply from three phase half-wave rectifier.

LIMITING VALUES

f max.			50	Mc/s
V_a max.			6.0	kV
V_g max.			−1.25	kV
R_{g-f} max.			10	kΩ
Duty factor max.	1.0	0.5	0.2	
Averaging time max.	—	10	5.0	s
p_a max.	800	1200	1500	W
I_a max.	750	1100	1400	mA
p_g max.	120	150	175	W
I_g max. (at p_a max.)	300	450	560	mA

OPERATING CONDITIONS

Cooling	Additional	Natural		
f	≦50	≦50	≦50	Mc/s
Duty factor	1.0	0.5	0.2	
t_{on}	—	5.0	1.0	s
t_{off}	—	5.0	4.0	s
$V_{tr(r.m.s.)}$ max.	4.25	4.25	4.25	kV
V_a	5.0	5.0	5.0	kV
I_a	700	740	900	mA
I_g	160	170	210	mA
p_a	780	960	1200	W
η_a	78	74	73	%
R_{g-f}	2.5	2.4	1.9	kΩ
R_a	3.8	3.4	2.4	kΩ
Feedback Ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.16	0.17	0.17	
P_{out}	2.7	2.74	3.3	kW
*P_{load}	2.3	2.2	2.7	kW

*0.85(P_{out}−P_{drive})

CLASS 'C' POWER OSCILLATOR

Anode supply from transformer without intermediate rectifier.

LIMITING VALUES

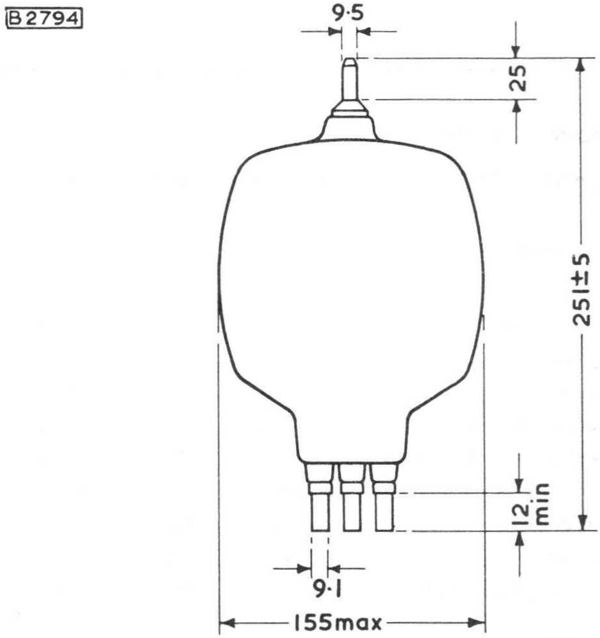
f max.			50	Mc/s
$V_{tr(r.m.s.)}$ max.			5.6	kV
V_g max.			−1.25	kV
R_{g-f} max.			10	kΩ
Duty factor max.	1.0	0.5	2.0	
Averaging time max.	—	10	5.0	s
p_a max.	800	1200	1500	W
*I_a max.	400	600	750	mA
p_g max.	120	150	175	W
*I_g max. (at p_a max.)	160	240	300	mA

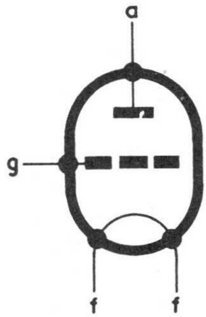
OPERATING CONDITIONS

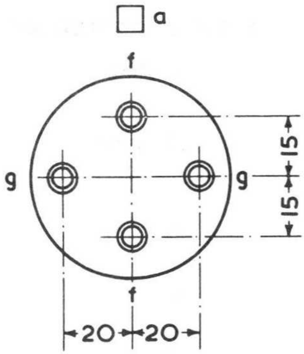
Cooling	Additional	Natural		
f	≦50	≦50	≦50	Mc/s
Duty factor	1.0	0.5	0.2	
t_{on}	—	5.0	1.0	s
t_{off}	—	5.0	4.0	s
$V_{tr(r.m.s.)}$	5.2	5.2	5.2	kV
*I_a	360	540	675	mA
*I_g	100	150	190	mA
p_a	520	870	1170	W
η_a	75	72	70	%
R_{g-f}	1800	1200	950	Ω
R_a	3.2	2.2	1.7	kΩ
Feedback Ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$	0.15	0.2	0.23	
P_{out}	1.56	2.24	2.73	kW
**P_{load}	1.3	1.85	2.26	kW

*Averaged over one cycle of supply frequency.

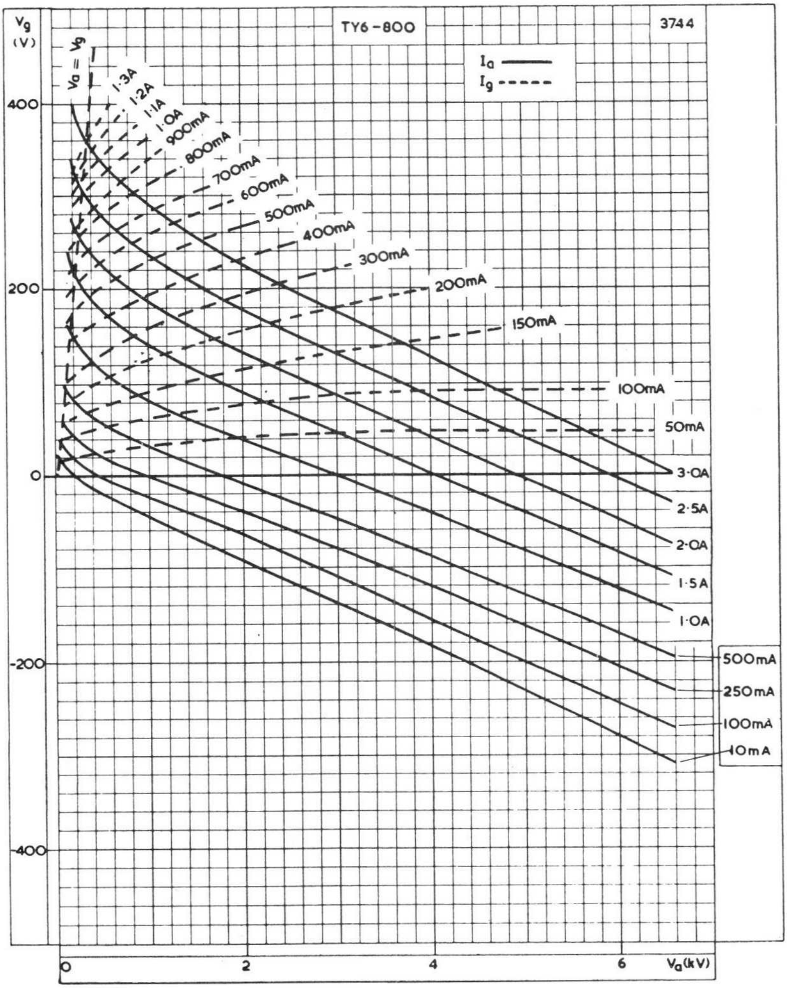
**$0.85(P_{out}-P_{drive})$







All dimensions in mm



CONSTANT CURRENT CHARACTERISTICS

V.H.F. POWER TRIODES

TY6-5000A
TY6-5000W
TY6-5000H

QUICK REFERENCE DATA

External anode triode, intended for use as v.h.f. amplifier or oscillator.
The TY6-5000A is forced-air cooled.
The TY6-5000W is water cooled by means of a water jacket.
The TY6-5000H is water cooled by means of an integral helical water cooler.

	Telegraphy or F.M. Telephony, Class 'C'		Telephony, Anode Modulation Class 'C'	Telephony, Class 'B'	
f	75	75	75	75	MHz
P_{out}	6.9	*13.8	4.7	1.9	kW
f max.	75		75	75	MHz
V_a max.	6.0		5.0	6.0	kV
P_a max.					
TY6-5000A	5.0		3.4	5.0	kW
TY6-5000W/H	6.0		4.0	6.0	kW

*Grounded grid configuration.

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

TELEGRAPHY OR F.M. TELEPHONY, CLASS 'C'

OPERATING CONDITIONS

f	75	75	75	MHz
P_{out}	4.0	5.6	6.9	kW
P_{load}	3.2	4.5	5.5	kW
η_a	73	75	77	%
V_a	4.0	5.0	6.0	kV
I_a	1.37	1.5	1.5	A
$-V_g$	200	300	400	V
I_g	350	330	310	mA
$v_{in}(pk)$	500	640	740	V
$P_{load(driver)}$	190	240	275	W
p_a	1.5	1.9	2.1	kW

OPERATING CONDITIONS for two valves in grounded grid configuration

f	110	110	MHz
$^*P_{out}$	$7.6 + 1.0$	$10.6 + 1.46$	kW
P_{load}	6.9	9.6	kW
η_a	69	71	%
V_a	4.0	5.0	kV
I_a	2×1.37	2×1.5	A
V_{f-g}	200	300	V
I_g	2×350	2×330	mA
$v_{in(f-f)}pk$	1.0	1.28	kV
$P_{load(driver)}$	2×0.705	2×0.965	kW
p_a	2×1.7	2×2.2	kW

*Includes power transferred from driver stage

TELEPHONY, ANODE MODULATION, CLASS 'C'

OPERATING CONDITIONS (Carrier conditions for 100% modulation)

f	75	75	75	75	75	MHz
P_{out}	2.2	3.0	3.5	4.1	4.7	kW
P_{load}	1.76	2.4	2.8	3.3	3.75	kW
η_a	73	72	73	76	78	%
V_a	3.0	3.5	4.0	4.5	5.0	kV
I_a	1.0	1.2	1.2	1.2	1.2	A
* $-V_g$	250	300	300	350	400	V
I_g	300	300	300	300	300	mA
v_{in}(pk)	510	600	600	650	690	V
$P_{load(driver)}$	170	205	205	230	205	W
p_a	0.8	1.2	1.3	1.3	1.3	kW
For 100% modulation						
P_{mod}	1.5	2.1	2.4	2.7	3.0	kW

*This bias voltage is partially obtained by the use of a grid resistor.

TELEPHONY, CLASS 'B'

OPERATING CONDITIONS (Carrier conditions for 100% modulation)

f	75	75	MHz
P_{out}	1.45	1.9	kW
P_{load}	1.16	1.52	kW
η_a	32	32	%
V_a	5.0	6.0	kV
I_a	900	990	mA
$-V_g$	145	180	V
v_{in}(pk)	225	250	V
p_a	3.0	4.0	kW
For 100% modulation			
I_g	320	300	mA
$P_{load(driver)}$	160	170	W

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Telegraphy Class 'C'	Telephony Class 'C'	Telephony Class 'B'	
V_a max.	6.0	5.0	6.0	kV
$-V_g$ max.	*1.0	1.0	-	kV
I_a max.	1.5	1.3	1.1	A
i_k(pk) max.	8.5	7.5	4.6	A
p_a max.				
TY6-5000A	5.0	3.4	5.0	kW
TY6-5000W/H	6.0	4.0	6.0	kW
I_g max.	350	350	-	mA
p_g max.	120	120	120	W
R_{g-f} max.	-	-	-	kΩ

*V_{f-g} in grounded grid configuration.

CATHODE

Directly heated, thoriated tungsten

*V_f	12.6	V
I_f	33	A

*The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

The connection f_{ct} is intended for use as the cathode current return. It is not an electrical centre tap and must not be used for filament current supply. At frequencies above 30MHz all three filament pins should be interconnected with suitable capacitors.

CAPACITANCES

c_{a-g}	11	pF
c_{out}	0.3	pF
c_{in}	16	pF

CHARACTERISTICS (measured at V_a = 4.0kV, I_a = 1.0A)

g_m	17	mA/V
μ	32	

MOUNTING POSITION — Vertical, with base up or down.

COOLING

TY6-5000A

Forced-air cooled

Maximum temperatures

Anode and grid seals	180	^{o}C
Pin seals	210	^{o}C

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals.
The amount of forced-air cooling required for this valve depends upon the anode dissipation and height above sea level.
Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet of the housing are given in the following table:

Anode and grid dissipation (kW)	Height above sea level (km)	Inlet temperature (^{o}C)	Rate of flow of air (m^3/minute)	Pressure difference between inlet and outlet (mm H_2O)
1.0	0	35	3.0	8.0
1.0	0	45	3.1	8.0
1.0	1.5	35	3.7	9.0
1.0	3.0	25	4.1	10
3.0	0	35	5.2	23
3.0	0	45	6.1	29
3.0	1.5	35	6.2	26
3.0	3.0	25	6.6	26
5.0	0	35	9.2	68
5.0	0	45	10.7	90
5.0	1.5	35	11.2	81
5.0	3.0	25	11.6	79

TY6-500W

Water cooled anode, low velocity air flow on seals.

Maximum temperatures

Anode and grid seals	180	^{o}C
Water inlet	50	^{o}C

Typical values of inlet temperature, rate of flow of water and pressure difference between the inlet and outlet housing at various anode dissipations are given in the following table:

COOLING - TY6-5000W (cont'd)

Anode and grid dissipation (kW)	Inlet temperature (°C)	Rate of flow of water (litres/minute)	Pressure difference between inlet and outlet (atm)
1.0	20	2.5	0.08
1.0	50	3.0	0.1
2.0	20	2.5	0.08
2.0	50	5.0	0.3
4.0	20	4.0	0.18
4.0	50	9.0	0.9
6.0	20	6.0	0.4
6.0	50	14	2.5

At inlet temperatures between 10 and 50°C the required quantity of water can be found by linear interpolation. In order to keep within the temperature limits it is necessary to direct a flow of air on to the seals at frequencies above 30MHz. The air flow should be started at the application of filament voltage.

TY6-5000H

Water cooled integral helix anode, low velocity air flow on seals

Maximum temperatures

Water inlet	50	°C
Filament seals	210	°C
Anode and grid seals	180	°C

The amount of water cooling required for this valve depends on the anode dissipation and the temperature of the water. At frequencies above 30MHz and at ambient temperatures above 35°C both grid and filament seals should be cooled by a low velocity air flow.
The minimum rate of water flow and the pressure drop across the helix for various values of dissipation and inlet temperature are given in the following table:

Anode and grid dissipation (kW)	Inlet temperature (°C)	Minimum rate of water flow (litres/minute)	Pressure drop across helix (atm)
1.0	20	0.8	0.02
1.0	50	1.5	0.06
2.0	20	1.5	0.06
2.0	50	3.0	0.20
4.0	20	3.0	0.22
4.0	50	6.0	0.73
6.0	20	5.0	0.56
6.0	50	10	1.8

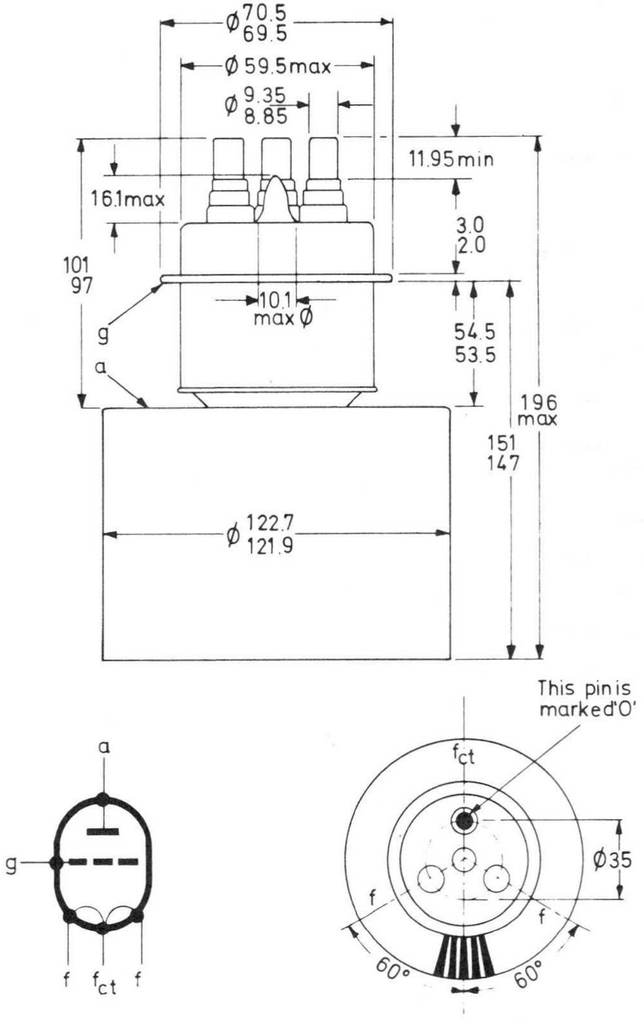
PHYSICAL DATA

	TY6-5000A	TY6-5000W	TY6-5000H	
Weight of valve	4.6	0.45	0.8	kg
Weight of valve plus carton	8.1	1.2	1.7	kg
Weight of insulating pedestal	2.1	-	-	kg
Weight of insulating pedestal plus carton	3.1	-	-	kg
Weight of water jacket	-	0.52	-	kg
Weight of water jacket plus carton	-	0.75	-	kg

ACCESSORIES

Filament clips × 3	40634
Grid connector × 1 > 30MHz	40622
Grid connector × 1 < 30MHz	40650
Insulating pedestal × 1 (TY6-5000A).	40630
Water jacket × 1 (TY6-5000W)	K713

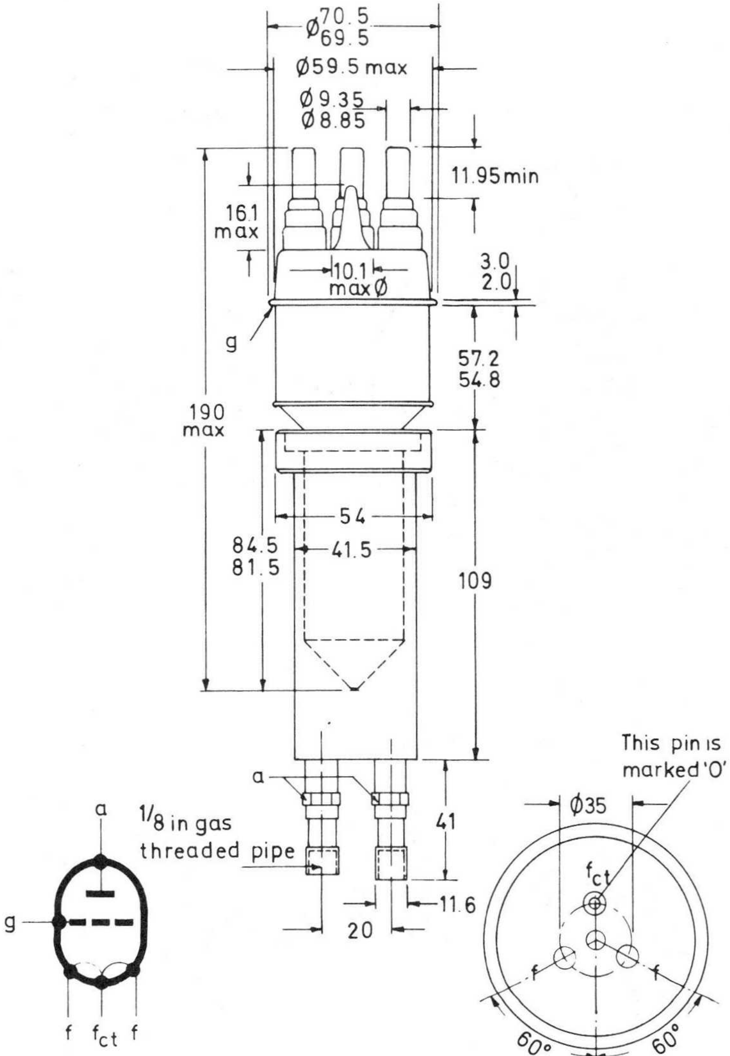
OUTLINE DRAWING OF TY6-5000A



All dimensions in mm

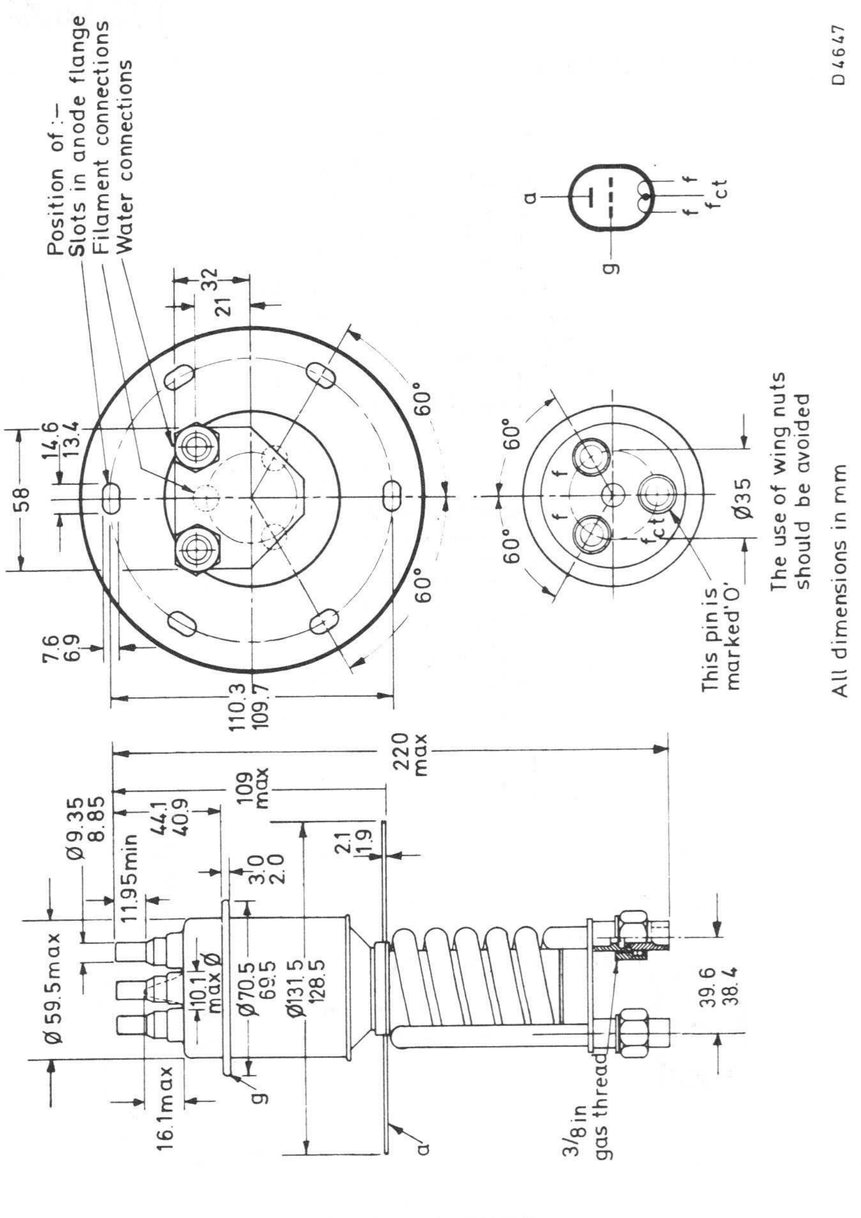
D 4646

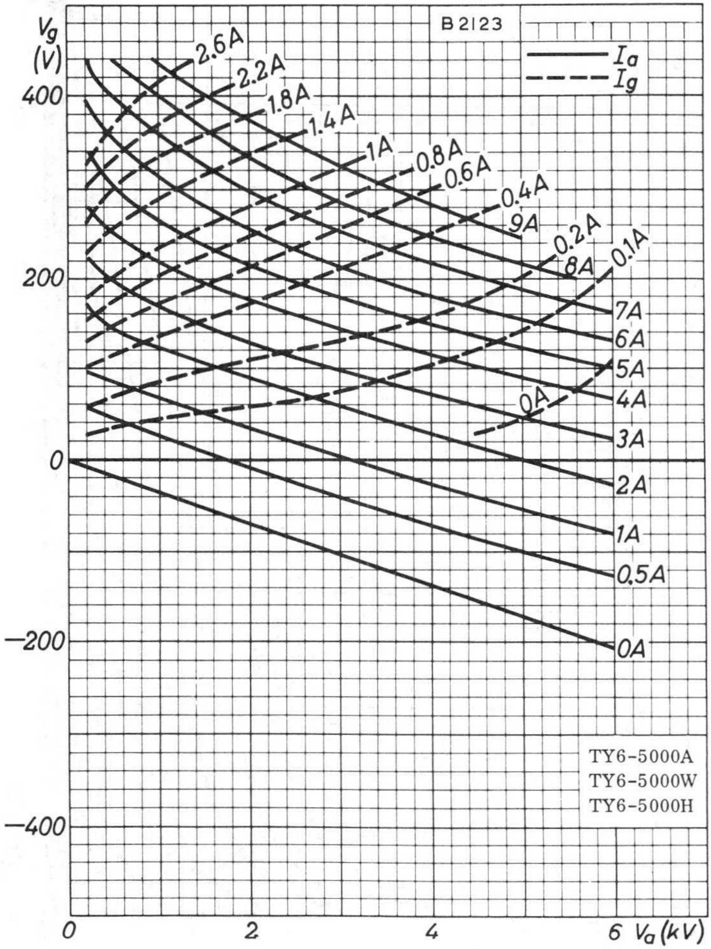
OUTLINE DRAWING OF TY6-5000W MOUNTED IN WATER JACKET K713



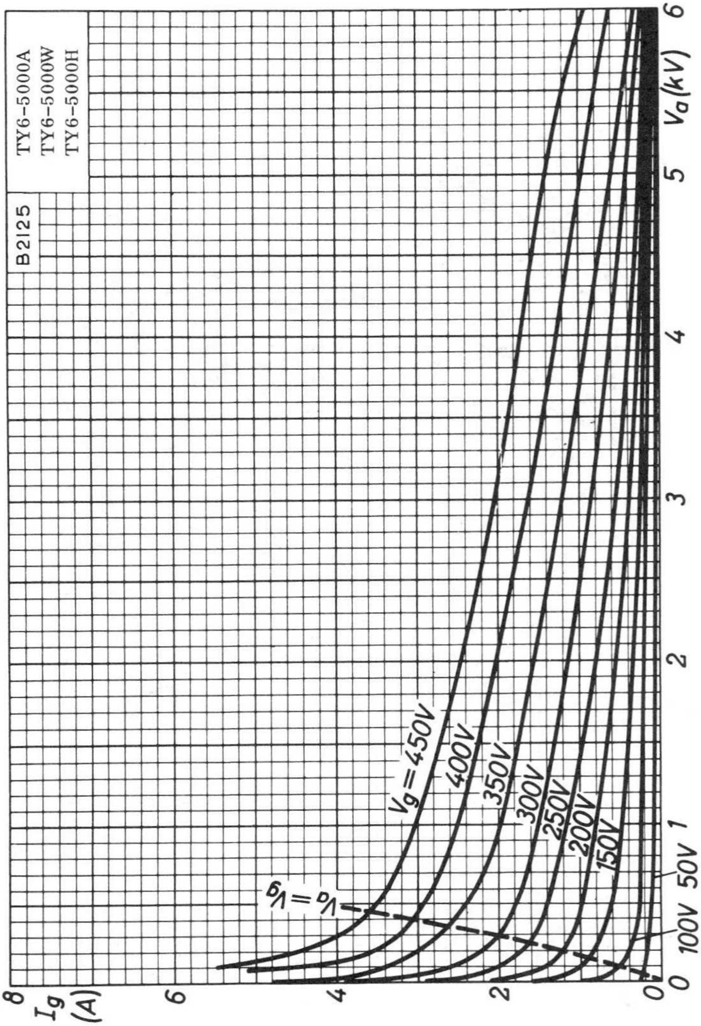
All dimensions in mm

D4648

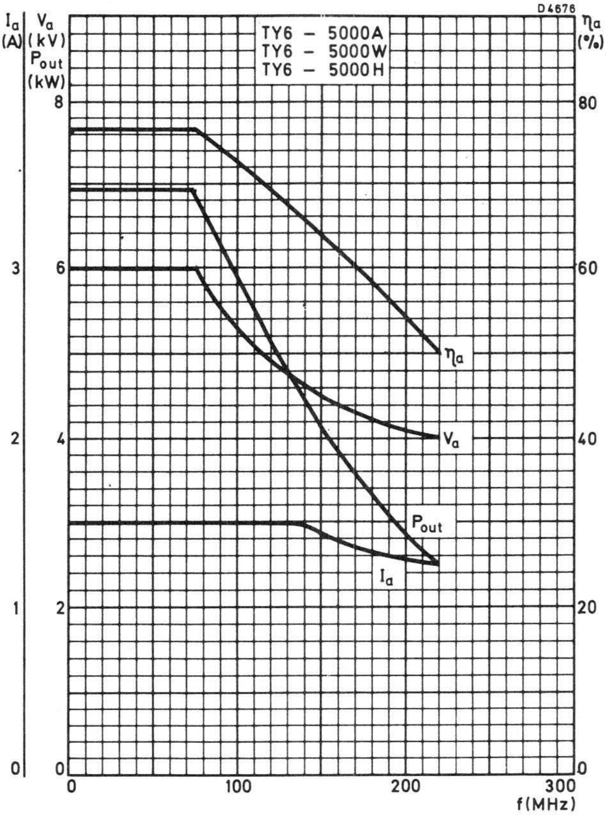

Position of :–
Slots in anode flange
Filament connections
Water connections
D4647
a
g
f
f
f_{ct}
32
21
14.6
13.4
58
60°
60°
60°
60°
7.6
6.9
110.3
109.7
This pin is marked 'O'
f_{ct}
Ø35
The use of wing nuts should be avoided
All dimensions in mm
Ø59.5max
Ø9.35
8.85
11.95min
44.1
40.9
109 max
220 max
3.0
2.0
2.1
1.9
10.1 max Ø
Ø70.5
69.5
Ø131.5
128.5
16.1max
g
a
3/8 in gas thread
39.6
38.4



CONSTANT CURRENT CHARACTERISTICS



GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH GRID VOLTAGE AS PARAMETER



FREQUENCY CHARACTERISTICS

V.H.F. POWER TRIODES

TY7-6000A
TY7-6000W
TY7-6000H

QUICK REFERENCE DATA

External anode triode, intended for use as v.h.f. amplifier or oscillator.
The TY7-6000A is forced air cooled.
The TY7-6000W is water cooled by means of a water jacket
The TY7-6000H is water cooled by means of an integral helical water cooler.

	Class 'C' Industrial Oscillator	Class 'C' Telegraphy or F.M. Telephony	
f	55	30	MHz
P_{out}	8.25	10	kW
f max.	85	30	MHz
V_a max.	7.0	7.2	kV
p_a max.	6.0	6.0	kW

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

Anode supply from three-phase halfwave rectifier without filter

OPERATING CONDITIONS

f	55	50	85	MHz
P_{out}	8.6	6.3	6.1	kW
P_{out}(less P_{drive})	8.25	6.0	5.75	kW
η_a	78	67	72	%
V_{tr}(r.m.s.)	5.55	5.13	4.27	kV
V_a	6.5	6.0	5.0	kV
I_a	1.7	1.5	1.7	A
I_g (loaded)	500	400	450	mA
(unloaded)	700	700	700	mA
R_{g-f}	900	1000	850	Ω
Feedback ratio $\frac{v_{in}(pk)}{v_{out}(pk)}$	0.15	0.15	0.19	
p_a	2.4	2.7	2.4	kW

TELEGRAPHY OR F.M. TELEPHONY, CLASS 'C'

OPERATING CONDITIONS

f	30	30	30	MHz
P_{out}	7.3	9.2	10	kW
P_{load}	5.8	7.4	8.0	kW
η_a	73	77	77	%
V_a	5.0	6.0	6.5	kV
I_a	2.0	2.0	2.0	A
$-V_g$	300	400	450	V
I_g	600	600	600	mA
$v_{in}(pk)$	700	820	850	V
$P_{load(driver)}$	378	443	460	W
p_a	2.7	2.8	3.0	kW

TELEPHONY, ANODE MODULATION, CLASS 'C'

OPERATING CONDITIONS (Carrier conditions for 100% modulation)

f	30	30	30	MHz
P_{out}	5.0	5.6	6.4	kW
P_{load}	4.0	4.5	5.1	kW
η_a	78	80	80	%
V_a	4.0	5.0	5.0	kV
I_a	1.6	1.4	1.6	A
$-V_g$	300	400	400	V
I_g	600	500	500	mA
$v_{in}(pk)$	680	730	800	V
$P_{load(driver)}$	367	328	432	W
p_a	1.4	1.4	1.6	kW
For 100% modulation				
P_{mod}	3.2	3.5	4.0	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

		Class 'C' Oscillator	Class 'C' Telegraphy	Class 'C' Telephony	
V_a max.	(f = 30MHz)	-	7.2	5.5	kV
	(f = 55MHz)	7.0	-	-	kV
	(f = 85MHz)	6.5	-	-	kV
$-V_g$ max.		1.25	1.25	1.25	kV
I_k max.		2.5	2.8	2.4	A
i_k(pk) max.		11	14	12	A
p_a max.		6.0	6.0	4.0	kW
I_g max.	(loaded)	500	600	600	mA
	(unloaded)	700	-	-	mA
p_g max.		250	250	250	W
R_{g-f} max.		10	-	-	kΩ

CATHODE

Directly heated, thoriated tungsten

*V_f	12.6	V
I_f	33	A

*The filament has been designed to accept temporary fluctuations of supply voltage of +5 and -10%.

The connection f_{ct} is not an electrical centre tap and must not be used for filament current supply. At frequencies above 30MHz all three filament pins should be inter-connected with suitable capacitors.

CAPACITANCE

c_{a-g}	11	pF
c_{g-f}	16	pF
c_{a-f}	0.3	pF

CHARACTERISTICS (measured at V_a = 6.0kV, I_a = 1.0A)

g_m	15	mA/V
μ	32	

MOUNTING POSITION — Vertical, with anode up or down.

COOLING

The valve must not be operated without a heat dissipating connector on pin f_{ct}.

TY7-6000A

Forced-air cooled

Maximum temperatures

Filament seals	210	^oC
Anode and grid seals	180	^oC

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the filament and grid seals.

The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea level.

Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet of the housing are given in the following table: -

Anode and grid dissipation (kW)	Height above sea level (km)	Inlet temperature (^oC)	Rate of flow of air (m^3/minute)	Pressure difference between inlet and outlet (mm H_2O)
2.0	0	35	4.8	20
2.0	0	45	5.7	25
2.0	1.5	35	5.7	23
2.0	3.0	25	6.1	23
3.5	0	35	6.2	32
3.5	0	45	7.3	42
3.5	1.5	35	7.3	36
3.5	3.0	25	7.8	36
6.0	0	35	9.2	68
6.0	0	45	10.7	91
6.0	1.5	35	11.2	81
6.0	3.0	25	11.7	80

TY7-6000W

Water cooled anode and low velocity air flow on seals

Maximum temperatures

Filament seals	210	^oC
Anode and grid seals	180	^oC

Typical values of inlet temperature, rate of flow of water and pressure difference between the inlet and outlet housing at various anode dissipations are given in the following table:

COOLING TY7-6000W (cont'd)

Anode and grid dissipation (kW)	Inlet temperature (^{o}C)	Rate of flow of water (litres/minute)	Pressure difference between inlet and outlet (atm)
1.0	20	2.5	0.08
1.0	50	3.0	0.1
2.0	20	2.5	0.08
2.0	50	5.0	0.3
4.0	20	4.0	0.18
4.0	50	9.0	0.9
6.0	20	6.0	0.4
6.0	50	14	2.5

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals. Air cooling will in general not be necessary at frequencies $\leq$30MHz and a maximum ambient temperature of 35^{o}C. At frequencies between 30 and 50MHz or at higher ambient temperatures, a low velocity air flow to the grid and filament seals will be necessary.

TY7-6000H

Water cooled integral helix anode, low velocity air flow on seals

Maximum temperatures

Filament seals	210	^{o}C
Anode and grid seals	180	^{o}C
Water inlet	50	^{o}C

The amount of water cooling required for this valve depends on the anode dissipation and the temperature of the water. At frequencies above 30MHz and at ambient temperature above 35^{o}C both grid and filament seals should be cooled by a low velocity air flow.

The minimum rate of water flow and the pressure drop across the helix for various values of dissipation and inlet temperature are given in the following table:

COOLING TY76000H (cont'd)

Anode and grid dissipation (kW)	Inlet temperature (^oC)	Minimum rate of water flow (litres/minute)	Pressure drop across helix (atm)
1.0	20	0.75	0.02
1.0	50	1.5	0.06
2.0	20	1.5	0.06
2.0	50	3.0	0.20
4.0	20	3.0	0.22
4.0	50	6.0	0.73
6.0	20	5.0	0.56
6.0	50	10	1.8

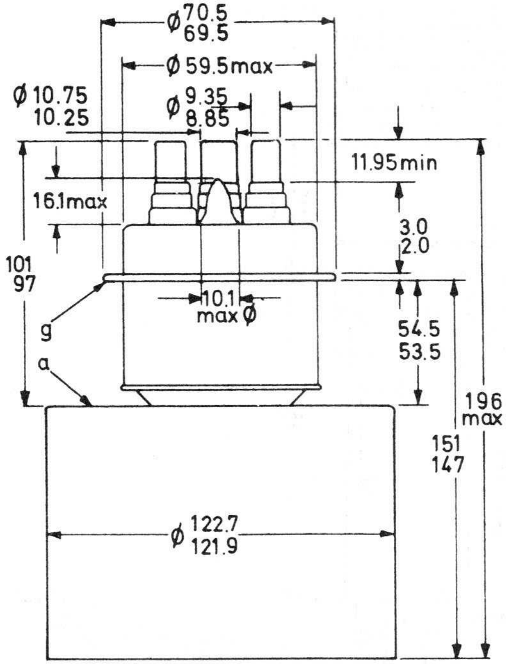
PHYSICAL DATA

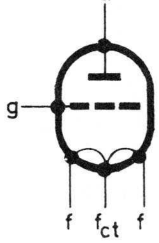
	TY7-6000A	TY7-6000W	TY7-6000H	
Weight of valve	4.6	0.45	0.8	kg
Weight of valve plus carton	8.1	1.2	1.7	kg
Weight of insulating pedestal	2.1	-	-	kg
Weight of insulating pedestal plus carton	3.1	-	-	kg
Weight of water jacket	-	0.52	-	kg
Weight of water jacket plus carton	-	0.75	-	kg

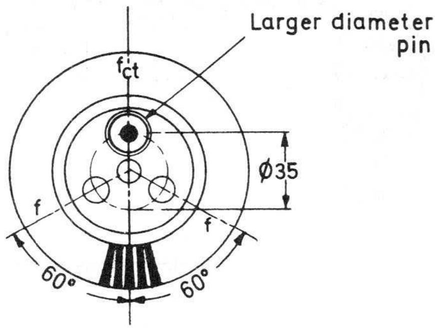
ACCESSORIES

Filament clips × 2	40634
Filament centre-tap clip × 1	40649
Grid connector f > 30MHz	40622
f < 30MHz	40650
Insulating pedestal (TY7-6000A)	40630
Water jacket (TY7-6000W)	K713

OUTLINE DRAWING OF TY7-6000A



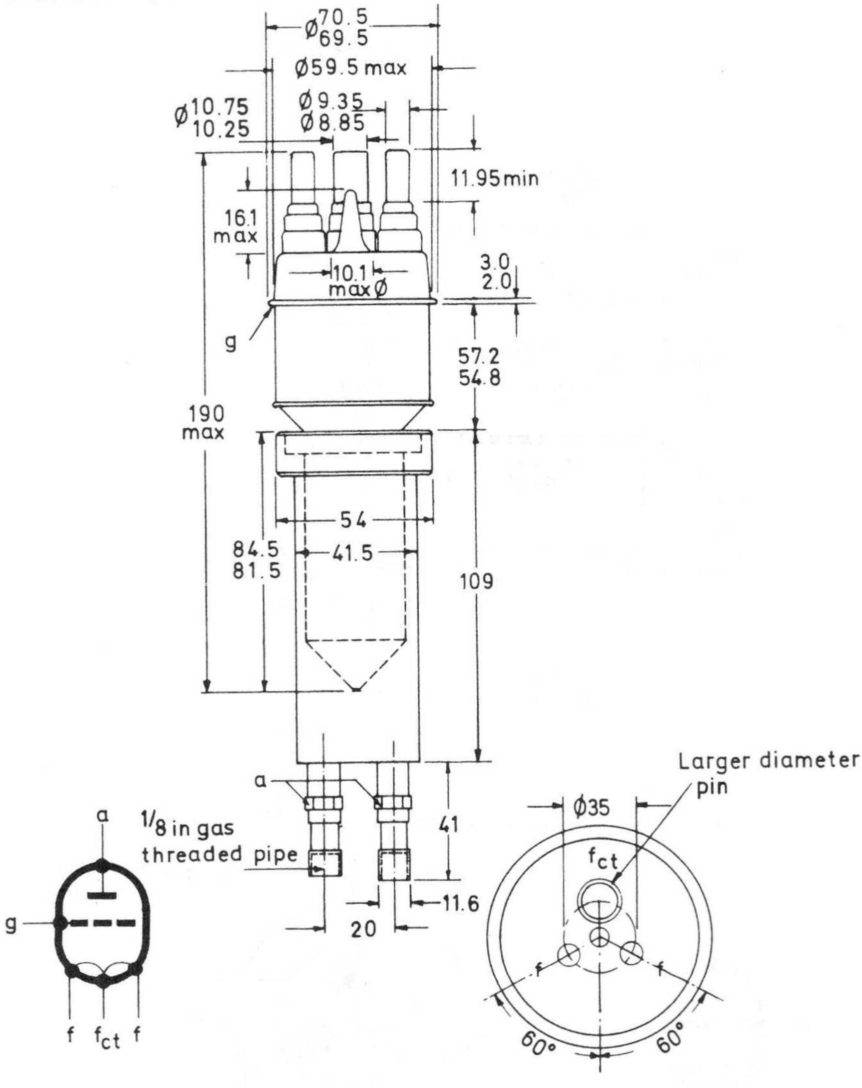




All dimensions in mm

D4649

OUTLINE DRAWING OF TY7-6000W MOUNTED IN WATER JACKET K713



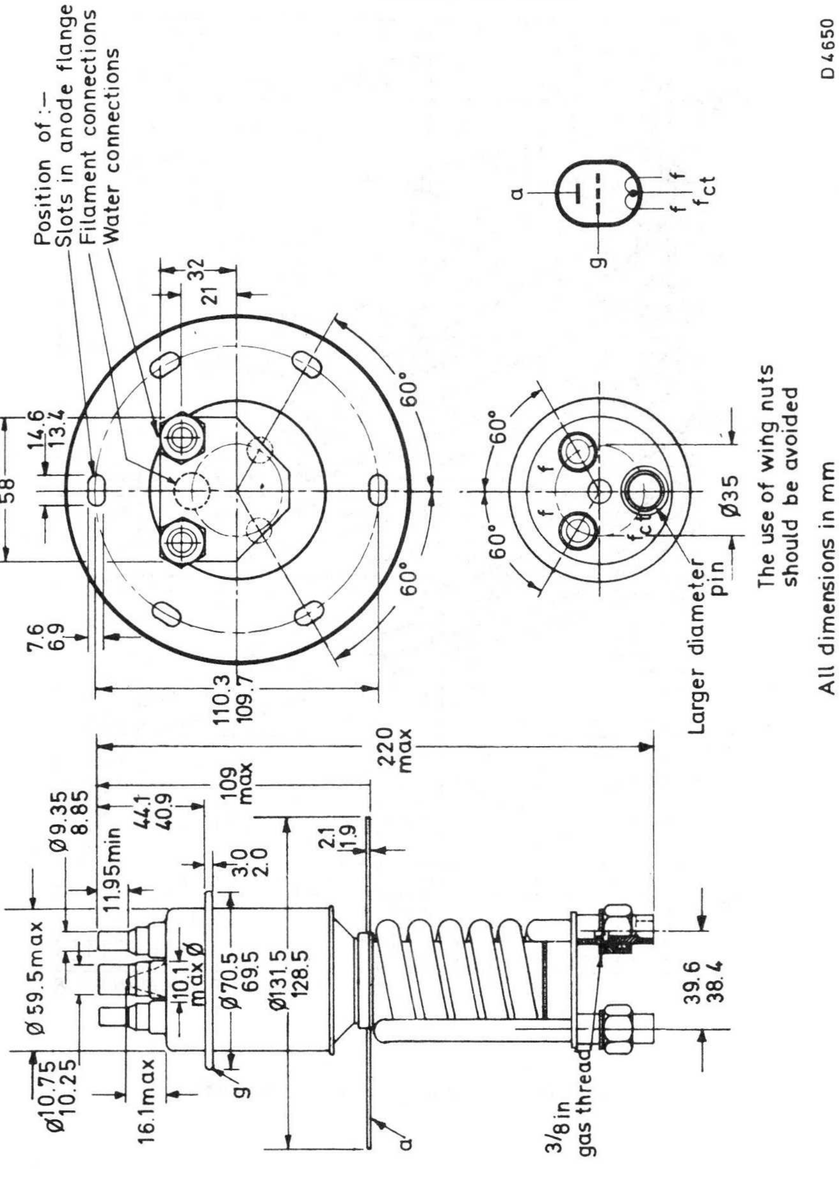
All dimensions in mm

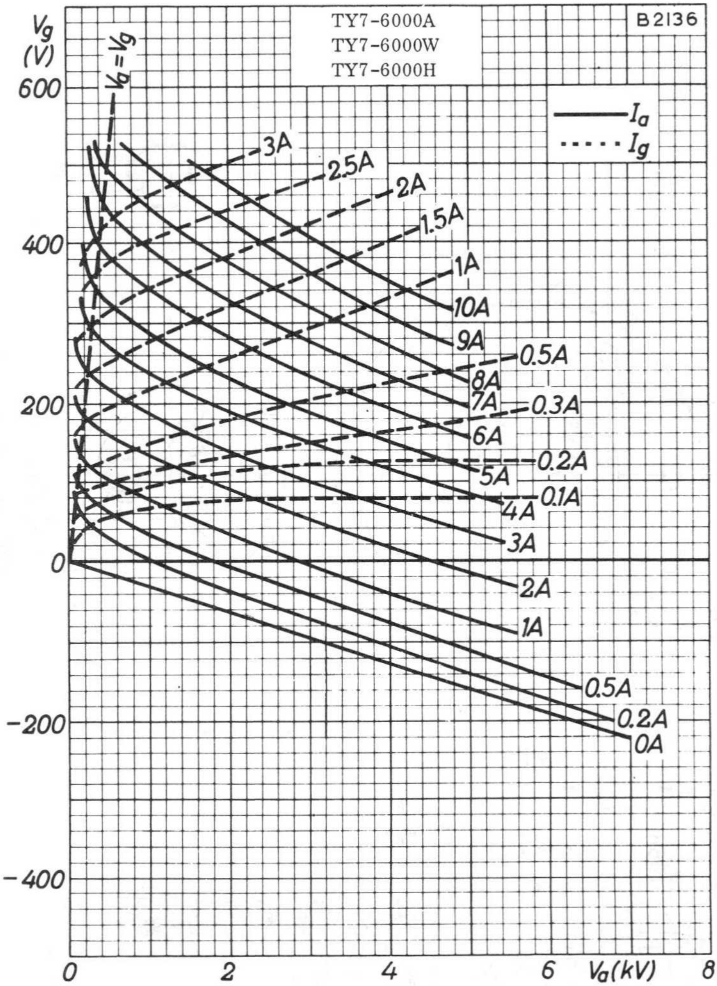
D4657

V.H.F. POWER TRIODES

TY7-6000A
TY7-6000W
TY7-6000H

OUTLINE DRAWING OF TY7-6000H





CONSTANT CURRENT CHARACTERISTICS

V.H.F. INDUSTRIAL TRIODES

YD1150 YD1152

QUICK REFERENCE DATA

External anode triodes of ceramic-metal construction, intended for use as industrial oscillators.

The YD1150 is forced-air cooled.

The YD1152 has an integral helical water cooler.

f	160	27.12	MHz
P_{out} (less P_{drive})	3.55	4.57	kW
f max.	160		MHz
V_a max.	7.2		kV
p_a max.	2.5		kW

Unless otherwise shown, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

OPERATING CONDITIONS

f	160	27.12	27.12	MHz
P_{out}	3.9	4.9	4.0	kW
P_{out} (less P_{drive})	3.55	4.57	3.75	kW
P_{load}	3.1	3.7	3.3	kW
Duty factor	1.0	1.0	1.0	
η_a	78	82	80	%
V_a	5.0	6.0	5.0	kV
I_a	1.0	1.0	1.0	A
$-V_g$	520	625	520	V
I_g	260	250	260	mA
R_{g-f}	2.0	2.5	2.0	kΩ
Feedback ratio $v_{in(pk)}/v_{a(pk)}$	0.17	0.17	0.17	
P_{drive}	350	330	250	W
p_a	1.1	1.1	1.0	kW
p_g	120	110	100	W
V_f	6.0	6.3	6.3	V

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	85	160	MHz
V_a max.	7.2	6.0	kV
$-V_g$ max.	1.0	1.0	kV
I_g max. on load	280	280	mA
off load	400	400	mA
I_k max.	1.4	1.4	A
$i_{k(pk)}$ max.	7.5	7.5	A
P_{in} max.	6.5	6.0	kW
p_a max.	2.5	2.5	kW
p_g max.	150	150	W
R_{g-f} max.	20	20	kΩ

CATHODE

Directly heated, thoriated tungsten

V_f (≤120MHz)	6.3	V
(>120MHz)	6.0	V
I_f (measured at 6.3V)	33	A

The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

CAPACITANCES

c_{a-g}	14	pF
c_{a-f}	0.4	pF
c_{g-f}	17	pF

CHARACTERISTICS (measured at V_a =2.0kV, I_a =0.5A)

g_m	10	mA/V
μ	20	

MOUNTING POSITION - YD1150, YD1152 Vertical, anode up or down

COOLING

Maximum temperature of ceramic-metal seals 220 ^{o}C

YD1150 - Forced-air cooled. See curves on page 7

YD1152 - Anode water cooled with integral helical cooler

Seals - low velocity air flow may be required

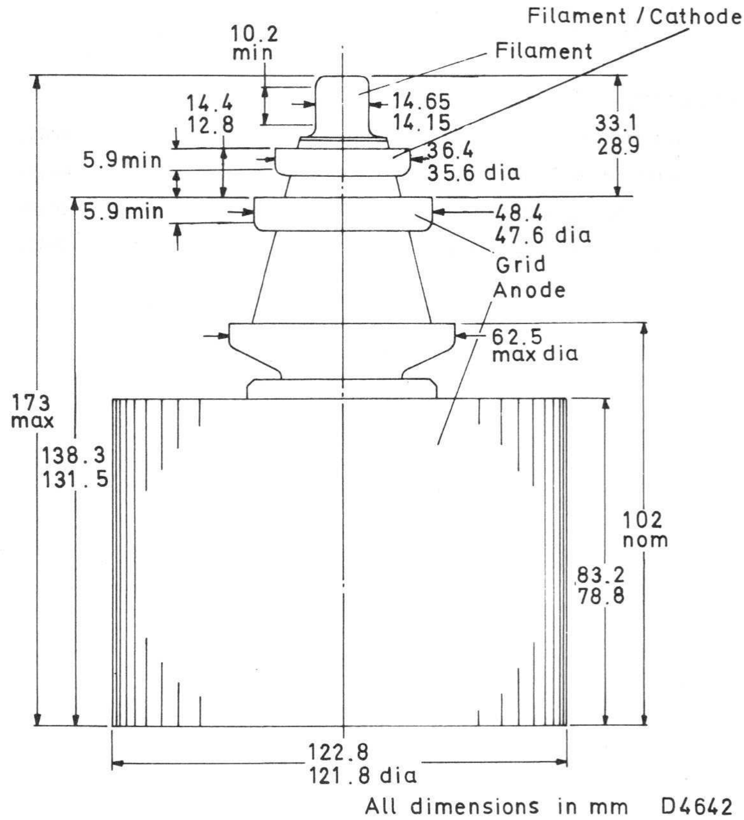
See curves on page 8

PHYSICAL DATA

	YD1150	YD1152	
Weight of valve	3.0	0.85	kg

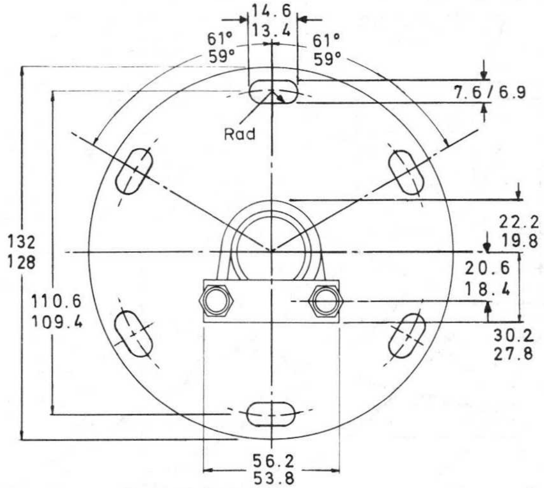
ACCESSORIES

Filament clip	40688
Filament/cathode clip	40689
Grid connector (f < 30MHz)	40686
Insulating pedestal (YD1150)	40630

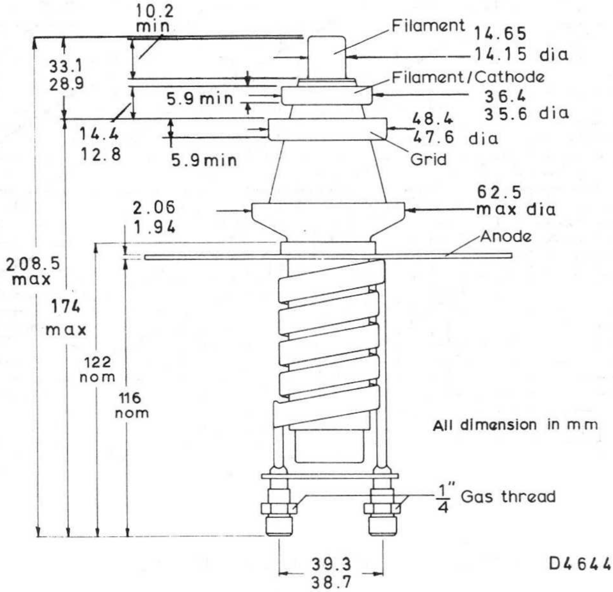


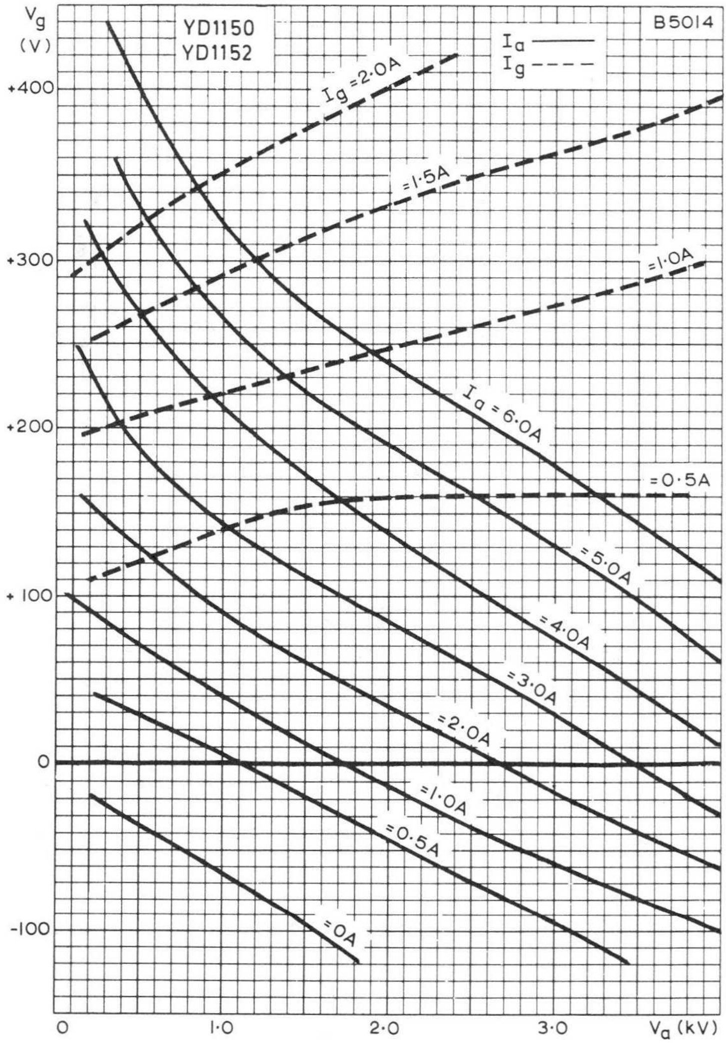
OUTLINE DRAWING OF YD1150

OUTLINE DRAWING OF YD1152

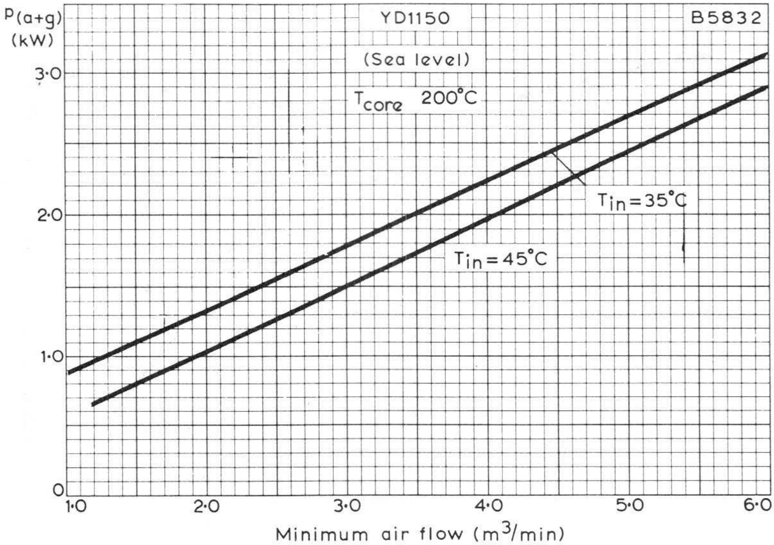


The use of wing nuts should be avoided

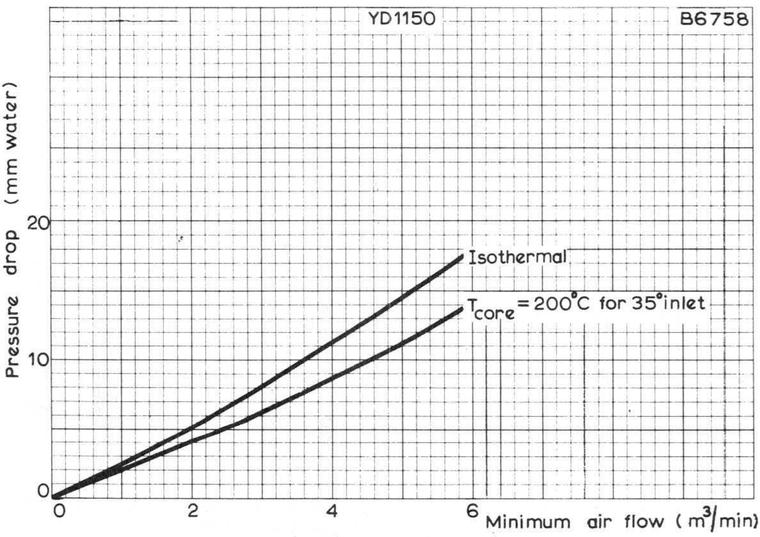




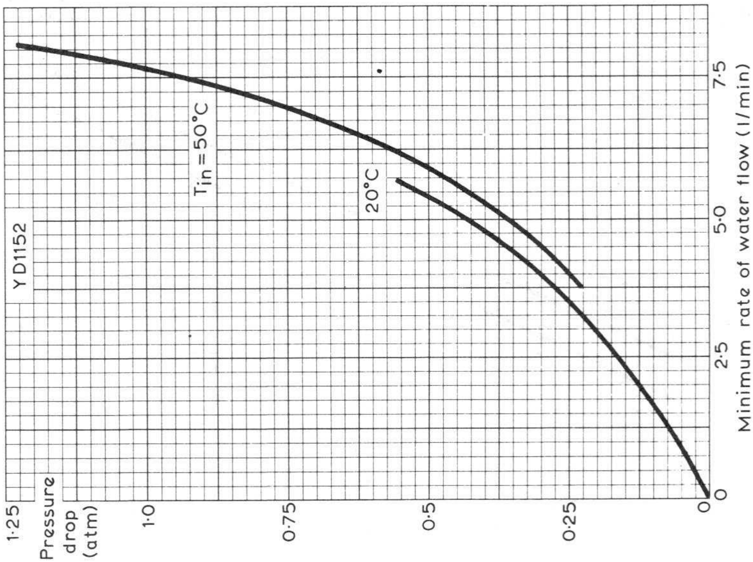
CONSTANT CURRENT CHARACTERISTICS

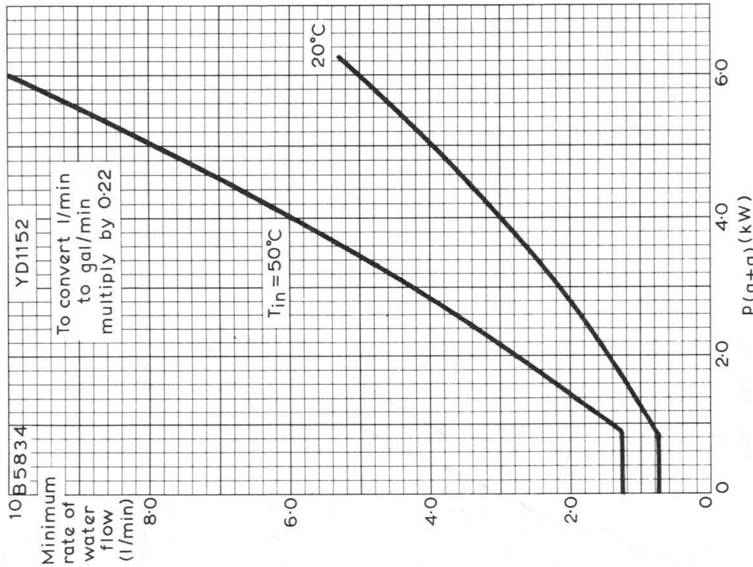


MINIMUM COOLING REQUIREMENTS AT SEA LEVEL



PRESSURE DROP PLOTTED AGAINST MINIMUM AIR FLOW





MINIMUM RATE OF WATER FLOW PLOTTED AGAINST ANODE AND GRID DISSIPATION FOR T_{in} = 20 AND 50°C
PRESSURE DROP PLOTTED AGAINST MINIMUM RATE OF WATER FLOW FOR T_{in} = 20 AND 50°C

V.H.F. INDUSTRIAL TRIODES

YD1160
YD1161
YD1162

QUICK REFERENCE DATA

External anode triode, ceramic-metal construction, intended for use as class 'C' industrial oscillator.

The YD1160 is forced-air cooled.
The YD1161 is water cooled by means of a separate jacket.
The YD1162 has an integral helical water cooler.

f	27.12	150	MHz
P_{out} (less P_{drive})	8.8	7.15	kW
f max.	150		MHz
V_a max.	7.2		kV
p_a max.	5.0		kW

Unless otherwise shown, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

f	27.12	27.12	150	MHz
P_{out}	7.9	9.2	7.5	kW
P_{out} (less P_{drive})	7.5	8.8	7.15	kW
P_{load}	6.4	7.5	6.4*	kW
Duty factor	1.0	1.0	1.0	
η_a	82.5	78.5	75.5	%
V_a	6.0	6.5	5.0	kV
I_a	1.6	1.8	2.0	A
$-V_g$	615	690	480	V
I_g on load	480	430	480	mA
off load	600	580	650	mA
R_{g-f}	1.3	1.6	1.0	kΩ
Feedback ratio $v_{in(pk)}/v_{a(pk)}$	0.15	0.16	0.15	
P_{drive}	400	400	350	W
p_a	1.7	2.5	2.45	kW
p_g	120	110	100	W
V_f	6.3	6.3	5.8	V

*In typical cavity circuit.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f	≤85	≤150	MHz
V_a max.	7.2	6.0	kV
P_{in} max.	12.5	11.0	kW
$-V_g$ max.	1.0	1.0	kV
I_g max. on load	550	550	mA
off load	750	750	mA
I_k max.	2.8	2.8	A
$i_{k(pk)}$ max.	15	15	A
p_a max.	5.0	5.0	kW
p_g max.	250	250	W
R_{g-f} max.	20	20	kΩ

CATHODE

Directly heated, thoriated tungsten

*V_f	6.3	V
I_f	66	A

*It is recommended that the filament voltage be reduced to 5.8V at 150MHz operating frequency.

The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

CAPACITANCES

c_{a-g}	19	pF
c_{a-f}	0.5	pF
c_{g-f}	16	pF

CHARACTERISTICS (measured at V_a = 2.0kV, I_a = 1.0A)

g_m	22	mA/V
μ	20	

MOUNTING POSITION - YD1160, YD1162 — Vertical, anode up or down
- YD1161 — Vertical, anode down

COOLING

Maximum temperature of ceramic-metal seals 220 °C

YD1160 - Forced air cooled. See curves on pages 8 and 9

YD1161 - Anode - water cooled using jacket type K713

Seals - low velocity air flow may be required

See curves on page 10

YD1162 - Anode - water cooled with integral helical cooler

Seals - low velocity air flow may be required

See curves on page 11

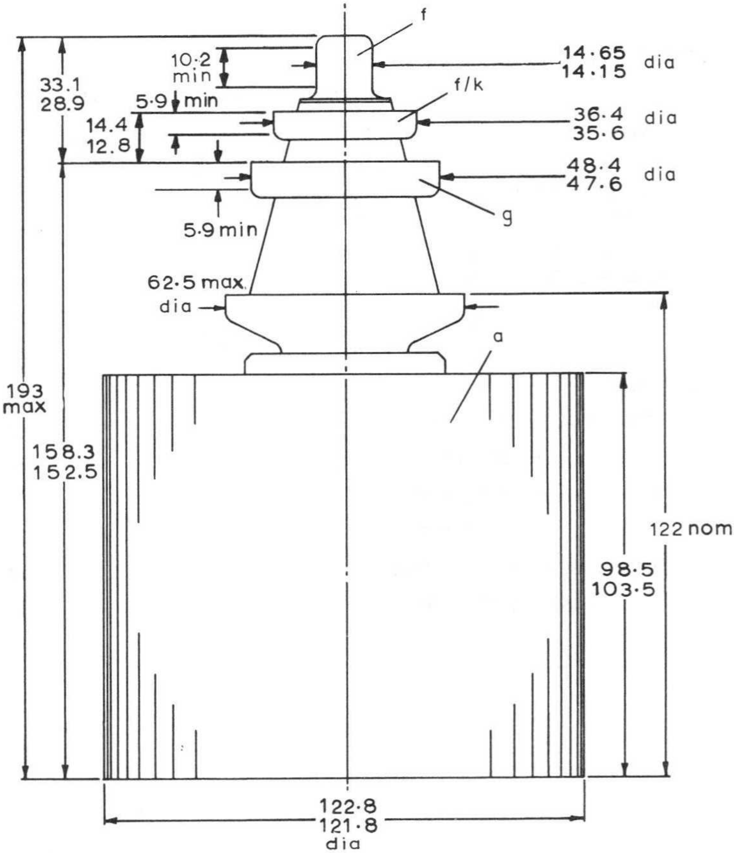
PHYSICAL DATA

	YD1160	YD1161	YD1162	
Weight of valve	8.5	1.5	2.3	lb
	3.9	0.66	1.03	kg
Weight of insulating	4.6	-	-	lb
pedestal	2.1	-	-	kg
Weight of insulating	6.8	-	-	lb
pedestal plus carton	3.1	-	-	kg
Weight of water jacket	-	1.6	-	lb
	-	0.73	-	kg

ACCESSORIES

Filament connector	40688
Filament/cathode connector (f < 30MHz)	40689
Grid connector (f ≤30MHz)	40686
(f > 30MHz)	40687
Insulating pedestal ×1 (YD1160)	40630
Water jacket ×1 (YD1161)	K726

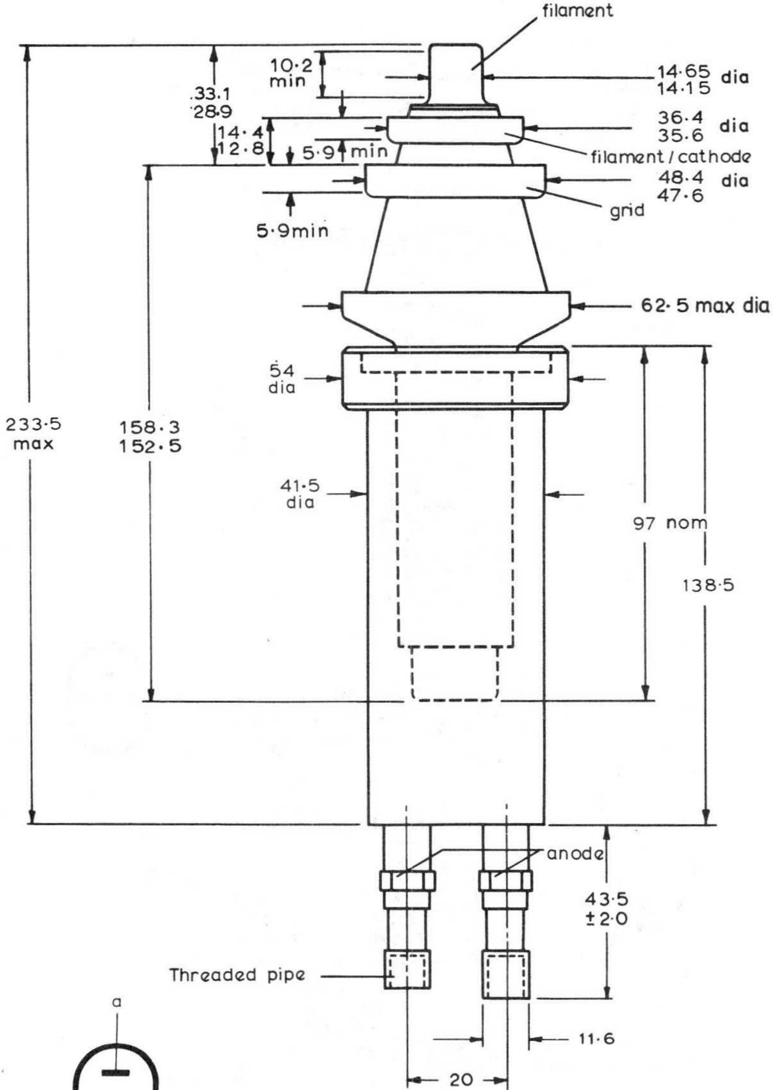
OUTLINE DRAWING OF YD1160

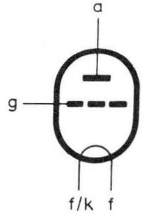


All dimensions in mm

D4638

OUTLINE DRAWING OF YD1161 MOUNTED IN WATER JACKET K726

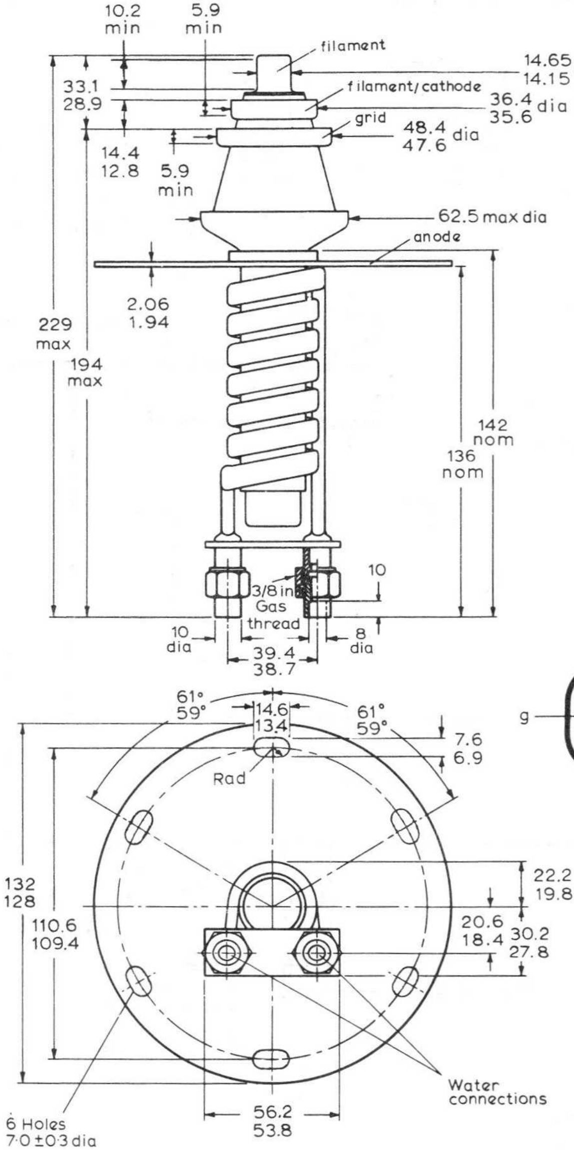


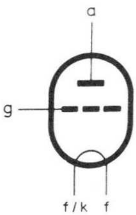


All dimensions in mm

D4640

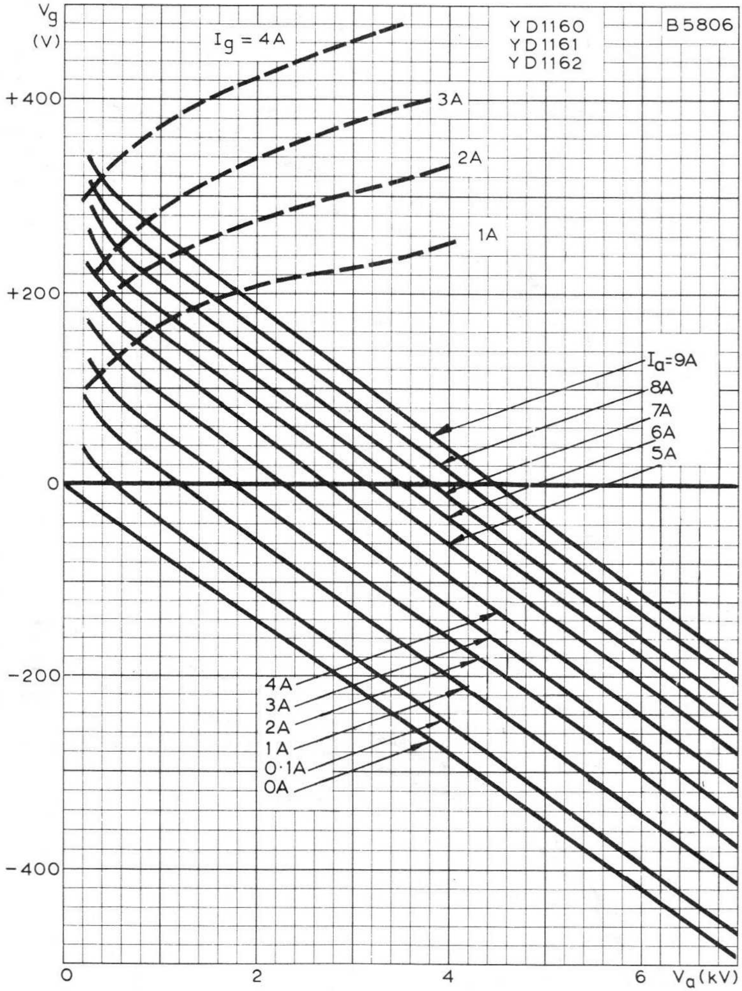
OUTLINE DRAWING OF YD1162



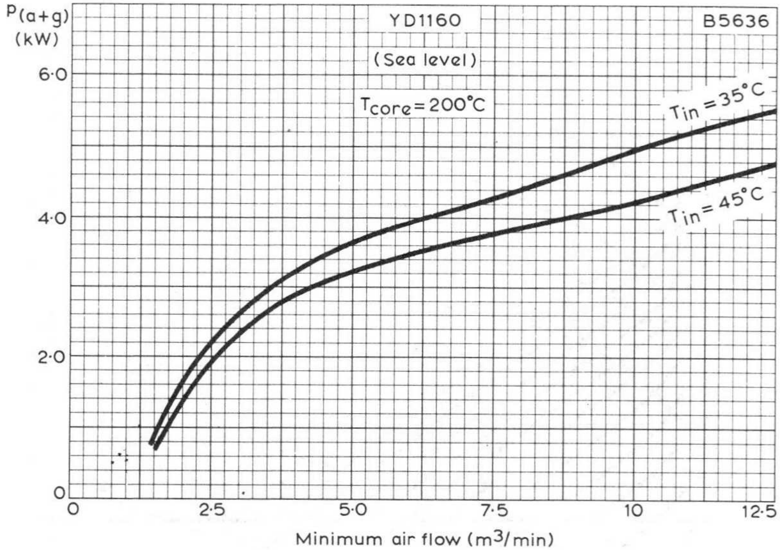


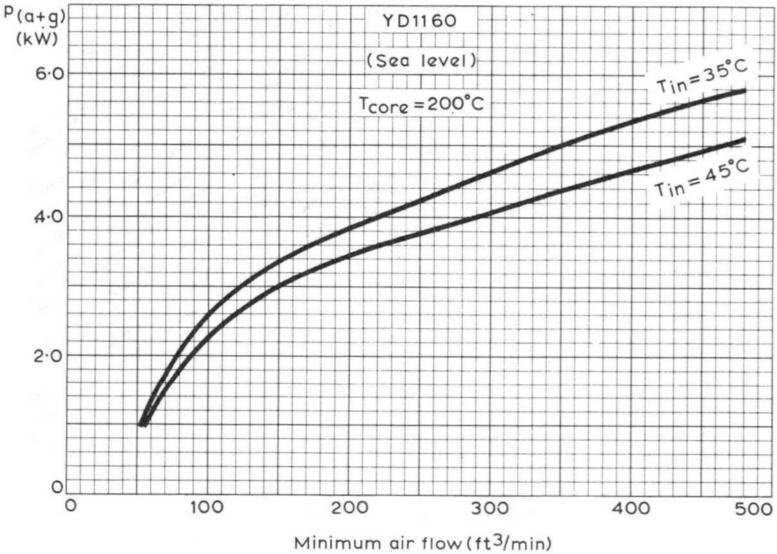
All dimensions in mm

D4641

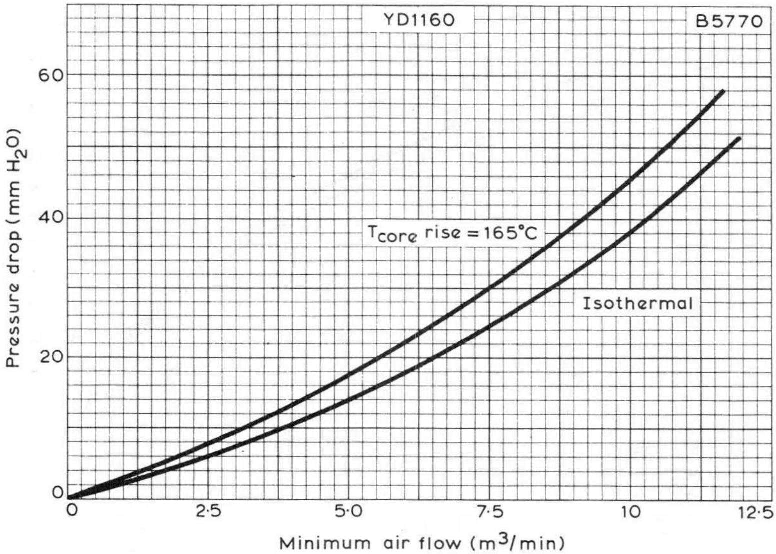


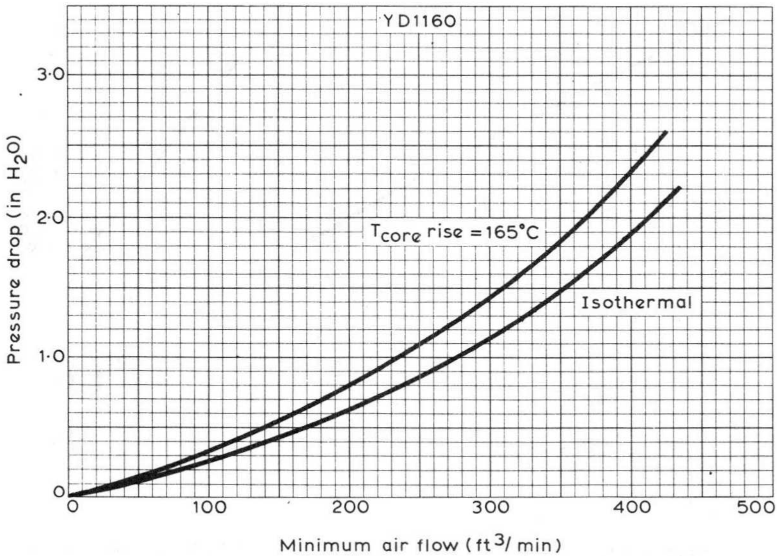
CONSTANT CURRENT CHARACTERISTICS



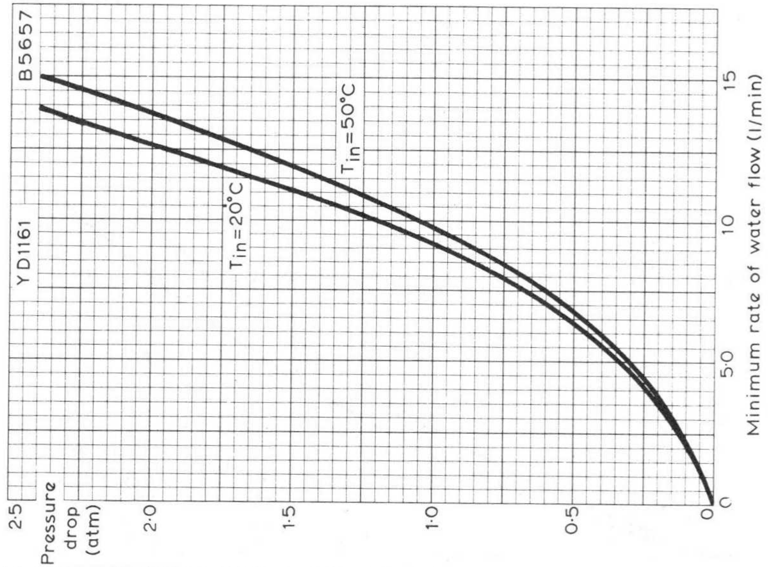


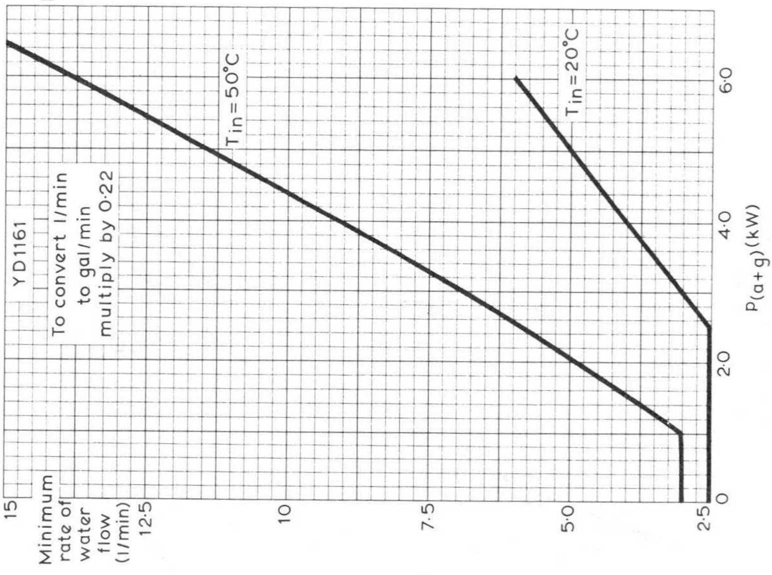
MINIMUM COOLING REQUIREMENTS WITH AIR INLET TEMPERATURES OF 35 AND 45°C AT SEA LEVEL. RADIATOR CORE TEMPERATURE = 200°C



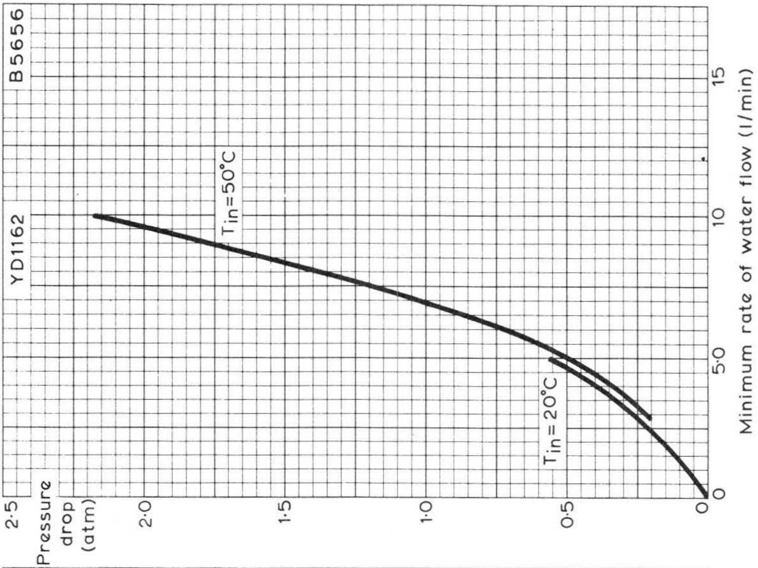


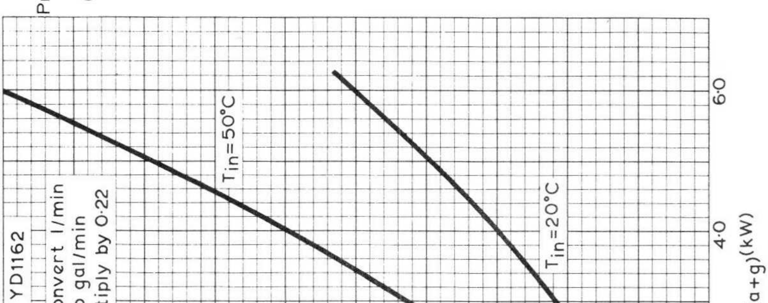
PRESSURE DROP PLOTTED AGAINST MINIMUM AIR FLOW FOR AN ISOTHERMAL CONDITION AND FOR A RISE IN CORE TEMPERATURE OVER INCOMING AIR OF 165°C





MINIMUM RATE OF WATER FLOW PLOTTED AGAINST ANODE AND GRID DISSIPATION FOR T_{in} = 20 AND 50°C
PRESSURE DROP PLOTTED AGAINST MINIMUM RATE OF WATER FLOW FOR T_{in} = 20 AND 50°C





MINIMUM RATE OF WATER FLOW PLOTTED AGAINST ANODE AND GRID DISSIPATION FOR T_{in} = 20 AND 50°C
PRESSURE DROP PLOTTED AGAINST MINIMUM RATE OF WATER FLOW FOR T_{in} = 20 AND 50°C

V.H.F. INDUSTRIAL TRIODES

YD1170 YD1171 YD1172

QUICK REFERENCE DATA		
External anode triodes of ceramic-metal construction, intended for use as industrial oscillators. The YD1170 is forced-air cooled. The YD1171 is water cooled by means of a separate water jacket. The YD1172 has an integral helical water cooler.		
f	120	MHz
P_{out} (less P_{drive})	15.4	kW
f max.	120	MHz
V_a max.	7.2	kV
p_a max.	10	kW

Unless otherwise stated, data is applicable to all types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

OPERATING CONDITIONS

f	120	MHz
P_{out}	16.2	kW
P_{out} (less P_{drive})	15.4	kW
η_a	76	%
V_a	6.0	kV
I_a	3.4	A
$-V_g$	460	V
I_g on load	920	mA
I_g off load	1.35	A
R_{g-f}	500	Ω
Feedback ratio $v_{in(pk)}/v_{a(pk)}$	0.15	
p_a	4.3	kW
p_g	280	W
P_{Rg}	423	W

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	120	MHz
V_a max.	7.2	kV
P_{in} max.	24	kW
$-V_g$ max.	1.5	kV
I_g max. on load	1.0	A
off load	1.5	A
I_a max.	4	A
I_k max.	5	A
p_a max.	10	kW
R_{g-f} max.	10	kΩ

CATHODE

Directly heated, thoriated tungsten

$^*V_f$	5.8	V
I_f	130	A
$i_{f(pk)}$ max. (starting)	800	A
r_f (cold)	5.6	mΩ

*It is recommended that the filament voltage be reduced to 5.5V at 120MHz operating frequency.

The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

CAPACITANCES

c_{a-g}	24	pF
c_{g-f}	47	pF
c_{a-f}	0.6	pF

CHARACTERISTICS (at $V_a = 6kV$, $I_a = 2A$)

g_m	33	mA/V
μ	29	

MOUNTING POSITION - YD1170, YD1172 Vertical, anode up or down

YD1171 Vertical, anode down

COOLING

YD1170

Anode - Forced-air cooled

Seals - At higher values of anode dissipation and at the highest operating frequencies additional cooling is required.

Maximum temperatures

Envelope and all seals	200	^{o}C
Air inlet	45	^{o}C

Anode and grid dissipation (kW)	Height above sea level (km)	Inlet temperature (^{o}C)	Outlet temperature (^{o}C)	Minimum rate of air flow (m^3/min)	Pressure difference between inlet and outlet (mm water)
10	0	35	94	9.5	55
8.0	0	35	105	6.5	28
6.0	0	35	113	4.5	15
4.0	0	35	117	3.0	8.0
10	0	45	98	11	69
8.0	0	45	108	7.6	35
6.0	0	45	115	5.2	19
4.0	0	45	119	3.5	10
10	1.5	35	94	11.4	63
8.0	1.5	35	105	7.8	32
6.0	1.5	35	113	5.5	17
4.0	1.5	35	117	3.6	9.0
10	3.0	25	90	12	62
8.0	3.0	25	102	8.2	32
6.0	3.0	25	111	5.7	17
4.0	3.0	25	116	3.8	9.0

YD1171

Anode - Water cooled (separate water jacket)

Seals - For frequencies >4MHz air cooling is required.

Maximum temperatures

Envelope and all seals	200	^{o}C
Water inlet	50	^{o}C

Anode and grid dissipation (kW)	Inlet temperature (^{o}C)	Outlet temperature (^{o}C)	Minimum rate of water flow (litres/min)	Pressure difference between inlet and outlet (atm)
10	20	36	10	0.6
8.0	20	37	7.8	0.38
6.0	20	38	5.7	0.22
10	50	61	15	1.25
8.0	50	62	11.3	0.75
6.0	50	62	8.2	0.42

For inlet temperatures between 20 and 50^{o}C the required water flow can be found by linear interpolation.

YD1172

Anode - Water cooled (integral cooler)

Seals - For frequencies >4MHz air cooling is required.

Maximum temperatures

Envelope and all seals	200	^{o}C
Water inlet	50	^{o}C

Anode and grid dissipation (kW)	Inlet temperature (^{o}C)	Outlet temperature (^{o}C)	Minimum rate of water flow (litres/min)	Pressure difference between inlet and outlet (atm)
10	20	46	6	0.25
8.0	20	49	4.5	0.15
6.0	20	53	3.0	0.07
10	50	67	9.0	0.52
8.0	50	69	6.7	0.31
6.0	50	72	4.5	0.15

For inlet temperatures between 20 and 50^{o}C the required water flow can be found by linear interpolation.

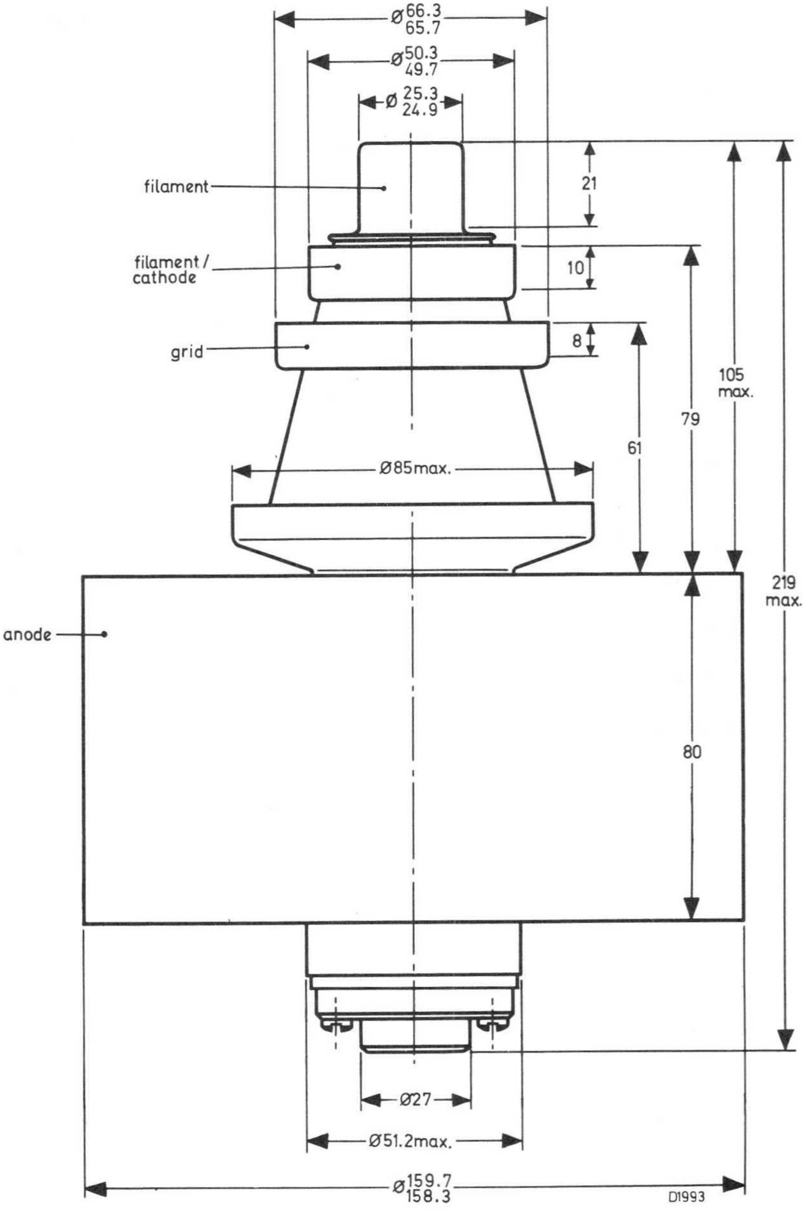
PHYSICAL DATA

	YD1170	YD1171	YD1172	
Weight of valve (approx.)	7.5	1.5	2.0	kg
Weight of insulating pedestal	4.25	-	-	kg
Weight of water jacket	-	2.0	-	kg

ACCESSORIES

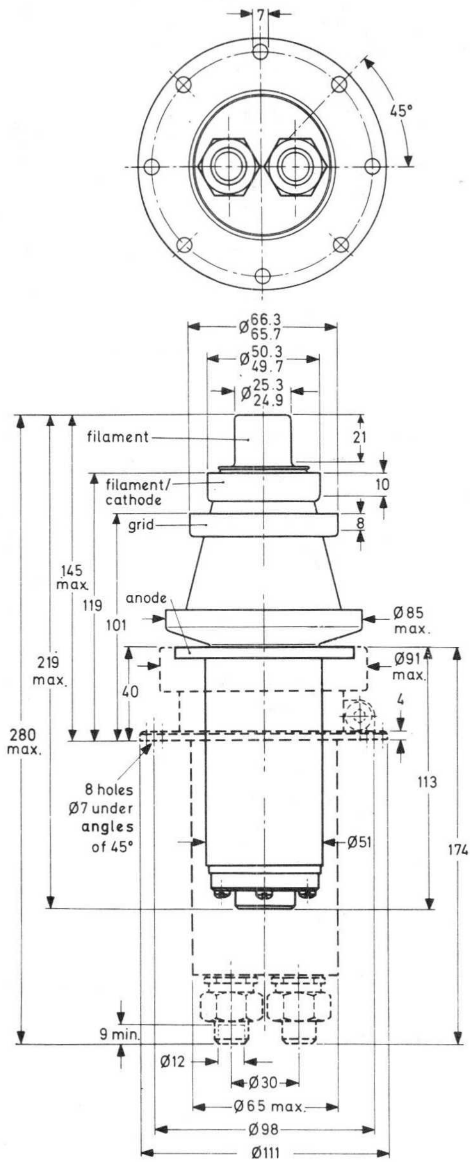
Filament connector	40692
Filament/cathode connector	40693
Grid connector	
f $\leq$4MHz	40690
f >4MHz	40691
Filament cables ×2	40715
Insulating pedestal (YD1170)	40654
Water jacket (YD1171)	K727

OUTLINE DRAWING OF YD1170



All dimensions in mm

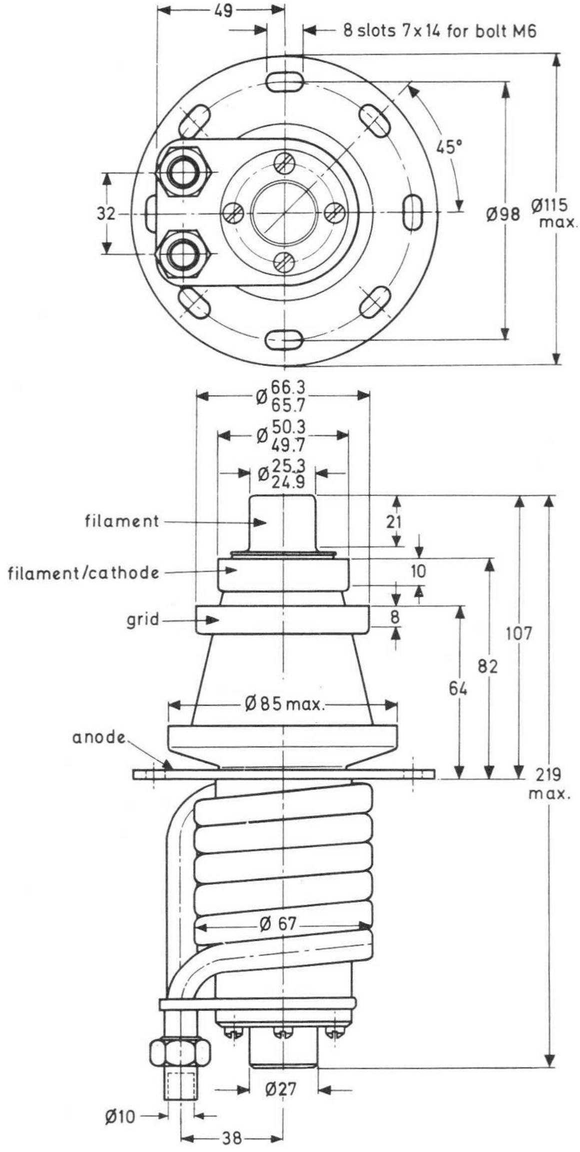
OUTLINE DRAWING OF YD1171 MOUNTED IN WATER JACKET K727



All dimensions in mm

D1994

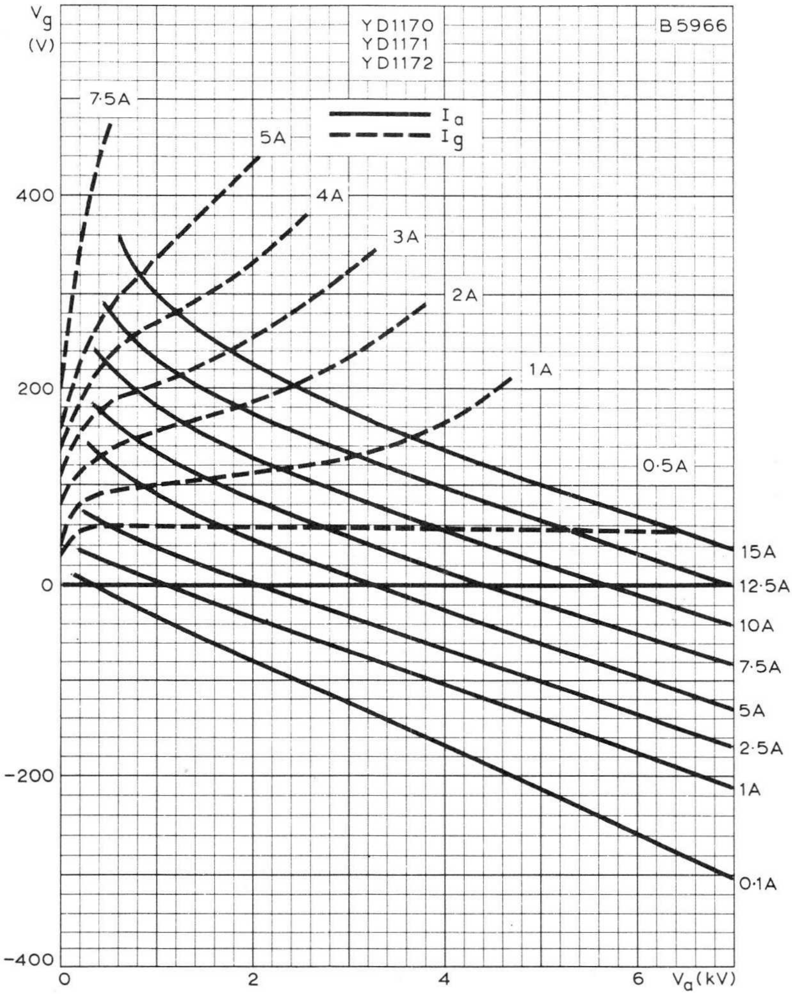
OUTLINE DRAWING OF YD1172



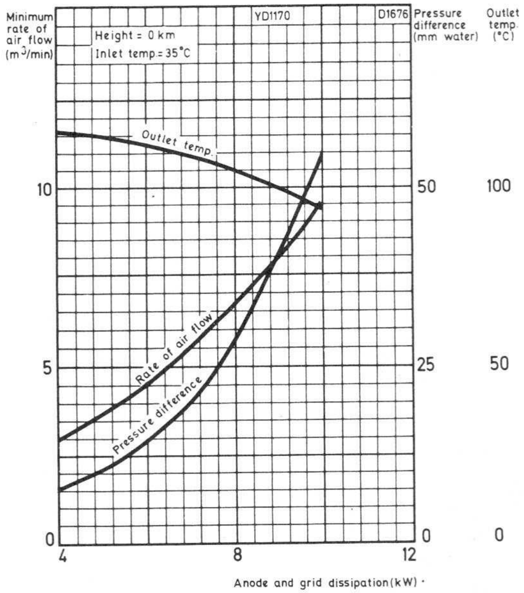
All dimensions in mm

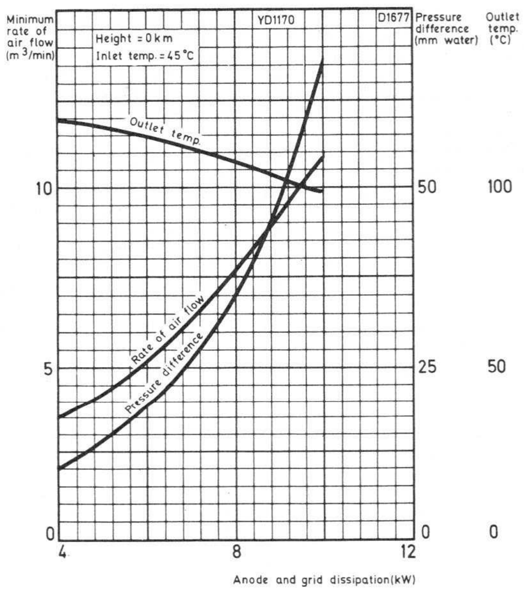
D1995

Mullard

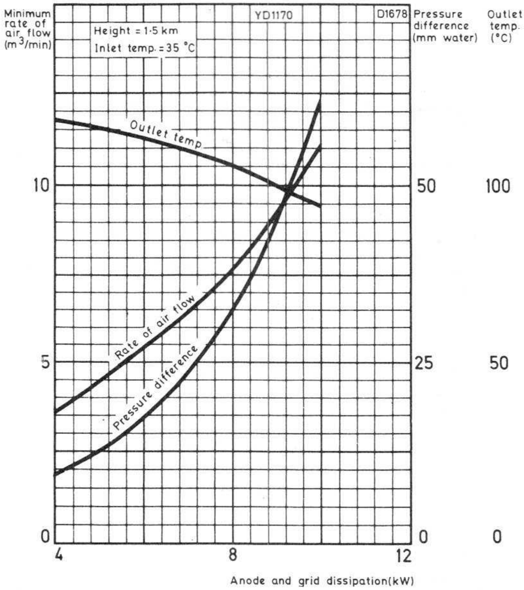


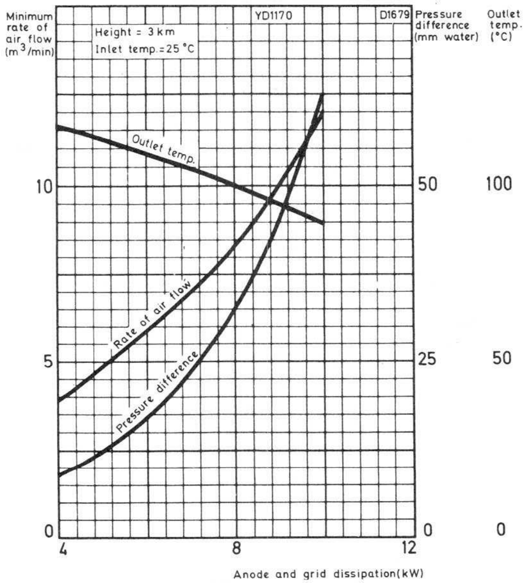
CONSTANT CURRENT CHARACTERISTICS



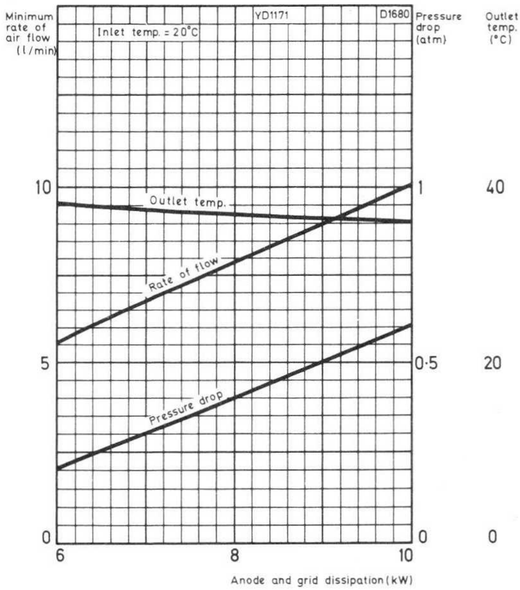


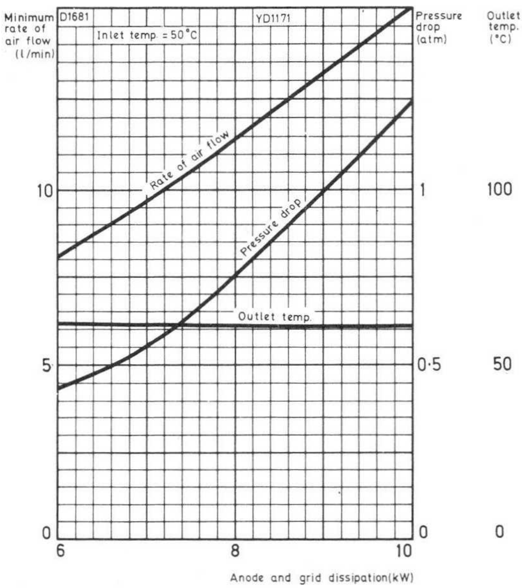
COOLING CHARACTERISTICS



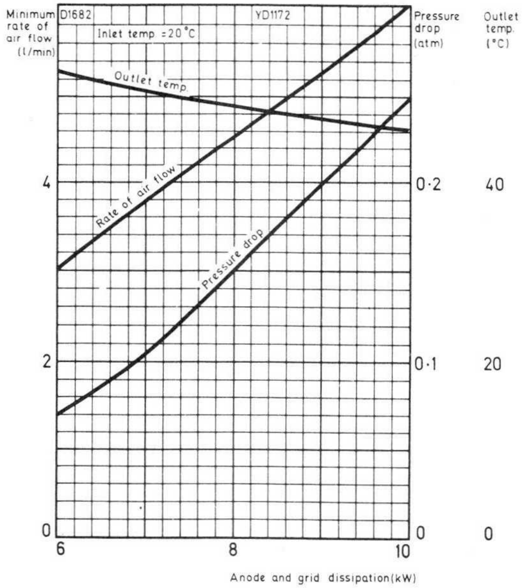


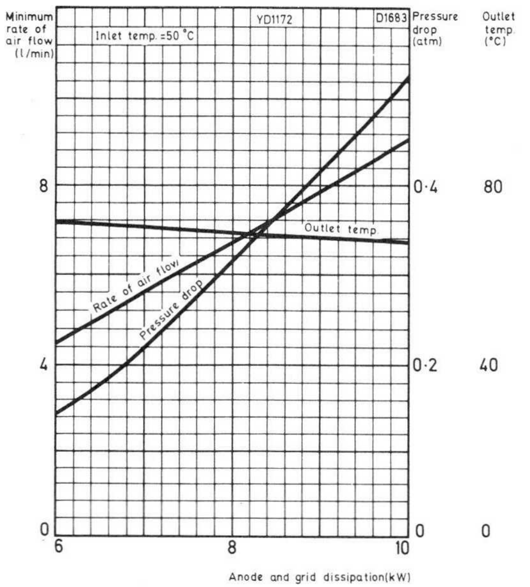
COOLING CHARACTERISTICS





COOLING CHARACTERISTICS





COOLING CHARACTERISTICS

V.H.F. INDUSTRIAL TRIODE

YD1173

QUICK REFERENCE DATA

Forced air cooled ceramic-metal triode, intended for use as an industrial oscillator.

f	50	MHz
P_{out} (less P_{drive})	13.22	kW
f max.	50	MHz
V_a max.	12	kV
p_a max.	10	kW

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

OPERATING CONDITIONS

f	50	MHz
P_{out}	13.7	kW
P_{out} (less P_{drive})	13.22	kW
η_a	78	%
V_a	10	kV
I_a	1.75	A
$-V_g$	675	V
I_g on load	450	mA
R_{g-f}	1.5	kΩ
Feedback ratio $v_{in(pk)}/v_{a(pk)}$	0.12	
p_a	3.8	kW
p_g	180	W
P_{Rg}	304	W

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	50	MHz
V_a max.	12	kV
P_{in} max.	20	kW
$-V_g$ max.	1.5	kV
I_g max. on load	600	mA
off load	800	mA
I_a max.	2.0	A
I_k max.	2.5	A
p_a max.	10	kW
R_{g-f} max.	10	kΩ

CATHODE

Directly heated, thoriated tungsten

V_f	5.4	V
I_f	65	A
$i_{f(pk)}$ max. (starting)	400	A
r_f (cold)	10	mΩ

The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

CAPACITANCES

c_{a-g}	17	pF
c_{g-f}	42	pF
c_{a-f}	0.4	pF

CHARACTERISTICS (at $V_a = 10$kV, $I_a = 800$mA)

g_m	14	mA/V
μ	45	

MOUNTING POSITION — Vertical, anode up or down

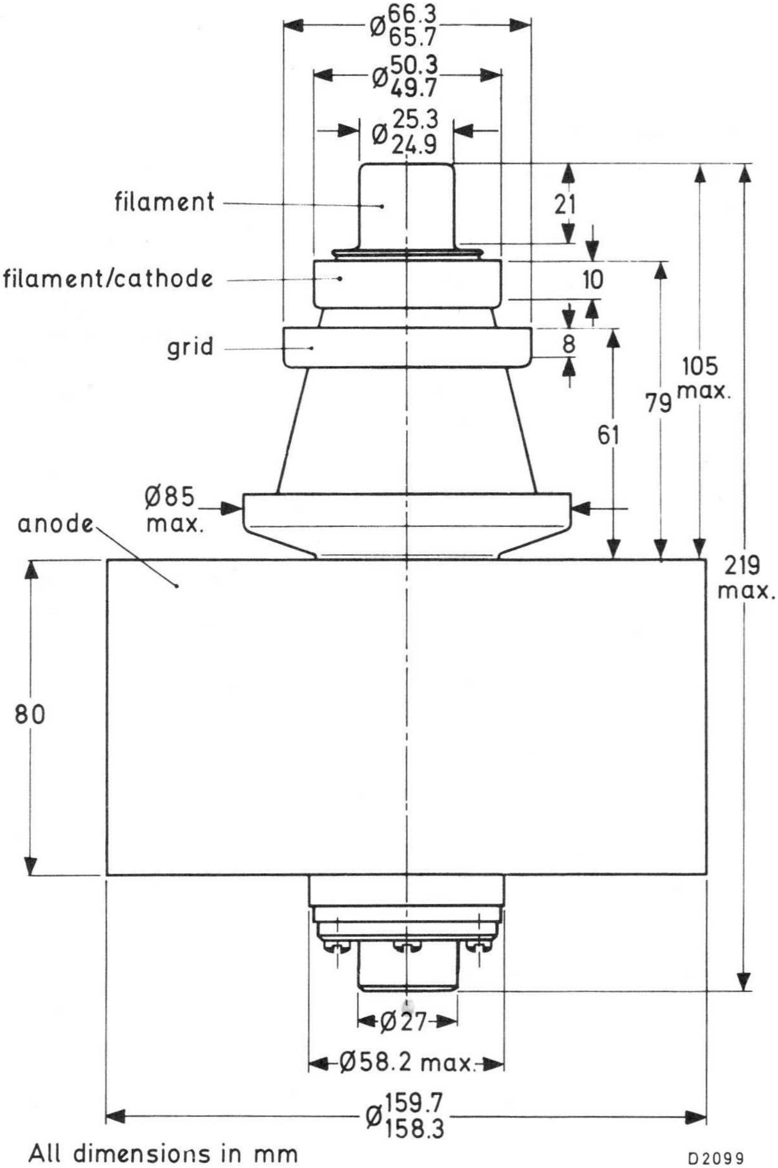
COOLING

Anode - Forced-air cooled

Maximum temperatures

Envelope and all seals	200	^{o}C
Air inlet	45	^{o}C

Anode and grid dissipation	Height above sea level	Inlet temperature	Outlet temperature	Minimum rate of air flow	Pressure difference between inlet and outlet
(kW)	(km)	(^{o}C)	(^{o}C)	(m^3/min)	(mm water)
10	0	35	94	9.5	55
8.0	0	35	105	6.5	28
6.0	0	35	113	4.5	15
4.0	0	35	117	3.0	8.0
10	0	45	98	11	69
8.0	0	45	108	7.6	35
6.0	0	45	115	5.2	19
4.0	0	45	119	3.5	10
10	1.5	35	94	11.4	63
8.0	1.5	35	105	7.8	32
6.0	1.5	35	113	5.5	17
4.0	1.5	35	117	3.6	9.0
10	3.0	25	90	12	62
8.0	3.0	25	102	8.2	32
6.0	3.0	25	111	5.7	17
4.0	3.0	25	116	3.8	9.0



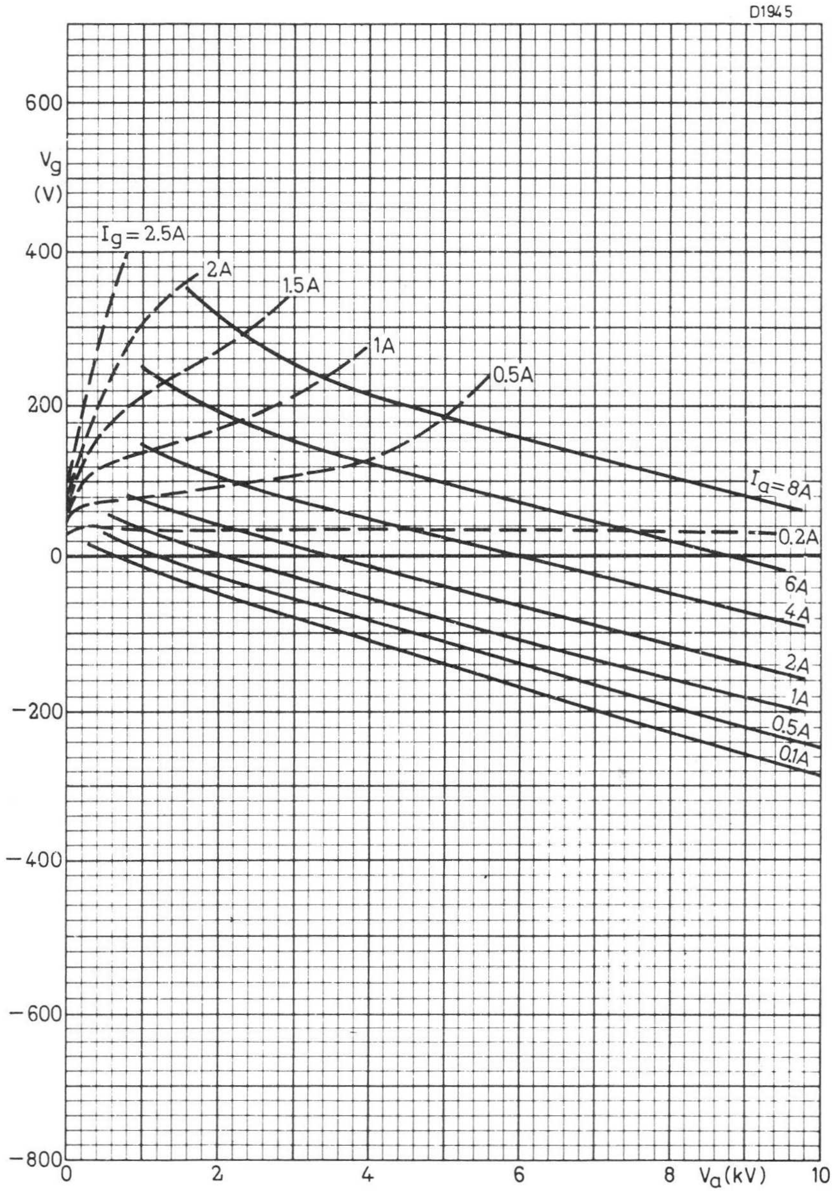
All dimensions in mm

PHYSICAL DATA

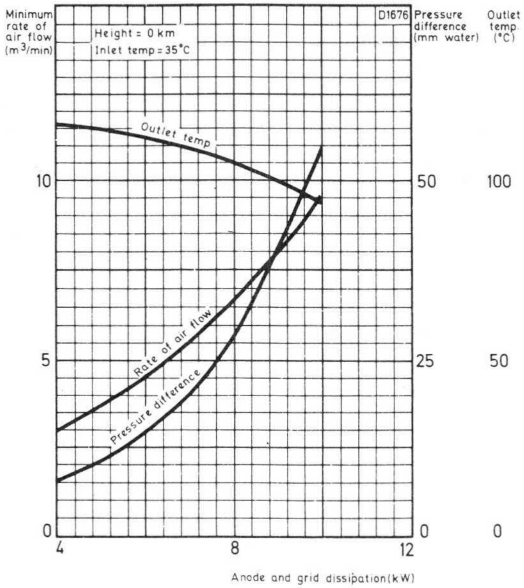
Weight of valve (approx.)	7.5	kg

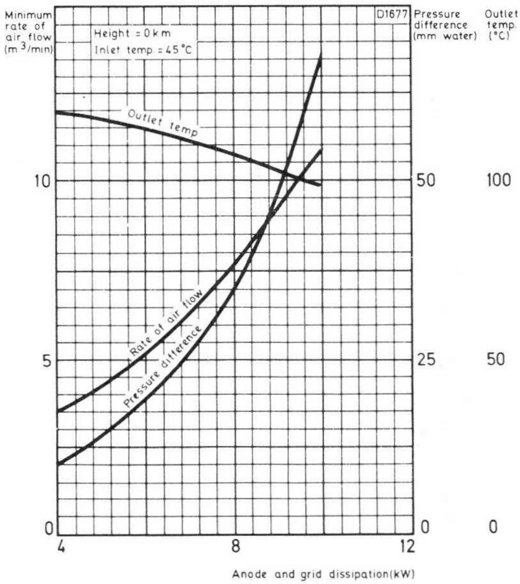
ACCESSORIES

Filament connector	40692
Filament/cathode connector	40693
Grid connector	
f $\leq$4MHz	40690
f >4MHz	40691
Filament cables ×2	40715
Insulating pedestal	40654

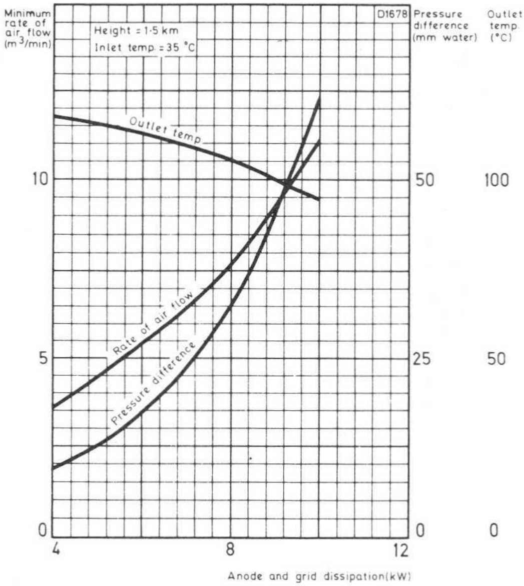


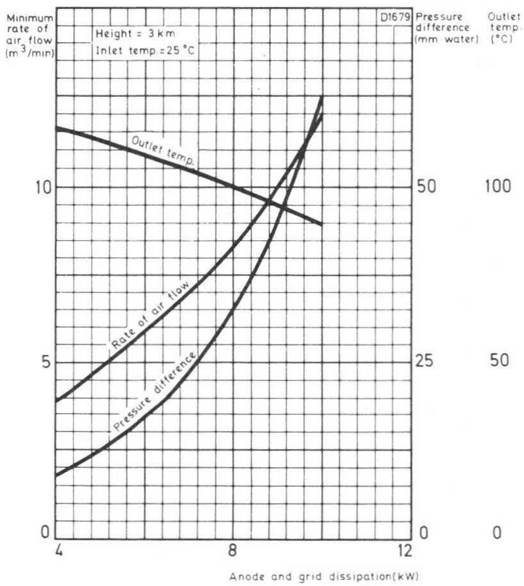
CONSTANT CURRENT CHARACTERISTICS





COOLING CHARACTERISTICS





COOLING CHARACTERISTICS

V.H.F. INDUSTRIAL TRIODE

YD1175

Forced air cooled triode of metal-ceramic construction with integral cooler intended for use as an industrial oscillator.

QUICK REFERENCE DATA

Oscillator output power (W_o - W_{feedb}), typical	W_{osc}		26,5	kW
Frequency for full ratings	f	max.	120	MHz

To be read in conjunction with "General Recommendations Transmitting tubes, Tubes for R.F. heating".

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	120	120	120	MHz
Oscillator output power (W_o - W_{feedb})	W_{osc}	15,6	22	26,5	kW
Anode voltage	V_a	6	8	10	kV
Anode current	I_a	3,6	3,6	3,4	A
Anode input power	W_{ia}	21,6	28,8	34	kW
Anode dissipation	W_a	5,4	6,1	6,8	kW
Anode output power	W_o	16,2	22,7	27,2	kW
Anode efficiency	η_a	75	78,8	80	%
Oscillator efficiency	η_{osc}	72,2	76,3	78	%
Feedback ratio	V_{g_p}/V_{a_p}	12	10	9	%
Grid resistor	R_g	300	400	560	Ω
Grid current, on load	I_g	1	1	0,9	A
Grid voltage, negative	$-V_g$	300	400	500	V
Grid dissipation	W_g	290	290	240	W
Grid resistor dissipation	W_{Rg}	300	400	450	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	120	MHz
Anode voltage	V_a	max.	12	kV
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	40	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	$-V_g$	max.	1,5	kV
Grid current, on load	I_g	max.	1,1	A
off load	I_g	max.	1,6	A
Grid dissipation	W_g	max.	350	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	5	A
peak	I_{k_p}	max.	25	A
Envelope temperature	t_{env}	max.	240	°C

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f		5,8	V
Filament current	I_f		130	A
Peak filament starting current	I_{f_p}	max.	800	A
Cold filament resistance	R_{f_o}		5,6	mΩ

The filament is designed to accept temporary fluctuations of +5% and -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so it must be borne in mind that the filament voltage-to-current ratio measured with only the filament voltage applied should remain constant under all operating conditions.

It is extremely important that the filament be properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded-grid circuits this resonance should be below the grid-cathode resonance. For further information please see Application Book "Tubes for R.F. heating" or contact the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	0,4	pF
Grid to filament	C_{gf}	47	pF
Anode to grid	C_{ag}	17	pF

CHARACTERISTICS measured at V_a = 12 kV, I_a = 2 A

Transconductance	S	33	mA/V
Amplification factor	μ	44	

COOLING

See also cooling curves

Anode + grid dissipation $W_a + W_g$ (kW)	Altitude h (m)	Inlet temperature t_i (°C)	Rate of flow q min. (m^3/min)	Pressure drop p_i (mm H_2O)	Outlet temperature t_o (°C)
10	0	35	9,5	55	94
8	0	35	6,5	28	105
6	0	35	4,5	15	113
4	0	35	3,0	8	117
10	0	45	11,0	69	98
8	0	45	7,6	35	108
6	0	45	5,2	19	115
4	0	45	3,5	10	119
10	1500	35	11,4	63	94
8	1500	35	7,8	32	105
6	1500	35	5,5	17	113
4	1500	35	3,6	9	117
10	3000	25	12,0	62	90
8	3000	25	8,2	32	102
6	3000	25	5,7	17	111
4	3000	25	3,8	9	116

Absolute max. air inlet temperature t_i max. 45 °C

At the lower values of anode dissipation and at the highest operating frequencies additional cooling of the seals is required.

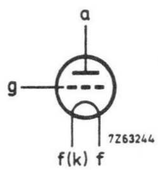
To obtain optimum life, the seal/envelope temperature under continuously loaded conditions should be kept at or below 200 °C.

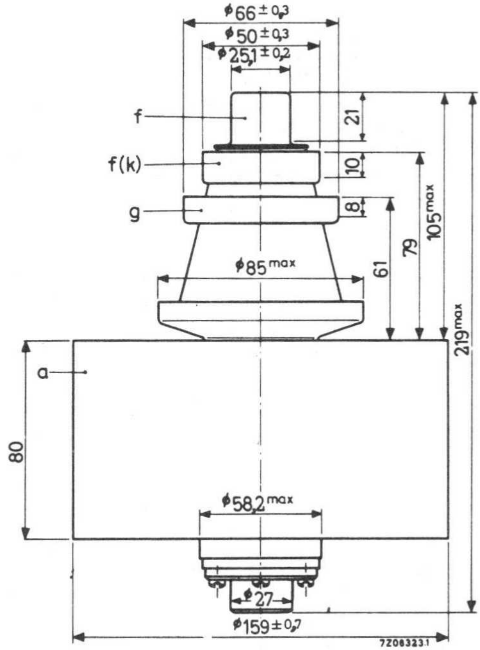
Direction of airflow: arbitrary.

MECHANICAL DATA Dimensions in mm

Mounting position : vertical with anode up or down

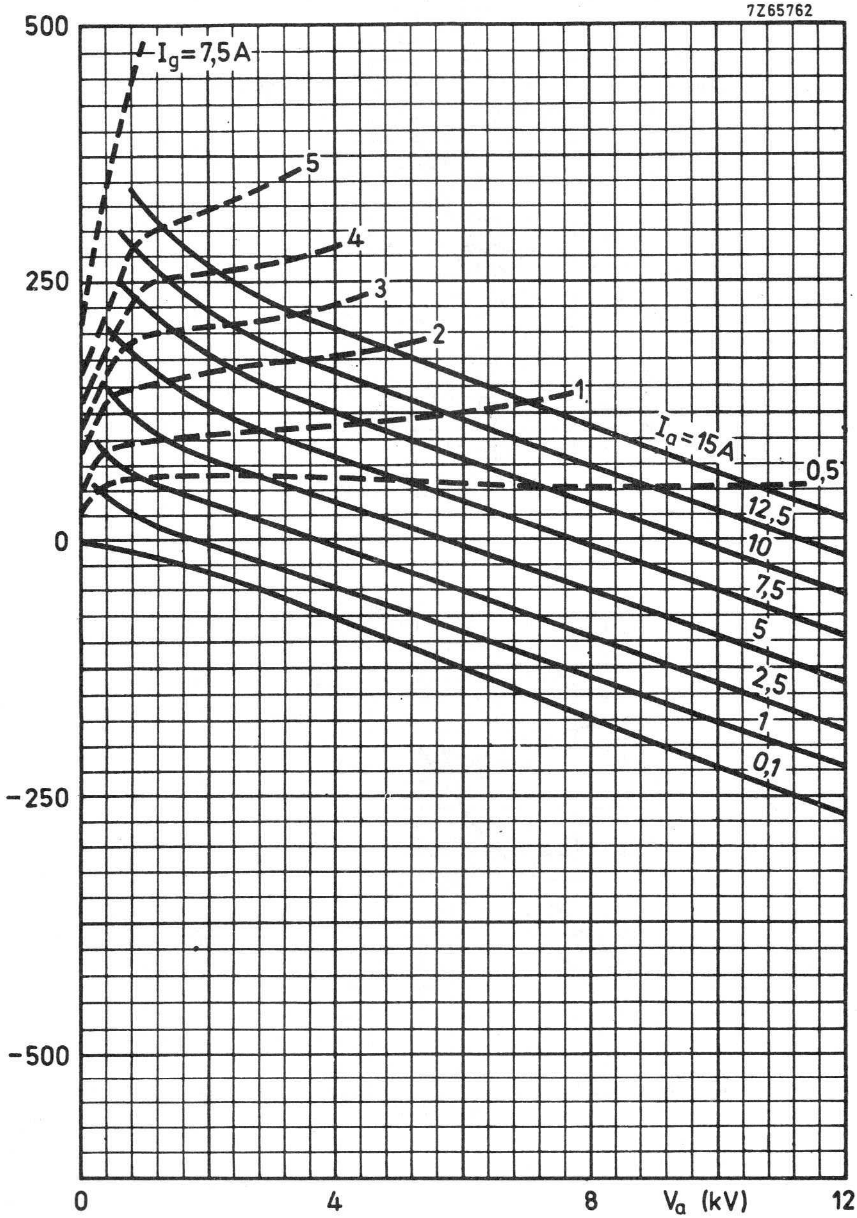
Net weight : approx. 7,5 kg





ACCESSORIES

Filament connector with cable	type	40692	net weight	450	g
Filament/cathode connector with cable	type	40693	net weight	490	g
Grid connector f ≤ 4 MHz	type	40690	net weight	55	g
f > 4 MHz	type	40691	net weight	240	g
Insulating pedestal	type	40654	net weight	4,25	kg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-250
-500
I_g=7,5A
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4
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2
1
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I_a=15A
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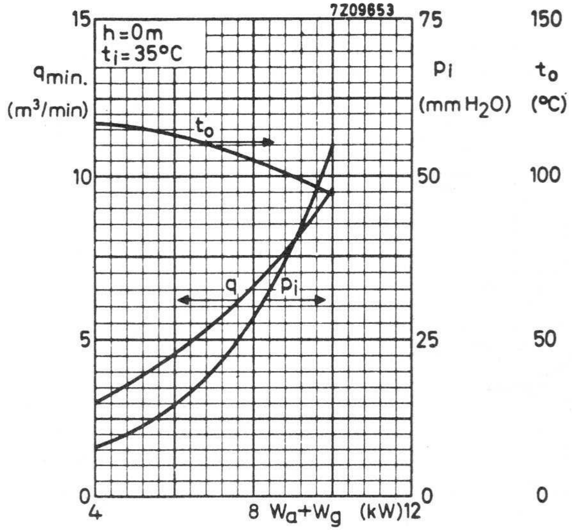
7,5
5
2,5
1
0,1
0
4
8
V_a (kV)
12


7Z09653
h=0m
t_i=35°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
(mm H_2O)
t_o
(°C)
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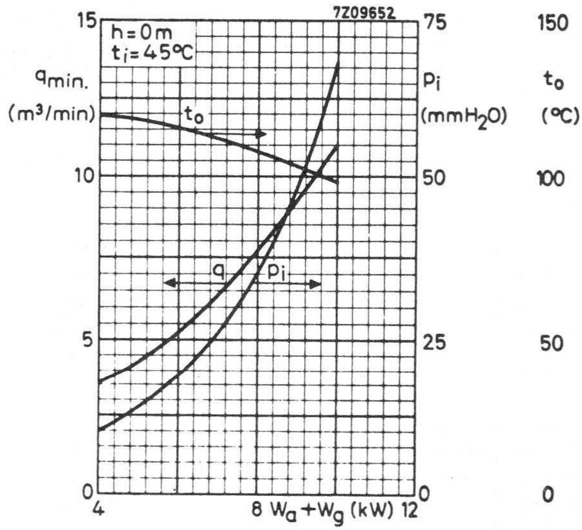
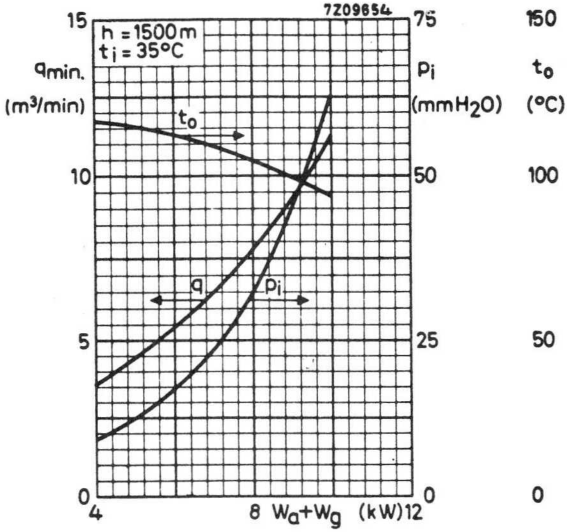
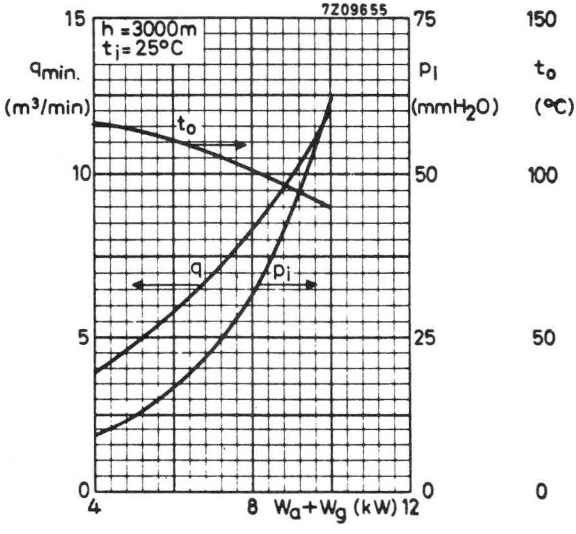
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


7Z09652
h=0m
t_i=45°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
(mmH_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


7Z09654
h = 1500 m
t_i = 35°C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12
q
p_i
t_o


7Z09655
h = 3000 m
t_i = 25°C
$q_{min.}$
(m³/min)
p_i
(mmH₂O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12
q
p_i
t_o

V.H.F. INDUSTRIAL TRIODE

YD1177

Water-cooled triode of metal-ceramic construction with integral helical cooler intended for use as an industrial oscillator

QUICK REFERENCE DATA

Oscillator output power (W_o - W_{feedb}), typical	W_{osc}	26,5	kW
Frequency for full ratings	f max	120	MHz

To be read in conjunction with "General Operational Recommendations Transmitting tubes, Tubes for R.F. heating"

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	120	120	120	MHz
Oscillator output power (W_o - W_{feedb})	W_{osc}	15,6	22,0	26,5	kW
Anode voltage	V_a	6	8	10	kV
Anode current	I_a	3,6	3,6	3,4	A
Anode input power	W_{ia}	21,6	28,8	34,0	kW
Anode dissipation	W_a	5,4	6,1	6,8	kW
Anode output power	W_o	16,2	22,7	27,2	kW
Anode efficiency	η_a	75	78,8	80	%
Oscillator efficiency	η_{osc}	72,2	76,3	78,0	%
Feedback ratio	V_{gp}/V_{ap}	12	10	9	%
Grid resistor	R_g	300	400	560	Ω
Grid current, on load	I_g	1,0	1,0	0,9	A
Grid voltage, negative	$-V_g$	300	400	500	V
Grid dissipation	W_g	290	290	240	W
Grid desistor dissipation	W_{R_g}	300	400	450	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	120	MHz [1]
Anode voltage	V_a	max.	12	kV
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	40	kW
Anode dissipation	W_a	max.	15	kW
Grid voltage	$-V_g$	max.	1,5	kV
Grid current, on load	I_g	max.	1,1	A
off load	I_g	max.	1,6	A
Grid dissipation	W_g	max.	350	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	5	A
peak	I_{kp}	max.	25	A
Envelope temperature	t_{env}	max.	240	^oC

HEATING : direct; filament thoriated tungsten.

