PHILIPS

Data handbook

PHILIPS

Electronic components and materials

Electron tubes

Part 1b January 1976

Transmitting tubes for communication

Tubes for r.f. heating

Amplifier circuit assemblies

ELECTRON TUBES

Part 1b **January 1976**

General section

Transmitting tubes for communication
Tubes for r.f. heating

Amplifier circuit assemblies

Associated accessories

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DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	**BLUE**
SEMICONDUCTORS AND INTEGRATED CIRCUITS	**RED**
COMPONENTS AND MATERIALS	**GREEN**

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

December 1972

ELECTRON TUBES (BLUE SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a Transmitting tubes for communications and Tubes for r.f. heating Types PE05/25 ÷ TBW15/125 — **December 1975**

Part 1b Transmitting tubes for communication — **January 1976**

Tubes for r.f. heating

Amplifier circuit assemblies

Part 2 Microwave products — **October 1974**

Communication magnetrons
Magnetrons for microwave heating
Klystrons
Travelling-wave tubes
Diodes
Triodes
T-R Switches
Microwave Semiconductor devices
Isolators Circulators

Part 3 Special Quality tubes; — **January 1975**

Miscellaneous devices

Part 4 Receiving tubes — **March 1975**

Part 5a Cathode-ray tubes — **April 1975**

Part 5b Camera tubes; Image intensifier tubes — **May 1975**

Part 6 Products for nuclear technology — **July 1975**

Photodiodes

Neutron tubes
Channel electron multipliers
Geiger-Mueller tubes
N.B. Photomultiplier tubes and Photo diodes will be issued in Part 9

Part 7 Gas-filled tubes — **August 1975**

Voltage stabilizing and reference tube
Counter, selector, and indicator tubes
Trigger tubes
Switching diodes
Thyratrons
Ignitrons
Industrial rectifying tubes
High-voltage rectifying tubes

Part 8 TV Picture tubes — **October 1975**

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a	**Rectifier diodes and thyristors**		**June 1974**
	Rectifier diodes Voltage regulator diodes (> 1,5 W) Transient suppressor diodes	Thyristors, diacs, triacs Rectifier stacks	
Part 1b	**Diodes**		**October 1975**
	Small signal germanium diodes Small signal silicon diodes Special diodes	Voltage regulator diodes (< 1,5 W) Voltage reference diodes Tuner diodes	
Part 2	**Low frequency transistors**		**December 1975**
Part 3	**High frequency and switching transistors**		**October 1974**
Part 4a	**Special semiconductors**		**November 1974**
	Transmitting transistors Microwave devices Field-effect transistors	Dual transistors Microminiature devices for thick- and thin-film circuits	
Part 4b	**Devices for optoelectronics**		**December 1974**
	Photosensitive diodes and transistors Light emitting diodes Photocouplers	Infrared sensitive devices Photoconductive devices	
Part 5	**Linear integrated circuits**		**March 1975**
Part 6	**Digital integrated circuits**		**April 1974**
	DTL (FC family) CML (GX family)	MOS (FD family) MOS (FE family)	

COMPONENTS AND MATERIALS (GREEN SERIES)

These series consists of the following parts, issued on the dates indicated.

Part 1 Functional units, Input/output devices, Peripheral devices — **November 1975**

High noise immunity logic FZ/30-Series
Circuit blocks 40-Series and CSA70
Counter modules 50-Series
Norbits 60-Series, 61-Series
Circuit blocks 90-Series
Input/output devices
Hybrid integrated circuits
Peripheral devices

Part 2a Resistors — **September 1974**

Fixed resistors
Variable resistors
Voltage dependent resistors (VDR)
Light dependent resistors (LDR)
Negative temperature coefficient thermistors (NTC)
Positive temperature coefficient thermistors (PTC)
Test switches

Part 2b Capacitors — **November 1974**

Electrolytic and solid capacitors
Paper capacitors and film capacitors
Ceramic capacitors
Variable capacitors

Part 3 Radio, Audio, Television — **February 1975**

FM tuners
Loudspeakers
Television tuners, aerial input assemblies
Components for black and white television
Components for colour television

Part 4a Soft ferrites — **April 1975**

Ferrites for radio, audio and television
Beads and chokes
Ferroxcube potcores and square cores
Ferroxcube transformer cores

Part 4b Piezoelectric ceramics, Permanent magnet materials — **May 1975**

Part 5 Ferrite core memory products — **July 1975**

Ferroxcube memory cores
Matrix planes and stacks
Core memory systems

Part 6 Electric motors and accessories — **September 1975**

Small synchronous motors
Stepper motors
Miniature direct current motors

Part 7 Circuit blocks — **September 1971**

Circuit blocks 100 kHz-Series
Circuit blocks 1-Series
Circuit blocks 10-Series
Circuit blocks for ferrite core memory drive

Part 8 Variable mains transformers — **July 1975**

Part 10 Connectors — **November 1975**

General section

TRANSMITTING TUBES FOR COMMUNICATION
TUBES FOR R.F. HEATING
LIST OF SYMBOLS

1. Symbols denoting electrodes and electrode connections

Anode	a
Beam plates	bp
Filament or heater	f
Filament or heater tap or starpoint of three star-connected filaments	f_c
Filament (and cathode) R.F. connection	f(k)
Grid	g
Tube pin which must not be connected externally	i.c.
Cathode	k
External conductive coating	m
Internal shield	s

Remarks

a. Similar electrodes of the same electrode system are distinguished by means of an additional numeral; the electrode nearest to the cathode has the smallest number. Example: with pentodes: g_1, g_2, g_3.
b. Equivalent electrodes of a multi-unit tube are distinguished by means of an apostrophe; e.g. the anodes of a double tetrode are indicated by a and a'.

2. Symbols denoting voltages

Remarks

a. In the case of indirectly heated tubes the voltages on the various electrodes are with respect to the cathode; in case of d.c. fed, directly heated tubes with respect to the negative side of the filament, and in case of a.c. fed, directly heated tubes with respect to the electrical centre of the filament, unless otherwise stated.
b. The symbols quoted below represent the average, or mean, values of the concerning voltages, unless otherwise stated.

Anode voltage	V_a
Anode a.c. voltage	$V_{a\sim}$
Anode voltage in cut-off or cold condition	V_{a_o}
Supply voltage of tube elctrodes	V_b

2. Symbols denoting voltages (continued)

Filament or heater voltage	V_f
Grid voltage	V_g
Grid a.c. voltage	$V_{g\sim}$
A.C. input voltage	V_i
Voltage between cathode and heater	V_{kf}
Peak value of a voltage	V_p
RMS value of a voltage	V_{RMS}, V_{rms}
Secondary transformer voltage	V_{tr}

3. Symbols denoting currents

Remarks

a. The direction of positive electrical current flow is opposite to that of electron flow.

b. The symbols quoted below represent the average values of the currents concerned, unless otherwise stated.

Anode current	I_a
Filament or heater current	I_f
Grid current	I_g
Cathode current	I_k
Peak value of a current	I_p
RMS value of a current	I_{RMS}, I_{rms}
Saturation current	I_{sat}

4. Symbols denoting powers

Anode dissipation	W_a
Driver output power, Driving power	W_{dr}
Grid dissipation	W_g
Anode d.c. supply power	W_{ia}
Input power	W_i
Output power in the load	W_ℓ
Modulation power	W_{mod}
Tube output power	W_o
Peak envelope output power	W_{oPEP}
Oscillator output power	W_{osc}

5. Symbols denoting capacitances

In general the published capacitance values refer to the cold tube

Capacitance between the anode and all other elements except the control grid	C_a
Capacitance between anode and filament (all other elements being earthed)	C_{af}
Capacitance between anode and grid (all other elements being earthed)	C_{ag}
Capacitance between anode and cathode (all other elements not connected to the cathode being earthed)	C_{ak}
Capacitance between grid and filament (all other elements being earthed)	C_{gf}
Capacitance between control grid and all other elements except anode	C_g
Capacitance between two grids (all other elements being earthed)	$C_{g_1g_2}$
Capacitance between grid and cathode (all other elements not connected to the cathode being earthed)	C_{gk}
Input capacitance of a push-pull circuit	C_i
Capacitance between cathode and all other elements	C_k
Output capacitance of a push-pull circuit	C_o

6. Symbols denoting resistances

External a.c. resistance in an anode lead or matching resistance	$R_{a\sim}$
Matching resistance of a push-pull amplifier (anode to anode)	$R_{aa\sim}$
Filament or heater resistance	R_f
Filament or heater resistance in cold condition	R_{fo}
External resistor in a grid lead	R_g
External resistor in a cathode lead	R_k

7. Symbols denoting various quantities

Bandwidth	B
Harmonic distortion factor	d
n-th harmonic distortion	d_n
Total harmonic distortion	d_{tot}

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7. Symbols denoting various quantities (continued)

Intermodulation distortion	d_i
n-th order intermodulation distortion	d_{i_n}
Frequency	f
Pulse repetition rate	f_{imp}
Height above sea level, altitude	h
Modulation factor	m
Pressure drop of cooling air or cooling water	p_i
Rate of flow of cooling air or cooling water	q
Thermal resistance	R_{th}
Transconductance	S
Temperature of anode block	t_a
Ambient temperature	t_{amb}
Bulb temperature	t_{bulb}
Envelope temperature	t_{env}
Cathode heating time	T_h
Waiting time (time which has to pass between switching on of the filament or heater voltage and switching on of the other voltages)	T_w
Inlet temperature of cooling air or cooling water	t_i
Outlet temperature of cooling air or cooling water	t_o
Pulse duration	T_{imp}
Seal temperature	t_s
Duty factor	δ
Efficiency	η
Wavelength	λ
Amplification factor	μ
Amplification factor of grid no. 2 with respect to grid no. 1	μ_{g2g1}

GENERAL OPERATIONAL RECOMMENDATIONS TRANSMITTING TUBES FOR COMMUNICATION TUBES FOR R.F. HEATING

1. GENERAL

1.1 In this Handbook data and curves are given for transmitting tubes and tubes for R.F. heating.

1.2 The tubes are classified into groups:

Preferred types	- Recommended for new equipment design.
Current types	- Available for equipment production and maintenance. No longer recommended for new equipment design.
Maintenance types	- Available for equipment maintenance. No longer recommended for equipment production.
Obsolescent types	- Available until present stocks are exhausted.
Obsolete types	- No longer available.

For the status of each type please refer to the "Catalogue Transmitting tubes" or consult your tube supplier.
Full details are given of Preferred types and Current types, Data on maintenance and obsolescent types is generally given in condensed form.

2. CHARACTERISTIC DATA

2.1 The characteristic data given in the data sheets is general and independent of specific application. This data (e.g. filament/heater current, amplification factor, transconductance, capacitances etc.) is applicable to a typical tube and deviations from the stated value are likely to occur in practice.

2.2 Filament/heater supply.

The published value of filament/heater voltage is generally that which should be present directly at the tube terminals. Filaments fed with direct current should have their supply polarity reversed at regular intervals (say monthly), to ensure uniform wear of the filament with consequent longer life.
Reduction of filament/heater voltage is sometimes recommended to compensate e.g. the heating by back-bombardment at high frequencies; see the relevant data sheets. Special precautions must be taken when operating the filaments/heaters of transmitting tubes in series and the manufacturer should be consulted before doing so.

2.2.1 Pure tungsten cathodes (filaments)

The published value of filament voltage is the maximum voltage required for a new tube to supply the rated output power. A lower voltage (giving longer life) will often suffice and every tube with a pure tungsten cathode is supplied together with a list stating the saturation current at various filament voltages. Thus, knowing the required emission current, the most suitable filament voltage can be selected. Alternatively the filament voltage can be adjusted until the required output power, or maximum distortion, is reached

and, (to obtain peak output power) further adjusted after modulation is applied. Regular adjustment (say monthly) will be necessary to maintain the required conditions and, towards the end of tube life, the filament voltage may be raised above the nominal.
To compensate for mains supply fluctuations, automatic or manual control of the filament voltage should be exercised, especially when operating at nominal, or higher than nominal, filament voltage.

2.2.2 Thoriated tungsten cathodes (filaments)

The maximum working life from these cathodes is obtained when the filament voltage is held within 1% of the nominal. Underheating and overheating may be harmful so temporary deviations from the nominal voltage must not exceed ± 5%, unless otherwise specified.

2.2.3 Quick heating cathodes (filaments)

In general, tubes with quick heating cathodes should have their filaments in parallel only. When a sinusoidal voltage is used for heating the filament, the frequency must not be in the range 200 Hz to 5000 Hz.
When a non-sinusoidal voltage from a d.c.-a.c. converter is used the r.m.s. value should be adjusted to the published value of filament voltage.
If required the heating time can be further reduced by applying a higher value for a short time. The manufacturer should be consulted before doing so.

2.2.4 Indirectly heated oxide coated cathodes

For maximum life the heater voltage should be as near as possible to the nominal value and the maximum permissible deviation must not exceed 10%, unless otherwise specified.
R.F. voltages between heater and cathode may induce faulty r.f. insulation with resultant r.f. power losses. To overcome these losses an increase in the driving power would be required resulting in an increase of cathode temperature with a consequent reduction of tube life. Such r.f. voltages should therefore be avoided e.g. by using one of the following techniques:

- by-passing the heater to cathode insulation and decoupling the heater at v.h.f. and u.h.f.

- r.f. blocking with series chokes in heater supply leads and decoupling with capacitors.

2.2.5 Switching on the filament voltage

Unless a maximum switch-on value of filament current is stated in the data sheet, switching on at full filament voltage is permissible. The published values of the maximum permissible filament current during switch on, refer to the absolute maximum of the instantaneous value under worst case conditions. With a.c. feed this will exist when switching on at the instantaneous peak voltage of the highest mains voltage that may occur. In practice the filament current during switching on can be limited by means of a filament transformer with high magnetic leakage or a series choke or resistor in the primary of the transformer. If necessary this choke or resistor may be short circuited by means of a relay after a delay of, say, 15 seconds.

2.2.6 By-passing the filament

Tubes with directly heated cathodes must have the filament terminals at the same r.f. potential. For this purpose it is usual to connect a capacitor, that has low reactance with respect to the operating frequency, near to and between the filament terminals. As an added safety precaution it should be established that the resonance of this capacitor together with the inductance of the filament structure falls well below the operating frequency.

2.3 Switching on of the electrode voltages

Unless prescribed otherwise simultaneous switching on of filament, anode, control-grid, and screen-grid voltages is permissible for tubes with an internal anode. Tubes with an external anode should in general not have their positive voltages applied until the cathode has reached its operating temperature. This can be checked by monitoring the filament current.

2.4 Effective cathode

If both filament limbs are marked "f" in the data sheets, the filament may be regarded as being symmetrical in its function as cathode. If such a filament is fed with d.c. the anode return lead should be connected to the negative end of the filament. All other decoupling and circuit returns must then also be connected to this point.

If the filament is fed with a.c. the anode return lead should be connected to the centre-tap of the filament transformer or to a tapped resistor shunted across the filament. The filament decoupling will then be symmetrical with regard to this point and all other circuit returns must also made to this point.

If one filament limb is marked "f" and the other "f(k)", only the one marked "f(k)" may be used as the circuit cathode. If such a filament is fed with d.c., the negative side of the filament supply should be connected to this point.

For either d.c. or a.c. filament supply, the anode supply as well as de-coupling and other circuit returns must be connected to "f(k)" only.

2.5 Inter-electrode capacitances

The published values of capacitances are average values measured on the cold tube with no operating voltages; individual deviations may however occur.
The definitions of the capacitance symbols are given in the appropriate list in I.E.C. Publication 100.

2.6 Amplification factor μ and transconductance S

The published values are average values and individual deviations may occur. Normally the conditions at which the values have been measured, are stated.

2.7 Saturation current I_{sat}

Each large tube with a pure tungsten cathode is marked with the value of filament voltage at which the saturation current has the value specified in the data sheet.

2.8 Accessories

Proper functioning of the tubes can be guaranteed only if accessories (sockets, cooling devices etc.) have been supplied, or approved, by the tube manufacturer.

3. LIMITING VALUES

3.1 Limiting values mean the maximum, or minimum, permissible values of the parameters listed. These limits are given either for all operating conditions together, or for a particular application.

3.2 The limiting values are applicable up to the maximum frequency stated. When operating at higher frequencies the limiting values must be decreased in accordance with the published data or curves.

3.3 Derating the limiting values

If no limiting values have been published for a specific application the derating factors listed in the following table must be applied. The values for class C telegraphy have been expressed as unity; the limiting values for other applications have been expressed as a factor of this unity.
A rectified 3-phase supply with or without filtering is equivalent to a d.c. supply.
The derating factors are determined by the physical limits of the tube and contain no safety margins. Where mains voltage fluctuations occur further derating must be applied (see section 3.5). The nature of operation, e.g. the industrial application of heating generators may necessitate further safety derating (see section 5.4).

Wo = tungsten filament Th = thoriated tungsten filament

		V_a	I_a	I_g	W_{ia}	W_a	W_{g2}
R.F. class C telegraphy		1	1	1	1	1	1
Anode mod.	Th Wo	0.8 0.8	0.833 0.5	1 1	0.67 0.4	0.67 0.4	0.67 0.4
R.F. class B	Th Wo	1 1	0.833 0.5	1 1	0.833 [1] 0.5	1 1	0.67 0.5
A.F. class B		1	1	1	1	1	1
A.F. class AB		1	1	1	1	1	1
A.F. class A		1	1		W_a	1	1
Self-rectifying oscillator	Th Wo	1.13 1.13	0.53 0.32	0.53 0.32	0.665 0.4	1 1	
Two-phase half-wave without filter	Th Wo	0.9 0.9	0.89 0.6	0.89 0.6	1 1	1 1	

[1]) or 1.5 W_a.

3.4 Rating system

The limiting values should be used in accordance with the "Absolute maximum rating system" as defined by I.E.C. Publication 134.

3.5 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, 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 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 components variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

3.6 Each limiting value should be regarded independently of other values; under no circumstances is any limiting value to be exceeded (e.g. if the anode voltage is decreased to a value lower than its limiting value, it is not permissible to exceed the limiting value of anode current or anode dissipation). Unless otherwise stated, the limiting values for currents and voltages are measured with a moving coil instrument.

3.7 Electrode voltages

The voltages (V_a, V_{g1}, V_{g2} etc.) listed under limiting values should not be exceeded even with a cold tube. Special attention should be paid to this point when a screen-grid is supplied via a series resistor.
When designing equipment to be supplied from non-stabilized mains, the maximum mains voltage occurring determines the nominal operating voltages of the tube. These nominal voltages must be lower than the limiting values. Should the transmitting tubes, and thus the voltage supply, be temporarily under a lower load their voltages will increase and these increased values, occurring at the highest mains voltage, determine the nominal operating voltages.
The limiting values of voltage are d.c. values. If an a.c. or an unsmoothed d.c. supply is used, the limiting values must be decreased in accordance with the derating factors shown in the table (section 3.3).

3.8 Anode dissipation

The limiting value of the anode dissipation W_a should not be exceeded when mains voltage fluctuations occur, or when grid drive fails. To prevent damage to the tube, in the latter case, adequate fixed bias or a quick action relay in the anode lead should be provided. When forced-air or water-cooling is sufficient only for an anode dissipation smaller than the absolute maximum, the smaller value must be regarded as the limiting value.

3.9 Anode input power

Usually the data sheets show the limiting value of input power W_{i_a} to be smaller than the product of limiting values of anode voltage and anode current; the latter two limits should not therefore occur simultaneously.
In practice the input power W_{i_a} is not always the product of the d.c. values of I_a and V_a. For pulsating supply voltages the form factor should be taken into account.

3.10 For the screen-grid dissipation the product of screen-grid voltage and current can always be taken.
The screen-grid should be protected against failure of anode voltage.

3.11 Control-grid dissipation

The control-grid dissipation W_g or W_{g1} can be approximated, by taking the power supplied to the grid bias source ($-V_g \times I_g$) from the grid driving power (approx. $0.95 \times V_{g_p} \times I_g$). When an a.c., or unsmoothed d.c., voltage supply is used the form factor should be taken into account.

3.12 Grid resistance

By the maximum permissible grid resistance R_g is meant the d.c. resistance in the grid circuit. A higher value may cause instability.

4. OPERATING CONDITIONS

4.1 General

In the published data, operating conditions for various applications have been given, stating the maximum frequency at which the conditions apply. If it is required to operate a tube at higher frequencies the manufacturer should be consulted. The published values of operating conditions are average values derived from measurements made on nominal tubes working under optimum conditions. Thus, small deviations from the published value can occur if measurements are made on a particular tube. However some of the measured values of voltage or current must be adjusted to give the published figure. As an example, the published value of output power is an average value which can be reached in practice by adjusting e.g. the r.f. or a.f. input voltage V_{gp}, when the published value of output power is not obtained at the nominal value of V_{gp}. When designing a multi-stage transmitter it is good practice to leave a margin in the output power and input voltage to allow for adjustments similar to that just described. The published output power W_o of transmitting tubes is the tube output, which means the anode dissipation W_a taken from the anode input W_{i_a}. When a tube is used in a common grid circuit (grounded grid circuit), the published value of the output power includes the power transferred from the input.

Unless otherwise stated losses in the anode circuit and coupling losses are not taken into account.

The quoted grid input power is assumed to be 0.9 x the product of the average grid current I_g and the peak value of the grid voltage V_{gp}. Losses in the grid circuit and the bleeder are sometimes accounted for by stating the required driver output power.

At high frequencies where reduced ratings have to be applied, the required driving power will often be considerably higher than the grid input power, and in some cases, may be determined almost exclusively by circuit losses.

4.2 R.F. class C telegraphy and F.M. telephony

A class C amplifier or oscillator is one in which the grid bias is appreciably greater than the cut-off voltage so that current flows for less than one half of each cycle of the alternating grid voltage. working to the values published in the data sheets will ensure good output power and efficiency.

If a grid resistor is used for obtaining automatic bias, care must be taken that the anode current does not become too high if the r.f. driving power should fail. A safety device in the anode or screen-grid lead should be incorporated for this purpose.

4.3 R.F.class C anode and screen-grid modulation

In an r.f. class C anode modulated stage the anode voltage is modulated with a.f., and at 100 % modulation the voltage is varied from zero to twice the d.c. value. With tetrodes or pentodes the screen-grid shpuld also be modulated to prevent it being overloaded. The average values of the grid bias and r.f. driving voltage remain constant during modulation. With 100 % modulation the average anode dissipation is 1.5 times the value without modulation and this is taken into account although the published limiting value of anode dissipation refers to the unmodulated power. Automatic grid bias by means of a grid leak can be used, but, to obtain minimum distortion, some fixed bias is recommended.

The modulation power published is the power required by the modulated r.f. stage. When the modulating stage is being calculated 5% to 10% must be added to allow for losses in transformer and choke.

4.4 R.F. class B telephony

A class B amplifier is one in which the grid is biased to the cut-off voltage so that the anode current flows for approximately one half of each cycle of the alternating grid voltage. The published data for r.f. class B telephony has been determined, by trial and error, to give a straight modulation characteristic.

4.5 R.F. class AB SSB amplifier

The given operating conditions are from measurements made in a circuit without feedback and with constant screen-grid voltage. They show the best compromise between output power and linearity. Linearity is measured with a double tone test signal in which the two tones have equal amplitude and lie 1000 Hz apart in frequency. The amplitudes of the distortion products d_3 and d_5 are in dB referred to the amplitude of either of the two equal tones. The published values of d_3 and d_5 are the worst encountered at any driving level and occur usually slightly below full output power. Distortion products of orders other than d_3 and d_5 are, in general, negligible. If the amplitudes of the distortion products are referred to the peak envelope amplitude, the figures for d_3 and d_5 go down 6 dB.

4.6 A.F. class B amplifier

With this amplifier the anode dissipation is dependent on the input signal voltage so that maximum anode dissipation is obtained when the signal is about 60% of the value at full drive. When this is not present continuously, as is the case with broadcast and telephony services, it is permissible for the limiting value of anode dissipation to be exceeded by 10%.
To suppress even harmonics, separate controllable grid bias for each tube, or a balancing circuit, should be incorporated. This data is purely arbitrary, i.e. the same output can be obtained with less modulation of the anode current (with smaller load resistance and lower peak grid current) although the efficiency would be lower. The requirements of the complete a.f. amplifier determines which kind of operation is preferred.

4.7 Industrial operating conditions

Section 5.4 gives some general information on the application of power tubes in industrial apparatus. With a single phase mains connection a hum filter will sometimes be omitted as is normal in three phase mains connection. Operating conditions and derating factors are given for this kind of operation (section 3.3). It must be ensured that no limiting values are exceeded because of fluctuations in the mains supply or by tolerances in other components. The published value of W_o is the actual tube output power. The output power of a self-oscillating circuit W_{osc} is obtained by deducting the grid dissipation W_g and the losses in the grid resistor W_{Rg} from the output power W_o, The power in the load W_l is obtained by deducting the losses in the output circuit from W_{osc}. A favourable load output characteristic may be obtained by automatically controlling the grid voltage and current, depending on the matching. A non-linear device e.g. a tungsten lamp or an P.T.C. resistor may perform this function

adequately and help to prevent overloading the grid.
With self oscillating circuits the frequency must be held within the available frequency band. This may be done by having large circuit capacitance, small stable self inductance, undercritical inductive coupling with the output circuit, electrostatic screening between oscillator and output circuit etc.
If the frequency of an industrial oscillator has to be limited to a narrow frequency band, crystal controlled driving stages may be used, then however, it is rather difficult to obtain matching between the tube input and output. A greater safety margin in the tube will be necessary with the output still depending on the load, or special measures, such as automatic tuning and/or matching control, will have to be taken.
For smaller tubes in industrial applications operating conditions have been given for when power is supplied from a single phase full-wave rectifier, a three phase half-wave rectifier (which is nearly equivalent to d.c.) and with raw a.c. In the latter case the output is about 0.6 times that obtained with d.c. and the peak inverse voltage is equal to the full anode voltage (this is of special importance as the grid voltage is in anti-phase to the anode voltage). With a single-phase, half-wave rectified anode voltage the useful output is nearly equal to that with a d.c. supply. To obtain the most favourable mains loading when using a self rectifying oscillator, a quasi push-pull circuit can be used, in which two tubes function alternately on each half wave. The best mains loading for three-phase, self rectification is obtained by using 6 tubes in a triple push-pull circuit.

4.8 Intermittent service

When data concerning intermittent service is published it is conditional that, although the cathode may be heated continuously, the on-period is no more than 5 minutes and that the off-period is equally long or longer.

5. APPLICATION OF THE OPERATING CONDITIONS

5.1 General

It is not always possible to operate the tube under the specified operating conditions. In some applications deviations from the published values are likely to occur causing the limiting values to be exceeded. Depending on the kind of service the following classification can be made:

- Fixed transmitters for broadcasting and telecommunication service, operated by a trained staff. (5.2)
- Mobile transmitters. (5.3)
- Equipment for industrial applications (r.f. heating, supersonics etc.) (5.4)
- Amateur transmitters and special applications. (5.5)
- Pulse operated equipment. (5.6)

5.2 Fixed transmitters

With fixed transmitters it is usually possible to use the tubes under ideal working conditions viz.

- only very small mains voltage deviations as the supply is derived from a special high tension line.
- stabilized mains voltage supply.
- a fairly constant and optimum transmitter load.
- the presence of safety devices which prevent tube damage under any circumstances.
- the presence of a well trained staff for the immediate repair of faults.

and thus it is permissible to operate near the limiting values.

5.3 Mobile transmitters

Mobile transmitters are transmitters which can be operated whilst mobile; they often have to function with widely varying supply voltages and with loads that are neither constant nor optimum. Safety devices are usually poor, especially in small transmitters, so the use of the tube at the published maximum operating conditions is not recommended. The actual operating conditions chosen will depend upon specific circumstances. Because the electrode system in the smaller quick heating or oxide coated transmitting tubes is rugged and can withstand the vibration and occasional shocks experienced in normally used road vehicles the tubes are ideal for mobile transmitters.

However in aircraft and vehicles used over rough ground it is advisable to shockmount the tubes. The oxide coated cathode is fairly insensitive to heater voltage variation and the high specific emission allows lower anode voltages to be used. Generally, when used in any apparatus that is likely to be subjected to shocks or vibration, tubes with thoriated tungsten cathodes require shock damping. If a special device is used to clamp a tube into its socket it must be ensured that the maximum permissible temperature is not exceeded in any part of the envelope.

5.4 Industrial application, r.f. heating, supersonics etc.

For the following reasons, in industrial equipment the tube seldom operates under ideal conditions.

- Large, uncompensated mains voltage fluctuations.
- Voltage supply with no provision against hum.
- Variable load.
- Relative large tolerances on the stability of the operating frequency.
- Intermittent service.
- Service personnel often untrained in the servicing of the electronic power equipment.

Thus the design of industrial equipment differs from that of fixed transmitters and generally demands the use of self oscillating triodes. The most reliable operation of the tube, and hence the equipment, is obtained by selecting a nominal supply potential which, at the maximum mains voltage, does not exceed the limiting value.
In equipment powered by a.c. or unsmoothed d.c., the pulsating waveform is such that the average values of voltage and current chosen must be lower than if they were supplied by a normal d.c. supply.
Special attention should be paid to the grid current and dissipation since, in most cases, they are critical values.
Special cases of intermittent service make it possible to increase the limiting values and information on these possibilities will be supplied on request.

5.4.1 Multiple tube operation

Since industrial generators are largely self oscillating, single tube operation is generally preferred. This mode of operation minimizes the risk of interaction between the tube and circuit stray reactances that could lead to parasitic oscillations. Whenever, for various reasons, such as the suppression of the even harmonics or the need for higher power at higher frequencies, push-pull or parallel operation is chosen, increased attention must be paid to the prevention of interaction between the tubes, be they in push-pull or parallel, through their connections or other stray circuit reactances.

5.5 Amateur transmitters and special adjustments

The maximum permissible load of a tube is determined by the physical maxima of the tube incorporated in the limiting values. No guaranteed tube life can be given if the limiting values are exceeded although this does not imply that exceeding the limits will always result in an immediate breakdown of the tube. In the case of I.C.A.S. (Intermittent Commercial and Amateur Service) for instance, higher operating conditions have been given (see section 4.8) but generally no guarantee of tube life is given. Information about special circuits, adjustments and operating conditions will be supplied on request.

5.6 Pulsed operation

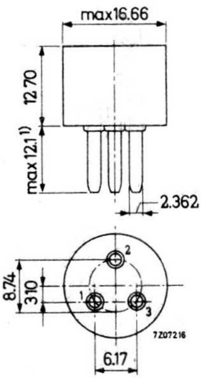
When a tube is used under pulsed operation the pulse duration must be so short that no part of the tube reaches an abnormally high temperature and flash-overs do not develop. In general the average load will be considerably less than the maximum limiting load value.
General information on this kind of information is not available but, if requested, information will be given on specific applications.

6. Conditioning

After transit or a period of storage it is recommended that power tubes should be operated for not less than 15 minutes with only the filaments/heaters energized before puting into full service.

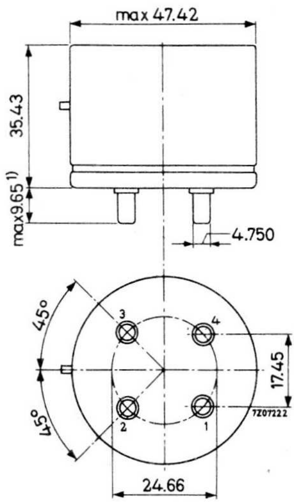
In addition, for tubes operating normally with anode voltages in excess of 5 kV, it is recommended that the anode voltage and input power should be increased gradually or in several steps for a further period of 15 minutes, or longer, until normal operation is achieved.
This treatment will remove any traces of gases which might cause premature failure of the tube.

Pee Wee 3-pin base
(IEC 67-I-19a)



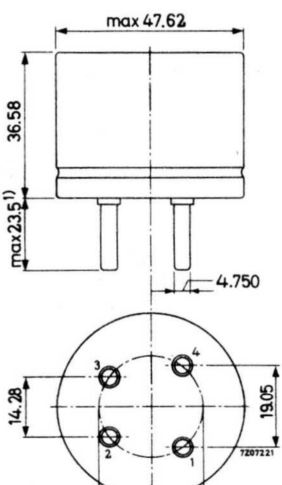
1) Including solder

Jumbo 4-pin base
(IEC 67-I-23)



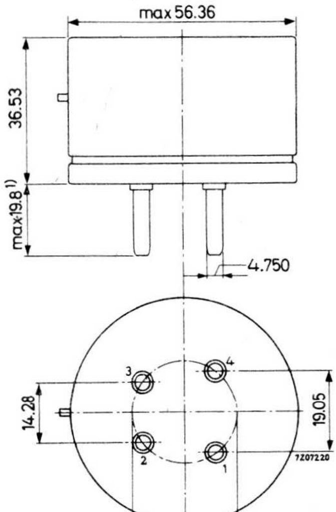
1) Including solder

Super Jumbo 4-pin base
(IEC 67-I-28a)



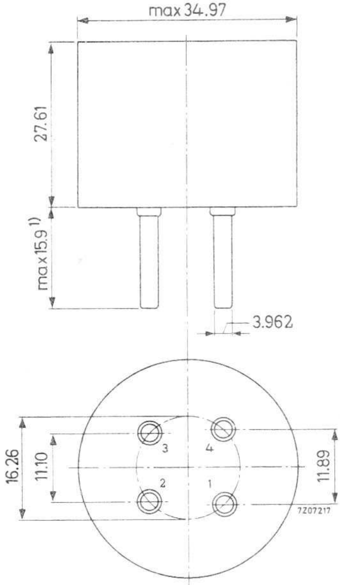
1) Including solder

Super Jumbo 4-pin base with bayonet
(IEC 67-I-24)



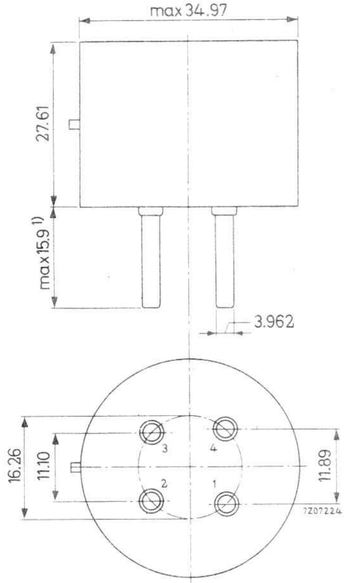
1) Including solder

Medium 4-pin base
(IEC 67-I-2)



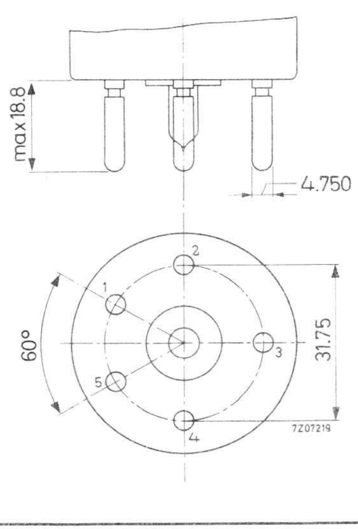
1) Including solder

Medium 4-pin base with bayonet
(IEC 67-I-3)

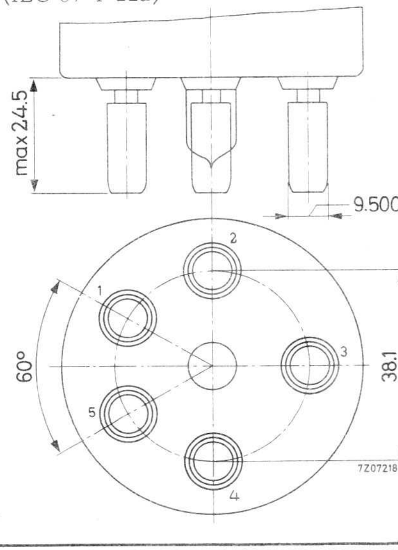


1) Including solder

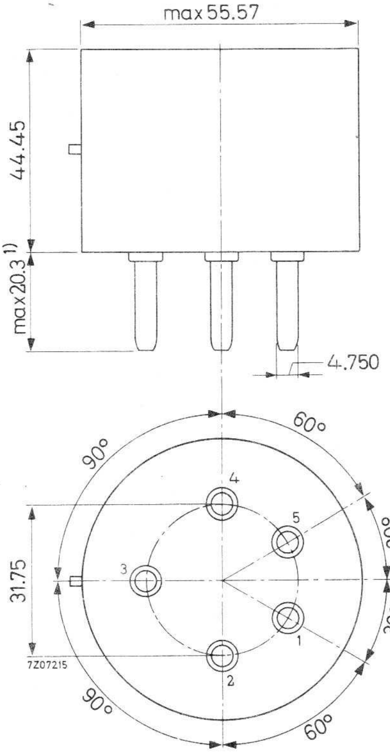
Giant 5-pin base
(IEC 67-I-21c)



Super Giant 5-pin base
(IEC 67-I-22a)

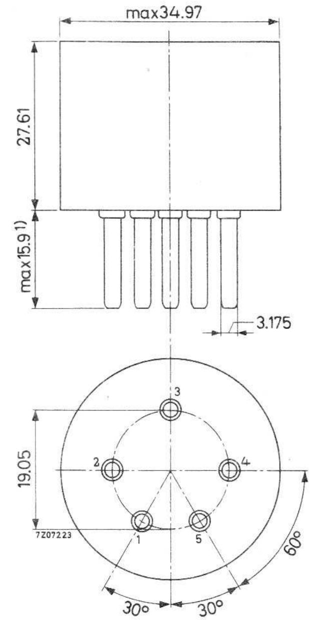


Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)



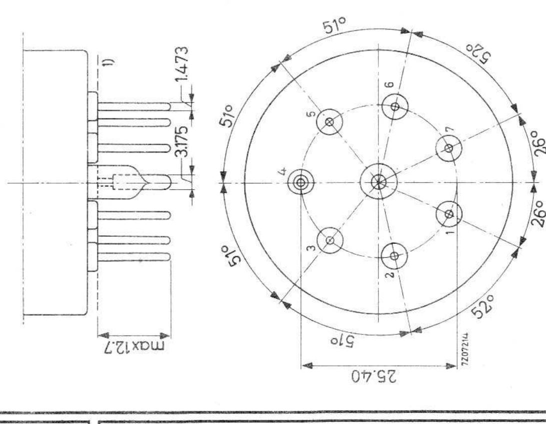
1) Including solder

Medium 5-pin base
(IEC 67-I-4a)



1) Including solder

Septar 7-pin base
(IEC 67-I-20a)



1) The reference line is established by the seating plane of the base and is determined by the three highest bosses.

Transmitting tubes for communication
Tubes for r.f. heating

TRIODES FOR R.F. HEATING

Preferred types for new equipment design

type	oscillator output power (kW)	cooling *)	frequency at full ratings max. (MHz)
YD1240	2,67	FA	250
YD1352S	3	W	5
YD1150	4,75	FA	85
YD1151		W	
YD1152		WH	
YD1160	8,8	F	85
YD1161		W	
YD1162		WH	
YD1173	13,2	FA	50
YD1170	15,4	FA	120
YD1172		WH	
YD1175	26,2	FA	120
YD1177		WH	
YD1180	31,6	FA	100
YD1182		W	
YD1185	50	FA	100
YD1187		W	
YD1192	62,7	W	100
YD1193		V	
YD1195	90	FA	30
YD1197	108	W	30
YD1202	163	W	100
YD1203		V	
YD1204		V	
YD1212	240	W	100
YD1213		V	
YD1342	480	W	30
YD1343		V	

*) FA = forced air
W = water
WH = water (helix)
V = vapour

R.F. POWER TRIODE

Triodes intended for use as H.F. amplifier, oscillator, and modulator.
The YD1000 is water cooled.
The YD1001 is forced-air cooled.
The YD1002 is vapour cooled.

QUICK REFERENCE DATA

Frequency (MHz)	C telegraphy		C anode mod.		R.F. class B		A.F. class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	120			15	110	10	78
30	12	90	11	66	12	110	10	78

HEATING: direct by a.c. or d.c. ; thoriated tungsten filament.

Filament voltage	V_f	12,6	V
Filament current	I_f	160	A

CAPACITANCES

Grid to filament	C_{gf}	120	pF
Anode to filament	C_{af}	1,4	pF
Anode to grid	C_{ag}	50	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Anode current	I_a	1	A
Amplification factor	μ	58	
Transconductance	S	60	mA/V

TEMPERATURE LIMITS

Absolute max. bulb temperature	t_{bulb}	220	^{o}C
Absolute max. seal temperature	t_s	220	^{o}C

COOLING

At frequencies higher than 10 MHz a low-velocity air flow should be directed to the grid and filament seals.

YD1000

See cooling curves.
For water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation.

YD1001

See cooling curves.
At higher temperatures the amount of air should be increased so that the outlet air temperature is not higher than that at t_i = 25 °C. At lower temperatures the amount of air should be the same as that at t_i = 25 °C.

YD1002

Cooling data for anode dissipation W_a = 60 kW

Total dissipation to be transferred by cooling system ($W_a + W_g + 0,8\ W_f$)	63	kW
equivalent to	3768	kJ/min
	(900	kcal/min)
Volume of produced vapour		
at back-flow water temperature of 20 °C	2,5	m^3/min
at back-flow water temperature of 90 °C	2,8	m^3/min
Amount of back-flowing water		
at back-flow water temperature of 20 °C	1,5	ℓ/min
at back-flow water temperature of 90 °C	1,7	ℓ/min

ACCESSORIES

Filament connector with cable	type	40670	
Filament/cathode connector with cable	type	40670	
Water jacket (YD1000 only)	type	K 724	net mass 5 kg
Insulating pedestal (YD1001 only)	type	40672	net mass 9,2 kg
Vapour cooling system (vapour jacket) (YD1002 only)	type	K 728	net mass 8 kg
Tube extractor	type	221 L	

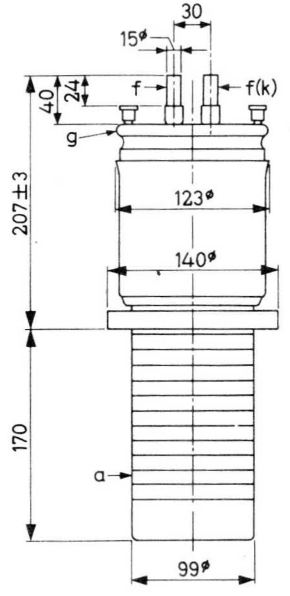
MECHANICAL DATA

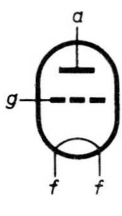
Dimensions in mm

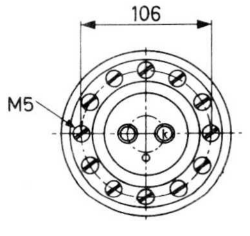
YD1000

Net mass : 6,2 kg

Mounting position : vertical with anode down



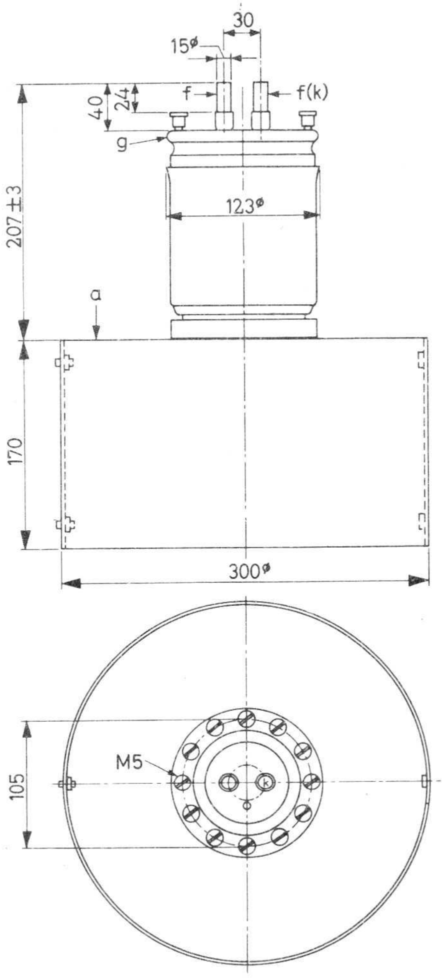




YD1001

Net mass : 39 kg

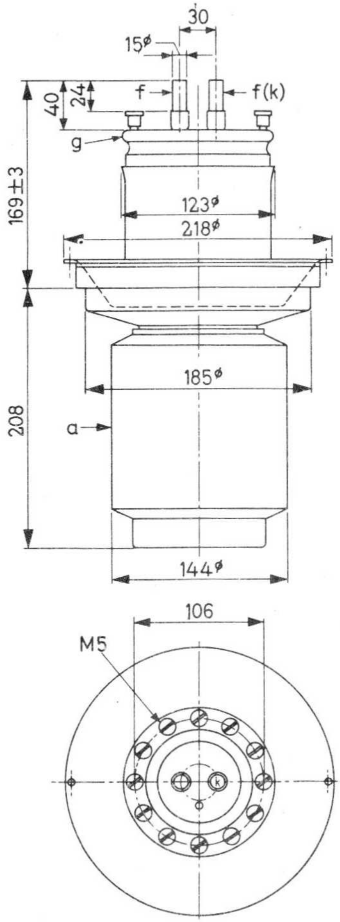
Mounting position : vertical with anode down



YD1002

Net mass : 17 kg

Mounting position : vertical with anode down



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

LIMITING VALUES (Absolute limits)

Frequency	f	up to	10	up to	30	MHz
Anode voltage	V_a	max.	16	max.	12,5	kV
Anode dissipation (YD1000)	W_a	max.	45	max.	45	kW
(YD1001)	W_a	max.	35	max.	35	kW
(YD1002)	W_a	max.	60	max.	60	kW
Grid voltage, negative	$-V_g$	max.	1000	max.	1000	V
Grid dissipation	W_g	max.	1,3	max.	1,3	kW
Anode current	I_a	max.	13	max.	13	A
Grid current	I_g	max.	3,3	max.	3,3	A

OPERATING CONDITIONS

Frequency	f	10	30	30	30	MHz
Anode voltage	V_a	15	12	10	8	kV
Grid voltage	V_g	-600	-550	-500	-450	V
Anode current	I_a	9,75	9,25	9,0	8,75	A
Grid current	I_g	2,2	2,2	2,1	1,85	A
Grid driving voltage, peak	V_{gp}	1000	940	875	810	V
Driving power	W_{dr}	2,1	1,9	1,7	1,55	kW
Anode input power	W_{ia}	146	111	90	70	kW
Anode dissipation	W_a	26	21	18	15	kW
Output power	W_o	120	90	72	55	kW
Efficiency	η	82	81	80	78,5	%

R.F. CLASS-B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency		f	up to	10	up to	30	MHz
Anode voltage		V_a	max.	16	max.	12,5	kV
Anode dissipation	(YD1000)	W_a	max.	45	max.	45	kW
	(YD1001)	W_a	max.	35	max.	35	kW
	(YD1002)	W_a	max.	60	max.	60	kW
Grid voltage, negative		$-V_g$	max.	1000	max.	1000	V
Grid dissipation		W_g	max.	1,3	max.	1,3	kW
Anode current		I_a	max.	13	max.	13	A
Grid current		I_g	max.	3,3	max.	3,3	A

OPERATING CONDITIONS

Frequency	f	10	10	30	30	MHz
Anode voltage	V_a	15	15	12	12	kV
Grid voltage	V_g	−260	−260	−210	−210	V
Anode current	I_a	10,1	7,75	12,7	9,85	A
Grid current	I_g	2,0	1,3	3,0	1,9	A
Grid driving voltage, peak	V_{gp}	600	520	650	520	V
Driving power	W_{dr}	1080	610	1770	880	W
Anode input power	W_{ia}	151	116,3	153	118	kW
Anode dissipation	W_a	41	31,3	43	33	kW
Output power	W_o	110	85	110	85	kW
Efficiency	η	73	73	72	72	%

R.F. CLASS-C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	11,5	kV
Anode dissipation	W_a	max.	30	kW
Grid voltage, negative	$-V_g$	max.	1000	V
Grid dissipation	W_g	max.	1,3	kW
Anode current	I_a	max.	9	A
Grid current	I_g	max.	3,3	A

OPERATING CONDITIONS

Frequency	f	30	30	MHz
Anode voltage	V_a	11	10	kV
Grid voltage	V_g	-480	-440	V [1])
Anode current	I_a	7,6	6,9	A
Grid current	I_g	3,1	3,1	A
Grid resistor	R_g	90	80	Ω
Grid driving voltage, peak	V_{gp}	880	810	V
Driving power	W_{dr}	2,7	2,4	kW
Anode input power	W_{ia}	83,6	69	kW
Anode dissipation	W_a	17,6	14	kW
Output power	W_o	66	55	kW
Efficiency	η	79	79	%
Modulation depth	m	100	100	%
Modulation power	W_{mod}	41,8	34,5	kW

[1]) Partially obtained by the grid resistor and grid current.

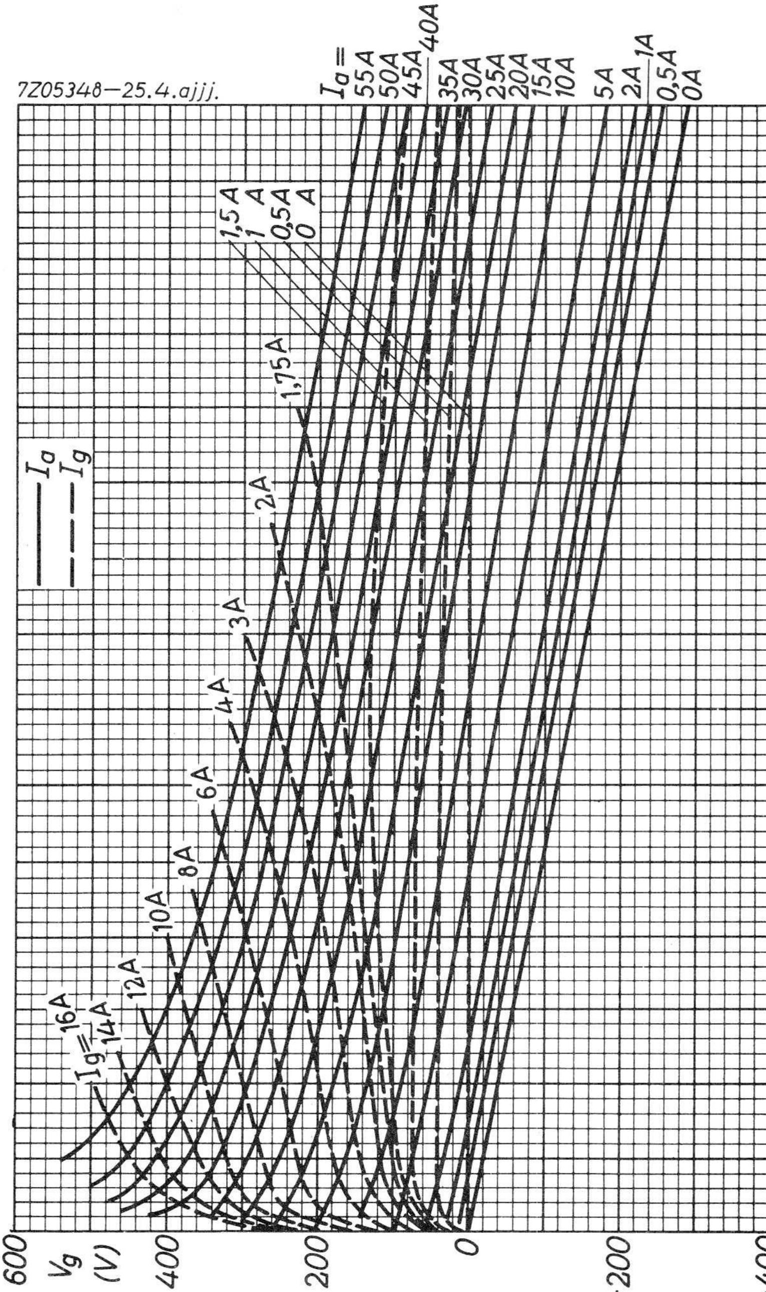
A.F. CLASS-B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

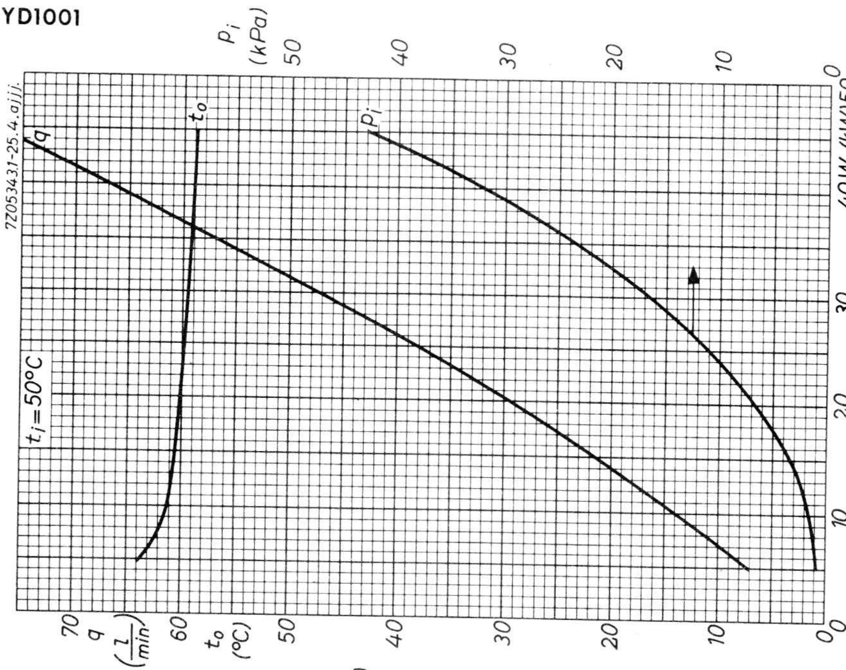
Anode voltage	V_a	max.	12	kV
Anode dissipation	W_a	max.	45	kW
Grid voltage, negative	$-V_g$	max.	1000	V
Grid dissipation	W_g	max.	1,3	kW
Anode current	I_a	max.	13	A
Grid current	I_g	max.	3,3	A

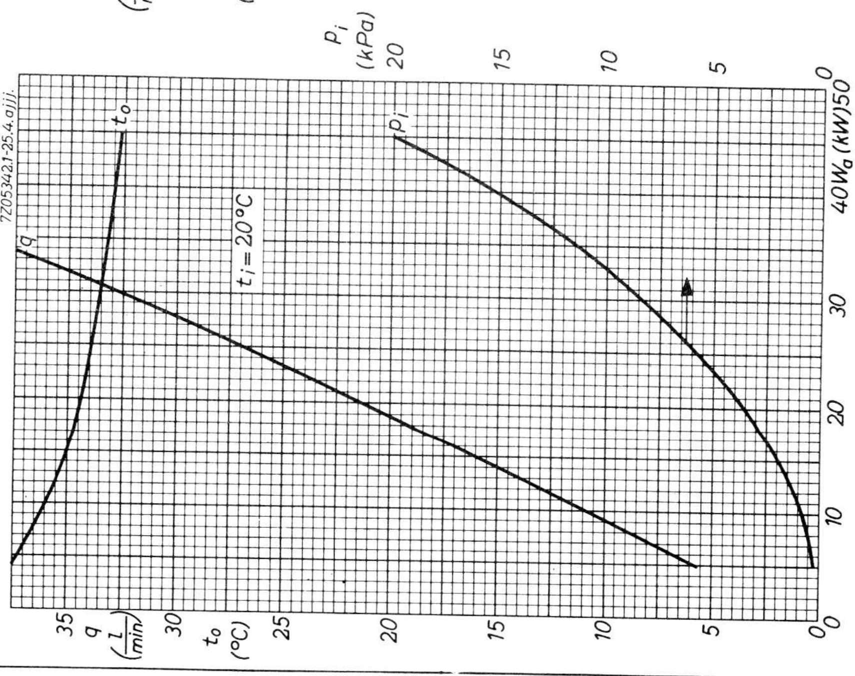
OPERATING CONDITIONS (two tubes in push-pull)

Anode voltage	V_a	12		10		kV
Grid voltage	V_g	−205		−170		V
Load resistance	$R_{aa\sim}$	2720		1810		Ω
Grid driving voltage, peak	V_{ggp}	0	710	0	710	V
Anode current	I_a	2x0,4	2x4,75	2x0,4	2x5,75	A
Grid current, average	I_g	0	2x0,45	0	2x0,72	A
Grid current, peak	I_{gp}	0	2x2,9	0	2x4,0	A
Driving power	W_{dr}	0	2x150	0	2x235	W
Anode input power	W_{ia}	2x4,0	2x57	2x4,0	2x57,5	kW
Anode dissipation	W_a	2x4,0	2x18	2x4,0	2x18,5	kW
Output power	W_o	0	78	0	78	kW
Efficiency	η	-	68,5	-	68	%


7Z05348–25.4.ajjj.
I_a =
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0,5A
0A
1,5A
1 A
0,5A
0 A
1,75A
2A
3A
4A
6A
8A
10A
12A
I_g = 16A
14A
I_a
I_g
V_g (V)
600
400
200
0
−200
−400
0
2
4
6
8
10
12
V_a (kV) 14

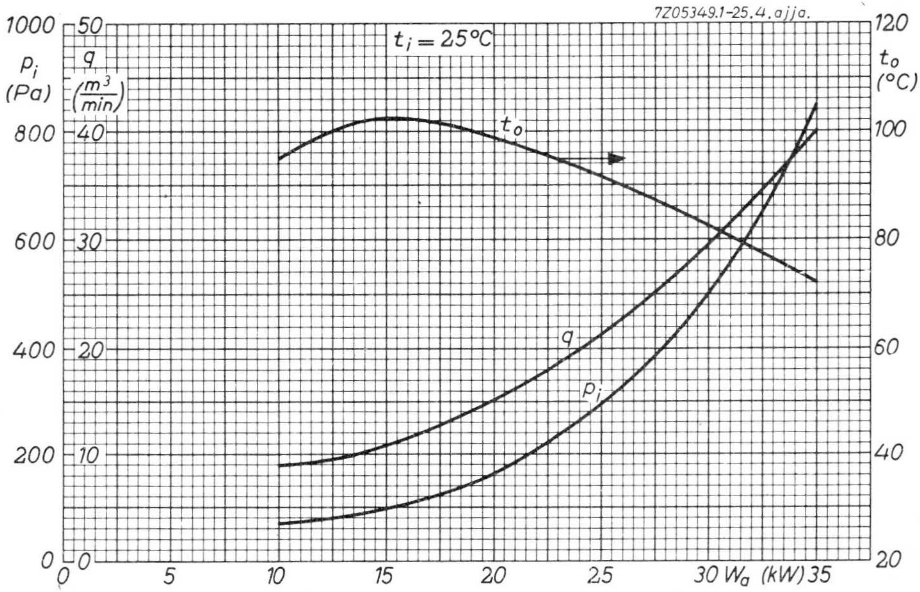
YD1001





100 kPa ≈ 1 at.

YD1001



1 Pa ≈ 0,1 mmH_2O.

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		C an.mod.		A.F.class B[1])	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	360					12	450
30	12	285	10	60	11	165	10	400
			8	50	10	135	8	300
			6	35	8	110	6	200

HEATING : direct by AC or DC; filament thoriated tungsten

Filament voltage	V_f	= 18	V
Filament current	I_f	= 280	A

CAPACITANCES

Anode to filament	C_{af}	= 7.5	pF
Grid to filament	C_{gf}	= 240	pF
Anode to grid	C_{ag}	= 120	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 4	kV
Anode current	I_a	= 5	A
Amplification factor	μ	= 55	
Mutual conductance	S	= 130	mA/V

[1]) Two tubes

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 180 °C

Seal temperature = max. 180 °C

COOLING CHARACTERISTICS . See also cooling curves

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
10	20	12	0.003
	50	17	0.005
40	20	37	0.03
	50	54	0.07
80	20	75	0.12
	50	112	0.26
120	20	120	0.3
	50	179	0.6

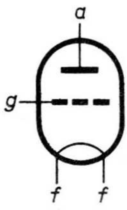
For inlet temperatures t_i between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation.
At frequencies higher than 10 MHz a low velocity air flow should be directed to the seals of grid and filament.

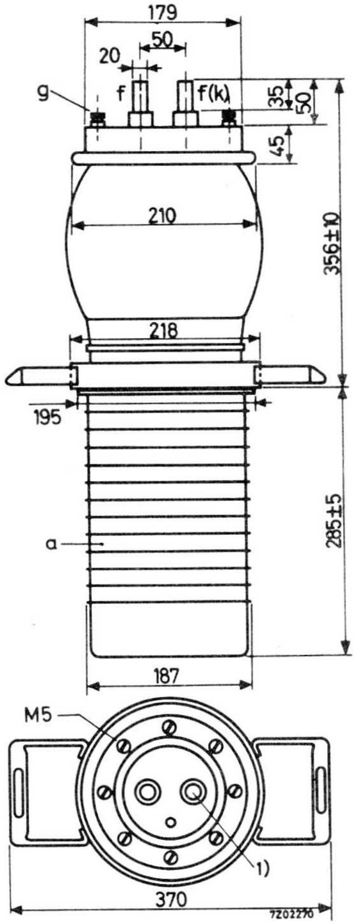
MECHANICAL DATA

Dimensions in mm

Net weight of tube : 32.5 kg

Net weight of water jacket: 30.5 kg





Mounting position: vertical with anode down

ACCESSORIES

Water jacket : K723

Filament connectors with cable: 40667

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1) This pin should be used for connecting the anode return lead.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	= max.	15	12	kV
Anode dissipation	W_a	= max.	120	120	kW
Negative grid voltage	$-V_g$	= max.	1200	1200	V
Grid dissipation	W_g	= max.	4	4	kW
Anode current	I_a	= max.	33	33	A
Grid current	I_g	= max.	8	8	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	-520	-800	-480	-720	V
Anode current	I_a	=	29.3	24.7	29.3	24.7	A
Grid current	I_g	=	5.4	5.2	5.9	5.5	A
Peak driving voltage	V_{g_p}	=	1090	1370	1050	1290	V
Driving power	W_{dr}	=	5.5	6.6	5.7	6.6	kW
Anode input power	W_{ia}	=	440	371	353	296	kW
Anode dissipation	W_a	=	80	61	68	51	kW
Output power	W_o	=	360	310	285	245	kW
Efficiency	η	=	81.8	83.5	80.8	82.6	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	11	kV
Anode dissipation	W_a	= max.	80	kW
Negative grid voltage	$-V_g$	= max.	1000	V
Grid dissipation	W_g	= max.	4	kW
Anode current	I_a	= max.	22	A
Grid current	I_g	= max.	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	11	10	8	kV
Grid voltage	V_g	=	-170	-140	-100	V
Grid resistor	R_g	=	40	44	33	Ω
Anode current	I_a	=	19	17.3	18	A
Grid current	I_g	=	7.4	6.9	7.6	A
Peak driving voltage	V_{g_p}	=	1000	930	855	V
Driving power	W_{dr}	=	7.1	6	6	kW
Anode input power	W_{ia}	=	209	173	144	kW
Anode dissipation	W_a	=	44	38	34	kW
Output power	W_o	=	165	135	110	kW
Efficiency	η	=	79	78	76.5	%
Modulation depth	m	=	100	100	100	%
Modulation power	W_{mod}	=	105	87	72	kW

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	= max.	15	12	kV
Anode dissipation	W_a	= max.	120	120	kW
Negative grid voltage	$-V_g$	= max.	800	800	V
Grid dissipation	W_g	= max.	4	4	kW
Anode current	I_a	= max.	27	27	A
Grid current	I_g	= max.	8	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	10	8	6	kV
Grid voltage	V_g	=	-150	-115	-82	V
Anode current	I_a	=	17	18.2	17.9	A
Grid current	I_g	=	0.8	1.2	1.5	A
Peak driving voltage	V_{g_p}	=	338	338	321	V
Driving power	W_{dr}	=	0.25	0.36	0.43	kW
Anode input power	W_{ia}	=	170	146	108	kW
Anode dissipation	W_a	=	110	96	73	kW
Output power	W_o	=	60	50	35	kW
Efficiency	η	=	35.3	34.3	32.6	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	5.9	6.8	7.2	A
Driving power	W_{dr}	=	3.6	4.1	4.1	kW

A.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

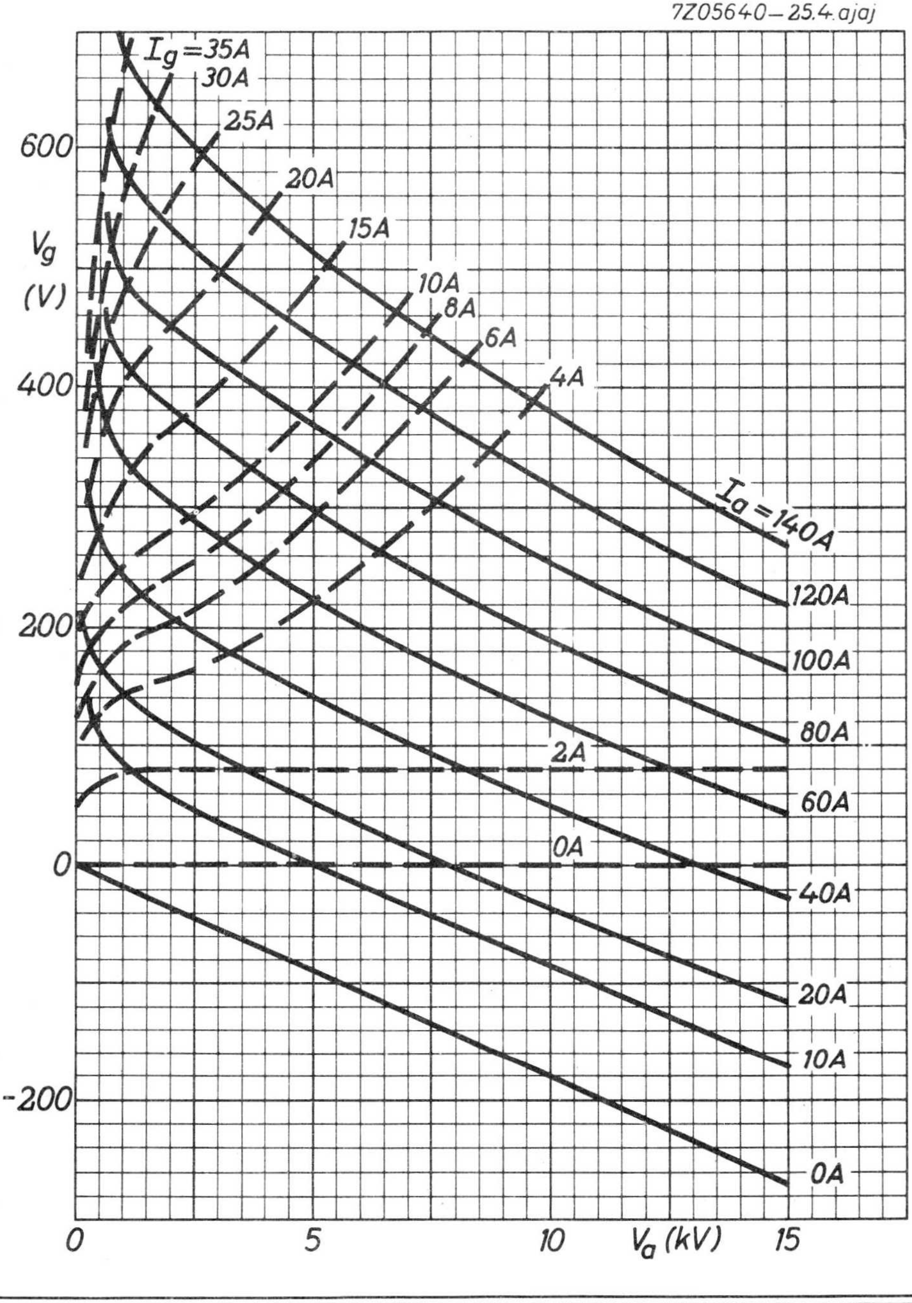
Anode voltage	V_a	= max.	12	kV
Anode dissipation	W_a	= max.	120	kW
Negative grid voltage	$-V_g$	= max.	800	V
Grid dissipation	W_g	= max.	4	kW
Anode current	I_a	= max.	33	A
Grid current	I_g	= max.	8	A

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{ggp}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2	2x26	2x1.8	2x28	A
Grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	$I_{g\,p}$	=	0	2x23	0	2x24	A
Driving power	W_{dr}	=	0	2x2.4	0	2x2.6	kW
Anode input power	W_{ia}	=	2x24	2x312	2x18	2x280	kW
Anode dissipation	W_a	=	2x24	2x87	2x18	2x80	kW
Output power	W_o	=	0	450	0	400	kW
Efficiency	η	=	-	72	-	71.4	%

OPERATING CONDITIONS, two tubes in push-pull (continued)

Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	-115		-82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{gg_p}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Grid current	I_g	=	0	2x5	0	2x4.9	A
Peak grid current	$I_{g\,p}$	=	0	2x24	0	2x22	A
Driving power	W_{dr}	=	0	2x2.5	0	2x2.2	kW
Anode input power	W_{ia}	=	2x12.8	2x216	2x8.4	2x150	kW
Anode dissipation	W_a	=	2x12.8	2x66	2x8.4	2x50	kW
Output power	W_o	=	0	300	0	200	kW
Efficiency	η	=	-	69.5	-	67	%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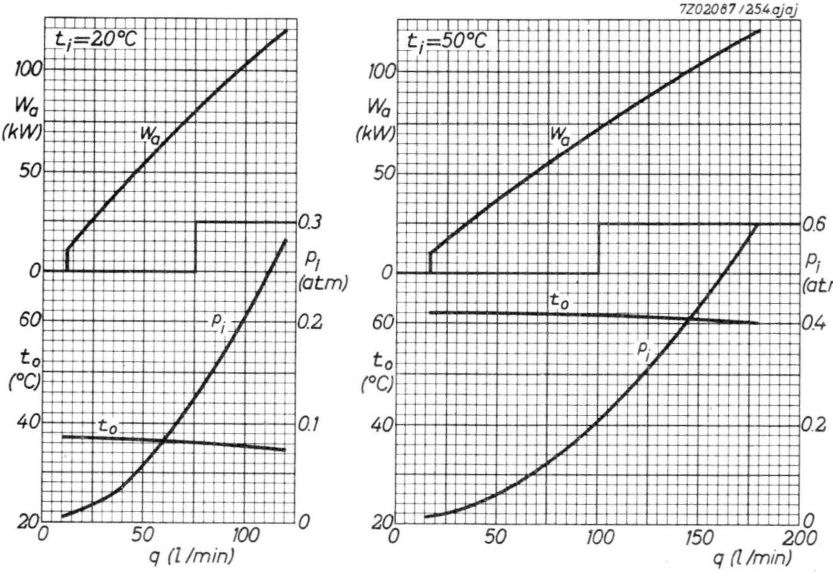
I_g=35A
30A
25A
20A
15A
10A
8A
6A
4A
2A
0A
I_a=140A
120A
100A
80A
60A
40A
20A
10A
0A
600
400
200
0
-200
V_g
(V)
0
5
10
V_a (kV)
15


7Z02087/254.ajaj
t_i=20°C
100
W_a
(kW)
50
0
60
t_o
(°C)
40
20
0
50
100
q (l/min)
0.3
p_i
(atm)
0.2
0.1
0
W_a
p_i
t_o
t_i=50°C
100
W_a
(kW)
50
0
60
t_o
(°C)
40
20
0
50
100
150
200
q (l/min)
0.6
p_i
(atm)
0.4
0.2
0
W_a
t_o
p_i

VAPOUR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		B telephony		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	360					12	450
30	12	285	11	165	10	60	10	400
			10	135	8	50	8	300
			8	110	6	35	6	200

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage	V_f	=	18	V
Filament current	I_f	=	280	A

CAPACITANCES

Grid to filament	C_{gf}	=	240	pF
Anode to filament	C_{af}	=	7.5	pF
Anode to grid	C_{ag}	=	120	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4	kV
Anode current	I_a	=	5	A
Amplification factor	μ	=	55	
Mutual conductance	S	=	130	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t	=	max. 180	^oC
Seal temperature	t	=	max. 180	^oC

COOLING

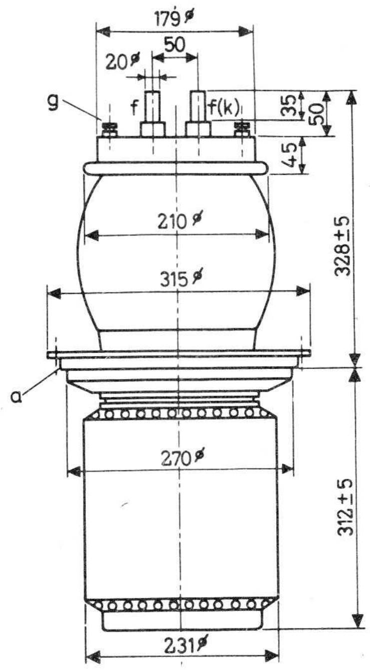
Cooling data for anode dissipation W_a = 180 kW

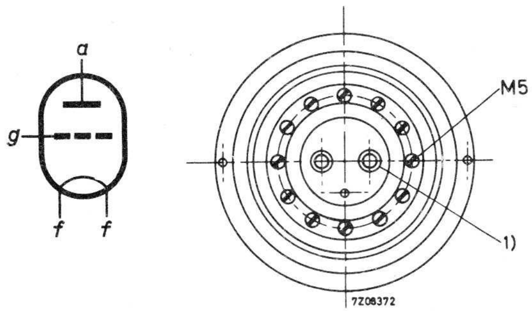
Total dissipation to be transferred by cooling system ($W_a + W_g + 0.8\ W_f$)	188	kW
equivalent to	2700	kcal/min
Volume of produced vapour		
at back flow water temperature of 20 °C	7.3	m^3/min
at back flow water temperature of 90 °C	8.3	m^3/min
Amount of back flowing water		
at back flow water temperature of 20 °C	4.4	l/min
at back flow water temperature of 90 °C	5.1	l/min

MECHANICAL DATA

Net weight: 51.5 kg

Dimensions in mm





Mounting position: vertical with anode down

ACCESSORIES

Vapour cooling system	K729
Filament connectors with cable	40667

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1) This pin should be used for connecting the anode return lead

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	=	max. 15	12	kV
Anode dissipation	W_a	=	max. 180	180	kW
Negative grid voltage	$-V_g$	=	max. 1200	1200	V
Grid dissipation	W_g	=	max. 4	4	kW
Anode current	I_a	=	max. 33	33	A
Grid current	I_g	=	max. 8	8	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	-520	-800	-480	-720	V
Anode current	I_a	=	29.3	24.7	29.3	24.7	A
Grid current	I_g	=	5.4	5.2	5.9	5.5	A
Peak driving voltage	V_{g_p}	=	1090	1370	1050	1290	V
Driving power	W_{dr}	=	5.5	6.6	5.7	6.6	kW
Anode input power	W_{i_a}	=	440	371	353	296	kW
Anode dissipation	W_a	=	80	61	68	51	kW
Output power	W_o	=	360	310	285	245	kW
Efficiency	η	=	81.8	83.5	80.8	82.6	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11	kV
Anode dissipation	W_a	=	max.	120	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	4	kW
Anode current	I_a	=	max.	22	A
Grid current	I_g	=	max.	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	11	10	8	kV
Grid voltage	V_g	=	-170	-140	-100	V
Grid resistor	R_g	=	40	44	33	Ω
Anode current	I_a	=	19	17.3	18	A
Grid current	I_g	=	7.4	6.9	7.6	A
Peak driving voltage	V_{gp}	=	1000	930	855	V
Driving power	W_{dr}	=	7.1	6.0	6.0	kW
Anode input power	W_{ia}	=	209	173	144	kW
Anode dissipation	W_a	=	44	38	34	kW
Output power	W_o	=	165	135	110	kW
Efficiency	η	=	79	78	76.5	%
Modulation depth	m	=	100	100	100	%
Modulation power	W_{mod}	=	105	87	72	kW

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	=	max. 15	12	kV
Anode dissipation	W_a	=	max. 180	180	kW
Negative grid voltage	$-V_g$	=	max. 800	800	V
Grid dissipation	W_g	=	max. 4	4	kW
Anode current	I_a	=	max. 27	27	A
Grid current	I_g	=	max. 8	8	A

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	10	8	6	kV
Grid voltage	V_g	=	-150	-115	-82	V
Anode current	I_a	=	17	18.2	17.9	A
Grid current	I_g	=	0.8	1.2	1.5	A
Peak driving voltage	V_{g_p}	=	338	338	321	V
Driving power	W_{dr}	=	0.25	0.36	0.43	kW
Anode input power	W_{i_a}	=	170	146	108	kW
Anode dissipation	W_a	=	110	96	73	kW
Output power	W_o	=	60	50	35	kW
Efficiency	η	=	35.3	34.3	32.6	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	5.9	6.8	7.2	A
Driving power	W_{dr}	=	3.6	4.1	4.1	kW

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max. 12	kV
Anode dissipation	W_a	=	max. 180	kW
Negative grid voltage	$-V_g$	=	max. 800	V
Grid dissipation	W_g	=	max. 4	kW
Anode current	I_a	=	max. 33	A
Grid current	I_g	=	max. 8	A

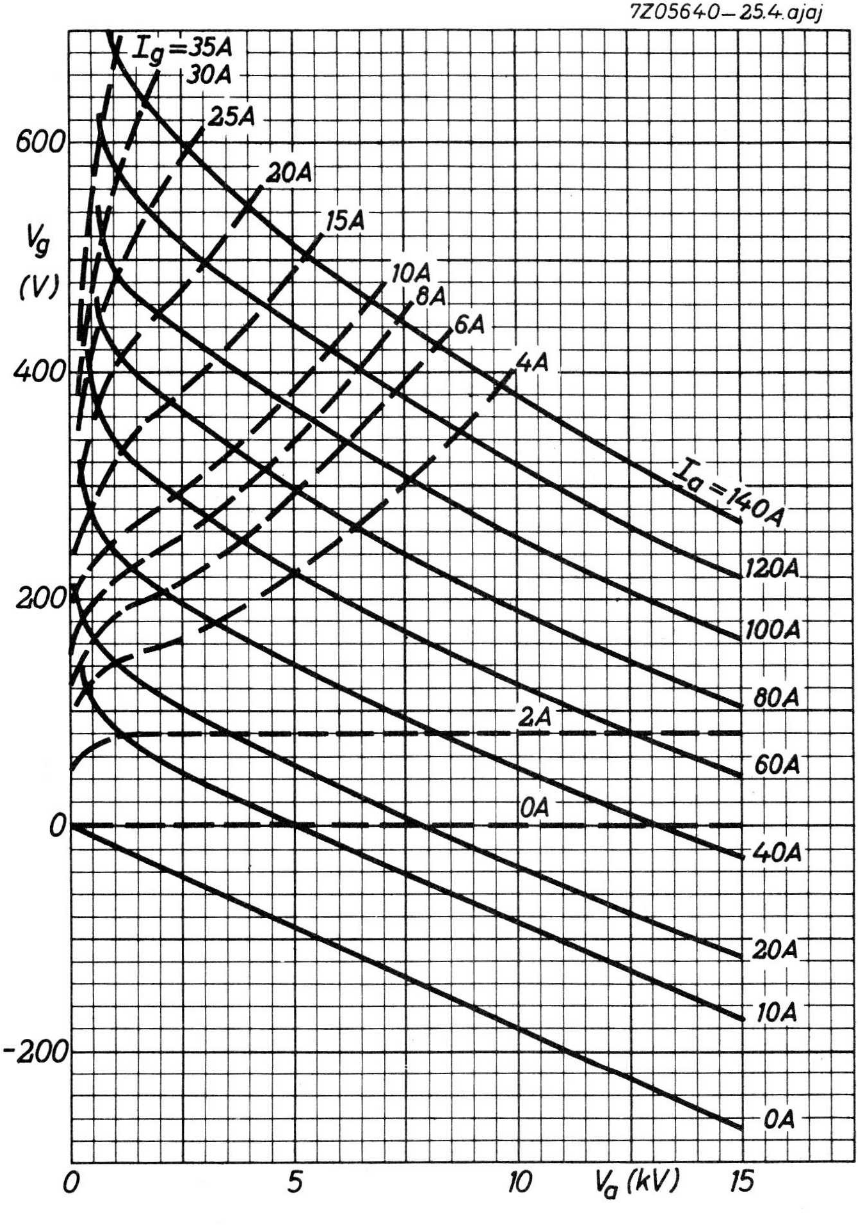
OPERATING CONDITIONS (Two tubes in push-pull)

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{gg_p}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2.0	2x26	2x1.8	2x28	A
Average grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	I_{g_p}	=	0	2x23	0	2x24	A
Driving power	W_{dr}	=	0	2x2.4	0	2x2.6	kW
Anode input power	W_{i_a}	=	2x24	2x312	2x18	2x280	kW
Anode dissipation	W_a	=	2x24	2x87	2x18	2x80	kW
Output power	W_o	=	0	450	0	400	kW
Efficiency	η	=	-	72	-	71.4	%

A.F. CLASS B AMPLIFIER AND MODULATOR

OPERATING CONDITIONS (Two tubes in push-pull; continued)

Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	−115		−82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{ggp}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Average grid current	I_g	=	0	2x5.0	0	2x4.9	A
Peak grid current	I_{gp}	=	0	2x24	0	2x22	A
Driving power	W_{dr}	=	0	2x2.5	0	2x2.2	kW
Anode input power	W_{i_a}	=	2x12.8	2x216	2x8.4	2x150	kW
Anode dissipation	W_a	=	2x12.8	2x66	2x8.4	2x50	kW
Output power	W_o	=	0	300	0	200	kW
Efficiency	η	=	-	69.5	-	67	%


7Z05640—25.4.ajaj
I_g=35A
30A
25A
20A
15A
10A
8A
6A
4A
2A
0A
I_a=140A
120A
100A
80A
60A
40A
20A
10A
0A
600
400
200
0
-200
V_g
(V)
0
5
10
V_a (kV)
15

R.F. POWER TRIODE

R.F. zero bias power triode intended for use as linear S.S.B. amplifier and A.F. class B amplifier

QUICK REFERENCE DATA				
Class B SSB			B mod. Two tubes	
Frequency (MHz)	V_a (V)	W_{load} (PEP) (W)	V_a (V)	W_o (W)
30	2500	580	3000	1310

HEATING: direct by A.C. or D.C.; filament thoriated tungsten

Filament voltage	V_f	=	5.0	V
Filament current	I_f	=	14.1	A

CAPACITANCES

Anode to filament	C_{af}	=	0.033	pF
Grid to filament	C_{gf}	=	8.0	pF
Anode to grid	C_{ag}	=	5.0	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	5	kV
Anode current	I_a	=	80	mA
Mutual conductance	S	=	11	mA/V
Amplification factor	μ	=	350	

TEMPERATURE LIMITS (Absolute limits)

Anode seal temperature	t	=	max. 220	^{o}C
Pin seal temperature	t	=	max. 180	^{o}C
Bulb temperature	t	=	max. 350	^{o}C

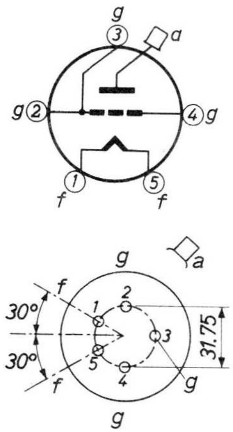
COOLING

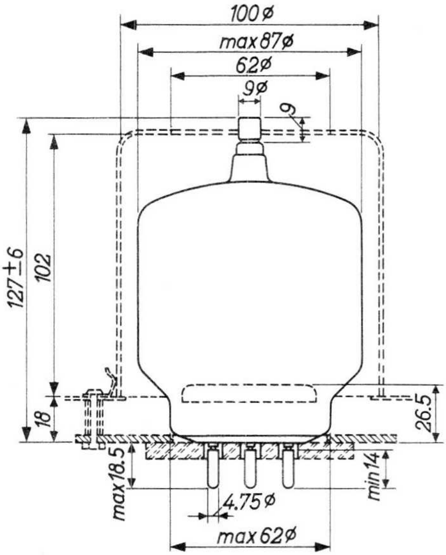
Radiation and low velocity air flow

MECHANICAL DATA

Net weight: 210 g

Base : Giant 5p.





Dimensions in mm

Mounting suggestion of tube with chimney

Mounting position: vertical with base up or down

In order to prevent overheating of the grid pins by high-frequency current it is recommended to include the three grid socket connections in the circuit.

ACCESSORIES

Anode connector	40624
Socket	2422 512 01001
Chimney	40666

R. F. CLASS B LINEAR POWER AMPLIFIER SINGLE SIDE BAND
suppressed carrier, zero bias, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to 110	MHz
Anode voltage	V_a	=	max. 3000	V
Anode input power	W_{i_a}	=	max. 1200	W
Anode dissipation	W_a	=	max. 400	W
Anode current	I_a	=	max. 400	mA
Grid dissipation	W_g	=	max. 20	W

OPERATING CHARACTERISTICS

			zero signal	single tone signal	double tone signal	
Frequency	f	=	30			MHz
Anode voltage	V_a	=	2500			V
Grid voltage	V_g	=	0			V
Peak cathode driving voltage	V_{k_p}	=	0	91	91	V
Anode current	I_a	=	72	400	270	mA
Grid current	I_g	=	–	140	80	mA
Driver output power	W_{dr}	=	–	35	35 (PEP)	W
Anode input power	W_{i_a}	=	180	1000	675	W
Anode dissipation	W_a	=	180	385	368	W
Output power	W_o	=	0	640[1])	640 (PEP)[2])	W
Output power in load	W_{load}	=	0	580	580 (PEP)	W[3])
Overall efficiency	η	=	–	58	43	%
Intermodulation distortion						
of the 3rd order	d_3	=	–	–	−29	dB[4])
of the 5th order	d_5	=	–	–	−34	dB[4])

[1]) Inclusive 25 W feedthrough power
[2]) Inclusive 25 W peak envelope feedthrough power
[3]) Measured in a circuit having an efficiency of 91 %
[4]) Maximum distortion level encountered at any driving level up to full drive, referred to the amplitude of either of the two tones in a double tone test signal at full drive.

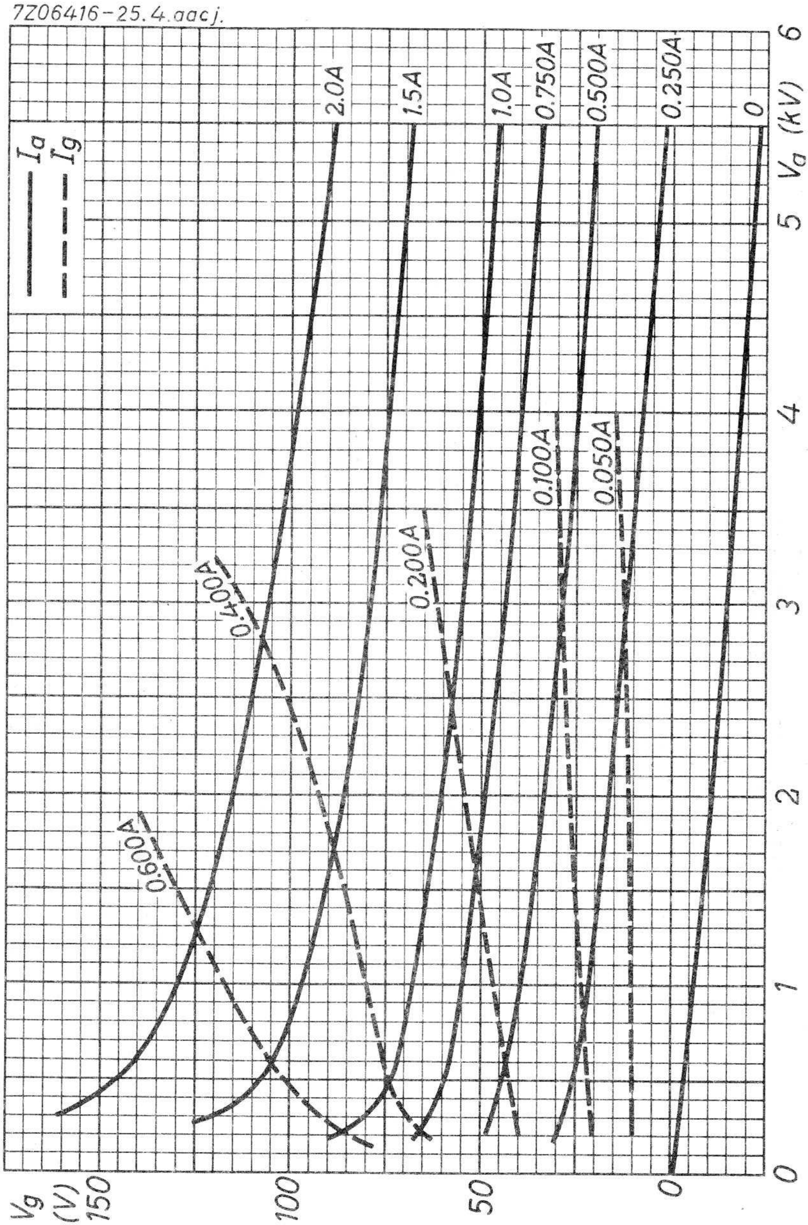
A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max. 3000	V
Anode input power	W_{i_a}	=	max. 1200	W
Anode dissipation	W_a	=	max. 400	W
Anode current	I_a	=	max. 400	mA
Grid dissipation	W_g	=	max. 20	W

OPERATING CONDITIONS Class B, two tubes in push-pull

Anode voltage	V_a	=	3000		V
Load resistance	$R_{aa\sim}$	=	9500		Ω
Peak grid driving voltage	V_{gg_p}	=	0	176	V
Anode current	I_a	=	2x90	2x333	mA
Grid current	I_g	=	0	2x120	mA
Driving power	W_{dr}	=	0	26	W
Anode input power	W_{i_a}	=	2x270	2x1000	W
Anode dissipation	W_a	=	2x270	2x345	W
Output power	W_o	=	0	1310	W
Efficiency	η	=	–	65	%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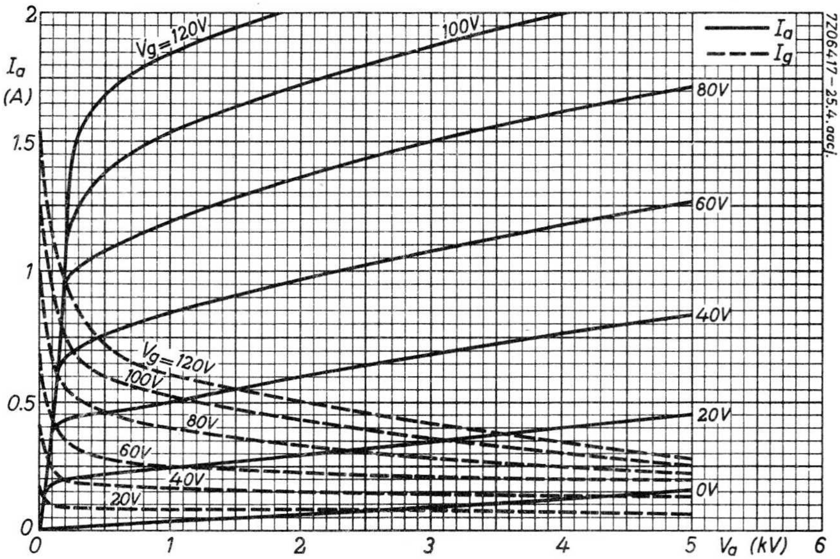
I_a
I_g
2.0A
1.5A
1.0A
0.750A
0.500A
0.250A
0
0.600A
0.400A
0.200A
0.100A
0.050A
V_a (kV)
0
1
2
3
4
5
6
V_g (V)
150
100
50
0



2
I_a
(A)
1.5
1
0.5
0
0
1
2
3
4
5
V_a (kV)
6
V_g=120V
100V
80V
60V
40V
20V
0V
V_g=120V
100V
80V
60V
40V
20V
I_a
I_g
7Z06417-25.4.aacl.

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.		C an. mod.		C industr. osc.		B mod [1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	12	108	10	83	12	124	10	106
	10	75	10	58	12	108	10	64
					10	75		

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	17.5	V
Filament current	I_f	=	196	A
Filament peak current	I_{fp}	max.	420	A
Cold filament resisrance	R_{fo}	=	0.012	Ω

CAPACITANCES

Anode to all other elements except grid	C_a	=	2.2	pF
Grid to all other elements except anode	C_g	=	122	pF
Anode to grid	C_{ag}	=	75	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	25	25	
Mutual conductance	S	=	140	60	mA/V

[1]) Two tubes

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	= max. 50 ^{o}C
Temperature of seals		= max. 180 ^{o}C

WATER COOLING CHARACTERISTICS ; see also cooling curves

W_a (kW)	t_i (^{o}C)	q_{min} (l/min)	p_i (atm)
30	20	25	0.15
	50	45	0.45
50	20	32	0.25
	50	65	0.85
100	20	55	0.6
	50	120	3.0

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

At frequencies below 6 MHz forced air cooling of the seals will, as a rule, not be necessary. Above 6 MHz air cooling must be used to keep the anode and grid seal temperatures below 180 ^{o}C. The seals can be cooled by connecting a blower of suitable size to the air inlet of the anti-corona ring, attached to the tube. At maximum frequency (30 MHz) and published operating conditions an air flow of 2.5 m^3/minute with a pressure loss of about 500 mm H_2O will in general be sufficient. The air flow must be started upon or before the application of filament voltage.

When using the special filament connectors type No. 40628, together with connecting leads of adequate cross-section, additional air cooling of the filament terminals is, as a rule, not necessary.

Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

MECHANICAL DATA

Dimensions in mm

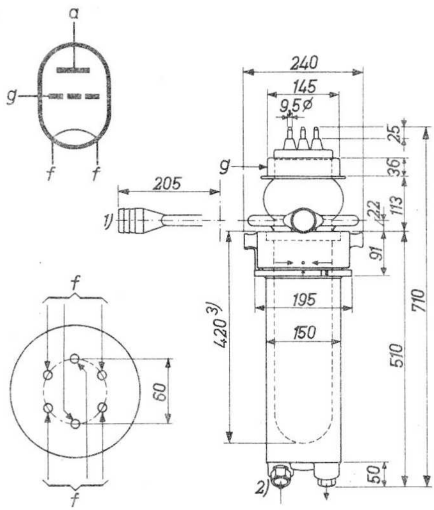
Water-jacket : K714

Filament connectors : 40628

O-ring : 2622 080 30916

Net mass of tube : 13,5 kg

Net mass of water-jacket : 20,5 kg



Mounting position: vertical with anode down

When connecting the filament the three pins of each group must be joined.

1) Use connecting hose with an inner diameter of 1 3/4".

2) Coupling for metal tubing with an outer diameter of 28 mm.

3) For removing the tube from its water-jacket the free height above the tube must be at least 420 mm.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	4	15	30	MHz
Anode voltage	V_a	= max.	15	13.5	12.5	kV
Anode current	I_a	= max.	12.5	12.5	12.5	A
Anode input power	W_{ia}	= max.	165	165	150	kW
Anode dissipation	W_a	= max.	100	100	100	kW
Negative grid voltage	$-V_g$	= max.	1200	1200	1200	V
Grid current	I_g	= max.	1.2	1.2	1.2	A

OPERATING CONDITIONS

Frequency	f =	30	30	MHz
Anode voltage	V_a =	12	10	kV
Grid voltage	V_g =	-1000	-800	V
Grid driving voltage	V_{gp} =	1500	1200	V
Anode current	I_a =	12	10	A
Grid current	I_g =	0.75	0.75	A
Anode input power	W_{ia} =	144	100	kW
Anode dissipation	W_a =	36	25	kW
Driving power	W_{dr} =	1100	850	W
Output power	W_o =	108	75	kW
Efficiency	η =	75	75	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	10.5	kV
Anode current	I_a	=	max.	10.5	A
Anode input power	W_{i_a}	=	max.	110	kW
Anode dissipation	W_a	=	max.	66	kW
Negative grid voltage	$-V_g$	=	max.	1200	V
Grid current	I_g	=	max.	1.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	10	10	kV
Grid voltage	V_g	=	-1050	-1050	V [1]
Grid driving voltage	V_{g_p}	=	1550	1450	V
Anode current	I_a	=	10.5	7.4	A
Grid current	I_g	=	1.1	0.8	A
Anode input power	W_{i_a}	=	105	74	kW
Anode dissipation	W_a	=	22	16	kW
Driving power	W_{dr}	=	1650	1100	W
Output power	W_o	=	83	58	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	53	37	kW

[1]) Grid bias partly obtained by a grid resistor

R.F. CLASS C OSCILLATOR for industrial use with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	15	A
Anode input power	W_{i_a}	= max.	180	kW
Anode dissipation	W_a	= max.	100	kW
Negative grid voltage	$-V_g$	= max.	1600	V
Grid current, loaded	I_g	= max.	1.0	A
Grid current, unloaded	I_g	= max.	1.4	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	12	10	kV
Anode current	I_a	=	14	12	10	A
Grid current	I_g	=	0.9	0.75	0.75	A
Grid circuit resistance	R_g	=	1100	1350	1100	Ω
Feedback ratio	$V_{g\sim}/V_{a\sim}$	=	15	14	14	%
Anode input power	W_{i_a}	=	168	144	100	kW
Anode dissipation	W_a	=	44	36	25	kW
Output power	W_o	=	124	108	75	kW
Efficiency	η	=	74	75	75	%
Output power in the load	W_ℓ	=	104	91	63	kW[1])

[1]) Useful power in the load measured in a circuit having an efficiency of 85%.

A.F. CLASS B AMPLIFIER AND MODULATOR

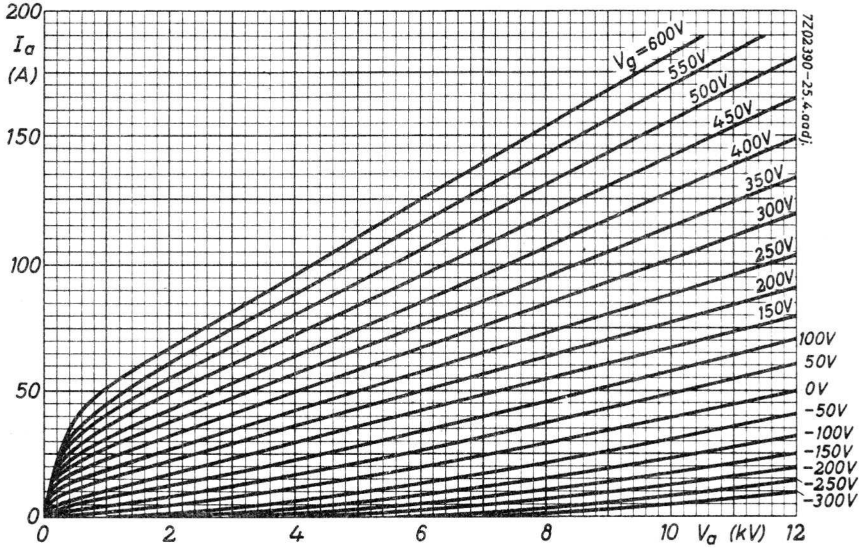
LIMITING VALUES (Absolute limits)

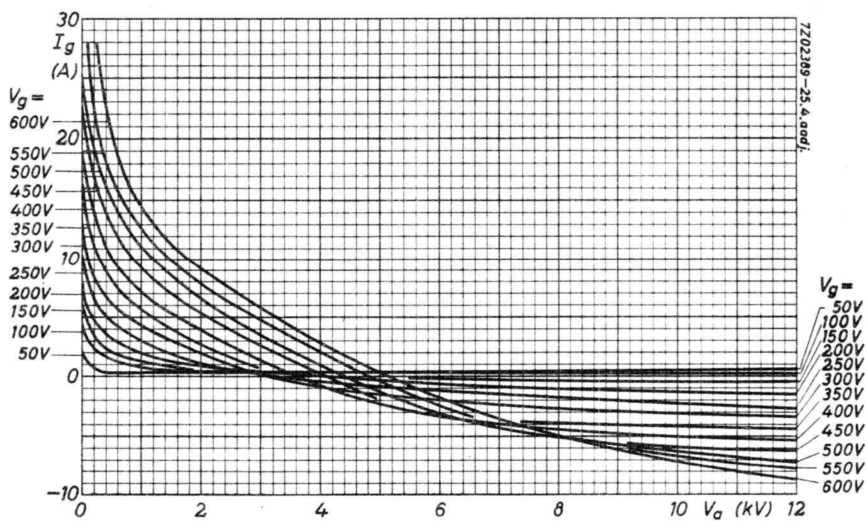
Anode voltage	V_a	= max.	15	kV
Anode current	I_a	= max.	12	A
Anode input power	W_{i_a}	= max.	162	kW
Anode dissipation	W_a	= max.	100	kW
Negative grid voltage	$-V_g$	= max.	1200	V
Grid current	I_g	= max.	1.2	A

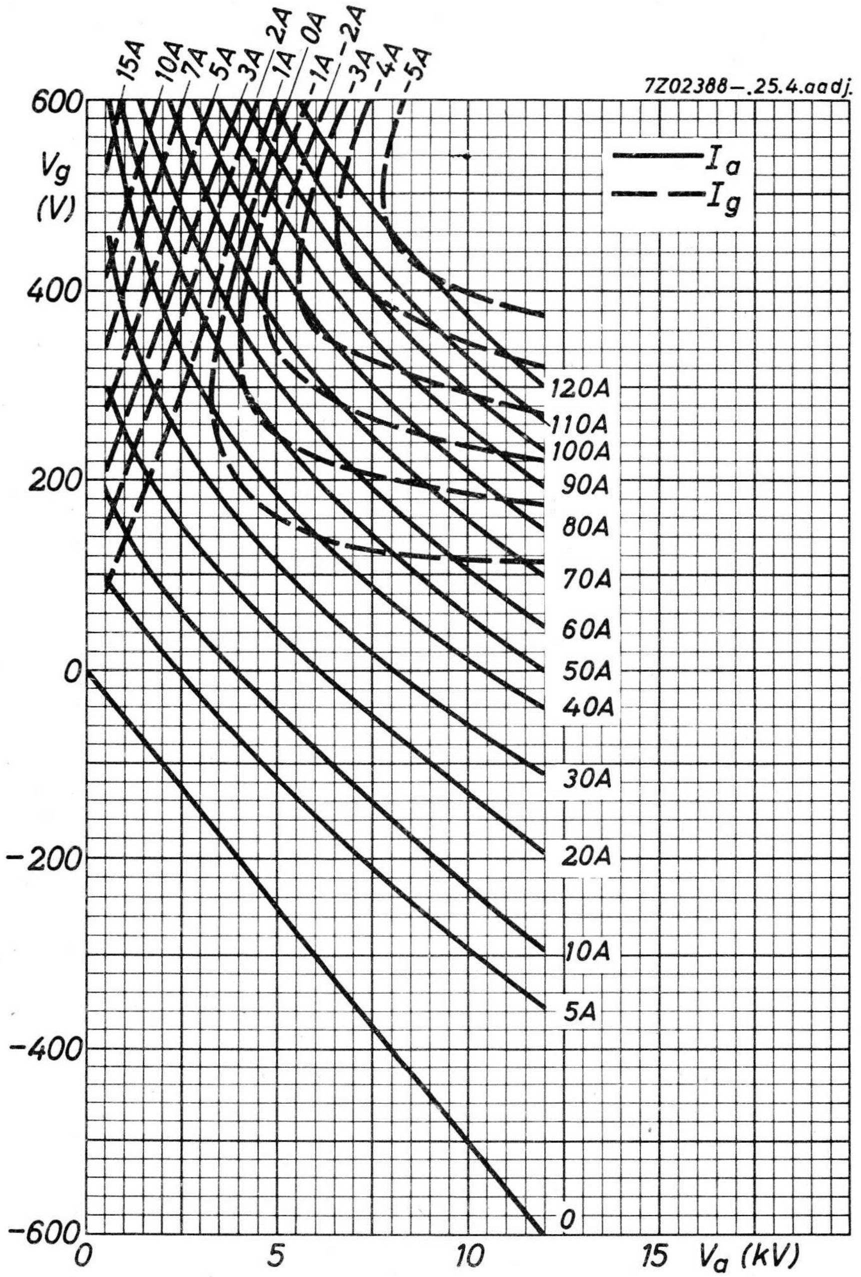
OPERATING CONDITIONS, two tubes in push-pull

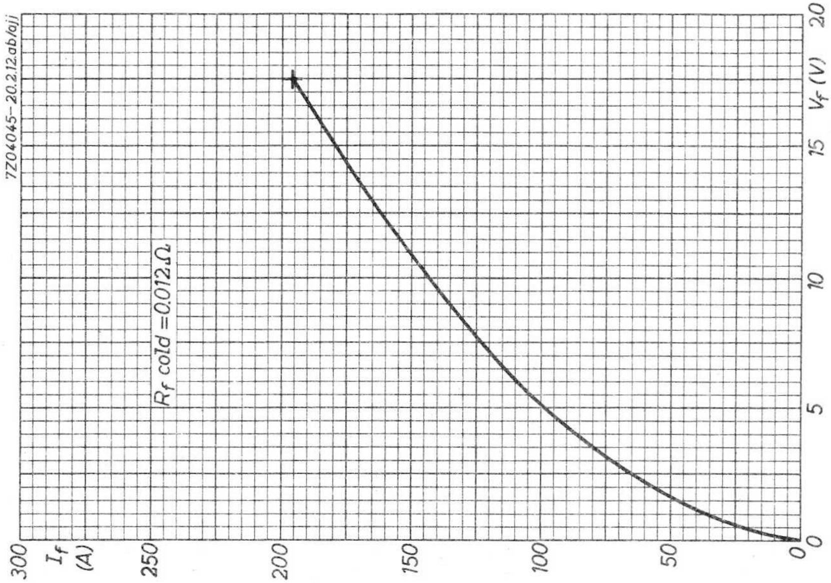
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	-540		-540		V 1)
Load resistance	$R_{aa\sim}$	=	1360		1440		Ω
Driving voltage	V_{gg_p}	=	0	1550	0	1300	V
Anode current	I_a	=	2x0.3	2x8	2x0.3	2x5.8	A
Grid current	I_g	=	0	2x0.2	0	2x0.15	A
Anode input power	W_{i_a}	=	2x3	2x80	2x3	2x58	kW
Anode dissipation	W_a	=	2x3	2x27	2x3	2x26	kW
Driving power	W_{dr}	=	0	2x150	0	2x100	W
Output power	W_o	=	0	106	0	64	kW
Efficiency	η	=	–	67	–	56	%

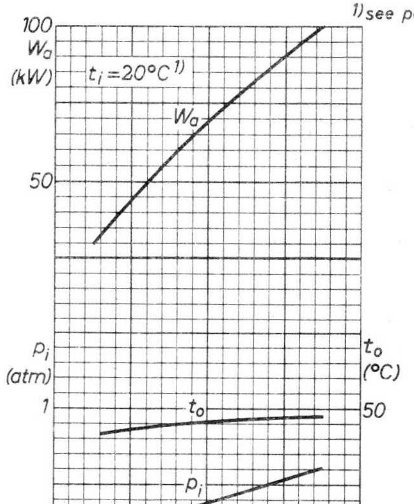
1) To be adjusted for a zero signal anode current of 0.3 A


200
I_a
(A)
150
100
50
0
0
2
4
6
8
10
V_a (kV)
12
V_g=600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
-50V
-100V
-150V
-200V
-250V
-300V
7Z02390-25.4.aad j.

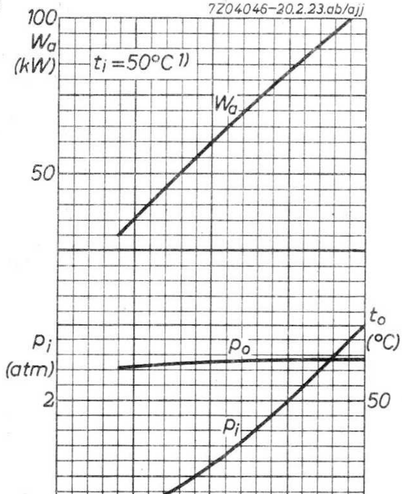

30
I_g
(A)
V_g =
600V
20
550V
500V
450V
400V
350V
300V
10
250V
200V
150V
100V
50V
0
-10
0
2
4
6
8
10
V_a (kV)
12
V_g =
50V
100V
150V
200V
250V
300V
350V
400V
450V
500V
550V
600V
7Z02389-25.4.aad j.


7Z02388—.25.4.aadj.
15A
10A
7A
5A
3A
2A
1A
0A
-1A
-2A
-3A
-4A
-5A
600
400
200
0
-200
-400
-600
Vg
(V)
Ia
Ig
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0
0
5
10
15
Va (kV)


7Z04045-20.2.12.ab/ajj
R_f cold = 0.012 Ω
V_f (V)
I_f (A)
300
250
200
150
100
50
0
5
10
15
20


100
W_a
(kW)
t_i = 20°C 1)
W_a
50
p_i
(atm)
1
t_o
(°C)
50
t_o
p_i
0
20
40
q (l/min)
60
0

1) see page 2


7Z04046-20.2.23.ab/ajj
100
W_a
(kW)
t_i = 50°C 1)
W_a
50
p_i
(atm)
2
p_o
t_o
(°C)
50
p_i
0
50
q (l/min)
100
0

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.		C an. mod.		C industr. osc.		B mod [1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	12 10	108 75	10 10	83 58	12 12 10	124 108 75	10 10	106 64

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	17.5	V
Filament current	I_f	=	196	A
Filament peak current	I_{fp}	max.	420	A
Cold filament resistance	R_{f_o}	=	0.012	Ω

CAPACITANCES

Anode to all other elements except grid	C_a	=	2.2	pF
Grid to all other elements except anode	C_g	=	122	pF
Anode to grid	C_{ag}	=	75	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	25	25	
Mutual conductance	S	=	140	60	mA/V

[1]) Two tubes

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 180 °C

AIR COOLING CHARACTERISTICS ; see also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
30	0	35	35	114
	0	45	40	143
	1500	35	42	136
	3000	25	44	132
45	0	35	54	275
	0	45	62.5	335
	1500	35	64.5	322
	3000	25	68	319

When the tube is used at frequencies above 6 MHz special attention must be paid to the anode and grid seal temperatures. For frequencies below 20 MHz cooling of these seals can be effected by air flowing through the slots at the top of the cooler. In certain cases, e.g. at low dissipation and cooling with the minimum quantity of air (according to the cooling curves), the air flow to the seals will not be sufficient to maintain the seal temperatures below 180 °C. In these cases and also if it is preferred to close the slots, cooling of the seals should be effected by a separate air flow to the seals.

When using the filament connectors type 40628, together with connecting leads of adequate cross-section, additional air cooling of the filament terminals is, as a rule, not necessary.

Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

MECHANICAL DATA

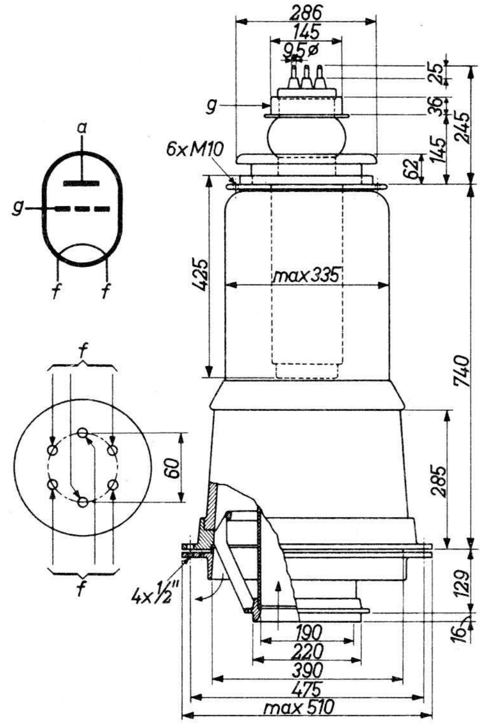
Dimensions in mm

Filament connectors : 40628

Cooler housing : K506

Net mass of tube : 26 kg

Net mass of K506 : 72 kg



Tube mounted in cooler housing type K506

Mounting position : vertical with anode down

When connecting the filament the three pins of each group must be joined.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 4	15	30	MHz
Anode voltage	V_a	=	max. 15	13.5	12.5	kV
Anode current	I_a	=	max. 12.5	12.5	12.5	A
Anode input power	W_{i_a}	=	max. 165	165	150	kW
Anode dissipation	W_a	=	max. 45	45	45	kW
Negative grid voltage	$-V_g$	=	max. 1200	1200	1200	V
Grid current	I_g	=	max. 1.2	1.2	1.2	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	12	10	kV
Grid voltage	V_g	=	-1000	-800	V
Grid driving voltage	V_{g_p}	=	1500	1200	V
Anode current	I_a	=	12	10	A
Grid current	I_g	=	0.75	0.75	A
Anode input power	W_{i_a}	=	144	100	kW
Anode dissipation	W_a	=	36	25	kW
Driving power	W_{dr}	=	1100	850	W
Output power	W_o	=	108	75	kW
Efficiency	η	=	75	75	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	10.5	kV
Anode current	I_a	= max.	10.5	A
Anode input power	W_{i_a}	= max.	110	kW
Anode dissipation	W_a	= max.	30	kW
Negative grid voltage	$-V_g$	= max.	1200	V
Grid current	I_g	= max.	1.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	10	10	kV
Grid voltage	V_g	=	-1050	-1050	V [1]
Grid driving voltage	V_{g_p}	=	1550	1450	V
Anode current	I_a	=	10.5	7.4	A
Grid current	I_g	=	1.1	0.8	A
Anode input power	W_{i_a}	=	105	74	kW
Anode dissipation	W_a	=	22	16	kW
Driving power	W_{dr}	=	1650	1100	W
Output power	W_o	=	83	58	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	53	37	kW

[1]) Grid bias partly obtained by a grid resistor

R.F. CLASS C OSCILLATOR for industrial use with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	15	A
Anode input power	W_{i_a}	= max.	180	kW
Anode dissipation	W_a	= max.	45	kW
Negative grid voltage	$-V_g$	= max.	1600	V
Grid current, loaded	I_g	= max.	1.0	A
Grid current, unloaded	I_g	= max.	1.4	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	12	10	kV
Anode current	I_a	=	14	12	10	A
Grid current	I_g	=	0.9	0.75	0.75	A
Grid circuit resistance	R_g	=	1100	1350	1100	Ω
Feedback ratio	$V_{g\sim}/V_{a\sim}$	=	15	14	14	%
Anode input power	W_{i_a}	=	168	144	100	kW
Anode dissipation	W_a	=	44	36	25	kW
Output power	W_o	=	124	108	75	kW
Efficiency	η	=	74	75	75	%
Output power in the load	W_ℓ	=	104	91	63	kW[1]

[1]) Useful power in the load measured in a circuit having an efficiency of 85%

A.F. CLASS B AMPLIFIER AND MODULATOR

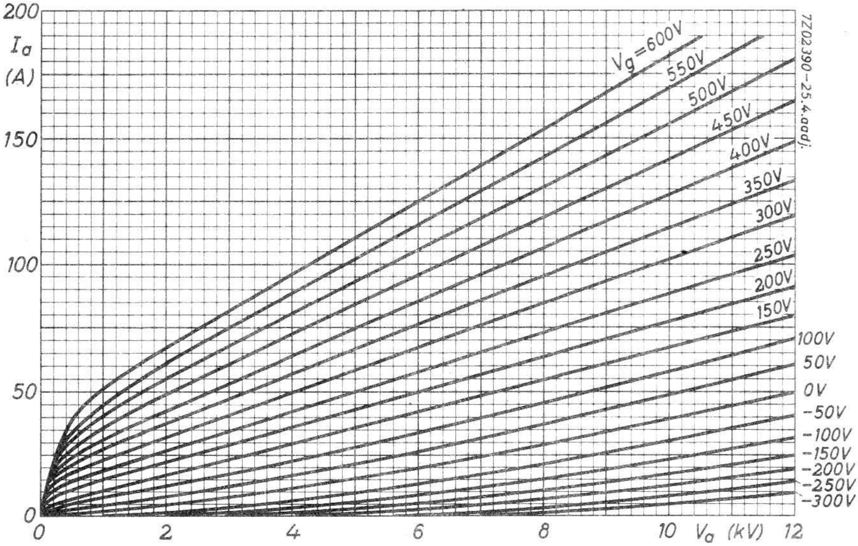
LIMITING VALUES (Absolute limits)

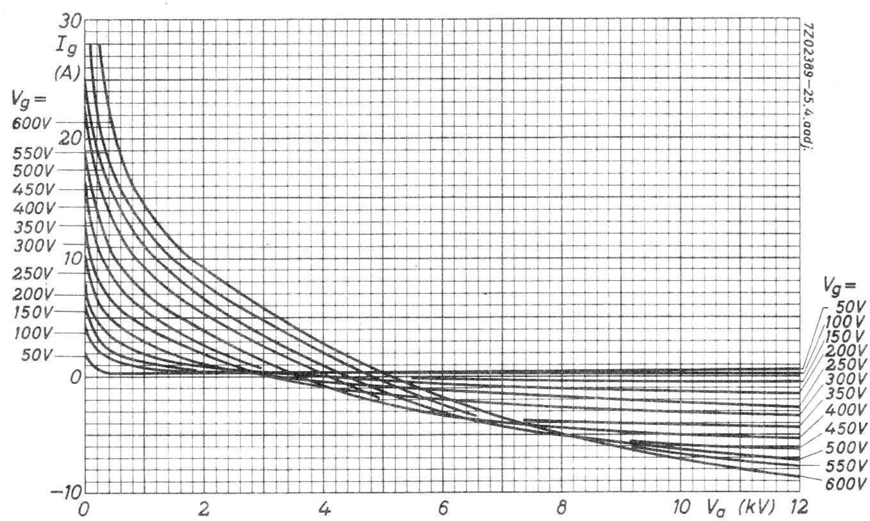
Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	12	A
Anode input power	W_{i_a}	=	max.	162	kW
Anode dissipation	W_a	=	max.	45	kW
Negative grid voltage	$-V_g$	=	max.	1200	V
Grid current	I_g	=	max.	1.2	A

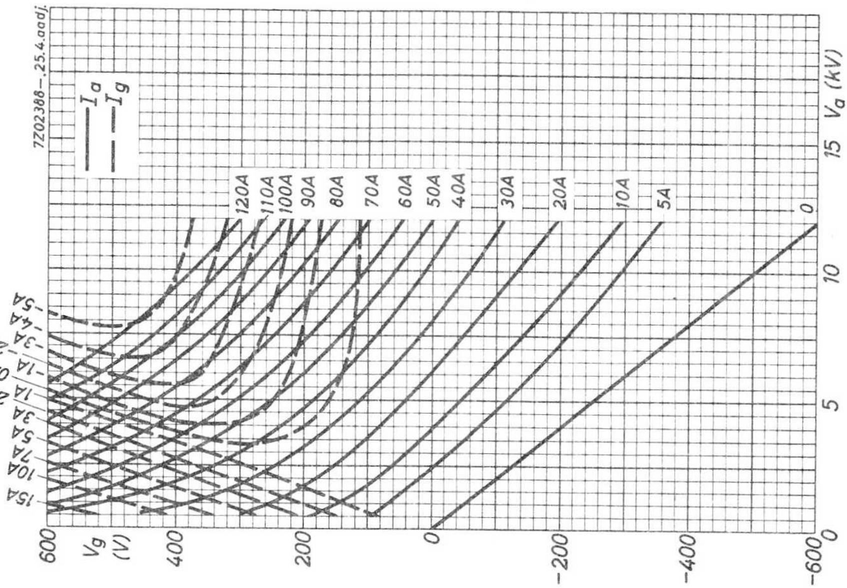
OPERATING CONDITIONS , two tubes in push-pull

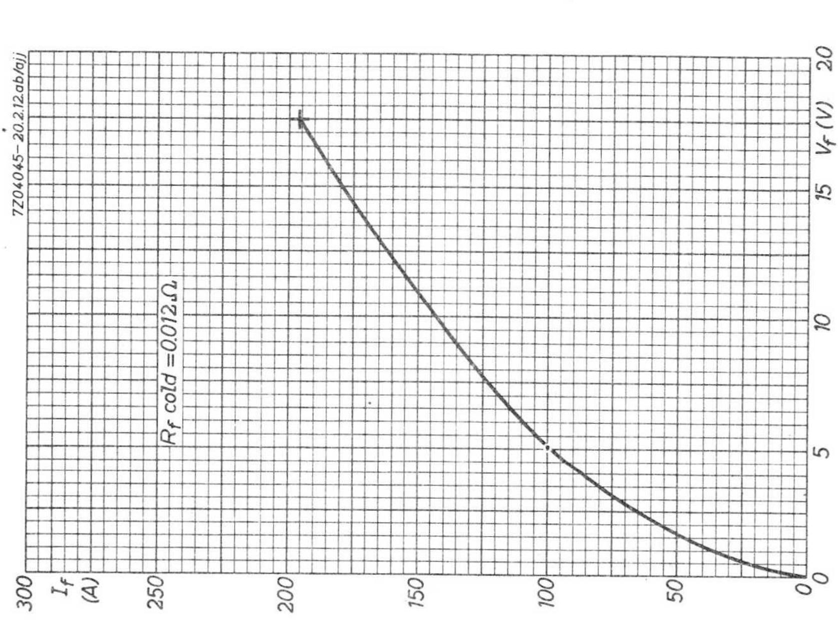
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	-540		-540		V [1]
Load resistance	$R_{aa\sim}$	=	1360		1440		Ω
Driving voltage	V_{gg_p}	=	0	1550	0	1300	V
Anode current	I_a	=	2x0.3	2x8	2x0.3	2x5.8	A
Grid current	I_g	=	0	2x0.2	0	2x0.15	A
Anode input power	W_{i_a}	=	2x3	2x80	2x3	2x58	kW
Anode dissipation	W_a	=	2x3	2x27	2x3	2x26	kW
Driving power	W_{dr}	=	0	2x150	0	2x100	W
Output power	W_o	=	0	106	0	64	kW
Efficiency	η	=	–	67	–	56	%

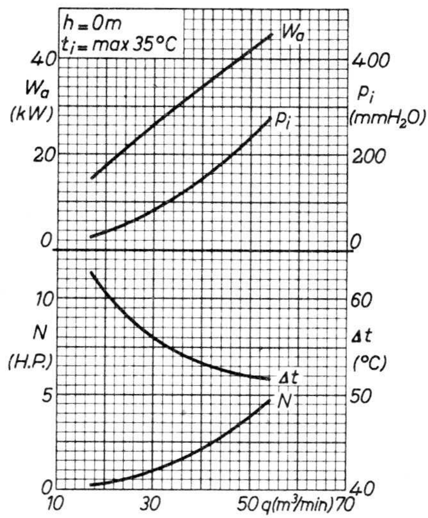
[1]) To be adjusted for a zero signal anode current of 0.3 A

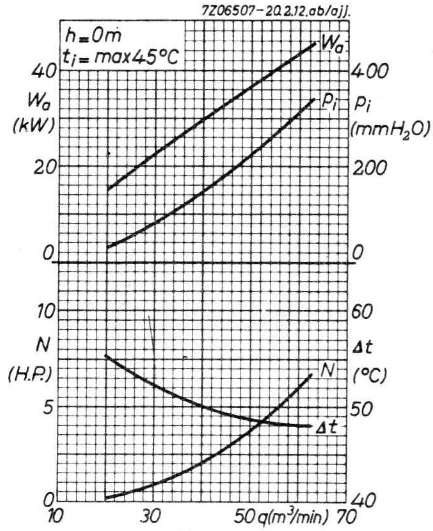

200
I_a
(A)
150
100
50
0
0
2
4
6
8
10
V_a (kV)
12
V_g=600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
-50V
-100V
-150V
-200V
-250V
-300V
7Z02390-25.4.aadj.

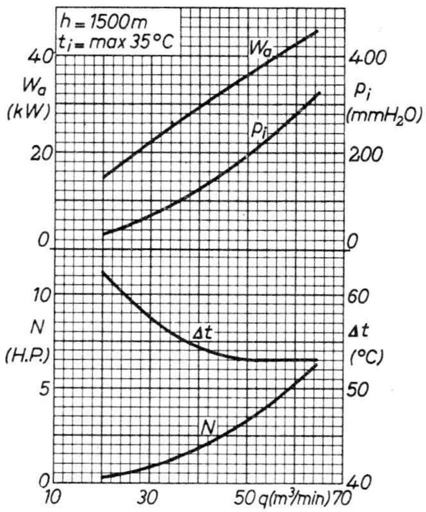

30
I_g
(A)
V_g=
600V
20
550V
500V
450V
400V
350V
300V
10
250V
200V
150V
100V
50V
0
-10
0
2
4
6
8
10
V_a (kV)
12
V_g=
50V
100V
150V
200V
250V
300V
350V
400V
450V
500V
550V
600V
7Z02389-25.4.aadj.

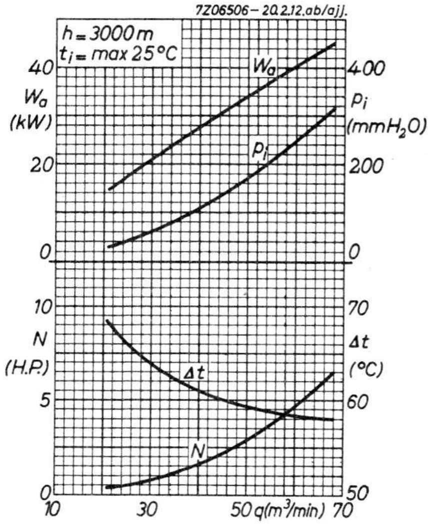

7Z02388-.25.4.aadj.
I_a
I_g
V_g (V)
V_a (kV)
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0
-5A
-4A
-3A
-2A
-1A
0A
1A
2A
3A
5A
7A
10A
15A
600
400
200
0
-200
-400
-600
5
10
15


7Z04045-20.2.12.ab/aij
R_f cold = 0.012 Ω
I_f (A)
V_f (V)
300
250
200
150
100
50
0
5
10
15
20


h = 0m
t_i = max 35°C
W_a
p_i
W_a (kW)
p_i (mmH2O)
N (H.P.)
Δt (°C)
Δt
N
50 q(m³/min) 70


7Z06507-20.2.12.ab/ajj.
h = 0m
t_i = max 45°C
W_a
p_i
W_a (kW)
p_i (mmH2O)
N (H.P.)
Δt (°C)
N
Δt
50 q(m³/min) 70


h = 1500m
t_i = max 35°C
W_a
p_i
W_a (kW)
p_i (mmH2O)
N (H.P.)
Δt (°C)
Δt
N
50 q(m³/min) 70


7Z06506-20.2.12.ab/ajj.
h = 3000m
t_i = max 25°C
W_a
p_i
W_a (kW)
p_i (mmH2O)
N (H.P.)
Δt (°C)
Δt
N
50 q(m³/min) 70

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction, intended for use as industrial oscillators.
The YD1150 is forced-air cooled, with integral cooler.
The YD1151 is water cooled by means of a separate jacket.
The YD1152 has an integral helical water cooler.

QUICK REFERENCE DATA				
Oscillator output power (W_o-W_{feedb}), typical	W_{osc}		4,75	kW
Frequency for full ratings	f	max.	85	MHz

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

R.F. CLASS-C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	160	27,12	27,12	MHz
Filament voltage	V_f	6,0	6,3	6,3	V
Oscillator output power (W_o-W_{feedb})	W_{osc}	3,75	4,75	3,85	kW
Anode voltage	V_a	5	6	5	kV
Anode current	I_a	1	1	1	A
Anode input power	W_{ia}	5	6	5	kW
Anode dissipation	W_a	1,03	1,0	0,93	kW
Anode output power	W_o	3,97	5,0	4,07	kW
Anode efficiency	η_a	79,4	83,3	81,4	%
Oscillator efficiency	η_{osc}	75,0	79,1	77,0	%
Feedback ratio	V_{gp}/V_{ap}	17	17	17	%
Grid resistor	R_g	2,0	2,5	2,0	kΩ
Grid current, on load	I_g	260	250	260	mA
Grid voltage, negative	$-V_g$	520	625	520	V
Grid dissipation	W_g	80	90	80	W
Grid resistor dissipation	W_{Rg}	135	156	135	W

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	85	160	MHz
Anode voltage	V_a	max.	7,2	6,0	kV
Anode current	I_a	max.	1,1	1,1	A
Anode input power	W_{ia}	max.	6,5	6,0	kW
Anode dissipation	W_a	max.	2,5	2,5	kW
Grid voltage	$-V_g$	max.	1	1	kV
Grid current, on load	I_g	max.	280	280	mA
off load	I_g	max.	400	400	mA
Grid dissipation	W_g	max.	150	150	W
Grid circuit resistance	R_g	max.	20	20	kΩ
Cathode current, mean	I_k	max.	1,4	1,4	A
peak	I_{kp}	max.	7,5	7,5	A
Envelope temperature	t_{env}	max.	240		°C

HEATING: direct; thoriated tungsten filament

Filament voltage (< 120 MHz)	V_f	6,3	V
(> 120 MHz)	V_f	6,0	V
Filament current at V_f = 6,3 V	I_f	33	A

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

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}	17	pF
Anode to grid	C_{ag}	14	pF

CHARACTERISTICS measured at V_a = 2,0 kV, I_a = 0,5 A

Transconductance	S	10	mA/V
Amplification factor	μ	20	

COOLING

See also cooling curves.

To obtain optimum life, the temperature of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

YD1150

With insulating pedestal type 40630

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 (Pa *)	Outlet temperature t_o (°C)
1	0	35	1, 25	32	83
	0	45	1, 9	50	78
3	0	35	5, 7	170	64
	0	45	6, 1	184	73

YD1151

With jacket K713

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa *)
1	20	2, 5	11
	50	3, 0	12
3	20	3, 0	14
	50	6, 8	38

Absolute max. water inlet temperature t_i max. 50 °C

A low-velocity air flow may be required for cooling of the seals at frequencies above 4 MHz.

*) 1 Pa ≈ 0, 1 mm H_2O ; 100k Pa ≈ 1 at.

YD1152

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (^oC)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (k Pa *)
1	20	0, 9	5
	50	1, 4	6
3	20	2, 2	14
	50	4, 1	27

Absolute max. water inlet temperature	t_i	max.	50 ^oC
Absolute max. water pressure	p	max.	600 kPa (abs)

A low-velocity air flow may be required for cooling of the seals at frequencies above 4 MHz.

ACCESSORIES

Filament connector		type 40688	
Filament/cathode connector		type 40689	
Grid connector	f ≤ 30 MHz	type 40686	
	f > 30 MHz	type 40687	
Insulating pedestal	(YD1150 only)	type 40630 net mass	2, 1 kg
Water jacket	(YD1151 only)	type K713 net mass	0, 52 kg
Gasket	(YD1151 only)	code 3322 026 82801	

*) 100 kPa ≈ 1 at.

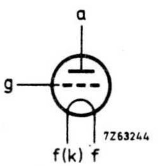
MECHANICAL DATA

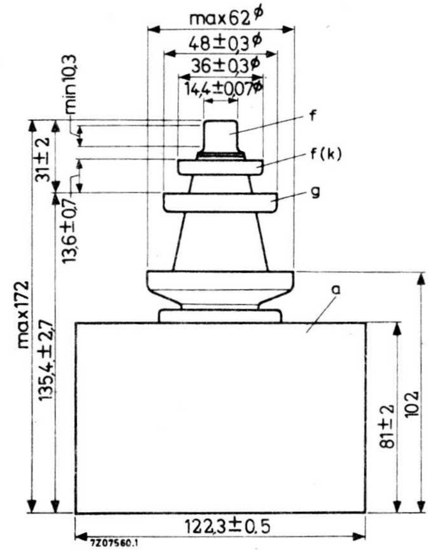
Dimensions in mm

YD1150

Mounting position: vertical with anode up or down

Net mass : 3 kg

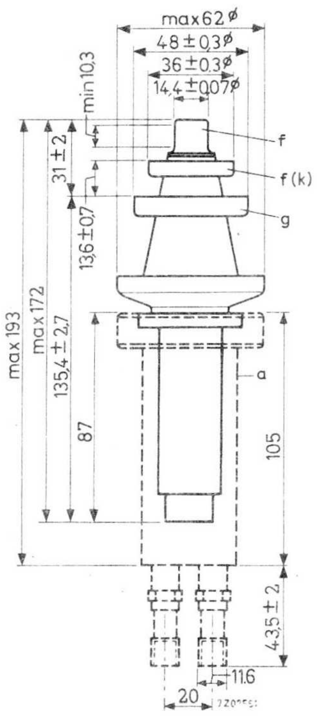




YD1151

Mounting position: vertical with anode down

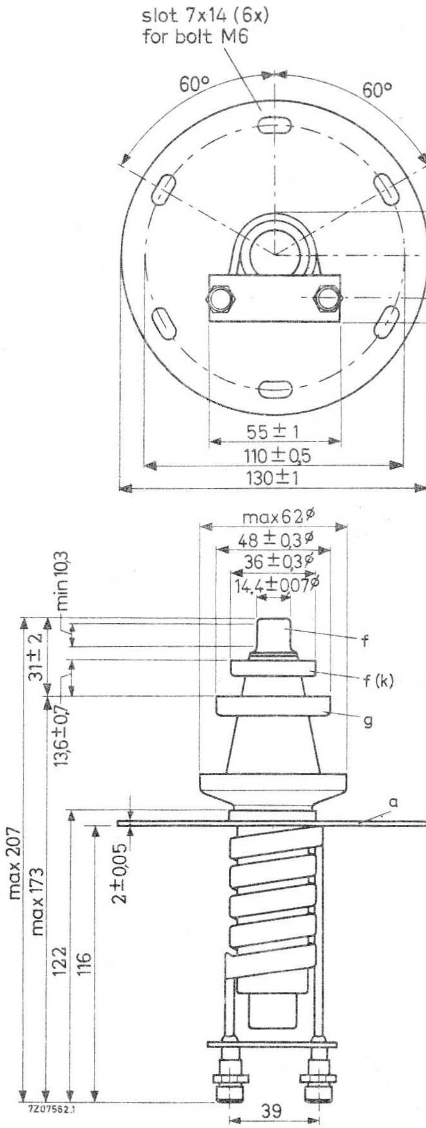
Net mass : 0,65 kg



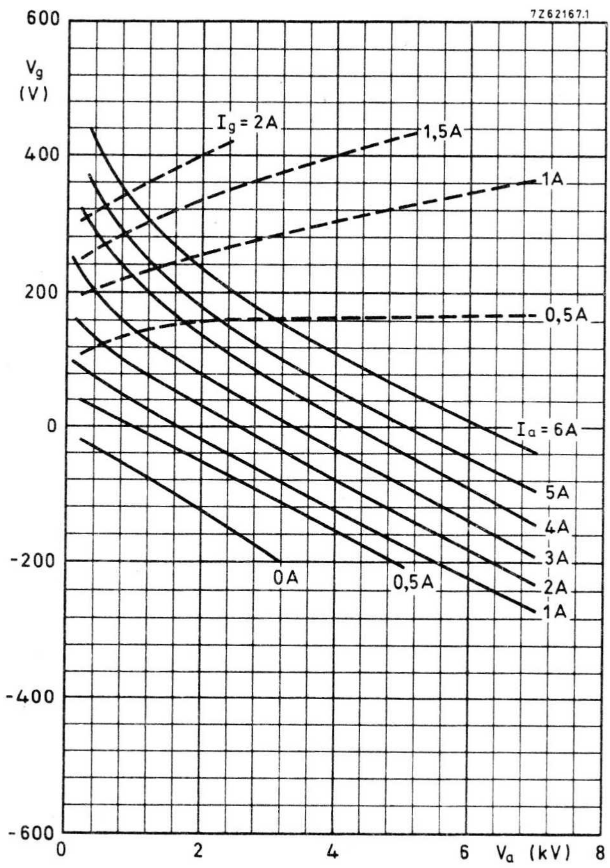
YD1152

Mounting position: vertical with anode down

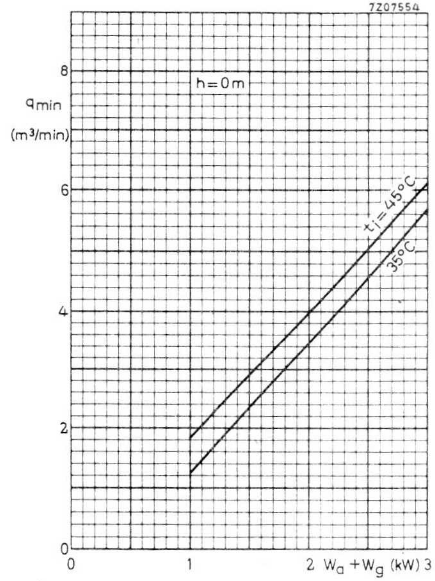
Net mass : 0, 85 kg

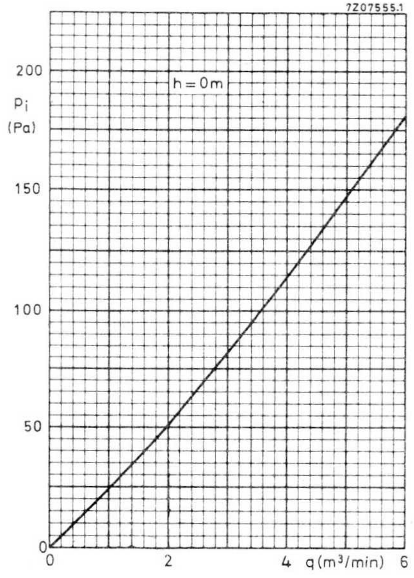


Thread of water connections BSP $\frac{1}{4}$ in.

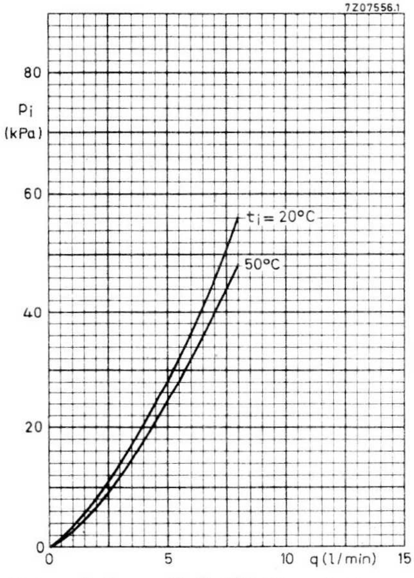

7Z62167.1
600
V_g
(V)
400
200
0
-200
-400
-600
0
2
4
6
V_a (kV)
8
I_g = 2A
1,5A
1A
0,5A
I_a = 6A
5A
4A
3A
2A
1A
0A
0,5A

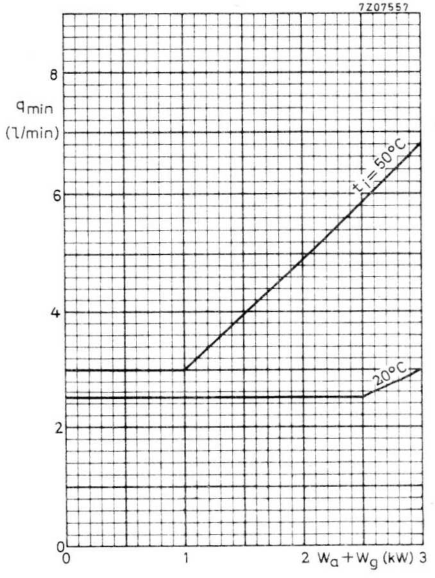
YD1150





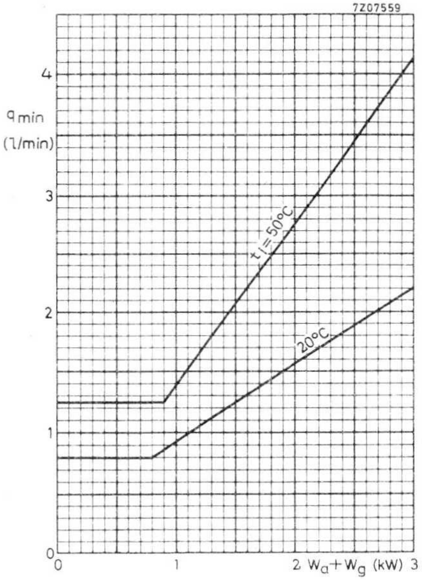
YD1151

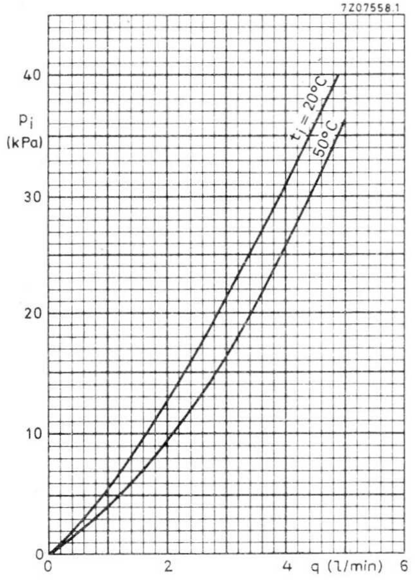




1 Pa ≈ 0,1 mm H_2O; 100 kPa ≈ 1 at.

YD1152





100 kPa ≈ 1 at.

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1160 is forced-air cooled, with integral cooler.
The YD1161 is water cooled by means of a separate jacket.
The YD1162 has an integral helical water cooler.

QUICK REFERENCE DATA				
Oscillator output power (W_o - W_{feedb}), typical	W_{osc}		8,8	kW
Frequency for full ratings	f	max.	85	MHz

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

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	150	27,12	27,12	MHz
Filament voltage	V_f	5,8	6,3	6,3	V
Oscillator output power (W_o-W_{feedb})	W_{osc}	7,15	8,8	7,5	kW
Anode voltage	V_a	5,0	6,5	6,0	kV
Anode current	I_a	2,0	1,8	1,6	A
Anode input power	W_{ia}	10,0	11,7	9,6	kW
Anode dissipation	W_a	2,45	2,5	1,7	kW
Anode output power	W_o	7,55	9,2	7,9	kW
Anode efficiency	η_a	75,5	78,6	82,3	%
Oscillator efficiency	η_{osc}	71,5	75,2	78,1	%
Feedback ratio	V_{gp}/V_{ap}	15	16	15	%
Grid resistor	R_g	1,0	1,6	1,3	kΩ
Grid current, on load	I_g	480	430	480	mA
Grid voltage, negative	$-V_g$	480	688	624	V
Grid dissipation	W_g	100	110	120	W
Grid resistor dissipation	W_{Rg}	230	296	300	W

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	85	150	MHz
Anode voltage	V_a	max.	7,2	6,0	kV
Anode current	I_a	max.	2,2	2,2	A
Anode input power	W_{ia}	max.	12,5	11	kW
Anode dissipation	W_a	max.	5	5	kW
Grid voltage	$-V_g$	max.	1	1	kV
Grid current, on load	I_g	max.	550	550	mA
off load	I_g	max.	750	750	mA
Grid dissipation	W_g	max.	250	250	W
Grid circuit resistance	R_g	max.	20	20	kΩ
Cathode current, mean	I_k	max.	2,8	2,8	A
peak	I_{kp}	max.	15	15	A
Envelope temperature	t_{env}	max.	240	240	^oC

HEATING : direct; filament thoriated tungsten

Filament voltage (f = 150 MHz)	V_f	5,8	V
(f < 150 MHz)	V_f	6,3	V
Filament current at V_f = 6,3 V	I_f	66	A

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

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}	0,5	pF
Grid to filament	C_{gf}	16	pF
Anode to grid	C_{ag}	19	pF

CHARACTERISTICS measured at V_a = 2 kV, I_a = 1 A.

Transconductance	S	22	mA/V
Amplification factor	μ	20	

COOLING

See also cooling curves.
To obtain optimum life, the temperature of the seals and of the envelope should, under continuously loaded conditions, be kept below 200 °C.

YD1160

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 (Pa*)	Outlet temperature t_o (°C)
3	0	35	3,6	90	82
3	0	45	4,2	110	87

YD1161

With jacket K726

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa*)
3	20	3	16
	50	7	52
5	20	5	34
	50	11,5	140

Absolute max. water inlet temperature t_i max. 50 °C

A low-velocity air flow may be required for cooling of the seals.

YD1162

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa*)
3	20	2,2	18
	50	4,3	38
5	20	4,0	40
	50	8,0	140

* 1 Pa ≈ 0,1 mm H_2O; 100 kPa ≈ 1 at.

Absolute max. water inlet temperature	t_i	max.	50	^oC
Absolute max. water pressure	p	max.	600	kPa(abs) *

A low-velocity air flow may be required for cooling of the seals.

ACCESSORIES

Filament connector		type	40688			
Filament/cathode connector		type	40689			
Grid connector f ≤ 30 MHz		type	40686			
f > 30 MHz		type	40687			
Insulating pedestal	(YD1160 only)	type	40630	net	mass 2,1	kg
Water jacket	(YD1161 only)	type	K726	net	mass 0,73	kg
Gasket	(YD1161 only)	code	3322 026 82801			

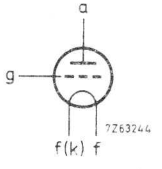
MECHANICAL DATA

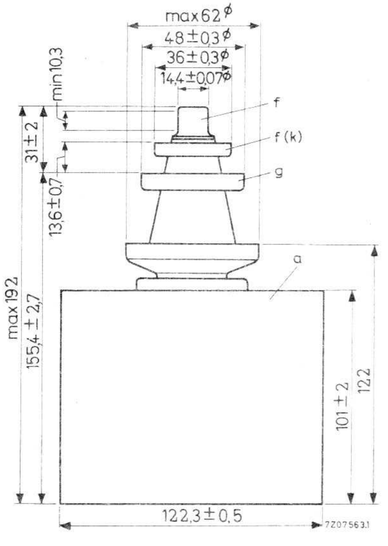
Dimensions in mm

YD1160

Mounting position : vertical, with anode up or down

Net mass : approx. 3,9 kg



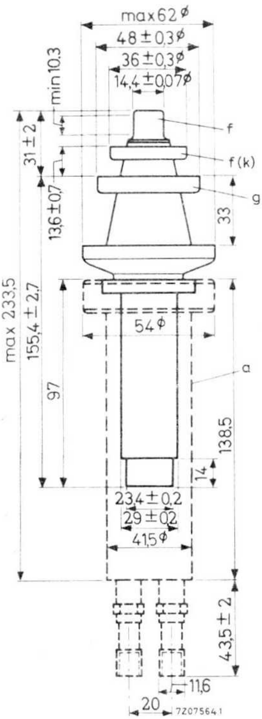


* 100 kPa ≈ 1 at.

YD1161

Mounting position : vertical with anode down

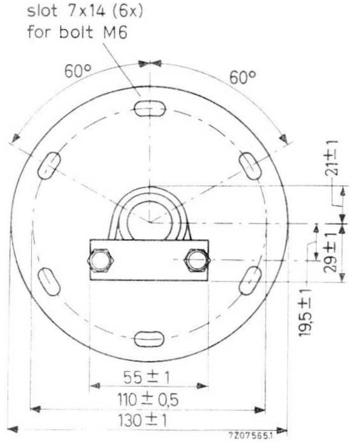
Net mass : approx. 0,66 kg

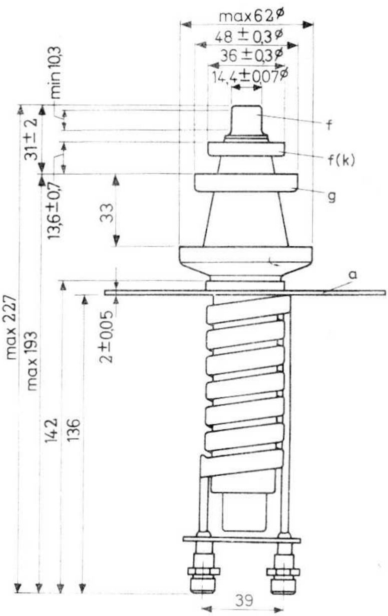


YD1162

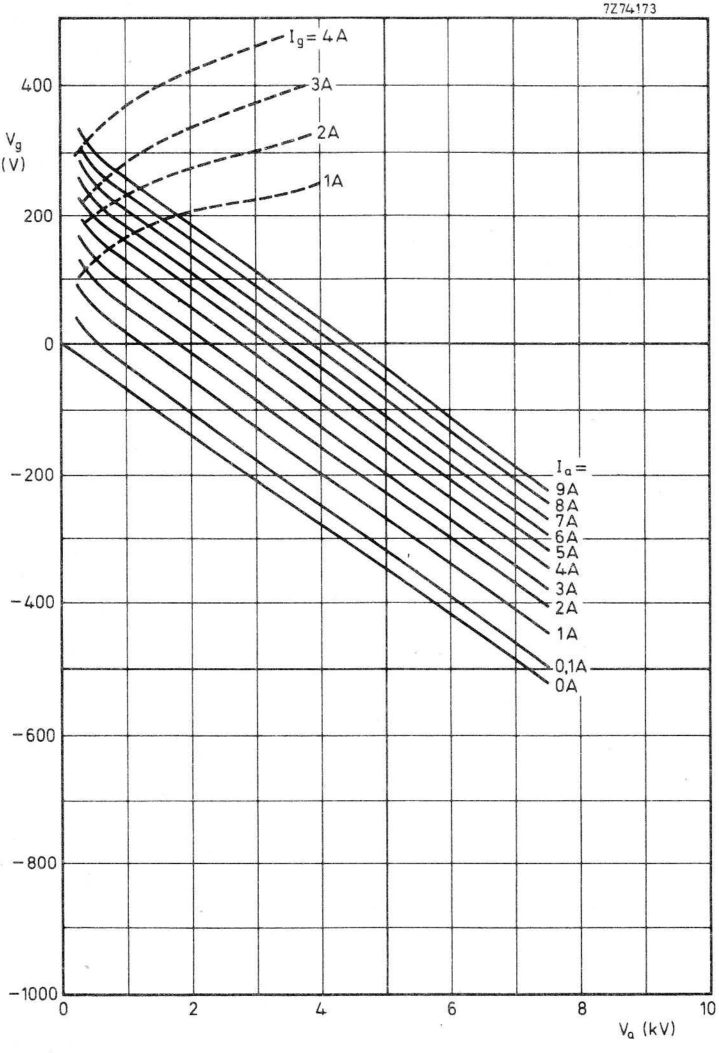
Mounting position : vertical with anode up or down

Net mass : approx. 1 kg

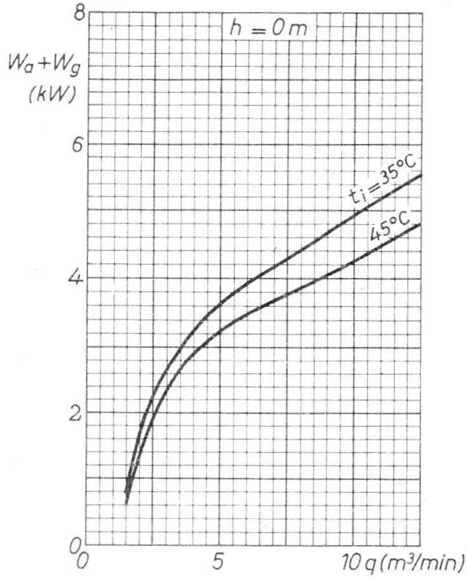


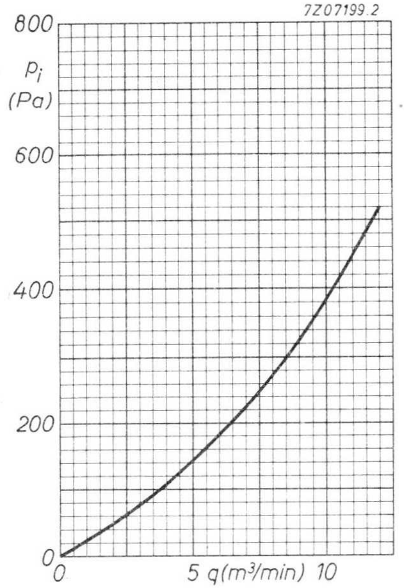


Thread of water connections BSP 3/8 in.

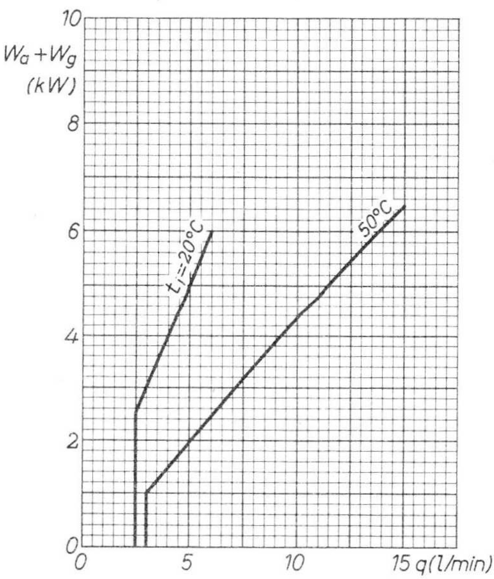

7Z74173
I_g = 4A
3A
2A
1A
400
200
0
-200
-400
-600
-800
-1000
V_g (V)
I_a =
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
0A
0
2
4
6
8
10
V_a (kV)

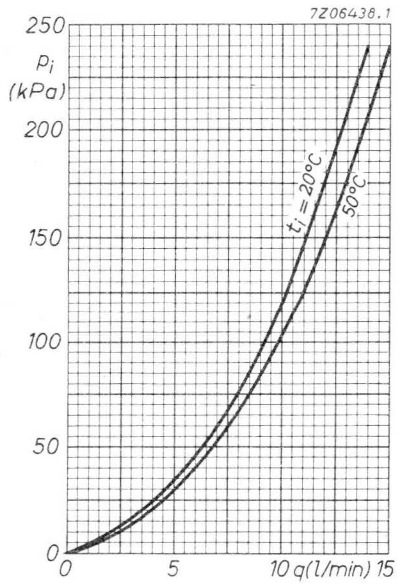
YD1160





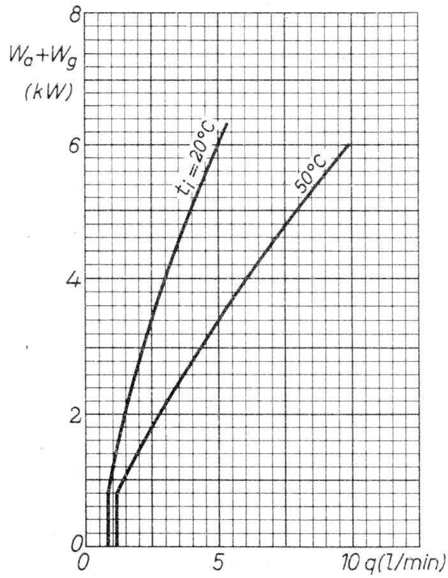
YD1161

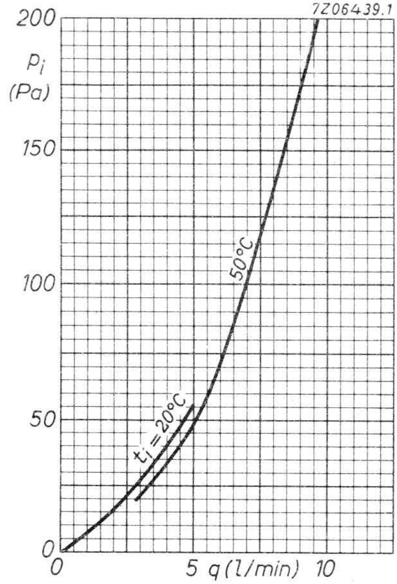




1Pa ≈ 0,1 mm H_2O; 100 kPa ≈ 1 at.

YD1162





100 kPa ≈ 1 at.

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1170 is forced-air cooled.
The YD1172 has an integral helical water cooler.

QUICK REFERENCE DATA				
Oscillator output power (W_o - W_{feedb})	W_{osc}		15,4	kW
Frequency for full ratings	f	max.	120	MHz

To be read in conjunction with "General Operational Recommendations Transmitting Tubes for Communication; Tubes for R.F. Heating".

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	120	MHz
Filament voltage	V_f	See under "HEATING"	
Oscillator output power (W_o - W_{feedb})	W_{osc}	15,4	kW
Anode voltage	V_a	6	kV
Anode current	I_a	3,4	A
Anode input power	W_{ia}	20,4	kW
Anode dissipation	W_a	4,3	kW
Anode output power	W_o	16,1	kW
Anode efficiency	η_a	78,9	%
Oscillator efficiency	η_{osc}	75,5	%
Feedback ratio	V_{gp}/V_{ap}	15,5	%
Grid resistor	R_g	500	Ω
Grid current, on load	I_g	920	mA
Grid voltage, negative	$-V_g$	460	V
Grid dissipation	W_g	280	W
Grid resistor dissipation	W_{Rg}	423	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	120	MHz
Anode voltage	V_a	max.	7,2	kV
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	24	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	$-V_g$	max.	1,5	kV
Grid current, on load	I_g	max.	1	A
off load	I_g	max.	1,5	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	^{o}C

HEATING : direct; thoriated tungsten filament

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_{fo}		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 funamental 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}	1	pF
Grid to filament	C_{gf}	61	pF
Anode to grid	C_{ag}	32	pF

CHARACTERISTICS measured at V_a = 6 kV, I_a = 2 A

Transconductance	S	40	mA/V
Amplification factor	μ	30	

COOLING

To obtain optimum life, the temperature of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

To maintain these temperatures additional cooling may be necessary. At frequencies higher than about 4 MHz cooling of the seals becomes mandatory.

YD1170

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 (Pa*)	Outlet temperature t_o (°C)
10	0	35	9,5	550	94
8	0	35	6,5	280	105
6	0	35	4,5	150	113
4	0	35	3,0	80	117
10	0	45	11,0	690	98
8	0	45	7,6	350	108
6	0	45	5,2	190	115
4	0	45	3,5	100	119
10	1500	35	11,4	630	94
8	1500	35	7,8	320	105
6	1500	35	5,5	170	113
4	1500	35	3,6	90	117
10	3000	25	12,0	620	90
8	3000	25	8,2	320	102
6	3000	25	5,7	170	111
4	3000	25	3,8	90	116

Absolute max. air inlet temperature	t_i	max. 45 °C
Direction of airflow		arbitrary

* 1 Pa ≈ 0,1 mm H_2O.

YD1172

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 (kPa*)	Outlet temperature t_o (°C)
10	20	6,0	25	46
	50	9,0	52	67
8	20	4,5	15	49
	50	6,7	31	69
6	20	3,0	7	53
	50	4,5	15	72

Absolute max. water inlet temperature t_i max. 50 °C

Absolute max. water pressure p max. 600 kPa(abs)

*100 kPa ≈ 1 at.

ACCESSORIES

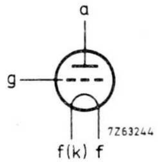
Filament connector with cable	40692	net mass	450	g
Filament/cathode connector with cable	40693	net mass	490	g
Grid connector $f \leq 4$ MHz	40690	net mass	55	g
$f > 4$ MHz	40691	net mass	240	g
Insulating pedestal (YD1170 only)	40654	net mass	4,25	g

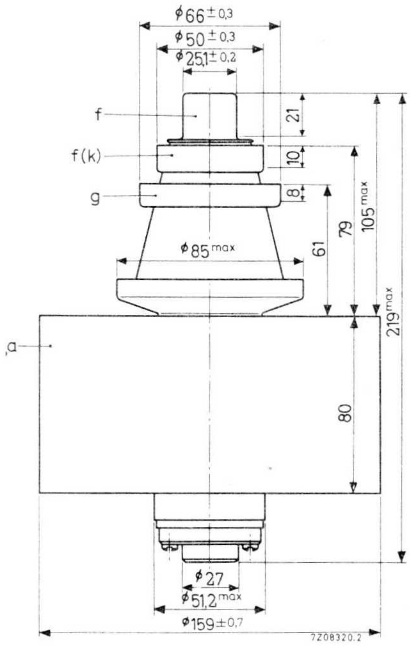
MECHANICAL DATA Dimensions in mm

YD1170

Mounting position : vertical with anode up or down

Net mass : approx. 7,5 kg

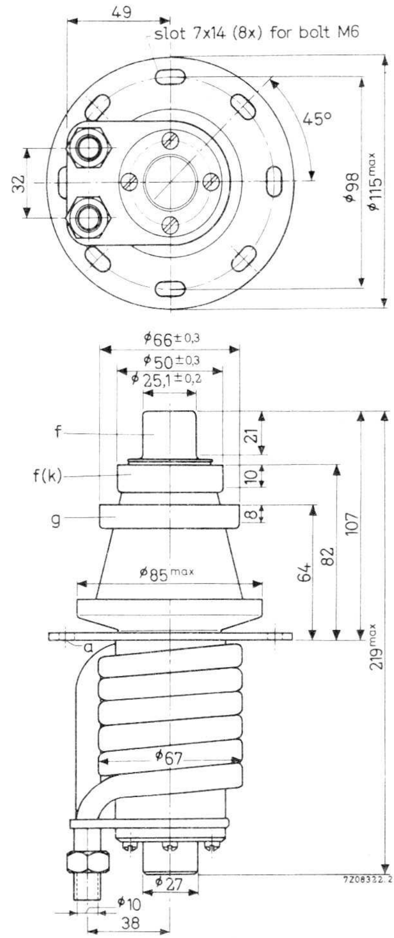




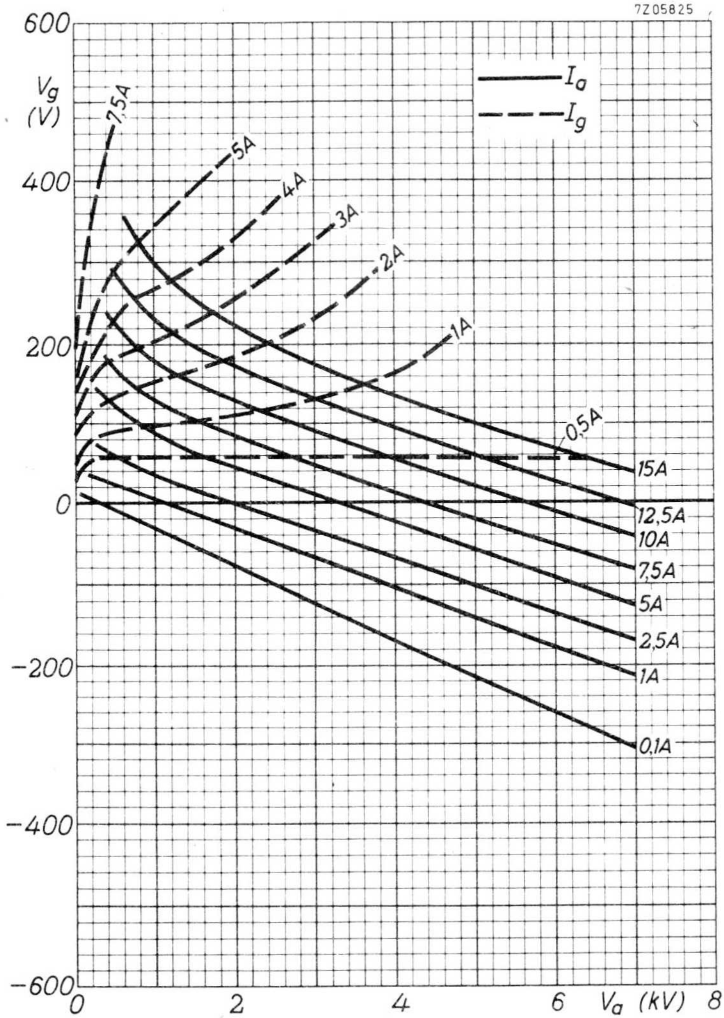
YD1172

Mounting position : vertical with anode up or down

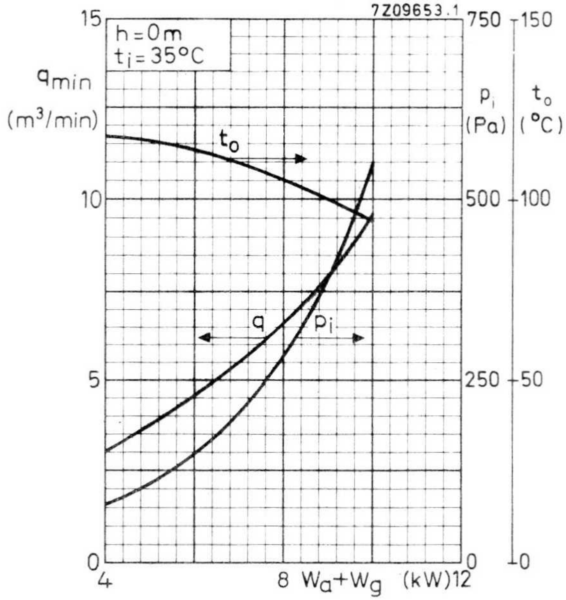
Net mass : approx. 2 kg

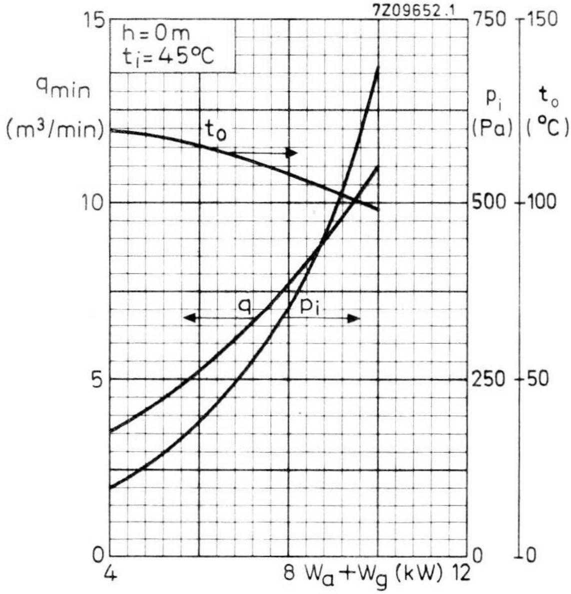


Thread of water connections BSP 3/8 in

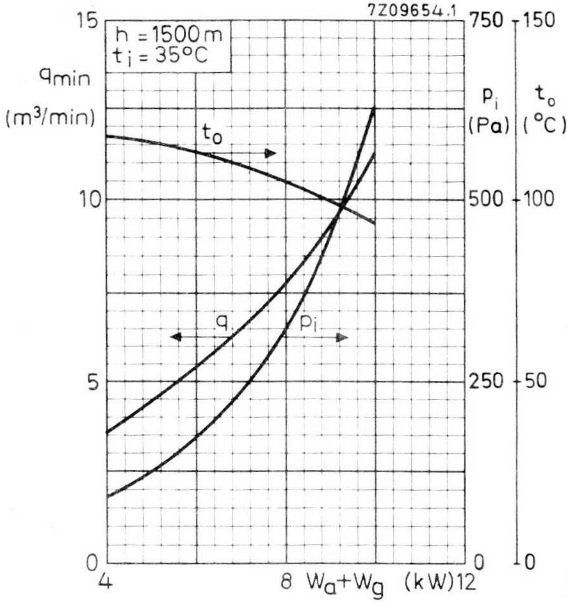

7Z05825
600
400
200
0
−200
−400
−600
V_g (V)
0
2
4
6
V_a (kV)
8
I_a
I_g
7,5A
5A
4A
3A
2A
1A
0,5A
15A
12,5A
10A
7,5A
5A
2,5A
1A
0,1A

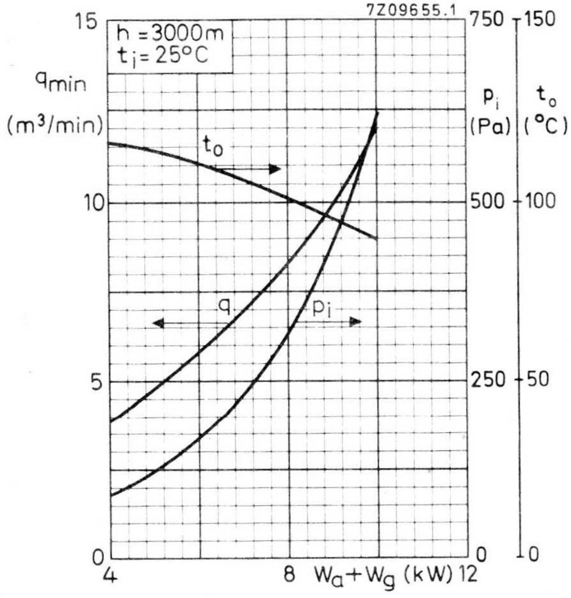
YD1170





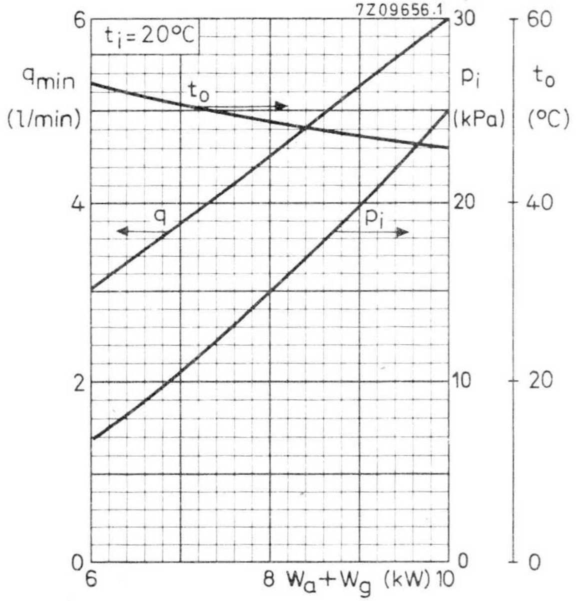
1 Pa ≈ 0,1 mm H_2O.

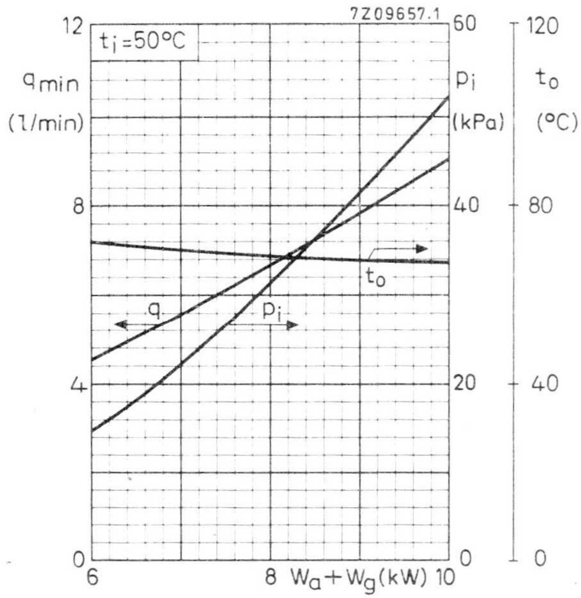

7Z09654.1
h = 1500 m
t_i = 35°C
q_{min}
(m^3/min)
p_i
(Pa)
t_o
(°C)
t_o
q
p_i
15
10
5
0
750
500
250
0
150
100
50
0
4
8
12
W_a+W_g (kW)


7Z09655.1
h = 3000 m
t_i = 25°C
q_{min}
(m^3/min)
p_i
(Pa)
t_o
(°C)
t_o
q
p_i
15
10
5
0
750
500
250
0
150
100
50
0
4
8
12
W_a+W_g (kW)

1 Pa ≈ 0,1 mm H_2O

YD1172





100 kPa ≈ 1 at

AIR COOLED R.F. INDUSTRIAL TRIODE

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}		13.22	kW
Frequency fur full ratings	f	max.	50	MHz

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

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	50	MHz
Oscillator output power (W_o-W_{feedb})	W_{osc}	13.22	kW
Anode voltage	V_a	10.0	kV
Anode current	I_a	1.75	A
Anode input power	W_{ia}	17.5	kW
Anode dissipation	W_a	3.8	kW
Anode output power	W_o	13.7	kW
Anode efficiency	η_a	78.3	%
Oscillator efficiency	η_{osc}	75.6	%
Feedback ratio	V_{gp}/V_{ap}	12.0	%
Grid resistor	R_g	1.5	kΩ
Grid current, on load	I_g	450	mA
Grid voltage, negative	$-V_g$	675	V
Grid dissipation	W_g	180	W
Grid resistor dissipation	W_{Rg}	304	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Anode voltage	V_a	max.	12	kV
Anode current	I_a	max.	2.0	A
Anode input power	W_{ia}	max.	20	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, on load	I_g	max.	0.6	A
off load	I_g	max.	0.8	A
Grid dissipation	W_g	max.	250	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	2.5	A
peak	I_{kp}	max.	10	A
Envelope temperature	t_{env}	max.	240	^oC

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f		5.4	V
Filament current	I_f		65	A
Peak filament starting current	I_{fp}	max.	400	A
Cold filament resistance	R_{fo}		10	mΩ

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

→ 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 Appication Book "Tubes for R.F. heating" or contact the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	0.4	pF
Grid to filament	C_{gf}	42	pF
Anode to grid	C_{ag}	17	pF

CHARACTERISTICS measured at V_a = 10 kV, I_a = 0.8 A

Transconductance	S	14	mA/V
Amplification factor	μ	45	

COOLING

See also cooling curves.

With insulating pedestal type 40654.

Anode + grid dissipation $W_a + W_g$ (kW)	Altitude h (m)	Inlet temperature t_i (°C)	Rate of flow qmin (m^3/min)	Pressure drop P_i (Pa)*	Outlet temperature t_o (°C)
10	0	35	9,5	550	94
8	0	35	6,5	280	105
6	0	35	4,5	150	113
4	0	35	3,0	80	117
10	0	45	11	690	98
8	0	45	7,6	350	108
6	0	45	5,2	190	115
4	0	45	3,5	100	119
10	1500	35	11,4	630	94
8	1500	35	7,8	320	105
6	1500	35	5,5	170	113
4	1500	35	3,6	90	117
10	3000	25	12	620	90
8	3000	25	8,2	320	102
6	3000	25	5,7	170	111
4	3000	25	3,8	90	116

To obtain optimum life, the temperatures of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

ACCESSORIES

Filament connector with cable	type	40692	net mass	450	g
Filament/cathode connector with cable	type	40693	net mass	490	g
Grid connector f ≤ 4 MHz	type	40690	net mass	55	g
f > 4 MHz	type	40691	net mass	240	g
Insulating pedestal	type	40654	net mass	4,25	kg

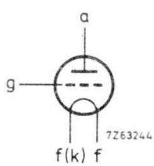
* 1 Pa ≈ 0,1 mmH_2O

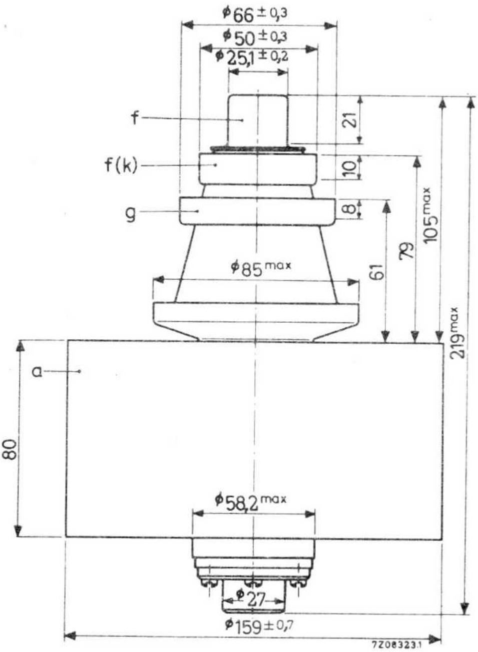
MECHANICAL DATA

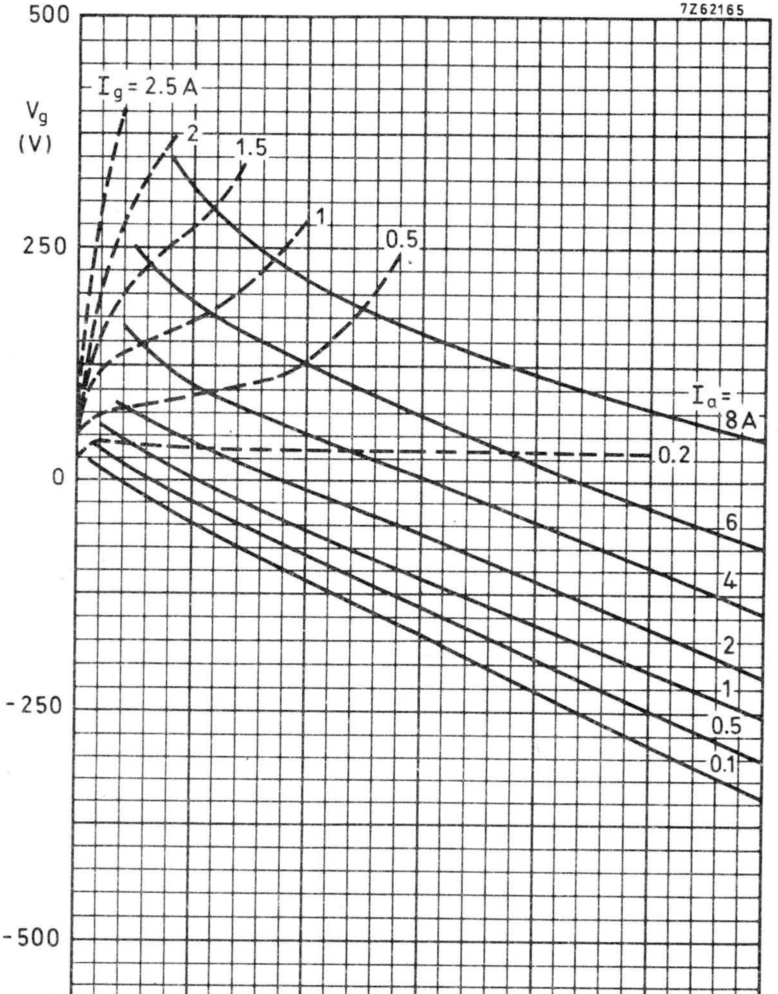
Dimensions in mm

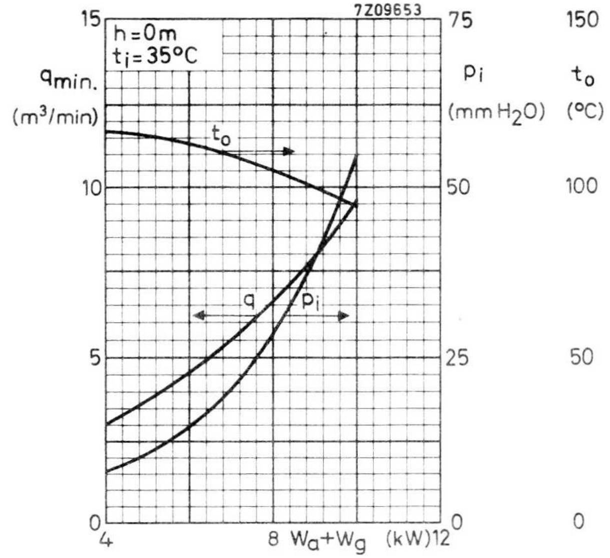
Mounting position : vertical with anode up or down

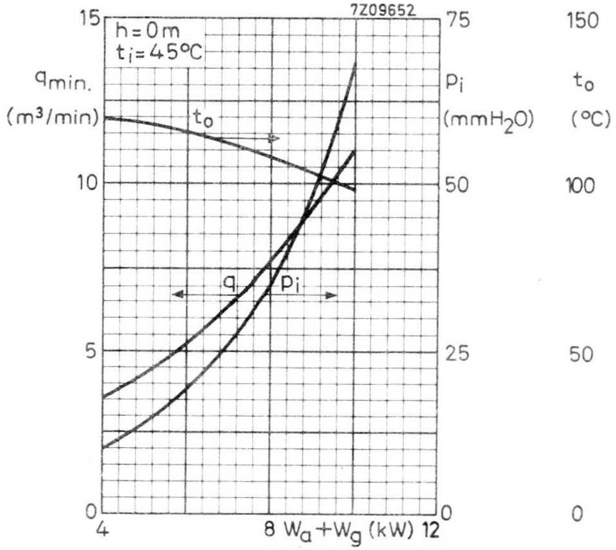
→ Net mass : approx. 7 kg

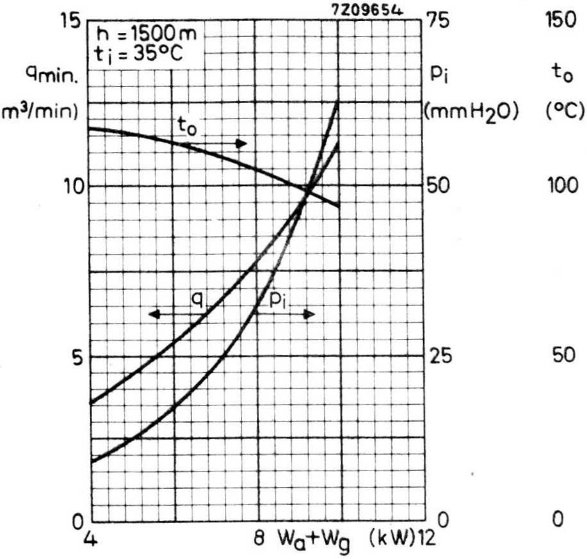


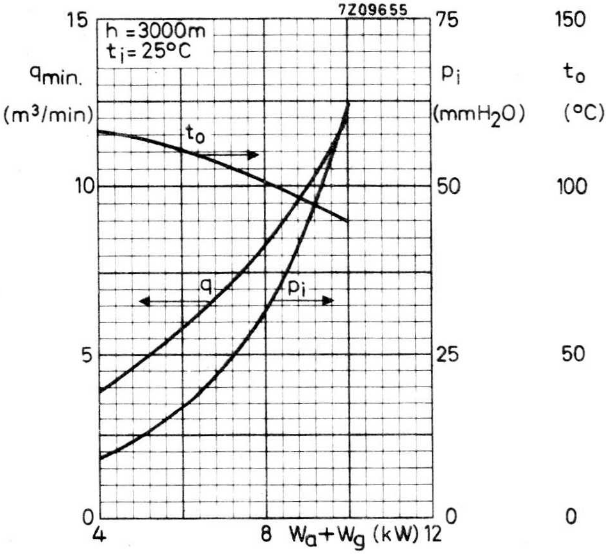



7Z62165
500
250
0
-250
-500
V_g
(V)
I_g = 2.5 A
2
1.5
1
0.5
0.2
I_a =
8 A
6
4
2
1
0.5
0.1
0
4
8
12
V_a (kV)


7Z09653
h = 0 m
t_i = 35°C
$q_{min.}$
(m^3/min)
p_i
(mm H_2O)
t_o
(°C)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8 $W_a + W_g$ (kW) 12


7Z09652
h = 0 m
t_i = 45°C
$q_{min.}$
(m^3/min)
p_i
(mm H_2O)
t_o
(°C)
t_o
q
p_i
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)
t_o
q
p_i
15
10
5
0
75
50
25
0
150
100
50
0
4
8 W_a+W_g (kW) 12


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

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1175 is forced-air cooled.
The YD1177 has an integral helical water cooler.

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 for Communication; 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	°C

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_0}		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.