Filament voltage	V_f		5,8	V
Filament current	I_f		130	A
Peak filament starting current	I_{fp}	max.	800	A
Cold filament resistance	R_{f_o}		5,6	mΩ

The filament is designed to accept temporary fluctuations of + 5 % and − 10 %

To ensure that the cathode temperature remains constant irrespective of the operating frequency it may be necessary to reduce the filament voltage at higher frequencies. When doing so it must be borne in mind that the filament voltage-to-current ratio, as measured with only the filament voltage applied, should remain constant under all operating conditions

It is extremely important that the filament be properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded-grid circuits this resonance should be below the grid-cathode resonance. For further information please see Application Book "Tubes for R.F. heating" or contact the manufacturer.

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[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.

CAPACITANCES

Anode to filament	C_{af}	0,4	pF
Grid to filament	C_{gf}	47	pF
Anode to grid	C_{ag}	17	pF

CHARACTERISTICS at V_a = 12 kV, I_a = 2 A

Transconductance	S	33	mA/V
Amplification factor	μ	44	

COOLING

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (^oC)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa)	Outlet temperature t_o (^oC)
15	20	7,5	50	50
	50	11,0	100	71
10	20	5,0	24	51
	50	7,2	47	72
5	20	2,5	7	53
	50	3,7	17	73

Absolute max. water inlet temperature t_i max 50 ^oC

At frequencies > 4 MHz, air-cooling of the seals becomes mandatory.

To obtain optimum life, the seal/envelope temperature under continuously loaded conditions should be kept at or below 200 ^oC

ACCESSORIES

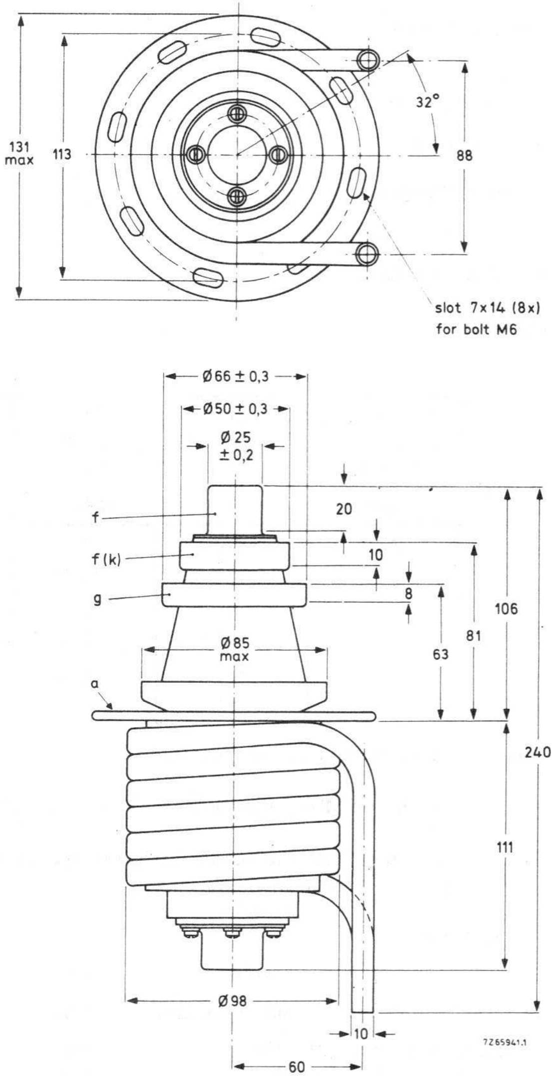
Filament connector with cable	type	40692	net weight	450	g
Filament/cathode connector with cable	type	40693	net weight	480	g
Grid connector f ≤ 4 MHz	type	40690	net weight	55	g
f > 4 MHz	type	40691	net weight	240	g

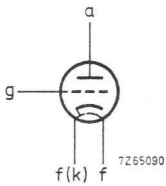
MECHANICAL DATA

Dimensions in mm

Mounting position: Vertical with anode up or down

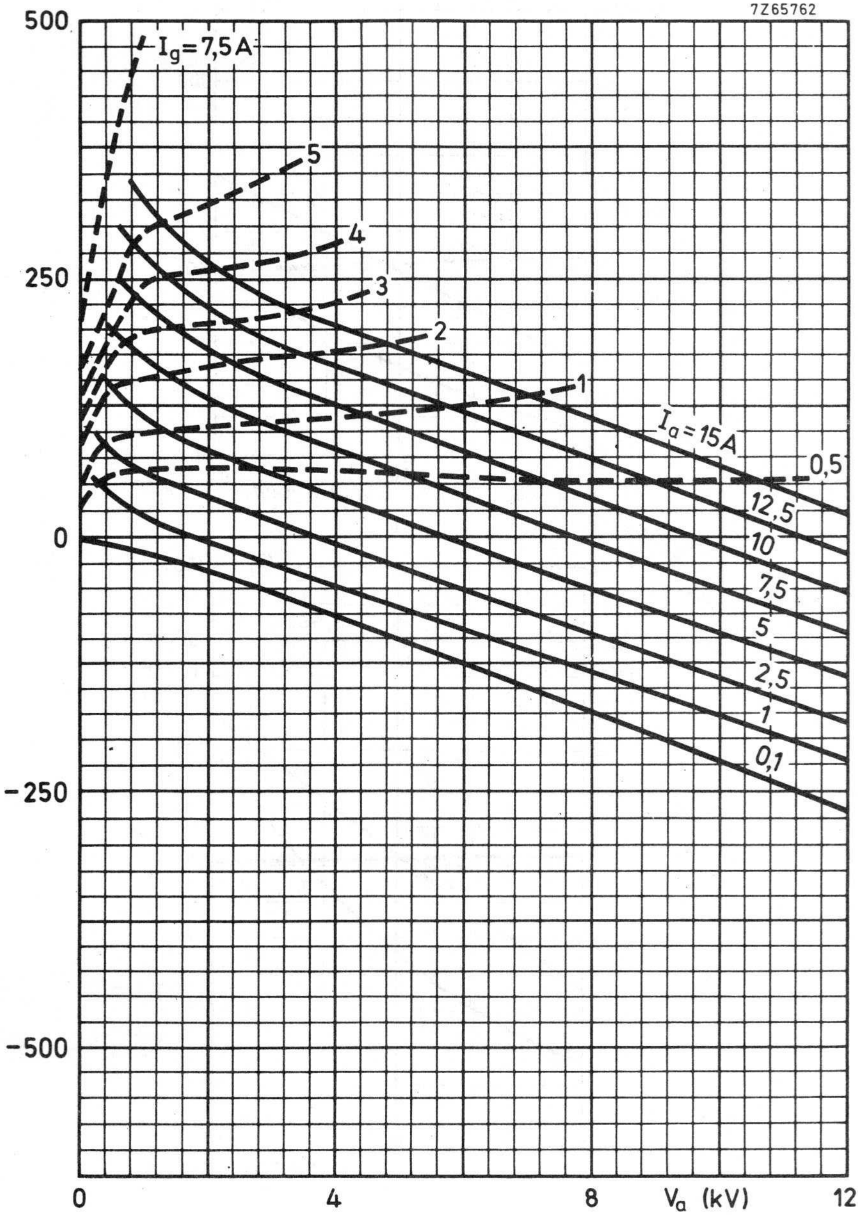
Net weight: approx. 6,5 kg

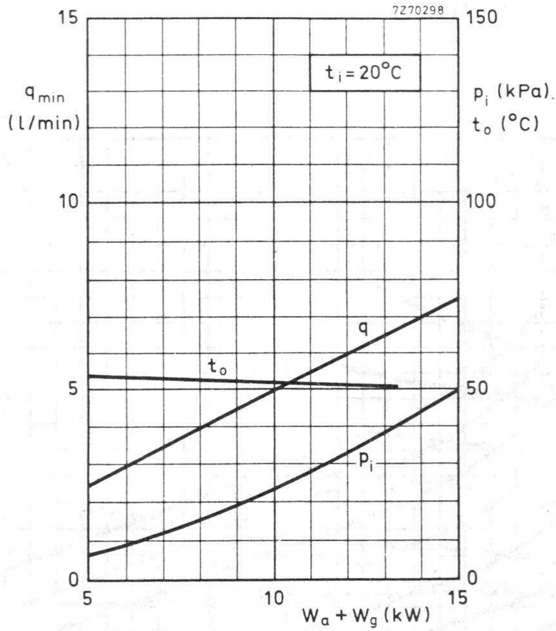


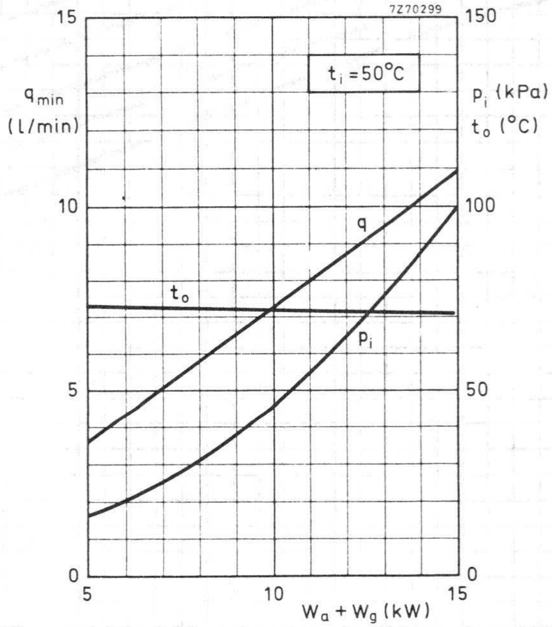


With the anode up the water connections should be interchanged.

7Z65762


500
250
0
-250
-500
I_g=7,5A
5
4
3
2
1
0,5
I_a=15A
12,5
10
7,5
5
2,5
1
0,1
0
4
8
V_a (kV)
12


7Z70298
$t_i = 20°C$
q_{min} (l/min)
p_i (kPa)
t_o (°C)
q
t_o
p_i
$W_a + W_g$ (kW)
15
10
5
0
150
100
50
0
5
10
15


7Z70299
$t_i = 50°C$
q_{min} (l/min)
p_i (kPa)
t_o (°C)
q
t_o
p_i
$W_a + W_g$ (kW)
15
10
5
0
150
100
50
0
5
10
15

R.F. INDUSTRIAL TRIODES

YD1180
YD1182

QUICK REFERENCE DATA

External anode triodes of ceramic-metal construction, intended for use as industrial oscillators.

YD1180 is forced-air cooled.

YD1182 is water cooled by an integral cooler.

f	90	MHz
P_{out} (less P_{drive})	31.6	kW
f max.	100	MHz
V_a max.	9.0	kV
p_a max.		
YD1180	15	kW
YD1182	20	kW

Unless otherwise stated, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

OPERATING CONDITIONS

f	90	MHz
P_{out}	33	kW
P_{out} (less P_{drive})	31.6	kW
η_a	81.5	%
η_{osc}	78.0	%
V_a	7.5	kV
I_a	5.4	A
$-V_g$	652	V
I_g on load	1.45	A
R_{g-f}	450	Ω
Feedback ratio $v_g(pk)/v_a(pk)$	0.15	
p_a	7.5	kW
p_g	450	W
P_{Rg}	946	W
P_{in}	40.5	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	100	MHz
V_a max.	9.0	kV
P_{in} max.	45	kW
$-V_g$ max.	1.25	kV
I_g max. on load	1.6	A
off load	2.4	A
I_a max.	6.0	A
I_k max.	7.5	A
i_k(pk) max.	40	A
p_a max.		
YD1180	15	kW
YD1182	20	kW
p_g max.	500	W
R_{g-f} max.	10	kΩ

CATHODE

Directly heated, thoriated tungsten, mesh construction

$*V_f$	7.0	V
I_f	175	A
i_f(pk) max.	1.0	kA
r_f (cold)	4.2	mΩ

*The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so, it must be borne in mind that the filament voltage-to-current ratio measured under all operating conditions should be the same as when only the normal filament voltage was applied.

It is extremely important that the filament is properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded grid circuits this resonance should be below the grid-cathode resonance. For further information please contact Mullard Ltd.

CAPACITANCES

c_{a-f}	1.0	pF
c_{a-g}	32	pF
c_{g-f}	61	pF

CHARACTERISTICS (measured at V_a = 7.5kV, I_a = 3.2A)

g_m	40	mA/V
μ	50	

MOUNTING POSITION

Vertical, anode up or down.

COOLING

Anode

YD1180 - forced-air.

YD1182 - water cooled by an integral cooler.

Seals

At frequencies above 4MHz a low velocity air flow should be directed at the filament and grid seals.

Temperatures (absolute maximum)

Envelope	200	°C
YD1180 air inlet	45	°C
YD1182 water inlet	50	°C

YD1180 COOLING CHARACTERISTICS

See curves on pages 8 and 9.

With insulating pedestal type 40648.

Anode and grid dissipation (kW)	Height above sea level (m)	Inlet air temperature (°C)	Minimum rate of air flow (m^3/min)	Pressure difference (mm water)	Outlet temperature (°C)
15	0	35	15	85	92
10	0	35	9.3	32	99
8	0	35	7	20	104
15	0	45	17.3	106	98
10	0	45	10.7	40	104
8	0	45	8.1	25	108
15	1500	35	18	97	93
10	1500	35	11.2	46	100
8	1500	35	8.4	23	104
15	3000	25	19	95	90
10	3000	25	11.8	45	95
8	3000	25	8.9	23	99

YD1182 COOLING CHARACTERISTICS

See curves on page 10

Anode and grid dissipation (kW)	Inlet water temperature (^oC)	Outlet water temperature (^oC)	Minimum rate of water flow (ℓ/min)	Pressure drop (atm)
20	20	51	10	0.40
	50	71	15	0.80
15	20	54	7.5	0.22
	50	73	10.5	0.43
10	20	58	4.5	0.10
	50	75	6.7	0.20

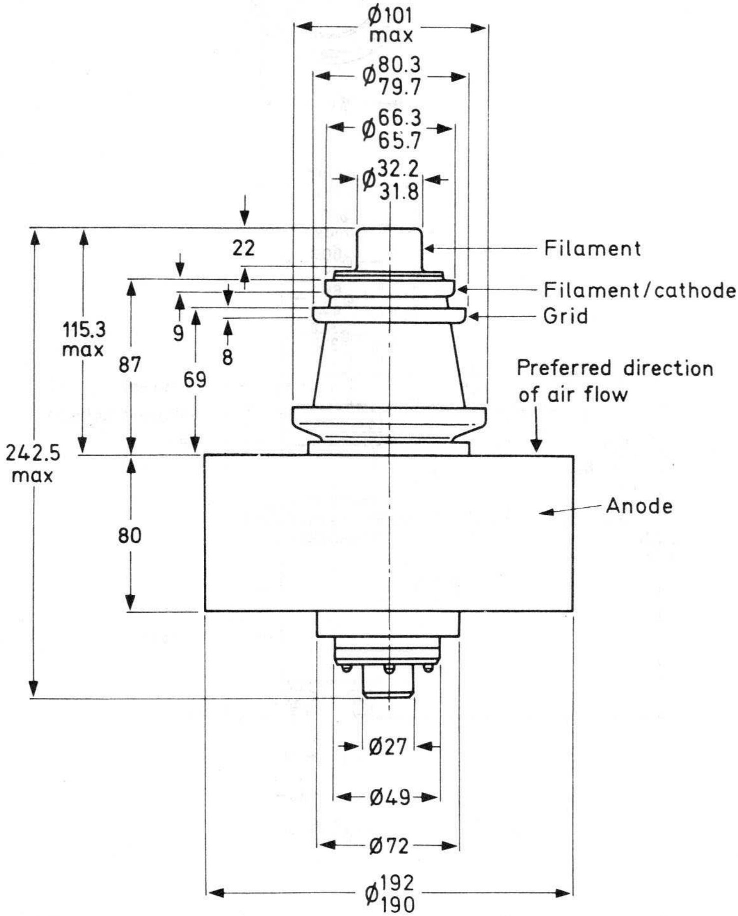
PHYSICAL DATA

	YD1180	YD1182	
Weight of tube (approx.)	12.1	3.0	kg
Weight of insulating pedestal	7.15		kg

ACCESSORIES

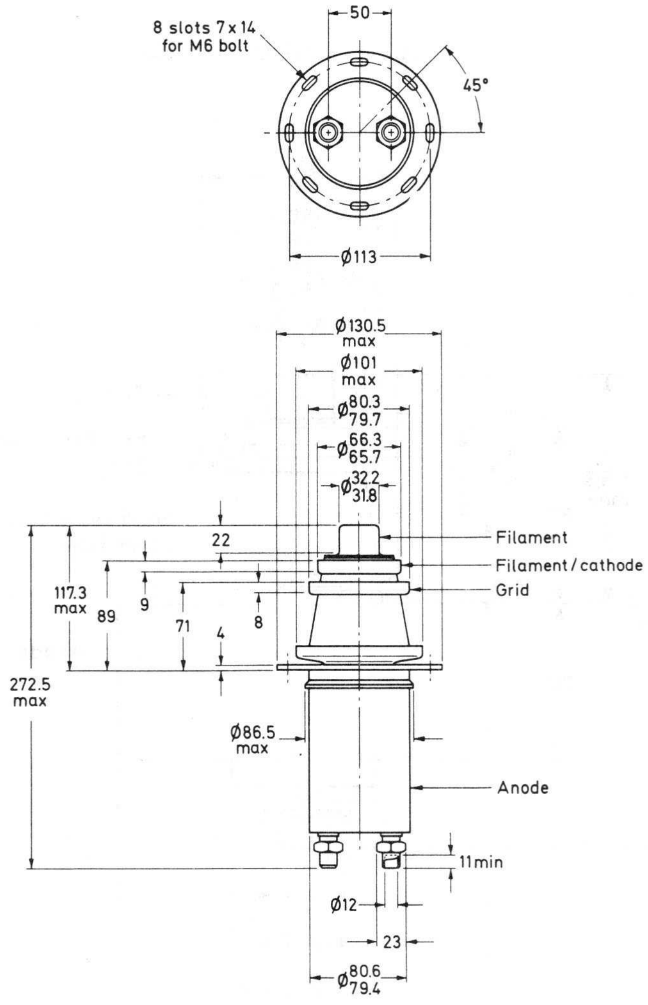
Filament connector		40708
Filament/cathode connector		40709
Grid connector	$f \leq 4MHz$	40710
	$f > 4MHz$	40711
Filament cables (two required)		40720
Insulating pedestal (YD1180)		40648

OUTLINE DRAWING OF YD1180



All dimensions in mm

D4318

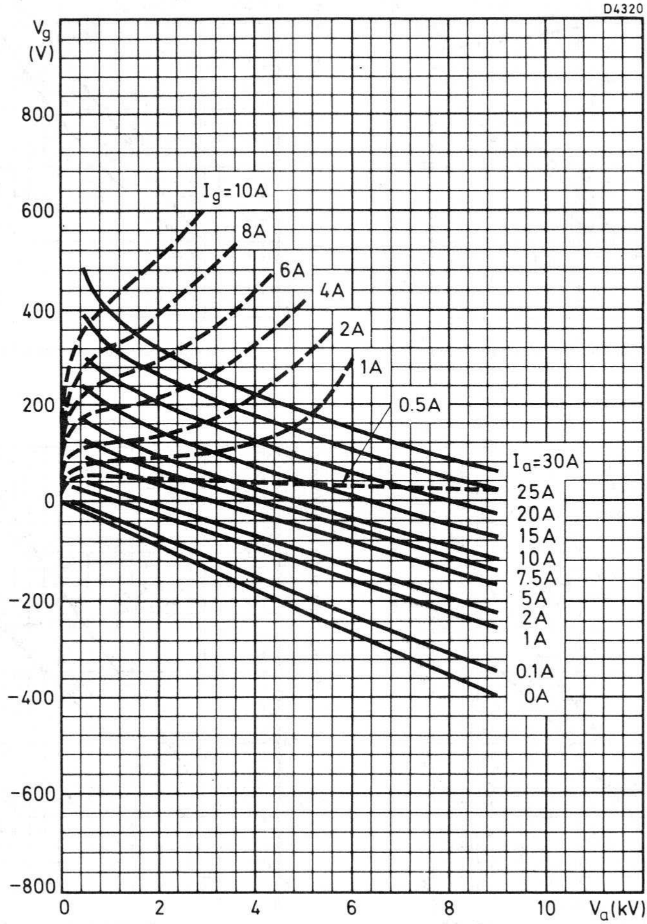


All dimensions in mm

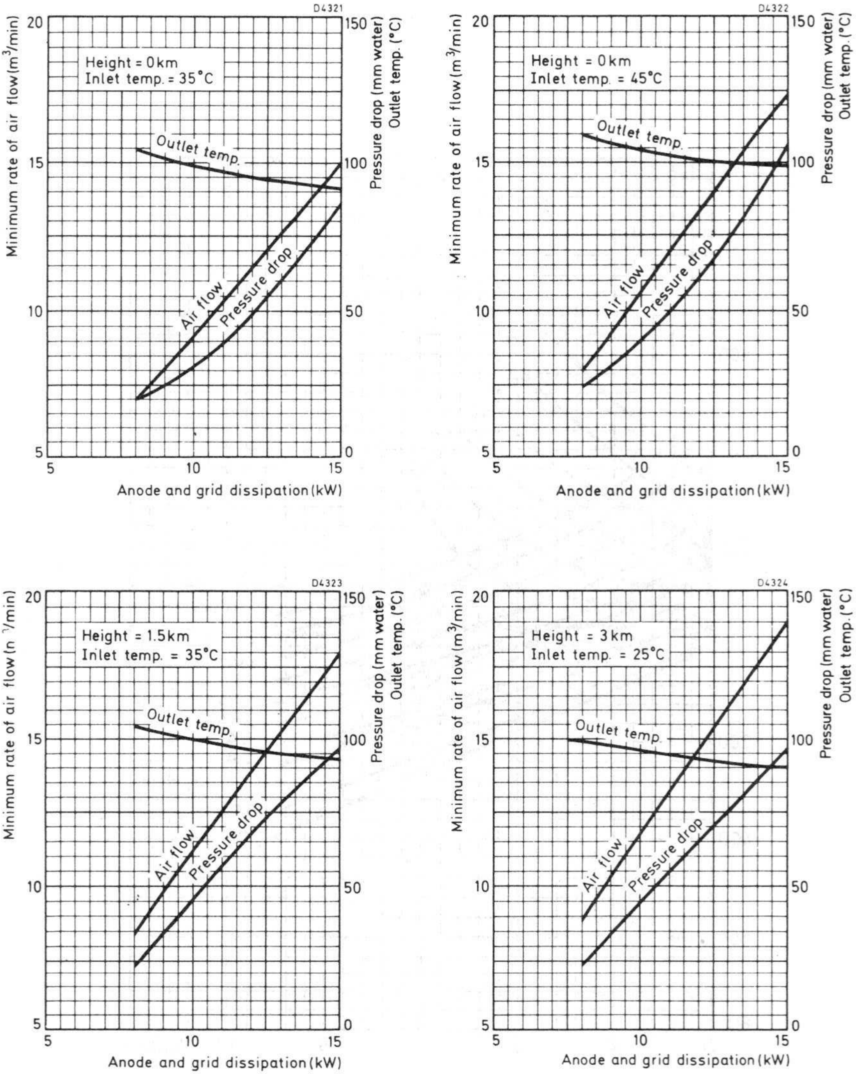
D4319

When tube is used with anode up, the water connections should be interchanged.

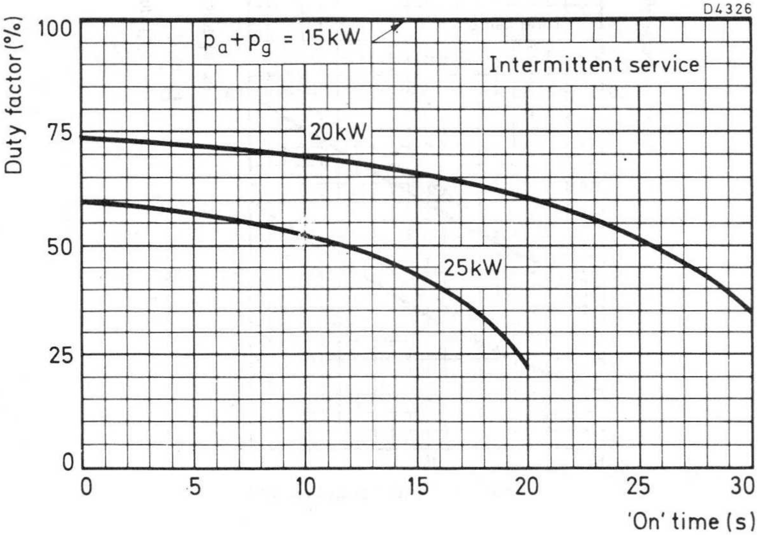
Water inlet and outlet connections are British Standard Pipe $\frac{1}{2}$ in. thread.

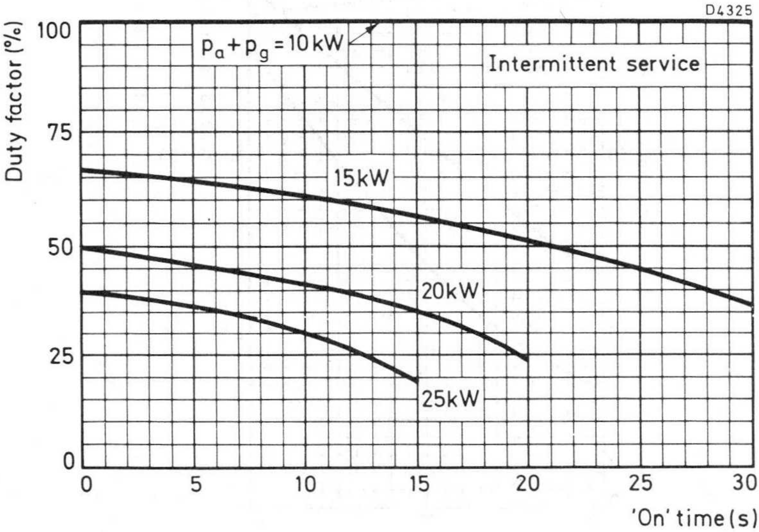


Constant current characteristics

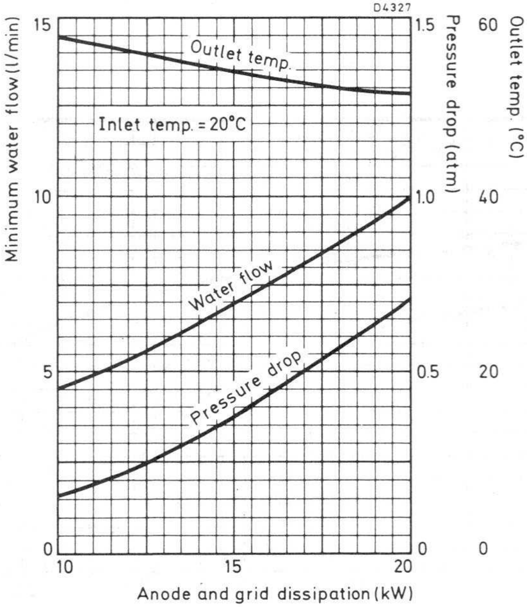


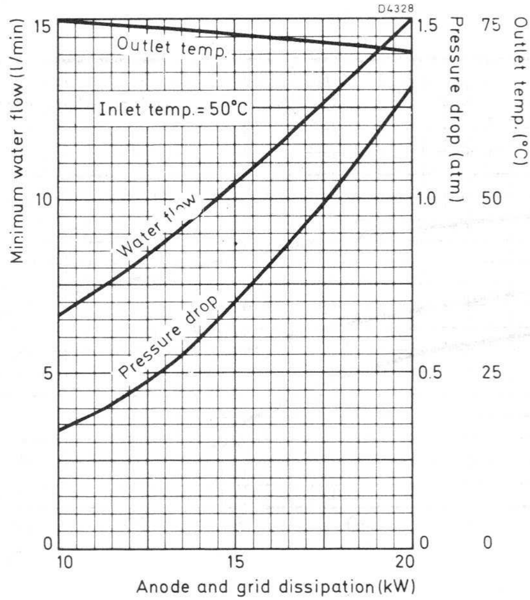
COOLING CHARACTERISTICS OF YD1180





YD1180 Effect of duty factor on cooling for 15 and 10kW continuous service conditions





COOLING CHARACTERISTICS OF YD1182

R.F. INDUSTRIAL TRIODES

YD1185
YD1187

QUICK REFERENCE DATA

External anode triodes of ceramic metal construction, intended for use as industrial oscillators.

YD1185 is forced-air cooled.

YD1187 is water cooled by an integral cooler.

f	90	MHz
P_{out} (less P_{drive})	50	kW
f max.	100	MHz
V_a max.	14.4	kV
p_a max.		
YD1185	15	kW
YD1187	20	kW

Unless otherwise stated, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

f	90	90	90	MHz
P_{out}	34.5	41.2	51.2	kW
P_{out} (less P_{drive})	33.4	40	50	kW
η_a	75.1	77.3	80	%
η_{osc}	72.7	75	78.1	%
V_a	8.5	10	12	kV
I_a	5.4	5.33	5.33	A
$-V_g$	495	580	600	V
I_g on load	1.5	1.45	1.4	A
R_{g-f}	330	400	430	Ω
Feedback ratio $v_g(pk)/v_a(pk)$	0.11	0.10	0.09	
p_a	11.4	12.1	12.8	kW
p_g	400	380	360	W
P_{Rg}	740	840	840	W
P_{in}	45.9	53.3	64	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	100	MHz
V_a max.	14.4	kV
P_{in} max.	72	kW
$-V_g$ max.	1.5	kV
I_g max. on load	1.6	A
off load	2.4	A
I_a max.	6.0	A
I_k max.	7.5	A
i_k(pk) max.	40	A
p_a max.		
YD1185	15	kW
YD1187	20	kW
p_g max.	500	W
R_{g-f} max.	10	kΩ

CATHODE

Directly heated, thoriated tungsten, mesh construction

$^*V_f$	7.0	V
I_f	175	A
i_f(pk) max.	1.0	kA
r_f (cold)	4.2	mΩ

*The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so, it must be borne in mind that the filament voltage-to-current ratio measured under all operating conditions should be the same as when only the normal filament voltage was applied.

It is extremely important that the filament is properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded grid circuits this resonance should be below the grid-cathode resonance. For further information please contact Mullard Ltd.

CAPACITANCES

c_{a-f}	1.0	pF
c_{a-g}	22	pF
c_{g-f}	61	pF

CHARACTERISTICS (measured at V_a = 12kV, I_a = 2.0A)

g_m	40	mA/V
μ	50	

MOUNTING POSITION

Vertical, anode up or down

COOLING

Anode

YD1185 - forced-air.

YD1187 - water cooled by an integral cooler. At frequencies above 4MHz a low velocity air flow should be directed at the filament and grid seals.

Temperatures (absolute maximum)

Envelope	200	^{o}C
YD1185 air inlet	45	^{o}C
YD1187 water inlet	50	^{o}C

YD1185 COOLING CHARACTERISTICS

See curves on page 8.

With insulating pedestal type 40648.

Anode and grid dissipation (kW)	Height above sea level (m)	Inlet air temperature (^{o}C)	Minimum rate of air flow (m^3/min)	Pressure difference (mm water)	Outlet temperature (^{o}C)
15	0	35	15	85	92
10	0	35	9.3	35	99
8	0	35	7	22	104
15	0	45	17.3	106	98
10	0	45	10.7	44	104
8	0	45	8.1	27	108
15	1500	35	18	97	93
10	1500	35	11.2	40	100
8	1500	35	8.4	25	104
15	3000	25	19	95	90
10	3000	25	11.8	39	95
8	3000	25	8.9	25	99

YD1187 COOLING CHARACTERISTICS

Anode and grid dissipation (kW)	Inlet water temperature (^oC)	Outlet water temperature (^oC)	Minimum rate of water flow (ℓ/min)	Pressure drop (atm)
20	20	51	10	0.40
	50	71	15	0.80
15	20	54	7	0.22
	50	73	10.5	0.43
10	20	58	4.5	0.10
	50	75	6.7	0.20

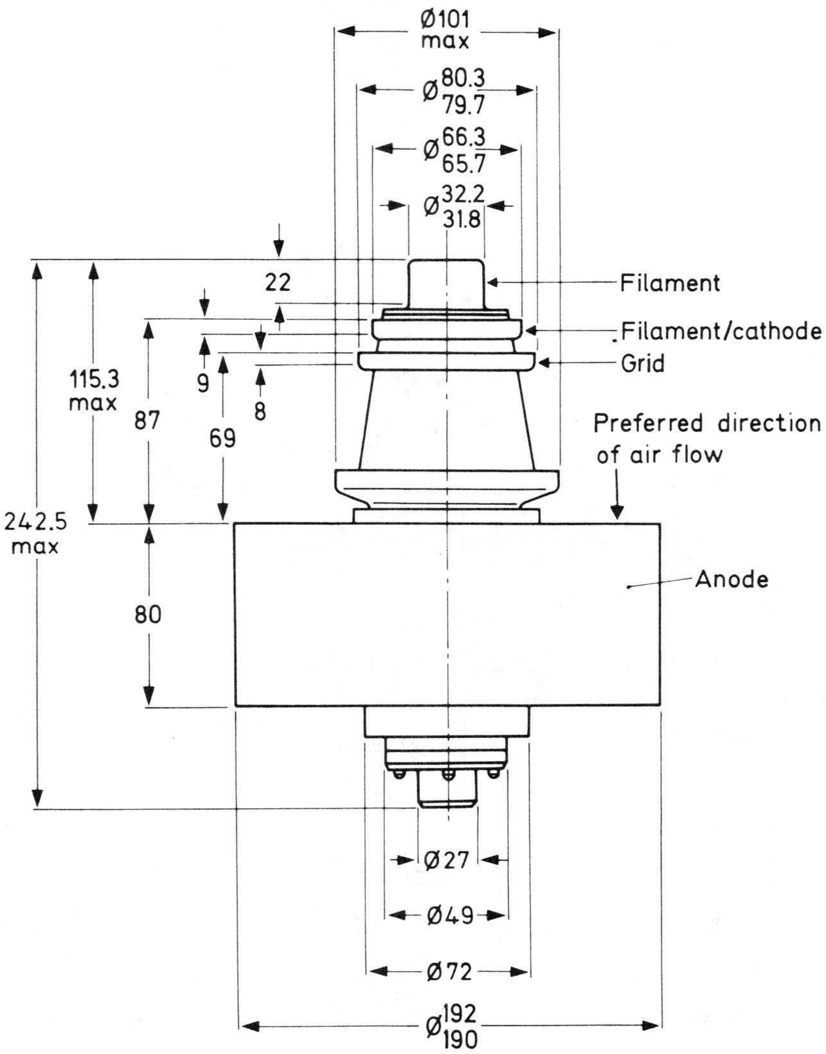
PHYSICAL DATA

	YD1185	YD1187	
Weight of tube (approx.)	12	3.0	kg
Weight of insulating pedestal	7.15	-	kg

ACCESSORIES

Filament connector	40708
Filament/cathode connector	40709
Grid connector	40711
Filament cables (two required)	40712
Insulating pedestal (YD1185)	40648

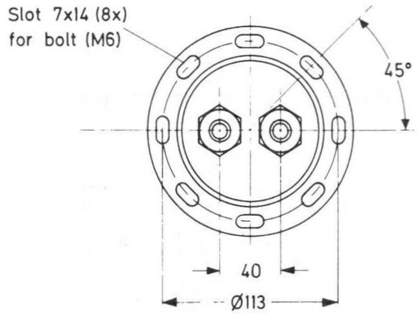
OUTLINE DRAWING OF YD1185

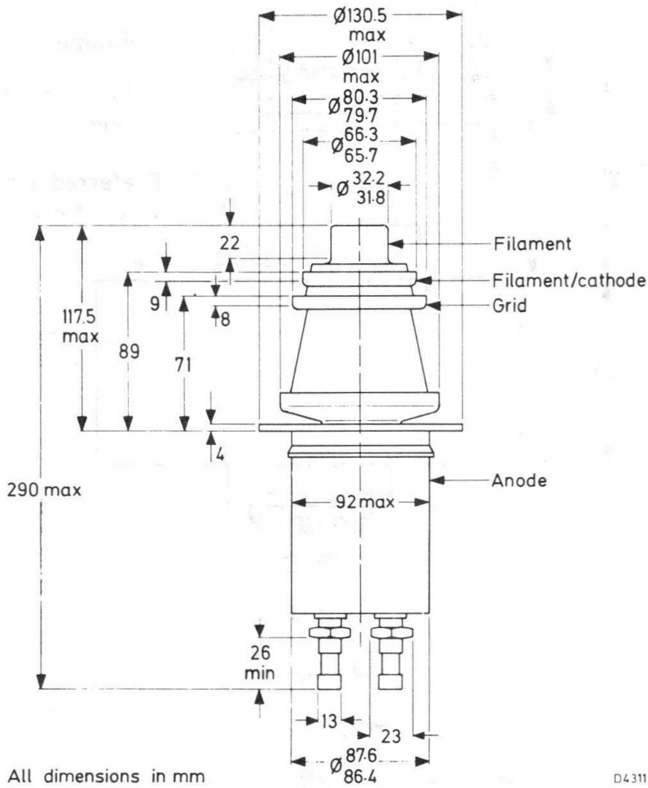


All dimensions in mm

D4310

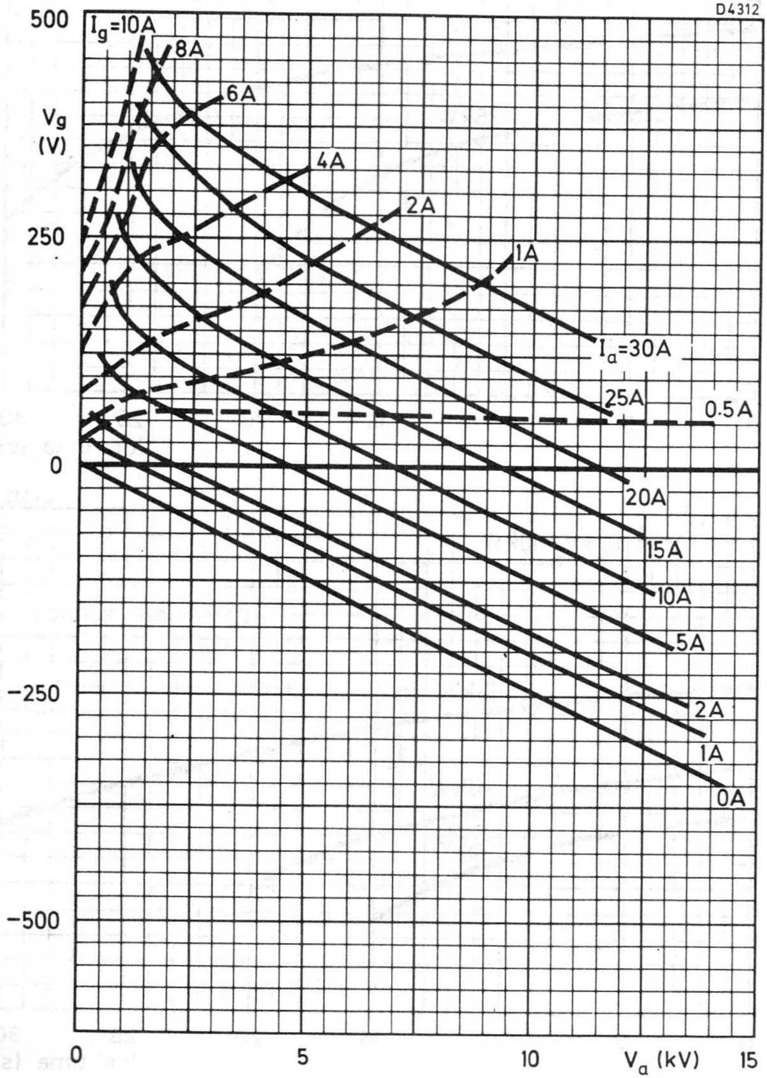
OUTLINE DRAWING OF YD1187



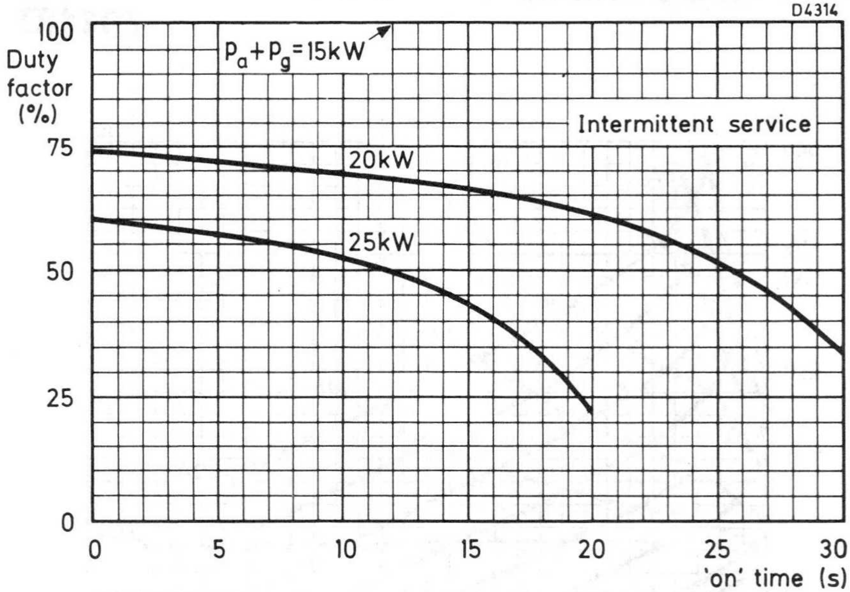


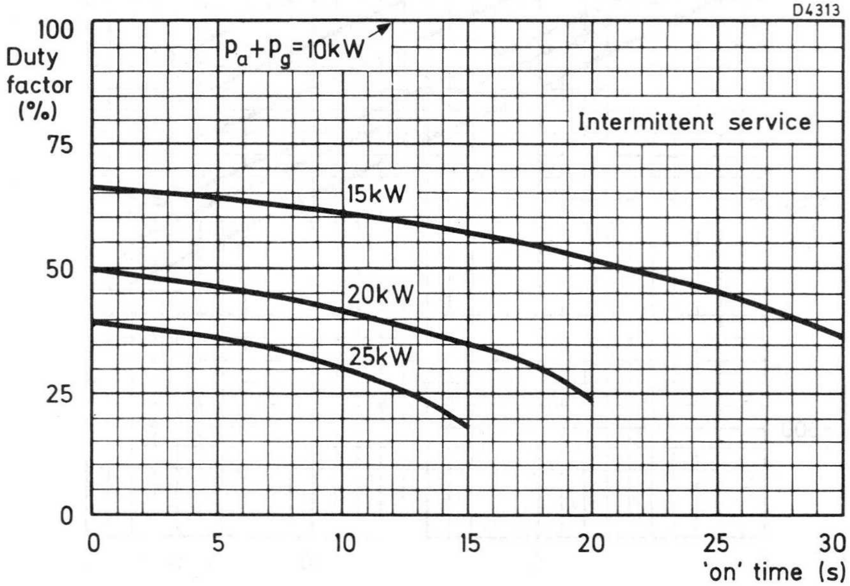
All dimensions in mm

When tube is used with anode up, the water connections should be interchanged.



Constant current characteristics





YD1185 Effect of duty factor on cooling for
15 and 10kW continuous service conditions

R.F. INDUSTRIAL TRIODES

YD1195
YD1197

QUICK REFERENCE DATA

External anode triodes of ceramic-metal construction, intended for use as industrial oscillators.

YD1195 is forced-air cooled.

YD1197 is water cooled by an integral cooler.

f		30	MHz
P_{out} (less P_{drive})		90	kW
*f max.		100	MHz
V_a max.		14.4	kV
p_a max.			
	YD1195	30	kW
	YD1197	40	kW

*For use at frequencies above 30MHz, Mullard Ltd should be consulted for more detailed information.

Unless otherwise stated, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

f	30	30	30	MHz
P_{out}	62.6	76	92.1	kW
P_{out} (less P_{drive})	60.6	74	90	kW
η_a	73.6	76	78.8	%
η_{osc}	71.2	74	77	%
V_a	8.5	10	12	kV
I_a	10	10	9.75	A
$-V_g$	500	550	600	V
I_g on load	2.4	2.3	2.3	A
R_{g-f}	210	240	260	Ω
Feedback ratio $v_g(pk)/v_a(pk)$	0.13	0.11	0.09	
p_a	22.4	24	24.9	kW
p_g	760	730	720	W
P_{Rg}	1.2	1.27	1.38	kW
P_{in}	85	100	117	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

*f max.	100	MHz
V_a max.	14.4	kV
P_{in} max.	144	kW
$-V_g$ max.	1.5	kV
I_g max. on load	2.5	A
off load	3.5	A
I_a max.	12	A
I_k max.	14	A
i_k(pk) max.	70	A
p_a max.		
YD1195	30	kW
YD1197	40	kW
p_g max.	1.0	kW
R_{g-f} max.	10	kΩ

*For use at frequencies above 30MHz, Mullard Ltd should be consulted for more detailed information.

CATHODE

Directly heated, thoriated tungsten, mesh construction

$^{**}V_f$	8.4	V
I_f	235	A
i_f(pk) max.	1.5	kA
r_f (cold)	3.9	mΩ

**The filament has been designed to accept temporary fluctuations of supply voltage +5 and -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so, it must be borne in mind that the filament voltage-to-current ratio measured under all operating conditions should be the same as when only the normal filament voltage was applied.

It is extremely important that the filament is properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded grid circuits this resonance should be below the grid-cathode resonance. For further information please contact Mullard Ltd.

CAPACITANCES

c_{a-f}	1.2	pF
c_{a-g}	33	pF
c_{g-f}	100	pF

CHARACTERISTICS

g_m	80	mA/V
μ	50	

COOLING

Anode

YD1195 - forced air.

YD1197 - water cooled by an integral cooler

Seals

At frequencies above 4MHz a low velocity air flow should be directed at the filament and grid seals.

Temperatures (absolute maximum)

Envelope	200	^{o}C
YD1195 air inlet	45	^{o}C
YD1197 water inlet	50	^{o}C

YD1195 COOLING CHARACTERISTICS

See curves on pages 4 and 5.

With insulating pedestal type 40729.

Anode and grid dissipation (kW)	Height above sea level (m)	Inlet air temperature (^{o}C)	Minimum rate of air flow (m^3/min)	Pressure difference (mm water)	Outlet temperature (^{o}C)
30	0	35	34.0	120	84
25	0	35	27.2	78	87
20	0	35	21.4	48	89
30	0	45	38.0	150	91
25	0	45	30.4	98	93
20	0	45	23.9	60	95
30	1500	35	41.0	138	84
25	1500	35	32.7	90	87
20	1500	35	25.7	55	89
30	3000	25	43.0	135	79
25	3000	25	34.4	88	83
20	3000	25	27.0	54	85

YD1197 COOLING CHARACTERISTICS

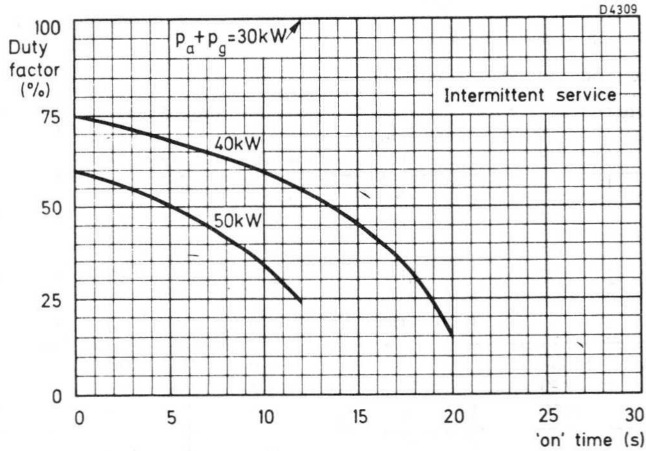
Anode and grid dissipation (kW)	Inlet water temperature (°C)	Outlet water temperature (°C)	Minimum rate of water flow (ℓ/min)	Pressure drop (atm)
40	20	51	20.0	0.5
	50	70	30.0	1.0
30	20	53	14.0	0.27
	50	72	21.0	0.55
20	20	56	9.0	0.12
	50	74	13.5	0.25

PHYSICAL DATA

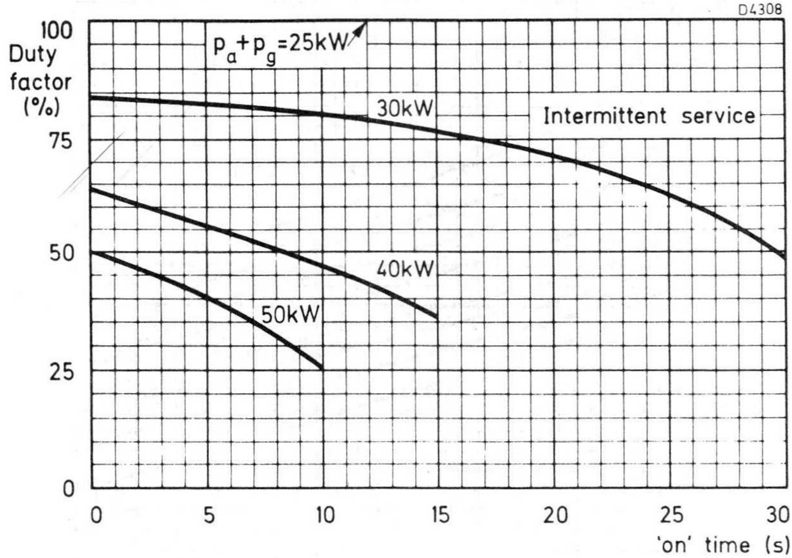
	YD1195	YD1197	
Weight of tube (approx.)	20	6.5	kg
Weight of insulating pedestal	8.2	-	kg

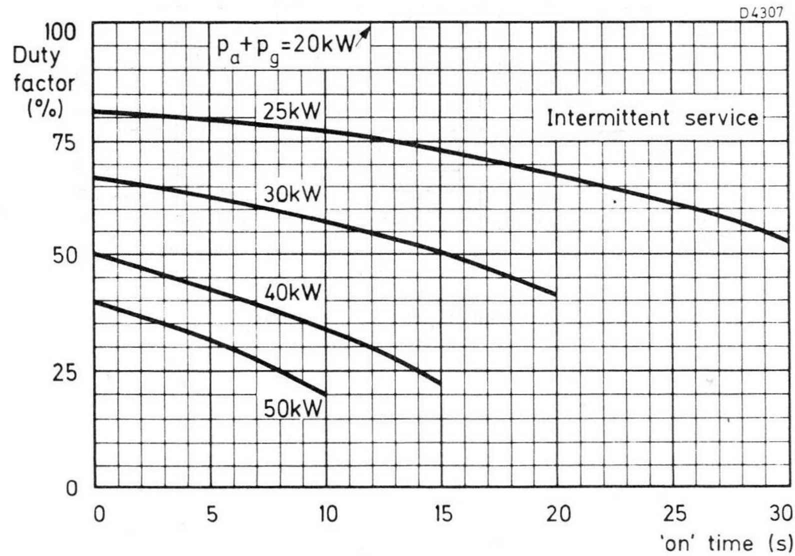
ACCESSORIES

Filament connector	40705
Filament/cathode connector	40706
Grid connector	40736
Filament cables (both required)	40718 40719
Insulating pedestal (YD1195)	40729

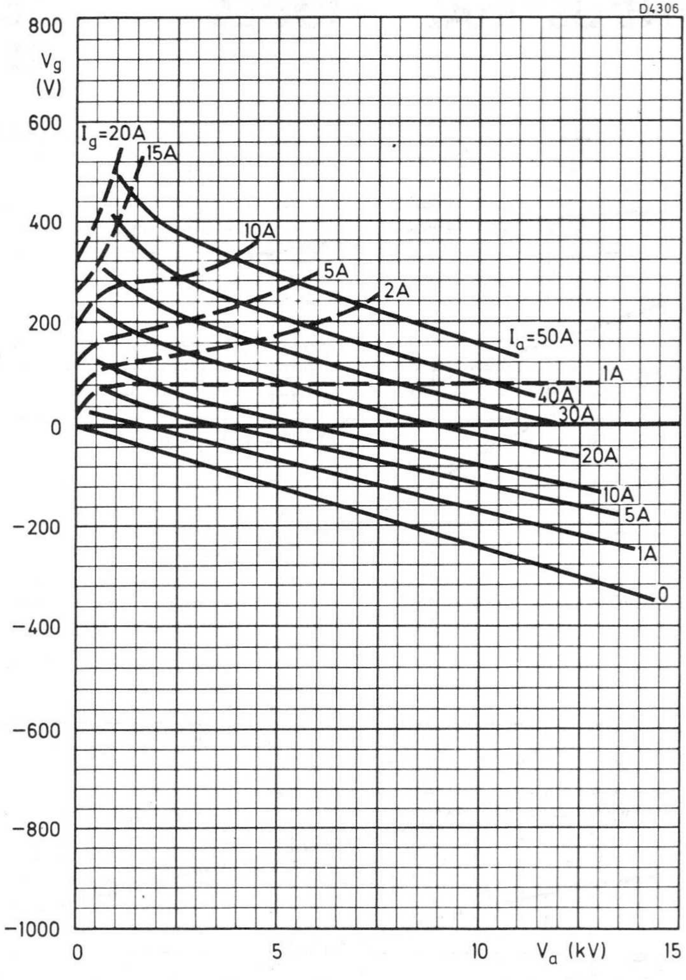


YD1195 Effect of duty factor on cooling for
30kW continuous service conditions



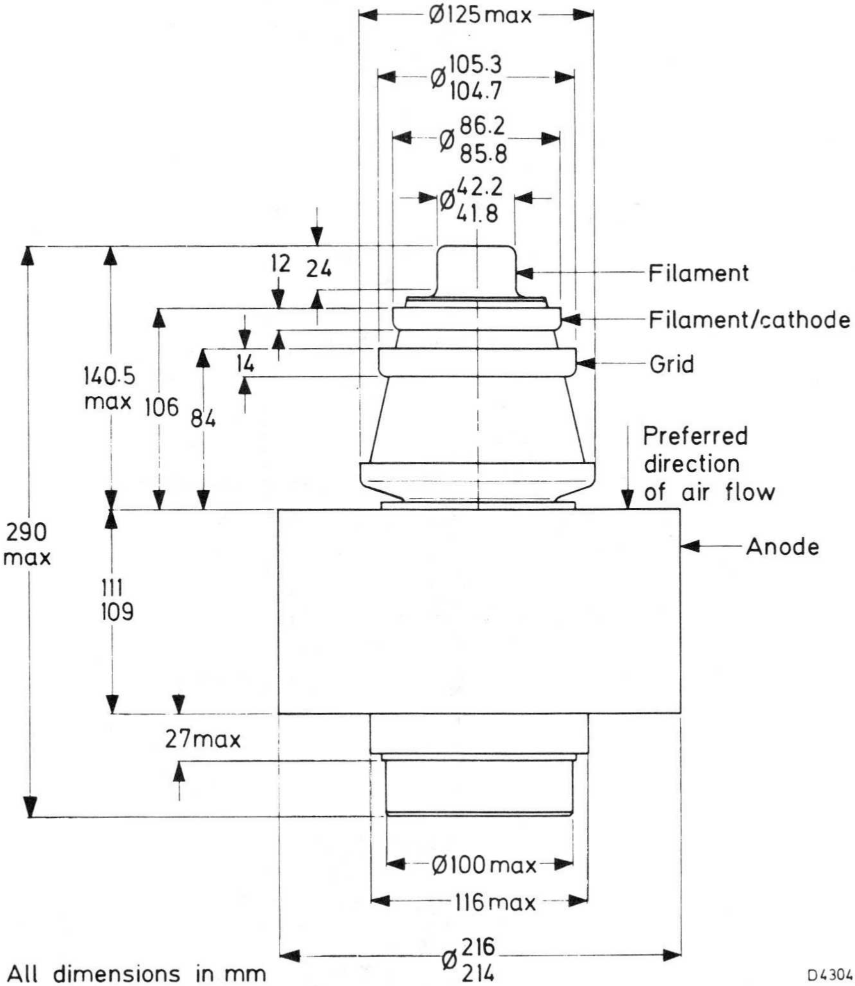


YD1195 Effect of duty factor on cooling for
25 and 20kW continuous service conditions



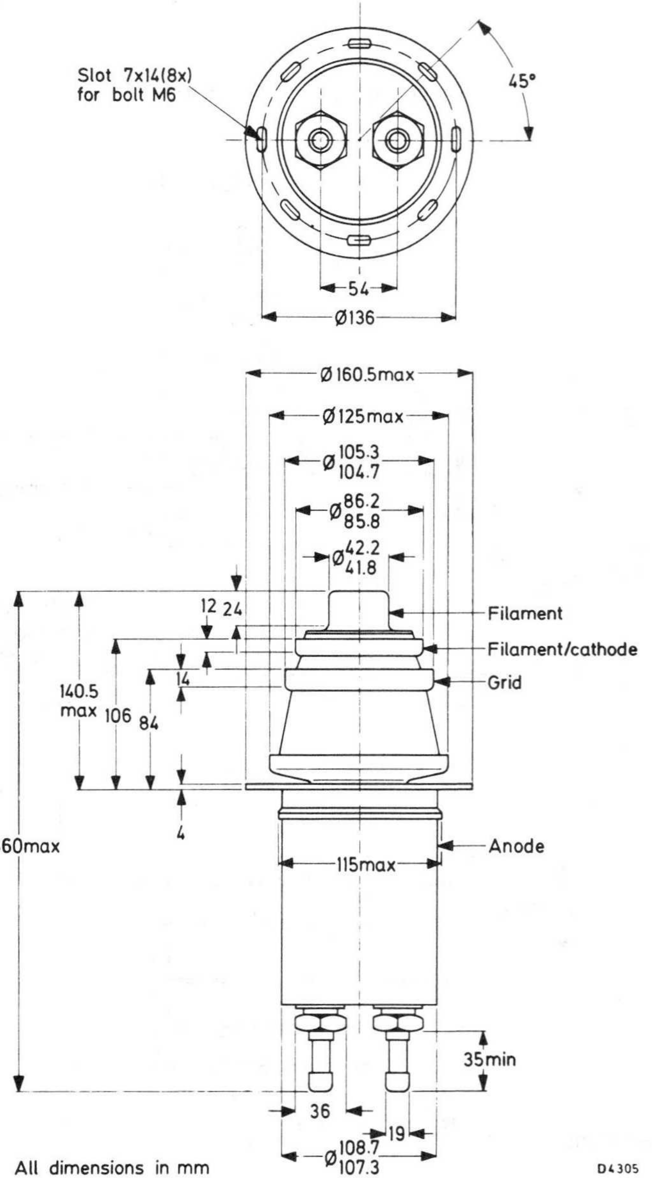
Constant current characteristics

OUTLINE DRAWING OF YD1195



All dimensions in mm

OUTLINE DRAWING OF YD1197



All dimensions in mm

D4305

When tube is used with anode up, the water connections should be interchanged.

R.F. INDUSTRIAL TRIODE

YD1202

Water-cooled triode of metal-ceramic construction with integral cooler intended for use as an industrial oscillator.

QUICK REFERENCE DATA

Oscillator output power (W_o - W_{feedb}), typical	W_{osc}		163	kW
Frequency for full ratings	f	max.	100	MHz

To be read in conjunction with "General Recommendations Transmitting tubes, Tubes for R.F. heating".

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	30	30	MHz
Oscillator output power (W_o - W_{feedb})	W_{osc}	120	163	kW
Anode voltage	V_a	10	12	kV
Anode current	I_a	16	18	A
Anode input power	W_{ia}	160	216	kW
Anode dissipation	W_a	36	47	kW
Anode output power	W_o	124	169	kW
Anode efficiency	η_a	77,5	78	%
Oscillator efficiency	η_{osc}	75	75,4	%
Feedback ratio	V_{gp}/V_{ap}	12,8	14	%
Grid resistor	R_g	200	225	Ω
Grid current, on load	I_g	3,5	4	A
Grid voltage, negative	$-V_g$	700	900	V
Grid dissipation	W_g	1,5	2	kW
Grid resistor dissipation	W_{Rg}	2,45	3,6	kW

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	100	MHz [1]	
Anode voltage	V_a	max.	15	kV	
Anode current	I_a	max,	19	A	
Anode input power	W_{ia}	max.	220	kW	
Anode dissipation	W_a	max.	100	kW	
Grid voltage	$-V_g$	max.	2	kV	
Grid current, on load	I_g	max.	5	A	
off load	I_g	max.	7	A	
Grid dissipation	W_g	max.	2,5	kW	
Grid circuit resistance	R_g	max.	10	kΩ	
Cathode current, mean	I_k	max.	24	A	
peak	I_{kp}	max.	100	A	
Envelope temperature	t_{env}	max.	220	°C	

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f		12,2	V
Filament current	I_f		250	A
Peak filament starting current	I_{f_p}	max.	1500	A
Cold filament resistance	R_{f_o}		5,3	mΩ

The filament is designed to accept temporary fluctuations of ± 5 %.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so it must be borne in mind that the filament voltage-to-current ratio measured with only the filament voltage applied should remain constant under all operating conditions.

It is extremely important that the filament be properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded-grid circuits this resonance should be below the grid-cathode resonance. For further information please see Application Book "Tubes for R.F. heating" or contact the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	2,7	pF
Grid to filament	C_{gf}	170	pF
Anode to grid	C_{ag}	55	pF

---

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.

CHARACTERISTICS measured at V_a = 10 kV, I_a = 8 A

Transconductance	S	150	mA/V
Amplification factor	μ	30	

COOLING

See also cooling curves.

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (^oC)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (atm)	Outlet temperature t_o (^oC)
100	20	52	0,55	49
	50	78	1,05	69
80	20	39	0,32	51
	50	60	0,65	70
60	20	29	0,19	52
	50	42	0,32	72
40	20	18	0,08	54
	50	27	0,15	73

Absolute max. water inlet temperature	t_i	max. 50	^oC
Absolute max. water pressure	p	max. 6×10^5 Pa = 6 atm abs	

To obtain optimum life the seal/envelope temperature under continuous loaded conditions should be kept at or below 200 ^oC.

At low frequencies the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of abt 0,5 ℓ/min. At frequencies higher than abt. Ω MHz, however, an additional air flow of abt. 4 m^3/min. must be led along the seals from a 50 mm diameter nozzle positioned at a distance of 250 mm from the tube header.

ACCESSORIES

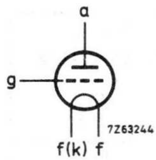
Filament connector with cable	type	40695	net weight	1,4 kg
Filament/cathode connector with cable	type	40696	net weight	1,6 kg
Grid connector f ≤ 4 MHz	type	40694	net weight	270 g
f > 4 MHz	type	40737	net weight	525 g

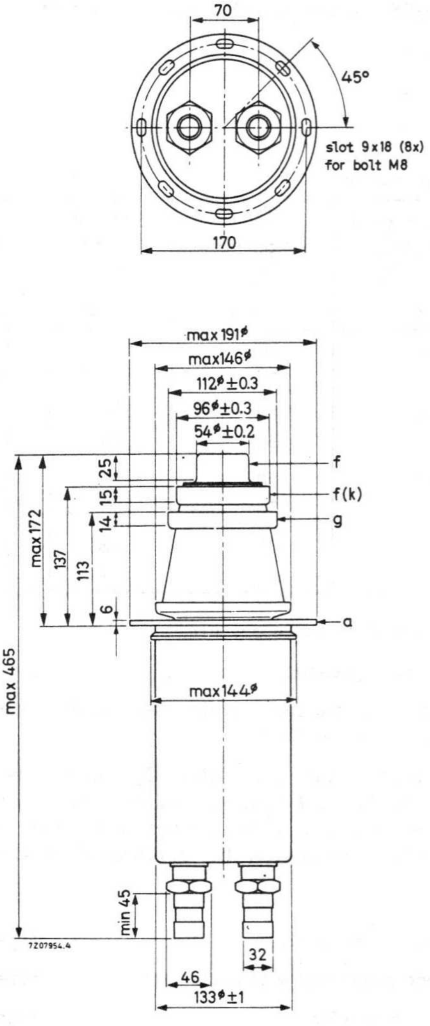
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical, anode up or down

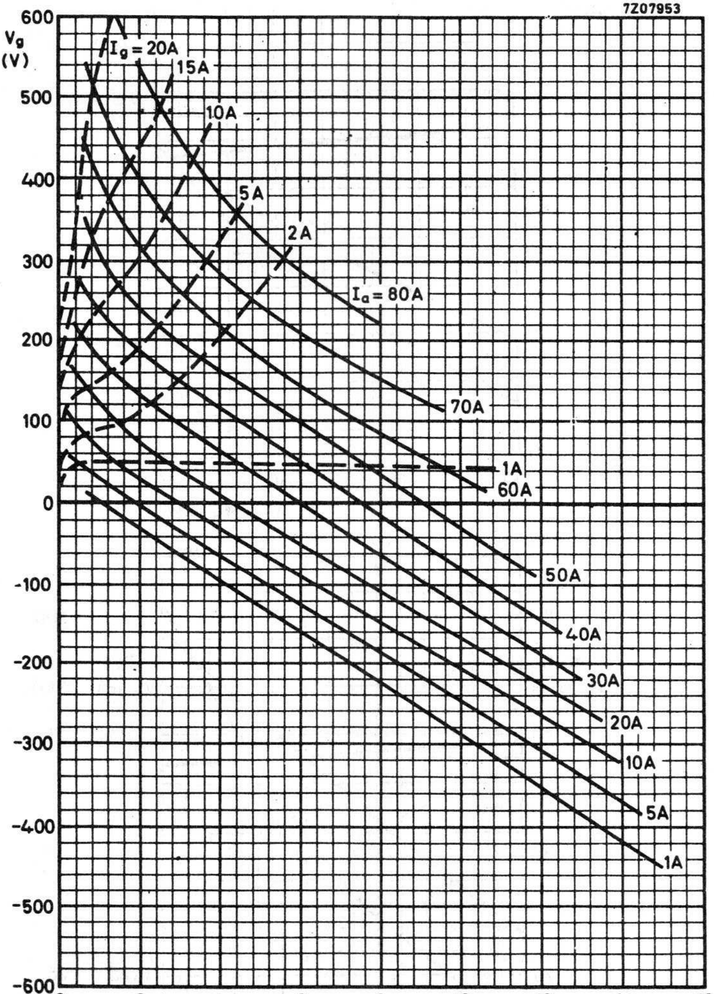
Net weight: approx. 11,5 kg

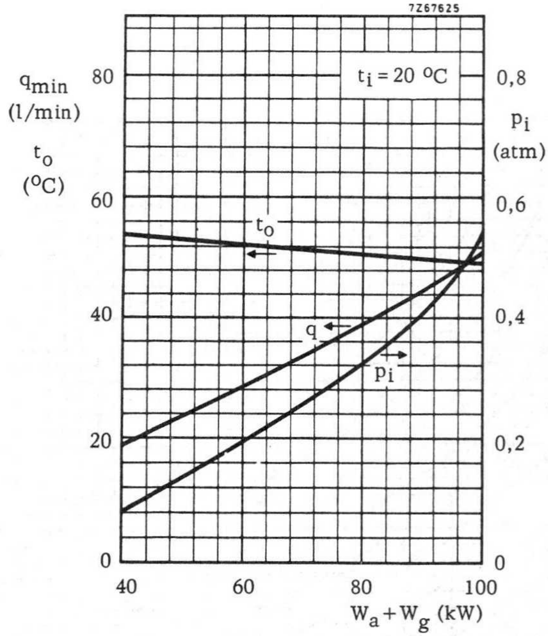




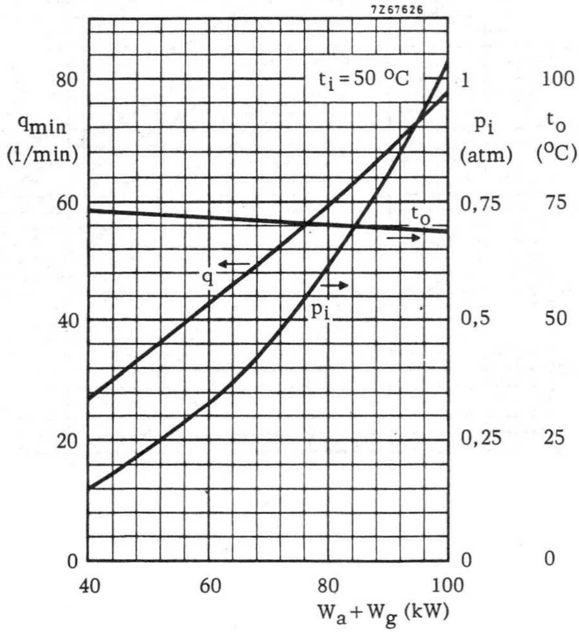
Thread of water connections BSP $1\frac{1}{4}$ in.

With the anode up the water inlet and outlet connections should be interchanged.


7Z07953
V_g (V)
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
0
2
4
6
8
10
12
14
16
V_a (kV)
I_g = 20A
15A
10A
5A
2A
1A
I_a = 80A
70A
60A
50A
40A
30A
20A
10A
5A
1A



7Z67625
$t_i = 20\ ^oC$
q_{min} (l/min)
t_o (^oC)
p_i (atm)
t_o
q
p_i
0
20
40
60
80
0
0,2
0,4
0,6
0,8
40
60
80
100
$W_a + W_g$ (kW)



7Z67626
$t_i = 50\ ^oC$
q_{min} (l/min)
p_i (atm)
t_o (^oC)
t_o
q
p_i
0
20
40
60
80
0
0,25
0,5
0,75
1
0
25
50
75
100
40
60
80
100
$W_a + W_g$ (kW)

R.F. INDUSTRIAL TRIODE

YD1212

Water-cooled triode of metal-ceramic construction with integral cooler intended for use as an industrial oscillator.

QUICK REFERENCE DATA				
Oscillator output power ($W_o - W_{feedb}$), typical	W_{osc}		240	kW
Frequency for full ratings	f	max.	100	MHz

To be read in conjunction with "General Recommendations Transmitting tubes, Tubes for R.F. heating."

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	30	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	240	kW
Anode voltage	V_a	14	kV
Anode current	I_a	23.5	A
Anode input power	W_{ia}	329	kW
Anode dissipation	W_a	81.5	kW
Anode output power	W_o	247.5	kW
Anode efficiency	η_a	75.2	%
Oscillator efficiency	η_{osc}	73.0	%
Feedback ratio	V_{gp}/V_{ap}	10.4	%
Grid resistor	R_g	135	Ω
Grid current, on load	I_g	6	A
Grid voltage, negative	$-V_g$	810	V
Grid dissipation	W_g	2.6	kW
Grid resistor dissipation	W_{Rg}	4.86	kW

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	100	MHz [1]
Anode voltage	V_a	max.	16.8	kV
Anode current	I_a	max.	25	A
Anode input power	W_{ia}	max.	375	kW
Anode dissipation	W_a	max.	120	kW
Grid voltage	$-V_g$	max.	2	kV
Grid current, on load	I_g	max.	7	A
off load	I_g	max.	8.5	A
Grid dissipation	W_g	max.	3	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	31	A
peak	I_{kp}	max.	175	A
Envelope temperature	t_{env}	max.	240	°C

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f		12.6	V
Filament current	I_f		380	A
Peak filament starting current	I_{f_p}	max.	2000	A
Cold filament resistance	R_{f_o}		3.6	mΩ

The filament is designed to accept temporary fluctuations of +5% and -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so it must be borne in mind that the filament voltage-to-current ratio measured with only the filament voltage applied should remain constant under all operating conditions.

It is extremely important that the filament be properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded-grid circuits this resonance should be below the grid-cathode resonance. For further information please see Application Book "Tubes for R.F. heating" or contact the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	3	pF
Grid to filament	C_{gf}	185	pF
Anode to grid	C_{ag}	60	pF

CHARACTERISTICS measured at V_a = 14 kV, I_a = 10 A

Transconductance	S	190	mA/V
Amplification factor	μ	41	

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.

COOLING

See also cooling curves

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q min (ℓ/min)	Pressure drop p_i (atm)	Outlet temperature t_o (°C)
120	20	60	0.7	50
	50	90	1.3	77
80	20	34	0.3	54
	50	54	0.55	72
40	20	15	0.07	60
	50	24	0.13	70

Absolute max. water inlet temperature	t_i	max.	50	°C
Absolute max. water pressure	p	max.	6×10^5 Pa = 6	atm abs

To obtain optimum life, the seal/envelope temperature under continuously loaded conditions should be kept at or below 200 °C.

At low frequencies the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of abt 0.5 ℓ/min. At higher frequencies, however, an additional airflow of abt 4 m^3/min must be led along the seals from a 50 mm diameter nozzle positioned at a distance of 250 mm from the tube header.

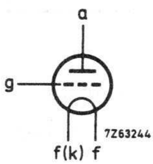
ACCESSORIES

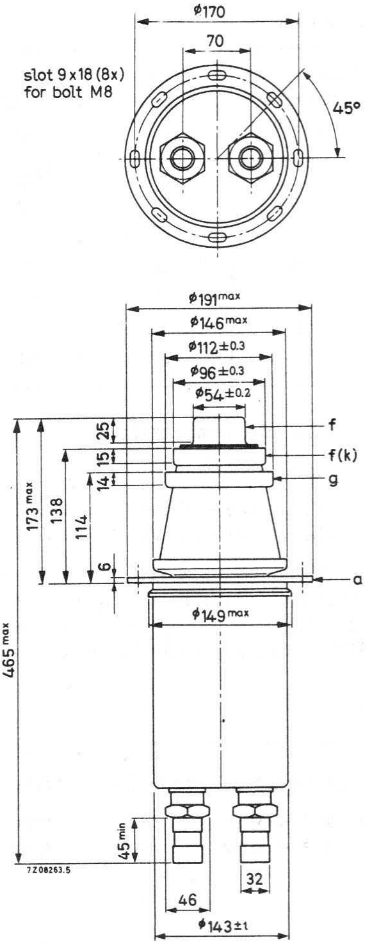
Filament connector with cable	type	40695	net weight	1.4	kg
Filament/cathode connector with cable	type	40696	net weight	1.6	kg
Grid connector f ≤ 4 MHz	type	40694	net weight	270	g
f > 4 MHz	type	40737	net weight	525	g

MECHANICAL DATA Dimensions in mm

Mounting position : vertical with anode up or down

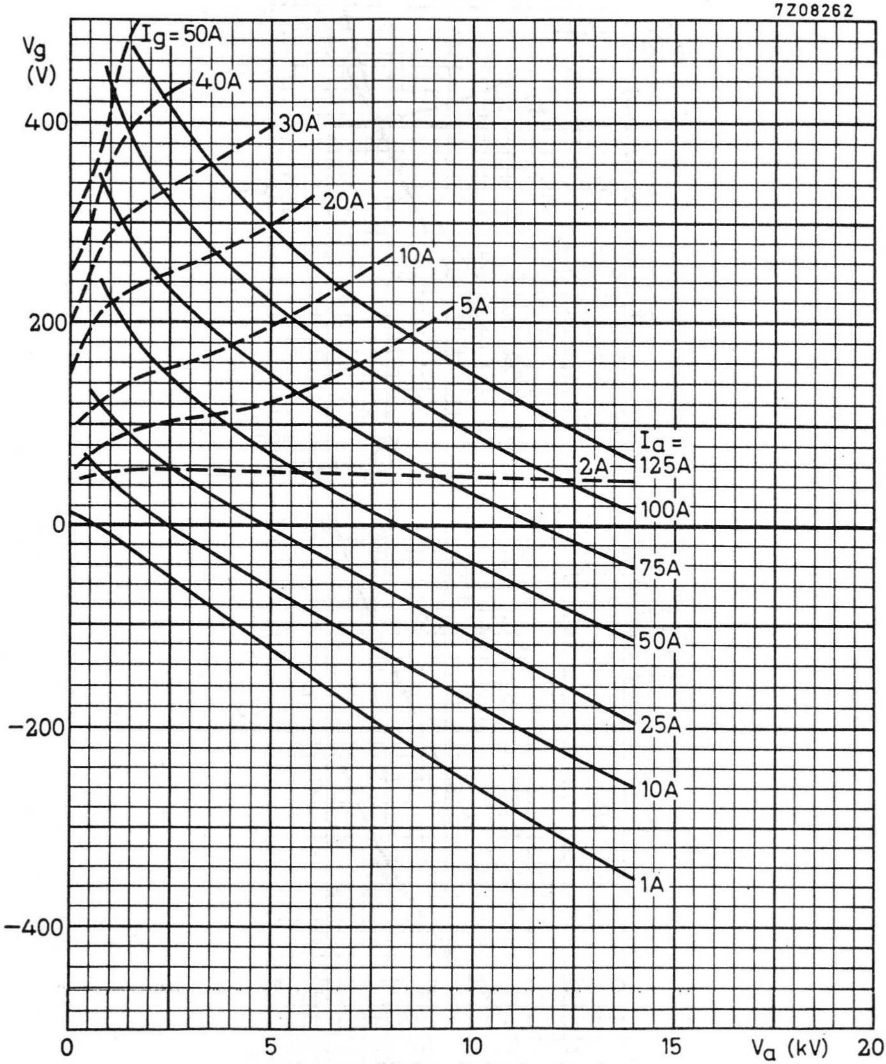
Net weight : approx. 15.6 kg

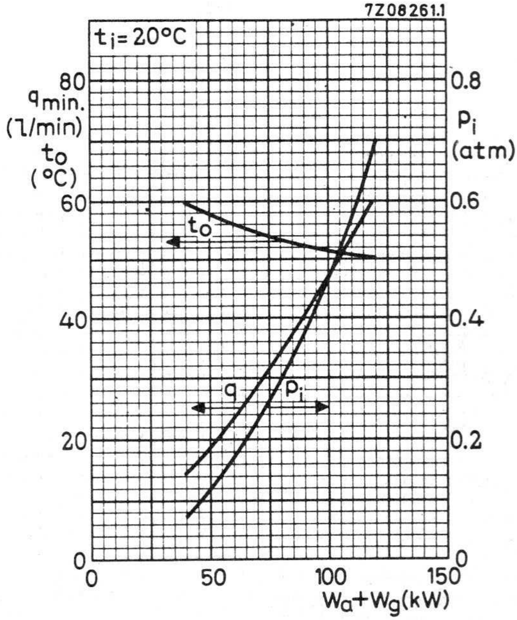




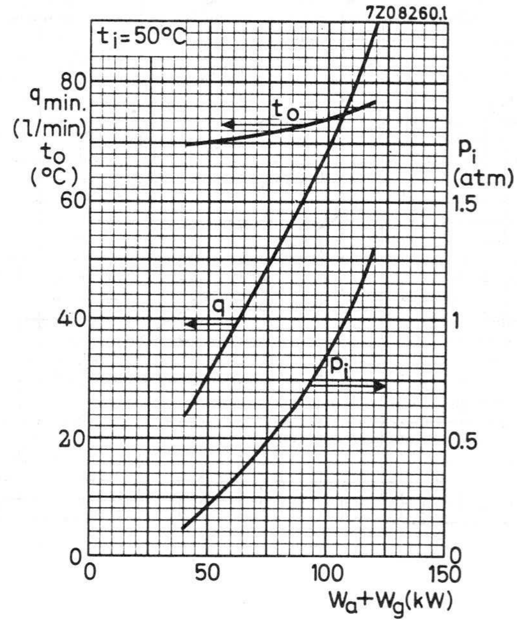
Thread of water connections BSP $1\frac{1}{4}$ in.

With anode up the water inlet and outlet connections should be interchanged.


7Z08262
V_g (V)
400
200
0
−200
−400
I_g = 50A
40A
30A
20A
10A
5A
2A
I_a =
125A
100A
75A
50A
25A
10A
1A
0
5
10
15
V_a (kV)
20



7Z08261.1
$t_i = 20°C$
80
60
40
20
0
$q_{min.}$ (l/min)
t_o (°C)
0.8
0.6
0.4
0.2
0
p_i (atm)
t_o
q
p_i
0
50
100
150
$W_a + W_g$ (kW)



7Z08260.1
$t_i = 50°C$
80
60
40
20
0
$q_{min.}$ (l/min)
t_o (°C)
p_i (atm)
1.5
1
0.5
0
t_o
q
p_i
0
50
100
150
$W_a + W_g$ (kW)

V.H.F. INDUSTRIAL TRIODES

YD1240
YD1244

QUICK REFERENCE DATA

Forced air cooled triodes of ceramic-metal construction, intended for use as industrial oscillators. The YD1244 includes a flange for ease of mounting.

f	160	27.12	MHz
P_{out} (less P_{drive})	2.22	2.67	kW
f max.	250		MHz
V_a max.	5.5		kV
p_a max.	1.5		kW

Unless otherwise stated, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

OPERATING CONDITIONS

f	27.12	160	MHz
P_{out}	2.9	2.4	kW
P_{out} (less P_{drive})	2.67	2.22	kW
P_{load}	2.3	2.0	kW
Duty factor	1.0	1.0	
η_a	78	76	%
V_a	5.0	4.5	kV
I_a	750	700	mA
$-V_g$	520	500	V
I_g	235	225	mA
R_{g-f}	2.2	2.2	kΩ
Feedback ratio $v_{in(pk)}/v_{a(pk)}$	0.17	0.17	
P_{drive}	230	180	W
p_a	830	750	W
p_g	80	70	W
V_f	6.3	6.0	V

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	250	MHz
V_a max.	5.5	kV
$-V_g$ max.	1.0	kV
I_g max. on load	280	mA
off load	400	mA
I_k max.	1.4	A
$i_{k(pk)}$ max.	7.5	A
P_{in} max.	6.0	kW
p_a max.	1.5	kW
p_g max.	150	W
R_{g-f} max.	20	kΩ

CATHODE

Directly heated, thoriated tungsten

V_f ($\leq$ 120MHz)	6.3	V
(> 120MHz)	6.0	V
I_f (measured at 6.3V)	33	A

The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

CAPACITANCES

c_{a-g}	14	pF
c_{a-f}	0.4	pF
c_{g-f}	17	pF

CHARACTERISTICS (measured at V_a = 2.0kV, I_a = 0.5A)

g_m	10	mA/V
μ	20	

MOUNTING POSITION — Vertical, anode up or down

COOLING

Anode - forced-air cooled. See curves on pages 9 and 10.

Filament and grid seals - convection - low velocity air flow as required.

Maximum temperatures

Envelope and all seals	220	°C

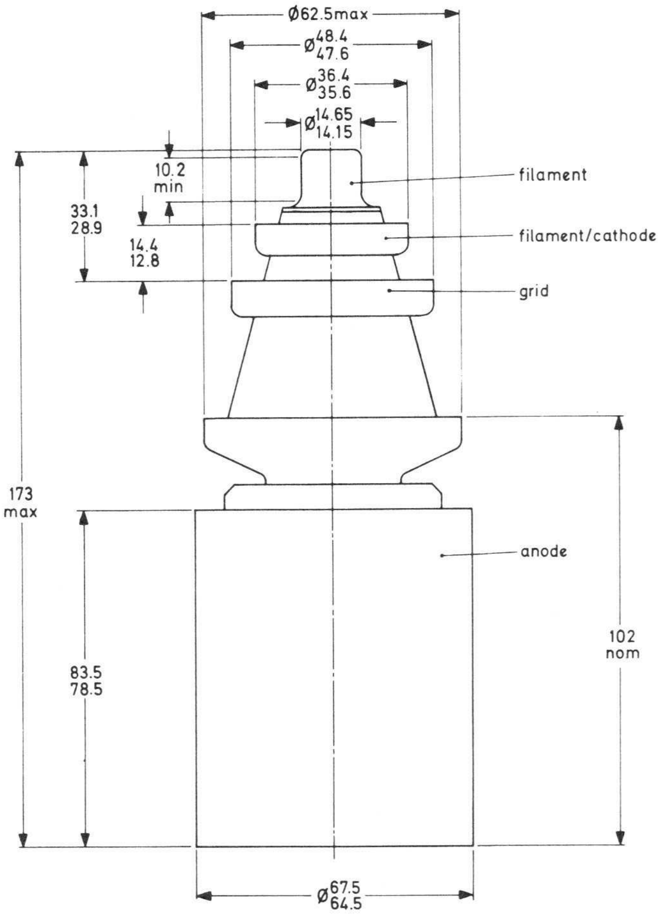
PHYSICAL DATA

Weight of valve (approx.)	1.13	kg

ACCESSORIES

Filament clip	40688
Filament/cathode clip	40689
Grid connector (f $\leq$ 30MHz)	40686
(f > 30MHz)	40687

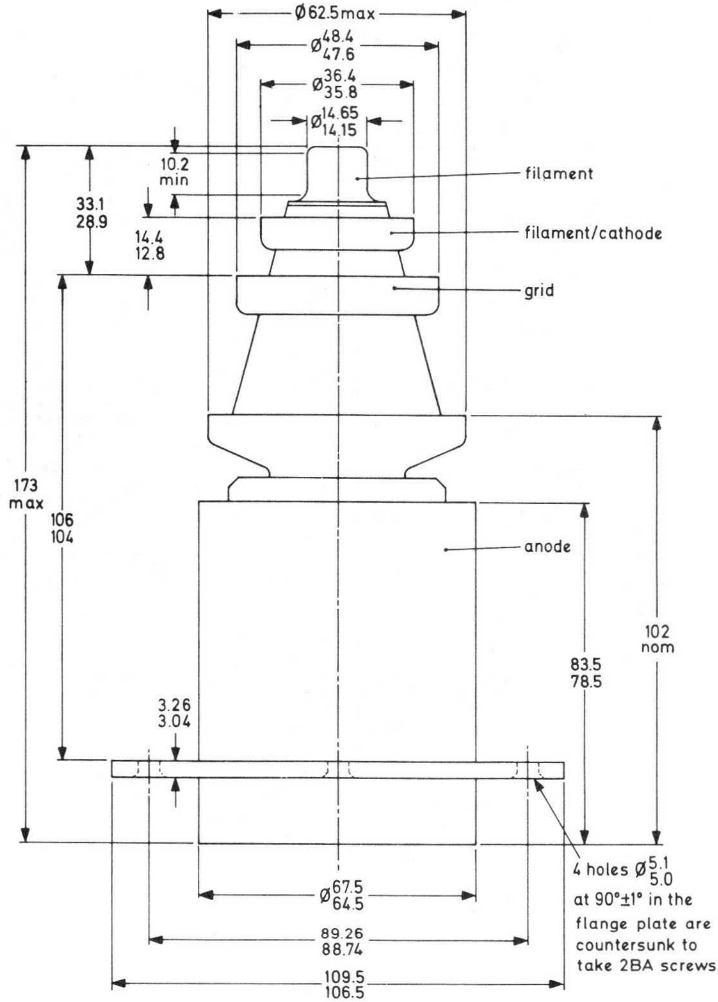
OUTLINE DRAWING OF YD1240



All dimensions in mm

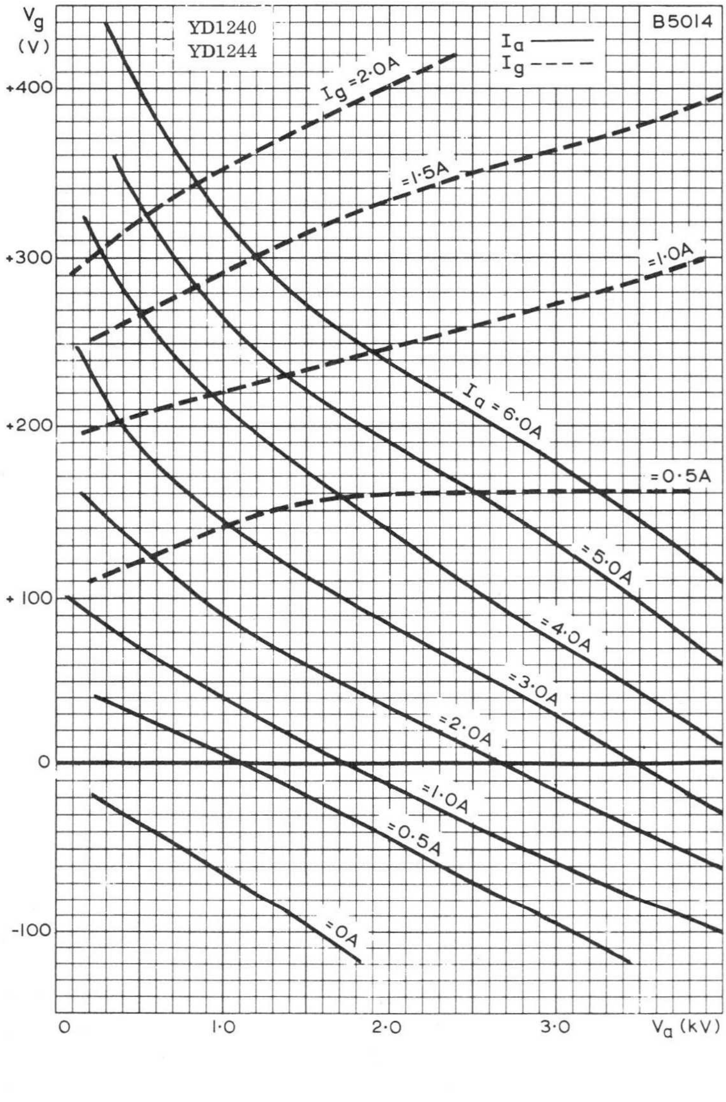
D4633

OUTLINE DRAWING OF YD1244

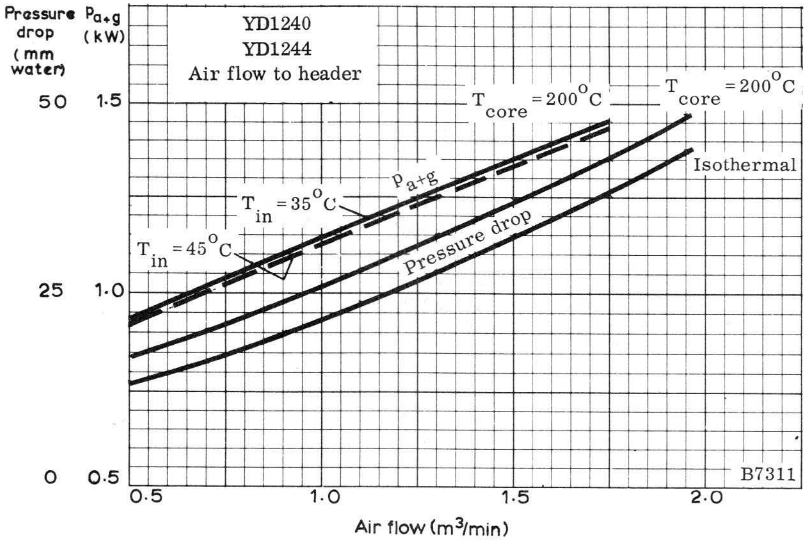


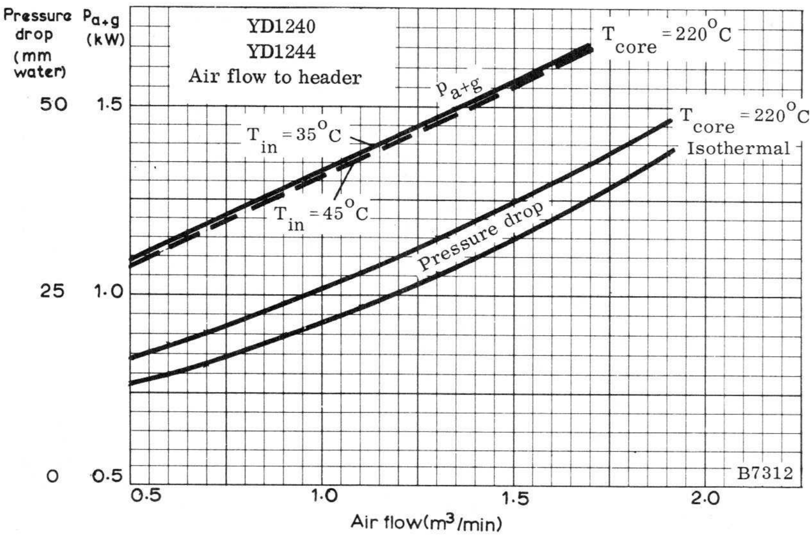
All dimensions in mm

D4632

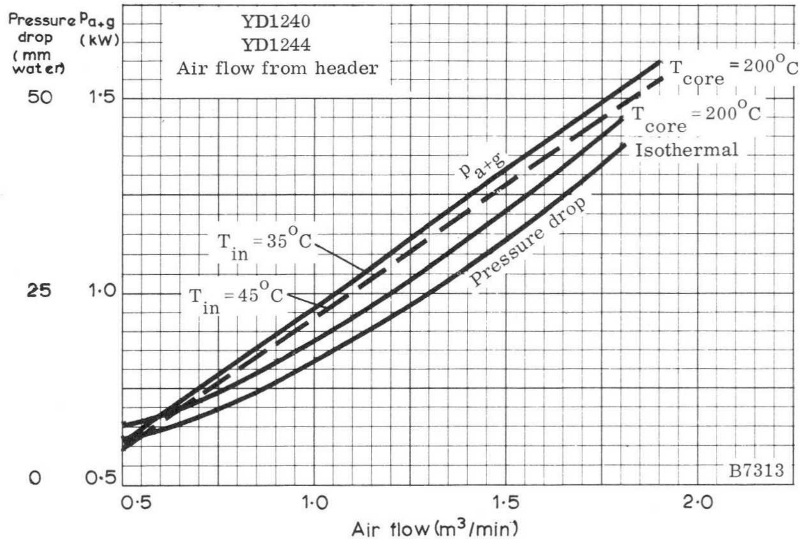


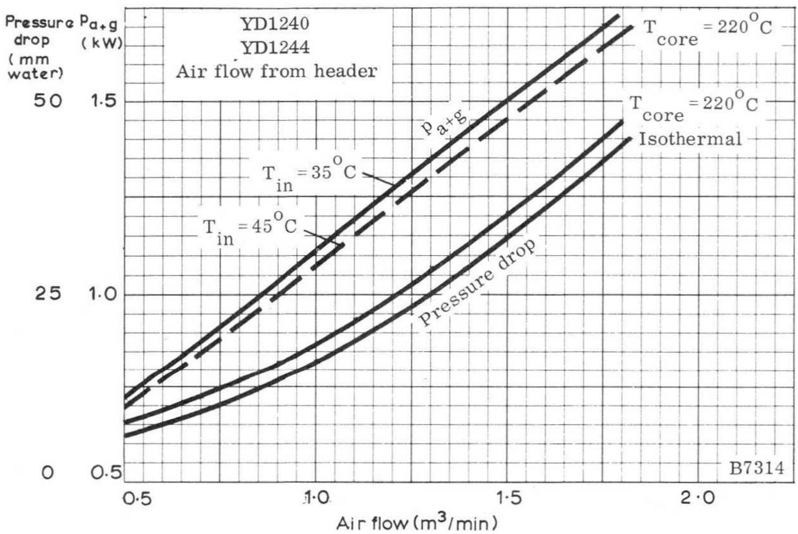
CONSTANT CURRENT CHARACTERISTICS





COOLING REQUIREMENTS AT SEA LEVEL WITH AIR INLET TEMPERATURES OF 35 and 45°C AND CORE TEMPERATURES OF 200 and 220°C





COOLING REQUIREMENTS AT SEA LEVEL WITH AIR INLET TEMPERATURES OF 35 and 45^{o}C AND CORE TEMPERATURES OF 200 and 220^{o}C

U.H.F. TRIODE

YD1300

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as a R.F. class AB linear broad-band amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)					
Frequency	f	470	to	860	MHz
Anode voltage	V_a			1700	V
Output power in load	W_ℓ			35	W
Power gain	G			20	dB
Vision amplifier					
Frequency	f	470	to	860	MHz
Anode voltage	V_a			1700	V
Output power in load	W_ℓ			35	W
Power gain	G			20	dB

HEATING : indirect by a.c. or d.c.; oxide coated cathode.

Heater voltage	V_f		5	V±5% [1]
Heater current	I_f		2,1	A
Cathode heating time	T_h	min.	120	s

CAPACITANCES

Anode to grid	C_{ag}	3,5	pF
Grid to cathode and heater	$C_{g/kf}$	17	pF
Anode to cathode and heater	$C_{a/kf}$	0,05	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	1700	V
Anode current	I_a	170	mA
Transconductance	S	55	mA/V
Amplification factor	μ	200	

[1]) For optimum transposer performance (linearity) ±2%.

TEMPERATURE LIMITS

Absolute max. anode and seal temperature t max. 150 °C

COOLING

Forced air

W_a (W)	t_i (°C)	q_{min} (l/min)	p_i (mm H_2O)
300	up to	550	85
250	45	400	52

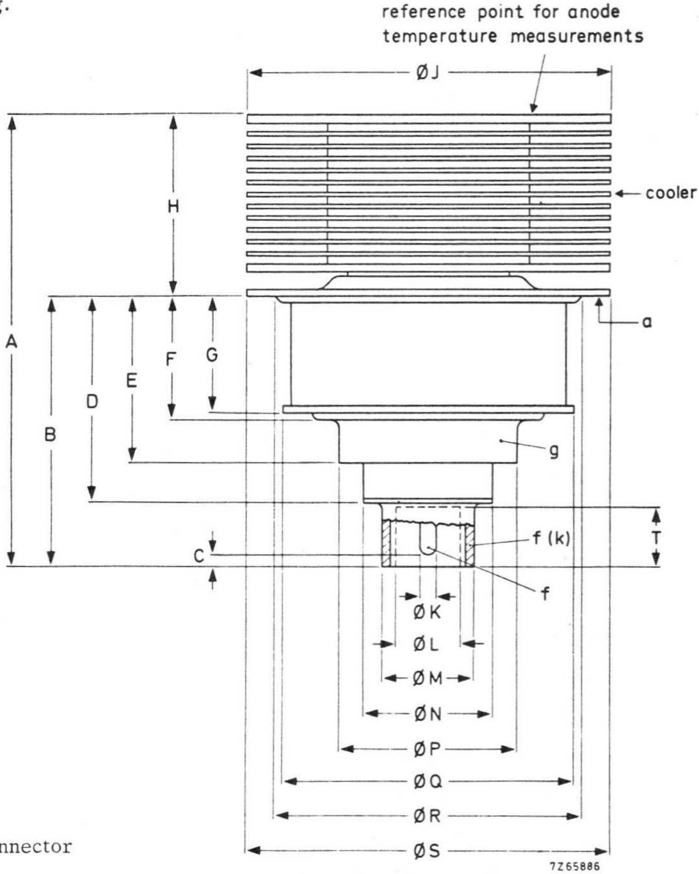
Recommended air duct see page 4.

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 180 g.

	min.	max.
A	52,2	55,2
B	32,2	34,2
C	0,9	2,3
D	25,0	26,4
E	19,9	21,9
F	14	15
G	13,5	14,5
H	20	21
J	44,6	45,4
K	1,9	2,1
L[1])	8	
M	11,3	11,7
N	15,8	16,4
P	22,6	23,0
Q	35,8	36,2
R	38	39
S	44,6	45,4
T[1])	7,5	



[1]) Available for heater connector

R.F. CLASS AB AMPLIFIER FOR TV TRANSPOSER SERVICE, grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	2000	V
Grid voltage	$-V_g$	max.	50	V
Anode dissipation	W_a	max.	300	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	200	mA

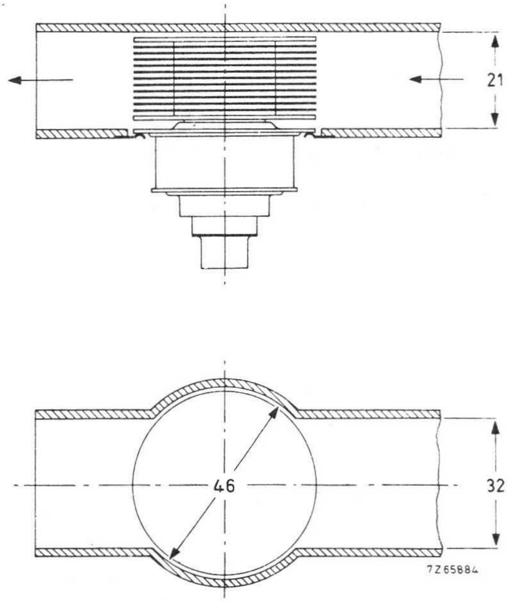
OPERATING CONDITIONS, grounded grid

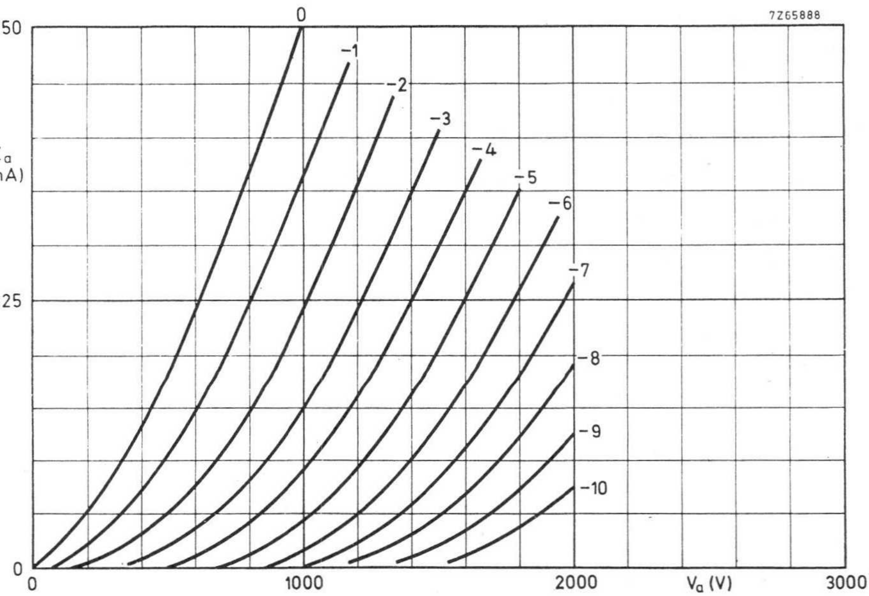
		CCIR standard L [1]	CCIR standard G [2]	
Frequency	f	470 to 860	470 to 860	MHz
Bandwidth (-1 dB)	B	9	9	MHz
Anode voltage	V_a	1700	1700	V
Grid voltage [3]	V_g	-5,8	-5,8	V
Grid current	I_g	≈0	≈0	mA
Anode current, no signal	I_a	120	120	mA
Anode current at c.w. output power = 35 W	I_a	170	170	mA
Driving power (peak white) (sync)	W_{dr}	0,35	0,35	W
Output power in load (peak white) (sync)	W_ℓ	35	35	W
Power gain	G	20	20	dB
Intermodulation products [4]	d	-	⩽ -52	dB
Differential phase		⩽ 2	[5] ⩽ 2	o
Differential gain		⩾ 96	[5] ⩾ 96	%

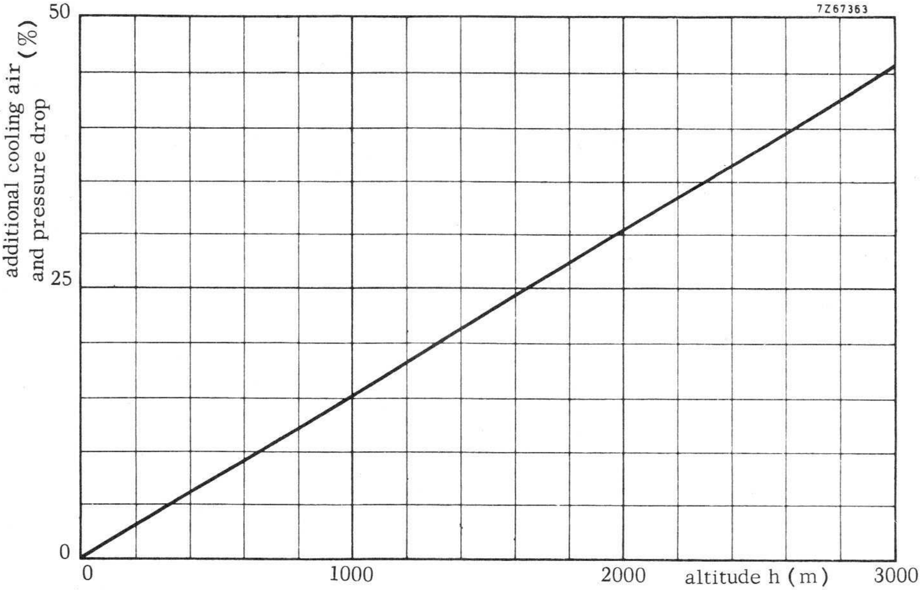
Notes see page 5.

Recommended air duct

Dimensions in mm







[1]) Positive modulation, negative synchronization, sound and vision separate.

[2]) Negative modulation, positive synchronization, combined sound and vision.

[3]) To be adjusted for the stated no-signal anode current.

[4]) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB with respect to the sum signal amplitude of the composite signal).
Stated figure applies to a vision-to-sound power ratio of 5 : 1.
For a vision-to sound power ratio of 10 : 1: IM products $\leq$ -55 dB.

[5]) Measured with a saw-tooth amplitude running from 17 % to 75 % of the peak sync value, with superimposed a 4,43 MHz sinewave with a 10 % peak-to-peak value.

U.H.F. TRIODE

YD1302

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as a R.F. class AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)

Frequency	f	470 to 860	MHz
Anode voltage	V_a	1900	V
Output power in load (sync)	W_ℓ	55	W
Power gain	G	19	dB

HEATING : indirect by a.c. or d.c.; oxide coated cathode.

Heater voltage	V_f		5	V±5% [1])
Heater current	I_f		2,1	A
Cathode heating time	T_h	min.	120	s

CAPACITANCES

Anode to grid	C_{ag}	3,5	pF
Grid to cathode and heater	$C_{g/kf}$	17	pF
Anode to cathode and heater	$C_{a/kf}$	0,05	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	1900	V
Anode current	I_a	180	mA
Transconductance	S	60	mA/V
Amplification factor	μ	200	

TEMPERATURE LIMITS

Absolute max. seal temperature	t_s	max.	150	^oC
Absolute max, anode temperature at reference point	t_a	max.	100	^oC

[1]) For optimum transposer performance (linearity) ±2%.

COOLING

Forced air

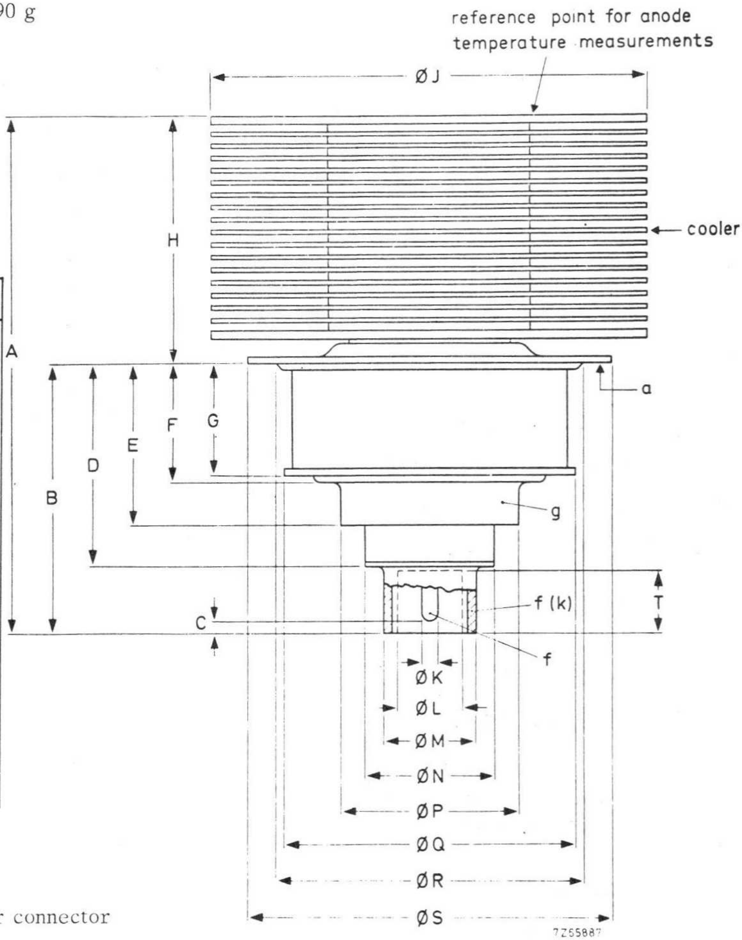
W_a (W)	t_i (^oC)	q_{min} (l/min)	p_i (mm H_2O)
325	up to	550	56
275	45	400	33

Recommended airduct see page 4.

MECHANICAL DATA

Dimensions in mm

Net weight : approx. 290 g



	min.	max.
A	61,2	64,2
B	32,2	34,2
C	0,9	2,3
D	25,0	26,4
E	19,9	21,9
F	14	15
G	13,5	14,5
H	29	30
J	53,9	54,1
K	1,9	2,1
L 1)	8	
M	11,3	11,7
N	15,8	16,4
P	22,6	23,0
Q	35,8	36,2
R	38	39
S	44,6	45,4
T 1)	7,5	

1) Available for heater connector

U.H.F. TRIODE YD1302

R.F. CLASS AB AMPLIFIER FOR TV TRANSPOSER SERVICE, grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	2000	V
Grid voltage	$-V_g$	max.	50	V
Anode dissipation	W_a	max.	325	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	250	mA

OPERATING CONDITIONS, grounded grid

		CCIR standard G 1)	
Frequency	f	470 to 860	MHz
Bandwidth (-1 dB)	B	9	MHz
Anode voltage	V_a	1900	V
Grid voltage 2)	V_g	-6,6	V
Grid current	I_g	≈ 0	mA
Anode current, no signal	I_a	130	mA
Anode current at zero dB level (vision carrier)	I_a	180	mA
Driving power (sync)	W_{dr}	0,7	W
Output power in load	W_ℓ	55	W
Power gain	G	19	dB
Intermodulation products 3)	d	-54	dB
Differential phase 4)		2	o
Differential gain 4)		96	%

1) Negative modulation, positive synchronization, combined sound and vision.

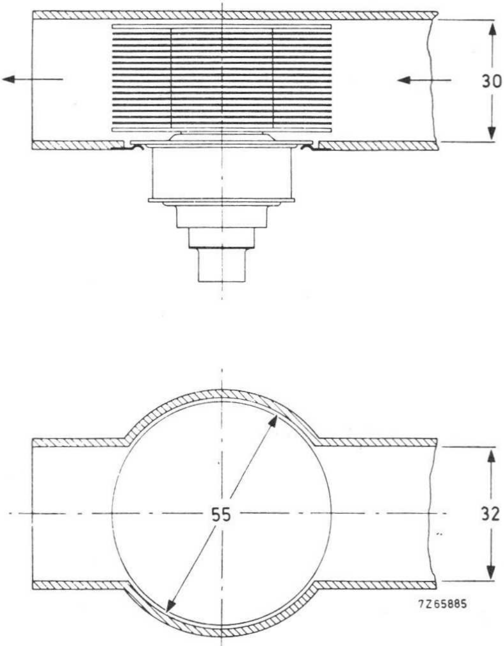
2) To be adjusted for the stated no-signal anode current.

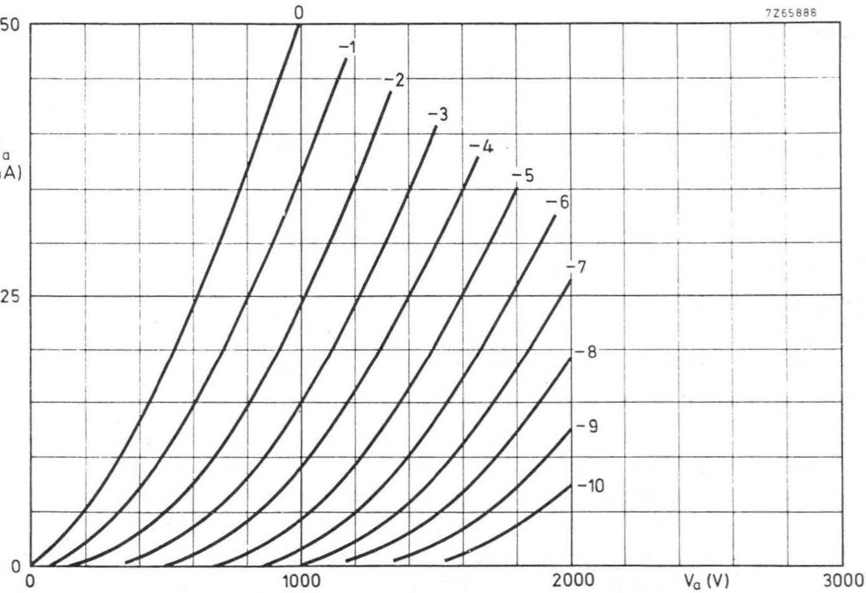
3) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB with respect to the sum signal amplitude of the composite signal).
Stated figure applies to a vision to sound power ratio of 5 : 1.
For a vision to sound power ratio of 10 : 1 : IM products ≤ -56 dB.

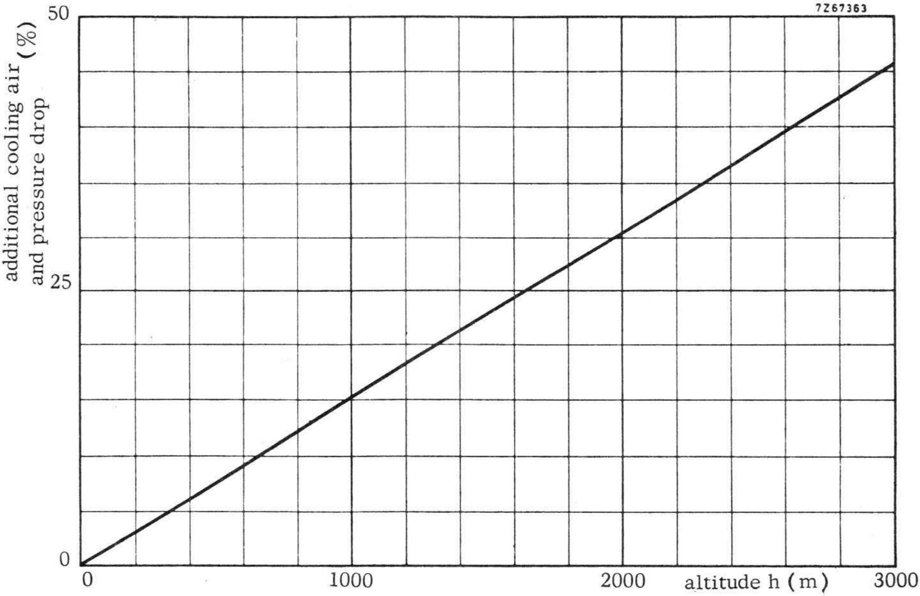
4) Measured with a saw-tooth amplitude running from 17 % to 75 % of the peak sync value, with superimposed a 4,43 MHz sinewave with a 10 % peak-to-peak value.

Recommended airduct

Dimensions in mm






7Z67363
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000

U.H.F. TRIODE

YD1336

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)			
Frequency	f	470 to 860	MHz
Anode voltage	V_a	3000	V
Output power in the load (sync)	W_ℓ	220	W
Power gain	G	16, 5	dB

HEATING : indirect, by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f		6, 0 to 6, 3	V ± 5% [1]
Heater current	I_f		4, 8 to 5, 8	A
Cathode heating time	T_h	min.	180	s

CAPACITANCES

Anode to grid	C_{ag}	6, 8 to 8	pF
Grid to cathode and heater	$C_{g/kf}$	20 to 30	pF
Anode to cathode and heater	$C_{a/kf}$	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Anode current	I_a	400	mA
Transconductance	S	70	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	t	max.	250	$^{\circ}C$

To obtain optimum life, this temperature should not exceed 200 $^{\circ}C$.

[1]) The heater voltage must be adjusted between 6, 0 and 6, 3 V.
For optimum performance (linearity) the voltage set must be maintained within ± 2% for transposer service, or ± 5% for other applications.

COOLING

Anode: forced air

W_a (W)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
1800	25	2,5	22

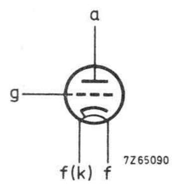
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

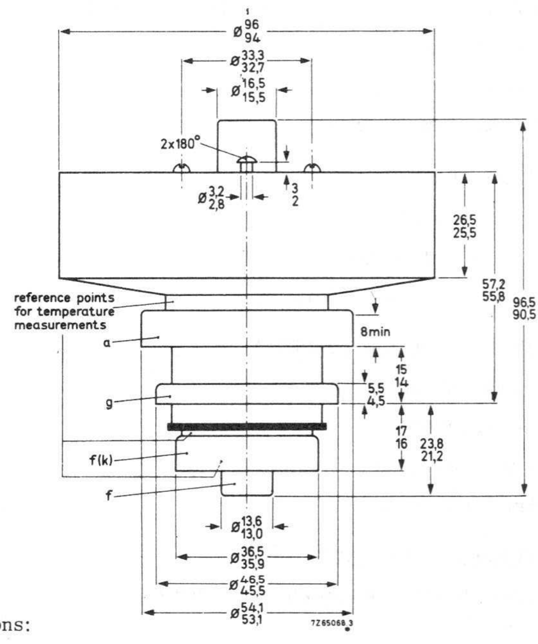
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 1000 g

Mounting position: any





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	97,0 dia
Anode terminal	55,1 dia
Grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

U.H.F. TRIODE

YD1336

R.F. CLASS AB AMPLIFIER FOR TV TRANSPOSER SERVICE grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	1800	W
Grid current	I_g	max.	±5	mA
Cathode current	I_k	max.	550	mA [1]

OPERATING CONDITIONS, grounded grid [2][3]

Standard		C.C.I.R-G	C.C.I.R-G	C.C.I.R-I	
Frequency	f	470 to 860	470 to 860	470 to 860	MHz
Anode voltage	V_a	3000	3000	3000	V
Grid voltage [4]	V_g	−30	−30	−30	V
Anode current, no signal	I_a	420	350	420	mA
Anode current at zero dB level (vision carrier)	I_a	650	550	650	mA
Grid current	I_g	≈ 0	≈ 0	≈ 0	mA
Driver output power (sync)	W_{dr}	7	8	7	W
Output power in load (sync)	W_ℓ	220	220	220	W
Output power at $I_g = 0$	W_o	≥ 390	≥ 390	≥ 390	W
Power gain	G	16,5	16,0	16,5	dB
Intermodulation products	d	-57 [5] < -55	-56 [5] < -54	-55 [6] < -53	dB

[1]) During a short period, for adjustment of the transmitter, I_k max. = 700 mA

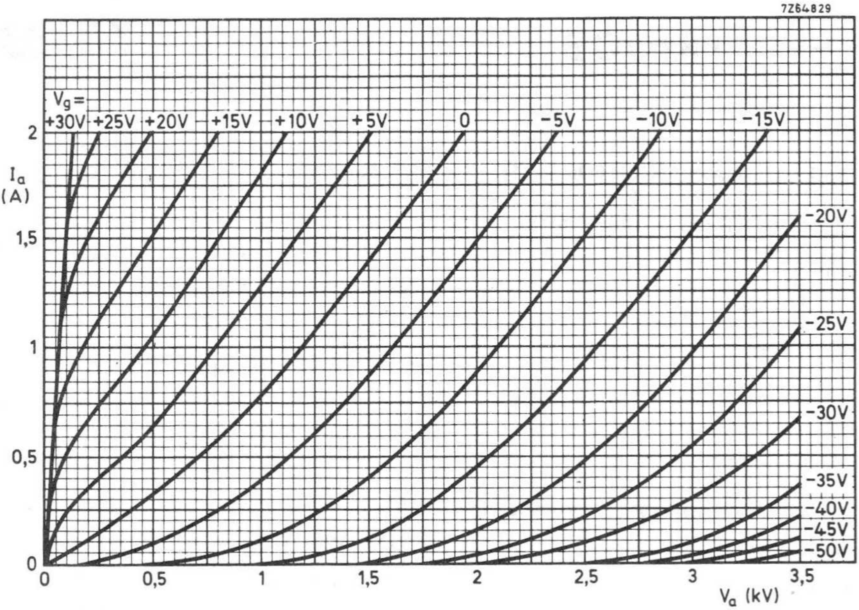
[2]) Negative modulation, positive synchronization, combined sound and vision.

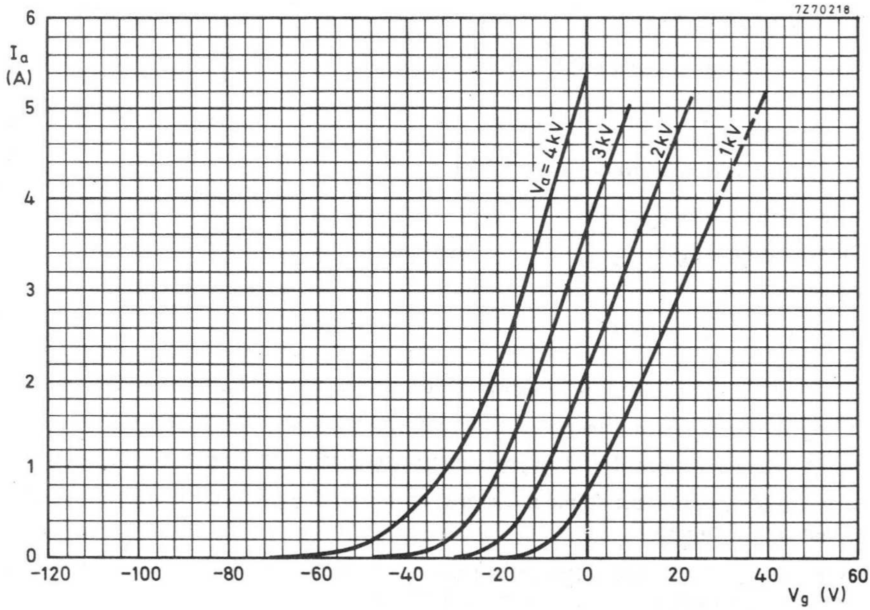
[3]) R.F. driving power should be applied after the heater and electrode voltages.

[4]) To be adjusted for the stated no- signal anode current. Range values for equipment design −15 to −45 V.

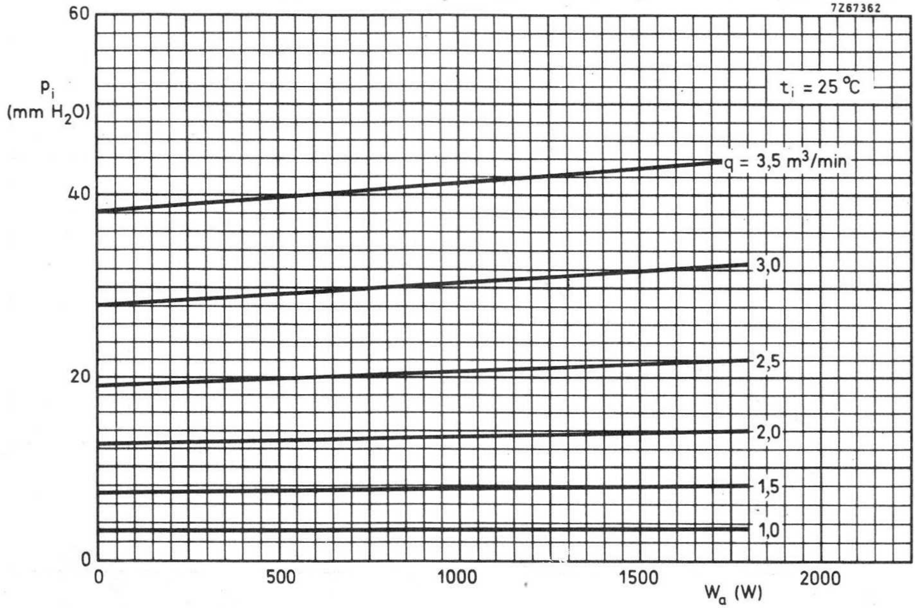
[5]) Three-tone test method (vision carrier -8 dB, sound carrier -10 dB sideband signal -16 dB with respect to peak sync level = 0 dB.).

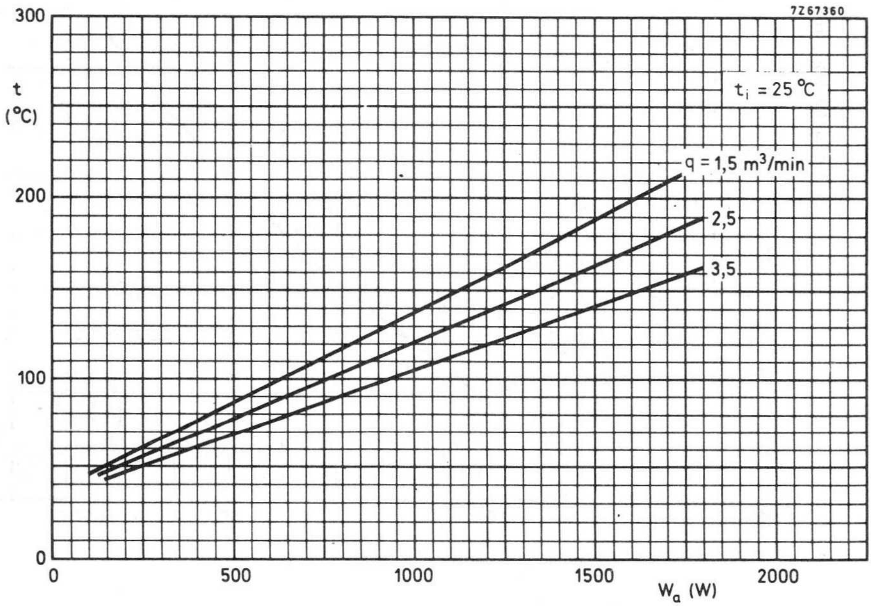
[6]) Three-tone test method (vision carrier - 8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync level = 0 dB).

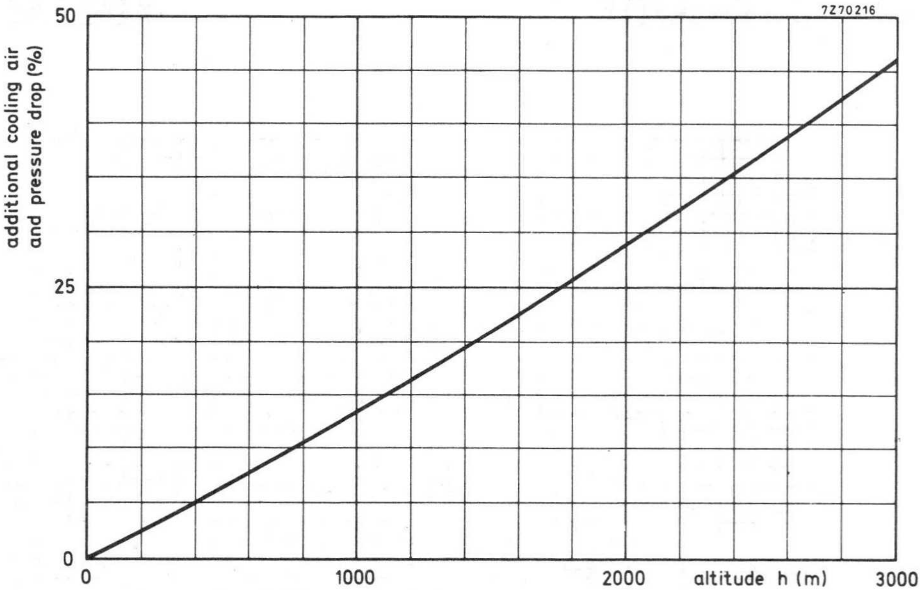

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
V_a (kV)
0
0,5
1
1,5
2
2,5
3
3,5

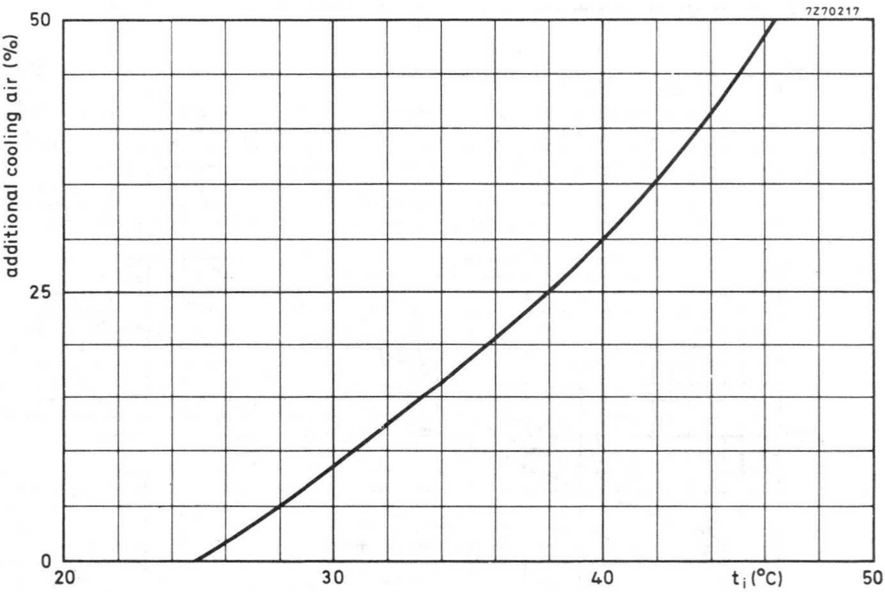

7Z70218
I_a (A)
V_a = 4kV
3kV
2kV
1kV
V_g (V)
−120
−100
−80
−60
−40
−20
0
20
40
60

Mullard


7Z67362
60
40
20
0
p_i
(mm H_2O)
t_i = 25 °C
q = 3,5 m^3/min
3,0
2,5
2,0
1,5
1,0
0
500
1000
1500
2000
W_a (W)


7Z67360
300
200
100
0
t
(°C)
t_i = 25 °C
q = 1,5 m^3/min
2,5
3,5
0
500
1000
1500
2000
W_a (W)


7Z70216
50
25
0
additional cooling air
and pressure drop (%)
0
1000
2000
altitude h (m)
3000


7Z70217
50
25
0
additional cooling air (%)
20
30
40
t_i (°C)
50

Mullard

TETRODES

C

C

V.H.F. POWER TETRODE

QY3-125

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES preceding this section of the handbook.