[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

Transconductance	S	33	mA/V
Amplification factor	μ	44	

COOLING

To obtain optimum life, the temperatures of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

To maintain these temperatures additional cooling may be necessary. At frequencies higher than about 4 MHz, cooling of the seals becomes mandatory.

YD1175

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 Pi (Pa *)	Outlet temperature t_o (°C)
10	0	35	9, 5	550	94
8	0	35	6, 5	280	105
6	0	35	4, 5	150	113
4	0	35	3, 0	80	117
10	0	45	11, 0	690	98
8	0	45	7, 6	350	108
6	0	45	5, 2	190	115
4	0	45	3, 5	100	119
10	1500	35	11, 4	630	94
8	1500	35	7, 8	320	105
6	1500	35	5, 5	170	113
4	1500	35	3, 6	90	117
10	3000	25	12, 0	620	90
8	3000	25	8, 2	320	102
6	3000	25	5, 7	170	111
4	3000	25	3, 8	90	116

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

Direction of airflow : arbitrary.

*1 Pa ≈ 0, 1 mmH_2O

YD1177

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 Pi (kPa *)	Outlet temperature t_o (°C)
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 °C

ACCESSORIES

Filament connector with cable	type	40692	net mass	450 g
Filament/cathode connector with cable	type	40693	net mass	490 g
Grid connector $f \leq 4$ MHz	type	40690	net mass	55 g
$f > 4$ MHz	type	40691	net mass	240 g
Insulating pedestal (YD1175 only)	type	40654	net mass	4,25 kg

* 100 kPa ≈ 1 at

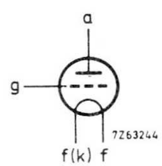
MECHANICAL DATA

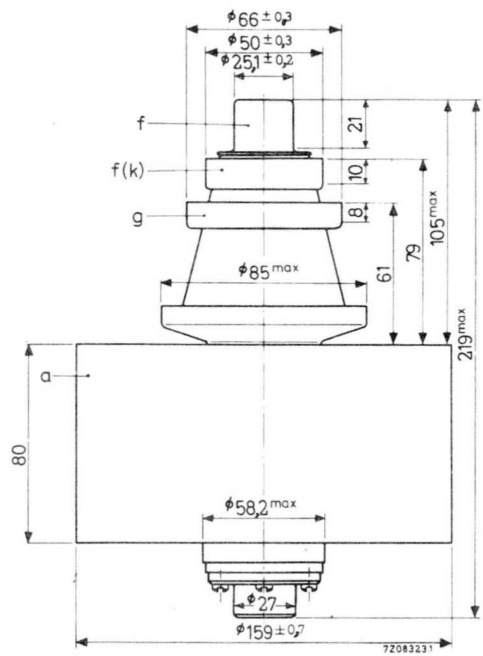
Dimensions in mm

YD1175

Mounting position : vertical with anode up or down

Net weight : mass 7,5 kg

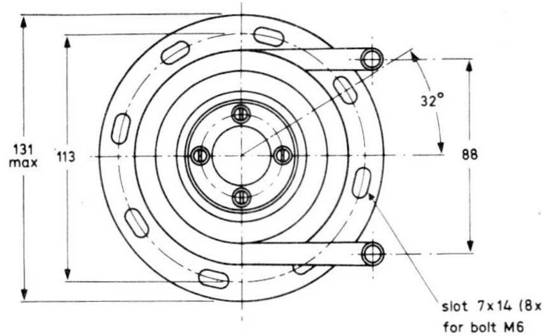


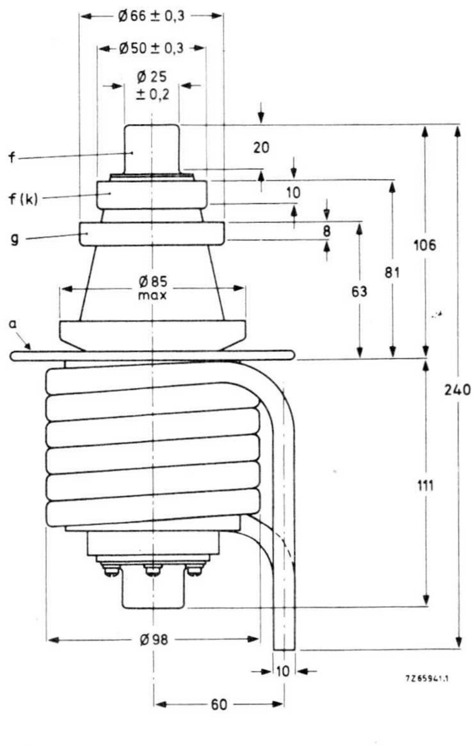


YD1177

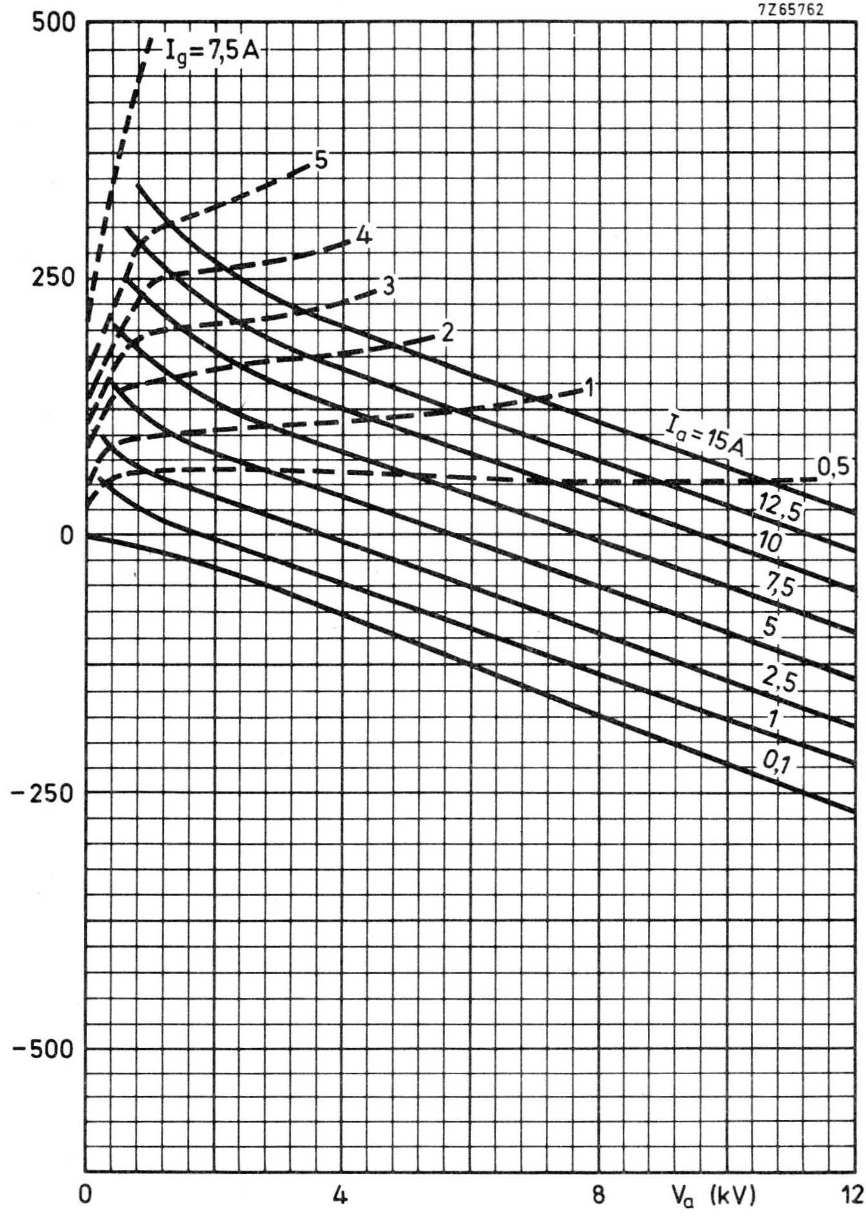
Mounting pisition : Vertical with anode up or down

Net weight : approx. 6,5 kg

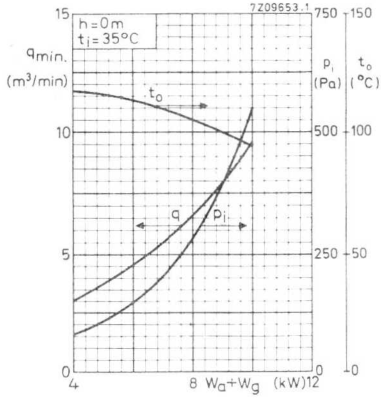


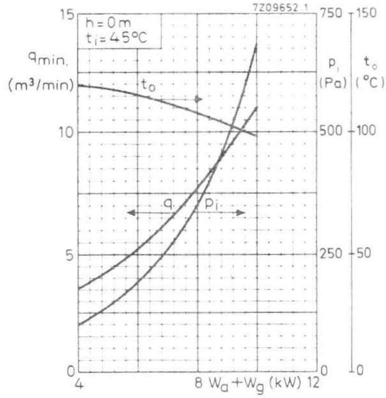


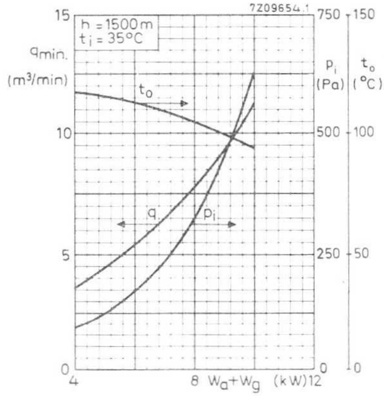
With the anode up the water connections should be interchanged

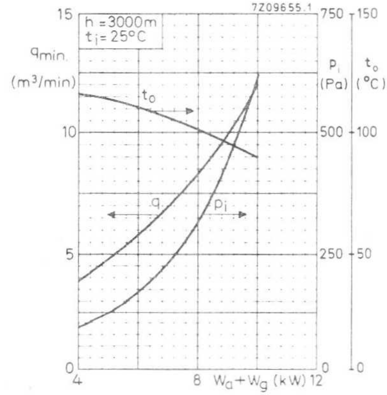

7Z65762
500
250
0
-250
-500
$I_g = 7,5$ A
5
4
3
2
1
0,5
$I_a = 15$ A
12,5
10
7,5
5
2,5
1
0,1
0
4
8
V_a (kV)
12

YD1175



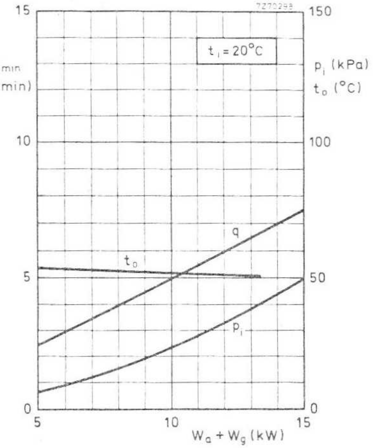


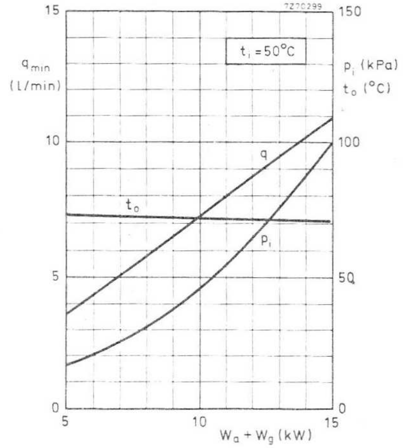




* 1 Pa ≈ 0,1 mmH_2O

YD1177





* 100 kPa ≈ 1 at

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.

The YD1180 is forced-air cooled
The YD1182 is water cooled by an integral cooler.

QUICK REFERENCE DATA				
Oscillator output power (W_o-W_{feedb}), typical	W_{osc}		31,6	kW
Frequency for full ratings	f	max.	100	MHz

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

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE
OPERATING CONDITIONS

Frequency	f	90	MHz
Oscillator output power (W_o-W_{feedb})	W_{osc}	31,6	kW
Anode voltage	V_a	7,5	kV
Anode current	I_a	5,4	A
Anode input power	W_{ia}	40,5	kW
Anode dissipation	W_a	7,5	kW
Anode output power	W_o	33	kW
Anode efficiency	η_a	81,5	%
Oscillator efficiency	η_{osc}	78	%
Feedback ratio	V_{gp}/V_{ap}	14,8	%
Grid resistor	R_g	450	Ω
Grid current, on load	I_g	1,45	A
Grid voltage, negative	$-V_g$	652	V
Grid dissipation	W_g	450	W
Grid resistor dissipation	W_{Rg}	946	W

LIMITING VALUES (Absolute max. rating system)

Frequency		f	up to	100	MHz
Anode voltage		V_a	max.	9	kV
Anode current		I_a	max.	6	A
Anode input power		W_{ia}	max.	45	kW
Anode dissipation: continuous service	(YD1180)	W_a	max.	15	kW
	(YD1182)	W_a	max.	20	kW
Grid voltage		$-V_g$	max.	1,25	kV
Grid current, on load		I_g	max.	1,6	A
of load		I_g	max.	2,4	A
Grid dissipation		W_g	max.	500	W
Grid circuit resistance		R_g	max.	10	kΩ
Cathode current, mean		I_k	max.	7,5	A
peak		I_{kp}	max.	40	A
Envelope temperature		t_{env}	max.	240	°C

HEATING : direct; thoriated tungsten filament, mesh construction

Filament voltage	V_f		7	V
Filament current	I_f		175	A
Peak filament starting current	I_{fp}	max.	1000	A
Cold filament resistance	R_{fo}		4,2	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 folament 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}	1	pF
Grid to filament	C_{gf}	61	pF
Anode to grid	C_{ag}	32	pF

CHARACTERISTICS measured at V_a = 7 kV, I_a = 2,4 A

Transconductance	S	40	mA/V
Amplification factor	μ	33	

COOLING

To obtain optimum life, the temperature of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

To maintain these temperatures additional cooling may be necessary.
At frequencies higher than about 4 MHz cooling of the seals becomes mandatory.

YD1180

Direction of airflow: see outline drawing.

See also cooling curves

With insulating pedestal type 40648

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 (Pa*)	Outlet temperature t_o (°C)
15	0	35	15	850	92
10	0	35	9,3	320	99
8	0	35	7	200	104
15	0	45	17,3	1060	98
10	0	45	10,7	400	104
8	0	45	8,1	250	108
15	1500	35	18	970	93
10	1500	35	11,2	460	100
8	1500	35	8,4	230	104
15	3000	25	19	950	90
10	3000	25	11,8	450	95
8	3000	25	8,9	230	99

*1 Pa ≈ 0,1 mm H_2O

YD1182

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 (kPa *)	Outlet temperature t_o (^oC)
20	20	10	40	51
	50	15	80	71
15	20	7,5	22	54
	50	10,5	43	73
10	20	4,5	10	58
	50	6,7	20	75

Absolute max. water inlet temperature	t_i	max.	50	^oC
Absolute max. water pressure	p	max.	600	kPa(abs)

ACCESSORIES

Filament connector with cable	type 40708	net mass	600	g
Filament /cathode connector with cable	type 40709	net mass	640	g
Grid connector f $\leq$ 4 MHz	type 40710	net mass	60	g
f > 4 MHz	type 40711	net mass	310	g
Insulating pedestal (YD1180 only)	type 40648	net mass	7,15	kg

* 100 kPa ≈ 1 at

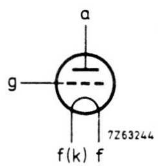
MECHANICAL DATA

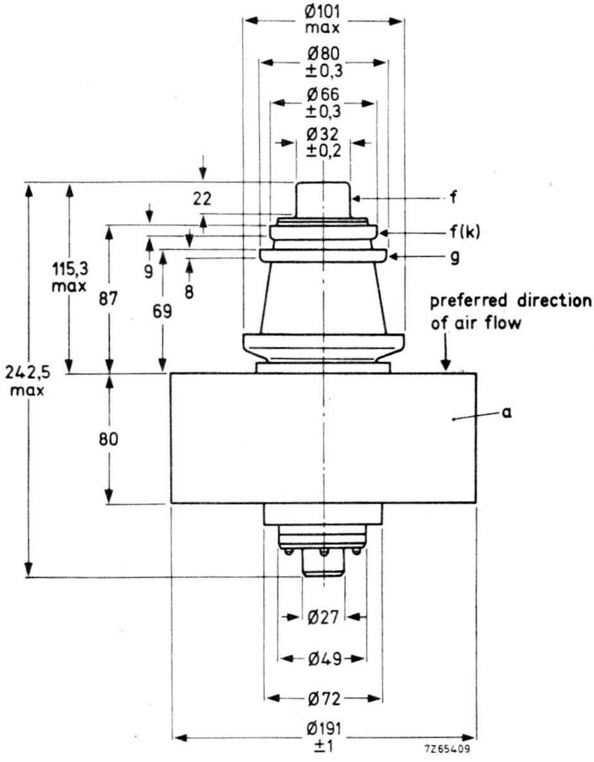
Dimensions in mm

YD1180

Mounting position : vertical with anode up or down

Net mass : approx. 12 kg

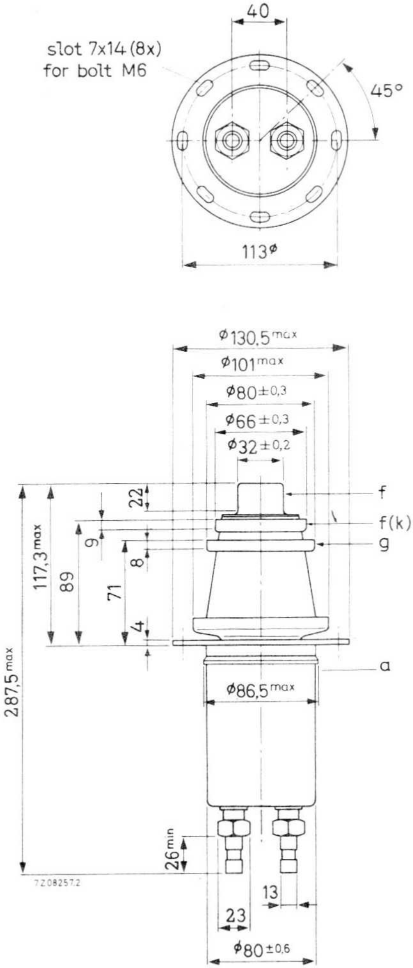




YD1182

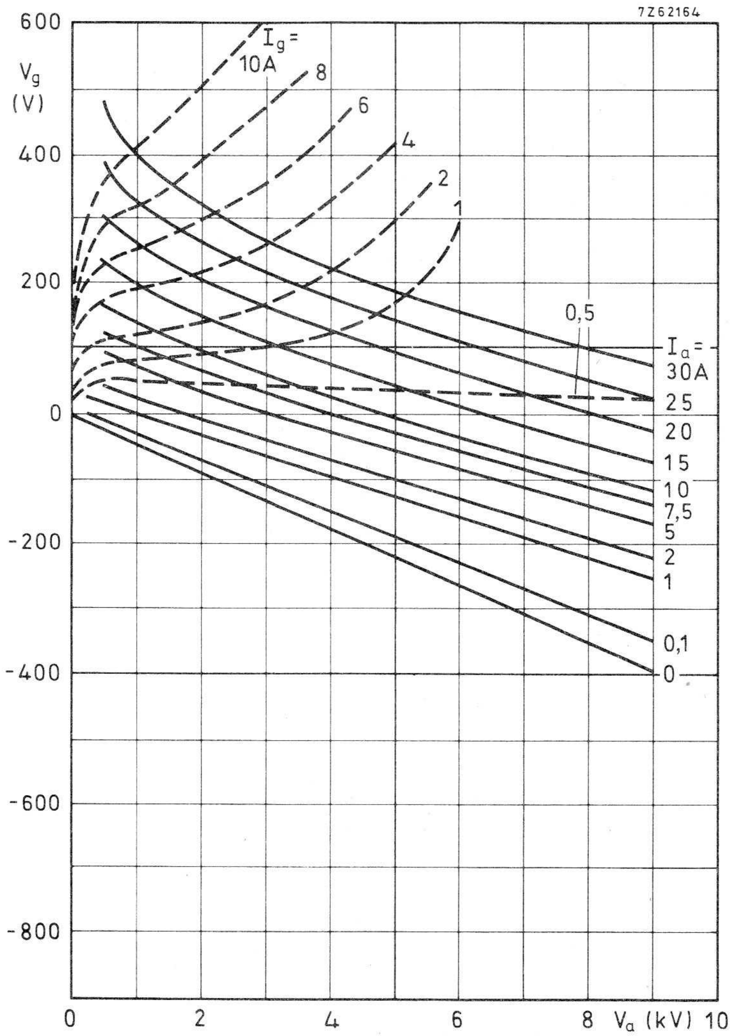
Mounting position : vertical with anode up or down

Net mass : approx. 3,5 kg

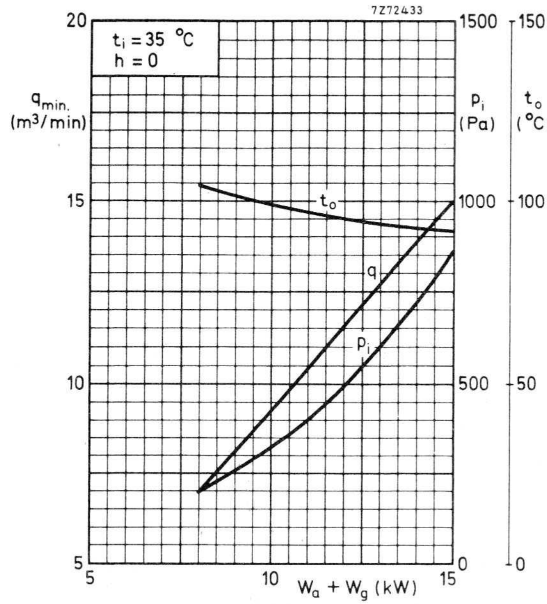


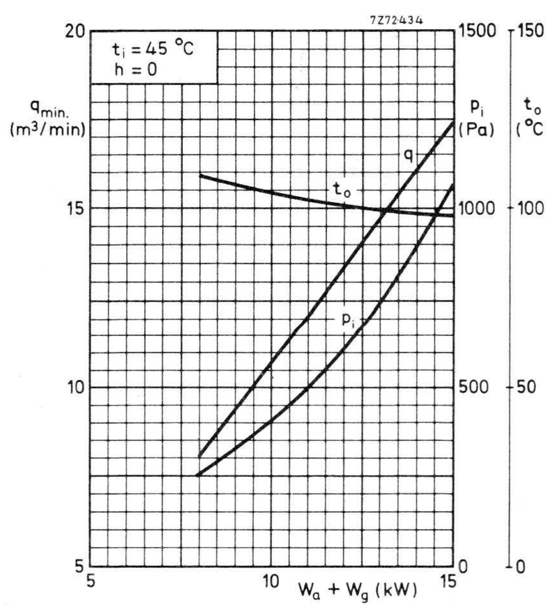
Thread of water connections BSP 1/2 in

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


7Z62164
600
V_g
(V)
400
200
0
-200
-400
-600
-800
I_g =
10A
8
6
4
2
1
0,5
I_a =
30A
25
20
15
10
7,5
5
2
1
0,1
0
0
2
4
6
8
V_a (kV)
10

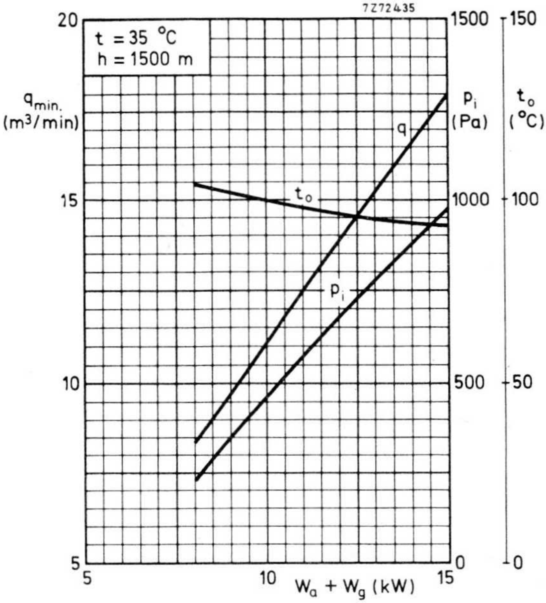
YD1180

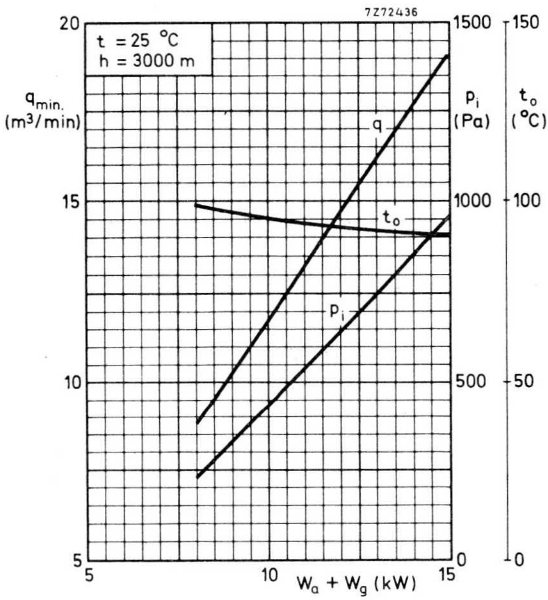




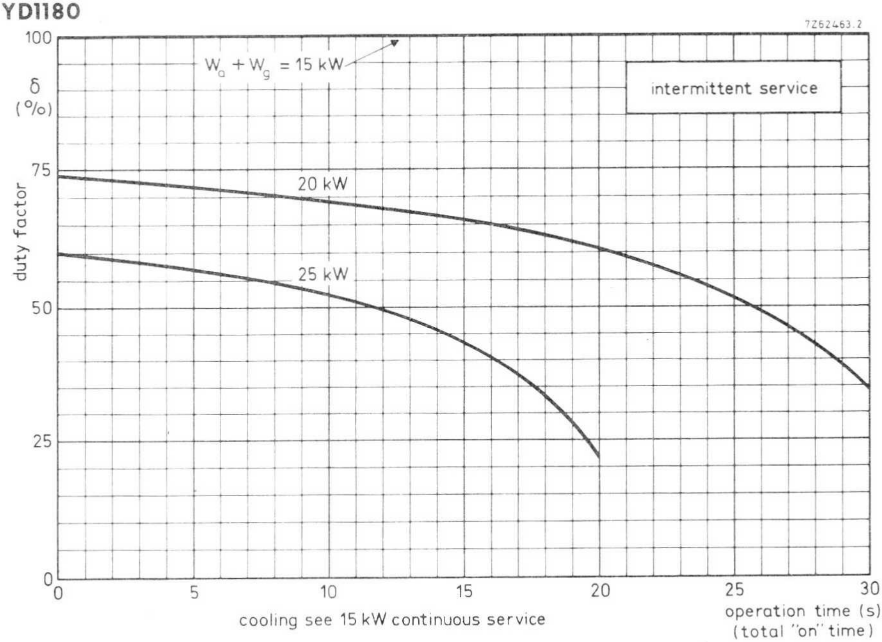
1 Pa ≈ 0, 1 mm H_2O

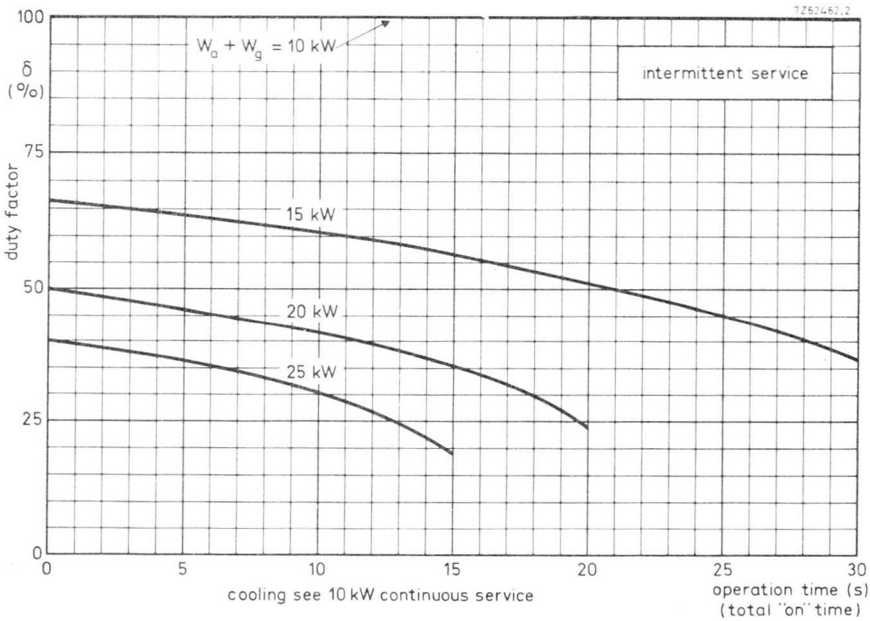
YD1180


7Z72435
t = 35 °C
h = 1500 m
$q_{min.}$ (m^3/min)
p_i (Pa)
t_o (°C)
q
t_o
p_i
20
15
10
5
1500
1000
500
0
150
100
50
0
5
10
15
$W_a + W_g$ (kW)

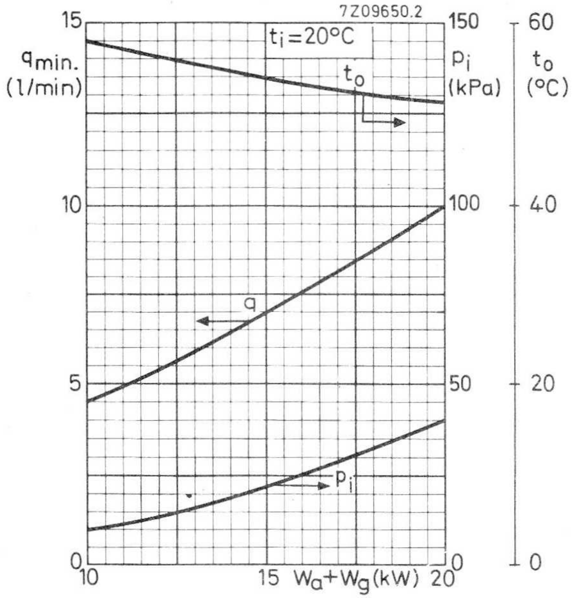

7Z72436
t = 25 °C
h = 3000 m
$q_{min.}$ (m^3/min)
p_i (Pa)
t_o (°C)
q
t_o
p_i
20
15
10
5
1500
1000
500
0
150
100
50
0
5
10
15
$W_a + W_g$ (kW)

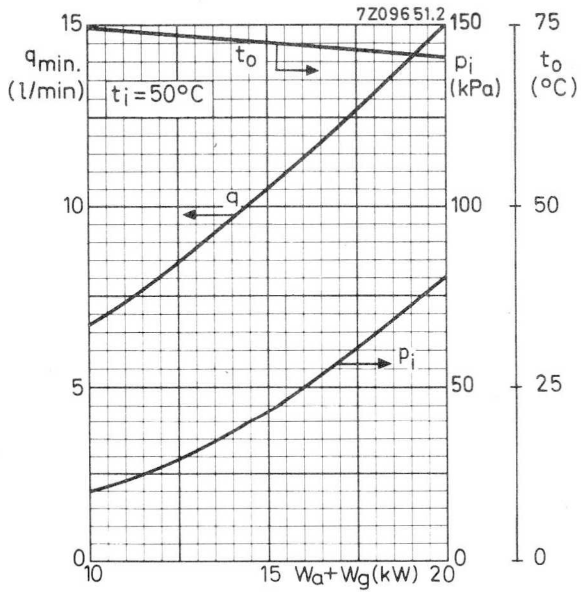
YD1180


7Z62463.2
duty factor
δ (%)
100
75
50
25
0
$W_a + W_g$ = 15 kW
intermittent service
20 kW
25 kW
0
5
10
15
20
25
30
cooling see 15 kW continuous service
operation time (s)
(total "on" time)


7Z62462.2
duty factor
δ (%)
100
75
50
25
0
$W_a + W_g$ = 10 kW
intermittent service
15 kW
20 kW
25 kW
0
5
10
15
20
25
30
cooling see 10 kW continuous service
operation time (s)
(total "on" time)

YD1182





100 kPa ≈ 1 at.

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1185 is forced-air cooled
The YD1187 is water cooled by an integral cooler.

QUICK REFERENCE DATA				
Oscillator output power (W_o-W_{feedb}), typical	W_{osc}		50	kW
Fequency for full ratings	f	max.	100	MHz

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

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	90	90	90	MHz
Oscillator output power (W_o-W_{feedb})	W_{osc}	33, 4	40	50	kW
Anode voltage	V_a	8, 5	10	12	kV
Anode current	Ia	5, 4	5, 33	5, 33	A
Anode input power	W_{ia}	45, 9	53, 3	64	kW
Anode dissipation	W_a	11, 4	12, 1	12, 8	kW
Anode output power	W_o	34, 5	41, 2	51, 2	kW
Anode efficiency	η_a	75, 1	77, 3	80, 0	%
Oscillator efficiency	η_{osc}	72, 7	75, 0	78, 1	%
Feedback ratio	V_{gp}/V_{ap}	11	10, 2	9	%
Grid resistor	R_g	330	400	430	Ω
Grid current, on load	I_g	1, 5	1, 45	1, 4	A
Grid voltage, negative	$-V_g$	495	580	600	V
Grid dissipation	W_g	400	380	360	W
Grid resistor dissipation	W_{R_g}	740	840	840	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	100	MHz
Anode voltage	V_a	max.	14,4	kV
Anode current	I_a	max.	6	A
Anode input power	W_{ia}	max.	72	kW
Anode dissipation, continuous service (YD1185)	W_a	max.	15	kW
(YD1187)	W_a	max.	20	kW
Grid voltage	$-V_g$	max.	1,5	kV
Grid current, on load	I_g	max.	1,6	A
off load	I_g	max.	2,4	A
Grid dissipation	W_g	max.	500	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	7,5	A
peak	I_{kp}	max.	40	A
Envelope temperature	t_{env}	max.	240	^oC

HEATING : direct; thoriated tungsten filament, mesh construction

Filament voltage	V_f		7	V
Filament current	I_f		175	A
Peak filament staring current	I_{fp}	max.	1000	A
Cold filament resistance	R_{f_o}		4,2	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 consult the manufacturer.

CAPACITANCES

Anode to filament	C_{af}	1	pF
Grid to filament	C_{gf}	61	pF
Anode to grid	C_{ag}	22	pF

CHARACTERISTICS measured at V_a = 11 kV, I_a = 1,5 A

Transconductance	S	40	mA/V
Amplification factor	μ	50	

COOLING

To obtain optimum life, the temperature of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

To maintain these temperatures additional cooling may be necessary.
At frequencies higher than about 4 MHz cooling of the seals becomes mandatory.

YD1185

See also cooling curves

With insulating pedestal type 40648

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 (Pa *)	Outlet temperature t_o (°C)
15	0	35	15	850	92
10	0	35	9,3	350	99
8	0	35	7	220	104
15	0	45	17,3	1060	98
10	0	45	10,7	440	104
8	0	45	8,1	270	108
15	1500	35	18	970	93
10	1500	35	11,2	400	100
8	1500	35	8,4	250	104
15	3000	25	19	950	90
10	3000	25	11,8	390	95
8	3000	25	8,9	250	99

*1 Pa ≈ 0,1 mm H_2O

YD1187

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 (kPa*)	Outlet temperature t_o (°C)
20	20	10	40	51
	50	15	80	71
15	20	7	22	54
	50	10, 5	43	73
10	20	4, 5	10	58
	50	6, 7	20	75

Absolute max. water inlet temperature	t_i	50	°C
Absolute max. water pressure	p	600	kPa* (abs)

ACCESSORIES

Filament connector with cable	type	40708	net mass	600	g
Filament/cathode connector with cable	type	40709	net mass	640	g
Grid connector	type	40711	net mass	310	g
Insulating pedestal (YD1180 only)	type	40648	net mass	7, 15	kg

*) 100 kPa ≈ 1 at

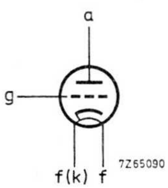
MECHANICAL DATA

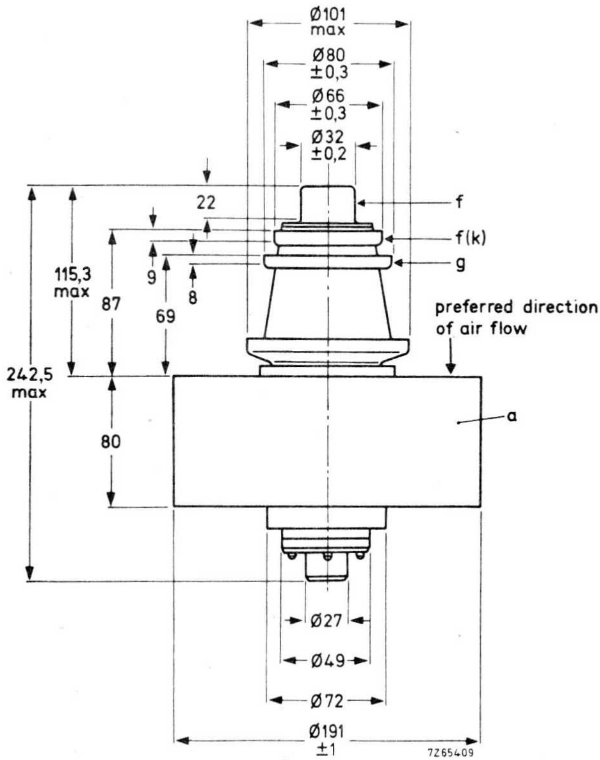
Dimensions in mm

YD1185

Mounting position : vertical with anode up or down

Net mass : approx. 11,3 kg

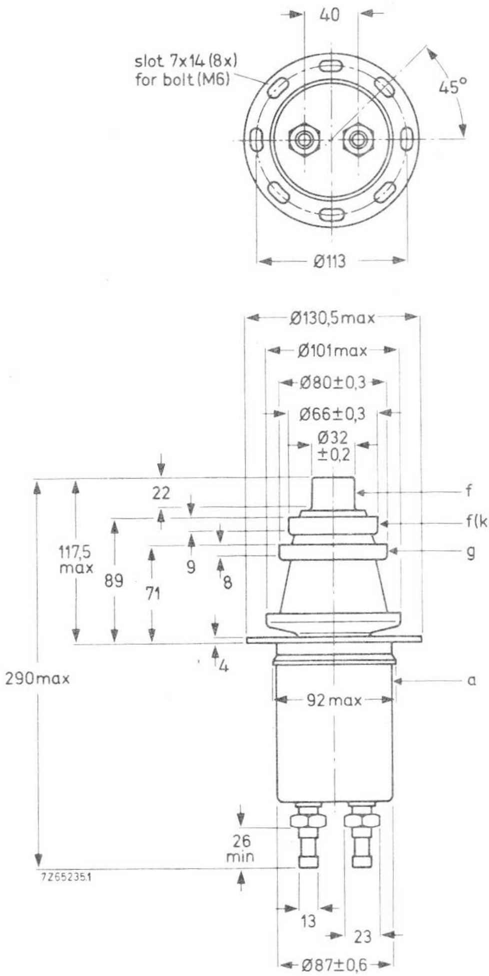




YD1187

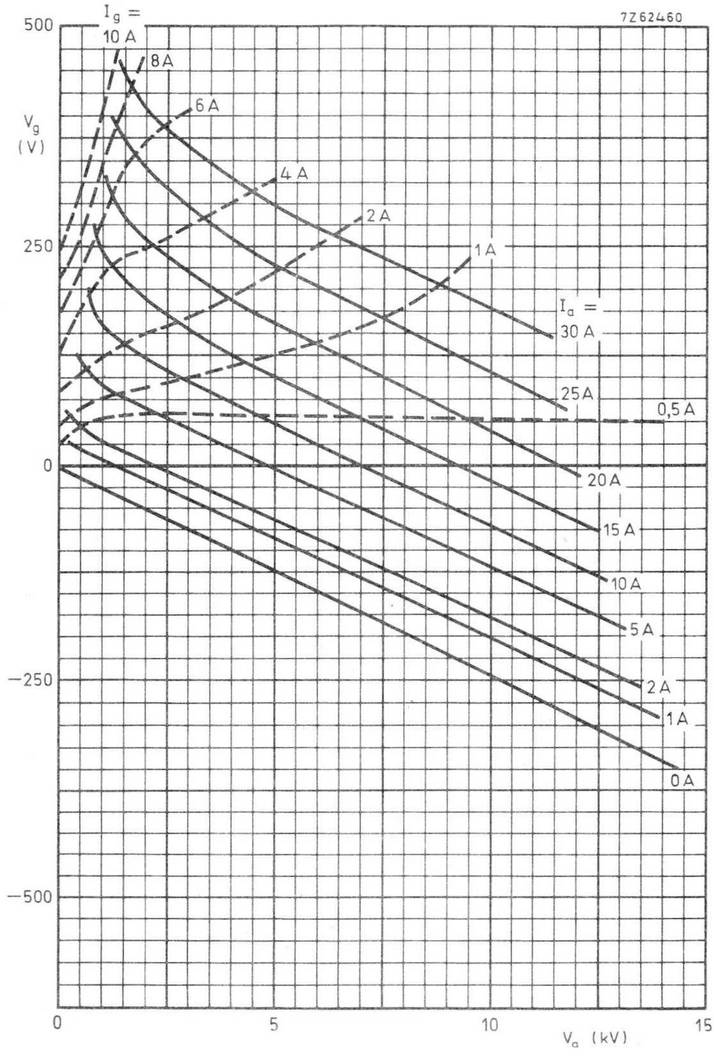
Mounting position : vertical, with anode up or down

Net mass : approx. 3,4 kg

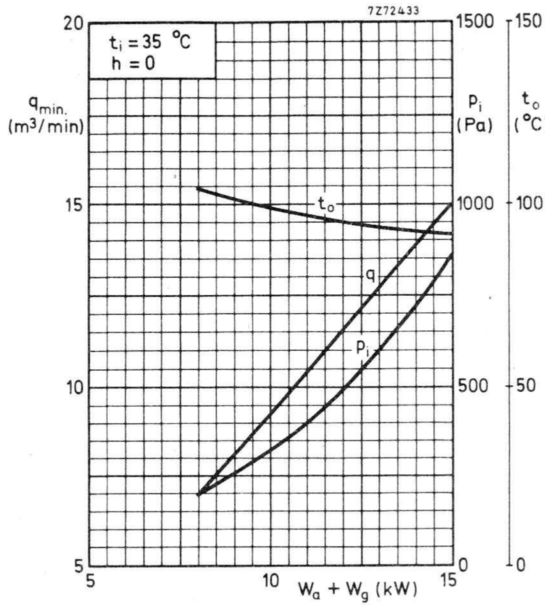


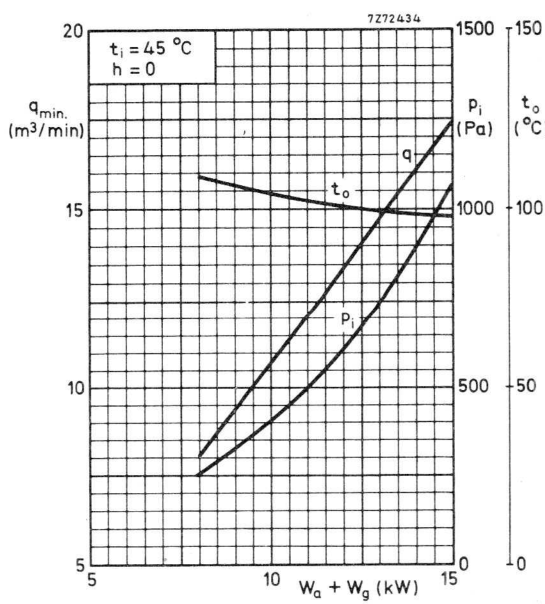
Thread of water connections BSP 1/2 in

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


7Z62460
I_g =
10 A
8 A
6 A
4 A
2 A
1 A
0,5 A
I_a =
30 A
25 A
20 A
15 A
10 A
5 A
2 A
1 A
0 A
V_g (V)
500
250
0
−250
−500
0
5
10
15
V_a (kV)

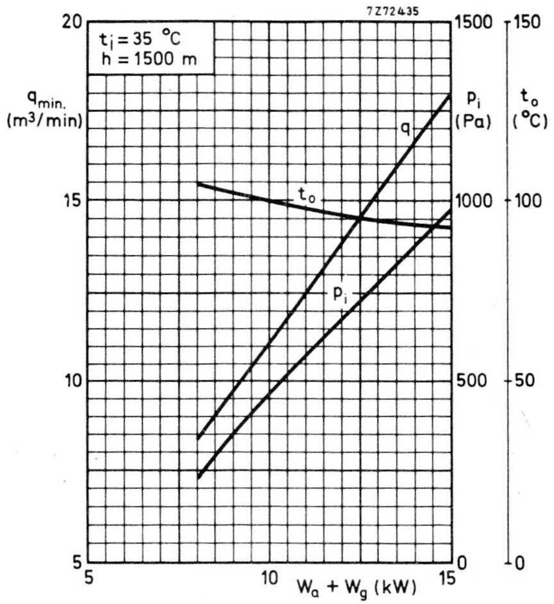
YD1185

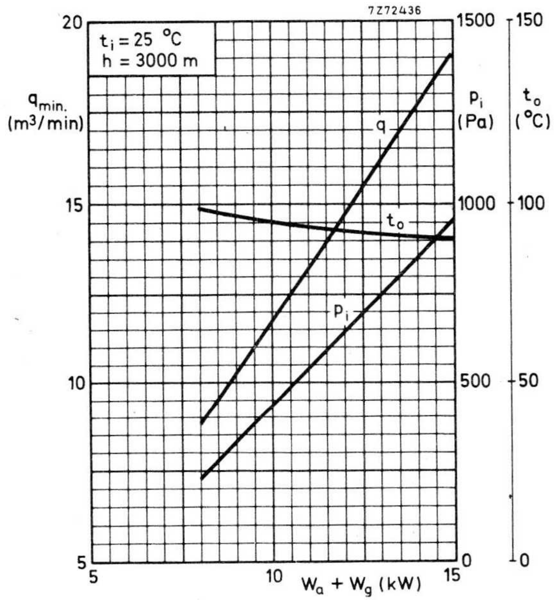




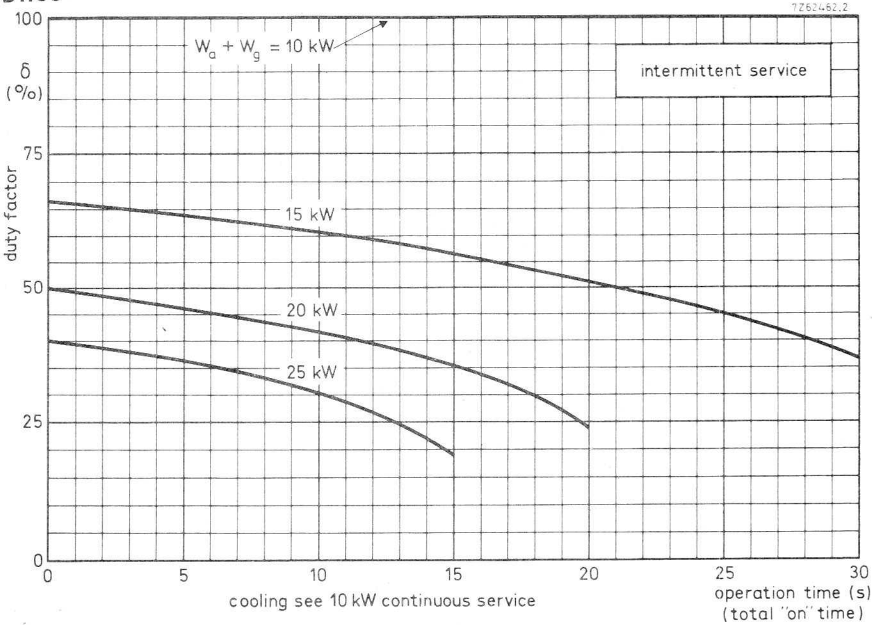
1 Pa ≈ 0, 1 mm H_2O

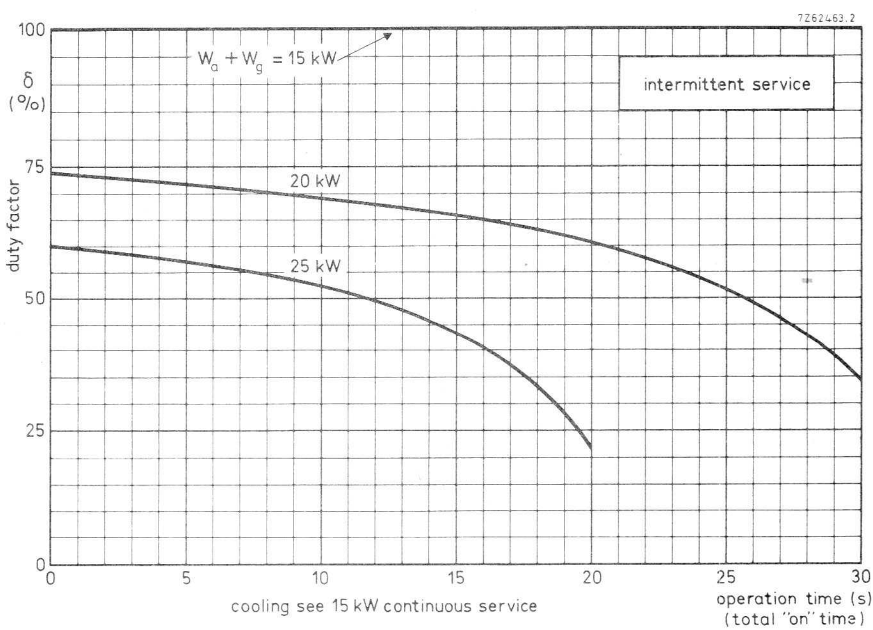
YD1185


7Z72435
$t_i = 35$ °C
h = 1500 m
$q_{min.}$ (m^3/min)
p_i (Pa)
t_o (°C)
q
t_o
p_i
20
15
10
5
5
10
15
1500
1000
500
0
150
100
50
0
$W_a + W_g$ (kW)

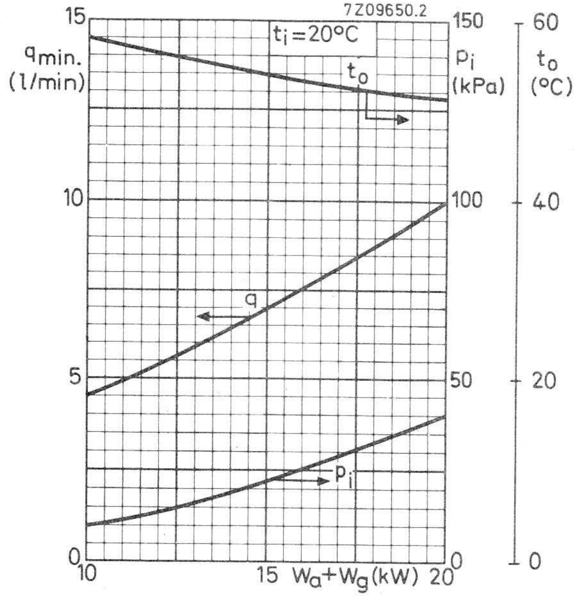

7Z72436
$t_i = 25$ °C
h = 3000 m
$q_{min.}$ (m^3/min)
p_i (Pa)
t_o (°C)
q
t_o
p_i
20
15
10
5
5
10
15
1500
1000
500
0
150
100
50
0
$W_a + W_g$ (kW)

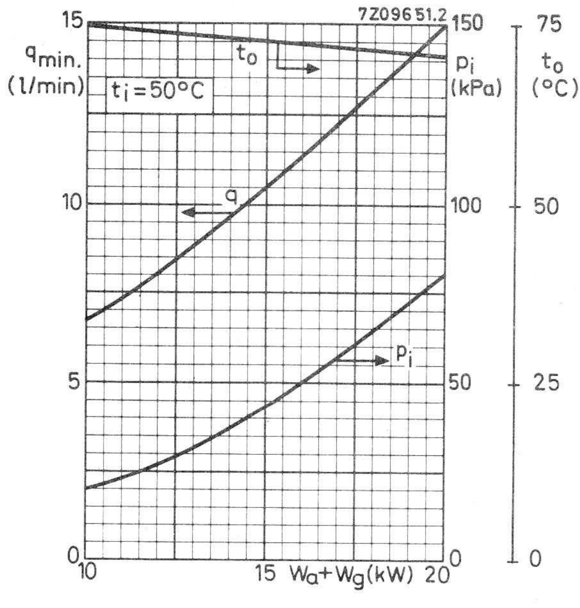
YD1185


7Z62462.2
intermittent service
$W_a + W_g = 10$ kW
15 kW
20 kW
25 kW
δ (%)
duty factor
100
75
50
25
0
0
5
10
15
20
25
30
cooling see 10 kW continuous service
operation time (s)
(total "on" time)


7Z62463.2
intermittent service
$W_a + W_g = 15$ kW
20 kW
25 kW
δ (%)
duty factor
100
75
50
25
0
0
5
10
15
20
25
30
cooling see 15 kW continuous service
operation time (s)
(total "on" time)

YD1187


7Z09650.2
t_i=20°C
$q_{min.}$ (l/min)
p_i (kPa)
t_o (°C)
t_o
q
p_i
15
10
5
0
150
100
50
0
60
40
20
0
10
15 W_a+W_g(kW) 20


7Z09651.2
t_i=50°C
$q_{min.}$ (l/min)
p_i (kPa)
t_o (°C)
t_o
q
p_i
15
10
5
0
150
100
50
0
75
50
25
0
10
15 W_a+W_g(kW) 20

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1192 has an integral water cooler.
The YD1193 is vapour cooled.

QUICK REFERENCE DATA				
Oscillator output power (W_o - W_{feedb})	W_{osc}		62,7	kW
Frequency for full ratings	f	max.	100	MHz

To be read in conjunction with "General Operational Recommendations Transmitting Tubes for Communication; 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}	62,7	kW
Anode voltage	V_a	8	kV
Anode current	I_a	10	A
Anode input power	W_{ia}	80	kW
Anode dissipation	W_a	15	kW
Anode output power	W_o	65	kW
Anode efficiency	η_a	81,2	%
Oscillator efficiency	η_{osc}	78,4	%
Feedback ratio	V_{gp}/V_{ap}	14,6	%
Grid resistor	R_g	300	Ω
Grid current, on load	I_g	2,25	A
Grid voltage, negative	$-V_g$	675	V
Grid dissipation	W_g	750	W
Grid resistor dissipation	W_{Rg}	1,52	kW

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	100	MHz [1])
Anode voltage	V_a	max.	9,6	kV
Anode current	I_a	max.	12	A
Anode input power	W_{ia}	max.	96	kW
Anode dissipation	W_a	max.	40	kW
Grid voltage	$-V_g$	max.	1,5	kV
Grid current, on load	I_g	max.	2,5	A
of load	I_g	max.	3,5	A
Grid dissipation	W_g	max.	1	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	14	A
peak	I_{kp}	max.	70	A
Envelope temperature	t_{env}	max.	240	°C

HEATING : direct; thoriated tungsten filament

Filament voltage	V_f		8,4	V
Filament current	I_f		235	A
Peak filament starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{fo}		3,9	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-to-cathode resonance. For further information please see Application Book "Tubes for R.F. heating" or contact the manufacturer.

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

CAPACITANCES

Anode to filament	C_{af}	1,3	pF
Grid to filament	C_{gf}	100	pF
Anode to grid	C_{ag}	45	pF

CHARACTERISTICS measured at V_a = 8 kV , I_a = 6 A

Transconductance	S	90	mA/V
Amplification factor	μ	35	

COOLING

To obtain optimum life, the temperature of the seals and the envelope should, under normal operating conditions, be kept below 200 °C.

At low frequencies the seals are sufficiently cooled when the filament connectors are water cooled by a flow of about 0, 5 ℓ/min.
At higher frequencies, however, an additional air flow of about 1m^3/min must be led along the seals from a 30 mm diameter nozzle positioned at a distance of 200 mm from the tube header.

YD1192

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 (kPa *)	Outlet temperature t_o (°C)
40	20	20	40	51
	50	30	80	71
30	20	14	21	53
	50	21	43	72
20	20	9	10	56
	50	13, 5	20	74

Absolute max. water inlet temperature	t_i	max.	50	°C
Absolute max water pressure	p	max.	600	kPa *

* 100 kPa ≈ 1 at.

YD1193

See also cooling curves

With integrated boiler-condenser type K735

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa*)	Outlet temperature t_o (°C)
40	20	11	5	74
	35	15	7	74
	50	25	16	74
30	20	8	3	76
	35	11	5	76
	50	17	9	76
20	20	5	2	80
	35	6, 7	3	80
	50	10	4	80

ACCESSORIES

Filament connector with cable	type 40705	net mass	700	g
Filament/cathode connector with cable	type 40706	net mass	830	g
Grid connector $f \leq 4$ MHz	type 40707	net mass	75	g
$f > 4$ MHz	type 40736	net mass	450	g
Boiler condenser (YD1193 only)	type K735	net mass	70	kg

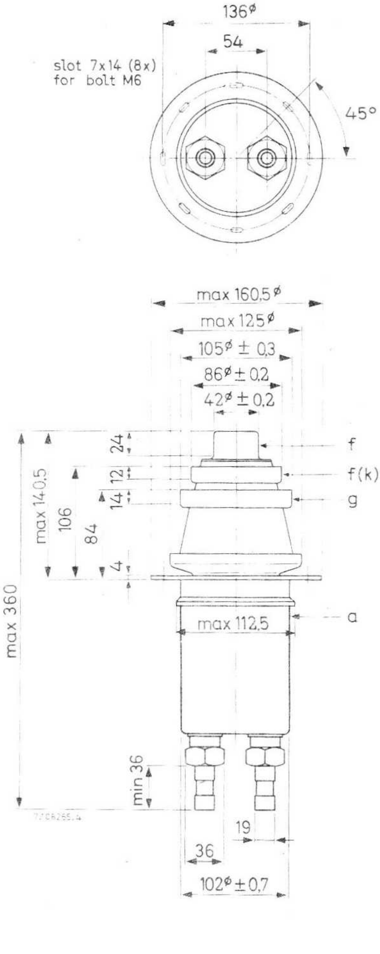
* 100 kPa ≈ 1 at.

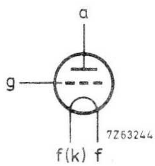
YD1192 Dimensions in mm

MECHANICAL DATA

Mounting position : vertical with anode up or down

Net mass : approx. 5,8 kg





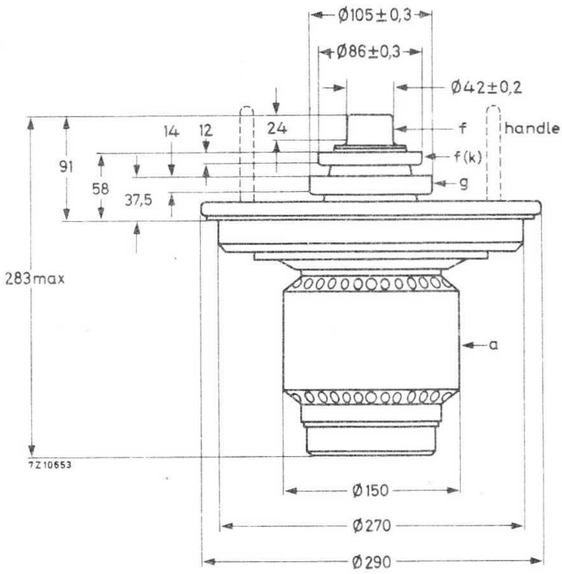
Thread of water connections BSP 1 in

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

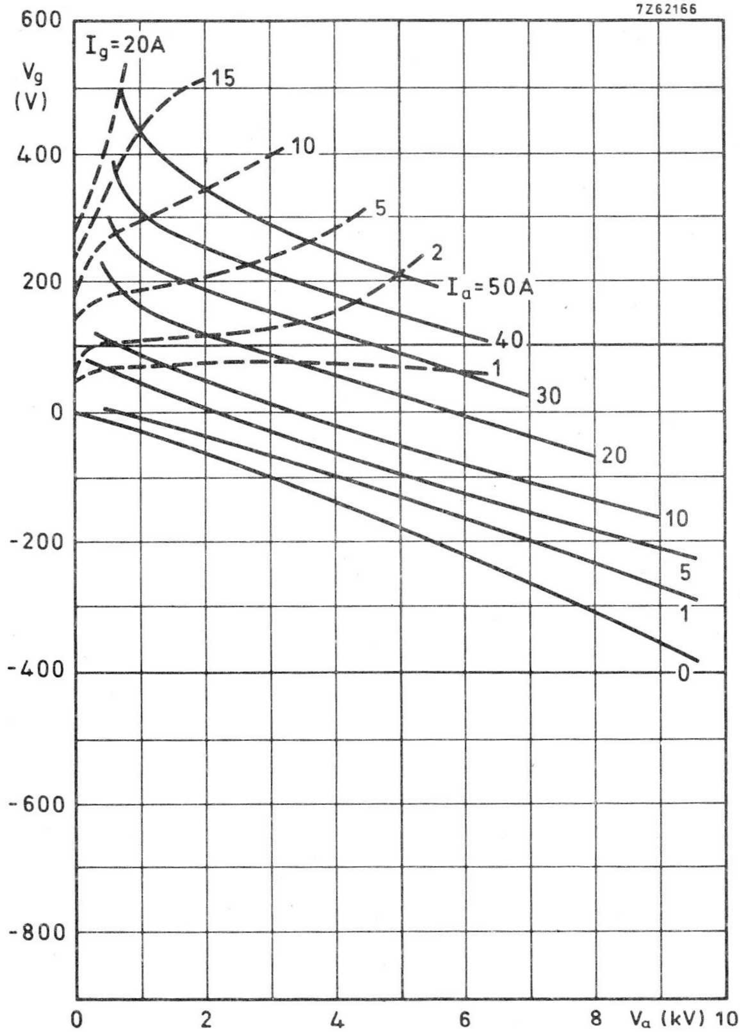
YD1193

Mounting position : vertical with anode down

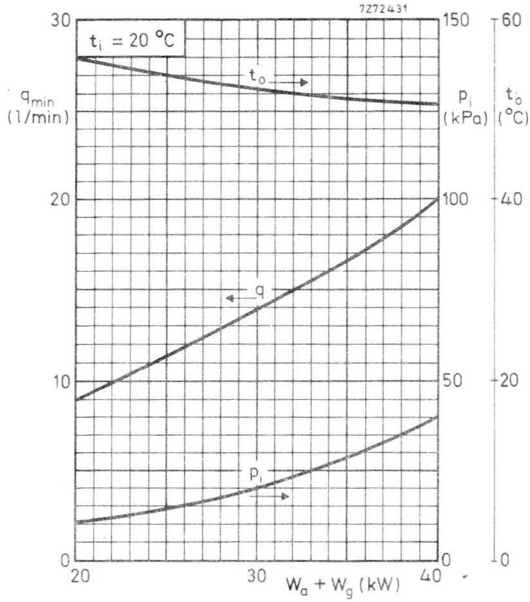
Net mass : approx. 15,7 kg

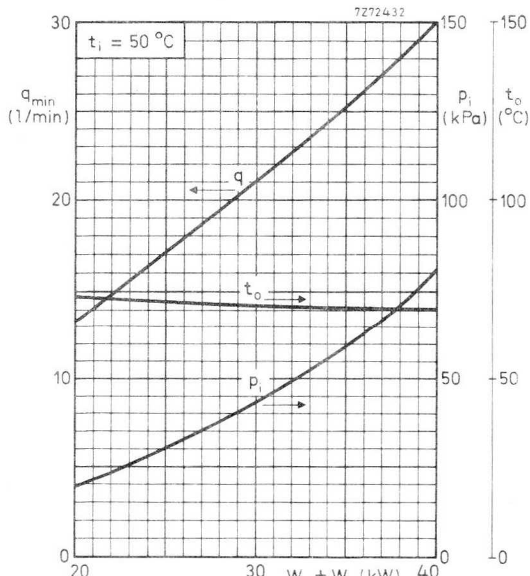


Note: The handles should be removed before switching on the tube.


7Z62166
600
400
200
0
-200
-400
-600
-800
V_g (V)
I_g=20A
15
10
5
2
1
I_a=50A
40
30
20
10
5
1
0
0
2
4
6
8
V_a (kV) 10

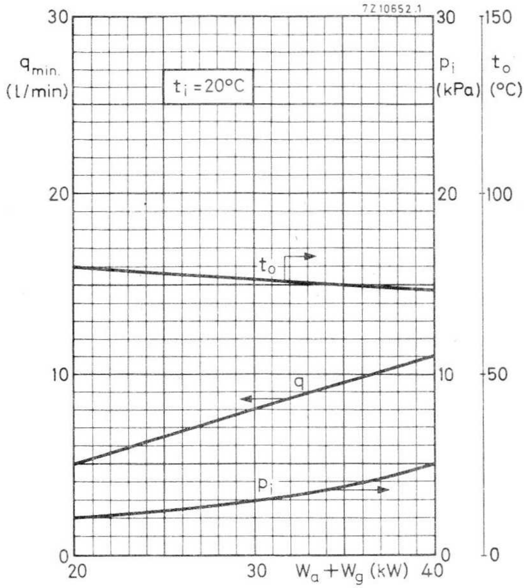
YD1192

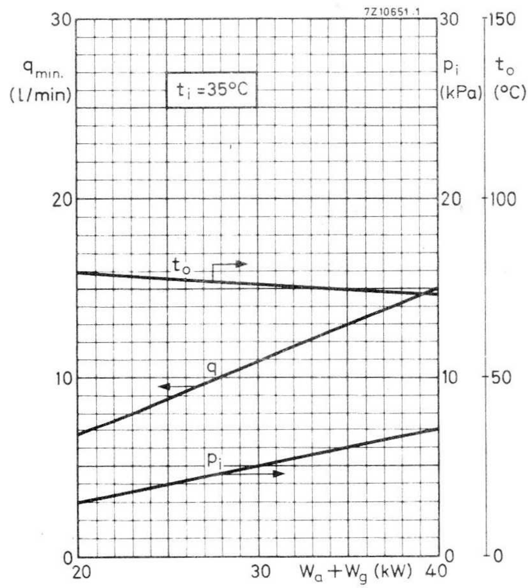




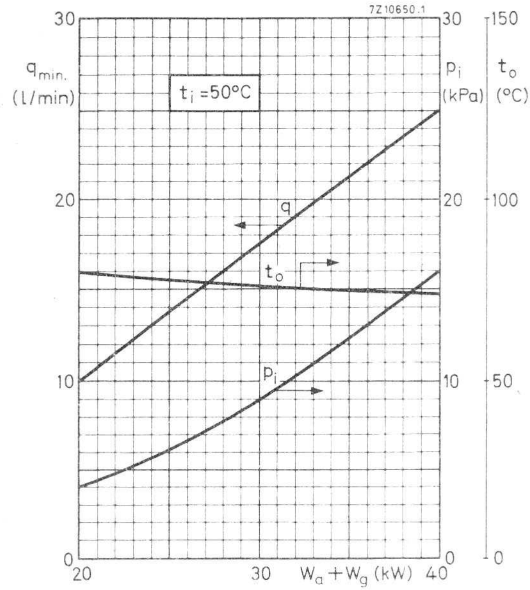
100 kPa ≈ 1 at

YD1193





100 kPa ≈ 1 at


7Z10650.1
$q_{min.}$ (l/min)
t_i = 50°C
q
t_o
p_i
p_i (kPa)
t_o (°C)
30
20
10
0
150
100
50
20
30
$W_a + W_g$ (kW)
40

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1195 is forced-air cooled.
The YD1197 has an integral water cooler.

QUICK REFERENCE DATA					
Oscillator output power (W_o-W_{feedb}), typical	YD1195	W_{osc}		90	kW
	YD1197	W_{osc}		107,6	kW
Frequency for full ratings		f	max.	30	MHz

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

OPERATING CONDITIONS

Frequency	f	30	30	30	30	MHz
Oscillator output power (W_o-W_{feedb})	W_{osc}	60,6	74	90	107,6	kW
Anode voltage	V_a	8,5	10	12	12	kV
Anode current	I_a	10	10	9,75	12	A
Anode input power	W_{ia}	85	100	117	144	kW
Anode dissipation	W_a	22,4	24	24,9	34	kW
Anode output power	W_o	62,6	76	92,1	110	kW
Anode efficiency	η_a	73,6	76	78,8	76,4	%
Oscillator efficiency	η_{osc}	71,2	74	77	74,7	%
Feedback ratio	V_{gp}/V_{ap}	12,5	10,9	9,4	11	%
Grid resistor	R_g	210	240	260	230	Ω
Grid current, on load	I_g	2,4	2,3	2,3	2,6	A
Grid voltage, negative	$-V_g$	500	550	600	600	V
Grid dissipation	W_g	760	730	720	840	W
Grid resistor dissipation	W_{Rg}	1,2	1,27	1,38	1,56	kW

LIMITING VALUES (Absolute max. ratings system)

Frequency		f	up to	100	MHz[1])
Anode voltage		V_a	max.	14,4	kV
Anode current	YD1195	I_a	max.	12	A
	YD1197	I_a	max.	15	A
Anode input power	YD1195	W_{ia}	max.	144	kW
	YD1197	W_{ia}	max.	150	kW
Anode dissipation, continuous service	YD1195	W_a	max.	30	kW
intermittent service	YD1195		see curves		
Anode dissipation	YD1197	W_a	max.	50	kW
Grid voltage		$-V_g$	max.	1,5	kV
Grid current, on load	YD1195	I_g	max.	2,5	A
off load		I_g	max.	3,5	A
on load	YD1197	I_g	max.	2,8	A
off load		I_g	max.	3,8	A
Grid dissipation	YD1195	W_g	max.	1	kW
Grid circuit resistance		R_g	max.	10	kΩ
Cathode current, mean	YD1195	I_k	max.	14	A
peak		I_{kp}	max.	70	A
mean	YD1197	I_k	max.	17,5	A
peak		I_{kp}	max.	70	A
Envelope temperature		t_{env}	max.	240	^oC

HEATING : direct; thoriated tungsten filament, mesh construction

Filament voltage	V_f		8,4	V
Filament current	I_f		235	A
Peak filament starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{fo}		3,9	mΩ

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

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

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}	1,2	pF
Grid to filament	C_{gf}	100	pF
Anode to grid	C_{ag}	33	pF

CHARACTERISTICS measured at V_a = 12 kV, I_a = 3 A

Transconductance	S	80	mA/V
Amplification factor	μ	50	

COOLING

YD1195

Anode + grid dissipation $W_a + W_g$ (kW)	Altitude h (m)	Inlet temperature t_i (^oC)	Rate of flow q_{min} (m^3/min)	Pressure drop p_i (Pa*)	Outlet temperature t_o (^oC)
30	0	35	34	1200	84
25	0	35	27,2	780	87
20	0	35	21,4	480	89
30	0	45	38	1500	91
25	0	45	30,4	980	93
20	0	45	23,9	600	95
30	1500	35	41	1380	84
25	1500	35	32,7	900	87
20	1500	35	25,7	550	89
30	3000	25	43	1350	79
25	3000	25	34,4	880	83
20	3000	25	27	540	85

* 1 Pa ≈ 0,1 mm H_2O.

The above cooling conditions apply to the air flow direction as indicated in the outline drawing. In case of reversed flow direction a larger air volume will be required to keep the anode temperature below the limiting value.

To obtain optimum life, the temperature of the seals and the envelope should, under normal operating conditions, be kept below 200 °C.

YD1197

See also cooling curves

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow qmin (ℓ/min)	Pressure drop p_i (kPa*)	Outlet temperature t_i (°C)
50	20	26	60	49
	50	39	123	69
40	20	20	40	51
	50	30	80	71
30	20	14	24	53
	50	21	43	72
20	20	9	10	56
	50	13,5	20	74

Absolute max. water inlet temperature	t_i	max.	50	°C
Absolute max. water pressure	p	max.	600	kPa(abs)

To obtain optimum life, the temperature of the seals and the envelope should, under continuously loaded conditions, be kept belwo 200 °C.

At low frequencies the seals are sufficiently cooled when the filament connectors are water cooled with a flow of about 0, 5 ℓ/min. At higher frequencies, however, an additional air flow of about 1 m^3/min must be led along the seals from a 30 mm diameter nozzle positioned at a distance of 200 mm from the tube header.

ACCESSORIES

Filament connector with cable	type	40705	net mass	700	g
Filament/cathode connector with cable	type	40706	net mass	830	g
Grid connector	type	40736	net mass	450	g
Insulating pedestal (YD1195 only)	type	40729	net mass	8, 2	g

*100 kPa ≈ 1 at

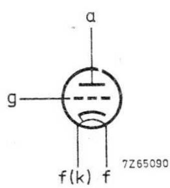
YD1195

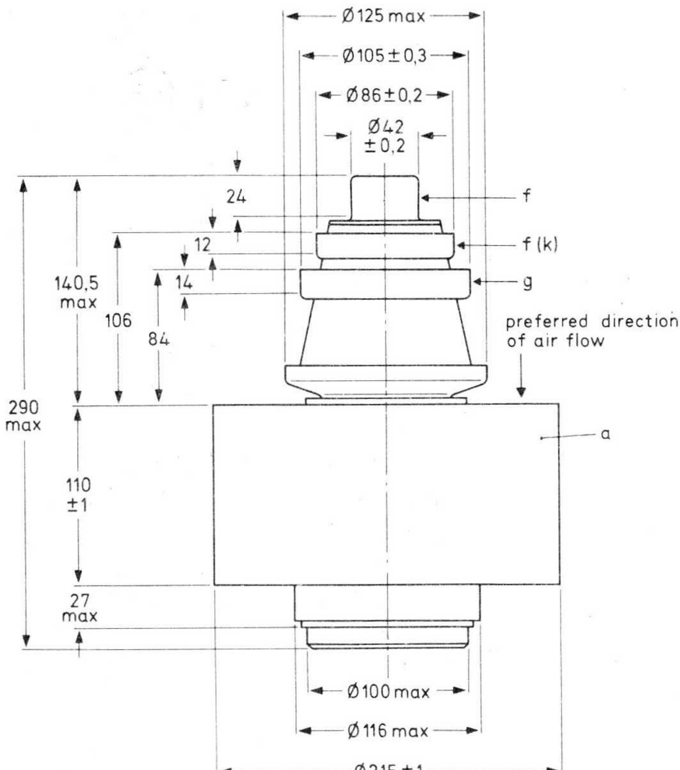
MECHANICAL DATA

Dimensions in mm

Mounting position : vertical with anode up or down

Net mass : approx. 20 kg





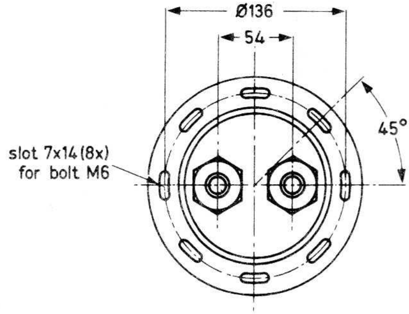
YD1197

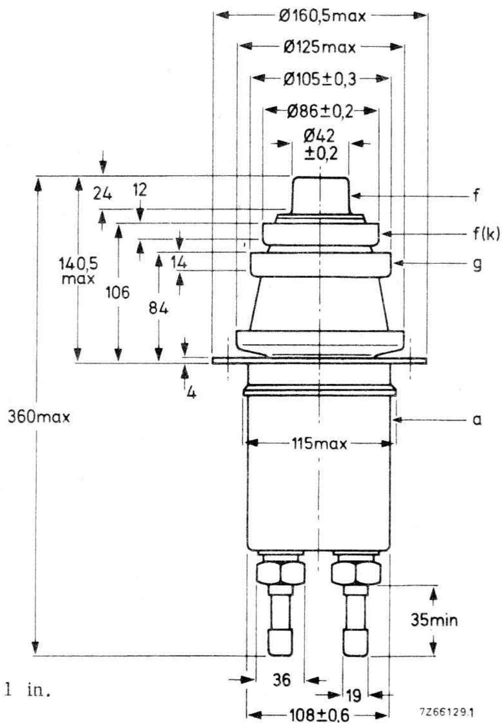
MECHANICAL DATA

Dimensions in mm

Mounting position : vertical with anode up or down

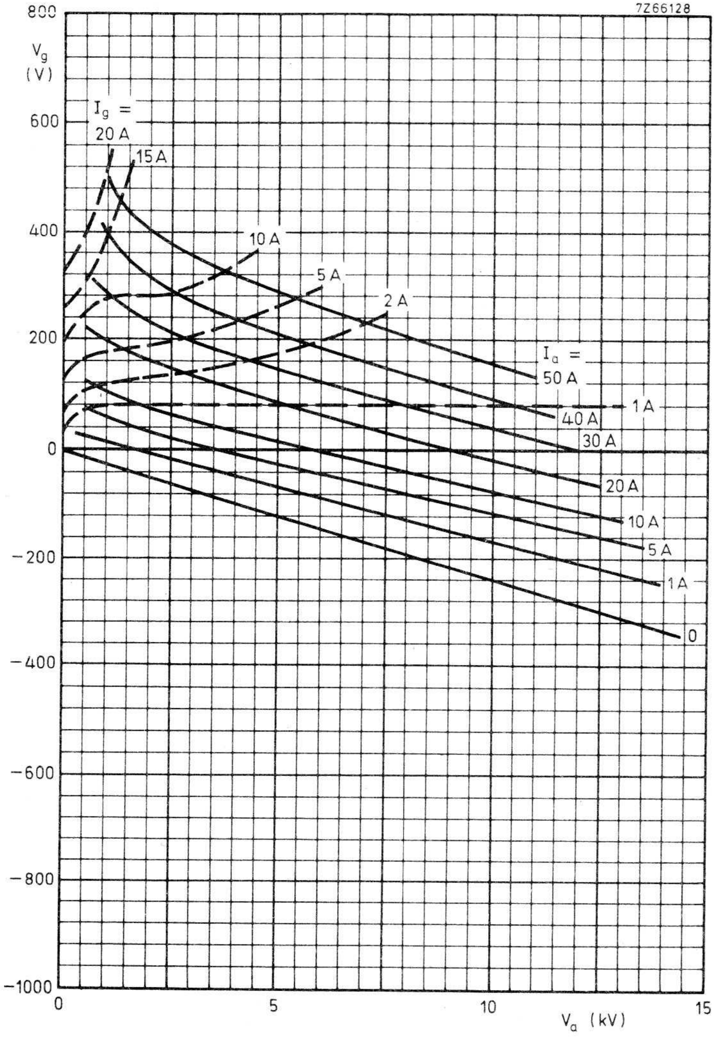
Net mass : approx. 6,5 kg



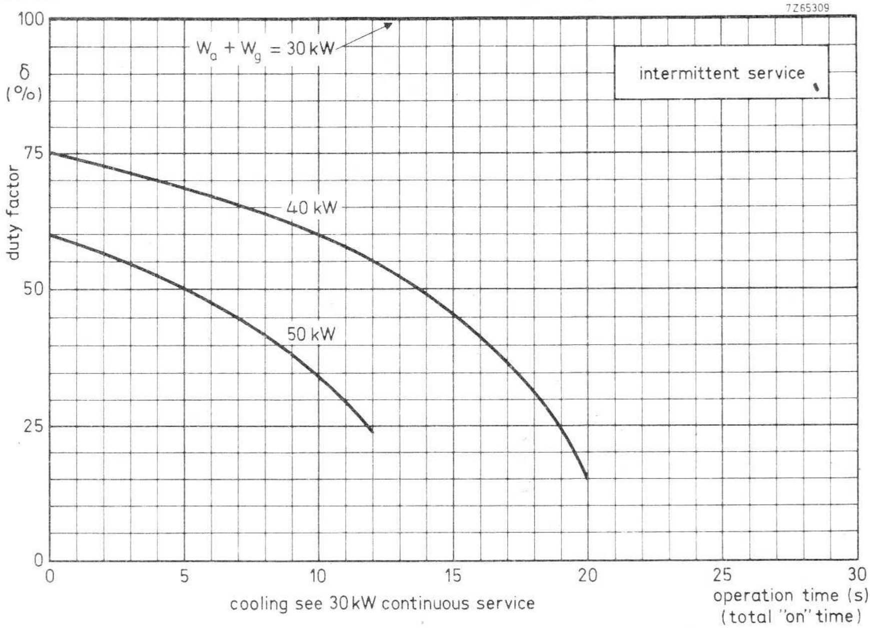


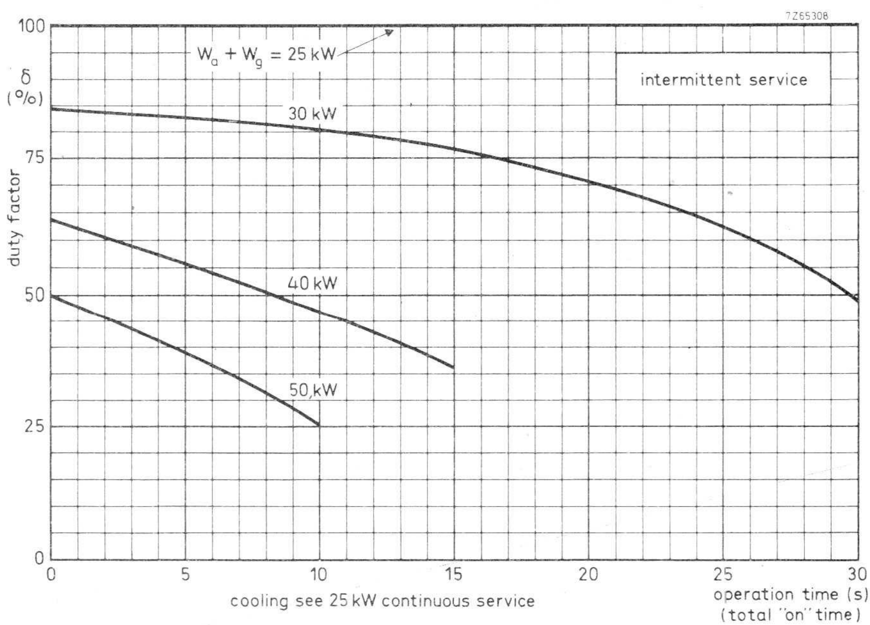
Thread of water connections BSP 1 in.

With the anode up the water connections should be interchanged.

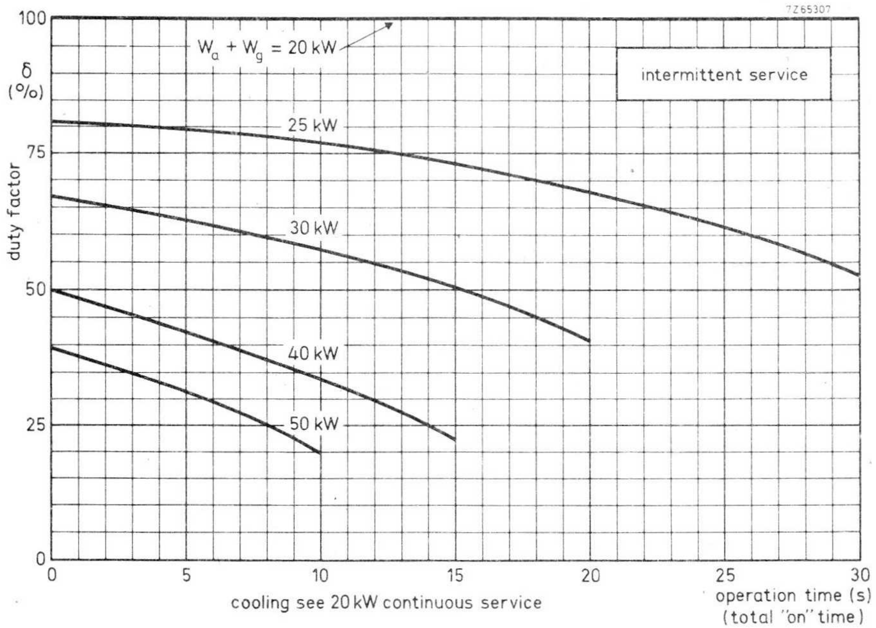

7Z66128
800
V_g
(V)
600
400
200
0
−200
−400
−600
−800
−1000
I_g =
20 A
15 A
10 A
5 A
2 A
1 A
I_a =
50 A
40 A
30 A
20 A
10 A
5 A
1 A
0
0
5
10
15
V_a (kV)

YD1195

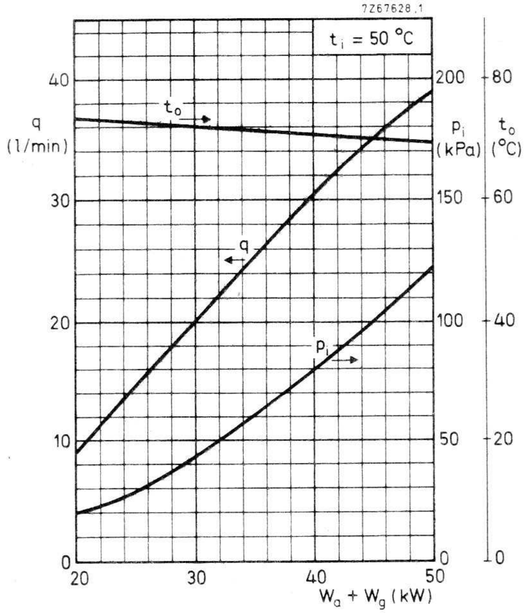

7Z65309
$W_a + W_g$ = 30 kW
intermittent service
δ
(%)
duty factor
40 kW
50 kW
100
75
50
25
0
0
5
10
15
20
25
30
cooling see 30 kW continuous service
operation time (s)
(total "on" time)

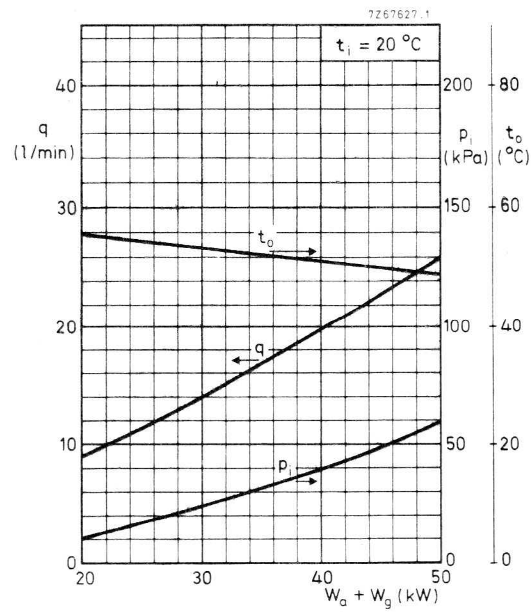

7Z65308
$W_a + W_g$ = 25 kW
intermittent service
δ
(%)
duty factor
30 kW
40 kW
50 kW
100
75
50
25
0
0
5
10
15
20
25
30
cooling see 25 kW continuous service
operation time (s)
(total "on" time)

YD1195


7Z65307
100
δ
(%)
duty factor
75
50
25
0
$W_a + W_g$ = 20 kW
intermittent service
25 kW
30 kW
40 kW
50 kW
0
5
10
15
20
25
30
cooling see 20 kW continuous service
operation time (s)
(total "on" time)

YD1197





100 kPa ≈ 1 at

INDUSTRIAL R.F. TRIODE

Triodes-in metal-ceramic construction-intended for use as industrial oscillators.
The YD1202 has an integral water cooler.
The YD1203 is vapour cooled.
The YD1204 has an integral vapour cooler.

QUICK REFERENCE DATA				
Oscillator output power (W_o-W_{feedb}), typical	W_{osc}		163	kW
Frequency for full ratings	f	max.	30	MHz

To be read in conjunction with "General Operational Recommendations Transmitting Tubes for Communication, 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.	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	^oC

HEATING : direct; thoriated tungsten filament

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 fluctuaions 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.

[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}	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	

COOLING

To obtain optimum life, the temperature of the seals and the envelope should, under continuously loaded conditions, be kept below 200 °C.

At frequencies up to about 4 MHz the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of about 0,5 ℓ/min.
At higher frequencies however, an additional airflow of about 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.

YD1202

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 (kPa*)	Outlet temperature t_o (°C)
100	20	52	55	49
	50	78	105	69
80	20	39	32	51
	50	60	65	70
60	20	29	19	52
	50	42	32	72
40	20	18	8	54
	50	27	15	73

Absolute max. water inlet temperature	t_i	50	°C
Absolute max. water pressure	p	600	kPa(abs)

* 100 kPa ≈ 1 at

YD1203

See also cooling curves

With integrated boiler condenser type K735

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa*)	Outlet temperature t_o (°C)
80	20	29	20	60
	35	48	51	59
60	20	16	8	75
	35	24	14	72
	50	45	45	70
40	20	10	4	80
	35	13,5	6	80
	50	20	10	80

Absolute max. water inlet temperature t_i 50 °C

YD1204

Type of condenser arbitrary.

Required capacity of condenser for W_a+W_g	80 72 x 10^3 302	60 55 x 10^3 230	40 37 x 10^3 150	kW kcal/h MJ/h
Volume of produced vapour				
at backflow temperature of 20 °C	3, 3	2, 5	1, 7	m^3/min
at backflow temperature of 90 °C	3, 7	2, 8	1, 9	m^3/min
Amount of backflowing water				
at backflow temperature of 20 °C	2, 0	1, 5	1, 0	ℓ/min
at backflow temperature of 90 °C	2, 1	1, 6	1, 1	ℓ/min

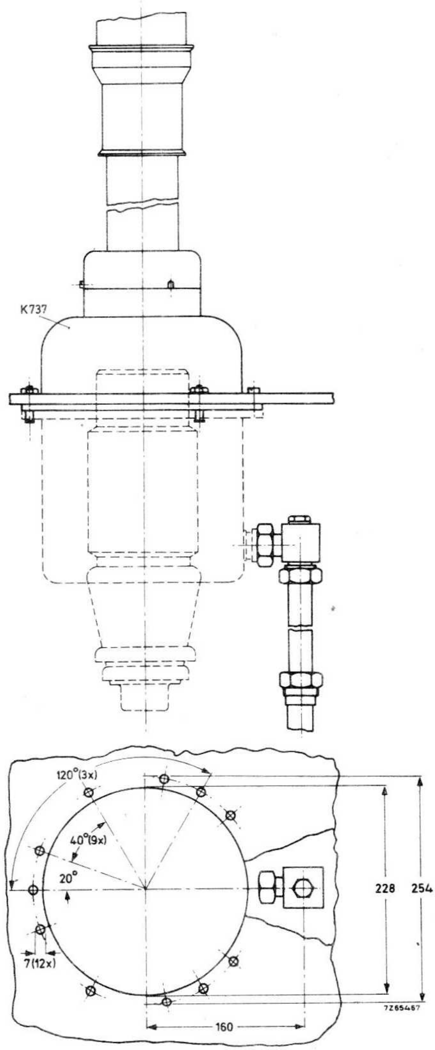
ACCESSORIES

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 (YD1203 only)	type	K735	net mass	70	kg
Water level control (YD1204 only)	type	40735	net mass	8, 5	kg

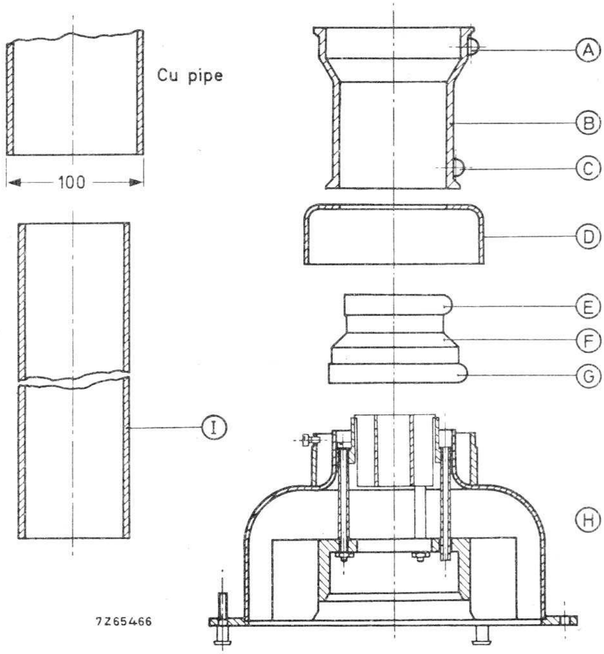
* 100 kPa ≈ 1 at

BOILER ASSEMBLY YD1204

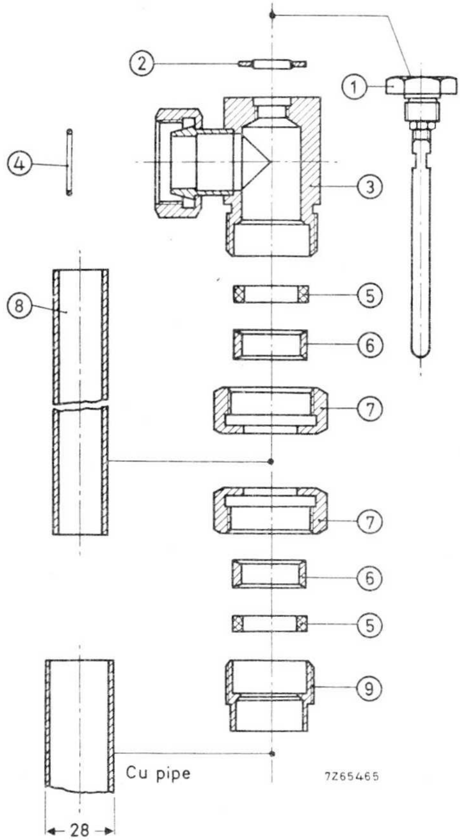
Dimensions in mm



PARTS OF BOILER YD1204



	description	catalogue number
A	Compression ring	9390 098 40002
B	Collar	9390 098 60002
C	Compression ring	9390 098 70002
D	Collar	9390 228 20002
E	Compression ring	9390 228 30002
F	Collar	9390 130 40002
G	Compression ring	9390 228 40002
H	Boiler hood	8222 033 73530
I	Quartz pipe	9390 098 10002



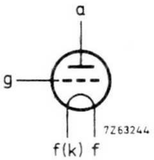
	description	catalogue number
1	Anti-corrosion pin	9390 245 10002
2	Gasket	2622 080 02801
3	90° joint	8222 033 73630
4	Gasket	2622 080 30721
5	Gasket	9390 098 80002
6	Gasket	9390 098 50002
7	Compression nut	9390 098 90002
8	Quartz pipe	9390 088 30002
9	Reduction collar	9390 099 00002

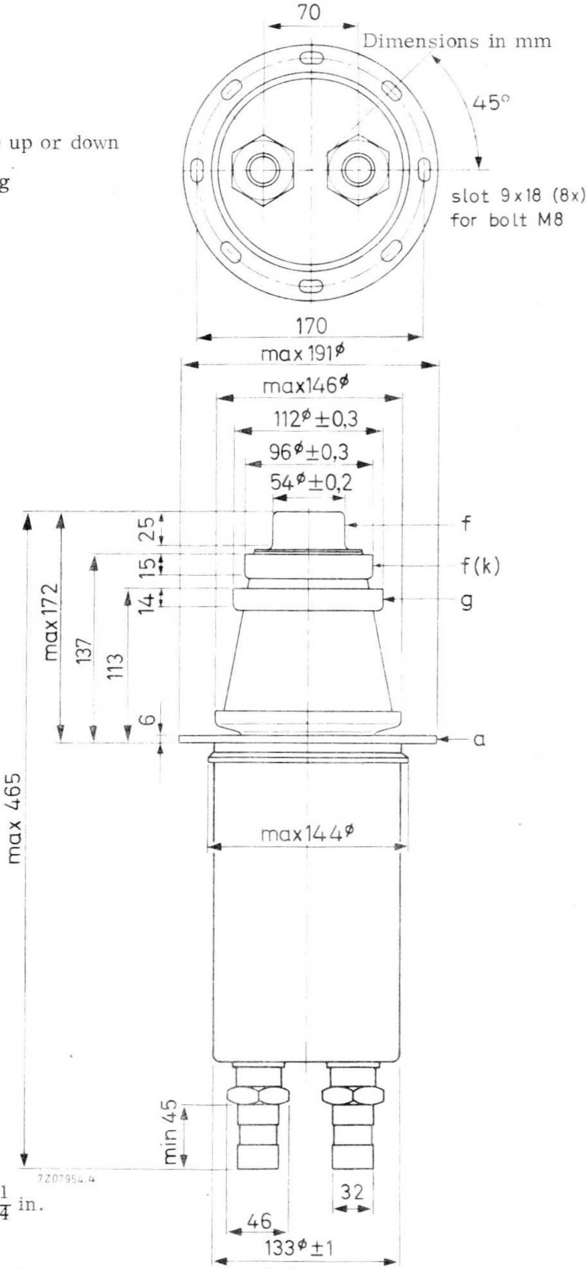
YD1202

MECHANICAL DATA

Mounting position : vertical, anode up or down

Net mass : approx. 11,5 kg





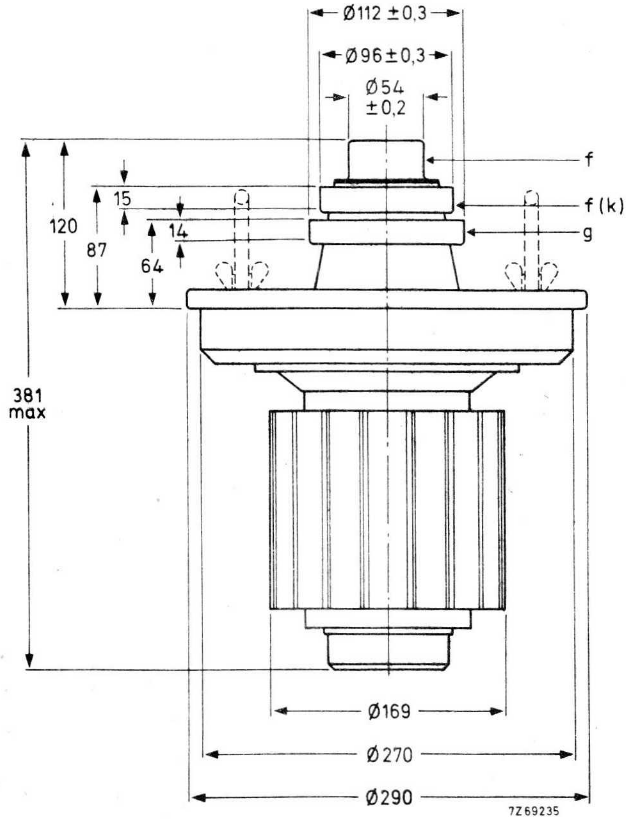
Thread of water connections BSP $1\frac{1}{4}$ in.

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

YD1203

Mounting position : vertical with anode down

Net mass : approx. 19, 8 kg

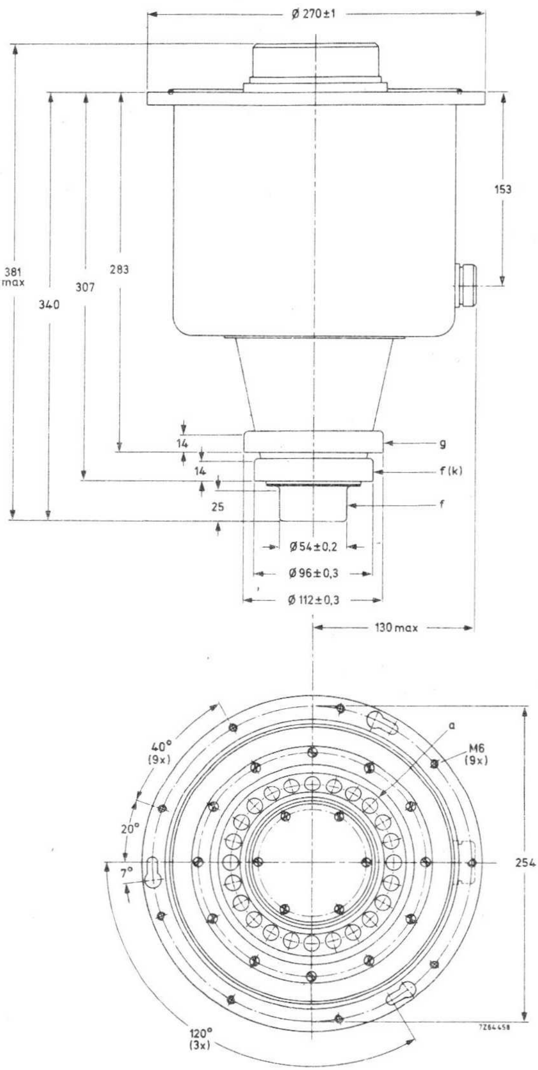


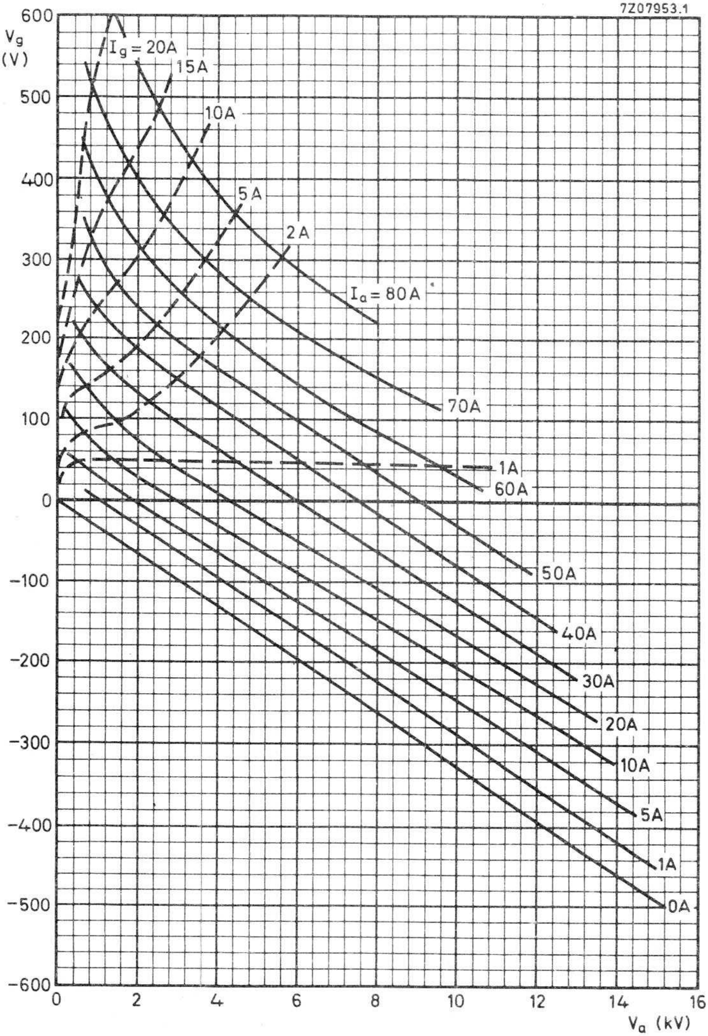
Note : The handles should be removed before switching on the tube.

YD1204

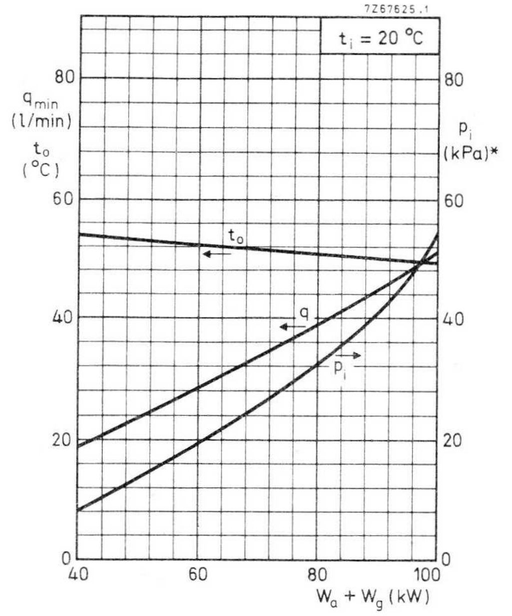
Mounting position : vertical with anode up

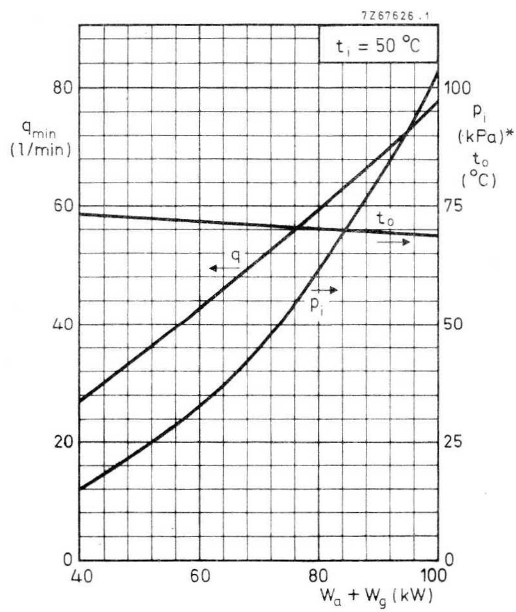
Net mass : approx. 17 kg




7Z07953.1
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
0A
0
2
4
6
8
10
12
14
16
V_a (kV)

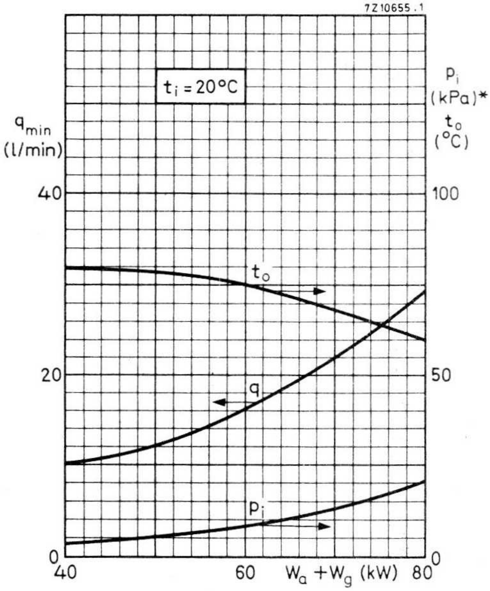
YD1202

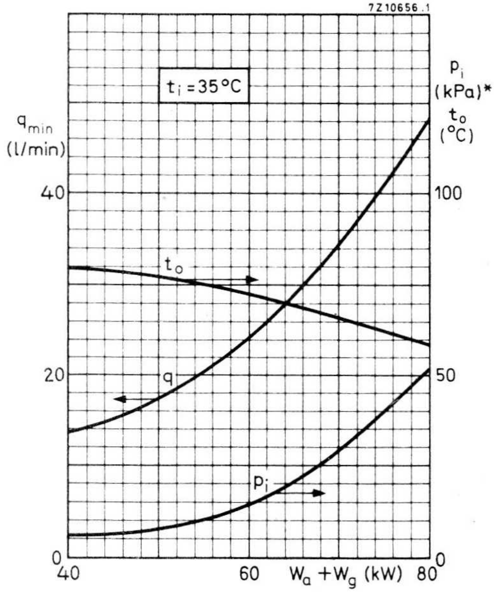


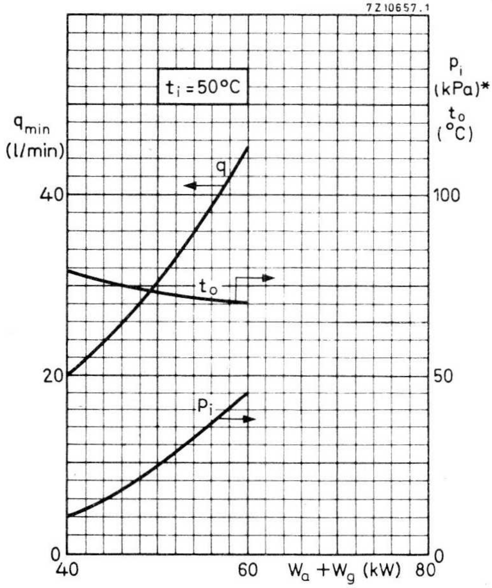


* 100 kPa ≈ 1 at

YD1203







* 100 kPa ≈ 1 at

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1212 has an integral water cooler.
The YD1213 is vapour cooled.

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 Operational Recommendations Transmitting Tubes for Communication, 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	°C

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_{fo}		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

[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 = 14 kV, I_a = 10 A

Transconductance	S	190	mA/V
Amplification factor	μ	40	

COOLING

To obtain optimum life, the seal/envelope temperature under normal operating conditions should be kept below 200 °C.

At low frequencies the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of about 0,5 ℓ/min. At higher frequencies, however, an additional airflow of about 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.

YD1212

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 (kPa*)	Outlet temperature t_o (°C)
120	20	60	70	50
	50	90	130	77
80	20	34	30	54
	50	54	55	72
40	20	15	7	60
	50	24	13	70

Absolute max. water inlet temperature	t_i	50	°C
Absolute max. water pressure	p	600	kPa(abs)

YD1213

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 (kPa*)	Outlet temperature t_o (°C)
120	20	59	84	50
80	20	29	20	61
	35	48	51	61
40	20	10	4	81
	35	13,5	6	81
	50	20	10	81

*100 kPa ≈ 1 at.

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 f ≤ 4 MHz	type	40694	net mass	270	g
f > 4 MHz	type	40737	net mass	525	g
Boiler condenser (YD1213 only)	type	K733	net mass	70	kg

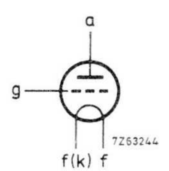
MECHANICAL DATA

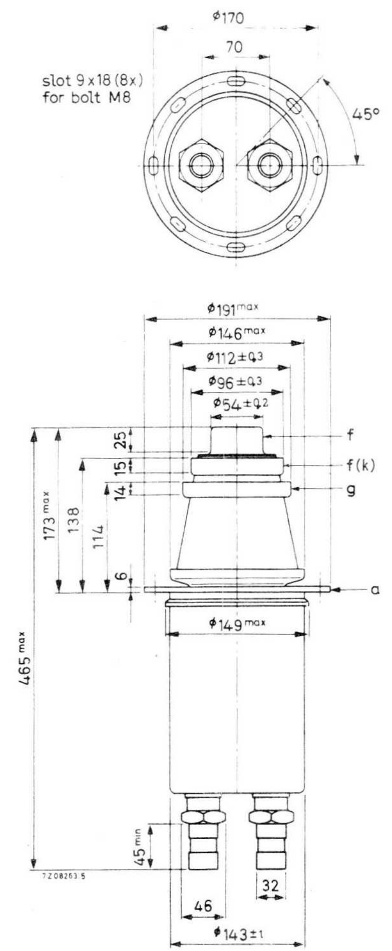
Dimensions in mm

YD1212

Mounting position : vertical with anode up or down

Net mass : approx. 15,6 kg





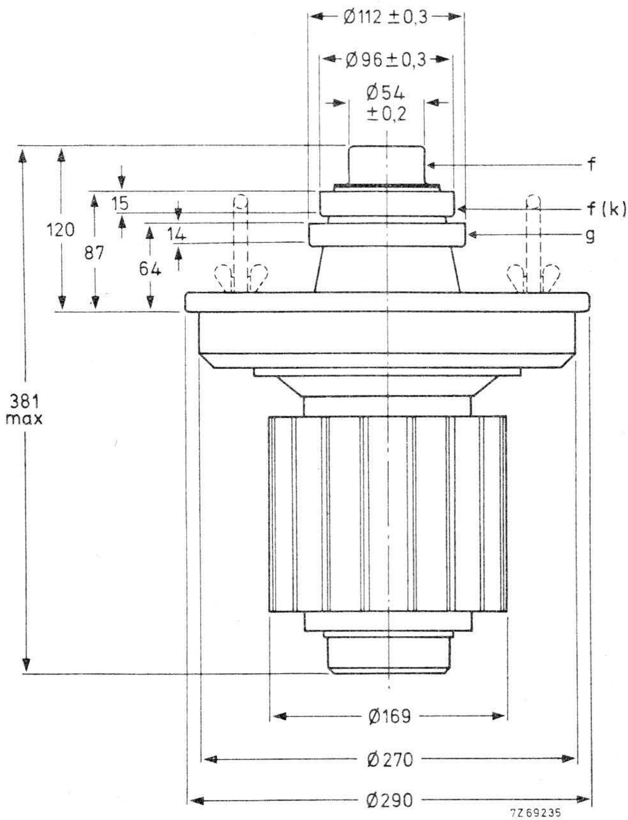
Thread of water connections BSP $1\frac{1}{4}$ in.

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

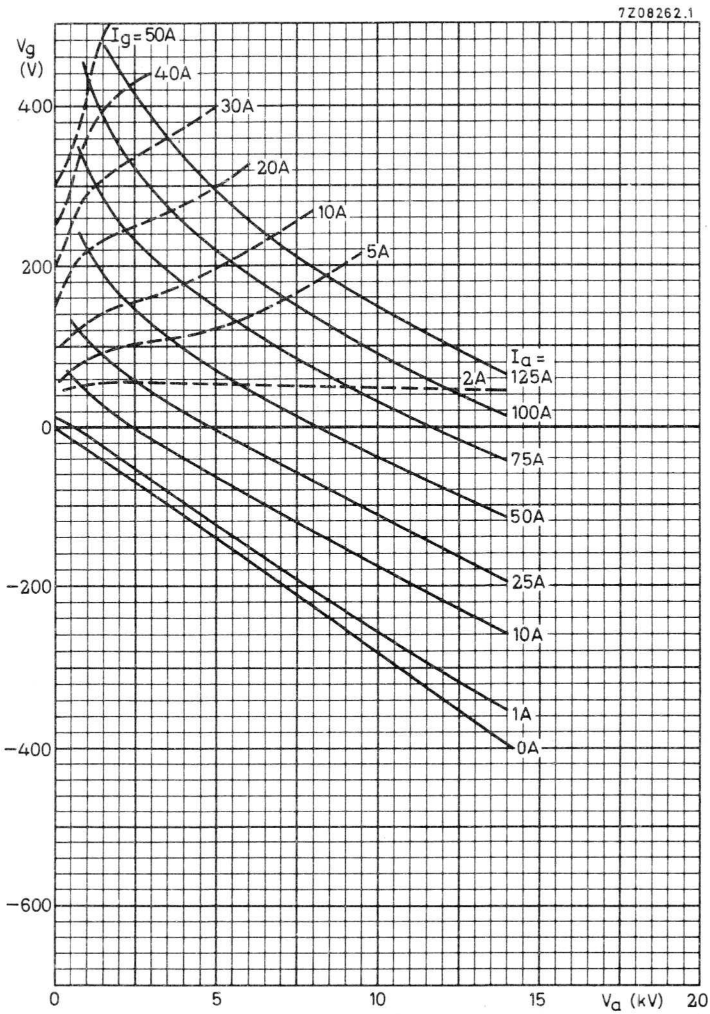
YD1213

Mounting position : vertical with anode down

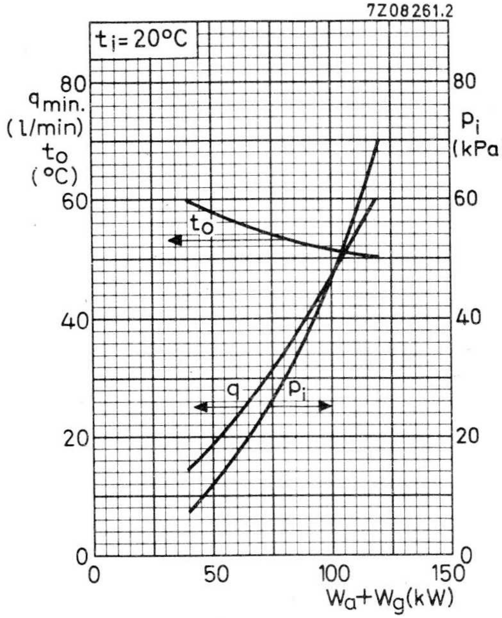
Net mass : approx. 19,8 kg

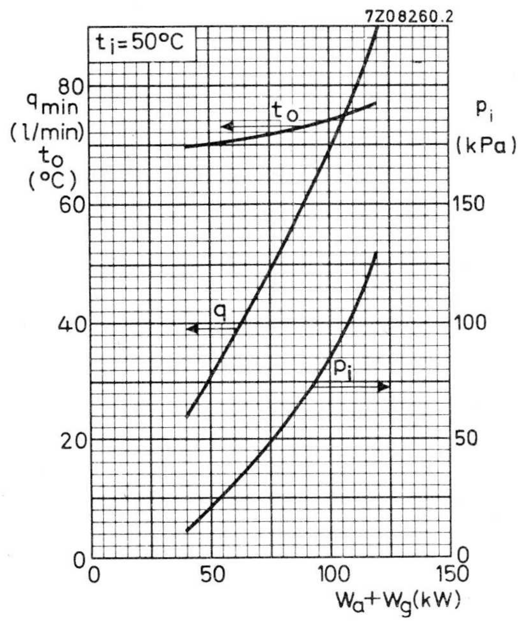


Note: The handles should be removed before switching on the tube.


7Z08262.1
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
0A
0
5
10
15
V_a (kV)
20

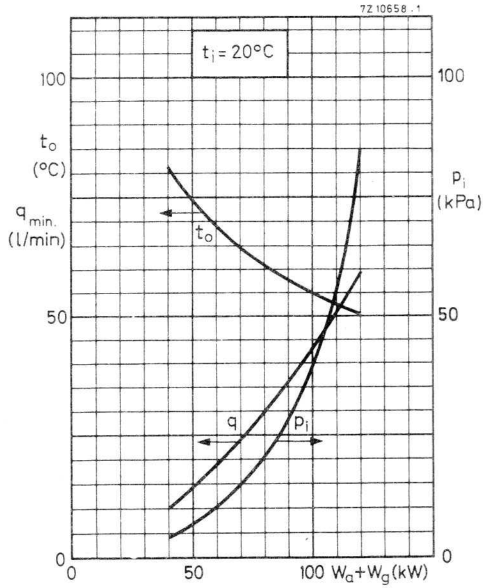
YD1212

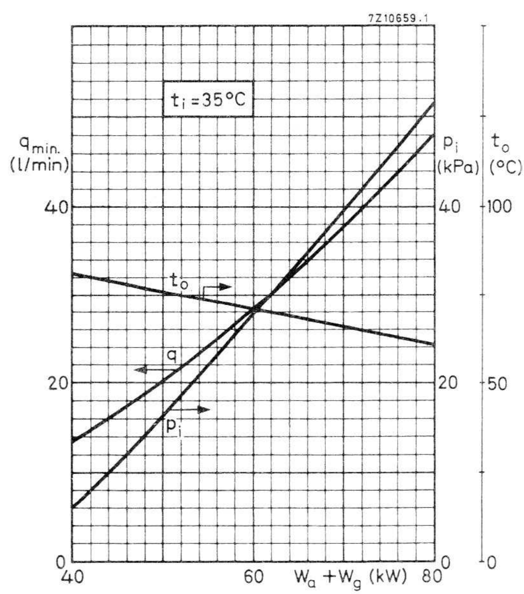




100 kPa ≈ 1 at.

YD1213





100 kPa ≈ 1 at.

AIR COOLED R.F. INDUSTRIAL TRIODE

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}		2.67	kW
Frequency for full ratings	f	max.	250	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	160	27.12	MHz
Filament voltage	V_f	6.0	6.3	V
Oscillator output power (W_o-W_{feedb})	W_{osc}	2.22	2.67	kW
Anode voltage	V_a	4.5	5.0	kV
Anode current	I_a	700	750	mA
Anode input power	W_{ia}	3.15	3.75	kW
Anode dissipation	W_a	0.75	0.83	kW
Anode output power	W_o	2.4	2.9	kW
Anode efficiency	η_a	76	78	%
Oscillator efficiency	η_{osc}	71	71	%
Feedback ratio	V_{gp}/V_{ap}	17	17	%
Grid resistor	R_g	2.2	2.2	kΩ
Grid current, on load	I_g	225	235	mA
Grid voltage, negative	$-V_g$	495	517	V
Grid dissipation	W_g	70	80	W
Grid resistor dissipation	W_{Rg}	111	121	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	250	MHz
Anode voltage	V_a	max.	5.5	kV
Anode current	I_a	max.	1.1	A
Anode input power	W_{ia}	max.	6.0	kW
Anode dissipation	W_a	max.	1.5	kW
Grid voltage	$-V_g$	max.	1.0	kV
Grid current, on load	I_g	max.	280	mA
off load	I_g	max.	400	mA
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	20	kΩ
Cathode current, mean	I_k	max.	1.4	A
peak	I_{kp}	max.	8	A
Envelope temperature	t_{env}	max.	240	°C

HEATING :direct; filament thoriated tungsten

Filament voltage	($f \leq 120$ MHz)	V_f	6.3	V
	($f > 120$ MHz)	V_f	6.0	V
Filament current at	$V_f = 6.3$ V	I_f	33	A

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

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 reamains below the funamental 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}	17	pF
Anode to grid	C_{ag}	14	pF

CHARACTERISTICS measured at $V_a = 2.0$ kV, $I_a = 0.5$ A

Transconductance	S	10	mA/V
Amplification factor	μ	20	

COOLING

See cooling curves.

A low velocity air flow directed to the seals may be required.

To obtain optimum life, the temperature of the seals and of the envelope should, under normal operating conditions, be kept below 200 ^{o}C.

To maintain these temperatures additional cooling maybe necessarey. At frequencies higher than about 4 MHz cooling of the seals becomes mandatory.

ACCESSORIES

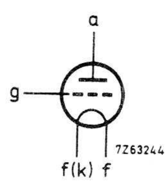
Filament connector		type	40688
Filament/cathode connector		type	40689
Grid connector	f < 30 MHz	type	40686
	f > 30 MHz	type	40687

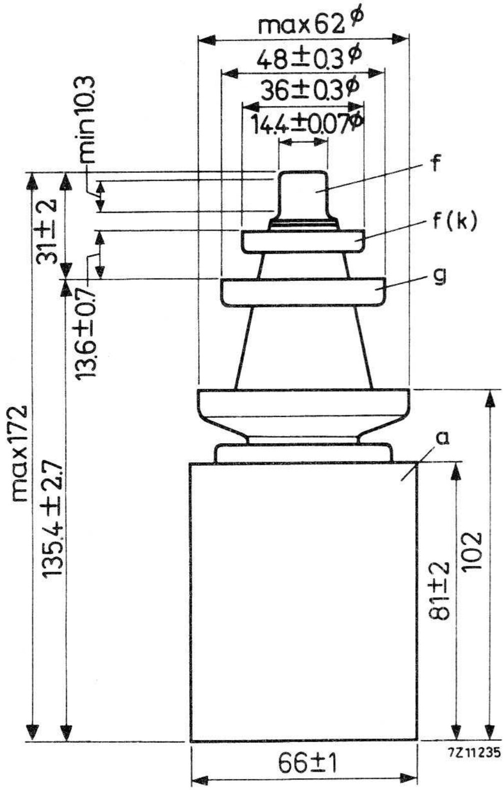
MECHANICAL DATA

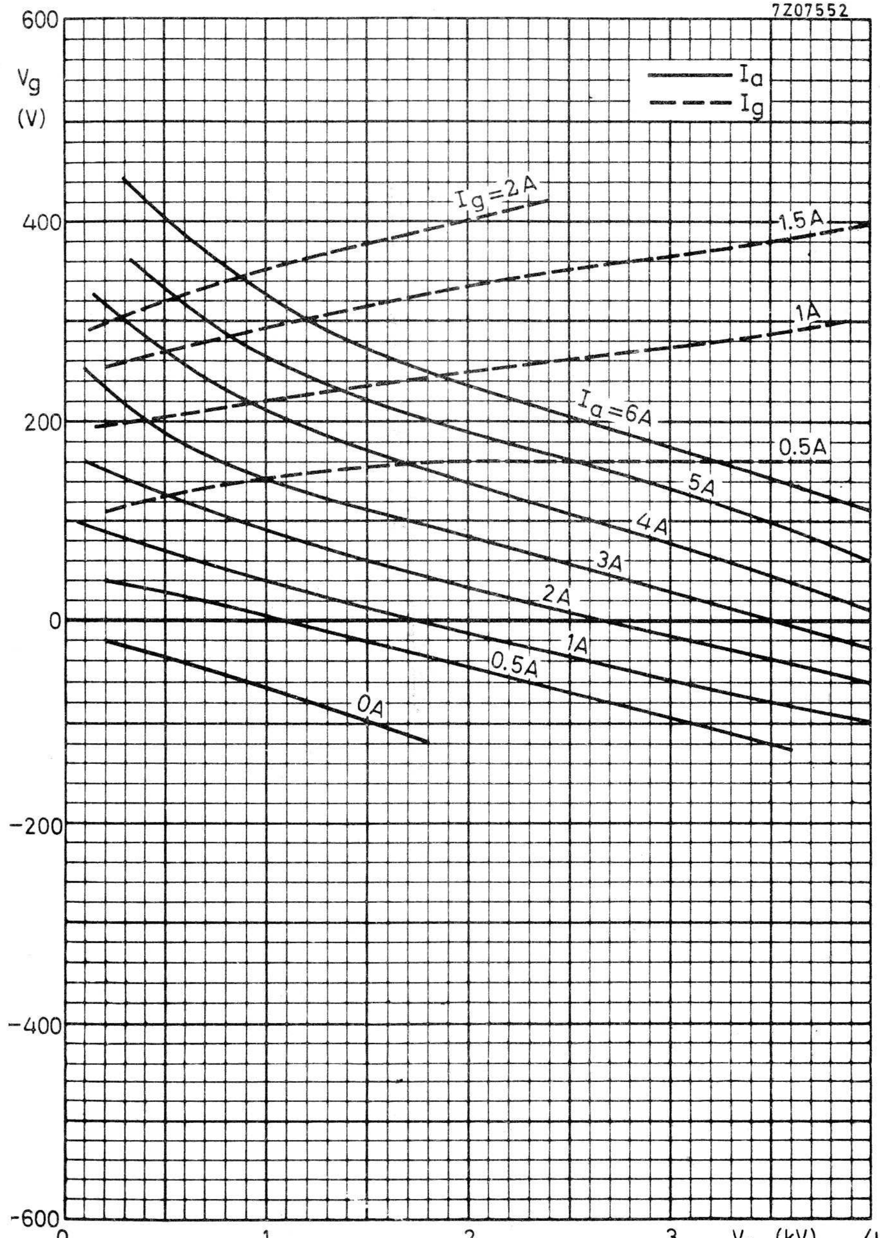
Dimensions in mm

Mounting position: vertical with anode up or down.

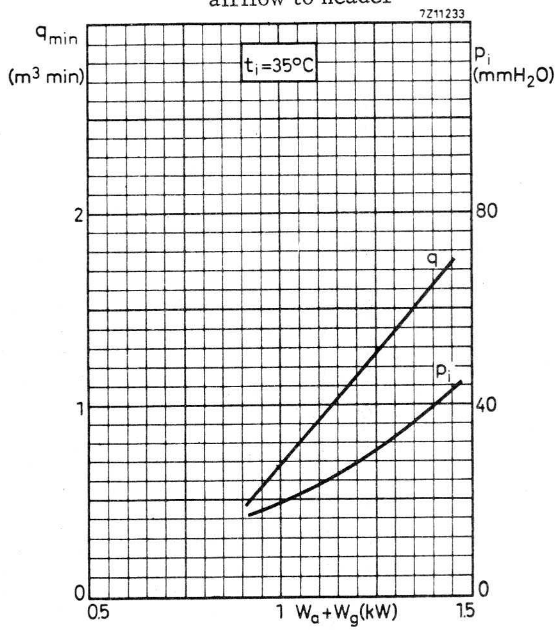
Net weight: approx. 1.13 kg



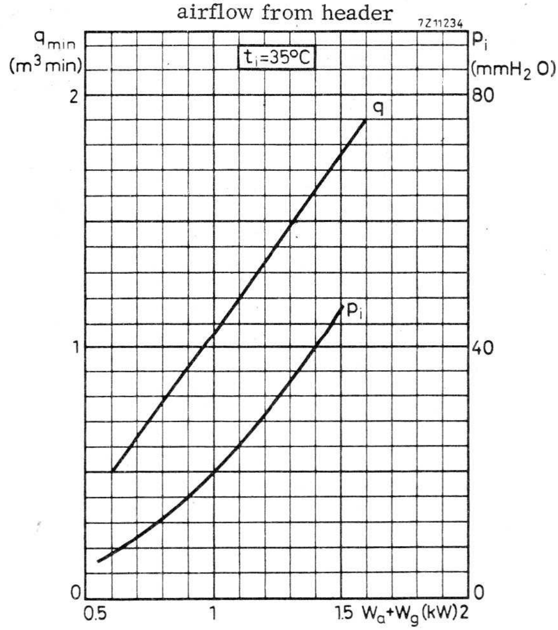



7Z07552
600
400
200
0
-200
-400
-600
V_g
(V)
Ia
Ig
Ig=2A
1.5A
1A
0.5A
Ia=6A
5A
4A
3A
2A
1A
0.5A
0A
0
1
2
3
4
V_a (kV)

airflow to header



airflow from header



AIR COOLED R.F. POWER TRIODE

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

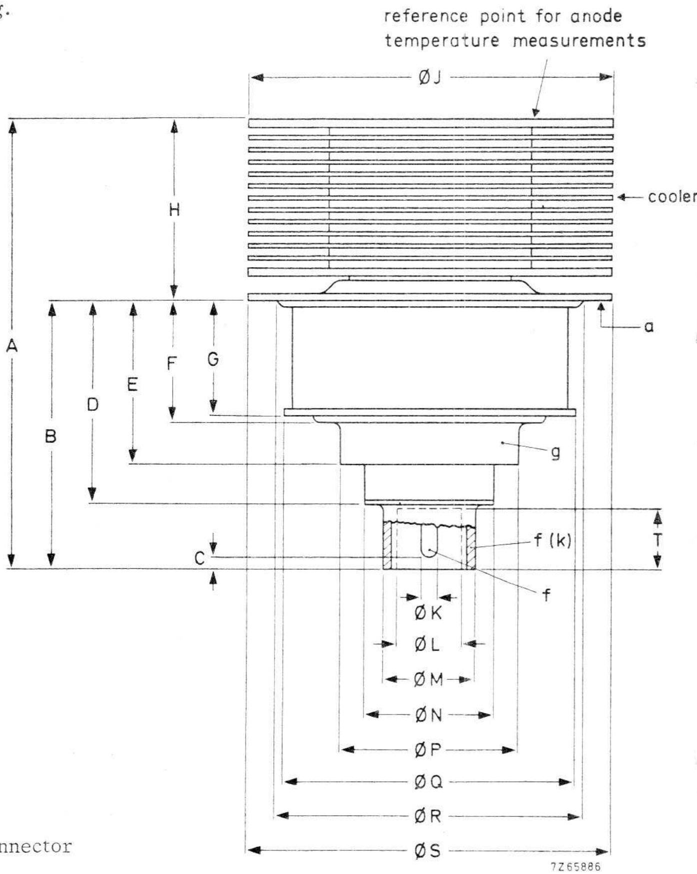
Recommended air duct see page 4.

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	-	$\leqslant$ -52	dB
Differential phase		$\leqslant$ 2	[5] $\leqslant$ 2	°
Differential gain		$\geqslant$ 96	[5] $\geqslant$ 96	%

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

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

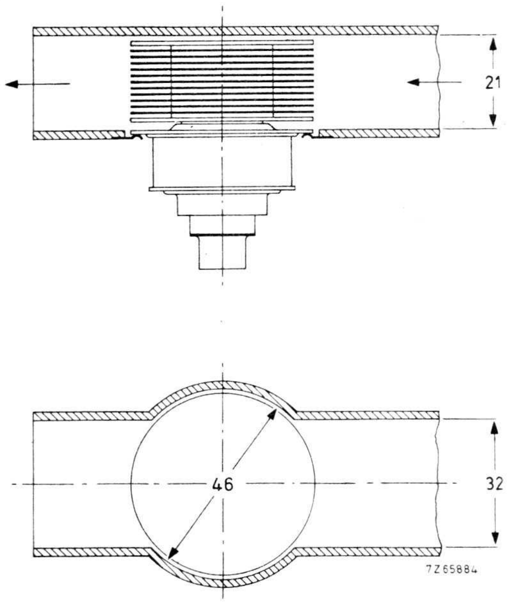
[3] To be adjusted for the stated no-signal anode current.

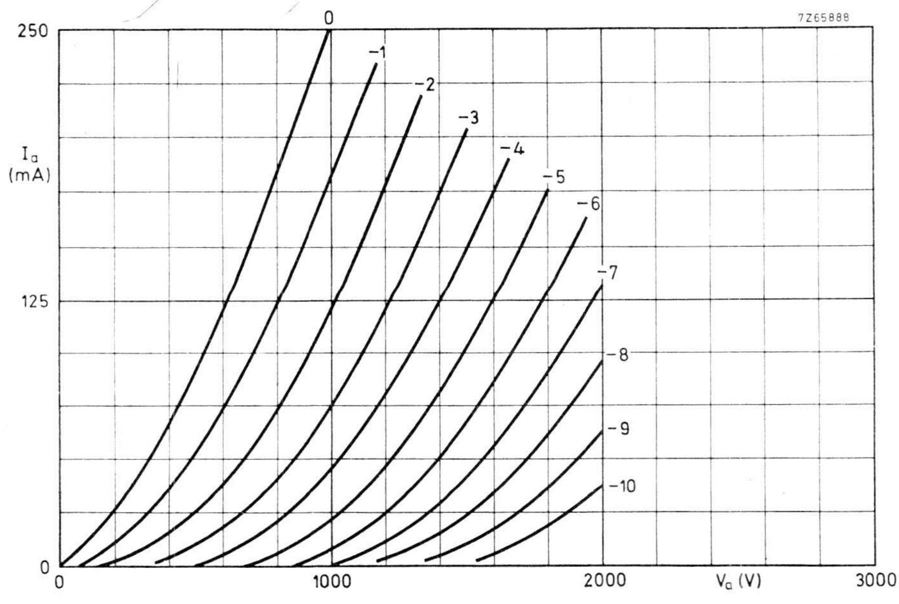
[4] Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB with respect to the sum signal amplitude of the composite signal).
Stated figure applies to a vision-to-sound power ratio of 5 : 1.
For a vision-to sound power ratio of 10 : 1: IM products $\leqslant$ -55 dB.

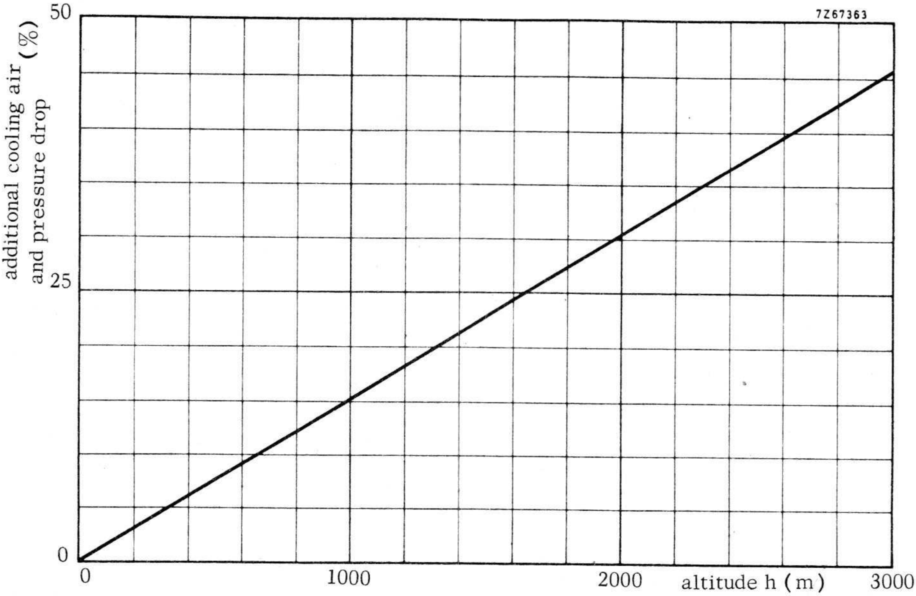
[5] Measured with a saw-tooth amplitude running from 17 % to 75 % of the peak sync value, with superimposed a 4,43 MHz sinewave with a 10% peak-to-peak value.

Recommended air duct

Dimensions in mm






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

AIR COOLED R.F. POWER TRIODE

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	°C
Absolute max, anode temperature at reference point	t_a	max.	100	°C

[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

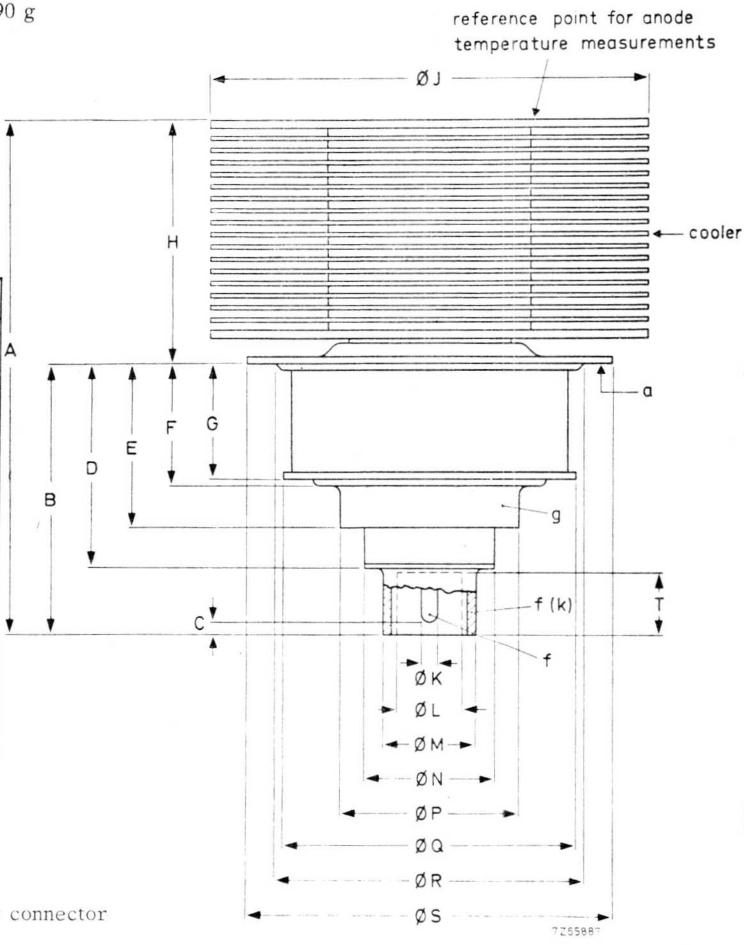
Recommended airduct see page 4.

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

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.

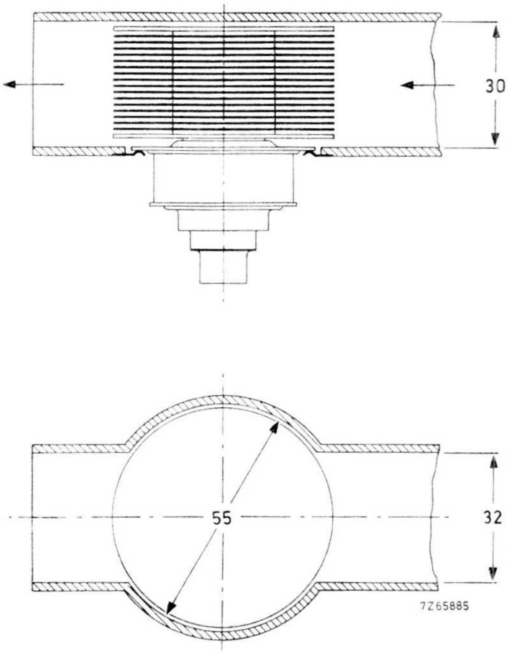
2) To be adjusted for the stated no-signal anode current.

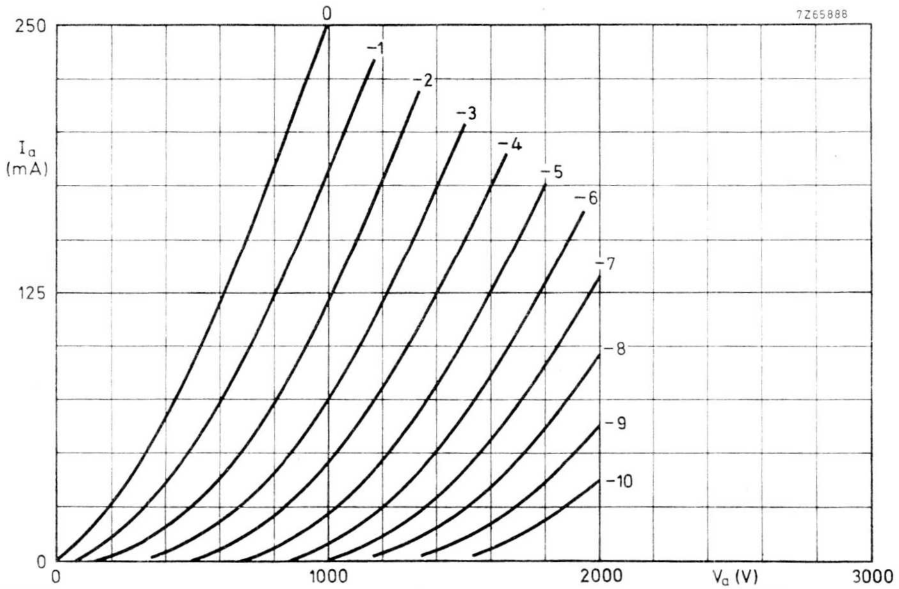
3) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -16 dB with respect to the sum signal amplitude of the composite signal).
Stated figure applies to a vision to sound power ratio of 5 : 1.
For a vision to sound power ratio of 10 : 1 : IM products ≤ -56 dB.

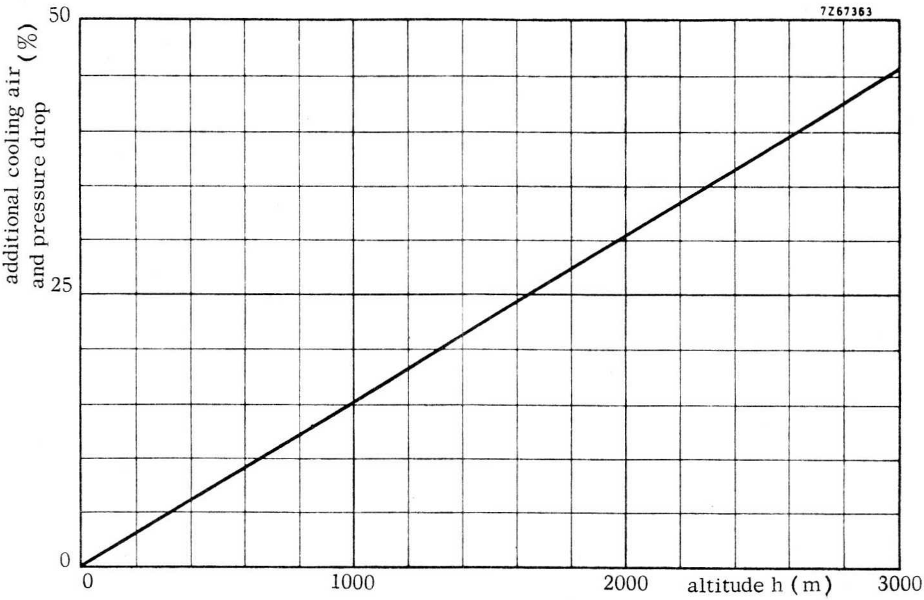
4) Measured with a saw-tooth amplitude running from 17 % to 75 % of the peak sync value, with superimposed a 4,43 MHz sinewave with a 10 % peak-to-peak value.

Recommended airduct

Dimensions in mm






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

CONDUCTION COOLED R.F. POWER TRIODE

Conduction cooled coaxial power triode in metal-ceramic construction primarily intended for use as an 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	1200	V
Output power in load	W_ℓ	25	W
Power gain	G	19	dB

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

Heater voltage [1]	V_f		5	V ± 5% [2]
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	1200	V
Anode current	I_a	150	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		see curve page 4		

Notes see page 3.

COOLING

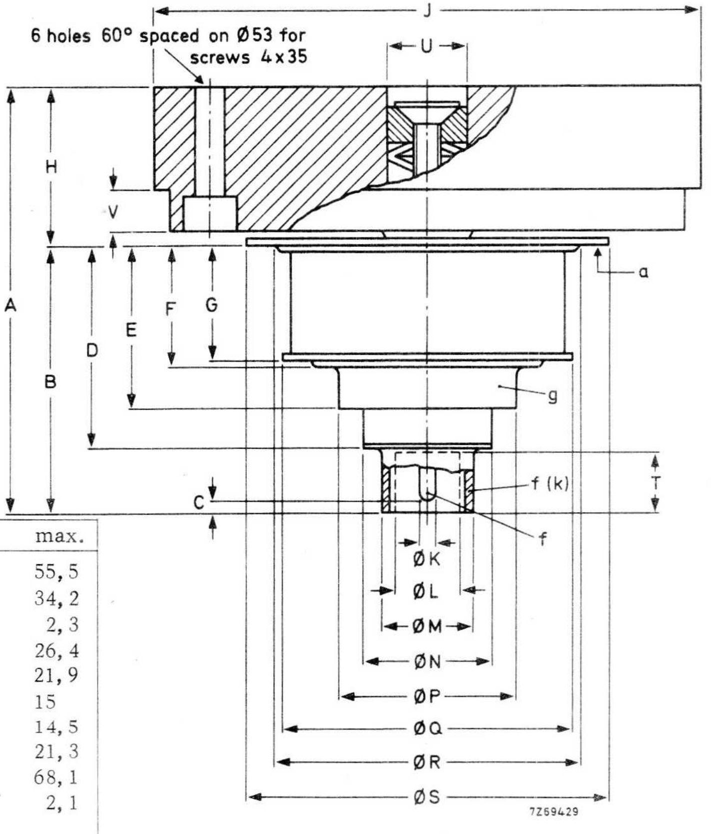
Anode cooling conduction-convection

The anode is fitted with an aluminium flange, which permits the mounting of a radiator for convection cooling.

MECHANICAL DATA

Dimensions in mm

Mounting position : any
Net mass : approx. 230 g



	min.	max.
A	52,5	55,5
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	20,3	21,3
J	67,9	68,1
K	1,9	2,1
L	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	7,5	
U		10,6

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.	150	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	200	mA

OPERATING CONDITIONS, grounded grid

		CCIR standard G[3]	
Frequency	f	470 to 860	MHz
Bandwidth (−1 dB)	B	9	MHz
Anode voltage	V_a	1200	V
Grid voltage [4]	V_g	−4,5	V
Grid current	I_g	≈ 0	mA
Anode current, no signal	I_a	100	mA
Driving power (sync)	W_{dr}	0,3	W
Output power in load	W_ℓ	25	W
Power gain	G	20	dB
Intermodulation products with respect to peak sync level [5]	d	−56 < −52	dB dB

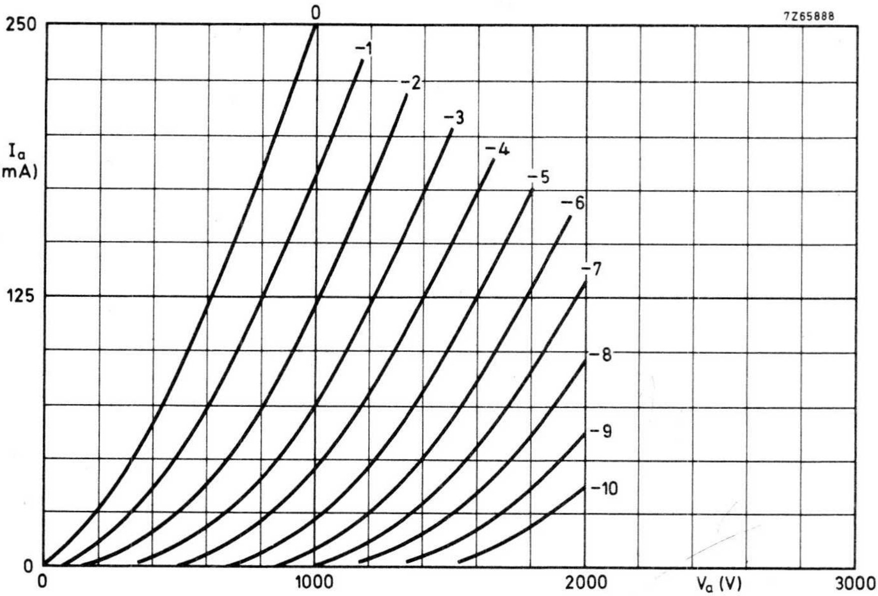
[1]) After the circuit has been adjusted for proper tube operation, the heater voltage should be reduced (depending on frequency and operating conditions) to prevent overheating of the cathode by back bombardment (resulting in short life).

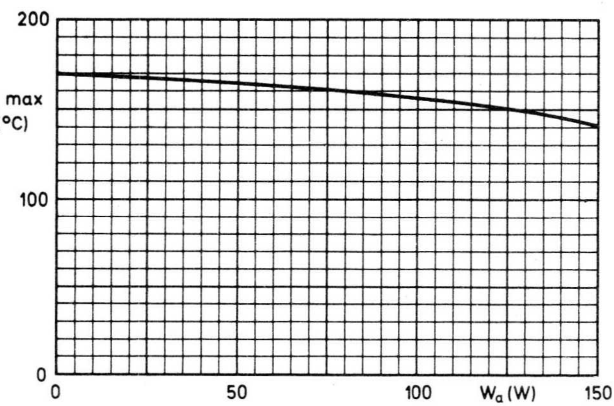
[2]) For optimum performance (linearity) the voltage set must be maintained within ±2%.

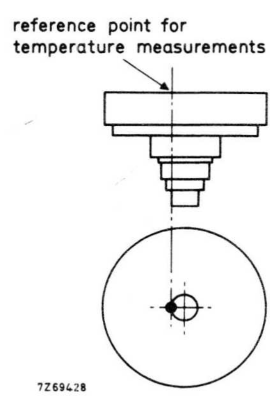
[3]) Negative modulation, positive synchronization, combined sound and vision.

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

[5]) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −17 dB with respect to the sum signal amplitude of the composite signal). Figures apply to a vision to sound power ratio of 5 : 1.


7Z65888
250
125
0
I_a (mA)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
0
1000
2000
V_a (V)
3000


200
100
0
t_a max (°C)
0
50
100
W_a (W)
150


reference point for temperature measurements
7Z69428

AIR COOLED R.F. POWER TRIODE

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	^oC

To obtain optimum life, this temperature should not exceed 200 ^oC.

[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

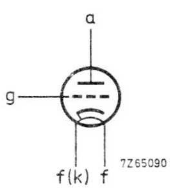
Anode: forced air

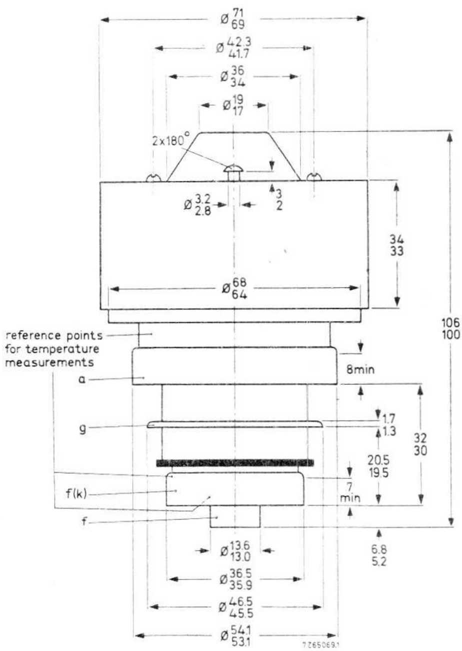
W_a (W)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
1800	25	2	180

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

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		$\approx$ 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.

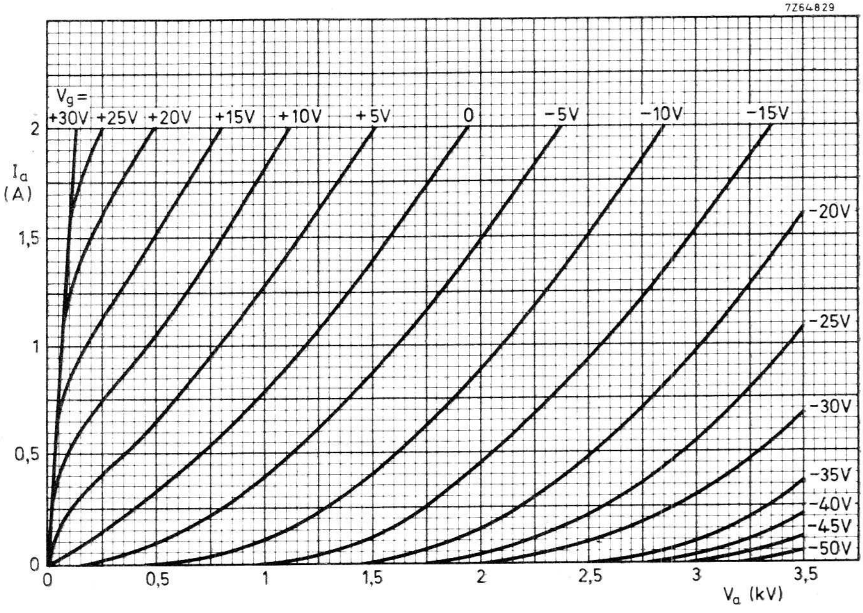
[2]) Negative modulation, positive synchronization, combined sound and vision.

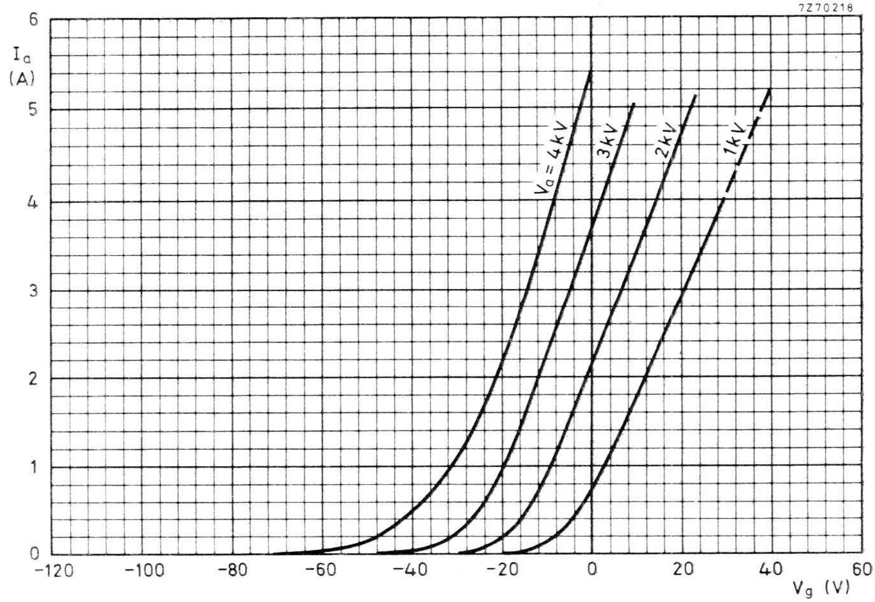
[3]) R.F. driving power should be applied after the heater and electrode voltages.

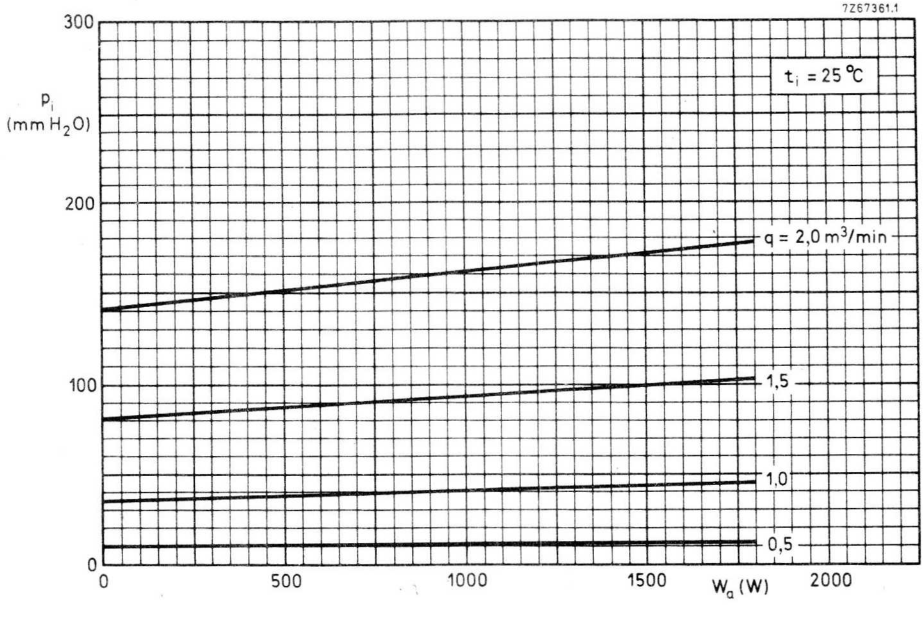
[4]) To be adjusted for the stated no-signal anode current. Range values for equipment design -15 to -45 V.

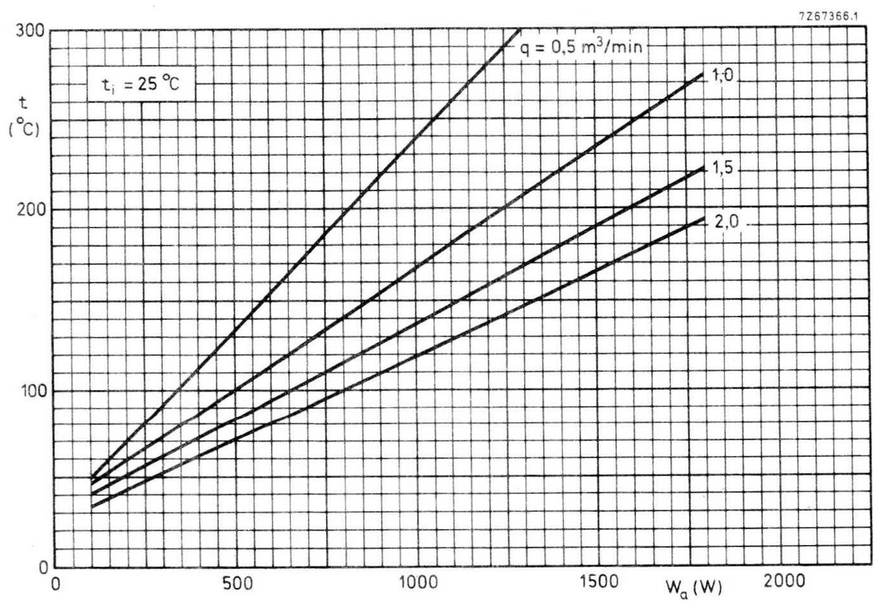
[5]) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync level = 0 dB).

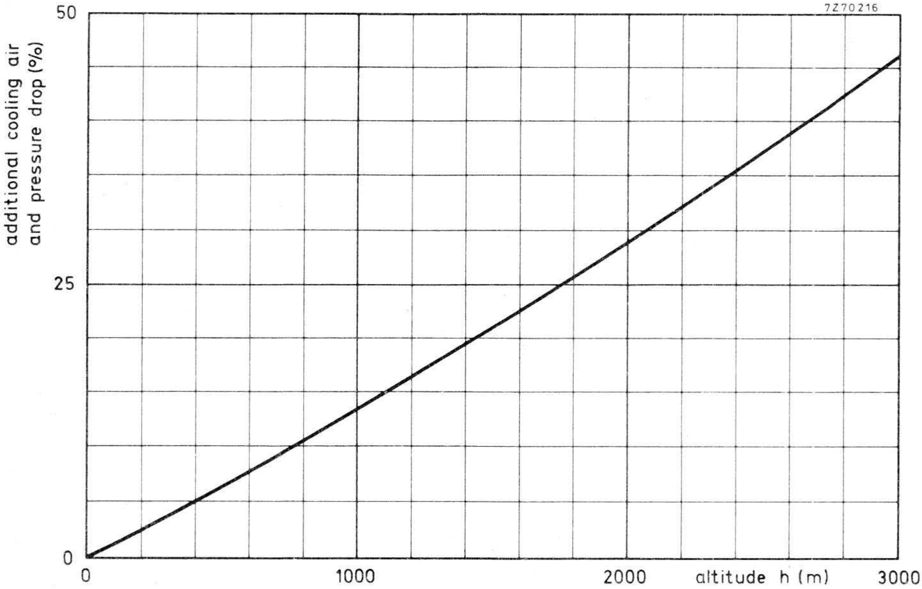
[6]) Three-tone test method (vision carrier -8 dB, sound carrier -10 dB, sideband signal -16 dB with respect to peak sync level = 0 dB).

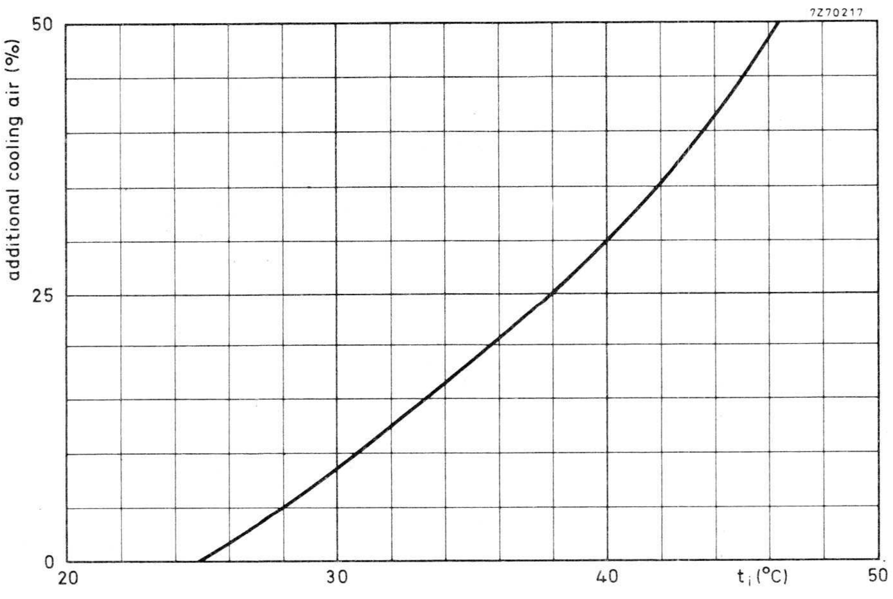

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


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)


7Z67361.1
300
p_i
($mm\,H_2O$)
200
100
0
0
500
1000
1500
2000
W_a (W)
t_i = 25 °C
q = 2,0 m³/min
1,5
1,0
0,5


7Z67366.1
300
t
(°C)
200
100
0
0
500
1000
1500
2000
W_a (W)
t_i = 25 °C
q = 0,5 m³/min
1,0
1,5
2,0


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

AIR COOLED R.F. POWER TRIODE

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

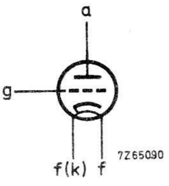
W_a (W)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
900	25	1,5	31

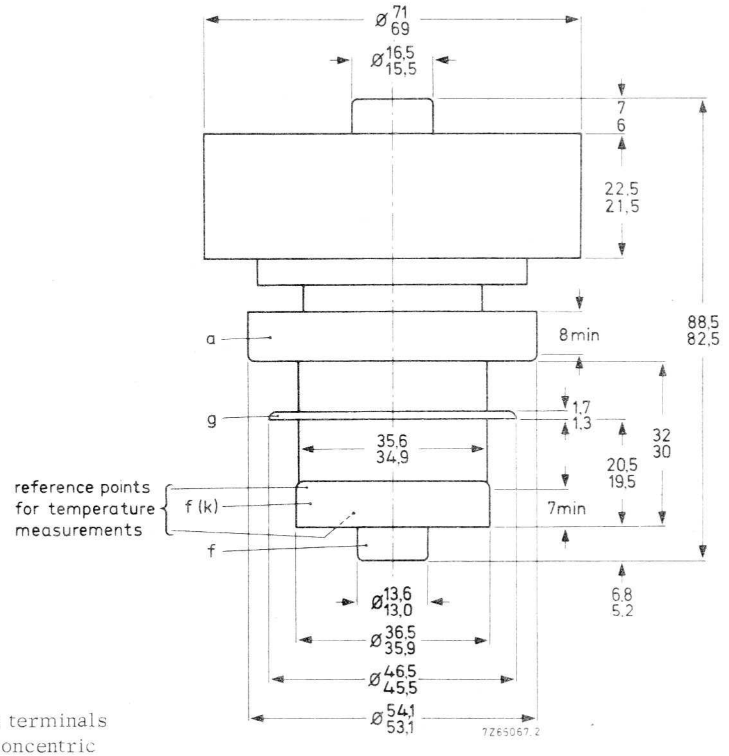
Other terminals: low velocity airflow.

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)

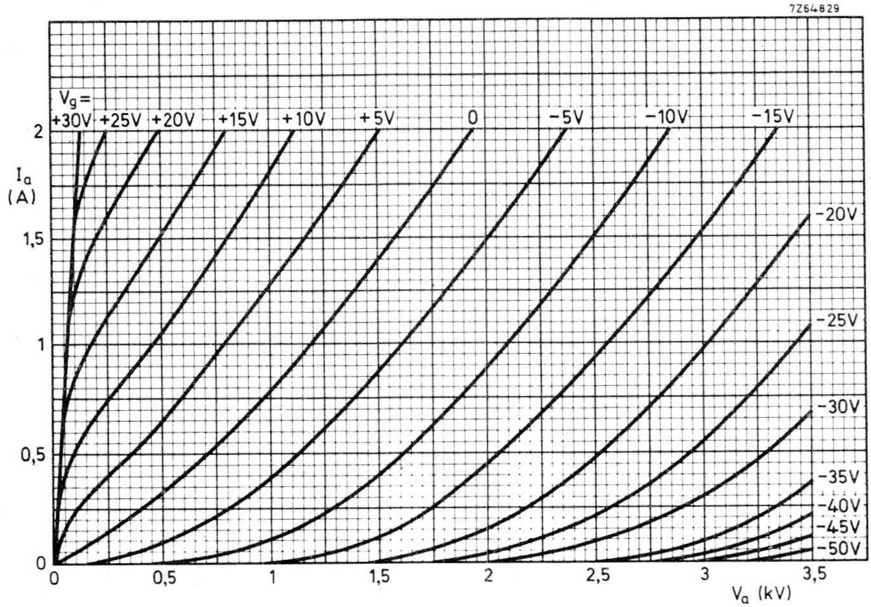
Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	900	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA

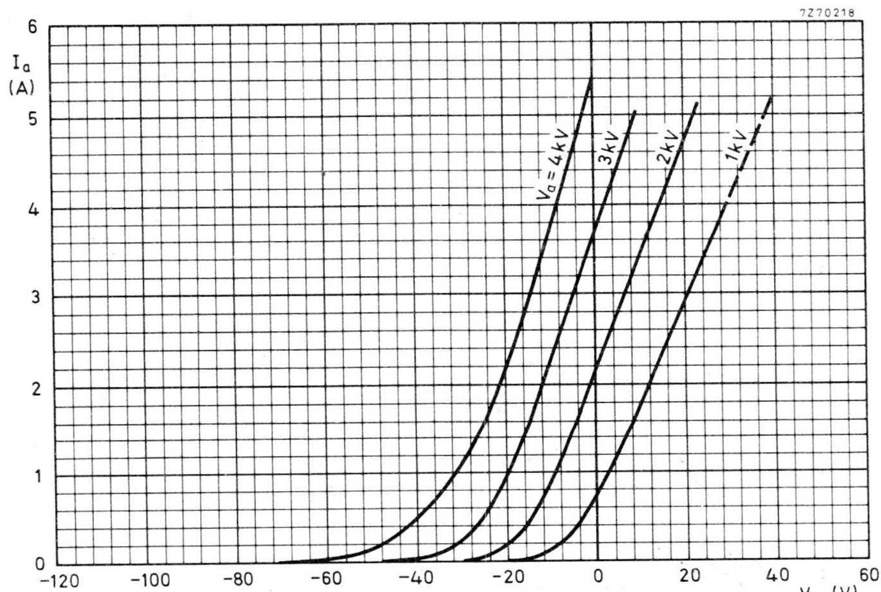
OPERATING CONDITIONS [1]

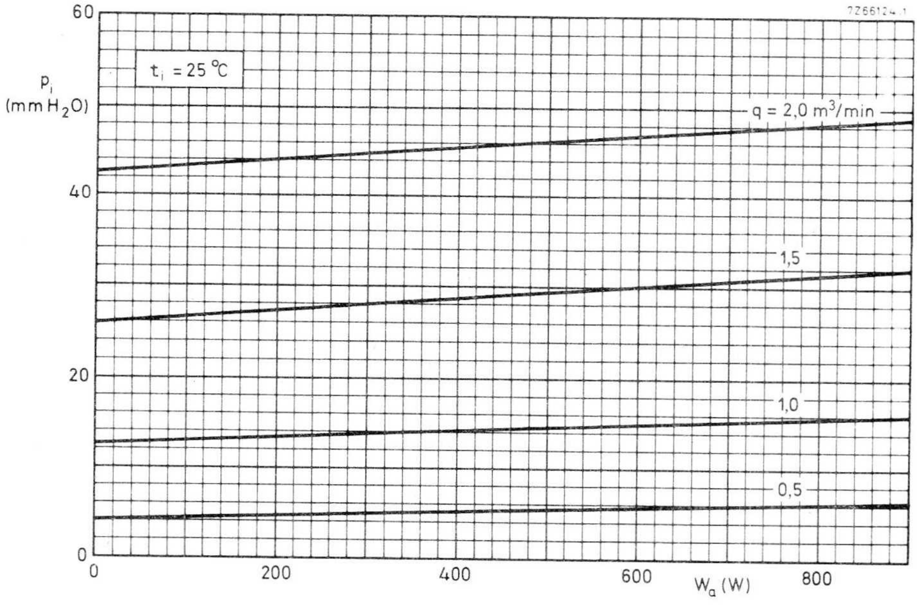
Frequency	f	174 to	860	MHz
Anode voltage	V_a		2700	V
Grid voltage [2]	V_g		-28	V
Anode current, no signal	I_a		200	mA
Anode current	I_a		350	mA
Grid current	I_g		0	mA
Driver output power	W_{dr}		8	W
Output power in load	W_ℓ		300	W
Power gain	G		16	dB

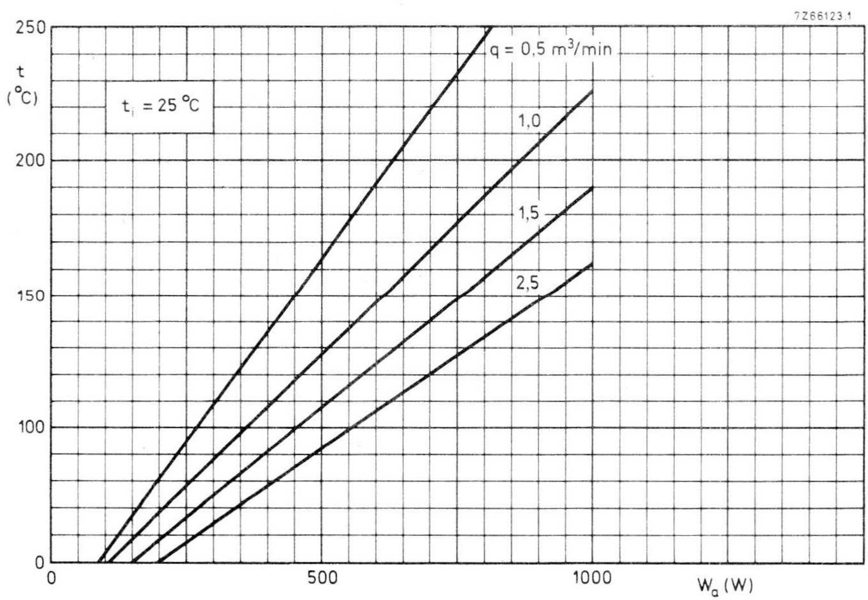
[1] R.F. driving power should be applied after the heater and electrode voltages.

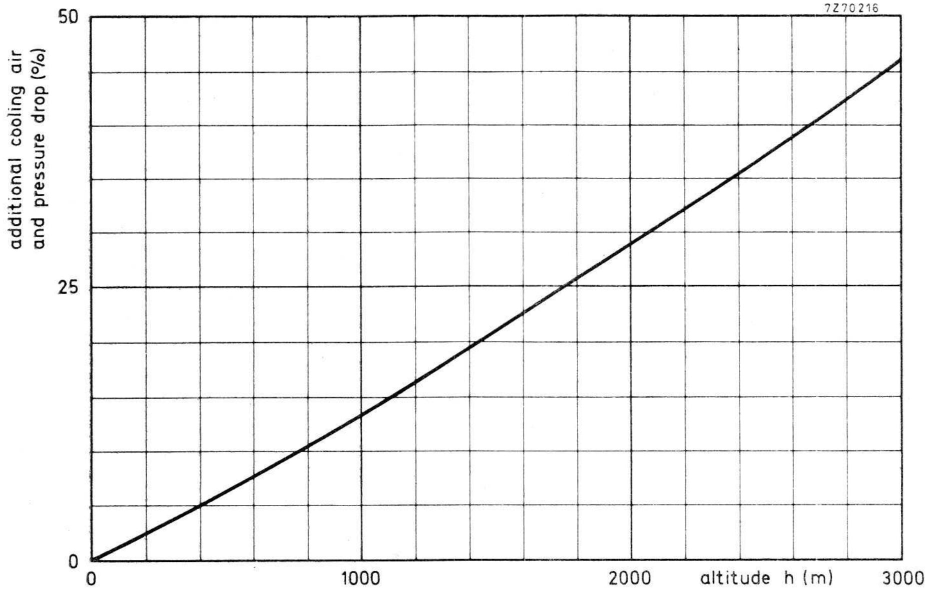
[2] To be adjusted for the stated no-signal anode current. Range values for equipment design -15 to -40 V. For "automatic bias" the cathode resistor range is 80 to 180 Ω.

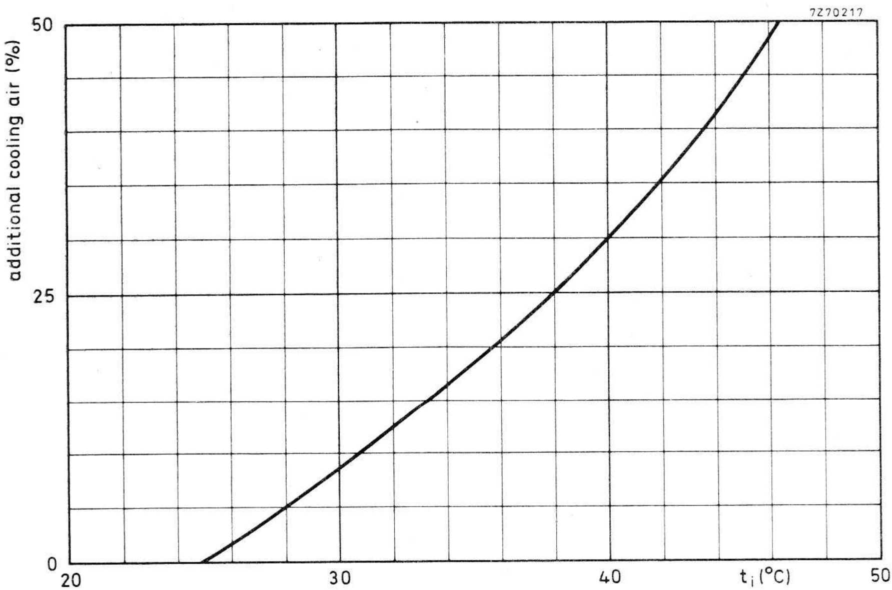

7Z64829
$V_g =$
+30V
+25V
+20V
+15V
+10V
+5V
0
-5V
-10V
-15V
-20V
-25V
-30V
-35V
-40V
-45V
-50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
6
5
4
3
2
1
0
$V_a = 4$kV
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

AIR COOLED R.F. POWERTRIODE

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 the load (sync)	W_ℓ	110	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	2	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	°C

To obtain optimum life, this temperature should not exceed 200 °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)
1000	25	0,7	2

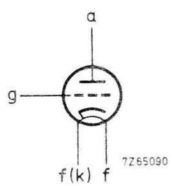
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

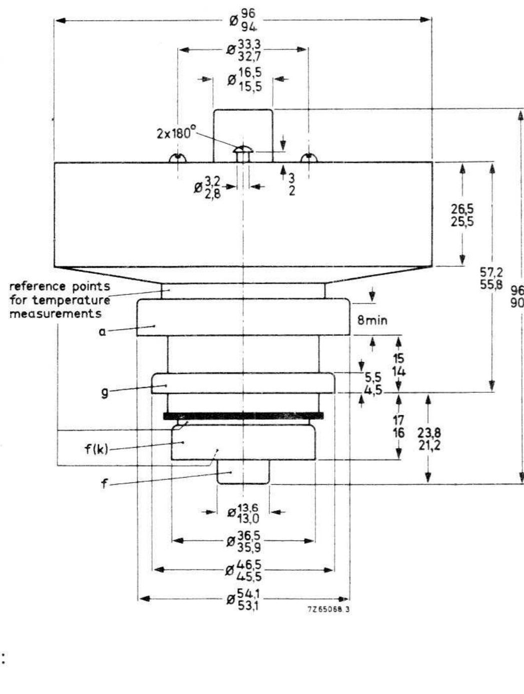
MECHANICAL DATA

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

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		CCIR-G	
Frequency	f	470 to 860	MHz
Anode voltage	V_a	2500	V
Grid voltage [4]	V_g	-25	V
Anode current, no signal [4]	I_a	200 to 300	mA
Anode current at zero dB level (vision carrier)	I_a	420 (<500)	mA
Grid current	I_g	≈ 0	mA
Driver output power (sync)	W_{dr}	4	W
Output power in load (sync)	W_ℓ	110	W
Power gain	G	16,5	dB
Intermodulation products	d	-60	dB
		< -58	dB

---

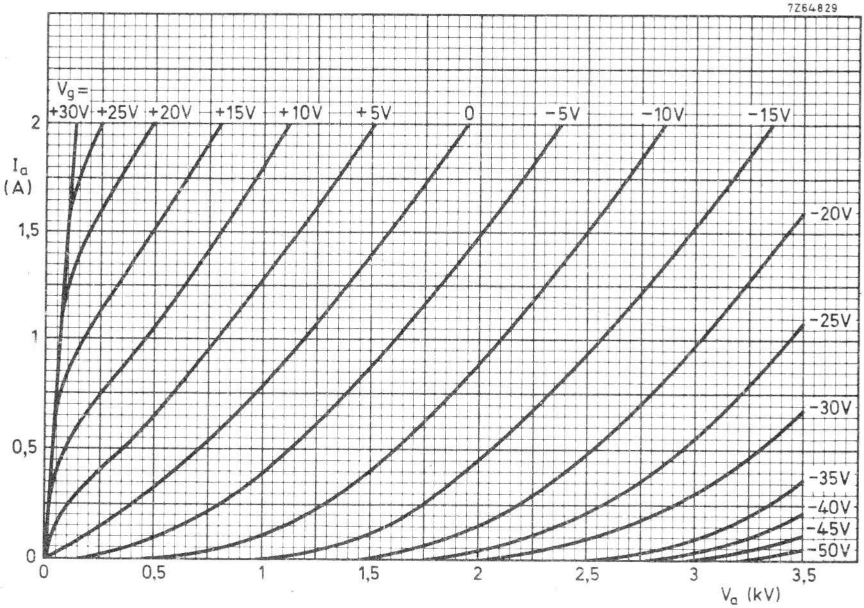
1) During a short period, for adjustment of the transmitter, I_k max. = 700 mA.

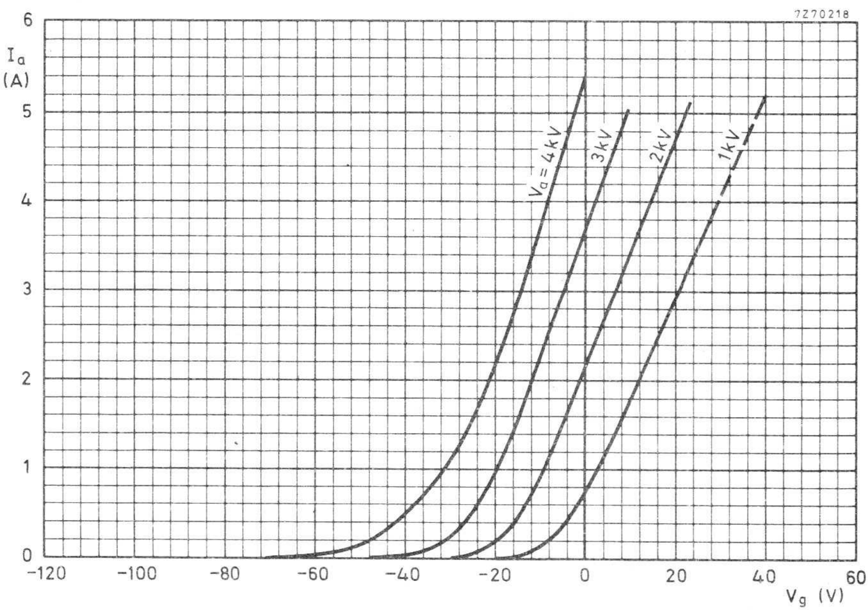
2) Negative modulation, positive synchronization, combined sound and vision.

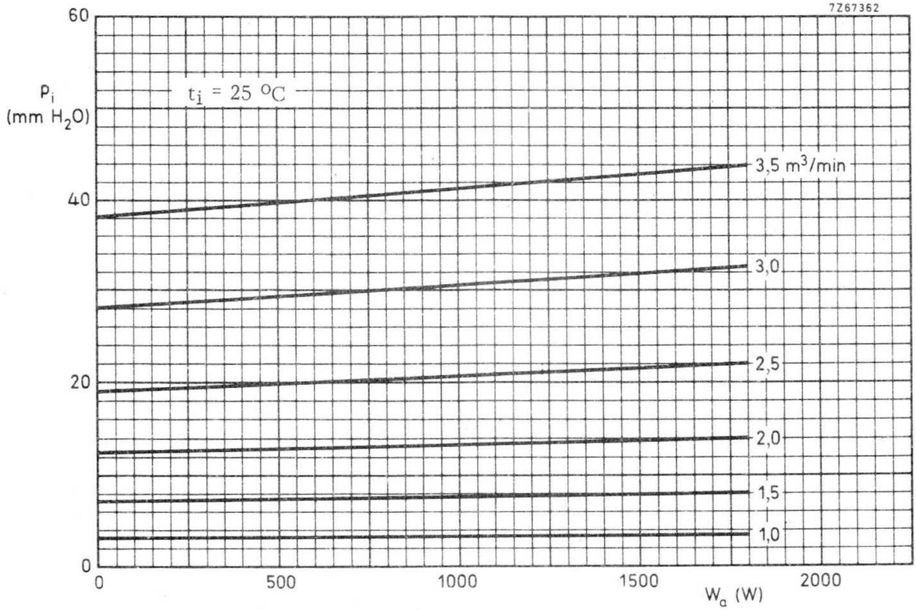
3) R.F. driving power should be applied after the heater and electrode voltages.