FILAMENT Thoriated tungsten.

V_f	5.0	V
I_f	6.5	A

MOUNTING POSITION Vertical, base up or down.

CAPACITANCES

c_{in}	10.8	pF
c_{out}	3.1	pF
c_{a-g1}	0.05	pF

CHARACTERISTICS (At V_a=2.5 kV, V_{g2}=350 V, I_a=40 mA)

g_m	2.2	mA/V
μ_{g1-g2}	6.2	

COOLING

$T_{anode\ seal}$ max.	220	°C
T_{pins} max.	180	°C

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the anode seal and the base of the valve at frequencies above 50 Mc/s. The air stream on to the base should be directed so that it also passes over the envelope. Below 50 Mc/s, radiation cooling of the envelope is sufficient, but an anode terminal connector of large surface area is necessary in order to keep the anode seal cool.

OPERATION AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)

Limiting Values

V_a max.	3.0	kV
p_a max. (corresponding to an anode temperature of 850°C, *i.e.*, red heat)	125	W
I_k max.	300	mA
$i_{k(pk)}$ max.	1.6	A
V_{g2} max.	400	V
p_{g2} max.	20	W
p_{g1} max.	5.0	W
$-V_{g1}$ max.	500	V
I_{g1} max.	15	mA

Typical Operating Conditions at f $\leqq$120 Mc/s.

V_a	2.0	2.5	3.0	kV
V_{g2}	350	350	350	V
V_{g1}	−100	−150	−150	V
I_a	200	200	167	mA
I_{g2}	50	40	30	mA
I_{g1}	9.0	9.0	6.5	mA
$v_{in(pk)}$	260	330	300	V
P_{drive}	2.4	3.0	2.0	W
p_a	125	125	125	W
p_{g2}	17.5	14	10.5	W
P_{out}	275	375	375	W
$*P_{load}$	220	300	300	W
η	69	75	75	%

* With a circuit transfer efficiency of 80%.

OPERATION AS SINGLE VALVE R.F. POWER AMPLIFIER (Class "B" Telephony)

Limiting Values

V_a max.	3.0	kV
p_a max. (corresponding to an anode temperature of 850°C, *i.e.*, red heat)	125	W
I_k max.	120	mA
$i_{k(pk)}$ max.	350	mA
V_{g2} max.	400	V
p_{g2} max.	14	W

Typical Operating Conditions at f $\leqq$120 Mc/s.

V_a	2.0	2.5	3.0	kV
V_{g2}	350	350	350	V
V_{g1}	−50	−50	−50	V
I_a	83	70	60	mA
I_{g2}	1.5	1.0	1.0	mA
$v_{in(pk)}$	65	55	50	V
p_a	112	120	122	W
p_{g2}	0.52	0.35	0.35	W
P_{out}	54	55	58	W
$*P_{load}$	43	45	46	W
η	32.5	31.5	32	%
For 100% modulation				
I_{g1}	4.0	4.0	4.5	mA
P_{drive}	0.52	0.44	0.45	W

* With a circuit transfer efficiency of 80%.

V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

OPERATION AS SINGLE VALVE R.F. POWER AMPLIFIER CLASS "C" TELEPHONY (Anode and screen grid modulated)

Limiting Values

V_a max.	2.5	kV
p_a max.	83	W
I_k max.	200	mA
$i_{k(pk)}$ max.	2.0	A
V_{g2} max.	400	V
p_{g2} max.	20	W
$-V_{g1}$ max.	500	V
I_{g1} max.	15	mA

Typical Operating Conditions at f $\leq$120 Mc/s.

V_a	2.0	2.5	kV
V_{g2}	350	350	V
V_{g1}	−220	−210	V
I_a	150	152	mA
I_{g2}	33	30	mA
I_{g1}	5.0	4.5	mA
P_{drive}	2.0	1.7	W
$v_{in(pk)}$	390	380	V
p_a	75	80	W
p_{g2}	11.5	10.5	W
P_{out}	225	300	W
$^*P_{load}$	180	240	W
η	75	79	%
For 100% modulation			
P_{mod}	150	190	W
$v_{g2(pk)\ mod.}$	300	300	V

* With a circuit transfer efficiency of 80%.

OPERATION OF TWO VALVES IN PUSH-PULL AS CLASS "B" A.F. POWER AMPLIFIER OR MODULATOR

Limiting Values

V_a max.	3.0	kV
p_a max. (corresponding to an anode temperature of 850°C, *i.e.*, red heat)	125	W
I_k max.	320	mA
$i_{k(pk)}$ max.	1.0	A
V_{g2} max. (I_{g1}=0)	600	V
V_{g2} max. (I_{g1}>0)	400	V
p_{g2} max.	20	W
$-V_{g1}$ max.	500	V
R_{g1-k} max.	150	kΩ

Typical Operating Conditions (Without I_{g1})

V_a	1.5	2.0	2.5	kV
V_{g2}	600	600	600	V
V_{g1}	−94	−96	−97	V
$I_{a(o)}$	2×30	2×30	2×30	mA
I_a (max. sig.)	2×109	2×111	2×108	mA
I_{g2} (max. sig.)	2×13.5	2×12	2×13	mA
$V_{in(g-g)\ (r.m.s.)}$	130	132	134	V
p_a	2×78	2×92	2×95	W
P_{out}	170	260	345	W
R_{a-a}	12	17.6	25	kΩ
η	52	58.5	64	%
D_{tot}	3.5	3.6	4.0	%

Typical Operating Conditions (With I_{g1})

V_a	1.5	2.0	2.5	kV
V_{g2}	350	350	350	V
V_{g1}	−48	−50	−51	V
$I_{a\ (o)}$	2×30	2×30	2×30	mA
I_a (max. sig.)	2×225	2×197	2×151	mA
I_{g2} (max. sig.)	2×42	2×32	2×18	mA
I_{g1}	2×16	2×12	2×8.5	mA
$V_{in\ (g-g)\ (r.m.s.)}$	234	210	170	V
P_{drive}	2×2.4	2×1.6	2×0.9	W
p_a	2×114	2×120	2×103	W
P_{out}	455	550	550	W
R_{a-a}	7.2	12	20	kΩ
η	66.5	69.5	72.5	%
D_{tot}	5.0	5.0	5.0	%

CIRCUIT NOTES

1. The R.F circuit returns must be brought to the filament connection on Pin No. 1.

2. To ensure equal distribution of the currents through the seals the screen-grid leads should be strapped together at the valve holder and the circuit connections joined to the midpoint of the strap. This should not be allowed to impair the free flotation of individual contacts.

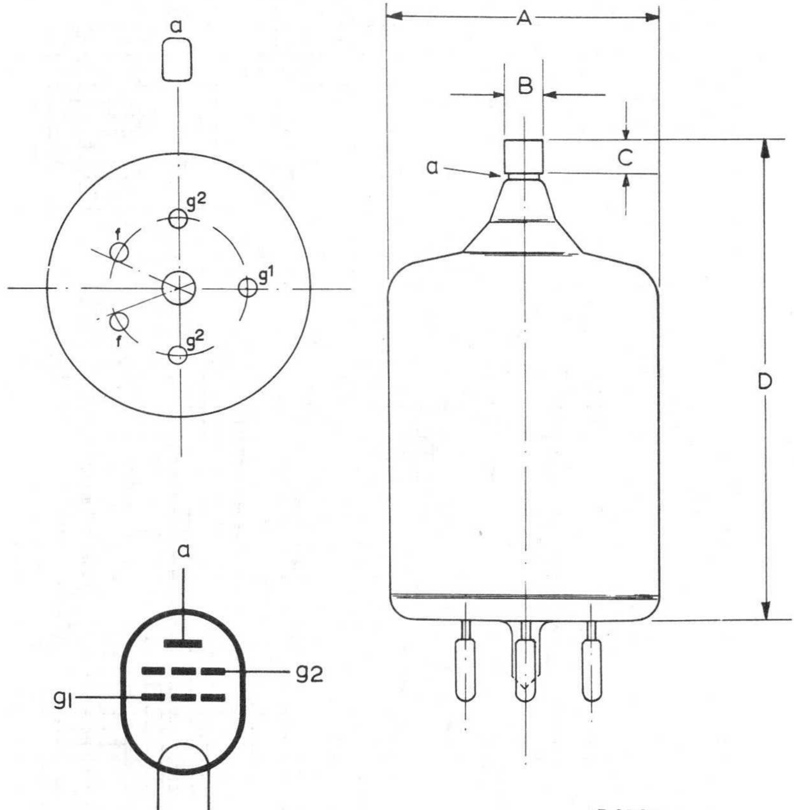
WEIGHT

Valve only	3.5	oz
	100	g

V.H.F. POWER TETRODE

QY3-125

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

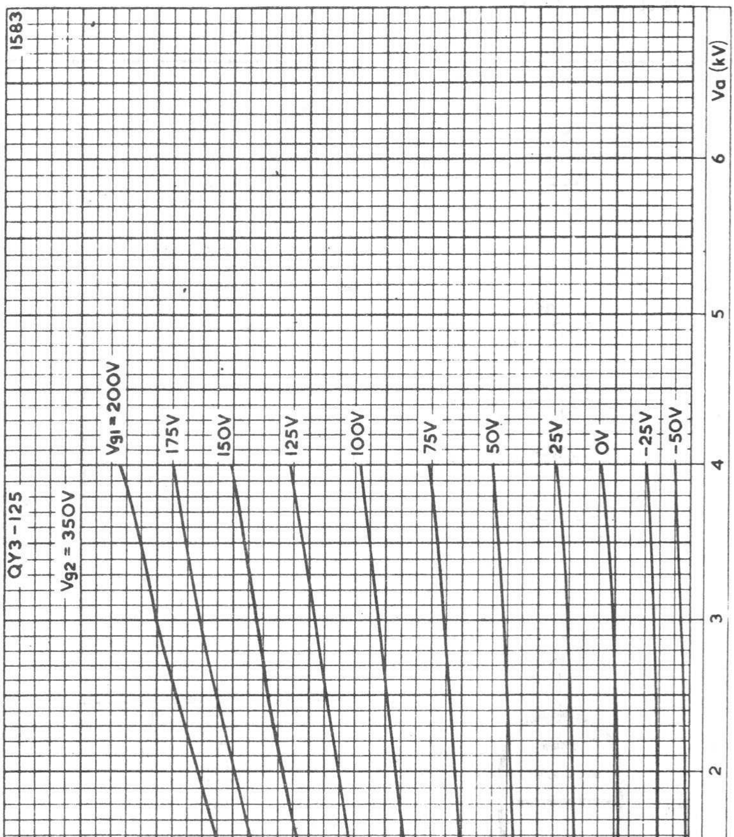


B 2608

DIMENSIONS

	Inches	Millimetres	
A	2.362 ± 0.020	60 ± 0.5	
B	0.354 ± 0.004	9.0 ± 0.1	
C	0.354	9.0	min
D	4.173 ± 0.157	106 ± 4.0	

Inch dimensions derived from original millimetre dimensions.

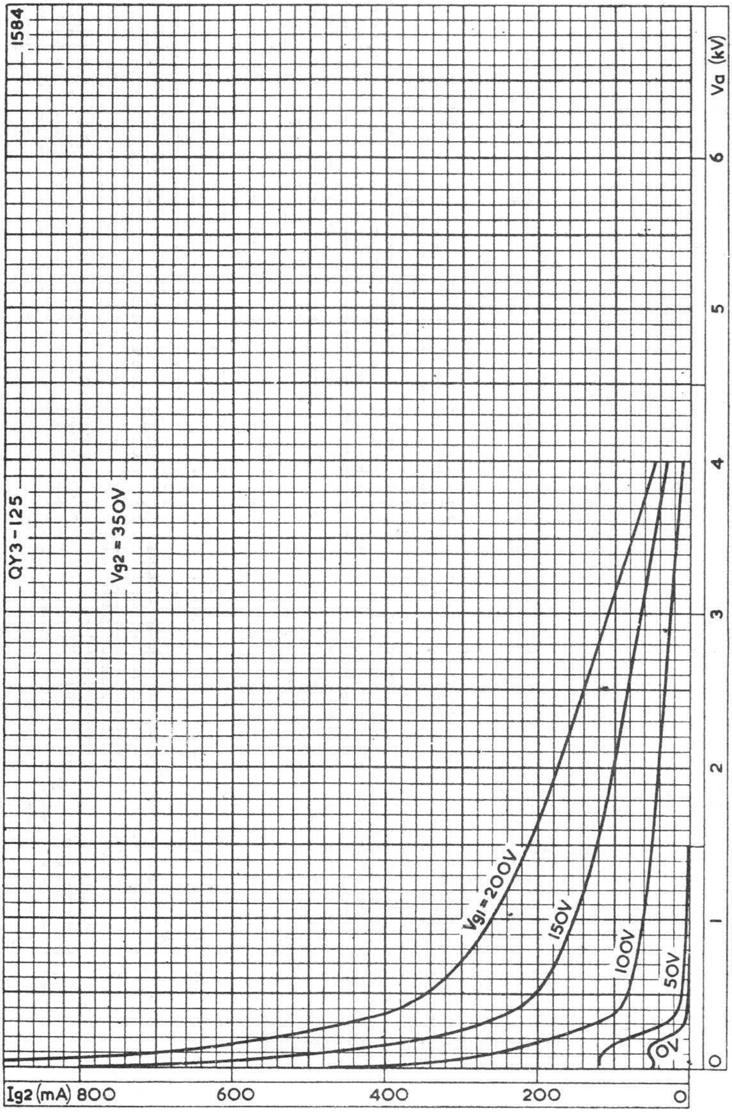


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE=350 V

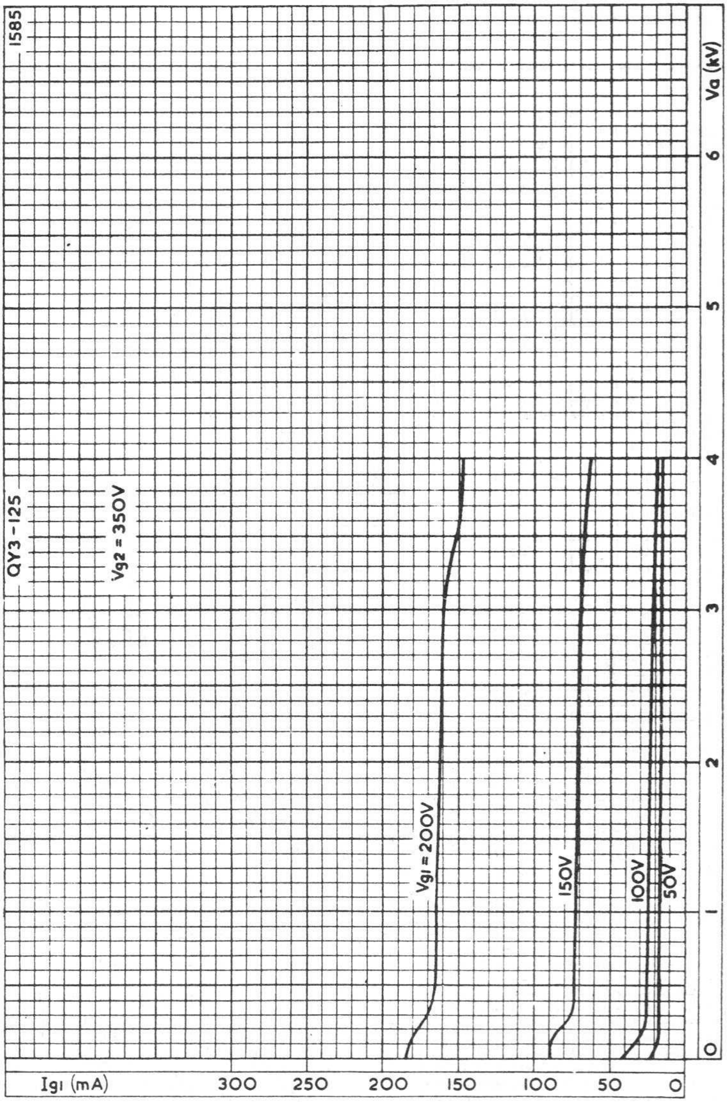
V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR SCREEN-GRID VOLTAGE = 350V

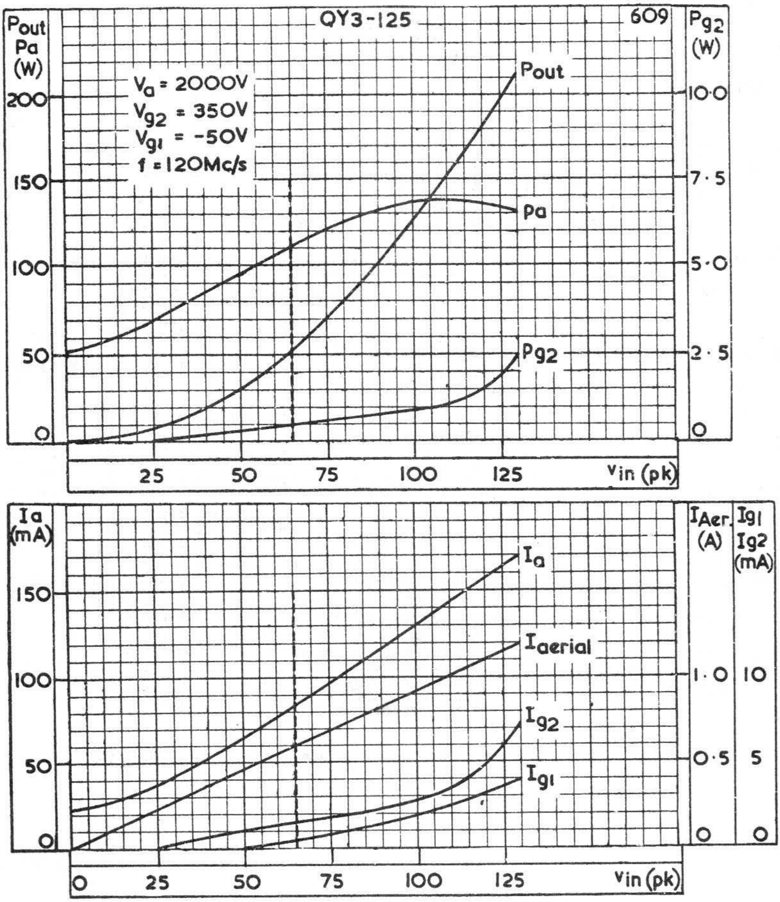


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
FOR SCREEN-GRID VOLTAGE OF 350 V

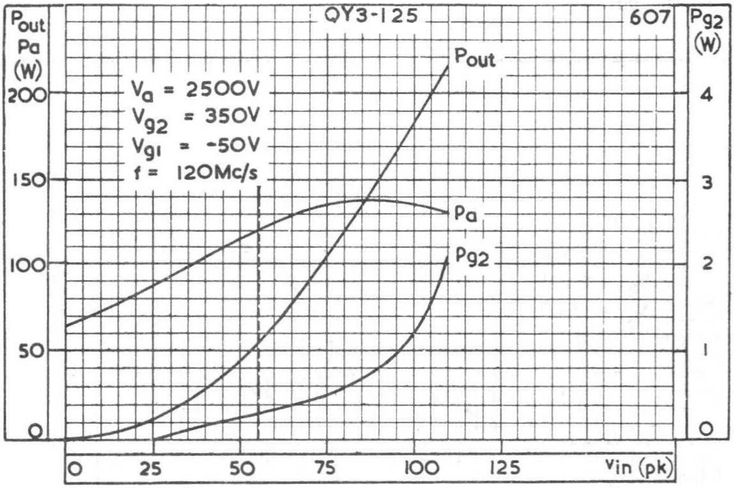
V.H.F. POWER TETRODE

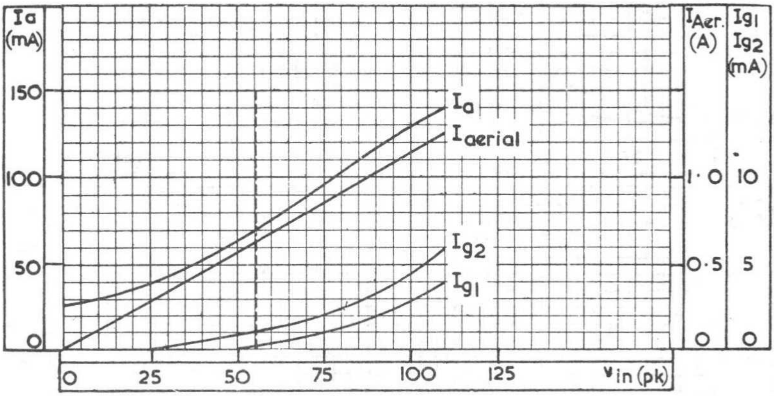
All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125

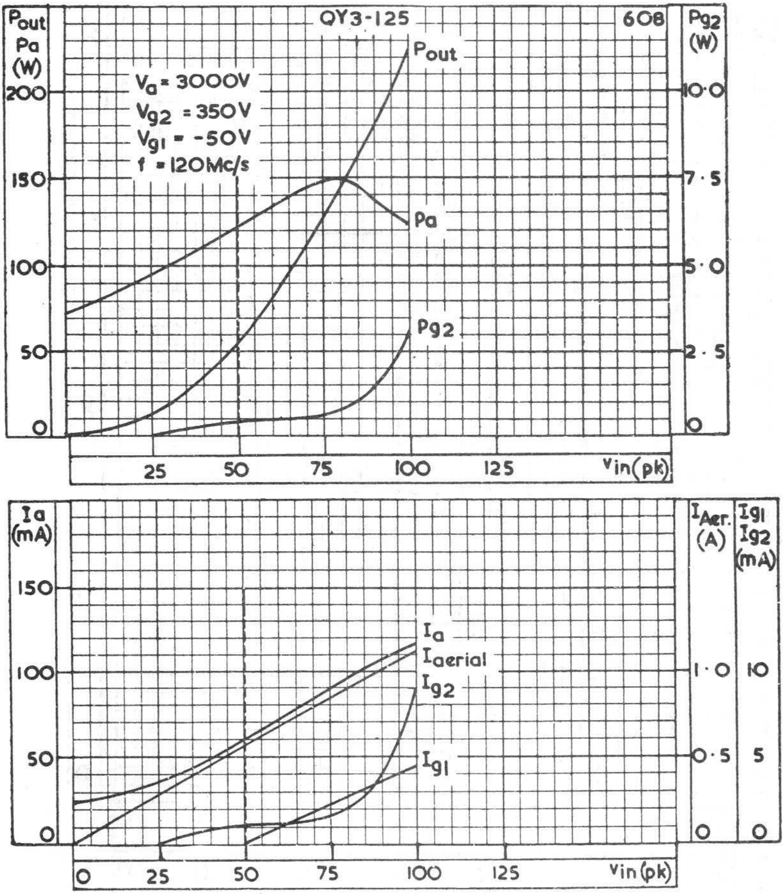


OPERATING CHARACTERISTICS FOR CLASS " B " TELEPHONY AT $V_a = 2$ kV

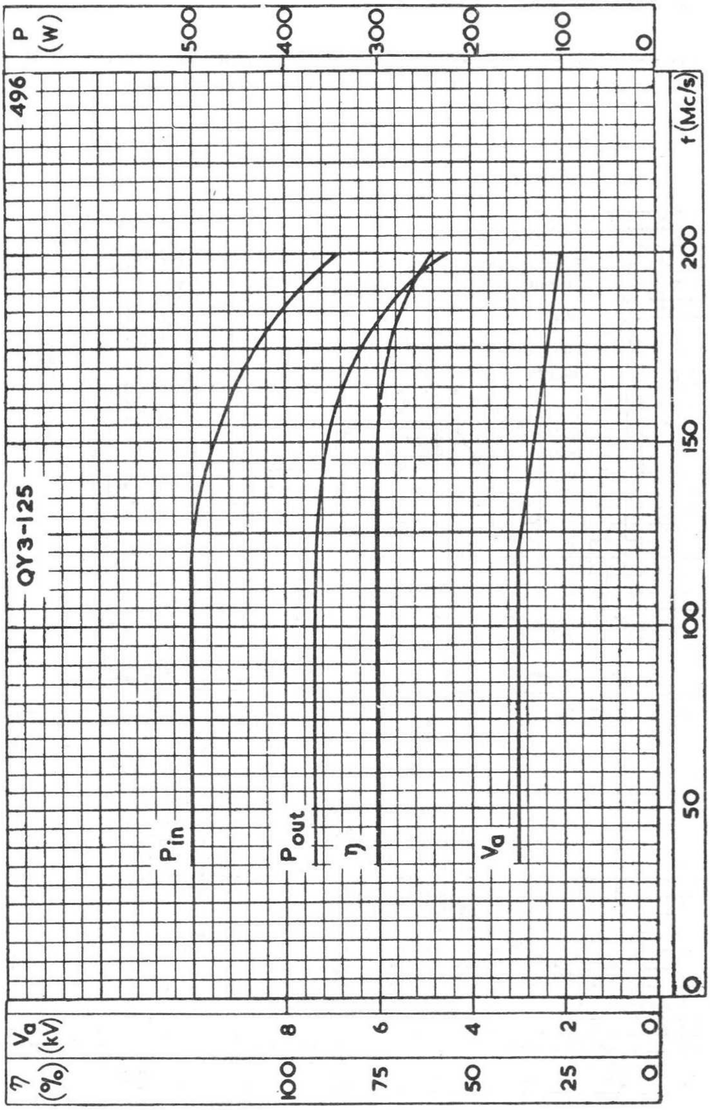




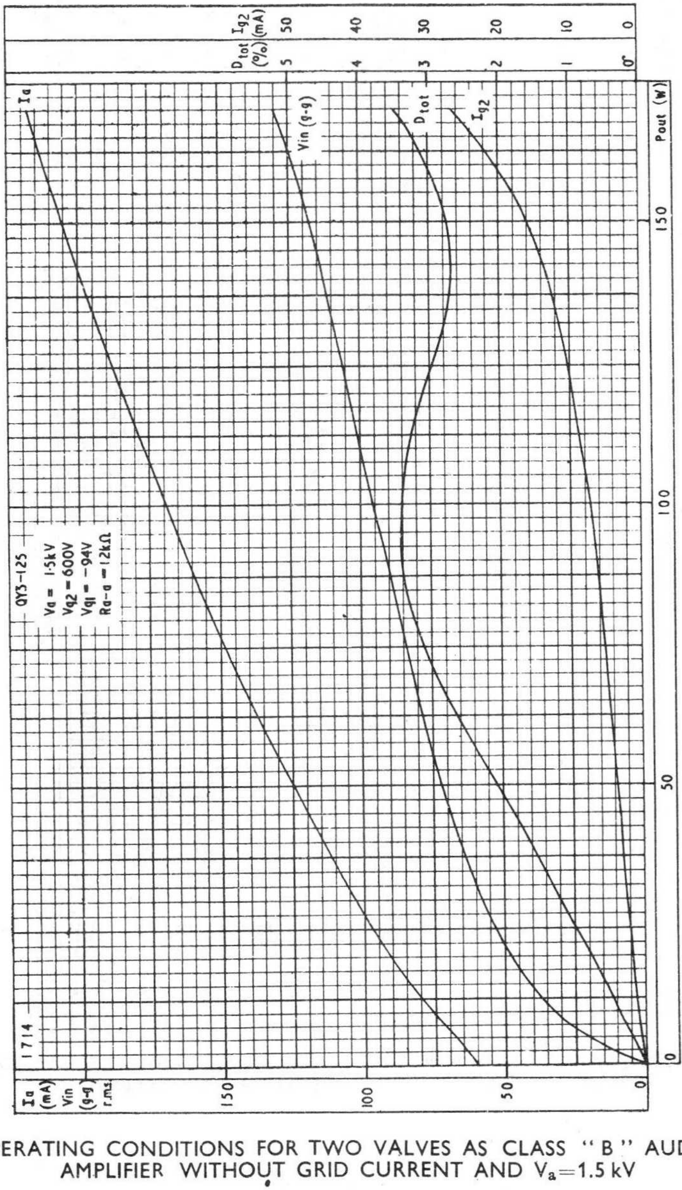
OPERATING CHARACTERISTICS FOR CLASS "B" TELEPHONY
AT $V_a = 2.5$ kV



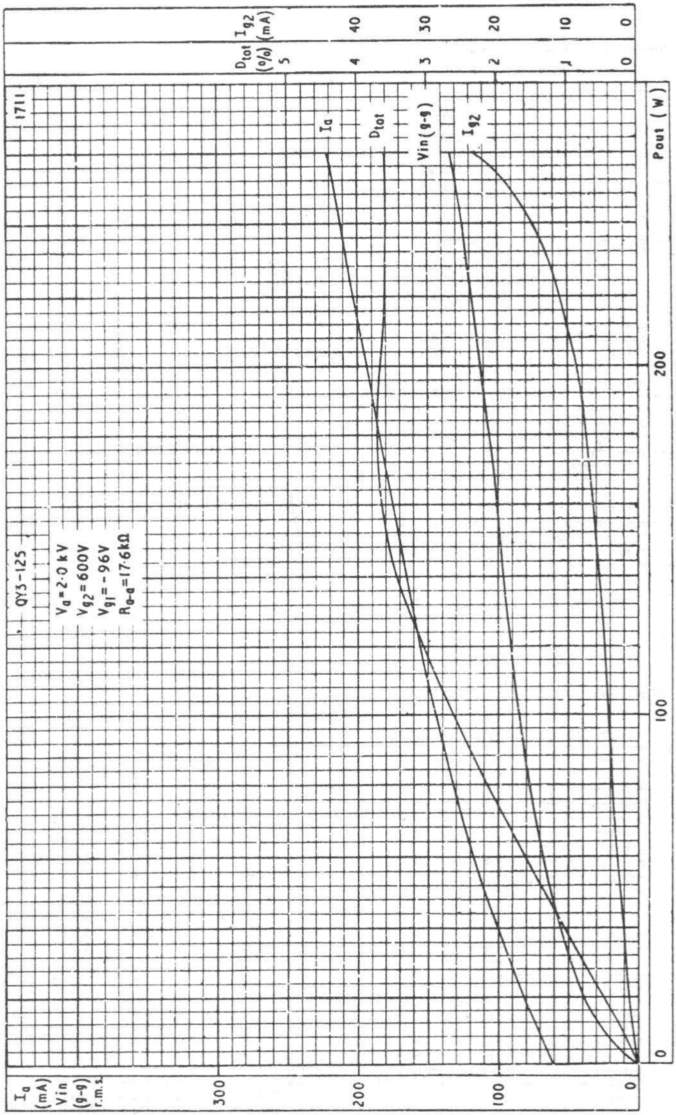
OPERATING CHARACTERISTICS FOR CLASS "B" TELEPHONY AT $V_a = 3.0$ kV



FREQUENCY CHARACTERISTICS AS CLASS " C " TELEGRAPHY AMPLIFIER



OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITHOUT GRID CURRENT AND $V_a = 1.5$ kV

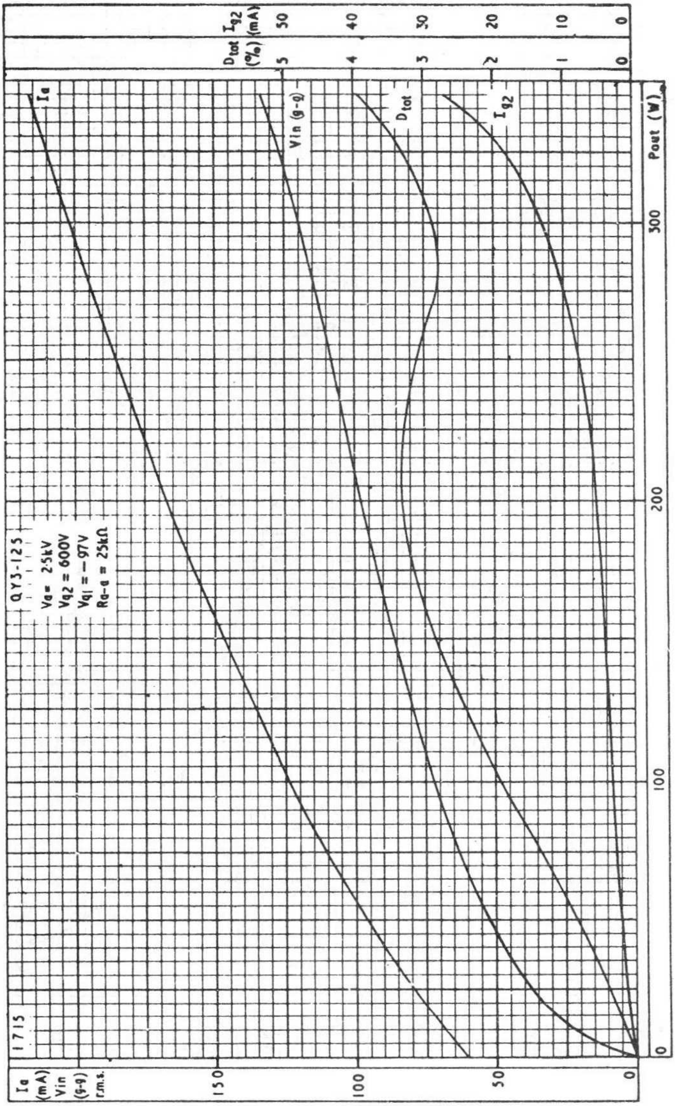


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITHOUT GRID CURRENT AND $V_a = 2.0$kV

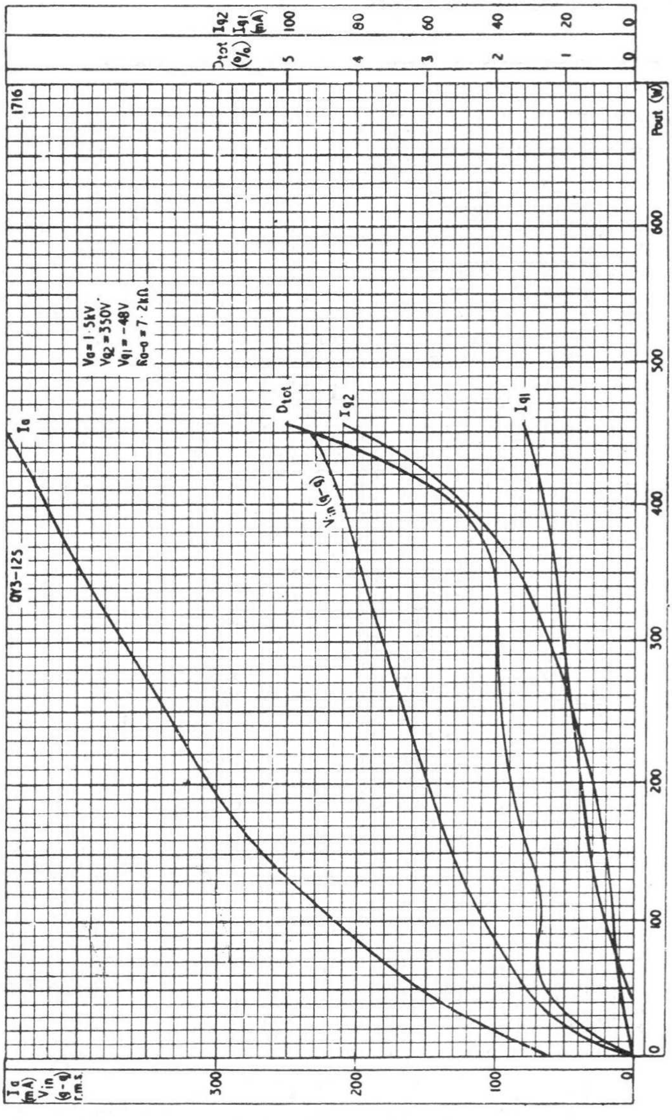
V.H.F. POWER TETRODE

QY3-125

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.



OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITHOUT GRID CURRENT AND V_a=2.5 kV

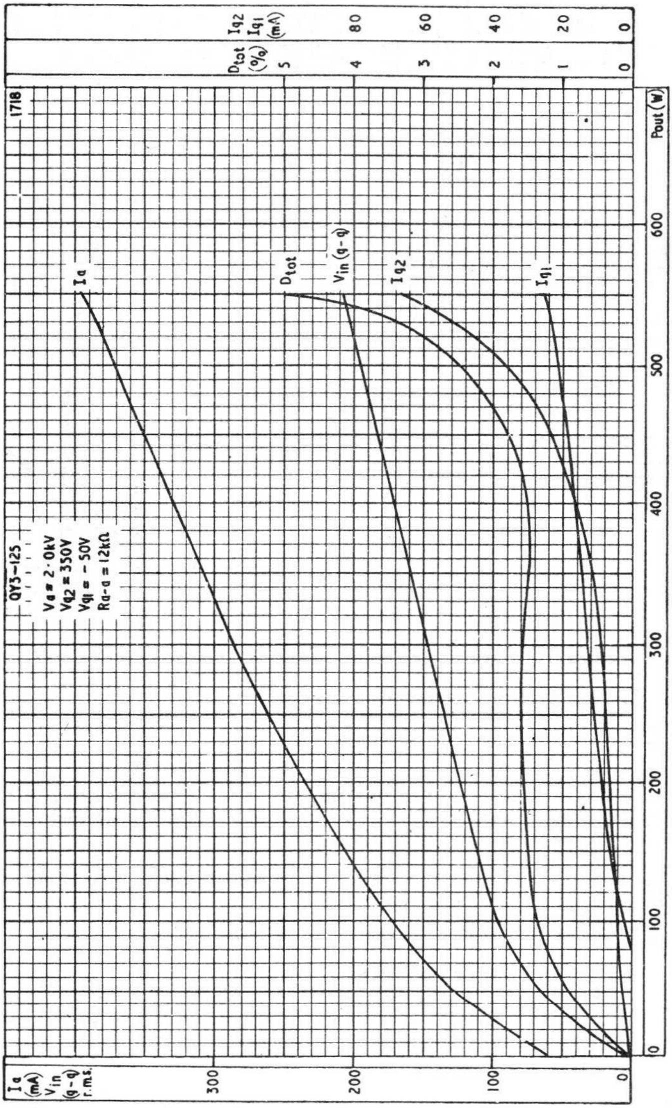


OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITH GRID CURRENT AND $V_a = 1.5$ kV

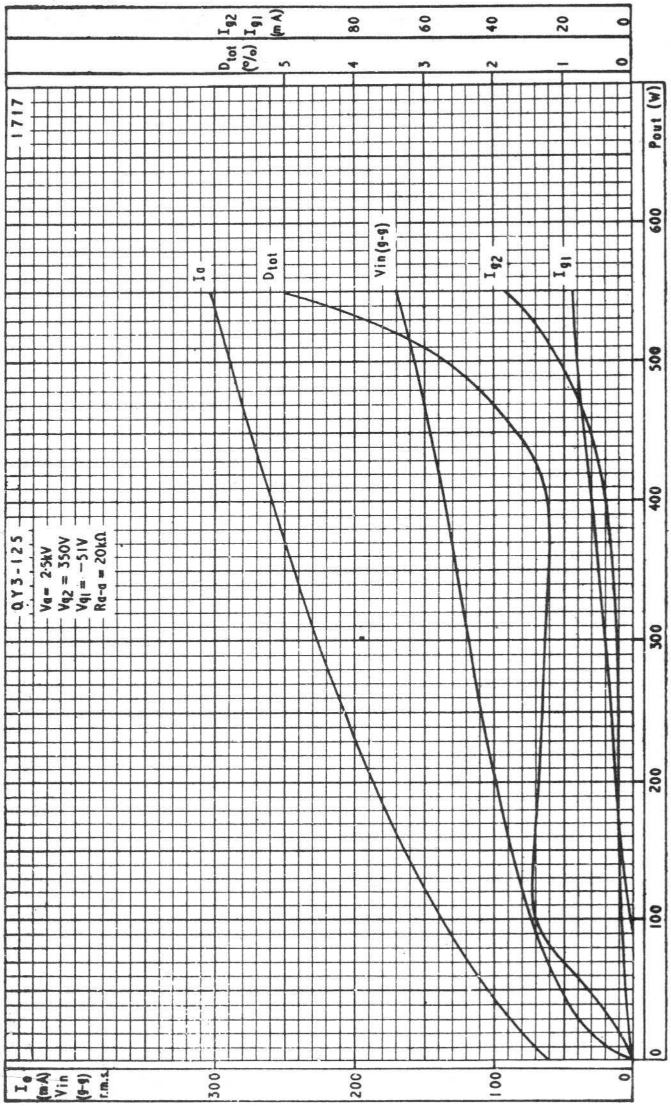
V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 125W and suitable for use at frequencies up to 200 Mc/s.

QY3-125



OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITH GRID CURRENT AND $V_a = 2.0$ kV



OPERATING CONDITIONS FOR TWO VALVES AS CLASS "B" AUDIO AMPLIFIER WITH GRID CURRENT AND $V_a = 2.5$ kV

BEAM POWER TETRODE QY4-400

QUICK REFERENCE DATA

Forced-air cooled beam power tetrode suitable for use as power amplifier, oscillator or modulator.

	Class 'B' Linear Amplifier for S.S.B. operation	Class 'C' Telephony Anode and Screen Grid Modulation	Class 'C' Telegraphy or F.M. Telephony	
f	60	75	100	Mc/s
P_{out}	*650	630	800	W
f max.	110	75	110	Mc/s
V_a max.	4.0	3.2	4.0	kV
p_a max.	400	270	400	W

* P.E. P_{out}

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Maximum operating conditions

f	<75	<75	<75	100	100	Mc/s
P_{out}	640	800	1100	650	800	W
P_{load}	550	680	940	520	640	W
η_a	73	76	79	74	74	%
V_a	2.5	3.0	4.0	3.5	4.0	kV
I_a	350	350	350	250	270	mA
V_{g2}	500	500	500	500	500	V
I_{g2}	35	30	25	17	16	mA
$-V_{g1}$	200	220	220	170	170	V
I_{g1}	6.5	6.0	6.0	9.0	10	mA
$v_{in\,(pk)}$	290	305	305	235	240	V
P_{load} (driver)	12	12	12	20	20	W
p_a	235	250	300	225	280	W
p_{g2}	17.5	15	12.5	8.5	8.0	W

CLASS 'C' TELEPHONY ANODE AND SCREEN-GRID MODULATION

Maximum operating conditions

	C.C.S.			I.C.A.S.	
f	75	75	75	30	Mc/s
P_{out}	380	510	630	765	W
P_{load}	324	435	540	650	W
η_a	69	74	76	77	%
V_a	2.0	2.5	3.0	3.65	kV
I_a	275	275	275	275	mA
V_{g2}	500	500	500	500	V
I_{g2}	40	38	36	30	mA
$-V_{g1}$	220	220	220	225	V
I_{g1}	6.0	6.0	6.0	6.0	mA
$v_{in(pk)}$	305	308	305	308	V
P_{load} (driver)	3.5	3.5	3.5	-	W
p_a	170	178	195	235	W
p_{g2}	20	19	18	15	W
For 100% modulation					
P_{mod}	275	344	413	500	W
$v_{g2\,(pk)}$	400	400	400	400	V

CLASS 'B' LINEAR AMPLIFIER FOR SINGLE SIDEBAND OPERATION

Maximum operating conditions at $I_{a(o)}$ = 90mA

f	60	Mc/s
P.E. P_{out}	500	W
P.E. P_{load}	425	W
**d_3	36	dB
**d_5	42	dB
V_a	3.0	kV
V_{g2}	810	V
***$-V_{g1}$	140	V
$I_{a(o)}$	90	mA
$I_{g2(o)}$	0	mA

	Single tone	Double tone	
I_a	300	215	mA
I_{g2}	15	11	mA
I_{g1}	0	0	mA
$v_{in(pk)}$	140	-	V
P_{load} (driver)	3.0	-	W
p_a	400	395	W
η_a	56	39	%

Maximum operating conditions at $I_{a(o)}$ = 75mA

f		60	Mc/s
P.E. P_{out}		600	W
P.E. P_{load}		510	W
** d_3		36	dB
** d_5		40	dB
V_a		3.5	kV
V_{g2}		750	V
*** $-V_{g1}$		135	V
$I_{a(o)}$		75	mA
$I_{g2(o)}$		0	mA
	Single tone	Double tone	
I_a	280	200	mA
I_{g2}	12	8.4	mA
I_{g1}	0	0	mA
$v_{in(pk)}$	135	-	V
P_{load} (driver)	3.0	-	W
p_a	380	400	W
η_a	61	43	%

Maximum operating conditions at $I_{a(o)}$ = 65mA

f		60	Mc/s
P.E.P_{out}		650	W
P.E.P_{load}		550	W
**d_3		34	dB
**d_5		40	dB
V_a		4.0	kV
V_{g2}		705	V
***-V_{g1}		130	V
$I_{a(o)}$		65	mA
$I_{g2(o)}$		0	mA
	Single tone	Double tone	
I_a	250	175	mA
I_{g2}	10	7.0	mA
I_{g1}	0	0	mA
$v_{in\ (pk)}$	130	-	V
P_{load} (driver)	3.0	-	W
p_a	350	375	W
η_a	65	47	%

**Third and fifth order intermodulation products.
Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two tones at that level.

***Adjust to give the desired value of $I_{a(o)}$.

CLASS 'AB2' AUDIO AMPLIFIER

Maximum operating conditions for two valves in push-pull

P_{out}	1.11	1.38	1.65	1.75	kW
R_{a-a}	9.0	10	11.3	15	kΩ
V_a	2.5	3.0	3.5	4.0	kV
V_{g2}	500	500	500	500	V
**$-V_{g1}$	75	80	85	90	V
$I_{a(o)}$	2 x 95	2 x 90	2 x 80	2 x 80	mA
I_a (max. sig)	2 x 350	2 x 350	2 x 350	2 x 319	mA
I_{g2} (max. sig)	2 x 30	2 x 20	2 x 20	2 x 20	mA
I_{g1}	2 x 7.0	2 x 6.5	2 x 6.5	2 x 6.0	mA
$v_{in\,(g1-g1)\,r.m.s.}$	205	205	215	215	V
P_{load} (driver)	8.6	9.0	10.2	7.0	W
p_a	2 x 320	2 x 362	2 x 400	2 x 400	W
η_a	64	66	68	69	%

CLASS 'AB1' AUDIO AMPLIFIER

Maximum operating conditions for two valves in push-pull

P_{out}	0.85	1.11	1.33	1.54	kW
R_{a-a}	6.8	8.9	11.5	14.5	kΩ
V_a	2.5	3.0	3.5	4.0	kV
V_{g2}	750	750	750	750	V
**$-V_{g1}$	130	137	145	150	V
$I_{a(o)}$	2 x 95	2 x 80	2 x 70	2 x 60	mA
I_a (max. sig)	2 x 318	2 x 318	2 x 305	2 x 293	mA
I_{g2} (max. sig)	2 x 11.6	2 x 11	2 x 13.5	2 x 15	mA
$V_{in\,(g1-g1)\,r.m.s.}$	184	194	205	212	V
p_a	2 x 370	2 x 400	2 x 400	2 x 400	W
η_a	54	58	63	66	%

**Adjust to give the desired value of $I_{a(o)}$.

BEAM POWER TETRODE QY4-400

ABSOLUTE MAXIMUM RATINGS

	Class 'AB1' or 'AB2' audio	Class 'B' S.S.B.	Class 'C' Telephony C.C.S.	Class 'C' Telephony I.C.A.S.	Class 'C' Telegraphy	
f max.	-	110	75	30	110	Mc/s
V_a max.	4.0	4.0	3.2	4.0	4.0	kV
V_{g2} max.	*800	850	600	600	600	V
$-V_{g1}$ max.	-	-	500	500	500	V
I_k max.	400	400	330	330	420	mA
p_a max.	400	400	270	270	400	W
p_{g2} max.	35	35	35	35	35	W
I_{g1} max.	25	-	25	25	25	mA
p_{g1} max.	10	-	10	10	10	W
R_{g1-f} max.	250	250	50	50	50	kΩ

*This can be increased to 1.0kV if $T_{base-seals} < 120^{o}C$.

CATHODE

Directly heated, thoriated tungsten

V_f	5.0	V
I_f	14.1	A

CAPACITANCES

c_{a-g1}	120	mpF
c_{out}	4.9	pF
c_{in}	12.7	pF

CHARACTERISTICS (measured at $V_a = 2.5kV$, $V_{g2} = 500V$, $I_a = 100mA$)

g_m	4.0	mA/V
μ_{g1-g2}	5.1	

Mullard

MOUNTING POSITION

Vertical, base up or down

COOLING

Forced-air

Maximum temperatures

Anode seal	220	^oC
Base seals	180	^oC
Bulb	350	^oC

$p_a < 250W$

In order to keep within the temperature limits of the base seals, an air flow of at least $5ft^3/min$ ($0.15m^3/min$) must be directed at the base and commence immediately the filament is energised.

$p_a > 250W$

An air flow over the envelope up to $14ft^3/min$ ($0.4\ m^3/min$) will be required. In order to assist the circulation of the cooling air, a glass chimney surrounding the valves should be used.

PHYSICAL DATA

	lb	kg
Weight of valve	0.42	0.19
Weight of valve and carton (9 valves per carton)	6.5	2.95

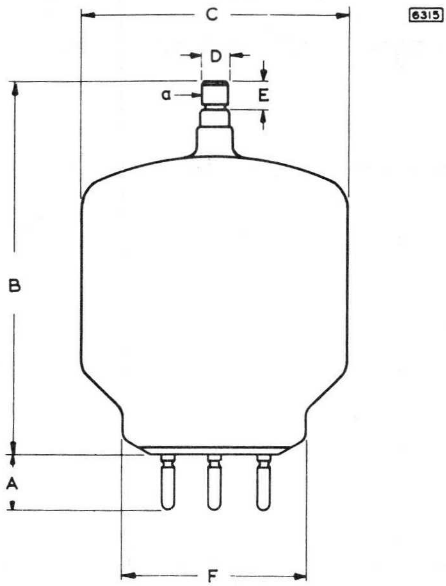
ACCESSORIES

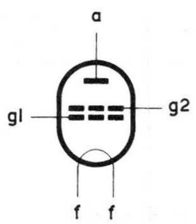
Socket	40211/01
Anode connector	40624
Glass chimney	40666

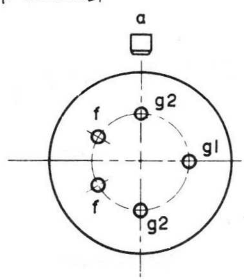
DIMENSIONS OF VALVE

	Inches	Millimetres		Inches	Millimetres
A	0.728	18.5 max.	D	0.354	9.0
B	5.000 ± 0.236	127 ± 6.0	E	0.354	9.0
C	3.425	87	F	2.441	62 max.

Inch dimensions derived from original millimetre dimensions

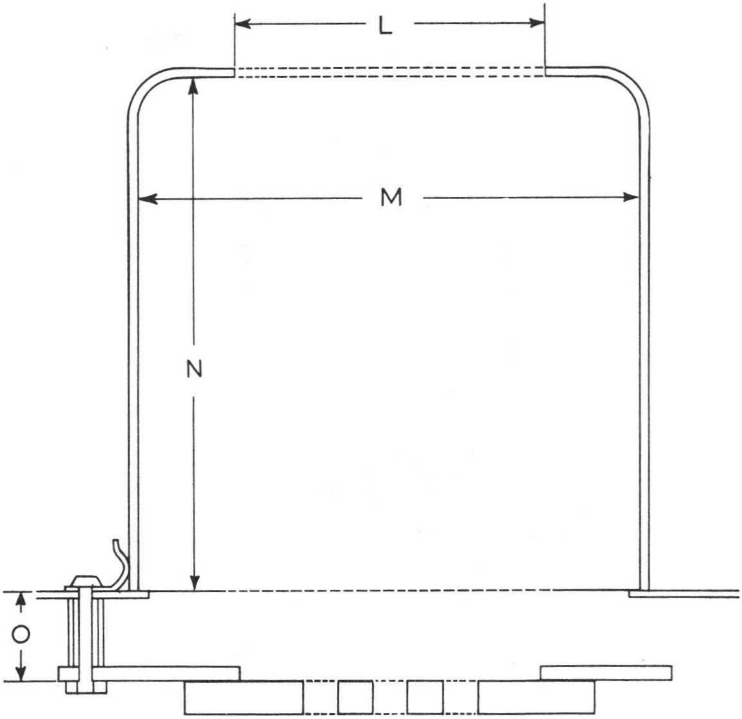






B5F Base

(According to B.S.448)



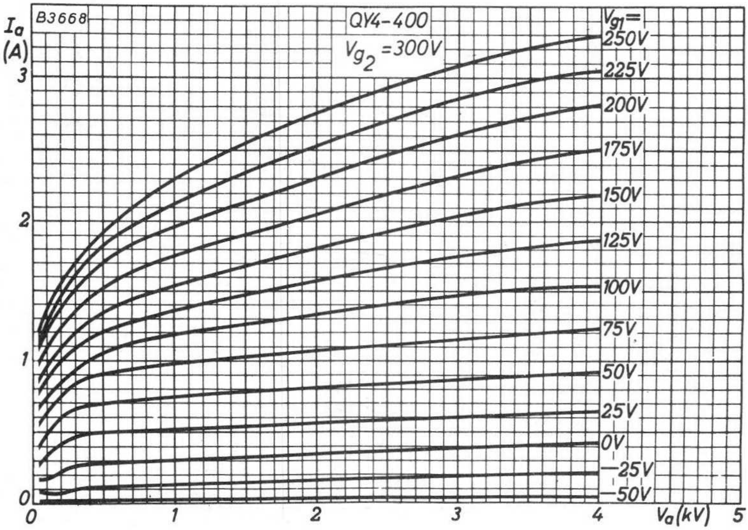
Glass chimney

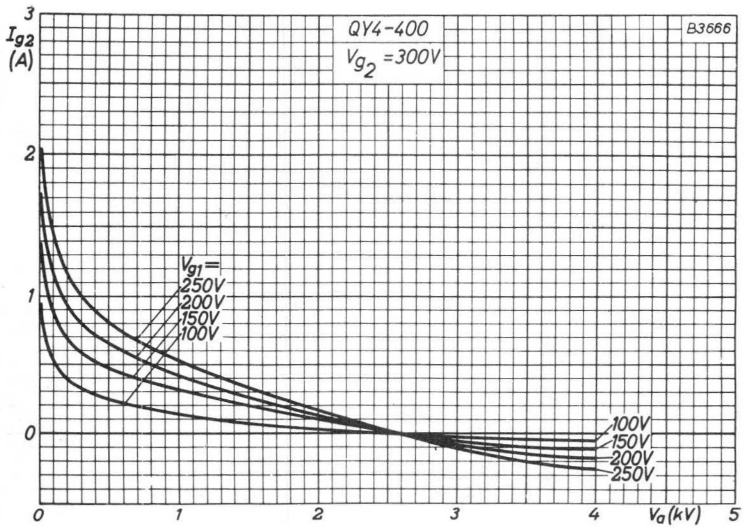
6451

DIMENSIONS OF GLASS CHIMNEY

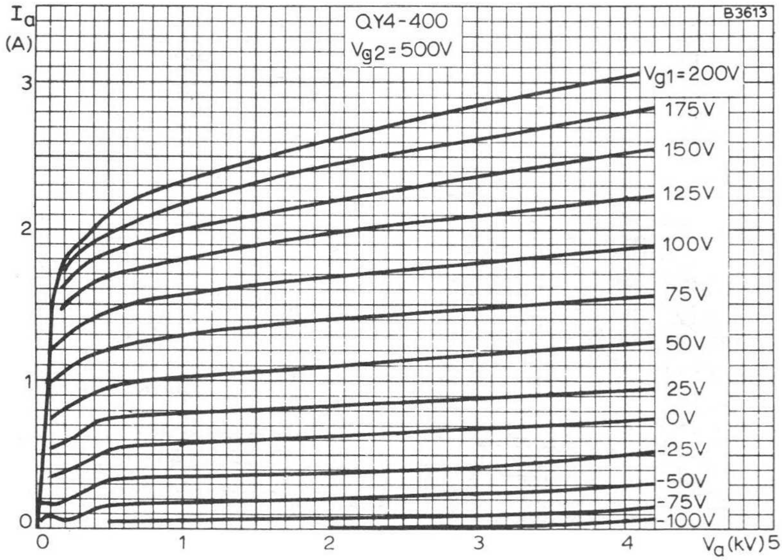
	Inches	Millimetres
L	2.441	62
M	3.937	100
N	4.016	102
O	0.709	18

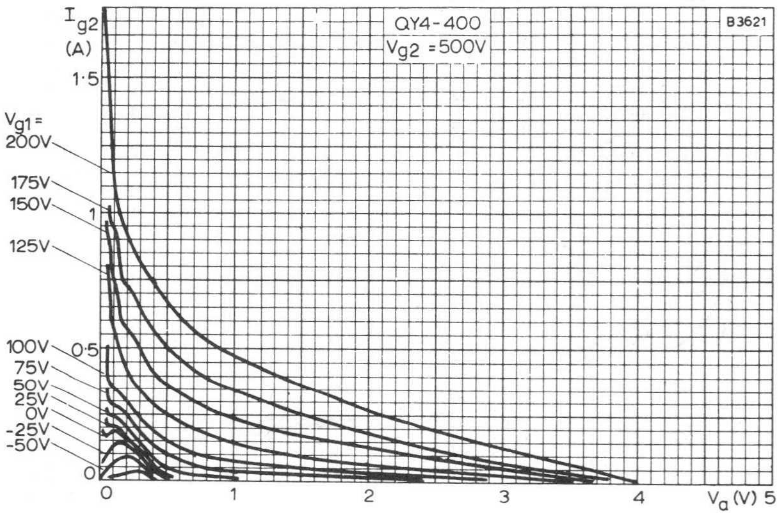
Inch dimensions derived from original millimetre dimensions



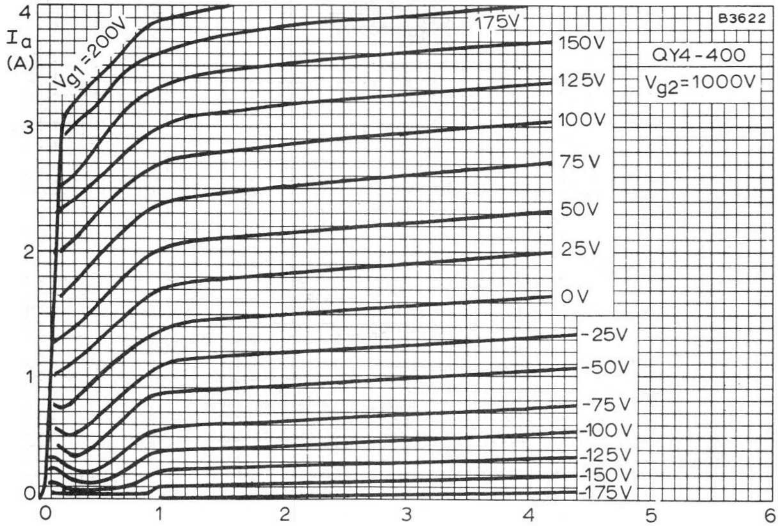


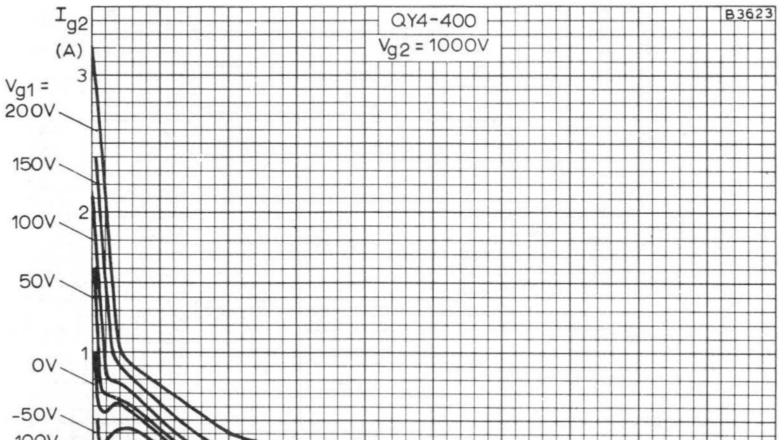
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =300V



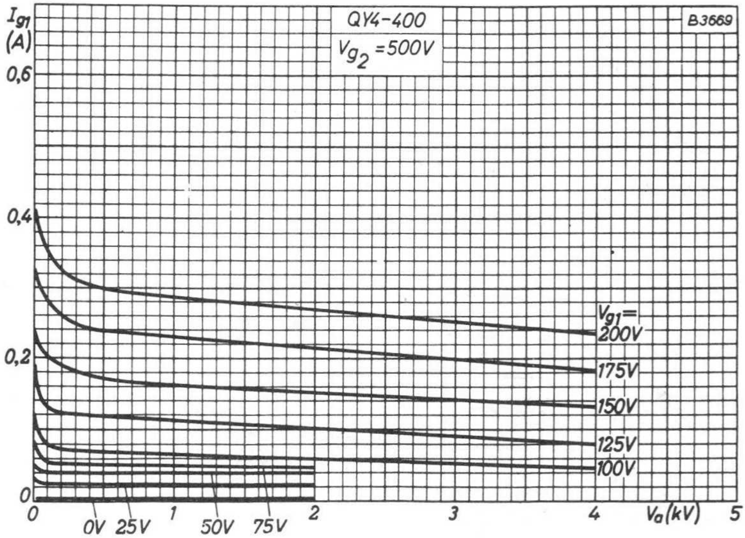


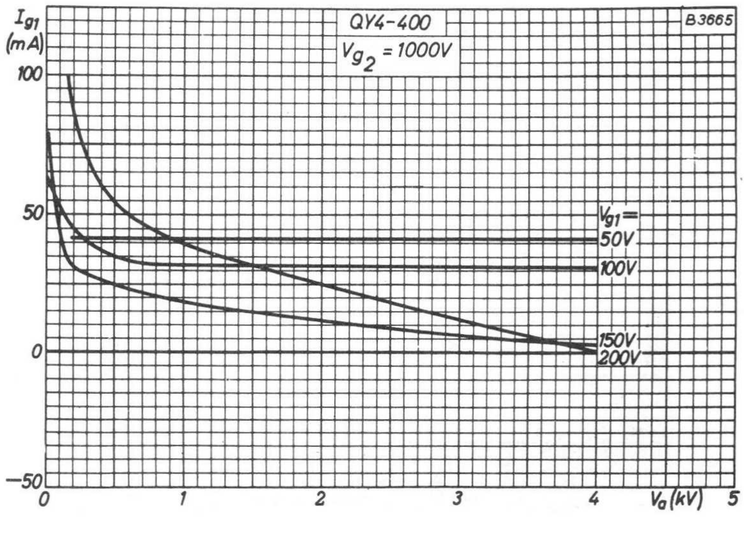
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =500V



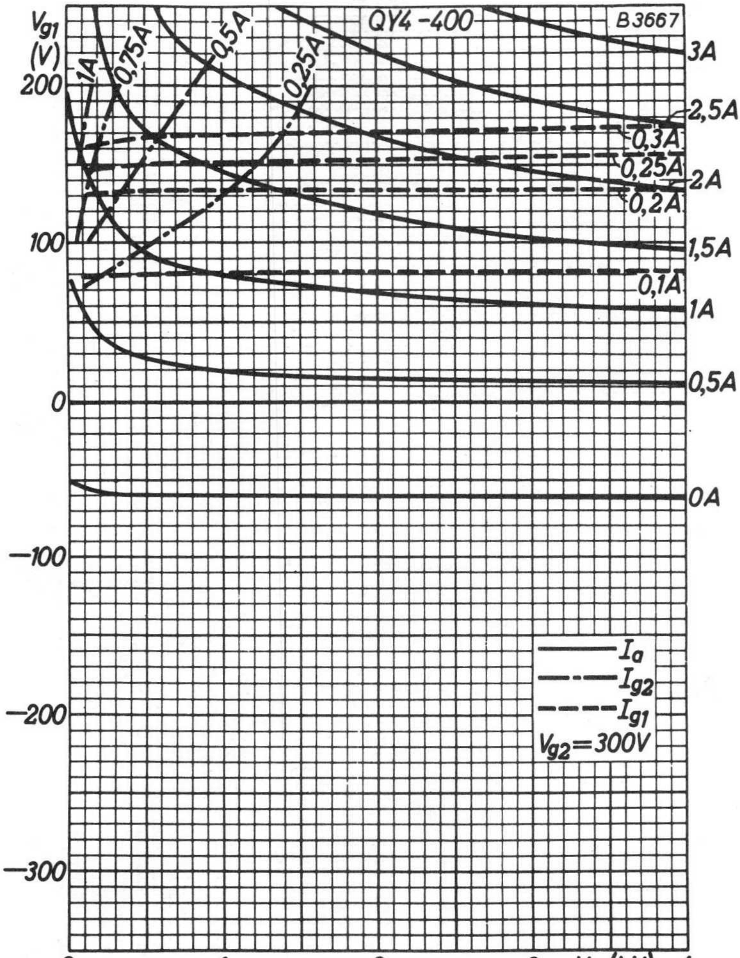


ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =1000V

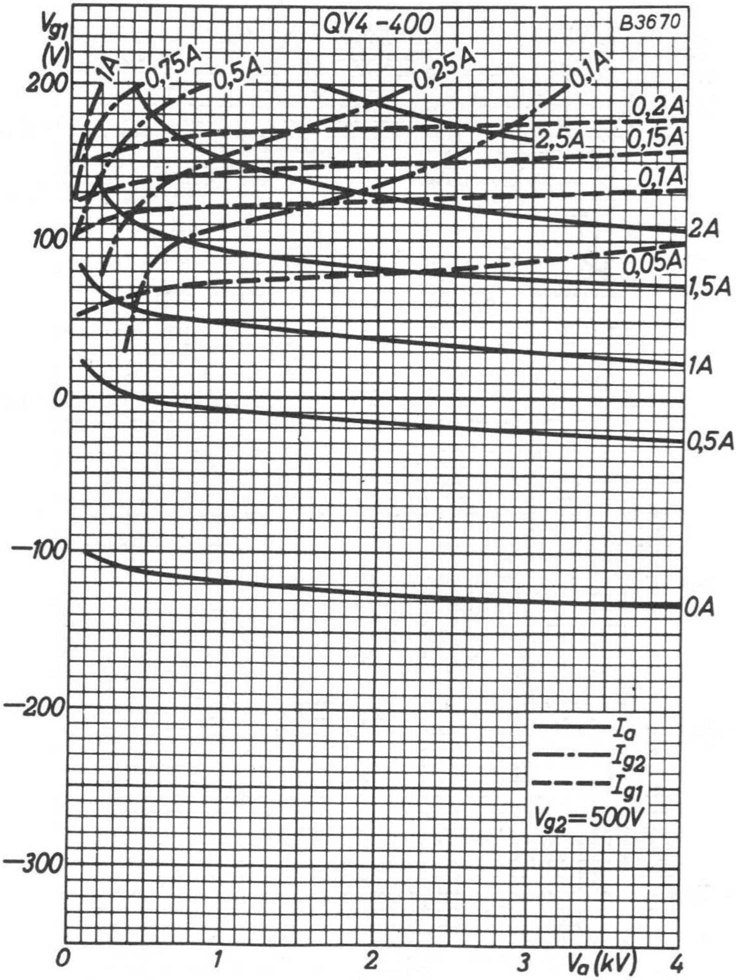




CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} =500V AND 1000V



CONSTANT CURRENT CHARACTERISTICS. $V_{g2} = 300V$



CONSTANT CURRENT CHARACTERISTICS. $V_{g2} = 500V$

V. H. F. POWER TETRODE

QY4-500A

QUICK REFERENCE DATA

Forced-air cooled power tetrode, intended for use as v.h.f. power amplifier or oscillator.

	Class 'B' Television	Class 'C' Telegraphy or F.M. Telephony	
fout	220	186	Mc/s
Pout	1200	630	W
f max.	220	220	Mc/s
Va max.	3.0	4.0	kV
pa max.	500	500	W

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES which precede this section of the handbook.

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Absolute maximum ratings

f max.	220	Mc/s
Va max.		
f < 120 Mc/s	4.0	kV
f < 220 Mc/s	3.0	kV
Vg2 max.	500	V
-Vg1 max.	500	V
Ia max.	350	mA
Ig2 max.	60	mA
Ig1 max.	30	mA
pa max.	500	W
pg2 max.	30	W
pg1 max.	10	W

Typical operating conditions

f	110	110	110	186	Mc/s
Va	2.5	3.0	4.0	3.0	kV
Vg2	500	500	500	500	V
-Vg1	150	150	150	150	V
Ia	310	310	315	300	mA
Ig2	26	24	22	22	mA
Ig1	15	16	16	11	mA
vin(pk)	230	230	230	220	V
Pload (driver)	15	15	15	20	W
pa	245	260	330	270	W
Pout	530	670	930	630	W
Pload	475	600	835	570	W
ηa	68.5	72	73.5	70	%

CLASS 'B' TELEVISION SERVICE
Negative modulation, positive synchronisation.

Absolute maximum ratings - each valve

f max.	220	Mc/s
Va max.	3.0	kV
Vg2 max.	500	V
Ia (black) max.	350	mA
Ia (sync) max.	465	mA
pa (sync) max.	500	W
pg2 (sync) max.	30	W
pg1 (sync) max.	10	W

Typical operating conditions - two valves in push-pull.

f	220	220	Mc/s
B (-3.0dB)	5.0	5.0	Mc/s
Va	1.85	2.4	kV
Vg2	500	500	V
-Vg1	100	100	V
vin (g1-g1) pk (sync)	280	370	V
Ia (sync)	2 x 285	2 x 400	mA
Ia (black)	2 x 215	2 x 300	mA
Ig2 (sync)	2 x 20	2 x 35	mA
Ig2 (black)	2 x 2.0	2 x 3.0	mA
Ig1 (sync)	2 x 10	2 x 15	mA
Ig1 (black)	2 x 2.0	2 x 5.0	mA
Pload (driver)	40	75	W
pa (black)	2 x 230	2 x 380	W
Pout (sync)	600	1200	W
Pout (black)	340	680	W
Pload (sync)	480	960	W
Pload (black)	270	560	W

CATHODE

Directly heated, thoriated tungsten

Vf	5.0	V
If	13.5	A

CAPACITANCES

cin	12.8	pF
cout	5.6	pF
ca-g1	0.05	pF

CHARACTERISTICS (measured at Va = 2.5kV, Vg2 = 500V, Ia = 200mA)

gm	5.0	mA/V
μg1-g2	6.0	

COOLING

Tseals max.	150	^{o}C
Tanode max.	150	^{o}C

COOLING

In order to keep within both temperature limits at p_a = 500 W it may be necessary to pass a minimum flow of air of 1.15 m^3/min. (40 ft^3/min.) through the anode cooler. A flow of air must also be directed on the base and screen seals. This cooling should be applied before the application of filament voltage and continued for three minutes after filament voltage has been removed.

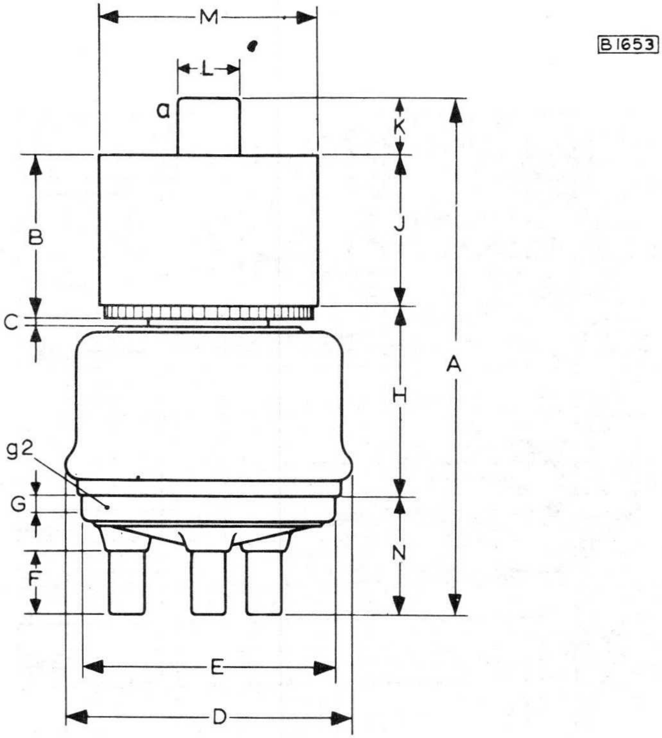
MOUNTING POSITION

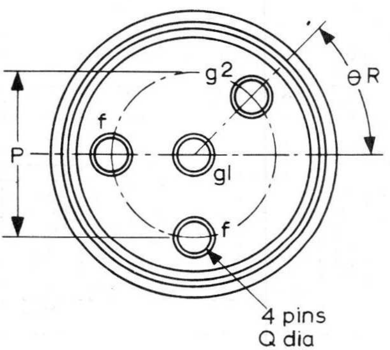
Vertical, base up or down.

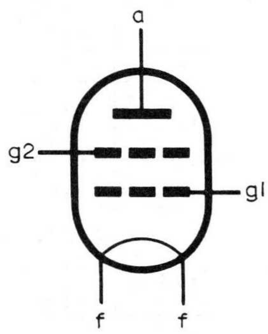
PHYSICAL DATA	oz	g
Weight of valve	17	490
Weight of valve and carton	40	1135

DIMENSIONS

	Inches	Millimetres	
A	4.724	120	
B	1.496	38	
C	0.063	1.6	min.
D	2.638	67	
E	2.374 ± 0.014	60.3 ± 0.35	
F	0.563	14.3	min.
G	0.158	4	
H	1.575	40	
J	1.378	35	
K	0.500	12.7	
L	0.563	14.3	
M	2.008	51	
N	1.000	25.4	
P	1.496	38	
Q	0.315	8	
ΘR	45°		


M
L
a
B1653
K
B
J
C
A
H
g2
G
N
F
E
D


g2
θR
f
P
gl
f
4 pins
Q dia


a
g2
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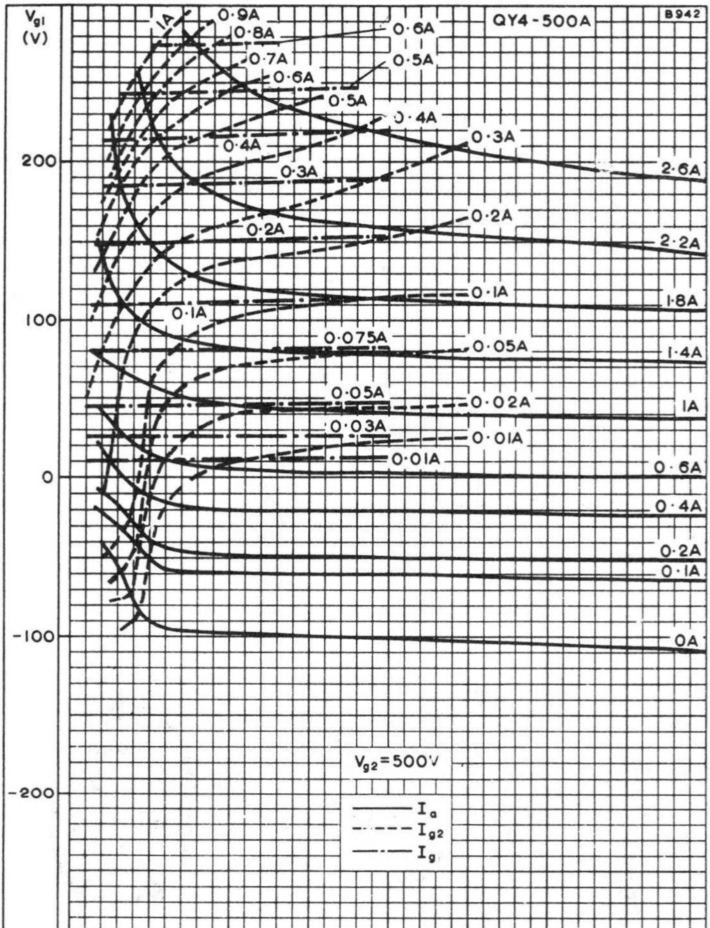
f
f



CONSTANT CURRENT CURVES Vg2 = 500V

R.F. POWER TETRODE

QY5-500

Application: *R.F. power amplifier, frequency multiplier or modulator.*
Power output: *1.76kW continuous rating.*
Frequency: *75Mc/s at full ratings, 110Mc/s at reduced ratings.*
Construction: *Glass, radiation or low velocity air cooled.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES which precede this section of the handbook.

FILAMENT Thoriated tungsten

V_f	10	V
I_f	9.9	A

MOUNTING POSITION Vertical, base up or down

CAPACITANCES

c_{in}	24	pF
c_{out}	8.3	pF
c_{a-g1}	250	mpF

CHARACTERISTICS (measured at $I_a = 120$mA)

g_m	7.0	mA/V
μ_{g1-g2}	9.5	

COOLING

In order to keep the temperature below the maximum permitted values it may be necessary to direct an air flow onto the seals.

$T_{anode\ seal}$ max.	220	°C
$T_{base\ seals}$ max.	180	°C
T_{bulb} max.	250	°C

CLASS 'C' TELEGRAPHY OR F.M. TELEPHONY

Limiting values (absolute ratings)

V_a max. ($f \leqslant 75$Mc/s)	5.0	kV
V_a max. ($f = 110$Mc/s)	4.5	kV
p_a max.	500	W
V_{g2} max.	700	V
p_{g2} max.	65	W
$-V_{g1}$ max.	500	V
p_{g1} max.	25	W
I_k max.	600	mA
$i_{k(pk)}$ max.	3.0	A
R_{g1-f} max.	5.0	kΩ

Typical operation

f	≤60	≤60	100	Mc/s
V_a	4.0	5.0	4.5	kV
V_{g2}	600	600	600	V
V_{g1}	−200	−200	−200	V
I_a	450	440	400	mA
I_{g2}	90	80	70	mA
I_{g1}	39	35	30	mA
$v_{in(pk)}$	350	350	340	V
$P_{load(driver)}$	22	20	30	W
p_a	390	440	500	W
η_a	78	80	72	%
P_{out}	1.41	1.76	1.3	kW
P_{load} ($\eta_{transfer} = 85\%$)	1.2	1.5	1.1	kW

CLASS 'C' AMPLIFIER (ANODE AND SCREEN-GRID MODULATION)

Limiting values (absolute ratings)

Carrier conditions for a modulation factor of 1

f max.	75	Mc/s
V_a max.	4.0	kV
p_a max.	330	W
V_{g2} max.	700	V
p_{g2} max.	50	W
$-V_{g1}$ max.	500	V
p_{g1} max.	25	W
I_k max.	520	mA
$i_{k(pk)}$ max.	4.7	A
R_{g1-f} max.	50	kΩ

Typical operation

Screen grid modulated via a choke of 2H

f	60	Mc/s
V_a	4.0	kV
V_{g2}	600	V
V_{g1}	−240	V
I_a	380	mA
I_{g2}	80	mA
I_{g1}	20	mA
$v_{in(pk)}$	415	V
$P_{load(driver)}$	22	W
p_a	320	W
p_{g2}	48	W
η_a	79	%
P_{out}	1.2	kW
P_{load} ($\eta_{transfer} = 85\%$)	1.02	kW

For 100% modulation

$P_{mod.}$	760	W

CLASS 'B' R.F. AMPLIFIER (S.S.B.)

Limiting values (absolute ratings)

f max.	75	Mc/s
V_a max.	5.0	kV
p_a max.	500	W
V_{g2} max.	700	V
p_{g2} max.	65	W
I_k max.	550	mA
$i_{k(pk)}$ max.	1.8	A
R_{g1-f} max.	50	kΩ

Typical operation

f	60	Mc/s
V_a	5.0	kV
V_{g2}	700	V
V_{g1}	−90	V
$I_{a(o)}$	56	mA
I_a (single tone)	280	mA
I_a (two tone)	200	mA
$I_{g2(o)}$	0	mA
$I_{g2\ (max.\ sig.)}$	25	mA
$I_{g1\ (max.\ sig.)}$	1.0	mA
$v_{in(pk)}$	130	V
$p_{a\ (max.\ sig.)}$	500	W
$p_{g2\ (max.\ sig.)}$	18	W
P_{out} (two tone)	450	W
η_a	64.5	%
P.E.P.	900	W
P_{load} ($\eta_{transfer}$ = 85%)	760	W

CLASS 'B' AUDIO AMPLIFIER AND MODULATOR (TWO VALVES IN PUSH-PULL)

Limiting values (absolute ratings)

V_a max.	5.0	kV
p_a max.	500	W
V_{g2} max.	700	V
p_{g2} max.	65	W
$-V_{g1}$ max.	500	V
I_{g1} max.	45	mA
I_k max.	550	mA
$i_{k(pk)}$ max.	1.8	A
R_{g1-f} max.	50	kΩ

Typical operation

V_a	4.0	4.0	5.0	kV
V_{g2}	600	600	600	V
V_{g1}	−62.5	−60	−62.5	V
$I_{a(o)}$	2×45	2×55	2×50	mA
$I_{a\ (max.\ sig.)}$	2×285	2×366	2×290	mA
$I_{g2\ (max.\ sig.)}$	2×40	2×60	2×43	mA
I_{g1}	2×13.5	2×18	2×13	mA
$V_{in(g1-g1)\ r.m.s.}$	178	214	182	V
P_{drive}	2×1.5	2×2.5	2×1.5	W
p_a	2×300	2×340	2×340	W
P_{out}	1.68	2.25	2.22	kW
R_{a-a}	20	16	26	kΩ
η_a	74	76.5	76.5	%
D_{tot}	4.7	5.0	5.0	%

WEIGHT

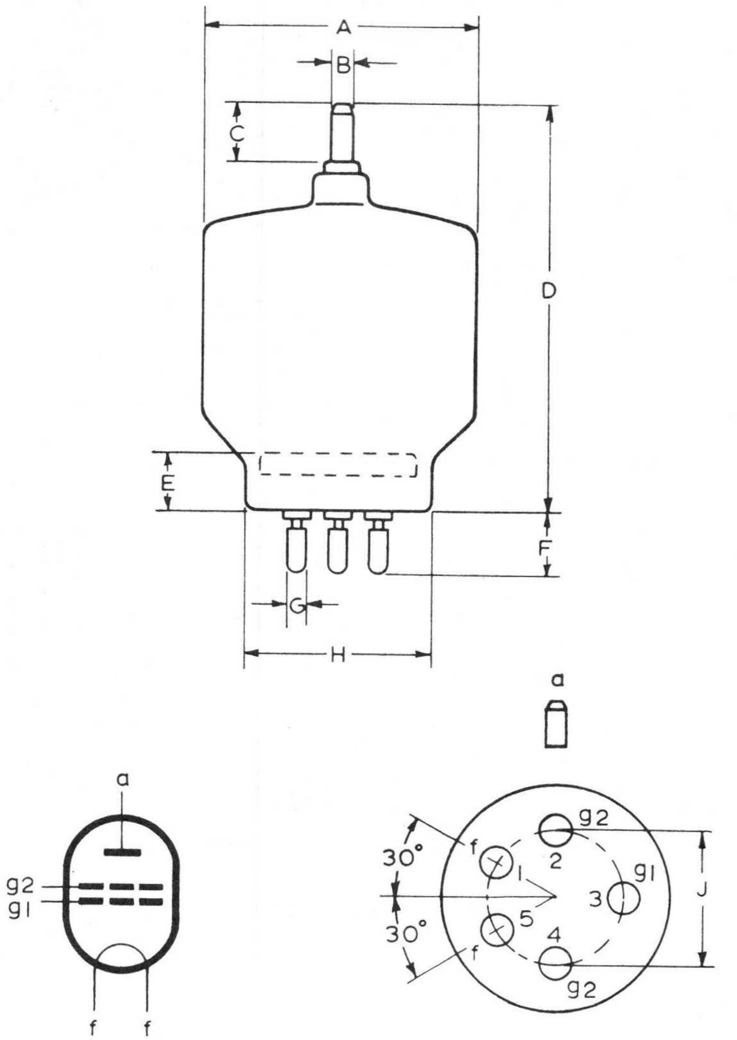
Valve only	13.22 oz 375 g

ACCESSORIES

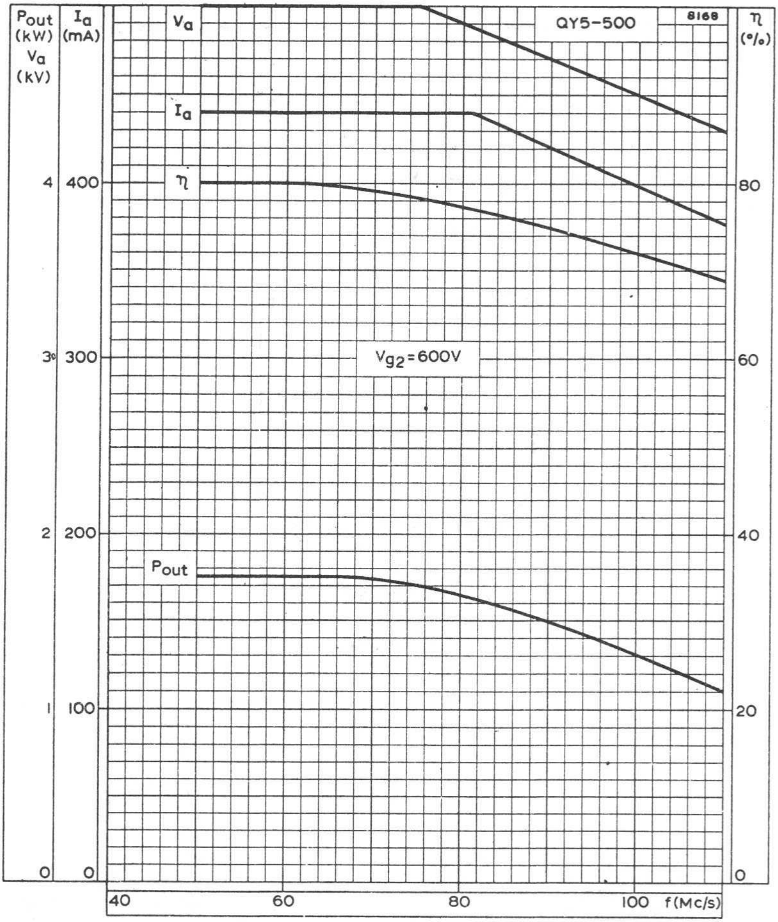
Socket	40216
Clip for anode connection	40626

DIMENSIONS

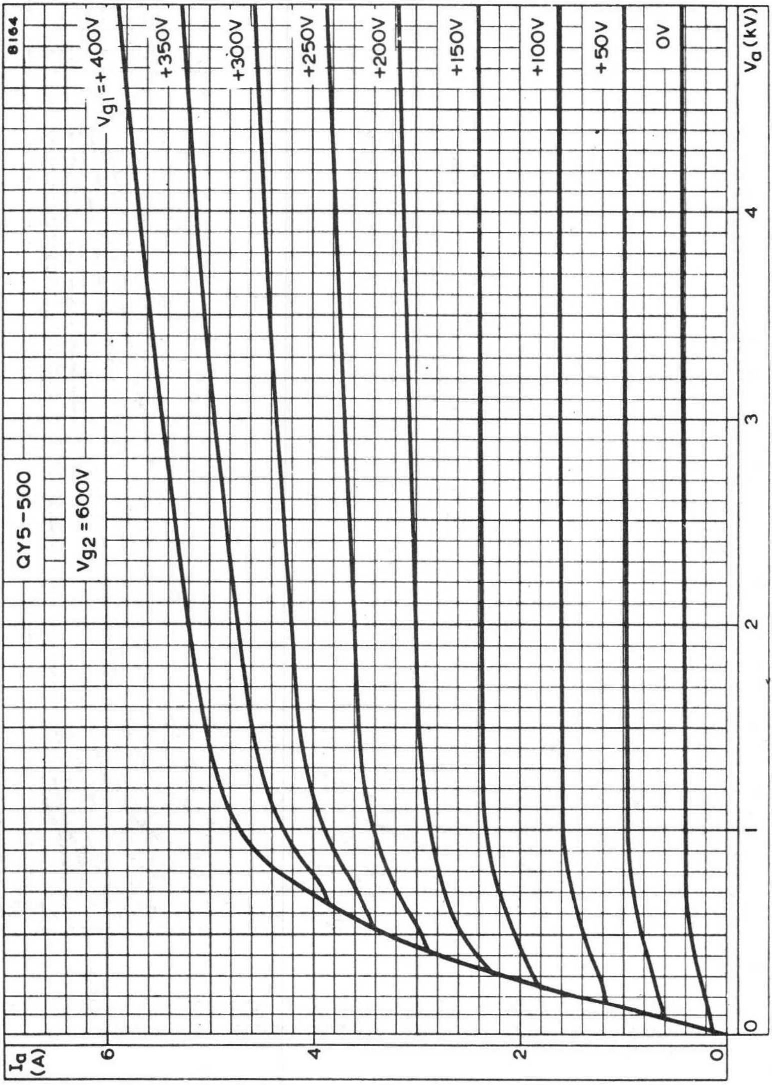
	Inches	*Millimetres*	
A	4.65	118	max.
B	0.374	9.5	
C	0.984	25	
D	6.93±0.24	176±6	
E	0.984	25	
F	1.06	27	
G	0.374	9.5	
H	3.19	81	max.
J	1.50	38.1	



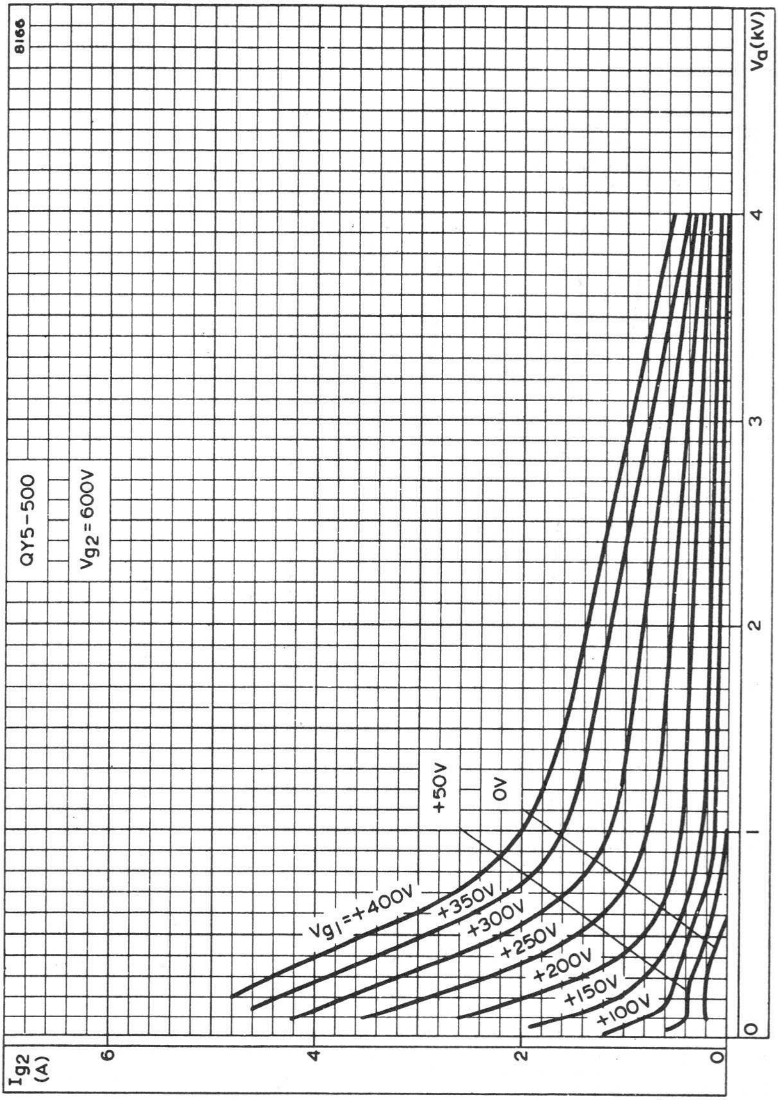
B5K Base



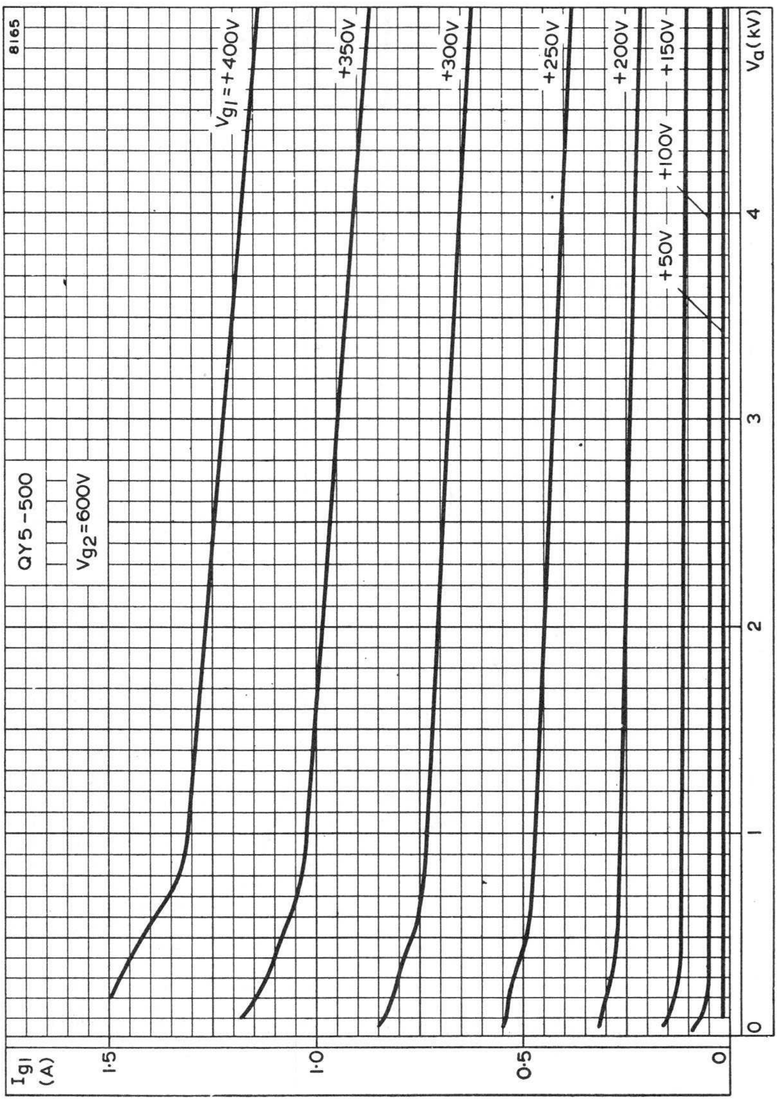
FREQUENCY CHARACTERISTICS



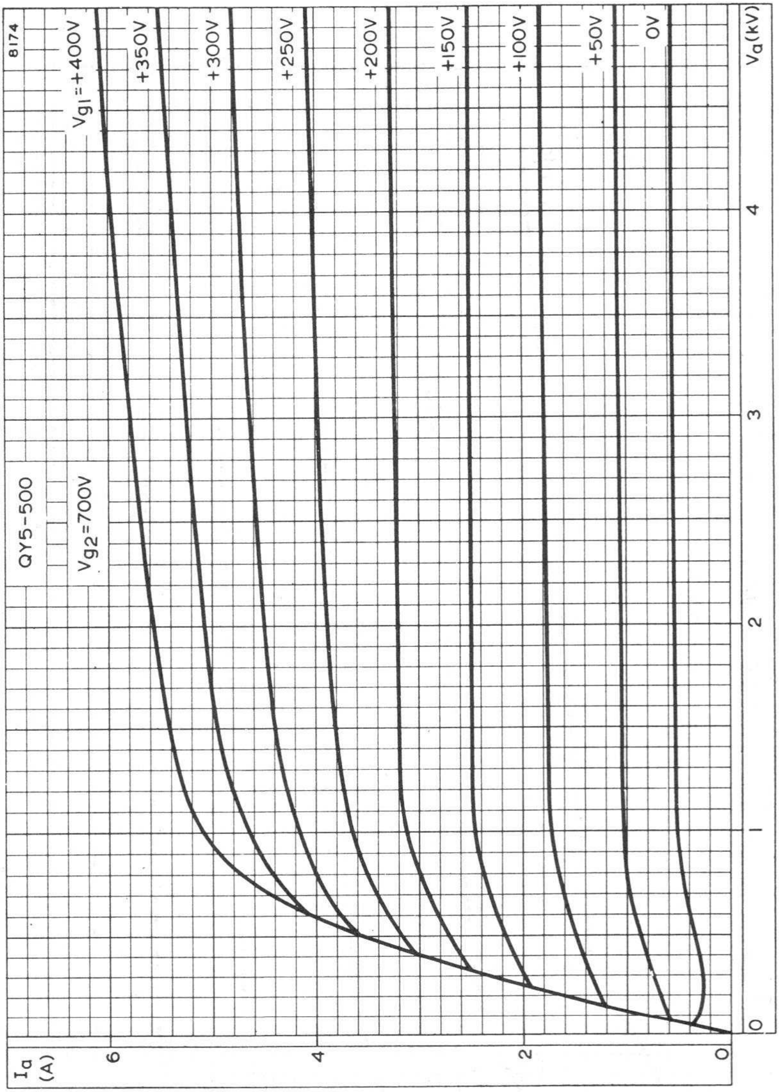
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 600V$.



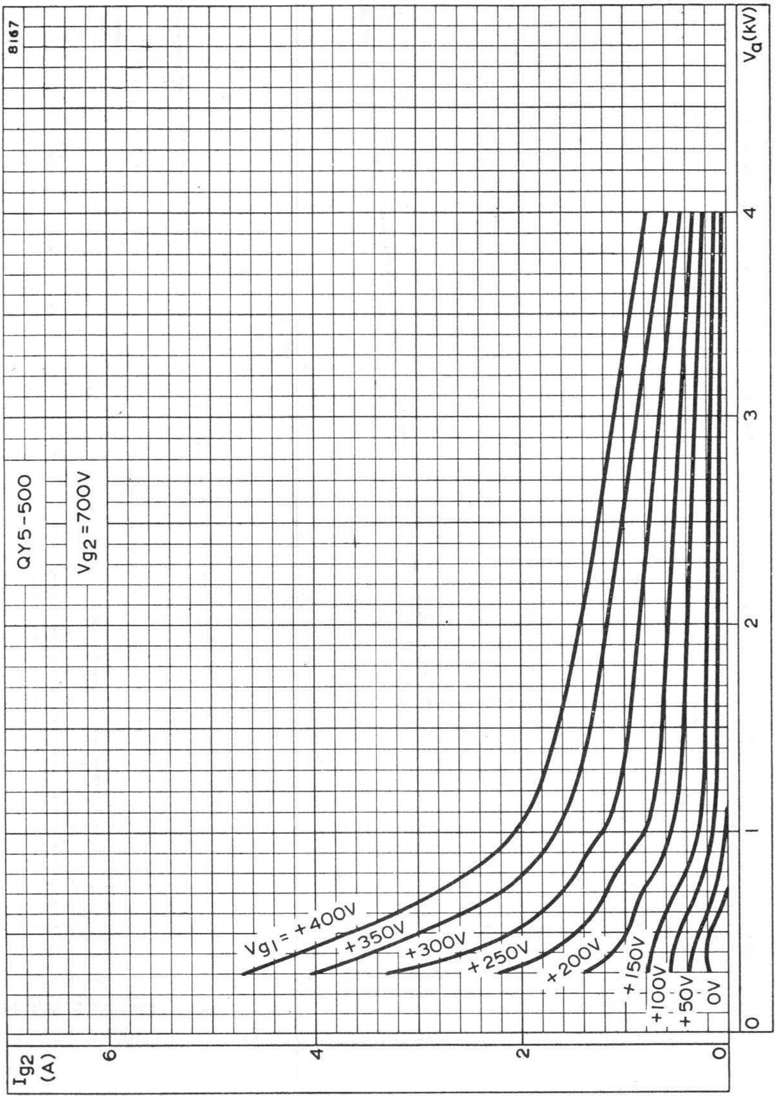
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 600V$.



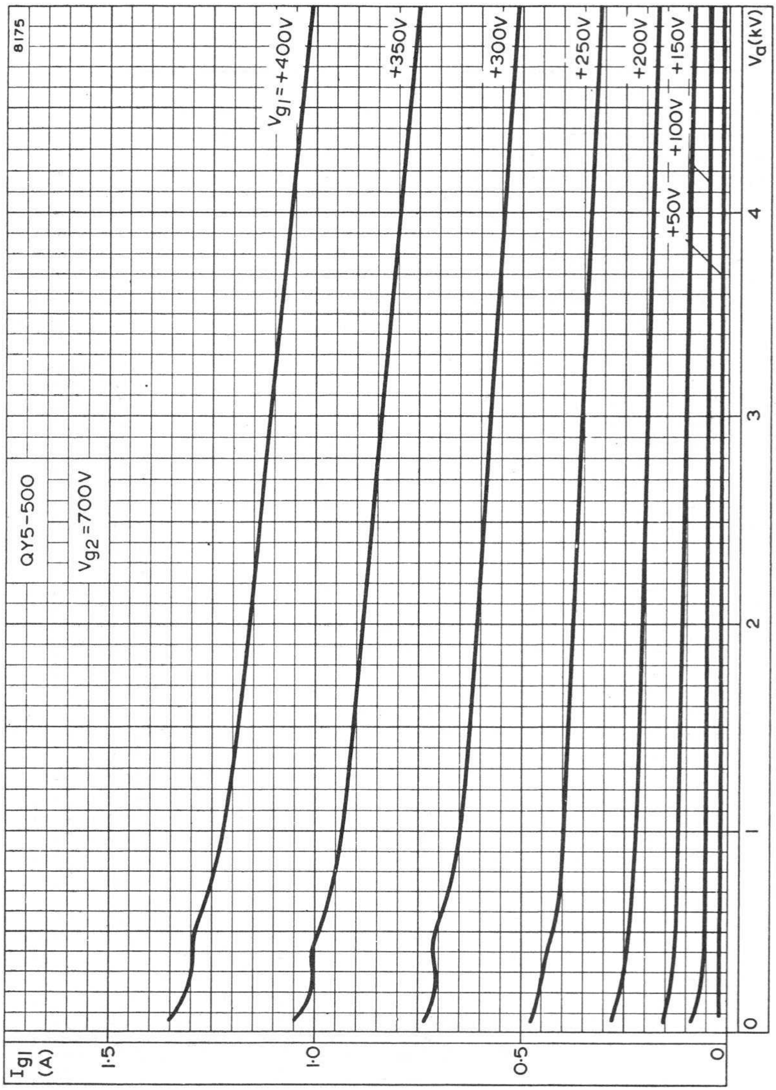
CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 600V$.



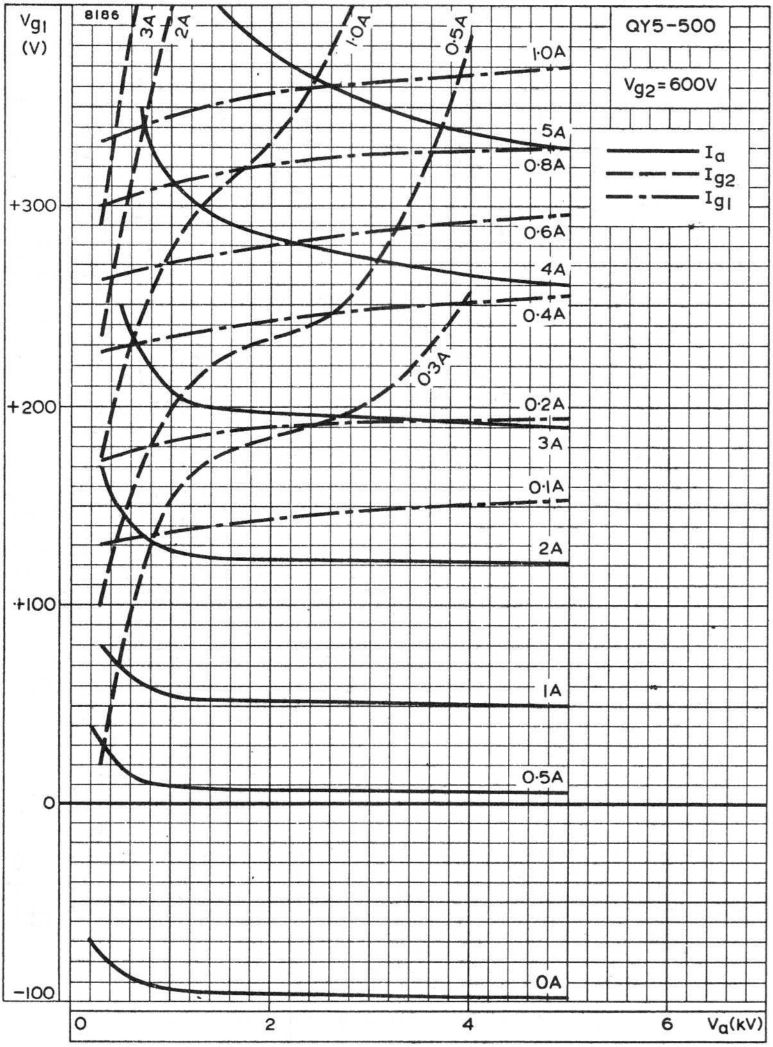
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 700V$.



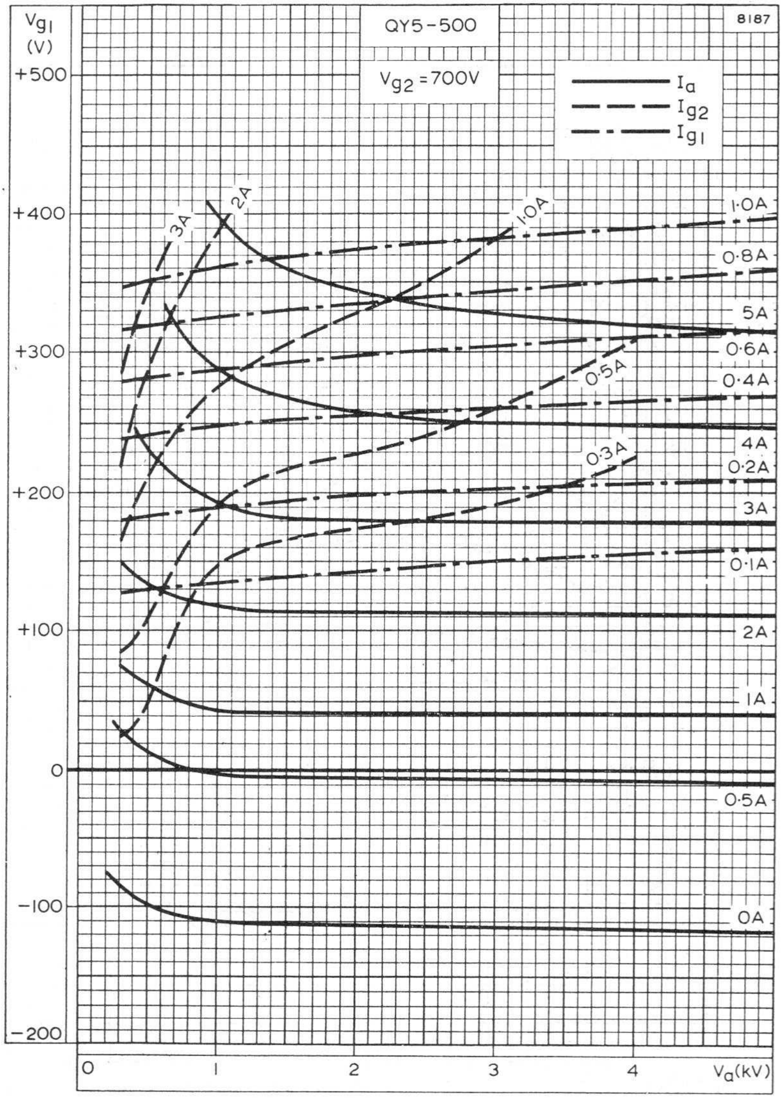
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. $V_{g2} = 700V$.



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER. V_{g2} = 700V.



CONSTANT CURRENT CURVES V_{g2} = 600V.



CONSTANT CURRENT CURVES. V_{g2} = 700V.

R.F. POWER TETRODE

QY5-3000A
QY5-3000W

QUICK REFERENCE DATA

Power tetrodes intended for use in V.H.F. television transmitters. The QY5-3000A is forced-air cooled, and the QY5-3000W water cooled.

	Class 'C' telegraphy	Class 'C' television	Class 'AB' S.S.B.	Class 'B' A.F.	
f max.	220	220	220	—	Mc/s
V_a max.	5.0	4.0	5.0	5.0	kV
p_a max.	3.0	3.0	3.0	3.0	kW
Performance					
f	75	220	30	—	Mc/s
P_{out}	4.1	4.0	1.57	9.5	kW

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES which precede this section of the handbook.

FILAMENT

Thoriated tungsten

V_f	6.3	V
I_f	32.5	A

CAPACITANCES

c_{in}	23.5	pF
c_{out}	8.4	pF
c_{a-g1}	< 350	mpF

CHARACTERISTICS (measured at $V_a = 4.0$kV, $I_a = 2.0$A)

g_m	19	mA/V
μ_{g1-g2}	8.5	

COOLING

T_{seals} max.	180	°C
T_{bulb} max.	250	°C

QY5-3000A

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals.
The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea-level.
Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet of the housing are given in the following table.

Anode Dissipation	Height above sea-level		Inlet Temperature	Rate of flow of air per minute		Pressure difference between inlet and outlet	
p_a (kW)	h (m)	(ft)	T_{in} (°C)	(m^3)	(ft^3)	(mm H_2O)	(in H_2O)
1.0	0	0	35	1.8	63.6	10	0.39
1.0	0	0	45	2.2	74.2	15	0.59
1.0	1,500	4,921	35	2.2	74.2	13	0.51
1.0	3,000	9,842	25	2.3	81.2	13	0.51
2.5	0	0	35	4.5	158.9	60	2.36
2.5	0	0	45	5.4	190.7	85	3.35
2.5	1,500	4,921	35	5.4	190.7	73	2.87
2.5	3,000	9,842	25	5.8	204.8	75	2.95
3.0	0	0	35	5.7	201.3	95	3.74

QY5-3000W

Typical values of inlet temperature, rate of flow of water and pressure difference between the inlet and outlet housing at various anode dissipations are given in the following table:—

Anode Dissipation	Inlet Temperature	Rate of flow of water per minute		Pressure difference between inlet and outlet
p_a (kW)	T_{in} (°C)	(litres)	(gal)	(atm)
1.0	20	2.5	0.55	0.073
1.0	50	3.0	0.66	0.1
2.0	20	2.5	0.55	0.073
2.0	50	4.8	1.06	0.25
3.0	20	3.0	0.66	0.105
3.0	50	6.9	1.52	0.55

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals. Air cooling will in general not be necessary at frequencies $\leq$75 Mc/s and $V_a \leq 4.0$ kV ($V_a \leq 3.2$ kV for class "C" anode and screen-grid modulation). At $V_a \leq 5.0$ kV ($V_a \leq 4.0$ kV for class "C" anode and screen-grid modulation) air cooling will in general be necessary at all frequencies.

CLASS "C" TELEGRAPHY OR F.M. TELEPHONY

Absolute maximum ratings

V_a max. ($f < 110$Mc/s)	5.0	kV
V_a max. ($f < 220$Mc/s)	4.0	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a max.	1.1	A
p_a max.	3.0	kW
p_{g2} max.	100	W
p_{g1} max.	30	W

Typical operating conditions

f	75	110	75	110	Mc/s
V_a	5.0	5.0	4.0	4.0	kV
V_{g2}	800	800	800	800	V
V_{g1}	–250	–250	–250	–250	V
I_a	1.1	1.1	1.1	1.1	A
I_{g2}	100	100	120	120	mA
I_{g1}	70	70	80	80	mA
$v_{in(pk)}$	480	480	500	500	V
P_{drive}	30	30	36	36	W
P_{out}	4.1	3.9	3.15	2.9	kW
η_a	74.5	71.5	72	69	%

CLASS "C" ANODE AND SCREEN-GRID MODULATION

Screen-grid modulated through a choke of 60H

Absolute maximum ratings Carrier condition for a modulation factor of 1.

V_a max. ($f < 110$Mc/s)	4.0	kV
V_a max. ($f < 220$Mc/s)	3.2	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a max.	900	mA
p_a max.	2.0	kW
*p_{g2} max.	100	W
p_{g1} max.	30	W

*For other methods of modulation, P_{g2} max. = 65W.

Typical operating conditions

V_a	4.0	kV
V_{g2}	800	V
V_{g1}	–375	V
I_a	900	mA
I_{g2}	120	mA
I_{g1}	85	mA
$v_{in(pk)}$	625	V
P_{drive}	48	W
P_{out}	2.7	kW
η_a	75	%
For 100% modulation		
$P_{mod.}$	1.8	kW

CLASS "C" GRID-MODULATION FOR TELEVISION SERVICE

(with positive modulation and negative synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a (peak white) max.	1.1	A
I_{g1} (peak white) max.	80	mA
P_{in} (peak white) max.	4.4	kW
p_a (peak white) max.	3.0	kW
p_{g2} (peak white) max.	100	W

Typical operating conditions for 2 valves in push-pull

f	170–220	170–220	Mc/s
*Bandwidth (–1.5db)	—	6.5	Mc/s
*Bandwidth (–3.0db)	7.5	12	Mc/s
V_a	4.0	4.0	kV
V_{g2}	800	800	V
V_{g1} (peak white)	–230	–230	V
V_{g1} (black)	–380	–380	V
$v_{in(g1-g1)pk}$	850	850	V
I_a (peak white)	1.7	2.1	A
I_a (black)	0.5	0.6	A
I_{g2} (peak white)	80	50	mA
I_{g2} (black)	10	10	mA
I_{g1} (peak white)	25	50	mA
I_{g1} (black) approx.	0	0	mA
†P_{drive} (peak white)	200–300	300–400	W
P_{out} (peak white)	4.0	2.8	kW
P_{out} (black)	360	250	W
‡P_{load} (peak white)	2.8	1.96	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

CLASS "B" FOR TELEVISION SERVICE

(with positive modulation and negative synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
I_a (peak white) max.	1.1	A
I_{g1} (peak white) max.	80	mA
P_{in} (peak white) max.	4.4	kW
p_a (peak white) max.	3.0	kW
p_{g2} (peak white) max.	100	W

Typical operating conditions for 2 valves in push-pull

f .	170–220	Mc/s
*Bandwidth (–1.5 db)	6.5	Mc/s
*Bandwidth (–3.0 db)	12	Mc/s
V_a	4.0	kV
V_{g2}	800	V
V_{g1}	–150	V
$V_{in(g1-g1)(pk)}$ (peak white)	700	V
$v_{in(g1-g1)(pk)}$ (black)	350	V
I_a (peak white)	2.1	A
I_a (black)	0.6	A
I_{g2} (peak white)	50	mA
I_{g2} (black)	10	mA
I_{g1} (peak white)	50	mA
I_{g1} (black) (approx.)	0	mA
†P_{drive} (peak white)	200 to 300	W
P_{out} (peak white)	2.8	kW
P_{out} (black)	250	W
‡P_{load} (peak white)	1.96	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

CLASS "C" GRID-MODULATION FOR TELEVISION SERVICE

(with negative modulation and positive synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
$-V_{g1}$ max.	500	V
I_a (sync.) max.	1.5	A
P_{in} (sync.) max.	6.0	kW
p_a (sync.) max.	3.0	kW
p_{g2} (sync.) max.	100	W
p_{g1} (sync.) max.	30	W

Typical operating conditions for 2 valves in push-pull

f	170–220	170–220	Mc/s
*Bandwidth (–1.5 db)	6.5	—	Mc/s
*Bandwidth (–3 db)	12	7.5	Mc/s
V_a	4.0	4.0	kV
V_{g2}	800	800	V
V_{g1} (sync.)	–150	–150	V
V_{g1} (black)	–230	–230	V
V_{g1} (white)	–450	–450	V
$v_{in(g1-g1)pk}$	850	850	V
I_a (sync.)	2.75	2.75	A
I_a (black)	2.1	1.7	A
I_{g2} (sync.)	110	250	mA
I_{g2} (black)	50	80	mA
I_{g1} (sync.)	100	80	mA
I_{g1} (black)	50	25	mA
†P_{drive} (sync.)	300–400	200–300	W
P_{out} (sync.)	5.0	5.9	kW
P_{out} (black)	2.8	4.0	kW
‡P_{load} (sync.)	3.5	4.13	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

CLASS "B" FOR TELEVISION SERVICE

(with negative modulation and positive synchronisation)

Absolute maximum ratings

f max.	220	Mc/s
V_a max.	4.0	kV
V_{g2} max.	800	V
I_a (sync.) max.	1.5	A
P_{in} (sync.) max.	6.0	kW
p_a (sync.) max.	3.0	kW
p_{g2} (sync.) max.	100	W
p_{g1} (sync.) max.	30	W

Typical operating conditions for 2 valves in push-pull

f	170–220	Mc/s
*Bandwidth (–1.5 db)	6.5	Mc/s
*Bandwidth (–3 db)	12	Mc/s
V_a	4.0	kV
V_{g2}	800	V
V_{g1}	–150	V
$v_{in(g1-g1)pk}$ (sync.)	850	V
$v_{in(g1-g1)pk}$ (black)	700	V
I_a (sync.)	2.75	A
I_a (black)	2.1	A
I_{g2} (sync.)	110	mA
I_{g2} (black)	50	mA
I_{g1} (sync.)	100	mA
I_{g1} (black)	50	mA
†P_{drive} (sync.)	300–400	W
P_{out} (sync.)	5.0	kW
P_{out} (black)	2.8	kW
‡P_{load} (sync.)	3.5	kW

*Bandwidth based on a single LC circuit.

†Includes power dissipated in circuit and loading resistors.

‡With a circuit transfer efficiency of 70%.

CLASS "AB" SINGLE SIDEBAND SUPPRESSED CARRIER

Absolute maximum ratings

f max.	200	Mc/s
V_a max.	5.0	kV
V_{g2} max.	1.0	kV
p_a max.	3.0	kW
p_{g2} max.	100	W
I_k max.	1.2	A
$i_{k(pk)}$ max.	3.8	A
$-V_{g1}$ max.	500	V

Typical operating conditions

Envelope peak to average $\geqslant 1$ and < 2

f	30	30	30	Mc/s
V_a	5.0	5.0	5.0	kV
V_{g2}	1.0	1.0	1.0	kV
$*V_{g1}$	−120	−117	−85	V
$I_{a(o)}$	200	200	500	mA

"Single tone" modulation, maximum signal conditions

I_a	474	505	640	mA
I_{g2}	20	70	15	mA
I_{g1}	0	20	0	mA
$v_{in(pk)}$	120	134	85	V
$P_{load(driver)}$	3.0	5.0	3.0	W
p_a	1.02	0.96	1.82	kW
p_{g2}	20	70	15	W
P_{out}	1.35	1.57	1.38	kW
η_a	57	63	43	%
P_{load}	1.15	1.34	1.17	kW

"Two tone" modulation, maximum signal conditions

I_a	351	380	576	mA
I_{g2}	8.5	25	7.0	mA
I_{g1}	0	1.5	0	mA
$v_{in(pk)}$	120	134	85	V
$P_{load(driver)}$	1.5	2.5	1.5	W
p_a	1.08	1.12	2.19	kW
p_{g2}	8.5	25	7.0	W
$P.E.P_{out}$	1.35	1.57	1.38	kW
P_{out} (mean)	675	785	690	W
η_a	38	41	24	%
$P.E.P_{(load)}$	1.15	1.34	1.17	kW
$\dagger D_{i.m.}$	33	30	42	dB

*V_{g1} is set to give the $I_{a(o)}$ and will vary slightly from valve to valve.

†The voltage amplitude of all intermodulation products are below this level, which is referred to the amplitude of either of the two tone frequencies. Relative to the peak envelope power these figures will be increased by 6dB. The figures are measured at full drive.

CLASS "B" A.F.

Absolute maximum ratings

V_a max.	5.0	kV
V_{g2} max.	800	V
I_k max.	1.7	A
$i_{k(pk)}$ max.	5.3	A
p_a max.	3.0	kW
p_{g2} max.	100	W
p_{g1} max.	30	W

Typical operating conditions for 2 valves in push-pull

V_a	5.0	5.0	4.0	4.0	kV
V_{g2}	800	800	800	800	V
V_{g1}	–107	–107	–103	–93	V
$I_{a(o)}$	2×100	2×100	2×100	2×150	mA
I_a (max. sig.)	2×1.1	2×1.46	2×0.6	2×1.37	A
I_{g2} (max. sig.)	2×50	2×120	2×60	2×75	mA
I_{g1}	2×40	2×150	2×11	2×84	mA
$V_{in(g1-g1)r.m.s.}$	420	505	259	414	V
P_{drive}	2×11	2×50	2×2.0	2×40	W
p_a	2×1.9	2×2.55	2×0.9	2×2.36	kW
η_a	65	65	62	57	%
R_{a-a}	5.0	3.7	7.0	3.43	kΩ
P_{out}	7.2	9.5	3.0	6.25	kW

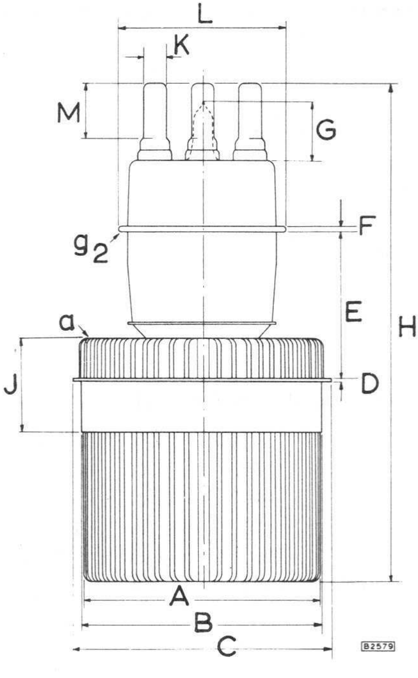
ACCESSORIES

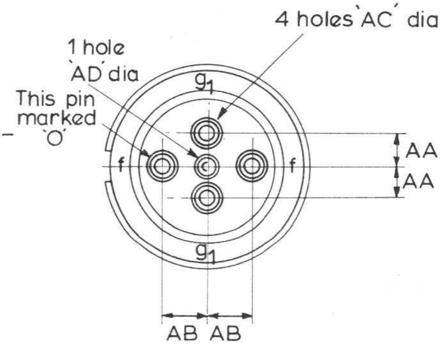
Filament and control grid clips	40634
Screen grid connector	40622
Insulating pedestal (QY5-3000A)	40635
Water jacket (QY5-3000W)	K713

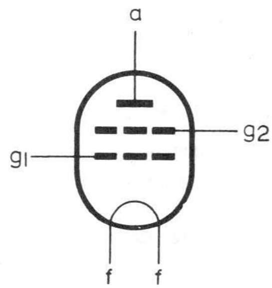
PHYSICAL DATA

	QY5-3000A	QY5-3000W	
Weight of valve	4.96	0.77	lb
	2.25	0.35	kg
Weight of valve plus carton	12.6	2.4	lb
	5.7	1.1	kg

OUTLINE DRAWING OF QY5-3000A





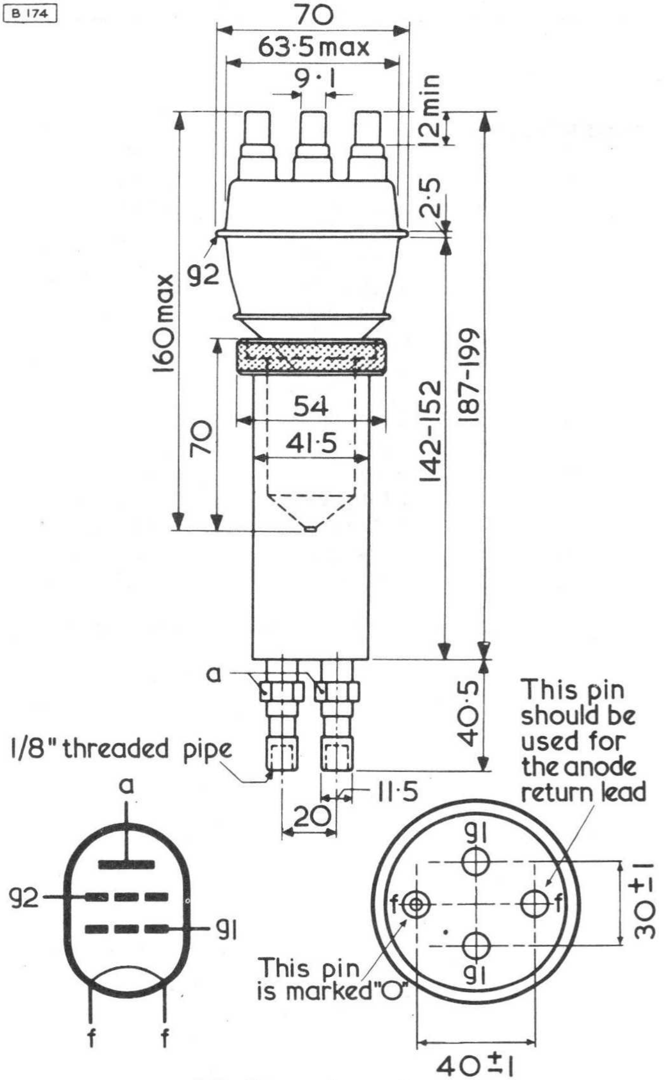


DIMENSIONS

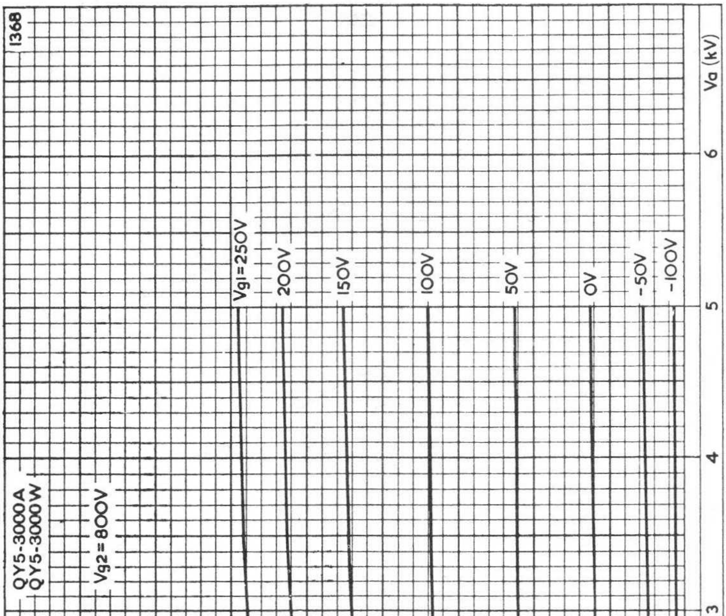
	Inches	Millimetres	
A	3.445	87.5	max
B	3.583 ± 0.031	91 ± 0.8	
C	3.799 ± 0.015	96.5 ± 0.4	
D	0.098 ± 0.020	2.5 ± 0.5	
E	2.008 ± 0.015	51 ± 0.4	
F	0.098 ± 0.020	2.5 ± 0.5	
G	0.630	16	max
H	6.614	168	max
J	1.535 ± 0.039	39 ± 1.0	
K	0.354 ± 0.004	9.0 ± 0.1	
L	2.756 ± 0.015	70 ± 0.4	
M	0.394	10	min
AA	0.591 ± 0.002	15 ± 0.05	
AB	0.787 ± 0.002	20 ± 0.05	
AC	0.394 ± 0.002	10 ± 0.05	
AD	0.295 ± 0.002	7.5 ± 0.5	

Inch dimensions derived from original millimetre dimensions.

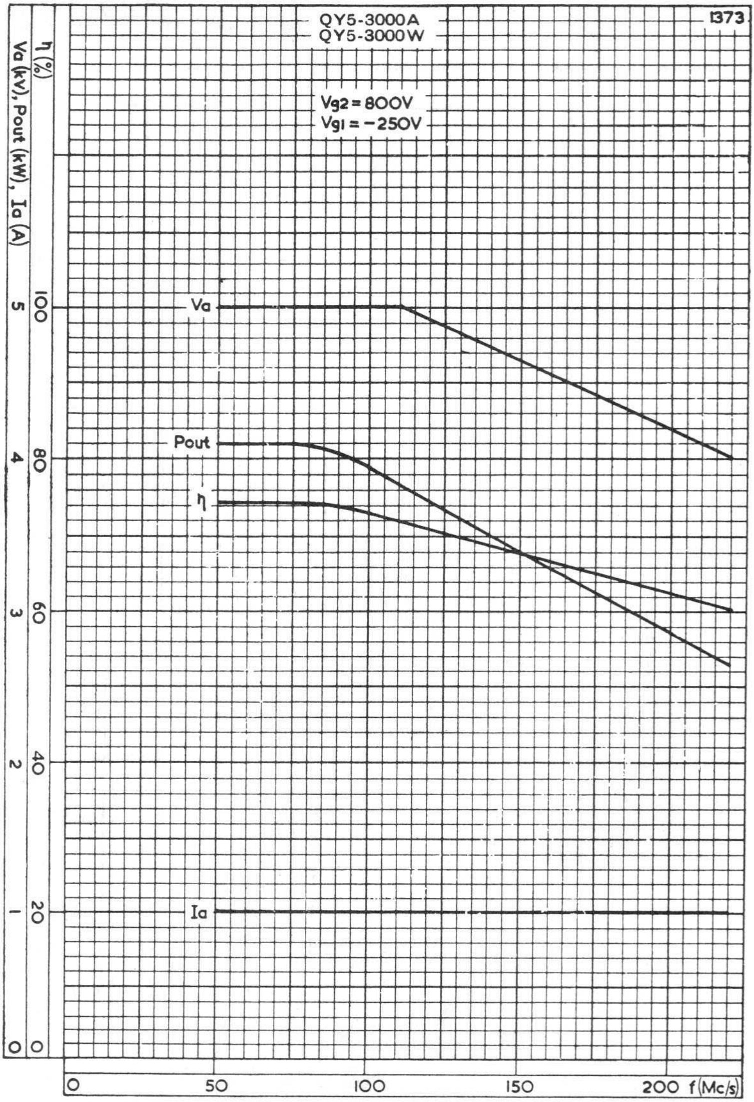
OUTLINE DRAWING OF QY5-3000W



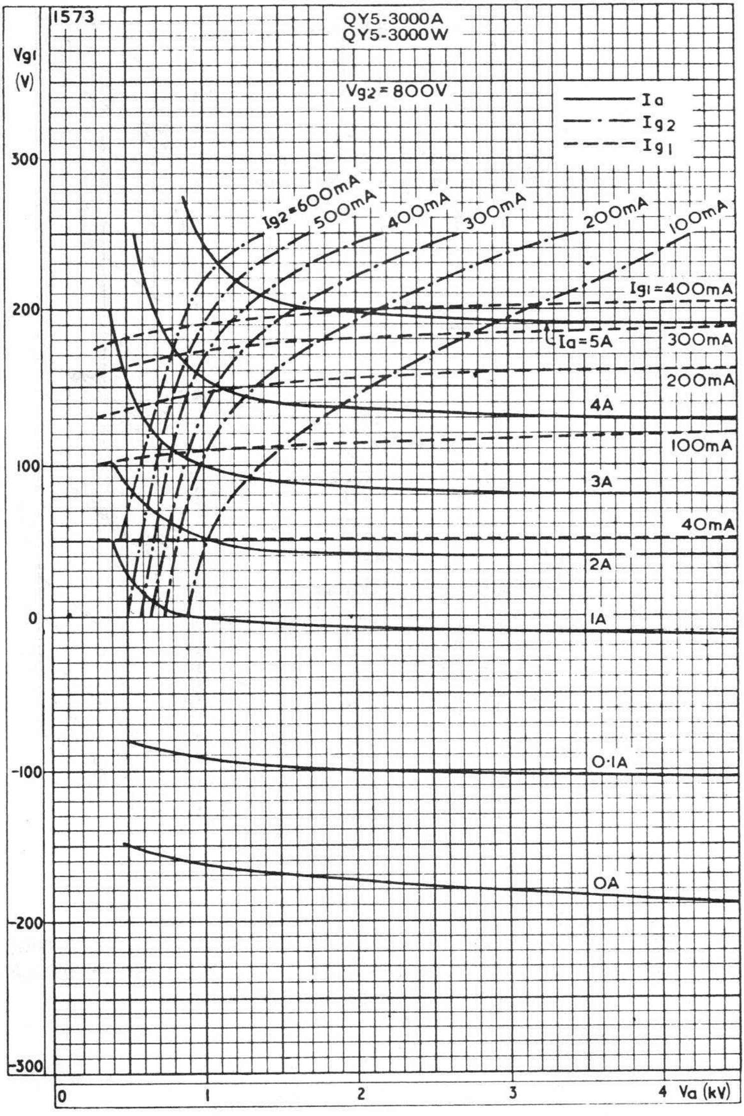
All dimensions in mm.