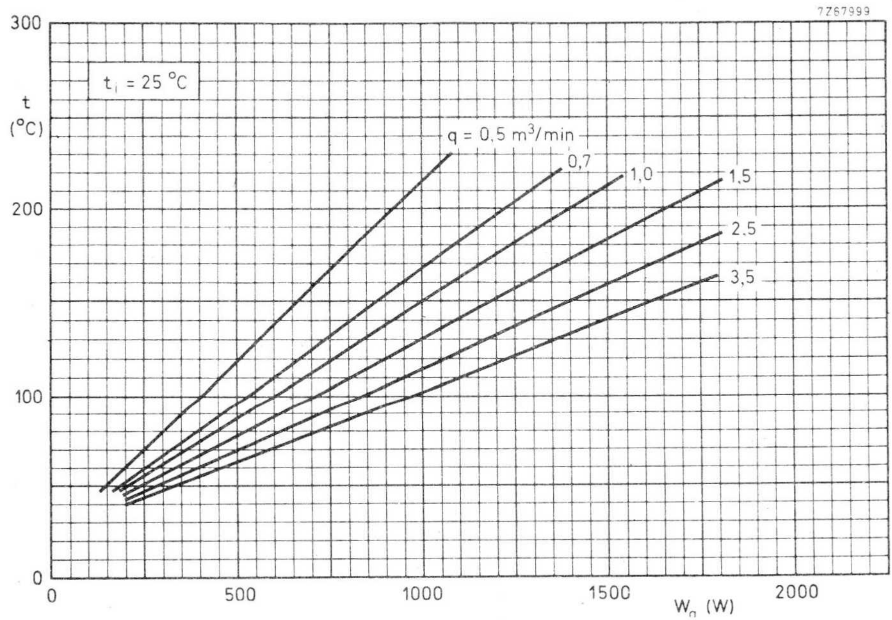
4) To be adjusted for the zero-signal anode current stated on the measuring report supplied with each tube.
Range values for equipment design -10 to -40 V.
The stated no-signal anode current results in optimum linearity.

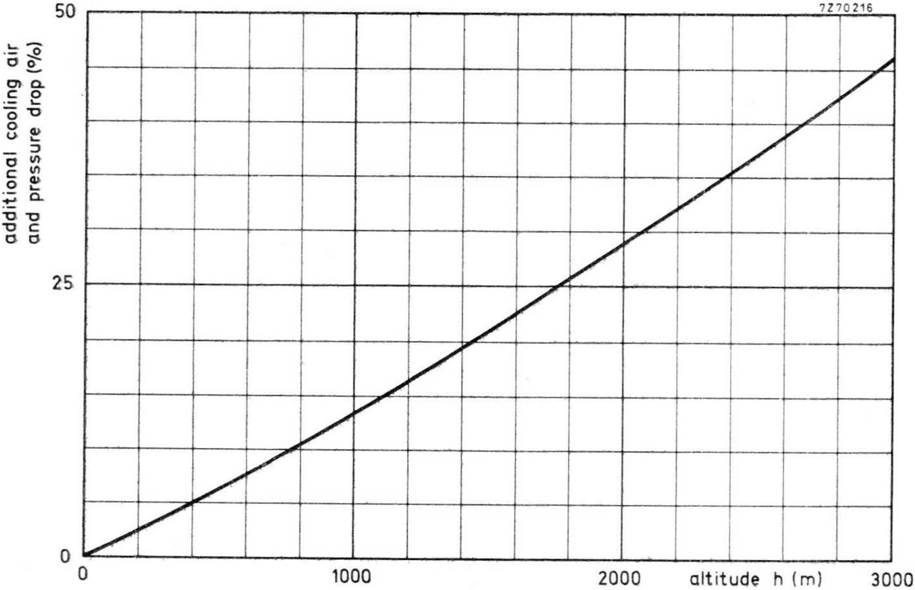
5) Three-tone method (vision carrier -8 dB, sound carrier -10 dB, sideband signal -16 dB with respect to peak sync level = 0 dB).

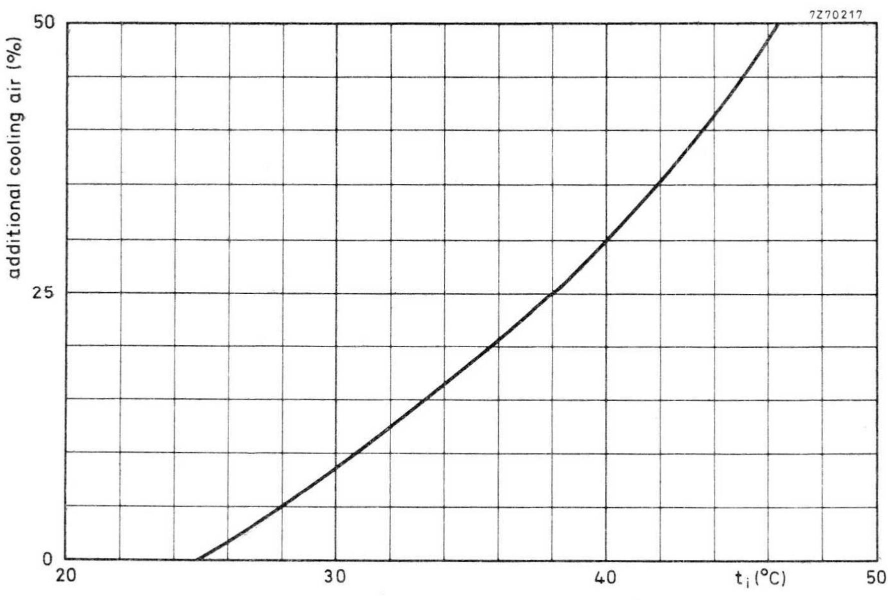

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
0
0,5
1
1,5
2
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
0
1
2
3
4
5
6
V_a = 4kV
3kV
2kV
1kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)


7Z67362
p_i (mm H_2O)
t_i = 25 °C
3,5 m³/min
3,0
2,5
2,0
1,5
1,0
0
20
40
60
0
500
1000
1500
2000
W_a (W)


7Z67999
t (°C)
t_i = 25 °C
q = 0,5 m³/min
0,7
1,0
1,5
2,5
3,5
0
100
200
300
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

AIR COOLED R.F. POWER TRIODE

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

QUICK REFERENCE DATA			
Frequency	f	470 to 860	MHz
Anode voltage	V_a	3500	V
Output power in the load (sync - CCIR-G)	W_ℓ	550	W
(peak white - CCIR - L)	W_ℓ	550	W
Power gain	G	15	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	^{o}C

To obtain optimum life this temperature should not exceed 200 ^{o}C.

[1]) For optimum performance as TV broadband amplifier (linearity) the voltage set must be maintained within ± 2%.

Data based on pre-production tubes.

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

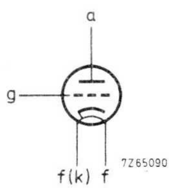
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

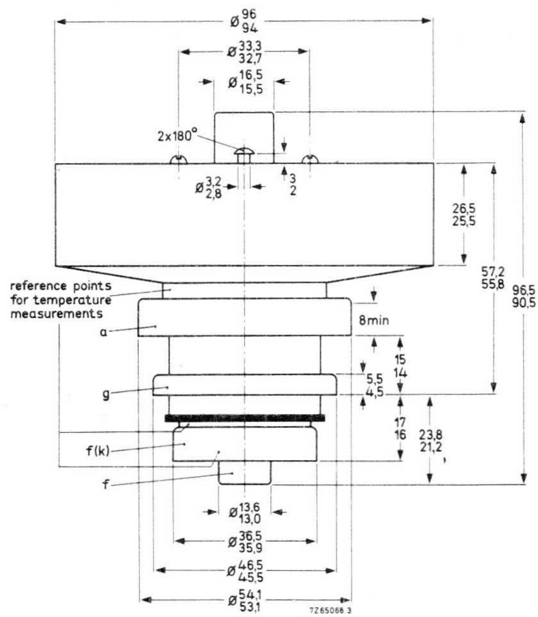
MECHANICAL DATA

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

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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3800	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	1900	W [1]
Grid current	I_g	max.	± 5	mA
Cathode current	I_k	max.	700	mA [1]

OPERATING CONDITIONS grounded grid [2]

Standard		CCIR-G	CCIR-L	
Frequency	f	470 to 860	470 to 860	MHz
Anode voltage	V_a	3500	3500	V
Grid voltage [3]	V_g	-38	-38	V
Anode current, no signal	I_a	250	250	mA
Anode current at average grey level	I_a	≈ 500	≈ 500	mA
Grid current	I_g	≈ 0	≈ 0	mA
Driver output power, sync	W_{dr}	21		W
peak white	W_{dr}		21	W
Output power in load, sync	W_ℓ	550		W
peak white	W_ℓ		550	W
Power gain	G	15	15	dB
Differential gain		95	95	% [4]

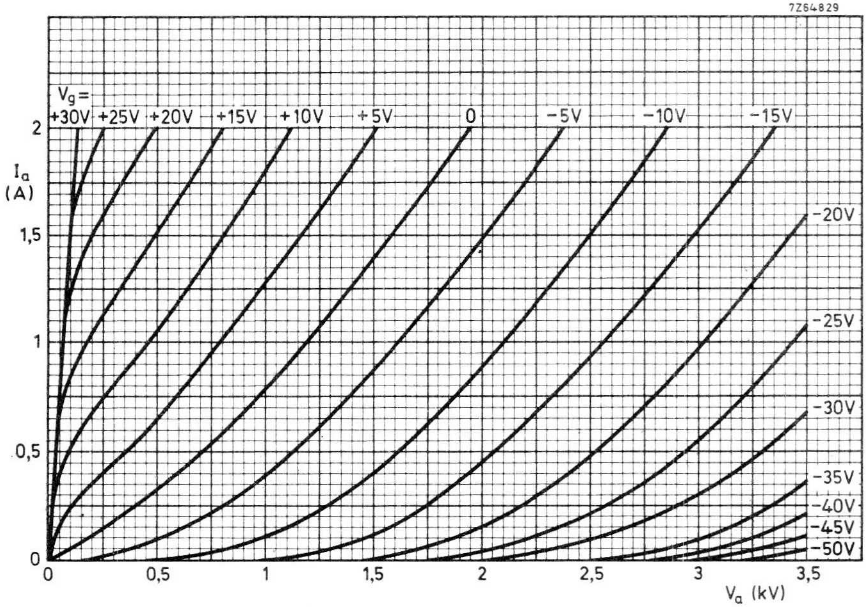
[1] During a short period, for adjustment of the transmitter, W_a = max. 2200 W, and I_k = max. 800 mA.

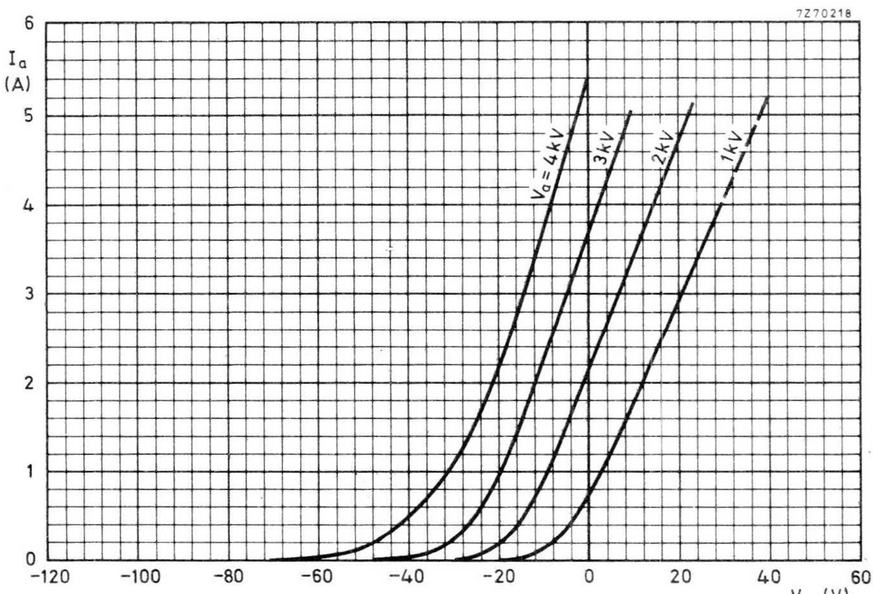
[2] R.F. driving power should be applied after the heater and electrode voltages.

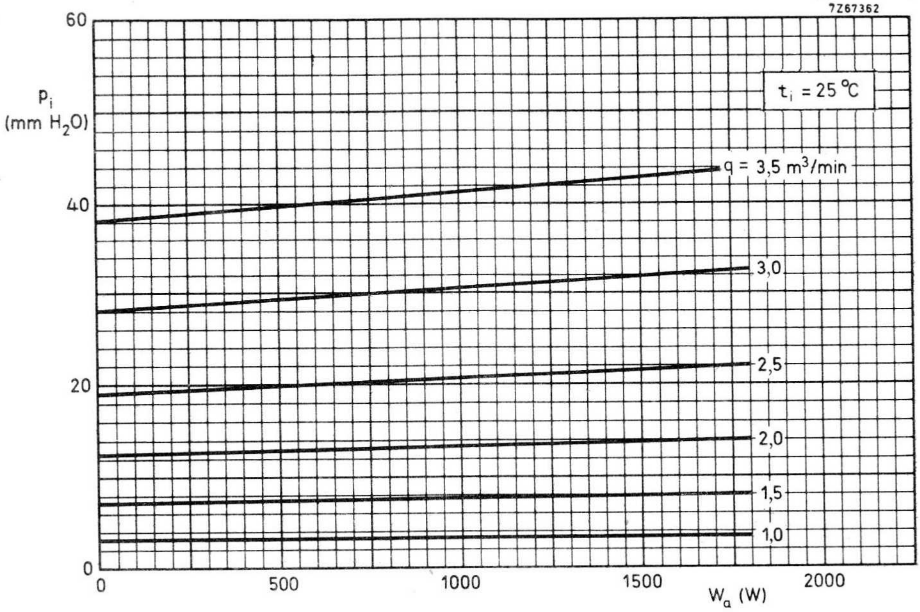
[3] To be adjusted for the stated no-signal anode current. Range values for equipment design -20 to -50 V.

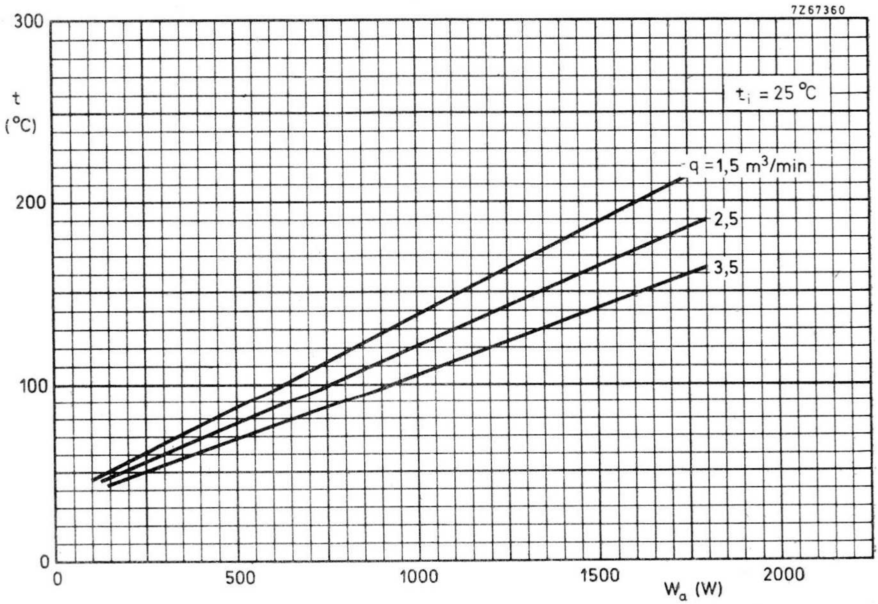
[4] Standard CCIR-G : Measured with a saw-tooth drive of 15% to 80% of peak sync amplitude with a superimposed 4,43 MHz signal with a peak-to-peak value of 10% of the peak sync amplitude adjusted at picture white level.

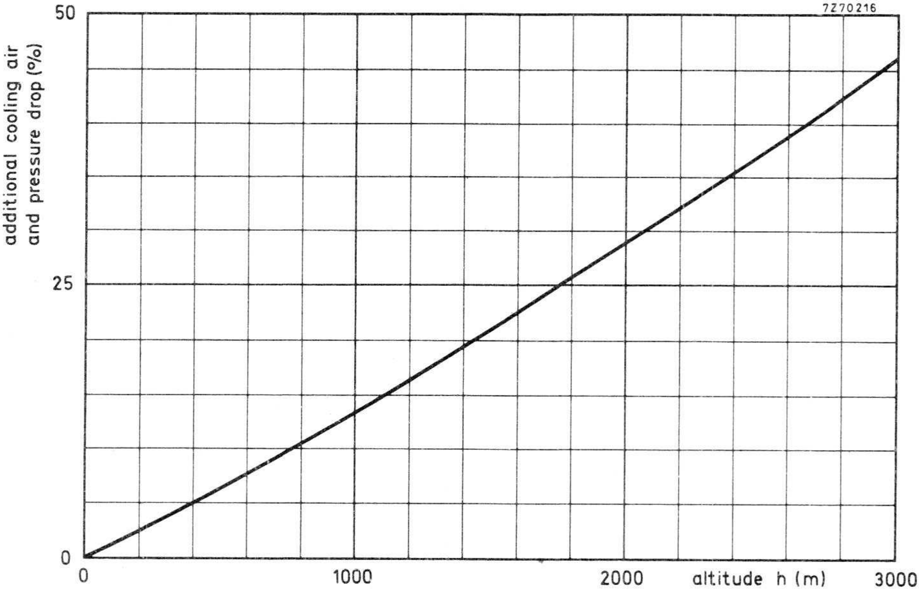
Standard CCIR-L: Measured on white level with a sawtooth drive of 30% to 100% of peak white amplitude with a superimposed 3 MHz signal with a peak-to-peak value of 30% of the picture white amplitude.

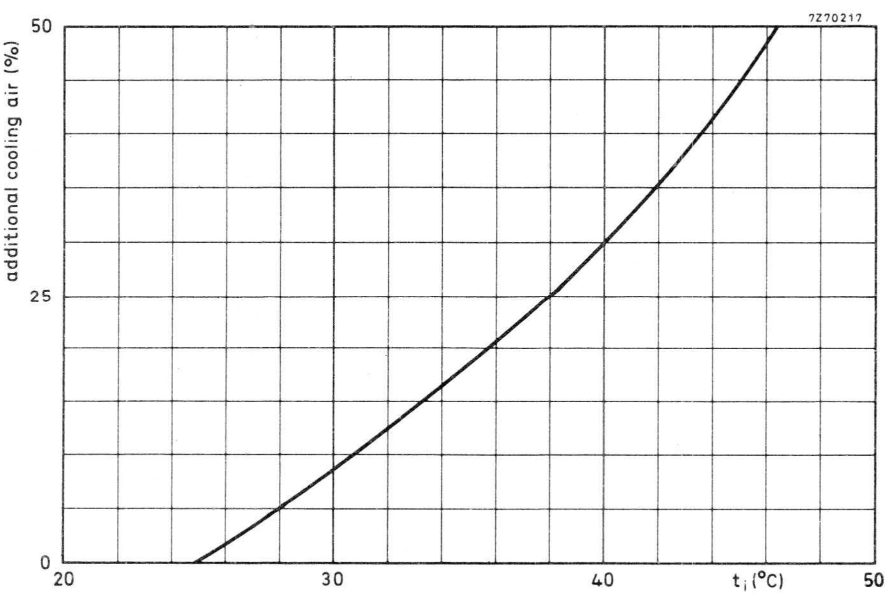

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


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)


7Z67362
60
p_i
(mm H_2O)
40
20
0
0
500
1000
1500
2000
W_a (W)
t_i = 25 °C
q = 3,5 m³/min
3,0
2,5
2,0
1,5
1,0


7Z67360
300
t
(°C)
200
100
0
0
500
1000
1500
2000
W_a (W)
t_i = 25 °C
q = 1,5 m³/min
2,5
3,5


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

AIR COOLED R.F. POWER TRIODE

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	^oC

To obtain optimum life, this temperature should not exceed 200 ^oC.

[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

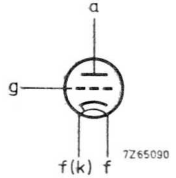
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

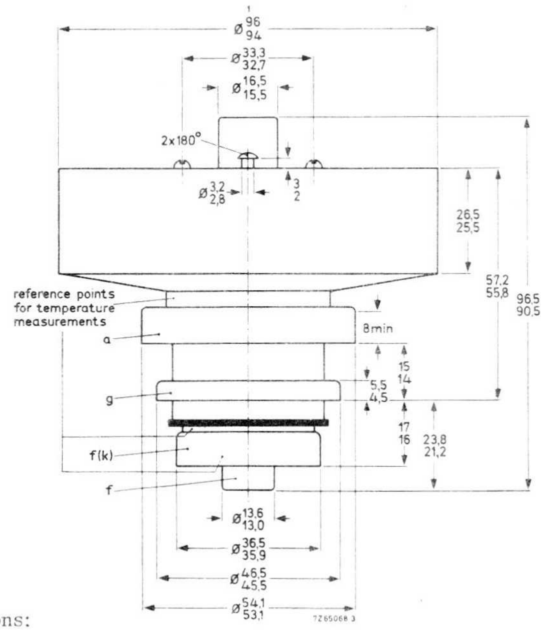
MECHANICAL DATA

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

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

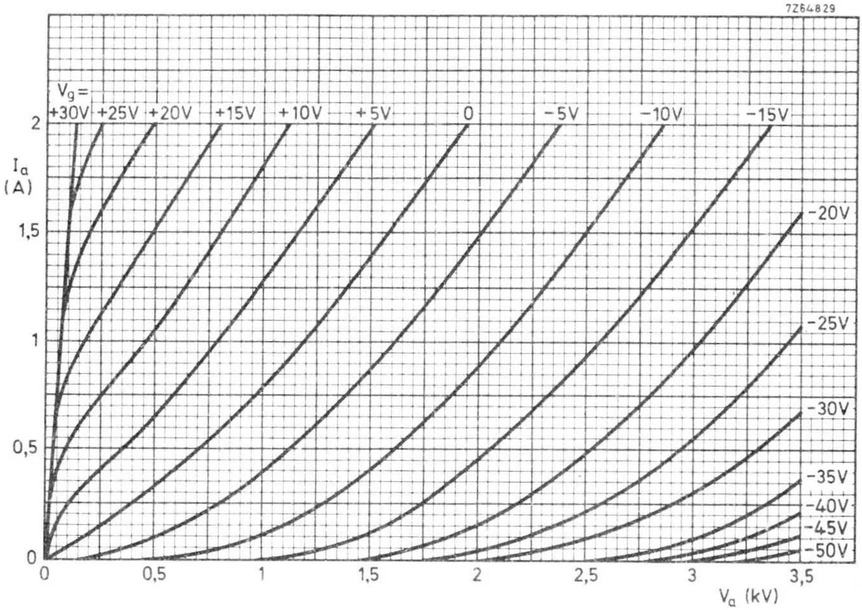
[2] Negative modulation, positive synchronization, combined sound and vision.

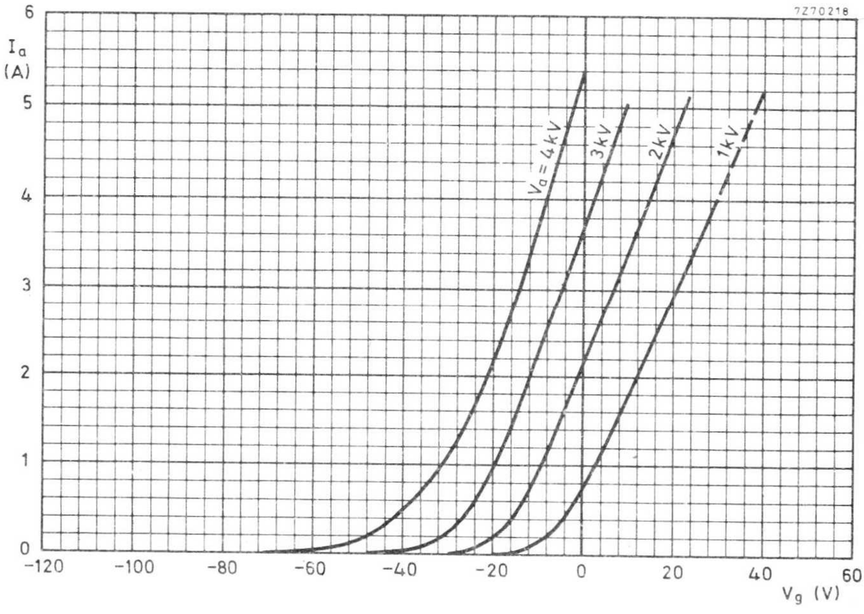
[3] R.F. driving power should be applied after the heater and electrode voltages.

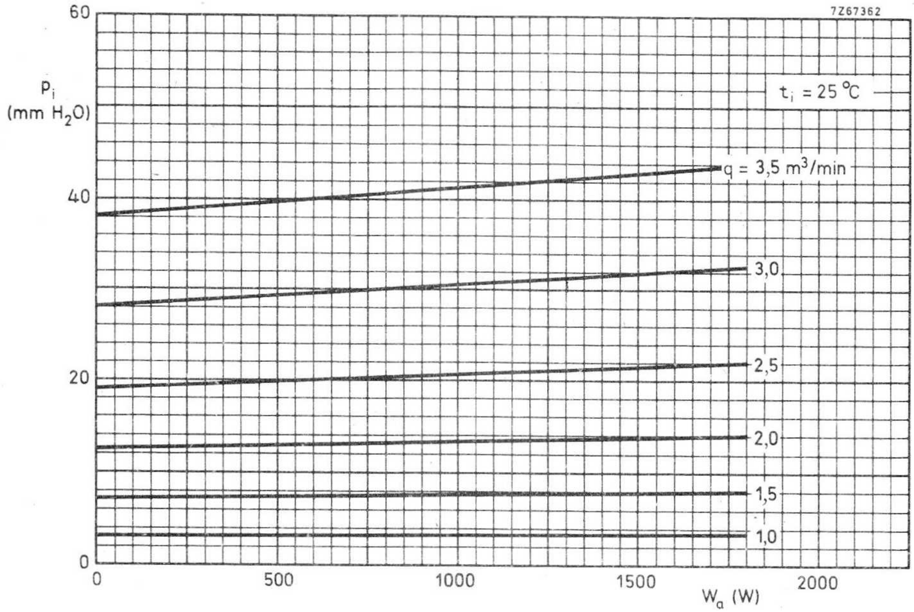
[4] To be adjusted for the stated no- signal anode current. Range values for equipment design −15 to −45 V.

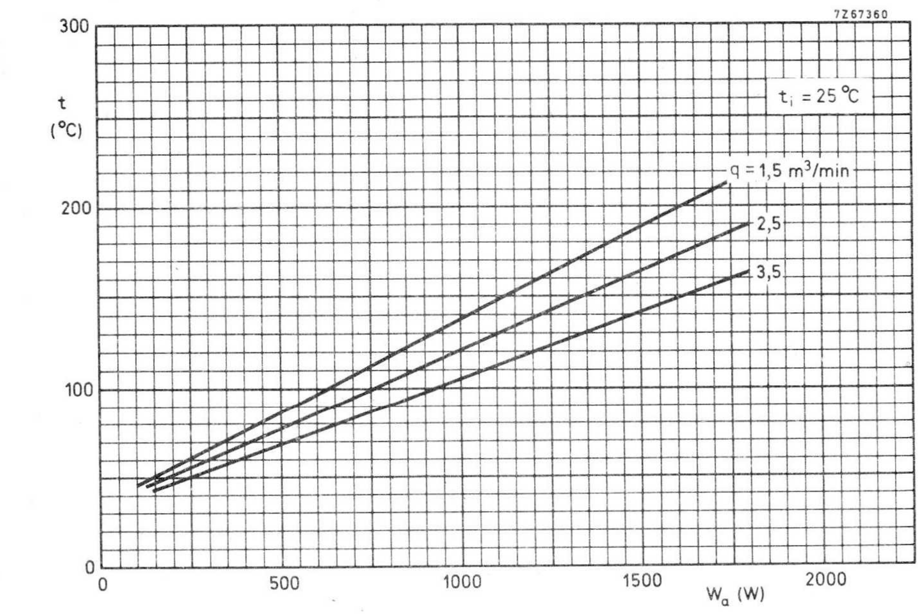
[5] Three-tone test method (vision carrier -8 dB, sound carrier -10 dB sideband signal -16 dB with respect to peak sync level = 0 dB.).

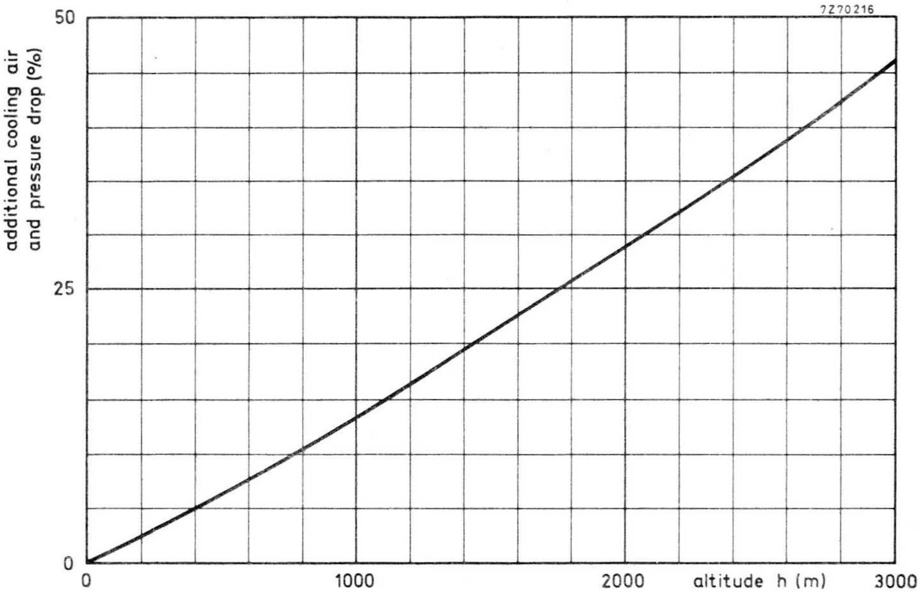
[6] Three-tone test method (vision carrier - 8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync level = 0 dB).

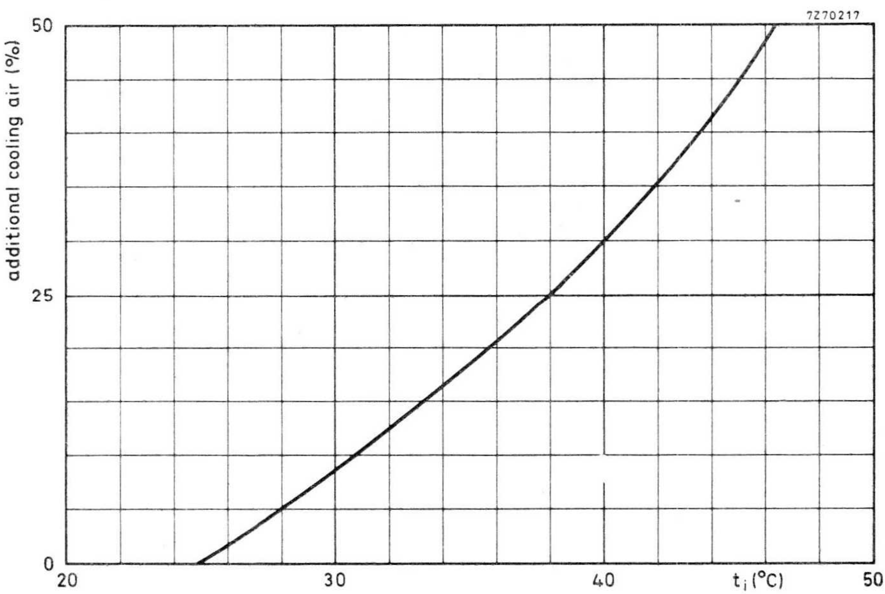

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


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)


7Z67362
p_i
(mm H_2O)
60
40
20
0
t_i = 25 °C
q = 3,5 m³/min
3,0
2,5
2,0
1,5
1,0
0
500
1000
1500
2000
W_a (W)


7Z67360
t
(°C)
300
200
100
0
t_i = 25 °C
q = 1,5 m³/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

INDUSTRIAL R.F. TRIODE

Triodes in metal-ceramic construction intended for use as industrial oscillators.
The YD1342 has an integral water cooler.
The YD1343 is vapour cooled.

QUICK REFERENCE DATA				
Oscillator output power (W_o - W_{feedb})	W_{osc}		480	kW
Frequency for full ratings	f	max.	30	MHz

To be read in conjunction with "General Recommendations Transmitting Tubes for Communication, 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}	480	kW
Anode voltage	V_a	16	kV
Anode current	I_a	42	A
Anode input power	W_{ia}	672	kW
Anode dissipation	W_a	183	kW
Anode output power	W_o	489	kW
Anode efficiency	η_a	73	%
Oscillator efficiency	η_{osc}	71,5	%
Feedback ratio	V_{gp}/V_{ap}	9,3	%
Grid resistor	R_g	100	Ω
Grid current, on load	I_g	7,5	A
Grid voltage, negative	$-V_g$	750	V
Grid dissipation	W_g	3,4	kW
Grid resistor dissipation	W_{Rg}	5,6	kW

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	30	MHz
Anode voltage	V_a	max.	19,5	kV
Anode current	I_a	max.	45	A
Anode input power	W_{ia}	max.	750	kW
Anode dissipation	W_a	max.	240	kW
Grid voltage	$-V_g$	max.	2,5	kV
Grid current, on load	I_g	max.	9	A
off load	I_g	max.	11	A
Grid dissipation	W_g	max.	6	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	55	A
peak	I_{kp}	max.	250	A
Envelope temperature	t_{env}	max.	240	^oC

HEATING : direct; thoriated tungsten filament, mesh construction

Filament voltage	V_f		14	V
Filament current	I_f		555	A
Peak filament starting current	I_{fp}	max.	3500	A
Cold filament resistance	R_{fo}		2,6	mΩ
Waiting time	T_w	min.	5	s

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

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}	3,9	pF
Grid to filament	C_{gf}	225	pF
Anode to grid	C_{ag}	70	pF

CHARACTERISTICS measured at V_a = 16 kV, I_a = 18 A

Transconductance	S	230	mA/V
Amplification factor	μ	35	

COOLING

To obtain optimum life, the temperature of the seals and of the envelope should, under normal operating conditions, be kept below 200 °C.

At low frequencies the seals are sufficiently cooled if the filament connectors are water-cooled by a flow of about 1 ℓ/min. At high frequencies, however, an additional airflow of about 6 m^3/min must be led along the seals from a 60 mm diameter nozzle positioned at a distance of 300 mm from the tube header.

YD1342

Anode + grid dissipation $W_a + W_g$ (kW)	Inlet temperature t_i (°C)	Rate of flow q_{min} (ℓ/min)	Pressure drop p_i (kPa *)	Outlet temperature t_o (°C)
240	20	120	100	50
	50	180	180	70
200	20	95	65	52
	50	144	120	71
160	20	72	42	54
	50	110	75	72

Absolute max. water inlet temperature	t_i	max.	50	°C
Absolute max. water pressure	p	max.	600	kPa *

* 100 kPa ≈ 1 at.

YD1343

With integrated boiler-condenser type K738

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)
240	20	80	38	64
	35	122	75	64
200	20	61	33	69
	35	88	44	69
	50	158	118	69
160	20	42	13	77
	35	58	22	76
	50	95	50	75

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 $f \leq 4$ MHz	type	40694	net mass	270	g
$f > 4$ MHz	type	40737	net mass	525	g
Boiler-condenser (YD1343 only)	type	K738	net mass	150	kg

* 100 kPa ≈ 1 at

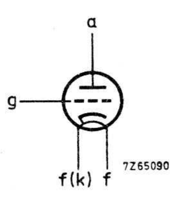
MECHANICAL DATA

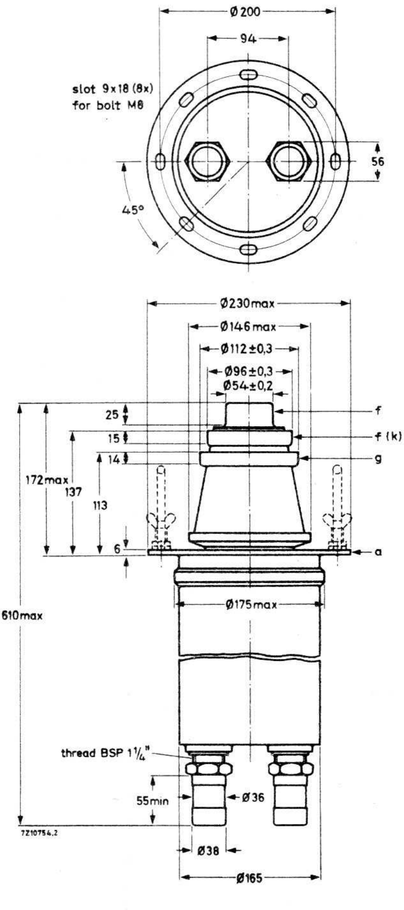
Dimensions in mm

YD1342

Mounting position : vertical with anode up or down

Net mass : approx. 30 kg





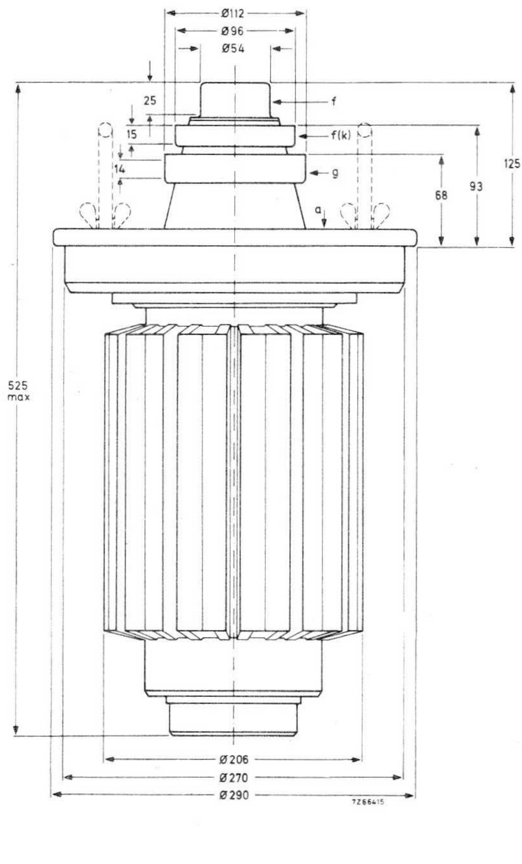
The handles should be removed before switching on the tube

When using the tube in the anode up position the input and output water connections should be reversed.

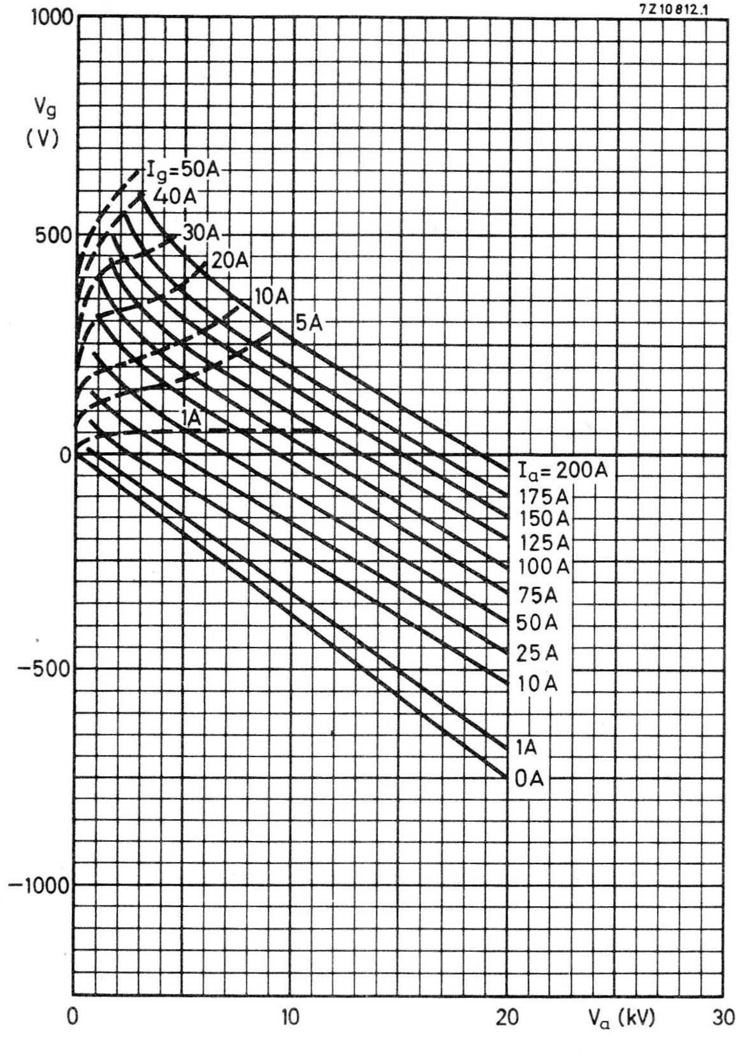
YD1343

Mounting position : vertical with anode up or down

Net mass : approx. 45 kg



The handles should be removed before switching on the tube.


7Z10812.1
1000
V_g
(V)
500
0
−500
−1000
I_g=50A
40A
30A
20A
10A
5A
1A
I_a= 200A
175A
150A
125A
100A
75A
50A
25A
10A
1A
0A
0
10
20
V_a (kV)
30

WATER-COOLED MAGNETICALLY BEAMED INDUSTRIAL R.F. TRIODE

Water-cooled magnetically focused triode of metal-ceramic construction with integral water jacket intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Oscillator output power ($W_o - W_{feedb}$), typical	W_{osc}		3	kW
Frequency for full ratings	f	max.	5	MHz

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

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

Anode voltage single phase, full-wave rectified, unfiltered

OPERATING CONDITIONS

Frequency	f	5	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	3094	W
Transformer voltage	$V_{tr\ rms}$	5000	V
Anode voltage, mean	V_a	4500	V
Anode current, mean	I_a	720	mA
Anode input power	W_{ia}	4000	W
Anode dissipation	W_a	900	W
Anode output power	W_o	3100	W
Anode efficiency	η_a	78	%
Oscillator efficiency	η_{osc}	77,4	%
Feedback ratio	V_{gp}/V_{ap}	33	%
Grid resistor	R_g	80	kΩ
Grid current, on load	I_g	4,5	mA
off load	I_g	9,0	mA
Grid voltage, negative	$-V_g$	360	V 1)
Grid dissipation	W_g	4,4	W
Grid resistor dissipation	W_{Rg}	1,6	W

1) Max. −565 V.

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	max.	5	MHz
Anode voltage, mean	V_a	max.	4500	V
Anode current, mean	I_a	max.	725	mA
Anode input power	W_{ia}	max.	4	kW
Anode dissipation	W_a	max.	2	kW
Grid voltage	V_g	max.	2400	V
Grid current	I_g	max.		see 1)
Grid dissipation	W_g	max.	25	W
Grid circuit resistance	R_g	max.	88	kΩ
Cathode current, mean	I_k	max.	730	mA
Seal temperature	t	max.	200	°C

HEATING : indirect; nickel-oxide cathode, dispenser type

Heater voltage	V_f		5	V
Heater current	I_f		6,1	A
Waiting time	T_w	min.	2	min.

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

CAPACITANCES

Anode to cathode	C_{ak}	0,3 pF
Grid to cathode	C_{gk}	9,8 pF
Anode to grid	C_{ag}	11,5 pF

CHARACTERISTICS measured at V_a = 3 kV, I_a = 500 mA

Transconductance	S		4	mA/V
Amplification factor	μ		25	
Magnetic flux density	B	min.	115	mT
			(= 1150	Gs)

Care should be taken that the magnetic flux density is not influenced by external magnetic materials.

1) Limited by W_g max. and I_k max.

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 *)
2	20	3,8	31
	50	5,7	62

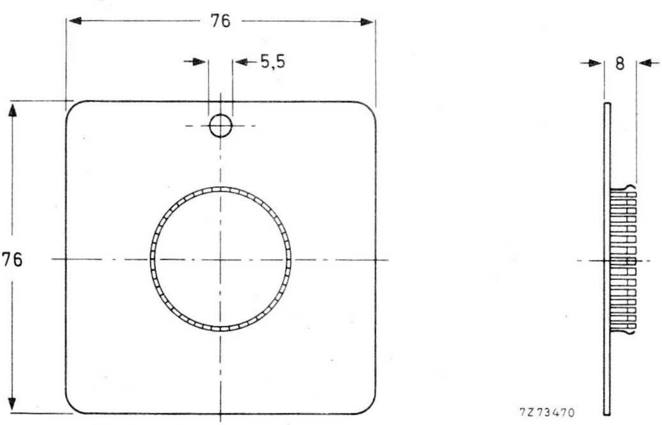
The water flow must be maintained for at least 1 minute after anode power is removed. Additional air cooling of the seals may be necessary to keep the temperature below the limiting value. The direction of the water flow must be such that the inflow is below the outlet for either of the two vertical mounting positions.

ACCESSORIES

Magnet assembly (magnetic nest) type 40765 net mass 2,3 kg

Grid connector 40766

Dimensions in mm



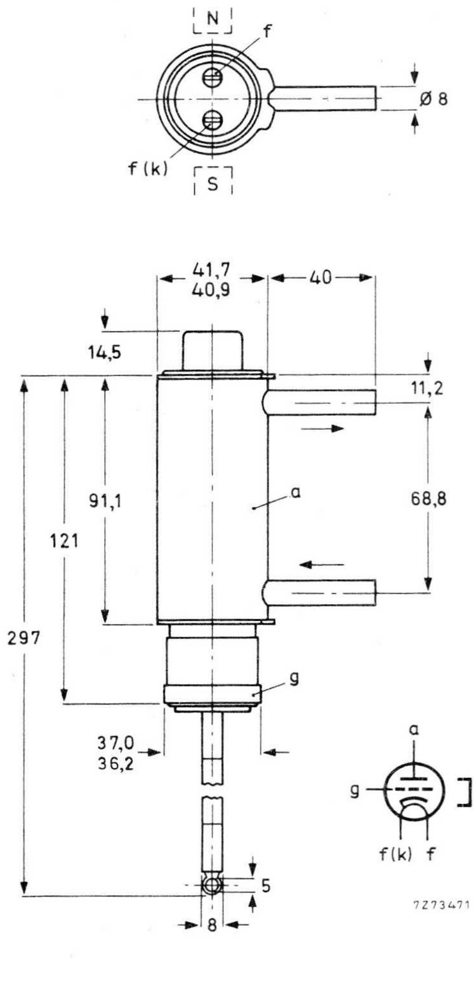
Grid connector 40766

* 100 Pa ≈ 1 at.

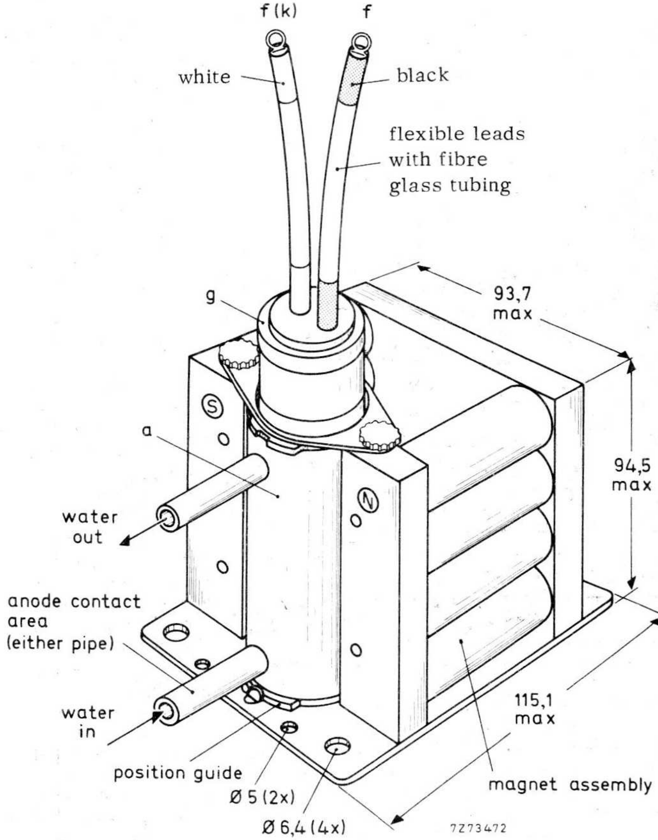
MECHANICAL DATA

Dimensions in mm

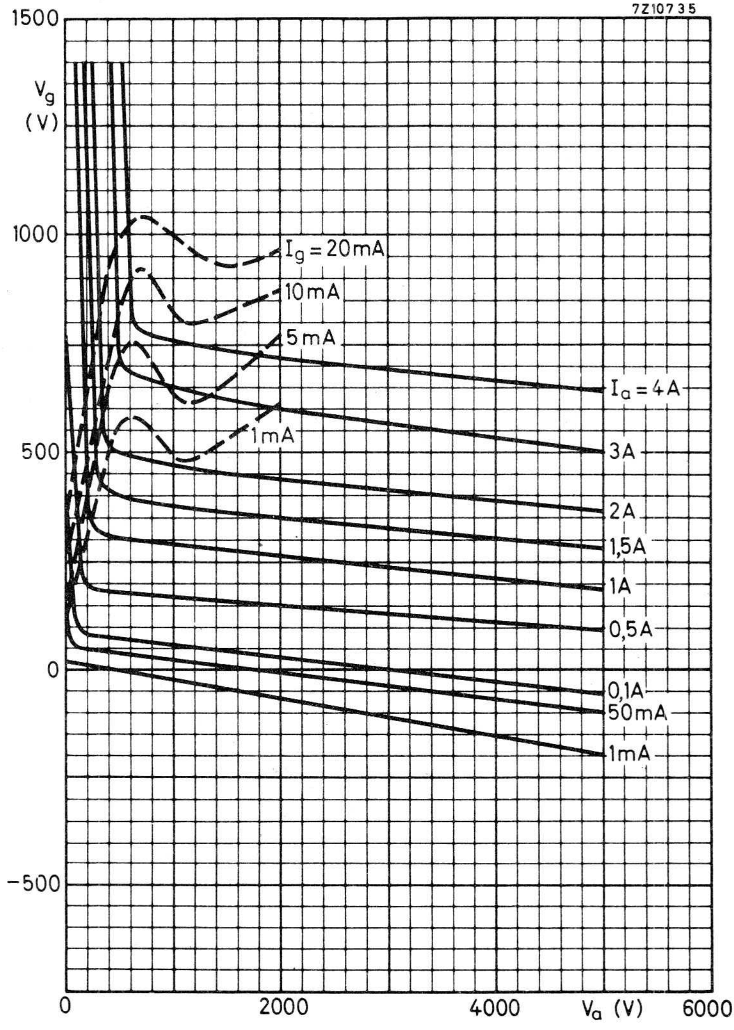
Mounting position : vertical
Net mass : approx. 0,45 kg



Due to the very rugged construction of this type, generally it can be shipped mounted in the equipment.



Tube mounted in magnet assembly 40765


7Z10735
1500
1000
500
0
-500
V_g (V)
0
2000
4000
6000
V_a (V)
I_g = 20mA
10mA
5mA
1mA
I_a = 4A
3A
2A
1,5A
1A
0,5A
0,1A
50mA
1mA

QUICK HEATING R.F. PENTODE

Quick-heating pentode for use as RF amplifier, oscillator or frequency multiplier up to 200 MHz and as AF modulator. Designed for intermittent or continuous filament operation in transistorised mobile transmitters.

QUICK REFERENCE DATA			
Frequency (MHz)	C telegraphy		
	V_a (V)	W_{drive} (W)	W_{load} (W)
50	300	0.2	8
175	250	1.0	3.6

HEATING: direct by AC or DC; parallel supply

Filament oxide-coated			
Filament voltage	V_f	1.1	V ± 15%
Filament current	I_f	0.88	A
Frequency of filament supply			
with sinusoidal voltage	f	max. 200	Hz
with square-wave voltage	f	any	

70% of the full output power will be reached within 0.5 sec after switching-on.

CAPACITANCES

Anode to all except grid No. 1	C_a	3.8	pF
Grid No. 1 to all except anode	C_{g1}	6.5	pF
Anode to grid No. 1	C_{ag1}	0.15	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	120 V
Grid No. 2 voltage	V_{g_2}	120 V
Anode current	I_a	30 mA
Amplification factor	$\mu_{g_2g_1}$	8
Mutual conductance	S	4.5 mA/V
Modulation hum		-60 dB relative to carrier (with centre tapped filament supply on a single stage

TEMPERATURE LIMITS (Absolute limits)

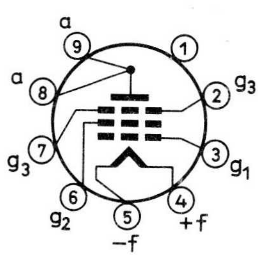
Bulb temperature	max.	200 °C
Pin seal temperature	max.	120 °C

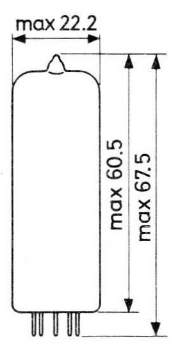
MECHANICAL DATA

Dimensions in mm

Base : Noval

Net weight: 15 g





Mounting position: any

ACCESSORIES

Socket: 2422 502 01003

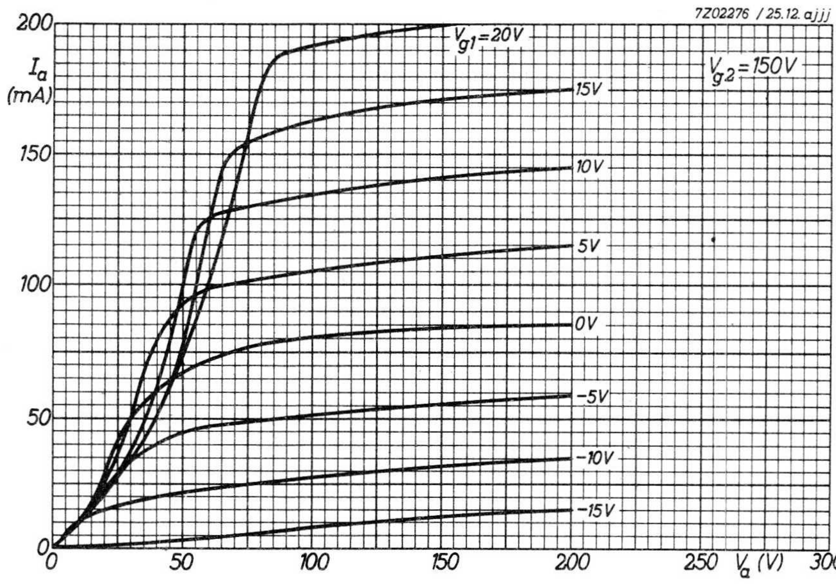
R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 50	up to 175	MHz
Anode voltage	V_a	max.	300	300	V
Anode input power	W_{i_a}	max.	12	9	W
Anode dissipation	W_a	max.	5	5	W
Anode current	I_a	max.	40	40	mA
Grid No. 2 voltage	V_{g_2}	max.	300	300	V
Grid No. 2 dissipation	W_{g_2}	max.	1	1	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	100	100	V
Grid No. 1 current	I_{g_1}	max.	2.5	2.5	mA

OPERATING CONDITIONS

f	50			175			MHz
V_a	300	250	200	300	250	200	V
V_{g_2}	150	150	150	150	150	150	V
V_{g_1}	-35	-35	-35	-35	-35	-35	V
I_a	40	40	40	30	35	40	mA
I_{g_2}	3.5	5	6	2	2.5	3	mA
I_{g_1}	0.85	0.95	1.05	0.07	0.2	0.5	mA
$V_{g_{1p}}$	49.5	52	53				V
W_{g_2}	0.53	0.75	0.9	0.3	0.38	0.45	W
W_{i_a}	12	10	8	9	8.75	8	W
W_a	3.6	3.0	2.5	4.6	4.2	3.5	W
W_{load}	8	6.7	5.2	3.3	3.6	3.6	W


7Z02276 / 25.12. ajjj
200
I_a
(mA)
150
100
50
0
V_{g1} = 20V
15V
10V
5V
0V
-5V
-10V
-15V
V_{g2} = 150V
0
50
100
150
200
250
V_a (V)
300

WATER COOLED R.F. POWER TETRODE

Water cooled R.F. power tetrode in coaxial metal-ceramic construction intended for use as V.H.F. amplifier and S.S.B. amplifier.

QUICK REFERENCE DATA						
Frequency (MHz)	S.S.B.		C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_o (kW)
30	8 10	30 33			10	55
220			5,5	25		

HEATING: direct; thoraited tungsten filament

Filament voltage	V_f	9	V
Filament current	I_f	200	A

CAPACITANCES

Anode to all except grid no. 1	$C_{a(g_1)}$	42	pF
Grid no. 1 to all except anode	$C_{g_1(a)}$	260	pF
Anode to grid no. 1	C_{ag_1}	1,5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid no. 2 voltage	V_{g2}	1,2	kV
Anode current	I_a	2,5	A
Transconductance	S	65	mA/V
Amplification factor	μ_{g2g1}	6,6	-

TEMPERATURE LIMITS AND COOLING

Absolute max. envelope and seal temperature	$t_{env.}$	max. 220 °C
Absolute max. water inlet temperature	t_i	max. 50 °C
Required quantity of water		see cooling curves

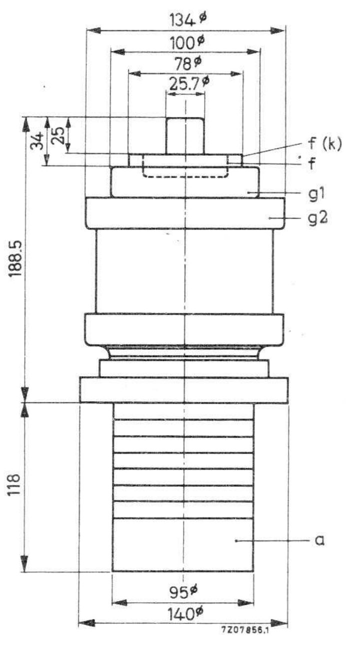
For temperatures t_i between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 7 kg

Mounting position: Vertical with anode down



ACCESSORIES

Water-jacket	type K732
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid No.1 connector	type 40727
Grid No.2 connector	type 40728

R.F. CLASS AB LINEAR AMPLIFIER , SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	12	kV
Grid No.2 voltage	V_{g2}	max.	1.4	kV
Grid No.1 voltage	$-V_{g1}$	max.	350	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g2}	max.	600	W
Grid No.1 dissipation	W_{g1}	max.	300	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid No.2 voltage	V_{g2}		1.2		kV
Grid No.1 voltage	V_{g1}		-175		V 1)
		zero signal	single tone	double tone	
Grid No.1 driving voltage	V_{g1P}	0	175	175	V
Anode current	I_a	2	5.9	3.8	A
Grid No.2 current	I_{g2}	0	250	100	mA
Grid No.1 current	I_{g1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW
Anode dissipation	W_a	16	17.2	15.4	kW
Grid No.2 dissipation	W_{g2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3d order	d_3	-	-	41	dB 2)
5th order	d_5	-	-	54	dB 2)

1) 2) See page 4

OPERATING CONDITIONS (continued)

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-185		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	185	185	V
Anode current	I_a	2	5.2	3.3	A
Grid No.2 current	I_{g_2}	0	250	80	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	20	52	33	kW
Anode dissipation	W_a	20	19	16.5	kW
Grid No.2 dissipation	W_{g2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3d order	d_3	-	-	-41	dB [2]
5th order	d_5	-	-	-54	dB [2]

1) Adjust to give the zero signal anode current.

2) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY, grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g_2}	max.	300	W
Grid No.1 dissipation	W_{g_1}	max.	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-200	V
Anode current	I_a	7	A
Grid No.2 current	I_{g_2}	250	mA
Grid No.1 current	I_{g_1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{i_a}	38.5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW[1]
Efficiency	η	77	%

[1]) Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

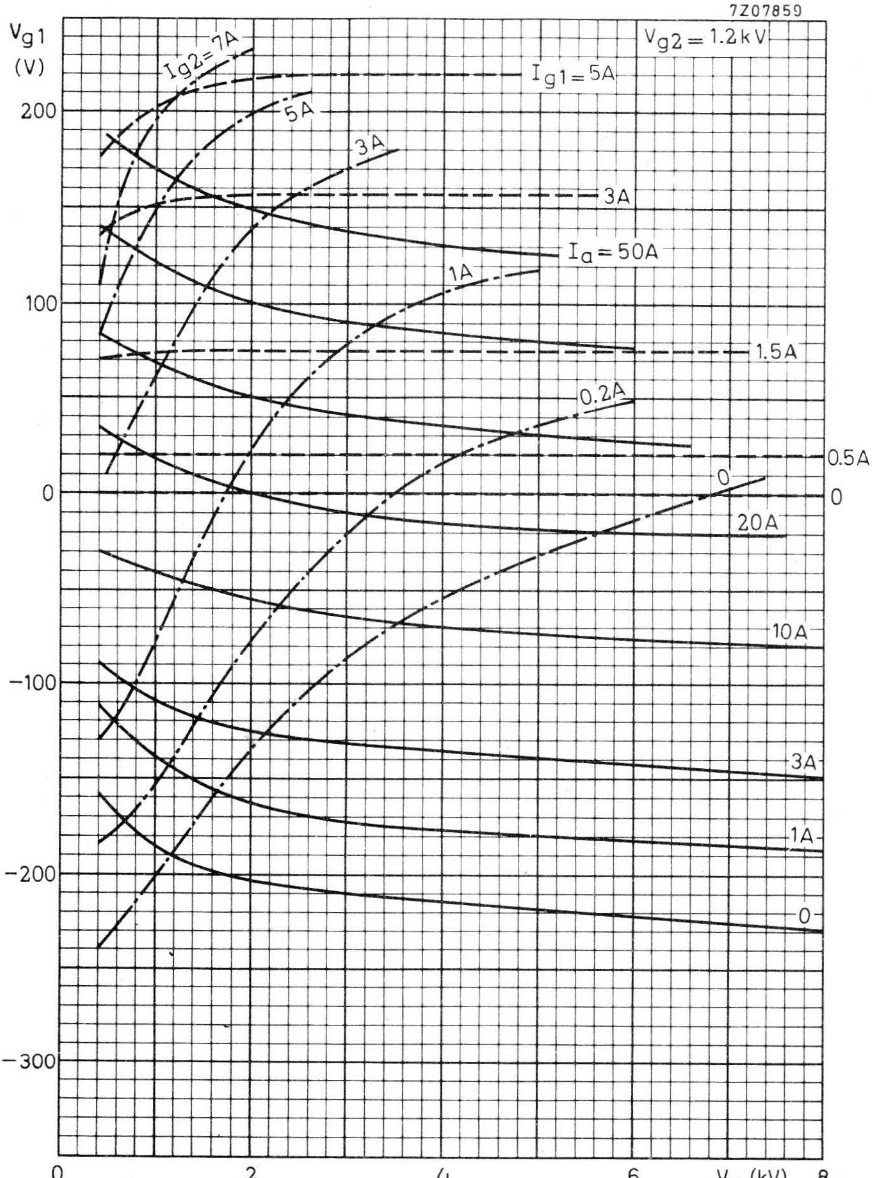
R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

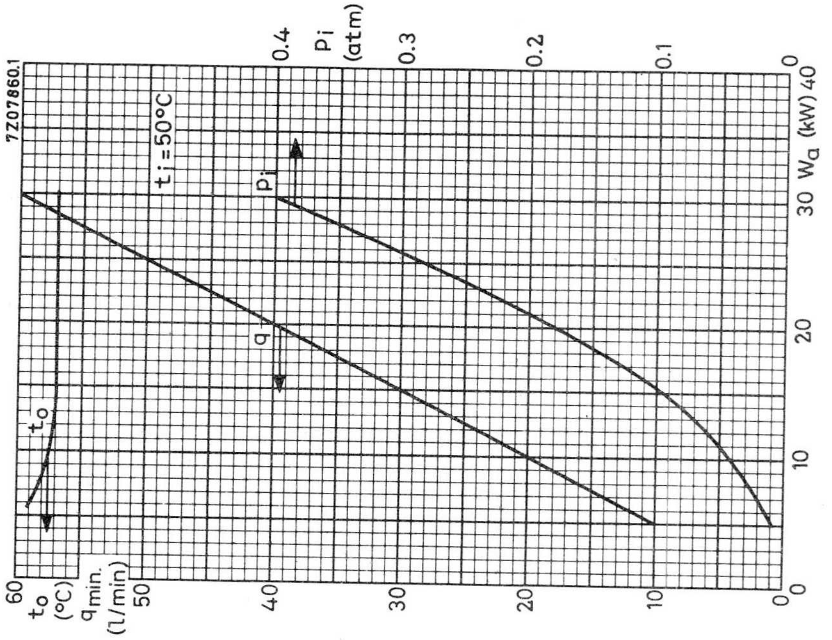
LIMITING VALUES (Absolute max. rating system)

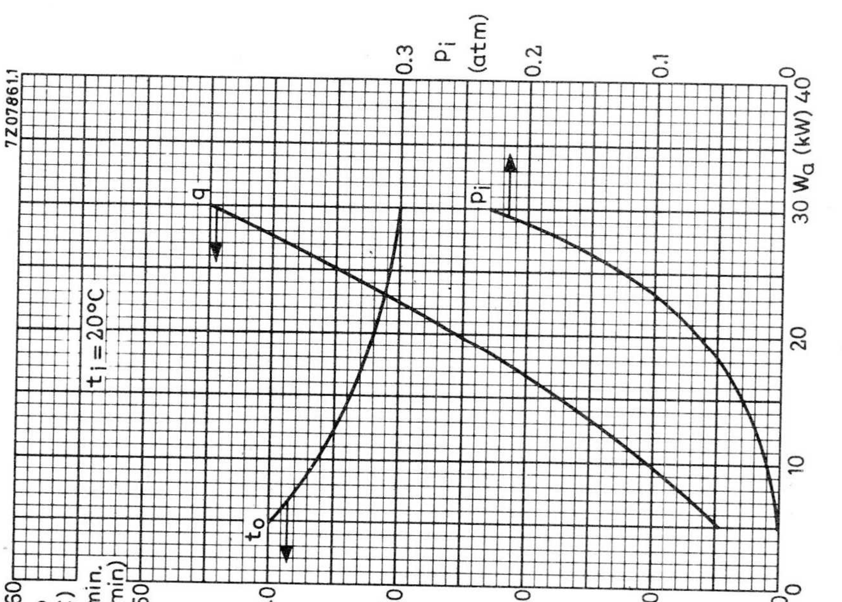
Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	10	kV
Anode input power	W_{i_a}	max.	74	kW
Anode dissipation	W_a	max.	20	kW
Anode current	I_a	max.	8.5	A
Grid No.2 voltage	V_{g_2}	max.	900	V
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	10	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-150	V
Grid No.1 resistor	R_{g_1}	500	Ω
Anode current	I_a	7.4	A
Grid No.2 current	I_{g_2}	340	mA
Grid No.1 current	I_{g_1}	310	mA
Driver output power	W_{dr}	120	W
Anode input power	W_{i_a}	74	kW
Anode dissipation	W_a	19	kW
Output power	W_o	55	kW
Efficiency	η	74.4	%
Modulation depth	m	100	%
Modulation power	W_{mod}	37	kW
Grid No.2 voltage, peak	V_{g_2p}	700	V


7Z07859
V_{g1} (V)
200
100
0
−100
−200
−300
$V_{g2} = 1.2$ kV
$I_{g2} = 7A$
$I_{g1} = 5A$
5A
3A
3A
$I_a = 50A$
1A
1.5A
0.2A
0.5A
0
0
20A
10A
3A
1A
0
0
2
4
6
V_a (kV)
8


7Z07860.1
$t_i = 50°C$
t_o
q
p_i
60
t_o (°C)
$q_{min.}$ (l/min)
50
40
30
20
10
0
0
10
20
30 W_a (kW) 40
0.4
p_i (atm)
0.3
0.2
0.1
0


7Z07861.1
$t_i = 20°C$
t_o
q
p_i
60
t_o (°C)
$q_{min.}$ (l/min)
50
40
30
20
10
0
0
10
20
30 W_a (kW) 40
0.3
p_i (atm)
0.2
0.1
0

AIR COOLED R.F. POWER TETRODE

Air cooled R.F. power tetrode in coaxial metal-ceramic construction intended for use as V.H.F. amplifier and S.S.B. amplifier.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		C telegr. FM teleph.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)
30	8	30		
	10	33		
220			5,5	25

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f	9	V
Filament current	I_f	200	A

CAPACITANCES

Anode to all except grid no. 1	$C_{a(g_1)}$	42	pF
Grid no. 1 to all except anode	$C_{g_1(a)}$	260	pF
Anode to grid no. 1	C_{ag_1}	1,5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid no. 2 voltage	V_{g2}	1,2	kV
Anode current	I_a	2,5	A
Transconductance	S	65	mA/V
Amplification factor	$\mu_{g_2g_1}$	6,6	-

TEMPERATURE LIMITS AND COOLING

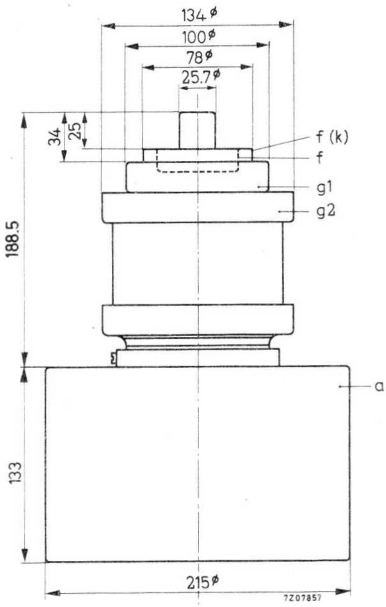
Absolute max. envelope and seal temperature $t_{env.}$ max. 220 °C

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 13.5 kg

Mounting position: Vertical with anode down



ACCESSORIES

Insulating pedestal	type 40729
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid No. 1 connector	type 40727
Grid No. 2 connector	type 40728

R.F. CLASS AB LINEAR AMPLIFIER , SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	12	kV
Grid No.2 voltage	V_{g_2}	max.	1.4	kV
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-175		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	V_{g_1p}	0	175	175	V
Anode current	I_a	2	5.9	3.8	A
Grid No.2 current	I_{g_2}	0	250	100	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW
Anode dissipation	W_a	16	17.2	15.4	kW
Grid No.2 dissipation	W_{g_2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3d order	d_3	-	-	41	dB 2)
5th order	d_5	-	-	54	dB [2]

[1] [2] See page 4

OPERATING CONDITIONS(continued)

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid No.2 voltage	V_{g2}		1.2		kV
Grid No.1 voltage	V_{g1}		-185		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	V_{g1p}	0	185	185	V
Anode current	I_a	2	5.2	3.3	A
Grid No.2 current	I_{g2}	0	250	80	mA
Grid No.1 current	I_{g1}	0	0	0	mA
Anode input power	W_{i_a}	20	52	33	kW
Anode dissipation	W_a	20	19	16.5	kW
Grid No.2 dissipation	W_{g2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3^d order	d_3	-	-	-41	dB [2]
5^{th} order	d_5	-	-	-54	dB [2]

[1]) Adjust to give the zero signal anode current.

[2]) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY , grounded grid

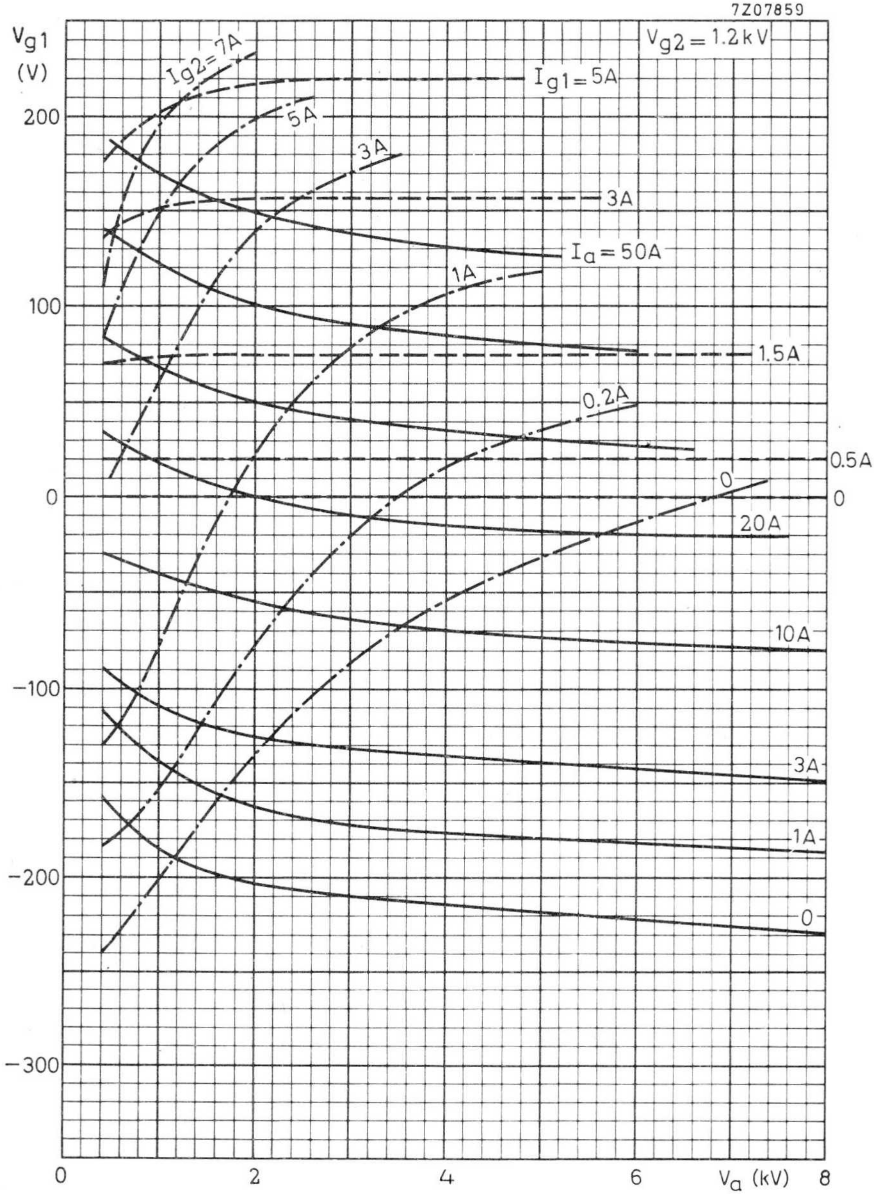
LIMITING VALUES (Absolute max. rating system)

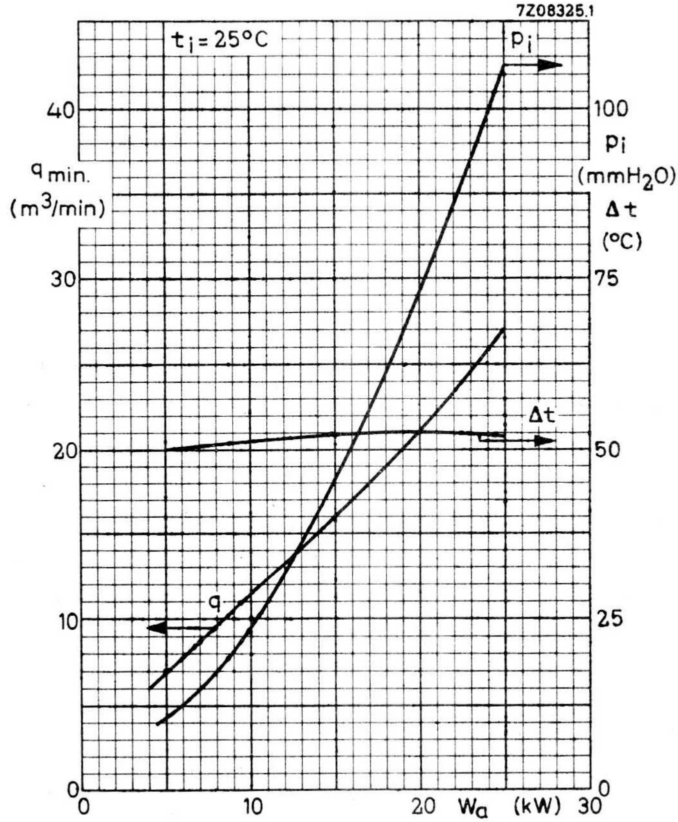
Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g_2}	max.	300	W
Grid No.1 dissipation	W_{g_1}	max.	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-200	V
Anode current	I_a	7	A
Grid No.2 current	I_{g_2}	250	mA
Grid No.1 current	I_{g_1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{i_a}	38.5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW [1])
Efficiency	η	77	%

[1]) Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.


7Z07859
$V_{g2} = 1.2\,kV$
V_{g1} (V)
200
100
0
−100
−200
−300
$I_{g2} = 7A$
$I_{g1} = 5A$
5A
3A
3A
$I_a = 50A$
1A
1.5A
0.2A
0.5A
0
0
20A
10A
3A
1A
0
0
2
4
6
V_a (kV)
8



7Z08325.1
$t_i = 25°C$
p_i
Δt
q
$q_{min.}$ (m^3/min)
p_i (mmH_2O)
Δt (°C)
0
10
20
30
40
0
25
50
75
100
0
10
20
W_a (kW)
30

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled R.F. power tetrode in coaxial metal-ceramic construction intended for use as V.H.F. amplifier and S.S.B. amplifier.

QUICK REFERENCE DATA						
Frequency (MHz)	S.S.B.		C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_o (kW)
30	8	30				
	10	33			10	55
220			5,5	25		

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f	9	V
Filament current	I_f	200	A

CAPACITANCES

Anode to all except grid no. 1	$C_{a(g_1)}$	42	pF
Grid no. 1 to all except anode	$C_{g_1(a)}$	260	pF
Anode to grid no. 1	C_{ag_1}	1,5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid no. 2 voltage	V_{g_2}	1,2	kV
Anode current	I_a	2,5	A
Transconductance	S	65	mA/V
Amplification factor	$\mu_{g_2g_1}$	6,6	-

TEMPERATURE LIMITS AND COOLING

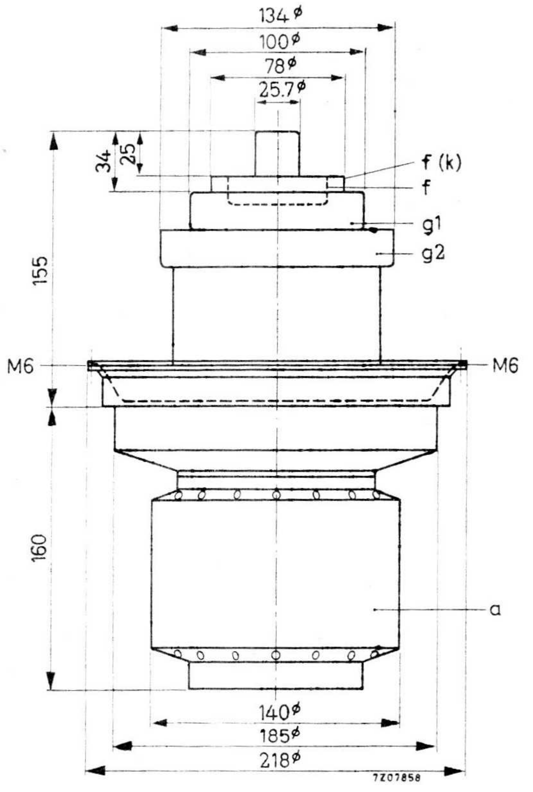
Absolute max. envelope and seal temperature $t_{env.}$ max. 220 °C

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 14.7 kg

Mounting position: Vertical with anode down



ACCESSORIES

Boiler	type K 728
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid No.1 connector	type 40727
Grid No.2 connector	type 40728

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	12	kV
Grid No.2 voltage	V_{g_2}	max.	1.4	kV
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	45	kW
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-175		V 1)
		zero signal	single tone	double tone	
Grid No.1 driving voltage	V_{g_1p}	0	175	175	V
Anode current	I_a	2	5.9	3.8	A
Grid No.2 current	I_{g_2}	0	250	100	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW
Anode dissipation	W_a	16	17.2	15.4	kW
Grid No.2 dissipation	W_{g_2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3rd order	d_3	-	-	41	dB 2)
5th order	d_5	-	-	54	dB 2)

1) 2) See page 4

OPERATING CONDITIONS (continued)

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-185		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	185	185	V
Anode current	I_a	2	5.2	3.3	A
Grid No.2 current	I_{g_2}	0	250	80	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	20	52	33	kW
Anode dissipation	W_a	20	19	16.5	kW
Grid No.2 dissipation	W_{g_2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3^d order	d_3	-	-	-41	dB [2]
5^th order	d_5	-	-	-54	dB [2]

[1]) Adjust to give the zero signal anode current.

[2]) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY, grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	45	kW
Grid No.2 dissipation	W_{g_2}	max.	300	W
Grid No.1 dissipation	W_{g_1}	max.	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-200	V
Anode current	I_a	7	A
Grid No.2 current	I_{g_2}	250	mA
Grid No.1 current	I_{g_1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{i_a}	38.5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW [1])
Efficiency	η	77	%

[1]) Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

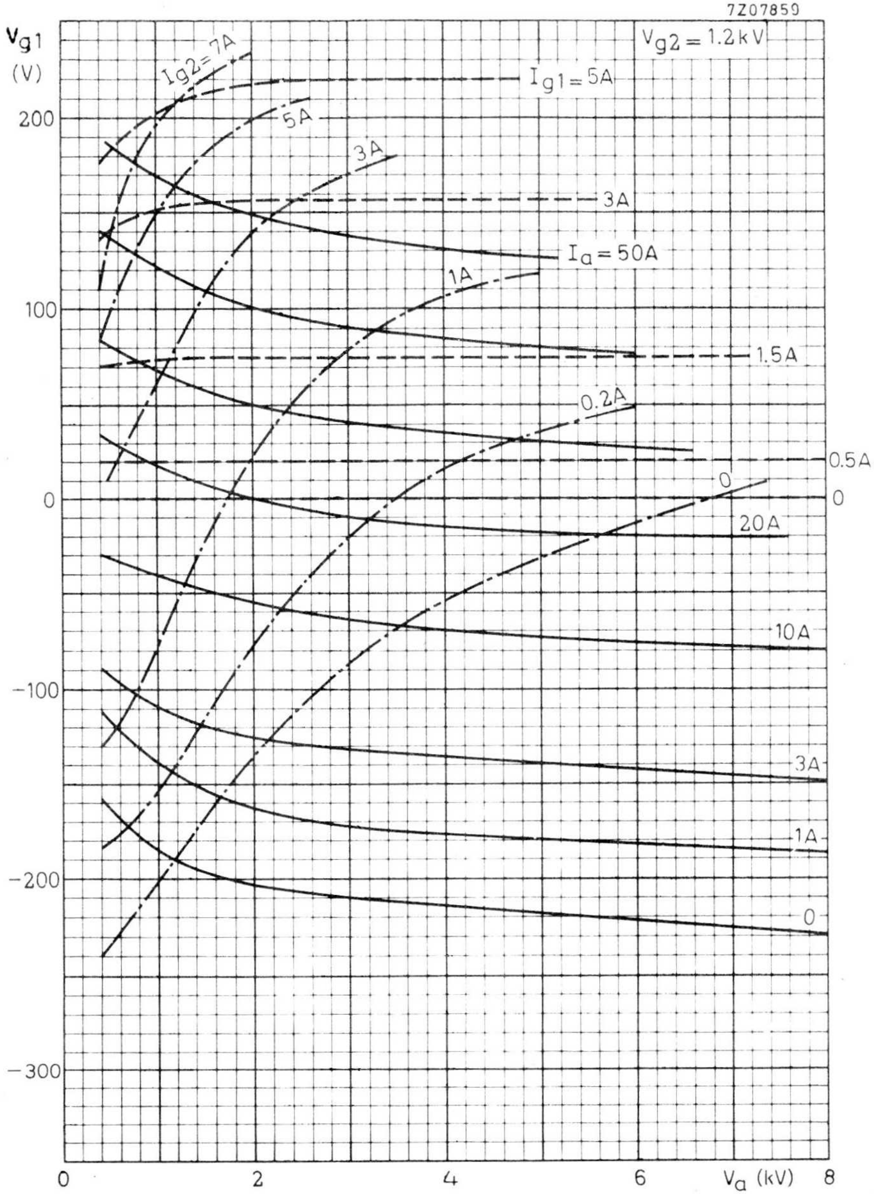
R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	10	kV
Anode input power	W_{i_a}	max.	74	kW
Anode dissipation	W_a	max.	30	kW
Anode current	I_a	max.	8.5	A
Grid No.2 voltage	V_{g_2}	max.	900	V
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	10	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-150	V
Grid No.1 resistor	R_{g_1}	500	Ω
Anode current	I_a	7.4	A
Grid No.2 current	I_{g_2}	340	mA
Grid No.1 current	I_{g_1}	310	mA
Driver output power	W_{dr}	120	W
Anode input power	W_{i_a}	74	kW
Anode dissipation	W_a	19	kW
Output power	W_o	55	kW
Efficiency	η	74.4	%
Modulation depth	m	100	%
Modulation power	W_{mod}	37	kW
Grid No.2 voltage, peak	V_{g2p}	700	V


7Z07859
V_{g1} (V)
$V_{g2} = 1.2$ kV
$I_{g2} = 7$A
$I_{g1} = 5$A
5A
3A
3A
$I_a = 50$A
1A
1.5A
0.2A
0.5A
0
0
20A
10A
3A
1A
0
200
100
0
−100
−200
−300
0
2
4
6
8
V_a (kV)

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating double tetrode for use as R.F. amplifier and frequency multiplier up to 500 MHz. Designed for intermittent service in transistorised mobile equipment.

QUICK REFERENCE DATA						
Freq. (MHz)	C telegr.		$C_{a\text{-}g2}$ mod.		C freq. tripler	
	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)
200	300	16	300	13		
	400	22	500	22		
	600	35				
460	400	17				
66.7/200					300	7
153/460					300	5.5

HEATING: Direct by A.C. or D.C. Filament oxide coated

Filament voltage	V_f	max.	1.6	V
Filament current at V_f = 1.6 V	I_f	=	4.0	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	sec

The filament has been designed to accept temporary variations in supply voltage of −25%..

The frequency of the A.C. filament supply may be

for sinusoidal supply voltages	max.	200	Hz
for square wave supply voltages		any	

CAPACITANCES in push-pull connection

Input capacitance	C_i	=	4.0	pF
Output capacitance	C_o	=	1.5	pF

The tube is internally neutralised

1) Useful power in the load

TYPICAL CHARACTERISTICS (each system)

Filament voltage	V_f	=	1.4	V
Anode voltage	V_a	=	300	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Mutual conductance	S	=	4.0	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	9	

TEMPERATURE LIMITS (Absolute limits)

Bulb and anode seal temperature	=	max.	250	^oC
Base seal temperature	=	max.	180	^oC

Anode connectors providing a high degree of heat transfer by radiation or conduction should be used

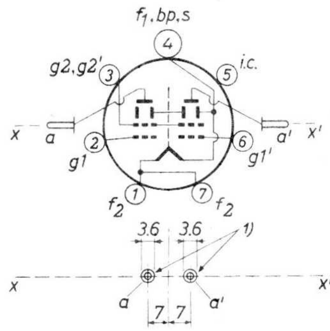
MECHANICAL DATA Dimensions in mm

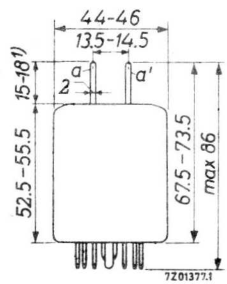
Net weight 50 g

Base : Septar

Socket : 2422 513 00001

Anode connector: 40623





Mounting position: any

If the tube is mounted with its main axis horizontally it is recommended that the plane of the anodes be vertical

Contacts 1 and 7 should be strapped together externally to reduce the effective contact resistance

1) Location of the anode pins within these circles.

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY. Two systems in push-pull intermittent mobile service

LIMITING VALUES (Absolute limits)

Frequency	f		up to 200	up to 500	MHz
Anode voltage	V_a	=	max. 600	max. 450	V
Anode input power	W_{ia}	=	max. 70	max. 50	W
Anode dissipation	W_a	=	max. 2x10	max. 2x10	W
Grid No.2 voltage	V_{g_2}	=	max. 300	max. 300	V
Grid No.2 dissipation	W_{g_2}	=	max. 2x1.5	max. 2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 75	max. 75	V
Grid No.1 current	I_{g_1}	=	max. 2x2.5	max. 2x2.5	mA
Grid No.1 dissipation	W_{g_1}	=	max. 2x0.5	max. 2x0.5	W
Cathode current	I_k	=	max. 2x60	max. 2x60	mA

OPERATING CHARACTERISTICS

Frequency	f	=	200	200	200	460	MHz
Anode voltage	V_a	=	300	400	600	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-40	-50	-60	-50	V
Driving voltage	$V_{g_1g_1'p}$	=	106	136	156	-	V
Anode current	I_a	=	2x50	2x50	2x50	2x50	mA
Grid No.2 current	I_{g_2}	=	2x4	2x3.5	2x3.0	2x3.0	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2x1.5	2x1.0	2x0.6	mA
Driver output power	W_{dr}	=	1.2	1.3	1.5	5.0	W
Anode input power	W_{ia}	=	30	40	60	40	W
Anode dissipation	W_a	=	2x5.5	2x6.0	2x7.5	2x9.5	W
Output power	W_o	=	19	28	45	21	W
Efficiency	η	=	63	70	75	52.5	%
Output power in load	W_ℓ	=	16	22	35	17	W

R.F. CLASS C ANODE AND SCREEN GRID MODULATION. Two systems in push-pull; intermittent mobile service

LIMITING VALUES (Absolute limits)

Frequency	f		up to	200	up to	500	MHz
Anode voltage	V_a	=	max.	500	max.	373	V
Anode input power	W_{ia}	=	max.	50	max.	37	W
Anode dissipation	W_a	=	max.	2x7	max.	2x7	W
Grid No.2 voltage	V_{g_2}	=	max.	300	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.2	max.	2x1.2	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x2.5	max.	2x2.5	mA
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.5	max.	2x0.5	W
Cathode current	I_k	=	max.	2x55	max.	2x55	mA

OPERATING CHARACTERISTICS

Frequency	f	=	200	200	MHz
Anode voltage	V_a	=	300	500	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-50	-80	V
Driving voltage	$V_{g_1 g_1' p}$	=	166	220	V
Anode current	I_a	=	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	2x3.5	2x4.0	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2x1.5	mA
Anode input power	W_{ia}	=	24	40	W
Anode dissipation	W_a	=	2x4	2x5.5	W
Output power	W_o	=	16	29	W
Efficiency	η	=	67	73	%
Output power in load	W_ℓ	=	13	22	W

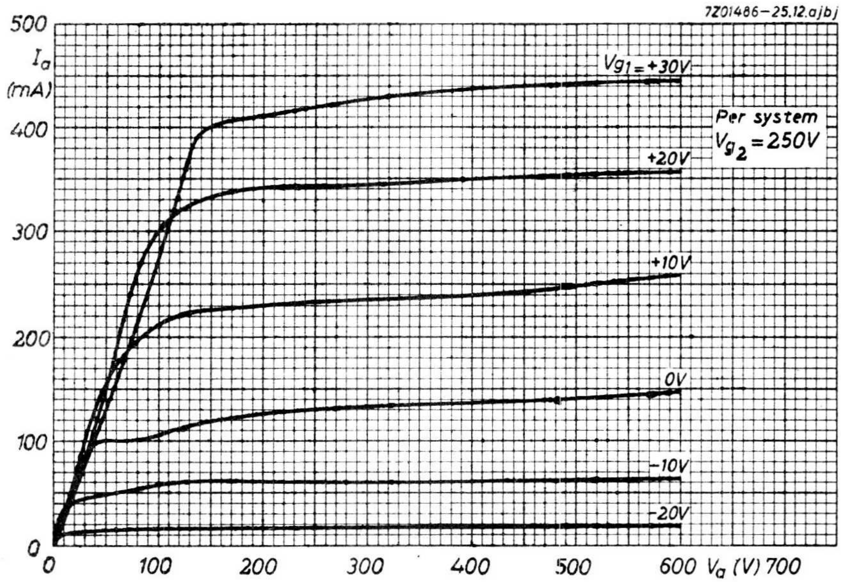
R.F. CLASS C FREQUENCY TRIPLER. Two systems in push-pull, intermittent mobile service.

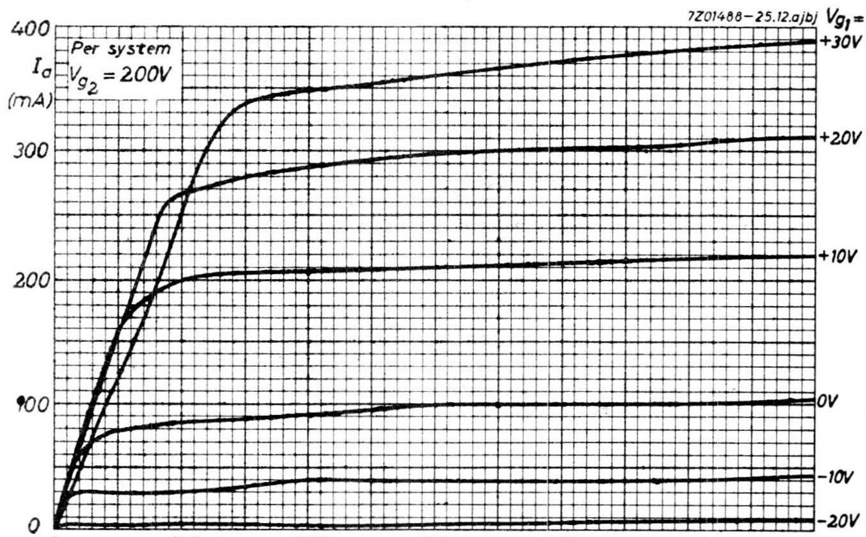
LIMITING VALUES (Absolute limits)

Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	54	W
Anode dissipation	W_a	=	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	200	V
Grid No.1 current	I_{g_1}	=	max.	2x4.5	mA
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.5	W
Cathode current	I_k	=	max.	2x55	mA

OPERATING CHARACTERISTICS

Frequency	f	=	66.7/200	153/460	MHz
Anode voltage	V_a	=	300	300	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-175	-175	V
Driving voltage	$V_{g_1 g_1' p}$	=	410	410	V
Anode current	I_a	=	2x45	2x45	mA
Grid No.2 current	I_{g_2}	=	2x4.0	2x3.5	mA
Grid No.1 current	I_{g_1}	=	2x3.0	2x2.5	mA
Driver output power	W_{dr}	=	3	5	W
Anode input power	W_{ia}	=	27	27	W
Anode dissipation	W_a	=	2x9	2x10	W
Output power	W_o	=	9	7	W
Efficiency	η	=	33	26	%
Output power in load	W_ℓ	=	7	5.5	W


7Z01486–25.12.ajbj
500
I_a
(mA)
400
300
200
100
0
0
100
200
300
400
500
600 V_a (V) 700
V_{g_1} = +30V
+20V
+10V
0V
−10V
−20V
Per system
V_{g_2} = 250V


7Z01488–25.12.ajbj
V_{g_1} =
400
I_a
(mA)
300
200
100
0
0
100
200
300
400
500 V_a (V) 600
Per system
V_{g_2} = 200V
+30V
+20V
+10V
0V
−10V
−20V

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating, radiation and convection cooled double tetrode for use as R.F. power amplifier or frequency multiplier in mobile transmitters.

QUICK REFERENCE DATA						
Freq. (MHz)	R.F. class C telegr.		R.F. class C ag_2 mod.		Frequency multiplier	
	C.C.S. W_ℓ (W)[1]	I.C.A.S. W_ℓ (W)[1]	C.C.S. W_ℓ (W)[1]	I.C.A.S. W_ℓ (W)[1]	C.C.S. W_ℓ (W)[1]	I.C.A.S. W_ℓ (W)[1]
180	45	75	32	53		
50/150					16	
157/470						12

HEATING: direct by A.C. or D.C.; filament oxide coated

Filament voltage	V_f	=	2.1	V
Filament current	I_f	=	4.5	A
Heating time for W_o = 70 % of $W_{o\,max}$.	T_h	<	0.5	sec

The frequency of the A.C. filament supply may be

with sinusoidal supply voltages	max. 200	Hz
with square-wave supply voltages	any	

The filament has been designed to accept temporary fluctuations of supply voltage of ± 15 %.

CAPACITANCES; two sections in push-pull connection

Input capacitance	C_i	=	6.0	pF
Output capacitance	C_o	=	2.0	pF

TYPICAL CHARACTERISTICS; each section

Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Mutual conductance	S	=	4.5	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	8	

[1]) Output power in the load

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250	°C
Temperature of all seals	=	max. 250	°C
Pin temperature	=	max. 180	°C

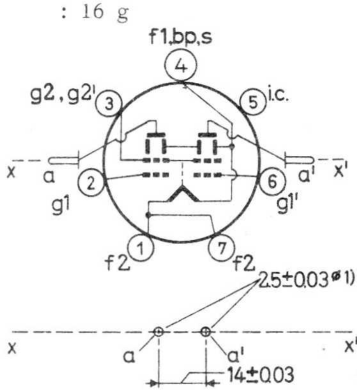
COOLING

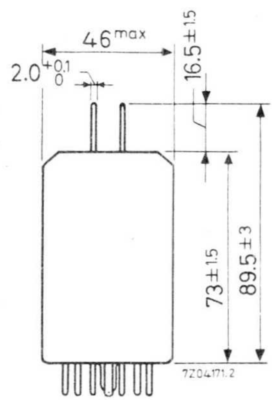
Radiation and convection
Anode connectors providing a high degree of heat transfer by radiation or conduction should be used.

MECHANICAL DATA

Dimensions in mm

Base	: Septar
Socket	: 2422 513 00001
Anode connector	: 40623
Net weight	: 16 g





Mounting position: any

Contacts 1 and 7 should be strapped together externally to reduce the effective contact resistance.

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1) Location of anode pins within these circles.

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

LIMITING VALUES (Each system; absolute limits)

Frequency	f		up to	200	500	MHz
Anode voltage	V_a	=	max.	750	500	V
Anode input power	W_{ia}	=	max.	72	48	W
Anode dissipation	W_a	=	max.	20	20	W
Grid No.2 voltage	V_{g_2}	=	max.	300	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	3.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	100	V
Grid No.1 current	I_{g_1}	=	max.	5.0	5.0	mA
Grid No.1 dissipation	W_{g_1}	=	max.	1.0	1.0	W
Grid No.1 circuit resistance						
with fixed bias	R_{g_1}	=	max.	50	50	kΩ
with automatic bias	R_{g_1}	=	max.	100	100	kΩ
Cathode current	I_k	=	max.	120	120	mA

OPERATING CONDITIONS; two systems in push-pull

			CCS		ICAS	
Frequency	f	=	180	475	180	MHz
Anode voltage	V_a	=	400	350	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-60	-45	-80	V
Anode current	I_a	=	2x100	2x100	2x100	mA
Grid No.2 current	I_{g_2}	=	2x8	2x4.5	2x9	mA
Grid No.1 current	I_{g_1}	=	2x3.0	2x2.0	2x3.5	mA
Driving power	W_{dr}	=	3	10	4	W
Anode input power	W_{ia}	=	2x40	2x35	2x60	W
Anode dissipation	W_a	=	2x13.5	2x16	2x17.5	W
Output power	W_o	=	53	38	85	W
Tube efficiency	η	=	66	54	71	%
Output power in the load	W_ℓ	=	45	-	75	W

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Each system; absolute limits)

Frequency	f		up to 200	500	MHz
Anode voltage	V_a	=	max. 600	400	V
Anode input power	W_{i_a}	=	max. 57.5	38.5	W
Anode dissipation	W_a	=	max. 14	14	W
Grid No.2 voltage	V_{g_2}	=	max. 300	300	V
Grid No.2 dissipation	W_{g_2}	=	max. 2.3	2.3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	175	V
Grid No.1 current	I_{g_1}	=	max. 5.0	5.0	mA
Grid No.1 dissipation	W_{g_1}	=	max. 1.0	1.0	W
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max. 50	50	kΩ
with automatic bias	R_{g_1}	=	max. 100	100	kΩ
Cathode current	I_k	=	max. 120	120	mA

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	
Frequency	f	=	180	180	MHz
Anode voltage	V_a	=	400	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−70	−80	V
Anode current	I_a	=	2x75	2x75	mA
Grid No.2 current	I_{g_2}	=	2x9	2x9	mA
Grid No.1 current	I_{g_1}	=	2x2	2x2	mA
Driving power	W_{dr}	=	4	5	W
Anode input power	W_{i_a}	=	2x30	2x45	W
Anode dissipation	W_a	=	2x10.5	2x13	W
Output power	W_o	=	39	64	W
Tube efficiency	η	=	65	71	%
Output power in the load	W_ℓ	=	32	53	W
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	47	47	W
Grid No.2 peak voltage	$V_{g_{2p}}$	=	185	185	V

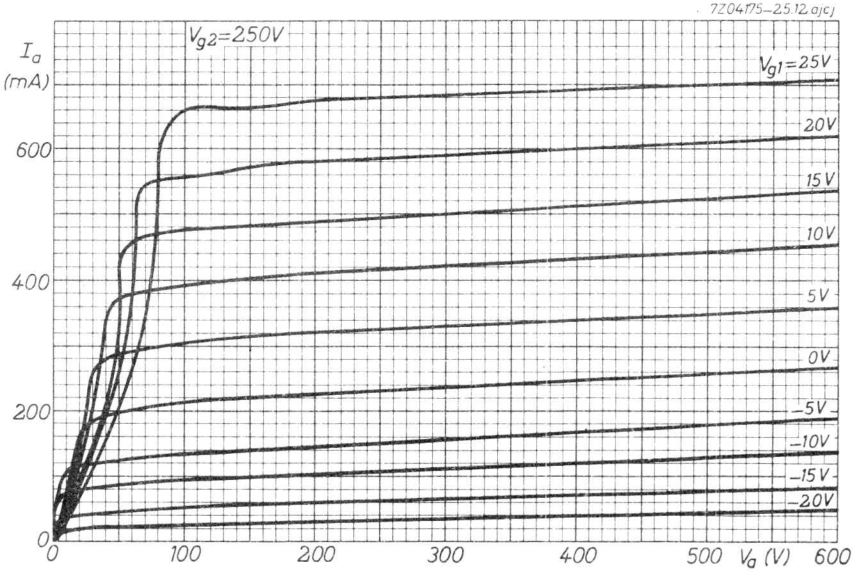
R.F. CLASS C **FREQUENCY** MULTIPLIER

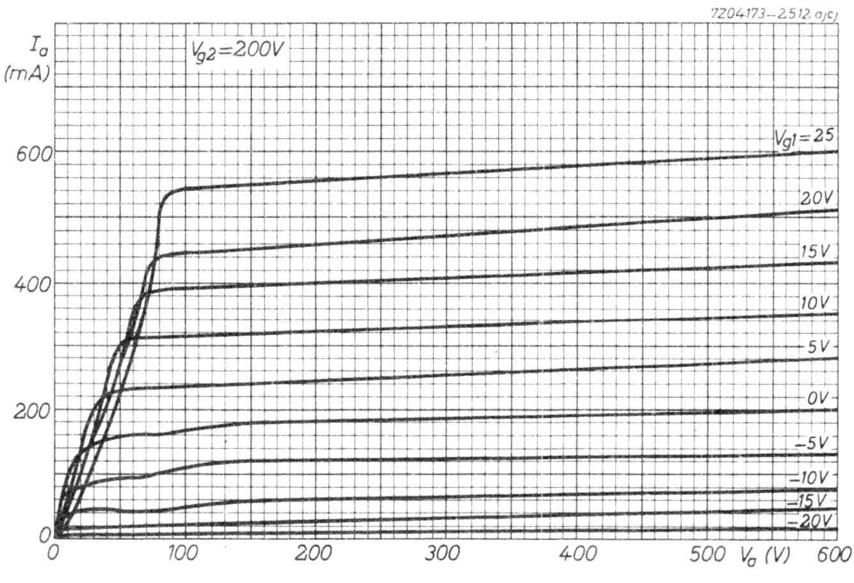
LIMITING VALUES (Each system; absolute limits)

Output frequency	f_{out}		up to	500	MHz
Anode voltage	V_a	=	max.	750	V
Anode input power	W_{ia}	=	max.	60	W
Anode dissipation	W_a	=	max.	20	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No.1 dissipation	W_{g_1}	=	max.	1.0	W
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max.	50	kΩ
with automatic bias	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	100	mA

OPERATING CONDITIONS; two systems in push-pull

			CCS		ICAS	
Frequency	f	=	50/150	50/150	157/470	MHz
Anode voltage	V_a	=	400	500	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	−150	−150	−175	V
Peak grid No.1 driving voltage	$V_{g_{1p}}$	=	360	360	360	V
Anode current	I_a	=	2x72	2x60	2x65	mA
Grid No.2 current	I_{g_2}	=	2x8	2x5	2x6	mA
Grid No.1 current	I_{g_1}	=	2x2.5	2x3.0	2x2.9	mA
Driving power	W_{dr}	=	9	10	8	W
Anode input power	W_{ia}	=	2x29	2x30	2x26	W
Anode dissipation	W_a	=	2x20	2x20	2x18	W
Output power	W_o	=	18	20	16	W
Tube efficiency	η	=	31	33	31	%
Output power in the load	W_ℓ	=	14.5	16	12	W


7Z04175–25.12.ajcj
V_{g2}=250V
I_a (mA)
V_{g1}=25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
0
200
400
600
0
100
200
300
400
500
V_a (V)
600


7Z04173–25.12.ajcj
V_{g2}=200V
I_a (mA)
V_{g1}=25
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
0
200
400
600
0
100
200
300
400
500
V_a (V)
600

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.				C_{ag_2} mod.			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)
175	900	132	1000	163	750	85	800	107

HEATING: indirect by A.C. or D.C. Cathode oxide coated

Heater voltage	V_f	=	6.3 V	12.6 V
Heater current	I_f	=	1.8 A	0.9 A
Pins			5-(1+7)	1-7

CAPACITANCES (each system, the elements of the other system being earthed)

Anode to all other elements except grid No.1	C_a	=	3.2	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.5	pF
Anode to grid No.1	C_{ag_1}	<	0.09	pF

For internal neutralization (C_n, C_n') please refer to the electrode connections

TYPICAL CHARACTERISTICS (each system)

Anode current	I_a	=	30	mA
Mutual conductance	S	=	4.5	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	8.2	

1) Useful power in the load

COOLING: radiation

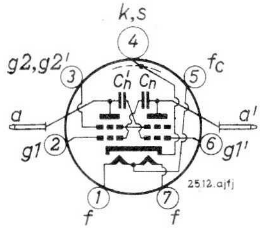
When the tube is used near its limiting values it may be necessary to direct an air flow on the bulb and the anode seals. In general an air flow of approximately 0.56 m^3/min. will be sufficient.

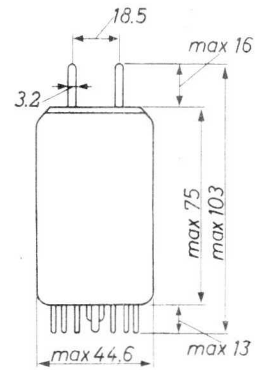
TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and anode seals	= max.	250	°C
Temperature of base pin seals	= max.	180	°C

MECHANICAL DATA Dimensions in mm

Base	: Septar
Socket	: 2422 513 00001
Anode connector	: 40681
Net weight	: 71 g





Mounting position: Vertical with base up or down
or horizontal with the anode pins in a horizontal plane

R.F. CLASS C TELEGRAPHY, two systems in push-pull

LIMITING VALUES (continuous service; absolute limits)

			C. C. S.		
Frequency	f		up to	175	MHz
Anode voltage	V_a	=	max.	1000	V
Anode current	I_a	=	max.	2x110	mA
Anode dissipation	W_a	=	max.	2x30	W
Anode input power	W_{ia}	=	max.	2x100	W
Grids No.2 voltage	$V_{g_2, g_2'}$	=	max.	300	V
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	max.	7	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ [1])
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS (continuous service)

			C. C. S.		
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	1000	900	V
Grids No.2 voltage	$V_{g_2, g_2'}$	=	230	245	V
Grid No.1 voltage	V_{g_1}	=	-85	-90	V
Common grids No.1 resistor	$R_{g_1, g_1'}$	=	15	15	kΩ
Anode current	I_a	=	2x100	2x110	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	11.2	12.5	mA
Grids No.1 current	$I_{g_1+g_1'}$	=	5.7	5.9	mA
Anode input power	W_{ia}	=	200	198	W
Anode dissipation	W_a	=	2x27	2x25	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	2.5	3.0	W
Driver output power	W_{dr}	=	3.5	3.5	W
Output power	W_o	=	146	150	W
Efficiency	η	=	73	75	%
Useful power in the load	W_ℓ	=	125	132	W

[1]) Each section

R.F. CLASS C TELEGRAPHY, two systems in push-pull (continued)

LIMITING VALUES (Intermittent service; absolute limits)

			I. C. A. S.	
Frequency	f	up to	175	MHz
Anode voltage	V_a	= max.	1000	V
Anode current	I_a	= max.	2x120	mA
Anode dissipation	W_a	= max.	2x34	W
Anode input power	W_{ia}	= max.	2x120	W
Grids No.2 voltage	V_{g_2,g_2}	= max.	300	V
Grids No.2 dissipation	$W_{g_2+g_2'}$	= max.	8	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	175	V
Grid No.1 current	I_{g_1}	= max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	50	kΩ [1]
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS (Intermittent service)

			I. C. A. S.		
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	1000	900	V
Grids No.2 voltage	$V_{g_2,g_2'}$	=	260	260	V
Grid No.1 voltage	V_{g_1}	=	-85	-85	V
Common grids No.1 resistor	$R_{g_1,g_1'}$	=	15	15	kΩ
Anode current	I_a	=	2x120	2x120	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	16.5	17.0	mA
Grids No.1 current	$I_{g_1+g_1'}$	=	5.7	5.7	mA
Anode input power	W_{ia}	=	240	216	W
Anode dissipation	W_a	=	2x30	2x25	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	4.3	4.5	W
Driver output power	W_{dr}	=	3.5	3.5	W
Output power	W_o	=	180	166	W
Efficiency	η	=	75	77	%
Useful power in the load	W_ℓ	=	163	147	W

[1]) Each section

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull

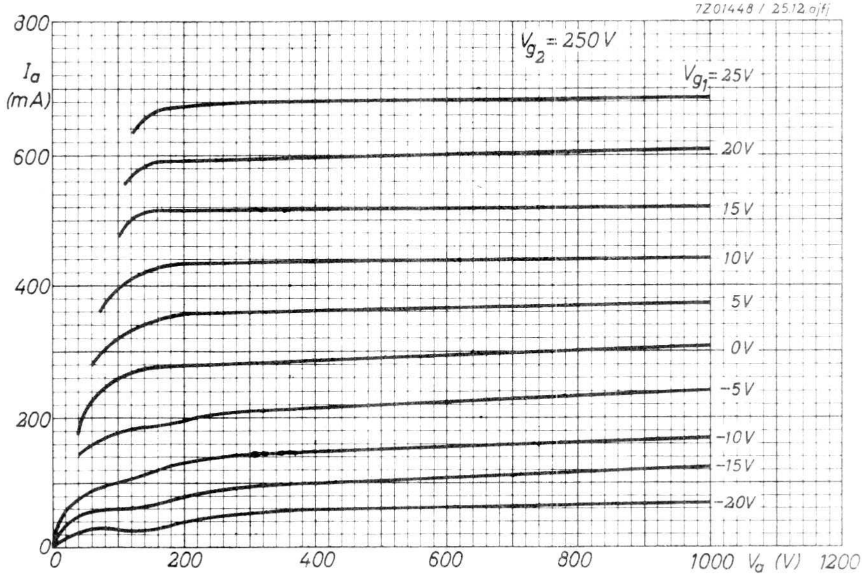
LIMITING VALUES (Absolute limits)

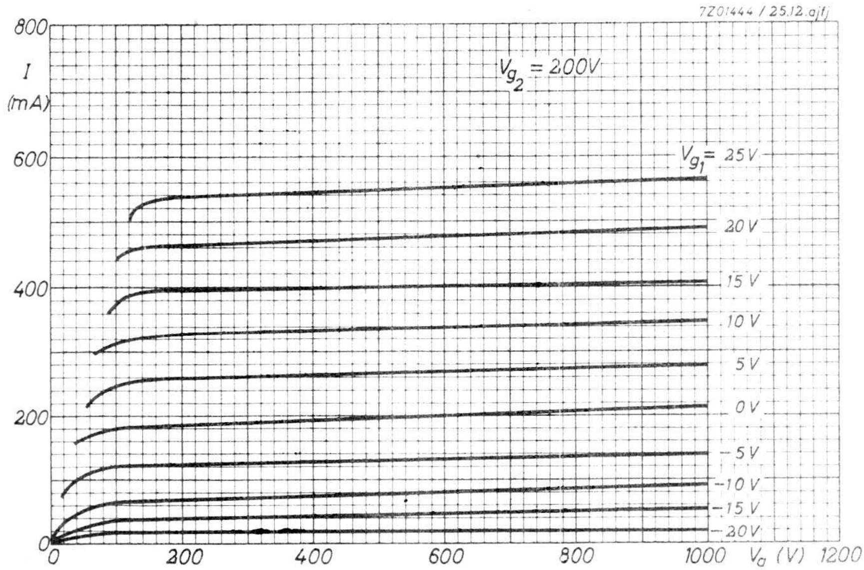
			C. C. S.		I. C. A. S.		
Frequency	f		up to	175	up to	175	MHz
Anode voltage	V_a	=	max.	800	max.	800	V
Anode current	I_a	=	max.	2x90	max.	2x100	mA
Anode dissipation	W_a	=	max.	2x21	max.	2x23.5	W
Anode input power	W_{ia}	=	max.	140	max.	160	W
Grids No.2 voltage	$V_{g_2,g_2'}$	=	max.	250	max.	250	V
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	max.	5.0	max.	5.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	max.	50	kΩ [1]
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

OPERATING CONDITIONS

			C. C. S.	I. C. A. S.	
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	750	800	V
Grids No.2 voltage	$V_{g_2,g_2'}$	=	250	225	V
Grid No.1 voltage	V_{g_1}	=	-66	-75	V
Common grids No.1 resistor	$R_{g_1,g_1'}$	=	15	15	kΩ
Anode current	I_a	=	2x90	2x100	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	10.2	8.8	mA
Grids No.1 current	$I_{g_1+g_1'}$	=	4.4	5.0	mA
Anode input power	W_{ia}	=	135	160	W
Anode dissipation	W_a	=	2x19	2x21	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	2.6	2.0	W
Driver output power	W_{dr}	=	3.4	3.0	W
Output power	W_o	=	97	122	W
Efficiency	η	=	72	74	%
Useful power in the load	W_ℓ	=	85	107	W
Modulation depth	m	=	100	100	%
Peak grids No.2 modulation voltage	$V_{g_2,g_2'p}$	=	90	80	V
Modulation power	W_{mod}	=	68	80	W

[1] Each section


7Z01448 / 25.12.ajfj
V_{g_2} = 250 V
I_a (mA)
800
600
400
200
0
V_{g_1} = 25 V
20 V
15 V
10 V
5 V
0 V
−5 V
−10 V
−15 V
−20 V
0
200
400
600
800
1000
V_a (V)
1200


7Z01444 / 25.12.ajfj
V_{g_2} = 200 V
I (mA)
800
600
400
200
0
V_{g_1} = 25 V
20 V
15 V
10 V
5 V
0 V
−5 V
−10 V
−15 V
−20 V
0
200
400
600
800
1000
V_a (V)
1200

DOUBLE TETRODES

Double tetrodes for use as linear single side band amplifier.

The YL1071 is electrically identical to the YL1070 except for the heater, and has been designed to fit into heatsink cooling equipment.

QUICK REFERENCE DATA				
AB1 linear S.S.B. amplifier, sections in parallel				
Freq. (MHz)	C.C.S.		I.C.A.S.	
	V_a (V)	W_{oPEP} (W)	V_a (V)	W_{oPEP} (W)
7	1000	141	1000	158

HEATING:

Indirect by A.C. or D.C.; parallel supply; oxide coated cathode

		Pins	5-(1+7)	1-7	
YL1070:	Heater voltage	V_f =	6.3	12.6	V
	Heater current	I_f =	1.8	0.9	A
YL1071:	Heater voltage	V_f =	13.25	26.5	V
	Heater current	I_f =	0.866	0.433	A

CAPACITANCES (each section)

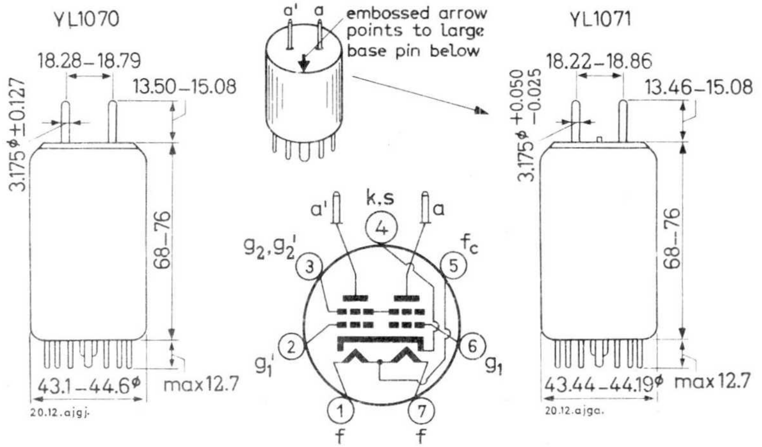
Anode to all other elements except grid No.1	C_a	=	3.15	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.6	pF
Anode to grid No.1	C_{ag_1}	<	0.09	pF

TYPICAL CHARACTERISTICS (each section)

Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	7	

MECHANICAL DATA

Dimensions in mm



Base:	Septar	
Accessories:	Anode connector	40681
	Socket	2422 513 00001
Mounting position:	Vertical with base up or down Horizontal with anode pins in a horizontal plane	
Net weight:	70 g	

COOLING: Radiation and convection

When the tube is used at maximum permissible values it may be necessary to direct an air flow of approx. 0.6 m^3/min to the bulb and to the anode seals. The YL1071 has a calibrated bulb held to close tolerances. This permits an accurate fit into heatsink cooling equipment.

7Z2 8844

TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and all seals	max. 250	°C

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

LIMITING VALUES (Absolute limits) (each section)

Frequency	f		up to 60	up to 175	MHz
Anode voltage	V_a	=	max. 850	max. 750	V
Anode input power	W_{ia}	=	max. 90	max. 75	V
Anode dissipation	W_a	=	max. 30	max. 30	W
Anode current	I_a	=	max. 110	max. 110	mA
Grid No.2 voltage	V_{g_2}	=	max. 300	max. 300	V
Grid No.2 dissipation	W_{g_2}	=	max. 7	max. 7	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	max. 175	V
Grid No.1 current	I_{g_1}	=	max. 5	max. 5	mA
Cathode to heater voltage	V_{kf}	=	max. 100	max. 100	V

R. F. CLASS AB1 LINEAR S. S. B. AMPLIFIER suppressed carrier

LIMITING VALUES (Absolute limits) (each section)

Frequency	f		up to 60		MHz
			C.C.S.	I.C.A.S.	
Anode voltage	V_a	=	max. 1000	max. 1000	V
Anode input power	W_{ia}	=	max. 100	max. 110	W
Anode dissipation	W_a	=	max. 30	max. 34	W
Anode current	I_a	=	max. 110	max. 110	mA
Grid No.2 voltage	V_{g_2}	=	max. 360	max. 360	V
Grid No.2 dissipation	W_{g_2}	=	max. 3.5	max. 4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	max. 175	V
Grid No.1 current	I_{g_1}	=	max. 5	max. 5	mA
Cathode to heater voltage	V_{kf}	=	max. 100	max. 100	V

7Z2 2885

OPERATING CONDITIONS (two sections in parallel)

Table A

				C.C.S.		
Frequency	f	=		7		MHz
Anode voltage	V_a	=		1000		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-34		V [1]
Load resistance	$R_{a\sim}$	=		3100		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	34	34	V
Anode current	$I_{a+a'}$	=	50	195	131	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1.2	26	11.5	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.01	0.01	mA
Anode input power	$W_{ia+a'}$	=	50	195	131	W
Anode dissipation	$W_{a+a'}$	=	50	54	61	W
Output power	W_o	=	-	141	141 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	-	-	< -30	dB [3]
of the fifth order	d_{i_5}	=	-	-	< -45	dB [3]

[1]) Adjust to obtain the stated zero signal anode current.

[2]) Peak envelope power value.

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2886

OPERATING CONDITIONS (two sections in parallel) (continued)

Table B

Frequency	f	=		7		MHz
Anode voltage	V_a	=		800		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-34		V [1]
Load resistance	R_a	=		2300		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	34	34	V
Anode current	$I_{a+a'}$	=	50	197	130	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1.2	26	12.5	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.01	0	mA
Anode input power	$W_{ia+a'}$	=	40	158	104	W
Anode dissipation	$W_{a+a'}$	=	40	46	43	W
Output power	W_o	=	–	112	112 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	–	–	< -30	dB [3]
of the fifth order	d_{i_5}	=	–	–	< -45	dB [3]

[1]) Adjust to obtain the stated zero signal anode current.

[2]) Peak envelope power value

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2887

OPERATING CONDITIONS (two sections in parallel) (continued)

Table C

				C.C.S.		
Frequency	f	=		7		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-32.5		V [1]
Load resistance	R_a	=		1410		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	32.5	32.5	V
Anode current	$I_{a+a'}$	=	60	212	144	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1.9	25	13.5	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.01	0	mA
Anode input power	$W_{ia+a'}$	=	36	127	86	W
Anode dissipation	$W_{a+a'}$	=	36	88	48	W
Output power	W_o	=	–	76	76 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	–	–	< -30	dB [3]
of the fifth order	d_{i_5}	=	–	–	< -45	dB [3]

[1]) Adjust to obtain the stated zero signal anode current.

[2]) Peak envelope power value.

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2888

OPERATING CONDITIONS (two sections in parallel) (continued)

Table D

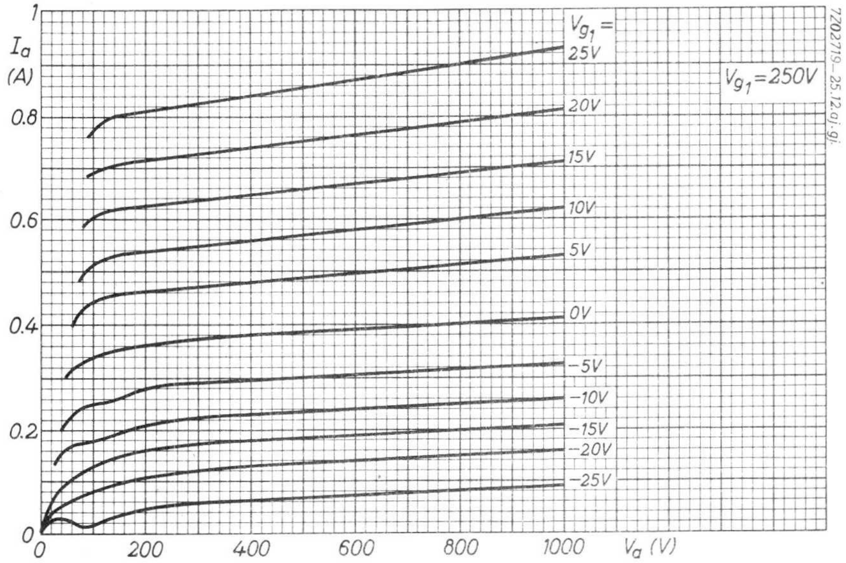
				I.C.A.S.		
Frequency	f	=		7		MHz
Anode voltage	V_a	=		1000		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-36		V [1]
Load resistance	R_a	=		3000		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	36	36	V
Anode current	$I_{a+a'}$	=	55	216	144	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1	25	13	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.05	0.02	mA
Anode input power	$W_{ia+a'}$	=	55	216	144	W
Anode dissipation	$W_{a+a'}$	=	55	58	65	W
Output power	W_o	=	–	158	158 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	–	–	< -30	dB [3]
of the fifth order	d_{i_5}	=	–	–	< -45	dB [3]

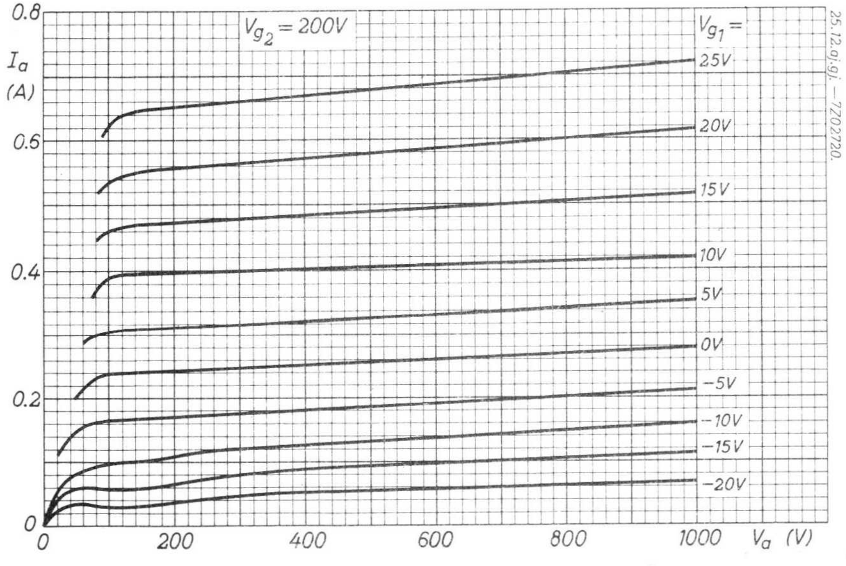
[1]) Adjust to obtain the stated zero signal anode current.

[2]) Peak envelope power value.

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2889


I_a (A)
1
0.8
0.6
0.4
0.2
0
0
200
400
600
800
1000
V_a (V)
V_{g_1} =
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
V_{g_1}=250V
7Z02719–25.12.aj.gj.


I_a (A)
0.8
0.6
0.4
0.2
0
0
200
400
600
800
1000
V_a (V)
V_{g_2}=200V
V_{g_1} =
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
25.12.aj.gj.–7Z02720.

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating double tetrode intended for use in mobile equipment as R.F. amplifier or frequency multiplier up to 200 MHz or as modulator.

QUICK REFERENCE DATA									
Freq. (MHz)	R.F. class C telegraphy			R.F. class C a-g_2 modulator			R.F. class C freq. multiplier		
	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W 2) (W)
200	300	1	12	200	1	7			
67/200							300	1	3,5

HEATING: direct by a.c. or d.c.; parallel or series supply
Oxide coated filament, harp type.

Frequency of the filament supply:

for sinusoidal supply voltage — 50 to 60 Hz

for square wave supply voltage (e.g. from a d.c.-a.c. converter) — any

Sinusoidal supply voltages within the frequency range from 200 to 5000 Hz shall not be used.

Filament voltage	V_f		1,6 V ± 15% 3)
Filament current	I_f		2,5 A
Heating time for W_o = 70% of full output power	T_h	<	0,5 s

COOLING: radiation and convection
The use of a closed tube shield is not recommended.

1) Driver output power

2) Useful power in the load

3) Total permissible variation due to variations of supply voltage and setting of V_f.

CAPACITANCES

Anode to all other elements except grid No. 1	C_a	= $C_{a'}$	= 3.1	pF
Grid No. 1 to all other elements except anode	C_{g_1}	= $C_{g_1'}$	= 7.5	pF
Anode to grid No. 1	C_{ag_1}	= $C_{a'g'_1}$	< 0.1	pF
Anode of one system to grid No. 1 of the other system	$C_{ag_1'}$	= $C_{a'g_1}$	< 0.1	pF
Between the grids No. 1	$C_{g_1g_1'}$		= 2	pF
Between the anodes	$C_{aa'}$		= 0.06	pF

The tube is internally neutralised up to 200 MHz

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	200	V
Grid No. 2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	30	mA
Amplification factor	$\mu_{g_2g_1}$	=	7	
Mutual conductance	S	=	3.3	mA/V

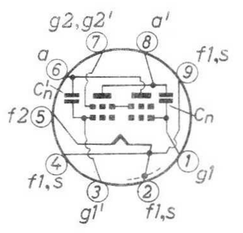
MECHANICAL DATA (Dimensions in mm)

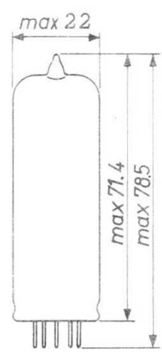
Base : Noval

Socket : 2422 502 01003

Tube retainer : 40647

Net weight : 16 g





Mounting position: any. If the tube is mounted with its main axis deviating from the vertical, it is recommended that pins 2 and 7 be in a vertical plane.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 250 °C

Pin temperature = max. 120 °C

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

LIMITING VALUES (each system; absolute limits)

Frequency	f	up to	200	MHz
Anode voltage	V_a	= max.	300	V
Anode current	I_a	= max.	45	mA
Anode dissipation	W_a	= max.	5	W
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	1	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	3	mA
Grid No.1 dissipation	W_{g_1}	= max.	0.2	W
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ
Cathode current	I_k	= max.	50	mA
Peak cathode current	I_{k_p}	= max.	225	mA

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	200	200	200	MHz
Anode voltage	V_a	=	300	250	200	V
Grid No.2 supply voltage	V_{bg_2}	=	300	250	200	V
Grid No.2 resistor	R_{g_2}	=	56	47	22	kΩ
Grid No.1 voltage	V_{g_1}	=	-40	-	-	V
Common grid No.1 resistor	R_{g_1}	=	-	18	15	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1g_1'p}$	=	110	110	115	V
Anode current	I_a	=	2 x 37.5	2 x 33.5	2 x 35	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	2.3	1.8	2.2	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	2 x 0.9	2.2	2.7	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.4	0.3	0.33	W
Driver output power	W_{dr}	=	1.0	1.0	1.0	W
Anode input power	W_{i_a}	=	2 x 11.3	2 x 8.4	2 x 7.0	W
Anode dissipation	W_a	=	2 x 4.0	2 x 2.9	2 x 2.8	W
Tube efficiency	η	=	65	65	60	%
Output power in the load	W_ℓ	=	12	9.0	7.4	W

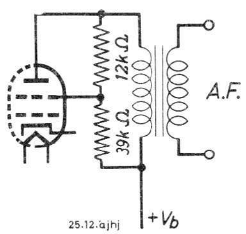
R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (each system; absolute limits)

Frequency	f	up to	200	MHz
Anode voltage	V_a	= max.	240	V
Anode current	I_a	= max.	37.5	mA
Anode input power	W_{i_a}	= max.	7.5	W
Anode dissipation	W_a	= max.	3.3	W
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No. 2 dissipation	W_{g_2}	= max.	0.65	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	3	mA
Grid No.1 dissipation	W_{g_1}	= max.	0.2	W
Cathode current	I_k	= max.	40	mA
Peak cathode current	I_{k_p}	= max.	180	mA

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	200	MHz
Anode voltage	V_a	=	200	V
Grid No.2 supply voltage (see fig. below)	V_{bg_2}	=	200	V
Common grid No.1 resistor	R_{g_1}	=	33	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1 g_1'p}$	=	130	V
Anode current	I_a	=	2 x 33.5	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	2.6	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	1.5	mA
Grid No.2 dissipation	W_{g_2}	=	0.46	W
Driver output power	W_{dr}	=	1.0	W
Anode input power	W_{ia}	=	2 x 6.7	W
Anode dissipation	W_a	=	2 x 2.65	W
Tube efficiency	η	=	60	%
Useful power in the load	W_ℓ	=	7.0	W
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	6.7	W



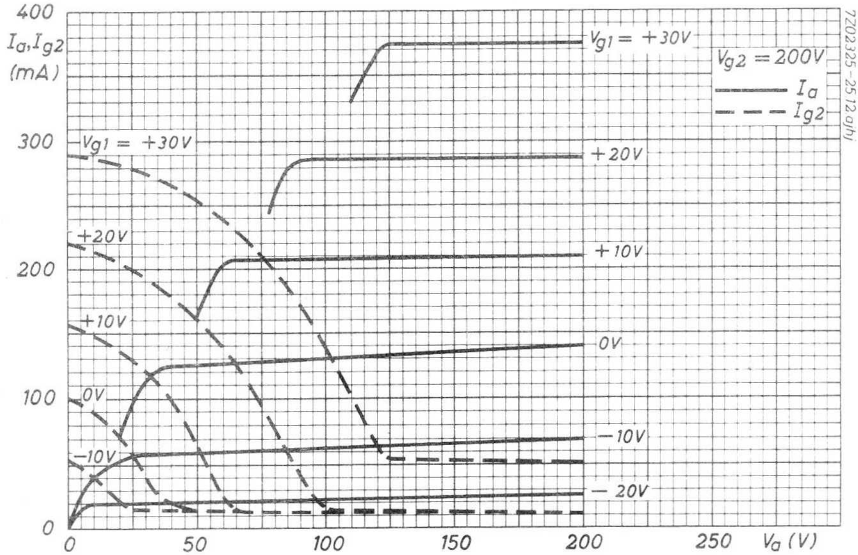
R.F. CLASS C FREQUENCY TRIPLER

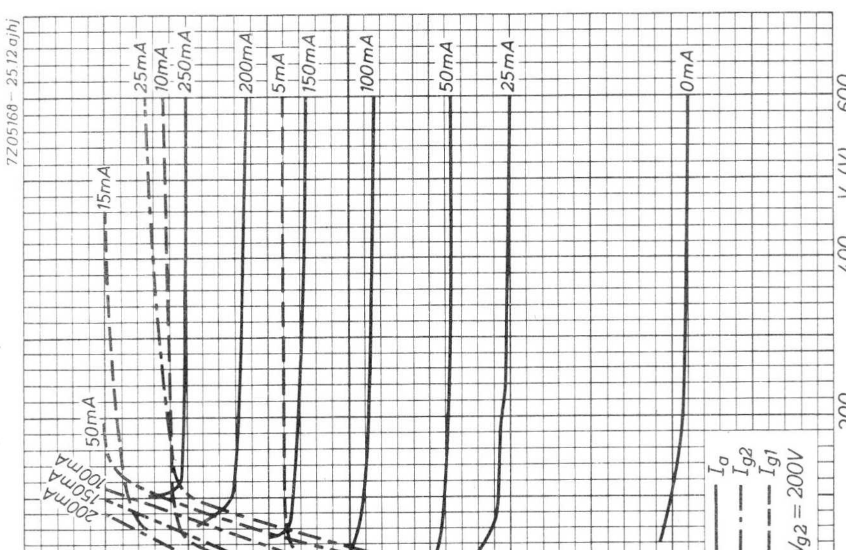
LIMITING VALUES (each system; absolute limits)

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	300	V
Anode current	I_a	=	max.	30	mA
Anode dissipation	W_a	=	max.	5	W
Grid No. 2 voltage	V_{g_2}	=	max.	200	V
Grid No. 2 dissipation	W_{g_2}	=	max.	1	W
Negative grid No. 1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No. 1 current	I_{g_1}	=	max.	2	mA
Grid No. 1 dissipation	W_{g_1}	=	max.	0.2	W
Grid No. 1 circuit resistance	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	35	mA
Peak cathode current	I_{k_p}	=	max.	225	mA

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	67/200	67/200	67/200	MHz
Anode voltage	V_a	=	300	250	200	V
Grid No. 2 supply voltage	V_{bg_2}	=	300	250	200	V
Grid No. 2 resistor	R_{g_2}	=	72	47	15	kΩ
Grid No. 1 voltage	V_{g_1}	=	-100	-	-	V
Common grid No. 1 resistor	R_{g_1}	=	-	47	33	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1g_1'p}$	=	230	230	230	V
Anode current	I_a	=	2 x 24	2 x 25	2 x 28.5	mA
Grid No. 2 current	$I_{g_2+g_2'}$	=	2.0	1.9	3.0	mA
Grid No. 1 current	$I_{g_1+g_1'}$	=	2 x 1.0	2.0	3.2	mA
Grid No. 2 dissipation	$W_{g_2+g_2'}$	=	0.30	0.31	0.46	W
Driver output power	W_{dr}	=	1.0	1.0	2.0	W
Anode input power	W_{i_a}	=	2 x 7.2	2 x 6.25	2 x 5.7	W
Anode dissipation	W_a	=	2 x 4.0	2 x 3.75	2 x 3.8	W
Tube efficiency	η	=	45	40	33.5	%
Output power in the load	W_ℓ	=	3.5	3.0	2.8	W


400
I_a, I_{g2} (mA)
300
200
100
0
0
50
100
150
200
250
V_a (V)
$V_{g1} = +30V$
+20V
+10V
0V
−10V
− 20V
$V_{g1} = +30V$
+20V
+10V
0V
−10V
$V_{g2} = 200V$
I_a
I_{g2}
7Z02325-25.12.ajhj


7Z05168-25.12.ajhj
25mA
10mA
250mA
200mA
5mA
150mA
100mA
50mA
25mA
0mA
15mA
50mA
100mA
150mA
200mA
V_a (V)
600
400
200
0
I_a
I_{g2}
I_{g1}
$V_{g2} = 200V$
40
V_{g1} (V)
20
0
−20
−40
−60

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled power tetrode in coaxial construction intended for use as R.F. amplifier in SSB transmitters and as A.M. amplifier.

QUICK REFERENCE DATA						
Frequency MHz	S.S.B.		C_a-g_2 mod.		Class B mod.	
	V_a(kV)	W_o(kW) P.E.P.	V_a(kV)	W_o(kW)	V_a(kV)	W_o(kW)
30	9	120	11	220	11	320

HEATING: Direct, filament thoriated tungsten

Filament voltage	V_f	20	V
Filament current	I_f	345	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	120	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	600	pF
Anode to grid No.1	C_{ag_1}	8.5	pF [1])

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	1	kV
Anode current	I_a	10	A
Transconductance	S	130	mA/V
Amplification factor	$\mu_{g_2g_1}$	4	-

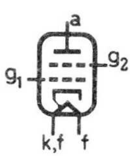
[1]) Measured with a flat shield of 500 mm diameter in the plane of grid No.2

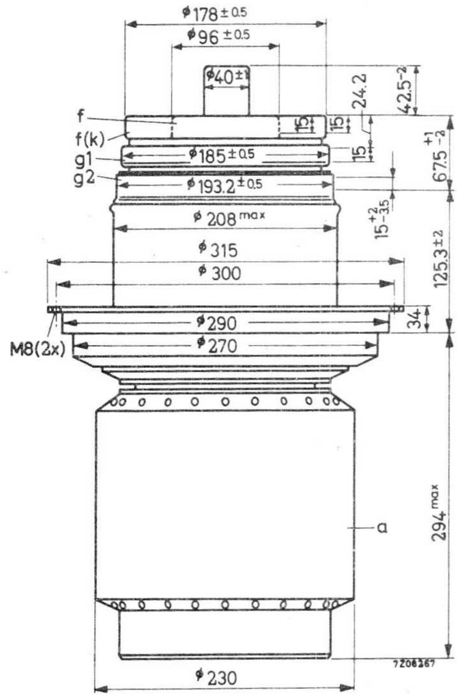
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 51 kg

Mounting position: vertical with anode down





ACCESSORIES

Boiler	type K729
Filament connector (one required)	type 40732
Grid No.1 connector	type 40733
Grid No.2 connector	type 40734
→ Filament connector with cable (four required)	type 40670

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	15	kV
Grid No.2 voltage	V_{g_2}	max.	1.6	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	40	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	360	kW
Anode dissipation	W_a	max.	150	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		9		kV
Grid No.2 voltage	V_{g_2}		1.5		kV
Grid No.1 voltage	V_{g_1}		-450		V 1)
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	450	450	V
Anode current	I_a	5	21	13.2	A
Grid No.2 current	I_{g_2}	0	0.8	0.5	A
Anode input power	W_{ia}	45	189	118.8	kW
Anode dissipation	W_a	45	69	58.8	kW
Grid No.2 dissipation	W_{g_2}	0	1.2	0.75	kW
Output power (P.E.P.)	W_o	-	120	120	kW

1) Adjust to give the zero signal anode current.

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	11.5	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	32	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	300	kW
Anode dissipation	W_a	max.	100	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	11	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-590	V
Grid No.1 resistor	R_{g_1}	60	Ω
Grid No.1 driving voltage	$V_{g_{1p}}$	960	V
Anode current	I_a	25	A
Grid No.2 current	I_{g_2}	3	A
Grid No.1 current	I_{g_1}	1.6	A
Driving power	W_{dr}	1.4	kW
Grid No.2 dissipation	W_{g_2}	2.4	kW
Anode input power	W_{i_a}	275	kW
Output power	W_o	220	kW
Anode dissipation	W_a	55	kW
Efficiency	η	80	%
Modulation depth	m	100	%
Modulation power	W_{mod}	140	kW
Grid No.2 voltage, peak	$V_{g_{2p}}$	700	V

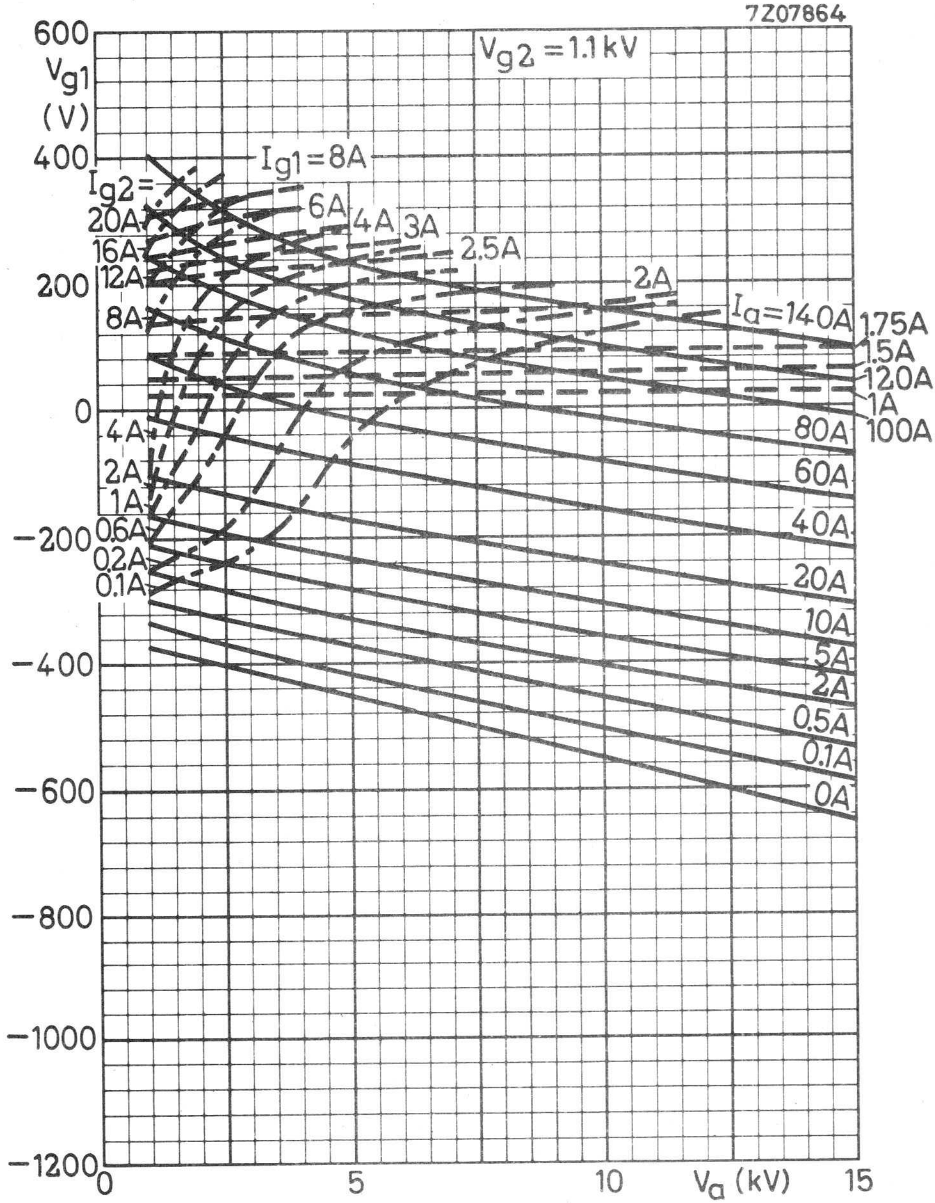
A.F. CLASS B AMPLIFIER AND MODULATOR

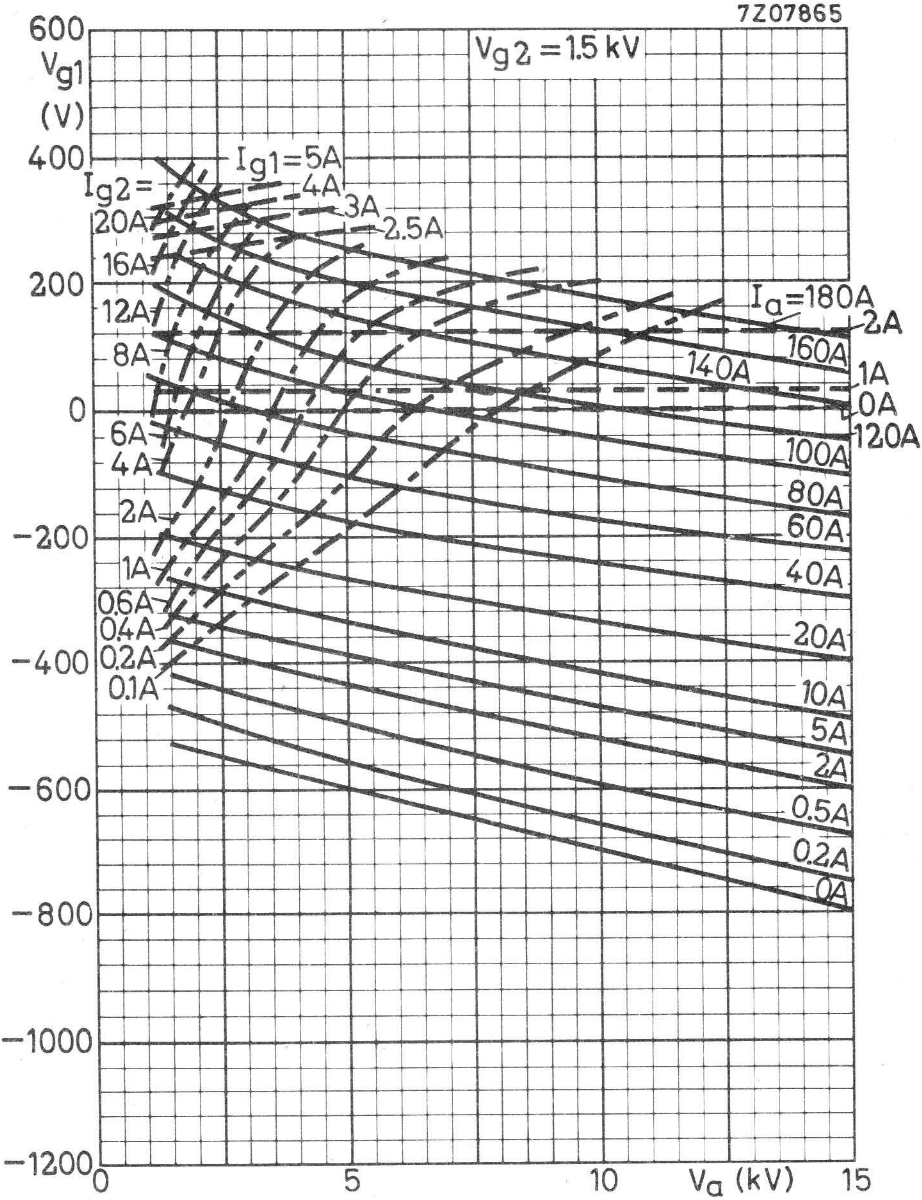
LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	max.	12	kV
Anode input power	W_{ia}	max.	300	kW
Anode dissipation	W_a	max.	150	kW
Cathode current	I_k	max.	50	A
Cathode current (peak)	I_{kp}	max.	280	A
Grid No.2 voltage	V_{g_2}	max.	1.7	kV
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 resistance	R_{g_1}	max.	1	kΩ
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS; two tubes in push-pull

Anode voltage	V_a	11		11		kV
Grid No.2 voltage	V_{g_2}	1.5		1.5		kV
Grid No.1 voltage	V_{g_1}	-520		-520		V
Load resistance	R_{aa}	500		670		Ω
Peak driving voltage	$V_{g_1g_{1p}}$	0	1100	0	950	V
Anode current	I_a	2x3	2x22	2x3	2x16.5	A
Grid No.2 current	I_{g_2}	0	2x0.45	0	2x0.35	A
Grid No.1 current	I_{g_1}	0	2x0.04	0	0	A
Grid No.2 dissipation	W_{g_2}	0	2x680	0	2x530	W
Anode input power	W_{ia}	2x33	2x242	2x33	2x182	kW
Anode dissipation	W_a	2x33	2x82	2x33	2x62	kW
Output power	W_o	0	320	0	240	kW
Efficiency	η		66		66	%


7Z07864
V_{g2} = 1.1 kV
600
V_{g1}
(V)
400
200
0
−200
−400
−600
−800
−1000
−1200
I_{g1} = 8A
6A
4A
3A
2.5A
2A
I_{g2} =
20A
16A
12A
8A
4A
2A
1A
0.6A
0.2A
0.1A
I_a = 140A
120A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.1A
0A
1.75A
1.5A
1A
0
5
10
V_a (kV)
15


7Z07865
V_{g2} = 1.5 kV
V_{g1} (V)
600
400
200
0
−200
−400
−600
−800
−1000
−1200
I_{g1}=5A
4A
3A
2.5A
2A
1A
0A
I_{g2}=
20A
16A
12A
8A
6A
4A
2A
1A
0.6A
0.4A
0.2A
0.1A
I_a=180A
160A
140A
120A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.2A
0A
0
5
10
V_a (kV)
15

COAXIAL BEAM POWER TETRODES

Beam power tetrodes with ceramic-to-metal seals and coaxial arrangement of the terminals. The tubes are intended for use as R.F. power amplifier, oscillator and frequency multiplier, and as A.F. amplifier and modulator in A.M., F.M. and S.S.B. transmitters for frequencies up to 2000 MHz.

QUICK REFERENCE DATA

Frequency (MHz)	C telegr.		C ag_2 mod.		S.S.B.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W) [1]
1200	900	40				
400	900	80	700	45		
60					850	40

COOLING

Forced air cooling of radiator and seals.

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

YL1100

Heater voltage	V_f		26,5	V
Heater current	I_f		0,52	A
Heating time	T_h	min.	60	s

YL1101

Heater voltage	V_f		6,3	V
Heater current	I_f		2,1	A
Heating time	T_h	min.	60	s

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

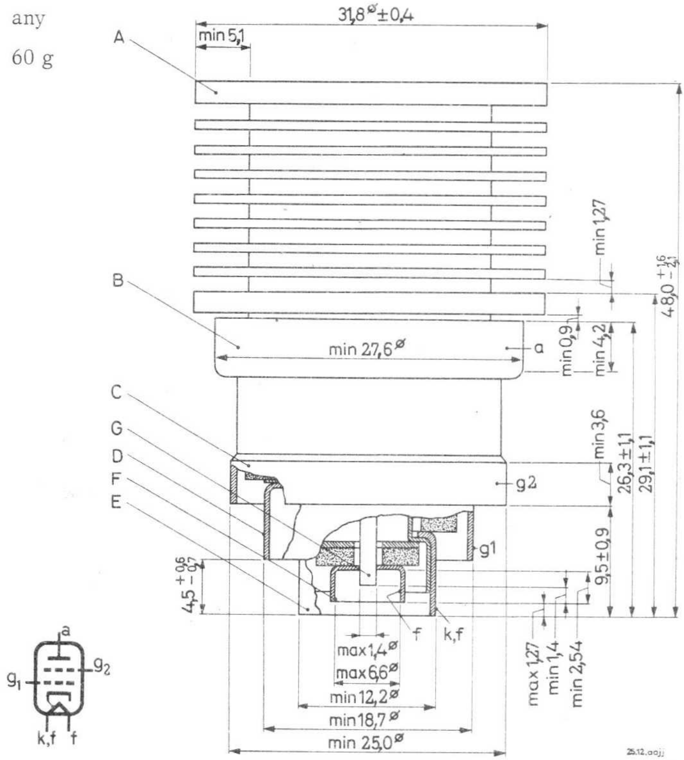
[1]) single tone operation

MECHANICAL DATA

Dimensions in mm

Mounting position : any

Net weight : 60 g



Radiator and terminals lie inside or outside concentric cylinders with the following diameters:

Radiator	:	A	inside	24, 15	mm diameter
Anode terminal	:	B	inside	28, 40	mm diameter
g_2 terminal	:	C	inside	25, 86	mm diameter
g_1 terminal	:	D	inside	19, 38	mm diameter
Cathode terminal	:	E	inside	13, 16	mm diameter
Heater terminal	:	F	outside	6, 07	mm diameter
		G	inside	1, 78	mm diameter

CAPACITANCES

Anode to grid no.1	C_{ag_1}	<	0,065	pF
Grid no.1 to cathode and heater	$C_{g_1/kf}$		14	pF
Anode to cathode and heater	$C_{a/kf}$	<	0,015	pF
Grid no.2 to grid no.1	$C_{g_1g_2}$		19	pF
Anode to grid no.2	C_{ag_2}		4,4	pF
Grid no.2 to cathode and heater	$C_{g_2/kf}$	<	0,4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	1000	V
Grid no.2 voltage	V_{g_2}	250	V
Anode current	I_a	100	mA
Amplification factor	$\mu_{g_2g_1}$	18	

TEMPERATURE LIMITS (Absolute limits)

Anode seal temperature	t	max. 250	^oC

Notes to page 4

1) Fixed supply or supply derived from the anode supply by means of a voltage divider.

2) Power transferred from driving stage included.

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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	1200	MHz
Anode voltage	V_a	max.	1000	V
Anode input power	W_{ia}	max.	180	W
Anode dissipation	W_a	max.	115	W
Anode current	I_a	max.	180	mA
Grid no.2 voltage	V_{g_2}	max.	300	V
Grid no.2 dissipation	W_{g_2}	max.	4,5	W
Grid no.1 voltage, negative	$-V_{g_1}$	max.	100	V
Grid no.1 current	I_{g_1}	max.	30	mA
Grid no.1 circuit resistance	R_{g_1}	max.	30	kΩ

OPERATING CONDITIONS (grid drive)

Frequency	f	400	1200	MHz
Anode voltage	V_a	900	900	V
Grid no.2 voltage	V_{g_2}	300	300	V [1])
Grid no.1 voltage	V_{g_1}	-30	-22	V
Anode current	I_a	170	170	mA
Grid no.2 current	I_{g_2}	1	1	mA
Grid no.1 current	I_{g_1}	10	4	mA
Driving power	W_{dr}	3	5	W
Output power in load	W_ℓ	80	40	W

OPERATING CONDITIONS (cathode drive)

Frequency	f	1200	MHz
Anode voltage	V_a	900	V
Grid no.2 voltage	V_{g_2}	300	V
Grid no.1 voltage	V_{g_1}	-31	V
Anode current	I_a	170	mA
Grid no.2 current	I_{g_2}	3,2	mA
Grid no.1 current	I_{g_1}	3,4	mA
Driving power	W_{dr}	8	W
Output power in load	W_ℓ	40	W [2])

Notes see page 3

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)

(Carrier conditions with modulation up to 100 %)

Frequency	f	up to	1200	MHz
Anode voltage	V_a	max.	800	V
Anode input power	W_{ia}	max.	120	W
Anode dissipation	W_a	max.	75	W
Anode current	I_a	max.	150	mA
Grid no.2 voltage	V_{g_2}	max.	300	V
Grid no.2 dissipation	W_{g_2}	max.	3	W
Grid no.1 voltage, negative	$-V_{g_1}$	max.	100	V
Grid no.1 current	I_{g_1}	max.	30	mA
Grid no.1 circuit resistance	R_{g_1}	max.	30	kΩ

OPERATING CONDITIONS

Frequency	f	400	MHz
Anode voltage	V_a	700	V
Grid no.2 voltage	V_{g_2}	250	V
Grid no.1 voltage	V_{g_1}	-50	V
Anode current	I_a	130	mA
Grid no.2 current	I_{g_2}	10	mA
Grid no.1 current	I_{g_1}	10	mA
Driving power	W_{dr}	3	W
Output power in load	W_{ℓ}	45	W

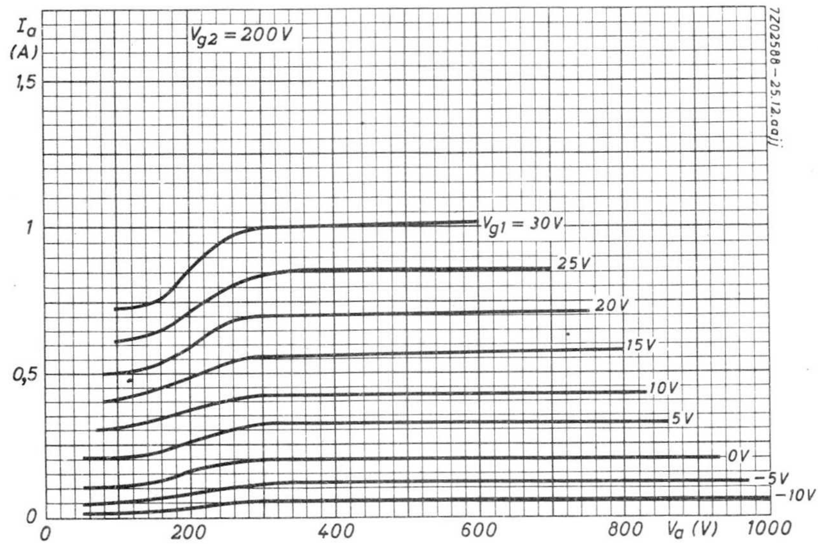
R.F. CLASS AB 1 SINGLE SIDEBAND AMPLIFIER

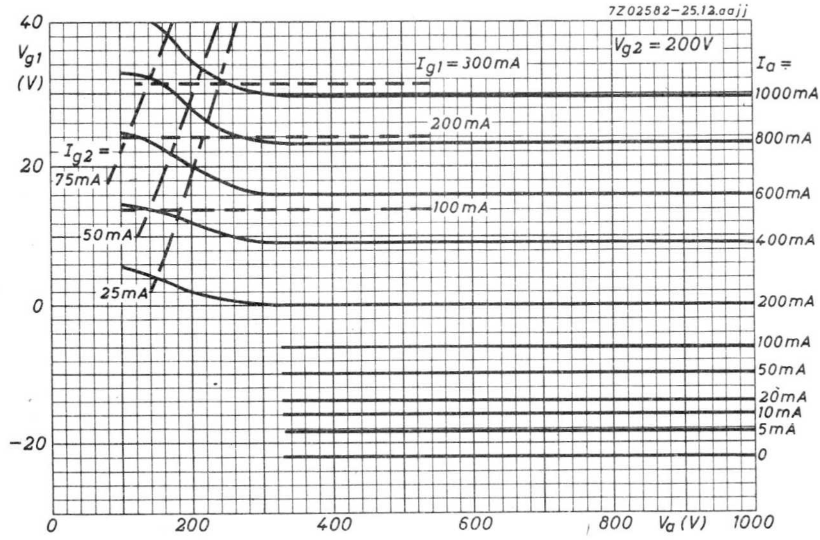
LIMITING VALUES (Absolute max. rating system)

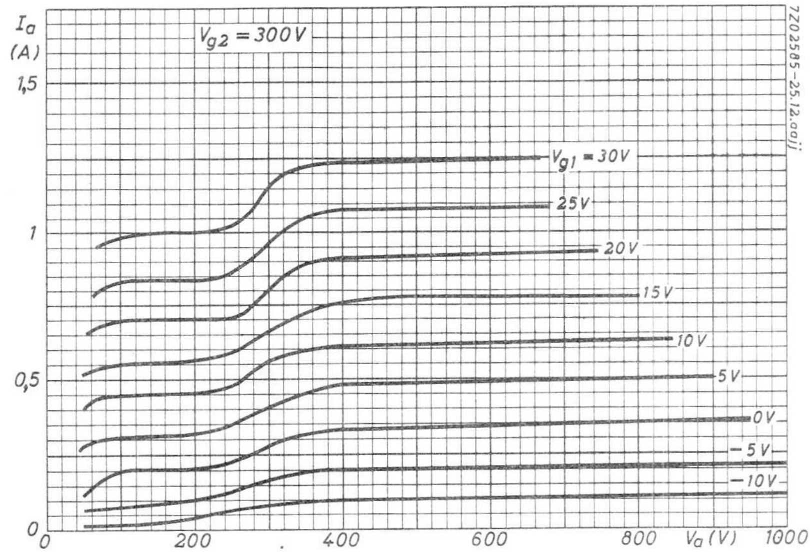
Frequency	f	up to	1200	MHz
Anode voltage	V_a	max.	1000	V
Anode input power	W_{ia}	max.	180	W
Anode dissipation	W_a	max.	115	W
Anode current	I_a	max.	180	mA
Grid no.2 voltage	V_{g2}	max.	300	V
Grid no.2 dissipation	W_{g2}	max.	4,5	W
Grid no.1 voltage, negative	$-V_{g1}$	max.	100	V
Grid no.1 circuit resistance	R_{g1}	max.	30	kΩ

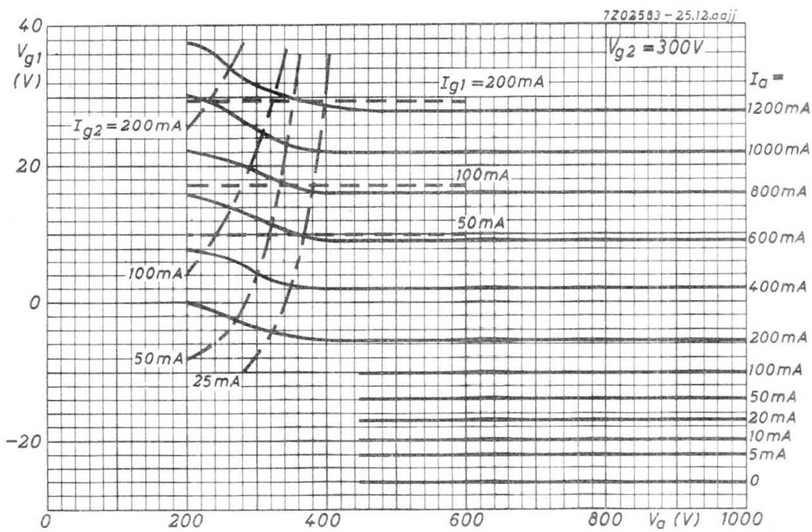
OPERATING CONDITIONS

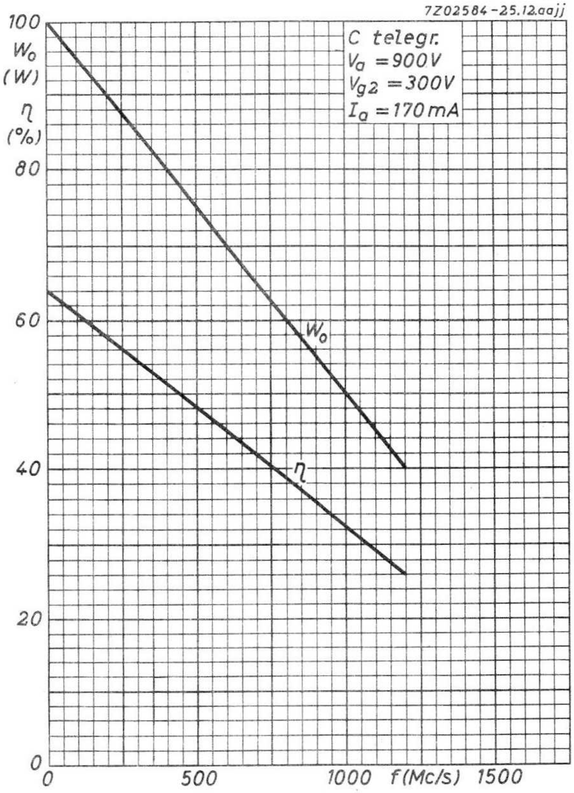
Frequency	f	60		60		MHz
Anode voltage	V_a	650		850		V
Grid no.2 voltage	V_{g2}	300		300		V
Grid no.1 voltage	V_{g1}	-15		-15		V
		zero signal	double tone	zero signal	double tone	
Driving voltage, peak	V_{g1p}	0	15	0	15	V
Anode current	I_a	40	100	40	100	mA
Grid no.2 current	I_{g2}	0	10	0	10	mA
Grid no.1 current	I_{g1}	0	0	0	0	mA
Driving power	W_{dr}	0	0	0	0	W
Peak envelope output power	W_{oPEP}	0	25	0	40	W

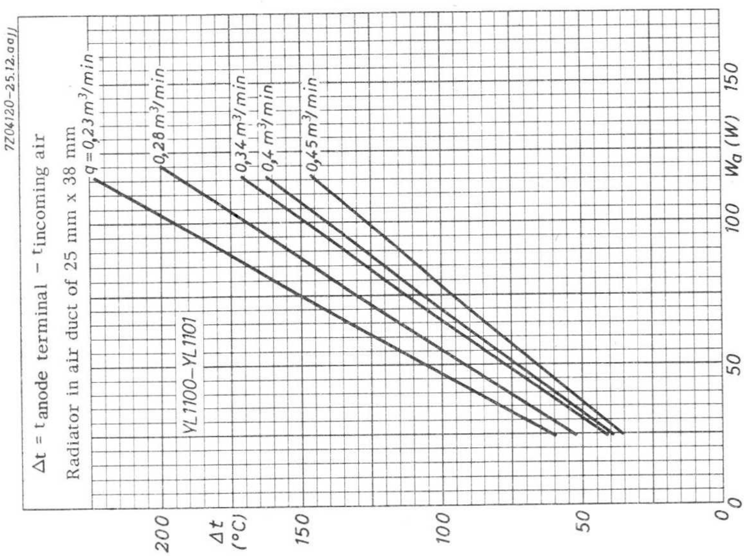

7Z02588 - 25.12.aajj
I_a (A)
$V_{g2} = 200V$
$V_{g1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
0
0,5
1
1,5
0
200
400
600
800
V_a (V)
1000

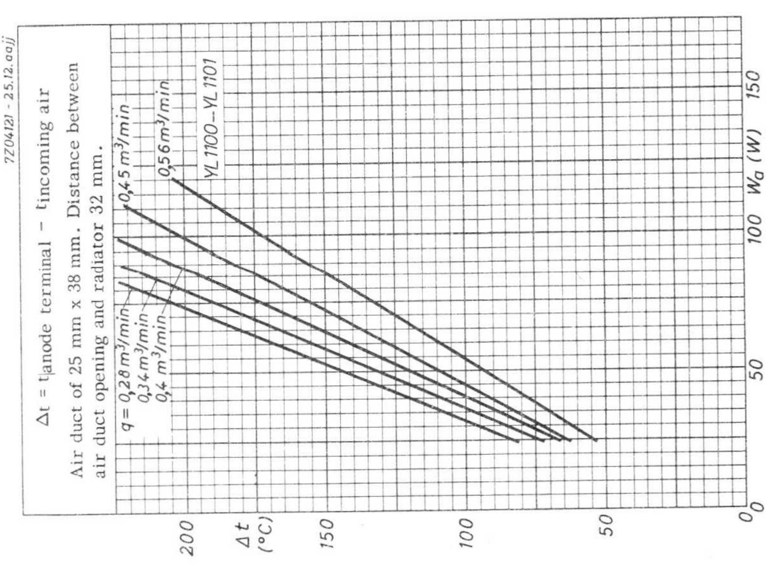

7Z02582−25.12.aajj
V_{g1} (V)
$V_{g2} = 200V$
$I_{g1} = 300mA$
200mA
100mA
$I_{g2} =$
75mA
50mA
25mA
$I_a =$
1000mA
800mA
600mA
400mA
200mA
100mA
50mA
20mA
10mA
5mA
0
40
20
0
−20
0
200
400
600
800
V_a (V)
1000


I_a (A)
$V_{g2} = 300V$
7Z02585-25.12.aajj
$V_{g1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
1,5
1
0,5
0
0
200
400
600
800
V_a (V)
1000


7Z02583-25.12.aajj
$V_{g2} = 300V$
V_{g1} (V)
$I_{g1} = 200mA$
$I_{g2} = 200mA$
100mA
50mA
100mA
50mA
25mA
I_a =
1200mA
1000mA
800mA
600mA
400mA
200mA
100mA
50mA
20mA
10mA
5mA
0
40
20
0
−20
0
200
400
600
800
V_a (V)
1000


7Z02584-25.12.aajj
C telegr.
V_a = 900 V
V_{g2} = 300 V
I_a = 170 mA
100
W_o
(W)
η
(%)
80
60
40
20
0
W_o
η
0
500
1000
f (Mc/s)
1500


7Z04120-25.12.aajj
Δt = t anode terminal − t incoming air
Radiator in air duct of 25 mm x 38 mm
q = 0,23 m^3/min
0,28 m^3/min
0,34 m^3/min
0,4 m^3/min
0,45 m^3/min
YL1100–YL1101
200
Δt (°C)
150
100
50
0
0
50
100
150
Wa (W)


7Z04121 - 25.12.aajj
Δt = t anode terminal − t incoming air
Air duct of 25 mm x 38 mm. Distance between air duct opening and radiator 32 mm.
q = 0,28 m^3/min
0,34 m^3/min
0,4 m^3/min
0,45 m^3/min
0,56 m^3/min
YL1100–YL1101
200
Δt (°C)
150
100
50
0
0
50
100
150
Wa (W)

AIR COOLED
COAXIAL BEAM POWER TETRODE

Forced air cooled beam power tetrode with integral radiator and coaxial, ceramic insulated terminals. Intended for use as UHF amplifier or oscillator at frequencies up to 1215 MHz.

QUICK REFERENCE DATA					
Frequency (MHz)	Anode voltage	RF class C telegraphy	RF class A linear ampl.	RF class B SSB	RF class C ag_2 mod.
	V_a (V)	W_{load} (W)	W_{load} (W)	W_o PEP (W)	W_{load} (W)
790	2500	590			
	1400		55		
470	2500	730			
400	2000				600
30	2500			680	

HEATING: indirect by A.C. or D.C.; cathode oxide coated, matrix type

Heater voltage	V_f	=	6.3	V ±10%
Heater current	I_f	=	7.85	A
Heating time	T_h	= min.	120	sec

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

CAPACITANCES

Anode to grid No.1	C_{ag_1}	<	0.11	pF
Grid No.1 to cathode and heater	$C_{g_1/kf}$	=	29	pF
Anode to cathode and heater	$C_{a/kf}$	<	0.011	pF
Grid No.1 to grid No.2	$C_{g_1g_2}$	=	37	pF
Grid No.2 to cathode and heater	$C_{g_2/kf}$	<	1.1	pF

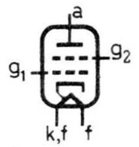
TYPICAL CHARACTERISTICS

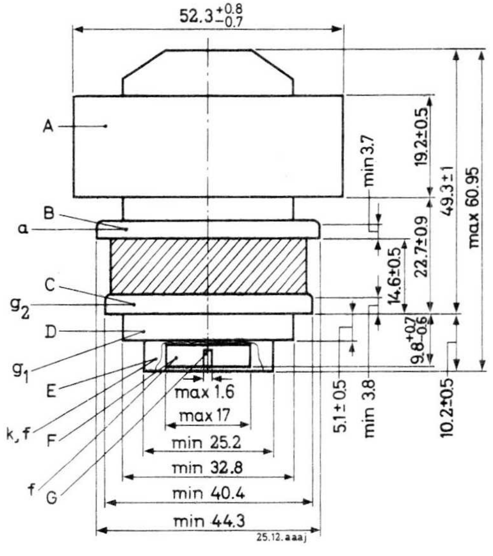
Anode voltage	V_a	=	225	2500	V
Grid No.2 voltage	V_{g_2}	=	225	400	V
Anode current	I_a	=	100	240	mA
Amplification factor	$\mu_{g_2 g_1}$	=	13	-	
Mutual conductance	S	=	-	22	mA/V

MECHANICAL DATA

Dimensions in mm

Net weight: 340 g





Radiator and terminals lie inside or outside concentric cylinders with the following diameters:

Radiator	:	A	inside	53.54 mm diameter
Anode terminal	:	B	inside	45.69 mm diameter
g_2 terminal	:	C	inside	40.87 mm diameter
g_1 terminal	:	D	inside	33.50 mm diameter
Cathode terminal	:	E	inside	25.88 mm diameter
Heater terminal	:	F	outside	15.72 mm diameter
		G	inside	2.51 mm diameter

Mounting position: any

TEMPERATURE LIMITS (Absolute limits)

Anode temperature	=	max. 250 °C
Temperature of all seals	=	max. 250 °C

COOLING CHARACTERISTICS

Forced air cooling of the anode at an air inlet temperature of 25 °C:

Anode dissipation	W_a	=	100	300	600	700	W
Min. required air flow	q_{min}	=	0.06	0.12	0.32	0.46	m^3/min
Pressure loss	p_i	=	2	4	17	25	mm H_2O

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

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{i_a}	=	max.	1250	W
Anode dissipation	W_a	=	max.	700	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS in grounded grid circuit

Frequency	f	=	790	470	MHz
Anode voltage	V_a	=	2500	2500	V
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.1 voltage	V_{g_1}	=	−45	−35	V
Anode current	I_a	=	500	500	mA
Grid No.2 current	I_{g_2}	=	7	8	mA
Grid No.1 current	I_{g_1}	=	10	12	mA
Driving power	W_{dr}	=	60	35	W
Output power in load	W_{load}	=	590	730	W

R.F. CLASS A LINEAR AMPLIFIER, T.V. TRANSLATOR SERVICE, SOUND AND VISION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 1215	MHz
Anode voltage	V_a	=	max. 2500	V
Anode input power	W_{ia}	=	max. 1250	W
Anode dissipation	W_a	=	max. 600	W
Anode current	I_a	=	max. 500	mA
Grid No.2 voltage	V_{g_2}	=	max. 1200	V
Grid No.2 dissipation	W_{g_2}	=	max. 25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 current	I_{g_1}	=	max. 100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 15	kΩ

OPERATING CONDITIONS

Frequency	f	=	790	MHz
Bandwidth	B	>	6.5	MHz
Anode voltage	V_a	=	1400	V
Grid No.2 voltage	V_{g_2}	=	400	V
Grid No.1 voltage	V_{g_1}	=	-30	V
Anode current	I_a	=	400	mA
Grid No.2 current	I_{g_2}	=	-10	mA
Driving power	W_{dr}	=	5	W
Output power in load	W_{load}	=	55	W

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{ia}	=	max.	1250	W
Anode dissipation	W_a	=	max.	600	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS

Frequency	f	=	30		MHz
Anode voltage	V_a	=	2500		V
Grid No.2 voltage	V_{g_2}	=	450		V
Grid No.1 voltage	V_{g_1}	=	−37		V
			zero signal	double tone signal	
Anode current	I_a	=	160	350	mA
Grid No.2 current	I_{g_2}	=	0	2.5	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Driving power	W_{dr}	=	0	1	W
Peak envelope power output	W_{oPEP}	=	–	680	W
Intermodulation distortion:					
of the third order	d_{i_3}	=	–	−31	dB
of the fifth order	d_{i_5}	=	–	−36	dB

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

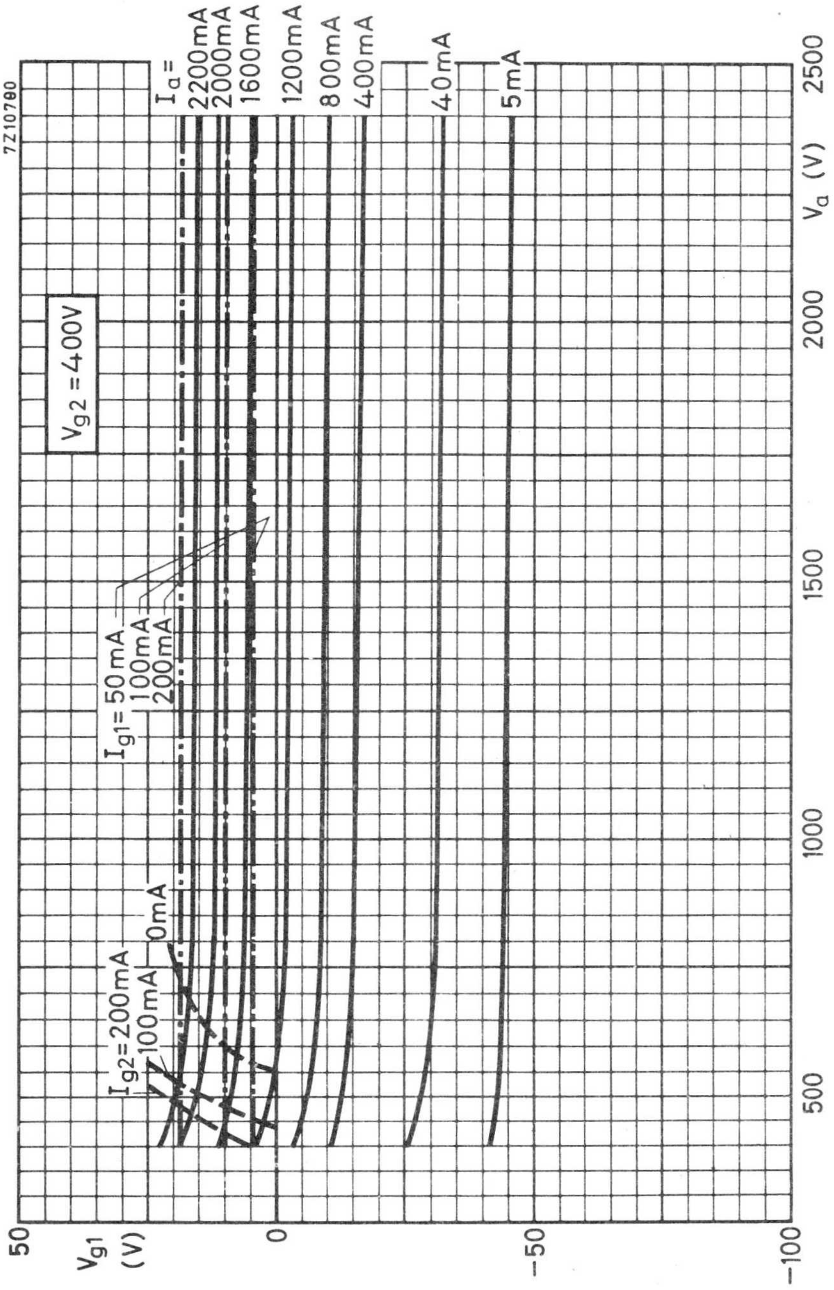
Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2000	V
Anode input power	W_{ia}	=	max.	1000	W
Anode dissipation	W_a	=	max.	400	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	17	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS (cathode drive)

Frequency	f	=	400	MHz
Anode voltage	V_a	=	2000	V
Grid No.2 voltage	V_{g_2}	=	400	V [1]
Grid No.1 voltage	V_{g_1}	=	-35	V [2]
Anode current	I_a	=	500	mA
Grid No.2 current	I_{g_2}	=	8	mA
Grid No.1 current	I_{g_1}	=	12	mA
Driving power	W_{dr}	=	35	W
Output power in load	W_{load}	=	600	W

[1] Obtained preferably from a separate source, modulated along with the anode supply.

[2] Obtained from the grid resistor or from a combination of the grid resistor and either a fixed supply or a cathode resistor.


7Z10780
Vg2 = 400V
Ia =
2200mA
2000mA
1600mA
1200mA
800mA
400mA
40mA
5mA
Ig1 = 50 mA
100mA
200mA
Ig2 = 200mA
100mA
0mA
Va (V)
500
1000
1500
2000
2500
Vg1 (V)
50
0
−50
−100

AIR COOLED
COAXIAL R.F. POWER TETRODE

QUICK REFERENCE DATA		
Freq. (MHz)	Class AB1 linear SSB amplifier	
	V_a (V)	W_ℓ [1] (kW, PEP)
13	5000	5.1
28	5000	5.1

HEATING: indirect. Cathode oxide-coated

Heater voltage	V_f	=	12.6	V ±10 %
Heater current	I_f	=	14.5	A
Heating time	T_w	=	min. 10	min.