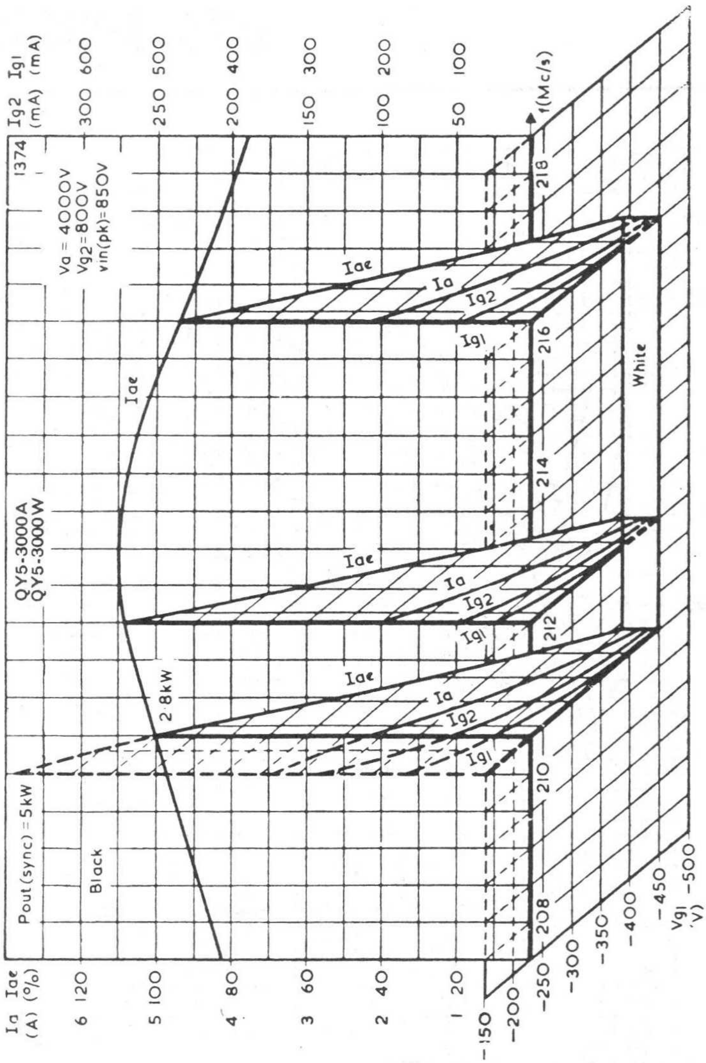
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



FREQUENCY CHARACTERISTICS.
SINGLE VALVE CLASS " C " TELEGRAPHY

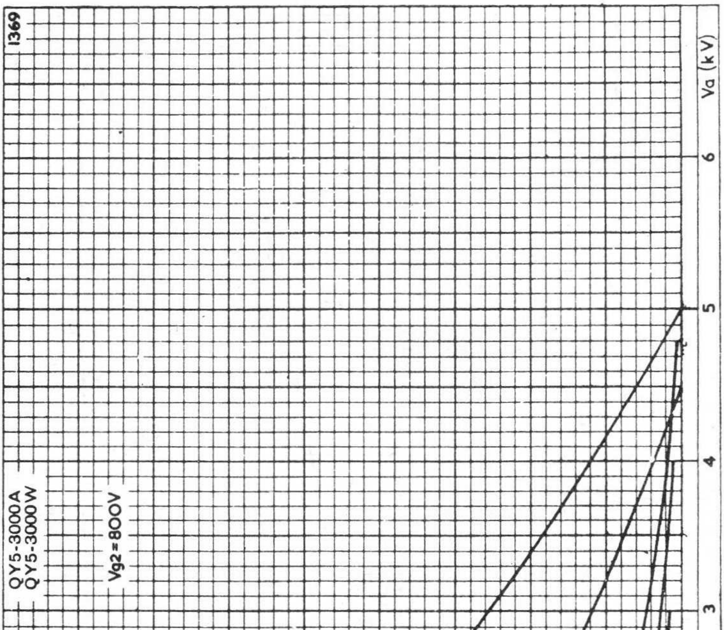


CONSTANT CURRENT CURVES

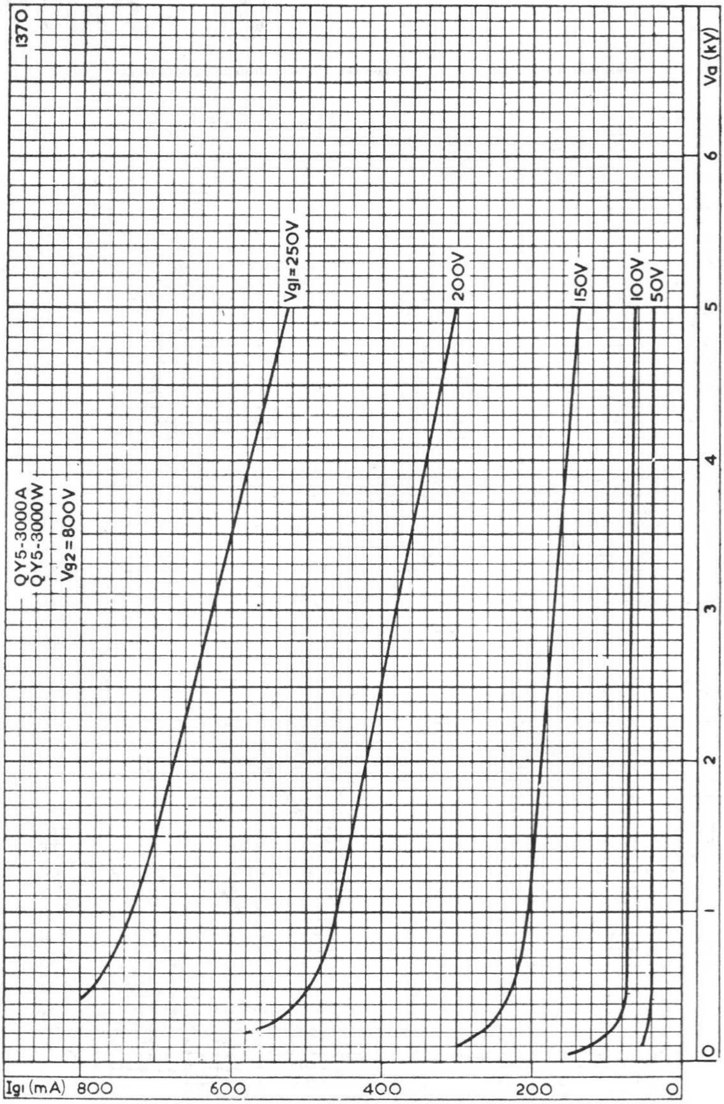


OPERATION OF TWO VALVES AS R.F. AMPLIFIER CLASS "C" GRID MODULATION FOR TELEVISION SERVICE, WITH NEGATIVE MODULATION AND POSITIVE SYNCHRONISATION

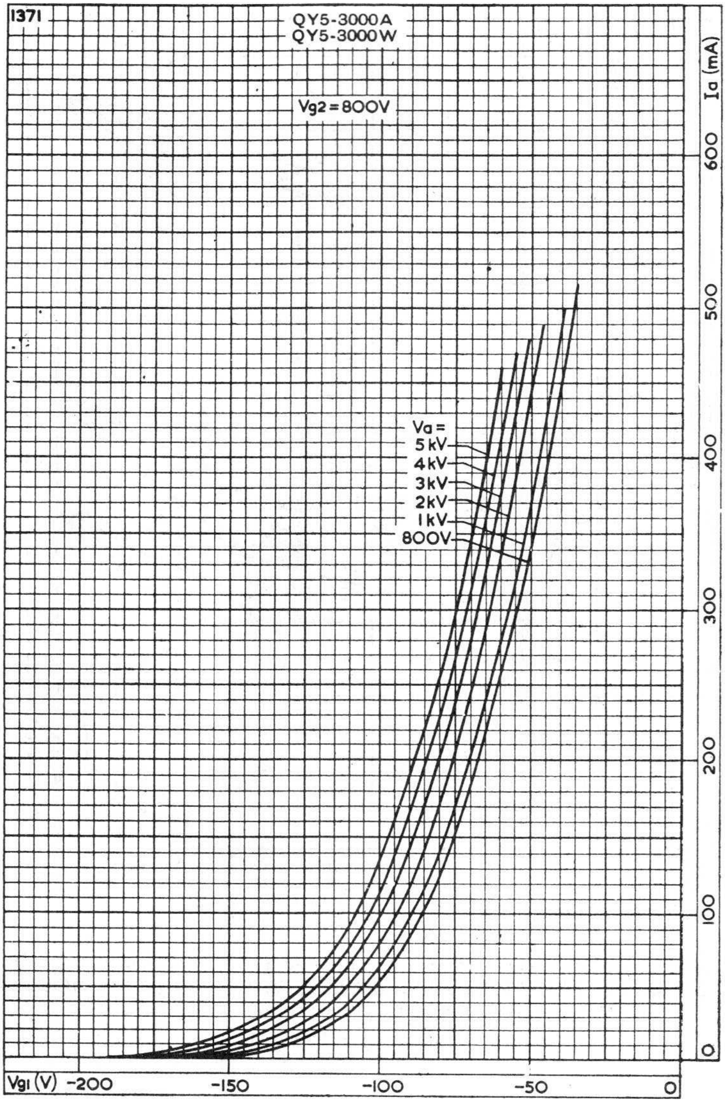
P_{out} (sync.) = 5.0kW



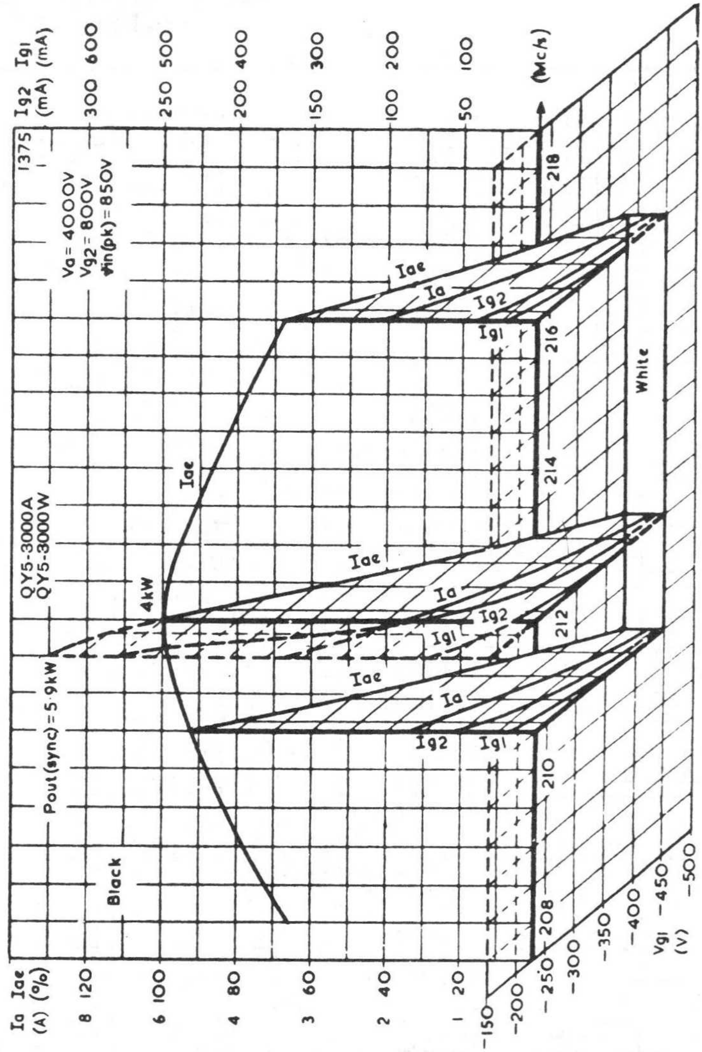
SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE
WITH CONTROL-GRID VOLTAGE AS PARAMETER

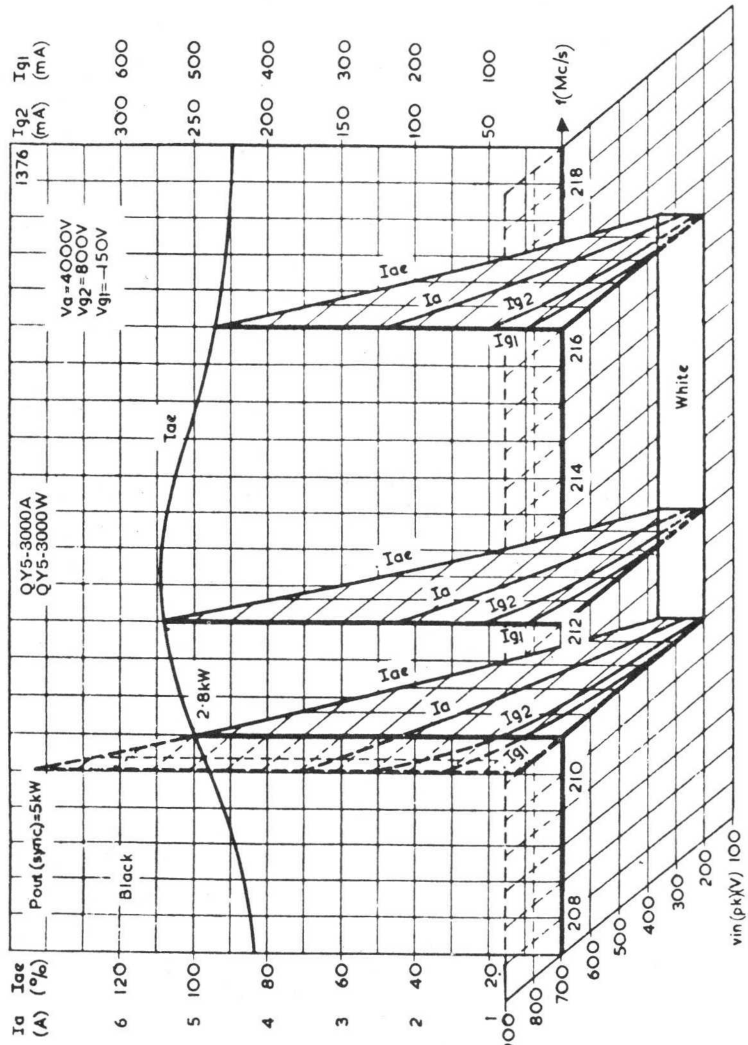


ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE
WITH ANODE VOLTAGE AS PARAMETER



OPERATION OF TWO VALVES AS R.F. AMPLIFIER CLASS "C" GRID MODULATION FOR TELEVISION SERVICE, WITH NEGATIVE MODULATION AND POSITIVE SYNCHRONISATION

P_{out} (sync.) = 5.9kW



OPERATION OF TWO VALVES AS R.F. AMPLIFIER CLASS "B" FOR TELEVISION SERVICE, WITH NEGATIVE MODULATION AND POSITIVE SYNCHRONISATION

U.H.F. BEAM POWER TETRODE

YL1110

QUICK REFERENCE DATA

Forced-air cooled coaxial beam power tetrode intended for use as u.h.f. amplifier or oscillator at frequencies up to 1215Mc/s.

	Amplifier for TV Translator Service, Class 'A'	Telegraphy or F.M. Telephony, Class 'C'		Linear Amplifier S.S.B. Class 'B'	
f	-	790	470	30	Mc/s
P_{out}	**55	590 + 30	765 + 25	*680	W
f max.	1215	1215		1215	Mc/s
V_a max.	2.5	2.5		2.5	kV
p_a max.	600	700		600	W

*P.E.P_{out} **P_{load}

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

Mullard

LINEAR AMPLIFIER FOR SINGLE SIDEBAND OPERATION, CLASS 'B'

OPERATING CONDITIONS

f	30		Mc/s
$P.E.P_{out}$	680		W
$P.E.P_{load}$	610		W
$*d_3$	-31		dB
$*d_5$	-36		dB
V_a	2.5		kV
V_{g2}	450		V
$**-V_{g1}$	37		V
$I_{a(o)}$	160		mA
$I_{g2(o)}$	0		mA
	Single Tone	Double Tone	
I_a	500	350	mA
I_{g2}	22.5	2.5	mA
I_{g1}	0	0	mA
$v_{in(pk)}$	36	36	V
$P_{load(driver)}$	1.0	1.0	W
p_a	530	535	W
η_a	54	39	%

*Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two tones at that level. Third and fifth order intermodulation products.

**Adjust to give the stated values of $I_{a(o)}$.

TELEGRAPHY OR F.M. TELEPHONY, CLASS 'C' •

OPERATING CONDITIONS for valve in common grid circuit.

f	790	470	Mc/s
†P_{out}	590 + 30	765 + 25	W
P_{load}	590	730	W
η_a	47	61	%
V_{a-g1}	2.5	2.5	kV
I_a	500	500	mA
V_{g2-g1}	400	400	V
I_{g2}	7.0	8.0	mA
V_{k-g1}	45	35	V
I_{g1}	10	12	mA
$P_{load(driver)}$	60	35	W
p_a	660	485	W

†Includes power transferred from driver stage.

LINEAR AMPLIFIER FOR TELEVISION TRANSLATOR SERVICE, CLASS 'A'

Sound and vision.

OPERATING CONDITIONS

Bandwidth (-1dB)	>6.5	Mc/s
P_{load}	55	W
*Intermodulation products	-51	dB
V_a	1.4	kV
V_{g2}	0.4	kV
$-V_{g1}$	30	V
I_a	400	mA
I_{g2}	-10	mA
$P_{load(driver)}$	5.0	W

*The intermodulation product in the passband of the output signal is measured with reference to peak envelope output.

TELEPHONY, ANODE AND SCREEN GRID MODULATION, CLASS 'C'

OPERATING CONDITIONS (cathode drive)

f	400	Mc/s
†P_{out}	640	W
P_{load}	600	W
η_a	64	%
V_a	2.0	kV
I_a	500	mA
V_{g2}	400	V
I_{g2}	8.0	mA
$-V_{g1}$	35	V
I_{g1}	12	mA
$P_{load(driver)}$	35	W
p_a	360	W
p_{g2}	3.2	W
For 100% modulation		
P_{mod}	502	W

†Includes power transferred from driver stage.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

	Telephony Class 'C'	Telegraphy Class 'C'	TV Class 'A'	S.S.B. Class 'B'	
V_a max.	2.0	2.5	2.5	2.5	kV
V_{g2} max.	1.2	1.2	1.2	1.2	kV
$-V_{g1}$ max.	250	250	250	250	V
I_a max.	500	500	500	500	mA
p_a max.	400	700	600	600	W
p_{g2} max.	17	25	25	25	W
I_{g1} max.	100	100	100	100	mA
R_{g1-k} max.	15	15	15	15	kΩ

CATHODE

Indirectly heated, oxide coated, matrix type.

V_h	6.3	V
I_h	7.85	A
t_{h-k} min.	120	s

The heater has been designed to accept temporary fluctuations of supply voltage of ±10%.

The heater voltage must be reduced depending on operating conditions and frequency.

CAPACITANCES

c_{a-g1}	<0.11	pF
c_{g1-k+h}	29	pF
c_{a-k+h}	<0.011	pF
c_{g1-g2}	37	pF
c_{g2-k+h}	<1.1	pF

CHARACTERISTICS

μ_{g1-g2} (measured at $V_a = V_{g2} = 225V$, $I_a = 100mA$)	13	
g_m (measured at $V_a = 2.5kV$, $V_{g2} = 400V$, $I_a = 240mA$)	22	mA/V

MOUNTING POSITION

Any

COOLING

Forced-air cooling will be required for the radiator and ceramic to metal seals.

Maximum temperature of anode and all seals 250 $^{\circ}C$

The amount of forced-air cooling of the anode at an air inlet temperature of 25°C is given in the table below:-

Anode dissipation (W)	Minimum rate of air flow (m^3/min)	(ft^3/min)	Pressure (mm water)
100	0.06	2.12	2.0
300	0.12	4.24	4.0
600	0.32	11.30	17
700	0.46	16.25	25

A low velocity air flow is required for all other electrodes and seals.

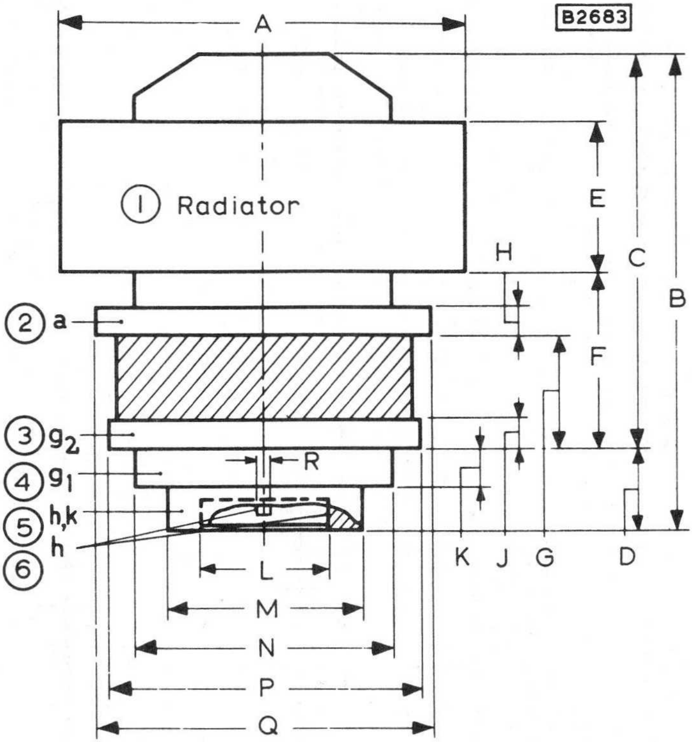
PHYSICAL DATA

	oz	g
Weight of valve only	12	340

DIMENSIONS

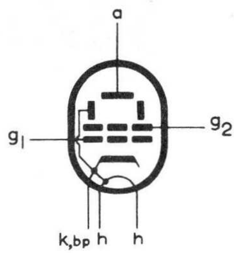
	Inches	Millimetres	
A	$2.059\,^{+0.031}_{-0.027}$	$52.3\,^{+0.8}_{-0.7}$	
B	2.399	60.95	max.
C	1.941 ± 0.039	49.3 ± 1.0	
D	0.402 ± 0.020	10.2 ± 0.5	
E	0.756 ± 0.020	19.2 ± 0.5	
F	0.894 ± 0.035	22.7 ± 0.9	
G	0.575 ± 0.020	14.6 ± 0.5	
H	0.146	3.7	min.
J	0.150	3.8	min.
K	0.201 ± 0.020	5.1 ± 0.5	
L	0.66	17	max.
M	0.993	25.2	min.
N	1.292	32.8	min.
P	1.591	40.4	min.
Q	1.744	44.3	min.
R	0.062	1.6	max.

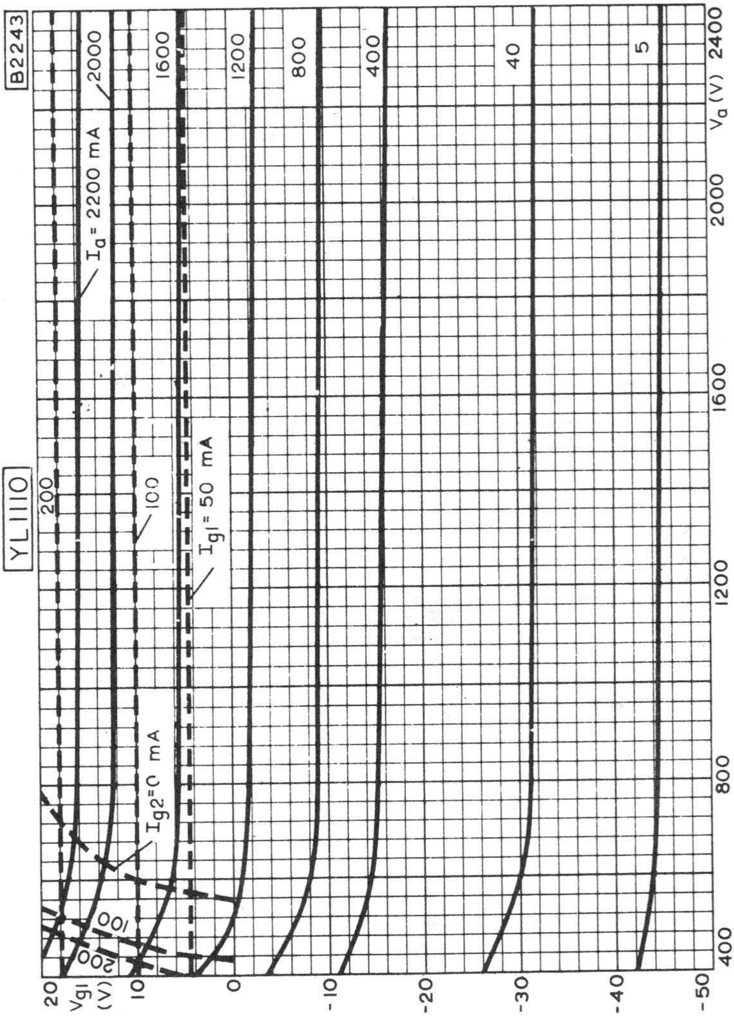
Inch dimensions derived from original millimetre dimensions



The radiator and connections lie inside or outside concentric circles with the following diameters

1.	2.108 in	53.54 mm	inside
2.	1.799 in	45.69 mm	inside
3.	1.609 in	40.87 mm	inside
4.	1.319 in	33.50 mm	inside
5.	1.019 in	25.88 mm	inside
6.	0.619 in	15.72 mm	outside
	0.099 in	2.51 mm	inside





CONSTANT CURRENT CHARACTERISTICS

V.H.F. TETRODE

YL1420

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in T V transmitters in the bands I and III. This type is also very suitable for A.M. and F.M. broadcast, A.F. modulator applications and in T V transposer service.

QUICK REFERENCE DATA			
Class AB linear amplifier (vision)			
Frequency	f	175, 25	MHz
Anode voltage	V_a	5	kV
Output power in load	W_ℓ	8, 6	kW
Power gain	G	24	
Class B amplifier			
Frequency	f	260	MHz
Anode voltage	V_a	7	kV
Output power in load	W_ℓ	10, 5	kW
Power gain	G	32	
R.F. Class C telegraphy or F.M. telephony			
Frequency	f	260	MHz
Anode voltage	V_a	7	kV
Output power in load	W_ℓ	11	kW
Power gain	G	32	
TV transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	4	kV
Output power in load	W	2, 5	kW
Power gain	G	30	

HEATING: direct; filament thoriated tungsten, mesh type

Filament voltage	V_f		6, 3	V ± 5%
Filament current	I_f		120	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{f_o}		6	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid No. 2 voltage	V_{g2}	600	V
Anode current	I_a	1, 45	A
Transconductance	S	30	mA/V
Amplification factor	μ_{g2g1}	7, 5	

CAPACITANCES

	(grounded cathode)		(grounded grid)		
Input	$C_{g1(a)}$	90	$C_{f(a)}$	48	pF
Output	$C_{a(g1)}$	16	$C_{a(f)}$	16, 4	pF
Anode to grid No. 1	C_{ag_1}	0, 55			pF
Anode to filament			C_{af}	0, 15	pF

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^oC
Recommended max. seal temperature	t	max.	200	^oC

COOLING

See curves
Direction of air flow: see drawing.

ACCESSORIES

Band I amplifier circuit assembly (vision)	type 40757
Band I amplifier circuit assembly (sound)	type 40758
Band III amplifier circuit assembly (vision)	type 40745
Band III amplifier circuit assembly (sound)	type 40746

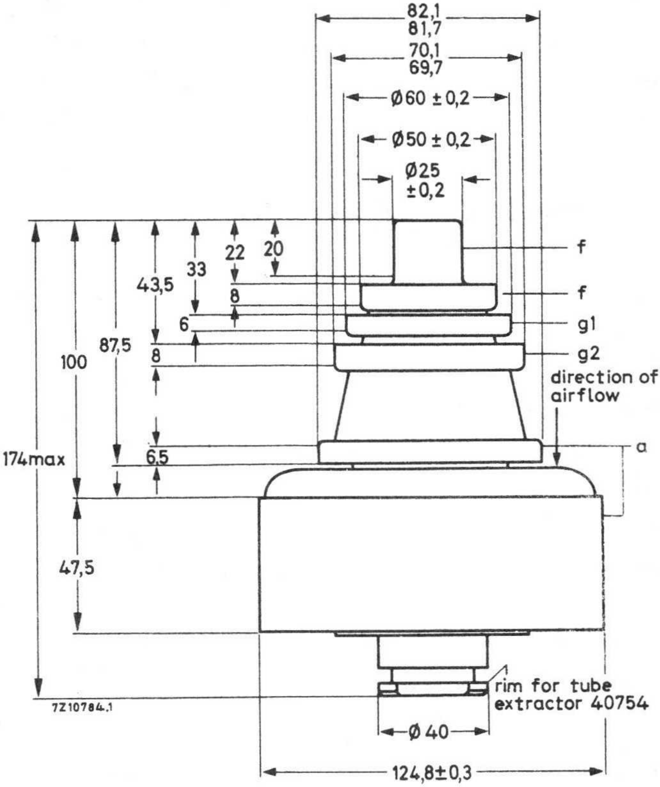
V.H.F. TETRODE

YL1420

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 3, 1 kg
Mounting position: Vertical with anode up or down.



R.F. CLASS B SERVICE

Unless otherwise stated the voltages are specified with respect to cathode

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	8,5	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	6	kW
Grid no. 2 dissipation	W_{g2}	max.	80	W
Grid no. 1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

OPERATING CONDITIONS : grounded grid

Frequency	f up to	260	MHz
Anode voltage	V_a	7	kV
Grid no. 2 voltage	V_{g2}	600	V
Grid no. 1 voltage	V_{g1}	-120	V [1])
Anode current, no signal condition	I_a	0,2	A
Anode current	I_a	2,2	A
Grid no.2 current	I_{g2}	80	mA
Grid no. 1 current	I_{g1}	125	mA
Anode input power	W_{ia}	15,4	kW
Anode dissipation	W_a	4,3	kW
Output power in load	W_ℓ	10,5	kW
Efficiency, total	η	68	%
Driving power	W_{dr}	325	W
Power gain	$\frac{W_\ell}{W_{dr}}$	32	

Note see page 8

V.H.F. TETRODE

YL1420

R.F. CLASS AB AMPLIFIER FOR TELEVISION SERVICE +

Negative modulation, positive synchronization (C.C.I.R. system)
Unless otherwise stated the voltages are specified with respect to the cathode.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	6,5	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Anode current, black	$I_{a\ black}$	max.	2,25	A
Anode input power, black	$W_{ia\ black}$	max.	12	kW
Anode dissipation	W_a	max.	6	kW
Grid no. 2 dissipation	W_{g2}	max.	80	W
Grid no. 1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

OPERATING CONDITIONS , grounded grid

Frequency of vision carrier	f	175,25	175,25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	5	4	kV	
Grid no. 2 voltage	V_{g2}	600	600	V	
Grid no. 1 voltage	V_{g1}	−75	−65	V	1)
Anode current, no signal condition	I_a	650	750	mA	
Anode current, black	I_{abl}	2,1	1,9	A	3)
Grid no. 2 current, black	I_{g2bl}	20	30	mA	3)
Grid no. 1 current, black	I_{g1bl}	75	55	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	8,6	6,25	kW	
black	$W_{\ell\ black}$	5,15	3,75	kW	
Driving power, sync	$W_{dr\ sync}$	350	260	W	
black	$W_{dr\ black}$	200	140	W	
Gain, sync	G_{sync}	24	24		2)
black	G_{black}	25,8	26,7		
Sync compression	sync in/out	27/25	29/25		4)
Differential phase		< 3	< 3	°	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	R_a	1100	900	Ω	2)

Notes see page 8

+ Detailed information on definitions of terms and application suggestions are available on request.

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f	83,25	55,25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	4	4	kV	
Grid no. 2 voltage	V_{g2}	600	600	V	
Grid no. 1 voltage	V_{g1}	−65	−65	V	1)
Anode current, no signal condition	I_a	750	750	mA	
Anode current, black	I_{abl}	2,1	2,3	A	3)
Grid no. 2 current, black	I_{g2bl}	45	45	mA	3)
Grid no. 1 current, black	I_{g1bl}	75	85	mA	3)
Output power in load, sync	W_{ℓ} sync	6,25	6,25	kW	
black	W_{ℓ} black	3,75	3,75	kW	
Driving power, sync	W_{dr} sync	340	385	W	
black	W_{dr} black	180	210	W	
Gain, sync	G sync	18,5	16		2)
black	G black	21,5	18		2)
Sync compression	sync in/out	30/25	29/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	810	690	Ω	2)

R.F. CLASS AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE, grounded grid

LIMITING VALUES

see page 5

OPERATING CONDITIONS , grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

Frequency	f	175 to 225	MHz
Bandwidth (−1 dB)	B	8	MHz
Anode voltage	V_a	4	kV
Grid no. 2 voltage	V_{g2}	700	V
Grid no. 1 voltage 1)	V_{g1}	−65	V
Anode current, no signal condition	I_a	1	A
Anode current 6)	I_a	1,65	A
Grid no. 2 current 6)	I_{g2}	25	mA
Grid no. 1 current 6)	I_{g1}	10	mA
Driving power, sync	W_{dr}	85	W
Output power in load, sync	W_{ℓ}	2,5	kW
Power gain	G	30	-
Intermodulation products 7)	d	−52	dB

Notes: see page 8

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	8,5	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	6	kW
Grid no. 2 dissipation	W_{g2}	max.	80	W
Grid no. 1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

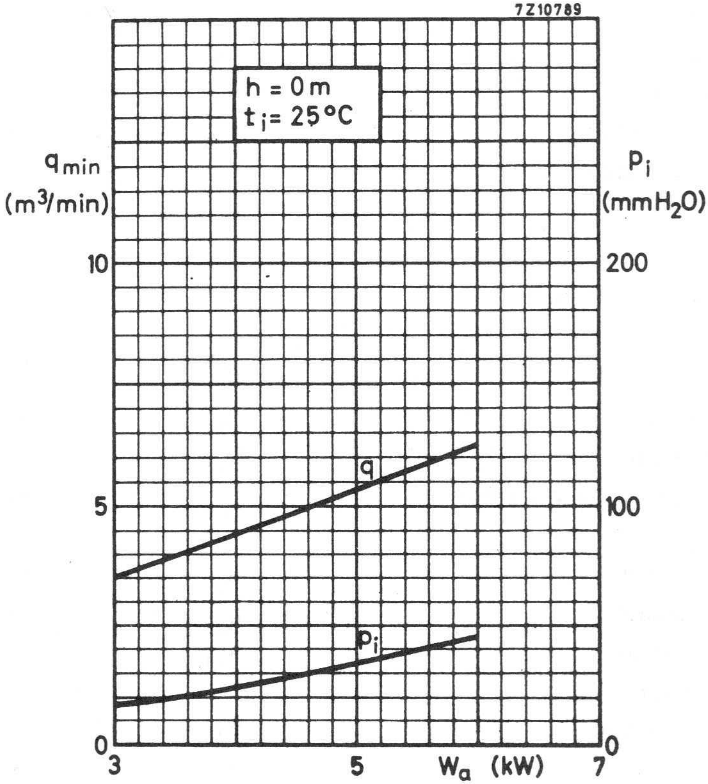
OPERATING CONDITIONS

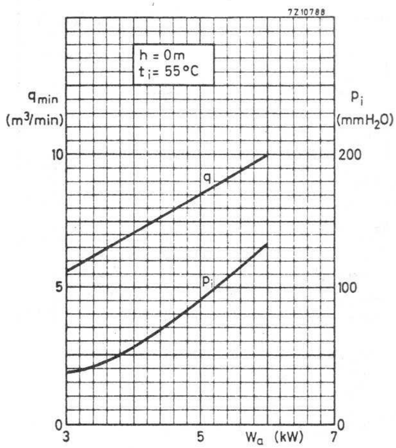
Frequency	f	260	MHz	
Anode voltage	V_a	7	kV	
Grid no. 2 voltage	V_{g2}	600	V	
Grid no. 1 voltage	V_{g1}	-120	V	[1])
Anode current, no signal condition	I_a	200	mA	
Anode current	I_a	2,3	A	
Grid no. 2 current	I_{g2}	80	mA	
Grid no. 1 current	I_{g1}	150	mA	
Anode input power	W_{ia}	16,1	kW	
Anode dissipation	W_a	5	kW	
Output power in load	W_ℓ	11	kW	
Efficiency, total	η	68	%	
Driving power	W_{dr}	325	W	
Power gain	$\frac{W_\ell}{W_{dr}}$	32		

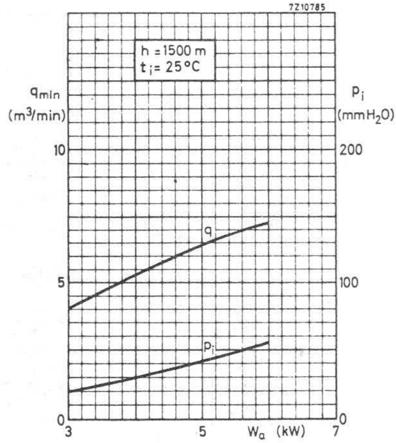
[1]) See page 8

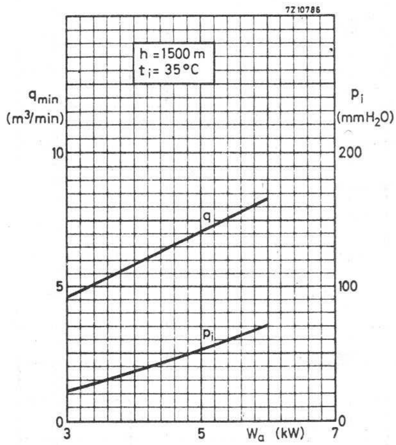
NOTES

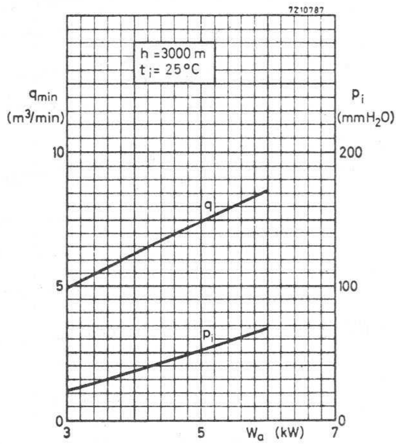
1) To be adjusted for the stated no signal anode current.
2) With double tuned circuit.
3) Black signal including line sync pulses
4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5) Measured with a saw tooth amplitude, running from 17 % to 75 % of the peak sync value, with superimposed a 4, 43 MHz sine wave with a 10 % peak to peak value.
6) At c.w. output power = 2, 5 kW
7) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync = 0 dB).

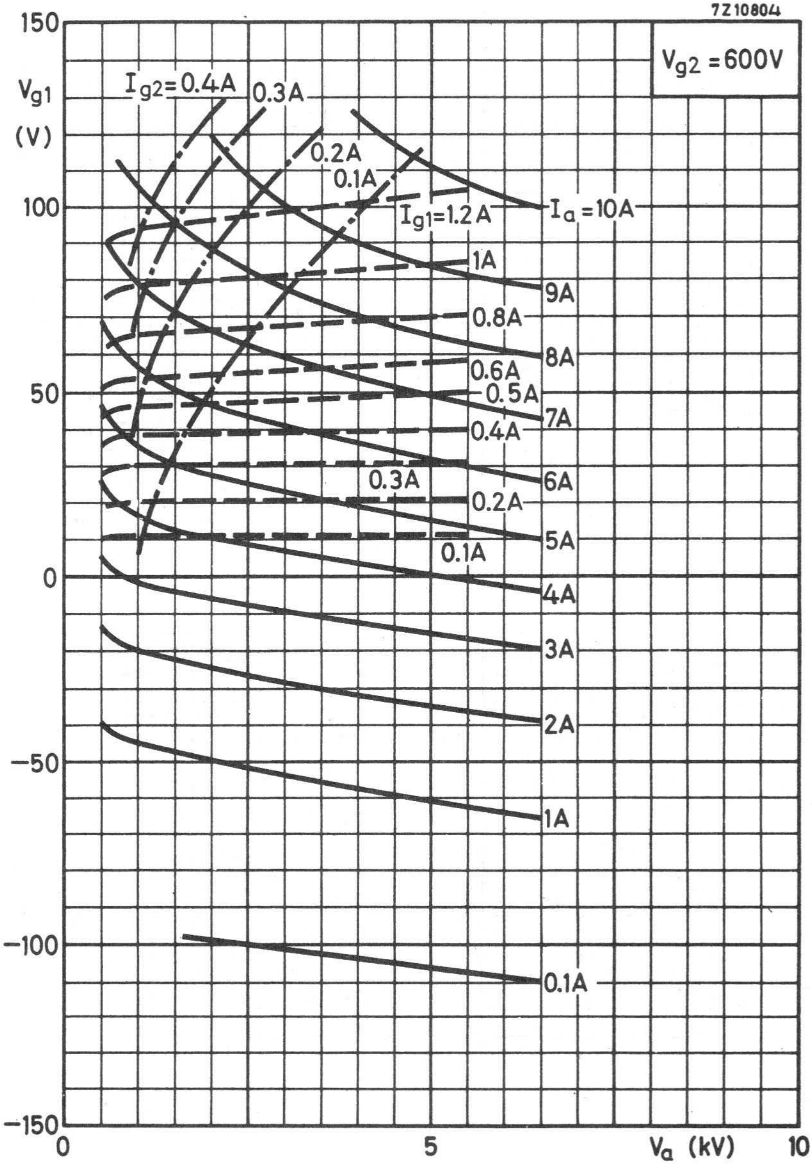


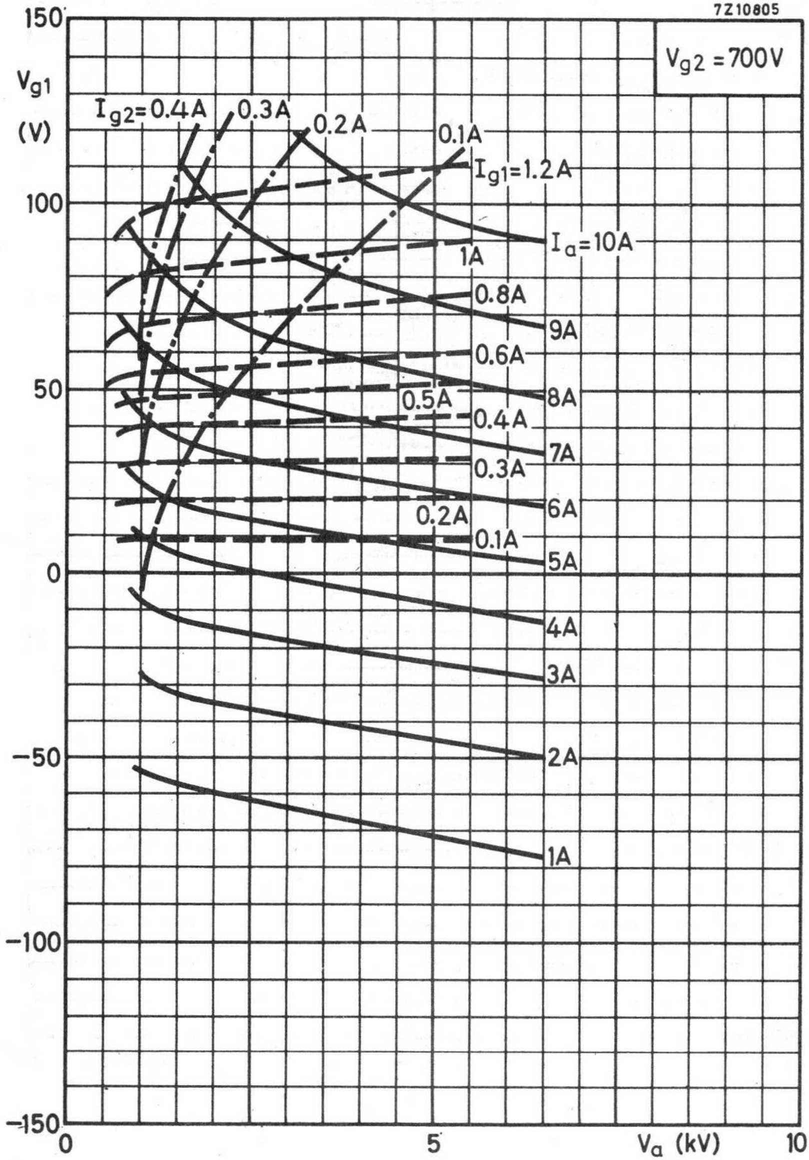

7Z10788
h = 0m
ti= 55°C
qmin
(m3/min)
pi
(mmH2O)
10
5
0
200
100
0
q
pi
3
5
Wa (kW)
7

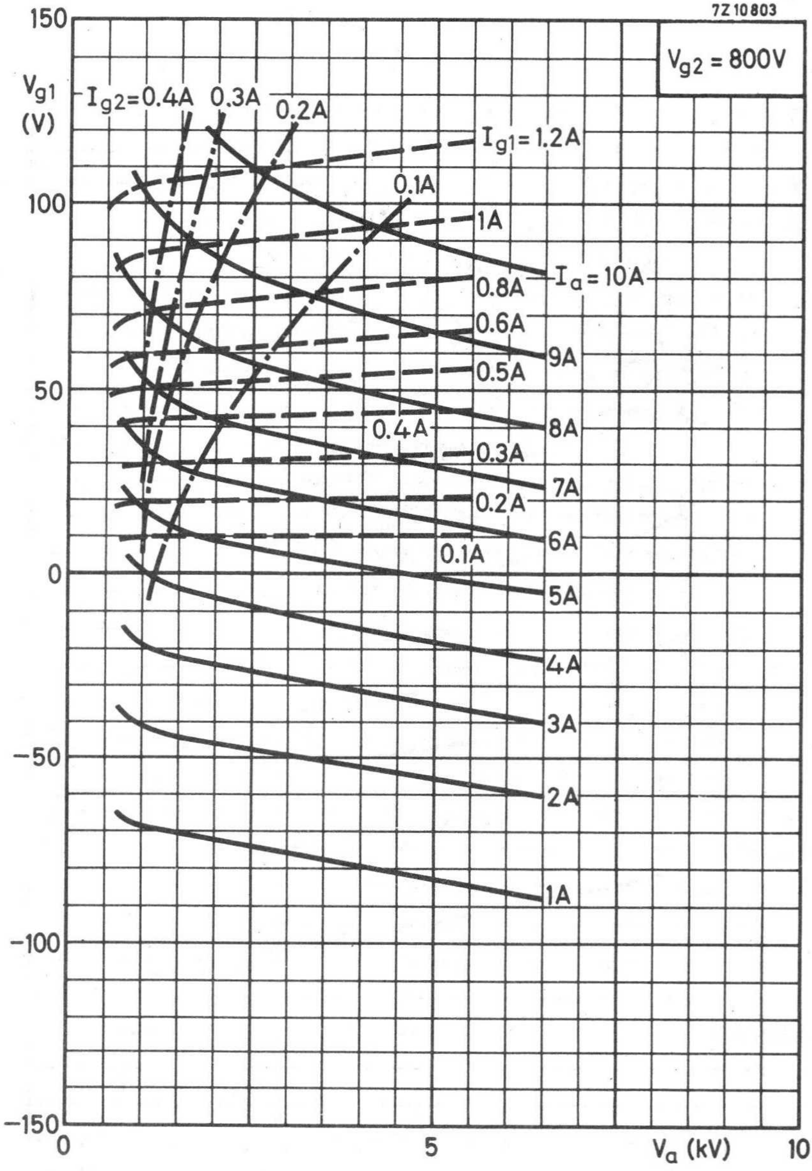

7Z10785
h =1500 m
ti= 25°C
qmin
(m3/min)
pi
(mmH2O)
10
5
0
200
100
0
q
pi
3
5
Wa (kW)
7


7Z10786
h =1500 m
ti= 35°C
qmin
(m3/min)
pi
(mmH2O)
10
5
0
200
100
0
q
pi
3
5
Wa (kW)
7


7Z10787
h =3000 m
ti= 25°C
qmin
(m3/min)
pi
(mmH2O)
10
5
0
200
100
0
q
pi
3
5
Wa (kW)
7


7Z10804
V_{g2} = 600V
150
V_{g1}
(V)
100
50
0
−50
−100
−150
0
5
V_a (kV)
10
I_{g2} = 0.4A
0.3A
0.2A
0.1A
I_{g1} = 1.2A
I_a = 10A
1A
9A
0.8A
8A
0.6A
0.5A
7A
0.4A
0.3A
6A
0.2A
5A
0.1A
4A
3A
2A
1A
0.1A


7Z10805
V_{g2} = 700V
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=1.2A
1A
0.8A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a=10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0
5
10
V_a (kV)


7Z10803
V_{g2} = 800V
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}= 1.2A
1A
0.8A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a = 10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0
5
10
V_a (kV)

V.H.F. TETRODE

YL1430

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in T V transmitters in the bands I and III. This type is also very suitable for A. M. and F. M broadcast, A. F. modulator applications, and in T V transposer service.

QUICK REFERENCE DATA			
Frequency	f	175, 25	MHz
Anode voltage	V_a	7	kV
Output power in load	W_ℓ	18, 4	kW
Power gain	G	25	
Class B amplifier			
Frequency	f	260	MHz
Anode voltage	V_a	7, 5	kV
Output power in load	W_ℓ	13	kW
Power gain	G	32, 5	
R. F. Class C telegraphy or F. M. telephony			
Frequency	f	260	MHz
Anode voltage	V_a	8	kV
Output power in load	W_ℓ	18	kW
Power gain	G	30	
TV transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	6	kV
Output power in load	W_ℓ	7	kW
Power gain	G	32	

HEATING : direct; filament thoriated tungsten, mesh type.

Filament voltage	V_f		8	V ± 5%
Filament current	I_f		120	A
Filament peak starting current	I_{f_p}	max.	750	A
Cold filament starting current	R_{f_o}		7, 5	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6	kV
Grid no. 2 voltage	V_{g2}	650	V
Anode current	I_a	2,4	A
Transconductance	S	45	mA/V
Amplification factor	μ_{g2g1}	8,5	

CAPACITANCES

	grounded cathode		grounded grid		
Input	$C_{g1(a)}$	110	$C_{f(a)}$	55	pF
Output	$C_{a(g1)}$	17,5	$C_{a(f)}$	18	pF
Anode to grid no. 1	C_{ag1}	0,7			pF
Anode to filament			C_{af}	0,2	pF

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^oC
Recommended max. seal temperature	t	max.	200	^oC

COOLING

See curves.
Direction of air flow: see drawing.

ACCESSORIES

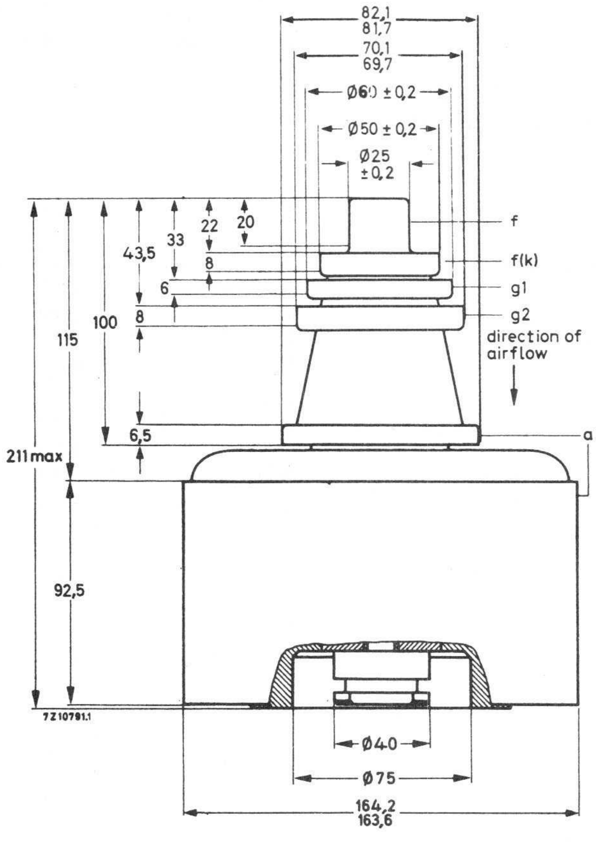
Band I amplifier circuit assembly (vision)	type 40759
Band II amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40747
Band III amplifier circuit assembly (sound)	type 40748

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 11 kg

Mounting position: vertical with anode up or down



R.F. CLASS B SERVICE

Unless otherwise stated the voltages are specified with respect to cathode

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	5	A
Anode input power	W_{ia}	max.	24	kW
Anode dissipation	W_a	max.	12	kW
Grid no. 2 dissipation	W_{g2}	max.	100	W
Grid no. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	6	A

OPERATING CONDITIONS , grounded grid

Frequency	f	up to	260	MHz	
Anode voltage	V_a		7,5	kV	
Grid no. 2 voltage	V_{g2}		650	V	
Grid no. 1 voltage	V_{g1}		-125	V	1)
Anode current, no signal condition	I_a		0,1	A	
Anode current	I_a		2,5	A	
Grid no. 2 current	I_{g2}		80	mA	
Grid no. 1 current	I_{g1}		90	mA	
Anode input power	W_{ia}		18,75	kW	
Anode dissipation	W_a		5	kW	
Output power in load	W_ℓ		13	kW	
Efficiency, total	η		69,3	%	
Driving power	W_{dr}		400	W	
Power gain	$\frac{W_\ell}{W_{dr}}$		32,5		

Note see page 9

V.H.F. TETRODE YL1430

R.F. CLASS AB LINEAR AMPLIFIER FOR TELEVISION SERVICE +

Negative modulation, positive synchronization (C.C.I.R. system)
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current, black	$I_{a\ black}$	max.	3,5	A
Anode input power, black	$W_{ia\ black}$	max.	24	kW
Anode dissipation	W_a	max.	12	kW
Grid no. 2 dissipation	W_{g2}	max.	100	W
Grid no. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	6	A

OPERATING CONDITIONS , grounded grid

Frequency of vision carrier	f		175,25	MHz	
Bandwidth (-1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	7	6	kV	
Grid no. 2 voltage	V_{g2}	700	650	V	
Grid no. 1 voltage	V_{g1}	-85	-70	V	1)
Anode current, no signal condition	I_a	750	900	mA	
Anode current, black	I_{abl}	2,9	2,5	A	3)
Grid no. 2 current, black	I_{g2bl}	45	25	mA	3)
Grid no. 1 current, black	I_{g1bl}	170	90	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	18,4	12,5	kW	
black	$W_{\ell\ black}$	11	7,5	kW	3)
Driving power, sync	$W_{dr\ sync}$	720	415	W	
black	$W_{dr\ black}$	370	225	W	2)
Gain, sync	G_{sync}	25	30		
black	G_{black}	29,7	33		
Sync compression	sync in/out	30/25	28/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	1050	1050	Ω	2)

Notes see page 9
+Detailed information on definitions of terms and application suggestions are available on request.

Mullard

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f		83, 25	MHz	
Bandwidth (−1 dB)	B		7	MHz	2)
Anode voltage	V_a		5, 5	kV	
Grid no. 2 voltage	V_{g2}		700	V	
Grid no. 1 voltage	V_{g1}		−72	V	1)
Anode current, no signal condition	I_a		900	mA	
Anode current, black	I_{abl}		3, 2	A	3)
Grid no. 2 current, black	I_{g2bl}		55	mA	3)
Grid no. 1 current, black	I_{g1bl}		165	mA	3)
Output power in load, sync	W_{ℓ} sync		13, 2	kW	
black	W_{ℓ} black		7, 9	kW	3)
Driving power, sync	$W_{dr\ sync}$		660	W	
black	$W_{dr\ black}$		350	W	2)
Gain, sync	G_{sync}		20		
black	G_{black}		22		
Sync compression	sync in/out		30/25		4)
Differential phase			< 3	o	5)
Differential gain			≥ 85	%	5)
Anode resistance	$R_{a\sim}$		740	Ω	2)

Frequency of visions carrier	f	55, 25		MHz	
Bandwidth (−1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	4	5, 5	kV	
Grid no. 2 voltage	V_{g2}	700	700	V	
Grid no. 1 voltage	V_{g1}	−70	−72	V	1)
Anode current, no signal condition	I_a	800	900	mA	
Anode current, black	I_{abl}	2, 4	3, 4	A	3)
Grid no. 2 current, black	I_{g2bl}	55	45	mA	3)
Grid no. 1 current, black	I_{g1bl}	60	175	mA.	3)
Output power in load, sync	W_{ℓ} sync	6, 4	13, 2	kW	
black	W_{ℓ} black	3, 8	7, 9	kW	3)
Driving power, sync	$W_{dr\ sync}$	352	733	W	
black	$W_{dr\ black}$	190	390	W	2)
Gain, sync	G_{sync}	18	18		
black	G_{black}	20	20		
Sync compression	sync in/out	28/25	30/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	650	670	Ω	2)

Notes: see page 9

R.F. CLASS AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE , grounded grid

LIMITING VALUES

See page 5

OPERATING CONDITIONS , grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

Frequency		f	175 to 225	MHz
Bandwidth (-1 dB)		B	8	MHz
Anode voltage		V_a	6	kV
Grid no. 2 voltage		V_{g2}	800	V
Grid no. 1 voltage	[1])	V_{g1}	-80	V
Anode current, no signal condition		I_a	1,2	A
Anode current	6)	I_a	2,5	A
Grid no. 2 current	[6])	I_{g2}	30	mA
Grid no. 1 current	[6])	I_{g1}	50	mA
Driving power, sync		W_{dr}	220	W
Output power in load, sync		W_ℓ	7	kW
Power gain		G	32	
Intermodulation products	[7])	d	-52	dB

Notes: see page 9

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9,5	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	5	A
Anode input power	W_{ia}	max.	30	kW
Anode dissipation	W_a	max.	12	kW
Grid no. 2 disipation	W_{g2}	max.	100	W
Grid no. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	6	A

OPERATING CONDITIONS

Frequency	f	260	MHz	
Anode voltage	V_a	8	kV	
Grid no. 2 voltage	V_{g2}	700	V	
Grid no. 1 voltage	V_{g1}	-115	V	[1])
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	3,5	A	
Grid no. 2 current	I_{g2}	100	mA	
Grid no. 1 current	I_{g1}	300	mA	
Anode input power	W_{ia}	28	kW	
Anode dissipation	W_a	10	kW	
Output power in load	W_ℓ	18	kW	
Efficiency, total	η	64,3	%	
Driving power	W_{dr}	600	W	
Power gain	$\frac{W_\ell}{W_{dr}}$	30		

---

[1]) see page 9

NOTES

1) To be adjusted for the stated no signal anode current.

2) With double tuned circuit.

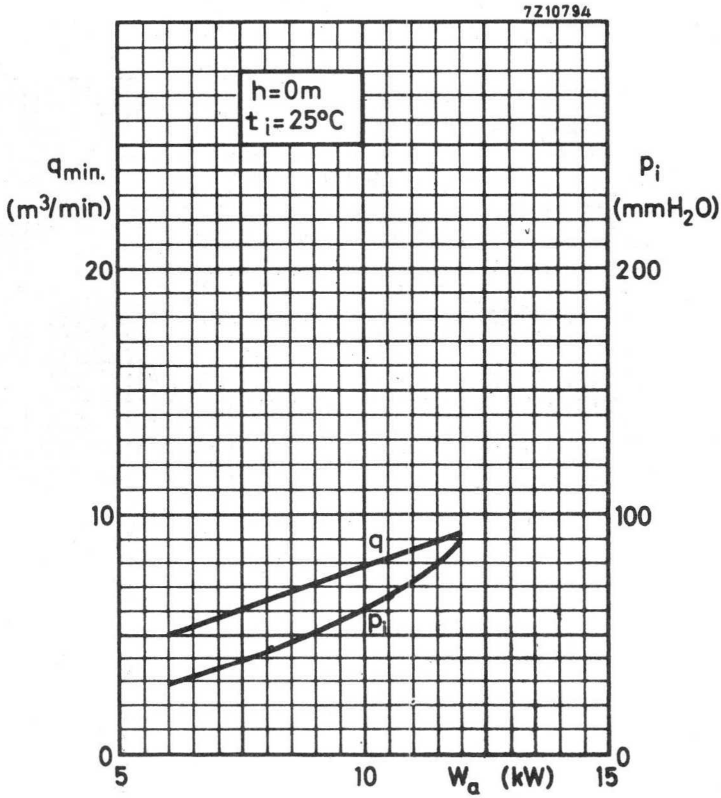
3) Black signal including line sync pulses.

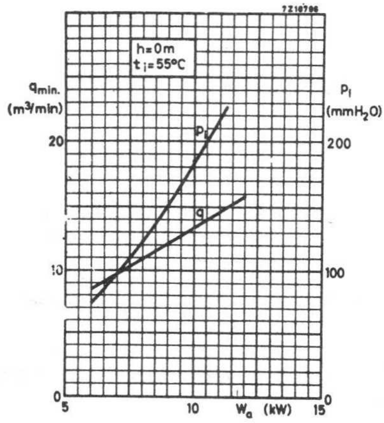
4) A picture/sync ratio of 72/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

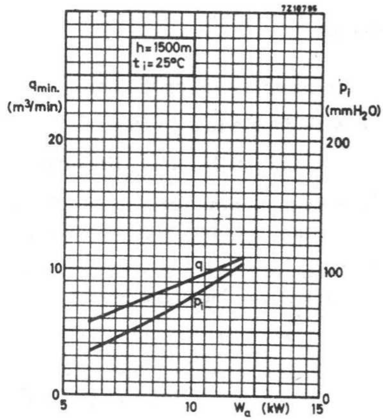
5) Measured with a saw tooth amplitude, running from 17 % to 75 % of the peak sync value, with superimposed a 4, 43 MHz sine wave with a 10 % peak to peak value.

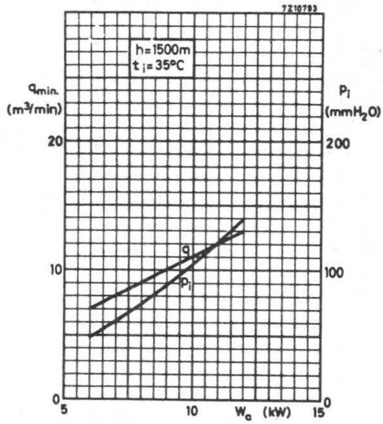
6) At c.w. output power = 7 kW

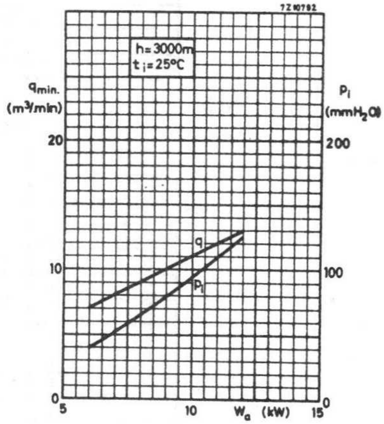
7) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync = 0 dB).

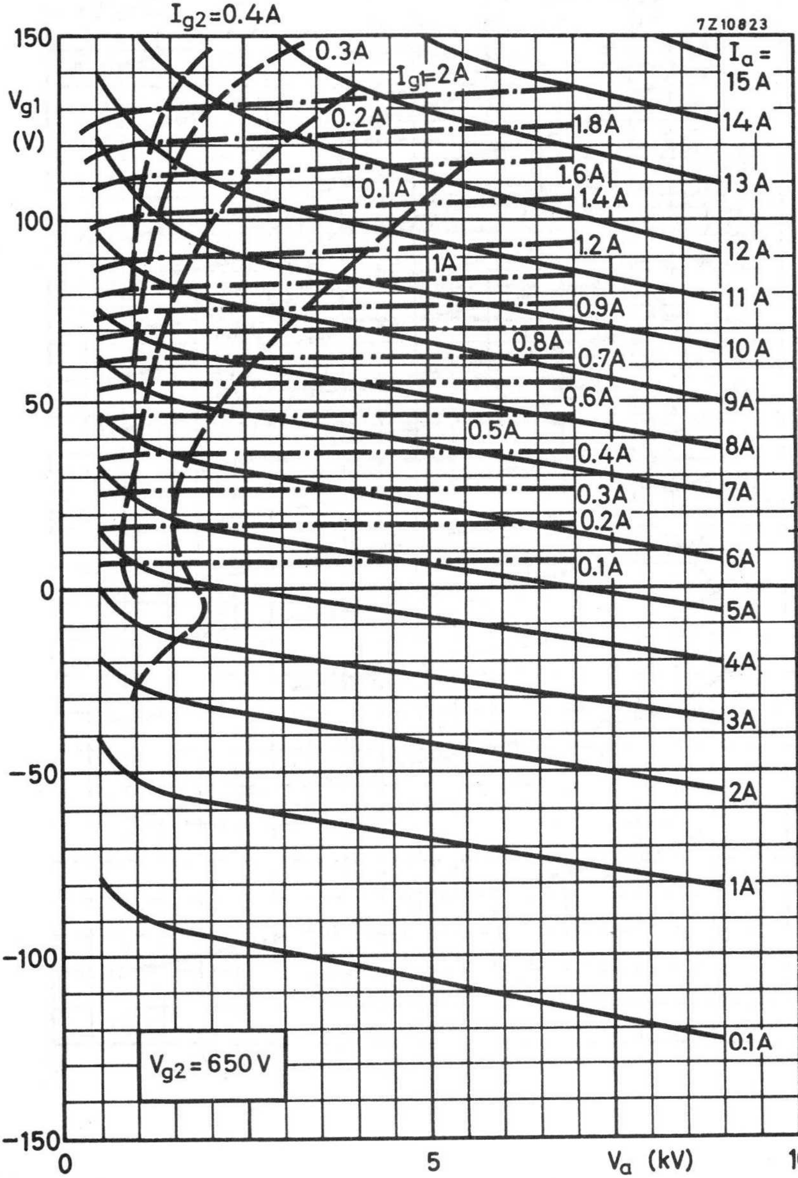



7Z10796
h = 0 m
t i = 55°C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
0
5
10
20
0
100
200
10
15
W_a (kW)
p_i
q

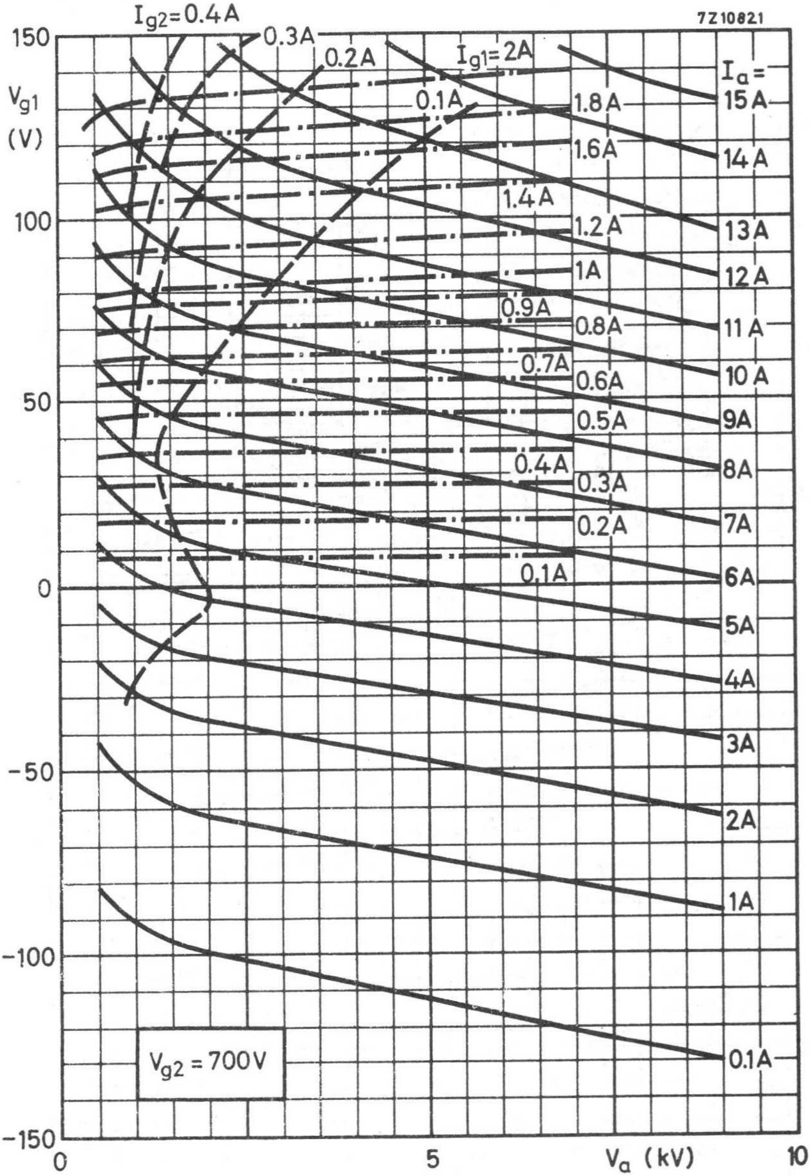

7Z10795
h = 1500m
t i = 25°C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
0
5
10
20
0
100
200
10
15
W_a (kW)
q
p_i


7Z10793
h = 1500m
t i = 35°C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
0
5
10
20
0
100
200
10
15
W_a (kW)
q
p_i

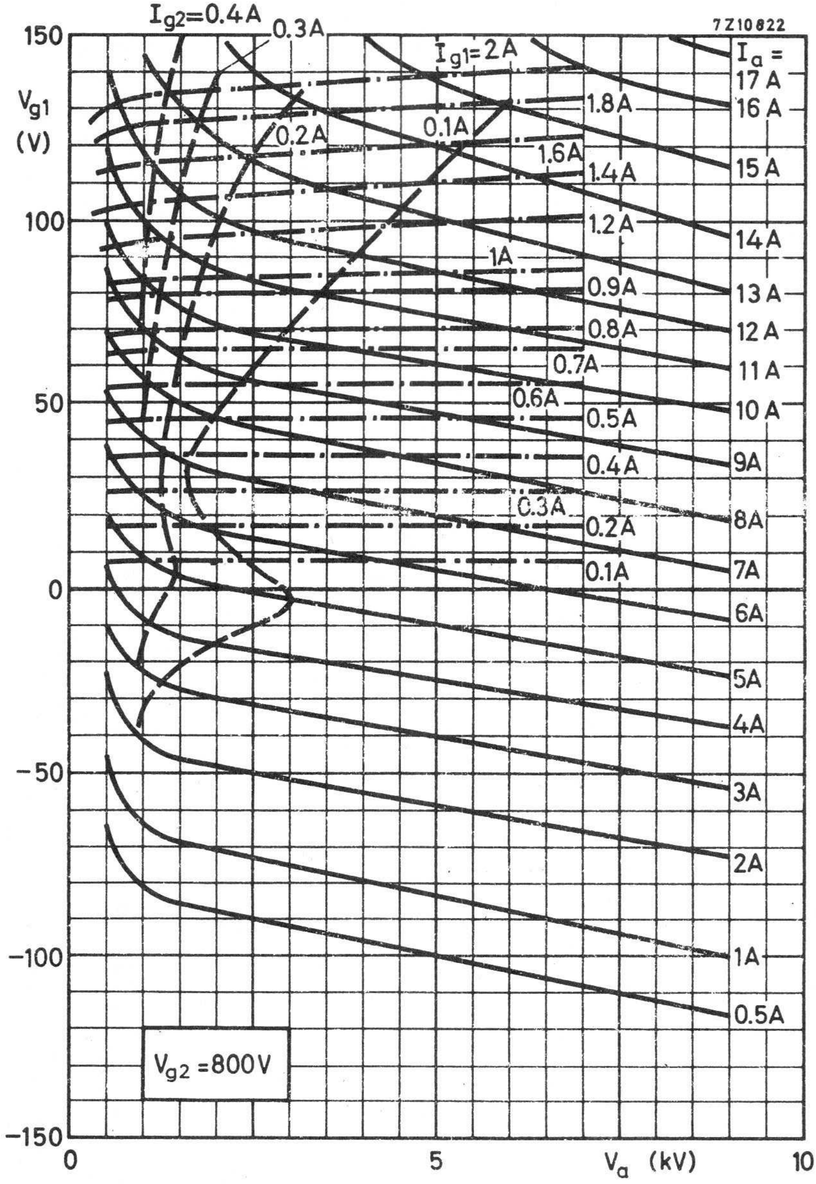

7Z10792
h = 3000m
t i = 25°C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
0
5
10
20
0
100
200
10
15
W_a (kW)
q
p_i



7Z10823
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
15 A
14 A
13 A
12 A
11 A
10 A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
V_{g1}
(V)
150
100
50
0
−50
−100
−150
0
5
10
V_a (kV)
V_{g2} = 650 V



7Z10821
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a=
15A
14A
13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
V_{g1} (V)
150
100
50
0
-50
-100
-150
0
5
10
V_a (kV)
V_{g2} = 700V


7Z10822
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
17 A
16 A
15 A
14 A
13 A
12 A
11 A
10 A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
V_{g1} (V)
150
100
50
0
−50
−100
−150
V_{g2} =800V
0
5
10
V_a (kV)

V.H.F. TETRODE

YL1440

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in T V transmitters in the bands I and III. This type is also very suitable for A.M. and F.M. broadcast, A.F. modulator applications, and in T V transposer service.

QUICK REFERENCE DATA			
Class AB linear amplifier (vision)			
Frequency	f	175,25	MHz
Anode voltage	V_a	3	kV
Output power in load	W_ℓ	1,55	kW
Power gain	G	26	
Class B amplifier			
Frequency	f	260	MHz
Anode voltage	V_a	3,5	kV
Output power in load	W_ℓ	2,4	kW
Power gain	G	26	
TV transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	2,5	kV
Output power in load	W_ℓ	0,55	kW
Power gain	G	30	

HEATING: direct; filament thoriated tungsten, mesh type.

Filament voltage	V_f		4,2	V ± 5%
Filament current	I_f		53	A
Filament peak starting current	I_{fp}	max.	300	A
Cold filament resistance	R_{f_o}		8,5	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Grid no. 2 voltage	V_{g2}	500	V
Anode current	I_a	0,4	A
Transconductance	S	25	mA/V
Amplification factor	μ_{g2g1}	16	

CAPACITANCES

	grounded cathode		grounded grid		
Input	$C_{g1(a)}$	47	$C_{f(a)}$	24	pF
Output	$C_{a(g1)}$	9	$C_{a(f)}$	9	pF
Anode to grid no. 1	C_{ag1}	0,1			pF
Anode to filament			C_{af}	< 0,1	pF

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^{o}C
Recommended max. seal temperature	t	max.	200	^{o}C

COOLING

See curves
Direction of air flow: see drawing.

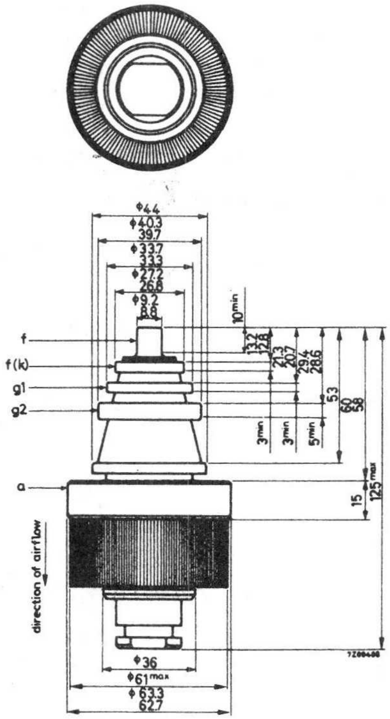
ACCESSORIES

Band I amplifier circuit assembly (vision)	type 40755
Band I amplifier circuit assembly (sound)	type 40756
Band III amplifier circuit assembly (vision)	type 40743
Band III amplifier circuit assembly (sound)	type 40744

MECHANICAL DATA Dimensions in mm

Net weight: approx. 0, 55 kg

Mounting position: vertical with anode up or down.



R.F. CLASS B SERVICE

Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	4	kV
Grid no. 2 voltage	V_{g2}	max.	700	V
Grid no. 1 voltage	$-V_{g1}$	max.	100	V
Anode current	I_a	max.	1, 2	A
Anode input power	W_{ia}	max.	4	kW
Anode dissipation	W_a	max.	1, 5	kW
Grid no. 2 dissipation	W_{g2}	max.	50	W
Grid no. 1 dissipation	W_{g1}	max.	30	W
Cathode current	I_k	max.	1, 5	A
Grid no. 1 circuit resistance	R_{g1}	max.	10	kΩ

OPERATING CONDITIONS grounded grid

Frequency	f	up to	260	MHz	
Anode voltage	V_a		3, 5	kV	
Grid no. 2 voltage	V_{g2}		600	V	
Grid no. 1 voltage	V_{g1}		-30	V	2)
Anode current, no signal condition	I_a		100	mA	
Anode current	I_a		980	mA	
Grid no. 2 current	I_{g2}		70	mA	
Grid no. 1 current	I_{g1}		120	mA	
Anode input power	W_{ia}		3, 43	kW	
Anode dissipation	W_a		0, 9	kW	
Output power in load	W_ℓ		2, 4	kW	
Efficiency, total	η		70	%	
Driving power	W_{dr}		90	W	
Power gain	$\frac{W_\ell}{W_{dr}}$		≈ 26		

2) See page 8

R.F. CLASS AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronization (C.C.I.R. system).
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	4	kV
Grid no. 2 voltage	V_{g2}	max.	700	V
Grid no. 1 voltage	$-V_{g1}$	max.	100	V
Anode current, black	$I_{a\ black}$	max.	1	A
Anode input power, black	$W_{ia\ black}$	max.	4	kW
Anode dissipation	W_a	max.	1,5	kW
Grid no. 2 dissipation	W_{g2}	max.	50	W
Grid no. 1 dissipation	W_{g1}	max.	30	W
Cathode current	I_k	max.	1,5	A
Grid no. 1 circuit resistance	R_{g1}	max.	10	kΩ

OPERATING CONDITIONS grounded grid.

Frequency of vision carrier	f		175,25	MHz	
Bandwidth (−1 dB)	B	7	8	MHz	1)
Anode voltage	V_a	3	2,5	kV	
Grid no. 2 voltage	V_{g2}	500	500	V	
Grid no. 1 voltage	V_{g1}	−23	−14	V	2)
Anode current, no signal condition	I_a	200	400	mA	
Anode current, black	$I_{a\ black}$	700	600	mA	3)
Grid no. 2 current, black	$I_{g2\ black}$	50	40	mA	3)
Grid no. 1 current, black	$I_{g1\ black}$	60	30	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	1550	700	W	
black	$W_{\ell\ black}$	930	420	W	3)
Driving power, sync	$W_{dr\ sync}$	60	30	W	
black	$W_{dr\ black}$	32,5	17	W	
Gain, sync	G_{sync}	26	23		
black	G_{black}	28,6	24,7		
Sync compression	sync in/out	28/25	27/25		4)
Diferential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	
Anode resistance	$R_{a\sim}$	1,8	1,6	kΩ	1)

Notes: see page 8
+ Detailed information on definitions of terms and application suggestions are available on request.

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f		55, 25		MHz	
Bandwidth (−1 dB)	B	7	7	6	MHz	1)
Anode voltage	V_a	2, 5	2	2, 5	kV	
Grid no. 2 voltage	V_{g2}	600	600	600	V	
Grid no. 1 voltage	V_{g1}	−21	−20	−21	V	2)
Anode current, no signal condition	I_a	200	200	200	mA	
Anode current, black	$I_{a\ black}$	820	650	900	mA	3)
Grid no. 2 current, black	$I_{g2\ black}$	45	40	50	mA	3)
Grid no. 1 current, black	$I_{g1\ black}$	80	50	90	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	1170	670	1500	W	
black	$W_{\ell\ black}$	700	400	900	W	3)
Driving power, sync	$W_{dr\ sync}$	83	42	94	W	
black	$W_{dr\ black}$	46	24	50	W	
Gain, sync	G_{sync}	14	16	16		
black	G_{black}	15, 2	16, 6	18		
Sync compression	sync in/out	28/25	27/25	30/25		4)
Differential phase		< 3	< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	≥ 85	%	
Anode resistance	$R_{a\sim}$	0, 9	0, 9	1, 05	kΩ	1)

Frequency of vision carrier	f	83, 25		MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1)
Anode voltage	V_a	2, 5	2	kV	
Grid no. 2 voltage	V_{g2}	600	600	V	
Grid no. 1 voltage	V_{g1}	−21	−20	V	2)
Anode current, no signal condition	I_a	200	200	mA	
Anode current, black	$I_{a\ black}$	900	610	mA	3)
Grid no. 2 current, black	$I_{g2\ black}$	50	45	mA	3)
Grid no. 1 current, black	$I_{g1\ black}$	90	45	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	1500	670	W	
black	$W_{\ell\ black}$	900	400	W	3)
Driving power, sync	$W_{dr\ sync}$	94	39	W	
black	$W_{dr\ black}$	50	22	W	
Gain, sync	G_{sync}	16	17		
black	G_{black}	18	18		
Sync compression	sync in/out	30/25	28/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	
Anode resistance	$R_{a\sim}$	1, 05	1, 05	kΩ	1)

Notes: see page 8

R.F. CLASS AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE, grounded grid

LIMITING VALUES

See page 5

OPERATING CONDITIONS, grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

Frequency	f	175 to 225	MHz
Bandwidth (-1 dB)	B	8	MHz
Anode voltage	V_a	2,5	kV
Grid no. 2 voltage	V_{g2}	600	V
Grid no. 1 voltage [2]	V_{g1}	-13,5	V
Anode current, no signal condition	I_a	550	mA
Anode current [6]	I_a	730	mA
Grid no. 2 current [6]	I_{g2}	50	mA
Grid no. 1 current [6]	I_{g1}	35	mA
Driving power, sync	W_{dr}	18	W
Output power in load, sync	W_ℓ	0,55	kW
Power gain	G	30	-
Intermodulation products [7]	d	-52	dB

Notes: see page 8

NOTES

1) With double tuned circuit.

2) To be adjusted for the stated no signal anode current.

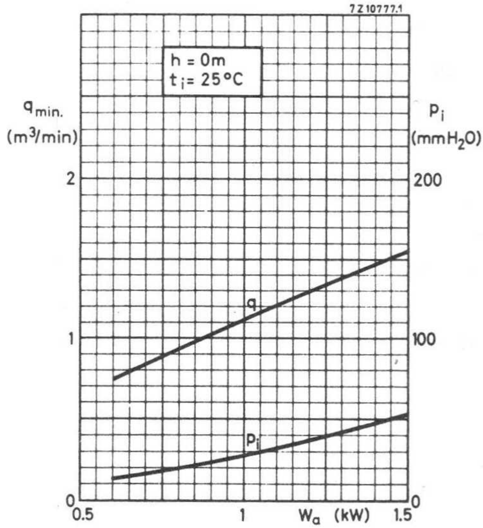
3) Black signal including line sync pulses.

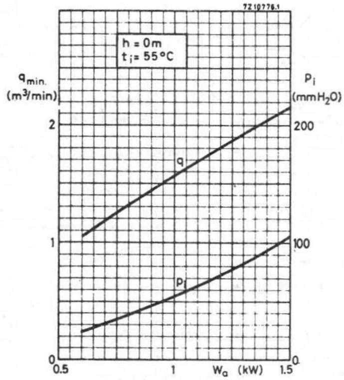
4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

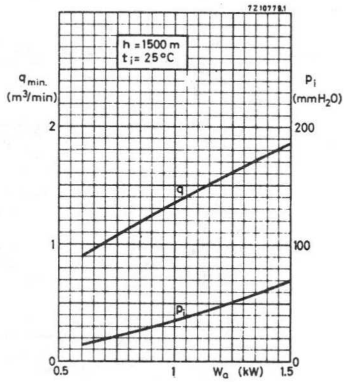
5) Measured with a saw tooth amplitude, running from 17 % to 75 % of the peak sync value, with superimposed a 4, 43 MHz sine wave with a 10 % peak to peak value.

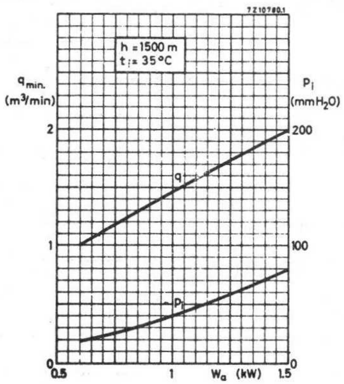
6) At c.w. output power = 550 W

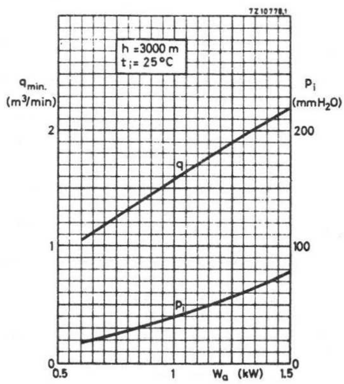
7) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −17 dB with respect to peak sync = 0 dB).

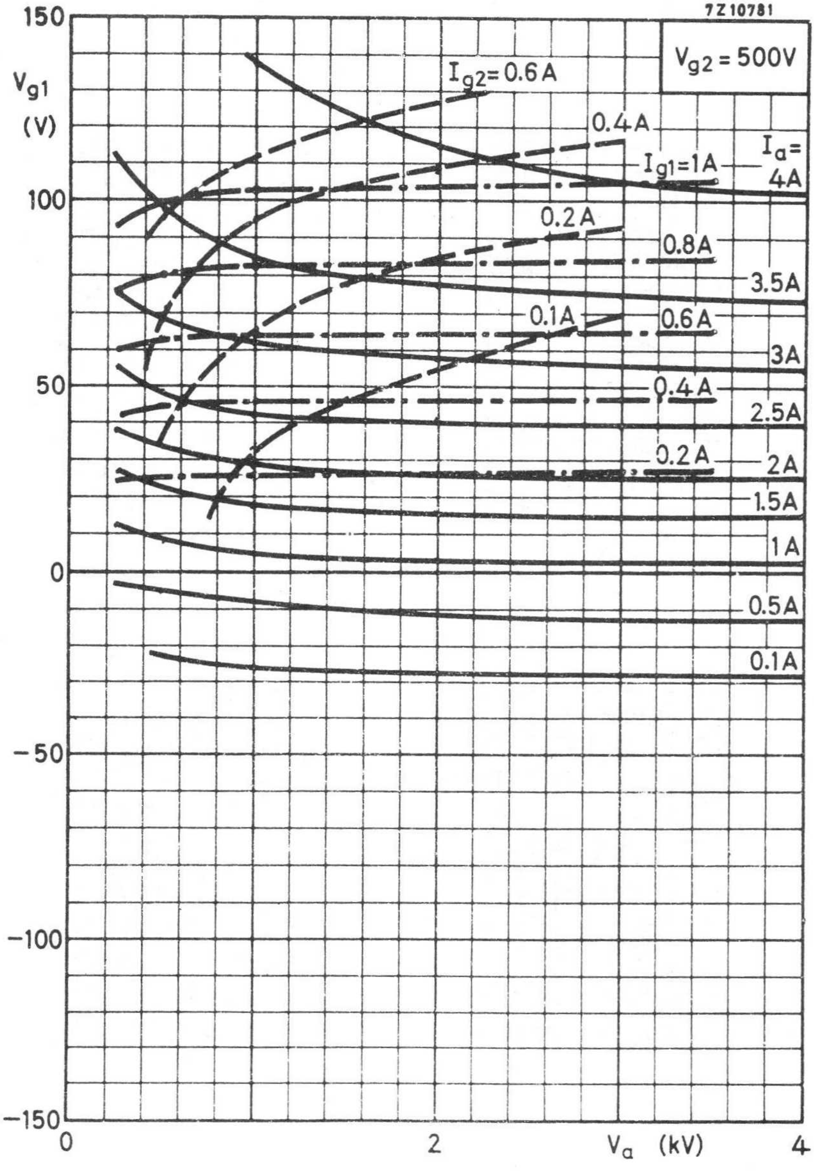


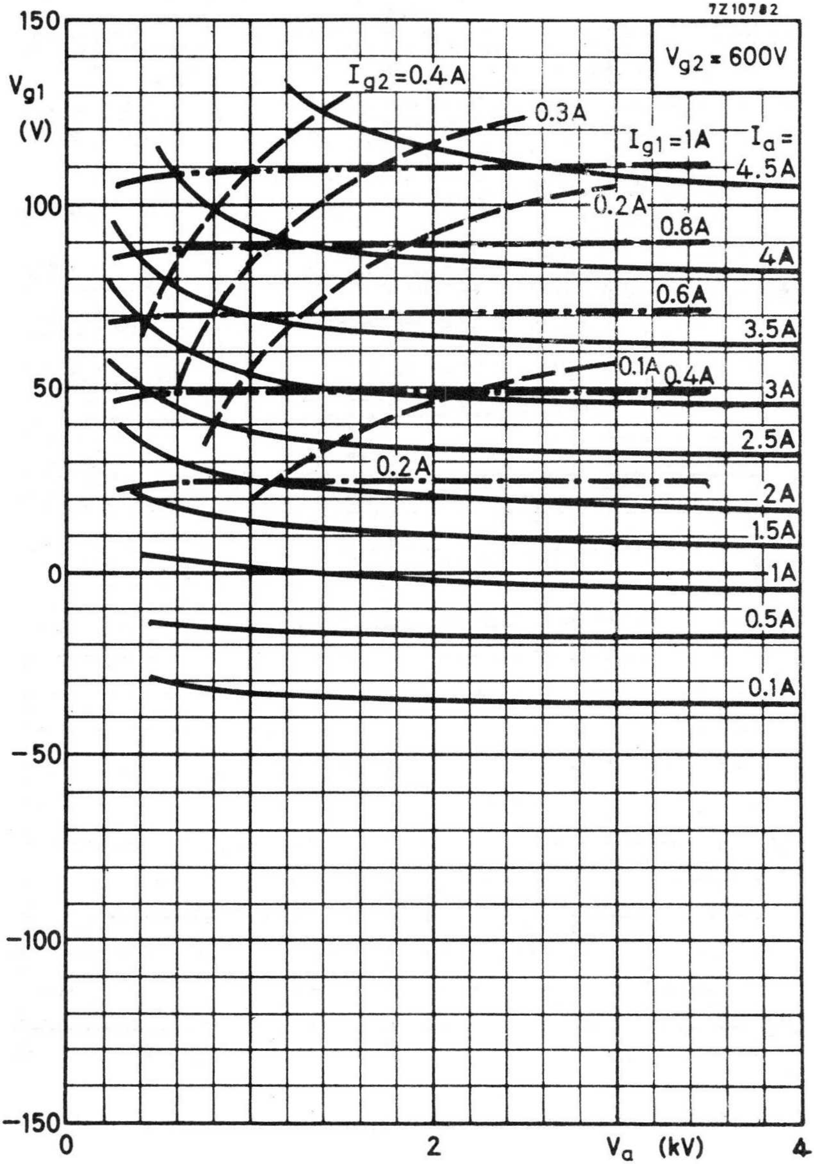

7Z10776.1
h = 0m
t_i = 55°C
$q_{min.}$ (m^3/min)
P_i (mmH_2O)
q
P_i
0.5
1
W_a (kW)
1.5

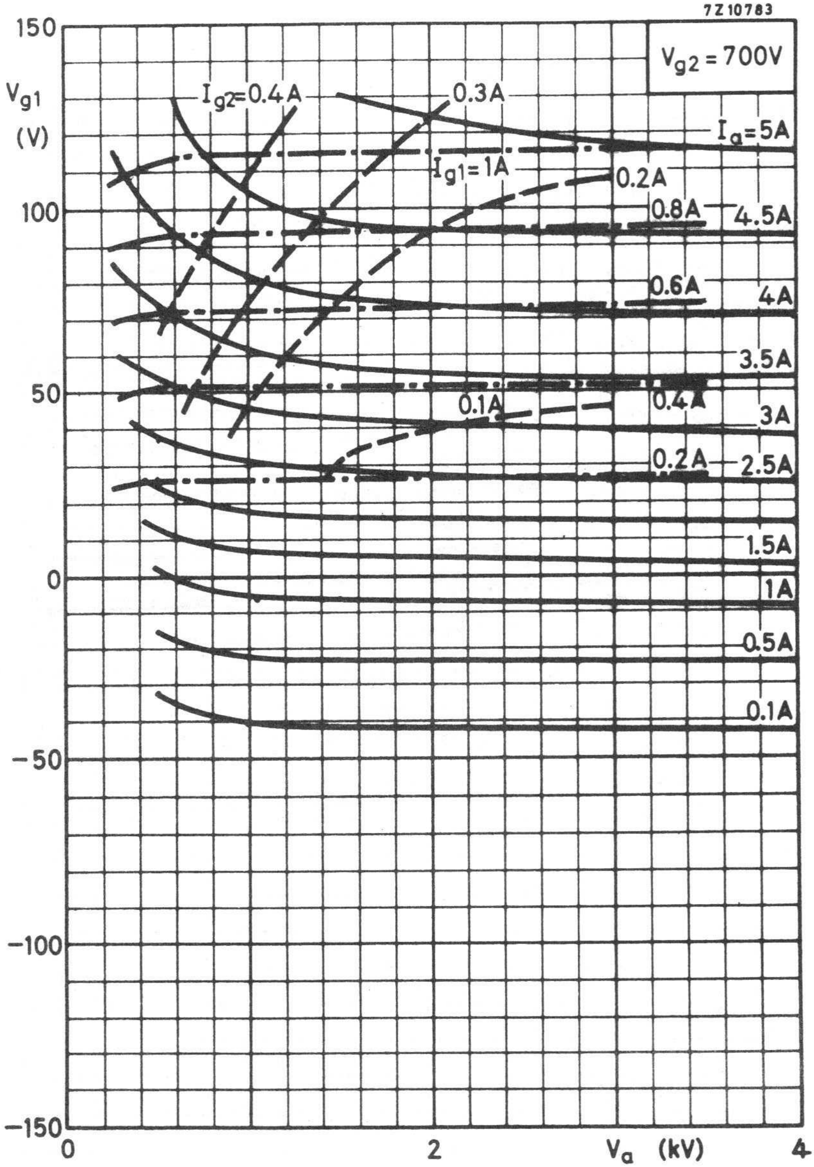

7Z10779.1
h = 1500 m
t_i = 25°C
$q_{min.}$ (m^3/min)
P_i (mmH_2O)
q
P_i
0.5
1
W_a (kW)
1.5


7Z10780.1
h = 1500 m
t_i = 35°C
$q_{min.}$ (m^3/min)
P_i (mmH_2O)
q
P_i
0.5
1
W_a (kW)
1.5


7Z10778.1
h = 3000 m
t_i = 25°C
$q_{min.}$ (m^3/min)
P_i (mmH_2O)
q
P_i
0.5
1
W_a (kW)
1.5


7Z10781
V_{g2} = 500V
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2}= 0.6 A
0.4 A
0.2 A
0.1A
I_{g1}=1A
0.8A
0.6A
0.4A
0.2A
I_a= 4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A
0
2
4
V_a (kV)


7Z10782
V_{g2} = 600V
150
V_{g1}
(V)
100
50
0
−50
−100
−150
0
2
V_a (kV)
4
I_{g2} = 0.4A
0.3A
0.2A
0.1A
I_{g1} = 1A
0.8A
0.6A
0.4A
0.2A
I_a =
4.5A
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A


7Z10783
$V_{g2} = 700V$
150
100
50
0
−50
−100
−150
V_{g1}
(V)
I_{g2}=0.4A
0.3A
I_a=5A
I_{g1}=1A
0.2A
0.8A
4.5A
0.6A
4A
3.5A
0.1A
0.4A
3A
0.2A
2.5A
1.5A
1A
0.5A
0.1A
0
2
V_a (kV)
4

V.H.F. TETRODE

YL1520

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in T V transmitters in the bands I and III. This type is also very suitable for A.M. and F.M. broadcast and A.F. modulator applications, and in T V transposer service.

QUICK REFERENCE DATA			
Class AB linear amplifier (vision)			
Frequency	f	175, 25	MHz
Anode voltage	V_a	8	kV
Output power in load	W_ℓ	27, 5	kW
Power gain	G	28, 5	
Class C telegraphy or F.M. telephony			
Frequency	f	260	MHz
Anode voltage	V_a	8, 5	kV
Output power in load	W_ℓ	25	kW
Power gain	G	31	
Television transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	8	kV
Output power in load	W	10, 5	kW
Power gain	G	42	

HEATING : direct; filament thoriated tungsten, mesh type.

Filament voltage	V_f		11, 5	V ± 5 %
Filament current	I_f		120	A
Filament peak starting current	If_p	max.	750	A
Cold filament resistance	Rf_o		10, 5	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8	kV
Grid no. 2 voltage	V_{g_2}	700	V
Anode current	I_a	2,4	A
Transconductance	S	60	mA/V
Amplification factor	μ	8,5	

CAPACITANCES

	grounded cathode		grounded grid		
Input	$C_{g_1(a)}$	135	$C_{f(a)}$	69	pF
Output	$C_{a(g_1)}$	23	$C_{a(f)}$	23	pF
Anode to grid no. 1	C_{ag_1}	0,85			pF
Anode to filament			C_{af}	0,25	pF

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^oC
Recommended max. seal temperature	t	max.	200	^oC

COOLING

See cooling curves.
Direction of airflow: see outline drawing.

ACCESSORIES

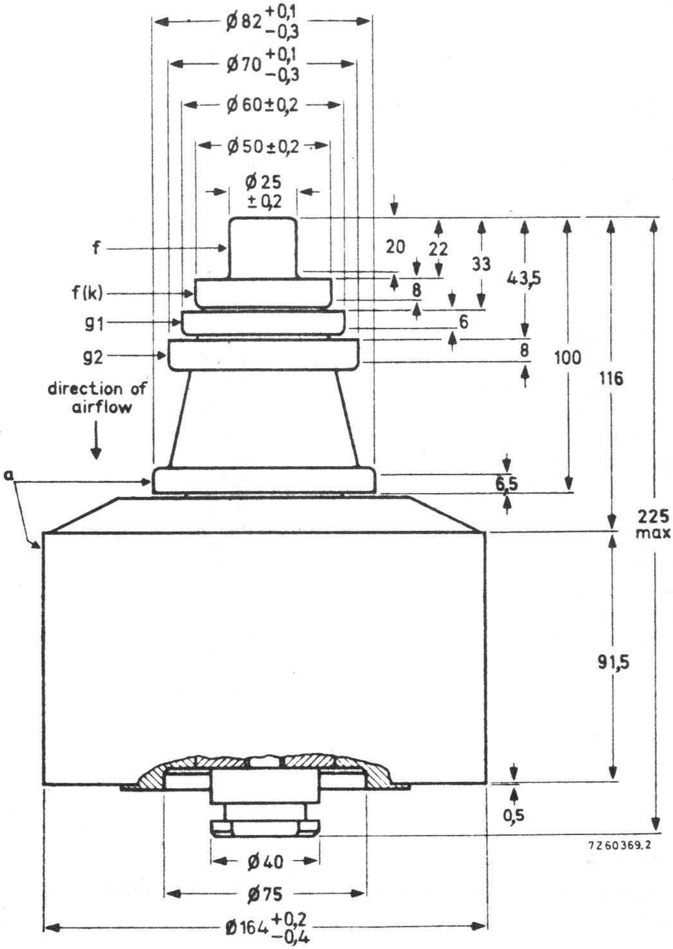
Band I amplifier circuit assembly (vision)	type	40759
Band I amplifier circuit assembly (sound)	type	40760
Band III amplifier circuit assembly (vision)	type	40768
Band III amplifier circuit assembly (sound)	type	40769

MECHANICAL DATA

Dimensions in mm

Net weight : approx. 11 kg

Mounting position : vertical with anode up or down



R.F. CLASS AB LINEAR AMPLIFIER FOR TELEVISION SERVICE +

Negative modulation, positive synchronization (C.C.I.R. system)
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current, black	$I_{a\ black}$	max.	7	A
Anode input power, black	$W_{ia\ black}$	max.	40	kW
Anode dissipation	W_a	max.	18	kW
Grid no. 2 dissipation	W_{g2}	max.	100	W
Grid no. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	9	A

OPERATING CONDITIONS, grounded grid

Frequency of vision carrier	f	175,25	MHz	
Bandwidth (−1 dB)	B	7,5	MHz	2)
Anode voltage	V_a	8	kV	
Grid no. 2 voltage	V_{g2}	700	V	
Grid no. 1 voltage	V_{g1}	−84	V	1)
Anode current, no signal condition	I_a	900	mA	
Anode current, black	$I_{a\ black}$	3,9	A	3)
Grid no. 2 current, black	$I_{g2\ black}$	55	mA	3)
Grid no. 1 current, black	$I_{g1\ black}$	180	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	27,5	kW	
black	$W_{\ell\ black}$	16,5	kW	3)
Anode dissipation, black	$W_{a\ black}$	14	kW	
Driving power, sync	$W_{dr\ sync}$	965	W	
black	$W_{dr\ black}$	520	W	2)
Gain, sync	G_{sync}	28,5		
black	G_{black}	31,6		
Sync compression	sync in/out	30/25		4)
Differential phase		< 3	deg	5)
Differential gain		≥ 85	%	5)
Anode resistance	$R_{a\sim}$	920	Ω	

Notes see page 5

\+ Detailed information on defenitions of terms and application suggestions are available on request.

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f	83, 25	55, 25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	6, 5	6, 5	kV	
Grid no. 2 voltage	V_{g2}	700	700	V	1)
Grid no. 1 voltage	V_{g1}	−88	−88	V	
Anode current, no signal condition	I_a	900	900	mA	
Anode current, black	$I_{a\ black}$	4, 1	4, 5	A	3)
Grid no. 2 current, black	$I_{g2\ black}$	55	45	mA	3)
Grid no. 1 current, black	$I_{g1\ black}$	160	175	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	20	20	kW	
black	$W_{\ell\ black}$	12	12	kW	3)
Anode dissipation, black	$W_{a\ black}$	14, 6	17, 2	kW	
Driving power, sync	$W_{dr\ sync}$	835	910	W	
black	$W_{dr\ black}$	444	520	W	2)
Gain, sync	G_{sync}	24	22		
black	G_{black}	27	23		
Sync compression	sync in/out	30/25	27/25		4)
Differential phase		< 3	< 3	deg	5)
Differential gain	R_a	≥85	≥85	%	5)
Anode resistance	$R_{a\sim}$	720	580	Ω	

NOTES

1) To be adjusted for the stated no signal anode current.

2) With double tuned circuit.

3) Black signal including line sync pulses.

4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

5) Measured with a sawtooth amplitude, running from 17 % to 75 % of the peak sync value, with superimposed a 4, 43 MHz sine wave with a 10 % peak to peak value.

6) At c.w. output power = 10, 5 kW.

7) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −17 dB with respect to peak sync = 0 dB).

R.F. CLASS AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE , grounded grid

LIMITING VALUES

See page 4

OPERATING CONDITIONS , grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

Frequency		f	175 to 225	MHz
Bandwidth (-1 dB)		B	8	MHz
Anode voltage		V_a	8	kV
Grid no. 2 voltage		V_{g2}	900	V
Grid no. 1 voltage	1)	V_{g1}	-95	V
Anode current, no signal condition		I_a	1,8	A
Anode current	6)	I_a	3,3	A
Grid no. 2 current	6)	I_{g2}	35	mA
Grid no. 1 current	6)	I_{g1}	20	mA
Driving power, sync		W_{dr}	250	W
Output power in load, sync		W_ℓ	10,5	kW
Power gain		G	42	-
Intermodulation products	7)	d	-55	dB

Notes : See page 5.

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

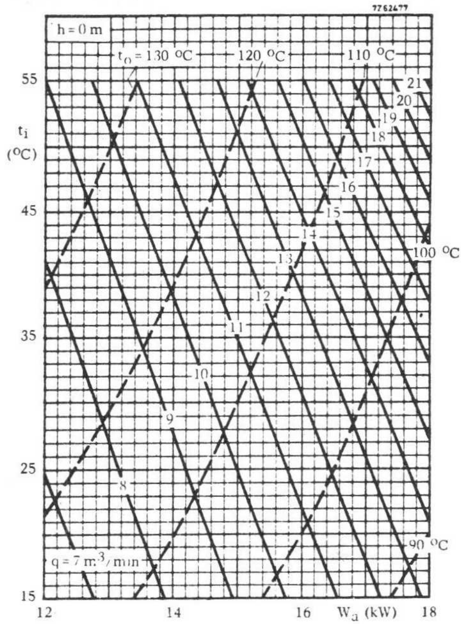
LIMITING VALUES (Absolute max. rating system)

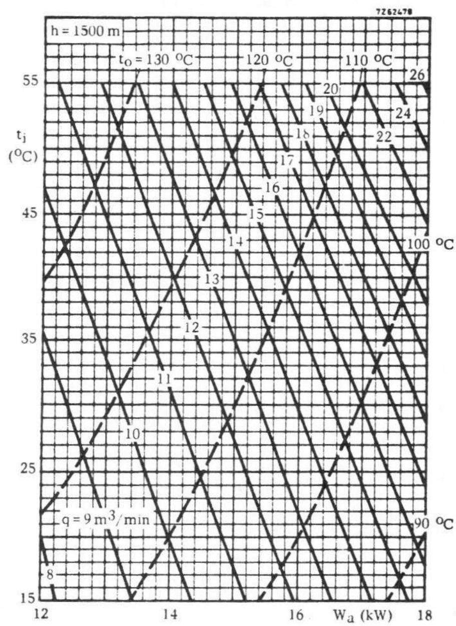
Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9,5	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	7	A
Anode input power	W_{ia}	max.	42	kW
Anode dissipation	W_a	max.	18	kW
Grid no. 2 dissipation	W_{g2}	max.	100	W
Grid no. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	9	A

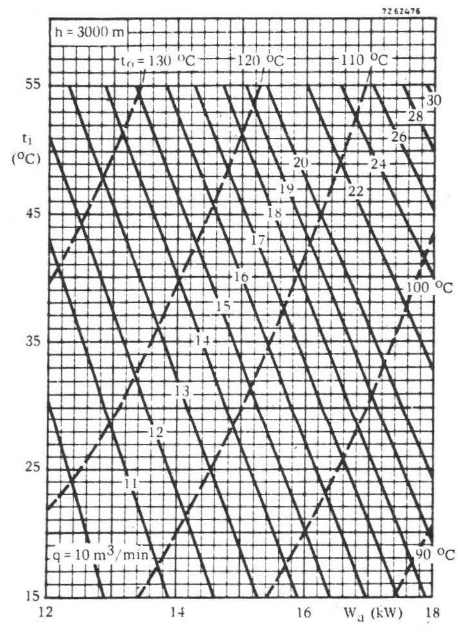
OPERATING CONDITIONS

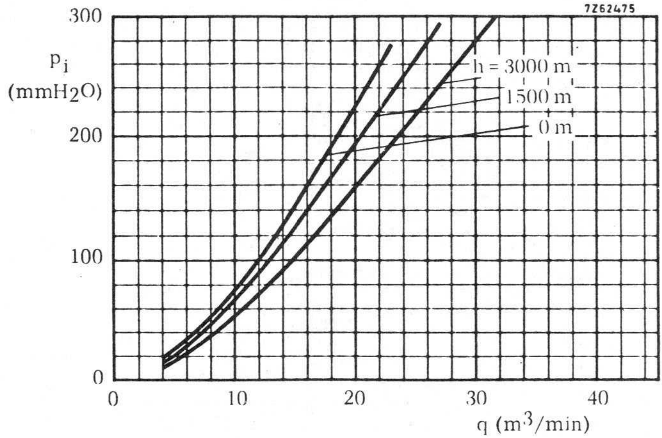
Frequency	f	260	MHz	
Anode voltage	V_a	8,5	kV	
Grid no. 2 voltage	V_{g2}	700	V	
Grid no. 1 voltage	V_{g1}	-106	V	1)
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	4,6	A	
Grid no. 2 current	I_{g2}	100	mA	
Grid no. 1 current	I_{g1}	325	mA	
Anode input power	W_{ia}	39,1	kW	
Anode dissipation	W_a	14	kW	
Output power in load	W_ℓ	25	kW	
Efficiency, total		64	%	
Driving power	W_{dr}	800	W	
Power gain	$\frac{W_\ell}{W_{dr}}$	31		

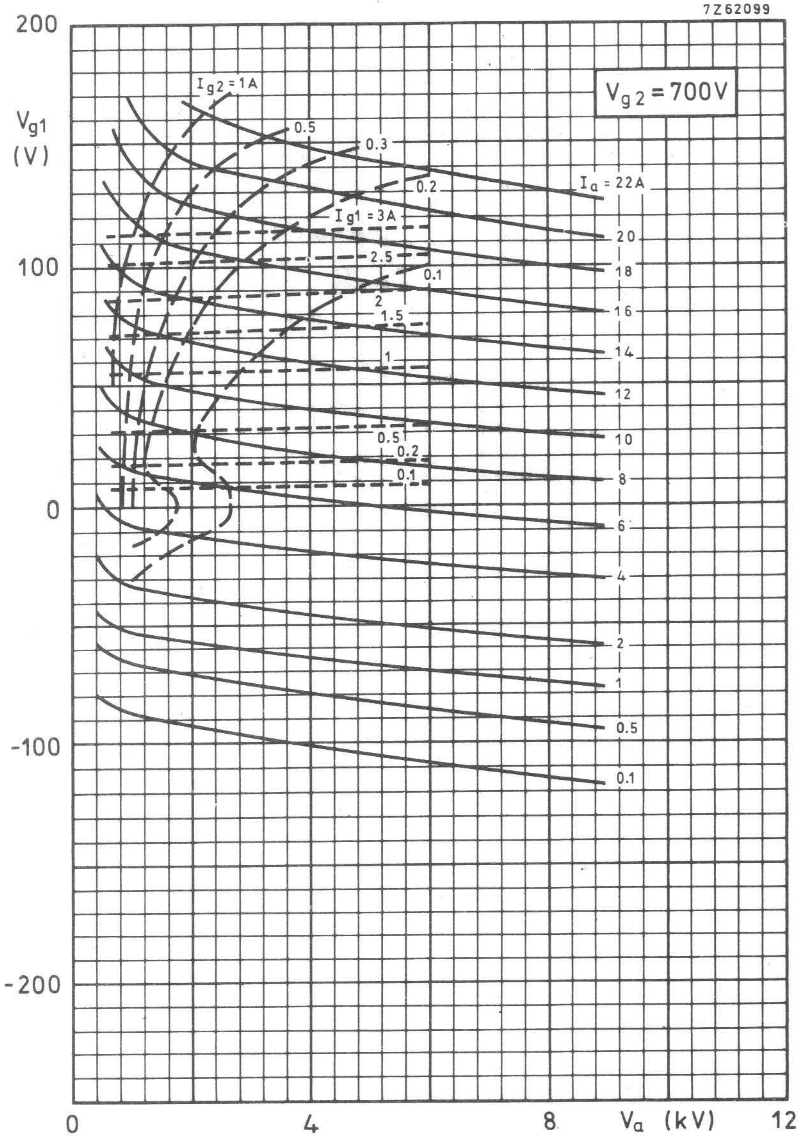
Note : See page 5


7Z62477
h = 0 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
q = 7 m³/min
8
9
10
11
12
13
14
15
16
17
18
19
20
21
t_i (°C)
15
25
35
45
55
12
14
16
18
W_a (kW)


7Z62478
h = 1500 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
q = 9 m³/min
8
10
11
12
13
14
15
16
17
18
19
20
22
24
26
t_i (°C)
15
25
35
45
55
12
14
16
18
W_a (kW)


7Z62476
h = 3000 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
q = 10 m³/min
11
12
13
14
15
16
17
18
19
20
22
24
26
28
30
t_i (°C)
15
25
35
45
55
12
14
16
18
W_a (kW)


7Z62475
300
p_i
(mmH_2O)
200
100
0
0
10
20
30
40
q (m^3/min)
h = 3000 m
1500 m
0 m


7Z62099
200
100
0
-100
-200
V_{g1}
(V)
V_{g2} = 700V
I_{g2} = 1A
0.5
0.3
0.2
0.1
I_{g1} = 3A
2.5
2
1.5
1
0.5
0.2
0.1
I_a = 22A
20
18
16
14
12
10
8
6
4
2
1
0.5
0.1
0
4
8
V_a (kV)
12

TRAVELLING WAVE TUBES

D

D

1. HEATER

1.1. Low noise values

To obtain the minimum noise figure the heater voltage must be within $\pm 2.5\%$ of the specified value and temporary fluctuations must be within $\pm 5\%$.

1.2. Intermediate and power values

To obtain the maximum life the heater voltage must be within $\pm 2.5\%$ of the nominal value and temporary fluctuations must be within $\pm 10\%$.

2. COOLING

It may be necessary to provide additional cooling to prevent the valve and focusing system temperature limits being exceeded.

Forced cooling of the collector terminal may be required and recommendations will be given in the individual valve data.

Normally cooling of electromagnetic focusing systems will be required.

3. FOCUSING MOUNTS

A suitable magnetic field is provided by the mounts available from Mullard Limited.

Designers who do not propose to use one of these mounts should consult the valve manufacturer as an unsuitable mount can impair the performance of the valve. In many instances, the focusing mount incorporates the radio frequency input and output connections with suitable matching devices.

Focus alignment screws are provided on the approved mounts and a presetting procedure for these has been established (see appropriate data sheets). This procedure will reduce the risk of damage to the valve due to excessive helix dissipation during the focusing operations.

4. SHIELDING

Any disturbance of the focusing field may impair the performance of the valve, and the valve must be protected from the effects of nearby ferrous material and stray magnetic fields.

The degree of susceptibility to such interference varies for different focusing systems and specific information will be given in the individual data sheets. Unless magnetic shielding or component orientation is adopted ferrous objects should be kept more than 9 inches away and other magnetic objects should be positioned 18 inches away from the valve.

5. POWER SUPPLIES

5.1. Protective devices

Protective devices are desirable to prevent damage to the valve if the power supply or cooling arrangements fail.

5.2. Regulation

The regulation requirements can be determined with reference to the typical curves of gain, phase shift and electrode voltages.

The change in gain with electrode voltage is usually greatest for the current controlling electrode (normally the first grid) and the helix.

Any ripple voltage on the helix will give rise to phase modulation of the signal.

With an electromagnetic focusing system the solenoid current must be stabilised.

6. INSTALLATION SEQUENCE

When putting a valve into operation the initial adjustments should be made in the following order:

Ensure that the control electrode voltage is set at zero and then apply simultaneously the remaining electrode voltages and adjust in accordance with recommended values. Increase the control electrode voltage until cathode current is drawn, ensuring that the maximum helix current limit is not exceeded. Adjust the focus alignment screws so that the helix current is a minimum and the collector current is a maximum. Repeat this procedure until the required collector current is achieved and the helix current is a minimum. A typical helix current is given in the valve data under operating conditions.

Inject a low level radio frequency signal at the desired operating frequency ensuring that the value is not saturated and observe the output level. Adjust the helix voltage until a maximum output level is achieved. Recheck for optimum focusing and lock focus alignment screws.

7. OPERATING SEQUENCE

The following sequence should be followed:

a. Apply the heater voltage and allow the specified heater warm up time.

b. Switch on the power supply of the electromagnetic focusing system.

c. The electrode voltages may be applied simultaneously but it is preferable that the control electrode voltage be delayed with respect to the other electrode voltages.

8. SWITCHING OFF

All the electrode voltages may be removed simultaneously but it is preferable for the control electrode voltage to decrease more rapidly than the other electrode voltages.

Where an electromagnetic focusing arrangement is used the valve electrode voltages must be removed before switching off the solenoid power supply.

9. STORAGE

The valve should be stored in its original packing, which is designed to give reasonable protection against vibration and knocks. This also ensures that the spacing between permanent magnet valves and other ferrous objects is adequate to avoid reduction of magnetisation.

Unpacked permanent magnet valves should **NEVER** be placed on steel benches or shelves.

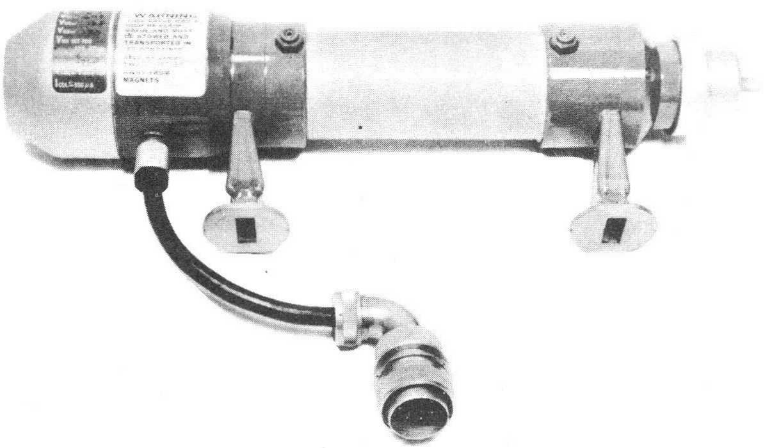
RADAR
TRAVELLING-WAVE TUBE

LA9-3B

QUICK REFERENCE DATA		
Forward wave amplifier for general purpose use.		
Frequency range	7.0 to 11.5	GHz
Power output	10	mW
Gain	30	dB
Construction		Packaged
Output connections		Waveguide WR90

Services type: CV6087

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION

Operating conditions (electrode potentials measured with respect to cathode)

Heater voltage	6.3	V
Grid 1 voltage	-100	V
Grid 2 voltage	150	V
Grid 3 voltage	100	V
Helix voltage	1.3	kV
Collector voltage	1.4	kV
Operating frequency	9.0	GHz

Typical performance

Gain	30	dB
Power output (saturated)	10	mW
Power output (working)	50	μW
Noise factor	22	dB
Input match	2.0	
Output match	2.0	
Grid 1 current	1.0	μA
Grid 2 current	1.0	μA
Grid 3 current	1.0	μA
Helix current	15	μA
Collector current	550	μA

CATHODE

Indirectly heated, dispenser cathode

Heater voltage (d.c. or r.m.s.) (see note 1)	6.3	V
Heater current	0.5 to 0.7	A
Pre-heating time (minimum) (see note 2)	500	s

TEST CONDITIONS AND LIMITS

The travelling-wave tube is tested to comply with the following electrical conditions.

Test conditions

Heater voltage	6.3	V
Grid 1 voltage	-100	V
*Grid 2 voltage range	0 to 250	V
*Grid 3 voltage range	0 to 400	V
*Helix voltage range	1.15 to 1.45	kV
Collector voltage	helix voltage +100V	
Collector current	550	μA
Frequency range (see note 3)	7.0 to 11.5	GHz

*Specified on data sheet enclosed with tube.

Limits and characteristics

	Min.	Max.	
Gain	20	35	dB
Noise factor	-	24	dB
Power output	3.0	-	mW
Grid 1 current	-	10	μA
Grid 2 current	-	10	μA
Grid 3 current	-	10	μA
Helix current	-	50	μA
Attenuation (see note 4)			

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (electrode potentials measured with respect to cathode)

These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

	Min.	Max.	
Grid 1 voltage	-200	0	V
Grid 2 voltage	-	450	V
Grid 3 voltage	-	450	V
Helix voltage	-	1.6	kV
Helix current	-	100	μA
Collector voltage	-	1.7	kV
Collector current	-	600	μA

DESIGN RANGES FOR POWER SUPPLY (electrode potentials with respect to cathode)

Normal operation

	Min.	Max.	
Grid 1 voltage	-100	-70	V
Grid 1 current	-	10	μA
Grid 2 voltage	0	200	V
Grid 2 current	-	10	μA
Grid 3 voltage	0	250	V
Grid 3 current	-	10	μA
Helix voltage	1.15	1.45	kV
Helix current	-	60	μA
Collector voltage (see note 5)			
Collector current	-	550	μA

MOUNTING POSITION

Any. The barrel of the mount must be protected from strong magnetic fields such as from isolators and should be several centimetres from steel plates.

COOLING

Horizontally or vertically mounted natural

AMBIENT TEMPERATURE RANGE

	Min.	Max.	
Operation to full specification	-10	+65	^{o}C

PHYSICAL DATA

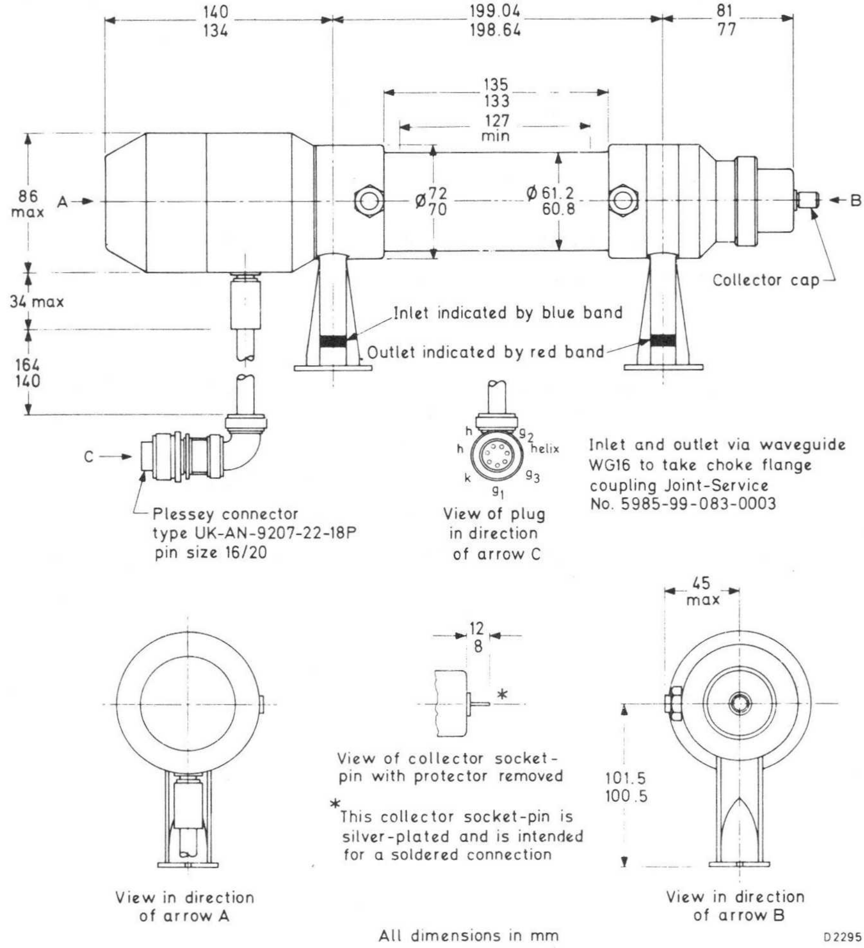
Packaged tube

	kg	lb
Weight	3.4	7.5
Weight in inner storage pack	3.9	8.5
Weight in transit carton (1 tube per carton)	58.5	129
	mm	in
Dimensions of inner storage pack	525 × 232 × 243	20.7 × 9.2 × 9.6
Dimensions of transit carton	900 × 560 × 600	35.4 × 22.3 × 23.5

NOTES

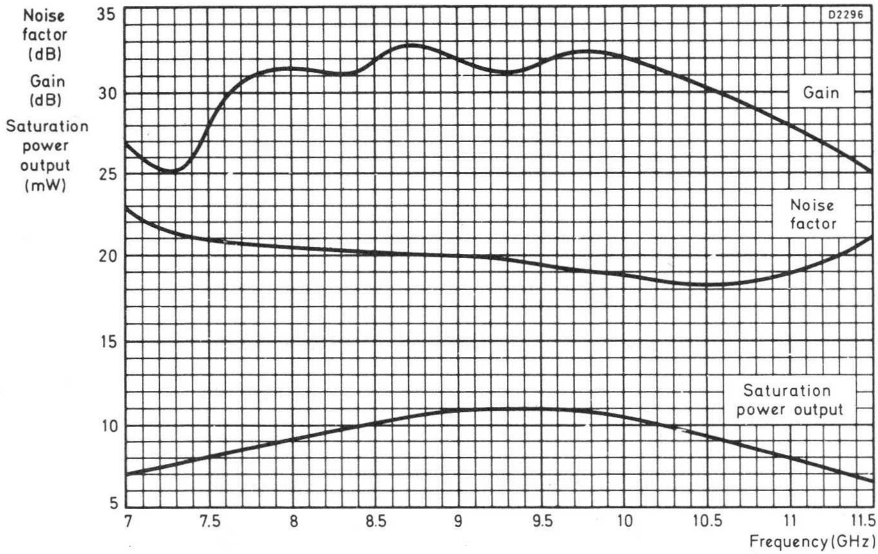
1. The absolute variation of heater voltage should be less than ±5%. When operated on d.c. the heater must be negative with respect to cathode.
2. The pre-heating time for a new tube must be at least 10 minutes.
3. The tube is tested at the centre and the extremes of the frequency range.
4. With electrode voltages not applied minimum attenuation is 40dB.
5. The collector voltage must be 100V greater than helix voltage. A stabilised supply is unnecessary.

OUTLINE DRAWING OF LA9-3B



CONVERSION TABLE
(Rounded outwards)

mm	in
12/8	0.472/0.315
34 max.	1.34 max.
45 max.	1.77 max.
Ø61.2/60.8	Ø2.409/2.394
Ø72/70	Ø2.835/2.756
81/77	3.189/3.031
86 max.	3.39 max.
101.5/100.5	3.996/3.957
127 min.	5.00 min.
135/133	5.315/5.236
140/134	5.512/5.276
164/140	6.456/5.512
199.04/198.64	7.836/7.820



TYPICAL SATURATION POWER OUTPUT, GAIN AND NOISE FACTOR
PLOTTED AGAINST FREQUENCY

COMMUNICATIONS TRAVELLING-WAVE TUBE

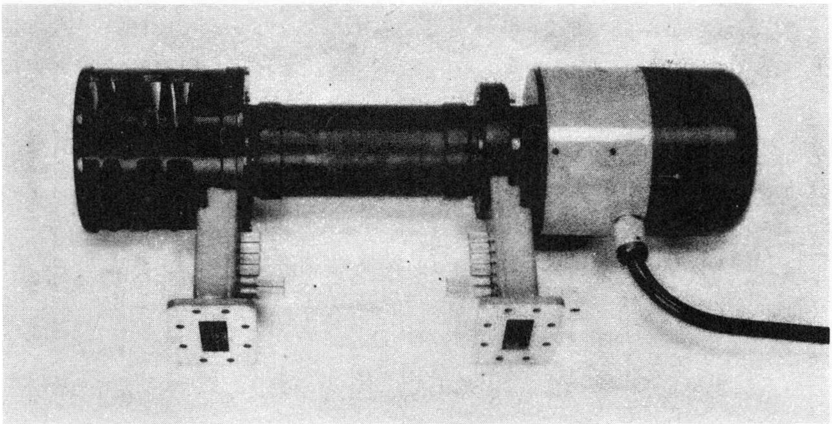
LB6-10

QUICK REFERENCE DATA

Forward wave amplifier for use in the power output stages of wide band multi-channel microwave links.

Frequency range	5.9 to 6.5	GHz
Saturation power output	10	W
Working power output	5.0	W
Gain at working power	35	dB
Construction		Unpackaged
Output connections		Waveguide WR137

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION

As a power amplifier focused in a focusing mount type P6L4. Tubes are fully interchangeable in mounts and tube replacement is a simple operation.

Operating conditions (electrode potentials measured with respect to cathode)

Heater voltage	6.3	V
Grid 1 voltage	-8.0	V
Helix voltage	2.6	kV
Collector voltage (earth)	1.8	kV
Operating frequency	6.0	GHz
Collector current	40	mA

Typical performance

Gain	35	dB
Power output	5.0	W
Noise factor (including gas noise)	25	dB
Hot input match (v.s.w.r.)	1.08	
Hot output match (v.s.w.r.)	1.15	
Grid 1 current	1.0	μA
Grid 2 current	10	μA
Helix current	0.25	mA
Grid 2 voltage	1.9	kV

CATHODE

• Indirectly heated dispenser cathode

Heater voltage (d.c. or r.m.s.) (see note 1)	6.3	V
Heater current	0.75 to 0.95	A
Pre-heating time (minimum) (see note 2)	120	s

TEST CONDITIONS AND LIMITS

The travelling-wave tube is focused in mount type P6L4 and tested to comply with the following electrical conditions.

Test conditions

Heater voltage	6.3	V
Grid 1 voltage	-8.0	V
Grid 2 voltage (see notes 3 and 8)		
Helix voltage (see note 4)		
Collector voltage	1.7	kV
*Collector current range	35 to 42	mA
Power output	5.0	W
Frequency range (see note 5)	5.925 to 6.475	GHz

*Specified on data sheet enclosed with tube.

Limits and characteristics

	Min.	Max.	
Gain (at 5W output)	34	37	dB
**Noise factor (at 5W output)	-	30	dB
Saturation power output (see note 6)	10	-	W
Hot input match (v.s.w.r.) (see note 7)	-	1.08	
Hot output match (v.s.w.r.) (see note 7)	-	1.15	
Grid 2 voltage	1.6	2.3	kV
Helix voltage	2.4	2.9	kV
Grid 1 current	-	100	μA
Grid 2 current	-	250	μA
Helix current (see note 8)	-	1.5	mA
**A.M./P.M. conversion (at 5W output) (see note 9)	-	2.0	deg/dB
Attenuation (see note 10)			

**Design test only

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (electrode potentials measured with respect to cathode)

These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

	Min.	Max.	
Grid 1 voltage	-250	0	V
Grid 2 voltage	-	3.0	kV
Helix voltage	-	4.0	kV
Helix current (see note 8)	-	1.5	mA
Collector voltage	1.7	1.9	kV
Collector current	-	50	mA
Collector power dissipation	-	110	W
R.F. power input (see note 11)	-	0.25	W
Voltage between heater and cathode	-	50	V

DESIGN RANGES FOR POWER SUPPLY (electrode potentials with respect to cathode)

Normal operation

	Min.	Max.	
Grid 1 voltage (see note 12)			
Grid 1 current	-	100	μA
Grid 2 voltage (see note 13 and 14)	1.6	2.3	kV
Grid 2 current	-250	+250	μA
Helix voltage	2.4	2.9	kV
Helix current (see notes 8 and 14)	-	1.5	mA
Collector voltage (see note 15)			
Collector current	-	45	mA

MOUNTING POSITION

Any (but see cooling). The barrel of the mount must be protected from strong magnetic fields such as from isolators, and **should** be several centimetres from steel plates.

COOLING

Tube installed in convection-cooled mount type P6L4.

Horizontally mounted	natural
Vertically mounted	assisted by convection duct or low velocity air flow

Temperatures

Collector seal max.	200	°C
Reference point on mount cooler max.	140	°C

AMBIENT TEMPERATURE RANGE

	Min.	Max.	
Operation to full specification (see note 16)	-10	+65	°C
Switch-on	-20	+65	°C
Storage (see note 17)	-60	+85	°C

PHYSICAL DATA

Tube

	kg	lb
Weight	0.14	0.31
Weight in inner storage pack	0.25	0.55
Weight in transit carton (4 inner packs per carton)	4.5	10.5

	mm	in
Dimensions of inner storage pack	75 × 57 × 502	3 × 2.3 × 19.8
Dimensions of transit carton	375 × 325 × 715	14.8 × 13 × 28.3

Mount

	kg	lb
Weight	5.0	11
Weight in inner storage pack	5.3	11.7
Weight in transit carton	25.4	55.9

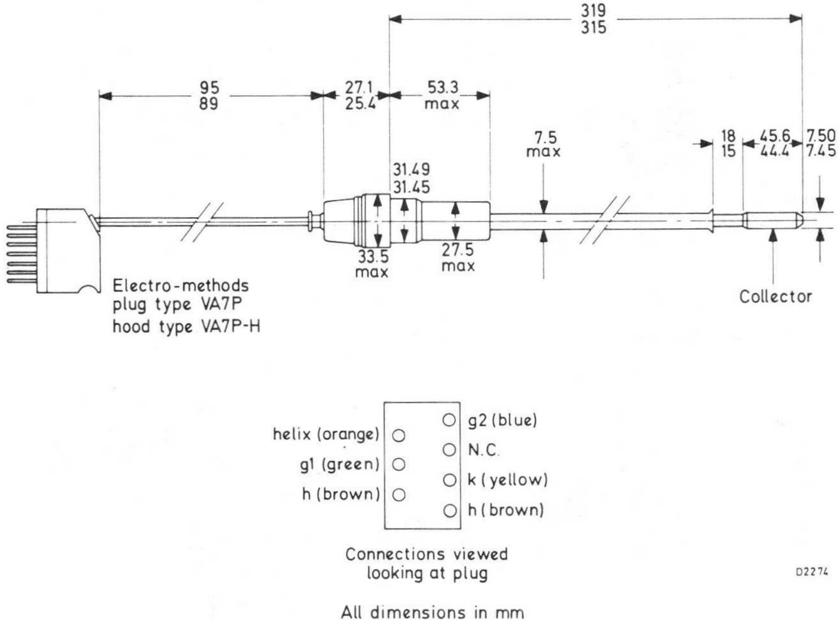
	mm	in
Dimensions of inner storage pack	255 × 140 × 495	10 × 5.5 × 19.5
Dimensions of transit carton	520 × 410 × 640	20.5 × 16.3 × 25.3

NOTES

1. The absolute variation of the heater voltage must be less than ± 3%. When operated on d.c. the heater must be negative with respect to the cathode.
2. The pre-heating time for a new tube must be at least 5 minutes.
3. Grid 2 voltage should be adjusted to give the specified collector current while cyclically adjusting focusing screws for minimum helix current.
4. The helix voltage should be adjusted to give the maximum gain at the specified power output. Focusing should then be re-optimised.
5. The tube is tested at the centre and the extremes of the frequency range.
6. Measured pulsed at a duty ratio of 1:2. If necessary the helix voltage is readjusted to give maximum power output as the input power is increased and the focusing re-optimised.
7. This is obtained over a bandwidth of ± 25MHz after adjustment of the matching screws.
8. During the focusing operation the helix current may (transiently) be allowed to reach 2.5mA. It may be useful to set the focusing screws on a new mount 1.5 turns back from fully home before commencing the switch-on operation.
9. The value given for A.M. to P.M. conversion is that obtained under the stated conditions. Improved values may be obtained with other settings of helix voltage and input power.
10. With electrode voltages not applied minimum attenuation is 65dB.
11. The output power reflected back into the tube by the load (for example the output isolator) should also not exceed this rating.
12. The grid 1 voltage is normally fixed at -8V.
13. For adjustment of focus it is also necessary for the grid 2 voltage to be variable in the range 0 to 1.6kV without stabilisation. As an alternative the negative voltage on grid 1 may be increased within certain limits to reduce the collector current (see ratings).
14. The power supply should be designed so that any automatic switching allows the correct cathode warm-up period (which may be reduced or eliminated for momentary breaks of 5 seconds), followed by establishment of all electrode voltages except grid 2. The grid 2 voltage may then be applied. All supplies should usually be stabilised to ± 2% except where otherwise stated. A protective device to reduce the grid 2 voltage should operate if the helix current exceeds the figure in the ratings (but see note 8).
15. The collector voltage is usually fixed at 1.8kV. This supply need not be stabilised provided that it remains in the range 1.7 to 1.9kV.
16. The magnetic circuit is fully temperature-compensated in this range, and the operation of the tube will not change as the temperature is varied.
17. If the temperature of the mount is lowered below -60°C the magnets will suffer an irreversible change.

OUTLINE DRAWING OF LB6-10

Note tube is fragile. It should be inserted carefully into mount and then pushed home axially. Rotation is also necessary to negotiate the withdrawl check lugs.

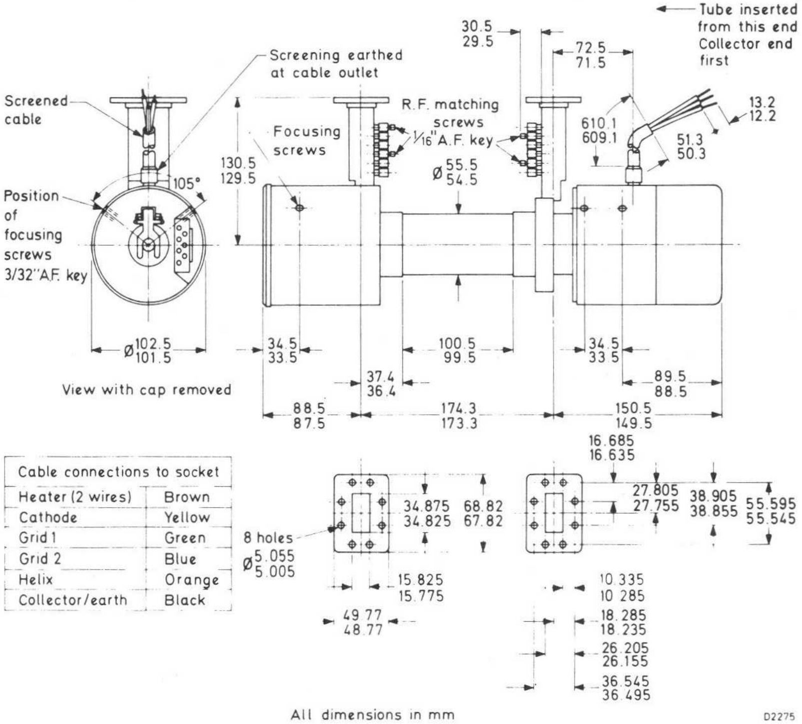


CONVERSION TABLE
(Rounded outwards)

mm	in
7.50/7.45	0.2953/0.2933
7.5 max.	0.295 max.
18/15	0.71/0.59
27.1/25.4	1.067/1.000
27.5 max.	1.082 max.
31.49/31.45	1.2397/1.2382
33.5 max.	1.319 max.
45.6/44.4	1.795/1.748
53.3 max.	2.098 max.
95/89	3.74/3.50
319/315	12.56/12.40

OUTLINE DRAWING OF P6L4 MOUNT

Note that the installation should be designed so that maximum misalignment moment at r.f. connectors is 19.6N m (2kgf m). The cooling fins are movable and require about 3mm clearance. The mount should be handled with special care during installation to avoid damage to the cooling fins.

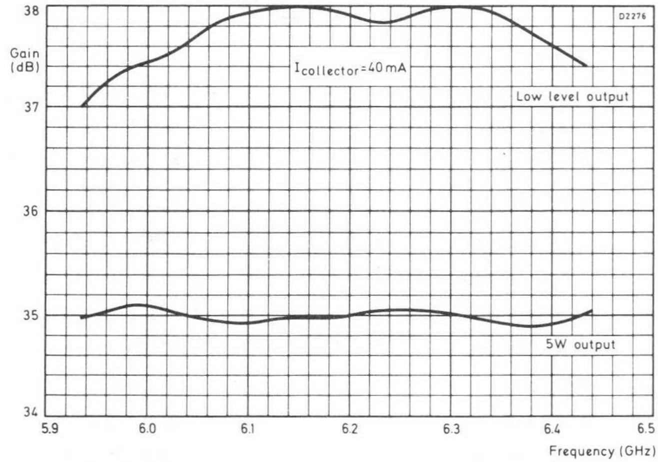


Cable connections to socket	
Heater (2 wires)	Brown
Cathode	Yellow
Grid 1	Green
Grid 2	Blue
Helix	Orange
Collector/earth	Black

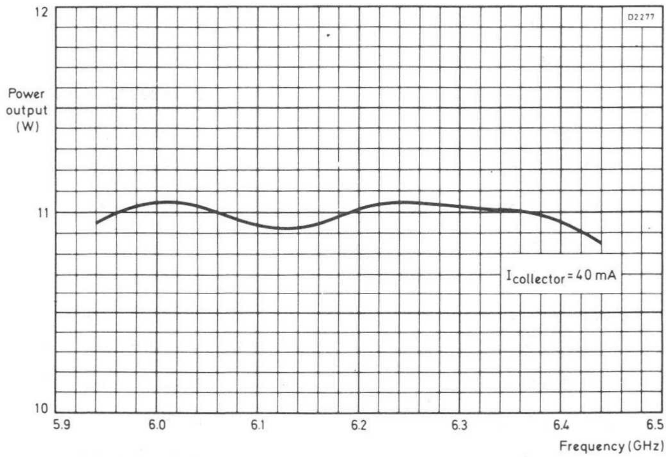
Mullard

CONVERSION TABLE
(Rounded outwards)

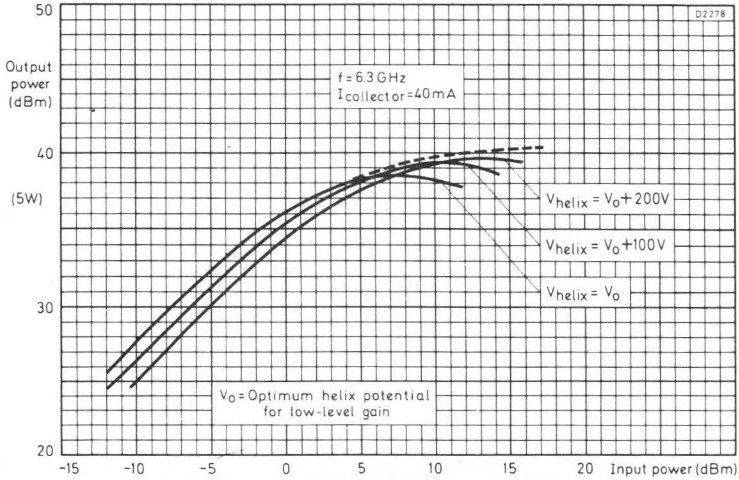
mm	in
Ø 5.055/5.005	Ø0.19901/0.19694
10.335/10.285	0.40689/0.40492
13.2/12.2	0.519/0.480
15.825/15.775	0.62303/0.62106
16.685/16.635	0.65689/0.65492
18.285/18.235	0.71988/0.71791
26.205/26.155	1.03169/1.02972
27.805/27.755	1.09468/1.09350
30.5/29.5	1.200/1.161
34.5/33.5	1.358/1.319
34.875/34.825	1.37303/1.37106
36.545/36.495	1.43877/1.43681
37.4/36.4	1.472/1.433
38.905/38.855	1.53169/1.5297
49.77/48.77	1.9594/1.9201
51.3/50.3	2.019/1.980
Ø 55.5/54.5	Ø2.185/2.145
55.595/55.545	2.18877/2.18681
68.82/67.82	2.7094/2.6701
72.5/71.5	2.854/2.815
88.5/87.5	3.484/3.445
89.5/88.5	3.524/3.484
100.5/99.5	3.957/3.917
Ø102.5/101.5	Ø4.035/3.996
130.5/129.5	5.138/5.098
150.5/149.5	5.925/5.886
174.3/173.3	6.862/6.823
610.1/609.1	24.019/23.980



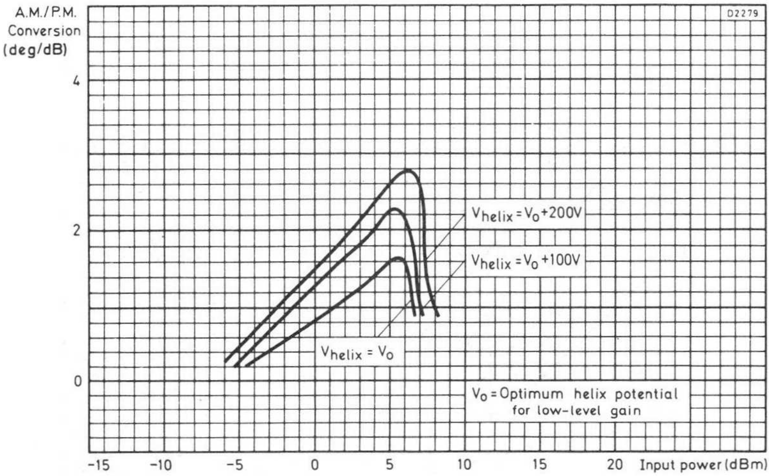
TYPICAL GAIN PLOTTED AGAINST FREQUENCY



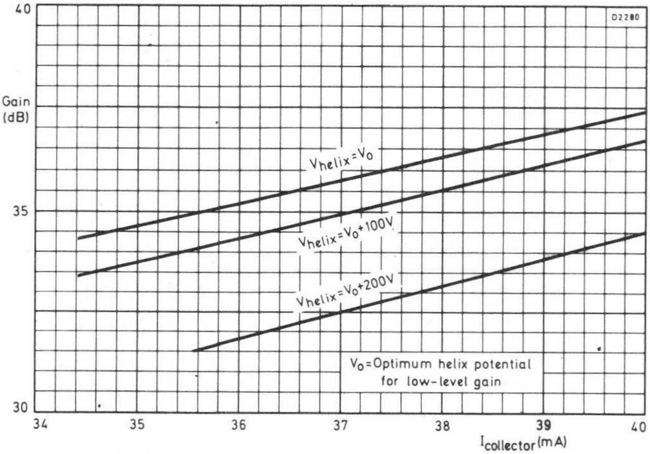
TYPICAL SATURATION POWER OUTPUT PLOTTED
AGAINST FREQUENCY



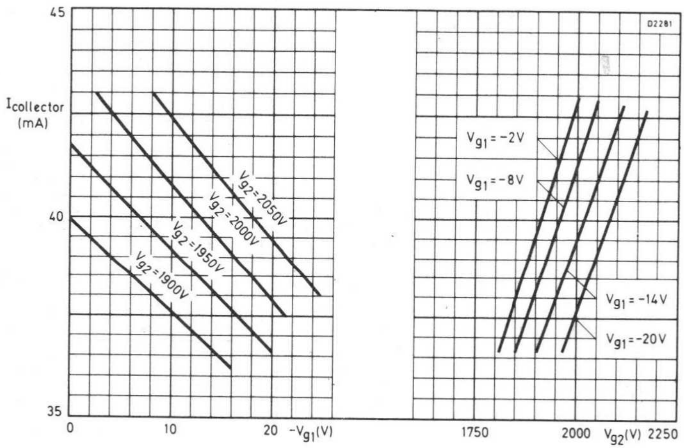
TYPICAL OUTPUT POWER PLOTTED AGAINST INPUT POWER FOR VARIOUS HELIX POTENTIALS



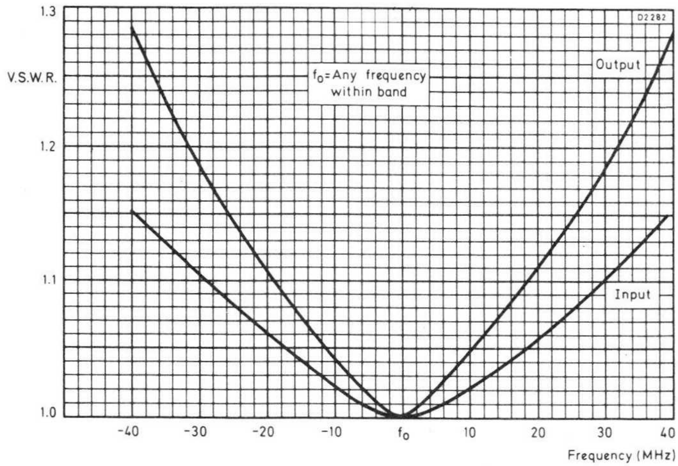
TYPICAL A.M./P.M. CONVERSION FIGURES PLOTTED AGAINST INPUT POWER FOR VARIOUS HELIX POTENTIALS



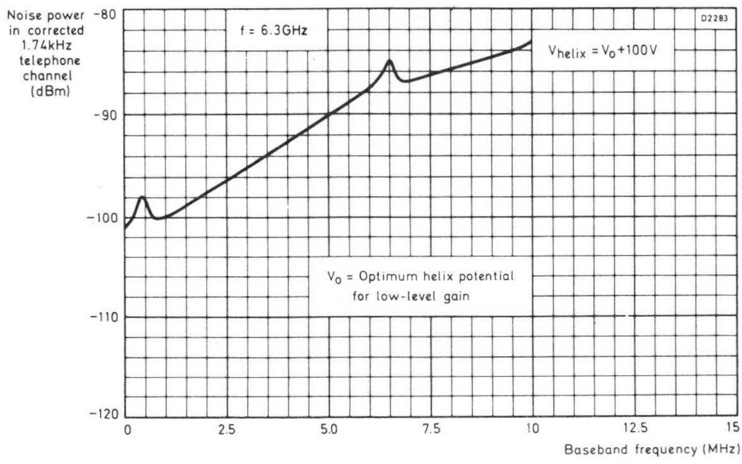
TYPICAL LOW LEVEL GAIN PLOTTED AGAINST COLLECTOR CURRENT FOR VARIOUS HELIX POTENTIALS



TYPICAL COLLECTOR CURRENT PLOTTED AGAINST GRID 1 AND GRID 2 POTENTIALS



TYPICAL INPUT AND OUTPUT HOT MATCH
PLOTTED AGAINST FREQUENCY



TYPICAL DISTRIBUTION OF CHANNEL NOISE IN
F.M. TELEPHONY

RADAR
TRAVELLING-WAVE TUBE

LB3-250B

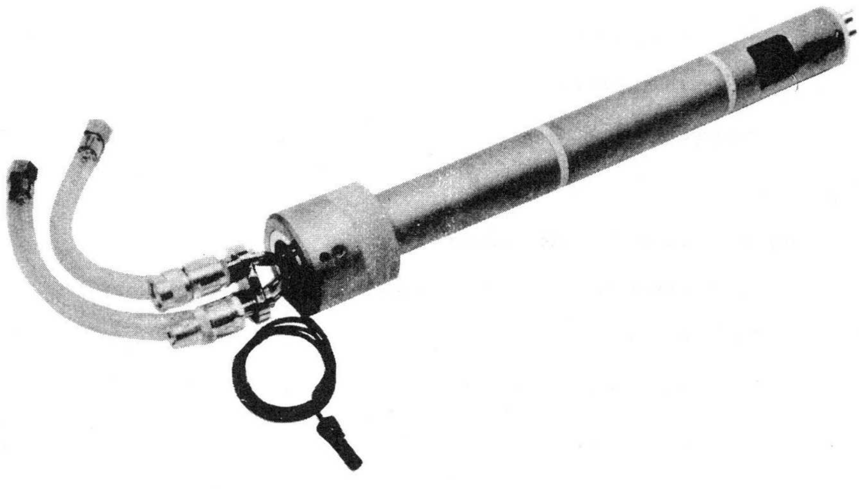
QUICK REFERENCE DATA

Forward wave amplifier for use in pulsed radar systems.

Frequency range	2.7 to 3.3	GHz
Saturation power output	600	W
Working power output	250	W
Gain at working power	32	dB
Construction	Unpackaged, pre-focused	
Output connections	Type C coaxial	

Services type: **CV6223**

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



TYPICAL OPERATION

As a power amplifier focused in a focusing mount type S3L1.
Tubes are fully interchangeable in mounts and tube replacement is a simple operation.

Operating conditions (electrode potentials measured with respect to cathode)

Heater voltage	6.3	V
Grid 1 voltage	5.0	kV
Helix voltage	5.0	kV
Collector voltage	5.0	kV
Operating frequency	3.0	GHz
Pulse duration	20	μs
Pulse repetition frequency	275	pulse/s
Solenoid current	21	A

Typical performance

Gain	32	dB
Power output	250	W
Grid 1 current (pulsed)	20	mA
Helix current (pulsed)	125	mA
Collector current (pulsed)	800	mA

CATHODE

Indirectly heated, dispenser cathode

Heater voltage (d.c. or r.m.s.) (see note 1)	6.3	V
Heater current	0.75 to 1.0	A
Pre-heating time (minimum) (see note 2)	120	s

TEST CONDITIONS AND LIMITS

The travelling-wave tube is focused in mount type S3L1 and tested to comply with the following electrical conditions.

Test conditions

Heater voltage	6.3	V
*Grid 1 voltage range	4.5 to 6.5	kV
Helix voltage (see note 3)		
Collector voltage (see note 3)		
Frequency range (see note 4)	2.7 to 3.3	GHz
Solenoid current	21	A

*Specified on data sheet enclosed with tube.

Limits and characteristics

	Min.	Max.	
Gain (at 250W output)	27.5	35	dB
Power output	250	-	W
Cold input match (v.s.w.r.) (see note 5)	-	3.0	
Cold output match (v.s.w.r.) (see note 5)	-	3.0	
Grid 1 current (pulsed)	-	25	mA
Helix current	-	200	mA
Collector current (pulsed)	-	1.0	A
Attenuation (see note 6)			

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (electrode potentials measured with respect to cathode)

These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

Grid 1 voltage	7.5	kV
Helix voltage (see note 3)	7.5	kV
Helix current (pulsed)	250	mA
Collector voltage (see note 3)	7.5	kV
Collector current (pulsed)	1.5	mA
Pulse duration	22	μs
Duty cycle	0.005	

DESIGN RANGES FOR POWER SUPPLY (electrode potentials with respect to cathode)

Normal operation

	Min.	Max.	
Grid 1 voltage (pulsed)	4.5	6.5	kV
Grid 1 current (pulsed)	-	25	mA
Helix voltage (see note 3)			
Helix current	-	200	mA
Collector voltage (see note 3)			
Collector current	-	1.0	A
Solenoid current	20.5	21.5	A
Solenoid resistance	-	1.0	Ω

MOUNTING POSITION

Any

COOLING

Tube installed in water-cooled mount type S3L1. Both the capsule and mount require water cooling. The cooling systems may be connected in series.

Minimum rate of water flow	1.0	l/min
Back pressure of capsule	120	mm of mercury
Back pressure of mount	300	mm of mercury
Inlet water temperature	50	^{o}C

AMBIENT TEMPERATURE RANGE

	Min.	Max.	
Operation to full specification	-10	+65	^{o}C

PHYSICAL DATA

	kg	lb
Weight of capsule	2.3	5.0
Weight of mount	21	46

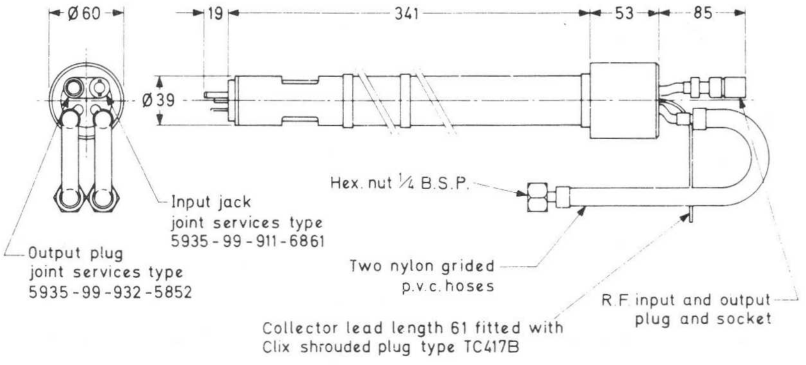
R.F. CONNECTIONS

Coaxial plugs: type C

NOTES

1. The absolute variation of heater voltage should be less than ±5%. When operated on d.c. the heater must be negative with respect to cathode.
2. The pre-heating time for a new tube must be at least 5 minutes.
3. Same potential as grid 1. Maximum potential with respect to tube body 100V.
4. The tube is tested at the centre and the extremes of the frequency range.
5. Obtained without adjustment at each frequency ("plug-in" match).
6. With electrode voltages not applied minimum attenuation is 45dB.

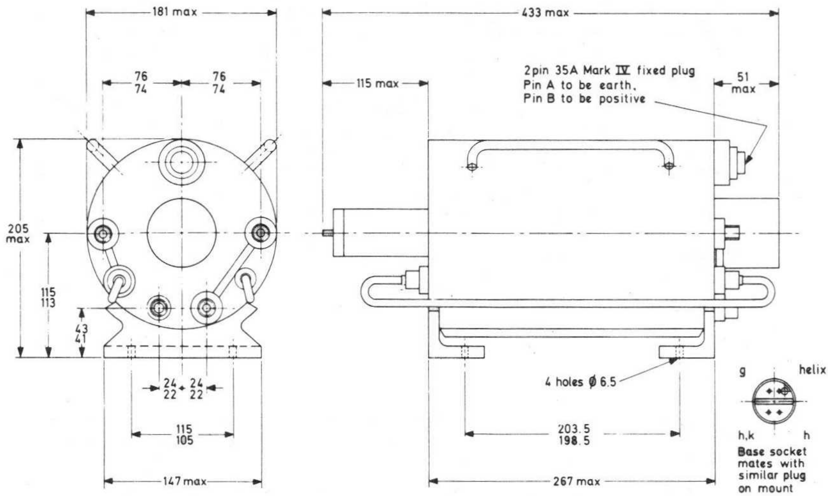
OUTLINE DRAWING OF LB3-250B



CONVERSION TABLE
(Rounded outwards)

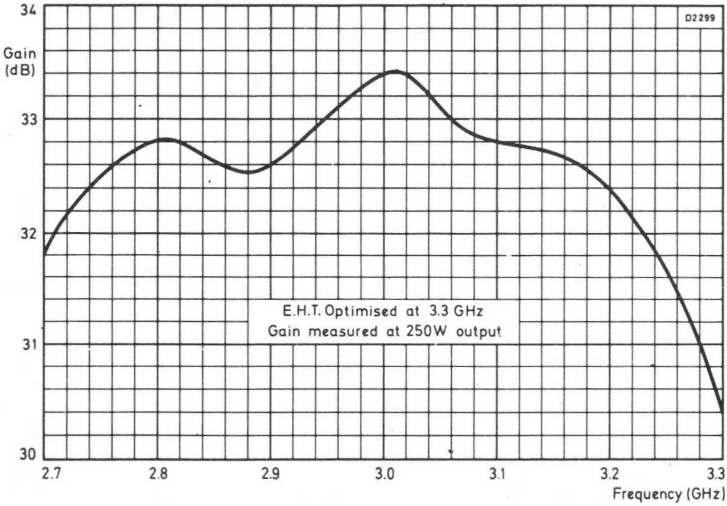
LB3-250B mm	LB3-250B in	LB3-250B MOUNT (S3L1) mm	LB3-250B MOUNT (S3L1) in
19	0.75	Ø6.5	Ø0.238
Ø39	Ø1.54	24/22	0.945/0.866
53	2.09	43/41	1.693/1.614
Ø60	Ø2.36	51 max.	2.0 max.
61	2.40	76/74	2.992/2.913
85	3.35	115 max.	4.53 max.
341	13.42	115/105	4.53/4.13
		115/113	4.527/4.448
		147 max.	5.79 max.
		181 max.	7.12 max.
		203.5/198.5	8.012/7.815
		205 max.	8.07 max.
		267 max.	10.51 max.
		433 max.	17.05 max.

OUTLINE DRAWING OF LB3-250B MOUNT (S3L1)

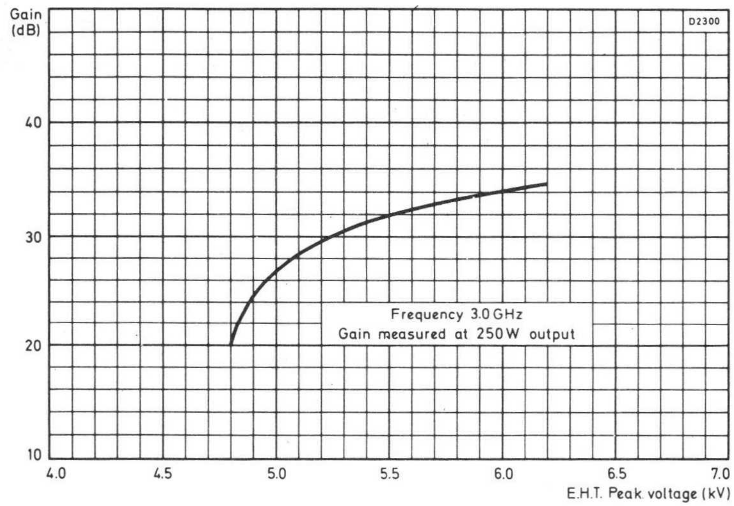


All dimensions in mm

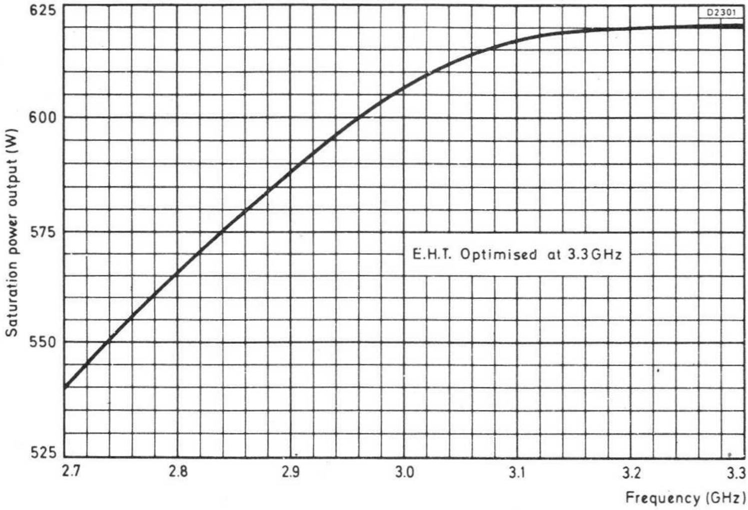
D2298



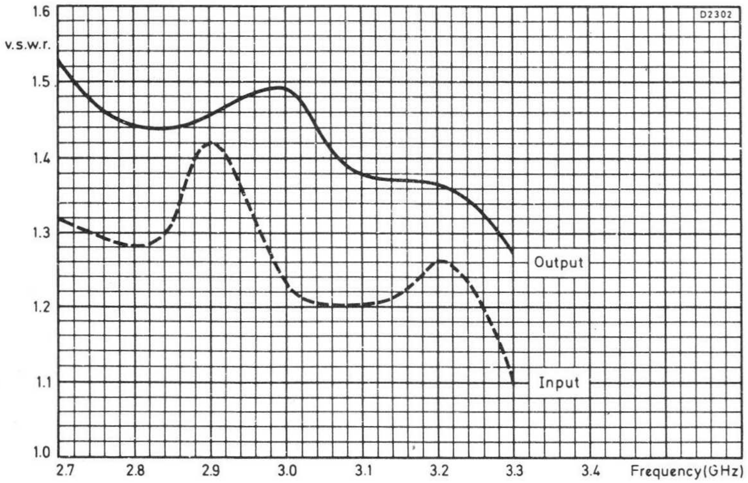
TYPICAL GAIN PLOTTED AGAINST FREQUENCY



TYPICAL GAIN PLOTTED AGAINST PEAK VOLTAGE



TYPICAL SATURATION POWER OUTPUT PLOTTED AGAINST FREQUENCY



TYPICAL INPUT AND OUTPUT V.S.W.R. PLOTTED AGAINST FREQUENCY

COMMUNICATIONS TRAVELLING-WAVE TUBE

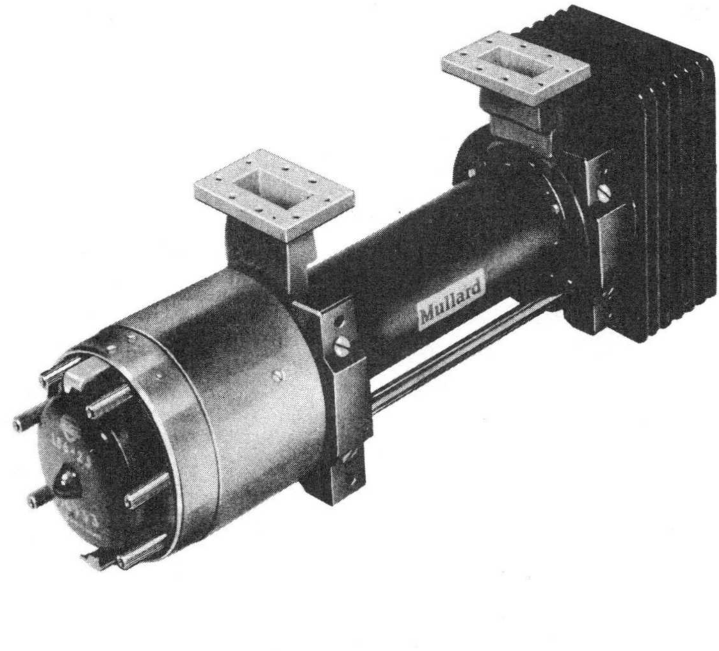
LB6-25

QUICK REFERENCE DATA

Forward wave amplifier for use in the power output stages of wideband multi-channel microwave links.

Frequency range	5.9 to 6.5	GHz
Saturation power output	25	W
Working power output	15	W
Gain at working power	38	dB
Construction		Unpackaged
Output connections		Waveguide WR137

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



LB6-25 in mount P6L11 with end cap removed

TYPICAL OPERATION

As a power amplifier focused in a focusing mount type P6L11. Tubes are fully interchangeable in mounts and tube replacement is a simple operation.

Operating conditions (electrode potentials measured with respect to cathode)

Heater voltage	6.3	V
Grid 1 voltage	-15	V
Helix voltage	3.4	kV
Collector voltage (earth)	2.0	kV
Operating frequency	6.0	GHz
Collector current	45	mA

Typical performance

Gain	38	dB
Power output	15	W
Noise factor (including gas noise)	28	dB
Hot input match (v.s.w.r.)	1.2	
Hot output match (v.s.w.r.)	1.4	
Grid 1 current	1.0	μA
Grid 2 current	5.0	μA
Helix current	0.5	mA
Grid 2 voltage	2.2	kV

CATHODE

Indirectly heated, dispenser cathode

Heater voltage (d.c. or r.m.s.) (see note 1)	6.3	V
Heater current	0.85 to 1.05	A
Pre-heating time (minimum) (see note 2)	120	s

TEST CONDITIONS AND LIMITS

The travelling-wave tube is focused in mount type P6L11 and tested to comply with the following electrical conditions.

Test conditions

Heater voltage	6.3	V
Grid 1 voltage	-15	V
Grid 2 voltage (see notes 3 and 8)		
Helix voltage (see note 4)		
Collector voltage	1.9	kV
*Collector current range	40 to 50	mA
Power output	15	W
Frequency range (see note 5)	5.925 to 6.475	GHz

*Specified on data sheet enclosed with tube

Limits and characteristics

	Min.	Max.	
Gain (at 15W output)	37	40	dB
**Noise factor (at 15W output)	-	30	dB
Saturation power output (see note 6)	23	-	W
Hot input match (v.s.w.r.) (see note 7)	-	1.5	
Hot output match (v.s.w.r.) (see note 7)	-	2.0	
Grid 2 voltage	1.9	2.7	kV
Helix voltage	3.2	3.9	kV
Grid 1 current	-	100	μA
Grid 2 current	-	250	μA
Helix current (see note 8)	-	1.3	mA
**A.M./P.M. conversion (at 15W output) (see note 9)	-	2.0	deg/dB
Attenuation (see note 10)			

**Design test only

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (electrode potentials measured with respect to cathode)

These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

	Min.	Max.	
Grid 1 voltage	-250	0	V
Grid 2 voltage	-	3.0	kV
Helix voltage	-	4.0	kV
Helix current (see note 8)	-	1.3	mA
Collector voltage	1.9	2.1	kV
Collector current	-	50	mA
Collector power dissipation	-	110	W
R.F. power input (see note 11)	-	250	mW

DESIGN RANGES FOR POWER SUPPLY (electrode potentials with respect to cathode)

Normal operation

	Min.	Max.	
Grid 1 voltage (see note 12)			
Grid 1 current	-	100	μA
Grid 2 voltage (see notes 13 and 14)	1.9	2.7	kV
Grid 2 current	-250	+250	μA
Helix voltage	3.2	3.9	kV
Helix current (see notes 8 and 14)	-	1.5	mA
Collector voltage (see note 15)			
Collector current	-	50	mA

MOUNTING POSITION

Any (but see cooling). The barrel of the mount must be protected from strong magnetic fields such as from isolators, and should be several centimetres from steel plates.

COOLING

1. Tube installed in convection-cooled mount type P6L11

Horizontally mounted	natural
Vertically mounted	assisted by convection duct or low velocity air flow

2. Tube installed in conduction-cooled mount type P6L11A

Heatsink temperature max.	90	^{o}C

Temperatures

Collector seal max.	200	^{o}C
Reference point on mount cooler max.	140	^{o}C

AMBIENT TEMPERATURE RANGE

	Min.	Max.	
Operation to full specification (see note 16)	-10	+65	^{o}C
Switch-on	-20	+65	^{o}C
Storage (see note 17)	-60	+85	^{o}C

PHYSICAL DATA

Tube	kg	lb
Weight	0.15	0.33
Weight in inner storage pack (2 tubes per inner pack)	0.55	1.2
Weight in transit carton	4.5	9.9
	mm	in
Dimensions of inner storage pack	150 × 115 × 505	6 × 4.5 × 20
Dimensions of transit carton	375 × 325 × 715	14.8 × 13 × 28.3

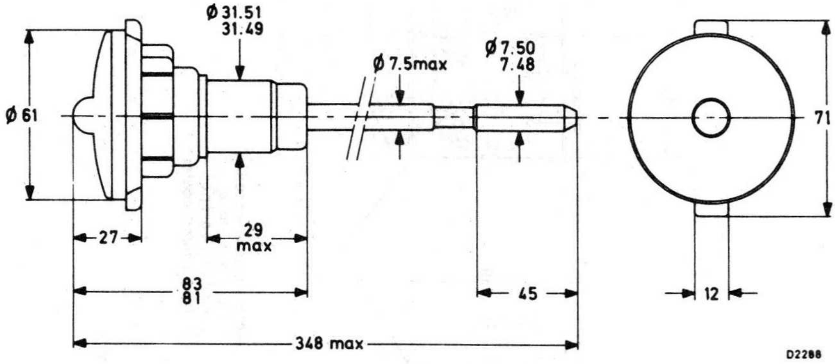
Mount	kg	lb
Weight	4.9	10.7
Weight in inner storage pack	5.2	11.4
Weight in transit carton (2 inner packs per carton)	25.3	55.6
	mm	in
Dimensions of inner storage pack	255 × 140 × 495	10 × 5.5 × 19.5
Dimensions of transit carton	520 × 410 × 640	20.5 × 16.3 × 25.3

NOTES

1. The absolute variation of the heater voltage must be less than ± 2%. When operated on d.c. the heater must be negative with respect to the cathode.
2. The pre-heating time for a new tube must be at least 5 minutes.
3. Grid 2 voltage should be adjusted to give the specified collector current while cyclically adjusting focusing screws for minimum helix current.
4. The helix voltage should be adjusted to give the maximum gain at the specified power output. Focusing should then be re-optimised.
5. The tube is tested at the centre and the extremes of the frequency range.
6. Measured pulsed at a duty ratio of 1:2. If necessary the helix voltage is readjusted to give maximum power output as the input power is increased and the focusing re-optimised.
7. This is obtained without adjustment at each frequency ("plug-in" match).
8. During the focusing operation the helix current may (transiently) be allowed to reach 2mA. It may be useful to set the focusing screws on a new mount 1.5 turns back from fully home before commencing the switch-on operation.
9. The value given for A.M. to P.M. conversion is that obtained under the stated conditions. Improved values may be obtained with other settings of helix voltage and input power.
10. With electrode voltages not applied minimum attenuation is 60dB.
11. The output power reflected back into the tube by the load (for example the output isolator) should also not exceed this rating.
12. The grid 1 voltage is normally fixed at -15V.
13. For adjustment of focus it is also necessary for the grid 2 voltage to be variable in the range 0 to 1.9kV without stabilisation. As an alternative the negative voltage on grid 1 may be increased within certain limits to reduce the collector current (see ratings).
14. The power supply should be designed so that any automatic switching allows the correct cathode warm-up period (which may be reduced or eliminated for momentary breaks of 5 seconds), followed by establishment of all electrode voltages except grid 2. The grid 2 voltage may then be applied. All supplies should usually be stabilised to ± 2% except where otherwise stated. A protective device to reduce the grid 2 voltage should operate if the helix current exceeds the figure in the ratings (but see note 8).
15. The collector voltage is usually fixed at 2kV. This supply need not be stabilised provided that it remains in the range 1.9 to 2.1kV.
16. The magnetic circuit is fully temperature-compensated in this range, and the operation of the tube will not change as the temperature is varied.
17. If the temperature of the mount is lowered below -60°C the magnets will suffer an irreversible change.

OUTLINE DRAWING OF LB6-25

Note tube is fragile. It should be inserted carefully into the mount and then pushed home axially. Rotation is also necessary to negotiate the withdrawal check lugs.



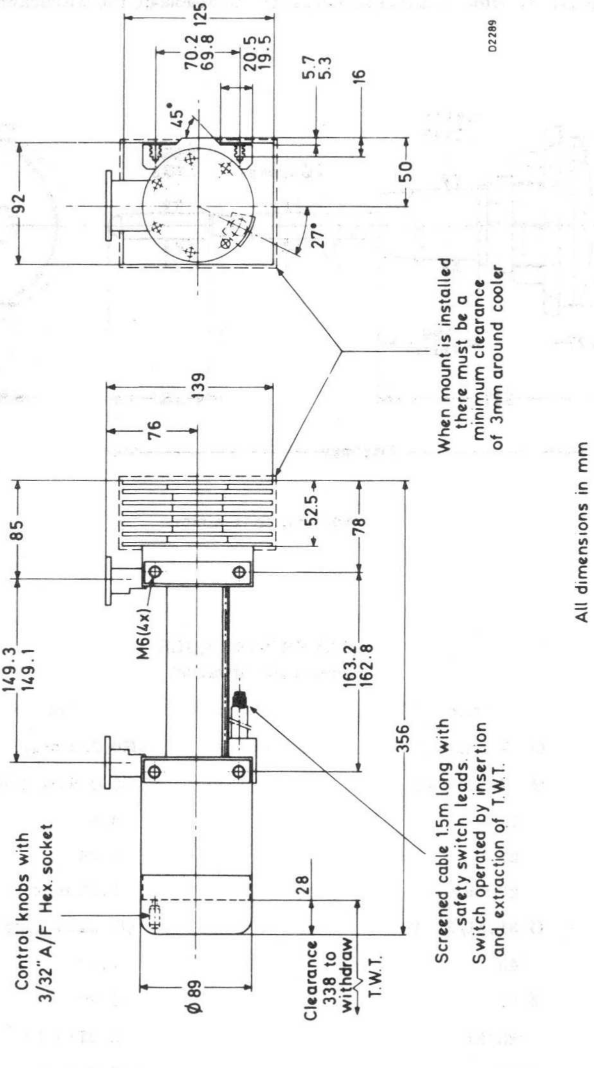
All dimensions in mm

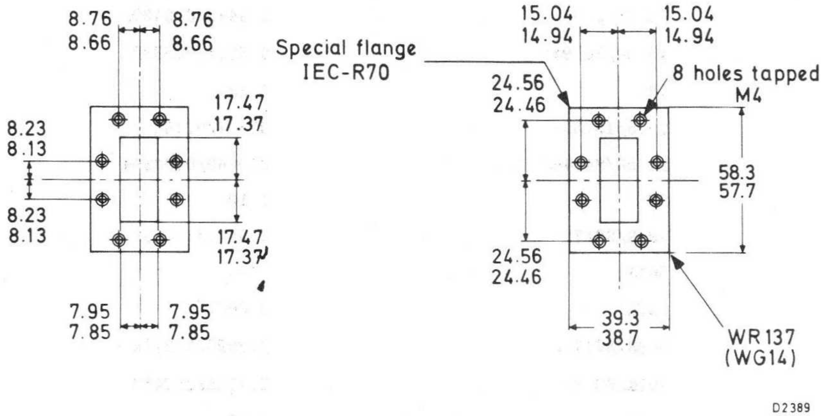
CONVERSION TABLE
(Rounded outwards)

mm	in
Ø 7.5 max.	Ø0.295 max.
Ø 7.50/7.48	Ø0.2953/0.2945
12	0.47
27	1.06
29 max.	1.14 max.
Ø 31.51/31.49	Ø1.2405/1.2398
45	1.77
Ø 61	Ø2.40
83/81	3.27/3.19
348 max.	13.7 max.

OUTLINE DRAWING OF P6L11 MOUNT

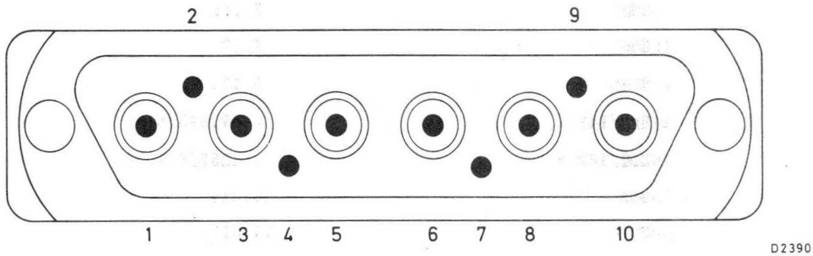
Note that the installation should be designed so that maximum misalignment moment at r.f. connectors is 19.6N m (2kgf m). The cooling fins are movable and require about 3mm clearance. The mount should be handled with special care during installation to avoid damage to the cooling fins.





All dimensions in mm

AMPHENOL PLUG 17-801

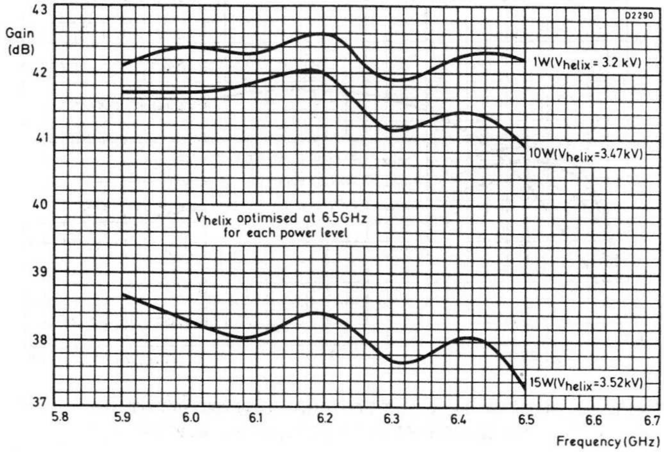


Plug connections to mount

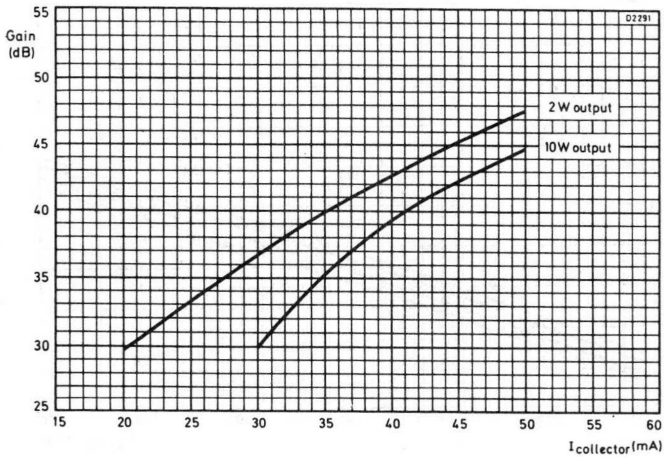
1. Helix
2. Collector (earth)
3. Grid 2
4. -
5. Grid 1
6. Cathode
7. Safety circuit
8. Heater
9. Safety circuit
10. Heater

CONVERSION TABLE
(Rounded outwards)

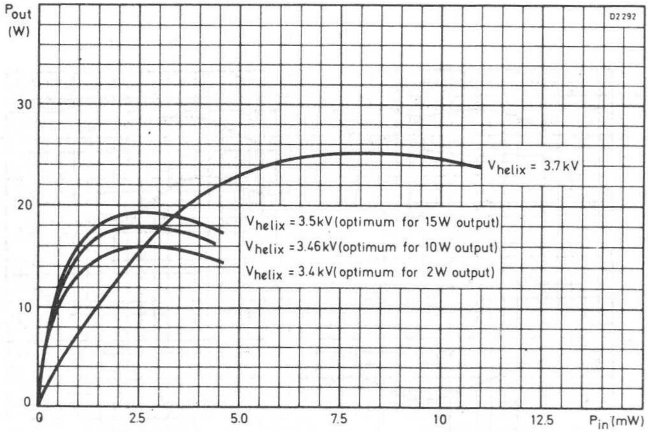
mm	in
5.7/5.3	0.2244/0.2087
7.95/7.85	0.3130/0.3091
8.23/8.13	0.3240/0.3201
8.76/8.66	0.3449/0.3409
15.04/14.94	0.5921/0.5882
16	0.63
20.5/19.5	0.807/0.768
24.56/24.46	0.9669/0.9630
28	1.10
39.3/38.7	1.5472/1.5236
50	1.97
52.5	2.067
58.3/57.7	2.2953/2.2716
70.2/69.8	2.7638/2.7480
76	2.99
78	3.07
85	3.35
Ø 89	Ø 3.50
92	3.62
125	4.92
139	5.47
149.3/149.1	5.8779/5.8701
163.2/162.8	6.4252/6.4094
338	13.31
356	14.01
1500	59.05



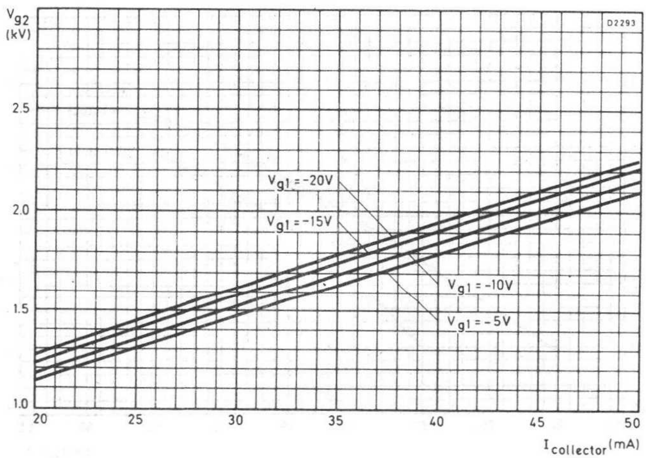
TYPICAL GAIN PLOTTED AGAINST FREQUENCY AT VARIOUS POWER LEVELS



TYPICAL GAIN PLOTTED AGAINST COLLECTOR CURRENT AT 6.2GHz



TYPICAL OUTPUT POWER PLOTTED AGAINST INPUT POWER AT VARIOUS HELIX VOLTAGES AT 6.2GHz



TYPICAL GRID 2 VOLTAGE PLOTTED AGAINST COLLECTOR CURRENT

Mullard

COMMUNICATIONS TRAVELLING-WAVE TUBE

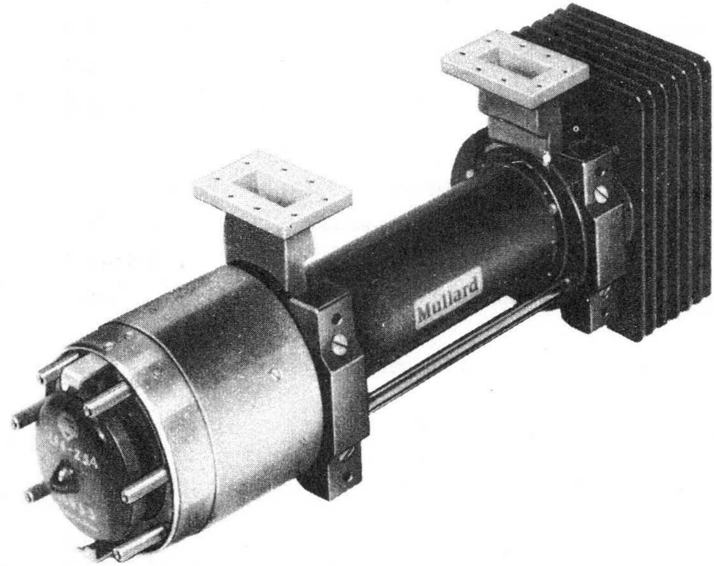
LB6-25A

QUICK REFERENCE DATA

Forward wave amplifier for use in the power output stages of wideband multi-channel microwave links.

Frequency range	6.4 to 7.2	GHz
Saturation power output	20	W
Working power output	10	W
Gain at working power	38	dB
Construction		Unpackaged
Output connections		Waveguide WR137

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES



LB6-25A in mount P6L11 with end cap removed

TYPICAL OPERATION

As a power amplifier focused in a focusing mount type P6L11A. Tubes are fully interchangeable in mounts and tube replacement is a simple operation.

Operating conditions (electrode potentials measured with respect to cathode)

Heater voltage	6.3	V
Grid 1 voltage	-15	V
Helix voltage	3.5	kV
Collector voltage (earth)	2.0	kV
Operating frequency	6.8	GHz
Collector current	45	mA

Typical performance

Gain	38	dB
Power output	10	W
Noise factor (including gas noise)	28	dB
Hot input match (v.s.w.r.)	1.2	
Hot output match (v.s.w.r.)	1.4	
Grid 1 current	1.0	μA
Grid 2 current	5.0	μA
Helix current	0.5	mA
Grid 2 voltage	2.2	kV

CATHODE

Indirectly heated, dispenser cathode

Heater voltage (d.c. or r.m.s.) (see note 1)	6.3	V
Heater current	0.8 to 1.1	A
Pre-heating time (minimum) (see note 2)	120	s

TEST CONDITIONS AND LIMITS

The travelling-wave tube is focused in mount type P6L11A and tested to comply with the following electrical conditions.

Test conditions

Heater voltage	6.3	V
Grid 1 voltage	-15	V
Grid 2 voltage (see notes 3 and 8)		
Helix voltage (see note 4)		
Collector voltage	1.9	kV
*Collector current range	40 to 50	mA
Power output	10	W
Frequency range (see note 5)	6.425 to 7.175	GHz

*Specified on data sheet enclosed with tube.

Limits and characteristics

	Min.	Max.	
Gain (at 10W output)	37	40	dB
**Noise factor (at 10W output)	-	30	dB
Saturation power output (see note 6)	20	-	W
Hot input match (v.s.w.r.) (see note 7)	-	1.5	
Hot output match (v.s.w.r.) (see note 7)	-	2.0	
Grid 2 voltage	1.9	2.7	kV
Helix voltage	3.2	3.9	kV
Grid 1 current	-	100	μA
Grid 2 current	-	250	μA
Helix current (see note 8)	-	1.3	mA
**A.M./P.M. conversion (at 10W output) (see note 9)	-	2.0	deg/dB
Attenuation (see note 10)			

**Design test only

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (electrode potentials measured with respect to cathode)

These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

	Min.	Max.	
Grid 1 voltage	-250	0	V
Grid 2 voltage	-	3.0	kV
Helix voltage	-	4.0	kV
Helix current (see note 8)	-	1.3	mA
Collector voltage	1.9	2.1	kV
Collector current	-	50	mA
Collector power dissipation	-	110	W
R.F. power input (see note 11)	-	250	mW

DESIGN RANGES FOR POWER SUPPLY (electrode potentials with respect to cathode)

Normal operation

	Min.	Max.	
Grid 1 voltage (see note 12)			
Grid 1 current	-	100	μA
Grid 2 voltage (see notes 13 and 14)	1.9	2.7	kV
Grid 2 current	-250	+250	μA
Helix voltage	3.2	3.9	kV
Helix current (see notes 8 and 14)	-	1.5	mA
Collector voltage (see note 15)			
Collector current	-	50	mA

MOUNTING POSITION

Any (but see cooling). The barrel of the mount must be protected from strong magnetic fields such as from isolators, and should be several centimetres from steel plates.

COOLING

1. Tube installed in convection-cooled mount type P6L11.

Horizontally mounted	natural
Vertically mounted	assisted by convection duct or low velocity air flow

2. Tube installed in conduction-cooled mount type P6L11A

Heatsink temperature max.	90	°C

Temperatures

Collector seal max.	200	°C
Reference point on mount cooler max.	140	°C

AMBIENT TEMPERATURE RANGE

	Min.	Max.	
Operation to full specification (see note 16)	-10	+65	°C
Switch-on	-20	+65	°C
Storage (see note 17)	-60	+85	°C

PHYSICAL DATA

Tube

	kg	lb
Weight	0.15	0.33
Weight in inner storage pack (2 tubes per inner pack)	0.55	1.2
Weight in transit carton	4.5	9.9
	mm	in
Dimensions of inner storage pack	150 × 115 × 505	6 × 4.5 × 20
Dimensions of transit carton	375 × 325 × 715	14.8 × 13 × 28.3

Mount

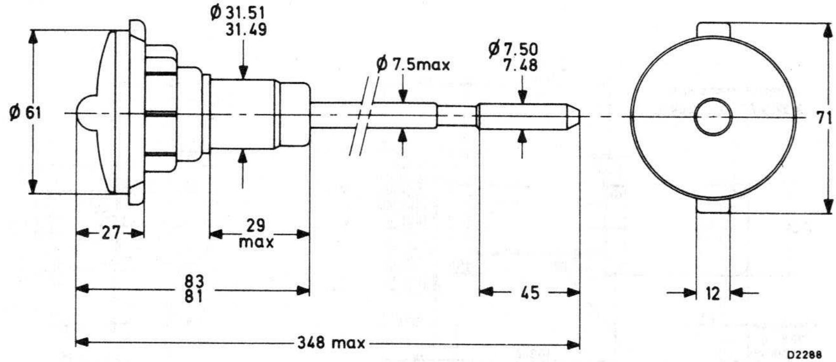
	kg	lb
Weight	4.9	10.7.
Weight in inner storage pack	5.2	11.4
Weight in transit carton (2 inner packs per carton)	25.3	55.6
	mm	in
Dimensions of inner storage pack	255 × 140 × 495	10 × 5.5 × 19.5
Dimensions of transit carton	520 × 410 × 640	20.5 × 16.3 × 25.3

NOTES

1. The absolute variation of the heater voltage must be less than ± 2%. When operated on d.c. the heater must be negative with respect to the cathode.
2. The pre-heating time for a new tube must be at least 5 minutes.
3. Grid 2 voltage should be adjusted to give the specified collector current while cyclically adjusting focusing screws for minimum helix current.
4. The helix voltage should be adjusted to give the maximum gain at the specified power output. Focusing should then be re-optimised.
5. The tube is tested at the centre and the extremes of the frequency range.
6. Measured pulsed at a duty ratio of 1:2. If necessary the helix voltage is readjusted to give maximum power output as the input power is increased and the focusing re-optimised.
7. This is obtained without adjustment at each frequency ("plug-in" match).
8. During the focusing operation the helix current may (transiently) be allowed to reach 2mA. It may be useful to set the focusing screws on a new mount 1.5 turns back from fully home before commencing the switch-on operation.
9. The value given for A.M. to P.M. conversion is that obtained under the stated conditions. Improved values may be obtained with other settings of helix voltage and input power.
10. With electrode voltages not applied minimum attenuation is 60dB.
11. The output power reflected back into the tube by the load (for example the output isolator) should also not exceed this rating.
12. The grid 1 voltage is normally fixed at -15V.
13. For adjustment of focus it is also necessary for the grid 2 voltage to be variable in the range 0 to 1.9kV without stabilisation. As an alternative the negative voltage on grid 1 may be increased within certain limits to reduce the collector current (see ratings).
14. The power supply should be designed so that any automatic switching allows the correct cathode warm-up period (which may be reduced or eliminated for momentary breaks of 5 seconds), followed by establishment of all electrode voltages except grid 2. The grid 2 voltage may then be applied. All supplies should usually be stabilised to ± 2% except where otherwise stated. A protective device to reduce the grid 2 voltage should operate if the helix current exceeds the figure in the ratings (but see note 8).
15. The collector voltage is usually fixed at 2kV. This supply need not be stabilised provided that it remains in the range 1.9 to 2.1kV.
16. The magnetic circuit is fully temperature-compensated in this range, and the operation of the tube will not change as the temperature is varied.
17. If the temperature of the mount is lowered below -60°C the magnets will suffer an irreversible change.

OUTLINE DRAWING OF LB6-25A

Note tube is fragile. It should be inserted carefully into the mount and then pushed home axially. Rotation is also necessary to negotiate the withdrawal check lugs.



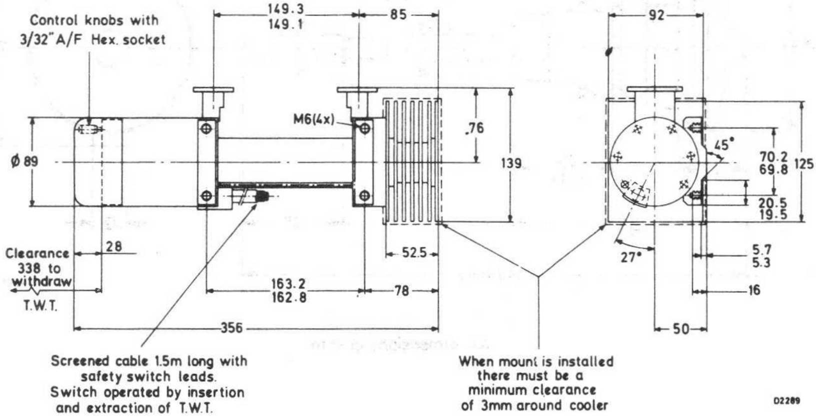
All dimensions in mm

CONVERSION TABLE
(Rounded outwards)

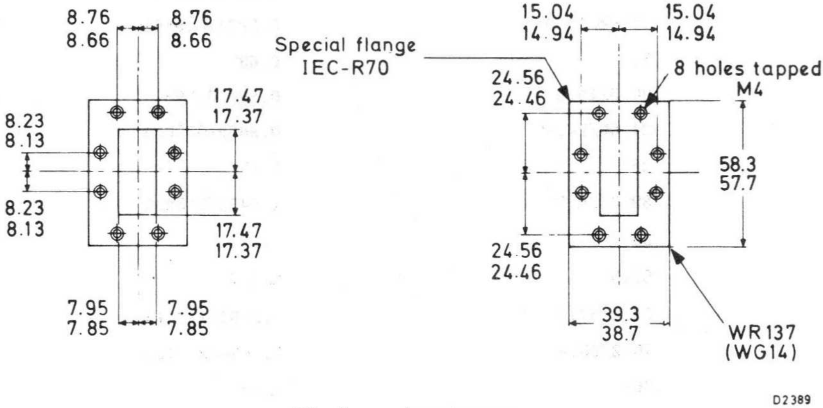
mm	in
Ø 7.5 max.	Ø 0.295 max.
Ø 7.50/7.48	Ø 0.2953/0.2945
12	0.47
27	1.06
29 max.	1.14 max.
Ø 31.51/31.49	Ø 1.2405/1.2398
45	1.77
61	Ø 2.40
83/81	3.27/3.19
348 max.	13.7 max.

OUTLINE DRAWING OF P6L11A MOUNT

Note that the installation should be designed so that maximum misalignment moment at r.f. connectors is 19.6N m (2kgf m). The cooling fins are movable and require about 3mm clearance. The mount should be handled with special care during installation to avoid damage to the cooling fins.

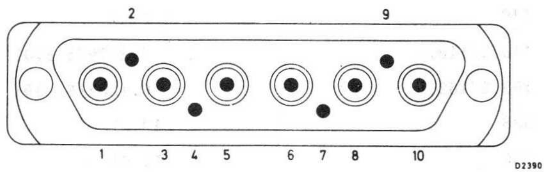


All dimensions in mm



All dimensions in mm

AMPHENOL PLUG NO. 17-801



Plug connections to mount

1. Helix
2. Collector (earth)
3. Grid 2
4. -
5. Grid 1
6. Cathode
7. Safety circuit
8. Heater
9. Safety circuit
10. Heater

CONVERSION TABLE
(Rounded outwards)

mm	in
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15.04/14.94	0.5921/0.5882
16	0.63
20.5/19.5	0.807/0.768
24.56/24.46	0.9669/0.9630
28	1.10
39.3/38.7	1.5472/1.5236
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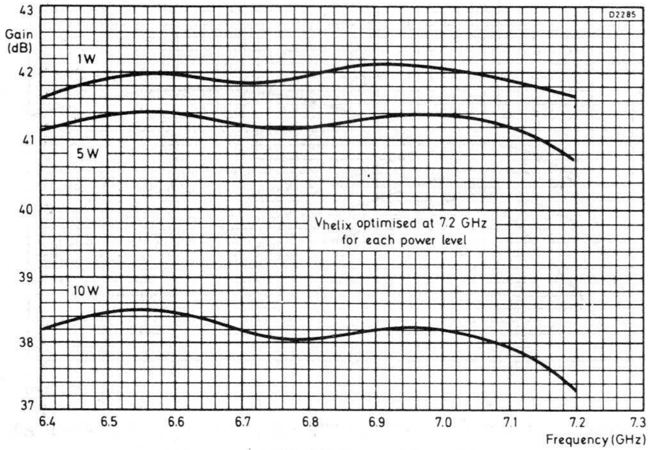
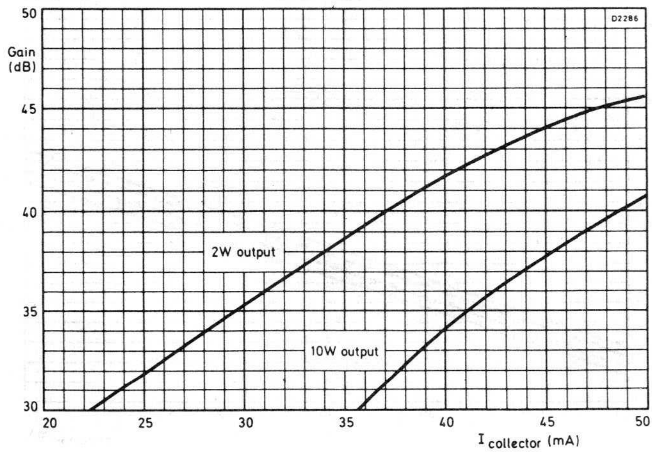
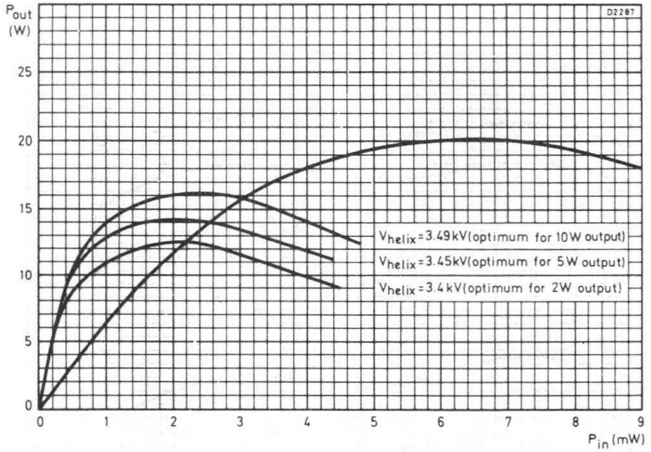
70.2/69.8	2.7638/2.7480
76	2.99
78	3.07
85	3.35
Ø 89	Ø 3.50
92	3.62
125	4.92
139	5.47
149.3/149.1	5.8779/5.8701
163.2/162.8	6.4252/6.4094
338	13.31
356	14.01
1500	59.05



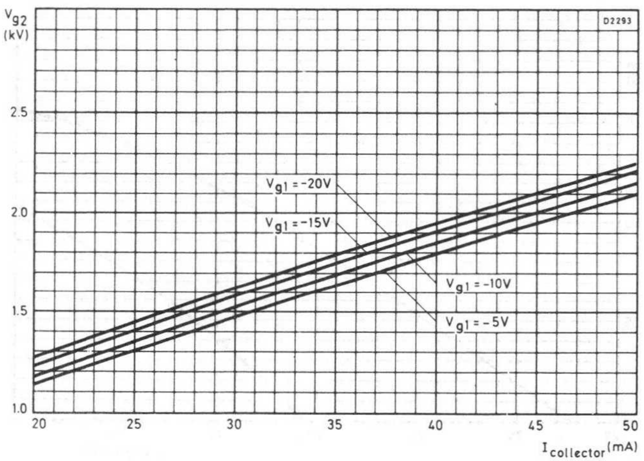
TYPICAL GAIN PLOTTED AGAINST FREQUENCY AT VARIOUS POWER LEVELS



TYPICAL GAIN PLOTTED AGAINST COLLECTOR CURRENT AT 6.8GHz



TYPICAL OUTPUT POWER PLOTTED AGAINST INPUT POWER AT VARIOUS HELIX VOLTAGES AT 6.8GHz



TYPICAL GRID 2 VOLTAGE PLOTTED AGAINST COLLECTOR CURRENT

Mullard

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

This data sheet should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES included in this volume of the handbook.

FILAMENT Thoriated tungsten.

V_f	5.0	V
I_f	14.1	A

MOUNTING POSITION

Vertical base up or down.

CAPACITANCES

c_{in}	12.7	pF
c_{out}	4.5	pF
c_{a-g1}	0.12	pF

CHARACTERISTICS (measured at $I_a = 100mA$)

g_m	4.0	mA/V
μ_{g1-g2}	5.1	

COOLING

Max. temperature of anode seal	220	°C
Max. temperature of base seals	180	°C
Max. bulb temperature	350	°C

In order to keep within the temperature limits of the base seals, an air flow of at least 5cu.ft./min. must be directed at the base and commence immediately the filament is energised.
A small movement of air over the envelope is generally sufficient to maintain the temperature of the anode seals below the limit when operating below 30Mc/s, but above this frequency it will be necessary to direct an air flow at the anode terminal.
An anode terminal connector of large surface area is necessary.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" TELEGRAPHY OR F.M. TELEPHONY)

Limiting values

V_a max.	4.0	kV
p_a max.	250	W
V_{g2} max.	600	V
p_{g2} max.	35	W
p_{g1} max.	10	W
I_k max.	420	mA
$i_{k(pk)}$ max.	2.2	A
R_{g1-f} max.	250	kΩ

Mullard

Typical operation at f≤75 Mc/s

V_a	2.5	3.0	4.0	kV
V_{g2}	500	500	500	V
V_{g1}	–150	–180	–225	V
I_a	300	345	312	mA
I_{g2}	60	60	45	mA
I_{g1}	9.0	10	9.0	mA
$v_{in(pk)}$	220	265	303	V
$P_{load(driver)}$	2.1	2.8	3.0	W
p_a	175	235	248	W
p_{g2}	30	30	22.5	W
P_{out}	575	800	1,000	W
*P_{load}	460	640	800	W
η	77	77	80	%

*With a circuit transfer efficiency of 80%.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "C" TELEPHONY, ANODE AND SCREEN GRID MODULATION)

Limiting values (carrier conditions for modulation factor of 1)

V_a max.	3.2	kV
p_a max.	165	W
V_{g2} max.	600	V
p_{g2} max.	35	W
p_{g1} max.	10	W
I_k max.	270	mA
$i_{k(pk)}$ max.	2.6	A
R_{g1-f} max.	250	kΩ

Typical operation at f≤75 Mc/s

V_a	2.5	3.0	kV
V_{g2}	400	400	V
V_{g1}	–200	–310	V
I_a	200	225	mA
I_{g2}	30	30	mA
I_{g1}	9.0	9.0	mA
$v_{in(pk)}$	280	400	V
$P_{load(driver)}$	2.7	3.9	W
p_a	125	165	W
p_{g2}	12	12	W
P_{out}	375	510	W
*P_{load}	300	410	W
η	75	75.5	%
For 100% modulation			
$P_{mod.}$	256	344	W
$v_{g2(pk)\,mod.}$	350	350	V

*With a circuit transfer efficiency of 80%.

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

OPERATING CONDITIONS AS SINGLE VALVE R.F. POWER AMPLIFIER (CLASS "B" TELEPHONY)

Limiting values (carrier condition for a modulation factor of 1)

V_a max.	4.0	kV
p_a max.	250	W
V_{g2} max.	600	V
p_{g2} max.	23	W
p_{g1} max.	6.5	W
I_k max.	200	mA
$i_{k(pk)}$ max.	1.5	A
R_{g1-f} max.	250	kΩ

Typical operation at f≦75 Mc/s

Unmodulated				
V_a	2.5	3.0	4.0	kV
V_{g2}	500	500	500	V
V_{g1}	−84	−90	−100	V
I_a	150	125	94	mA
I_{g2}	0	0	0	mA
$v_{in(pk)}$	66	61	56	V
p_a	250	250	250	W
P_{out}	125	125	126	W
*P_{load}	100	100	100	W
η	33	33	33.5	%
Modulated 100%				
I_{g1}	5.5	2.0	0.5	mA
$P_{load(driver)}$	1 0	0.4	0.25	W
p_{g2}	6.0	3.8	4.0	W

*With a circuit transfer efficiency of 80%.

OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL AS CLASS "B" A.F. POWER AMPLIFIER OR MODULATOR

Limiting values

V_a max.	4.0	kV
p_a max.	250	W
V_{g2} max.	600	V
p_{g2} max.	35	W
p_{g1} max.	10	W
I_k max.	450	mA
$i_{k(pk)}$ max.	1.5	A
R_{g1-f} max.	250	kΩ

Typical operation (without I_{g1})

V_a	1.5	2.0	2.5	3.0	kV
V_{g2}	500	500	500	500	V
V_{g1}	–85	–88	–91	–94	V
$I_{a(o)}$	2×50	2×50	2×50	2×50	mA
I_a (max. sig.)	2×150	2×150	2×155	2×155	mA
I_{g2} (max. sig.)	2×15	2×14	2×10	2×10	mA
$V_{in(g1-g1)\ r.m.s.}$	117	122	126	130	V
p_a	2×91	2×105	2×132	2×147	W
P_{out}	268	390	510	635	W
R_{a-a}	10	14.5	18	22	kΩ
η	60	65	66	68	%
D_{tot}	3.0	3.2	2.6	2.8	%

Typical operation (with I_{g1})

V_a	1.5	2.0	2.5	3.0	kV
V_{g2}	300	300	300	300	V
V_{g1}	–45	–49	–51	–55	V
$I_{a(o)}$	2×50	2×50	2×50	2×50	mA
I_a (max. sig.)	2×347	2×347	2×312	2×275	mA
I_{g2} (max. sig.)	2×58	2×55	2×44	2×34.5	mA
I_{g1}	2×28	2×27	2×21	2×15	mA
$V_{in(g1-g1)\ r.m.s.}$	228	232	216	198	V
P_{drive}	2×4.0	2×4.0	2×2.9	2×1.9	W
p_a	2×190	2×207	2×210	2×205	W
P_{out}	660	974	1,140	1,240	W
R_{a-a}	4.55	6.6	9.2	14	kΩ
η	63.5	70	73	75	%
D_{tot}	5.0	5.0	5.0	5.0	%

OPERATING CONDITIONS AS SINGLE SIDE BAND CLASS "B" R.F. AMPLIFIER

Limiting values

V_a max.	4.0	kV
p_a max. (max. averaging time = 5s)	250	W
p_a max. (during modulation cycle)	275	W
V_{g2} max.	600	V
p_{g2} max.	35	W
I_a max.	350	mA
R_{g1-f} max.	250	kΩ

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

Typical operation at f = 30Mc/s

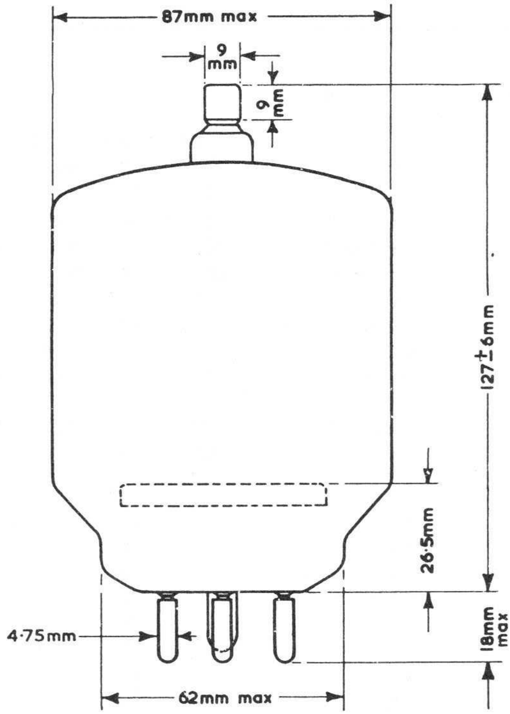
V_a	2.5	3.0	3.5	4.0	kV
V_{g2}	500	500	500	500	V
V_{g1}	−91	−94	−98	−105	V
$I_{a(o)}$	50	50	50	50	mA
I_a (single tone)	164	164	164	164	mA
I_a (two tone)	118	118	118	118	mA
$I_{g2(o)}$	0	0	0	0	mA
I_{g2} (max. signal)	10.5	10	9.0	8.0	mA
$v_{in(pk)}$	91	94	98	105	V
p_a (max. signal)	140	157	175	200	W
p_{g2} (max. signal)	5.3	5.0	4.5	4.0	W
P_{out} (single tone)	270	333	400	460	W
η	66	68	69	70	%

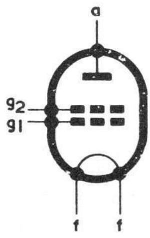
V_a	3.5	4.0	kV
V_{g2}	600	550	V
V_{g1}	−110	−105	V
$I_{a(o)}$	50	50	mA
I_a (single tone)	207	182	mA
I_a (two tone)	145	128	mA
$I_{g2(o)}$	0	0	mA
I_{g2} (max. signal)	12	9	mA
$v_{in(pk}$	110	105	V
p_a (max. signal)	235	220	W
p_{g2} (max. signal)	7.2	5.0	W
P_{out} (single tone)	490	510	W
η	67	69	%

CIRCUIT NOTES

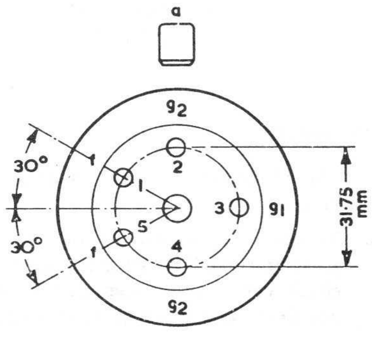
1. The r.f. circuit returns must be brought to the filament connection on pin No. 1.
2. To ensure equal distribution of the currents through the seals the g_2 leads should be strapped together at the valve holder and the circuit connections joined to the midpoint of the strap. This should not be allowed to impair the free flotation of individual contacts.

WEIGHT $\begin{cases} 6 & \text{oz} \\ 180 & \text{g} \end{cases}$





30Ci

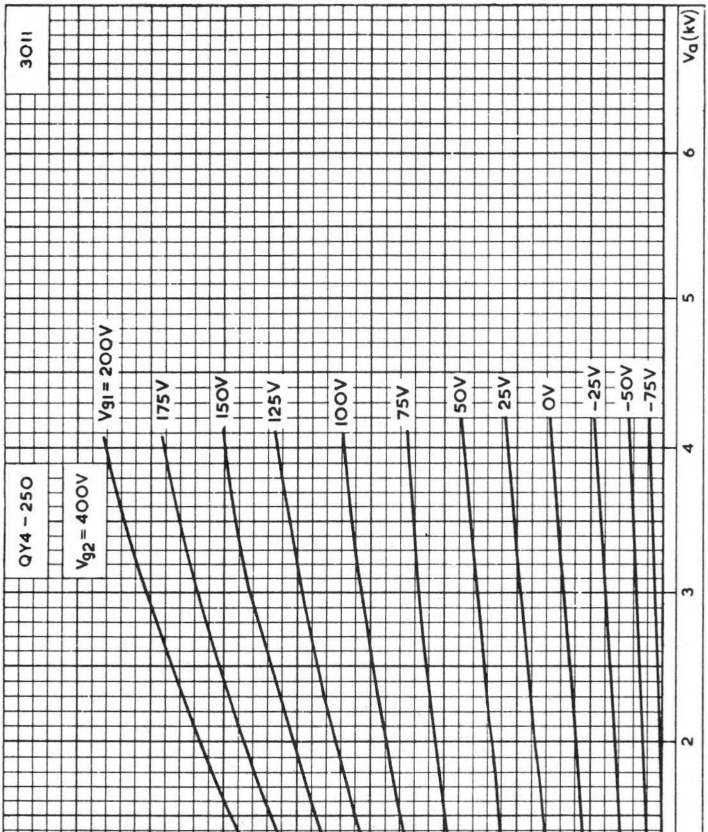


B5F Base

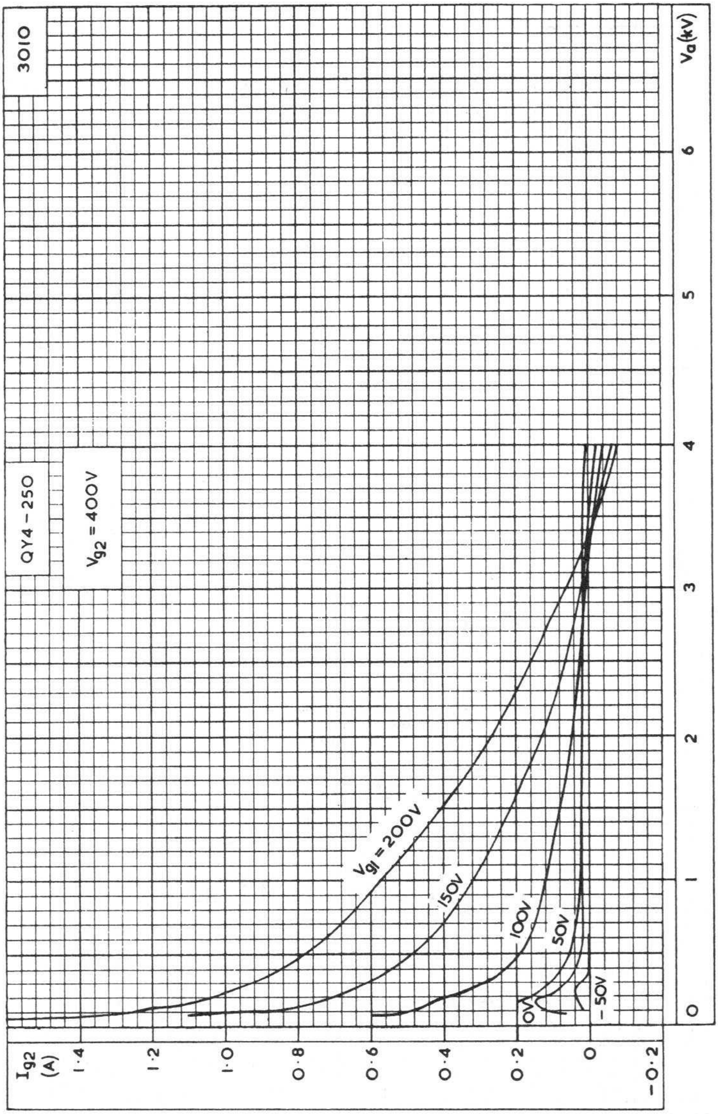
V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2}=400V

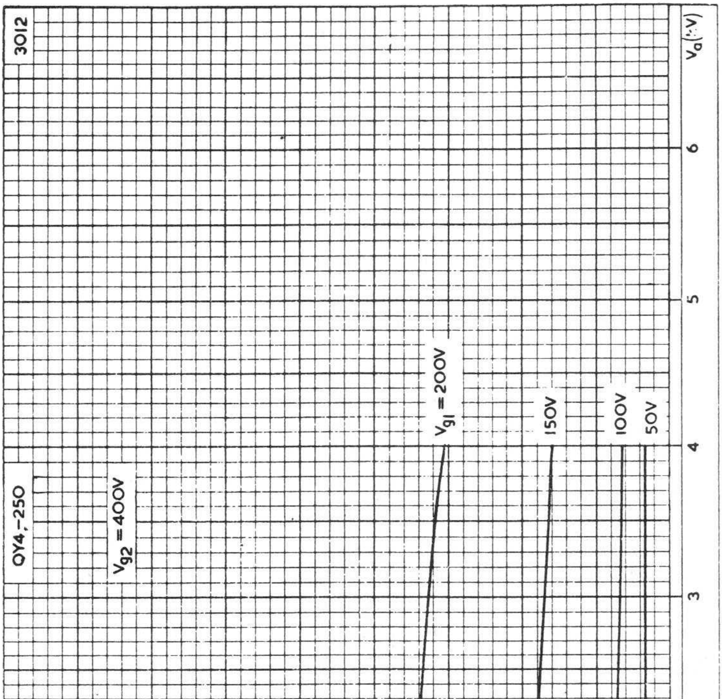


SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR $V_{g2} = 400V$

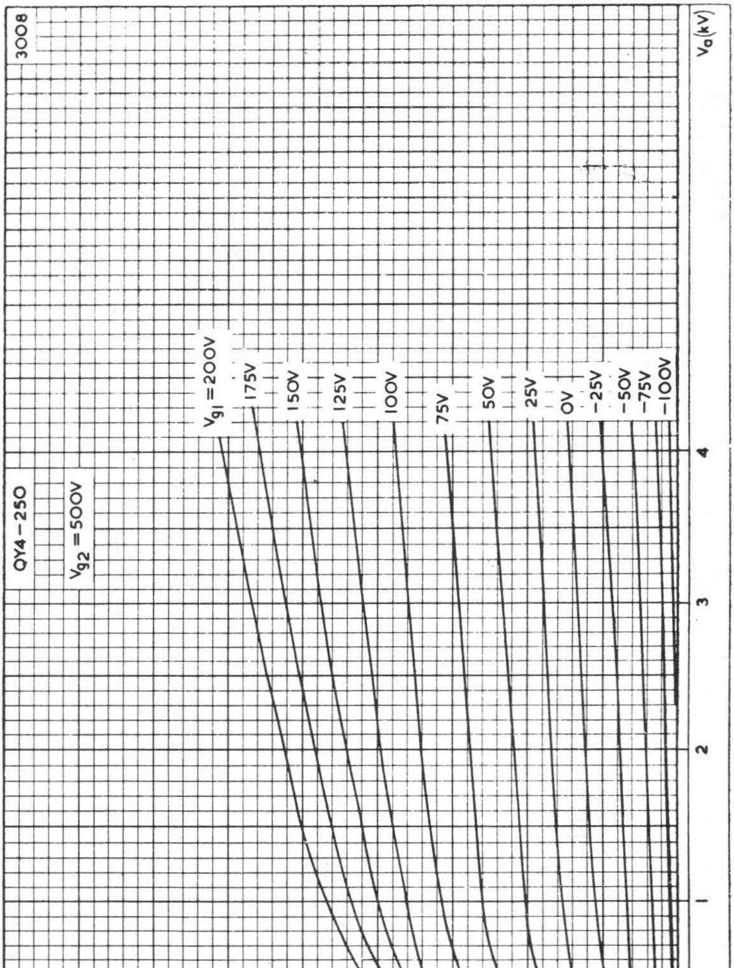
V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR $V_{g2}=400V$

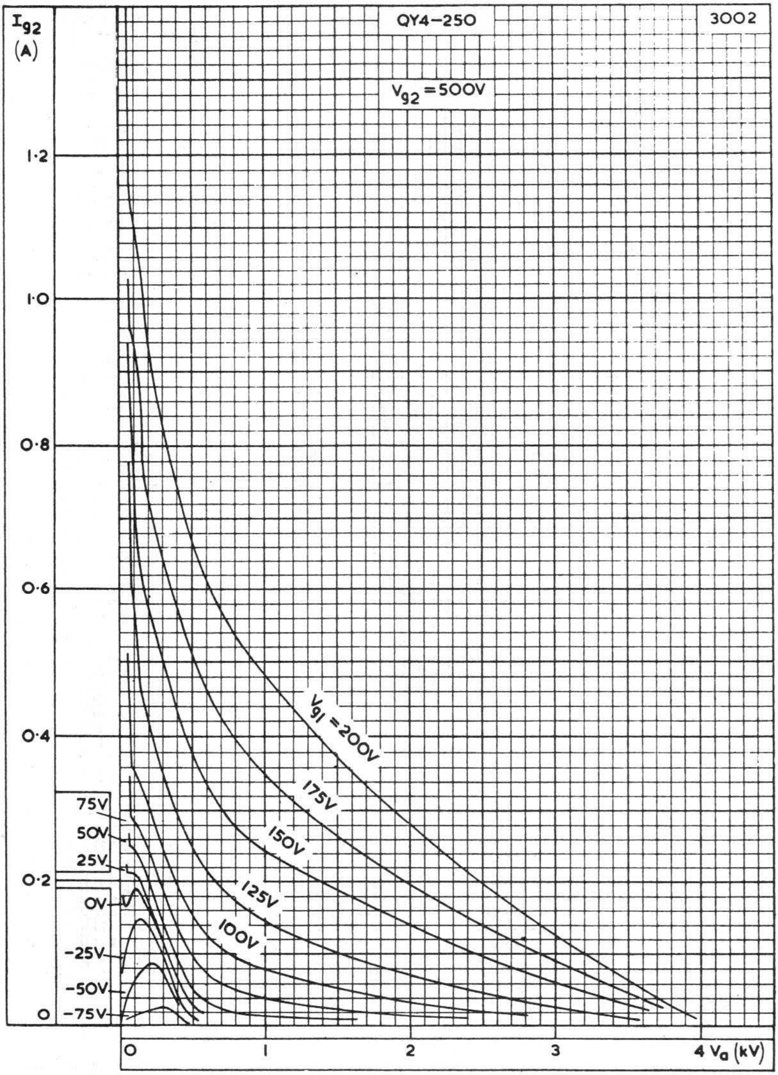


ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR $V_{g2}=500V$

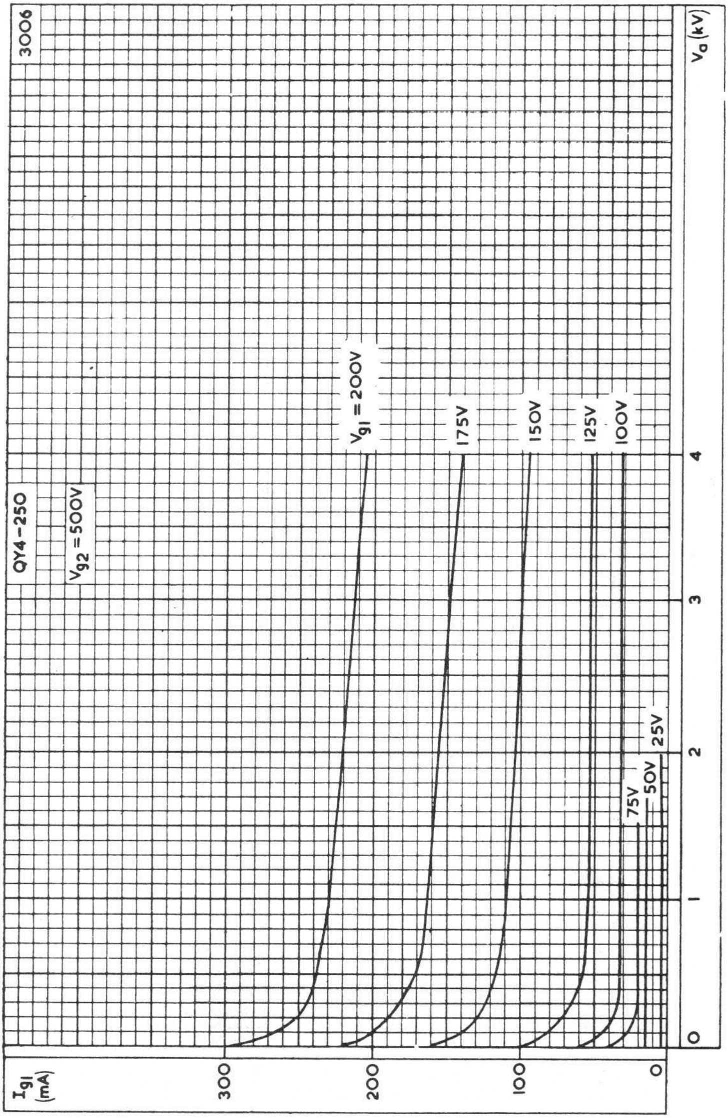
V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



SCREEN-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR V_{g2}=500V

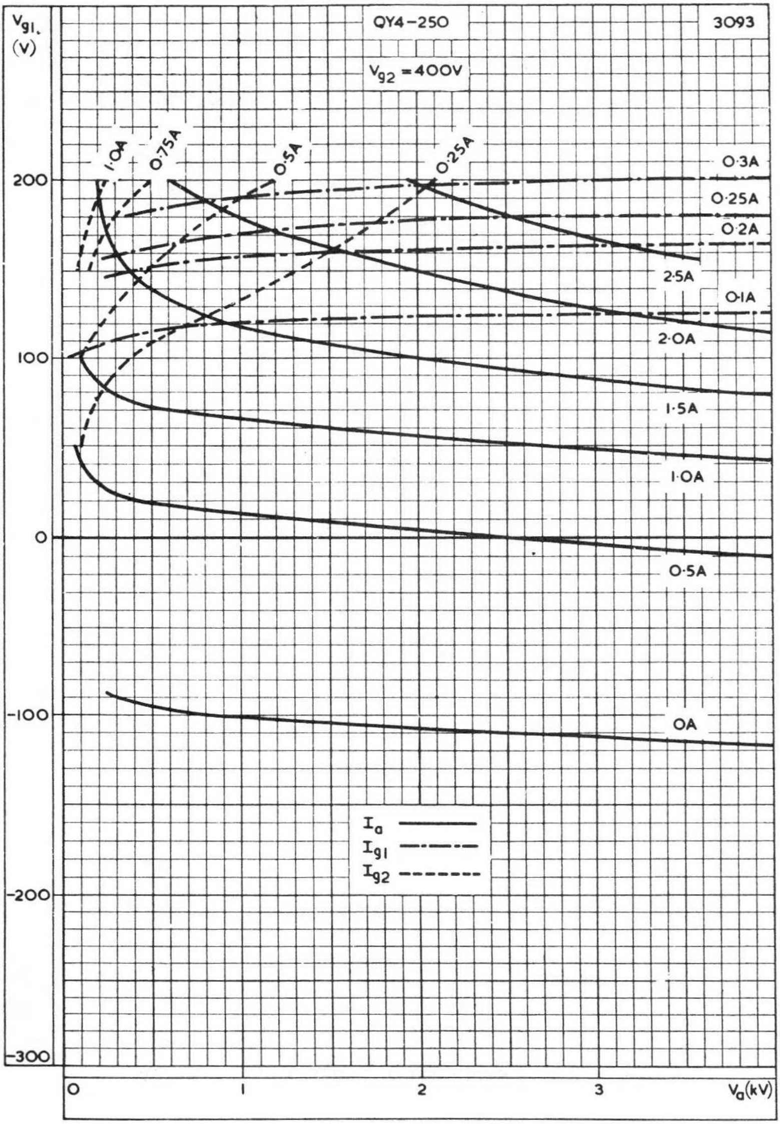


CONTROL-GRID CURRENT PLOTTED AGAINST ANODE VOLTAGE FOR $V_{g2} = 500V$

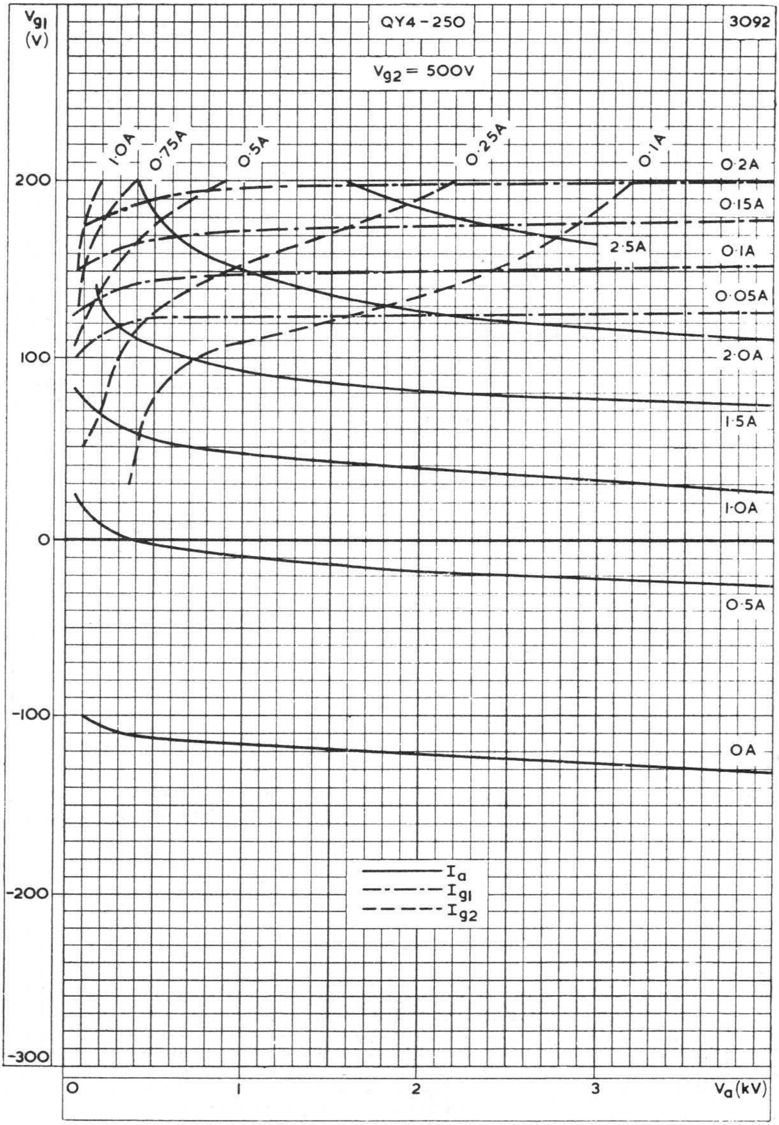
V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



CONSTANT CURRENT CURVES FOR V_{g2}=400V

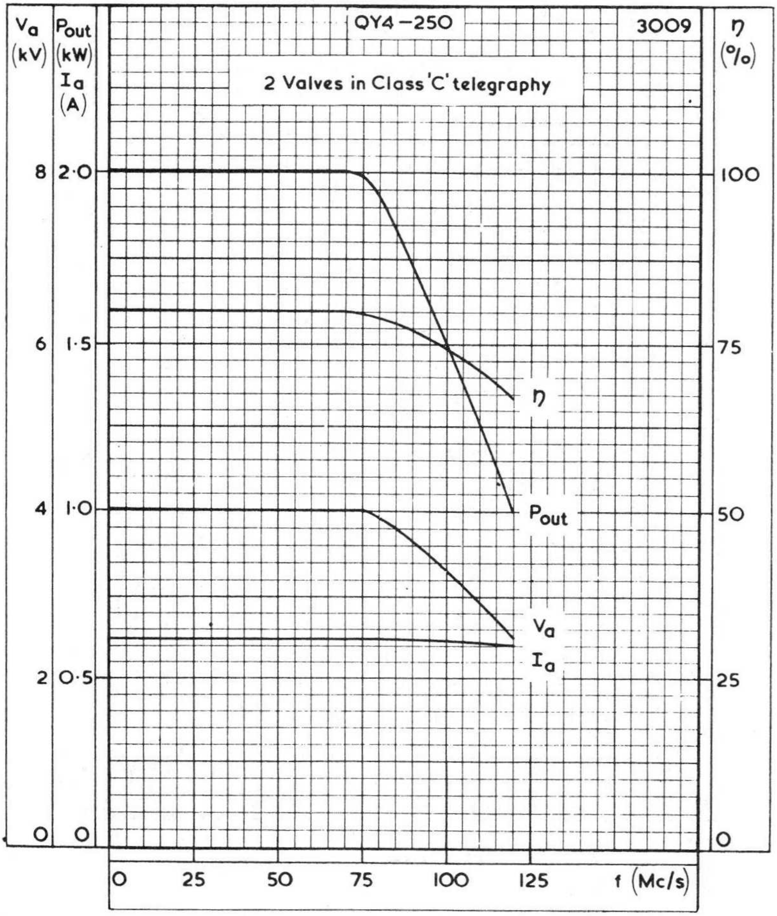


CONSTANT CURRENT CURVES FOR V_{g2} = 500V

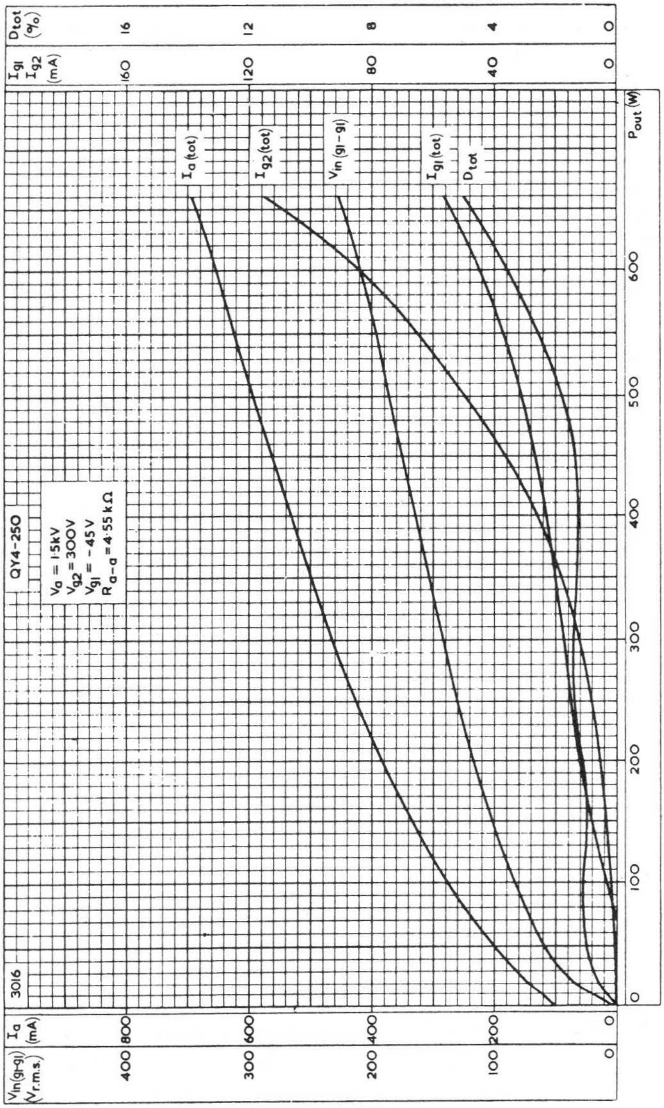
V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



FREQUENCY CHARACTERISTICS

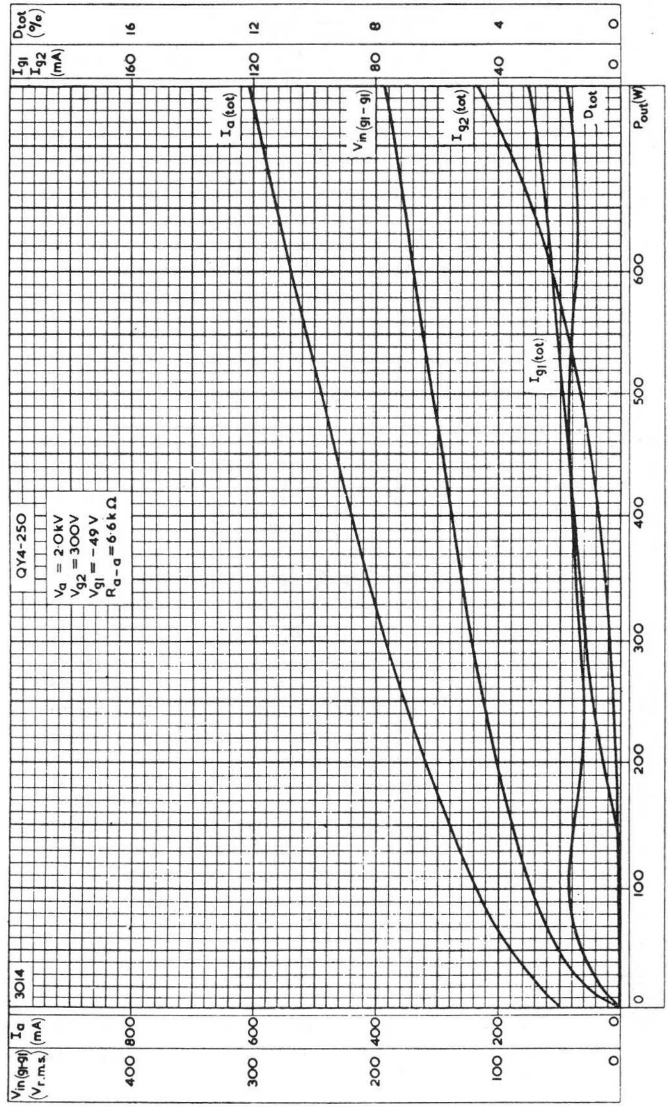


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. $V_a = 1.5kV$

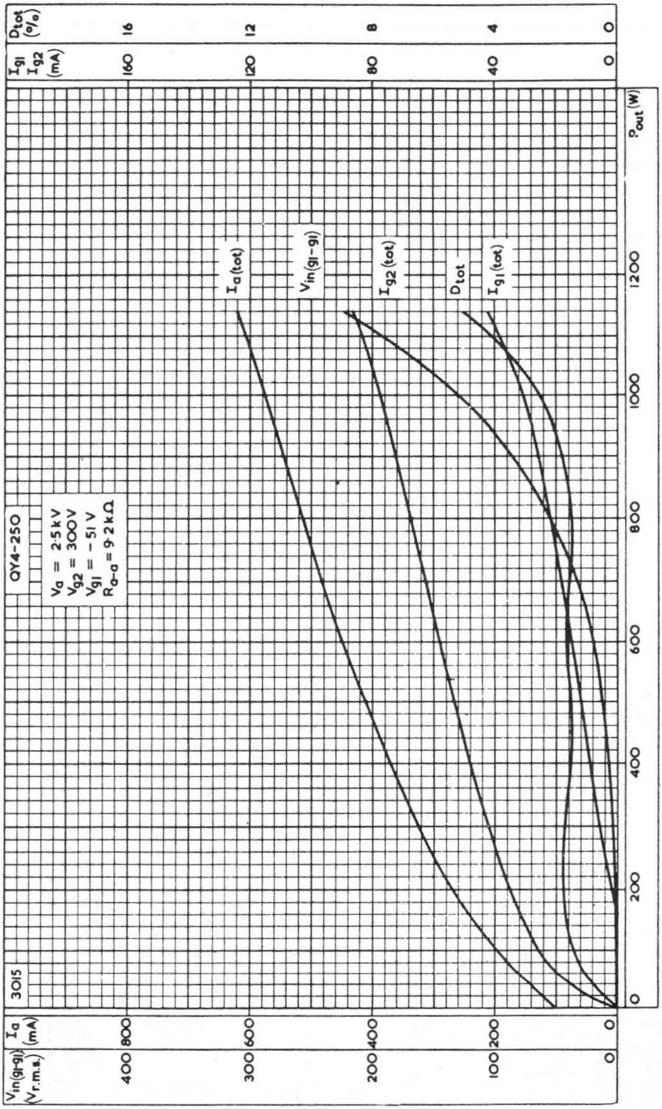
V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. $V_a = 2.0kV$

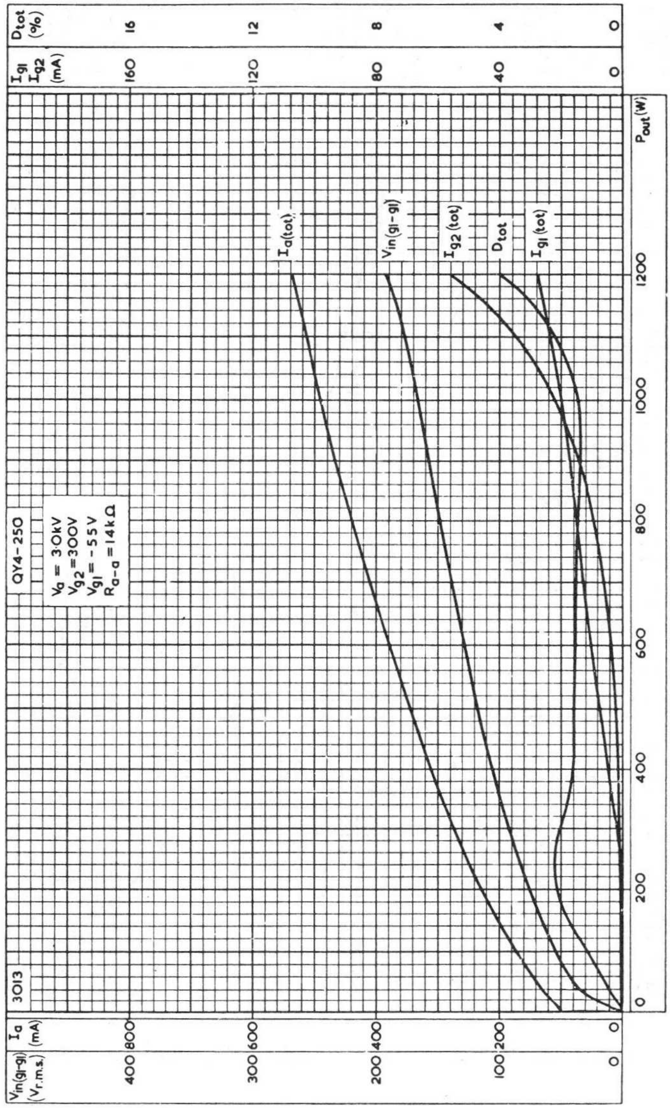


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. $V_a = 2.5kV$

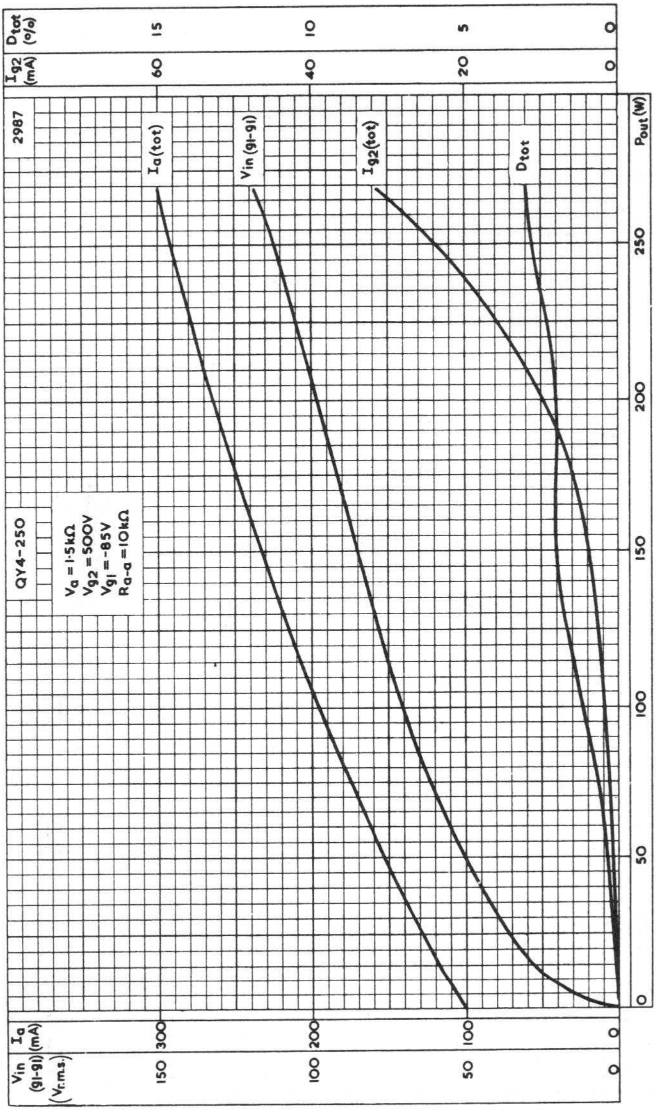
V.H.F. POWER TETRODE

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

QY4-250



TWO VALVES AS CLASS 'B' A.F. AMPLIFIER WITH I_{g1}. V_a=3.0kV



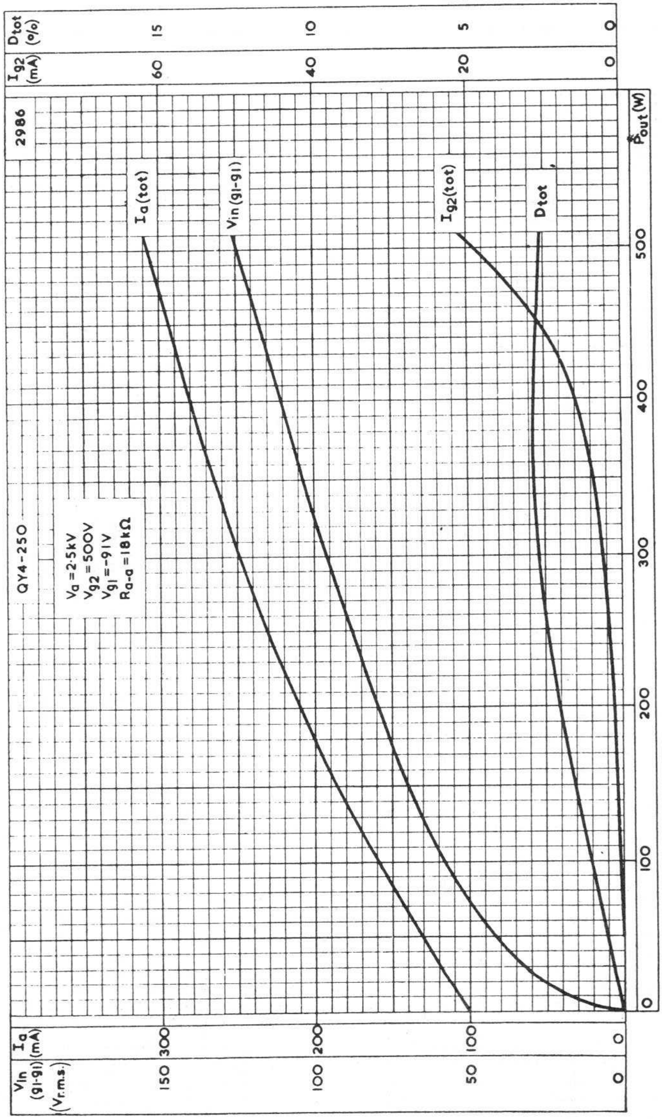
TWO VALVES AS CLASS 'B' A.F. AMPLIFIER. $V_a = 1.5kV$

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.

TWO VALVES AS CLASS 'B' A.F. AMPLIFIER. V_a=2.0kV

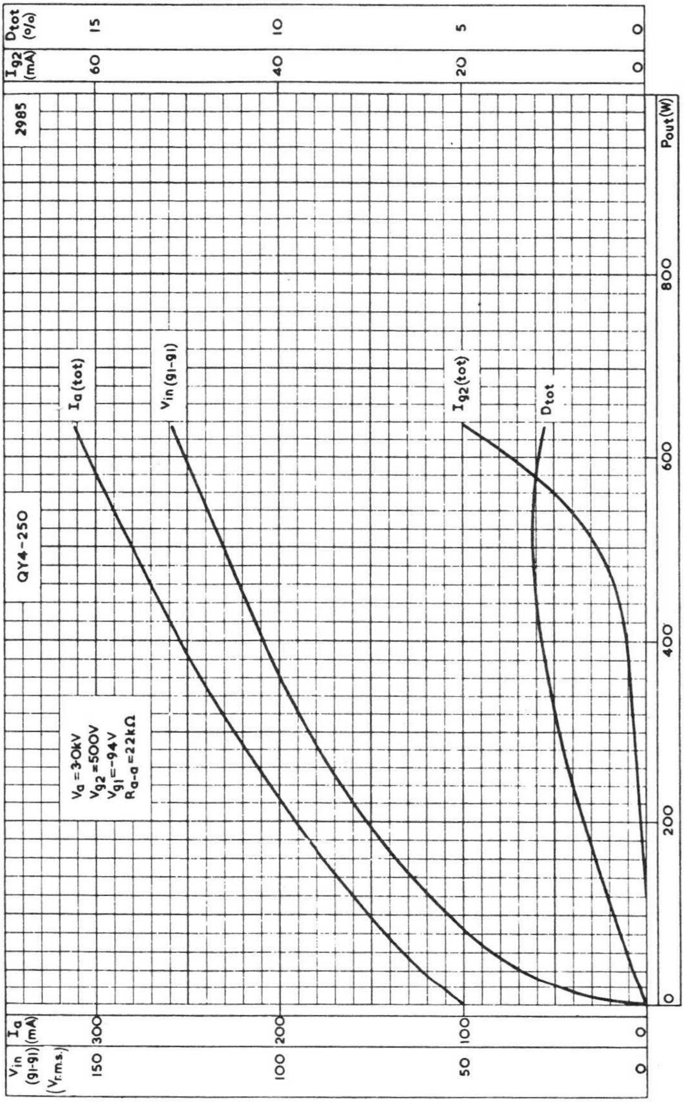


TWO VALVES AS CLASS 'B' A.F. AMPLIFIER $V_a = 2.5$kV

V.H.F. POWER TETRODE

QY4-250

All-glass tetrode rated for a maximum anode dissipation of 250W and suitable for use at frequencies up to 120Mc/s.



TWO VALVES AS CLASS 'B' A.F. AMPLIFIER $V_a = 3.0kV$

Mullard

COMMUNICATIONS TRAVELLING-WAVE TUBE

YH1210

TENTATIVE DATA

QUICK REFERENCE DATA

High power linear amplifier for television transposer service with common vision and sound transmission in the U.H.F. bands IV and V (470-860MHz).

Frequency range	470 to 860	MHz
*Output power, peak sync (CCIR system G)	220	W
*Gain (approx.)	30	dB
*Intermodulation product (ref. peak sync)	-54	dB
Construction		Unpackaged
tube		metal-ceramic
mount		permanent magnet
Input and output connector		50Ω. type N

*With phase compensation unit type 55382

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

TYPICAL OPERATION

Vision and sound combined (CCIR system G) using phase compensation unit type 55382.

Operating conditions (electrode potentials measured with respect to cathode)

Frequency of vision carrier	550	615	780	MHz
Helix voltage	3.65	3.5	3.3	kV
Collector voltage	3.65	3.5	3.3	kV
Grid 1 voltage	-100	-100	-100	V
Grid 2 voltage (approx.) (see note 1)	560	610	680	V
Cathode current	850	850	850	mA
Helix current	10	10	10	mA

Typical performance

Output power, peak sync	220	220	220	W
Output power, sound	44	44	44	W
Gain (see note 2)	30	31	32	dB
Intermodulation product (ref. peak sync) (see note 3)	-54	-54	-54	dB
Low frequency linearity (see note 4)	$\geq$95	$\geq$95	$\geq$95	%
Differential gain (see note 4)	$\geq$95	$\geq$95	$\geq$95.	%
Differential phase of colour subcarrier	$\leq$3.0	$\leq$3.0	$\leq$3.0	deg

CATHODE

Indirectly heated dispenser cathode

Heater voltage (a.c. or d.c.)	6.5 ±2%	V
Heater current (V_h = 6.5V) (approx.)	3.2	A
Pre-heating time (minimum)	300	s

The heater starting current should never exceed a peak value of 8A with an a.c. supply, or 6A when a d.c. supply is used. When operated from d.c. the cathode must be connected to the positive side of the heater supply.

RATINGS (ABSOLUTE MAXIMUM SYSTEM) (electrode potentials measured with respect to cathode)

These ratings cannot necessarily be used simultaneously and no individual rating should be exceeded.

	Min.	Max.	
Grid 1 voltage	-200	0	V
Grid 2 voltage	-	1.0	kV
Grid 2 current	-	3.0	mA
Helix voltage	-	4.2	kV
Helix current	-	20	mA
Collector to helix voltage	-	500	V
Collector dissipation	-	4.0	kW
Power reflected from load	-	20	W
Cathode current	-	1.0	A
Altitude	-	3.0	km

MOUNTING POSITION

Any (but see cooling). The barrel of the mount must be protected from strong magnetic fields such as from isolators, and should be several centimetres from steel plates.

COOLING

Forced-air

Minimum airflow (at sea level and for inlet temperatures up to 45°C)	3.5	m^3/min
	50	mm of water
for other altitudes		see page 7

Temperature

Reference point on mount cooler max. (see outline drawing)	200	°C

AMBIENT TEMPERATURE

	Min.	Max.	
Operation to full specification	-20	+50	°C
Storage for tube and mount	-40	-	°C

PHYSICAL DATA

Tube

	kg	lb
Weight (approx.)	3.5	7.7

Mount

Weight (approx.)	53	117

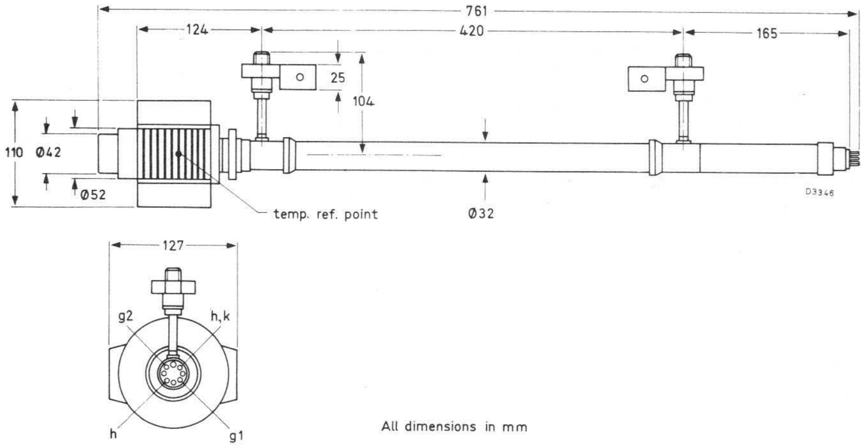
ACCESSORIES

Permanent magnet mount	55380
Base connector with 5 core cable (2m long)	55381
Phase compensation unit for 19 in. rack	55382

NOTES

1. To be adjusted for indicated cathode current.
2. Including a loss of approximately 3dB in the phase compensation unit.
3. The intermodulation products of the input test signals are -70dB with respect to peak sync. The signals are set at f_v = -8dB, f_s = -7dB and f_{sb} = -17dB with respect to peak sync level. Vision/sound ratio 5:1.
4. Measured with vision signal as well as with combined vision-sound signals.

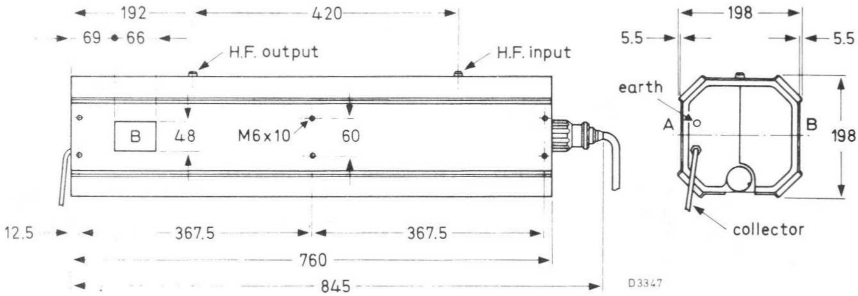
OUTLINE DRAWING OF YH1210



CONVERSION TABLE

mm	in	mm	in
25	0.98	124	4.88
Ø 32	Ø1.26	127	5.00
Ø 42	Ø1.65	165	6.50
Ø 52	Ø2.05	420	16.54
104	4.09	761	29.96
110	4.33		

OUTLINE DRAWING OF MOUNT



All dimensions in mm

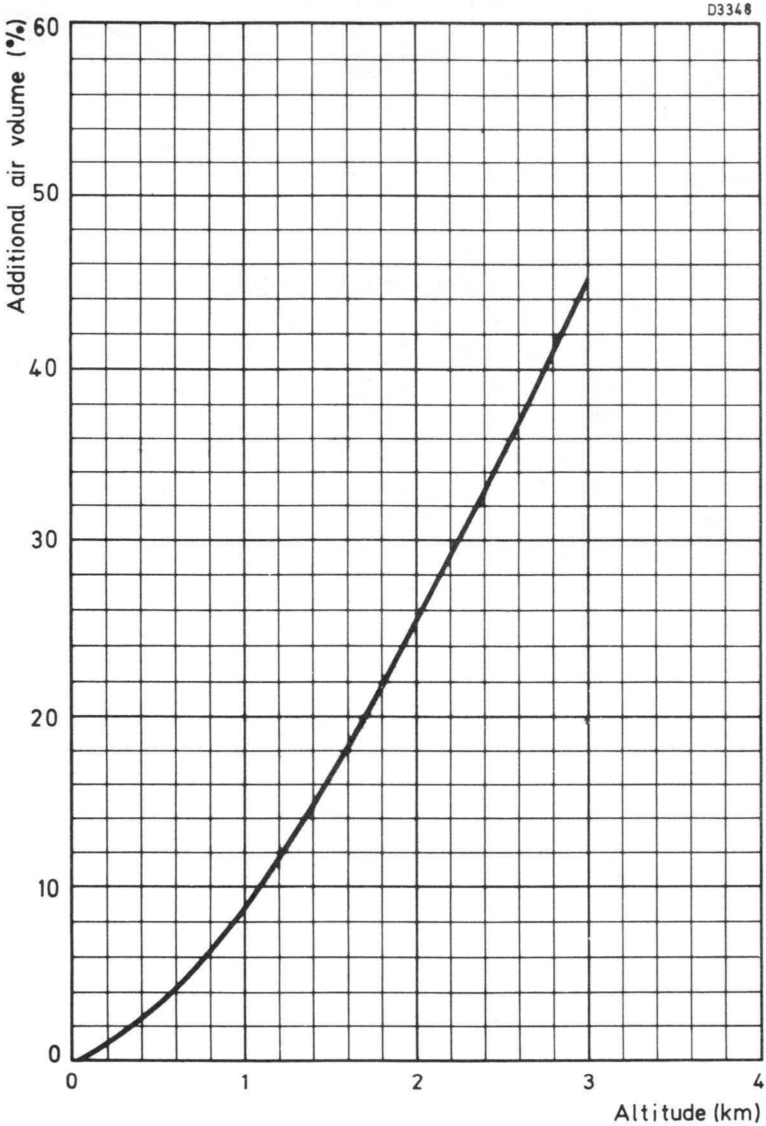
Plug connections to mount	
Heater	Brown
Heater/Cathode	Brown/Yellow
Cathode	Yellow
Grid 1	Green
Grid 2	Blue
Earth via mount	Black

The helix is internally connected to the tube body, which in turn is connected to the mount. The mount is earthed.

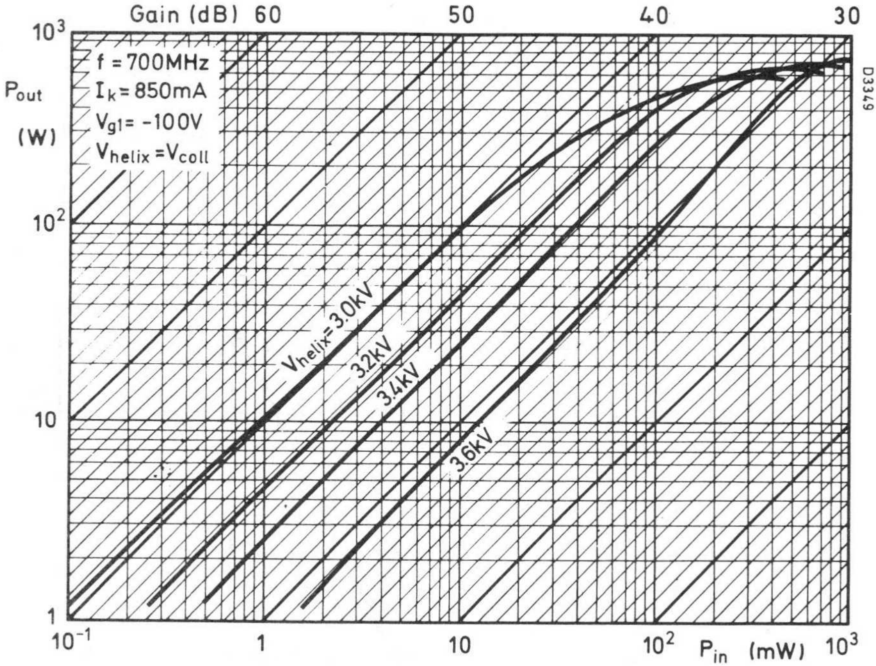
The collector is electrically isolated from the tube body and is connected to its power supply via the flying lead.

CONVERSION TABLE

mm	in	mm	in
5.5	0.217	192	7.56
12.5	0.492	198	7.80
48	1.89	367.5	14.47
60	2.36	420	16.53
66	2.60	760	29.92
69	2.72	845	33.27



ADDITIONAL AIR VOLUME PLOTTED
AGAINST ALTITUDE



OUTPUT POWER PLOTTED AGAINST
INPUT POWER

R.F. INDUSTRIAL TRIODES

YD1192 YD1193

QUICK REFERENCE DATA

External anode triodes of ceramic-metal construction, intended for use as class 'C' industrial oscillators.
The YD1192 has an integral water cooler.
The YD1193 is vapour cooled.

f	30	MHz
P_{out} (less P_{drive})	62.7	kW
f max.	30	MHz
V_a max.	9.6	kV
p_a max.	40	kW

Unless otherwise shown, data is applicable to both types

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR CLASS 'C'
OPERATING CONDITIONS

f	30	MHz
P_{out}	65	kW
P_{out} (less P_{drive})	62.7	kW
P_{load}	55*	kW
Duty factor	1.0	
η_a	81	%
V_a	8.0	kV
I_a	10	A
$-V_g$	675	V
I_g on load	2.25	A
off load	3.3	A
R_{g-f}	300	Ω
Feedback ratio $v_{in(pk)}/v_{a(pk)}$	0.146	
P_{drive}	2.3	kW
p_a	15	kW
p_g	750	W
P_{R_g}	1.52	kW
P_{in}	80	kW

*Cavity circuit, 85% transfer.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	30	MHz
V_a max.	9.6	kV
P_{in} max.	96	kW
$-V_g$ max.	1.5	kV
I_g max. on load	2.5	A
off load	3.5	A
I_a max.	12	A
I_k max.	14	A
$i_{k(pk)}$ max.	68	A
p_a max.	40	kW
p_g max.	1.0	kW
R_{g-f} max.	10	kΩ

CATHODE

Directly heated, thoriated tungsten

$*V_f$	8.4	V
I_f	235	A
$i_{f(pk)}$ max. starting	1.5	kA
r_f (cold)	0.0039	Ω

*The filament has been designed to accept temporary fluctuations of supply voltage of +5% and -10%.

CAPACITANCES

c_{a-g}	45	pF
c_{a-f}	1.3	pF
c_{g-f}	100	pF

CHARACTERISTICS (Measured at $V_a = 8.0kV$, $I_a = 6.0A$)

g_m	90	mA/V
μ	35	

MOUNTING POSITION

YD1192	*Vertical, anode up or down
YD1193	Vertical, anode down

*With anode uppermost the water inlet and outlet connections should be interchanged.

COOLING

YD1192

Anode - water cooled with integral cooler

Seals - low velocity air flow at frequencies >4MHz

Temperatures

Envelope and all seals max.	200	°C
Water inlet absolute max.	50	°C

Cooling characteristics

Anode + Grid dissipation (kW)	Inlet temperature (°C)	Rate of flow (l/min)	Inlet pressure (atm)	Outlet temperature (°C)
40	20	20	0.7	51
40	50	30	1.3	70
30	20	14	0.37	53
30	50	21	0.7	72
20	20	9.0	0.17	56
20	50	13.5	0.32	74

YD1193

Anode - vapour cooled with boiler-condenser K735

Seals - low velocity air cooling is required

Temperatures

Envelope and all seals max.	200	°C

Cooling characteristics

Anode + Grid dissipation (kW)	Inlet temperature (°C)	Rate of flow (l/min)	Inlet pressure (atm)	Outlet temperature (°C)
40	20	11	0.05	74
40	35	15	0.07	74
40	50	25	0.16	74
30	20	8.0	0.03	76
30	35	11	0.05	76
30	50	17	0.09	76
20	20	5.0	0.02	80
20	35	6.7	0.03	80
20	50	10	0.04	80

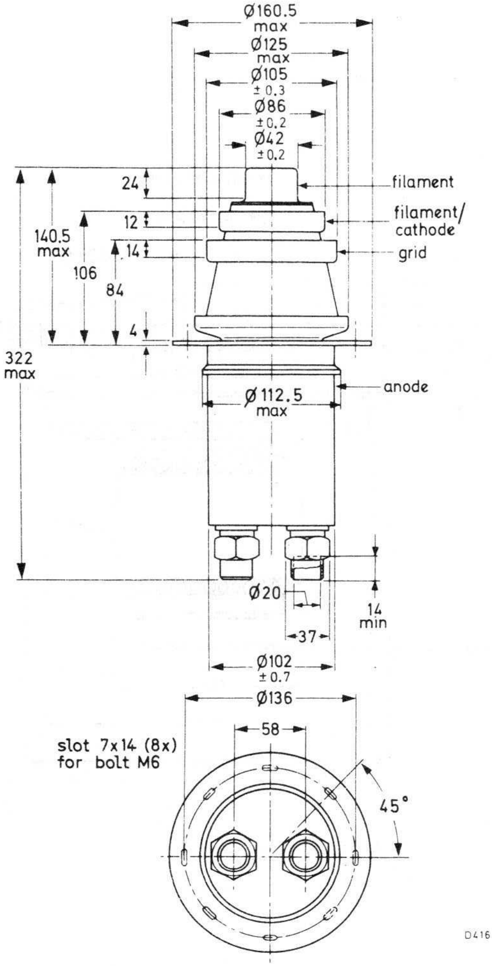
PHYSICAL DATA

	YD1192	YD1193	
Weight of valve (approx.)	6.0	15.7	kg

ACCESSORIES

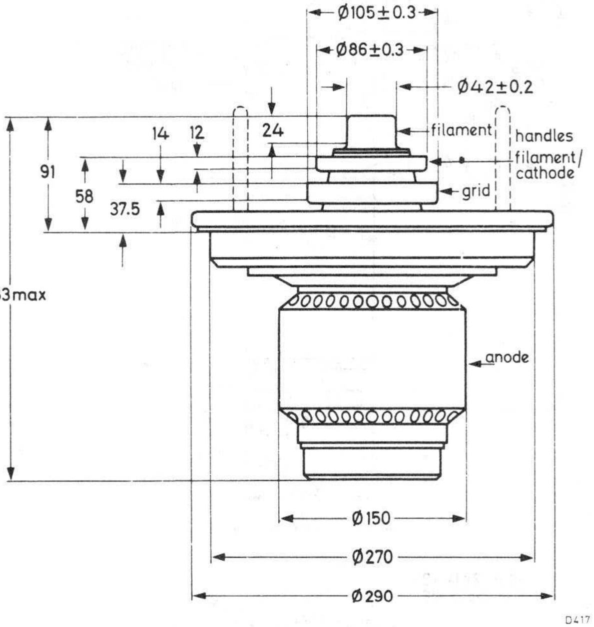
Grid connector (f< 4MHz)	40707
Grid connector (f> 4MHz)	40736
Filament connectors (both types required)	40705 and 40706
Filament cables (both types required)	40718 and 40719
YD1193 only	
Boiler-condenser (weight approx. 70kg)	K735

OUTLINE DRAWING OF YD1192



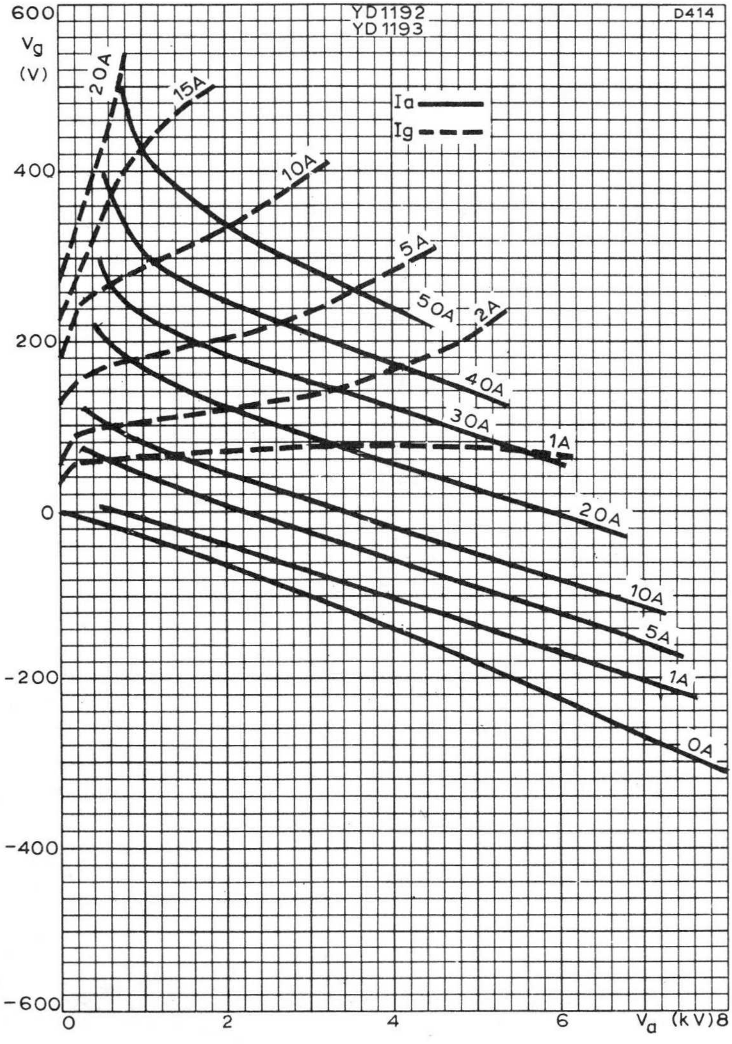
All dimensions in mm

OUTLINE DRAWING OF YD1193



All dimensions in mm

The handles should be removed before switching on the valve



CONSTANT CURRENT CHARACTERISTICS

R.F. INDUSTRIAL TRIODE

YD1203

Vapour cooled triode of metal-ceramic construction intended for use as an industrial oscillator.