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	115	pF
Anode to all other elements except grid No.1	C_a	=	41	pF
Anode to grid No.1	C_{ag_1}	=	0.2	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	5	1	kV
Grid No.2 voltage	V_{g_2}	=	700	700	V
Anode current	I_a	=	0.7	6	A
Amplification factor	$\mu_{g_2g_1}$	=	3.5	–	
Mutual conductance	S	=	–	45	mA/V

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	= max. 200 °C
Air inlet temperature	= max. 45 °C

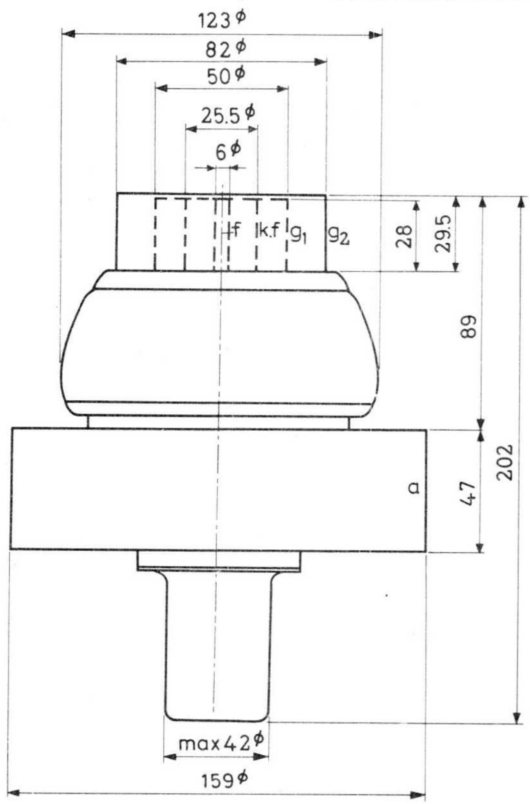
AIR COOLING CHARACTERISTICS

	W_a (kW)	q_{min} (m^3/min)	p_i (mm H_2O)
Anode radiator	4	6	20
Socket		0.5	20

MECHANICAL DATA

Dimensions in mm

Socket	40682
Air duct	40683
or	
Insulating pedestal	40654
Net weight of tube	4.5 kg



Mounting position: vertical with anode up or down

CLASS AB LINEAR S. S. B. AMPLIFIER, suppressed carrier service

LIMITING VALUES (Absolute limits)

Frequency	f		up to	60	MHz
Anode voltage	V_a	=	max.	5.5	kV
Anode current	I_a	=	max.	2	A
Anode input power	W_{i_a}	=	max.	10	kW
Anode dissipation	W_a	=	max.	4	kW
Grid No.2 voltage	V_{g_2}	=	max.	1	kV
Grid No.2 dissipation	W_{g_2}	=	max.	150	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	25	mA

OPERATING CHARACTERISTICS

Frequency	f	=		13		MHz
Anode voltage	V_a	=		5		kV
Grid No.2 voltage	V_{g_2}	=		700		V
Grid No.1 voltage	V_{g_1}	=		-150		V 1)
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	150	150	V
Anode current	I_a	=	0.7	1.8	1.26	A
Grid No.2 current	I_{g_2}	=	-10 to +10	120	40	mA
Grid No.1 current	I_{g_1}	=	0	-1	-0.3	mA
Anode input power	W_{i_a}	=	3.5	9	6.3	kW
Anode dissipation	W_a	=	3.5	2.85	3.2	kW
Output power in the load (PEP)	W_ℓ	=	–	5.1	5.1	kW
Total efficiency	η	=	–	57	45	%
3rd order intermodulation distortion	d_3	=	–	–	<-35	dB 2)
5th order intermodulation distortion	d_5	=	–	–	<-40	dB 2)

1)2) See page 4

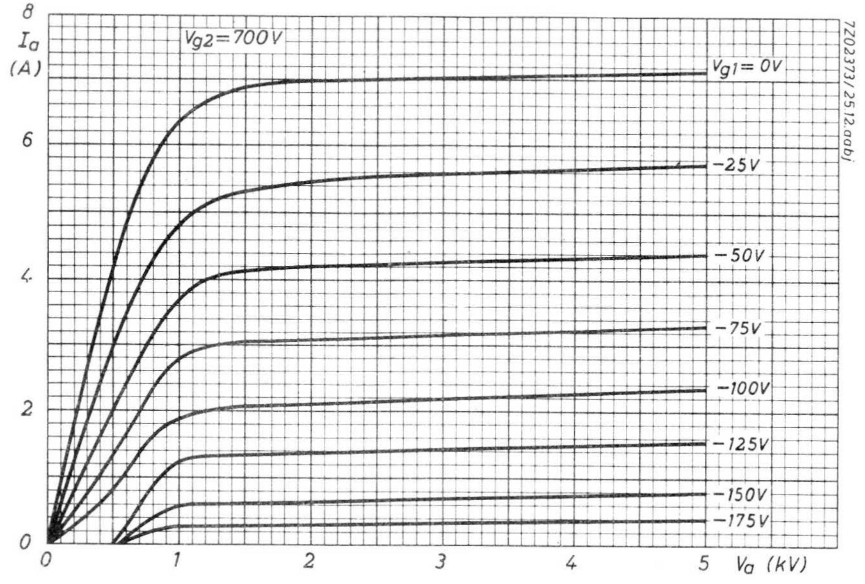
CLASS AB LINEAR S. S. B. AMPLIFIER, suppressed carrier service

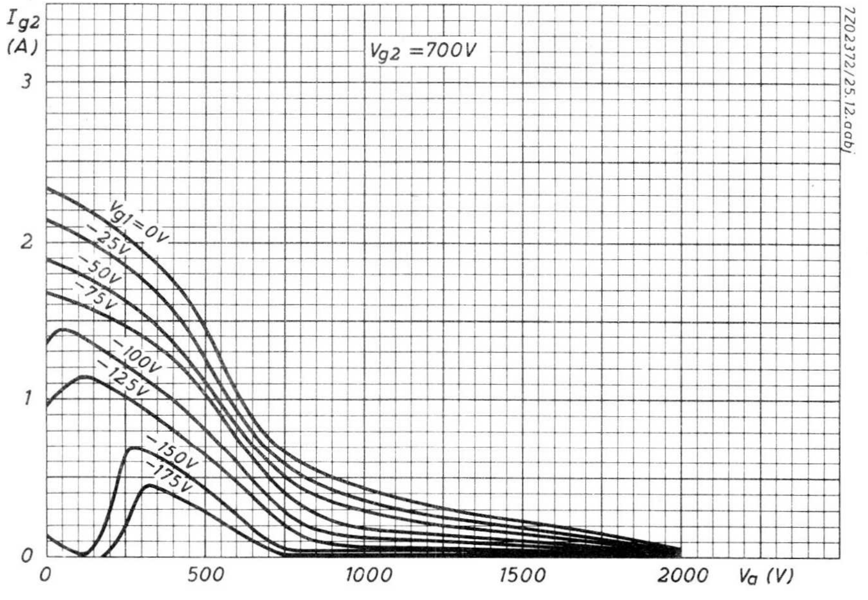
OPERATING CHARACTERISTICS (continued)

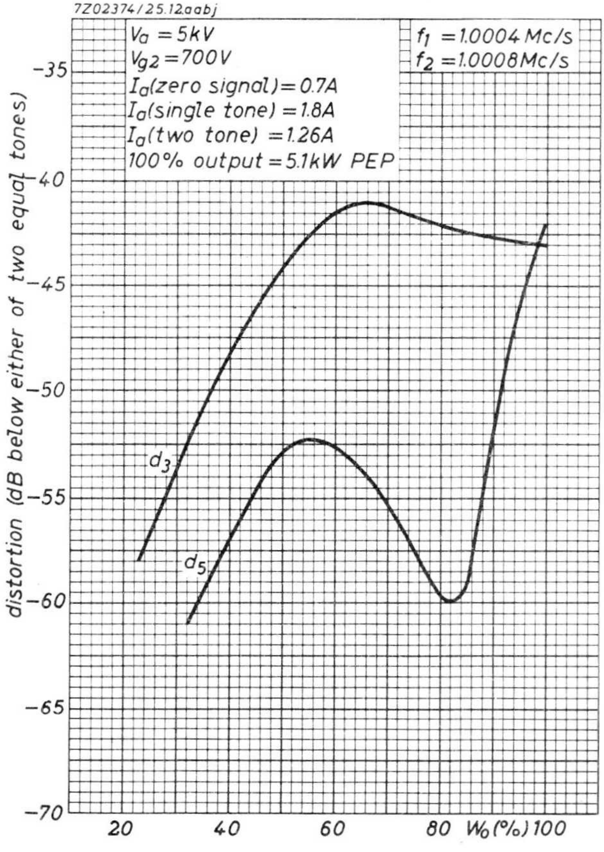
Frequency	f	=		28		MHz
Anode voltage	V_a	=		5		kV
Grid No.2 voltage	V_{g_2}	=		700		V
Grid No.1 voltage	V_{g_1}	=		-150		V [1])
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	150	150	V
Anode current	I_a	=	0.7	1.8	1.26	A
Grid No.2 current	I_{g_2}	=	-10 to +10	120	40	mA
Grid No.1 current	I_{g_1}	=	0	-4	-1	mA
Anode input power	W_{i_a}	=	3.5	9	6.3	kW
Anode dissipation	W_a	=	3.5	2.85	3.2	kW
Output power in the load (PEP)	W_ℓ	=	-	5.1	5.1	kW
Total efficiency	η	=	-	57	45	%
3rd order intermodulation distortion	d_3	=	-	-	<-35	dB [2])
5th order intermodulation distortion	d_5	=	-	-	<-40	dB [2])

[1]) To be adjusted for zero signal anode current.

[2]) Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two equal tones at that level.
Relative to the peak envelope power these figures will be increased by 6 dB.
Considerably better distortion figures can be achieved with I_a at zero signal = 0.8 A at the cost of higher zero signal anode dissipation. Efficiency for full drive is hardly deteriorated by this higher value of zero signal anode current.


8
I_a
(A)
6
4
2
0
V_{g2}=700V
V_{g1}= 0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
1
2
3
4
5
V_a (kV)
7Z02373/25.12.aabj


I_{g2}
(A)
3
2
1
0
V_{g2} =700V
V_{g1}=0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
500
1000
1500
2000
V_a (V)
7Z02372/25.12.aabj


7Z02374/25.12aabj
$V_a = 5kV$
$V_{g2} = 700V$
I_a(zero signal) = 0.7A
I_a(single tone) = 1.8A
I_a(two tone) = 1.26A
100% output = 5.1kW PEP
$f_1 = 1.0004$ Mc/s
$f_2 = 1.0008$ Mc/s
distortion (dB below either of two equal tones)
-35
-40
-45
-50
-55
-60
-65
-70
d_3
d_5
20
40
60
80
W_o(%)
100

AIR COOLED R.F. POWER TETRODE

Forced air cooled coaxial tetrode intended for use as linear amplifier for single side band, suppressed carrier service.

QUICK REFERENCE DATA				
Frequency (MHz)	Class AB1 SSB		Class B anode mod.	
	V_a (kV)	W_o PEP (kW)	V_a (kV)	W_o (kW)
1	5.0	5.7	5.0	5.1
30	5.0	5.0		

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=		12.6	V
Heater current	I_f	=		14.5	A
Waiting time	T_w	=	min.	10	min.

CAPACITANCES

Anode to all except grid No.1	C_a	=	33	pF
Grid No.1 to all except anode	C_{g_1}	=	156	pF
Anode to grid No.1	C_{ag_1}	=	0.16	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1	5	kV
Grid No.2 voltage	V_{g_2}	=	650	650	V
Anode current	I_a	=	6	0.7	A
Amplification factor	$\mu_{g_2g_1}$	=		3	
Mutual conductance	S	=	45		mA/V

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t	=	max.	200	^{o}C
Air inlet temperature	t_i	=	max.	45	^{o}C

COOLING DATA

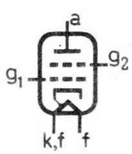
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
4.0	0	45	5	23

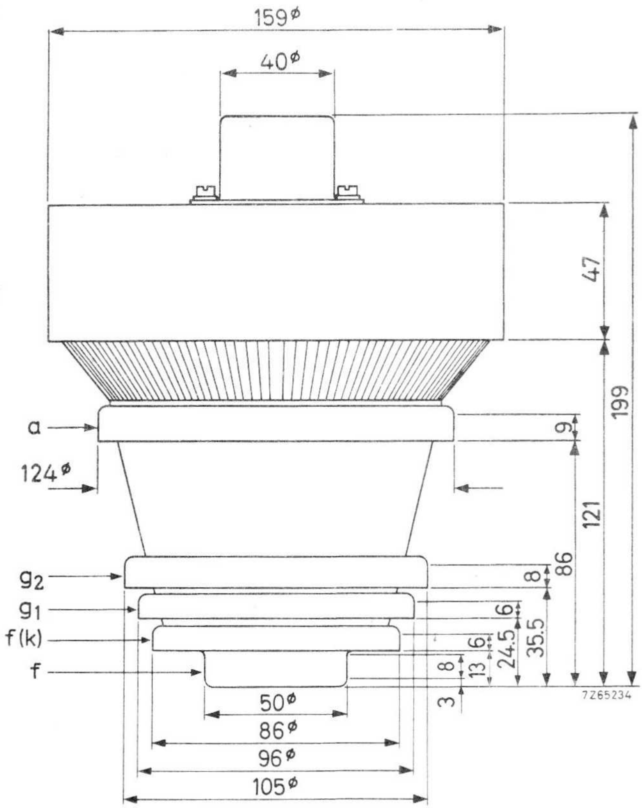
Required air flow on socket q = min. 0.55 m^3/min
at a pressure loss p_i = 16 mm H_2O

MECHANICAL DATA

Net weight : 5.8 kg

Dimensions in mm





ACCESSORIES

Socket 40699

Chimney 40683

Mounting position : vertical with anode up or down

R. F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute limits)

Frequency	f		up to 30	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 9.5	kW
Anode dissipation	W_a	=	max. 4	kW
Anode current	I_a	=	max. 2	A
Grid No.2 voltage	V_{g_2}	=	max. 1	kV
Grid No.2 dissipation	W_{g_2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

			zero signal	single tone signal	double tone signal	
Frequency	f	=		1		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		−185		V 1)
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160 2)	160 2)	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	−10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Anode input power	W_{ia}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.25	3.5	kW
Output power in load	W_ℓ	=	0	5.7	−	kW 3)
PEP output power in load	W_ℓ	=	0	−	5.7	kW 3)
Total efficiency	η	=	−	61.5	43.5	%
Intermodulation distortion						
of the 3rd order	d_3	=	−	−	−40	dB 4)
of the 5th order	d_5	=	−	−	−40	dB 4)

1)2)3)4) See page 4.

R. F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

OPERATING CONDITIONS (continued)

Frequency	f	=		30		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		-185		V [1]
			zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160[2]	160[2]	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	-10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	< 5	< 5	mA
Anode input power	W_{i_a}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.35	3.55	kW
Output power in load	W_ℓ	=	0	5.0	-	kW[5]
PEP output power in load	W_ℓ	=	0	-	5.0	kW[5]
Total efficiency	η	=	-	54	38	%
Intermodulation distortion						
of the 3rd order	d_3	=	-	-	-38	dB [4]
of the 5th order	d_5	=	-	-	-40	dB [4]

[1] To be adjusted for zero signal anode current of 0.7 A; characteristic range values 150 to 215 V.

[2] Maximum 175 V.

[3] Measured in a circuit having an efficiency of 95%.

[4] Maximum values encountered at any level of drive voltage rèferred to the amplitude of either of the two equal tones at that level.
Relative to the peak envelope power these figures will be increased by 6 dB.

[5] Measured in a circuit having an efficiency of 85%.

R.F. CLASS B ANODE MODULATION

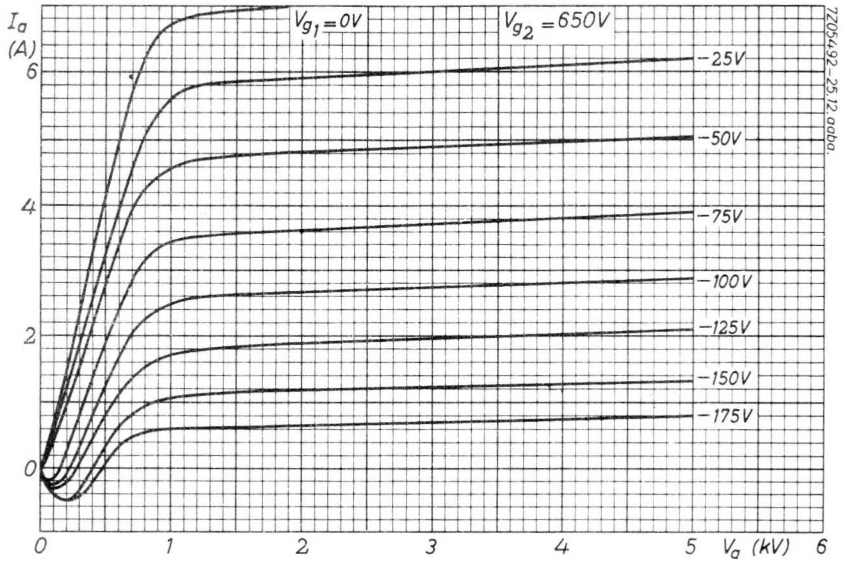
LIMITING VALUES (Absolute limits)

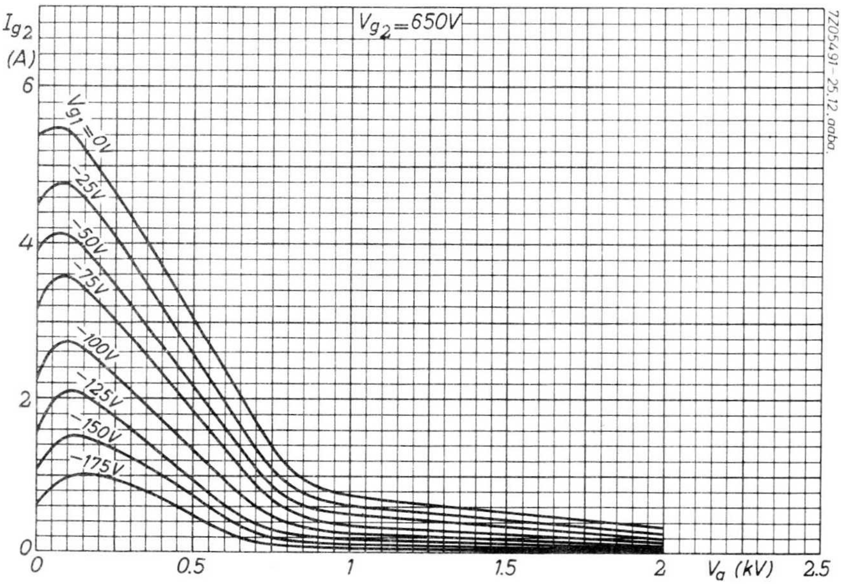
Frequency	f		up to 60	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 7.5	kW
Anode dissipation	W_a	=	max. 2.6	kW
Anode current	I_a	=	max. 1.6	A
Grid No.2 voltage	V_{g_2}	=	max. 800	V
Grid No.2 dissipation	W_{g2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

Frequency	f	=	1	MHz
Anode voltage	V_a	=	5.0	kV
Grid No.2 voltage	V_{g2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	-230	V
Peak grid No.1 driving voltage	$V_{g_{1p}}$	=	230	V
Anode current	I_a	=	1.46	A
Grid No.2 current	I_{g2}	=	100	mA
Grid No.1 current	I_{g1}	=	0	mA
Grid No.2 dissipation	W_{g_2}	=	60	W
Driving power	W_{dr}	=	0	W
Anode input power	W_{ia}	=	7.3	kW
Anode dissipation	W_a	=	2.2	kW
Output power in the load	W_ℓ	=	4.6	kW [1])
Tube efficiency	η	=	70	%
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	3.65	kW

[1]) Measured in a circuit having an efficiency of 90 %.


I_a (A)
6
4
2
0
$V_{g_1} = 0V$
$V_{g_2} = 650V$
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
1
2
3
4
5
V_a (kV)
6
7Z05492-25.12.aaba.


I_{g_2} (A)
6
4
2
0
$V_{g_2} = 650V$
$V_{g_1} = 0V$
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
0.5
1
1.5
2
V_a (kV)
2.5
7Z05491-25.12.aaba.

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating radiation and convection cooled double tetrode for use as R.F. amplifier and frequency multiplier up to 500 MHz, designed for intermittent filament operation in transistorised mobile transmitters.

QUICK REFERENCE DATA						
Freq. (MHz)	Class C telegraphy			Class C frequency multiplier		
	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)
200	275	0.7	12.5			
500	175	1.5	6.0			
167/500				175	1.5	2.0

HEATING: direct by A.C. or D.C.; series or parallel supply
Filament oxide coated

Filament voltage	V_f	=	1.1	V ±15%
Filament current	I_f	=	2.9	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	sec

The frequency of the A.C. filament supply may be

for sinusoidal supply voltage	max.	200	Hz
for square wave supply voltage		any	

CAPACITANCES, two systems in push-pull connection

Input capacitance	C_i	=	4.1	pF
Output capacitance	C_o	=	1.2	pF

The tube is internally neutralised for frequencies up to 500 MHz

1) Driver output power

2) Useful power in the load

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	175	V
Grid No.2 voltage	V_{g_2}	=	175	V
Anode current	I_a	=	40	mA
Amplification factor	$\mu_{g_2g_1}$	=	22	
Mutual conductance	S	=	7	mA/V

COOLING: Radiation and convection

The use of a closed tube shield is not recommended

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 230 °C

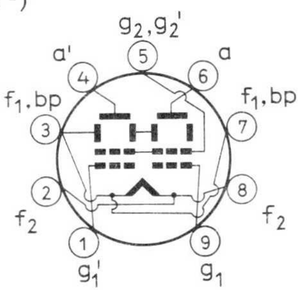
MECHANICAL DATA

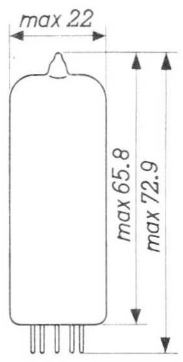
Dimensions in mm

Base : Noval

Socket : 2422 502 01004 [1])

Net weight: 16 g





Mounting position: any

If the tube is mounted with its main axis horizontally, it is recommended that the pins 3 and 7 be in a horizontal plane.

The filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

[1]) Or equivalent type suitable for the high filament current

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY; two systems in push-pull

LIMITING VALUES (Absolute limits)

Frequency	f	up to	200	500	MHz
Anode voltage	V_a	= max.	300	200	V
Anode current	I_a	= max.	2x50	2x50	mA
Anode input power	W_{i_a}	= max.	30	20	W
Anode dissipation	W_a	= max.	2x4	2x4	W
Grid No.2 voltage	V_{g_2}	= max.	200	200	V
Grid No.2 dissipation	W_{g_2}	= max.	3	3	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	150	V
Grid No.1 current	I_{g_1}	= max.	2x5	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	100	100	kΩ

OPERATING CONDITIONS

Frequency	f	=	200	500	MHz
Anode voltage	V_a	=	275	175	V
Grid No.2 supply voltage	V_{bg_2}	=	275	175	V
Grid No.2 series resistor	R_{g_2}	=	6.8	0.1	kΩ
Grid No.1 voltage	V_{g_1}	=	-20	-22	V
Grid No.1 resistor	R_{g_1}	=	3.9 [1]	9.4 [2]	kΩ
Driving voltage	$V_{g_1g_1'p}$	=	65	65	V
Anode current	I_a	=	2x42.5	2x40	mA
Grid No.2 current	I_{g_2}	=	14	12	mA
Grid No.1 current	I_{g_1}	=	2x2.6	2x2.3	mA
Grid No.2 dissipation	W_{g_2}	=	2.5	2.1	W
Driver output power	W_{dr}	=	0.7	1.5	W
Anode input power	W_{i_a}	=	23.4	14	W
Anode dissipation	W_a	=	2x3.5	2x3	W
Output power	W_o	=	16	8	W
Efficiency	η	=	68	57	%
Output power in the load	W_ℓ	=	13	6.5	W [3]

[1] Common for both units.

[2] It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[3] For optimum conditions R_{g_1} should be adjusted to obtain the desired anode current.

R.F. CLASS C FREQUENCY TRIPLER , two systems in push-pull

LIMITING VALUES (Absolute limits)

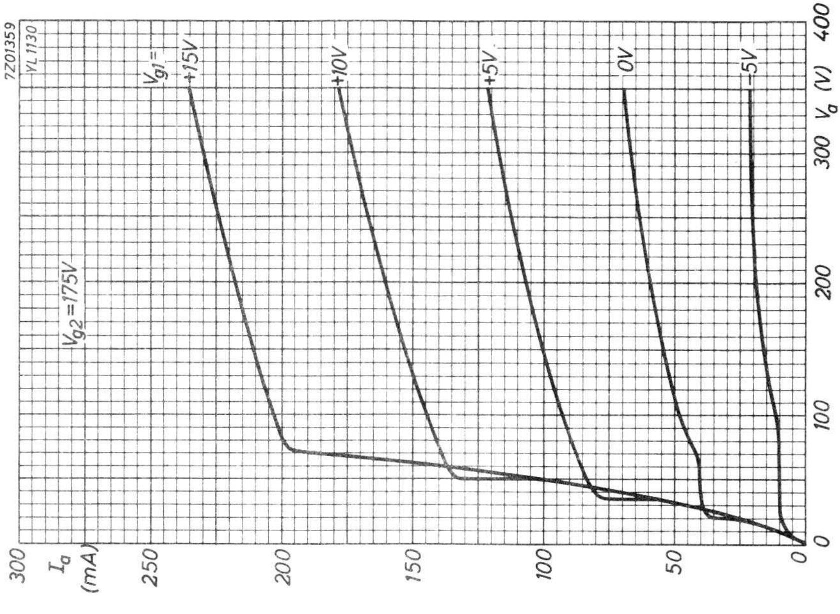
Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	200	V
Anode current	I_a	= max.	2x35	mA
Anode input power	W_{i_a}	= max.	12	W
Anode dissipation	W_a	= max.	2x4	W
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	2x3	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ

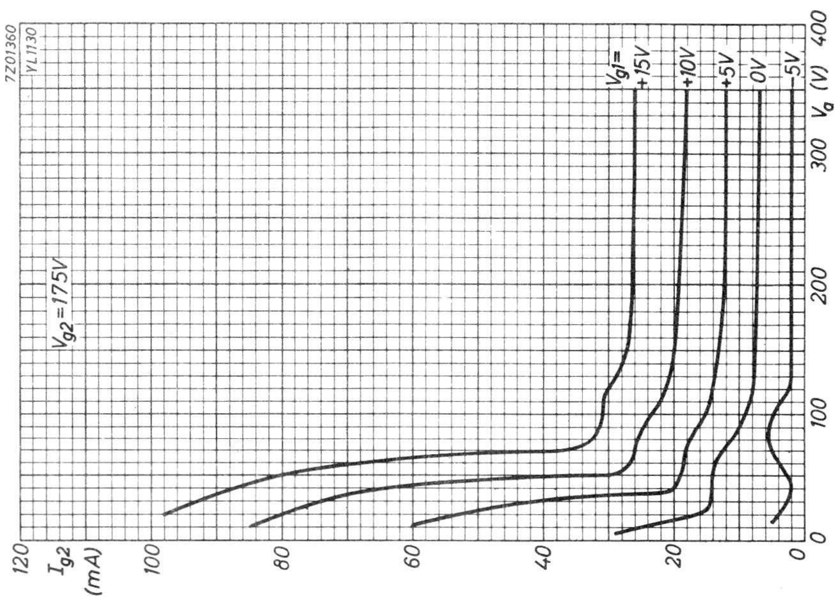
OPERATING CONDITIONS

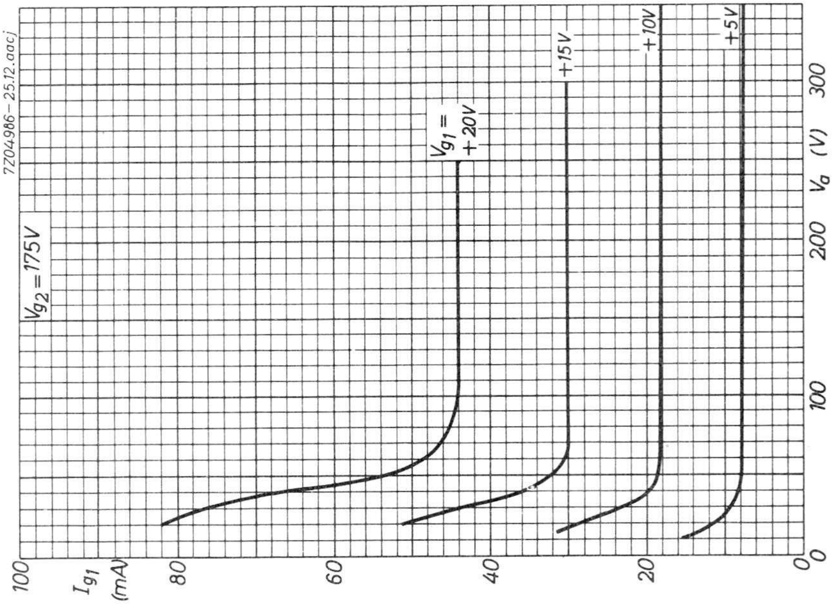
Frequency	f	=	167/500	MHz
Anode voltage	V_a	=	175	V
Grid No.2 supply voltage	V_{bg_2}	=	175	V
Grid No.2 series resistor	R_{g_2}	=	100	Ω
Grid No.1 resistor	R_{g_1}	=	56	kΩ 1)
Driving voltage	$V_{g_1g_1'p}$	=	175	V
Anode current	I_a	=	2x30	mA
Grid No.2 current	I_{g_2}	=	9	mA
Grid No.1 current	I_{g_1}	=	2x1.2	mA
Grid No.2 dissipation	W_{g_2}	=	1.6	W
Driver output power	W_{dr}	=	1.5	W
Anode input power	W_{i_a}	=	10.5	W
Anode dissipation	W_a	=	2x3.5	W
Output power	W_o	=	3.5	W
Efficiency	η	=	33	%
Output power in the load	W_ℓ	=	2	W 2)

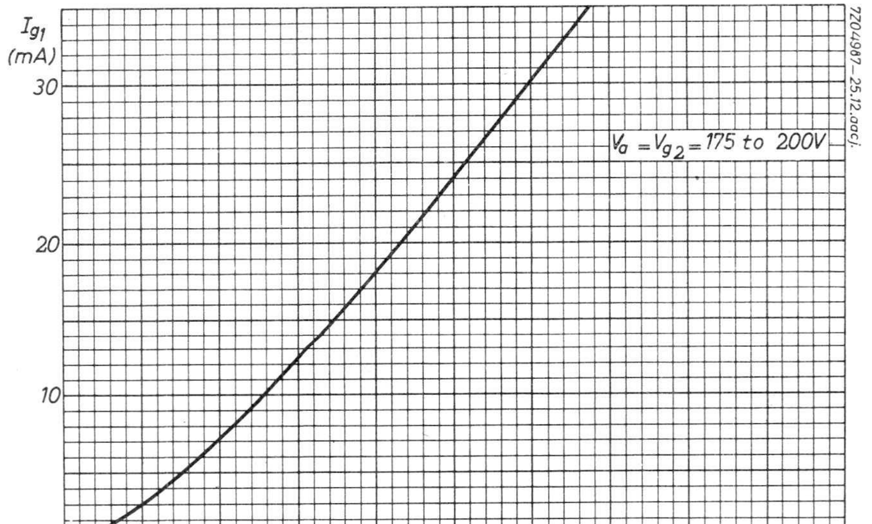
1) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

2) For optimum conditions R_{g_1} should be adjusted to obtain the desired anode current.


7Z01359
YL1130
V_{g2} = 175V
V_{g1} =
+15V
+10V
+5V
0V
−5V
I_a (mA)
300
250
200
150
100
50
0
0
100
200
300
400
V_a (V)


7Z01360
YL1130
V_{g2} = 175V
V_{g1} =
+15V
+10V
+5V
0V
−5V
I_{g2} (mA)
120
100
80
60
40
20
0
0
100
200
300
400
V_a (V)


7Z04986 - 25.12.aacj
V_{g2} = 175V
V_{g1} = +20V
+15V
+10V
+5V
V_a (V)
300
200
100
0
I_{g1} (mA)
100
80
60
40
20
0


I_{g1} (mA)
30
20
10
0
7Z04987 - 25.12.aacj.
V_a = V_{g2} = 175 to 200V
0
5
10
15
20
V_{g1} (V)
25

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	Class AB Single sideband		Class AB mod. Two tubes	
	V_a (V)	W_ℓ [1] (W)	V_a (V)	W_o (W)
30 60	600 600	110 100	600	200

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=	6.3 V	12.6 V
Heater current	I_f	=	1.90 A	0.95 A
Pins			(5+6)−2	5−6
Heating time	T_h	=	min. 30 sec	

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	10.7 pF
Grid No.1 to all other elements except anode	C_{g_1}	=	24.5 pF
Anode to grid No.1	C_{ag_1}	=	0.23 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	600 V
Grid No.2 voltage	V_{g_2}	=	250 V
Anode current	I_a	=	100 mA
Amplification factor	$\mu_{g_2g_1}$	=	4.0
Mutual conductance	S	=	10 mA/V

1) Peak envelope power. Useful power in the load.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 °C
Base pin seal temperature	=	max. 180 °C
Anode seal temperature	=	max. 220 °C

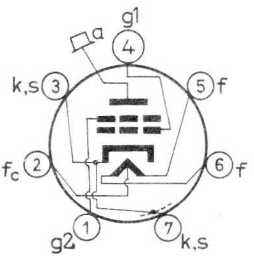
COOLING

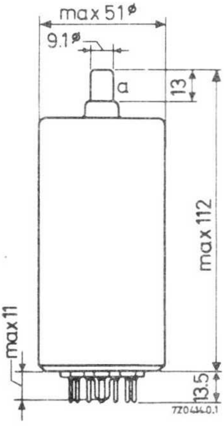
Radiation and convection. In order to keep the temperatures below the maximum permitted values it may be necessary to direct an air flow to the bulb or seals.

MECHANICAL DATA

Dimensions in mm

Base	:	Septar
Socket	:	2422 513 00001
Anode connector	:	40634
Net weight	:	110 g





Mounting position: any

R. F. CLASS AB LINEAR AMPLIFIER , single sideband, suppressed carrier

LIMITING VALUES (Absolute limits)

Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	750	V
Anode current	I_a	= max.	350	mA
Anode dissipation	W_a	= max.	75	W
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	7.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	100	V
Grid No.1 dissipation	W_{g_1}	= max.	0.5	W
Grid No.1 circuit resistance	R_{g_1}	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=		30		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-50		V 1)
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	50	50	V
Anode current	I_a	=	100	325	220	mA
Grid No.2 current	I_{g_2}	=	3	22	12	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA 2)
Grid No.2 dissipation	W_{g_2}	=	0.75	7	3.5	W
Driving power	W_{dr}	=	–	2	2	W
Anode input power	W_{i_a}	=	60	195	132	W
Anode dissipation	W_a	=	60	71	70	W
Output power in the load	W_ℓ	=	–	110	110 3)	W
Efficiency	η	=	–	57	42	%
Intermodulation products third order	d_3	=	–	–	< 30	dB 4)
fifth order	d_5	=	–	–	< 40	dB 4)

1) 2) 3) 4) See page 4

R. F. CLASS AB LINEAR AMPLIFIER, single sideband, suppressed carrier (continued)

OPERATING CONDITIONS (continued)

Frequency	f	=		60		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-50		V [1]
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	50	50	V
Anode current	I_a	=	100	325	220	mA
Grid No.2 current	I_{g_2}	=	3	22	12	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA [2]
Grid No.2 dissipation	W_{g_2}	=	0.75	7	3.5	W
Driving power	W_{dr}	=	–	2	2	W
Anode input power	W_{i_a}	=	60	195	132	W
Anode dissipation	W_a	=	60	75	72	W
Output power in the load	W_ℓ	=	–	100	100 [3]	W
Efficiency	η	=	–	51	38	%
Intermodulation products third order	d_3	=	–	–	< 30	dB [4]
fifth order	d_5	=	–	–	< 40	dB [4]

[1] To be adjusted for the stated value of the zero-signal anode current.

[2] Due to transit-time effects this value can differ from 0 mA and vary between +1 mA and −1 mA. This value will increase with increasing frequency.

[3] Peak envelope power.

[4] Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two equal tones at that level.
Relative to the peak envelope power these figures will be increased by 6 dB.

A.F. CLASS AB AMPLIFIER AND MODULATOR

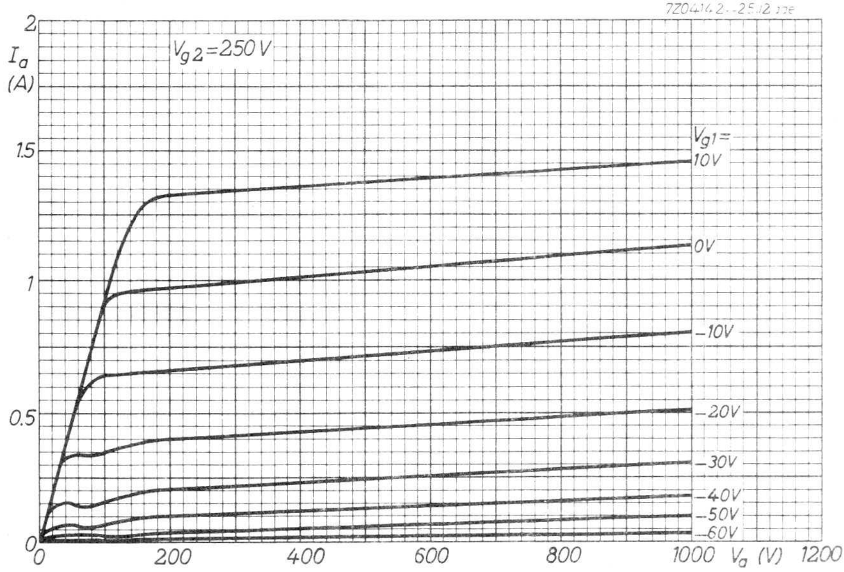
LIMITING VALUES (Absolute limits)

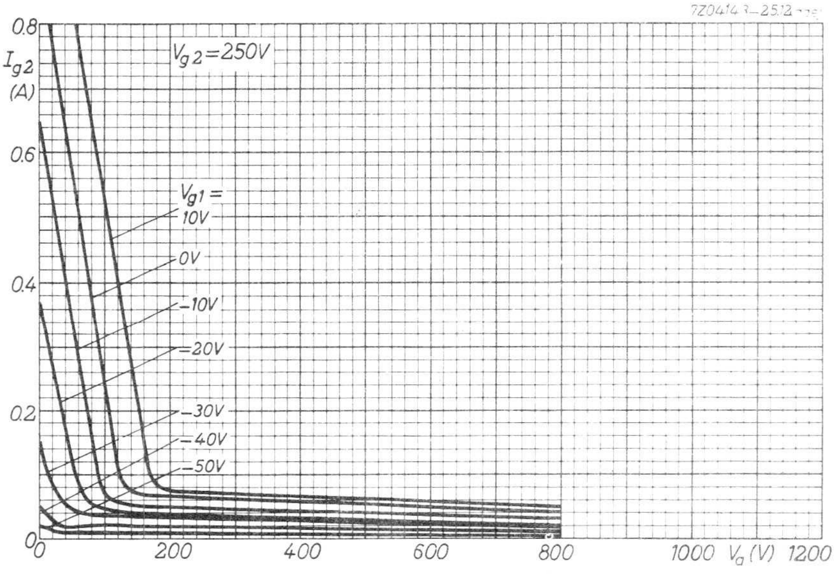
Anode voltage	V_a	=	max.	750	V
Anode current	I_a	=	max.	350	mA
Anode dissipation	W_a	=	max.	75	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	7.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	10	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	10	kΩ

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a	=	600		V
Grid No.2 voltage	V_{g_2}	=	250		V
Grid No.1 voltage	V_{g_1}	=	-50		V [1]
Load resistance	$R_{aa\sim}$	=	2.8		kΩ
Peak driving voltage	$V_{g_1g_{1p}}$	=	0	100	V
Anode current	I_a	=	2x100	2x260	mA
Grid No.2 current	I_{g_2}	=	2x3	2x24	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.2 dissipation	W_{g_2}	=	2x0.75	2x6	W
Anode input power	W_{i_a}	=	2x60	2x156	W
Anode dissipation	W_a	=	2x60	2x56	W
Output power	W_o	=	0	200	W
Efficiency	η	=	–	64	%
Total harmonic distortion	d_{tot}	=	–	< 2	%

[1] To be adjusted for the stated value of the zero-signal anode current


7Z04142-25.12
V_{g2}=250 V
I_a (A)
2
1.5
1
0.5
0
V_{g1}=
10V
0V
−10V
−20V
−30V
−40V
−50V
−60V
0
200
400
600
800
1000
V_a (V)
1200


7Z04143-25.12
V_{g2}=250V
I_{g2} (A)
0.8
0.6
0.4
0.2
0
V_{g1} =
10V
0V
−10V
−20V
−30V
−40V
−50V
0
200
400
600
800
1000
V_a (V)
1200

AIR COOLED R.F. POWER TETRODE

Forced air cooled power tetrode in coaxial metal-glass construction intended for use as S.S.B. amplifier and amplifier in T.V. transmitters.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		Class B television service	
	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_ℓ sync (kW)
30	4.5	3		
230			4	5.5

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	64	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	14	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	78	pF
Anode to grid No.1	C_{ag_1}	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	600	V
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.2	

TEMPERATURE LIMITS AND COOLING

Absolute max. envelope temperature t_{env} max. 220 °C

Cooling data

W_a (kW)	h (m)	t_i (°C)	q (m^3/min.)	p_i mm H_2O
2.5	0	25	2.7	50
4	0	25	4.3	130

See also cooling curve.

A low velocity air flow (> 0.5 m^3/min) should be directed to the filament and grid seals.

MECHANICAL DATA

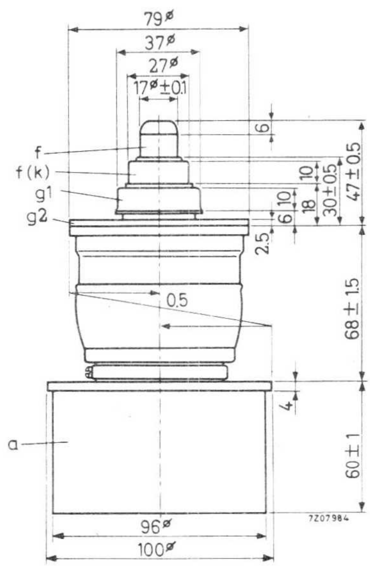
Dimensions in mm

Mounting position: vertical, anode up or down

Net weight: approx. 2.5 kg

Accessories:

Filament connector (one required)	type 40721
Grid No.1 connector	type 40722
Grid No.2 connector	type 40723
Insulating pedestal	type 40724



H.F. CLASS AB LINEAR POWER AMPLIFIER, SINGLE SIDE BAND, suppressed carrier.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	30	MHz
Anode voltage	V_a	max.	6	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g_1}	max.	0.2	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	4	kW
Grid No.2 dissipation	W_{g_2}	max.	120	W
Grid No.1 dissipation	W_{g_1}	max.	40	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		4.5		kV
Grid No.2 voltage	V_{g_2}		800		V
Grid No.1 voltage	V_{g_1}		-140		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	140	140	V
Anode current	I_a	0.5	1.33	0.93	A
Grid No.2 current	I_{g_2}	0	30	8	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	2.25	6	4.2	kW
Anode dissipation	W_a	2.25	2.8	2.6	kW
Grid No.2 dissipation	W_{g_2}	0	24	6.4	W
Driver output power	W_{dr}	0	30	30	W [3]
Output power in load (P.E.P.)	W_ℓ		3	3	kW [2]

[1]) Adjust to give the zero signal anode current.

[2]) Measured in a circuit having an efficiency of 95%.

[3]) The indicated driver output power is required to take care of losses in damping resistors and circuit losses.

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE; linear grounded-grid amplifier. Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute max. rating system)

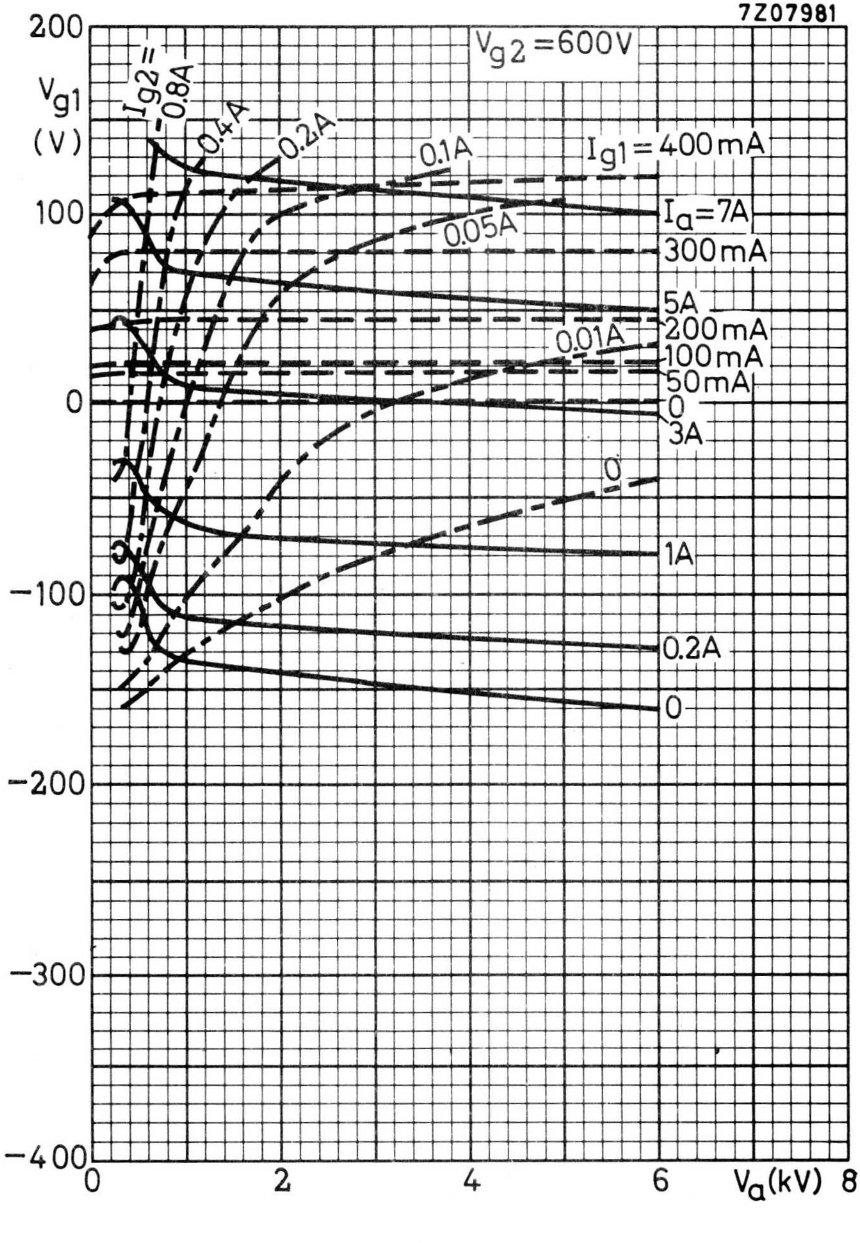
Frequency	f	max. 230	MHz
Anode voltage	V_a	max. 4.2	kV
Grid No.2 voltage	V_{g_2}	max. 800	V
Grid No.1 voltage	$-V_{g_1}$	max. 400	V
Anode current	I_a	max. 2.5	A
Grid No.1 current	I_{g_1}	max. 200	mA
Anode input power	W_{i_a}	max. 8	kW
Anode dissipation	W_a	max. 4	kW
Grid No.2 dissipation	W_{g_2}	max. 100	W
Grid No.1 dissipation	W_{g_1}	max. 30	W

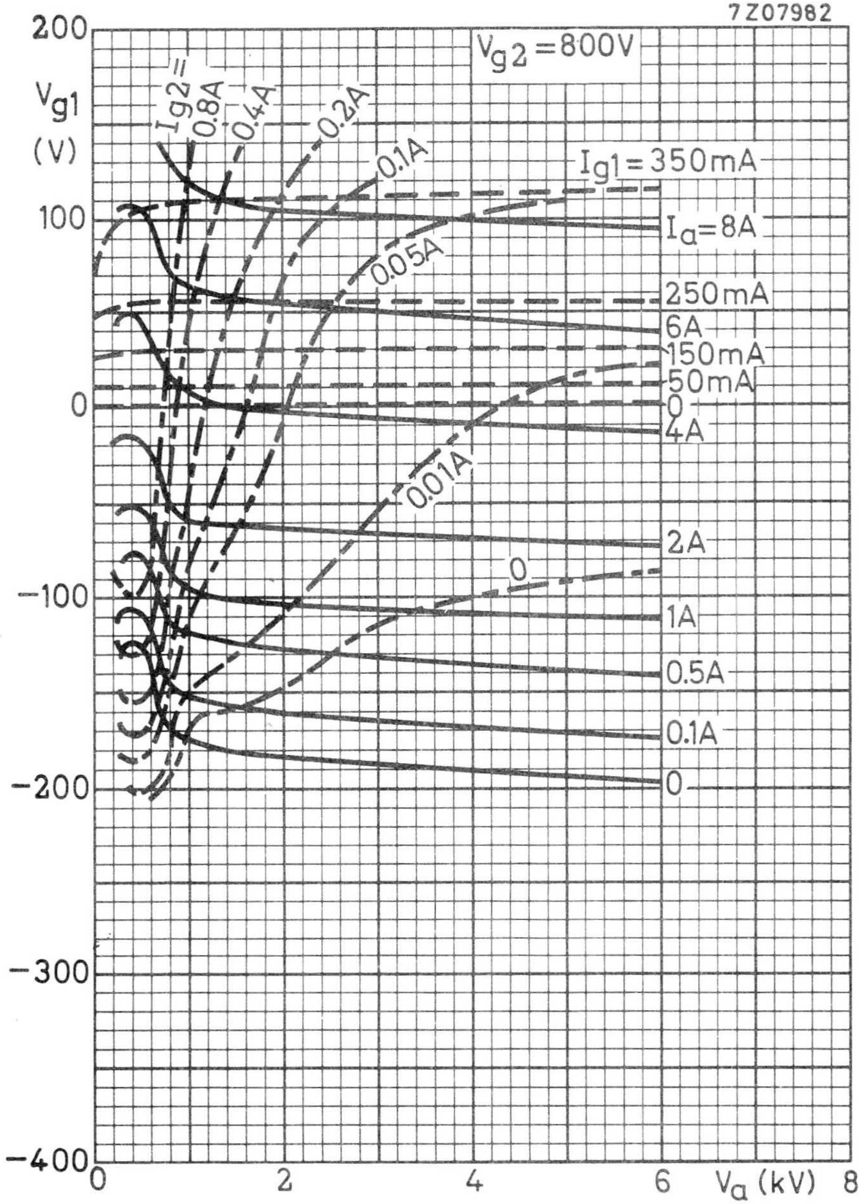
OPERATING CONDITIONS

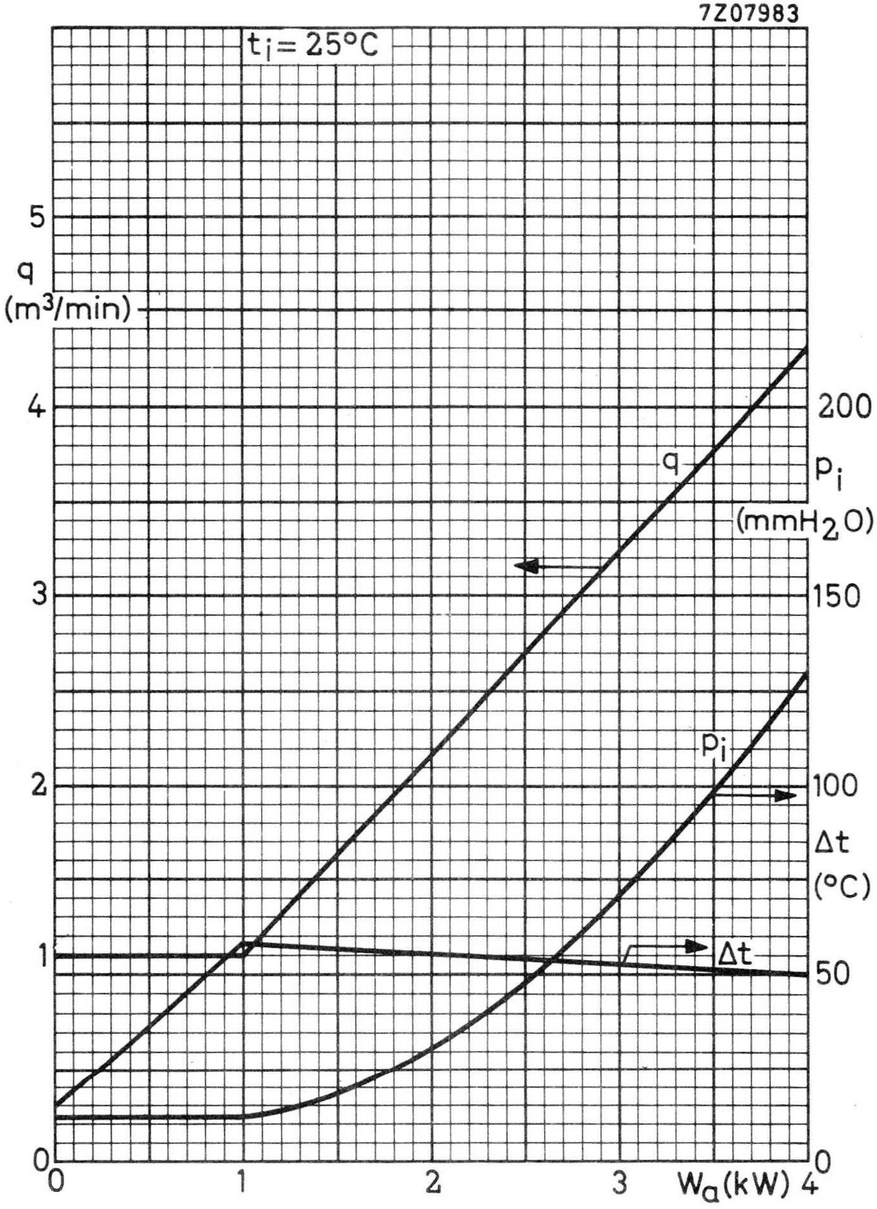
Frequency	f		230	MHz
Bandwidth (−3 dB)	B (−3 dB)		10	MHz [1]
Anode voltage	V_a		4	kV
Grid No.2 voltage	V_{g_2}		600	V
Grid No.1 voltage	V_{g_1}		−115	V
Input A.C. voltage, peak	V_{g1p}	sync	280	V
Anode current	I_a	black	1.5	A
Grid No.2 current	I_{g_2}	black	40	mA
Grid No.1 current	I_{g_1}	black	60	mA
Driver output power	W_{dr}	sync	550	W
Output power in load	W_ℓ	sync	5.5	kW [2]
		black	3	kW [2]
Anode dissipation	W_a	black	3	kW

[1] Bandwidth obtained with secondary circuit.

[2] W_ℓ represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.


7Z07981
V_{g2} = 600V
200
100
0
−100
−200
−300
−400
V_{g1} (V)
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 400 mA
I_a = 7A
300 mA
5A
200 mA
100 mA
50 mA
0
3A
1A
0.2A
0
0
2
4
6
V_a (kV)
8


7Z07982
V_{g2} = 800V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 350mA
250mA
150mA
50mA
0
I_a = 8A
6A
4A
2A
1A
0.5A
0.1A
0
0
2
4
6
8
V_a (kV)


7Z07983
$t_i = 25°C$
q
(m^3/min)
5
4
3
2
1
0
q
p_i
p_i
(mmH_2O)
200
150
100
50
0
Δt
Δt
(°C)
0
1
2
3
4
W_a(kW)

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled power tetrode in coaxial metal-glass construction intended for use as S.S.B. amplifier and amplifier in T.V. transmitters.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		Class B television service	
	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_ℓ sync (kW)
30	4.5	3		
230			4	5.5

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	64	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	14	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	78	pF
Anode to grid No.1	C_{ag_1}	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	600	V
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.2	

TEMPERATURE LIMITS AND COOLING

Absolute max. envelope temperature t_{env} max. 220 °C

A low velocity air flow (> 0.5 m^3/min) should be directed to the filament and grid seals.

MECHANICAL DATA

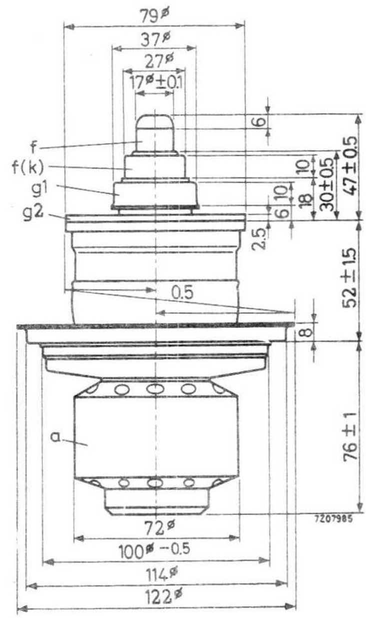
Dimensions in mm

Mounting position: vertical, anode down

Net weight: approx. 1.7 kg

Accessories

Filament connector (one required)	type 40721
Grid No.1 connector	type 40722
Grid No.2 connector	type 40723
Boiler	type K 731



H.F. CLASS AB LINEAR POWER AMPLIFIER, SINGLE SIDE BAND, suppressed carrier.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	30	MHz
Anode voltage	V_a	max.	6	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g_2}	max.	120	W
Grid No.1 dissipation	W_{g_1}	max.	40	W

OPERATING CONDITIONS

		zero signal	single tone	double tone	
Frequency	f		30		MHz
Anode voltage	V_a		4.5		kV
Grid No.2 voltage	V_{g_2}		800		V
Grid No.1 voltage	V_{g_1}		-140		V [1]
Grid No.1 driving voltage	$V_{g_{1p}}$	0	140	140	V
Anode current	I_a	0.5	1.33	0.93	A
Grid No.2 current	I_{g_2}	0	30	8	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	2.25	6	4.2	kW
Anode dissipation	W_a	2.25	2.8	2.6	kW
Grid No.2 dissipation	W_{g_2}	0	24	6.4	W
Driver output power	W_{dr}	0	30	30	W [3]
Output power in load (P.E.P.)	W_ℓ	-	3	3	kW [2]

[1]) Adjust to give the zero signal anode current.

[2]) Measured in a circuit having an efficiency of 95%.

[3]) The indicated driver output power is required to take care of losses in damping resistors and circuit losses.

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE ; linear grounded-grid amplifier.
Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute max. rating system)

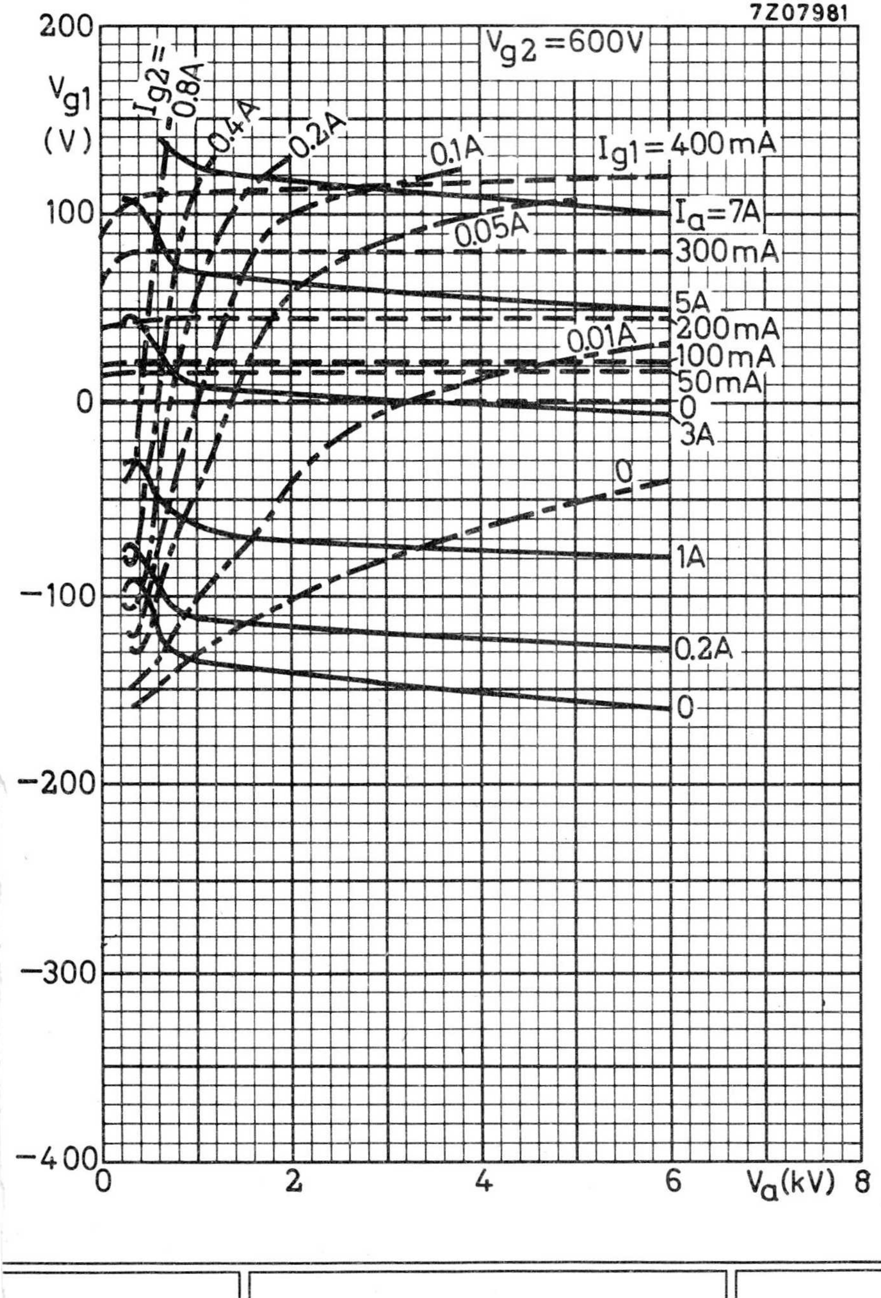
Frequency	f	max.	230	MHz
Anode voltage	V_a	max.	4.2	kV
Grid No.2 voltage	V_{g2}	max.	800	V
Grid No.1 voltage	$-V_{g1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g1}	max.	0.2	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g2}	max.	100	W
Grid No.1 dissipation	W_{g1}	max.	30	W

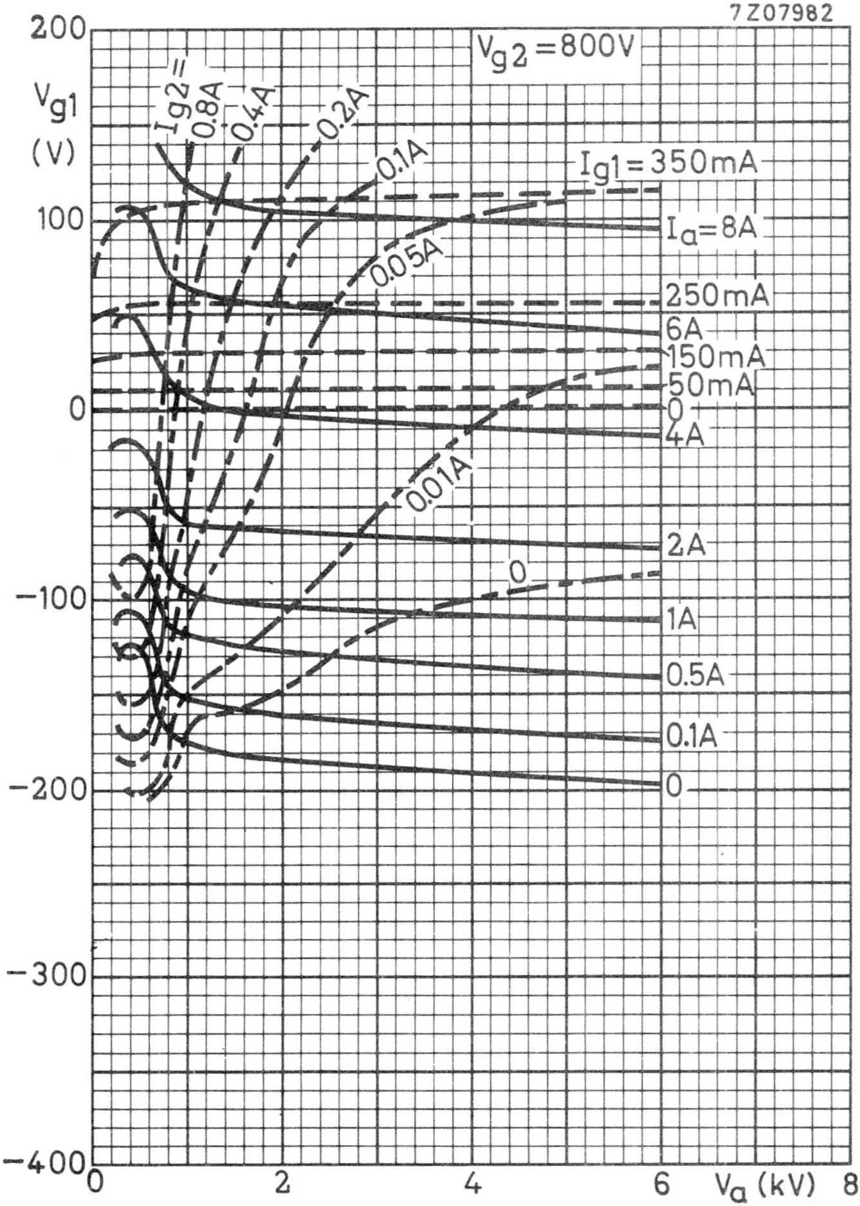
OPERATING CONDITIONS

Frequency	f		230	MHz
Bandwidth (-3 dB)	B (-3 dB)		10	MHz [1]
Anode voltage	V_a		4	kV
Grid No.2 voltage	V_{g2}		600	V
Grid No.1 voltage	V_{g1}		-115	V
Input A.C. voltage, peak	V_{g1p}	sync	280	V
Anode current	I_a	black	1.5	A
Grid No.2 current	I_{g2}	black	40	mA
Grid No.1 current	I_{g1}	black	60	mA
Driver output power	W_{dr}	sync	550	W
Output power in load	W_ℓ	sync	5.5	kW [2]
		black	3	kW [2]
Anode dissipation	W_a	black	3	kW

[1]) Bandwidth obtained with secondary circuit.

[2]) W_ℓ represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.


7Z07981
V_{g2} = 600V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 400 mA
300 mA
200 mA
100 mA
50 mA
0
I_a = 7A
5A
3A
1A
0.2A
0
0
2
4
6
V_a (kV)
8


7Z07982
200
100
0
−100
−200
−300
−400
V_{g1} (V)
V_{g2} = 800V
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 350mA
I_a = 8A
250mA
6A
150mA
50mA
0
4A
2A
0
1A
0.5A
0.1A
0
0
2
4
6
V_a (kV)
8

QUICK HEATING R.F. DOUBLE TETRODE

Radiation and convection cooled double tetrode intended for use as RF amplifier and frequency multiplier up to 500 MHz, designed for intermittent filament operation in transistorized mobile transmitters.

QUICK REFERENCE DATA						
RF class C telegraphy	f	200	MHz	V_a	350	V
	W_{dr}	1.0	W	W_ℓ	26	W
RF class C telegraphy	f	500	MHz	V_a	250	V
	W_{dr}	2.5	W	W_ℓ	14.5	W
RF class C frequency multiplier	f	167/500	MHz	V_a	250	V
	W_{dr}	2.2	W	W_ℓ	2.5	W
RF class C a/g_2 mod.	f	175	MHz	V_a	280	V
	W_{dr}	1.5	W	W_ℓ	15	W

FILAMENT oxide coated

HEATING: Direct by A.C. or D.C.; series and parallel supply

The frequency of A.C. filament supply may be:

sinusoidal supply voltage max. 200 Hz

square wave supply voltage: any

Filament voltage	V_f		1.1	V ±15 %
Filament current	I_f		4.2	A
Heating time for W_o = 70 % of $W_{o\,max.}$		max.	0.5	s

CAPACITANCES

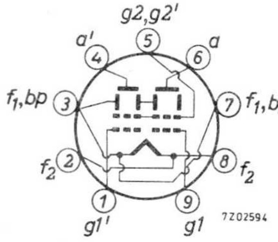
Units in push-pull

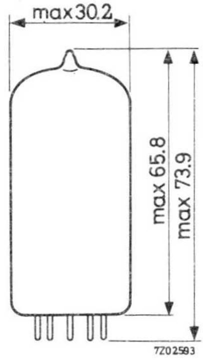
Input	C_i	4.7	pF
Output	C_o	1.2	pF

The tube is internally neutralized for frequencies up to 500 MHz

DIMENSIONS AND CONNECTIONS

Base: Magnoval





TYPICAL CHARACTERISTICS, each unit

Amplification factor			
at V_a = 150 V, V_{g2} = 150 V, I_a = 45 mA	$\mu_{g_2g_1}$	20	
Transconductance			
at V_a = 150 V, V_{g2} = 150 V, I_a = 45 mA	S	9.5	mA/V

MOUNTING POSITION any

If the tube is mounted with its main axis horizontally it is recommended that the pins 3 and 7 be in a horizontal plane.

ACCESSORIES

Socket: magnoval 2422 502 05001 or equivalent type suitable for the high filament current.
Filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

WEIGHT

Net weight 27 g

TEMPERATURE LIMITS AND COOLING

Radiation and convection cooling. The use of a closed tube shield is not recommended.

Absolute maximum bulb temperature t_{bulb} max. 230 °C

R.F. CLASS C TELEGRAPHY AND F.M. TELEPHONY, two units in push-pull

LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	200	500	MHz
Anode voltage	V_a	max.	400	300	V
Grid No.2 voltage	V_{g_2}	max.	200	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	100	V
Anode current	I_a	max.	2x75	2x75	mA
Grid No.1 current	I_{g_1}	max.	2x7	2x7	mA
Anode input power	W_{ia}	max.	56	42	W
Anode dissipation	W_a	max.	2x8	2x8	W
Grid No.2 dissipation	W_{g_2}	max.	3.5	3.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	100	kΩ

OPERATING CONDITIONS Intermittent service, **ICAS**

Frequency	f	200	200	500	MHz
Anode voltage	V_a	350	350	260	V
Grid No.2 supply voltage	V_{bg_2}	350	350	260	V
Grid No.2 series resistor	R_{g_2}	9	9	4.3	kΩ
Grid No.1 voltage	V_{g_1}	-26	-13	-22.5	V
Grid No.1 circuit resistance	R_{g_1}	4.7[1])	2[1])	6.9[2])	kΩ
Driving voltage	$V_{g_1g_1'p}$	85	85	65	V
Anode current	I_a	2x70	2x70	2x70	mA
Grid No.2 current	I_{g_2}	20	23.5	20	mA
Grid No.1 current	I_{g_1}	2x6.5	2x6.5	2x3.25	mA
Anode input power	W_{i_a}	49	49	36.5	W
Anode dissipation	W_a	2x8	2x8	2x8	W
Grid No.2 dissipation	W_{g_2}	3.4	3.3	3.5	W
Driver output power	W_{dr}	1.0	1.0	2.5	W
Output power	W_o	33	33	19	W
Efficiency	η	67	67	52	%
Output power in load	W_ℓ	26	26	14	W [3])

---

[1]) Common for both units.

[2]) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[3]) For optimal conditions R_{g_1} should be adjusted to obtain the desired anode current.

R.F. CLASS C FREQUENCY TRIPLER, two units in push-pull

LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	500	MHz
Anode voltage	V_a	max.	300	V
Grid No.2 voltage	V_{g_2}	max.	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	V
Anode current	I_a	max.	2x50	mA
Grid No.1 current	I_{g_1}	max.	2x3	mA
Anode input power	W_{ia}	max.	27	W
Anode dissipation	W_a	max.	2x8	W
Grid No.2 dissipation	W_{g_2}	max.	3.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	kΩ

OPERATING CONDITIONS Intermittent service. **ICAS**

Frequency	f	167/500	MHz
Anode voltage	V_a	250	V
Grid No.2 supply voltage	V_{bg_2}	250	V
Grid No.2 series resistor	R_{g_2}	5.6	kΩ
Grid No.1 circuit resistance-each unit	R_{g_1}	27	kΩ [1]
Driving voltage	$V_{g_1g_1'p}$	170	V
Anode current	I_a	2x45	mA
Grid No.2 current	I_{g_2}	14	mA
Grid No.1 current	I_{g_1}	2x2.5	mA
Anode input power	W_{ia}	22.5	W
Anode dissipation	W_a	2x8	W
Grid No.2 dissipation	W_{g_2}	2.4	W
Driver output power	W_{dr}	2.2	W
Output power	W_o	6.5	W
Efficiency	η	29	%
Output power in load	W_ℓ	3	W [2]

[1] It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[2] For optimal conditions R_{g_1} should be adjusted to obtain the desired anode current.

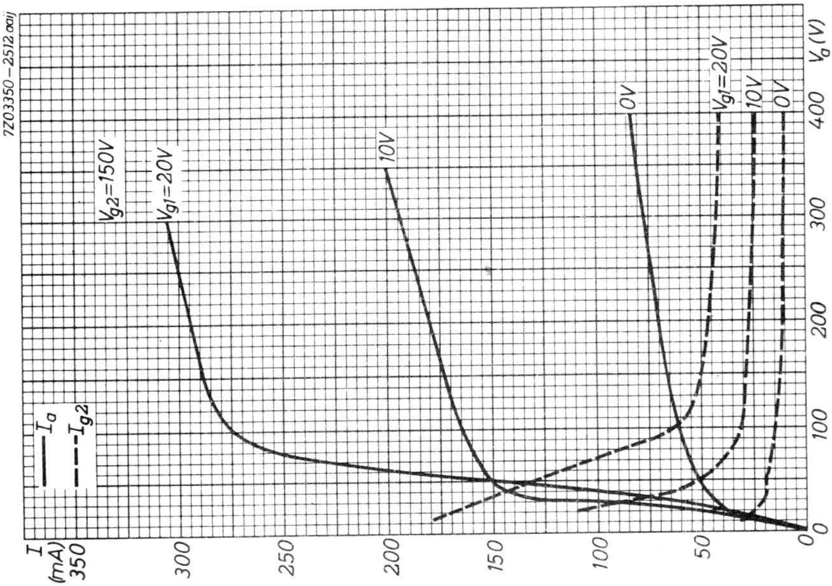
R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two units in push-pull

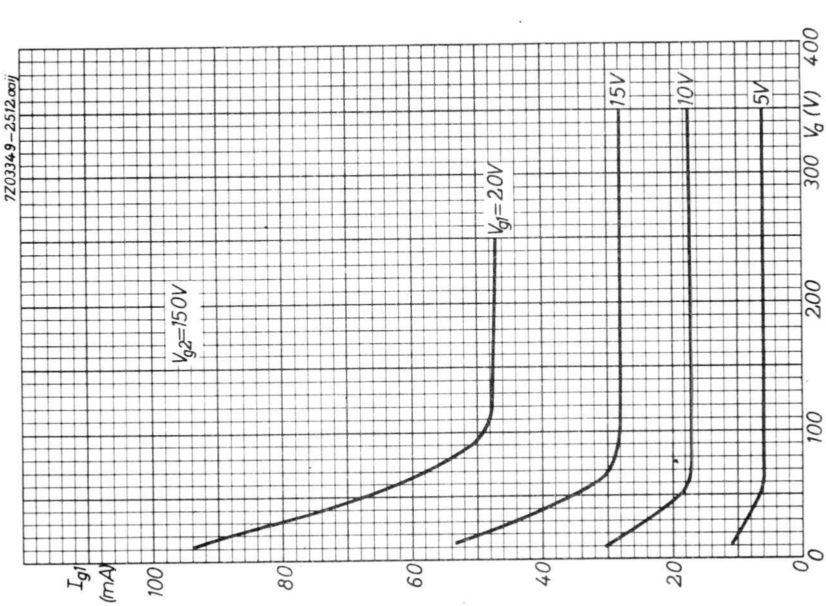
LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	200	500	MHz
Anode voltage	V_a	max.	330	260	V
Grid No.2 voltage	V_{g_2}	max.	200	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	150	V
Anode current	I_a	max.	2x56	2x56	mA
Grid No.1 current	I_{g_1}	max.	2x5	2x5	mA
Anode input power	W_{ia}	max.	40	40	W
Anode dissipation	W_a	max.	2x5.5	2x5.5	W
Grid No.2 dissipation	W_{g_2}	max.	2x1.5	2x1.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	100	kΩ

OPERATING CONDITIONS ; intermittent service, **ICAS**

Frequency	f	175	500	MHz
Anode voltage	V_a	280	225	V
Grid No.2 voltage	V_{g_2}	150	150	V
Grid No.1 voltage	$-V_{g_1}$	35	25	V
Anode current	I_a	2x50	2x50	mA
Grid No.2 current	I_{g_2}	19	17	mA
Grid No.1 current	I_{g_1}	2x4	2x3	mA
Anode input power	W_{ia}	28	22.5	W
Anode dissipation	W_a	2x4.5	2x4.5	W
Driver output power	W_{dr}	1.5	3.0	W
Output power	W_o	19	13	W
Efficiency	η	68	58	%
Output power in load	W_ℓ	15	10	W
Depth of modulation	m	100	100	%
Modulator output power	$W_{o\ mod}$	16	12.5	W
Grid No.2 peak modulator voltage	$V_{g_{2p}\ mod}$	120	120	V


7Z03350-2512.aaij
I (mA)
350
300
250
200
150
100
50
0
0
100
200
300
400
V_a (V)
I_a
I_{g2}
V_{g2}=150V
V_{g1}=20V
10V
0V
V_{g1}=20V
10V
0V


7Z03349-2512.aaij
I_{g1} (mA)
100
80
60
40
20
0
0
100
200
300
400
V_a (V)
V_{g2}=150V
V_{g1}=20V
15V
10V
5V

R.F. POWER PENTODE

QUICK REFERENCE DATA			
Heater voltage	V_f	=	12.6 V
Amplification factor	$\mu_{g_2g_1}$	=	6.7
Mutual conductance	S	=	6 mA/V

HEATING: indirect by A.C. or D.C.; parallel supply
Cathode oxide coated

Heater voltage	V_f	=	12.6 V
Heater current	I_f	=	1.3 A

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	20.5 pF
Anode to all other elements except grid No.1	C_a	=	12 pF
Anode to grid No.1	C_{ag_1}	=	0.1 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1000 V
Grid No.2 voltage	V_{g_2}	=	250 V
Anode current	I_a	=	40 mA
Amplification factor	$\mu_{g_2g_1}$	=	6.7
Mutual conductance	S	=	6 mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	= max.	300 °C
Pin seal temperature	= max.	180 °C

COOLING

Radiation and convection

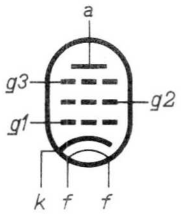
MECHANICAL DATA

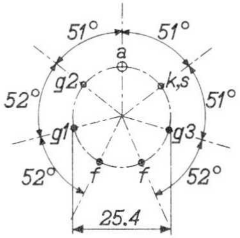
Dimensions in mm

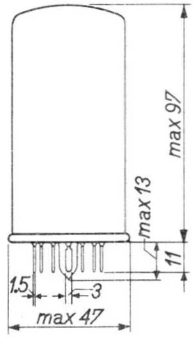
Base : Septar

Socket : 2422 513 00001

Net weight : 80 g







Mounting position: any

LIMITING VALUES (Absolute limits)

Anode voltage without cathode current	V_{a_o}	= max.	3	kV
Anode voltage at W_a = 45 W	V_a	= max.	1	kV
Anode dissipation	W_a	= max.	45	W
Positive grid No.3 voltage	V_{g_3}	= max.	200	V
Negative grid No.3 voltage	$-V_{g_3}$	= max.	200	V
Grid No.3 dissipation	W_{g_3}	= max.	1	W
Grid No.3 circuit resistance	R_{g_3}	= max.	50	kΩ
Grid No.2 voltage without cathode current	$V_{g_{2o}}$	= max.	1	kV
Grid No.2 voltage at W_{g_2} = 7 W	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	7	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	300	V
Grid No.1 dissipation	W_{g_1}	= max.	0.5	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
Average cathode current	I_k	= max.	240	mA
Peak cathode current	I_{k_p}	= max.	1.5	A
Cathode to heater voltage	V_{kf}	= max.	100	V
Heater voltage	V_f	= max.	13.9	V
		= min.	11.3	V

CHARACTERISTICS AND RANGE VALUES

Column I : Setting of the tube and typical (average) measuring results of new tubes
II : Characteristic range values for equipment design
III : Data indicating the end point of life

			I	II	III	
Heater current						
Heater voltage	V_f	=	12.6			V
Heater current	I_f	=	1.3	1.1-1.5	1.1-1.5	A
Characteristics						
Heater voltage	V_f	=	12.6			V
Anode voltage	V_a	=	100			V
Grid No.3 voltage	V_{g_3}	=	0			V
Grid No.2 voltage	V_{g_2}	=	250			V
Anode current	I_a	=	100			mA
Grid No.1 voltage	$-V_{g_1}$	=	18	14 - 20	12 - 22	V
Grid No.2 current	I_{g_2}	=		12 - 25	8 - 30	mA
Grid No.1 current	$-I_{g_1}$	=			20	μA
Cut-off voltage						
Heater voltage	V_f	=	12.6			V
Anode voltage	V_a	=	100			V
Grid No.3 voltage	V_{g_3}	=	0			V
Grid No.2 voltage	V_{g_2}	=	250			V
Anode current	I_a	=	0.2			mA
Cut-off voltage	$-V_{g_1}$	=		<60	65	V
Capacitances						
Anode to all other elements except grid No.1	$C_{a(g_1)}$	=	12	11 - 13		pF
Grid No.1 to all other elements except anode	$C_{g_1(a)}$	=	20.5	19 - 22		pF
Anode to grid No.1	C_{ag_1}	=		<0.22		pF

CHARACTERISTICS AND RANGE VALUES (continued)

Insulation between the electrodes

A leakage current of 10 μA is not exceeded when the following voltages, with polarity as indicated are applied to the indicated electrodes via a series resistor of 10 MΩ

		I	II	III	
Grid No.1 (-) to grids No.2 and 3 and anode (+)	$V_{g_1}(-)/a, g_2, g_3(+)$	= 1000		550	V
Grid No.2 (+) to grid No.3 (-)	$V_{g_2}(+)/g_3(-)$	= 1000		550	V
Anode (+) to grid No.3 (-)	$V_{a(+)}/g_3(-)$	= 3000		1200	V
Cathode (+) to grid No.1 (-)	$V_{k(+)}/g_1(-)$	= 200		150	V

LIFE EXPECTANCY

3000 hours under the following conditions:

Heater voltage	V_f	=	12.6	V
Anode voltage	V_a	=	100	V
Grid No.3 voltage	V_{g_3}	=	0	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g_{1p}}$	=	40	V
Pulse repetition frequency	f_{imp}	=	80	Hz
Pulse duration	T_{imp}	=	8	ms

AGEING

In order to detect "early failures" and to ensure that the tubes are properly stabilised, all tubes are aged prior to testing during 200 hours under the following conditions:

Heater voltage	V_f	=	12.6	V
Anode current	I_a	=	70	mA
Anode dissipation	W_a	=	20	W
Peak anode voltage	V_{a_p}	=	515	V

STAND-BY PERFORMANCE [1]

After 200 hours of operation with V_f = 14 V only, the tubes are criticised for

Cathode interface resistance >10 Ω (continuous wave method IEC Publ. 151-9, two frequency method)

LIFE PERFORMANCE [1]

After 3000 hours of operation under the following conditions

Heater voltage	V_f	=	12.6	V
Anode voltage	V_a	=	100	V
Grid No.3 voltage	V_{g_3}	=	0	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g_{1p}}$	=	40	V
Pulse repetition frequency	f_{imp}	=	80	Hz
Pulse duration	T_{imp}	=	8	ms

the tubes are critised for

Inoperatives

Control grid voltage for cut-off
Control grid current
Leakage current

} See section "Characteristics and range values".

[1] This test is performed on a sample taken from each production run.

VIBRATIONAL NOISE OUTPUT [1][2]

Conditions:

Anode voltage	V_a	=	100	V
Grid No. 2 voltage	V_{g_2}	=	150	V
Grid No. 3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	10	mA
Vibrational acceleration		=	10	g
Duration	T	=	60	sec in each of the three directions X_1, X_2 and Y
Frequency	f	=	25	Hz
Anode load resistance	R_a	=	2	kΩ

Limit of the vibrational noise output V_{noise} = max. 750 mV(RMS)

FATIGUE : 2.5 g [1][2]

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of the three directions X_1, X_2 and Y

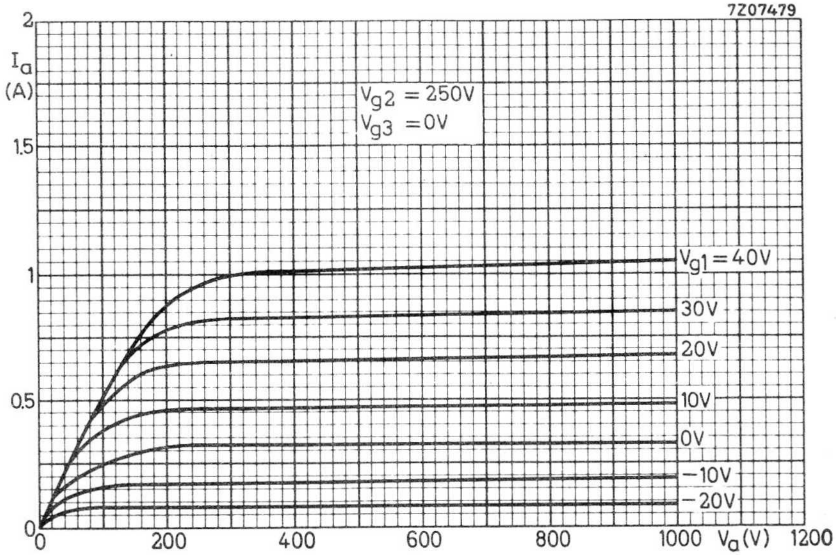
VIBRATION: 5 g [1][2]

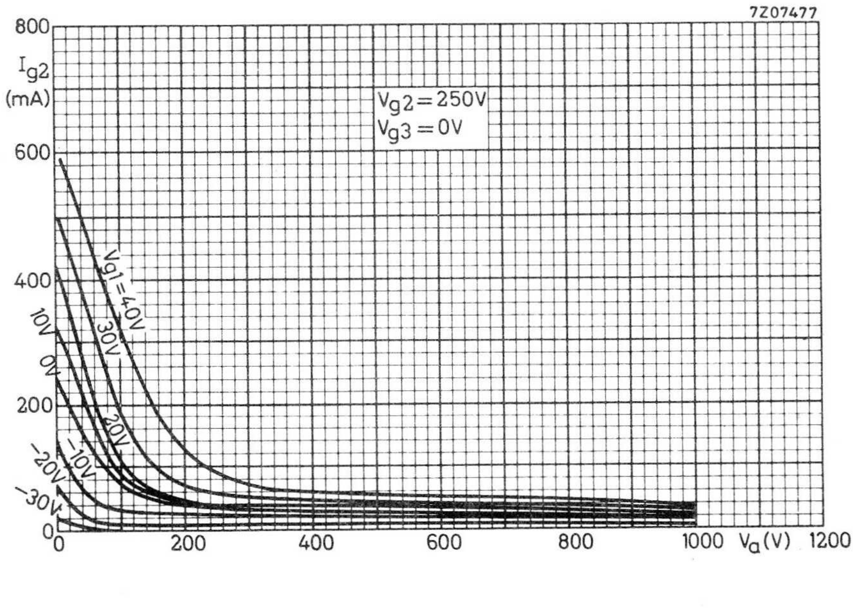
Vibrational forces for a period of 2 hours at a frequency of 25 Hz in each of the three directions X_1, X_2 and Y

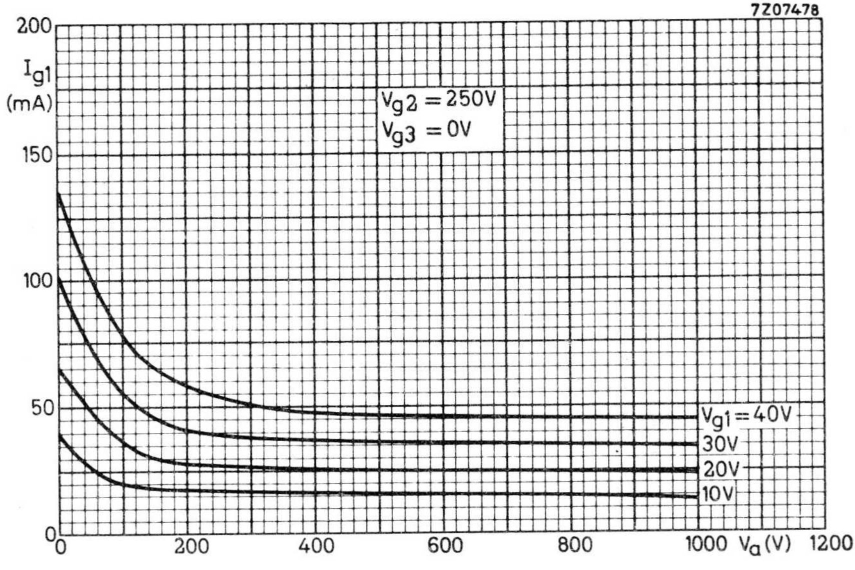
---

1) This test is performed on a sample taken from each production run.

2) These test conditions are only given for evaluation of the ruggedness of the tube and should by no means be interpreted as suitable operating conditions. Fatigue and vibration are destructive tests.


7Z07479
2
I_a (A)
1.5
1
0.5
0
0
200
400
600
800
1000
V_a (V)
1200
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0V
−10V
−20V


7Z07477
800
I_{g2} (mA)
600
400
200
0
0
200
400
600
800
1000
V_a (V)
1200
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0V
−10V
−20V
−30V


7Z07478
200
I_{g1}
(mA)
150
100
50
0
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0
200
400
600
800
1000
V_a (V)
1200

R.F. DOUBLE TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	720	mA	360	mA
Pin connections			9-(4+5)		4-5	

For further data and curves of this type please refer to type QQE03/12

R.F. DOUBLE TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	560	mA	280	mA
Pin connections			9-(4+5)		4-5	

For further data and curves of this type
please refer to type QQE02/5

AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	Class B amplifier		Class AB SSB	
	V_a (V)	W_{load} (W)	V_a (V)	$W_{o\ PEP}$ (W)
220	3000	1000		
30			3000	> 1050

HEATING : indirect by a.c. or d.c.; oxide-coated cathode, matrix type

Heater voltage	V_f		5.0	V ± 3%
Heater current	I_f		18	A
		<	20	A
Waiting time	T_w	min.	5	min

CAPACITANCES

Anode to cathode and heater	$C_{a/kf}$		<	0.08	pF
Anode to grid no.1	C_{ag1}		<	0.1	pF
Anode to grid no.2	C_{ag2}	13	to	17	pF
Grid no.1 to cathode and heater	$C_{g1/kf}$	33	to	42	pF
Grid no1 to grid no.2	C_{g1g2}	48	to	64	pF
Grid no.2 to cathode and heater	$C_{g2/kf}$		<	1.7	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid no.2 voltage	V_{g2}	550	V
Anode current	I_a	500	mA
Transconductance	S	20	mA/V
Amplification factor	μ_{g2g1}	7.5	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals (see also outline drawing)	t_s	max.	200	^{o}C
Air inlet temperature	t_i	max.	45	^{o}C

COOLING

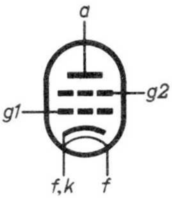
Forced air cooling for the anode. For cooling characteristics see page 5. Low velocity air flow for the ceramic to metal seals.
Cooling will also be necessary when only the heater voltage is applied to the tube.