QUICK REFERENCE DATA				
Oscillator output power ($W_o - W_{feedb}$), typical	W_{osc}		163	kW
Frequency for full ratings	f	max.	100	MHz

To be read in conjunction with "General Recommendations Transmitting tubes, Tubes for heating."

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	30	30	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	120	163	kW
Anode voltage	V_a	10	12	kV
Anode current	I_a	16	18	A
Anode input power	W_{ia}	160	216	kW
Anode dissipation	W_a	36	47	kW
Anode output power	W_o	124	169	kW
Anode efficiency	η_a	77.5	78	%
Oscillator efficiency	η_{osc}	75	75.4	%
Feedback ratio	V_{gp}/V_{ap}	12.8	14	%
Grid resistor	R_g	200	225	Ω
Grid current, on load	I_g	3.5	4	A
Grid voltage, negative	$-V_g$	700	900	V
Grid dissipation	W_g	1.5	2	kW
Grid resistor dissipation	W_{Rg}	2.45	3.6	kW

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	100	MHz [1]
Anode voltage	V_a	max.	15	kV
Anode current	I_a	max.	19	A
Anode input power	W_{ia}	max.	220	kW
Anode dissipation	W_a	max.	80	kW
Grid voltage	$-V_g$	max.	2	kV
Grid current, on load	I_g	max.	5	A
off load	I_g	max.	7	A
Grid dissipation	W_g	max.	2.5	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	24	A
peak	I_{kp}	max.	100	A
Envelope temperature	t_{env}	max.	240	°C

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f		12.2	V
Filament current	I_f		250	A
Peak filament starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{fo}		5.3	mΩ

The filament is designed to accept temporary fluctuations of +5% and -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so it must be borne in mind that the filament voltage-to-current ratio measured with only the filament voltage applied should remain constant under all operating conditions.

It is extremely important that the filament be properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounde-grid circuits this resonance should be below the grid-cathode resonance. For further information please see Application book "Tubes for R.F. heating" or contact the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	2.7	pF
Grid to filament	C_{gf}	170	pF
Anode to grid	C_{ag}	55	pF

CHARACTERISTICS measured at V_a = 10 kV, I_a = 8 A

Transconductance	S	150	mA/V
Amplification factor	μ	30	

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.

COOLING

See also cooling curves

With integrated boiler condenser type K735

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (^oC)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (atm)	Outlet temperature t_o (^oC)
80	20	29	0.20	60
	35	48	0.51	59
60	20	16	0.08	75
	35	24	0.14	72
	50	45	0.45	70
40	20	10	0.04	80
	35	13.5	0.06	80
	50	20	0.10	80

Absolute max. water inlet temperature t_i max. 50 ^oC

At low frequencies the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of abt. 0.5 ℓ/min. At high frequencies, however, an additional airflow of abt 4 m^3/min must be led along the seals from a 50 mm diameter nozzle positioned at a distance of 250 mm from the tube header.

To obtain optimum life, the seal/anode temperature under continuous loaded conditions should be kept at or below 200 ^oC.

ACCESSORIES

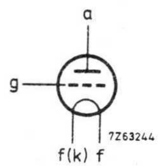
Filament connector with cable	type 40695	net mass	1,4	kg
Filament/cathode connector with cable	type 40696	net mass	1,6	kg
Grid connector	type 40737	net mass	525	g
Boiler condenser	type K733	net mass	70	kg

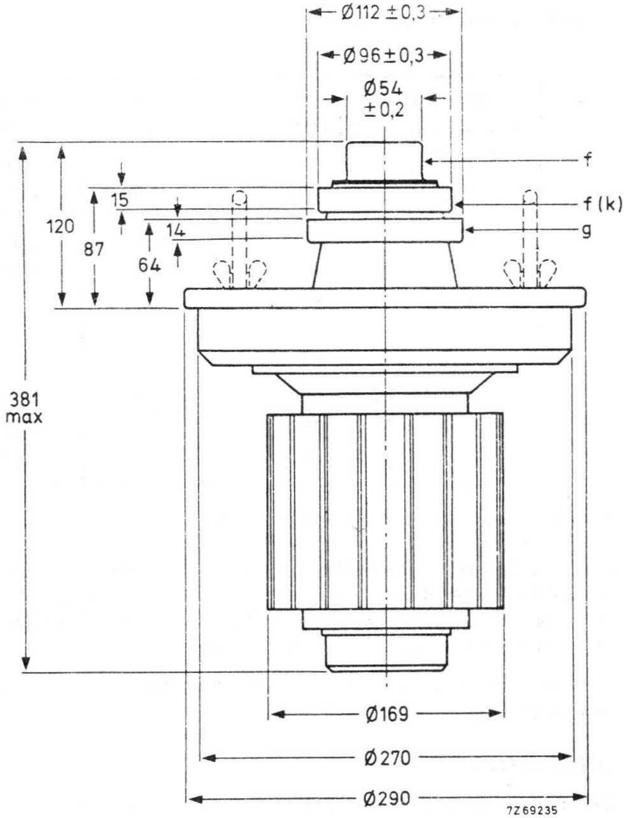
MECHANICAL DATA

Dimensions in mm

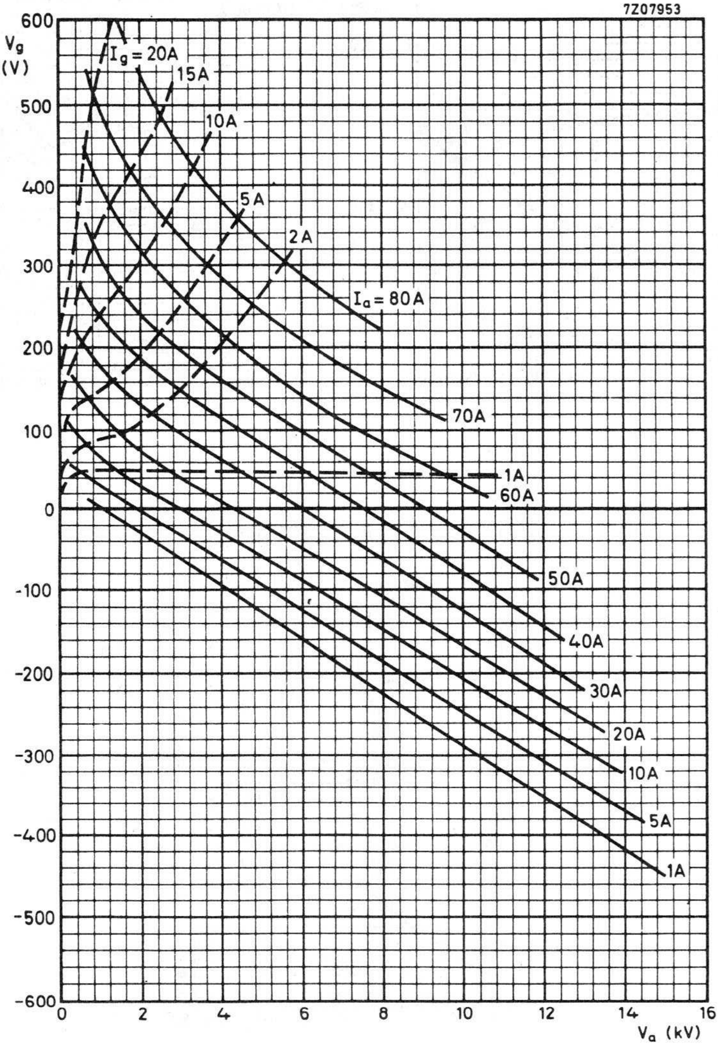
Mounting position : vertical with anode down

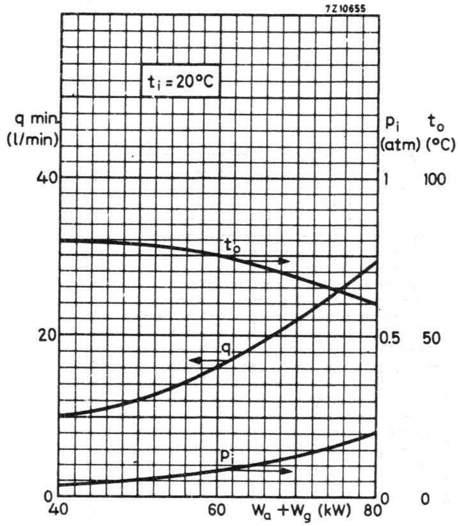
Net mass : approx. 19,8 kg

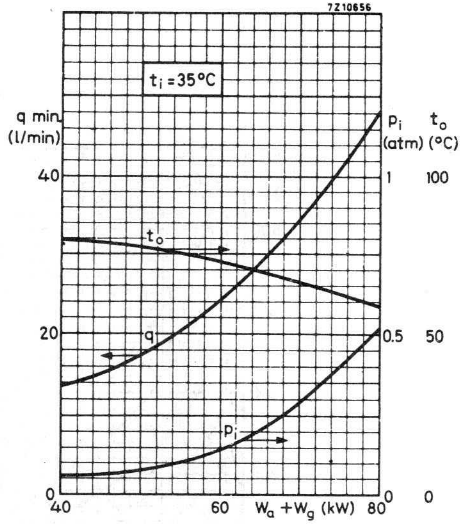


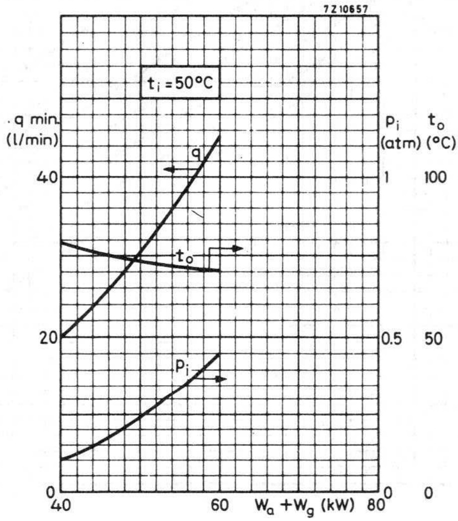


Note : The handles should be removed before switching on the tube.


7Z07953
V_g (V)
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
I_g = 20A
15A
10A
5A
2A
1A
I_a = 80A
70A
60A
50A
40A
30A
20A
10A
5A
1A
0
2
4
6
8
10
12
14
16
V_a (kV)


7Z10655
$t_i = 20°C$
q min
(l/min)
40
20
0
p_i
(atm)
1
0.5
0
t_o
(°C)
100
50
0
t_o
q
p_i
40
60
$W_a + W_g$ (kW)
80


7Z10656
$t_i = 35°C$
q min
(l/min)
40
20
0
p_i
(atm)
1
0.5
0
t_o
(°C)
100
50
0
t_o
q
p_i
40
60
$W_a + W_g$ (kW)
80


7Z10657
$t_i = 50°C$
q min
(l/min)
40
20
0
p_i
(atm)
1
0.5
0
t_o
(°C)
100
50
0
q
t_o
p_i
40
60
$W_a + W_g$ (kW)
80

R.F. INDUSTRIAL TRIODE

YD1213

Vapour cooled triode of metal-ceramic construction intended for use as an industrial oscillator.

QUICK REFERENCE DATA				
Oscillator output power ($W_o - W_{feedb}$), typical	W_{osc}		240	kW
Frequency for full ratings	f	max.	100	MHz

To be read in conjunction with "General Recommendations Transmitting tubes, Tubes for R.F. heating."

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	30	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	240	kW
Anode voltage	V_a	14	kV
Anode current	I_a	23.5	A
Anode input power	W_{ia}	329	kW
Anode dissipation	W_a	81.5	kW
Anode output power	W_o	247.5	kW
Anode efficiency	η_a	75.2	%
Oscillator efficiency	η_{osc}	73	%
Feedback ratio	V_{gp}/V_{ap}	10.4	%
Grid resistor	R_g	135	Ω
Grid current, on load	I_g	6	A
Grid voltage, negative	$-V_g$	810	V
Grid dissipation	W_g	2.6	kW
Grid resistor dissipation	W_{Rg}	4.86	kW

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	100	MHz [1]
Anode voltage	V_a	max.	16.8	kV
Anode current	I_a	max.	25	A
Anode input power	W_{ia}	max.	375	kW
Anode dissipation	W_a	max.	120	kW
Grid voltage	$-V_g$	max.	2	kV
Grid current, on load	I_g	max.	7	A
off load	I_g	max.	8.5	A
Grid dissipation	W_g	max.	3	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	31	A
peak	I_{kp}	max.	175	A
Envelope temperature	t_{env}	max.	240	^oC

HEATING : direct ; filament thoriated tungsten

Filament voltage	V_f		12.6	V
Filament current	I_f		380	A
Peak filament starting current	I_{fp}	max.	2000	A
Cold filament resistance	R_{f_o}		3.6	mΩ

The filament is designed to accept temporary fluctuations of +5% and -10%.

To ensure that the cathode temperature remains constant irrespective of the operating frequency, it may be necessary to reduce the filament voltage at higher frequencies. When doing so it must be borne in mind that the filament voltage-to-current ratio measured with only the filament voltage applied should remain constant under all operating conditions.

It is extremely important that the filament be properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded-grid circuits this resonance should be below the grid-cathode resonance. For further information please see Application Book "Tubes for R.F. heating" or contact the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	3	pF
Grid to filament	C_{gf}	185	pF
Anode to grid	C_{ag}	60	pF

CHARACTERISTICS measured at V_a = 14 kV, I_a = 10 A

Transconductance	S	190	mA/V
Amplification factor	μ	41	

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.

COOLING

See also cooling curves

With integrated boiler condenser type K733

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q min (ℓ/min)	Pressure drop p_i (atm)	Outlet temperature t_o (°C)
120	20	59	0.84	50
80	20	29	0.20	61
	35	48	0.51	61
40	20	10	0.04	81
	35	13.5	0.06	81
	50	20	0.10	81

To obtain optimum life, the seal/envelope temperature under continuous loaded conditions should be kept at or below 200 °C.

At low frequencies the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of abt. 0.5 ℓ/min. At high frequencies, however, an additional airflow of abt. 4 m^3/min must be led along the seals from a 50 mm diameter nozzle positioned at a distance of 250 mm from the tube header.

ACCESSORIES

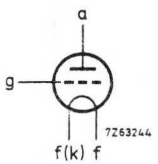
Filament connector with cable	type	40695	net mass	1.4	kg
Filament/cathode connector with cable	type	40696	net mass	1.6	kg
Grid connector	type	40694	net mass	270	g
Boiler condenser	type	K733	net mass	70	kg

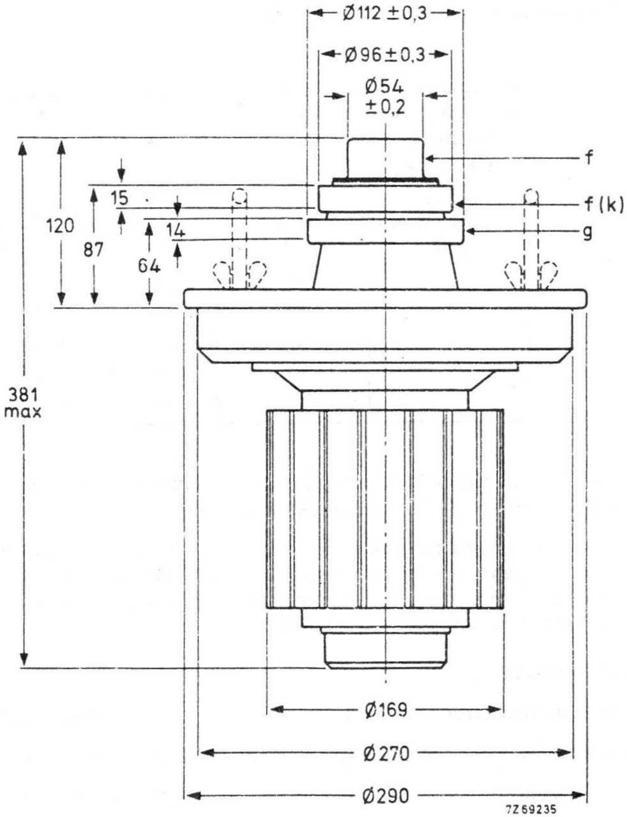
MECHANICAL DATA

Dimensions in mm

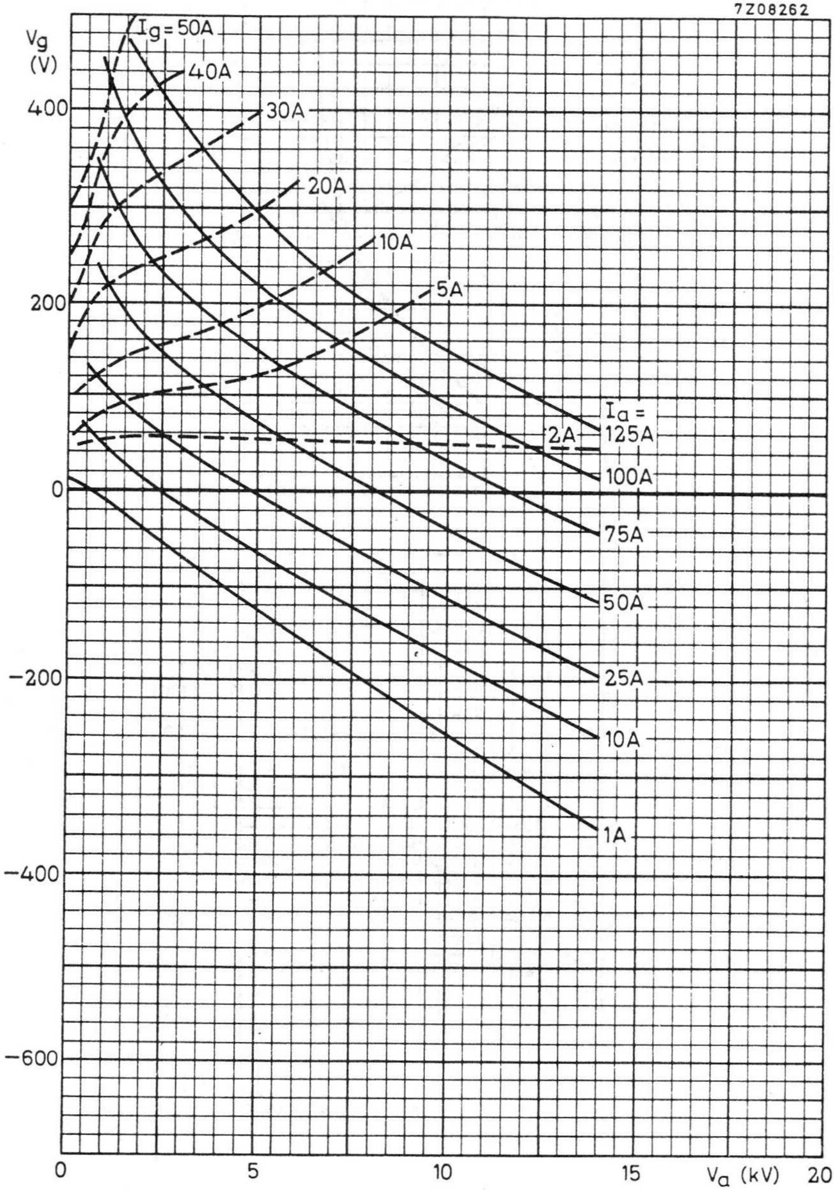
Mounting position : vertical with anode down

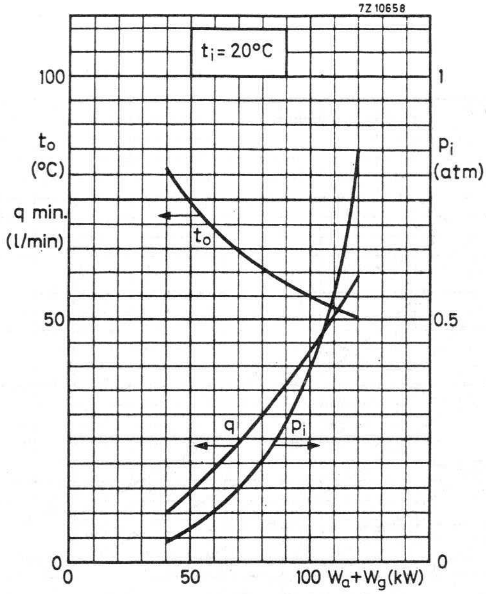
Net mass : approx. 19.8 kg

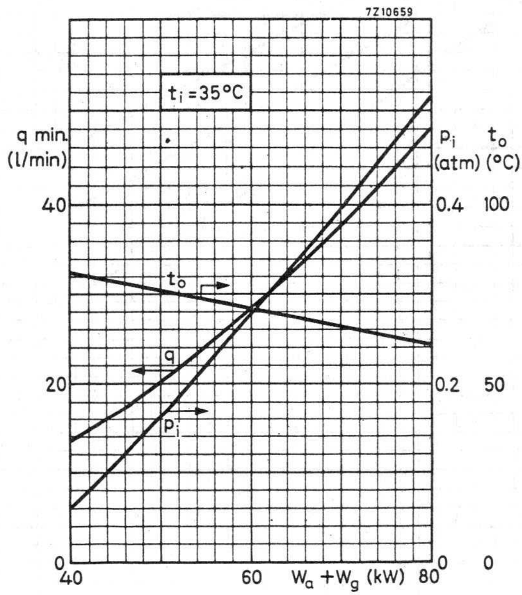




Note.: The handles should be removed before switching on the tube.


7Z08262
V_g (V)
400
200
0
−200
−400
−600
I_g = 50A
40A
30A
20A
10A
5A
2A
I_a =
125A
100A
75A
50A
25A
10A
1A
0
5
10
15
V_a (kV)
20


7Z10658
$t_i = 20°C$
100
t_o
(°C)
q min.
(l/min)
50
0
1
p_i
(atm)
0.5
0
t_o
q
p_i
0
50
100 W_a+W_g (kW)


7Z10659
$t_i = 35°C$
q min.
(l/min)
40
20
0
p_i t_o
(atm) (°C)
0.4 100
0.2 50
0 0
t_o
q
p_i
40
60
W_a+W_g (kW)
80

U.H.F. TRIODE

YD1330

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA			
Frequency	f	370 to 860	MHz
Anode voltage	V_a	3000	V
Output power in load	W_ℓ	220	W
Power gain	G	16, 5	dB

HEATING : indirect, by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f	6,0 to	6, 3	V ±5% 1)
Heater current	I_f	4, 8 to	5, 8	A
Cathode heating time	T_h	min.	180	s

CAPACITANCES

Anode to grid	C_{ag}	6, 8 to 8, 0	pF
Grid to cathode and heater	$C_{g/kf}$	20 to 30	pF
Anode to cathode and heater	$C_{a/kf}$	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Anode current	I_a	400	mA
Transconductance	S	70	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	t	max.	250	^{o}C

To obtain optimum life, this temperature should not exceed 200 ^{o}C.

---

1) The heater voltage must be adjusted between 6, 0 and 6, 3 V.
For optimum performance (linearity) the voltage set must be maintained within ± 2% for transposer service, or ± 5% for other applications.

COOLING

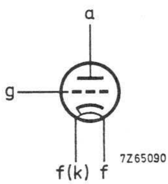
Anode: forced air

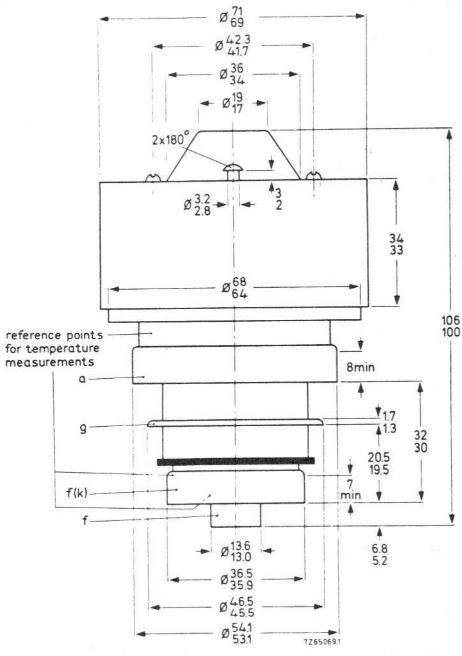
W_a (W)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
1800	25	2	180

Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

MECHANICAL DATA

Dimensions in mm





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	72,0 dia
Anode terminal	55,1 dia
grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

U.H.F. TRIODE YD1330

R.F. CLASS AB AMPLIFIER FOR TV TRANSPOSER SERVICE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz	
Anode voltage	V_a	max.	3500	V	
Grid voltage	$-V_g$	max.	200	V	
Anode dissipation	W_a	max.	1800	W	
Grid current	I_g	max.	5	mA	
Cathode current	I_k	max.	550	mA	[1]

OPERATING CONDITIONS, grounded grid

Standard		CCIR -G		[2] [3]
Frequency	f	470 to 860	MHz	
Anode voltage	V_a	3000	V	
Grid voltage [4]	V_g	-30	V	
Anode current, no signal	I_a	420	mA	
Anode current at zero dB level (vision carrier)	I_a	650	mA	
Grid current	I_g	≈ 0	mA	
Driver output power (sync)	W_{dr}	7	W	
Output power in load (sync)	W_ℓ	220	W	
Power gain	G	16,5	dB	
Intermodulation products [5]	d	-55	dB	
		< -53	dB	
Intermodulation products [6]	d	-57	dB	
		< -55	dB	

---

[1] During a short period, for adjustment of the transmitter, I_k max. = 700 mA.

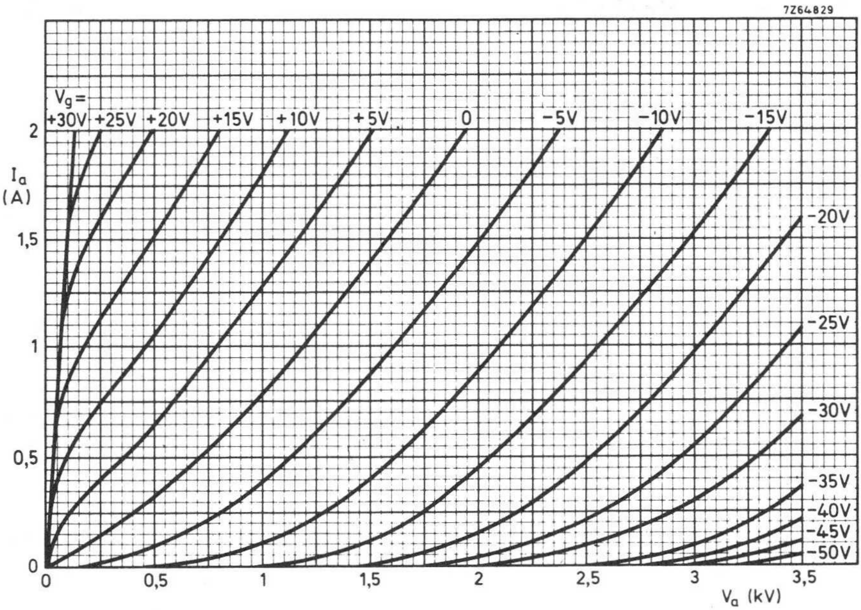
[2] Negative modulation, positive synchronization, combined sound and vision.

[3] R.F. driving power should be applied after the heater and electrode voltages.

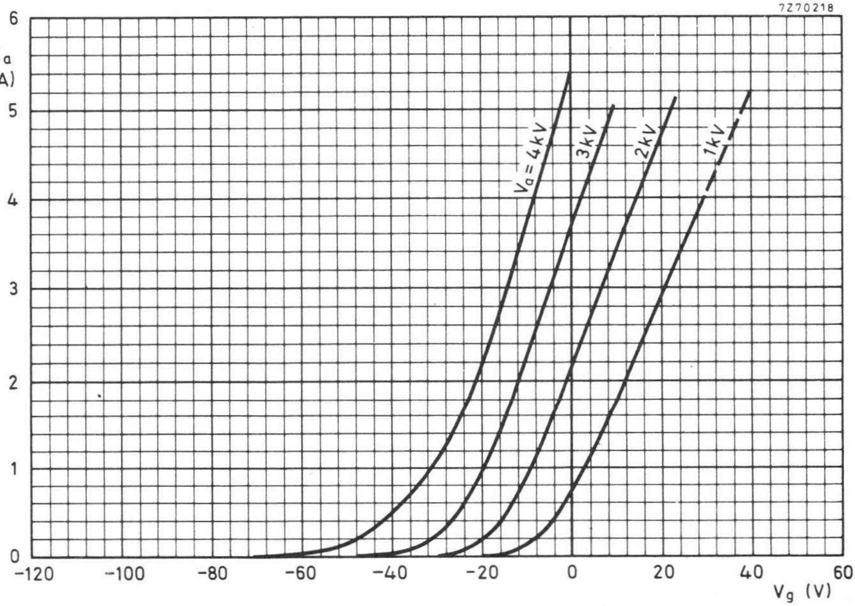
[4] To be adjusted for the stated no-signal anode current. Range values for equipment design -15 to -45 V.

[5] Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync level = 0 dB).

[6] Three-tone test method (vision carrier -8 dB, sound carrier -10 dB, sideband signal -16 dB with respect to peak sync level = 0 dB).

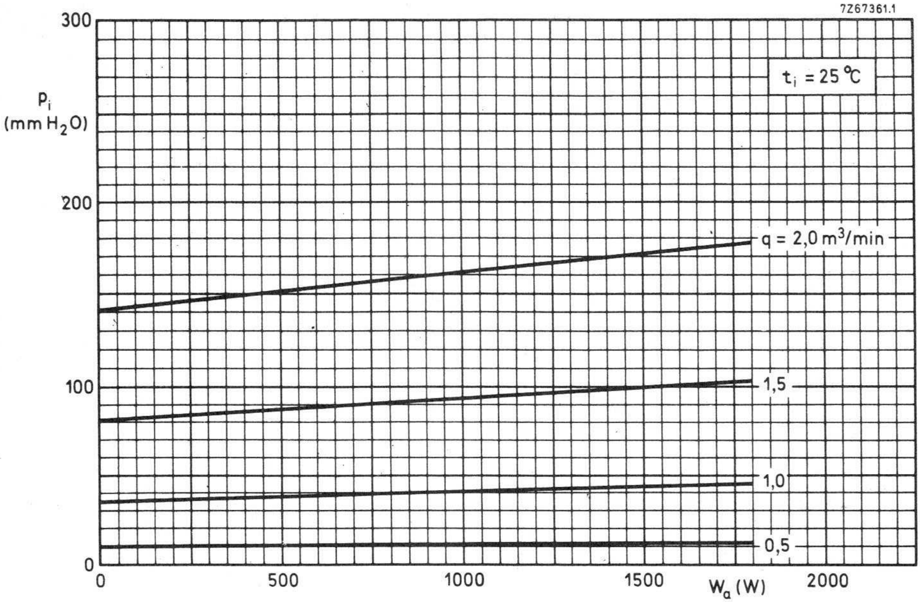


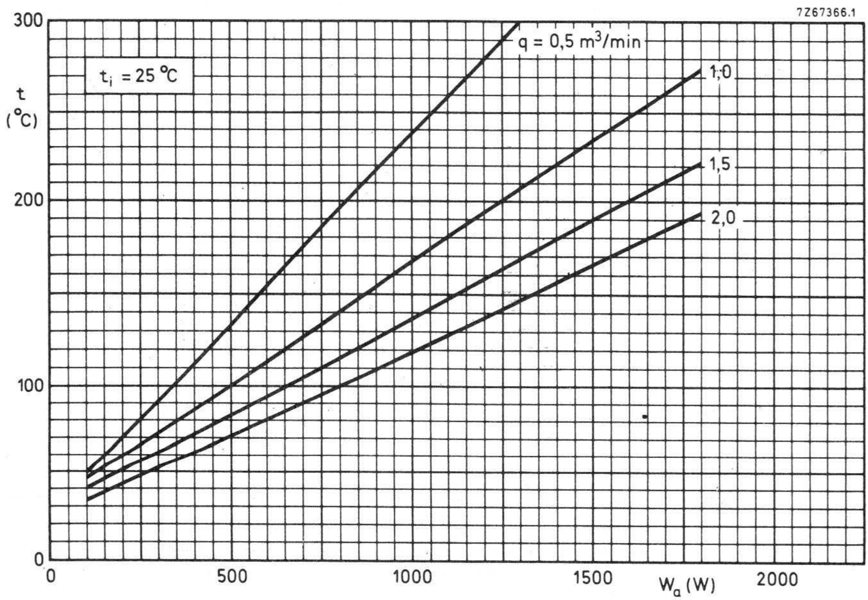
7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)

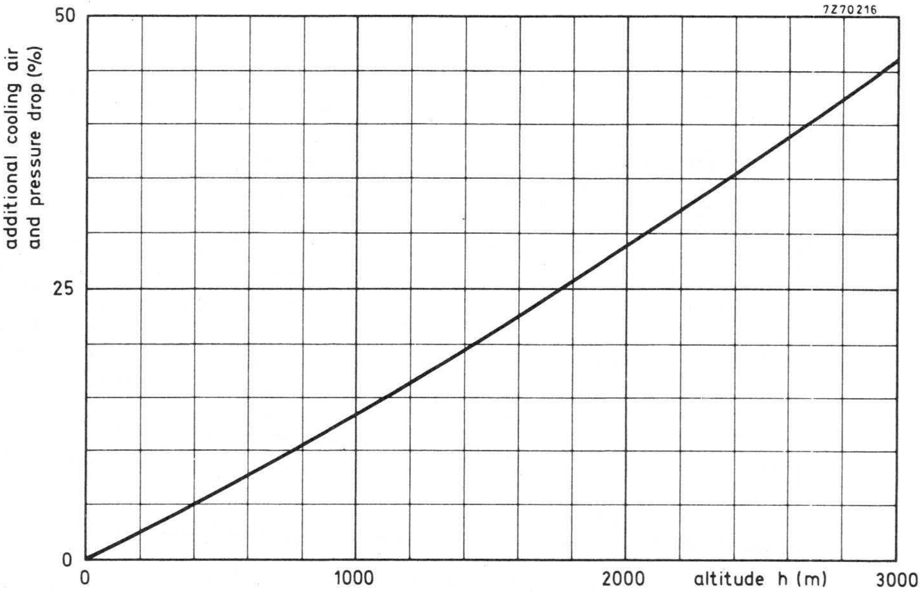


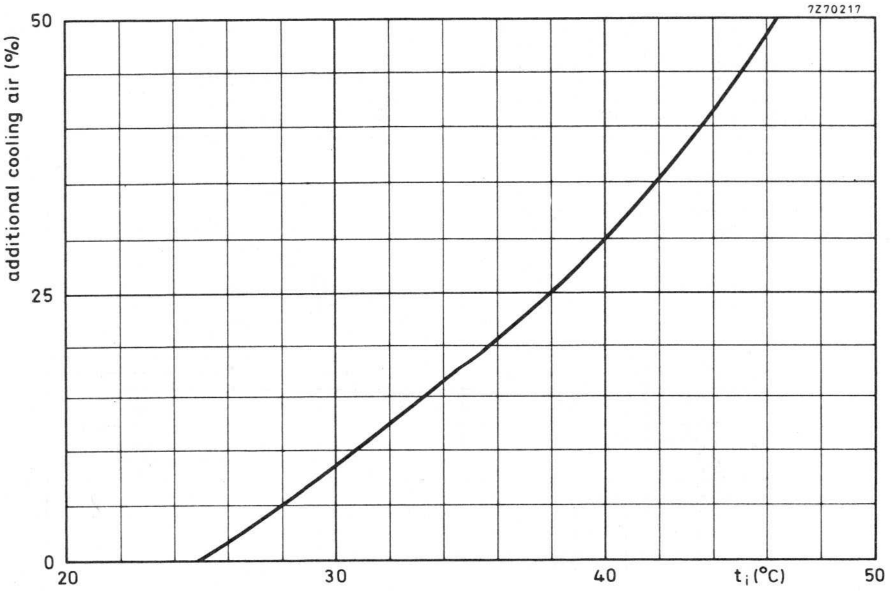
7Z70218
I_a (A)
6
5
4
3
2
1
0
V_a = 4kV
3kV
2kV
1kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)

Mullard


7Z67361.1
300
200
100
0
p_i
(mm H_2O)
t_i = 25 °C
q = 2,0 m³/min
1,5
1,0
0,5
0
500
1000
1500
2000
W_a (W)


7Z67366.1
300
200
100
0
t
(°C)
t_i = 25 °C
q = 0,5 m³/min
1,0
1,5
2,0
0
500
1000
1500
2000
W_a (W)


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

Mullard

U.H.F. TRIODE

YD1333

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)

Frequency	f	470 to 860	MHz
Anode voltage	V_a	2500	V
Output power in load (sync)	W_ℓ	110	W
Power gain	G	16	dB

HEATING : indirect by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f		6.0 to 6.3	V ±5% [1])
Heater current	I_f		4.8 to 5.8	A
Cathode heating time	T_h	min.	180	s

CAPACITANCES

Anode to grid	C_{ag}	6.8 to 8.0	pF
Grid to cathode and heater	$C_{g/kf}$	20 to 30	pF
Anode to cathode and heater	$C_{a/kf}$	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2	kV
Anode current	I_a	250	mA
Transconductance	S	60	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	t	max.	250	^{o}C

To obtain optimum life, this temperature should not exceed 200 ^{o}C.

[1]) The heater voltage must be adjusted between 6.0 and 6.3 V.
For optimum performance (linearity) the voltage set must be maintained within ±2% for transposer service, or ±5% for other applications.

COOLING

Anode: forced air

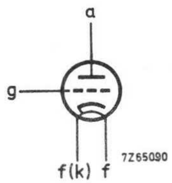
W_a (W)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
900	25	1,5	31

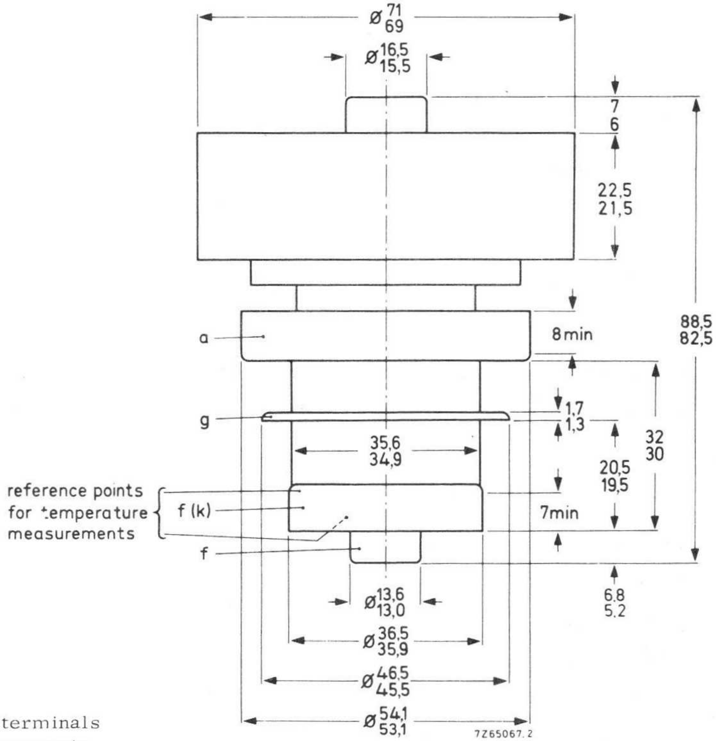
Other terminals: low velocity airflow.

When only the heater voltage is applied the heater and heater/cathode terminals should also be cooled.

Cooling air and voltages may be switched off simultaneously.

MECHANICAL DATA





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	72,0 dia
Anode terminal	55,1 dia
Grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

R.F. CLASS AB AMPLIFIER FOR TV TRANSPOSER SERVICE grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	900	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA

OPERATING CONDITIONS grounded grid

Standard		CCIR-G		[1] [2]
Frequency	f	470 to 860	470 to 860	MHz
Anode voltage	V_a	2500	1800	V
Grid voltage [3]	V_g	-24	-14	V
Anode current, no signal	I_a	250	330	mA
Anode current at zero dB level (vision carrier)	I_a	420	450	mA
Grid current	I_g	≈ 0	≈ 0	mA
Driver output power (sync)	W_{dr}	3.5	3.5	W
Output power in load (sync)	W_ℓ	110	110	W
Power gain	G	16	16	dB
Intermodulation products [4]	d	-58	-56	dB
		< -56	< -54	dB

[1]) Negative modulation, positive synchronization, combined sound and vision.

[2]) R.F. driving power should be applied after the heater and electrode voltages.

[3]) To be adjusted for the stated no-signal anode current. Range values for equipment design : -10 to -40 V, -5 to -35 V respectively.

[4]) Three-tone test method (vision carrier -8 dB, sound carrier -10 dB, sideband signal -16 dB with respect to peak sync level = 0 dB).

R.F. CLASS AB AMPLIFIER FOR TV SOUND SERVICE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	900	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA

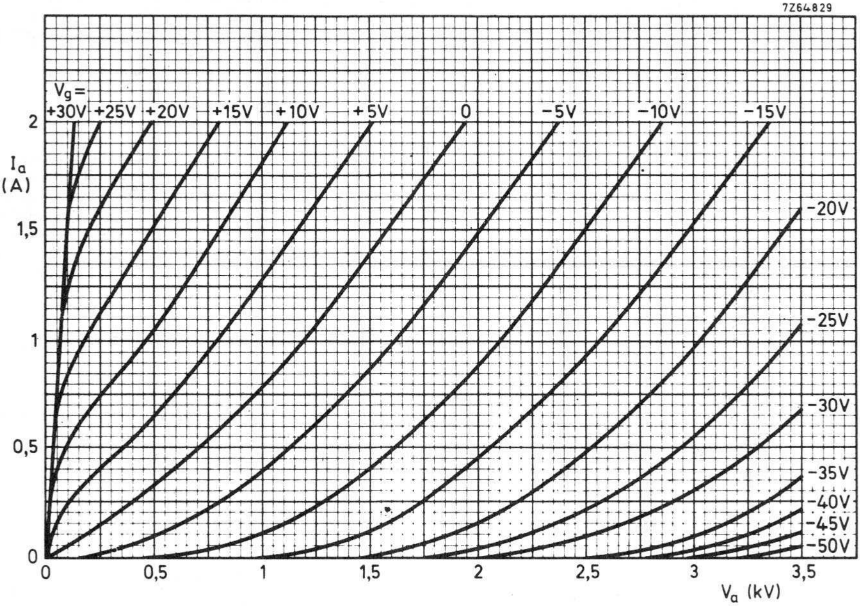
OPERATING CONDITIONS [1]

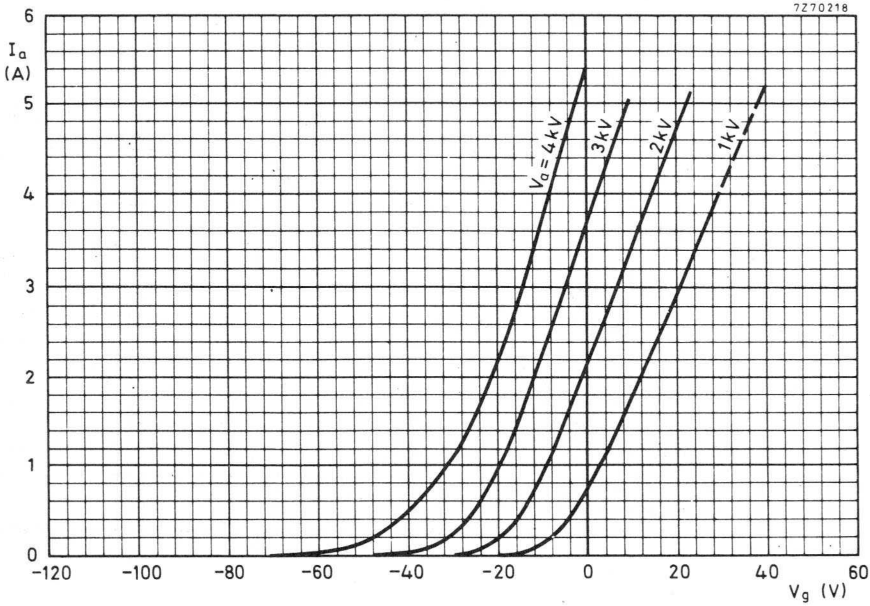
Frequency	f	174 to 860	MHz
Anode voltage	V_a	2700	V
Grid voltage [2]	V_g	-28	V
Anode current, no signal	I_a	200	mA
Anode current	I_a	350	mA
Grid current	I_g	0	mA
Driver output power	W_{dr}	8	W
Output power in load	W_ℓ	300	W
Power gain	G	16	dB

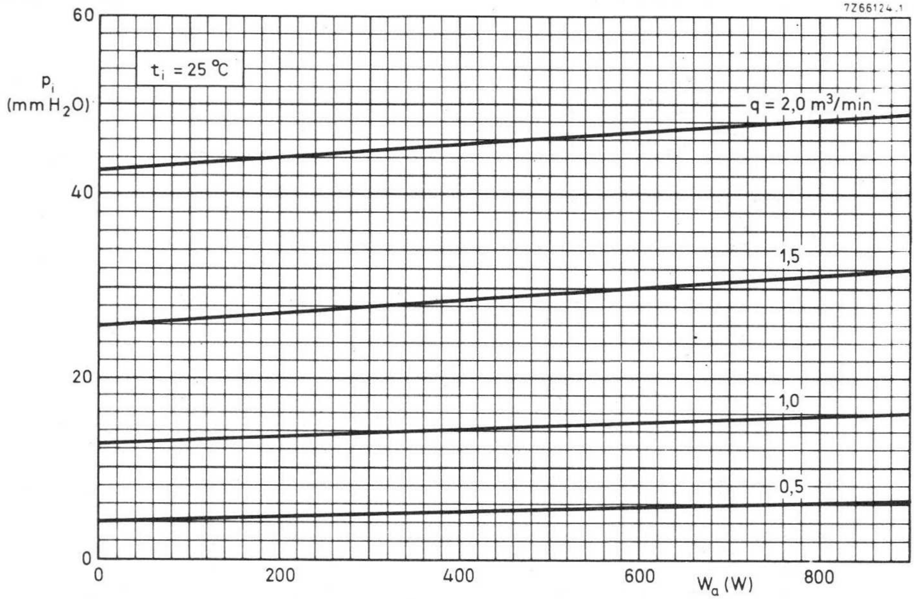
---

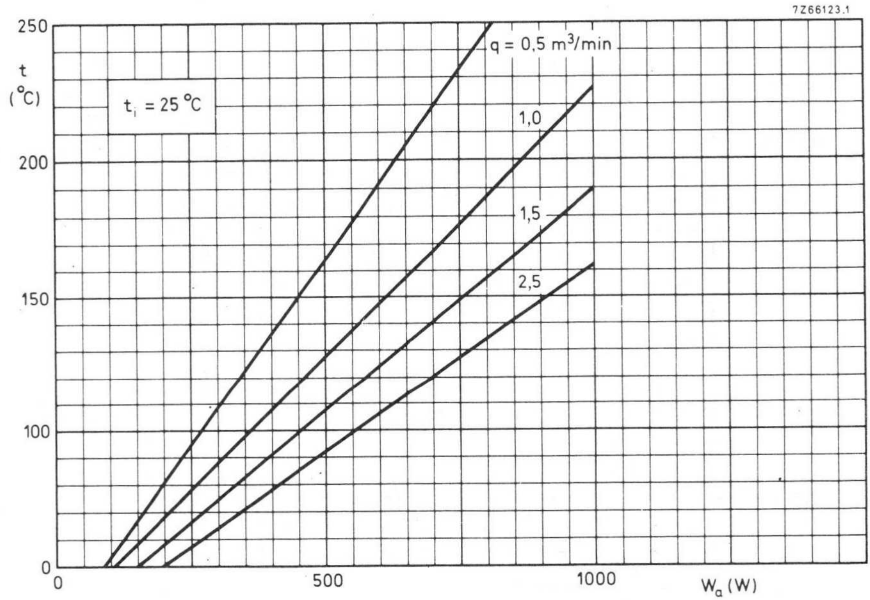
[1] R.F. driving power should be applied after the heater and electrode voltages.

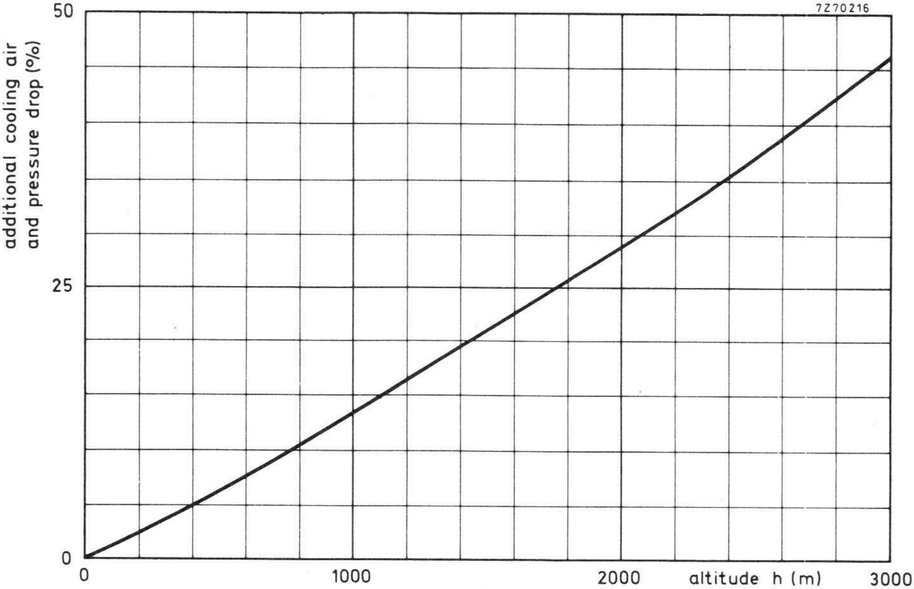
[2] To be adjusted for the stated no-signal anode current. Range values for equipment design -15 to -40 V. For "automatic bias" the cathode resistor range is 80 to 180 Ω.

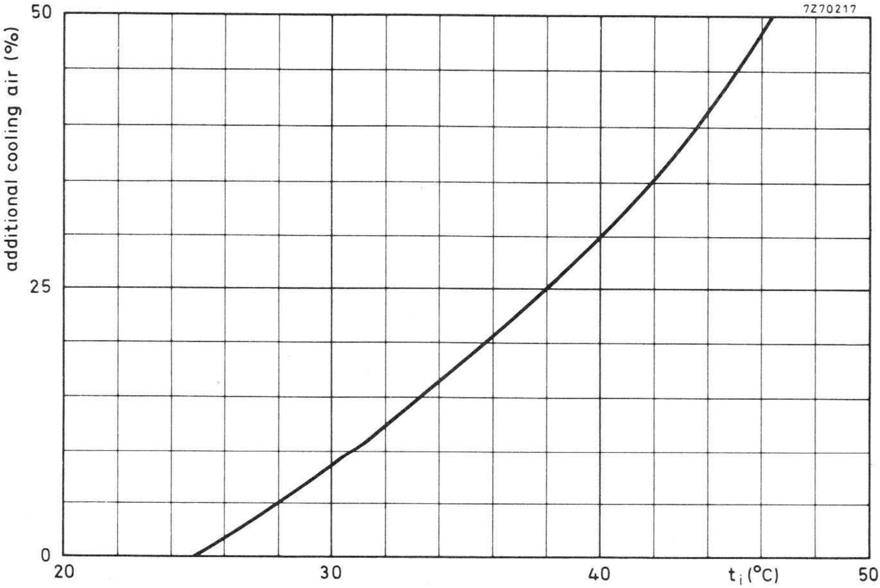

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
6
5
4
3
2
1
0
V_a = 4kV
3kV
2kV
1kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)


7Z66124.1
60
40
20
0
p_i
(mm H_2O)
t_i = 25 °C
q = 2,0 m³/min
1,5
1,0
0,5
0
200
400
600
800
W_a (W)


7Z66123.1
250
200
150
100
0
t
(°C)
t_i = 25 °C
q = 0,5 m³/min
1,0
1,5
2,5
0
500
1000
W_a (W)


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

R.F. INDUSTRIAL TRIODES

YD1342
YD1343

QUICK REFERENCE DATA		
External anode triodes of ceramic-metal construction, intended for use as industrial oscillators.		
YD1342 is water cooled by an integral cooler.		
YD1343 is vapour cooled.		
f	30	MHz
P_{out}(less P_{drive})	480	kW
f max.	30	MHz
V_a max.	19.2	kV
p_a max.	240	kW

Unless otherwise stated, data is applicable to both types.

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - TRANSMITTING VALVES

INDUSTRIAL OSCILLATOR, CLASS 'C'

OPERATING CONDITIONS

f	30	MHz
P_{out}	489	kW
P_{out}(less P_{drive})	480	kW
η_a	73	%
η_{osc}	71.5	%
V_a	16	kV
I_a	42	A
$-V_g$	750	V
I_g on load	7.5	A
R_{g-f}	100	Ω
Feedback ratio $v_g(pk)/v_a(pk)$	0.09	
p_a	183	kW
p_g	3.4	kW
P_{Rg}	5.6	kW
P_{in}	672	kW

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

f max.	30	MHz
V_a max.	19.2	kV
P_{in} max.	750	kW
$-V_g$ max.	2.5	kV
I_g max. on load	9.0	A
off load	11	A
I_a max.	45	A
I_k max.	55	A
i_k(pk) max.	250	A
p_a max.	240	kW
p_g max.	6.0	kW
R_{g-f} max.	10	kΩ

CATHODE

Directly heated, thoriated tungsten.

*V_f	14	V
I_f	555	A
i_f(pk) max.	3.5	kA
r_f(cold)	2.6	mΩ

*The filament has been designed to accept temporary fluctuations of supply voltage of +5 to -10%.

It is extremely important that the filament is properly decoupled. This should be so done that the resonance of the circuit formed by the filament and decoupling elements remains below the fundamental oscillator frequency. In grounded grid circuits this resonance should be below the grid-cathode resonance. For further information please contact Mullard Ltd.

CAPACITANCES

c_{a-f}	3.9	pF
c_{a-g}	70	pF
c_{g-f}	225	pF

CHARACTERISTICS (measured at V_a = 16kV, I_a = 15A)

g_m	230	mA/V
μ	33	

MOUNTING POSITION

Vertical, anode up or down.

COOLING

Anode

YD1342 - water

YD1343 - vapour cooled by an integrated boiler-condenser type K738.

Seals

At frequencies below 4MHz the filament and grid seals should be cooled by a low velocity air flow or by water cooling of the filament connectors. The cooling circuits of these accessories may be connected in series. A water flow of approximately 1 ℓ/min will be sufficient.

At frequencies above 4MHz an air flow of approximately $6m^3$/min should be directed at the filament and grid seals from a 60mm dia. nozzle placed at a distance of 300mm from the tube header.

Temperatures (absolute maximum)

Envelope	200	^oC
Inlet	50	^oC

YD1342 COOLING CHARACTERISTICS

Anode and grid dissipation (kW)	Inlet water temperature (^oC)	Outlet water temperature (^oC)	Minimum rate of water flow (ℓ/min)	Pressure drop (atm)
240	20	50	120	1.00
	50	70	180	1.80
200	20	52	95	0.65
	50	71	144	1.20
160	20	54	72	0.42
	50	72	110	0.75

YD1343 COOLING CHARACTERISTICS

Anode and grid dissipation (kW)	Inlet temperature (^{o}C)	Outlet temperature (^{o}C)	Minimum rate of flow (ℓ/min)	Pressure drop (atm)
240	20	64	80	0.38
	35	64	122	0.75
200	20	69	61	0.33
	35	69	88	0.44
	50	69	158	1.18
160	20	77	42	0.13
	35	76	58	0.22
	50	75	95	0.50

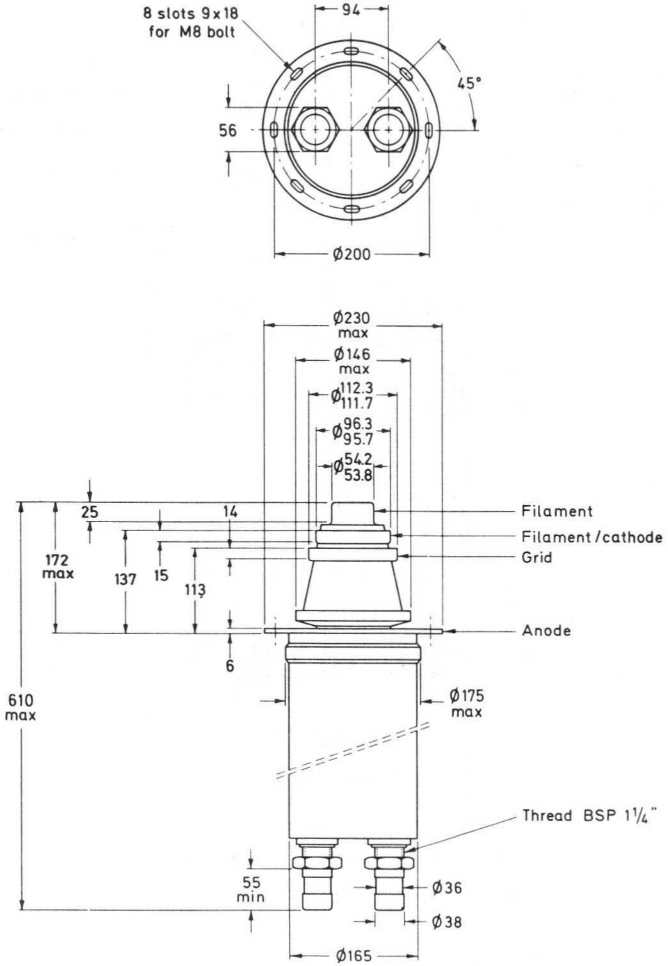
PHYSICAL DATA

	YD1342	YD1343	
Weight of tube	30	45	kg

ACCESSORIES

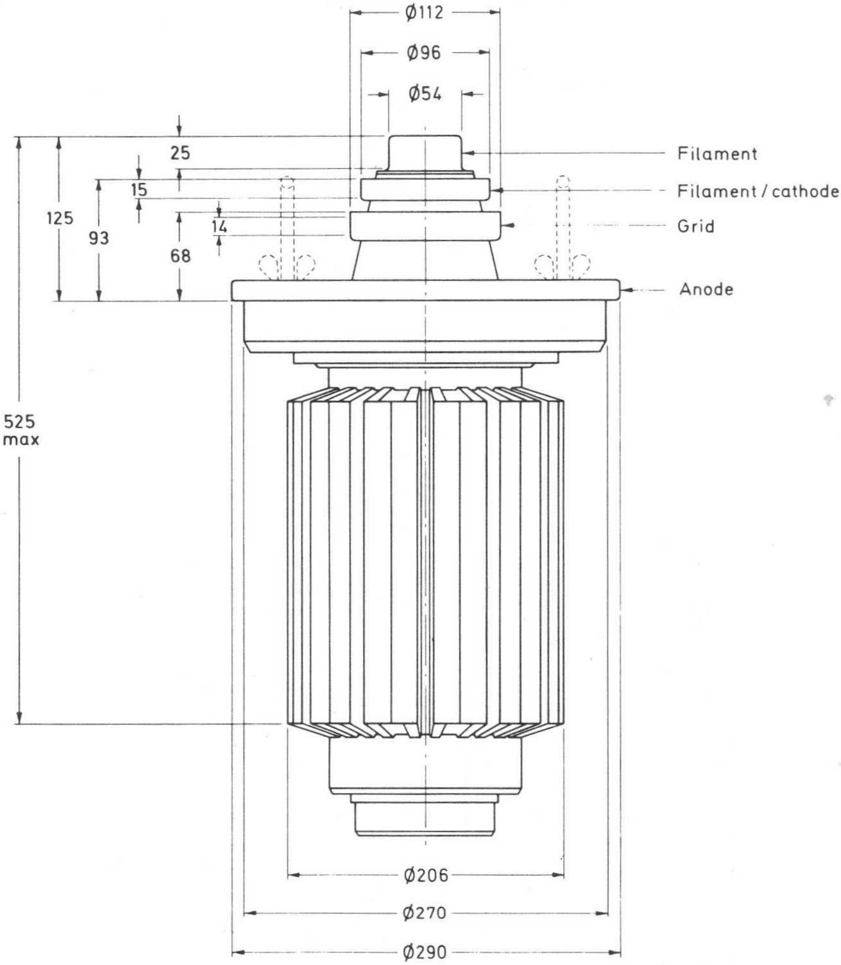
Filament connector	40695
Filament/cathode connector	40696
Filament cables (both required)	40716
	40717
Grid connector (YD1343)	40737
Grid connector f≤ 4MHz (YD1342)	40694
f > 4MHz (YD1342)	40737
Boiler-condenser (YD1343)	K738

OUTLINE DRAWING OF YD1342



When tube is used with anode up, the water connections should be interchanged.

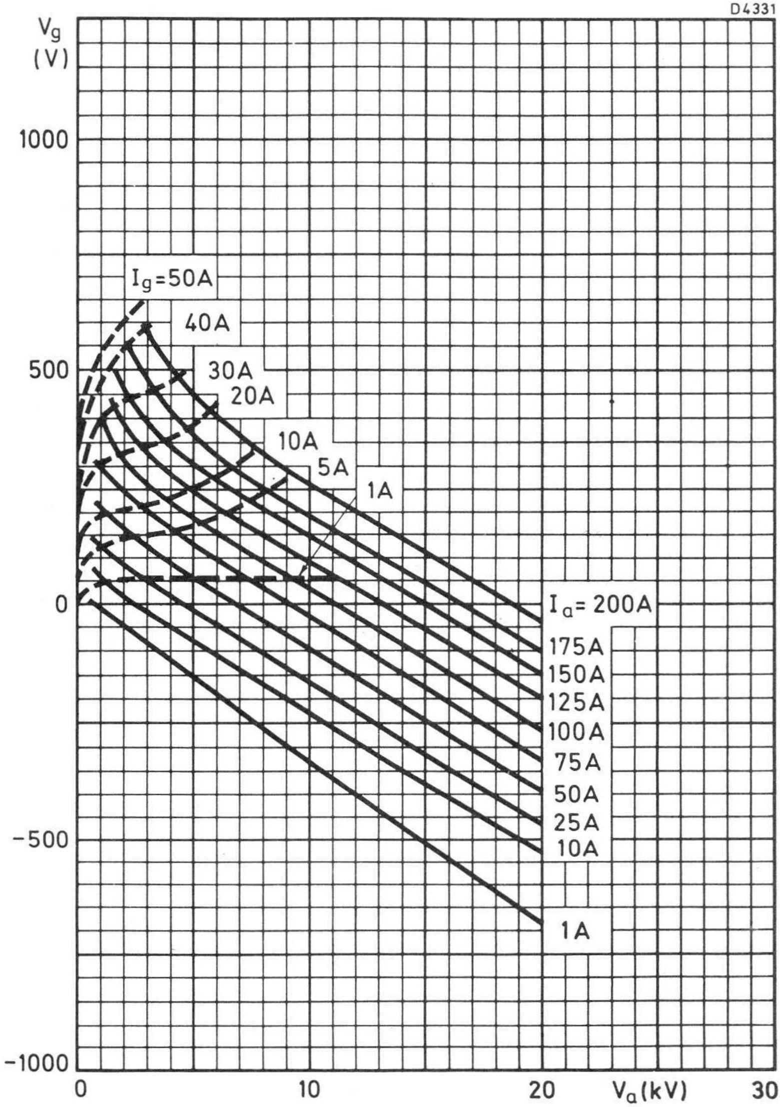
OUTLINE DRAWING OF YD1343



All dimensions in mm

D4330

The handles should be removed before switching on the tube.



Constant current characteristics

TRAVELLING-WAVE TUBE YH1172

Travelling-wave tube with a periodic permanent magnet mount designed for wide-band microwave link applications.

QUICK REFERENCE DATA

Frequency	7.0 to 8.0	8.0 to 8.5	GHz
Saturation output power at midband	22	17	W
Low-level gain at midband	45	42	dB
Interchangeability	plug-in focus, plug-in match		
Construction	unpackaged		
tube	glass-metal envelope, metal-ceramic base		
mount	periodic permanent magnet		
Cooling	conduction		

CATHODE : Dispenser type

HEATING : Indirect by A.C. or D.C.

When operated on D.C. the cathode must be connected to the positive side of the heater power supply.

Heater voltage	V_f		6.3	V ± 2%
Heater current at V_f = 6.3 V	I_f	approx.	1	A
Waiting time (Heating time before application of high voltage)	T_w	min.	2	min

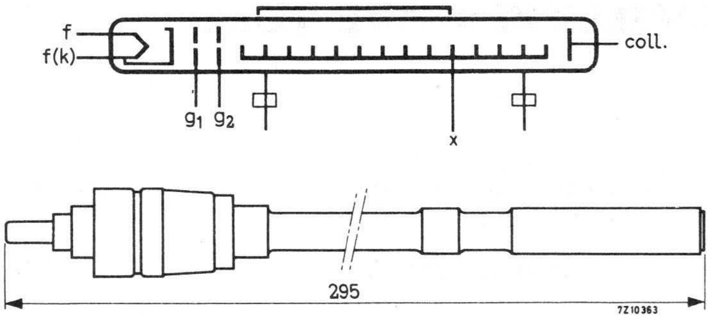
For shorter waiting time when the tube already has been in operation see "Application of voltages".

COOLING : By conduction. See also page 9.

MECHANICAL DATA Dimensions in mm

Mounting position: Any. See "Design and operating notes" under "Cooling"

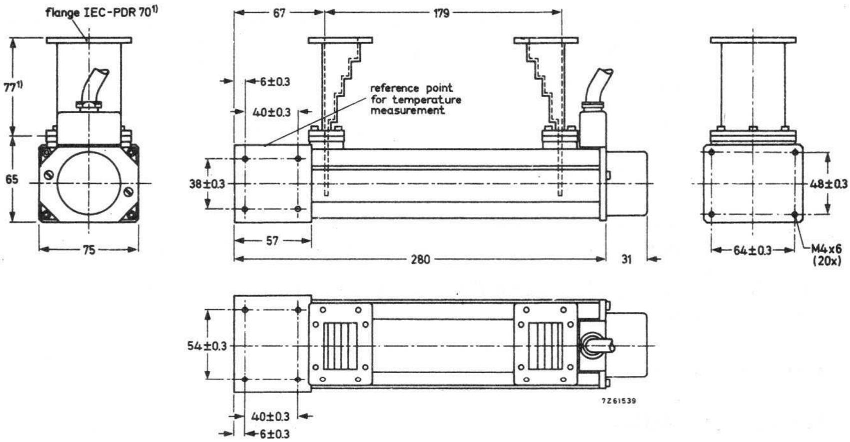
Weight of tube	approx.	60	g
Weight of mount	approx.	4.5	kg

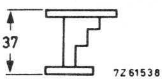


ACCESSORIES (to be ordered separately)

PPM mount for conduction cooling	type	55361
Waveguide taper (two required) to waveguide IEC-R70 (34, 85 x 15, 80 mm^2) with flange mating IEC-PDR70	type	55338
Waveguide taper (two required) to waveguide IEC-R84 (28, 50 x 12, 62 mm^2) with falnge mating IEC-UER84	type	55342

Mount with conduction (heatsink) cooling and waveguide tapers type 55338





Flange IEC-UER84

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1) Waveguide taper 55342

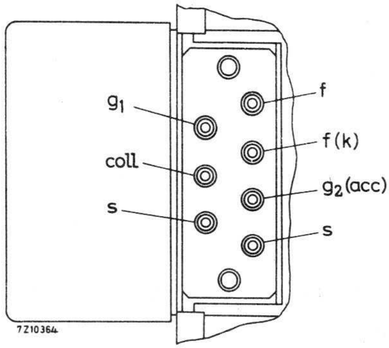
TRAVELLING-WAVE TUBE YH1172

Connections

The mount is provided with a cable with colour marked leads:

Heater/cathode	yellow
Heater	brown
Focusing electrode	green
Accelerator	blue
Helix	to be earthed via mount
Collector	red
Safety circuit (closed or opened, when putting on respectively off the mount cap)	two violet leads

Connections in cable housing



GENERAL CHARACTERISTICS

Frequency range	f	7.0 to 8.0	8.0 to 8.5	GHZ	
Saturation output power (CW)	W_{sat}	22	17	W	1)
Low-level gain	G	45	42	dB	2)
Gain at W_o = 15 W	G	41		dB	3)
at W_o = 10 W	G		39	dB	3)
Thermal noise factor at W_o = 15 W	F	24		dB	3)
at W_o = 10 W	F		24	dB	3)
AM to PM conversion at W_o = 15 W	k_p	3		^{o}/dB	3)
Cold match at input and output (f = 7.0 to 8.5 GHz)	V.S.W.R.		max. 1.5		4)

Mullard

TYPICAL OPERATION

(Voltages are specified with respect to the cathode)

Frequency	f			7.0		GHz
Output power	W_o		15	10	5	W
Helix voltage (adjusted for optimum gain)	V_x	approx.	3100	3000	2950	V
Collector voltage	V_{coll}		1500	1450	1300	V
Focusing electrode voltage	V_{g1}		−6	−6	−6	V
Collector current	I_{coll}		55.0	52.5	52.5	mA
Gain	G		42	43	45	dB
Accelerator voltage 6)	V_{g2}	approx.	2050	2000	2000	V
Accelerator current	I_{g2}		<0.1	<0.1	<0.1	mA
Helix current (plug-in focus)	I_x		1.0	0.7	0.5	mA
Thermal noise factor	F		24	24	22	dB
AM to PM conversion	k_p		3.0	2.5	1.5	°/dB

Frequency	f			8.0		GHz
Output power	W_o		15	10	5	W
Helix voltage (adjusted for optimum gain)	V_x	approx.	3050	2950	2900	V
Collector voltage	V_{coll}		1500	1450	1300	V
Focusing electrode voltage	V_{g1}		−6	−6	−6	V
Collector current	I_{coll}		55.0	52.5	52.5	mA
Gain	G		39	40	43	dB
Accelerator voltage 6)	V_{g2}	approx.	2050	2000	2000	V
Accelerator current	I_{g2}		<0.1	<0.1	<0.1	mA
Helix current (plug-in focus)	I_x		1.0	0.7	0.5	mA
Thermal noise factor	F		24	24	22	dB
AM to PM conversion	k_p		3.0	2.5	1.5	°/dB

Frequency	f		8.5		GHz
Output power	W_o		10	5	W
Helix voltage (adjusted for optimum gain)	V_x	approx.	2900	2900	V
Collector voltage	V_{coll}		1450	1300	V
Focusing electrode voltage	V_{g1}		−6	−6	V
Collector current	I_{coll}		52.5	52.5	mA
Gain	G		37	40	dB
Accelerator voltage 6)	V_{g2}	approx.	2000	2000	V
Accelerator current	I_{g2}		<0.1	<0.1	mA
Helix current (plug-in focus)	I_x		0.7	0.5	mA
Thermal noise factor	F		24	22	dB
AM to PM conversion	k_p		2.5	1.5	^{o}/dB

LIMITING VALUES (Absolute maximum rating system)

(Voltages are specified with respect to the cathode unless otherwise specified)

Focusing electrode voltage	$-V_{g1}$	min.	0	V
		max.	50	V
Accelerator voltage	V_{g2}	max.	2700	V
Helix voltage	V_x	max.	3300	V
Collector to helix voltage	V_{coll-x}	max.	2500	V
Cathode current	I_k	max.	58	mA
Accelerator current	I_{g2}	max.	0.3	mA
Helix current	I_x	max.	3	mA
R.F. input level	W_i	max.	100	mW
Collector dissipation at $t_{amb} = 65\,^oC$ $I_{coll} \times V_{coll} - W_o$	W_{coll}	max.	90	W
Power reflected from load		max.	2	W 5)
Cooler temperature at reference point	t	max.	150	^oC

1) Typical values measured at $f = 7.5$ GHz, $I_{coll} = 55$ mA, or $f = 8.3$ GHz, $I_{coll} = 52.5$ mA respectively, W_i and V_x optimally adjusted for saturation output power.

2) Typical values measured at $f = 7.5$ GHz, $I_{coll} = 55$ mA, or $f = 8.3$ GHz, $I_{coll} = 52.5$ mA respectively, $W_o < 1$ W, V_x optimally adjusted for low level gain.

3) Typical value measured at $f = 7.5$ GHz, $I_{coll} = 55$ mA, or $f = 8.3$ GHz, $I_{coll} = 52.5$ mA respectively, V_x adjusted for optimum gain.

4) Measured on the cold tube, i.e. with the beam switched off and without use of any matching device (plug-in match).

5) To avoid overheating of the helix.

6) To be adjusted for indicated collector current.

DESIGN AND OPERATING NOTES

1. INSTALLATION OF THE MOUNT

Two main methods may be discerned:

a) Fixing the mount relative to the microwave circuit by only connecting the waveguide tapers to the input and output sides of the circuit.
b) Employing a) and establishing additional support by fastening the mount to the rack with clamps. In this case it is recommended to use a short piece of flexible waveguide at the input and output sides to prevent excessive strain on the mount via the tapers, unless very careful alignment of the waveguides can be assured.

Possible forces on the waveguides must not produce a moment greater than 2 mkg at the flanges.

1.1 Mount

The mount has no movable parts. If clamps are used (method b) the slightly larger dimensions of the cooler as compared to the main part of the mount must be considered.

1.2 Magnetic shielding

The periodic permanent magnet is completely shielded. This implies that no additional measures need be taken to prevent the magnetic properties of the mount from being affected by external magnetic fields. The mount will not influence surrounding equipment which is susceptible to stray magnetic fields. Several mounts may be placed side by side without disturbing the focusing qualities. Isolators may be installed quite near to the mount.

Warning

If any part of the shielding is removed, the magnetic properties of the mount may be disturbed irreversibly.

2. INSTALLATION OF THE TUBE

Unlock the mount cap (see outline drawing) by turning it slightly counterclockwise. The cap can then easily be removed, and the tube inserted by carefully pushing it in.
Finally put the cap on the mount again, and lock by turning it clockwise.
These instructions also apply (in the reverse order) for taking the tube out of the mount.

3. SAFETY

The supply voltages are fed to the tube via the mount cap. When the cap is unlocked all voltages are removed from the tube. The two violet leads can be incorporated into an additional safety circuit which switches the voltages off at the power supply if the cap is unlocked. Thus the voltages can also be removed from the mount.

The mount should always be earthed.

4. POWER SUPPLY

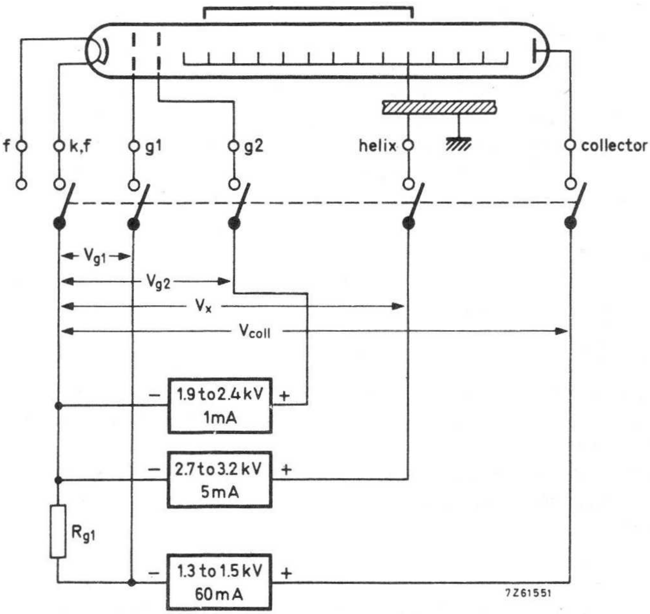
An example of a supply circuit for 5, 10 and 15 W operation is given in the figure.

Design ranges for the power supply
(electrode voltages with respect to cathode)

	Min.	Max.	
Accelerator voltage	1900	2400	V
Accelerator current		0.3	mA
Helix voltage	2700	3200	V 1)
Helix current		3	mA

The collector voltage is set at a fixed voltage dependent on the output power level.

Output power level	W_o	5	10	15	W_{sat}	W
Collector voltage	V_{coll}	1300	1450	1500	1700	V
Collector current	I_{coll}	52.5	52.5	55.0	52.5/55.0	mA
Focusing electrode voltage	V_{g_1}	-6	-6	-6	-6	V



1) At saturation the helix voltage may reach 3300 V.

5. COOLING

Tube and mount need no artificial means of cooling. Natural cooling of the collector has been made possible by depression of the collector potential with respect to the helix and by ensuring adequate heat transfer from the collector to the environment.

Under typical operating conditions and at an ambient temperature of not more than 65 °C, the cooler temperature at the reference point (see drawing) is well below the limit, provided an aluminium heatsink of 300 mm x 300 mm x 6 mm is mounted on one of the cooler surfaces. The heatsink is best fixed with its centre coinciding with that of the cooler, and in a vertical position. The mount itself may have any position in the equipment.
Other heatsink configurations may be employed. It will then be necessary to check the temperatures reached at the reference point under extreme conditions e.g. 65°C ambient temperature.

6. APPLICATION OF VOLTAGES

6.1 Switching-on procedure for new tubes

6.1.1 Apply the heater voltage for the specified waiting time.
6.1.2 Apply the rated voltages to the collector, the helix, the accelerator (and in case of a separate supply to the focusing electrode) simultaneously (see Remarks).
6.1.3 Adjust the accelerator voltage to obtain the collector current of 52.5 or 55.0 mA.
6.1.4 Apply the R.F. input signal, adjust the level to obtain the required output power while simultaneously adjusting the helix voltage for optimum gain.

6.2 Readjustment during life

During life the collector current may decrease.
A readjustment of the accelerator voltage to obtain I_{coll} = 52.5 (55.0) mA will then be necessary.

6.3 Switching-off procedure

All voltages should be switched off simultaneously.
If this is not feasible, do as described under "Remarks".

6.4 Switching-on procedure after interruption of voltage (also see the Remarks)

6.4.1 Interruption of less than 40 s:
Switch on all voltages simultaneously.
6.4.2 Interruption of more than 40 s but less than 1 week:
Apply the heater voltage for min. 40 s, then apply all other voltages simultaneously.

6.4.3 Interruption of more than 1 week:
Apply the heater voltage for the specified waiting time of 2 min.
Apply all other voltages simultaneously.

Remarks

When the voltages cannot be switched simultaneously all the cathode current may flow to the accelerator or the helix. If this condition lasts for more than 10 ms, it may cause permanent damage to the tube. The remedy is to switch the accelerator voltage on after the other electrode voltages, or off before the other electrode voltages.

7. INPUT AND OUTPUT CIRCUIT AND GROUP DELAY

In order to avoid phase distortions due to long-line effect, the insertion of an isolator between tube and antenna, and another between tube and pre-stage is strongly recommended. The isolators should be positioned as close to the tube as possible.
If isolators with a V.S.W.R. of less than 1.05 are used at a short distance from the tube, the reflections result in a variation of the group delay of less than 0.2 nanoseconds over a band of 20 MHz.

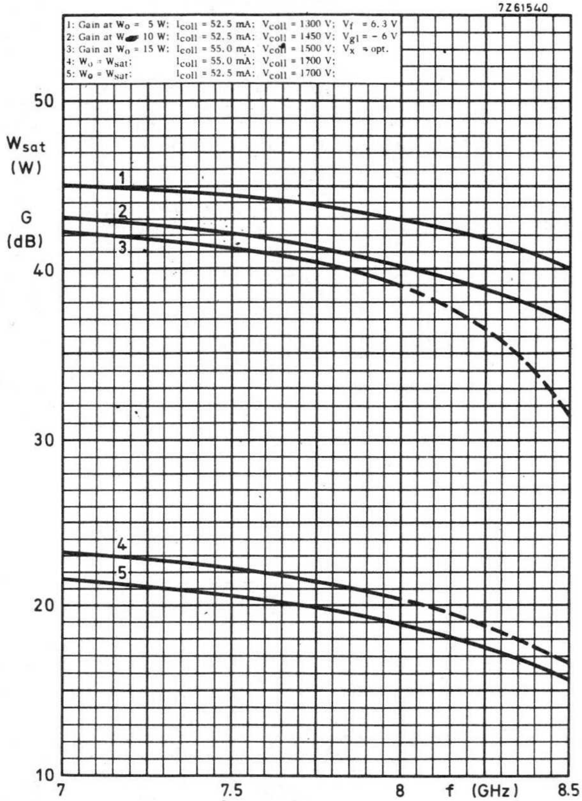
It may be noted that the difference between the voltage reflection coefficients of the hot and the cold (i.e. with respectively without electron beam) tube is less than 0.2 for the input as well as the output side, measured at an output power level of 5 W or more.

8. ENVIRONMENTAL CONDITIONS

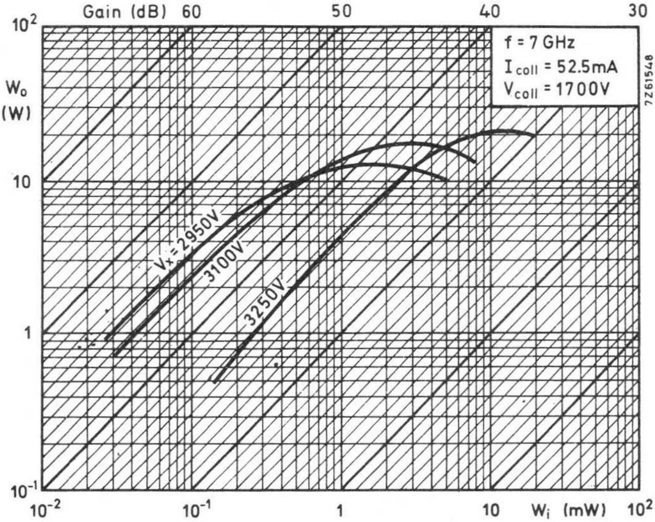
Ambient temperature,

storage	t_{amb}	min.	-60	°C
		max.	+65	°C
operation	t_{amb}	min.	-30	°C
		max.	+65	°C
Relative humidity			0 to 95	%

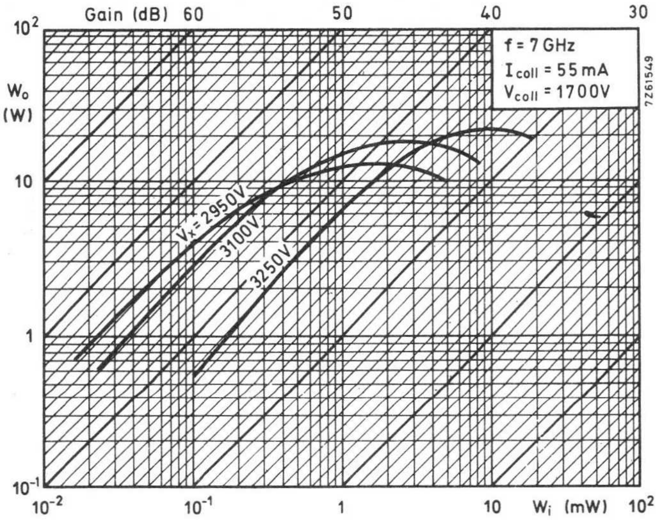
The tube and mount resist fungus attack.



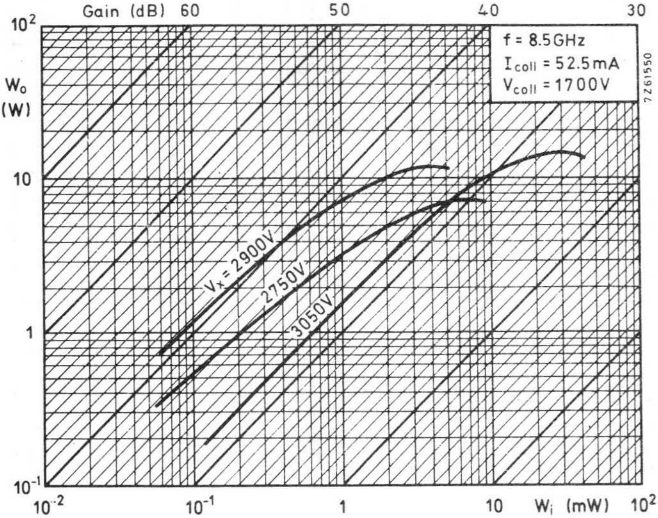
Gain and saturation power = f (frequency)



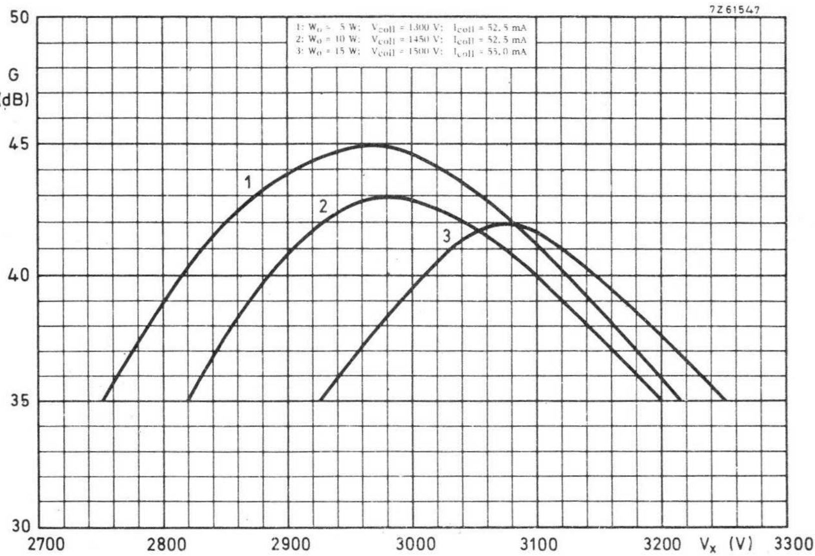
Output power = f (input power)



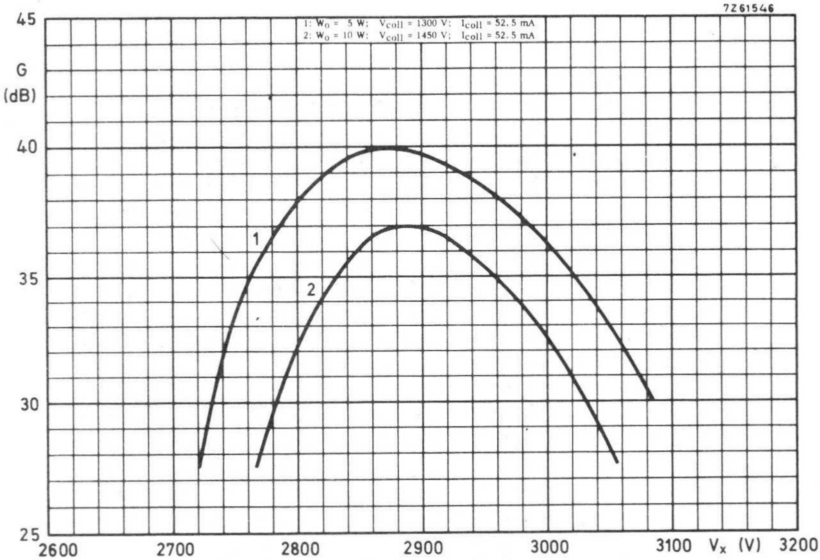
Output power = f (input power)



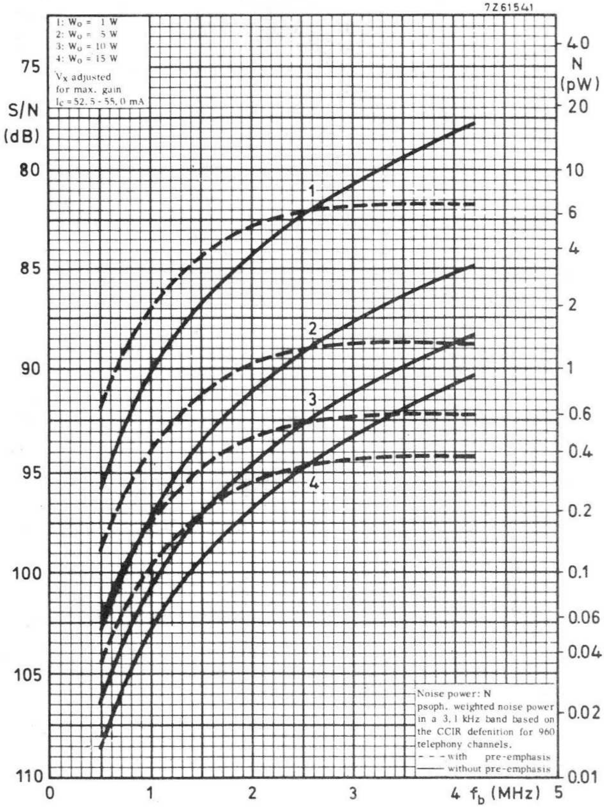
Output power = f (input power)



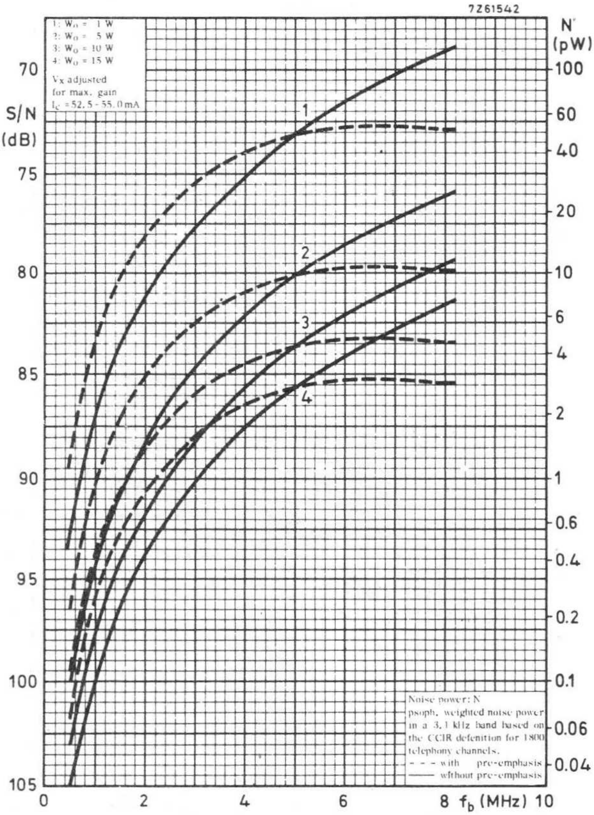
Gain = f (helix voltage); f = 7.0 GHz



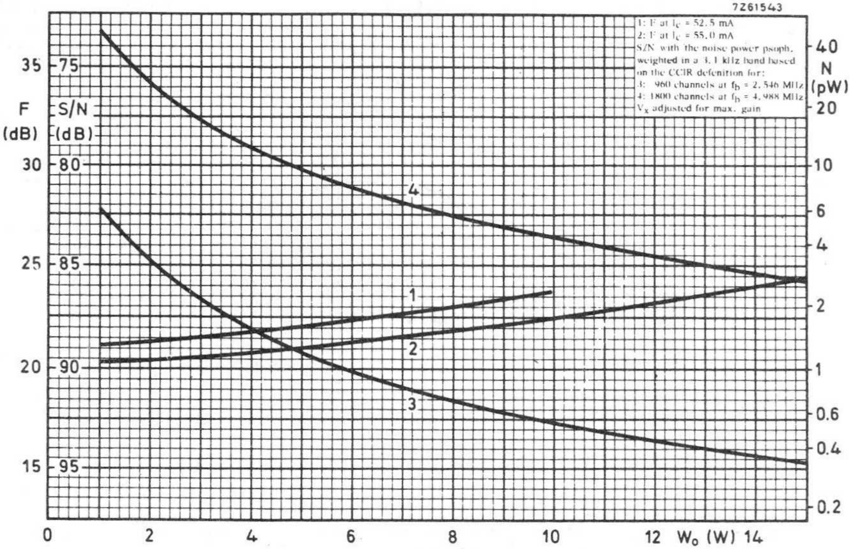
Gain = f (helix voltage); f = 8.5 GHz



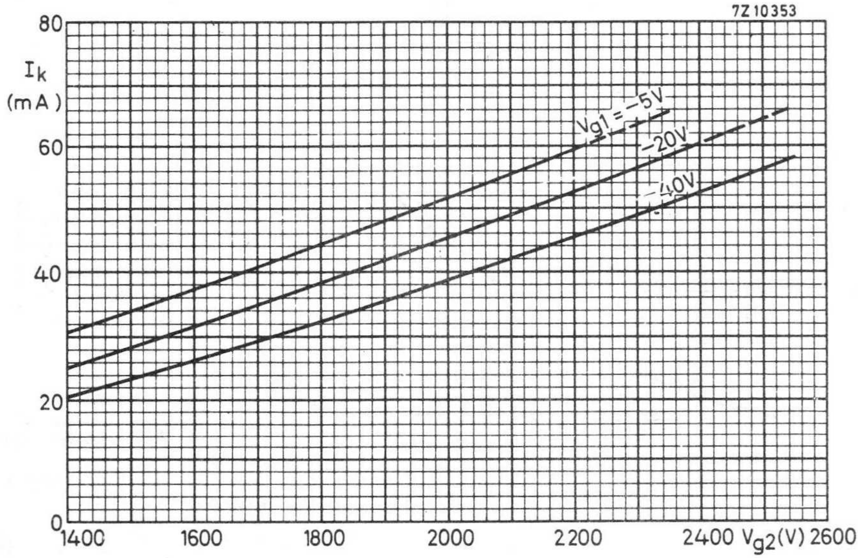
Signal to noise ratio (FM) = f (baseband freq.) at f = 7 GHz



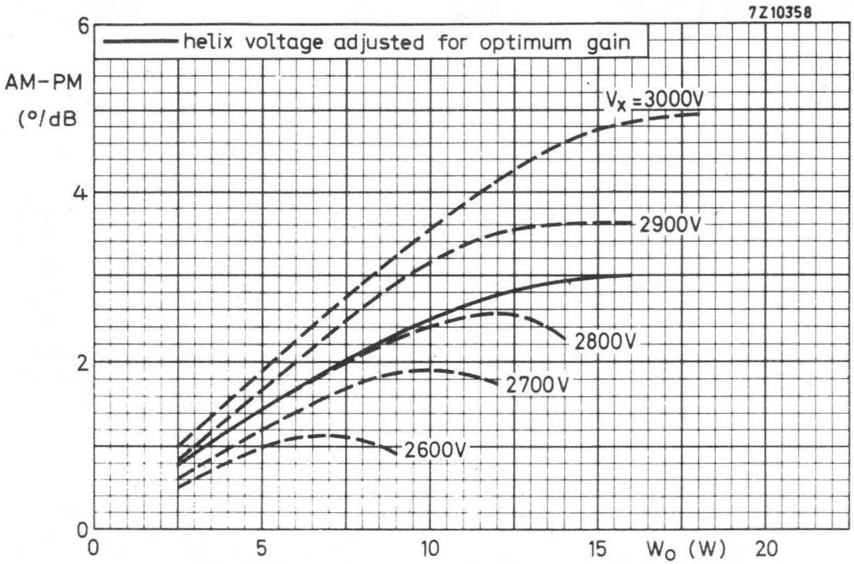
Signal to noise ratio (FM) = f (baseband freq.) at f = 7 GHz



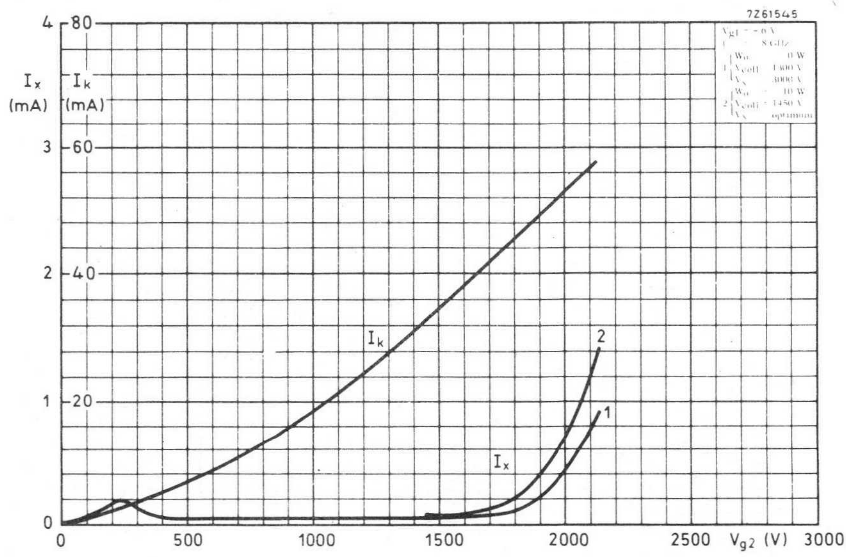
Thermal noise (FM) = f (output power) at 7 GHz



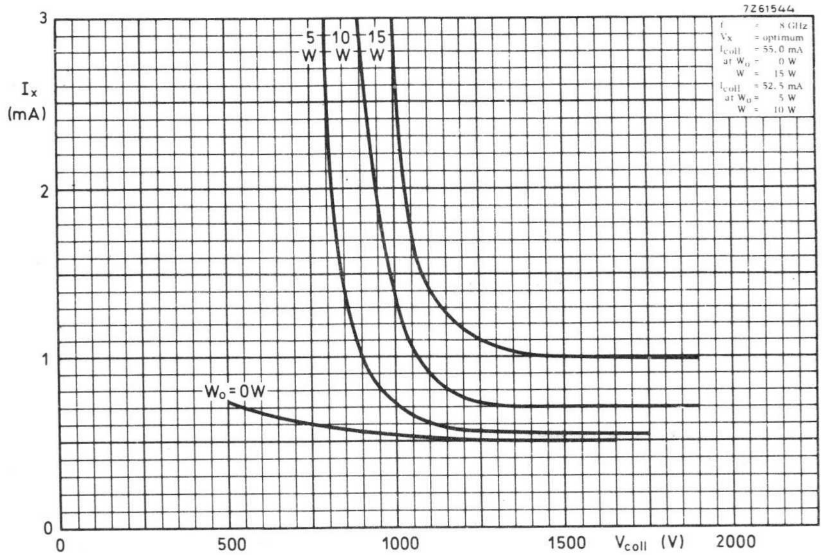
Cathode current = f (accelerator voltage)



AM to PM conversion = f (output power) at f = 7 GHz



Cathode current and helix current = f (accelerator voltage)



Helix current = f (collector voltage)

V.H.F. TETRODE

YL1470

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as final amplifier in F.M. transmitters in band II in grounded cathode circuits.

QUICK REFERENCE DATA			
Frequency (MHz)	H.F. Class B amplifier		
	V_a (kV)	W_ℓ (kW)	Power gain
110	6	6,6	200
	7	11	220

HEATING : Direct; filament thoriated tungsten, mesh type

Filament voltage	V_f	6,3	V	5 %
Filament current	I_f	120	A	
Filament peak starting current	I_{f_p} max.	750	A	
Cold filament resistance	R_{f_o}	6	mΩ	
Waiting time	T_w min.	1	s	

CAPACITANCES

Input	$C_{g_1(a)}$	87	pF
Output	$C_{a(g_1)}$	20	pF
Anode to grid no.1	C_{ag_1}	0,5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid no.2 voltage	V_{g2}	600	V
Anode current	I_a	1,2	A
Transconductance	S	30	mA/V
Amplification factor	$\mu_{g_2g_1}$	7,2	-

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env} max.	240	^oC
Recommended max. seal temperature	t max.	200	^oC

COOLING

In order to keep the temperature of the seals below the maximum permissible value, it may be necessary to direct an air flow to the seals.

Anode cooling: see cooling curves.

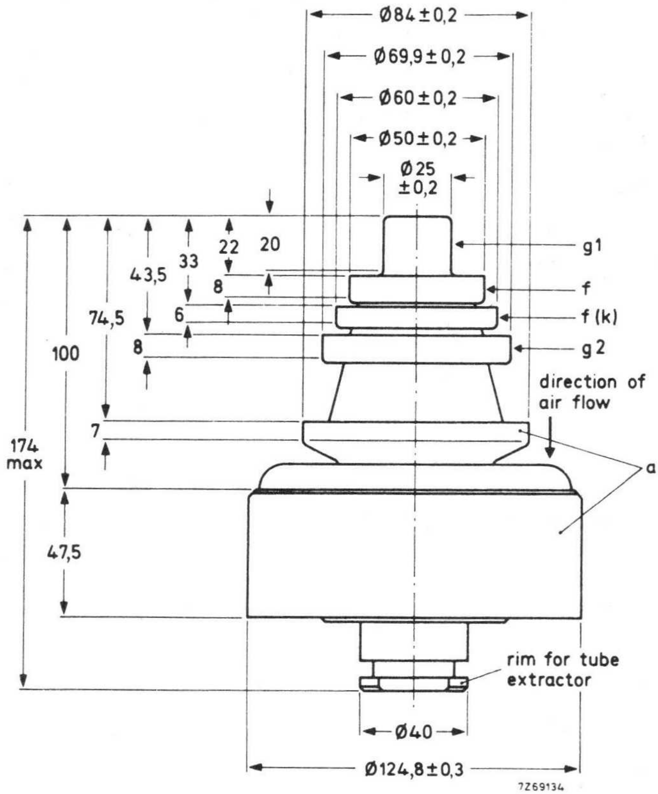
Direction of air flow: see outline drawing.

MECHANICAL DATA

Dimensions in mm

Net weight : approx. 3,1 kg

Mounting position: vertical with anode up or down.



ACCESSORIES

Insulating pedestal	type	40630

V.H.F. TETRODE YL1470

R.F. CLASS B AMPLIFIER

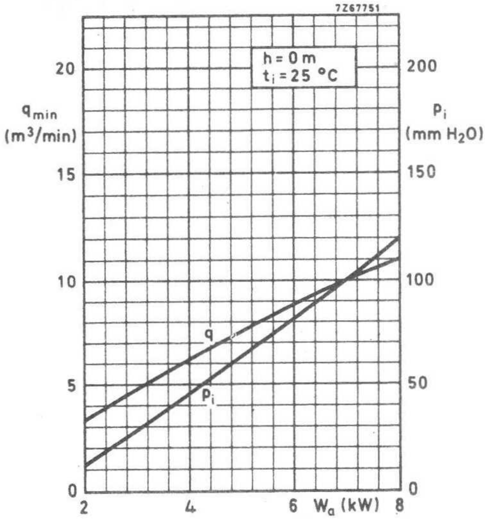
LIMITING VALUES (Absolute max. rating system)

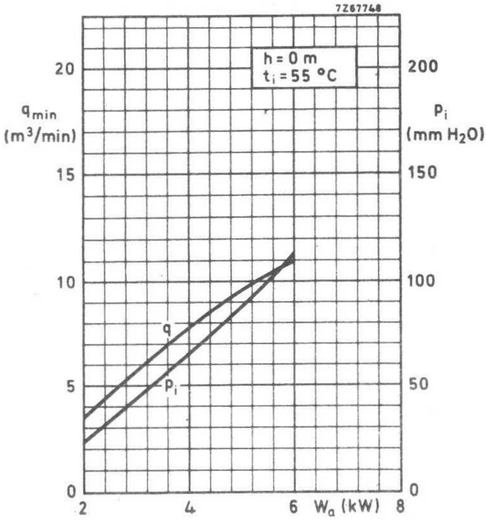
Frequency	f	up to	110	MHz
Anode voltage	V_a	max.	8,5	kV
Grid no.2 voltage	V_{g2}	max.	1	kV
Grid no.1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	8	kW
Grid no.2 dissipation	W_{g2}	max.	80	W
Grid no.1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

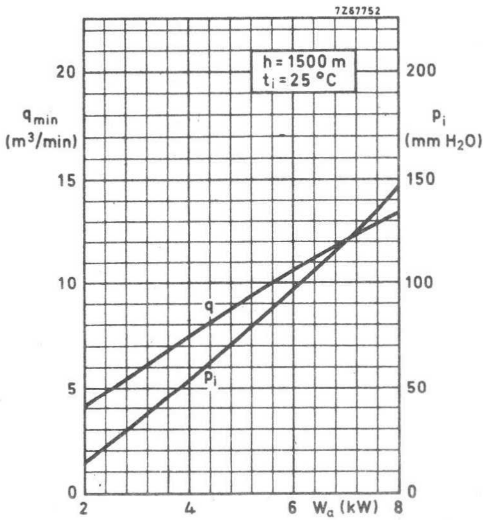
OPERATING CONDITIONS grounded cathode

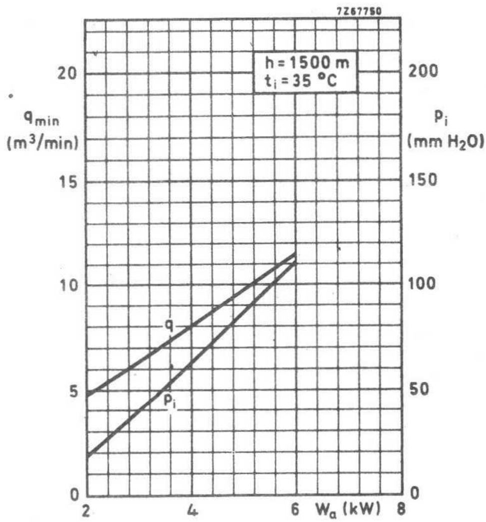
Frequency	f	110	110	MHz	
Anode voltage	V_a	7	6	kV	
Grid no.2 voltage	V_{g2}	600	500	V	
Grid no.1 voltage	V_{g1}	-120	-90	V	[1]
Anode current, no signal condition	I_a	200	200	mA	
Anode current	I_a	2,3	1,5	A	
Grid no.2 current	I_{g2}	80	85	mA	
Grid no.1 current	I_{g1}	150	90	mA	
Anode input power	W_{ia}	16,1	9	kW	
Anode dissipation	W_a	5	2,1	kW	
Output power in load	W_ℓ	11	6,6	kW	
Efficiency, total	η	68	78	%	
Driving power	W_{dr}	50	22	W	
Power gain	$\frac{W_\ell}{W_{dr}}$	220	300		

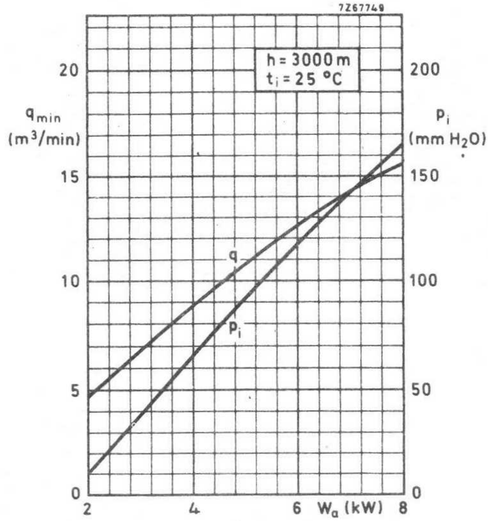
[1]) To be adjusted for the stated no signal-anode current.

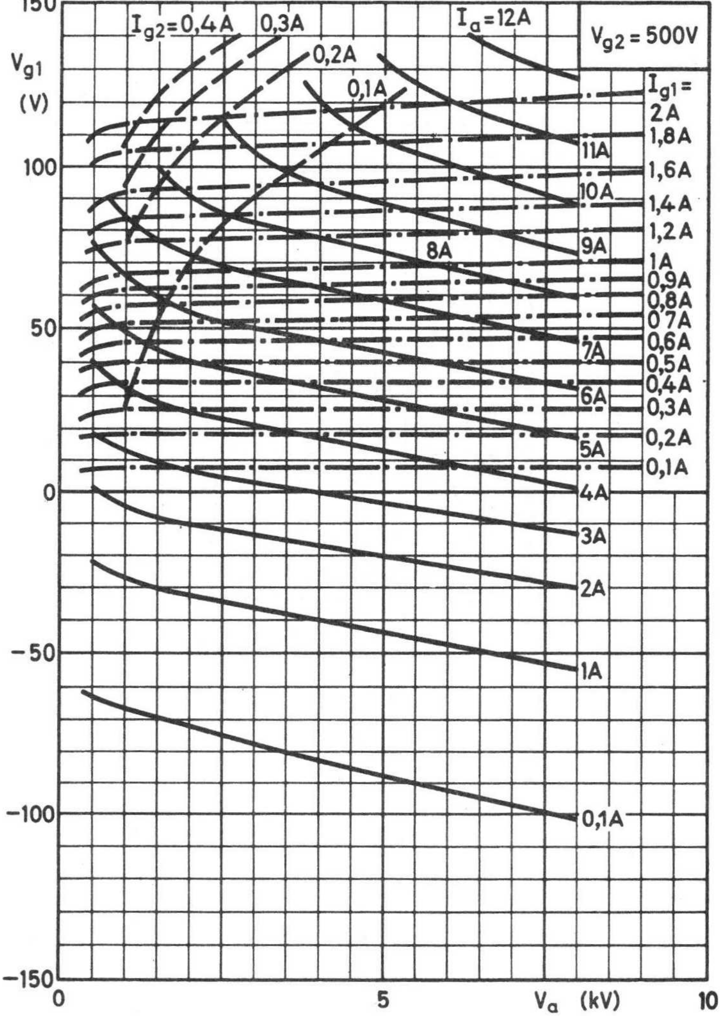

7Z67751
h = 0 m
t_i = 25 °C
q_{min} (m^3/min)
p_i (mm H_2O)
q
p_i
W_a (kW)

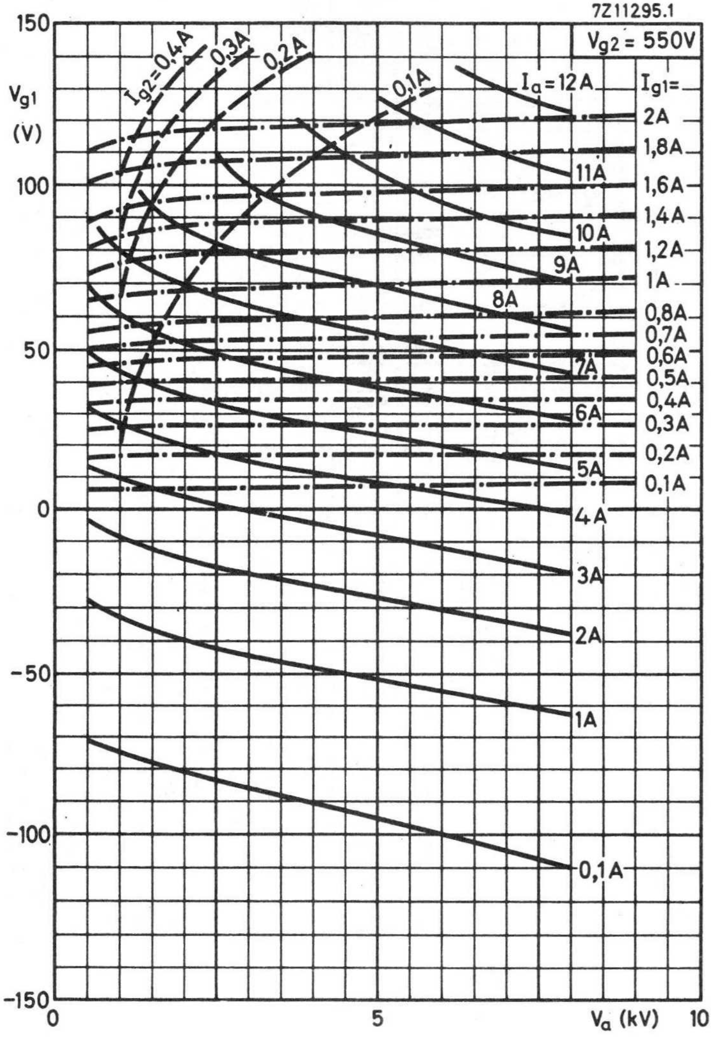

7Z67748
h = 0 m
t_i = 55 °C
q_{min} (m^3/min)
p_i (mm H_2O)
q
p_i
W_a (kW)

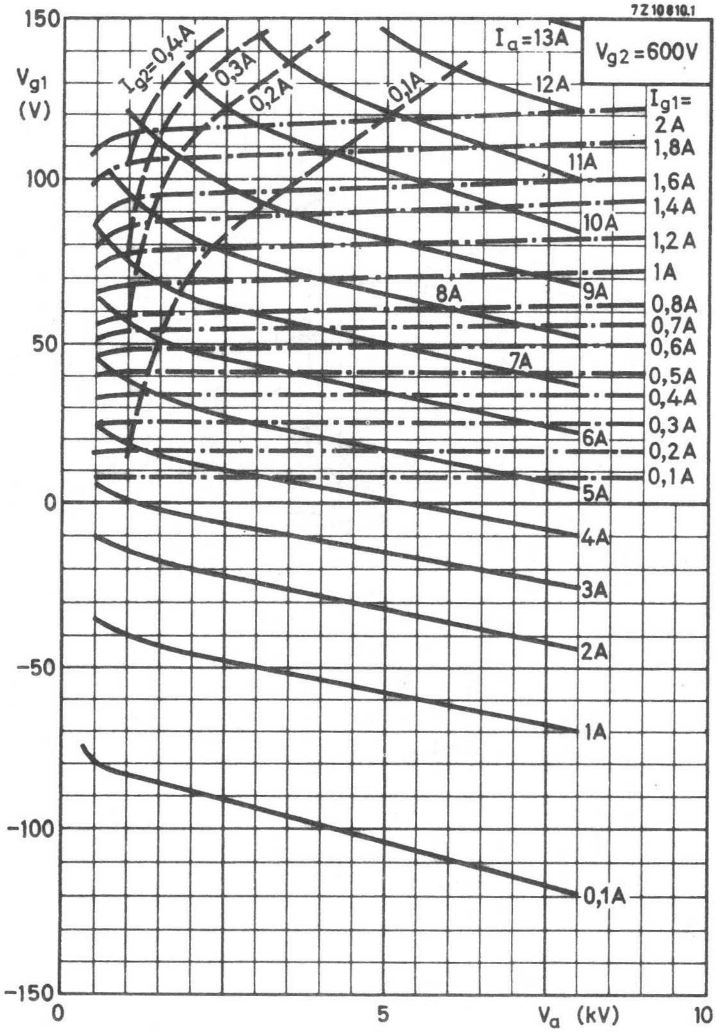

7Z67752
h = 1500 m
t_i = 25 °C
q_{min} (m^3/min)
p_i (mm H_2O)
q
p_i
W_a (kW)


7Z67750
h = 1500 m
t_i = 35 °C
q_{min} (m^3/min)
p_i (mm H_2O)
q
p_i
W_a (kW)

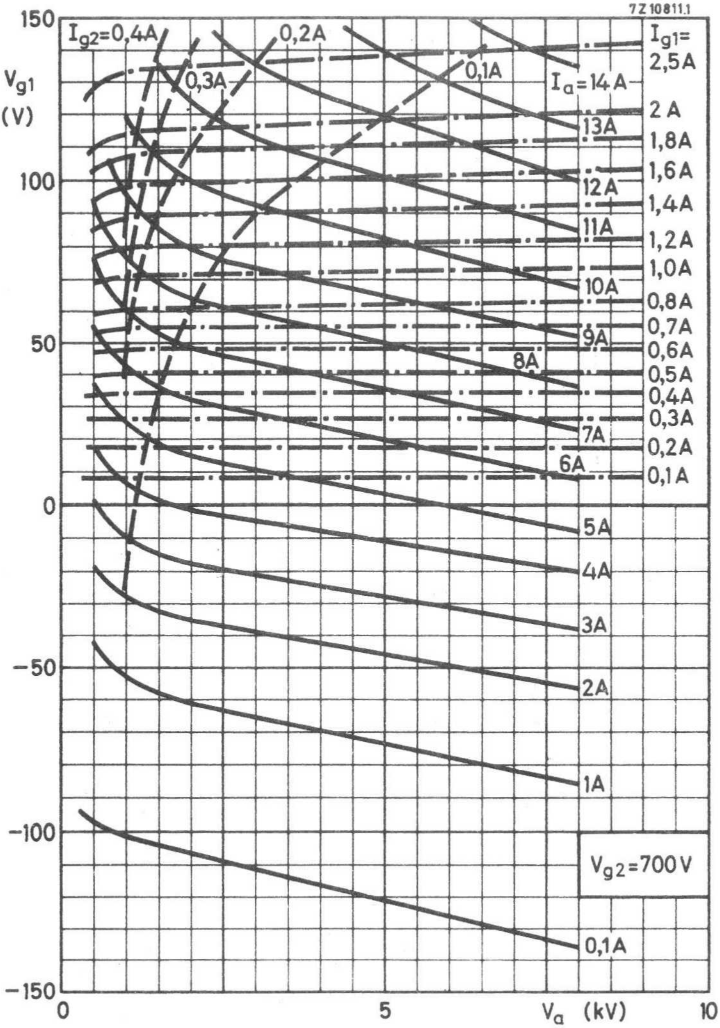

7Z67749
h = 3000 m
t_i = 25 °C
q_{min} (m^3/min)
p_i (mm H_2O)
q
p_i
20
15
10
5
0
200
150
100
50
0
2
4
6
W_a (kW)
8


7Z10809.1
150
100
50
0
−50
−100
−150
V_{g1}
(V)
I_{g2}=0,4A
0,3A
0,2A
0,1A
I_a=12A
V_{g2} = 500V
I_{g1} =
2A
1,8A
1,6A
1,4A
1,2A
1A
0,9A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3A
0,2A
0,1A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
0
5
V_a (kV)
10


7Z11295.1
V_{g2} = 550V
V_{g1} (V)
150
100
50
0
-50
-100
-150
0
5
10
V_a (kV)
I_{g2}=0,4A
0,3A
0,2A
0,1A
I_a=12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
I_{g1}=
2A
1,8A
1,6A
1,4A
1,2A
1A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3A
0,2A
0,1A



7Z10810.1
V_{g2} = 600V
I_a = 13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
I_{g1} =
2 A
1,8A
1,6A
1,4A
1,2 A
1A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3 A
0,2 A
0,1 A
I_{g2} = 0,4A
0,3A
0,2A
0,1A
V_{g1} (V)
150
100
50
0
-50
-100
-150
0
5
10
V_a (kV)


7Z10811.1
150
100
50
0
−50
−100
−150
V_{g1} (V)
0
5
10
V_a (kV)
I_{g2}=0,4A
0,3A
0,2A
0,1A
I_a=14A
13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
I_{g1}=
2,5A
2 A
1,8A
1,6A
1,4A
1,2A
1,0A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3A
0,2A
0,1A
V_{g2}=700V

TRAVELLING-WAVE TUBE YH1090

QUICK REFERENCE DATA

The YH1090 travelling-wave tube has a periodic permanent magnet mount designed for wide-band microwave link applications.

Frequency	3.4 to 4.2	GHz
Saturation power output (at mid-band)	25	W
Gain (low-level)	42	dB
Construction: Tube	Glass to metal envelope and metal to ceramic base	
Mount	Periodic permanent magnet	

To be read in conjunction with
GENERAL OPERATIONAL RECOMMENDATIONS - MICROWAVE DEVICES

TYPICAL OPERATION

Operating conditions

Frequency	3.6	3.6	3.6	4.0	4.0	4.0	GHz
Collector voltage	1.5	1.3	1.1	1.5	1.3	1.1	kV
Collector current	60	60	60	60	60	60	mA
*Helix voltage	2.25	2.2	2.15	2.15	2.1	2.05	kV
Helix current (plug-in focus)	0.3	0.3	0.2	0.3	0.3	0.2	mA
Focusing electrode voltage	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	V
Accelerator voltage	1.55	1.55	1.55	1.55	1.55	1.55	kV
Accelerator current	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mA
Gain	38	40	41	38	40	41	dB
Power output	15	10	5.0	15	10	5.0	W
Thermal noise factor	24	21.5	20.5	24	21.5	20.5	dB
AM to PM conversion	3.0	2.5	1.5	3.0	2.5	1.5	deg/dB

*Adjusted for optimum gain

CHARACTERISTICS

Frequency	3.4 to 4.2	GHz
Gain (P_{out} = 15W)	38	dB
Low-level gain	42	dB
Thermal noise factor (P_{out} = 15W)	24	dB
Saturation power output (CW)	25	W
Cold match at input and output v.s.w.r. max.	1.5:1	
AM to PM conversion (P_{out} = 15W)	3.0	deg/dB

CATHODE

Indirectly heated, dispenser type

Heater voltage	6.3 ± 2%	V
Heater current (V_h = 6.3V)	1.0	A
Heating time min.	2.0	minutes

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Collector to helix voltage max.	2.5	kV
Collector dissipation (T_{amb} = 65°C) max.	90	W
Cathode current max.	65	mA
Helix voltage max.	2.7	kV
Helix current max.	3.0	mA
*Focusing electrode voltage max.	-50	V
Accelerator voltage max.	2.0	kV
Accelerator current max.	0.3	mA
R.F. input level max.	200	mW
Power reflected from load max.	2.0**	W
Cooler temperature at reference point max.		
mount type 55329	140	°C
mount type 55332	150	°C

*Care must be taken to ensure that the focusing electrode potential never becomes positive with respect to the cathode.

**Overheating of the helix will occur if the maximum stated value is exceeded.

MOUNTING POSITION — Any

COOLING — Natural

Two mounts are available for either convection or conduction.
See under "Accessories".

PHYSICAL DATA

Weight of tube approx.	60	g
Weight of mount approx.	4.5	kg

ACCESSORIES

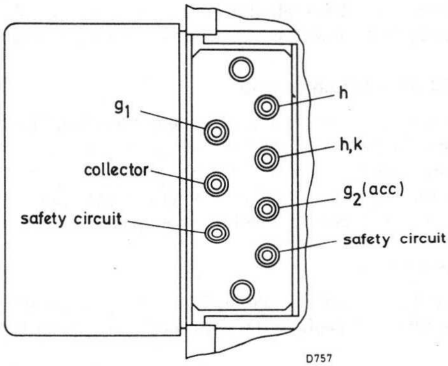
PPM mount for convection cooling	55329
PPM mount for conduction cooling	55332
Waveguide taper to waveguide IEC-R40 (WG11A.WR229) with flange IEC-UER40)	2 × 55330
Waveguide taper to waveguide IEC-F40 with flange IEC-UGF40	2 × 55333
Clamp for fastening of mount	2 × 55331

CONNECTIONS

The mount is supplied with coloured flying leads.

Heater	Brown
Heater/cathode	Yellow
Focusing electrode	Green
Accelerator	Blue
Helix	Earthed via mount
Collector	Red
Safety circuit (opened or closed when removing or replacing the mount cap)	2 Violet leads

Connections in the cable housing



OPERATING NOTES

Due to normal production spreads the design parameters will vary around the nominal values stated.

1. **Safety recommendations**

The supply voltages are applied to the tube via the mount cap. When the cap is unlocked all voltages are isolated from the tube.
The mount must be earthed.
The two violet leads can be incorporated into an additional safety circuit which switches off the applied voltages at the power supply if the cap is unlocked. Thus the mount may also be isolated.

2. **Magnetic shielding**

No additional measures are necessary to prevent the magnetic properties of the mount from being affected by external magnetic fields. Several mounts may be placed side by side without disturbing the focusing quality.

WARNING: The mount shielding should not be removed as this may permanently affect the focusing.

3. **Installing the mount**

Two methods may be employed:

(a) Attaching the mount to the microwave circuitry by the waveguide tapers alone.

(b) Using method (a) plus establishing additional support by fastening the mount to the rack with two 55331 clamps. When using this method, insert a short piece of flexible waveguide at the input and output side to prevent excessive strain on the mount via the tapers, unless the waveguide components are accurately aligned. Forces on the mount must not give a moment at the flanges greater than 2kgf m.

3.1 **Mount 55329 (Convection cooled)**

The mount must not rest on parts A or B of the cooler (see page 7). Part A should always be freely moveable and must be handled carefully.
Under conditions of operation at ambient temperatures greater than 65°C additional cooling by a low-velocity air flow may be required. It is recommended that the temperature at the reference point be checked. (See page 7.)

3.2 **Mount 55332 (Conduction cooled)**

If clamps are used (method b) it should be noted that the cooler dimensions are slightly larger than the body of the mount. An aluminium heatsink 300 × 300 × 6mm should be mounted on one of the cooler surfaces with its centre in contact with the cooler and in a vertical position. The temperature at the reference point should be checked. (See page 7.)

4. **Installing the tube**

Unlock the mount cap by turning it a few degrees anti-clockwise. Carefully insert the tube and replace the cap. Lock the cap by turning it clockwise.

OPERATING NOTES (contd.)

5. **Application of voltages**

Apply the heater voltage for the specified waiting time.
Apply the rated voltage to the collector, approximately 2.2kV to the helix and 1.5kV to the accelerator simultaneously. (See note.)
Adjust the accelerator voltage to obtain a collector current of 60mA.
Apply the r.f. input signal, adjust the level to obtain the required output power while simultaneously adjusting the helix voltage for optimum gain.

5.1 **Switching-off**

All voltages should be switched off simultaneously. (See note.)

5.2 **Switching-on after interruption of voltage**

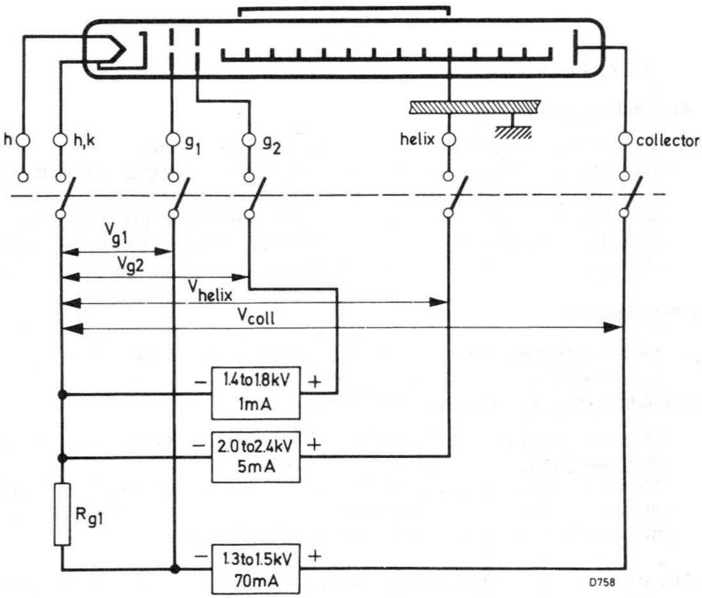
When the interruption is less than 40 seconds all voltages may be switched on simultaneously.
When the interruption is greater than 40 seconds but less than 1 week apply the heater voltage for a minimum time of 40 seconds (more than 1 week, 2 minutes) then apply all other voltages simultaneously.

NOTE: If the voltages cannot be applied simultaneously all the cathode current may flow to the accelerator or the helix. This condition must not last for more than 10ms, otherwise permanent damage will be caused to the tube. To avoid such damage, switch the accelerator voltage on after the other electrode voltages, or off before the other electrode voltages.

6. **Power supply**

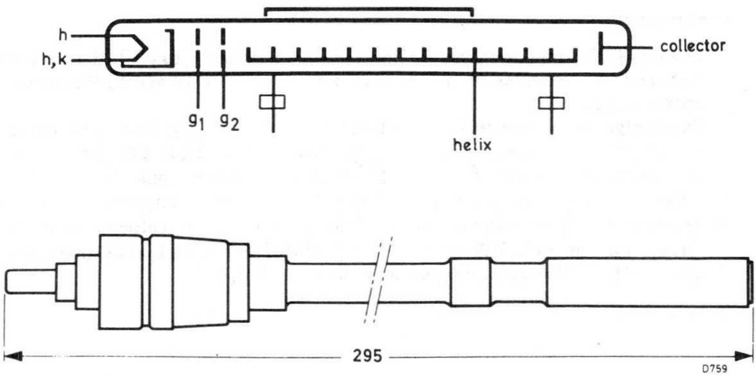
The design of the power supply depends on whether 5, 10 or 15W operation is required. An example of a power supply circuit for 10 and 15W operation is shown on page 6.
The design of the power supply should be such that V_{g2} (accelerator) can be varied between 1.4 and 1.8kV, V_{helix} between 2.0 and 2.4kV and V_{g1} is -5V at a collector current of 60mA. The collector voltage must be 1.1, 1.3, or 1.5kV at a collector current of 60mA for a desired output of 5, 10 or 15W respectively. For measurements of saturation power output the collector voltage should be 1.7kV (between 3.8 and 4.2GHz) or 1.85kV (between 3.4 and 3.8GHz). The helix voltage may then reach 2.7kV.

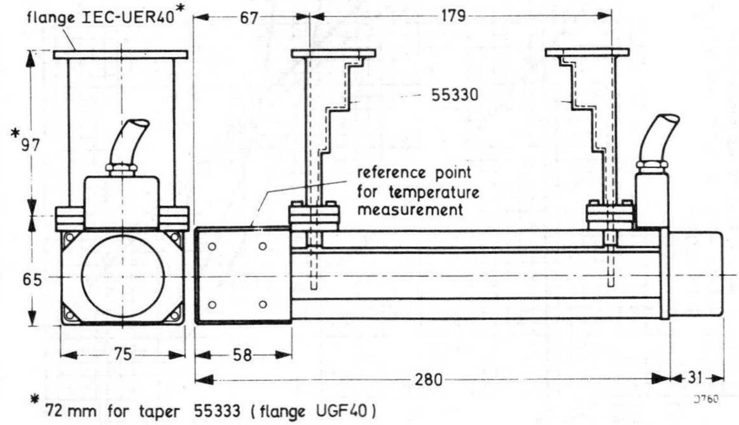
CIRCUIT DIAGRAM OF POWER SUPPLY FOR 10 AND 15W OPERATION



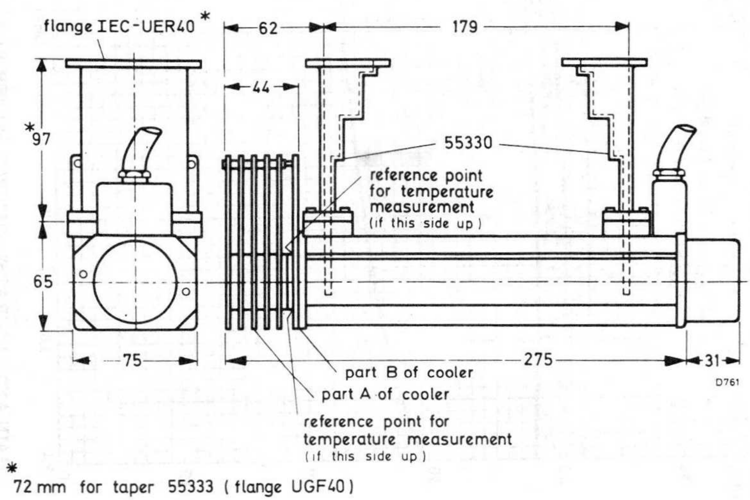
*For 5W operation a minimum of 1.1kV is required.

OUTLINE DRAWING OF YH1090

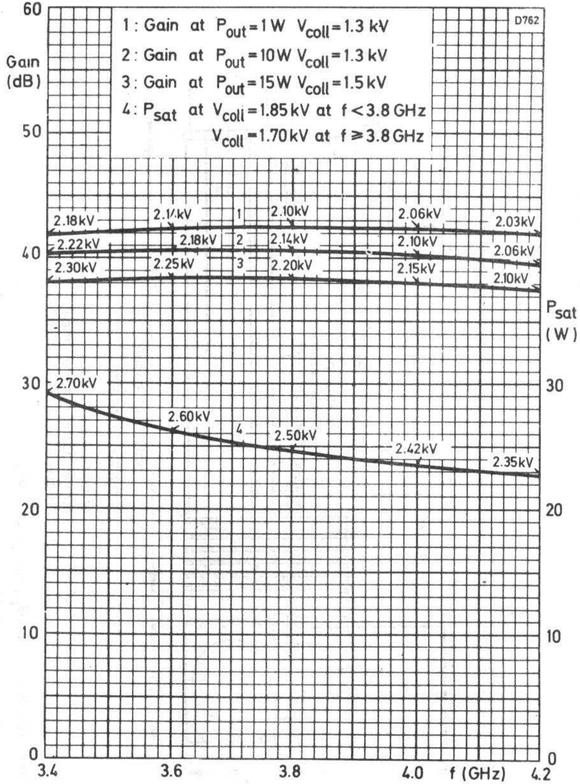




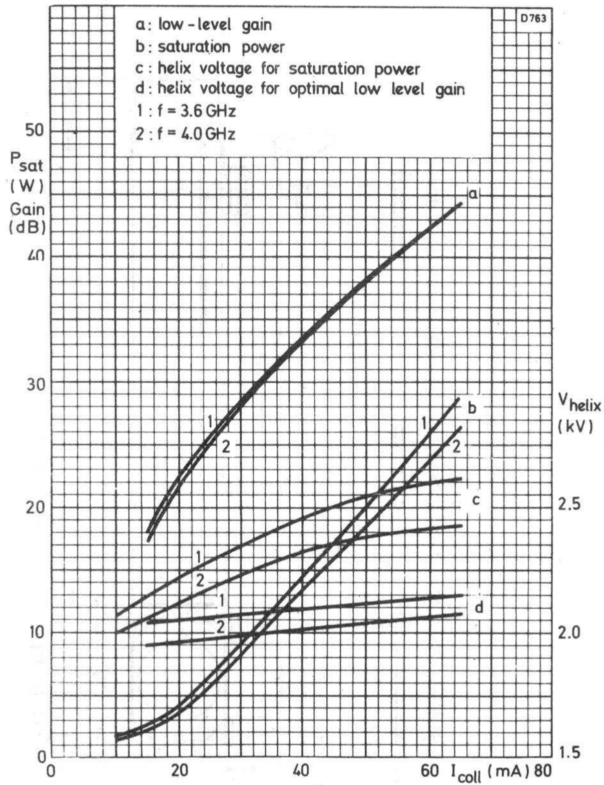
Mount 55332 with conduction cooling and waveguide tapers 55330



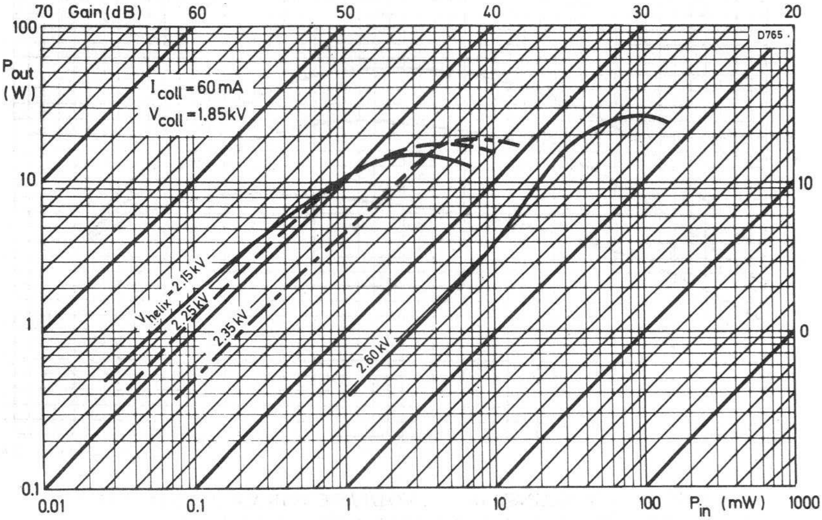
Mount 55329 with convection cooling and waveguide tapers 55330



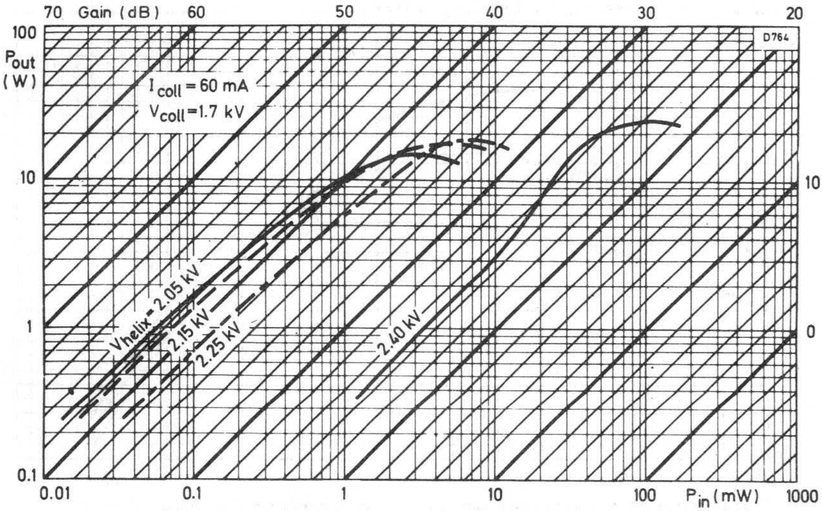
GAIN AND SATURATED OUTPUT POWER PLOTTED AGAINST FREQUENCY FOR VARIOUS OPERATING CONDITIONS



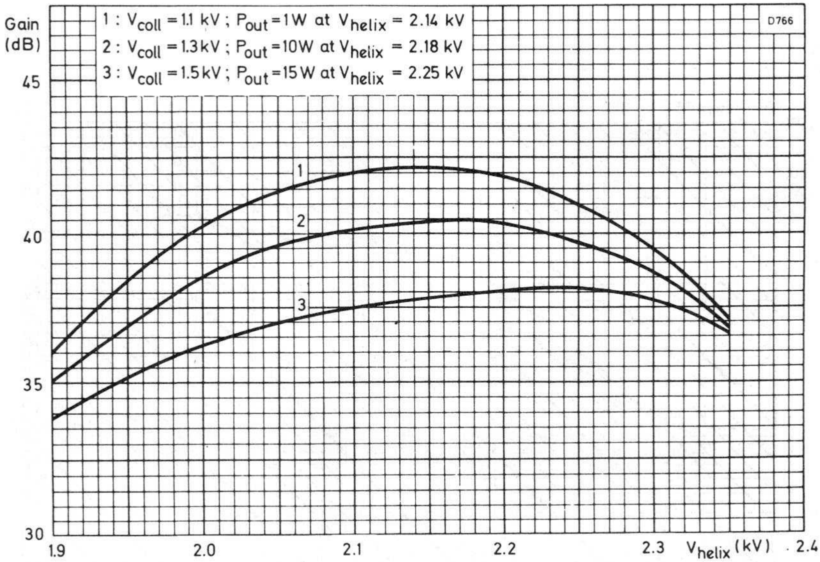
GAIN, SATURATED OUTPUT POWER AND HELIX VOLTAGE PLOTTED AGAINST COLLECTOR CURRENT AT TWO SPECIFIC FREQUENCIES



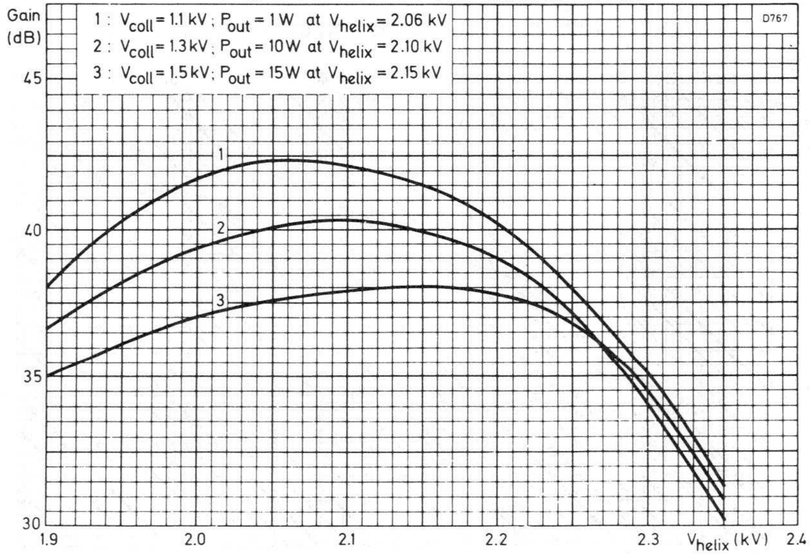
OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 3.6GHz



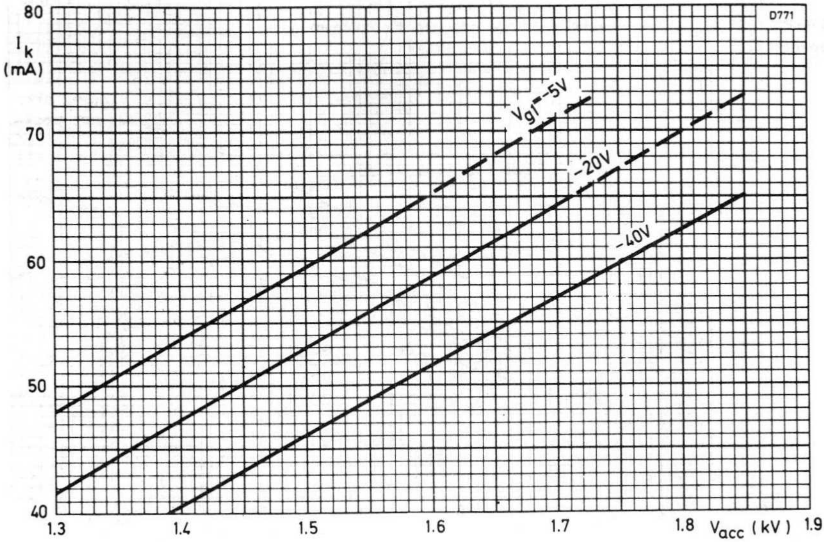
OUTPUT POWER PLOTTED AGAINST INPUT POWER AT 4GHz



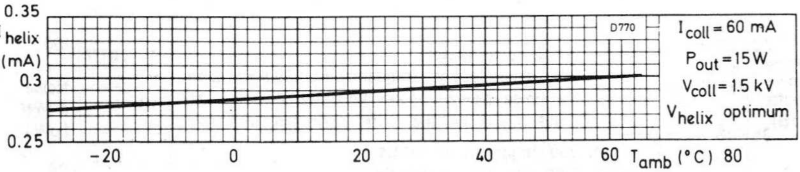
GAIN PLOTTED AGAINST HELIX VOLTAGE FOR VARIOUS OUTPUT POWERS AND COLLECTOR VOLTAGES AT 3.6GHz

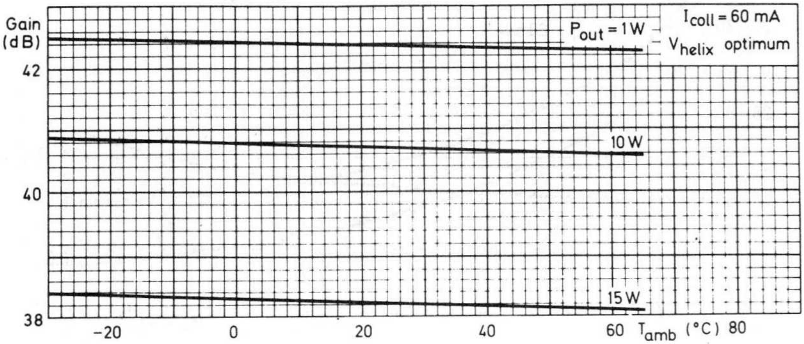


GAIN PLOTTED AGAINST HELIX VOLTAGE FOR VARIOUS OUTPUT POWERS AND COLLECTOR VOLTAGES AT 4GHz

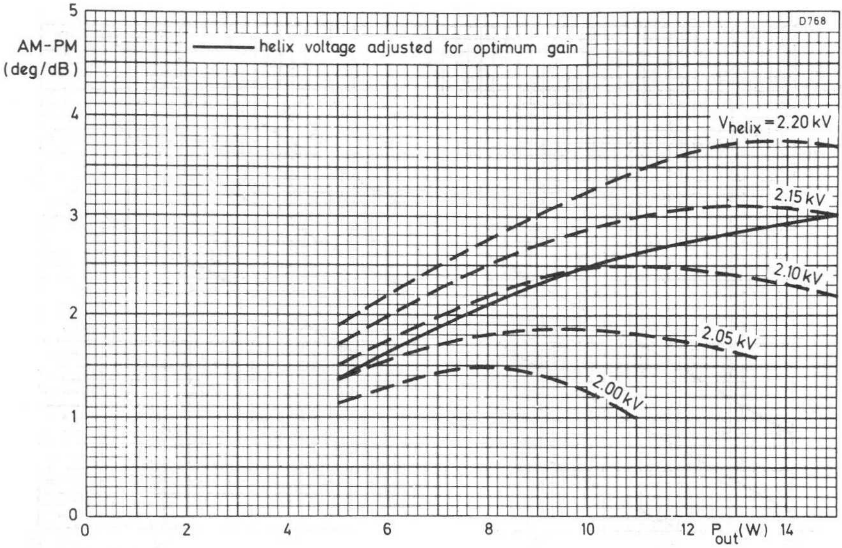


CATHODE CURRENT PLOTTED AGAINST ACCELERATOR VOLTAGE WITH GRID VOLTAGE AS PARAMETER

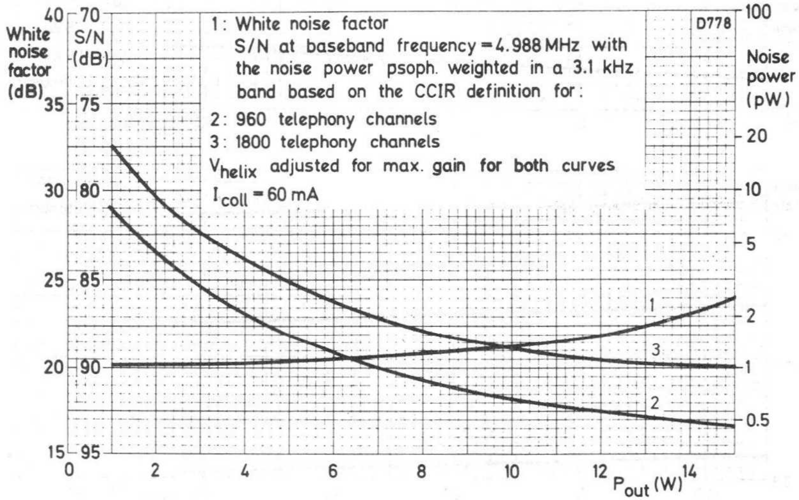




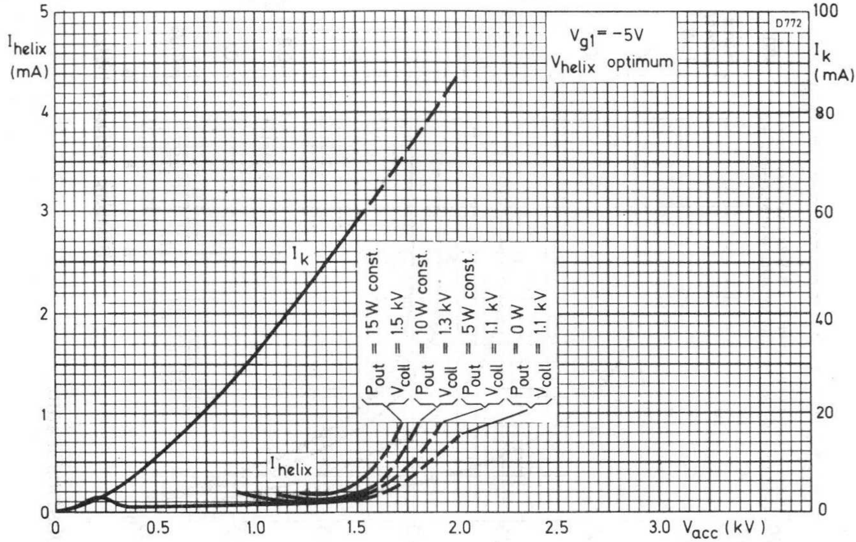
HELIX CURRENT AND GAIN PLOTTED AGAINST AMBIENT TEMPERATURE WITH OUTPUT POWER AS PARAMETER. FREQUENCY=4GHz



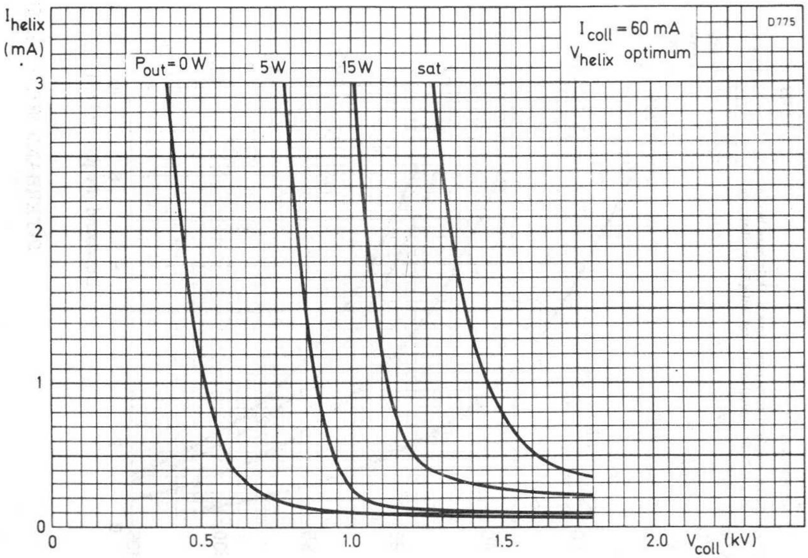
AM TO PM CONVERSION PLOTTED AGAINST POWER OUTPUT
WITH HELIX VOLTAGE AS PARAMETER. FREQUENCY = 4GHz



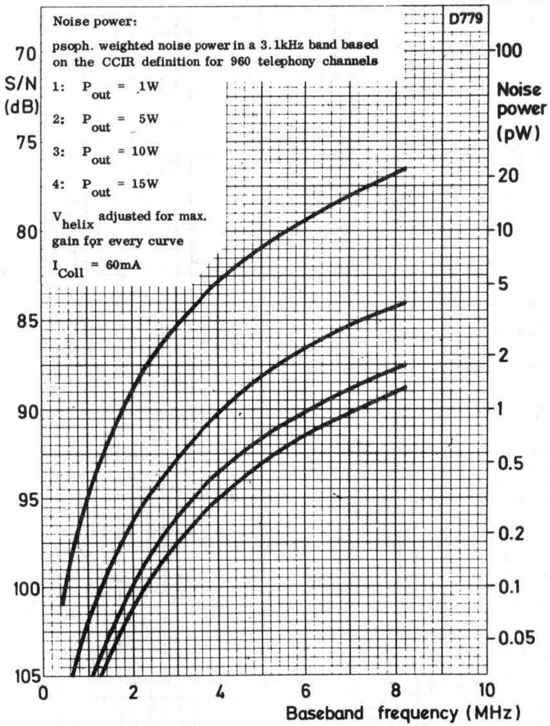
SIGNAL TO NOISE RATIO AND WHITE NOISE FACTOR
PLOTTED AGAINST POWER OUTPUT AT 4GHz

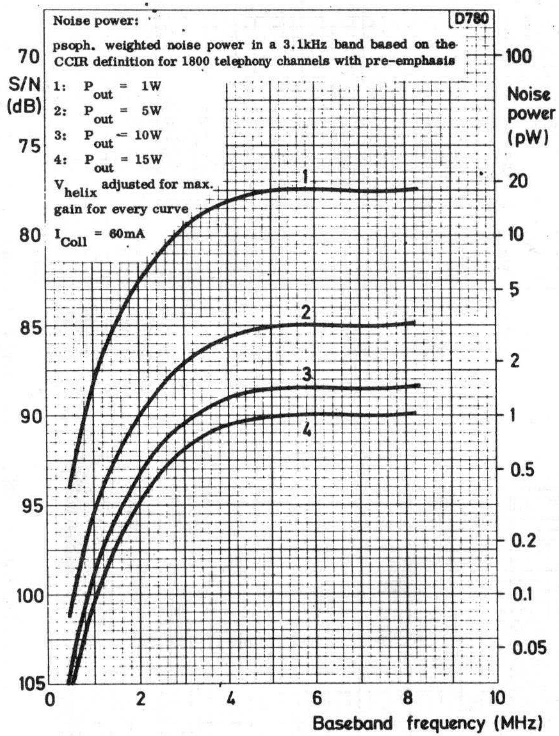


CATHODE AND HELIX CURRENTS PLOTTED AGAINST ACCELERATOR VOLTAGE. FREQUENCY = 4GHz



HELIX CURRENT PLOTTED AGAINST COLLECTOR VOLTAGE WITH POWER OUTPUT AS PARAMETER. FREQUENCY = 4GHz





INTERBAND NOISE CHARACTERISTICS at 4GHz

TRAVELLING-WAVE TUBE

YH1170

Travelling-wave tube with a periodic permanent magnet mount designed for wide-band microwave link applications.

QUICK REFERENCE DATA	
Frequency	5.8 to 8.5 GHz
Saturation output power at midband	20 W
Low-level gain at midband	45 dB
Interchangeability	plug-in focus, plug-in match
Construction	unpackaged
tube	glass-metal envelope, metal-ceramic base
mount	periodic permanent magnet
Cooling	conduction

CATHODE : Dispenser type

HEATING : Indirect by A.C. or D.C.

When operated on D.C. the cathode must be connected to the positive side of the heater power supply.

Heater voltage	V_f		6.3	V ± 2%
Heater current at $V_f = 6.3$ V	I_f	approx.	1	A
Waiting time (Heating time before application of high voltage)	T_w	min.	2	min

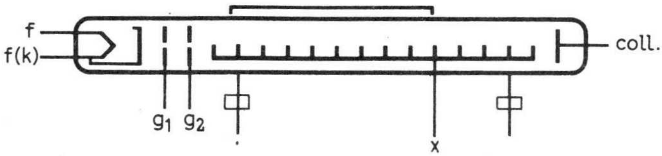
For shorter waiting time when the tube already has been in operation see "Application of voltages".

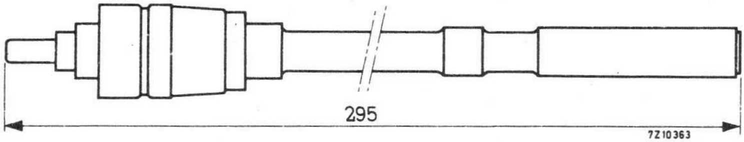
COOLING : By conduction. See also page 9.

MECHANICAL DATA Dimensions in mm

Mounting position: Any. See "Design and operating notes" under "Cooling"

Weight of tube	approx.	60	g
Weight of mount	approx.	4.5	kg





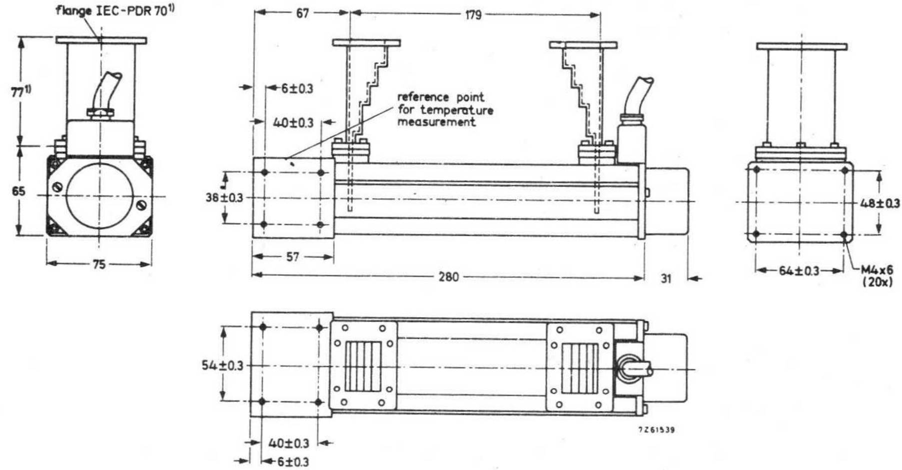
ACCESSORIES (to be ordered separately)

PPM mount for conduction cooling type 55337

Waveguide taper (two required)
to waveguide IEC-R70 (34.85 x 15.80 mm^2)
with flange mating IEC-PDR70 type 55338

Waveguide taper (two required)
to waveguide IEC-R84 (28.50 x 12.62 mm^2)
with flange mating IEC-UER84 type 55342

Mount with conduction (heatsink) cooling and waveguide tapers 55338



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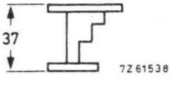
1) Flange IEC-UER-84

Waveguide taper 55342

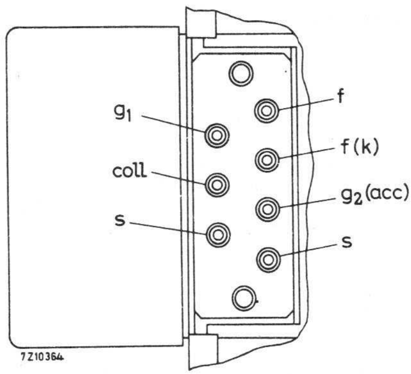


Connections

The mount is provided with flying leads, marked by colours

Heater/cathode	yellow
Heater	brown
Focusing electrode	green
Accelerator	blue
Helix	to be earthed via mount
Collector	red
Safety circuit (closed or opened, when putting on respectively off the mount cap)	two violet leads

Connections in cable housing



GENERAL CHARACTERISTICS

Frequency range	f	5.8 to 8.5	GHz	
Saturation output power (CW)	W_{sat}	**20**	W	1)
Low-level gain	G	**45**	dB	2)
Gain at W_o = 15 W	G	**39**	dB	3)
Thermal noise factor at W_o = 15 W	F	**25**	dB	4)
AM to PM conversion at W_o = 15 W	k_p	3	°/dB	4)
Cold match at input and output (f = 5.8 to 8.5 GHz)	V.S.W.R.	max. 1.5		5

---

1) Typical value measured at f = 7.2 GHz, I_{coll} = 55 mA, W_i and V_x optimally adjusted for saturation output power.

2) Typical value measured at f = 7.2 GHz, I_{coll} = 55 mA, W_o < 1 W, V_x optimally adjusted for low level gain.

3) Typical value measured at f = 7.2 GHz, I_{coll} = 55 mA, V_x adjusted for optimum gain.

4) Typical value measured at f = 6 GHz, I_{coll} = 55 mA, V_x adjusted for optimum gain.

5) Measured on the cold tube, i.e. with the beam switched off and without use of any matching device **(plug-in match).**

TYPICAL OPERATION

(Voltages are specified with respect to the cathode)

Frequency	f			6.0		GHz
Output power	W_o		15	10	5	W
Helix voltage (adjusted for optimum gain)	V_x	approx.	2950	2900	2900	V
Collector voltage	V_{coll}		1500	1450	1300	V
Focusing electrode voltage	V_{g1}		−6	−6	−6	V
Collector current	I_{coll}		55	55	55	mA
Gain	G		41	43	45	dB
Accelerator voltage 1)	V_{g2}	approx.	2050	2050	2050	V
Accelerator current	I_{g2}		<0.1	<0.1	<0.1	mA
Helix current (plug-in focus)	I_x		0.8	0.8	0.5	mA
Thermal noise factor	F		25	23	22	dB
AM to PM conversion	k_p		3.0	2.5	1.5	°/dB

Frequency	f			7.0		GHz
Output power	W_o		15	10	5	W
Helix voltage (adjusted for optimum gain)	V_x	approx.	2850	2800	2800	V
Collector voltage	V_{coll}		1500	1450	1300	V
Focusing electrode voltage	V_{g1}		−6	−6	−6	V
Collector current	I_{coll}		55	55	55	mA
Gain	G		39	42	44	dB
Accelerator voltage 1)	V_{g2}	approx.	2050	2050	2050	V
Accelerator current	I_{g2}		<0.1	<0.1	<0.1	mA
Helix current (plug-in focus)	I_x		0.8	0.8	0.5	mA
Thermal noise factor	F		25	23	22	dB
AM to PM conversion	k_p		3.0	2.5	1.5	°/dB

1) To be adjusted for indicated collector current.

Frequency	f		8.0		GHz
Output power	W_o		10	5	W
Helix voltage (adjusted for optimum gain)	V_x	approx.	2750	2750	V
Collector voltage	V_{coll}		1450	1300	V
Focusing electrode voltage	V_{g_1}		−6	−6	V
Collector current	I_{coll}		55	55	mA
Gain	G		38	40	dB
Accelerator voltage 2)	V_{g_2}	approx.	2050	2050	V
Accelerator current	I_{g_2}		<0.1	<0.1	mA
Helix current (plug-in focus)	I_x		0.8	0.5	mA
Thermal noise factor	F		23	22	dB
AM to PM conversion	k_p		2.5	1.5	^{o}/dB

LIMITING VALUES (Absolute maximum rating system)

(Voltages are specified with respect to the cathode unless otherwise specified)

Focusing electrode voltage	$-V_{g_1}$	min.	0	V
		max.	50	V
Accelerator voltage	V_{g_2}	max.	2700	V
Helix voltage	V_x	max.	3300	V
Collector to helix voltage	V_{coll-x}	max.	2500	V
Cathode current	I_k	max.	60	mA
Accelerator current	I_{g_2}	max.	0.3	mA
Helix current	I_x	max.	3	mA
R.F. input level	W_i	max.	100	mW
Collector dissipation at $t_{amb} = 65\ ^oC$ $I_{coll} \times V_{coll} - W_o$	W_{coll}	max.	90	W
Power reflected from load		max.	2	W 1)
Cooler temperature at reference point	t	max.	150	^oC

1) To avoid overheating of the helix.

2) To be adjusted for indicated collector current.

DESIGN AND OPERATING NOTES

1. INSTALLATION OF THE MOUNT

Two main methods may be discerned:

a) Fixing the mount relative to the microwave circuit by only connecting the waveguide tapers to the input and output sides of the circuit.

b) Employing a) and establishing additional support by fastening the mount to the rack with clamps. In this case it is recommended to use a short piece of flexible waveguide at the input and output sides to prevent excessive strain on the mount via the tapers, unless very careful alignment of the waveguides can be assured.

Possible forces on the waveguides must not produce a moment greater than 2 mkg at the flanges.

1.1 Mount

The mount has no movable parts. If clamps are used (method b) the slightly larger dimensions of the cooler as compared to the main part of the mount must be considered.

1.2 Magnetic shielding

The periodic permanent magnet is completely shielded. This implies that no additional measures need be taken to prevent the magnetic properties of the mount from being affected by external magnetic fields. The mount will not influence surrounding equipment which is susceptible to stray magnetic fields. Several mounts may be placed side by side without disturbing the focusing qualities. Isolators may be installed quite near to the mount.

Warning

If any part of the shielding is removed, the magnetic properties of the mount may be disturbed irreversibly.

2. INSTALLATION OF THE TUBE

Unlock the mount cap (see outline drawing) by turning it slightly counterclockwise. The cap can then easily be removed, and the tube inserted by carefully pushing it in.
Finally put the cap on the mount again, and lock by turning it clockwise.
These instructions also apply (in the reverse order) for taking the tube out of the mount.

3. SAFETY

The supply voltages are fed to the tube via the mount cap. When the cap is unlocked all voltages are removed from the tube. The two violet leads can be incorporated into an additional safety circuit which switches the voltages off at the power supply if the cap is unlocked. Thus the voltages can also be removed from the mount.

The mount should always be earthed.

4. POWER SUPPLY

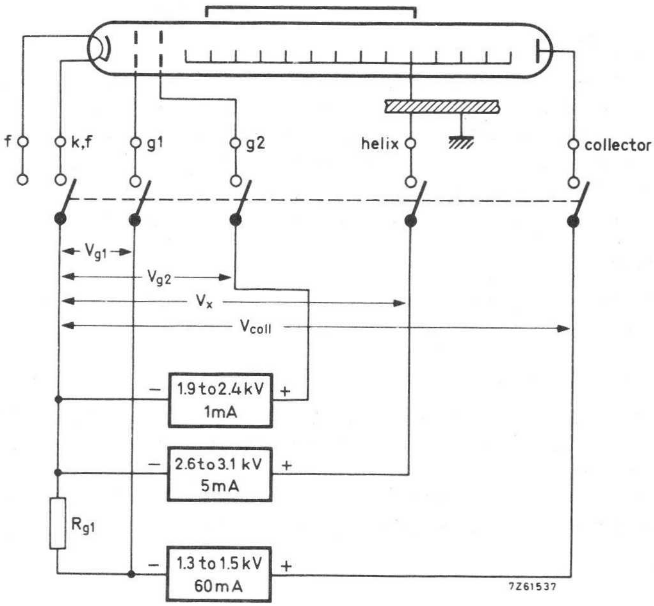
An example of a supply circuit for 5, 10 and 15 W operation is given in the figure.

Design ranges for the power supply
(electrode voltages with respect to cathode)

	Min.	Max.	
Accelerator voltage	1900	2400	V
Accelerator current		0.3	mA
Helix voltage	2600	3100	V [1]
Helix current		3	mA

The collector voltage is set at a fixed voltage dependent on the output power level.

Output power level	W_o	5	10	15	W_{sat}	W
Collector voltage	V_{coll}	1300	1450	1500	1700	V
Collector current	I_{coll}	55	55	55	55	mA
Focusing electrode voltage	V_{g_1}	−6	−6	−6	−6	V



[1] At saturation the helix voltage may reach 3200 V

5. COOLING

Tube and mount need no artificial means of cooling. Natural cooling of the collector has been made possible by depression of the collector potential with respect to the helix and by ensuring adequate heat transfer from the collector to the environment.

Under typical operating conditions and at an ambient temperature of not more than 65 °C, the cooler temperature at the reference point (see drawing) is well below the limit, provided an aluminium heatsink of 300 mm x 300 mm x 6 mm is mounted on one of the cooler surfaces. The heatsink is best fixed with its centre coinciding with that of the cooler, and in a vertical position. The mount itself may have any position in the equipment.
Other heatsink configurations may be employed. It will then be necessary to check the temperatures reached at the reference point under extreme conditions e.g. 65 °C ambient temperature.

6. APPLICATION OF VOLTAGES

6.1 Switching-on procedure for new tubes

6.1.1 Apply the heater voltage for the specified waiting time.
6.1.2 Apply the rated voltages to the collector, the helix, the accelerator (and in case of a separate supply to the focusing electrode) simultaneously (see Remarks).
6.1.3 Adjust the accelerator voltage to obtain a collector current of 55 mA.
6.1.4 Apply the R.F. input signal, adjust the level to obtain the required output power while simultaneously adjusting the helix voltage for optimum gain.

6.2 Readjustment during life

During life the collector current may decrease.
A readjustment of the accelerator voltage to obtain I_{coll} = 55 mA will then be necessary.

6.3 Switching-off procedure

All voltages should be switched off simultaneously.
If this is not feasible, do as described under "Remarks".

6.4 Switching-on procedure after interruption of voltage (also see the Remarks)

6.4.1 Interruption of less than 40 s:
Switch on all voltages simultaneously.
6.4.2 Interruption of more than 40 s but less than 1 week:
Apply the heater voltage for min. 40 s, then apply all other voltages simultaneously.
6.4.3 Interruption of more than 1 week:
Apply the heater voltage for the specified waiting time of 2 min.
Apply all other voltages simultaneously.

Remarks

When the voltages cannot be switched simultaneously all the cathode current may flow to the accelerator or the helix. If this condition lasts for more than 10 ms, it **may** cause permanent damage to the tube. The remedy is to switch the accelerator voltage on after the other electrode voltages, or off before the other electrode voltages.

7. INPUT AND OUTPUT CIRCUIT AND GROUP DELAY

In order to avoid phase distortions due to long-line effect, the insertion of an isolator between tube and antenna, and another between tube and pre-stage is strongly recommended. The isolators should be positioned as close to the tube as possible.

If isolators with a V.S.W.R. of less than 1.05 are used at a short distance from the tube, the reflections result in a variation of the group delay of less than 0.2 nanoseconds over a band of 20 MHz.

It may be noted that the difference between the voltage reflection coefficients of the hot and the cold tube (i.e. with respectively without electron beam) is less than 0.2 for the input as well as the output side, measured at an output power level of 5 W or more.

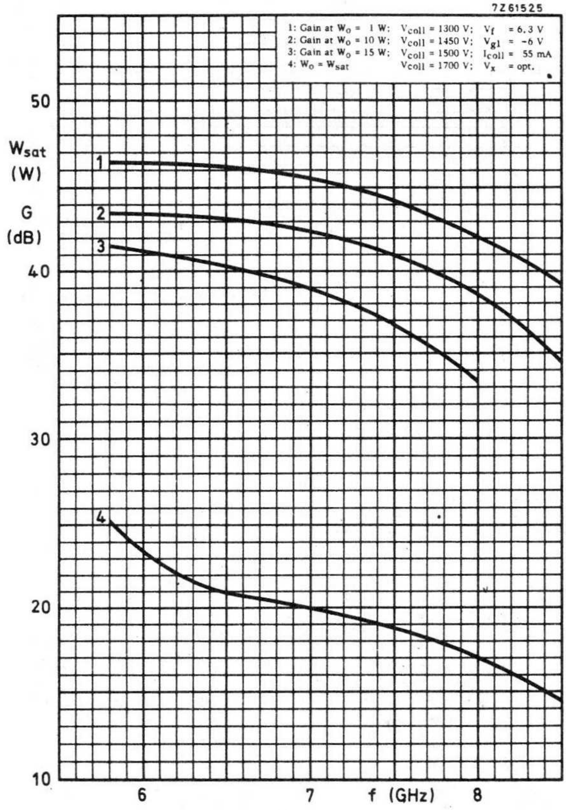
8. ENVIRONMENTAL CONDITIONS

Ambient temperature

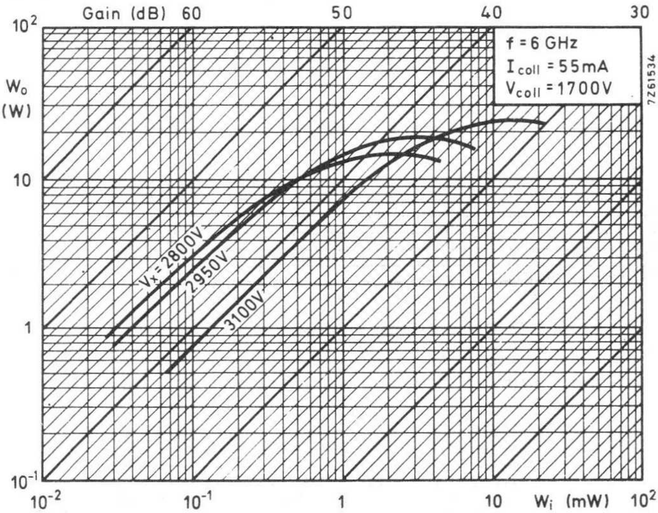
storage	t_{amb}	min.	-60	^{o}C
		max.	+65	^{o}C
operation	t_{amb}	min.	-30	^{o}C
		max.	+65	^{o}C

Relative humidity 0 to 95 %

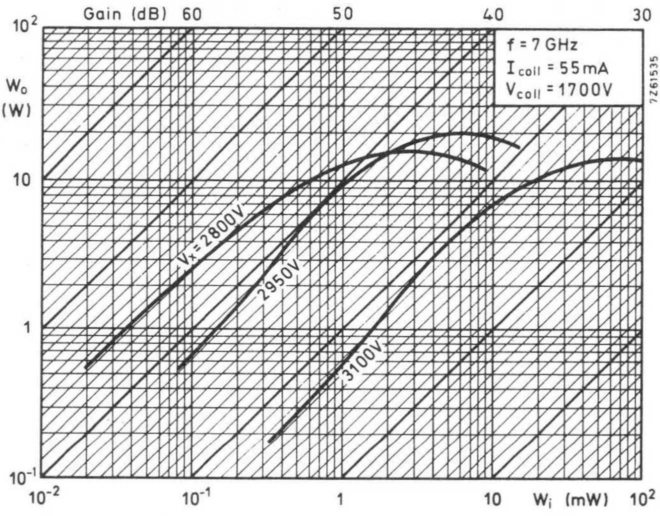
The tube and mount resist fungus attack.



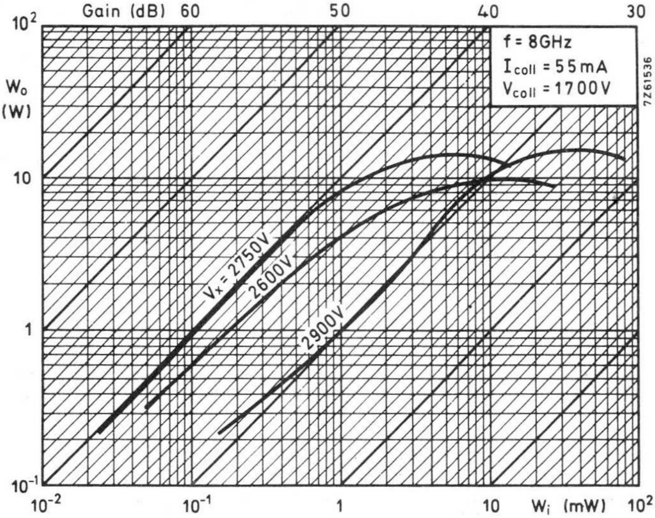
Gain and saturation power = f (frequency)



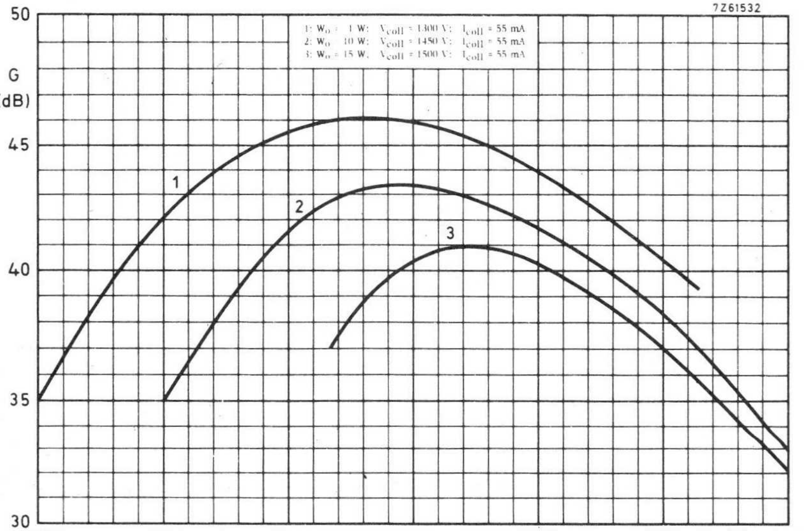
Output power = f (input power)



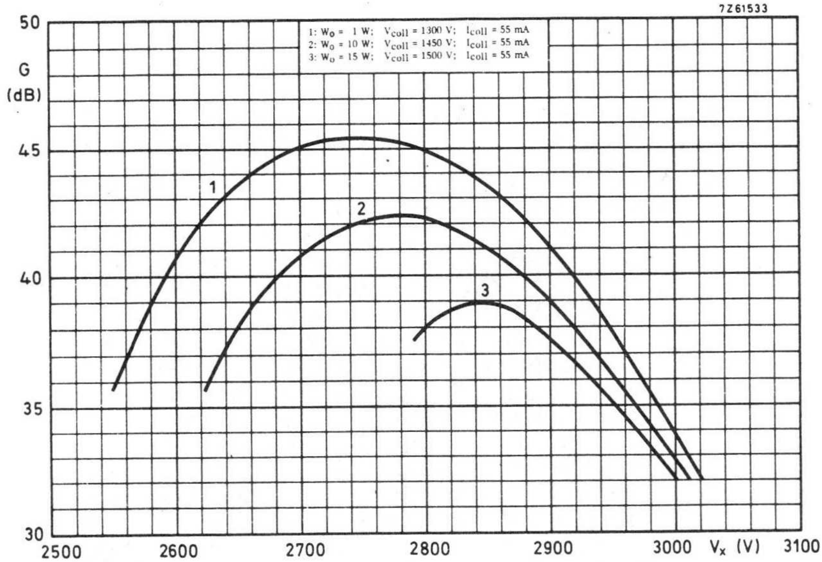
Output power = f (input power)



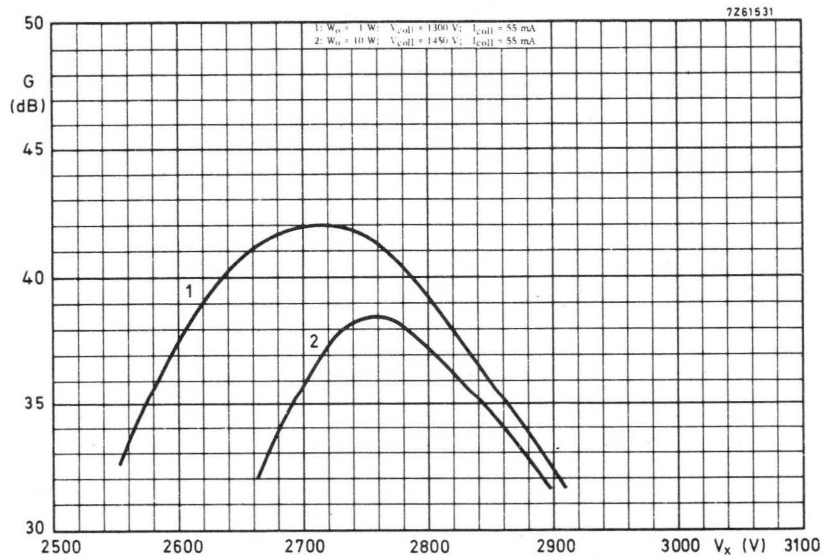
Output power = f (input power)



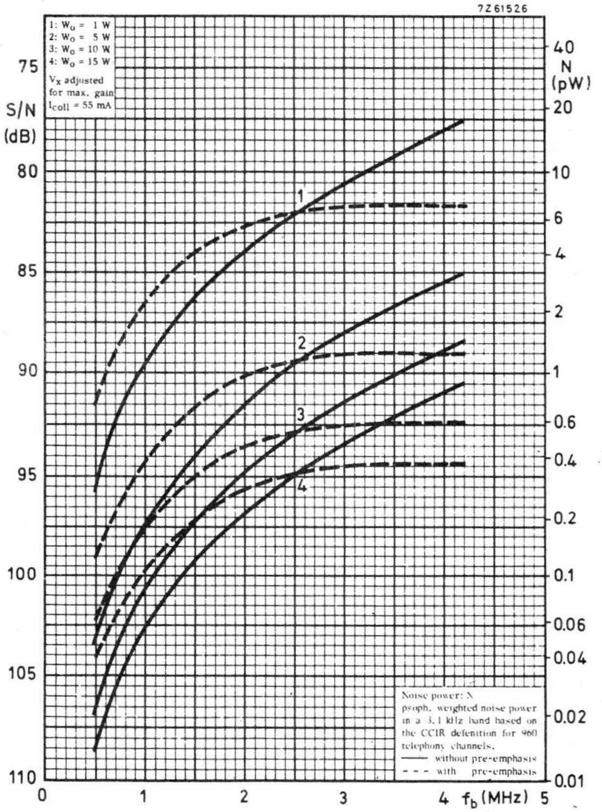
Gain = f (helix voltage) f = 6 GHz



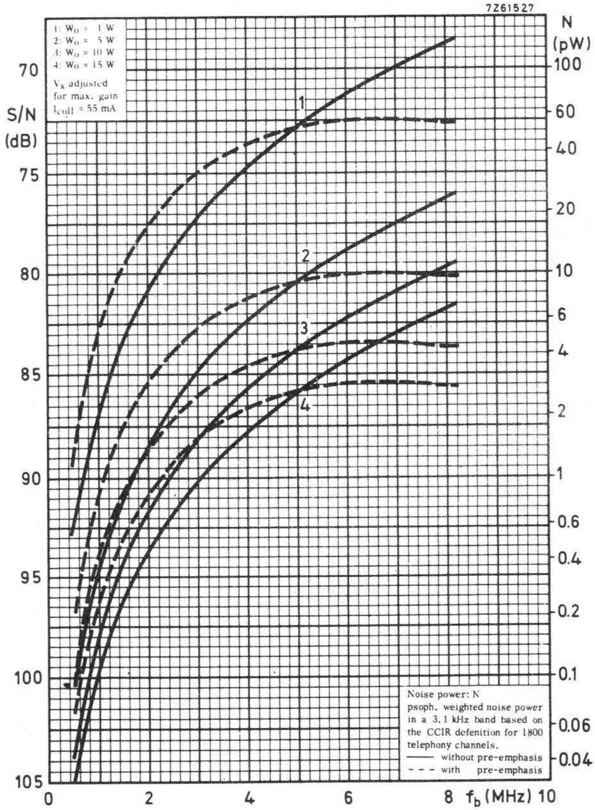
Gain = f (helix voltage) f = 7 GHz



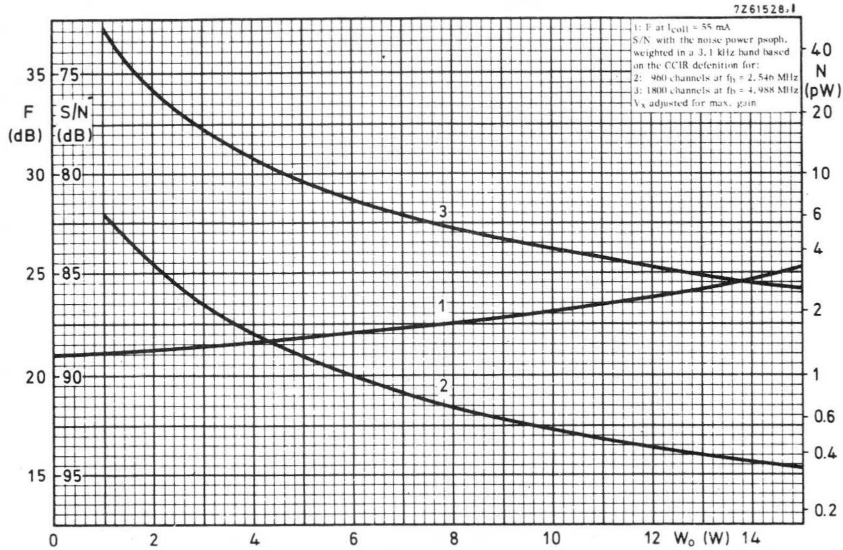
Gain = f (helix voltage) f = 8 GHz



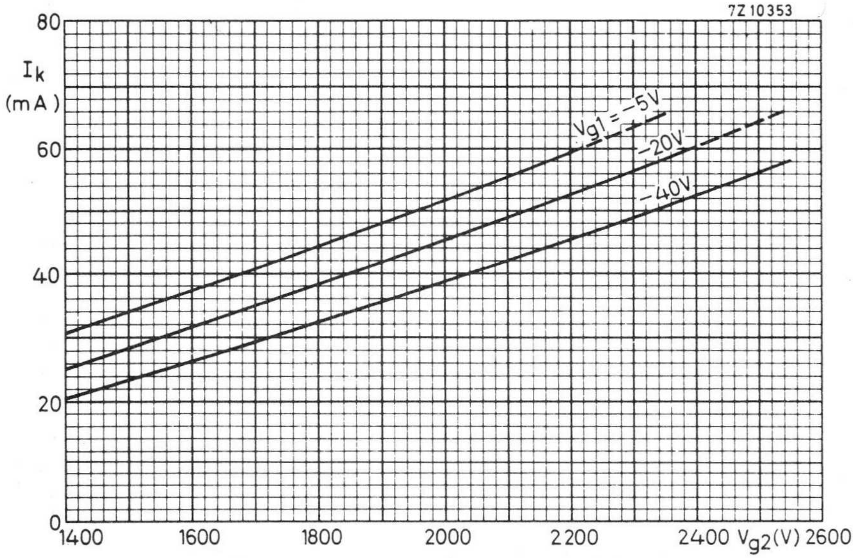
Signal to noise ratio (FM) = f (baseband freq.) at f = 6 GHz



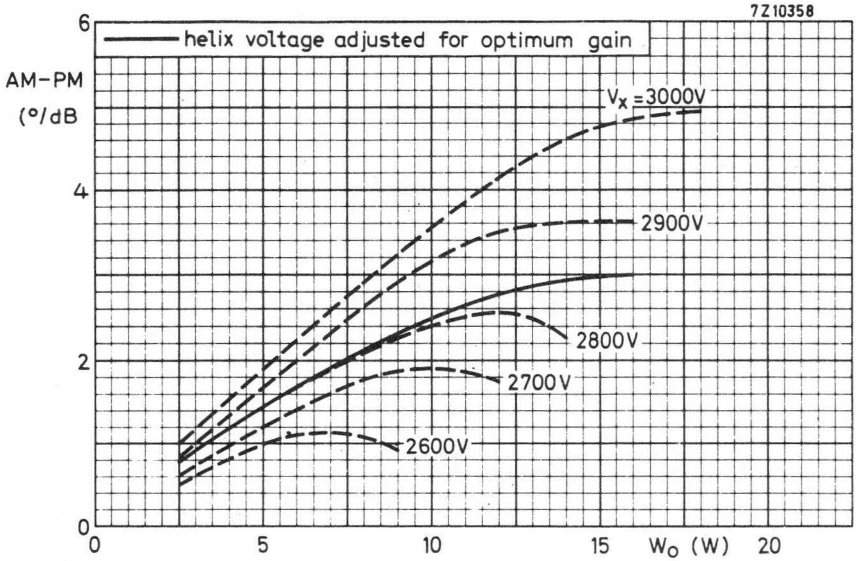
Signal to noise ratio (FM) = f (baseband freq.) at f = 6 GHz



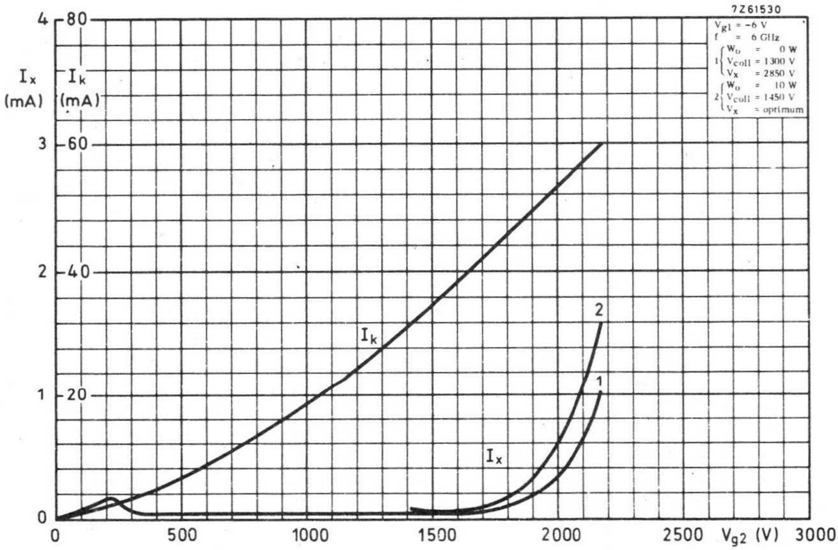
Thermal noise (FM) = f (output power) at f = 6 GHz



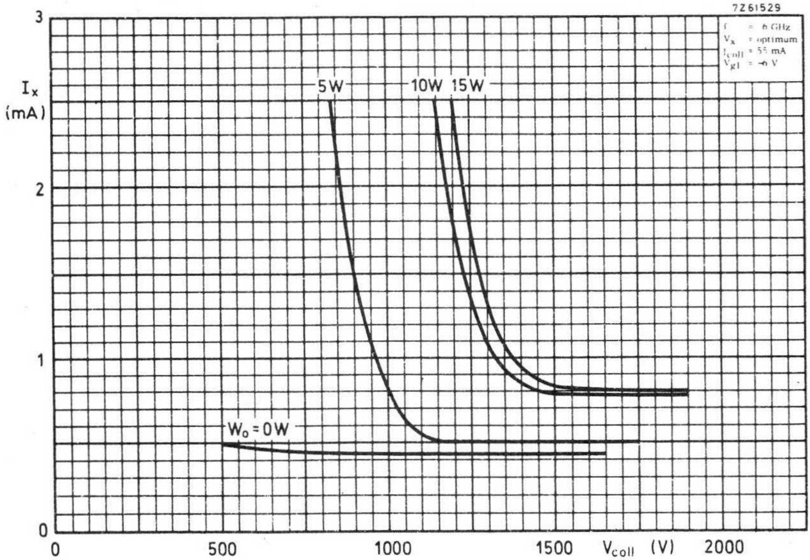
Cathode current = f (accelerator voltage)



AM to PM conversion = f (output power) at f = 6 GHz



Cathode current and helix current = f (accelerator voltage)



Helix current = f (collector voltage)

VACUUM PRODUCTS

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IONISATION GAUGE HEAD

IOG-22

TENTATIVE DATA

A double filament ultra-high Bayard-Alpert vacuum gauge head, suitable for direct sealing to G28 or Kodial glass systems.

The gauge heads have an electrically conductive layer on the inside of the glass envelope. By applying a fixed potential to the layer, excess primary electrons are attracted directly to the walls rather than oscillating around the collector, thereby leading to very stable measurements of low pressures.

Spiral tungsten filaments are used, these are less liable to fracture and therefore give a longer usable life.

The gauge heads feature a low thermal inertia and a low filament power consumption.

CHARACTERISTICS AND OPERATING CONDITIONS

Pressure range		10^{-3} to 10^{-10}	torr
Sensitivity (for nitrogen)	approx.	12	per torr
X-ray limit		10^{-10}	torr
Filament voltage			
measurement		0 to 5	V
outgassing		0 to 8	V
Collector voltage (with respect to filament)			
measurement		-25 to -80	V
outgassing			connected to grid
Grid voltage (with respect to filament)			
measurement		+112 to +145	V
outgassing		+550	V
Emission current range			
measurement		1 μA to 10 mA	
outgassing		max. 110	mA
Insulation resistance			
Collector to other electrodes		min. 10^{14}	Ω
Grid to other electrodes		min. 10^{12}	Ω

Note - The screen on IOG-22 should be at collector potential.

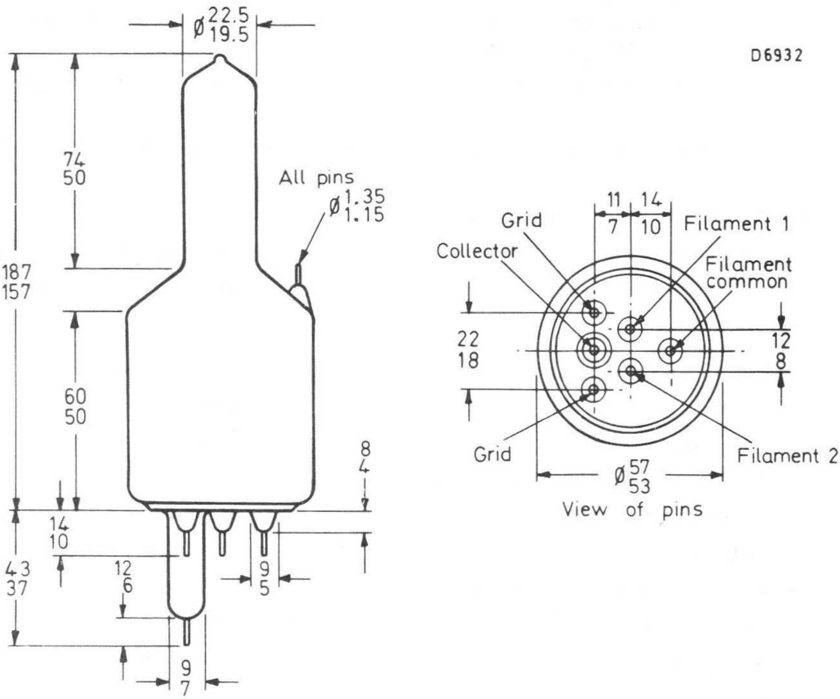
(1 torr = 133 N/m^2)

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Grid power for outgassing (min.)	60	W
Bulb temperature during operation (max.)	250	^{o}C
Bake-out temperature (max.)	450	^{o}C

OPERATING POSITION Any

OUTLINE DRAWING OF IOG-22



Dimensions in mm

IONISATION GAUGE HEAD

IOG-39

TENTATIVE DATA

A miniature centre filament ionisation gauge designed to be sealed to a metal vacuum system by means of a special Viton gasket, or by an O ring and a suitable metal union. It has an all molybdenum grid and a nickel mesh collector. The filament is a thoriated iridium helix which resists burn out and can survive exposure to atmospheric pressure at normal operating temperature without damage when used with an electronic filament control.

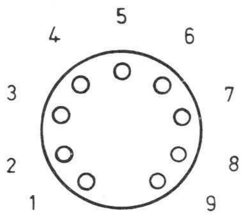
CHARACTERISTICS AND OPERATING CONDITIONS

Pressure range		10^{-1} to 10^{-7}	torr
Sensitivity (for nitrogen)	approx.	5.5	per torr
Filament voltage		2 to 5	V
Filament current		2 to 3	A
Collector voltage (with respect to filament)		-20 to -60	V
Grid voltage (with respect to filament)		120 to 250	V
Emission current		0 to 10	mA
Insulation resistance		10^{10}	Ω

Bakeout temperature - unsuitable for baking due to type of vacuum union.

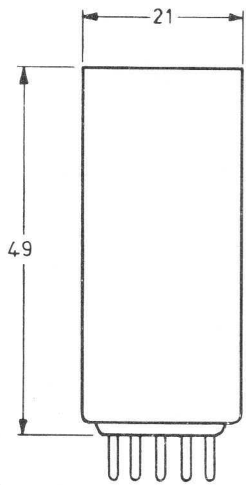
(1 torr = 133 N/m^2)

D6934



B9A base

Pin connections:
2 and 4 filament
7 grid
9 collector



Dimensions in mm

IONISATION GAUGE HEAD

IOG-71

Ruggedised triode ionisation gauge head suitable for use where pressure readings lower than 10^{-7} torr are not required. The gauge head can be connected to a vacuum system either by direct fusion to glass or by means of a clamping ring and an elastomer 'O' ring.

CHARACTERISTICS AND OPERATING CONDITIONS

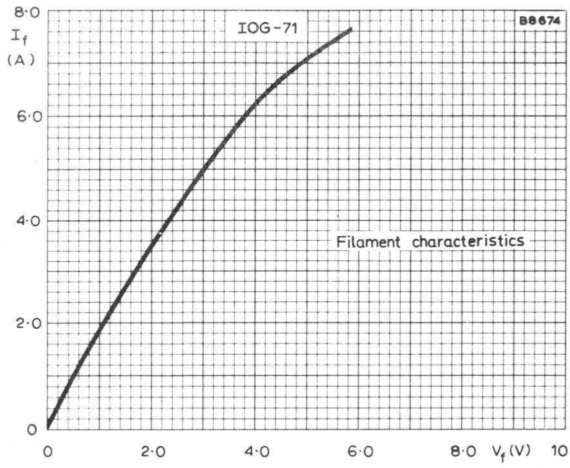
Pressure range	10^{-3} to 5×10^{-8}	torr
Sensitivity (for dry air)	20	per torr
Filament voltage	adjust to give required grid current	
Collector voltage	-20	V
Grid voltage	+125	V
Grid current		
above 10^{-4} torr	5.0	mA
below 10^{-4} torr	10	mA
Outgassing	filament current of 7A for 30s (at lowest pressure) Apply 7.5V (8A approx.) across grid for 1 minute min.	

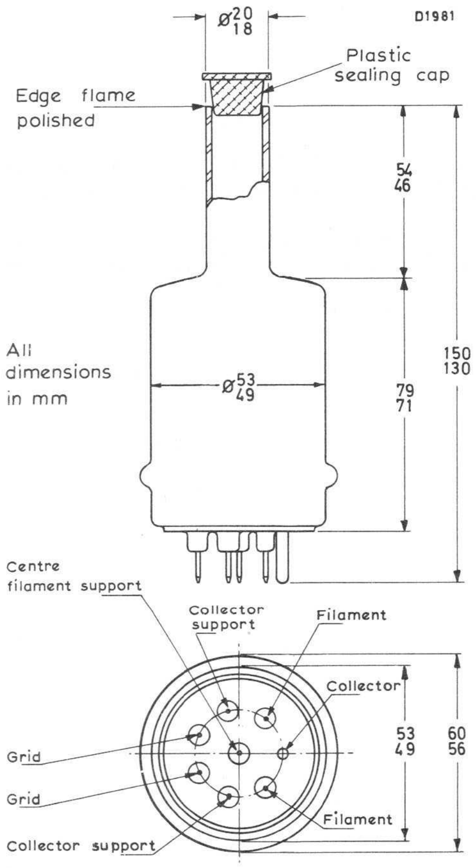
Note - It is recommended that a d.c. amplifier should be used to measure the collector current, since this may be as low as 10^{-8}A in the lower pressure regions.

RATINGS (ABSOLUTE MAXIMUM SYSTEM)

Filament operating pressure	max.	5×10^{-3}	torr
Filament voltage	max.	10	V
Bake-out temperature	max.	450	^{o}C

(1 torr = 133 N/m^2)





OUTLINE DRAWING OF IOG-71

Collector pin ø3.3
3.0

6 other pins and centre pin ø1.65
1.45

Pitch circle ø25.4

Dimensions in mm

CIRCUIT ASSEMBLIES

F

F

SURVEY OF CIRCUIT ASSEMBLIES

Tube Type No.	Circuit Assembly Type No.
Band 1 Vision	
YL1420	40757
YL1430	40759
YL1440	40755
YL1520	40759
Band 1 Sound	
YL1420	40758
YL1430	40760
YL1440	40756
YL1520	40760
Band 2	
YL1470	40775
Band 3 Vision and combined sound and vision	
YL1420	40745
YL1430	40747
YL1440	40743
YL1520	40768
Band 3 Sound	
YL1420	40746
YL1430	40748
YL1440	40744

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

40743

Continuously tunable cavity-type circuit assembly to be used with YL1440 to form a broad-band grounded-grid linear amplifier for television signals in Band III. The unit thus obtained can be put to good use in any of the principal monochrome and colour television systems.

QUICK REFERENCE DATA				
Class AB linear amplifier (vision)				
Frequency	170	to	260	MHz
Anode voltage			3	kV
Output power in load , sync			1,55	kW
Power gain			26	
Frequency	170	to	260	MHz
Anode voltage			2,5	kV
Output power in load , sync			0,7	kW
Power gain			23	
Class AB amplifier for television transposer service				
Frequency	175	to	225	MHz
Anode voltage			2,5	kV
Output power in load , sync			0,55	kW
Power gain			30	

FREQUENCY RANGE

170 to 247 MHz continuously tunable. Up to 260 MHz with minor, channel dependent, modifications.

OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

COOLING

See cooling curves.
Direction of airflow: see drawing page 5.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 1201 (200 to 230 MHz) is recommended.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

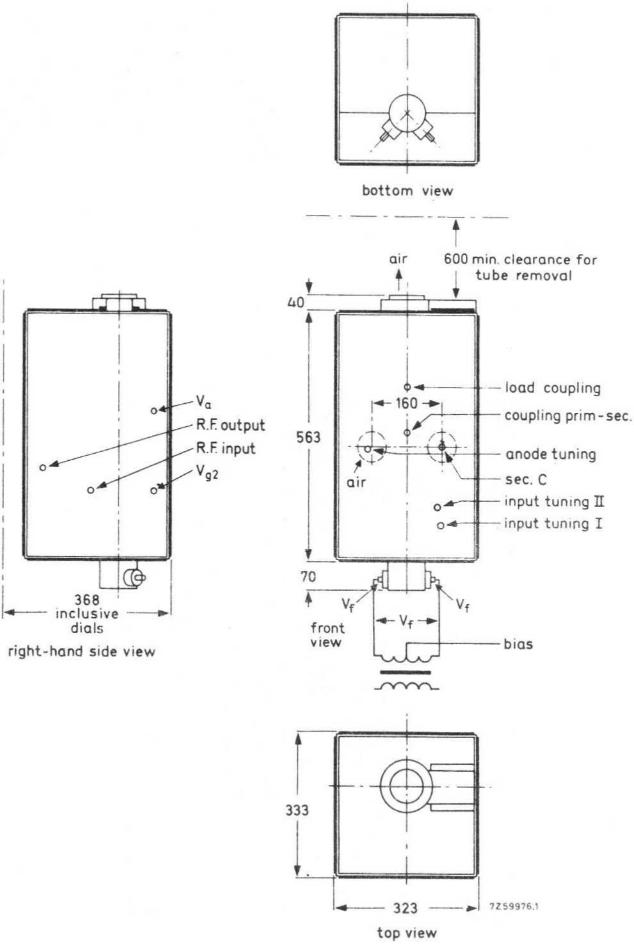
40743

MECHANICAL DATA

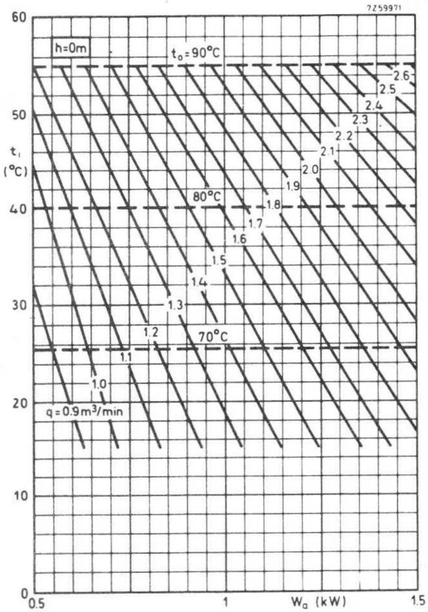
Dimensions in mm

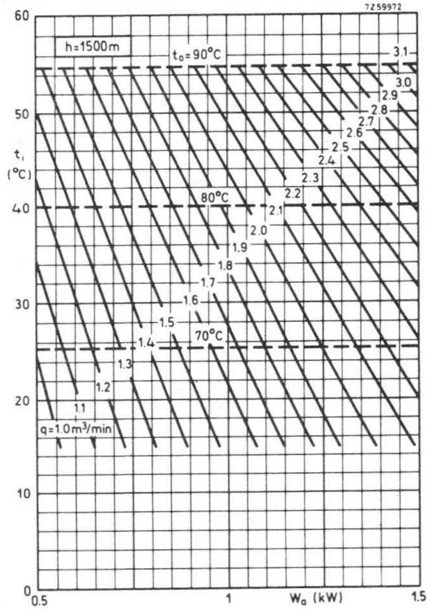
Dimensions : approx. 673 x 333 x 323 mm^3

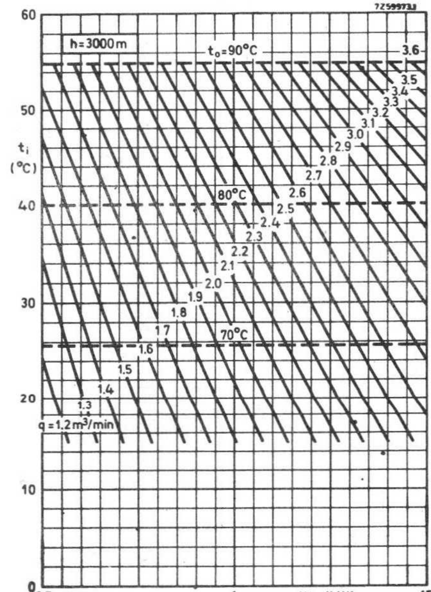
Net weight : approx. 38 kg

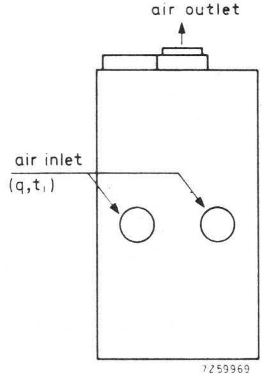


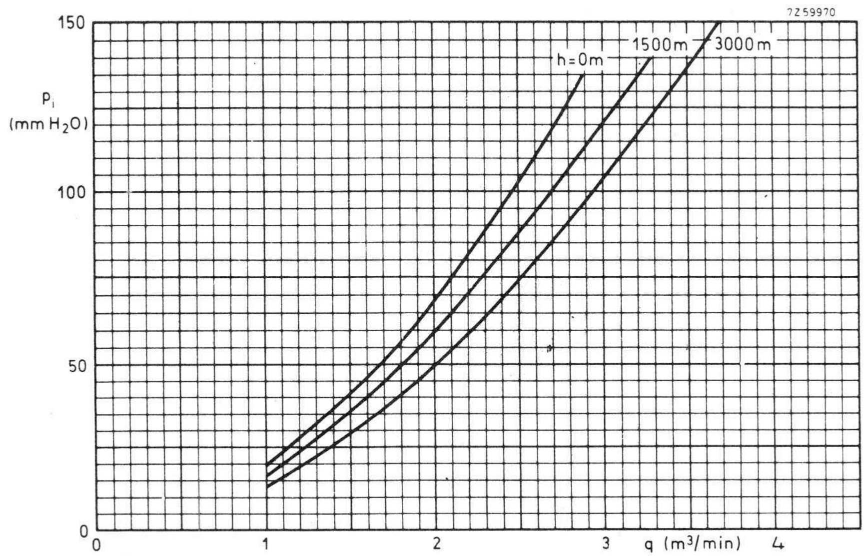
Cooling curves



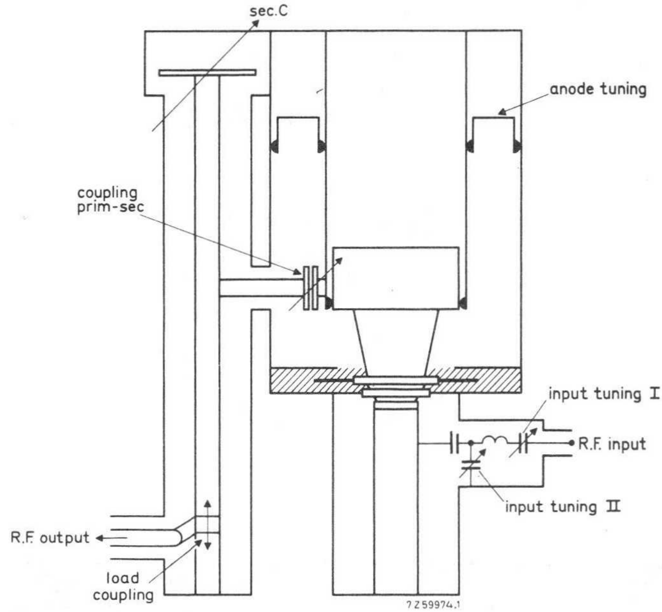





air outlet
air inlet
(q,t_i)
7Z59969


7Z59970
150
100
50
0
p_i
(mm H_2O)
h=0m
1500m
3000m
0
1
2
3
q (m^3/min)
4

CIRCUIT DIAGRAM



BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

40744

Continuously tunable cavity-type circuit assembly to be used with YL1440 to form a grounded-grid amplifier of frequency-modulated signals in Band III.

QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain
70 to 260	3.5	2.4	26

FREQUENCY RANGE

170 to 260 MHz, continuously tunable.

OPERATING CONDITIONS (For tube YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

COOLING

See cooling curves.
Direction of airflow: see drawing page 5.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature : 0 ^{o}C to +55 ^{o}C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

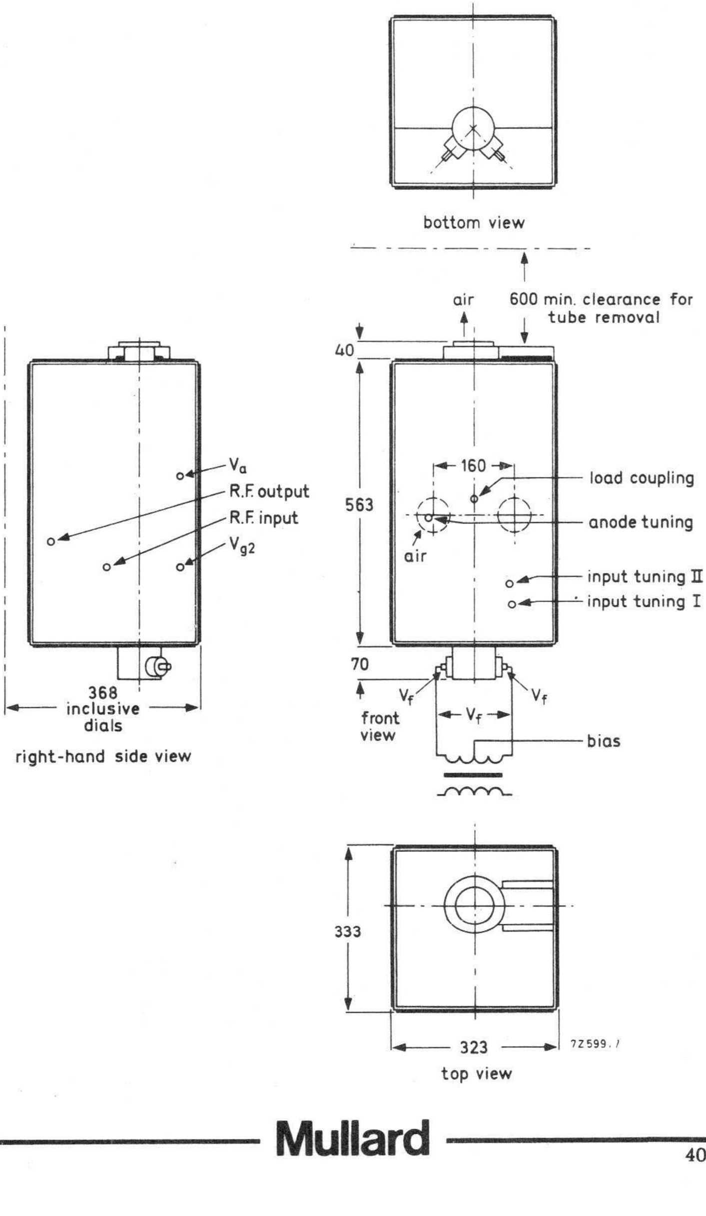
BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

40744

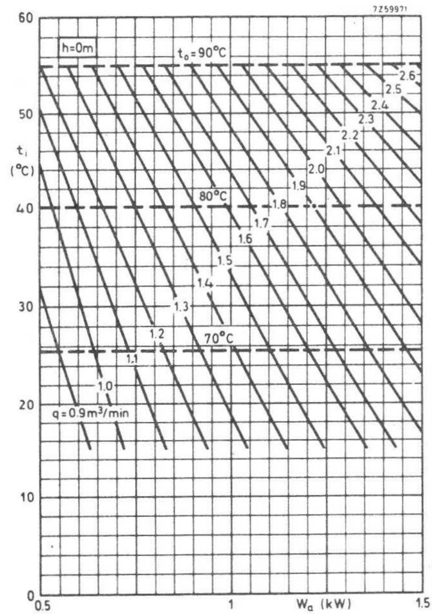
MECHANICAL DATA

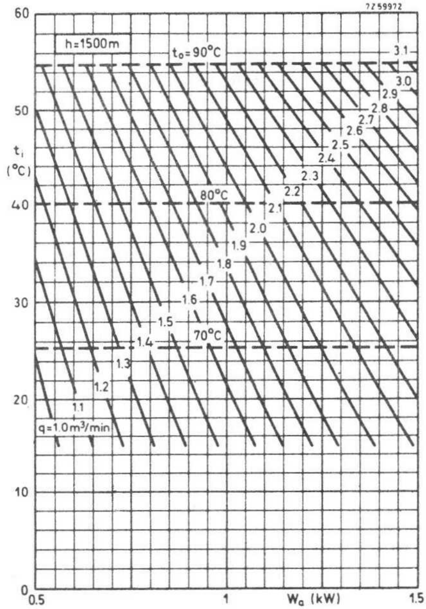
Dimensions in mm

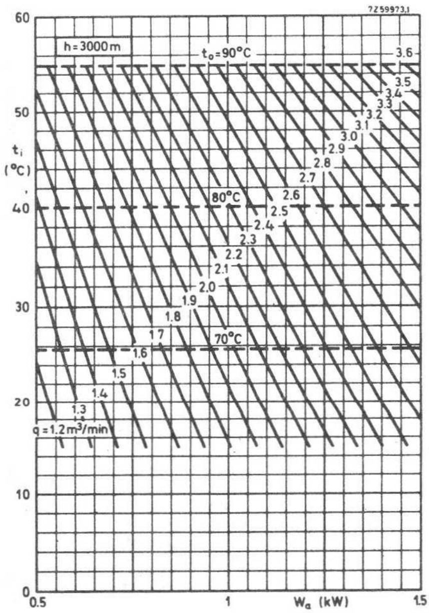
Dimensions : approx. 673 x 333 x 323 mm^3
Net weight : approx. 33 kg

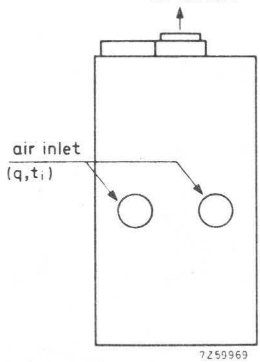


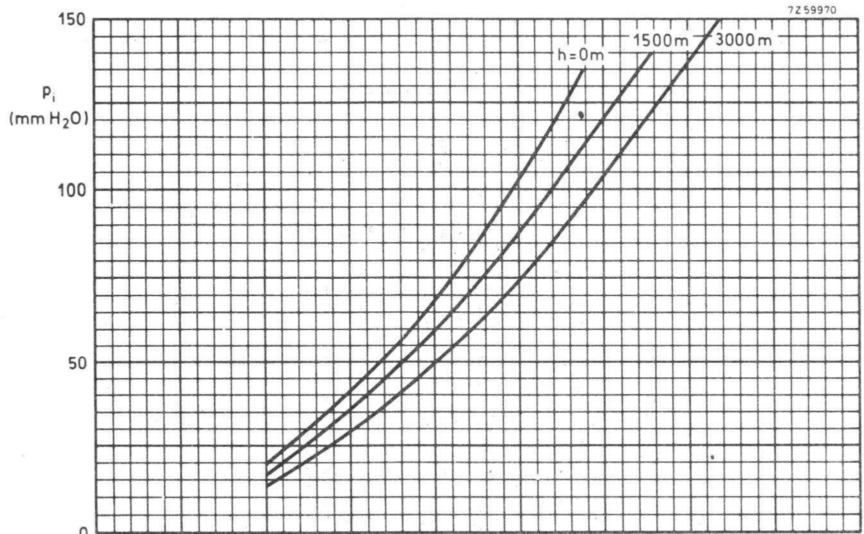
Cooling curves



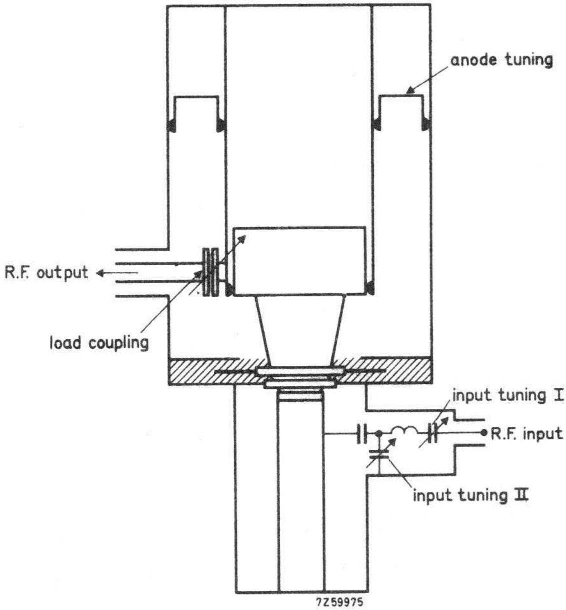





air outlet
air inlet
(q,t_i)
7Z59969


7Z59970
150
p_i
(mm H_2O)
100
50
0
0
1
2
3
q (m^3/min)
4
h=0m
1500m
3000m

CIRCUIT DIAGRAM



BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

40745

Continuously tunable cavity-type circuit assembly to be used with YL1420 to form a broad-band grounded-grid linear amplifier for television signals in Band III. The unit thus obtained can be put to good use in any of the principal monochrome and colour television systems.

QUICK REFERENCE DATA				
Class AB linear amplifier (vision)				
Frequency	170	to	230	MHz
Anode voltage			5	kV
Output power in load, sync			8,6	kW
Power gain			24	
Frequency	170	to	230	MHz
Anode voltage			4	kV
Output power in load, sync			6,25	kW
Power gain			24	
Class AB amplifier for television transposer service				
Frequency	175	to	225	MHz
Anode voltage			4	kV
Output power in load, sync			2,5	kW
Power gain			30	

FREQUENCY RANGE

170 to 230 MHz continuously tunable.

OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Either sucking and blowing is possible via connections on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial connector: see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175.25 MHz	7322 120 04730
Coupling loop for remaining frequencies except 223.25 MHz [1])	7322 120 04760
Insulating protection cap	7322 120 04750
Spanner for fitting	

b) Recommended
The use of circulator 2722 162 01191 (170 to 200 MHz) or
2722 162 01201 (200 to 230 MHz) is recommended.

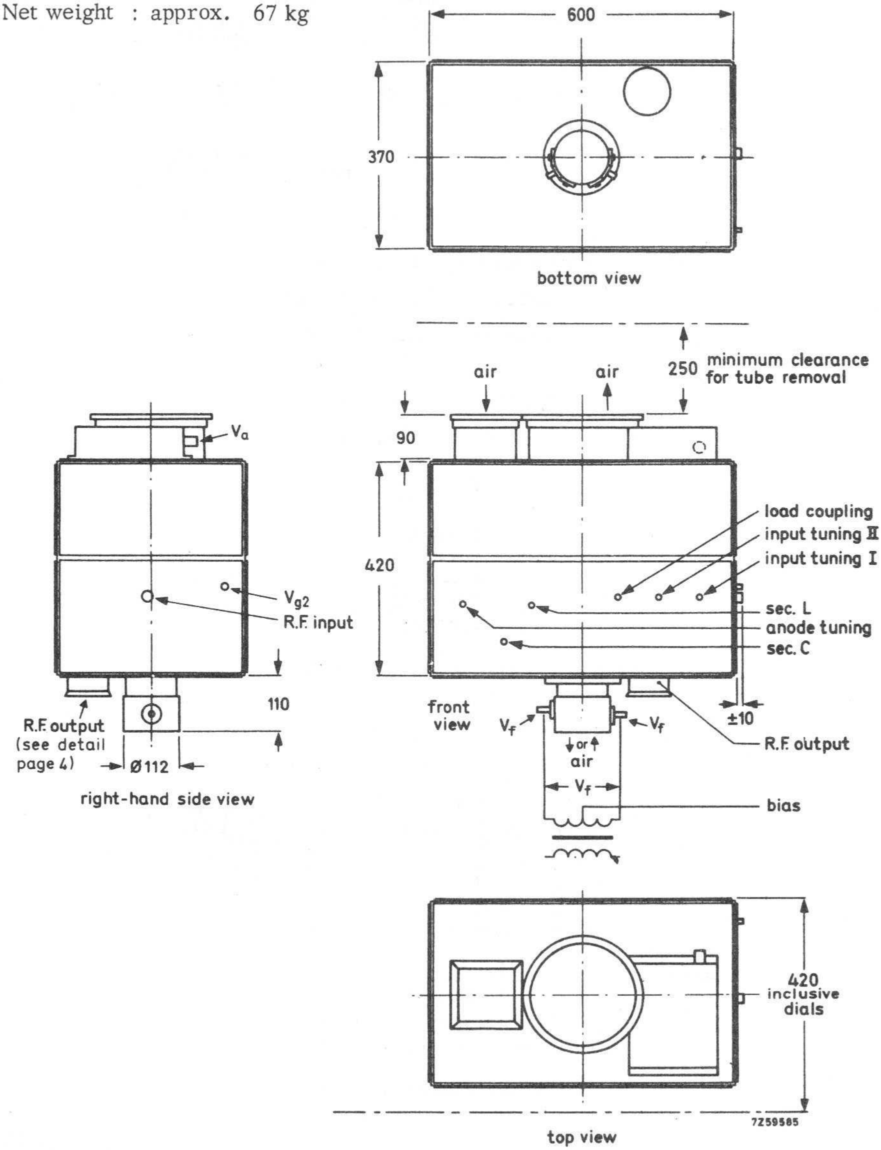
1) For 223.25 MHz a different coupling loop is needed, which can be delivered on request.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

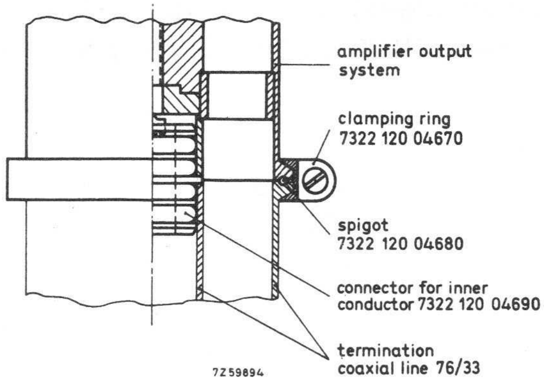
MECHANICAL DATA

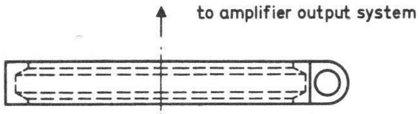
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 67 kg

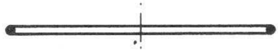


R.F. output connector

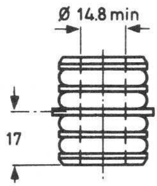




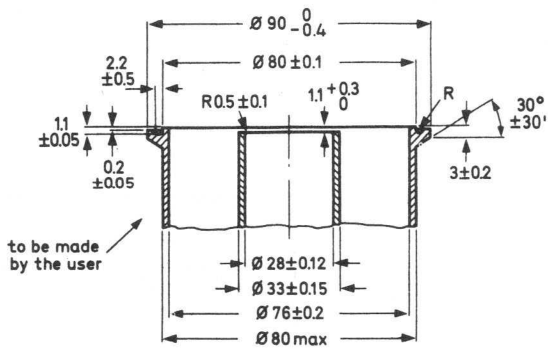
clamping ring 7322 120 04670



spigot 7322 120 04680

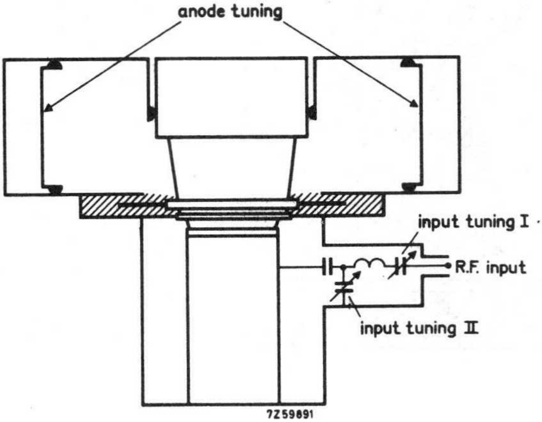


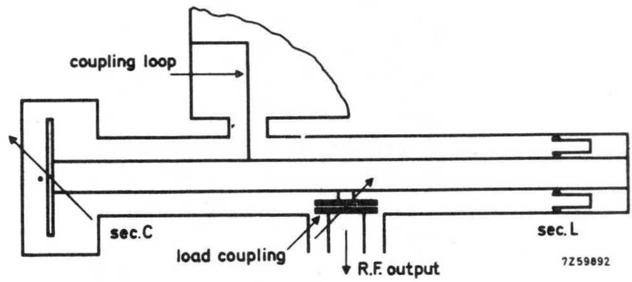
connector for inner conductor 7322 120 04690



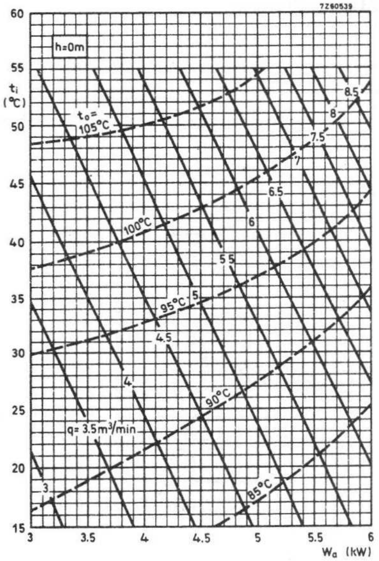
termination coaxial line 76/33

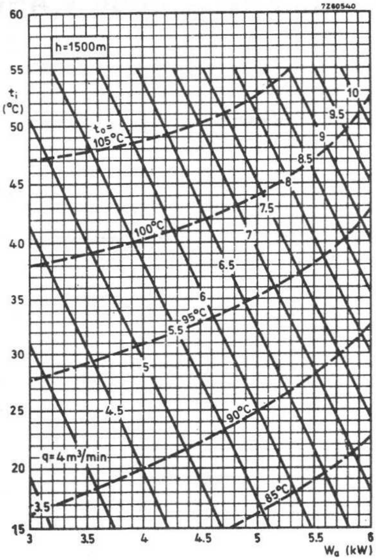
CIRCUIT DIAGRAM

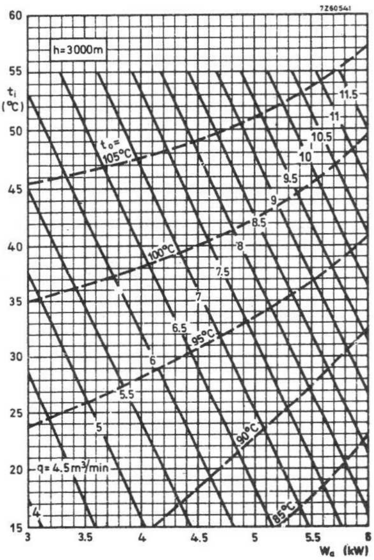




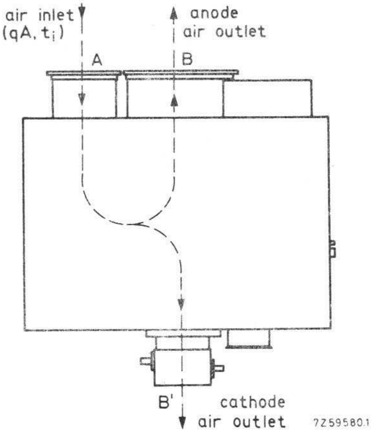
Cooling curves

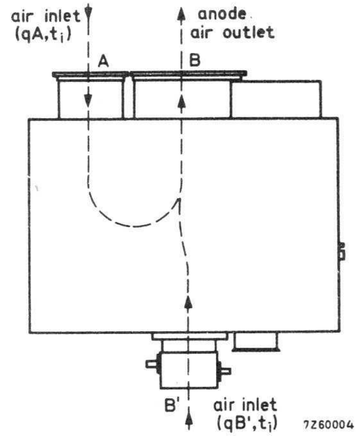


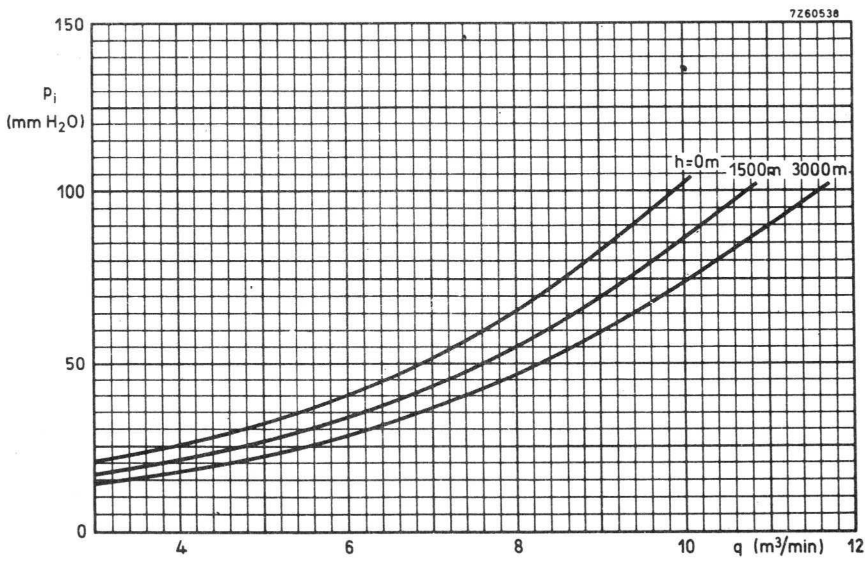




BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION







Pressure drop p_i across cavity with YL1420 as a function of airflow q.
p_i = pressure drop from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

40746

Continuously tunable cavity-type circuit assembly to be used with YL1420 to form a grounded-grid amplifier of frequency-modulated signal in Band III.

QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain
170 to 230	7	10.5	32

FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Both sucking and blowing is possible via connection on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial connector: see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature : 0 ^{o}C to +55 ^{o}C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor input connector	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

Recommended

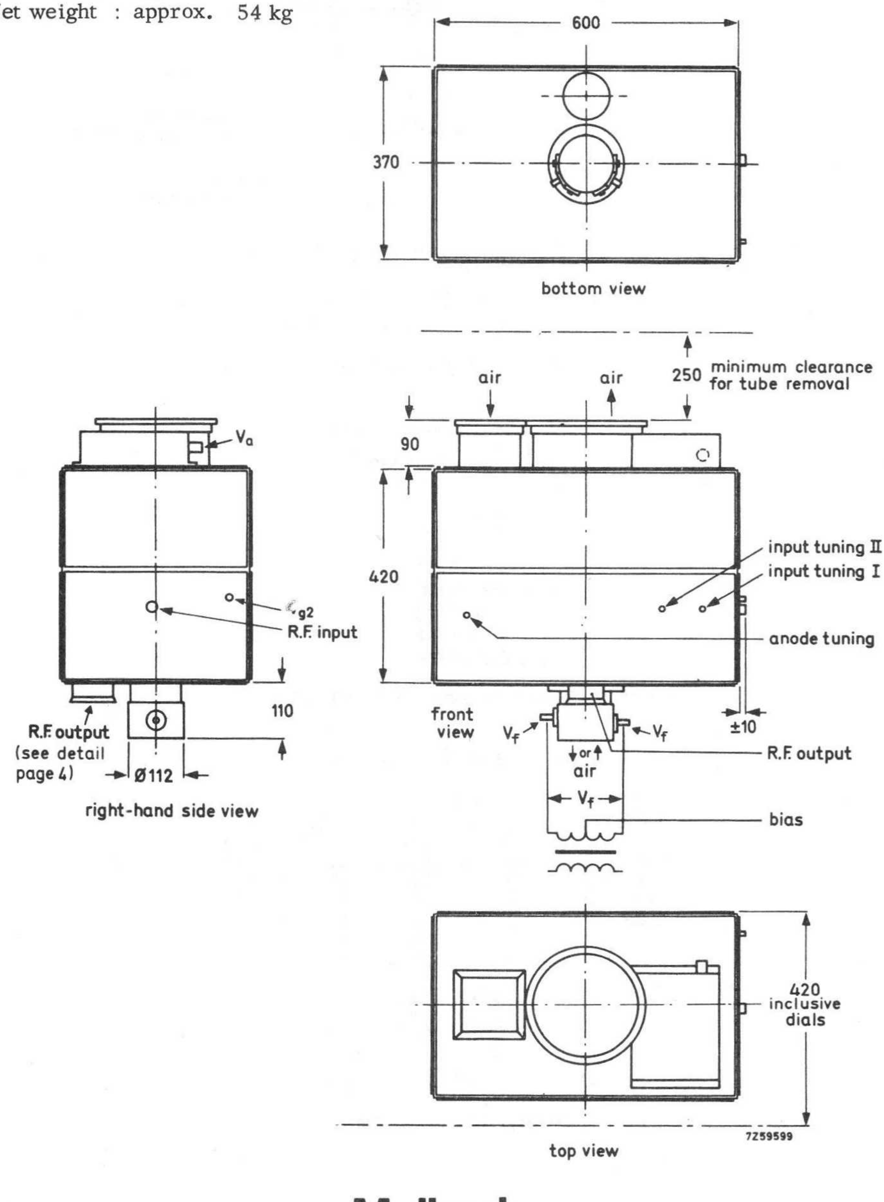
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

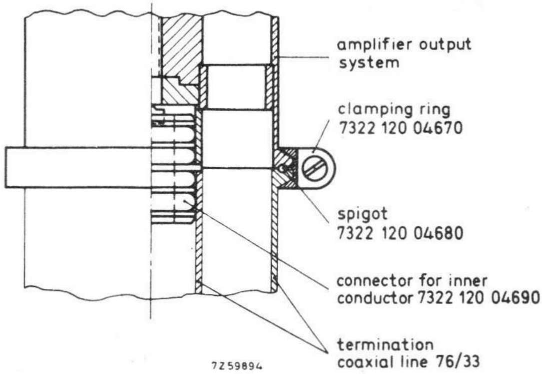
MECHANICAL DATA

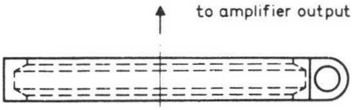
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 54 kg

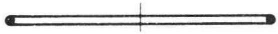


R. F. output connector

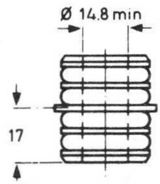




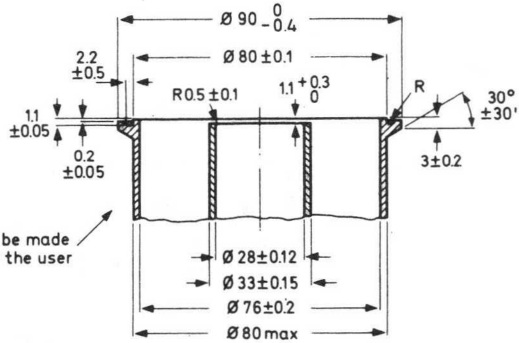
clamping ring 7322 120 04670



spigot 7322 120 04680

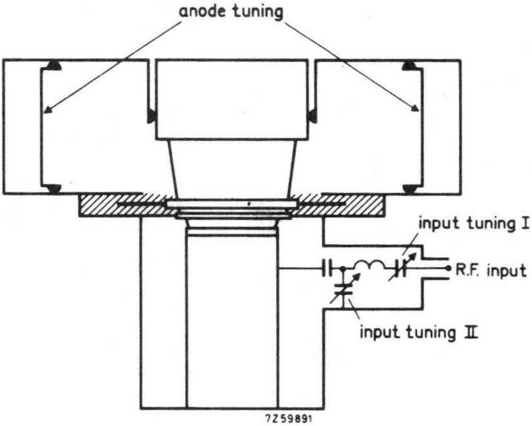


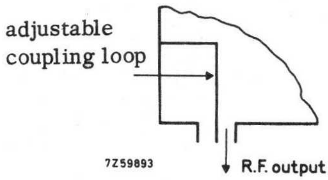
connector for inner conductor 7322 120 04690



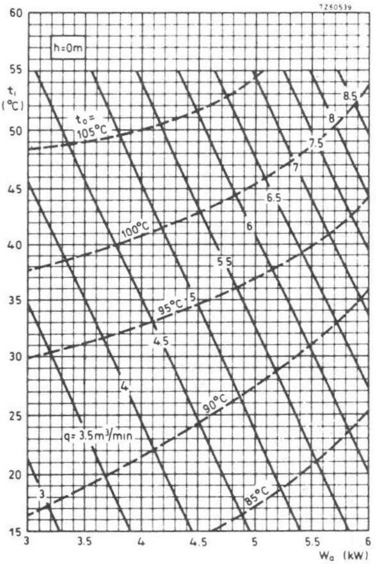
termination coaxial line 76/33

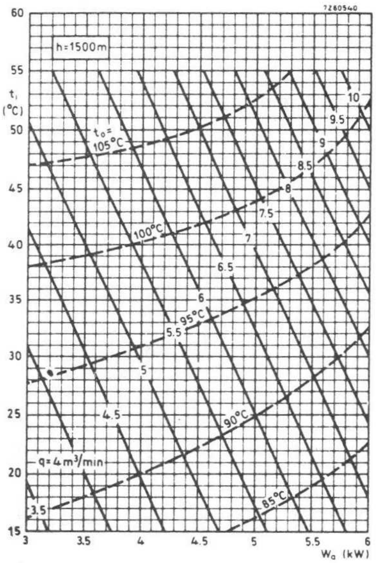
CIRCUIT DIAGRAM

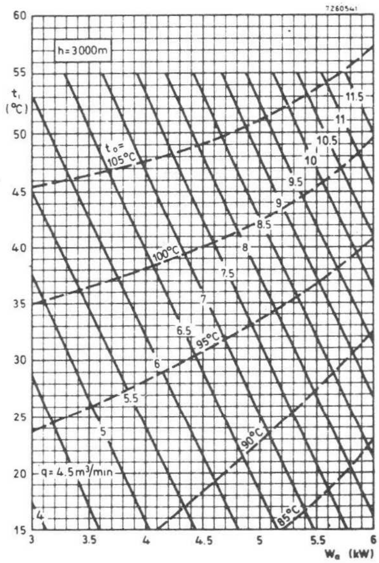


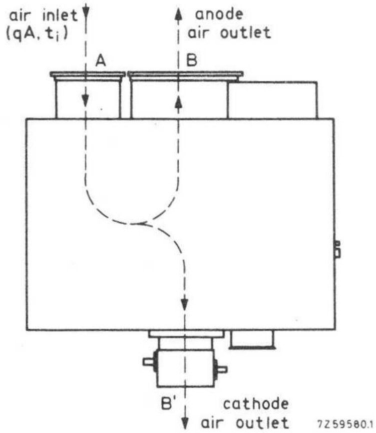


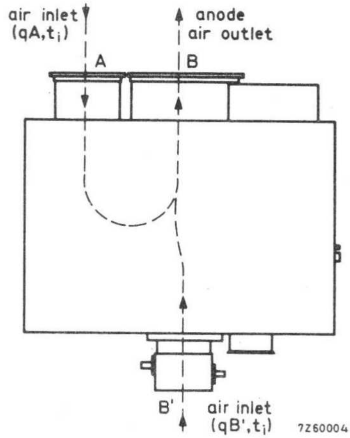
Cooling curves

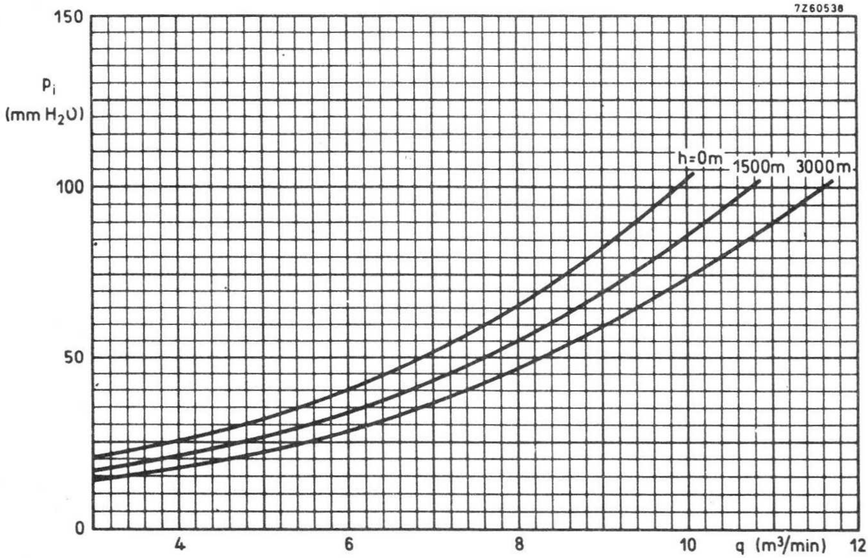












Pressure drop p_i across cavity with YL1420 as a function of airflow q.
p_i = pressure from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

40747

Continuously tunable cavity-type circuit assembly to be used with YL1430 to form a broad-band grounded-grid linear amplifier for television signals in Band III. The unit thus obtained can be put to good use in any of the principal monochrome and colour television systems.

QUICK REFERENCE DATA				
Class AB linear amplifier (vision)				
Frequency	170	to	230	MHz
Anode voltage			7	kV
Output power in load , sync			18, 4	kW
Power gain			25	
Frequency	170	to	230	MHz
Anode voltage			6	kV
Output power in load , sync			12, 5	kW
Power gain			30	
Class AB amplifier for television transposer service				
Frequency	175	to	225	MHz
Anode voltage			6	kV
Output power in load , sync			7	kW
Power gain			32	

FREQUENCY RANGE

170 to 230 MHz continuously tunable.

OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Either sucking and blowing is possible via connections on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial female connector: see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175.25 MHz	7322 120 04730
Coupling loop for remaining frequencies except 224.25 MHz	7322 120 04769 [1]
Insulating protection cap	7322 120 04750
Spanner for fitting the coupling loops	

b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or
2722 162 01201 (200 to 230 MHz) is recommended.

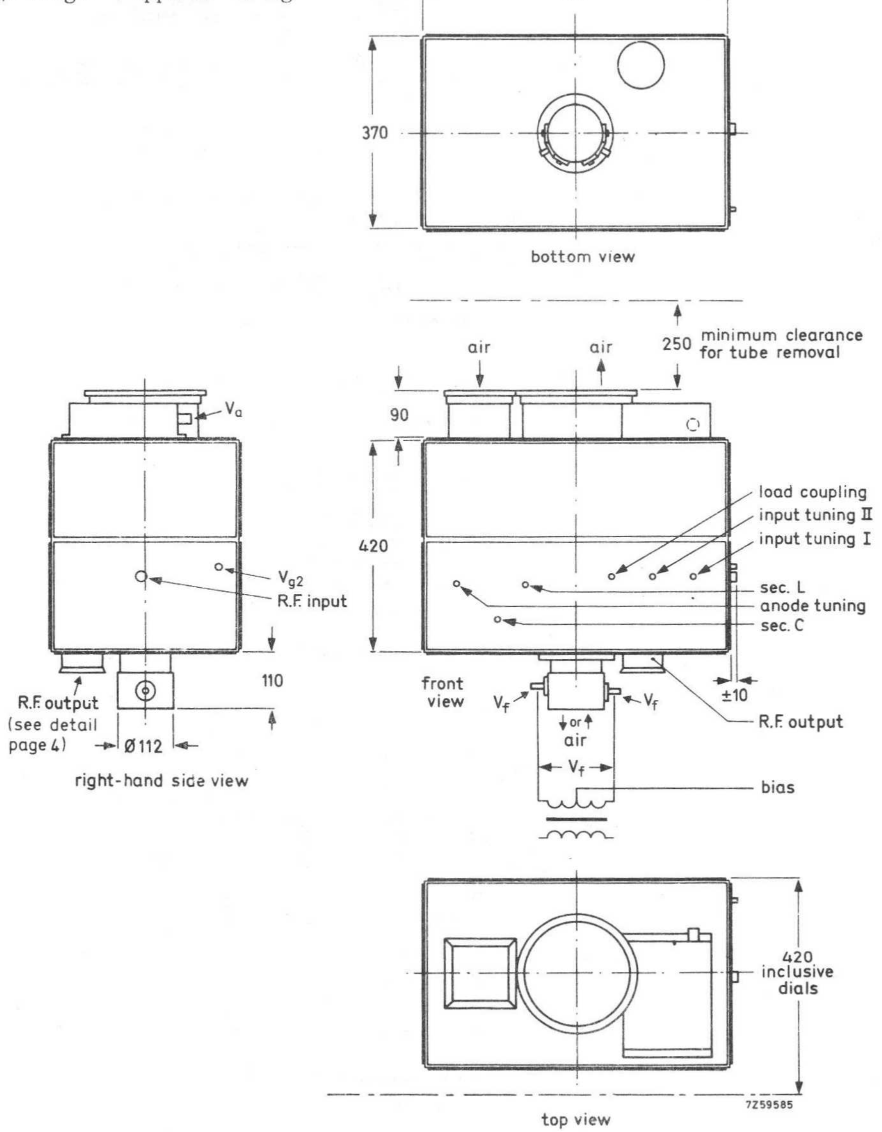
[1] For 224.25 MHz a different coupling loop is needed, which can be delivered on request.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

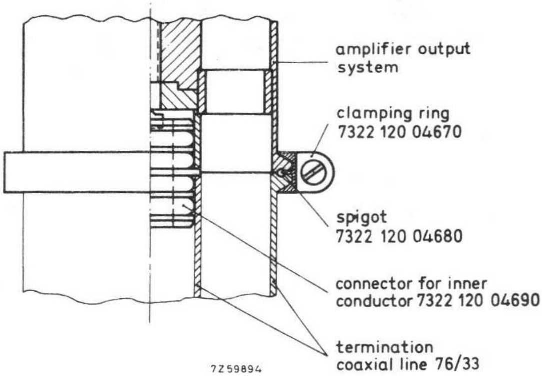
40747

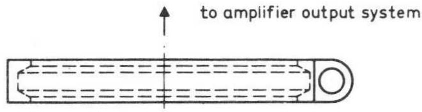
MECHANICAL DATA Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 67 kg

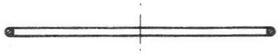


Output connector

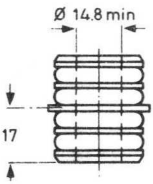




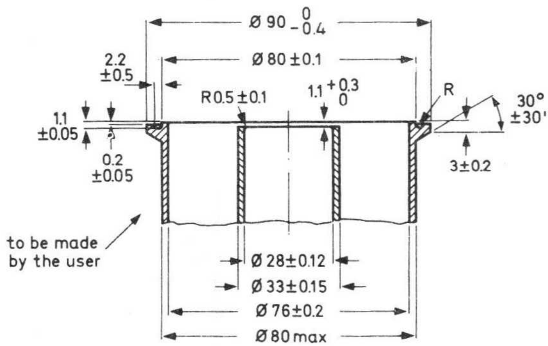
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690

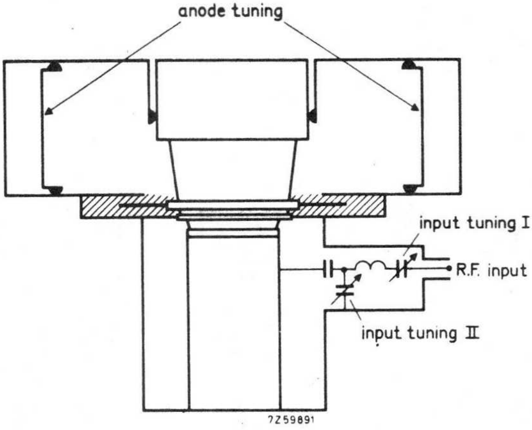


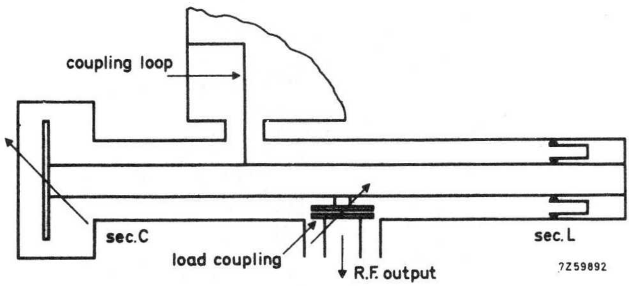
termination coaxial line 76/33

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

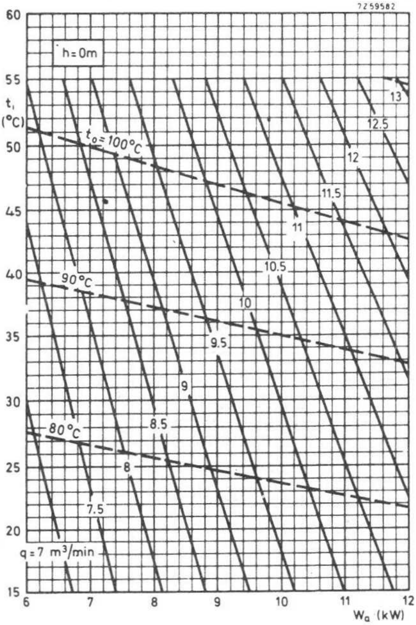
40747

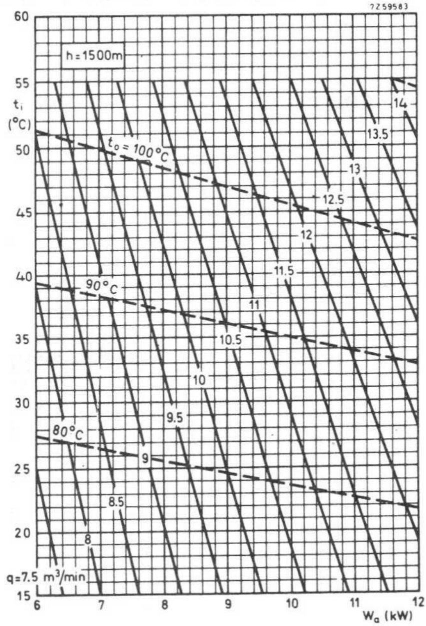
CIRCUIT DIAGRAM

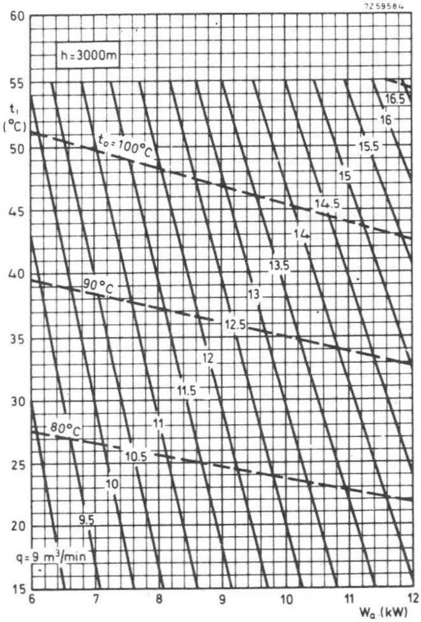




Cooling curves

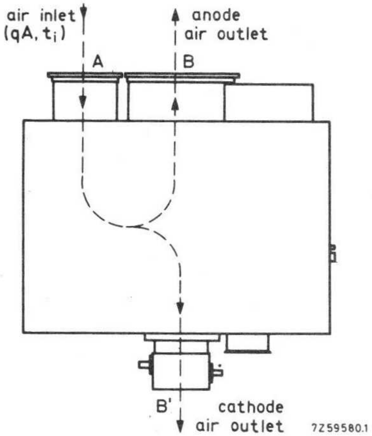


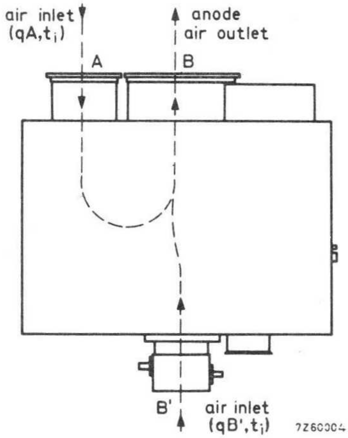


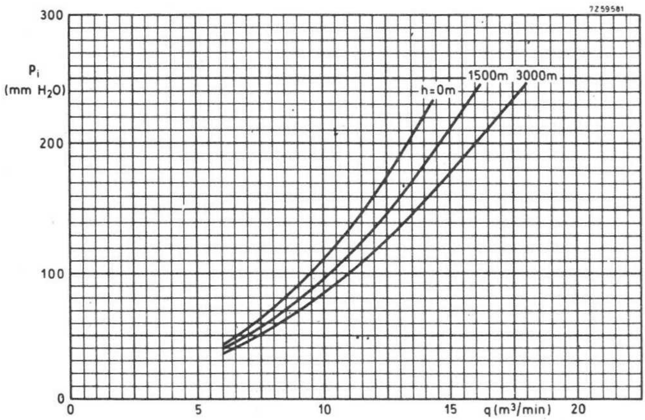


BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

40747







Pressure drop q_i across cavity with YL1430 as a function of airflow q.
p_i = pressure drop from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

40748

Continuously tunable cavity-type circuit assembly to be used with YL1430 to form a grounded-grid amplifier of frequency modulated signals in band III.

QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain
170 to 230	7.5	13	33

FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Either sucking and blowing is possible via connections on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial connector : see drawing page 4).

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

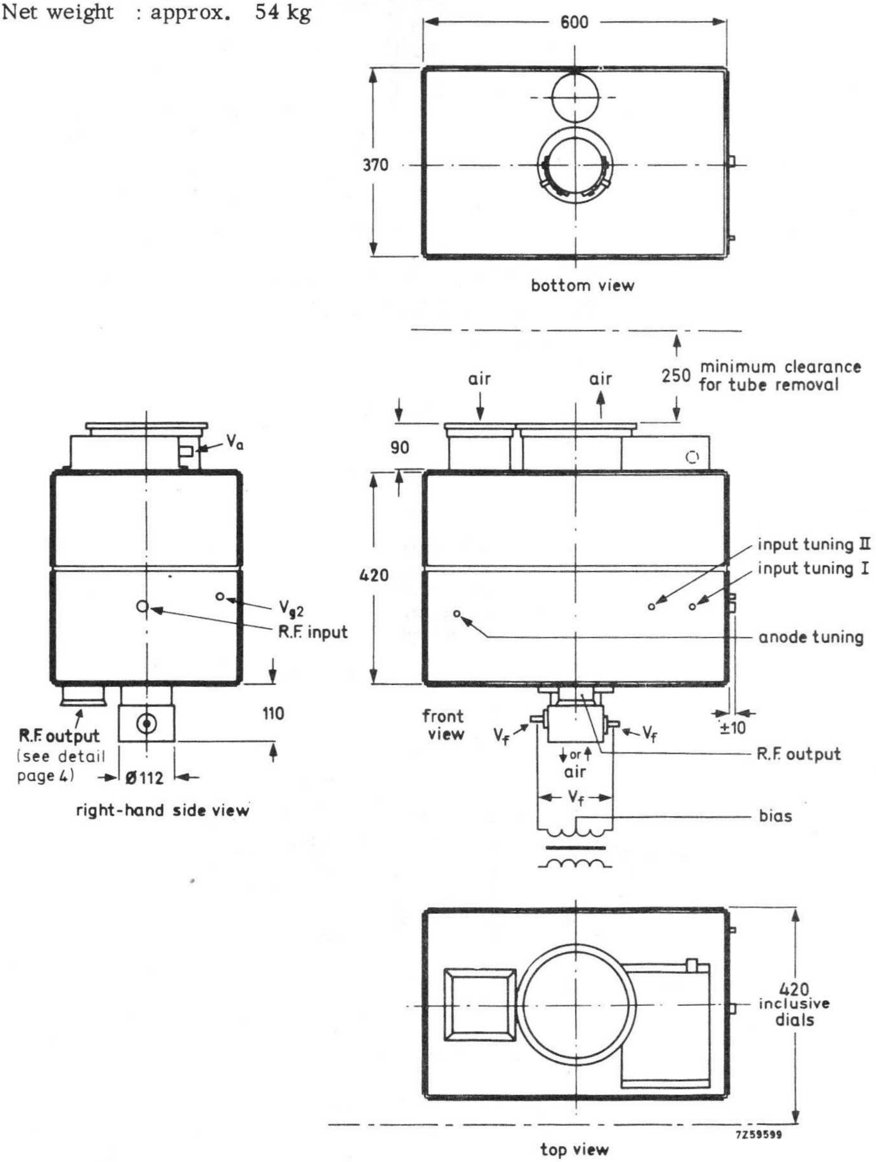
BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

40748

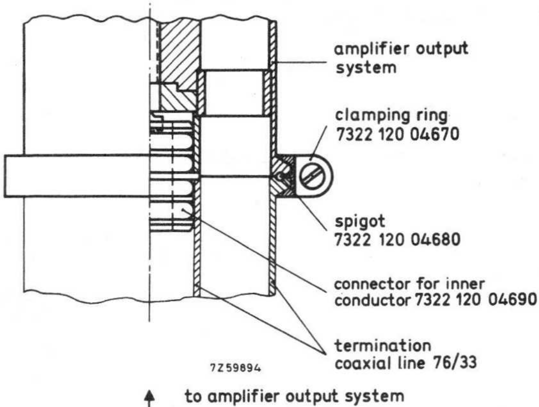
MECHANICAL DATA

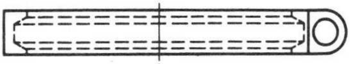
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 54 kg

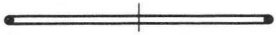


R.F. output connector

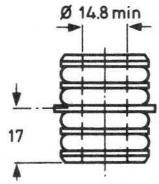




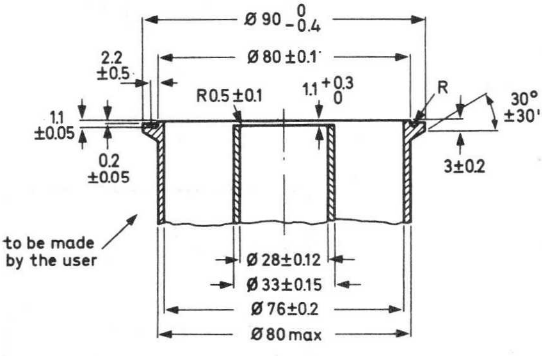
clamping ring 7322 120 04670



spigot 7322 120 04680



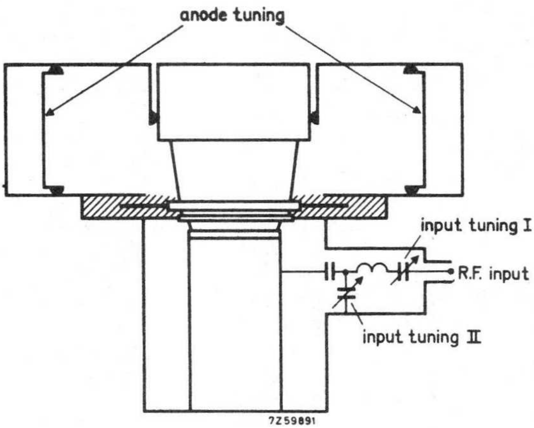
connector for inner conductor 7322 120 04690

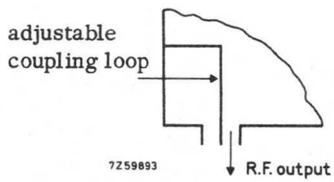


termination coaxial line 76/33

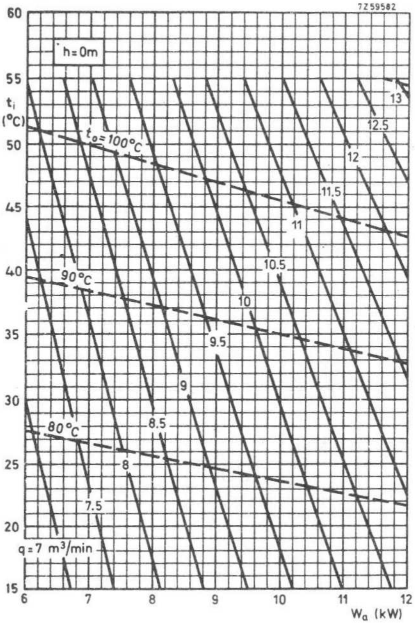
BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY

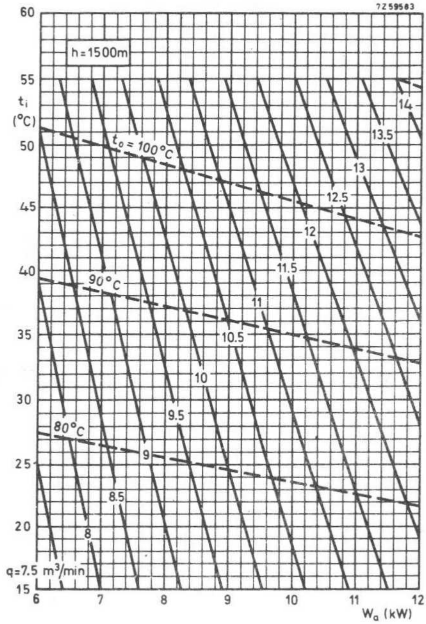
CIRCUIT DIAGRAM

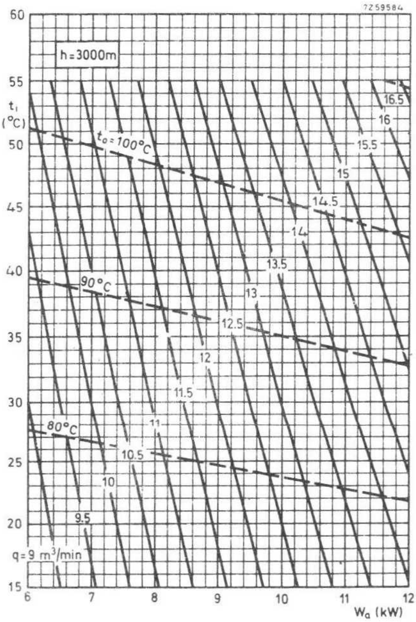




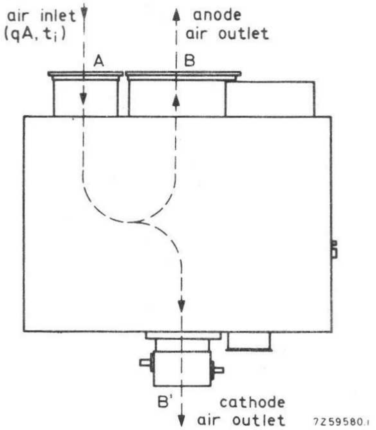
Cooling curves

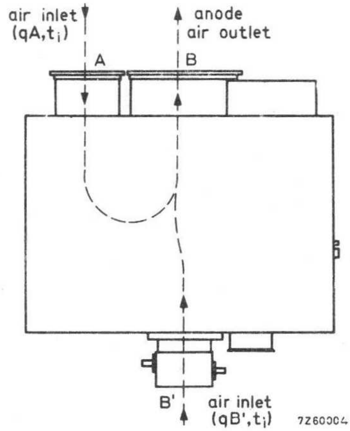


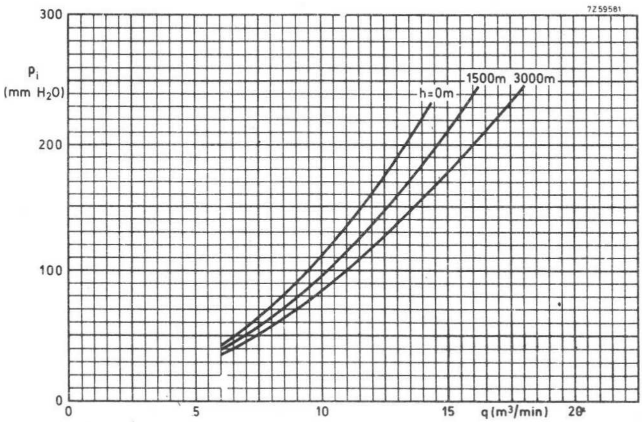




BAND III AMPLIFIER CIRCUIT SOUND ASSEMBLY







Pressure drop p_i across cavity with YL1430 as a function of air flow q.
p_i = pressure drop from plane A to plane B or B'.
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND I AMPLIFIER CIRCUIT VISION ASSEMBLY

40755

Channel tuned cavity-type circuit assembly to be used with YL1440 to form a broad-band grounded-grid linear amplifier for television signals in Band I.
The unit thus obtained can be put to good use in any of the principal monochrome and colour television systems.

QUICK REFERENCE DATA				
Class AB linear amplifier (vision)				
Frequency	48	to	83	MHz
Anode voltage			2,5	kV
Output power in load, sync			1,17	kW
Power gain			14	
Frequency	48	to	83	MHz
Anode voltage			2	kV
Output power in load, sync			0,67	kW
Power gain			16	

FREQUENCY RANGE

48,25 to 69,25 MHz and
77,25 to 83,25 MHz — channel tuned

OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

COOLING

See cooling curves.
Direction of airflow: see drawing page 5.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

Delivered with the assembly

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for vision carries	
5 coils for vision carrier frequencies 55.25; 61.25 to 62.25; 67.25; 77.25; 83.25 MHz	[1]
Spanner for fitting the coils	

1) Coils covering vision carrier frequencies other than specified can be delivered on request.

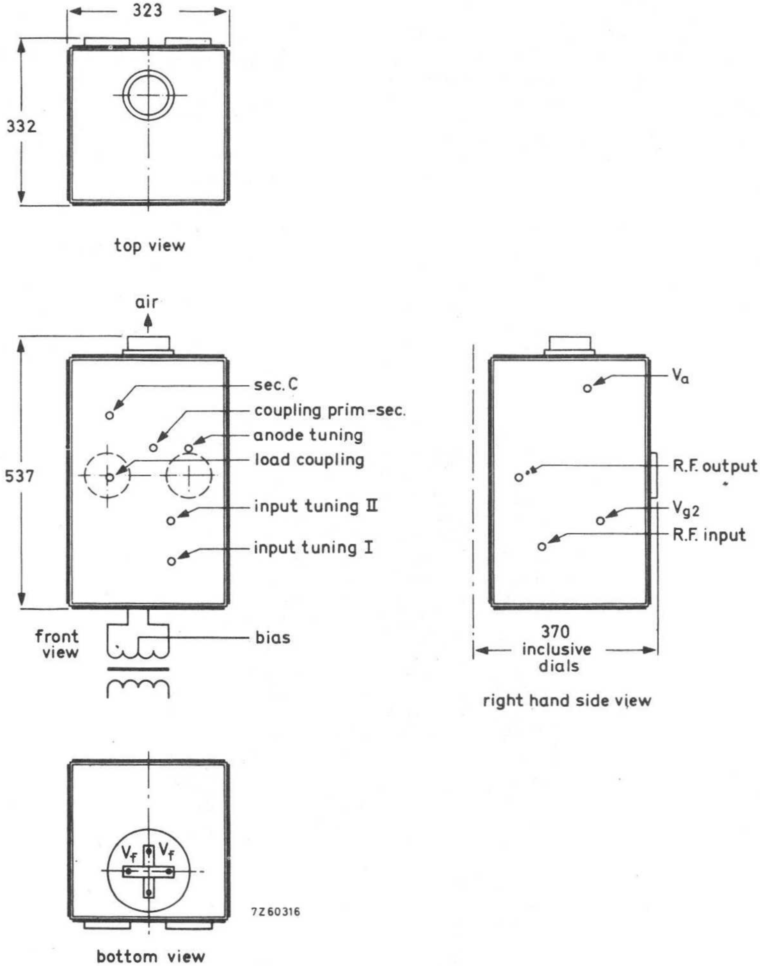
BAND I AMPLIFIER CIRCUIT
VISION ASSEMBLY

40755

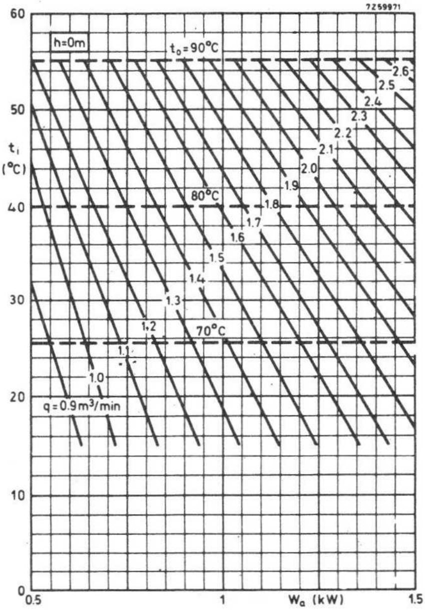
MECHANICAL DATA

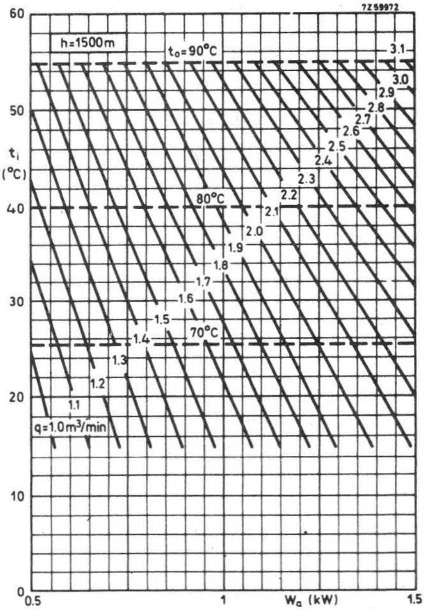
Dimensions in mm

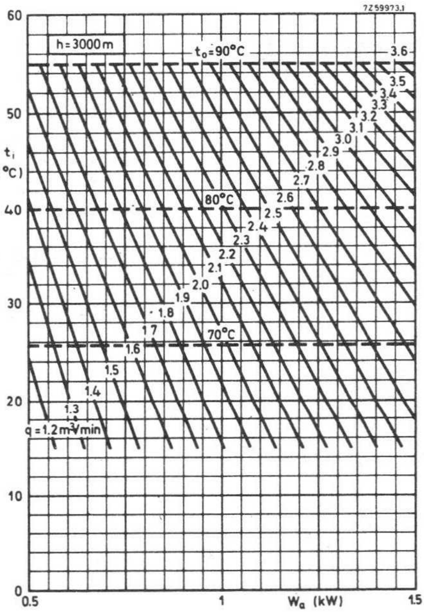
Dimensions: approx. 516 x 323 x 323 mm^3
Net weight : approx. 23 kg

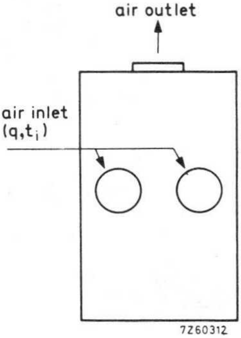


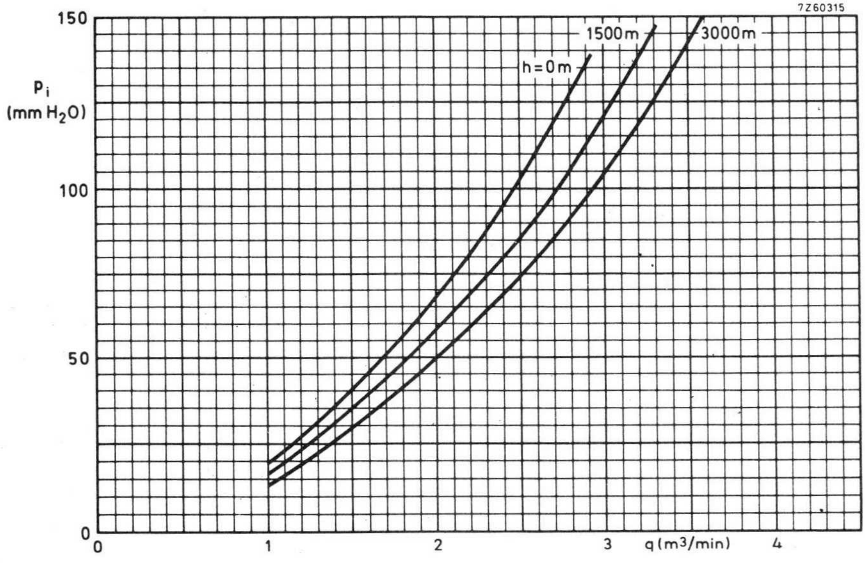
Cooling curves



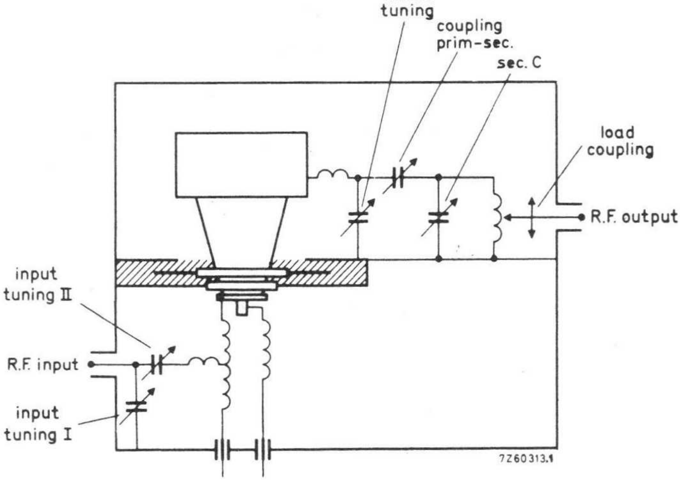





air outlet
air inlet
(q,t$_i$)
7Z60312


7Z60315
150
100
50
0
p_i
(mm H_2O)
h=0m
1500m
3000m
0
1
2
3
4
q (m^3/min)

CIRCUIT DIAGRAM



BAND I AMPLIFIER CIRCUIT SOUND ASSEMBLY

40756

Channel tuned amplifier circuit assembly to be used with YL1440 to form a grounded-grid amplifier of frequency-modulated signals in Band I.

QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain
up to 88	3.5	2.4	26

FREQUENCY RANGE

53 to 72 MHz and 82 to 88 MHz — channel tuned

OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

COOLING

See cooling curves.
Direction of airflow: see drawing page 5.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

Delivered with the assembly

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for sound carrier frequencies 59.75 to 60.75; 65.75 to 67.75; 71.75 81.75; 87.75 MHz	[1]
Spanner for fitting the coils	

[1] Coils covering sound carrier frequencies other than specified can be delivered on request.

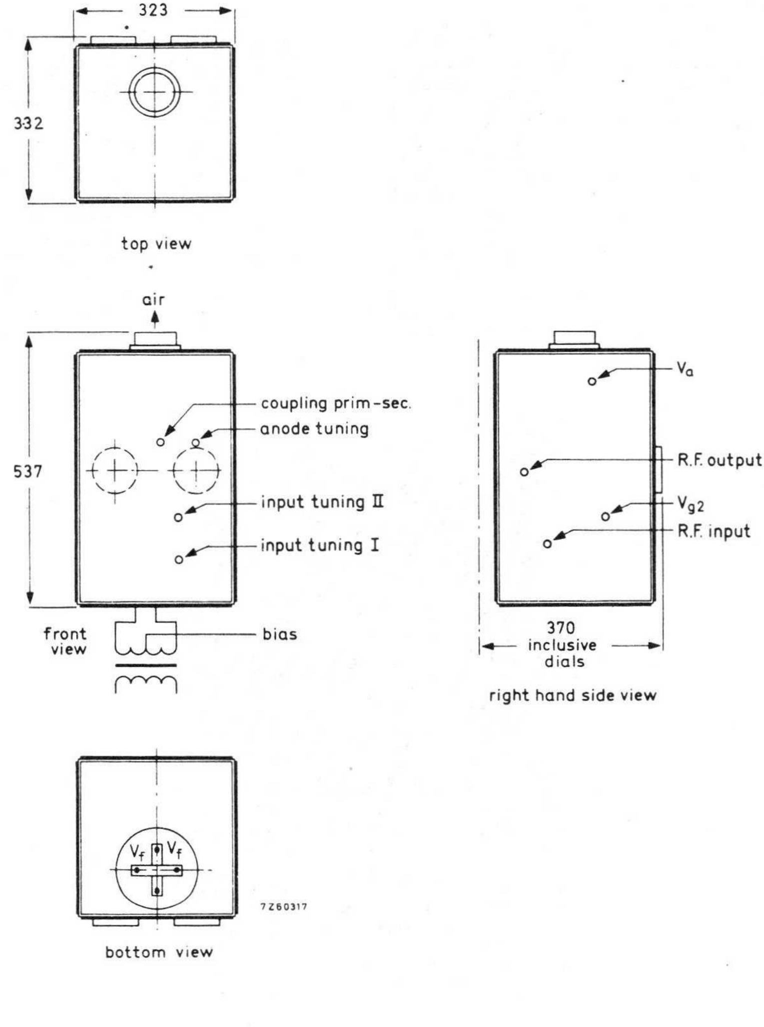
BAND I AMPLIFIER CIRCUIT
SOUND ASSEMBLY

40756

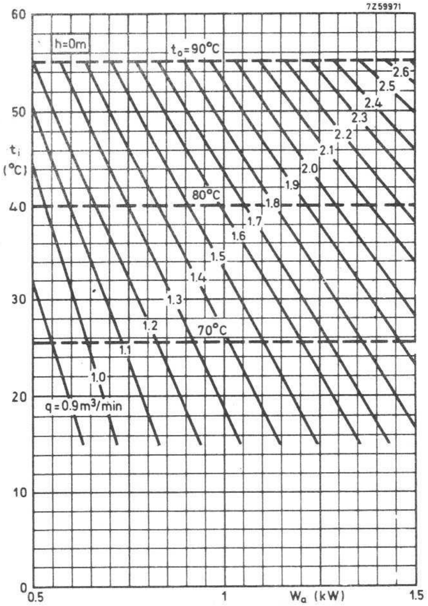
MECHANICAL DATA

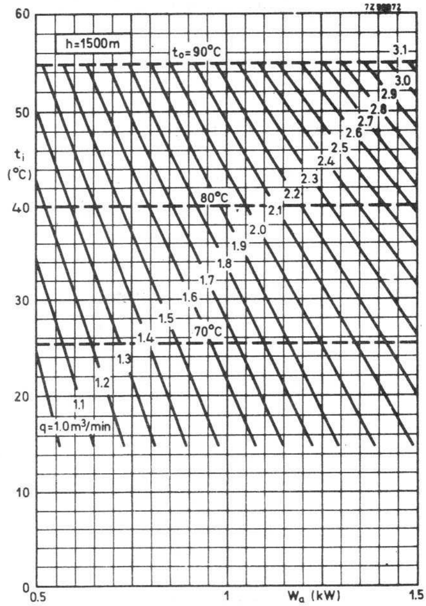
Dimensions in mm

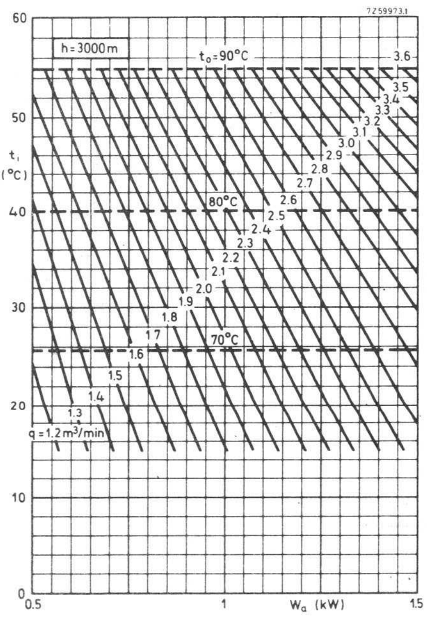
Dimensions: approx. 516 x 323 x 323 mm^3
Net weight : approx. 22.5 kg

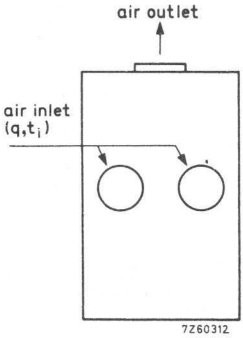


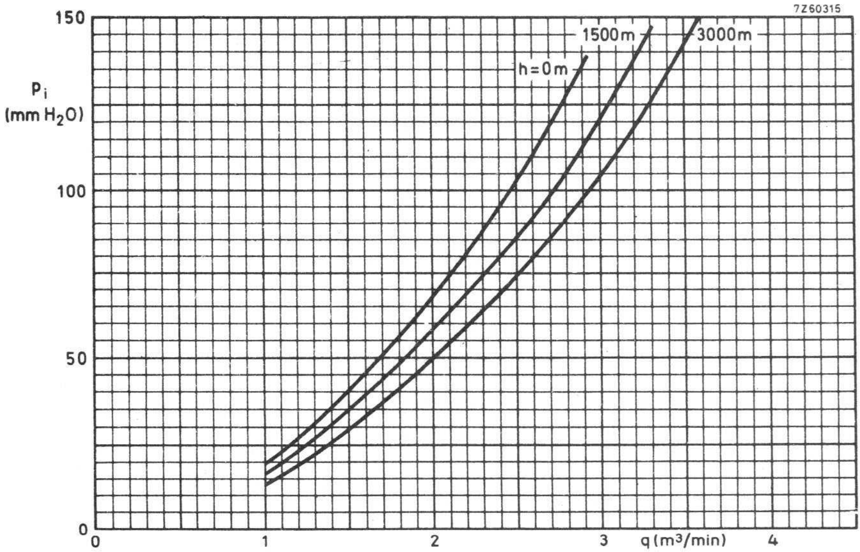
Cooling curves



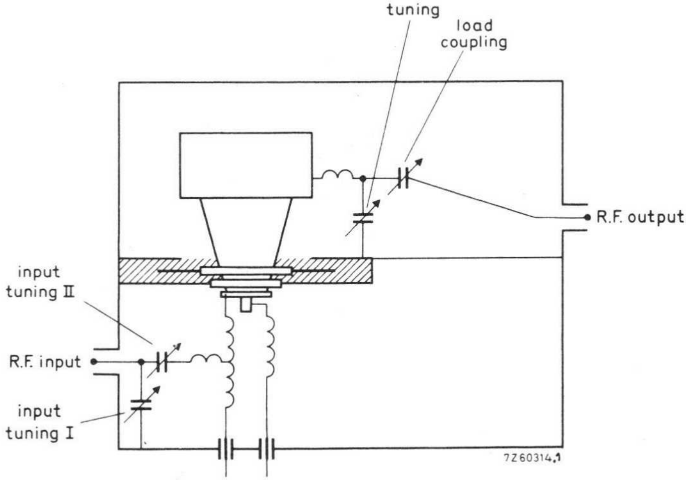





air outlet
air inlet
(q,t_i)
7Z60312


7Z60315
150
p_i
(mm H_2O)
100
50
0
1500m
3000m
h=0m
0
1
2
3
q(m^3/min)
4

CIRCUIT DIAGRAM



BAND I AMPLIFIER CIRCUIT VISION ASSEMBLY

40757

Amplifier circuit assembly to be used with YL1420 to form a broad-band grounded-grid linear amplifier for television signals in Band I.

QUICK REFERENCE DATA			
	Class AB linear amplifier (vision)		
Frequency (MHz)	V_a(kV)	$W_{\ell\,sync}$ (kW)(CCIR system)	Power gain
83.25	4	6.25	18.5
55.25	4	6.25	16

FREQUENCY RANGE

55.25 to 67.25 MHz and
77.25 to 83.25 MHz } channel tuned

OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

COOLING

See cooling curves.
Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial femal connector, type N)
Output: 50 Ω (coaxial female connector, see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance
Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with assembly

Tube extractor	7322 120 07850	
Mating male input connector	Radiall type N	
Output connector		
connector for inner conductor	7322 120 04690	
spigot for outer conductor	7322 120 04680	
clamping ring for outer conductor	7322 120 04670	
Mating connector for anode voltage	Radiall type R13060	
Mating connector for screen grid voltage	Radiall type R9510	
Anode coil covering frequency range 55.25 to 67.25 MHz	-----	1)
Elbow for secondary circuit covering frequency range 55.25 to 67.25 MHz	-----	

b) Not delivered with assembly

Anode coil covering frequency range 77.25 to 83.25 MHz	8222 032 11860	1)
Elbow for secondary circuit covering frequency range 77.25 to 83.25 MHz	8222 032 11790	

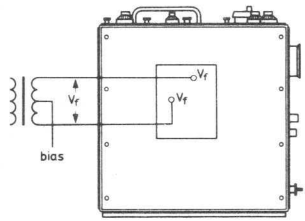
1) For use on carrier frequencies other than specified please contact the manufacturer.

MECHANICAL DATA

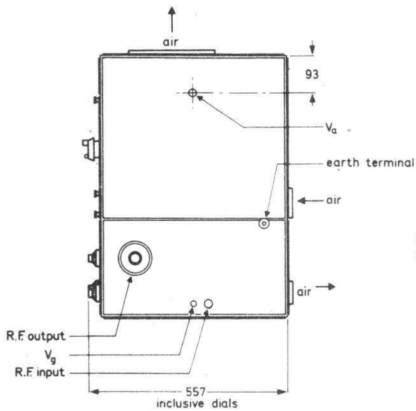
Dimensions in mm

Dimensions: approx. 700 x 500 x 500 mm^3

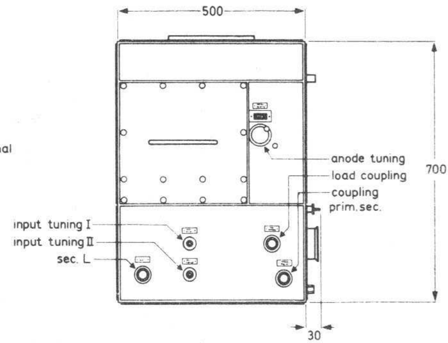
Net weight: approx. 70 kg



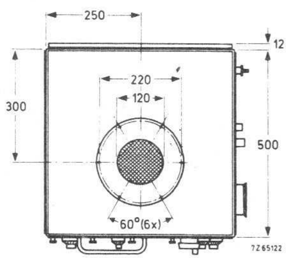
bottom view



right hand side view

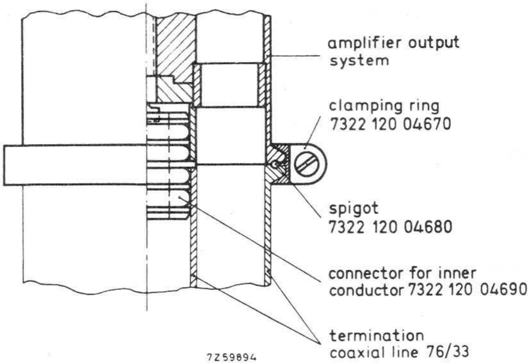


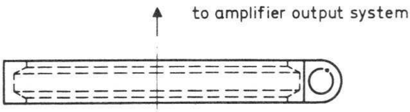
front view



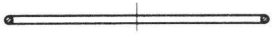
top view

Output connector

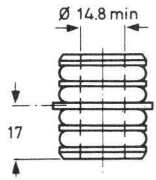




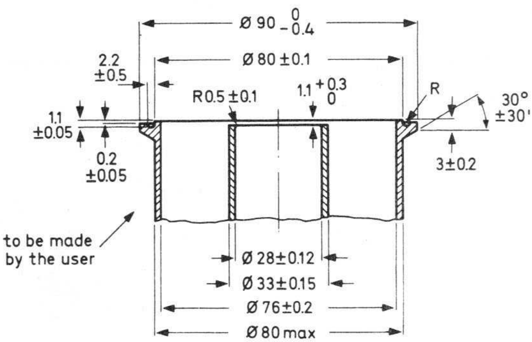
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690

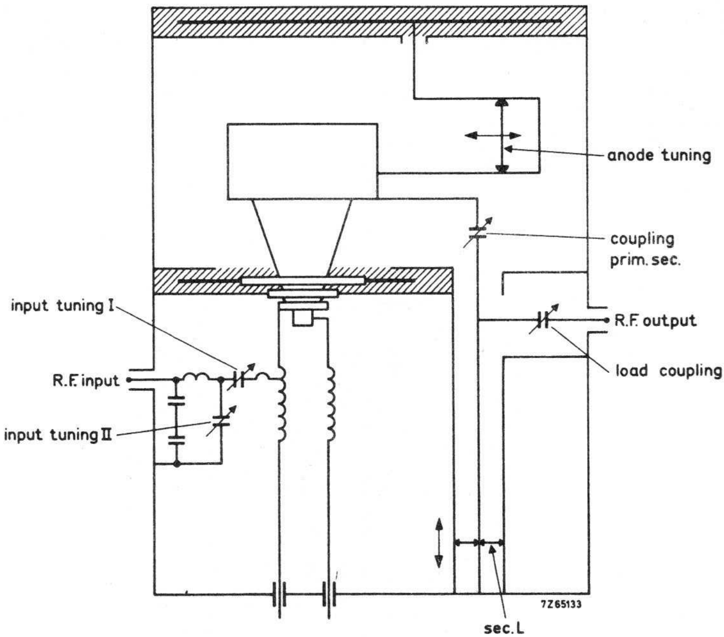


termination coaxial line 76/33

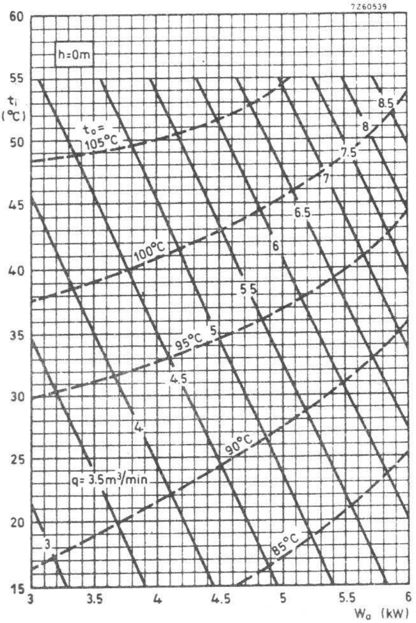
BAND I AMPLIFIER CIRCUIT VISION ASSEMBLY

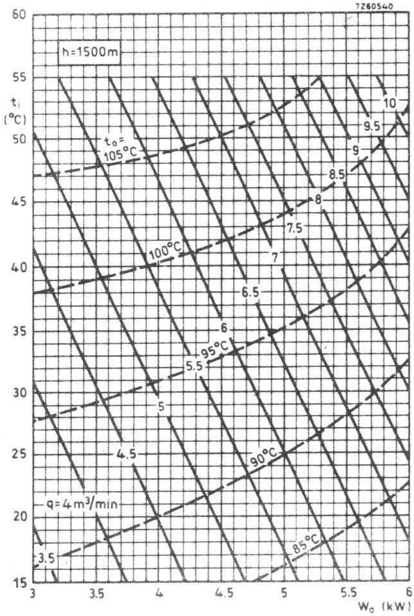
40757

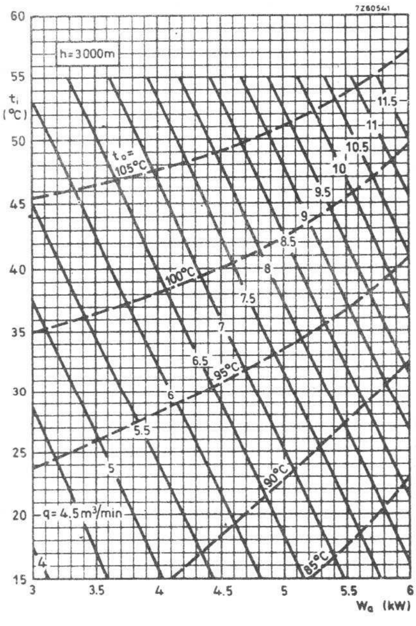
CIRCUIT DIAGRAM

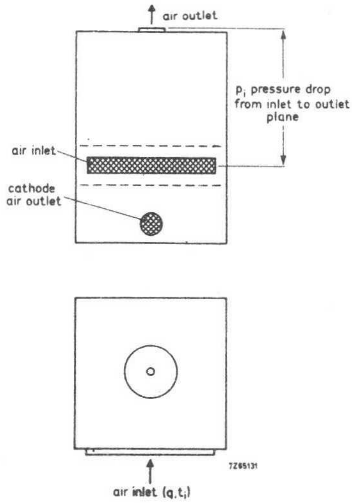


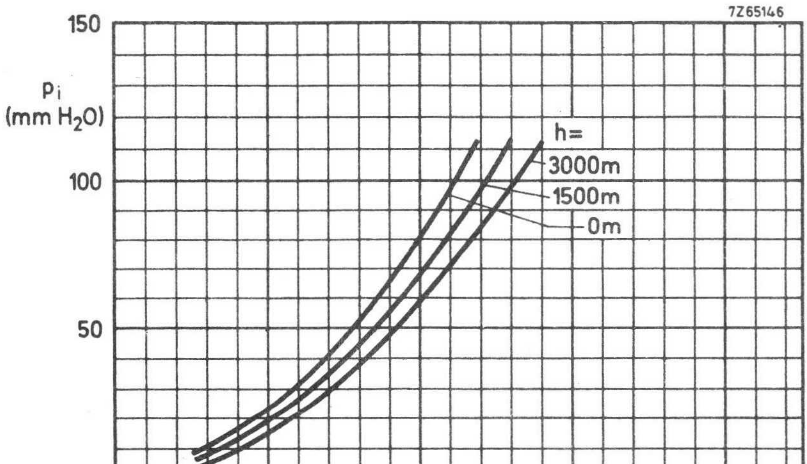
Cooling curves








air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65146
p_i (mm H_2O)
150
100
50
0
h=
3000m
1500m
0m
0
5
10
15
q(m^3/min)
20

BAND I AMPLIFIER CIRCUIT SOUND ASSEMBLY

40758

Channel tuned amplifier circuit assembly to be used with YL1420 to form a grounded-grid amplifier of frequency-modulated signals in Band I.

QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain
up to 88	7	10.5	32

FREQUENCY RANGE

53 to 72 MHz and
82 to 88 MHz } channel tuned

OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

COOLING

See cooling curves.
Direction of air flow : see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial female connector, see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Anode coil covering frequency range 53 to 72 MHz	----

b) Not delivered with assembly

Anode coil covering frequency range 82 to 88 MHz	8222 032 11860

BAND I AMPLIFIER CIRCUIT SOUND ASSEMBLY

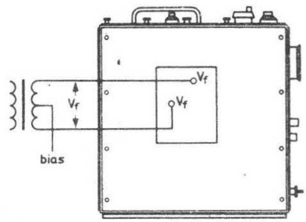
40758

MECHANICAL DATA

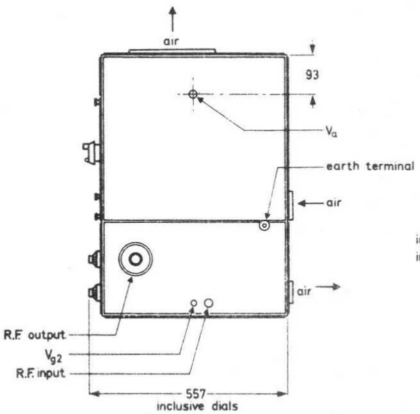
Dimensions in mm

Dimensions : approx. 700 x 500 x 500 mm^3

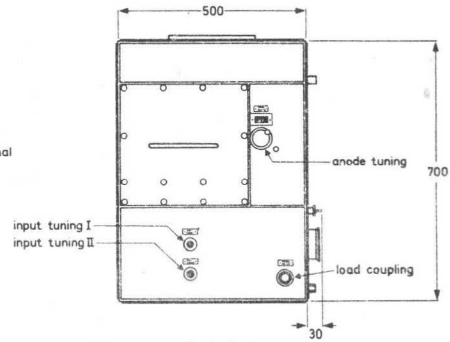
Net weight : approx. 58 kg



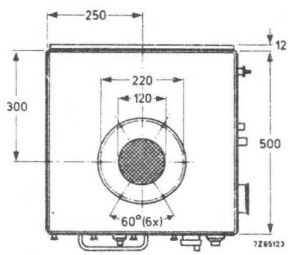
bottom view



right hand side view

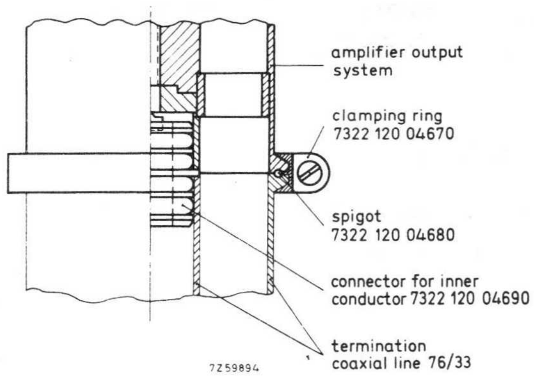


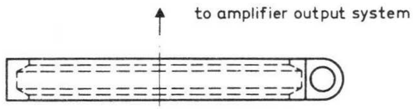
front view



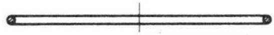
top view

Output connector

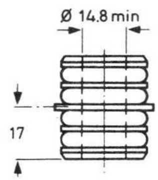




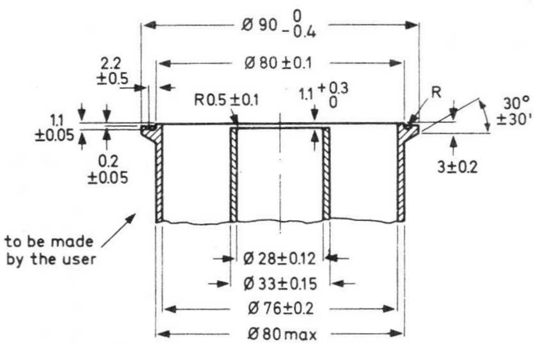
clamping ring 7322 120 04670



spigot 7322 120 04680

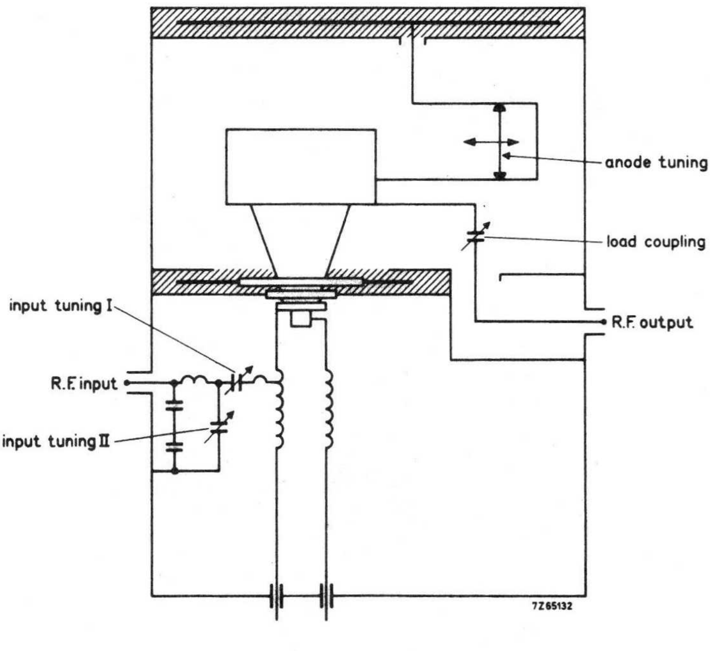


connector for inner conductor 7322 120 04690

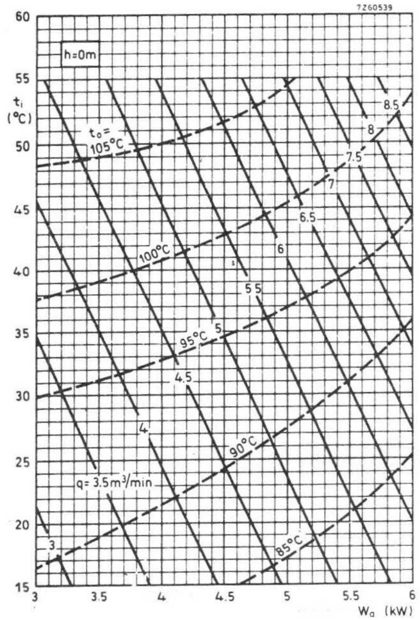


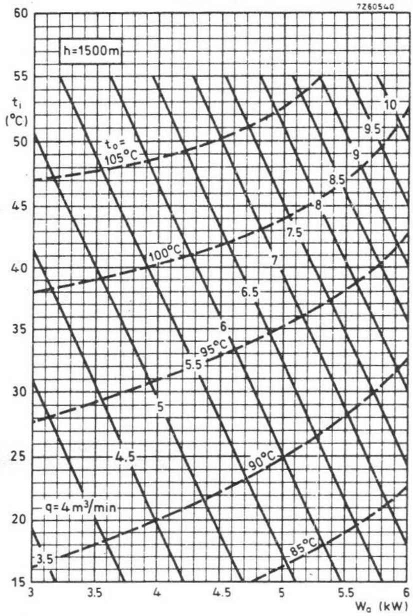
termination coaxial line 76/33

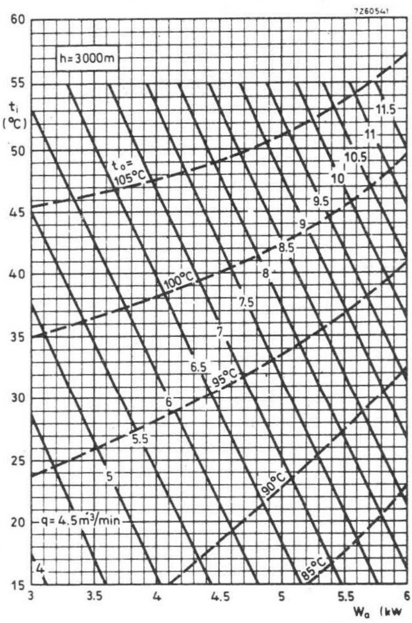
CIRCUIT DIAGRAM

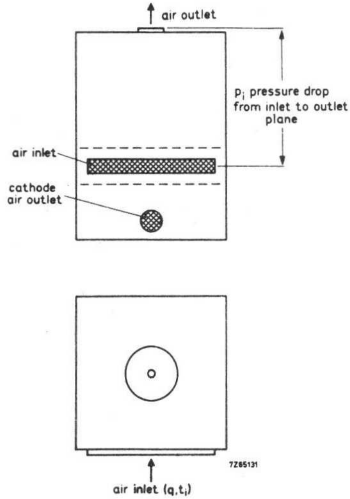


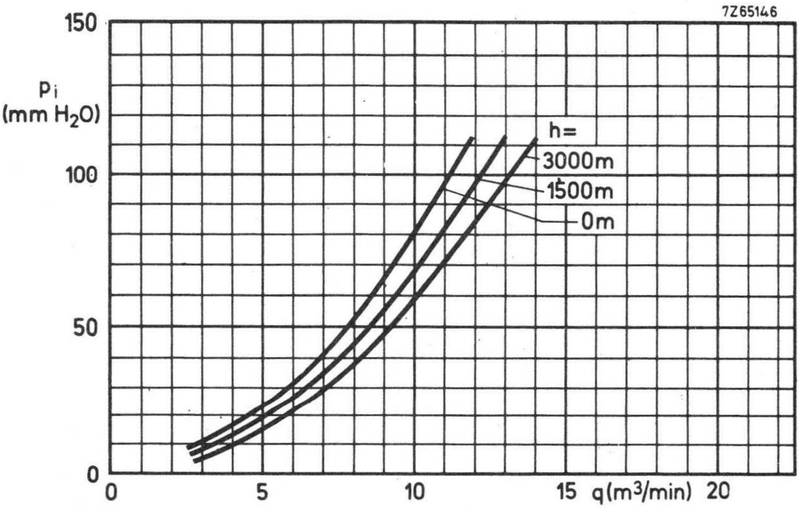
Cooling curves








air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65146
150
p_i (mm H_2O)
100
50
0
h=
3000m
1500m
0m
0
5
10
15
q(m^3/min)
20

BAND I AMPLIFIER CIRCUIT VISION ASSEMBLY

40759

Amplifier circuit to be used with YL1430 or YL1520 to form a broad-band grounded grid linear amplifier for television signals in Band I.

QUICK REFERENCE DATA				
Frequency (MHz)	Type	Class AB linear amplifier (vision)		
		V_a (kV)	W_ℓ sync (kW)(CCIR) system	Power gain
83.25 55.25 55.25	YL1430	5.5 5.5 4.0	13.2 13.2 6.4	20 18 18
83.25 55.25	YL1520	6.5	20 20	24 22

FREQUENCY RANGE

55.25 to 69.25 MHz and 77.25 to 83.25 MHz } channel tuned

OPERATING CONDITIONS (For YL1430 or YL1520)

For detailed operating conditions reference is made to the data sheets for tube type YL1430 or YL1520.

COOLING

See cooling curve.
Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)
Output : 50 Ω (coaxial female connector, see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance
Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with assembly

Tube extractor	7322 120 07850	
Mating male input connector	Radiall type N	
Output connector		
connector for inner conductor	7322 120 04690	
spigot for outer conductor	7322 120 04680	
clamping ring for outer conductor	7322 120 04670	
Mating connector for anode voltage	Radiall type R13060	
Mating connector for screen grid voltage	Radiall type R9510	
Anode coil covering frequency range 55.25 to 67.25 MHz for YL1430 and 55.25 to 61.25 MHz for YL1520	----	[1]
Elbow for secondary circuit covering frequency range 55.25 to 67.25 MHz for both types	----	

b) Not delivered with assembly

Anode coil covering frequency range 77.25 to 83.25 MHz for YL1430 and 67.25 to 83.25 MHz for YL1520	8222 032 11860	[1]
Elbow for secondary circuit covering frequency range 77.25 to 83.25 MHz for both types	8222 032 11790	

1) For use on carrier frequencies other than specified please contact the manufacturer.

BAND I AMPLIFIER CIRCUIT VISION ASSEMBLY

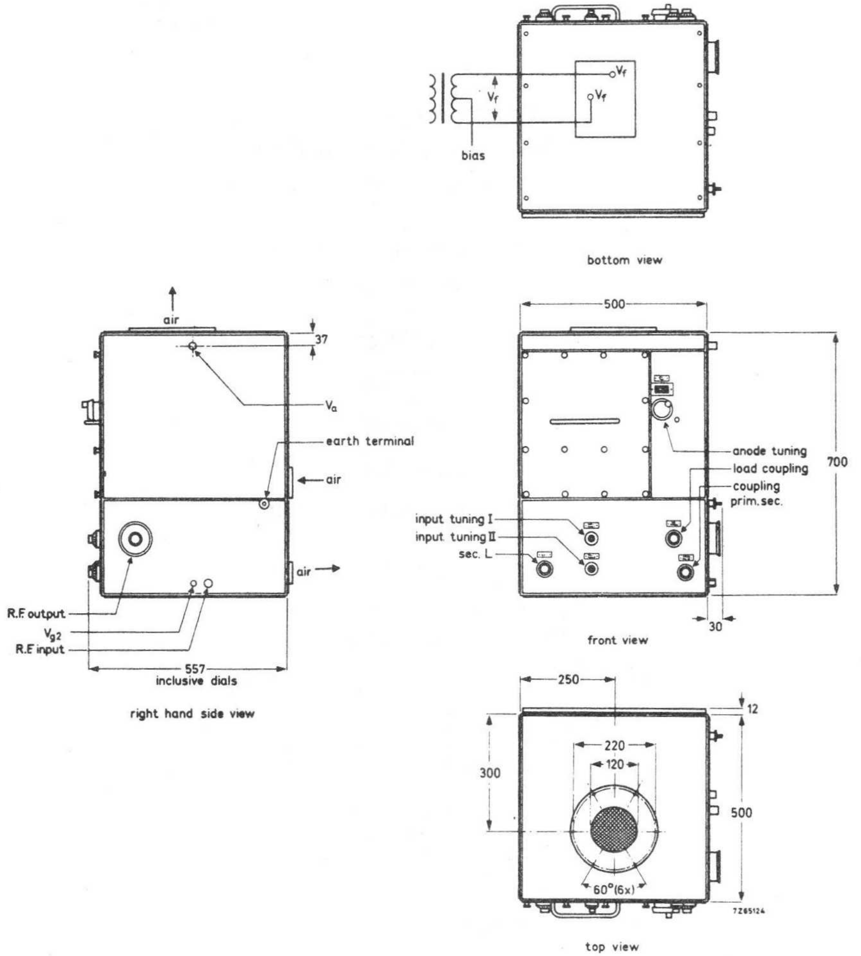
40759

MECHANICAL DATA

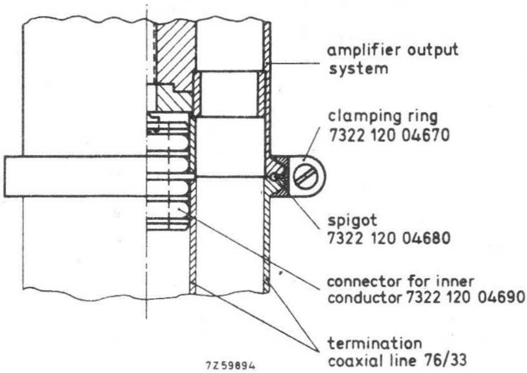
Dimensions in mm

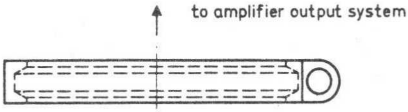
Dimensions: approx. 700 x 500 x 500 mm^3

Net weight : approx. 70 kg

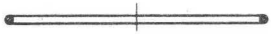


Output connector

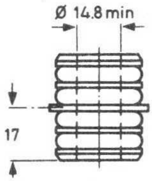




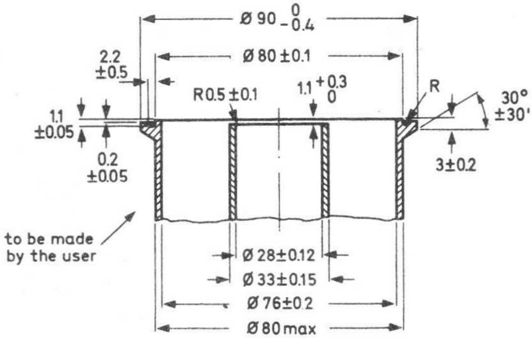
clamping ring 7322 120 04670



spigot 7322 120 04680



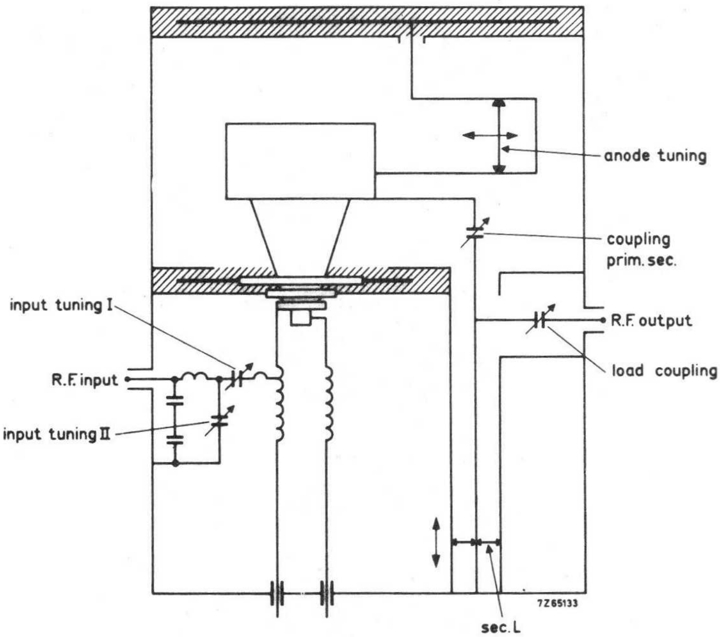
connector for inner conductor 7322 120 04690



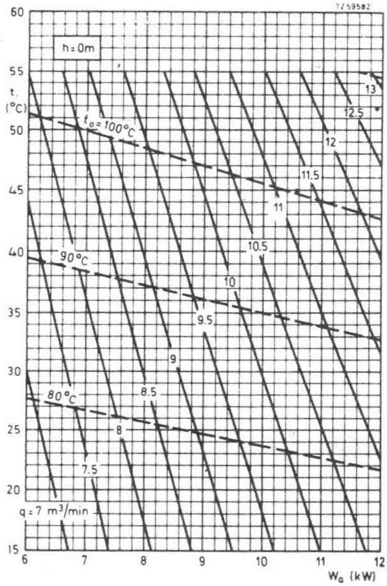
termination coaxial line 76/33

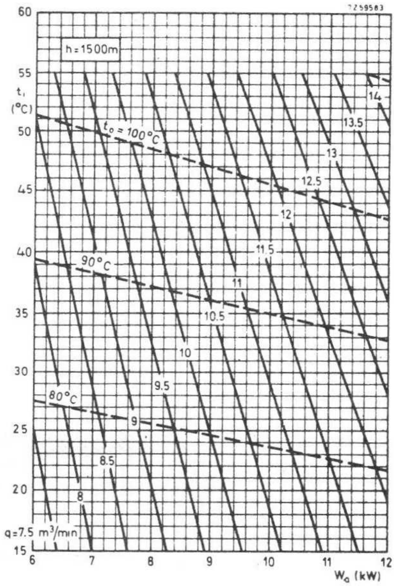
BAND I AMPLIFIER CIRCUIT VISION ASSEMBLY

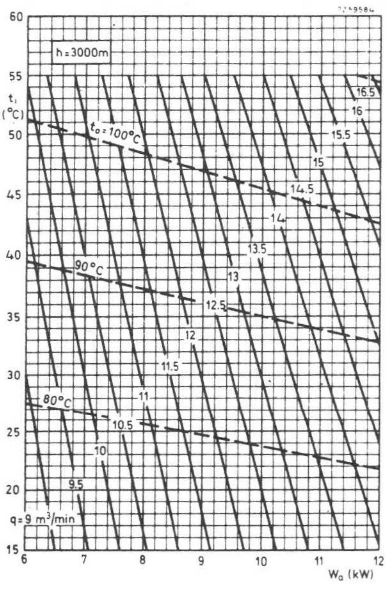
CIRCUIT DIAGRAM

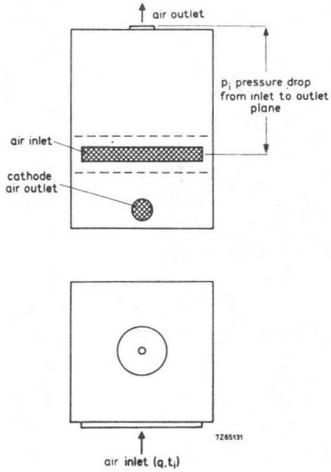


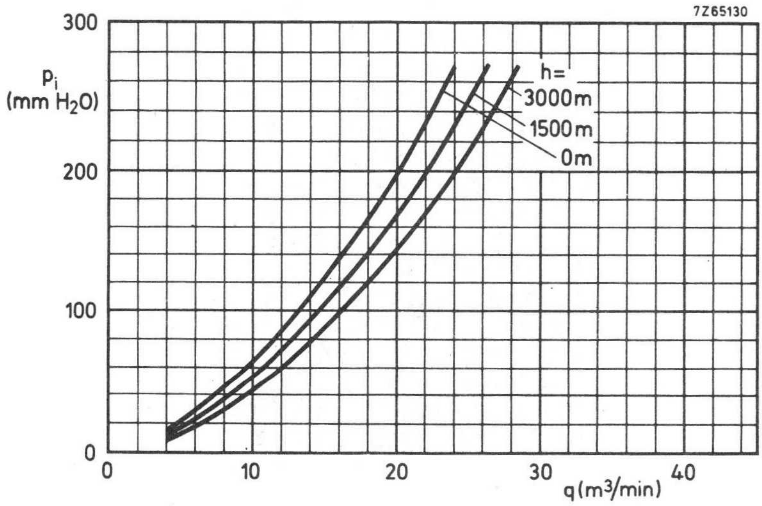
Cooling curves for amplifier 40759 fitted with tube YL1430



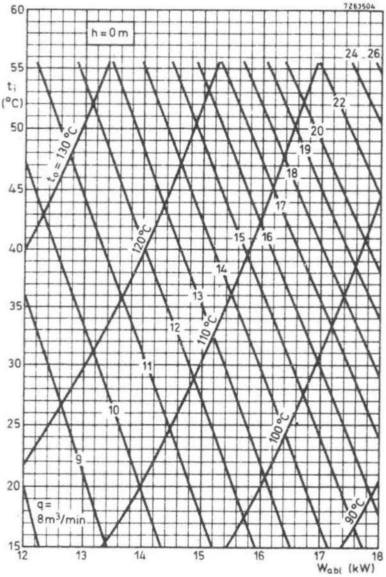


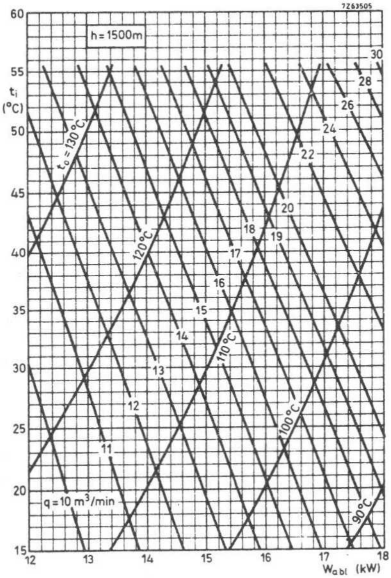


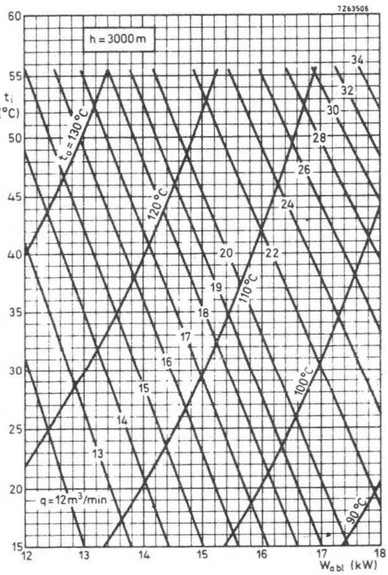

air outlet
p_i pressure drop
from inlet to outlet
plane
air inlet
cathode
air outlet
7Z65131
air inlet (q, t_i)


7Z65130
300
200
100
0
p_i
(mm H_2O)
h=
3000m
1500m
0m
0
10
20
30
40
q(m^3/min)

Cooling curves for amplifier 40759 fitted with tube YL1520







BAND I AMPLIFIER CIRCUIT SOUND ASSEMBLY

40760

Amplifier circuit assembly to be used with YL1430 or YL1520 to form a grounded-grid amplifier of frequency modulated signals in Band I.

QUICK REFERENCE DATA				
	Class AB linear amplifier (sound)			
Frequency (MHz)	Type	V_a (kV)	W_ℓ (kW)	Power gain
up to 88	YL1430	7.5	13	32.5

FREQUENCY RANGE

53 to 72 MHz and 82 to 88 MHz } channel tuned

OPERATING CONDITIONS (For YL1430 and YL1520)

For detailed operating conditions reference is made to the data sheets for tube type YL1430 or YL1520.

COOLING

See cooling curves.
Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)
Output : 50 Ω (coaxial female connector, see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C
Altitude : max. 3000 m
Relative humidity : up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance
Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Anode coil covering frequency range 53 to 72 MHz for YL1430 and 53 to 66 MHz for YL1520	---

b) Not delivered with assembly

Anode coil covering frequency range 82 to 88 MHz for YL1430 and 70 to 88 MHz for YL1520	8222 032 11860
Shorting bar to use in addition with coils, for highest channel for YL1520	8222 032 57110

BAND I AMPLIFIER CIRCUIT SOUND ASSEMBLY

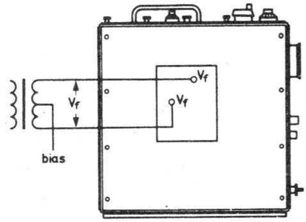
40760

MECHANICAL DATA

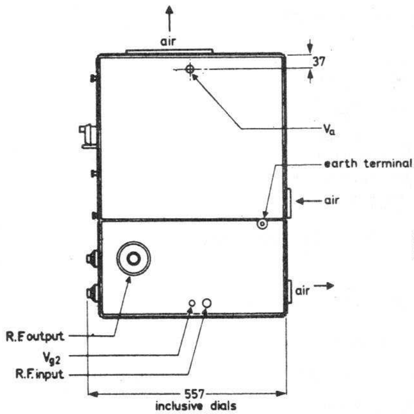
Dimensions in mm

Dimensions in : approx. 700 x 500 x 500 mm^3

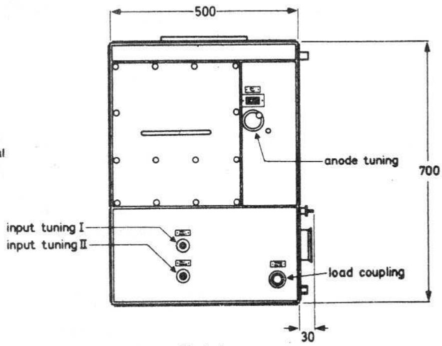
Net weight : approx. 58 kg



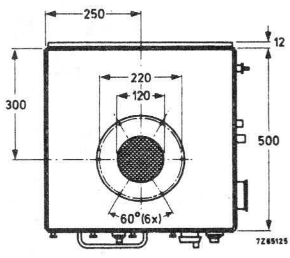
bottom view



right hand side view

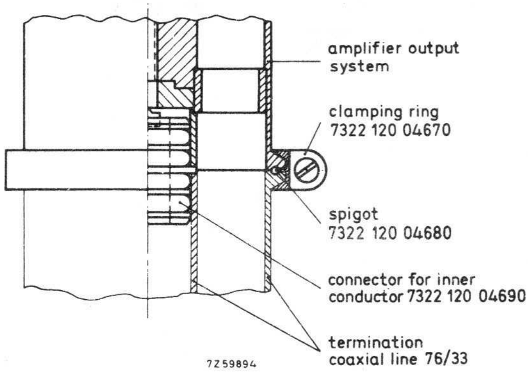


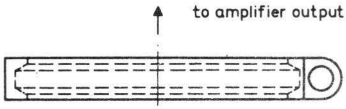
front view



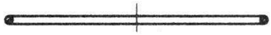
top view

Output connector

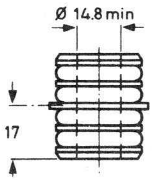




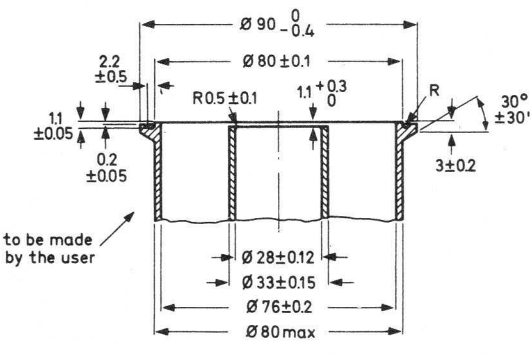
clamping ring 7322 120 04670



spigot 7322 120 04680



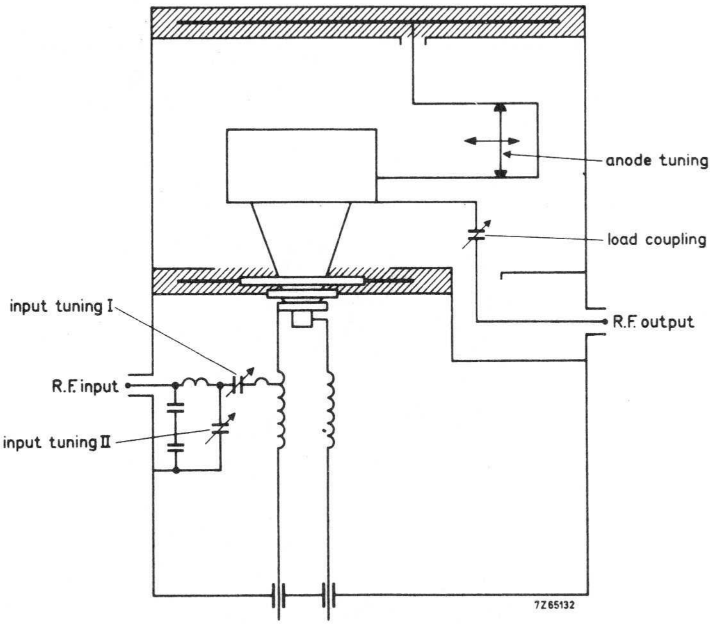
connector for inner conductor 7322 120 04690



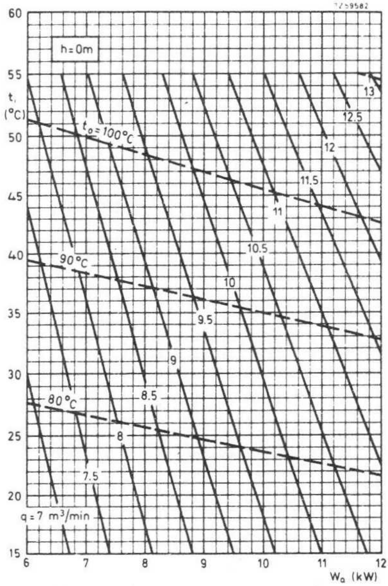
termination coaxial line 76/33

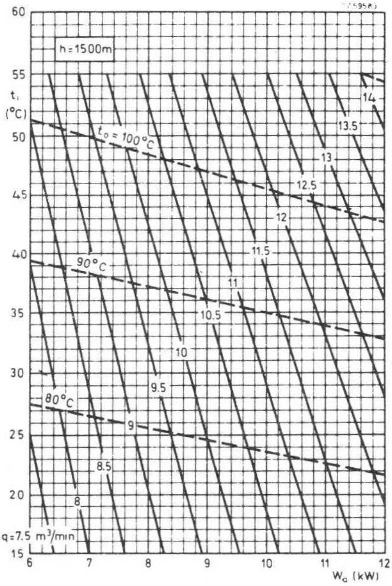
BAND I AMPLIFIER CIRCUIT SOUND ASSEMBLY

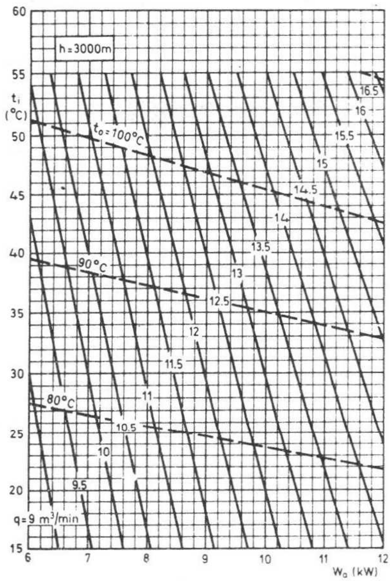
CIRCUIT DIAGRAM

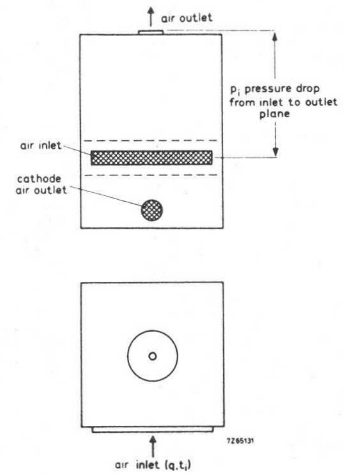


Cooling curves for amplifier 40760 fitted with tube YL1430

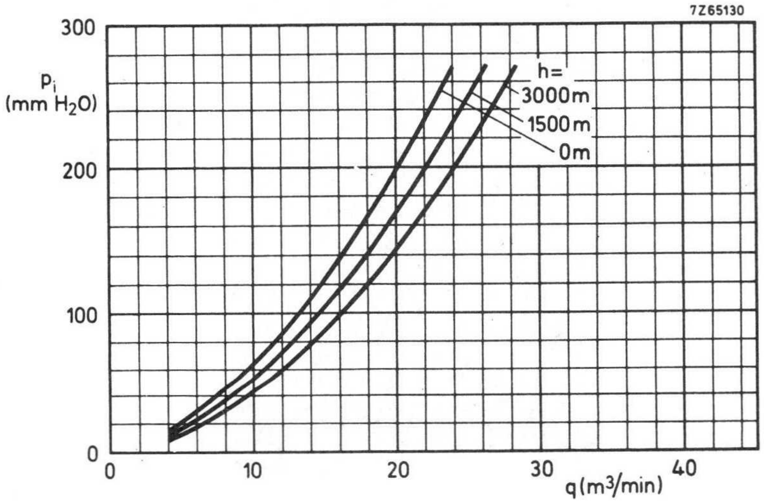






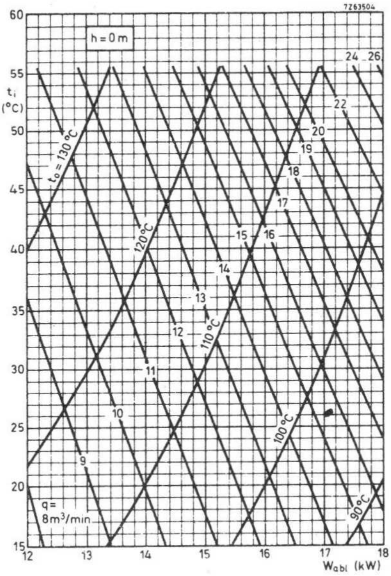


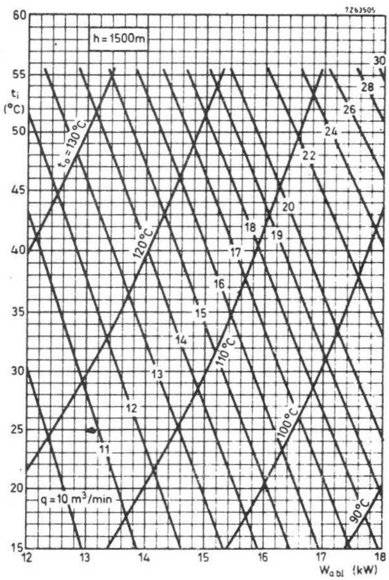
air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q,t_i)

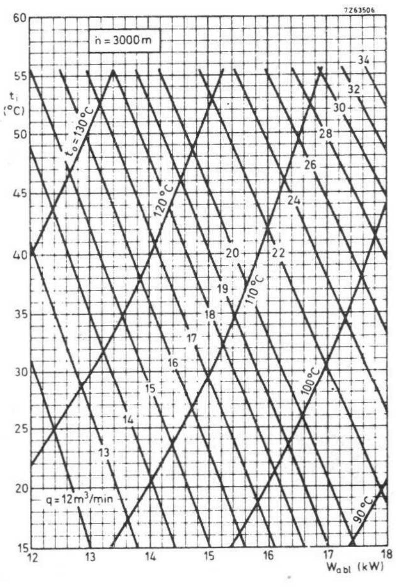


7Z65130
300
p_i (mm H_2O)
200
100
0
h=
3000m
1500m
0m
0
10
20
30
40
q(m^3/min)

Cooling curves for amplifier 40760 fitted with tube YL1520







BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

40768

Continuously tunable cavity-type circuit assembly to be used with YL1520 to form a broad-band grounded-grid linear amplifier for television signals in Band III.
The unit thus obtained can be put to good use in any of the principal monochrome and colour television systems.

QUICK REFERENCE DATA				
Class AB linear amplifier (vision)				
Frequency	170	to	230	MHz
Anode voltage			8	kV
Output power in load, sync			27,5	kW
Power gain			28,5	
Class AB amplifier for television transposer service				
Frequency	175	to	225	MHz
Anode voltage			8	kV
Output power in load, sync			10,5	kW
Power gain			42	

FREQUENCY RANGE

170 to 230 MHz continuously tunable.

OPERATING CONDITIONS (For YL1520)

For detailed operating conditions reference is made to the data sheets for tube type YL1520.

* Slight modifications make this cavity usable for YL1430 in the range 205 to 260 MHz.

COOLING

See cooling curves.
Direction of airflow: see drawing page 8.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type HN)

Output: 50 Ω (coaxial female connector: see drawing page 4)

ENVIRONMENTAL DATA

Ambient temperature: 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1,3 for acceptable performance

Output: max. permissible 1,3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type HN R7050
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175,25 MHz	7322 120 04730

b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or
2722 162 01201 (200 to 230 MHz) is recommended.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

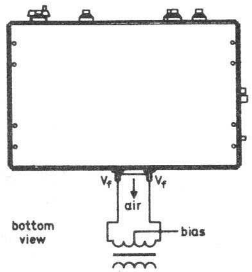
40768

MECHANICAL DATA

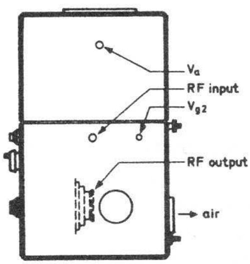
Dimensions in mm

Dimensions: approx. 685 x 415 mm^3

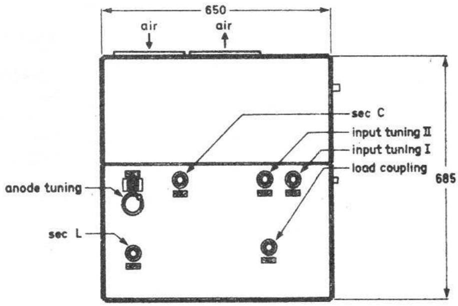
Net weight: approx. 85 kg



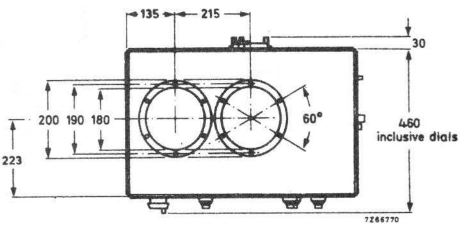
bottom view



right hand side view

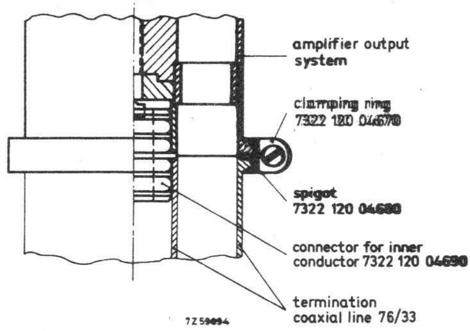


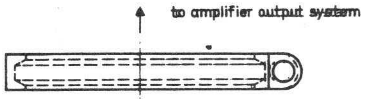
front view



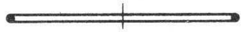
top view

Output connector

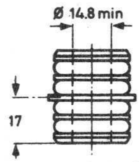




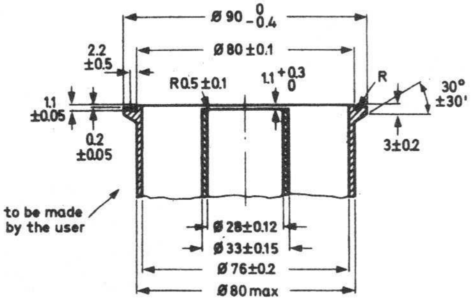
clamping ring 7322 120 04670



spigot 7322 120 04680



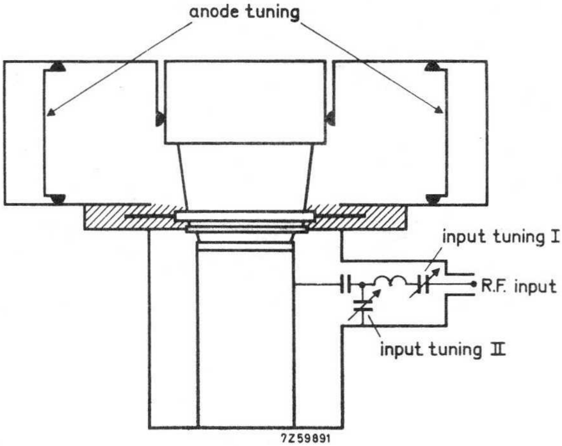
connector for inner conductor 7322 120 04690

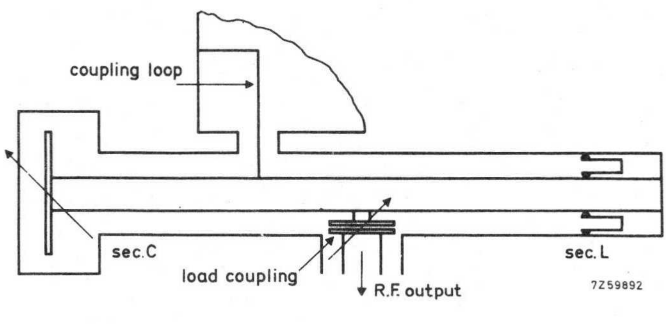


termination coaxial line 76/33

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR COMBINED SOUND AND VISION

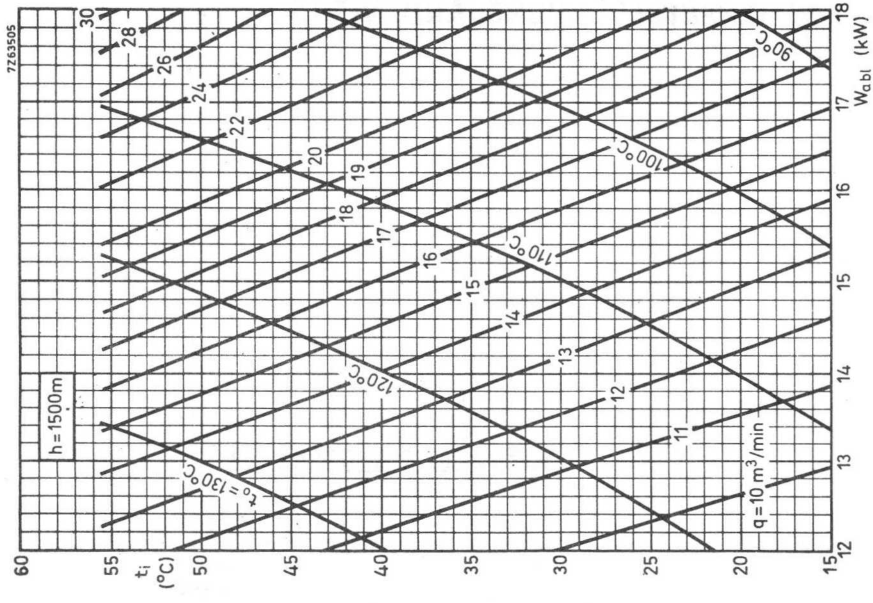
CIRCUIT DIAGRAM

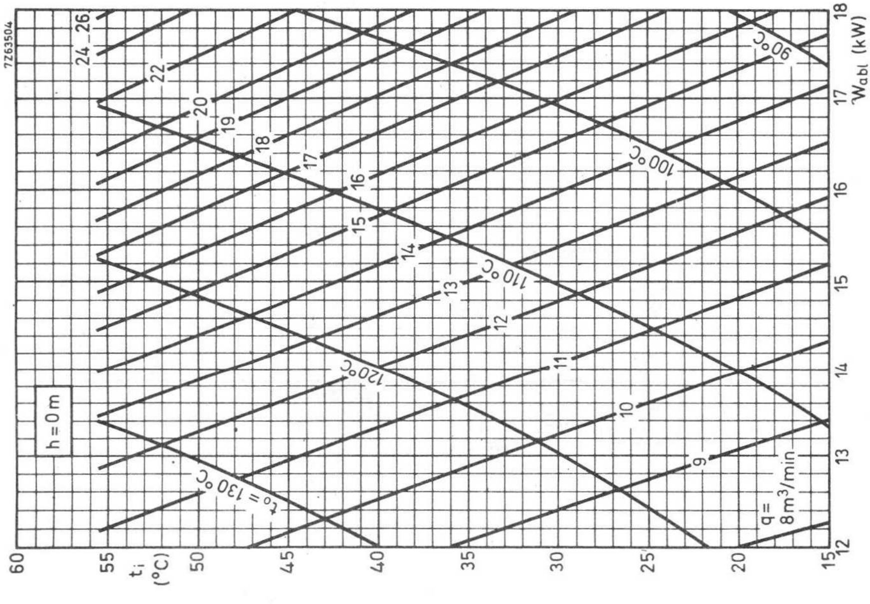




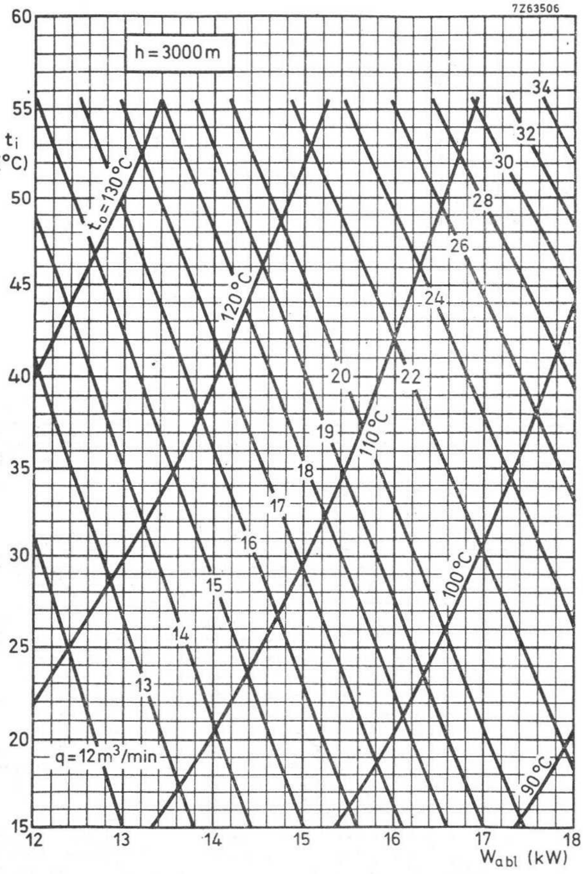
Mullard

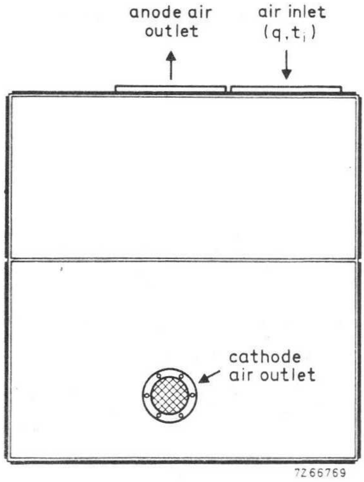
Cooling curves



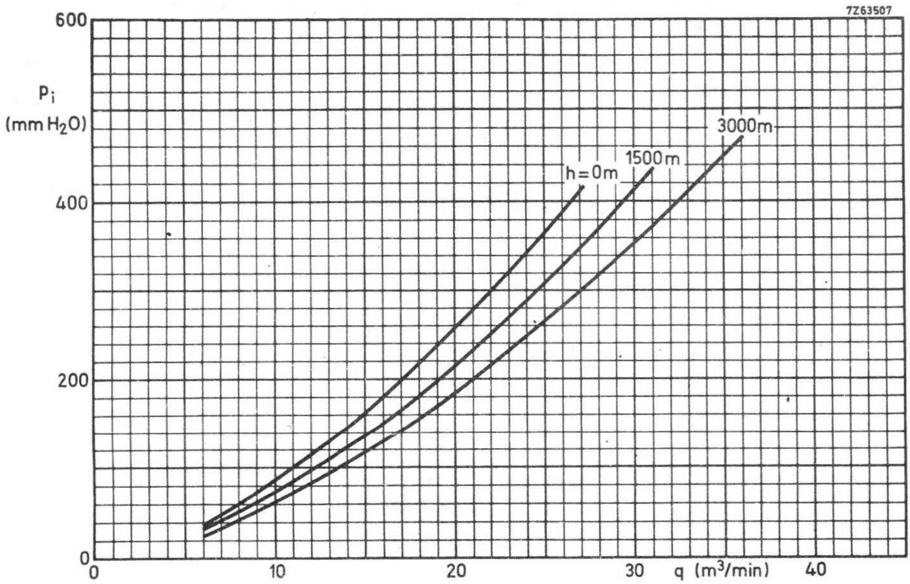


Cooling curves





anode air
outlet
air inlet
(q, t_i)
cathode
air outlet
7Z66769



7Z63507
600
p_i
(mm H_2O)
400
200
0
0
10
20
30
q (m^3/min)
40
h = 0m
1500m
3000m

BAND II AMPLIFIER CIRCUIT ASSEMBLY

40775

Continuously tunable cavity-type circuit assembly to be used with YL 1470 to form a grounded-cathode amplifier of freqency-modulated signals in Band II.

QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain (dB)
87,5 - 108	7	11	23

FREQUENCY RANGE

87,5 MHz to 108 MHz, continuously tunable.

OPERATING CONDITIONS

For detailed operating conditions reference is made to the data sheets for tube type YL 1470.

COOLING

See cooling curves.
Direction of airflow: see drawing page. Only blowing is allowed.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)
Output: 50 Ω (coaxial connector: EIA 1 $^5/_8$ in)

VOLTAGE STANDING - WAVE RATIO

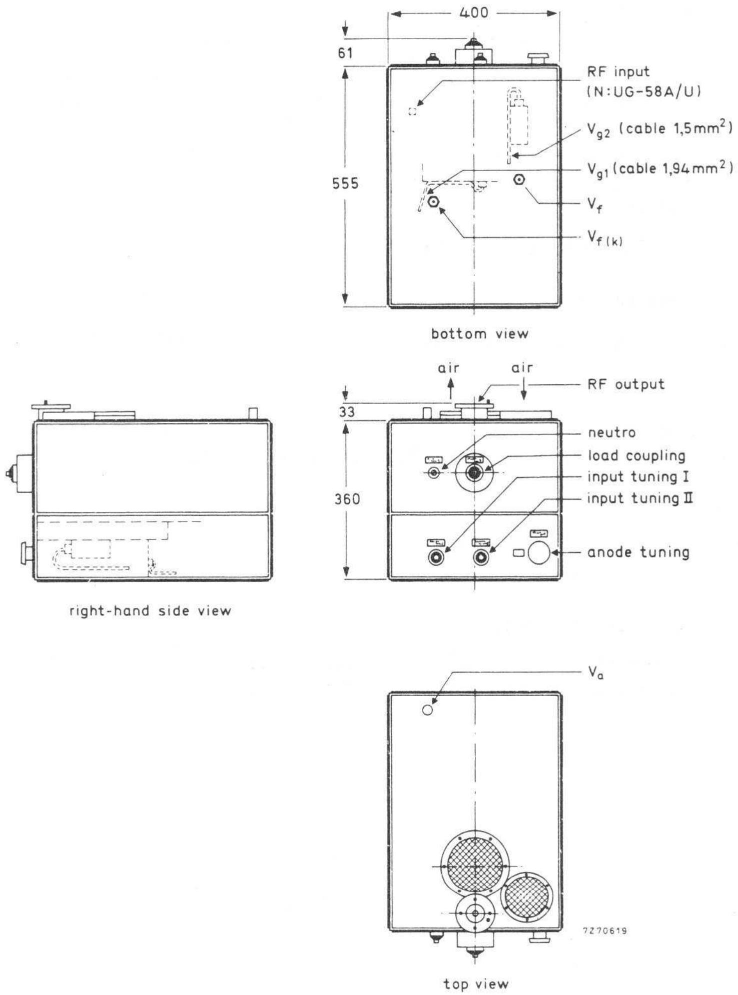
Input : max. permissible 1,3 for acceptable performance
Output: max. permissible 1,3 for acceptable performance

MECHANICAL DATA

Dimensions in mm

Dimensions: approx. 400 x 380 x 615 mm^3

Net mass : approx. 54 kg



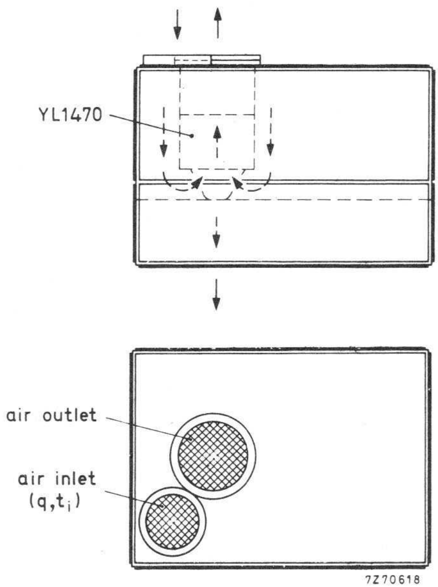
ENVIRONMENTAL DATA

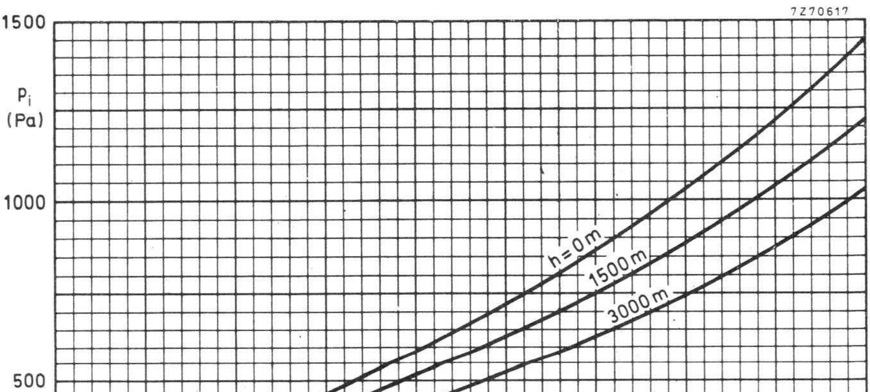
Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90%

ADDITIONAL COMPONENTS

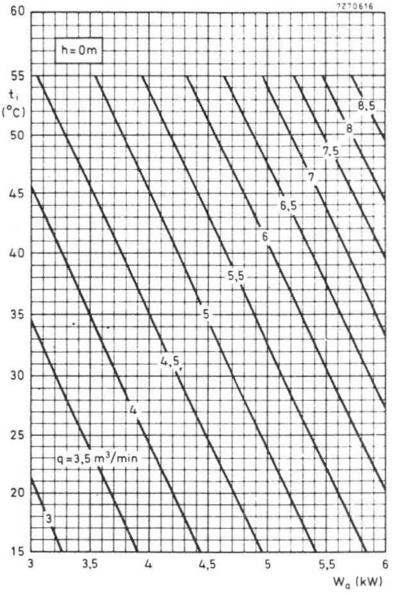
Supplied with the assembly

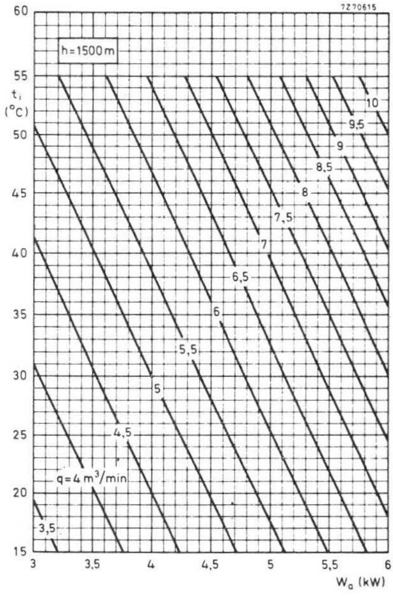
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating connector for anode voltage	Radiall type R 13060
Mating connector for screen grid voltage	Radiall type R 9510

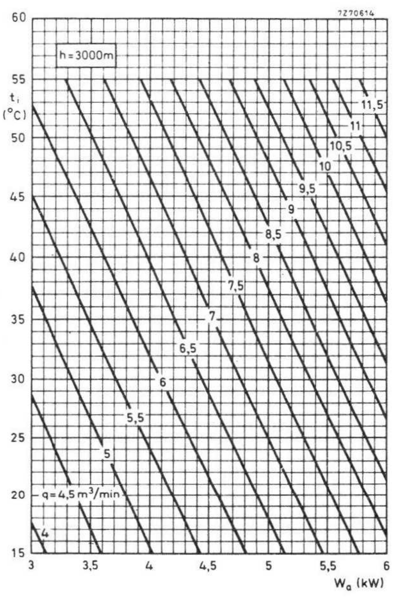

YL1470
air outlet
air inlet
(q,t$_i$)
7Z70618


7Z70617
1500
p$_i$
(Pa)
1000
500
0
4
6
8
10
q (m^3/min)
12
h=0 m
1500 m
3000 m

Cooling curves







ACCESSORIES

G

G

SURVEY OF ACCESSORIES

Tube Type No.	Connectors f	f/k	g	a	Socket	Water Jacket or Boiler Condenser	Miscellaneous
TRIODES							
TY4-500				40626	40216		
TY5-500				40626	B8.700.51		
TY6-800				40626	B8.700.51		
TY6-5000A	40634×3		40650* 40622†				Pedestal 40630
TY6-5000H	40634×3		40650* 40622†				
TY6-5000W	40634×3		40650* 40622†			K713	
TY7-6000A	40634×2	40649 (c. tap)	40650* 40622†				Pedestal 40630
TY7-6000H	40634×2	40649 (c. tap)	40650* 40622†				
TY7-6000W	40634×2	40649 (c. tap)	40650* 40622†			K713	
YD1150	40688	40689	40686* 40687†				Pedestal 40630
YD1152	40688	40689	40686* 40687†				
YD1160	40688	40689	40686* 40687†				Pedestal 40630
YD1161	40688	40689	40686* 40687†			K726	
YD1162	40688	40689	40686* 40687†				
YD1170	40692	40693	40690** 40691‡				Pedestal 40654
YD1171	40692	40693	40690** 40691‡			K727	
YD1172	40692	40693	40690** 40691‡				
YD1173	40692	40693	40690** 40691‡				Pedestal 40654
YD1175	40692	40693	40690** 40691‡				Pedestal 40654
YD1177	40692	40693	40690** 40691‡				
YD1180	40708	40709	40710** 40711‡				Pedestal 40648
YD1182	40708	40709	40710** 40711‡				
YD1185	40708	40709	40710** 40711‡				Pedestal 40648
YD1187	40708	40709	40710** 40711‡				

*f⩽30MHz †f>30MHz **f⩽4MHz ‡f>4MHz

Tube Type No.	Connectors f	f/k	g	a	Socket	Water Jacket or Boiler Con-denser	Miscellaneous
TRIODES (cont.)							
YD1192	40705	40706	40707** 40736‡				
YD1193	40705	40706	40707** 40736‡			K735	
YD1195	40705	40706	40707** 40736‡				Pedestal 40729
YD1197	40705	40706	40707** 40736‡				
YD1202	40695	40696	40694** 40737‡				
YD1203	40695	40696	40694** 40737‡			K735	
YD1212	40695	40696	40694** 40737‡				
YD1213	40695	40696	40694** 40737‡			K733	
YD1240	40688	40689	40686* 40687†				
YD1244	40688	40689	40686* 40687†				
YD1342	40695	40696	40694** 40737‡				
YD1343	40695	40696	40737			K738	
TETRODES							
QY4-400				40624	40211/01		Chimney 40666
QY5-500				40626	40216		
QY5-3000A	40634×2		g_1 40634 g_2 40622				Pedestal 40635
QY5-3000W	40634×2		g_1 40634 g_2 40622			K713	

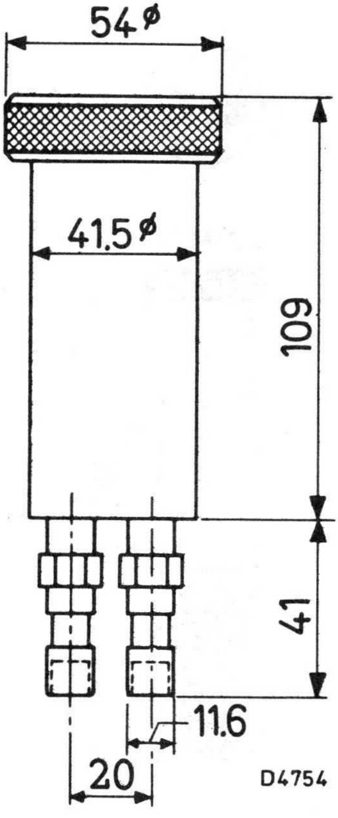
*f⩽30MHz †f>30MHz **f⩽4MHz ‡f>4MHz

WATER JACKET

K713

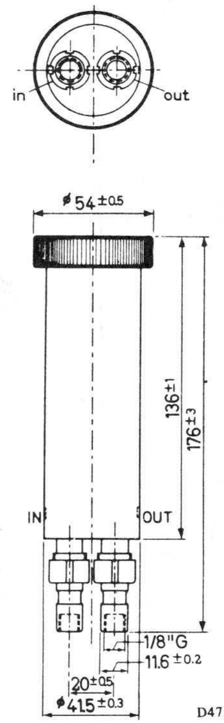
Net weight 520g

All dimensions in millimetres



WATER JACKET

All dimensions in millimetres



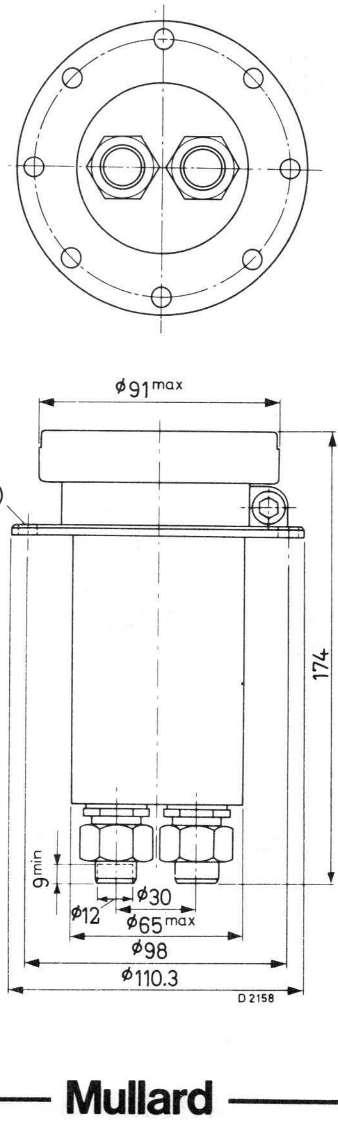
D4755

WATER JACKET

K727

Net weight 2 kg

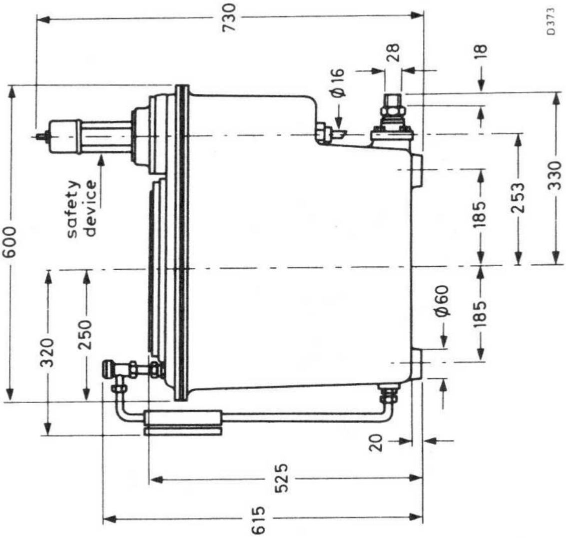
All dimensions in mm

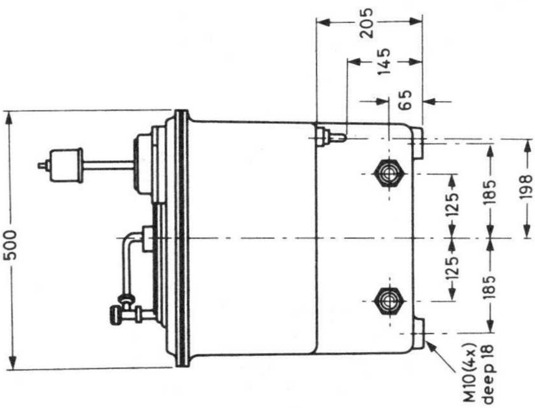


K733
K735

BOILER-CONDENSER

All dimensions in millimetres





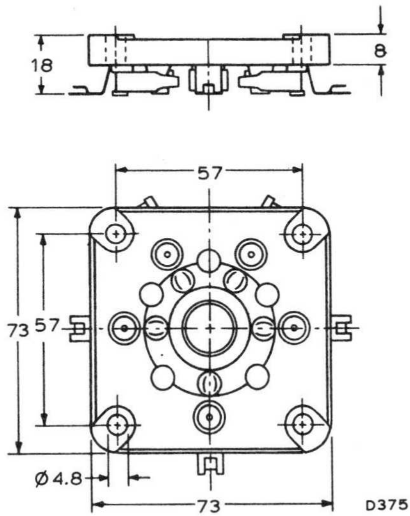
VALVE SOCKET

40211/01

Material: Ceramic

Chassis hole: Ø67 mm

All dimensions in millimetres



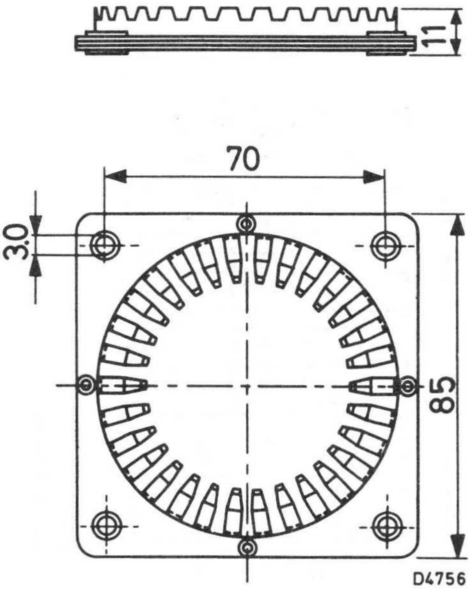
GRID CONNECTOR

40622

For ϕ70 mm terminals

Material: Brass, silver plated

Dimensions in millimetres

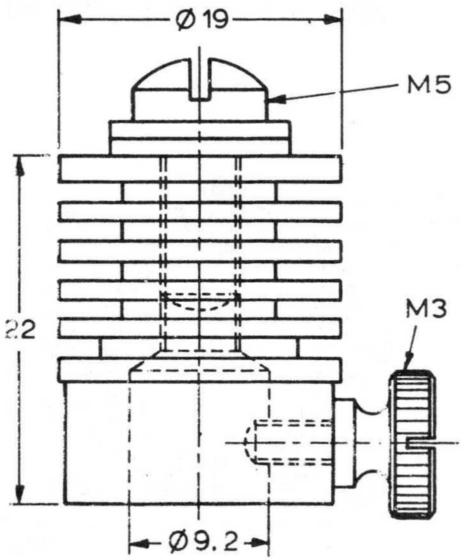


40624 ANODE CONNECTOR

For ϕ9 mm terminals

Material: Brass, nickel plated

Dimensions in millimetres



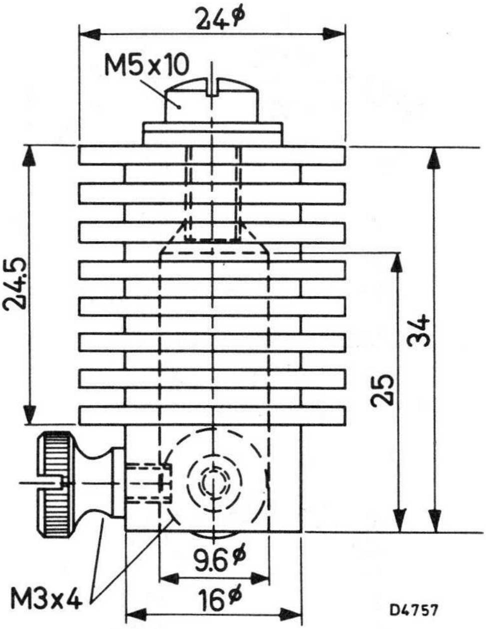
D378

ANODE CONNECTOR 40626

For ϕ9.5 mm terminals

Material: Brass, nickel plated

Dimensions in millimetres

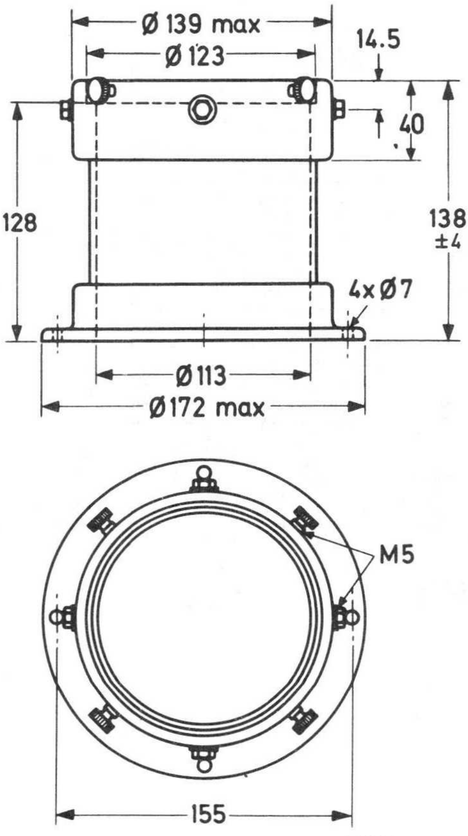


INSULATING PEDESTAL

Material: Ceramic

Net weight: 2.1 kg

All dimensions in millimetres

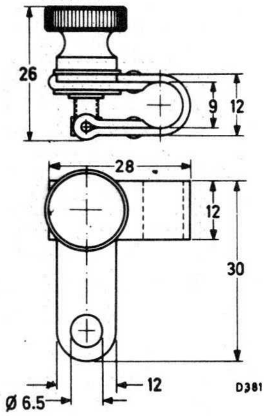


FILAMENT CONNECTOR 40634

For ϕ9.1 mm terminals

Material: Brass, nickel plated

Dimensions in millimetres

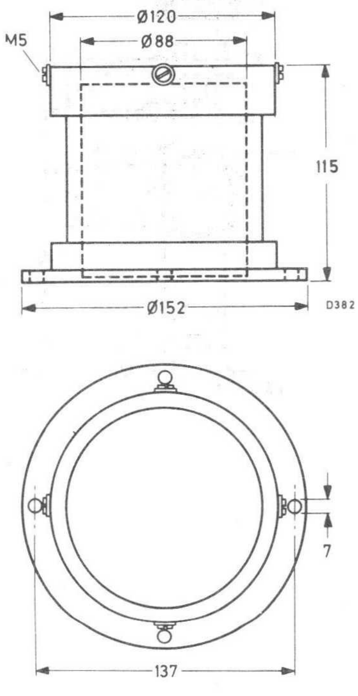


40635 INSULATING PEDESTAL

Material: Ceramic

Net weight: 1.6 kg

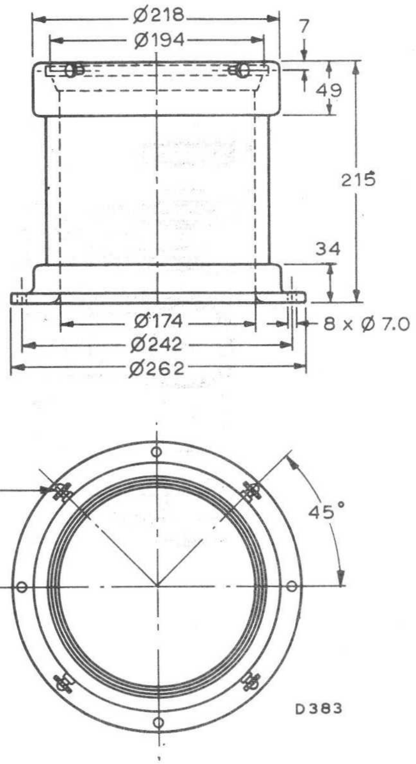
All dimensions in millimetres



INSULATING PEDESTAL 40648

Material: Ceramic

All dimensions in millimetres

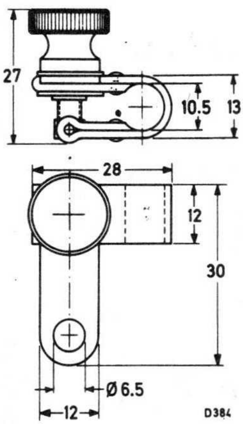


40649 FILAMENT CONNECTOR

For ϕ 10.5 mm terminals

Material: Brass, nickel plated

Dimensions in millimetres

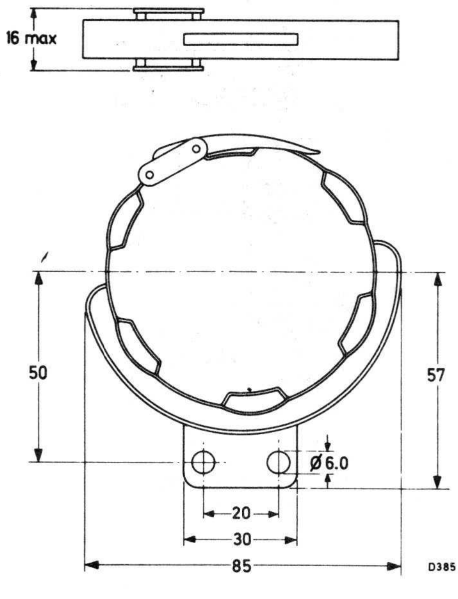


GRID CONNECTOR

For ϕ70 mm terminals

Material: Brass, nickel plated

Dimensions in millimetres

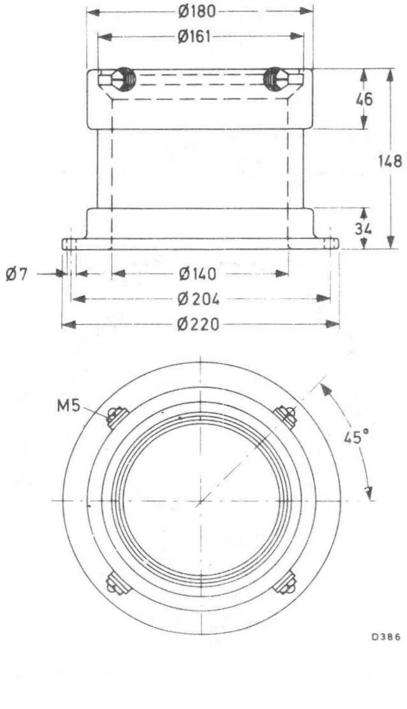


40654 INSULATING PEDESTAL

Material: Ceramic

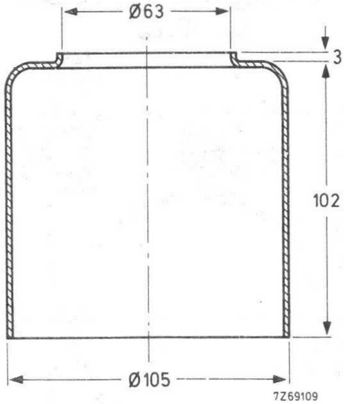
Net weight: 4.25 kg

All dimensions in millimetres



Material: Glass

All dimensions in millimetres

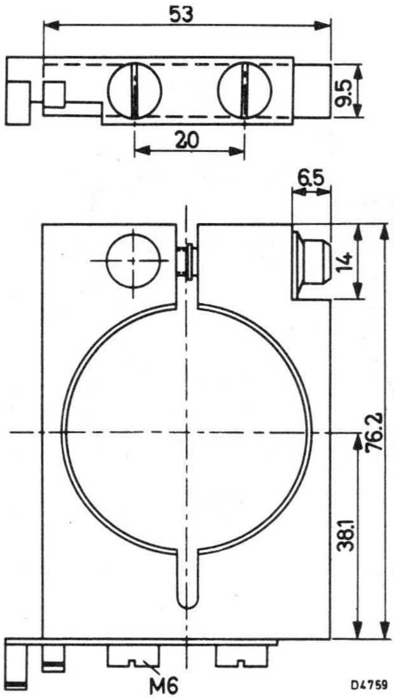


40686 GRID CONNECTOR

Grid connector for ϕ48 mm terminals

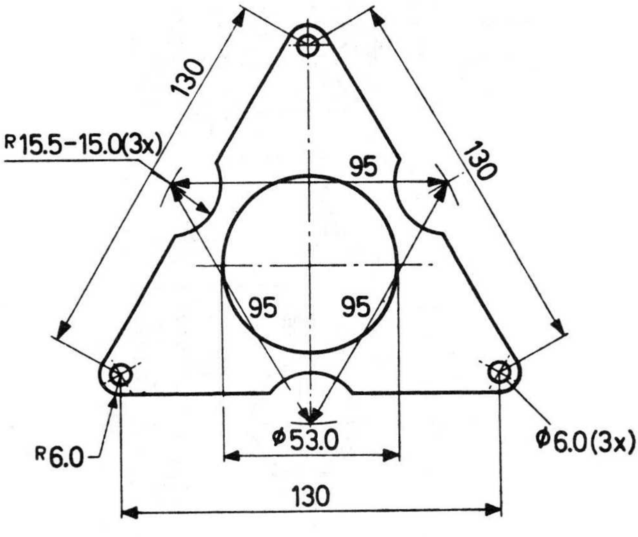
Material: Brass, silver plated

All dimensions in millimetres



Material: Brass

All dimensions in millimetres



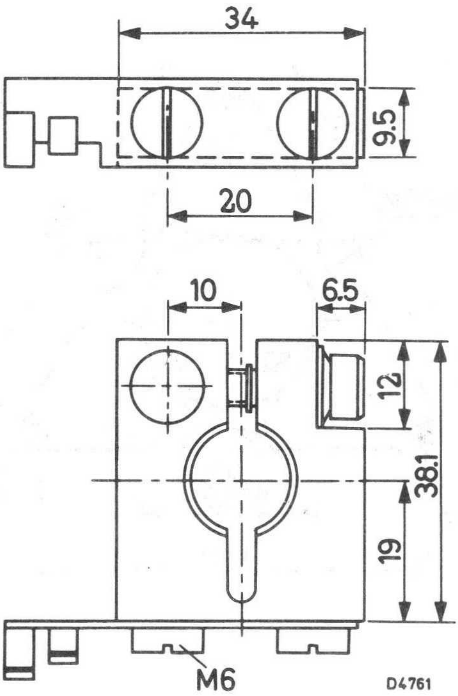
D4760

40688 FILAMENT CONNECTOR

Filament connector for ϕ14.4 mm terminals

Material: Brass, nickel plated

All dimensions in millimetres



Mullard

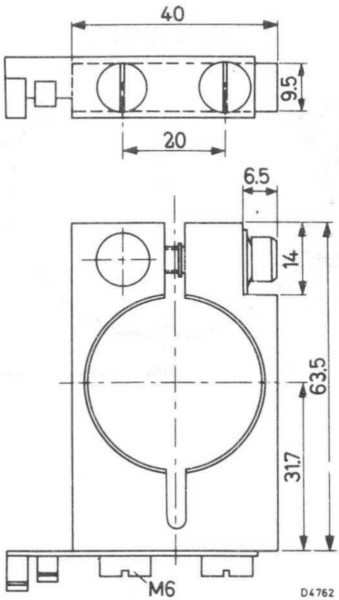
FILAMENT CONNECTOR

40689

Filament connector for ϕ36 mm terminals

Material: Brass, nickel plated

All dimensions in millimetres



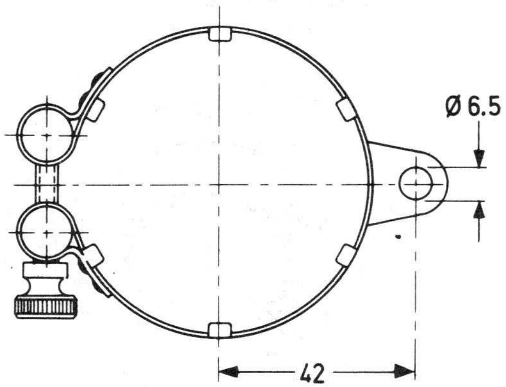
GRID CONNECTOR

For ϕ66 mm terminals

Material: Brass, nickel plated

Net mass: 55 g

Dimensions in millimetres



D390

Mullard

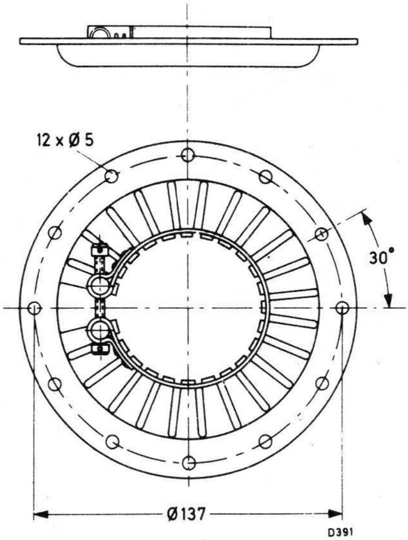
GRID CONNECTOR

For ϕ66 mm terminals

Material: Brass, silver plated

Net mass: 240 g

Dimensions in millimetres

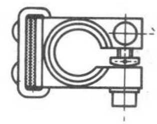


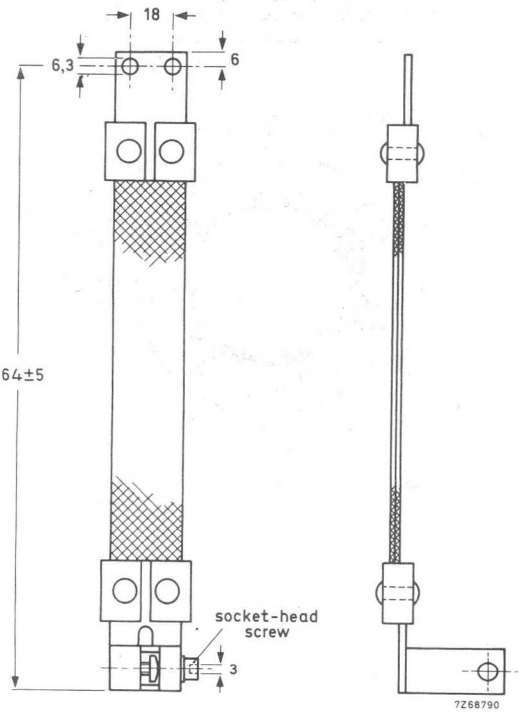
40692 FILAMENT CONNECTOR

For ϕ25 mm terminals

Net mass: 450 g (approx.)

Dimensions in millimetres



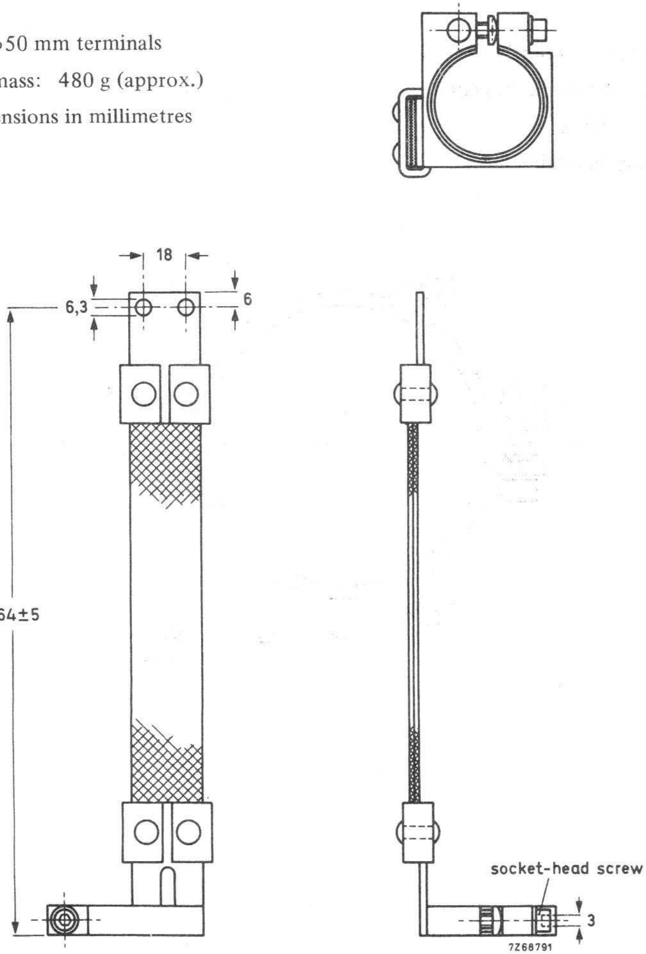


FILAMENT CONNECTOR 40693

For ϕ50 mm terminals

Net mass: 480 g (approx.)

Dimensions in millimetres



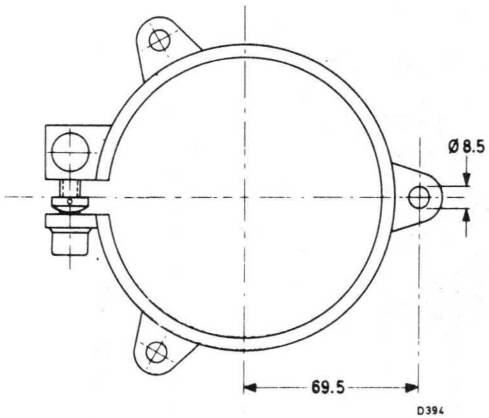
40694 GRID CONNECTOR

For ϕ112 mm terminals

Material: Brass, nickel plated

Net mass: 270 g

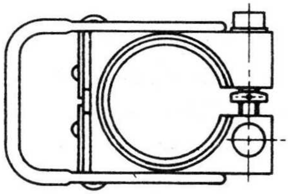
Dimensions in millimetres

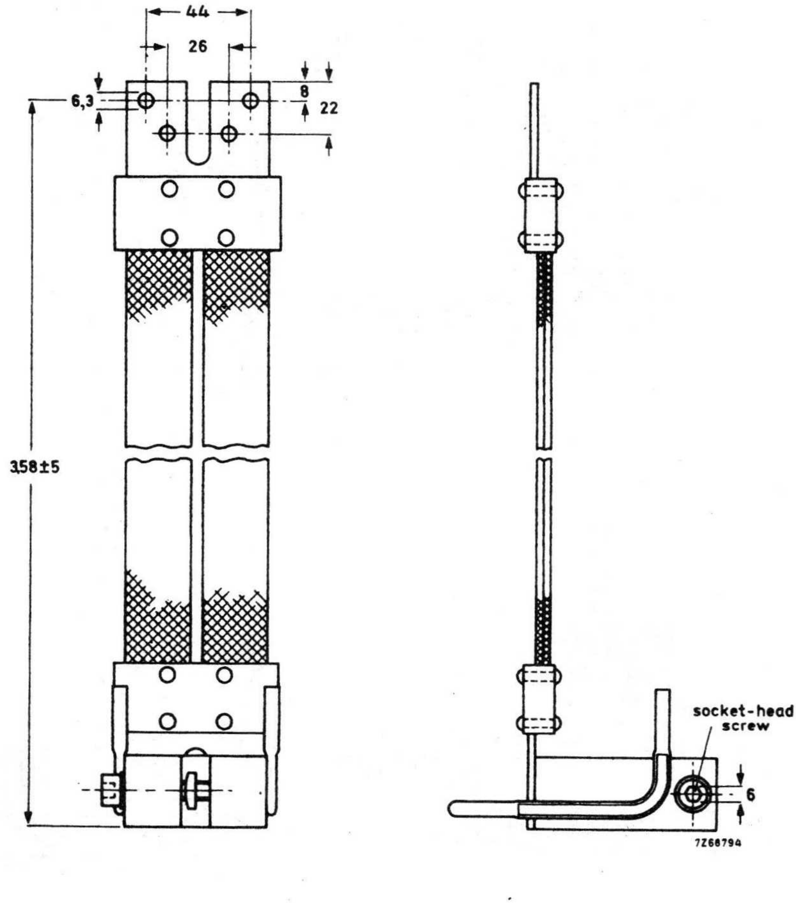


For ϕ54 mm terminals

Net mass: 1380 g (approx.)

Dimensions in millimetres



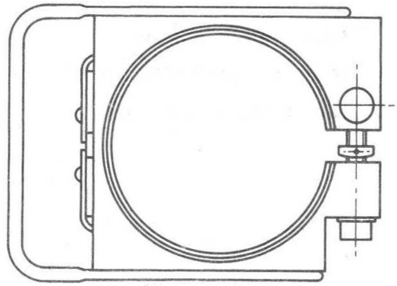


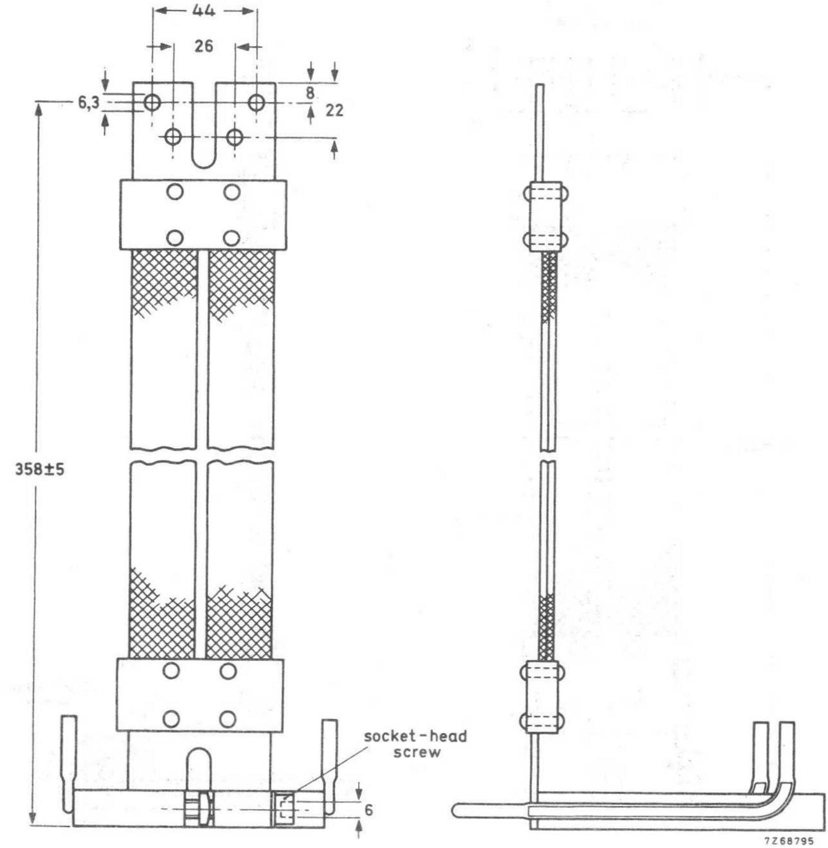
FILAMENT CONNECTOR

For $\phi 96$ mm terminals

Net mass: 1550 g (approx.)

Dimensions in millimetres



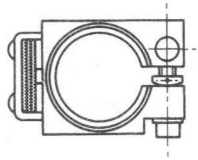


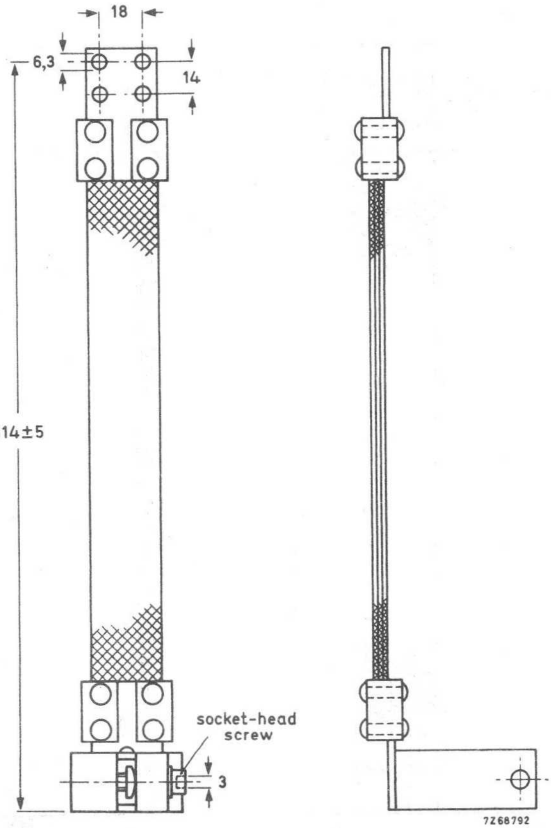
FILAMENT CONNECTOR 40705

For ϕ42 mm terminals

Net mass: 700 g (approx.)

Dimensions in millimetres



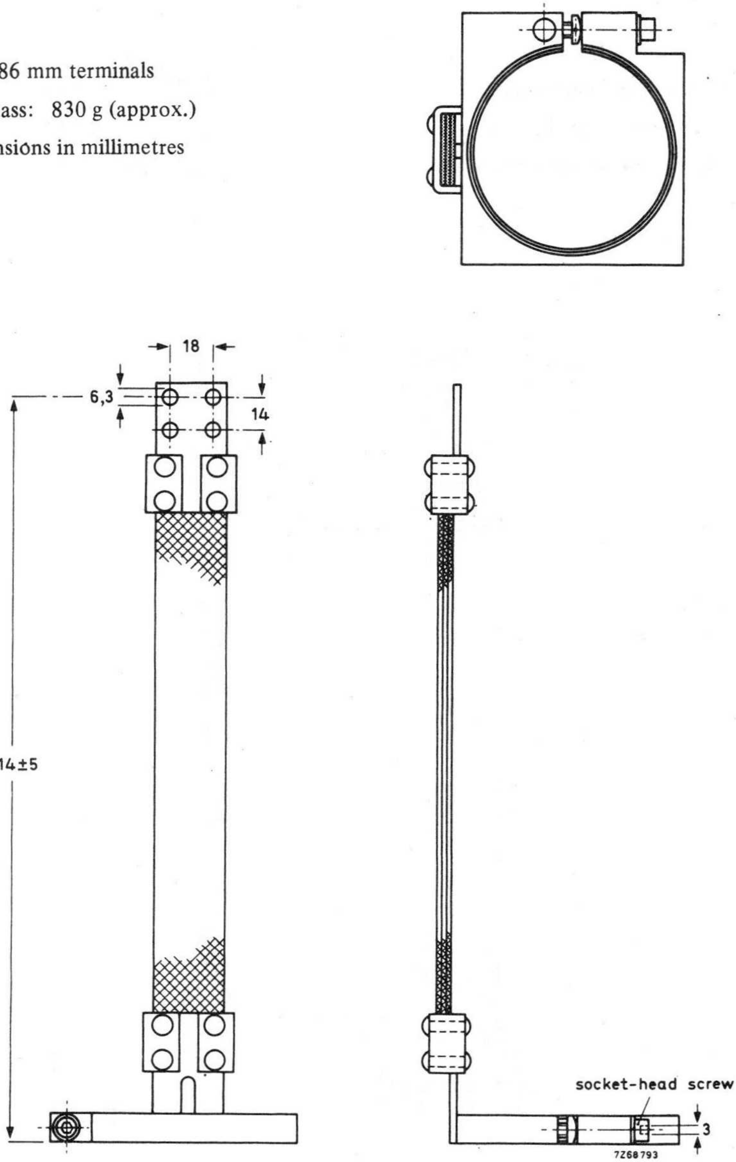


40706 FILAMENT CONNECTOR

For ϕ86 mm terminals

Net mass: 830 g (approx.)

Dimensions in millimetres

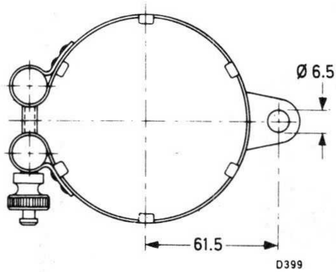


GRID CONNECTOR 40707

For ϕ105 mm terminals

Material: Brass, nickel plated

Dimensions in millimetres

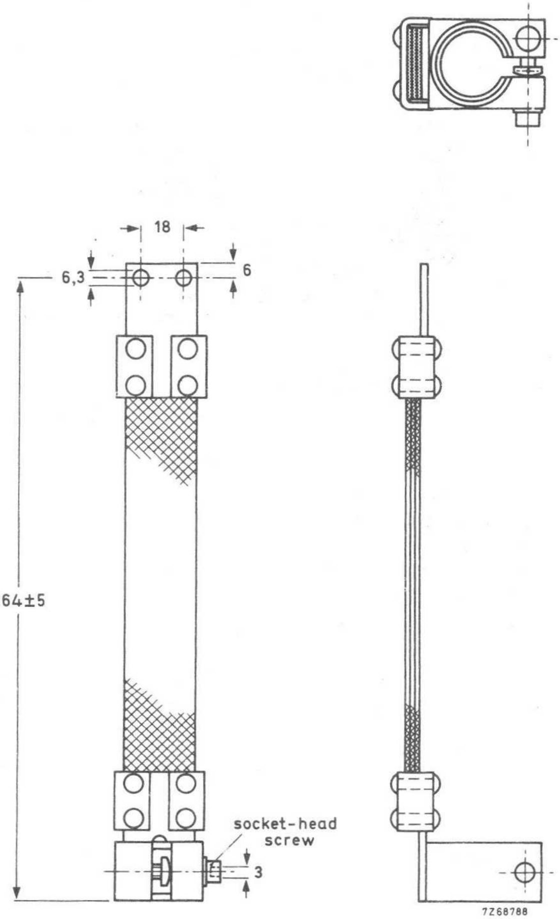


40708 FILAMENT CONNECTOR

For ϕ32 mm terminals

Net mass: 600 g (approx.)

Dimensions in millimetres

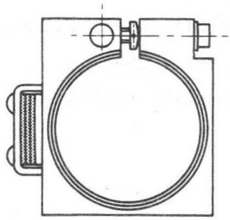


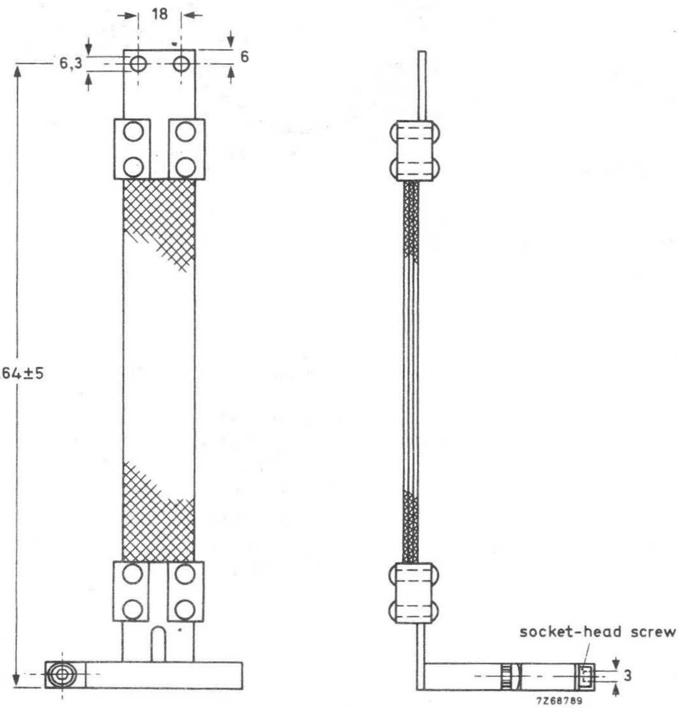
FILAMENT CONNECTOR 40709

Filament connector for ϕ66 mm terminals

Net mass: 640 g (approx.)

Dimensions in millimetres





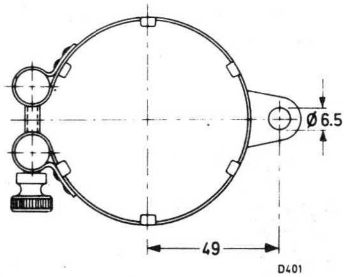
GRID CONNECTOR

For ϕ80 mm terminals

Material: Brass, nickel plated

Net mass: 60 g

Dimensions in millimetres



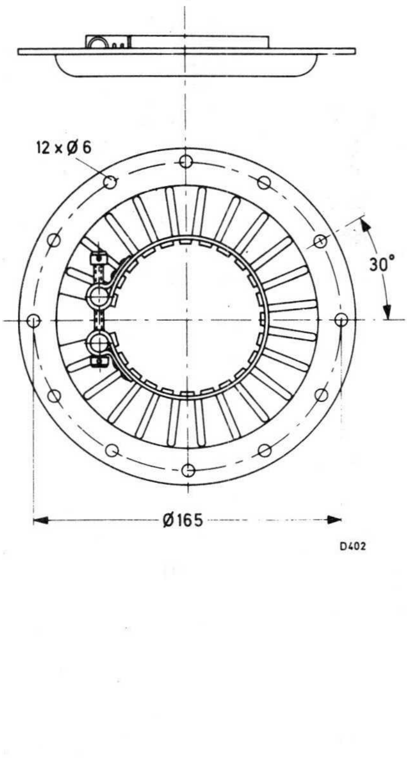
GRID CONNECTOR

For ϕ80 mm terminals

Material: Brass, silver plated

Net mass: 310 g

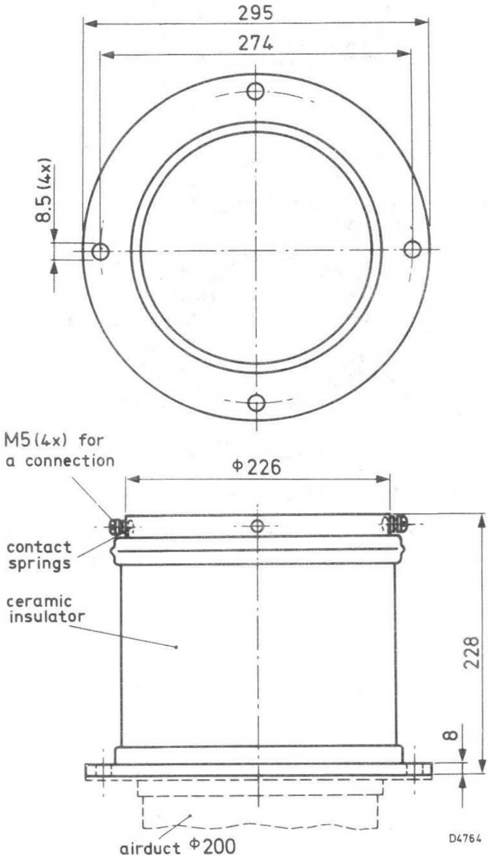
Dimensions in millimetres



INSULATING PEDESTAL

Net mass: 8.2 kg (approx.)

All dimensions in millimetres



Mullard

GRID CONNECTOR

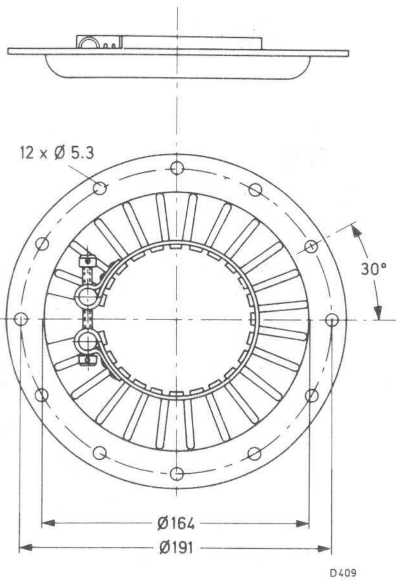
40736

For ϕ105 mm terminals

Material: Brass, silver plated

Net mass: 450 g

Dimensions in millimetres



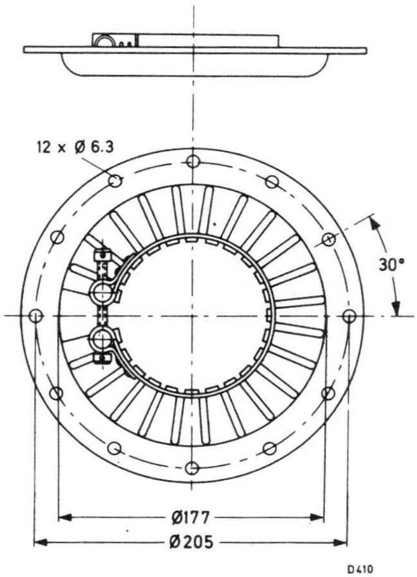
40737 GRID CONNECTOR

For $\phi 112$ mm terminals

Material: Brass, silver plated

Net mass: 525 g

Dimensions in millimetres



INDEX

INDEX TO BOOK 2, PART 4

TRANSMITTING, INDUSTRIAL HEATING AND MICROWAVE TUBES

Type No.	Section	Type No.	Section
40650	G		
40654	G		
40666	G		
40686	G		
40687	G		
40688	G		
40689	G		
40690	G		
40691	G		
40692	G		
40693	G		
40694	G		
40695	G		
40696	G		
40705	G		
40706	G		
40707	G		
40708	G		
40709	G		
40710	G		
40711	G		
40729	G		
40736	G		
40737	G		
40743	F		
40744	F		
40745	F		
40746	F		
40747	F		
40748	F		
40755	F		
40756	F		
40757	F		
40758	F		
40759	F		
40760	F		
40768	F		
40775	F		

TRANSMITTING, INDUSTRIAL HEATING AND MICROWAVE TUBES

CONTENTS

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