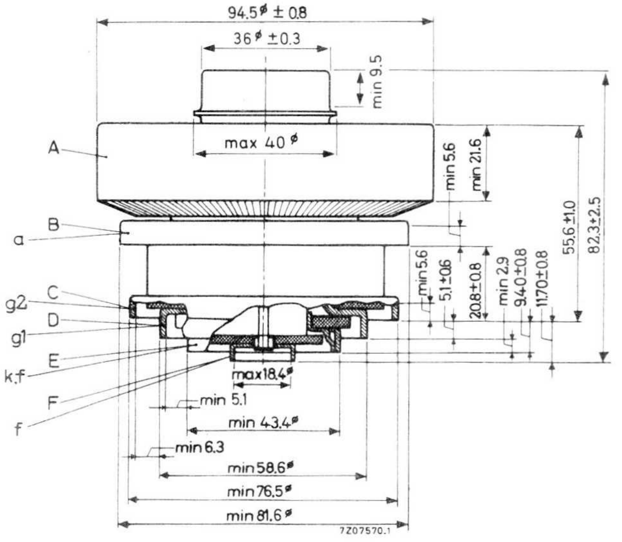
MECHANICAL DATA Dimensions in mm

Anode connector (for frequencies < 30MHz): 40689

Socket : 40704

Net weight : 90 g





The radiator and the terminals lie inside or outside concentric cylinders with the following dimensions:

Radiator	A :	inside	96.0 mm
Anode	B :	inside	82.8 mm
Grid No.2 connection	C :	inside	77.7 mm
Grid No.1 connection	D :	inside	59.4 mm
Cathode and heater connection	E :	inside	44.3 mm
Heater connection	F :	outside	17.6 mm

Mounting position: any

CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	3500	V
		max.	2500	V 1)
Anode input power	W_{i_a}	max.	3	kW
		max.	2	kW 1)
Anode dissipation	W_a	max.	1.5	kW
Anode current	I_a	max.	1	A
Grid No.2 voltage	V_{g_2}	max.	1000	V
Grid No.2 input power	$W_{i_{g_2}}$	max.	50	W
Grid No.2 current	I_{g_2}	max.	50	mA
	$-I_{g_2}$	max.	50	mA
Negative grid No.1 voltage	$-V_{g_1}$	max.	300	V
Grid No.1 current	I_{g_1}	max.	10	mA
Grid No.1 circuit resistance	R_{g_1}	max.	5	kΩ

OPERATING CHARACTERISTICS

Frequency	f	220		MHz
Anode voltage	V_a	3000		V
Grid No.2 voltage	V_{g_2}	450		V
Grid No.1 voltage	V_{g_1}	-60		V
Anode current	I_a	150	830	mA
Grid No.2 current	I_{g_2}	-5	-20	mA
Grid No.1 current	I_{g_1}	-	5	mA
Driver output power	W_{dr}	-	40	W
Anode input power	W_{i_a}	0.45	2.49	kW
Anode dissipation	W_a	0.45	1.35	kW
Output power in the load	W_ℓ	0	1.0	kW

1) For AM.

R.F. CLASS AB SINGLE SIDE BAND AMPLIFIER suppressed carrier

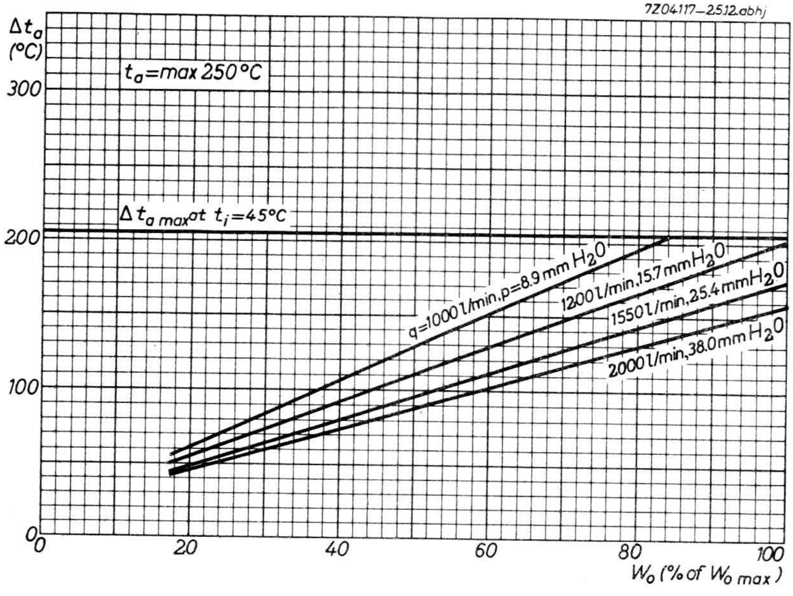
LIMITING VALUES (Absolute limits)

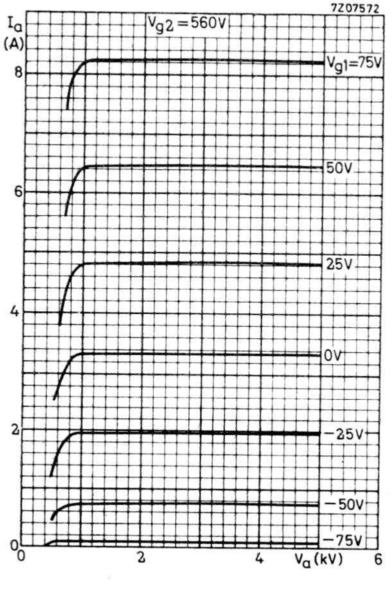
Frequency	f	up to	60	MHz
Anode voltage	V_a	max.	3.5	kV
Anode input power	W_{i_a}	max.	3.0	kW
Anode dissipation	W_a	max.	1.5	kW
Anode current	I_a	max.	1.0	A
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.2 dissipation	W_{ig_2}	max.	50	W
Grid No.2 current	I_{g_2}	max.	50	mA
	$-I_{g_2}$	max.	50	mA
Negative grid No.1 voltage	$-V_{g_1}$	max.	300	V
Grid No.1 current	I_{g_1}	max.	0	mA
Grid No.1 circuit resistance	R_{g_1}	max.	5	kΩ

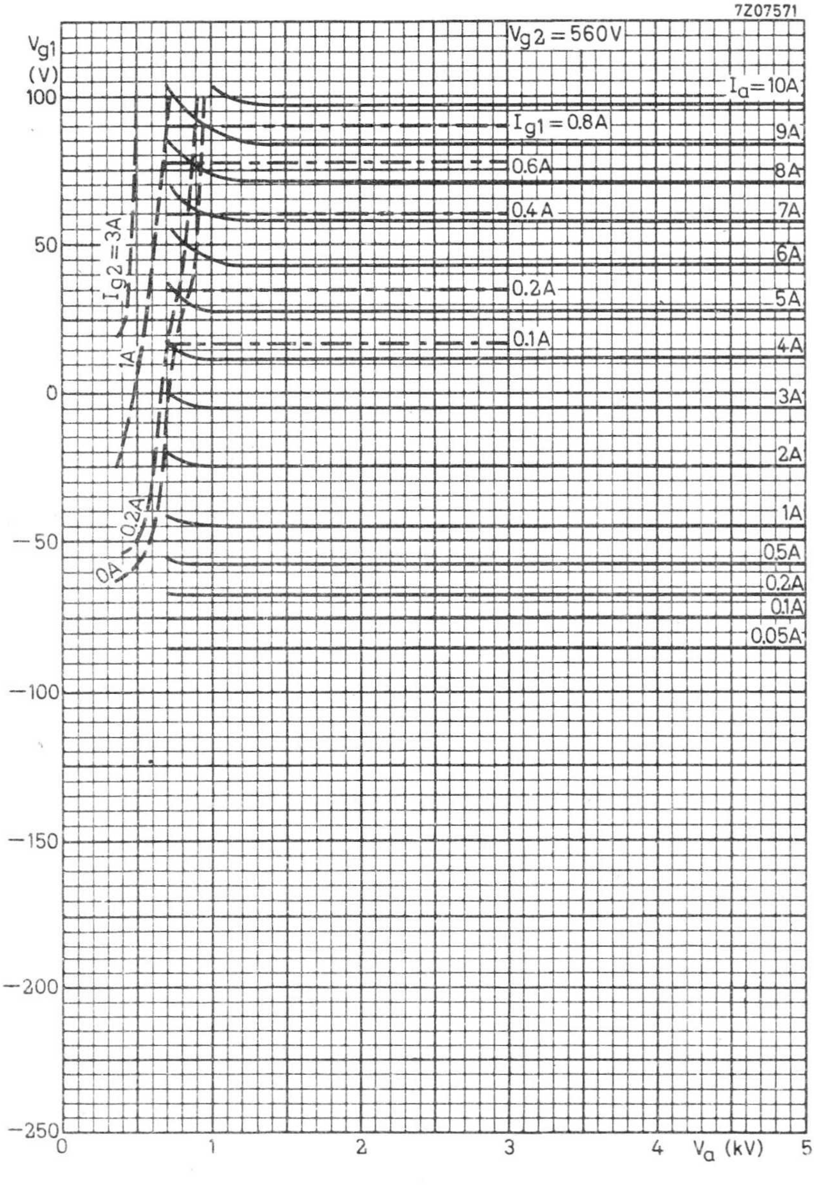
OPERATING CONDITIONS

Frequency	f		1 to 30		MHz
Anode voltage	V_a		3.0		kV
Grid No.2 voltage	V_{g_2}		560		V
Grid No.1 voltage	V_{g_1}		−55		V
		zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	0	48 (<53)	46 (<51)	V
Anode current	I_a	380	750	570	mA
Grid No.2 current	I_{g_2}	−5	−20	−15	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Grid No.1 resistor	R_{g_1}	2	2	2	kΩ
Driver output power	W_{dr}	0	< 5	< 5	W
Anode input power	W_{i_a}	1140	2250	1710	W
Anode dissipation	W_a	1140	1080	1100	W
Output power in load	W_ℓ	0	1050	–	W
PEP output power in load	W_ℓ	0	–	1050	W
Intermodulation distortion					
1 MHz. of the 3rd order	d_3	–	–	< −38	dB 2)
1 MHz. of the 5th order	d_5	–	–	< −38	dB 2)
30 MHz. of the 3rd order	d_3	–	–	< −36	dB 2)
30 MHz. of the 5th order	d_5			< −36	dB 2)

2) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.


7Z04117—2.5.12.abhj
Δt_a (°C)
t_a=max 250 °C
$\Delta t_{a\,max}$ at t_i=45°C
q=1000 l/min, p=8.9 mm H_2O
1200 l/min, 15.7 mm H_2O
1550 l/min, 25.4 mm H_2O
2000 l/min, 38.0 mm H_2O
300
200
100
0
0
20
40
60
80
100
W_o (% of $W_{o\,max}$)


7Z07572
I_a (A)
V_{g2} = 560V
V_{g1}=75V
50V
25V
0V
−25V
−50V
−75V
8
6
4
2
0
0
2
4
V_a (kV)
6


7Z07571
$V_{g2} = 560V$
V_{g1} (V)
100
50
0
−50
−100
−150
−200
−250
I_a=10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0.1A
0.05A
I_{g1} = 0.8A
0.6A
0.4 A
0.2A
0.1A
I_{g2} = 3A
1A
0.2A
0A
0
1
2
3
4
V_a (kV)
5

R.F. DOUBLE TETRODE

Single-ended double tetrode, indirectly heated, with novar base. Designed for mobile service as class C amplifier, oscillator or frequency multiplier up to 200 MHz. The tube is internally neutralised.

QUICK REFERENCE DATA		R.F. class C telegraphy or F.M. telephony	R.F. class C a-g_2 modulator	R.F. class C freq. tripler
		ICAS	ICAS	ICAS
Frequency	f =	up to 200 MHz	up to 200 MHz	up to 200 MHz
Anode voltage	V_a = max.	450 V	360 V	450 V
Anode dissipation	W_a = max.	2 x 10 W	2 x 6.5 W	2 x 10 W
Frequency	f =	175 MHz	175 MHz	58/174 MHz
Output power in load	W_ℓ =	30 W	19 W	10 W

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f =	6.75 V	13.5 V
Heater current	I_f =	0.8 A	0.4 A
Pins		9-(4+5)	4-5

CAPACITANCES

Input capacitance, each system	C_i	=	6.2 pF
Output capacitance, each system	C_o	=	2.7 pF
Anode to grid No.1, each system	C_{ag_1}	<	0.1 pF
Input capacitance, push-pull connection	C_i	=	5.1 pF
Output capacitance, push-pull connection	C_o	=	1.5 pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	30	mA
Amplification factor	$\mu_{g_2g_1}$	=	7.5	
Mutual conductance	S	=	3.3	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 225 °C
Pin seal temperature	=	max. 120 °C

COOLING: radiation and convection

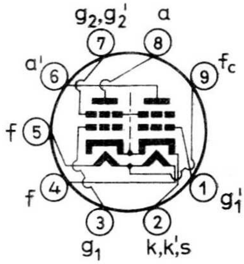
The use of a closed tube shield is not recommended

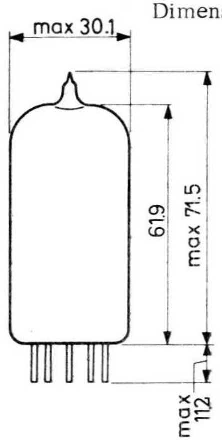
MECHANICAL DATA

Dimensions in mm

Base : Novar

Net weight: 28.5 g





Mounting position: any

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

LIMITING VALUES (Each system; absolute limits)

			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 400	max. 450	V
Anode current	I_a	=	max. 45	max. 55	mA
Anode input power	W_{ia}	=	max. 18	max. 25	W
Anode dissipation	W_a	=	max. 7.5	max. 10	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 3	max. 4	mA
Grid No.1 dissipation	W_{g_1}	=	max. 0.2	max. 0.2	W
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	ICAS	
Frequency	f	=	175	175	175	MHz
Anode voltage	V_a	=	400	400	450	V
Grid No.2 voltage	V_{g_2}	=	180	190	190	V
Grid No.1 voltage	V_{g_1}	=	-50	-50	-50	V
Grid No.1 resistor	R_{g_1}	=	31	28	26	kΩ
Anode current	I_a	=	2x45	2x55	2x55	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	3.8	5.0	4.5	mA
Grid No.1 current	I_{g_1}	=	2x0.8	2x0.9	2x0.95	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.68	0.95	0.85	W
Driving power	W_{dr}	=	1.0	1.1	1.2	W
Output power in the load	W_ℓ	=	21	26.5	30	W
Overall efficiency	η	=	58	60	61	%

R.F. CLASS C ANODE AND SCREEN GRID MODULATION. Grid No.3 modulated by a tertiary winding with a number of turns equal to 44% of that of the anode winding.

LIMITING VALUES (Each system; absolute limits)

			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 320	max. 360	V
Anode current	I_a	=	max. 37.5	max. 46	mA
Anode input power	W_{ia}	=	max. 12	max. 16.5	W
Anode dissipation	W_a	=	max. 5.0	max. 6.5	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 0.65	max. 0.65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 3	max. 4	mA
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	320	360	V
Grid No.2 voltage	V_{g_2}	=	140	160	V
Grid No.1 voltage	V_{g_1}	=	−20	−25	V
Anode current	I_a	=	2x37.5	2x46	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	5.0	6.0	mA
Grid No.1 current	I_{g_1}	=	2x1.25	2x1.5	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.7	1.0	W
Driving power	W_{dr}	=	2.0	2.5	W
Output power in the load	W_ℓ	=	13.5	19	W [1]
Overall efficiency	η	=	56	57	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	12.5	17	W

[1]) Measured in a circuit having an efficiency of 80%.

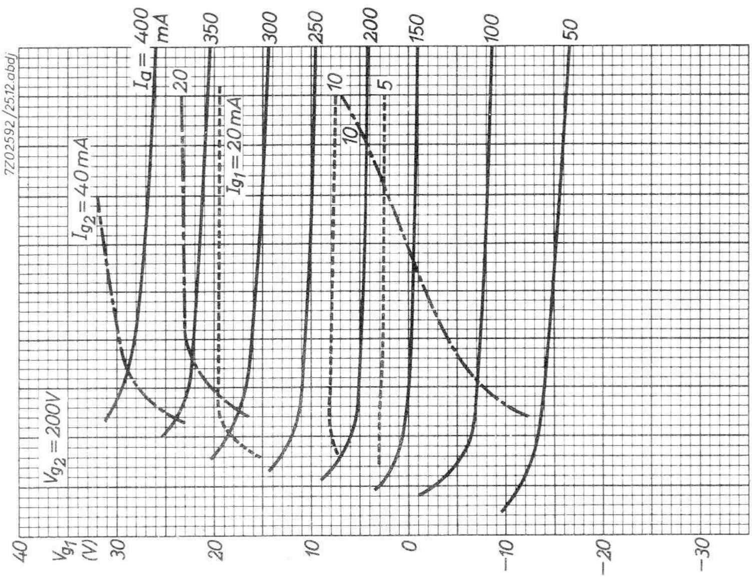
R.F. CLASS C FREQUENCY TRIPLER

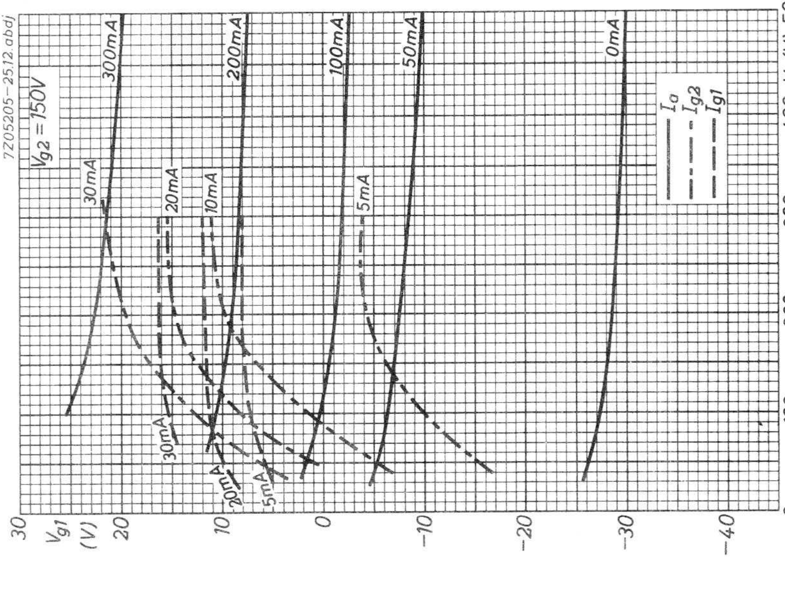
LIMITING VALUES (Each system; absolute limits)

			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 400	max. 450	V
Anode current	I_a	=	max. 30	max. 44	mA
Anode input power	W_{ia}	=	max. 11	max. 15	W
Anode dissipation	W_a	=	max. 7.5	max. 10	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 2	max. 3	mA
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			ICAS	
Frequency	f	=	58/174	MHz
Anode voltage	V_a	=	350	V
Grid No.2 voltage	V_{g_2}	=	165	V
Grid No.1 voltage	V_{g_1}	=	-150	V
Grid No.1 resistor	R_{g_1}	=	34	kΩ
Anode current	I_a	=	2x43	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	5.0	mA
Grid No.1 current	I_{g_1}	=	2x2.2	mA
Driving power	W_{dr}	=	2.0	W
Output power in the load	W_ℓ	=	10	W
Overall efficiency	η	=	33	%


7Z02592 /25.12.abdj
I_a = 400 mA
350
300
250
200
150
100
50
20
10
5
I_{g1} = 20 mA
10
I_{g2} = 40 mA
V_{g2} = 200V
V_{g1} (V)
V_a (V)


7Z05205–25.12.abdj
V_{g2} = 150V
300mA
200mA
100mA
50mA
0mA
30mA
20mA
10mA
5mA
30mA
20mA
5mA
I_a
I_{g2}
I_{g1}
V_{g1} (V)
V_a (V)

R.F. BEAM POWER TETRODE

Indirectly heated beam power tetrode designed for use as R.F. power amplifier, oscillator, frequency multiplier and A.F. amplifier or modulator for fixed or mobile equipment.

QUICK REFERENCE DATA			
Freq. (MHz)	R.F. class C telegraphy		
	V_a (V)	W_o (W)	
		CCS	**ICAS**
75	550	52	
	600		58.5
175	400	38	
	450	38	
	500		46
250	400		32

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	1.2	A	0.6	A
Pins			3-(6+7)		6-7	

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g1}	=	11.5	pF
Anode to all other elements except grid No.1	C_a	=	5.0	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	80	mA
Amplification factor	μ_{g2g1}	=	8	
Mutual conductance	S	=	7	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 ^{o}C
Seal temperature	=	max. 230 ^{o}C

MECHANICAL DATA

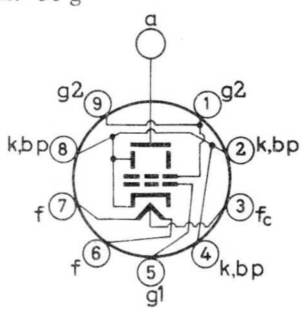
Dimensions in mm

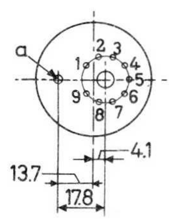
Base : Magnoval

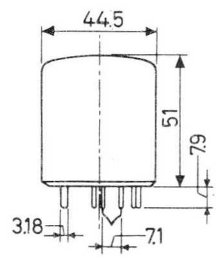
The anode pin is brought out through the base separated from the magnoval pin circle for convenient under-chassis circuitry.

Socket : 40685

Net weight: 36 g







Mounting position: any

R.F. AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY

CCS Continuous service

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 175	MHz
Anode voltage	V_a	=	max. 550	max. 450	V
Anode current	I_a	=	max. 150	max. 150	mA
Anode input power	W_{ia}	=	max. 75	max. 60	W
Anode dissipation	W_a	=	max. 25	max. 25	W
Grid No.2 voltage	V_{g_2}	=	max. 300	max. 300	V
Grid No.2 input power	W_{ig_2}	=	max. 4	max. 4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200	max. 200	V
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max. 50	max. 50	kΩ
with automatic bias	R_{g_1}	=	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 165	max. 165	mA
Heater to cathode voltage (any polarity)	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS **CCS** Continuous service

Frequency	f	=	75	175	175	MHz
Anode voltage	V_a	=	550	450	400	V
Grid No.2 voltage	V_{g_2}	=	235	250	230	V
Grid No.1 voltage	V_{g_1}	=	-50	-55	-51	V
Grid No.1 resistor	R_{g_1}	=	10	21	11	kΩ
Anode current	I_a	=	136	134	150	mA
Grid No.2 current	I_{g_2}	=	11	11	10	mA
Grid No.1 current	I_{g_1}	=	5.0	2.6	4.6	mA
Driving power	W_{dr}	=	0.5	1.5	1.5	W
Anode input power	W_{ia}	=	75	60	60	W
Output power in the load	W_{ℓ}	=	52	38	38	W
Overall efficiency	η	=	69	63.5	63.5	%

R.F. AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY

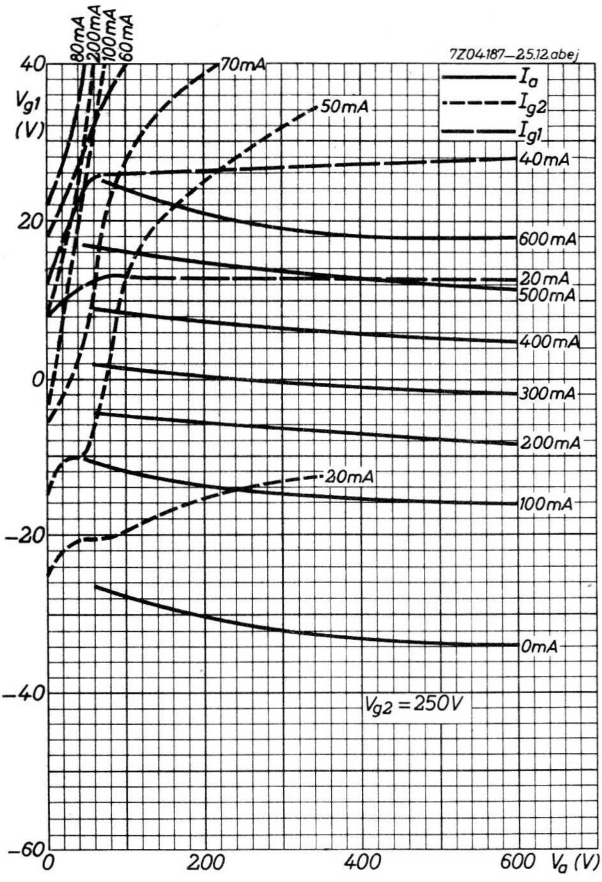
ICAS Intermittent service

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	175	250	MHz
Anode voltage	V_a	=	max. 600	500	400	V
Anode current	I_a	=	max. 150	150	150	mA
Anode input power	W_{ia}	=	max. 90	75	60	W
Anode dissipation	W_a	=	max. 30	30	30	W
Grid No.2 voltage	V_{g_2}	=	max. 300	300	300	V
Grid No.2 input power	W_{ig_2}	=	max. 4	4	4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200	200	200	V
Grid No.1 circuit resistance						
with fixed bias	R_{g_1}	=	max. 50	50	50	kΩ
with automatic bias	R_{g_1}	=	max. 100	100	100	kΩ
Cathode current	I_k	=	max. 165	165	165	mA
Heater to cathode voltage (any polarity)	V_{kf}	=	max. 100	100	100	V

OPERATING CONDITIONS **ICAS** Intermittent service

Frequency	f	=	75	175	250	MHz
Anode voltage	V_a	=	600	500	400	V
Grid No.2 voltage	V_{g_2}	=	255	225	235	V
Grid No.1 voltage	V_{g_1}	=	-50	-55	-54	V
Grid No.1 resistor	R_{g_1}	=	10	11	11	kΩ
Anode current	I_a	=	150	150	150	mA
Grid No.2 current	I_{g_2}	=	10	10	4	mA
Grid No.1 current	I_{g_1}	=	5.0	5.0	4.9	mA
Driving power	W_{dr}	=	0.7	1.5	2.0	W
Anode input power	W_{ia}	=	90	75	60	W
Output power in the load	W_ℓ	=	58.5	46	32	W
Overall efficiency	η	=	65	61.5	53.5	%


7Z04187—25.12.abej
I_a
I_{g2}
I_{g1}
80mA
200mA
100mA
60mA
70mA
50mA
40mA
600mA
20mA
500mA
400mA
300mA
200mA
20mA
100mA
0mA
$V_{g2} = 250V$
V_{g1} (V)
40
20
0
−20
−40
−60
0
200
400
600
V_a (V)

R.F. BEAM POWER TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	19	V
Heater current	I_f	=	2.3	A ←

For further data and curves of this type please refer to type QE08/200

HEATSINK COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA		
Frequency (MHz)	Class C telegraphy	
	V_a (V)	W_o (W)
175	2000	270
470	800	100

HEATING: indirect by AC or DC; cathode oxide coated

Heater voltage	V_f	=	6.0	V
Heater current	I_f	=	2.6	A
Waiting time	T_w	= min.	30	sec

At frequencies between 400 MHz and 500 MHz the heater voltage should be reduced to 5.0 V.

CAPACITANCES

Anode to all except grid No.1	C_a	=	4.5	pF
Grid No.1 to all except anode	C_{g_1}	=	15.7	pF
Anode to grid No.1	C_{ag_1}	=	0.03	pF

TYPICAL CHARACTERISTICS

Anode and grid No.2 voltage (interconnected)	$V_a = V_{g_2}$	=	300	V
Cathode current	I_k	=	50	mA
Amplification factor	$\mu_{g_2g_1}$	=	5.2	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	t_s	= max.	250	^oC

COOLING DATA

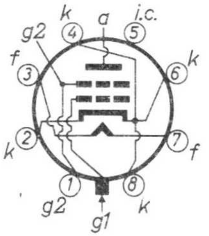
Thermal contact area		=	3.2	cm^2
Thermal resistance from seal to thermal contact area	R_{th}	=	0.03	$^oC/W$

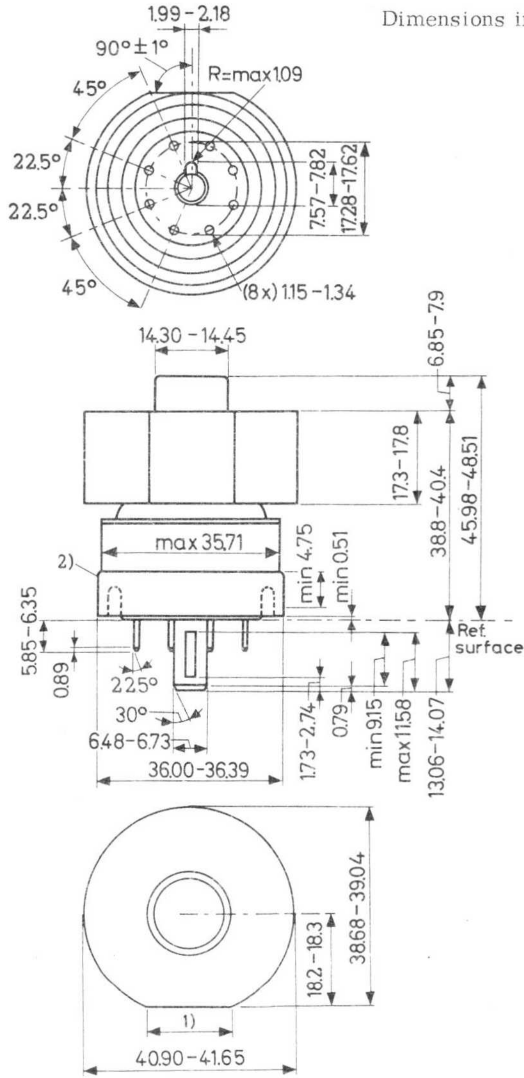
See also operating notes

MECHANICAL DATA

Dimensions in mm

Net weight: 230 g





Mounting position: any

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1) Heat sink contact area

2) Grid No. 2 contact

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	2000	V
Anode input power	W_{i_a}	=	max.	500	W
Anode dissipation		See operating notes			
Anode current	I_a	=	max.	250	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 dissipation	W_{g_1}	=	max.	2	W

OPERATING CONDITIONS

Frequency	f	=	175	470[1]	MHz
Anode voltage	V_a	=	2000	800	V
Grid No.2 voltage	V_{g_2}	=	200	[2]	V
Grid No.1 voltage	V_{g_1}	=	-90	-60	V
Anode current	I_a	=	250	250	mA
Grid No.2 current	I_{g_2}	=	8	-4 to +10	mA
Grid No.1 current	I_{g_1}	=	16	3	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	=	112	[2]	V
Driving power	W_{dr}	=	4	11	W
Anode input power	W_{i_a}	=	400	200	W
Output power	W_o	=	270	100	W
Efficiency	η	=	67.5	50	%

[1]) V_f should be reduced to 5.0 V at f = 470 MHz

[2]) To be adjusted for operating conditions

OPERATING NOTES

Heatsink or conduction cooling

Through the properties of beryllia (beryllium oxide), it is possible to remove heat directly from the anode of a tube to a safe point or "sink" while still maintaining the electrical insulation between the anode and the "sink", which is usually grounded. The path between the anode of the tube and the point of dissipation is known as a thermal system. This includes the anode of the tube, the beryllia insulating material, and the heatsink, plus all thermal compounds used to reduce the heat resistance between these parts. Consequently it is evident that a conduction cooled tube does not have an anode dissipation rating by itself. Only the entire thermal system has a dissipation rating. The purpose of this note is to assist in the understanding of the thermodynamics involved in a system of this type.

Thermal considerations

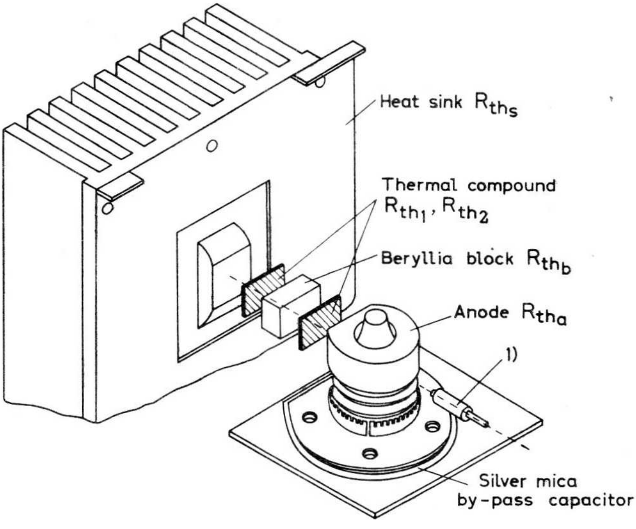
Page A shows a set of curves relating anode dissipation and ambient temperature to the maximum thermal resistance that will permit operation within the maximum allowable seal temperature. It is assumed that the equipment designer knows the anode power that must be dissipated (from circuit efficiencies) and the maximum ambient temperature in which his equipment must function. The problem is simply to devise a thermal circuit whose total thermal resistance is not more than that allowed. In order to determine the maximum thermal resistance of the system, the following equation may be used:

$$R_{th\ max} = \frac{t_{s\ max} - t_{amb}}{W_d} \qquad (1)$$

where $t_{s\ max}$ = max. seal temperature (^oC)
t_{amb} = ambient temperature (^oC)
W_d = power to be dissipated (W)

The graphs on page A illustrate a plot of this equation assuming the maximum seal temperature to be 250 ^oC. To use these graphs all that need be known is the maximum occurring anode dissipation and the ambient temperature.

As an example, suppose we wish to dissipate 100 W at an ambient temperature of 50 ^oC and a maximum allowable seal temperature of 250 ^oC. Through the use of either equation (1) or the curves of page A we see that the maximum allowable thermal resistance is 2.0 $^oC/W$.



According to the figure above the entire cooling system may be considered as the series circuit of a number of components, viz.:

The anode with a thermal resistance R_{th_a},

the compound, if used, between anode and beryllia block with thermal resistance R_{th_1},

the beryllia block with thermal resistance R_{th_b},

the compound between the beryllia block and the heat sink with thermal resistance R_{th_2}

and the heatsink with thermal resistance R_{th_s}.

The total thermal resistance of these components must be less than the maximum allowable thermal resistance $R_{th_{max}}$ of the entire system. This can be summarized in the following equation:

$$R_{th_a} + R_{th_1} + R_{th_b} + R_{th_2} + R_{th_s} \leqq R_{th_{max}} \qquad (2)$$

[1]) In order to assure a good thermal connection to the heat sink, it is necessary to apply a force of approximately 11.5 kg to the side of the tube opposite the heat sink. The method shown uses a small ceramic cylinder to apply this pressure while maintaining the high voltage insulation necessary for proper operation.

The thermal resistance of the beryllia block and the compounds may be calculated from

$$R_{th_x} = \frac{\text{thickness}}{\text{standard thickness}} \times \frac{\text{standard area}}{\text{area}} \times R_{th} \qquad (3)$$

where R_{th_x} is either R_{th_b} or R_{th_1} or R_{th_2}

and R_{th} is the specific thermal resistance of the material involved.

The specific thermal resistance of a number of materials is given in table 1.

The standard thickness in this table is taken as 1 cm for cubes and as 0.001 cm for films; the standard area for cubes as well as for films is 1 cm^2. The same values should be used for the standard thickness and the standard area in formula (3).

For the thermal resistance of a beryllia block of 3.2 cm^2 x 4.45 cm is found in this way:

$$R_{th_b} = \frac{4.45}{1} \times \frac{1}{3.2} \times 0.635 = 0.88\ ^oC/W.$$

The value of R_{th_a} is given in the data sheets as 0.03 $^oC/W$.

Assuming a value of 0.2 $^oC/W$ for the sum of R_{th_1} and R_{th_2} and the previous found value of 2.0 $^oC/W$ for $R_{th_{max}}$, equation (2) yields:

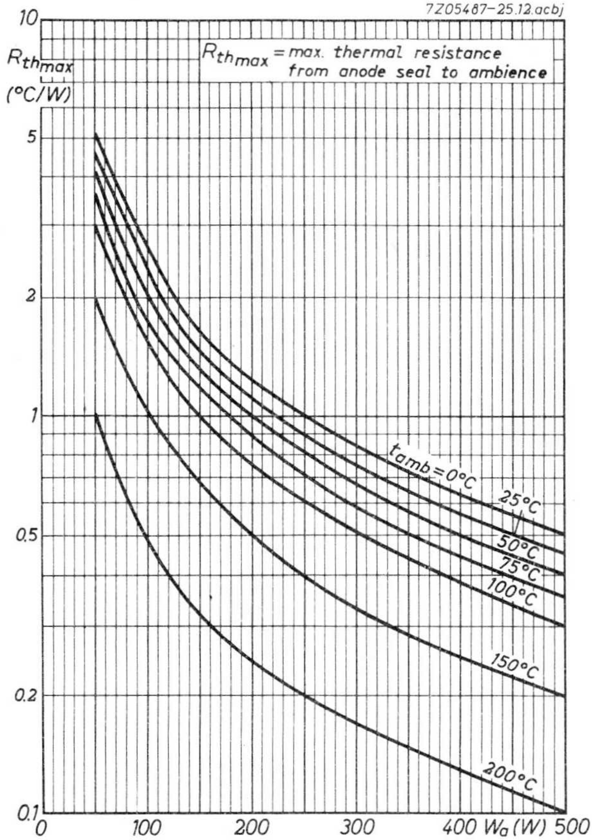
$$0.03 + 0.2 + 0.88 + R_{th_s} \leqq 2.0$$

thus leaving for R_{th_s} a value of max. 0.89 $^oC/W$.

With this figure a convenient heat sink can be selected from standard heat sink catalogues.

Table 1. Approximate thermal resistance R_{th} of typical materials

Films 0.001 cm x 1 cm^2		Cubes 1 cm x 1 cm^2	
Item	$^oC/W$	Item	$^oC/W$
Wakefield	0.127	Copper	0.28
Mica	0.254	Aluminium	0.51
Silicone	0.51	Beryllia	0.635
Mylar	0.61	Brass	0.89
Air (still)	3.1	Molybdenum	1.02
		Alumina	3.56


7Z05487-25.12.acbj
$R_{th_{max}}$ = max. thermal resistance from anode seal to ambience
$R_{th_{max}}$ (°C/W)
10
5
2
1
0.5
0.2
0.1
0
100
200
300
400
W_a (W)
500
t_{amb} = 0°C
25°C
50°C
75°C
100°C
150°C
200°C

AIR COOLED R.F. POWER TETRODE

Forced air cooled beam power tetrode in ceramic-metal construction intended for use in Class AB audio or R.F. amplifier service.

QUICK REFERENCE DATA				
Freq. (MHz)	S.S.B.		AB Mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W) [1]
30	2200	318		
A.F.			2200	770
			1000	190

HEATING: indirect; oxide coated cathode

Heater voltage	V_f		6.0	V
Heater current	I_f		3.2	A
Waiting time	T_w	min.	30	s

CAPACITANCES

Grounded cathode

Grid No.1 to all except anode	$C_{g_1(a)}$	24.2	pF
Anode to all except grid No.1	$C_{a(g_1)}$	5.5	pF
Anode to grid No.1	C_{ag_1}	0.05	pF

Grounded grid

Input	$C_{kf/(a)}$	19.9	pF
Output	$C_{a(kf)}$	5.5	pF
Anode to cathode	$C_{a/kf}$	0.01	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2200	V
Grid No.2 voltage	V_{g_2}	400	V
Anode current	I_a	150	mA
Transconductance	S	22	mA/V
Amplification factor	μ_{g2g1}	13	

TEMPERATURE LIMITS (Absolute max. rating system)

Temperature of all seals	t_s	max.	250	^oC
Temperature of anode core	t_a	max.	250	^oC

[1]) Two tubes

COOLING: Forced air

Above dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a (W)	h (m)	t_i (°C)	q min. (m^3/min.)	P_i (mm H_2O)
250	0	50	0.15	15.5
300	0	50	0.19	23
350	0	50	0.22	31
250	3000	50	0.22	22
300	3000	50	0.27	32
350	3000	50	0.34	48

→ **ACCESSORIES**

Air system socket — Johnson 124-110-1

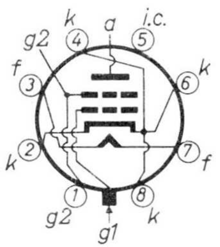
Air system chimney — Johnson 124-111-1 or equivalent

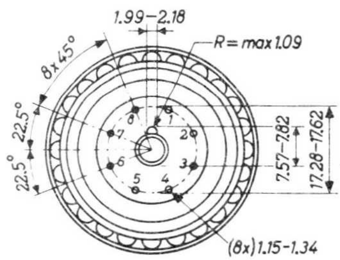
MECHANICAL DATA

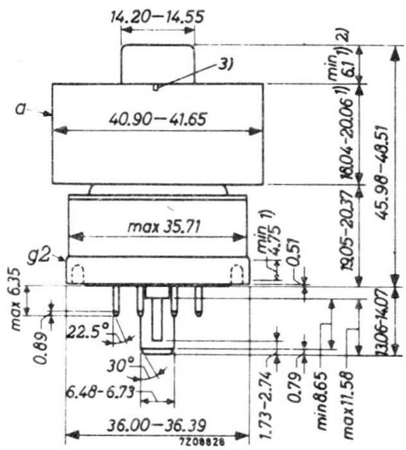
Dimensions in mm

Net weight: 120 g

Mounting position: any







[1]) Contact surface

[2]) Use this contact surface for frequencies up to 30 MHz only

[3]) Index aligned with grid No. 1 guide lug

A.F. CLASS AB AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	max.	2500	V
Anode current	I_a	max.	300	mA
Anode dissipation	W_a	max.	350	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	8	W
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Grid No.1 current	I_{g_1}	max.	2	mA
Cathode to heater voltage, peak	V_{kfp}	max.	150	V

OPERATING CONDITIONS two tubes in push-pull

Anode voltage	V_a	1000		1500		2200		V
Grid No.2 voltage	V_{g_2}	400		400		400		V
Grid No.1 voltage	V_{g_1}	-27		-27		-27		V [1]
Load resistance	R_{aa}	2600		5000		7800		Ω
Driving voltage, peak	$V_{g_{1p}}$	0	21	0	21	0	50	V
Anode current	I_a	2x100	2x260	2x100	2x265	2x100	2x290	mA
Grid No.2 current	I_{g_2}	-	2x -4	-	2x -5	-	2x -3	mA
Driving power	W_{dr}	-	0	-	0	-	0	
Anode input power	W_{ia}	2x100	2x260	2x150	2x400	2x220	2x640	W
Output power	W_o	0	190	0	400	0	770	W

[1]) To be adjusted for zero signal anode current.

R.F. SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	175	MHz
Anode voltage	V_a	max.	2500	V
Anode current	I_a	max.	300	mA
Anode dissipation	W_a	max.	350	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	8	W
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Grid No.1 current	I_{g_1}	max.	2	mA
Cathode to heater voltage, peak	V_{kfp}	max.	150	V

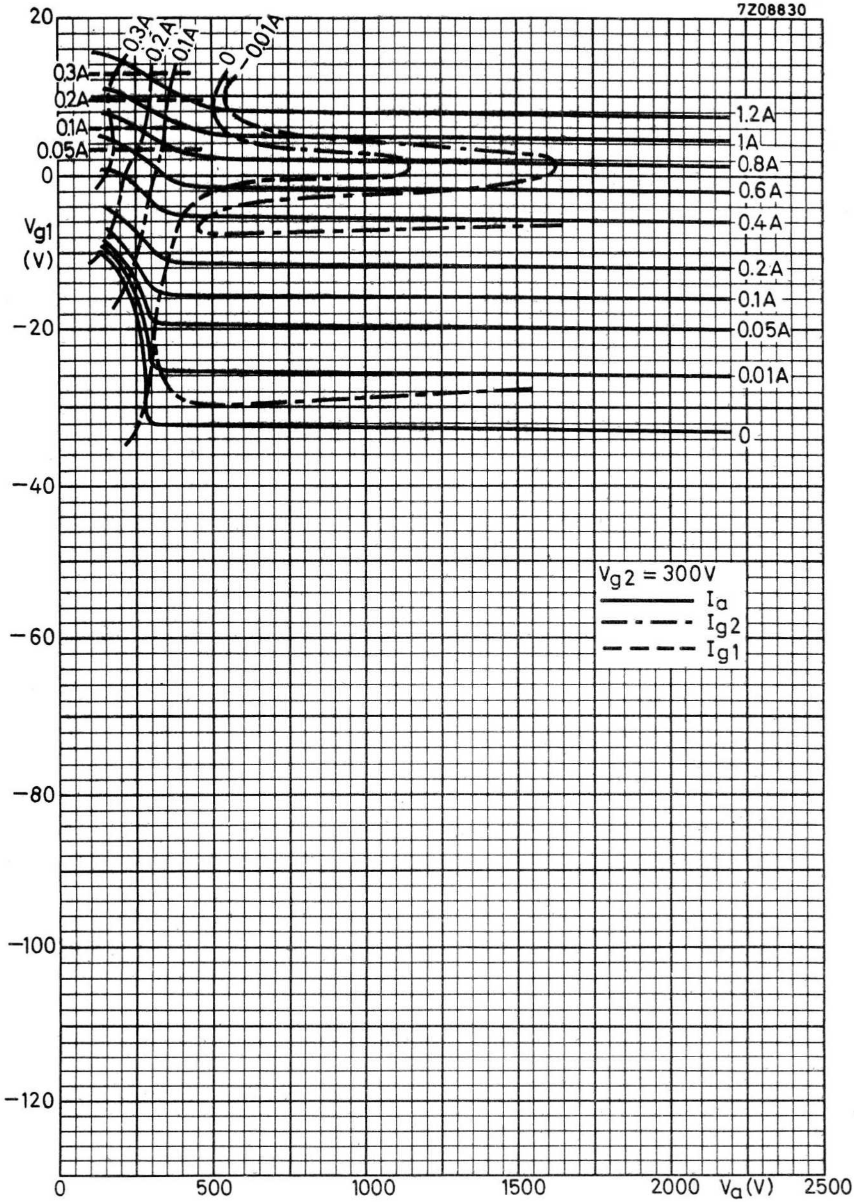
OPERATING CONDITIONS

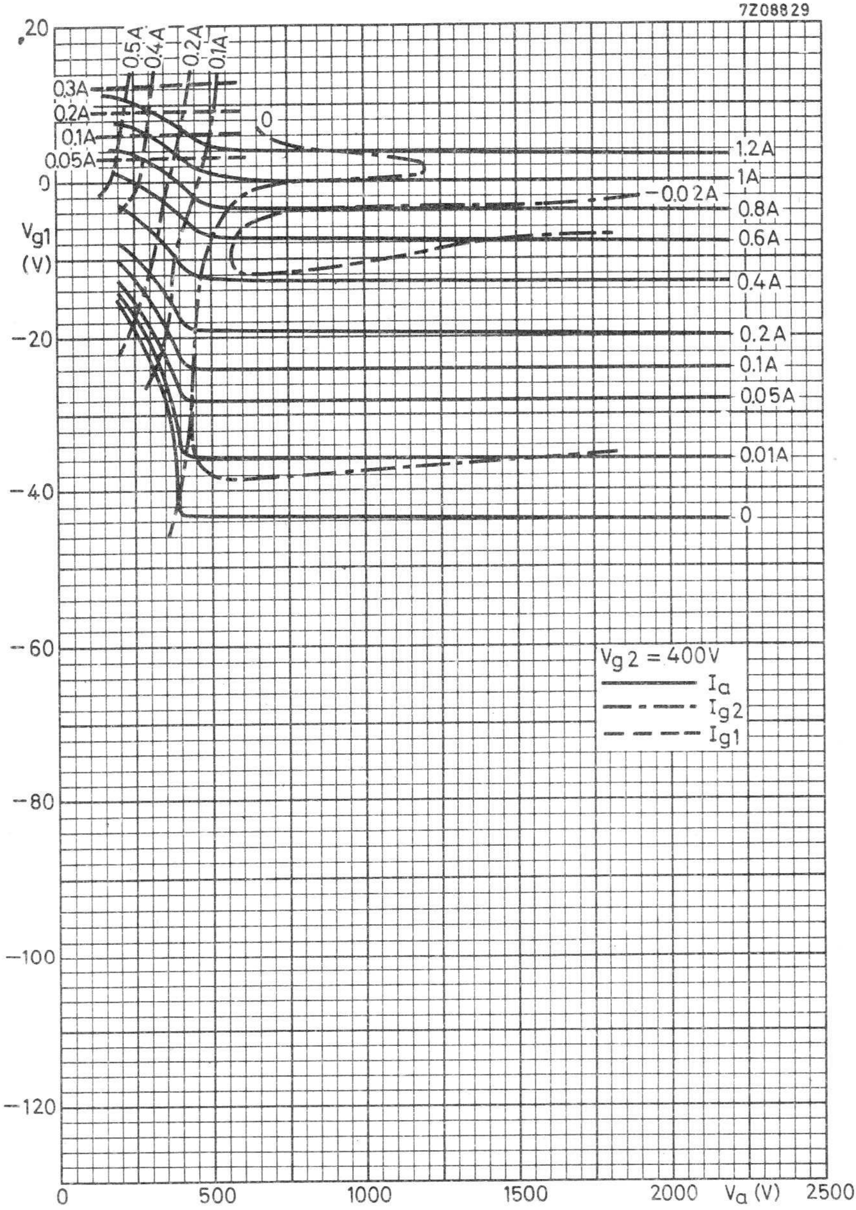
Frequency	f		30		MHz
Anode voltage	V_a		2200		V
Grid No.2 voltage	V_{g_2}		300		V
Grid No.1 voltage	V_{g_1}		-20		V [1]
Load resistance	$R_{a\sim}$		6000		Ω
		zero signal	single tone	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	18	18	V
Anode current	I_a	100	215	167	mA
Grid No.2 current	I_{g_2}	-	-2.5	-6	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	220	473	430	W
Output power in the load	W_{ℓ}(PEP)	0	318	318	W [2]
Intermodulation distortion					
of the 3d order	d_3			29	dB [3]
of the 5th order	d_5			30	dB [3]

[1]) To be adjusted for zero signal anode current.

[2]) Measured in a typical circuit having an efficiency of 85%.

[3]) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.


7Z08830
20
0
−20
−40
−60
−80
−100
−120
V_{g1}
(V)
0
500
1000
1500
2000
V_a (V)
2500
0.3A
0.2A
0.1A
0.05A
0
0.3A
0.2A
0.1A
0
−0.01A
1.2A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0.05A
0.01A
0
V_{g2} = 300V
I_a
I_{g2}
I_{g1}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V_{g1} (V)
20
0
−20
−40
−60
−80
−100
−120
0.5A
0.4A
0.2A
0.1A
0.3A
0.2A
0.1A
0.05A
0
1.2A
1A
−0.02A
0.8A
0.6A
0.4A
0.2A
0.1A
0.05A
0.01A
0
V_{g2} = 400V
I_a
I_{g2}
I_{g1}
0
500
1000
1500
2000
V_a (V)
2500

AIR COOLED R.F. POWER TETRODE

Forced air cooled beam power tetrode in ceramic-metal construction intended for use in Class AB audio or R.F. amplifier service.

HEATING: Indirect; oxide coated cathode

Heater voltage	V_f		26.5	V
Heater current	I_f		730	mA
Waiting time	T_w	min.	30	s

For further data please refer to type YL1340

R.F. DOUBLE TETRODE

HEATING: Indirect; cathode oxide-coated				
Heater voltage	V_f	=	13.5	V
Heater current	I_f	=	280	mA
Pin connections			1 - 8	

For further data and curves of this type please refer to type QQE04/5

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. power amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

QUICK REFERENCE DATA

C telegr.				C_{ag_2} mod.			Class AB SSB			
Freq. (MHz)	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS	Freq. (MHz)	V_a (V)	W_o PEP (W) CCS	W_o PEP (W) ICAS
60	750		85	600		62	30	750		61
60	600	63		475	42		30	600	49	
175	400		40							
175	320	29								

A.F. class AB [1][2]			A.F. class AB [1][3]		
V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
750		124	750		150
600	96		600	110	130
			500	100	

HEATING: indirect by A.C, or D.C.; cathode oxide-coated

Heater voltage	V_f		6.3	V
Heater current at V_f = 6.3 V	I_f		1.125	A
Cathode heating time	T_h	min.	60	s

See "Special performance data" for heater operation in stationary and mobile equipment.

[1]) Two tubes
[2]) Without grid current
[3]) With grid current

CAPACITANCES

Grid No. 1 to all except anode	$C_{g1(a)}$	13.0	pF
Anode to all except grid No. 1	$C_{a(g1)}$	8.5	pF
Anode to grid No. 1	C_{ag1}	< 0.22	pF

TYPICAL CHARACTERISTICS

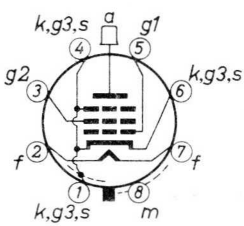
Anode voltage	V_a	200	V
Grid No. 2 voltage	V_{g2}	200	V
Anode current	I_a	100	mA
Transconductance	S	7	mA/V
Amplification factor	μ_{g2g1}	4.5	-

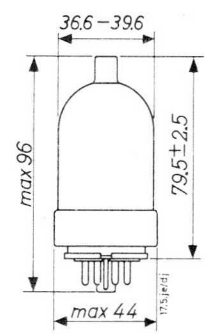
MECHANICAL DATA Dimensions in mm

Base: octal 8 pin

Socket: 2422 501 03001

Net weight: 65 g





Mounting position: any

TEMPERATURE LIMIT (Absolute limit)

Bulb temperature	t_{bulb}	max.	260	°C

R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

LIMITING VALUES (Absolute max. rating system)
(For maximum anode voltage and maximum anode input power at f > 60 MHz see page 18).

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	max. 600	max. 750	V
Anode input power	W_{i_a}	max. 90	max. 120	W
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g1}$	max. 150	max. 150	V
Grid No.1 current	I_{g1}	max. 3.5	max. 4	mA
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g1}	max. 30	max. 30	kΩ [1])

OPERATING CONDITIONS

Frequency	f	up to 60		MHz
Anode voltage	V_a	600	750	V
Grid No.2 voltage	V_{g2}	200	200	V [2])
Grid No.1 voltage	V_{g1}	-70	-77	V [3])
Grid No.1 resistor	R_{g1}	24	28	kΩ
Grid No.1 current	I_{g1}	2.8	2.7	mA
Grid No.1 driving voltage	V_{g1p}	90	95	V
Driving power	W_{dr}	0.3	0.3	W
Anode current	I_a	150	160	mA
Grid No.2 current	I_{g2}	10	10	mA
Anode input power	W_{i_a}	90	120	W
Anode dissipation	W_a	27	35	W
Output power	W_o	63	85	W
Efficiency	η	70	71	%

Notes see page 11

R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

OPERATING CONDITIONS (continued)

Frequency	f	up to	175	MH
Anode voltage	V_a	320	400	V
Grid No.2 voltage	V_{g_2}	210	220	V [2]
Grid No.1 voltage	V_{g_1}	-52	-55	V [3]
Grid No.1 resistor	R_{g_1}	26	30	kΩ
Grid No.1 current	I_{g_1}	2	1.9	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	65	67	V
Driving power	W_{dr}	2	2	W
Anode current	I_a	170	180	mA
Grid No.2 current	I_{g_2}	12	12	mA
Anode input power	W_{i_a}	55	72	W
Anode dissipation	W_a	26	32	W
Output power	W_o	29	40	W
Efficiency	η	53	56	%

Notes see page 11

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)
(For maximum anode voltage and maximum anode input power at f > 60 MHz see page 18)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	max. 480	max. 600	V
Anode input power	W_{i_a}	max. 60	max. 85	W
Anode dissipation	W_a	max. 18	max. 23	W
Anode current	I_a	max. 145	max. 180	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 2	max. 2	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1])

OPERATING CONDITIONS

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	475	600	V
Grid No.2 voltage	V_{g_2}	165	175	V [4])
Grid No.1 voltage	V_{g_1}	−86	−92	V [3])
Grid No.1 resistor	R_{g_1}	26	27	kΩ
Grid No.1 current	I_{g_1}	3.3	3.4	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	106	114	V
Driving power	W_{dr}	0.4	0.5	W
Anode current	I_a	125	140	mA
Anode input power	W_{i_a}	60	84	W
Anode dissipation	W_a	18	22	W
Output power	W_o	42	62	W
Efficiency	η	70	74	%
Modulation factor	m	100	100	%
Modulation power	W_{mod}	25	37	W

Notes see page 11

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 30		MHz
Anode voltage	V_a	max. 600	max. 750	V
Anode input power	W_{i_a}	max. 90	max. 126	W
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance (fixed bias)	R_{g_1}	max. 30	max.' 30	kΩ

OPERATING CONDITIONS

			C.C.S.		
Frequency	f		30		MHz
Anode voltage	V_a		600		V
Grid No.2 voltage	V_{g_2}		200		V 5)
Grid No.1 voltage	V_{g_1}		-47		V 5)
		zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	V_{g1_p}	0	47	47	V
Anode current	I_a	24	125	86	mA
Grid No.2 current	I_{g_2}		7.4	5	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	14.4	75	51.5	W
Anode dissipation	W_a	14.4	26	27	W
Output power (PEP)	W_o	-	49	49	W
Efficiency	η	-	65.5	47.5	%
Intermodulation distortion					
of the 3rd order	d_3			24.5	dB 6)
of the 5th order	d_5			30	dB 6)

Notes see page 11

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

OPERATING CONDITIONS (continued)

			I.C.A.S.		
Frequency	f		30		MHz
Anode voltage	V_a		750		V
Grid No.2 voltage	V_{g_2}		200		V 5)
Grid No.1 voltage	V_{g_1}		-48		V 5)
		zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	48	48	V
Anode current	I_a	25	125	86	mA
Grid No.2 current	I_{g_2}		6.3	3.9	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	18.8	94	64.5	W
Anode dissipation	W_a	18.8	33	34	W
Output power (PEP)	W_o	-	61	61	W
Efficiency	η	-	65	47	%
Intermodulation distortion					
of the 3rd order	d_3			26	dB 6)
of the 5th order	d_5			31	dB 6)

Notes see page 11

A.F. CLASS AB AMPLIFIER (without grid current)

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Anode voltage	V_a	max. 600	max. 750	V
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 0	max. 0	mA
Grid No.1 circuit resistance	R_{g_1}	max. 100	max. 100	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V

OPERATING CONDITIONS two tubes in push-pull

		C.C.S.		I.C.A.S.		
Anode voltage	V_a	600		750		V
Grid No.2 voltage	V_{g_2}	200		200		V [7]
Grid No.1 voltage	V_{g_1}	-47		-48		V
Load resistance	$R_{aa\sim}$	5600		7200		Ω
Grid to grid voltage, peak	$V_{g_1g_1p}$	0	94	0	96	V
Anode current	I_a	2 x 24	2 x 125	2 x 25	2 x 125	mA
Grid No.2 current	I_{g_2}	-	2 x 7.4	-	2 x 6.3	mA
Anode input power	W_{i_a}	2 x 14.4	2 x 75	2 x 19	2 x 94	W
Anode dissipation	W_a	2 x 14.4	2 x 27	2 x 19	2 x 32	W
Output power	W_o	0	96	0	124	
Efficiency	η	-	64	-	66	%

Notes see page 11

A.F. CLASS AB AMPLIFIER (with grid current)

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Anode voltage	V_a	max. 600	max. 750	V
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1])
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V

OPERATING CONDITIONS, two tubes in push-pull

		C.C.S.				
Anode voltage	V_a	500		600		V
Grid No.2 voltage	V_{g_2}	200		200		V [7])
Grid No.1 voltage	V_{g_1}	−46		−48		V
Load resistance	$R_{aa\sim}$	3620		5200		Ω
Grid to grid voltage, peak	$V_{g_1g_{1p}}$	0	108	0	106	V
Anode current	I_a	2 x 25	2 x 154	2 x 20	2 x 135	mA
Grid No.2 current	I_{g_2}	-	2 x 13	-	2 x 13.5	mA
Grid No.1 current	I_{g_1}	0	2x1.35	0	2 x 0.65	mA
Driving power	W_{dr}	0	0.2	0	0.7	W
Anode input power	W_{i_a}	2 x 12.5	2 x 77	2 x 12	2 x 81	W
Anode dissipation	W_a	2 x 12.5	2 x 27	2 x 12	2 x 26	W
Output power	W_o	0	100	0	110	W
Efficiency	η	-	65	-	68	%

Notes see page 11

OPERATING CONDITIONS(continued)

		I.C.A.S.				
Anode voltage	V_a	600		750		V
Grid No.2 voltage	V_{g_2}	200		150		V
Grid No.1 voltage	V_{g_1}	−47		−39		V
Load resistance	$R_{aa\sim}$	4160		6050		Ω
Grid to grid voltage, peak	$V_{g_1g_{1p}}$	0	114	0	110	V
Anode current	I_a	2 x 25	2 x 164	2 x 20	2 x 147	mA
Grid No.2 current	I_{g_2}	-	2 x 13	-	2 x 14	mA
Grid No.1 current	I_{g_1}	0	2 x 1.7	0	2 x 3.8	mA
Driving power	W_{dr}	0	0.2	0	0.5	W
Anode input power	W_{i_a}	2 x 12	2 x 98	2 x 15	2 x 110	W
Anode dissipation	W_a	2 x 12	2 x 33	2 x 15	2 x 35	W
Output power	W_o	0	130	0	150	W
Efficiency	η	-	66	-	68	%

Notes pages 3 through 9

1. For operation at maximum ratings.
   For operation at less than maximum ratings:
   R_{g_1} = max. 100 kΩ.
2. Obtained preferably from a separate source, or from the anode supply voltage with a voltage divider, or through a series resistor.
   A series resistor should be used only when the tube is used in a circuit which is not keyed. Grid No.2 voltage must not exceed 435 V under key-up conditions.
3. V_{g_1} may be obtained from a separate supply, or from R_{g_1} or R_k, or by combination methods.
4. Obtained preferably from a separate source modulated with the anode supply, or from the anode supply through a series resistor.
5. Obtained from a separate source.
6. Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.
7. Obtained preferably from a separate source or from the anode voltage supply with a voltage divider.

SPECIAL PERFORMANCE DATA

Stationary equipment operation

		min.	nom.	max.	
Heater voltage	V_f	-	6.3	-	V [1]
Heater current at V_f = 6.3 V	I_f	1050	-	1200	mA
Grid No.2 current	I_{g2}	-	-	15	mA [2]
Output power in load	W_ℓ	59	-	-	W [2]

Mobile equipment operation

		min.	design range	max.	
Heater voltage	V_f	-	6.0 to 7.5	-	V [3]
Heater current at V_f = 6.75 V	I_f	1100	-	1230	mA
Grid No.2 current	I_{g2}	-	-	15	mA [2]
Output power in load	W_ℓ	59			W [2]
Decrease output power in load	ΔW_ℓ			10	% [4]

Notes

1. Recommended design centre heater voltage 6.3 V. To ensure long life the heater voltage should not fluctuate more than 10%.
2. In a self-excited oscillator circuit and

Heater voltage	V_f	6.3	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g2}	200	V
Grid No.1 resistor	R_{g1}	24	kΩ ±10%
Anode current	I_a	max. 150	mA
Grid No.1 current	I_{g1}	2.5 to 3	mA
Frequency	f	15	MHz

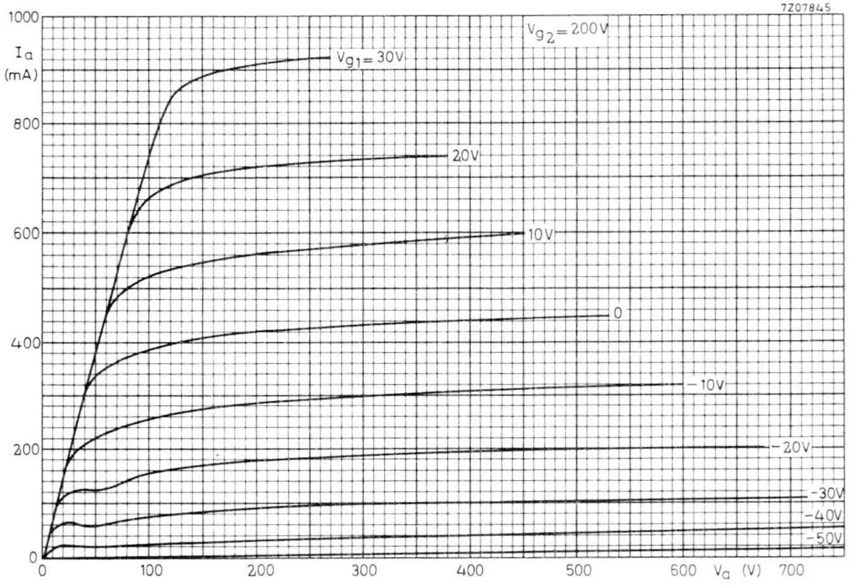
3. Recommended heater voltage within the range V_f 6.0 to 7.5 V
   In battery operation within the range V_f 5.0 to 8.0 V
4. With the conditions of note 2, reduce the heater voltage to 5.0 V. The decrease in output power ΔW_ℓ = max. 10%.

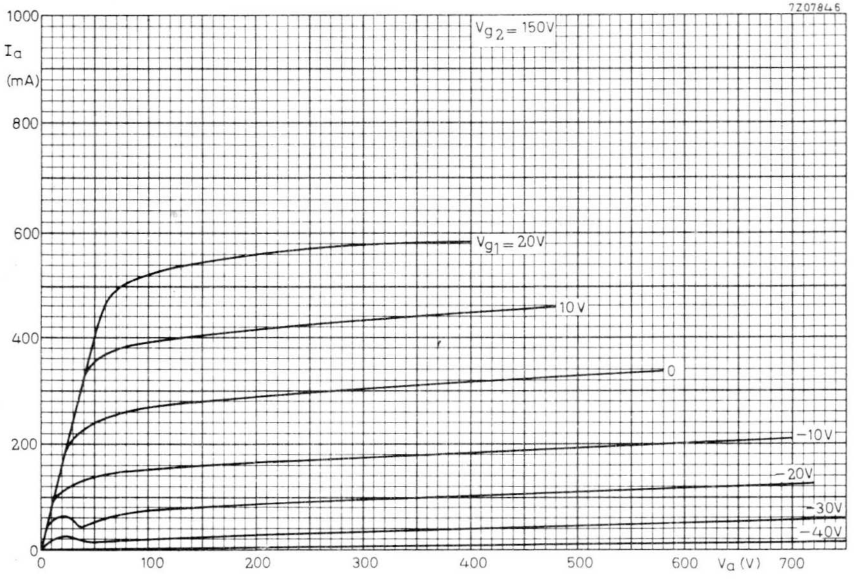
Over voltage heater life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 8 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 11 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of entermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 6.75 V; V_{kf} = ± 100 V	I_{kf}	max.	100	μA
Leakage resistance grid No.1 at V_f = 6.75 V; V_{g1} = −200 V; V_a = V_{g2} = V_k = 0 V	r_{ins}	min.	10	MΩ
Leakage resistance anode at V_f = 6.75 V; V_a = −200 V V_{g_2}, V_{g_1}, V_k = 0 V	r_{ins}	min.	10	MΩ


7Z07845
$V_{g_2} = 200V$
$V_{g_1} = 30V$
20V
10V
0
−10V
−20V
−30V
−40V
−50V
1000
I_a
(mA)
800
600
400
200
0
0
100
200
300
400
500
600
V_a (V)
700


7Z07846
$V_{g_2} = 150V$
$V_{g_1} = 20V$
10V
0
−10V
−20V
−30V
−40V
1000
I_a
(mA)
800
600
400
200
0
0
100
200
300
400
500
600
V_a (V)
700

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. power amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f		12.6	V
Heater current at V_f = 12.6 V	I_f		562	mA
Cathode heating time	T_h	min.	60	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$		13.0	pF
Anode to all except grid No.1	$C_{a(g_1)}$		8.5	pF
Anode to grid No.1	C_{ag1}	max.	0.24	pF

SPECIAL PERFORMANCE DATA

Stationary equipment operation		Min.	Nom.	Max.	
Heater voltage	V_f	-	12.6	-	V 1)
Heater current at V_f = 12.6 V	I_f	525	-	600	mA
Output power in load	W_ℓ	59	-	-	W 2)

Mobile equipment operation		Min.	Design range	Max.	
Heater voltage	V_f	-	12 to 15	-	V 3)
Heater current at V_f = 13.5 V	I_f	550	-	620	mA
Output power in load	W_ℓ	59	-	-	W 2)
Decrease output power in load	ΔW_ℓ	-	-	10	% 4)

1) 2) 3) 4) See page 2

NOTES

1. Recommended design centre heater voltage 12.6 V.
   To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self-excited oscillator circuit and

Heater voltage	V_f	12.6	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g_2}	200	V
Grid No.1 resistor	R_{g_1}	24	kΩ ± 10%
Anode current	I_a	max. 150	mA
Grid No.1 current	I_{g_1}	2.5 to 3	mA
Frequency	f	15	MHz

3. Recommended heater voltage within the range 12.0 to 15.0 V.
   In battery operation within the range 10 to 15 V.

4. With the conditions of note 2, reduce the heater voltage to 10 V. The decrease in output power ΔW_ℓ = max. 10%.

Overvoltage life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 16 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 22 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of intermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 13.5 V; V_{kf} = ± 100 V	I_{kf}	max. 100	μA
Leakage resistance grid No.1 at V_f = 13.5 V; V_{g_1} = − 200 V $V_a = V_{g_2} = V_k$ = 0 V	r_{ins}	min. 10	MΩ
Leakage resistance anode at V_f = 13.5 V; V_a = −200 V $V_{g_2} = V_{g_1} = V_k$ = 0 V	r_{ins}	min. 10	MΩ

For further data and curves please refer to type YL1370

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f		26.5	V
Heater current at V_f = 26.5 V	I_f		300	mA
Cathode heating time	T_h	min.	60	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g1(a)}$		13.0	pF
Anode to all except grid No.1	$C_{a(g1)}$		8.5	pF
Anode to grid No.1	C_{ag1}	min.	0.24	pF

SPECIAL PERFORMANCE DATA

<u>Stationary equipment operation</u>		Min.	Nom.	Max.	
Heater voltage	Vf	-	26.5	-	V 1)
Heater current at V_f = 26.5 V	If	280	-	320	mA
Output power in load	W_ℓ	59	-	-	W 2)
<u>Mobile equipment operation</u>		Min.	Design range	Max.	
Heater voltage	Vf	-	24 to 29	-	V 3)
Heater current at V_f = 26.5 V	If	280	-	320	mA
Output power in load	W_ℓ	59	-	-	2)
Decrease output power in load	ΔW_ℓ	-	-	10	% 4)

1) 2) 3) 4) See page 2.

NOTES

1. Recommended design centre heater voltage 26.5 V.
   To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self excited oscillator circuit and

Heater voltage	V_f	26.5	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g_2}	200	V
Grid No.1 resistor	R_{g_1}	24	kΩ ± 10%
Anode current	I_a	max. 150	mA
Grid No.1 current	I_{g_1}	2.5 to 3	mA
Frequency	f	15	MHz

3. Recommended heater voltage within the range 24 to 29 V.
   In battery operation within the range 21 to 31 V.

4. With the conditions of note 2, reduce the heater voltage to 10 V. The decrease in output power ΔW_ℓ = max. 10%.

Overvoltage life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 31 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 43 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of intermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 26.5 V; V_{kf} = ± 100 V	I_{kf}	max. 150	µA
Leakage resistance grid No.1 at V_f = 26.5 V; V_{g_1} = − 200 V, $V_a = V_{g_2} = V_k$ = 0 V	r_{ins}	min. 10	MΩ
Leakage resistance anode at V_f = 26.5 V; V_a = −200 V, $V_{g_2} = V_{g_1} = V_k$ = 0 V	r_{ins}	min. 10	MΩ

For further data and curves please refer to type YL1370

AIR COOLED V.H.F. POWER TETRODE

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_{fo}		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_{ag1}	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.

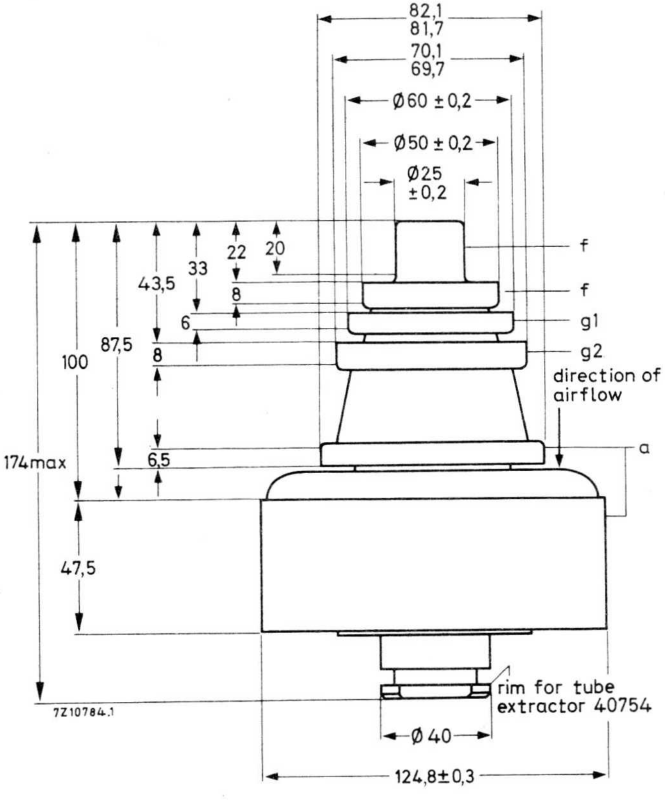
ACCESSORIES

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

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

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_{ab1}	2,1	2,3	A	3)
Grid no. 2 current, black	I_{g2b1}	45	45	mA	3)
Grid no. 1 current, black	I_{g1b1}	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

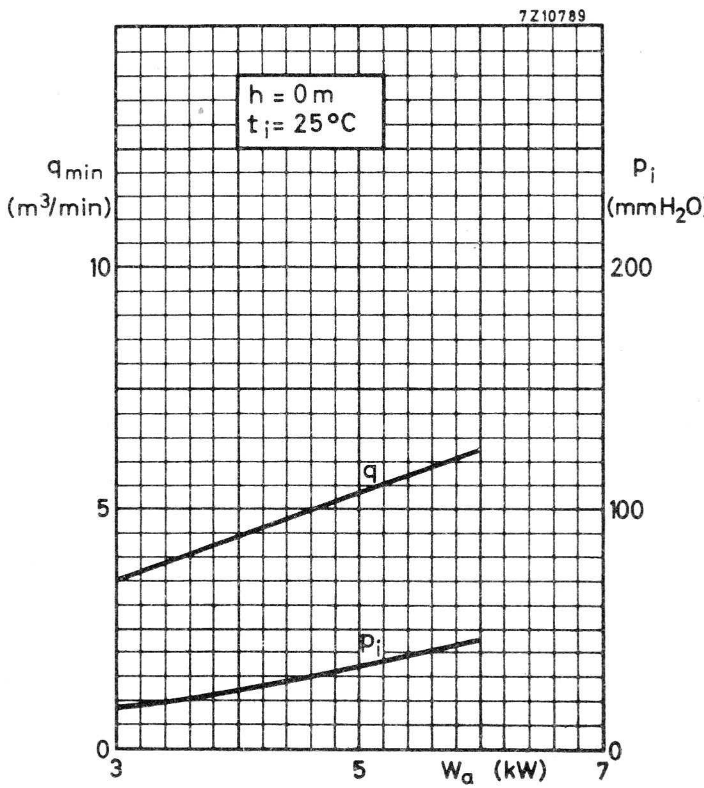
OPERATING CONDITIONS

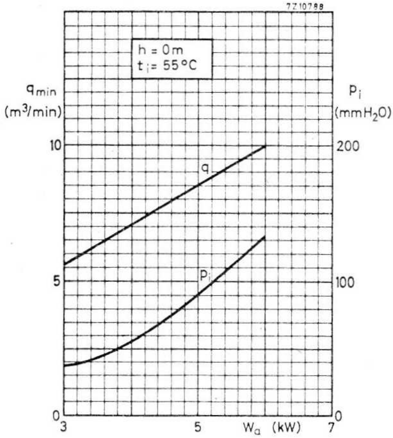
Frequency	f	260	MHz	
Anode voltage	V_a	7	kV	
Grid no. 2 voltage	V_{g2}	600	V	
Grid no. 1 voltage	V_{g1}	-120	V	1)
Anode current, no signal condition	I_a	200	mA	
Anode current	I_a	2,3	A	
Grid no. 2 current	I_{g2}	80	mA	
Grid no. 1 current	I_{g1}	150	mA	
Anode input power	W_{ia}	16,1	kW	
Anode dissipation	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		

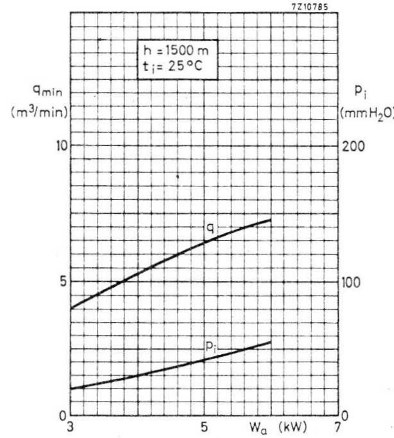
1) See page 8

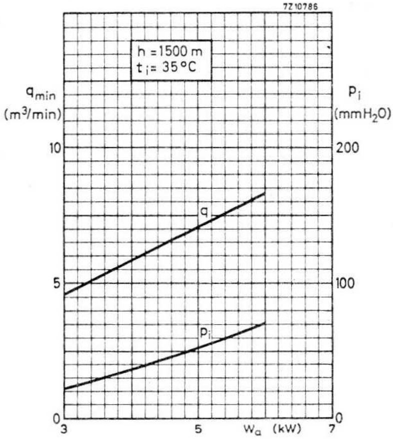
NOTES

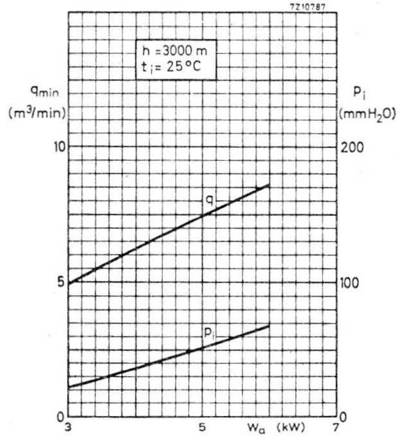
1) To be adjusted for the stated no signal anode current.
2) With double tuned circuit.
3) Black signal including line sync pulses
4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5) 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).

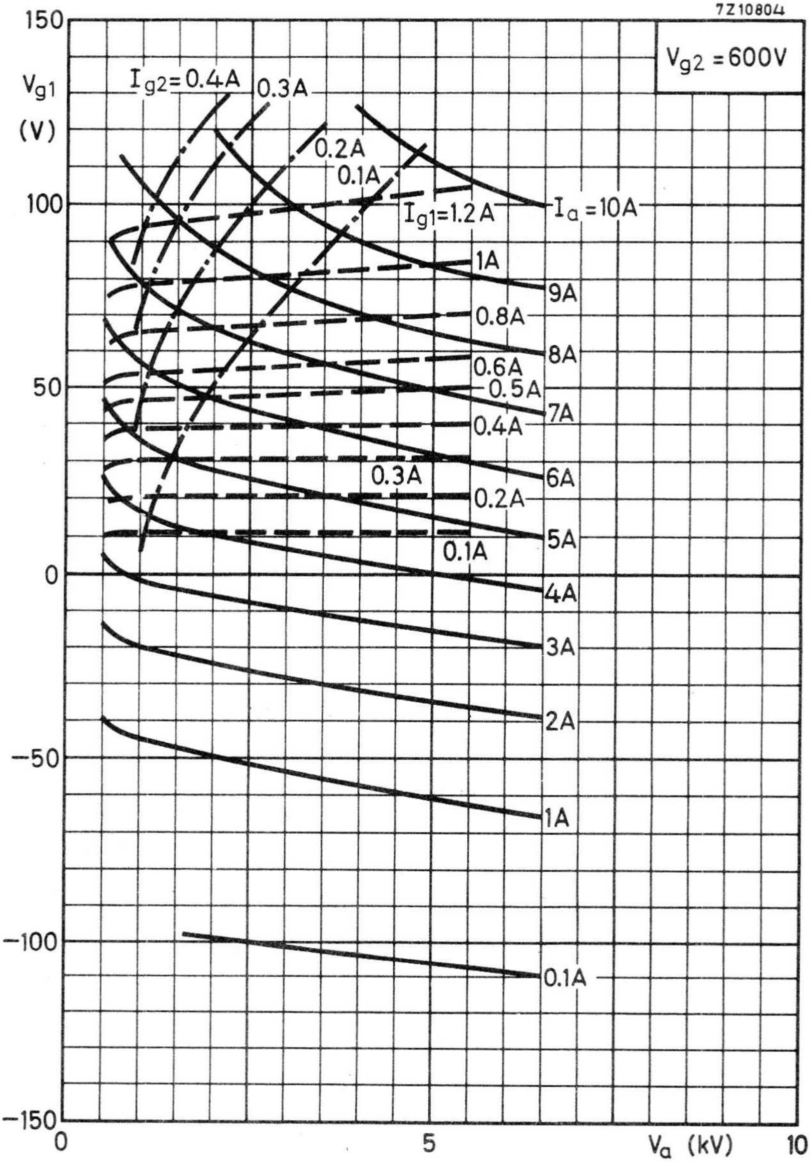


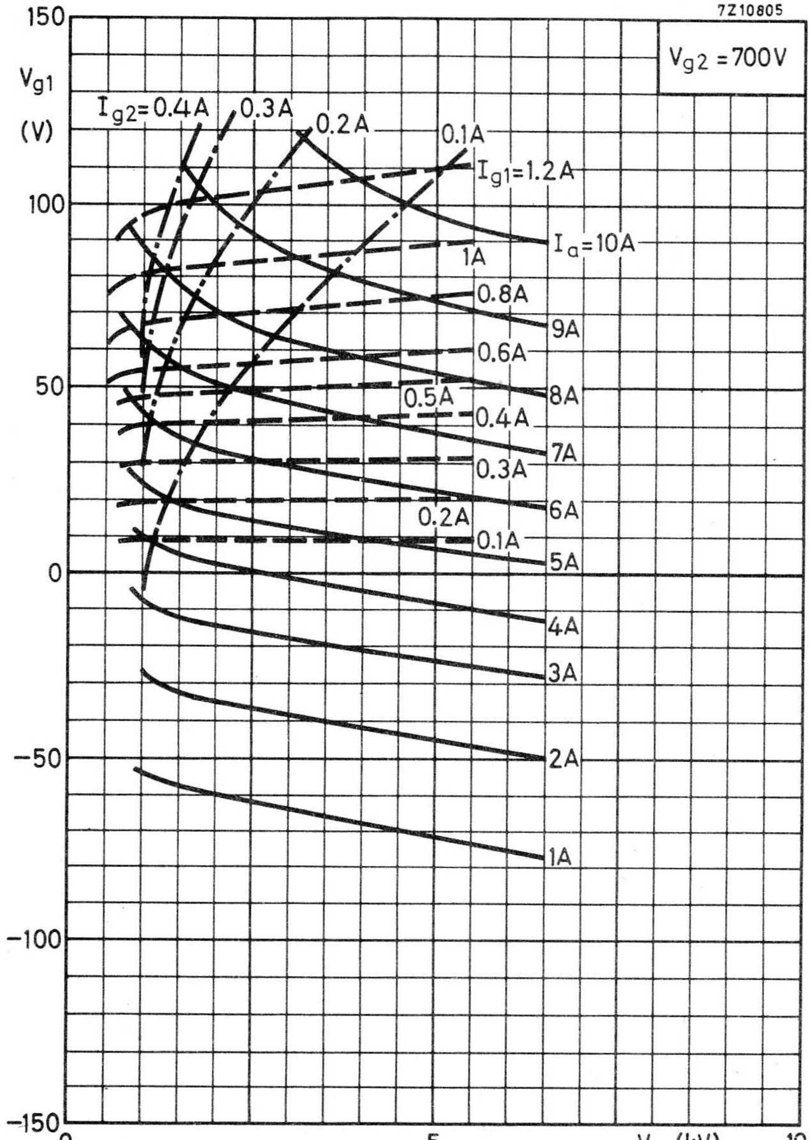

7Z10788
h = 0 m
t_i = 55 °C
q_{min}
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)


7Z10785
h = 1500 m
t_i = 25 °C
q_{min}
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)

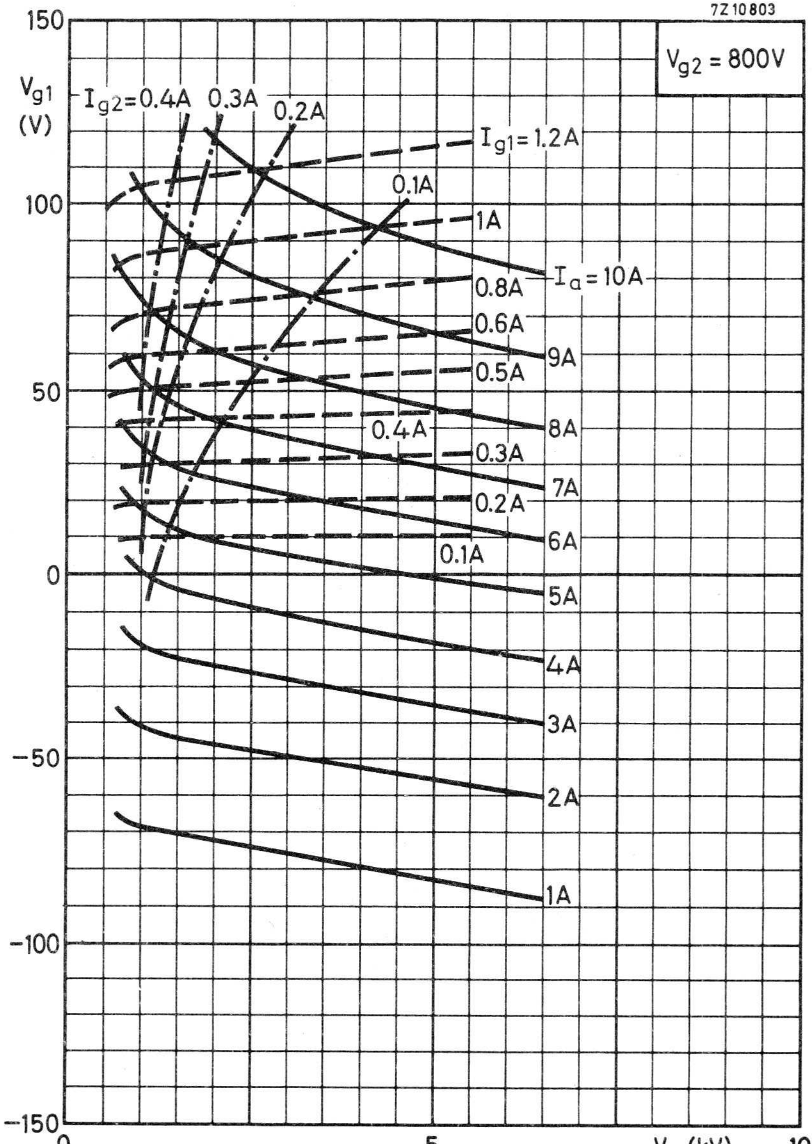

7Z10786
h = 1500 m
t_i = 35 °C
q_{min}
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)


7Z10787
h = 3000 m
t_i = 25 °C
q_{min}
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)


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



7Z10805
V_{g2} = 700V
150
100
50
0
−50
−100
−150
V_{g1}
(V)
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)

AIR COOLED V.H.F. POWER TETRODE

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	^{o}C
Recommended max. seal temperature	t	max.	200	^{o}C

COOLING

See curves.
Direction of air flow: see drawing.

ACCESSORIES

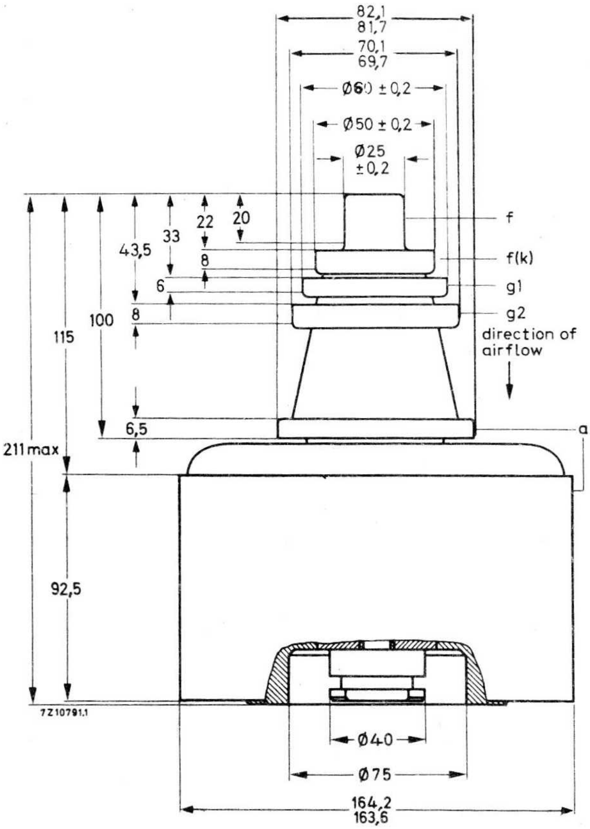
Band I amplifier circuit assembly (vision)	type 40759
Band II amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40747
Band III amplifier circuit assembly (sound)	type 40748

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

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.

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	$W_{\ell\ sync}$	13,2	kW	
black	$W_{\ell\ black}$	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	$W_{\ell\ sync}$	6,4	13,2	kW	
black	$W_{\ell\ black}$	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.

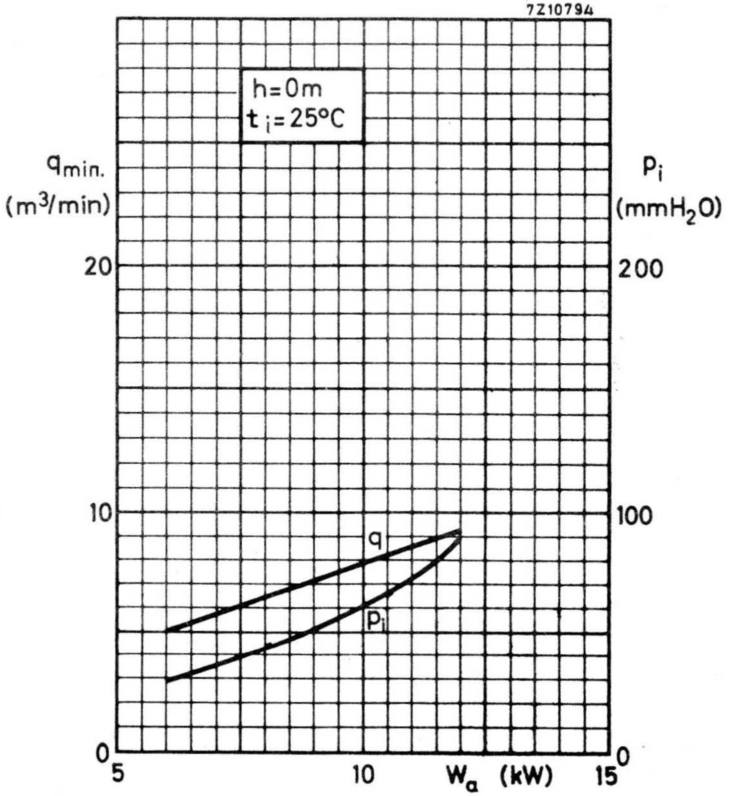
3) Black signal including line sync pulses.

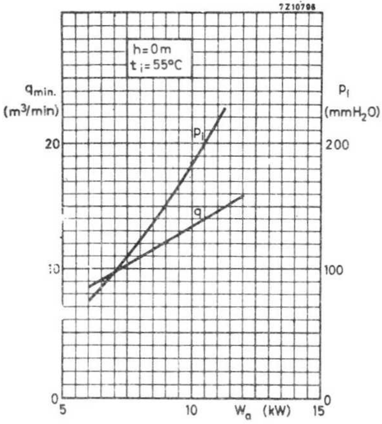
4) A picture/sync ratio of 72/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

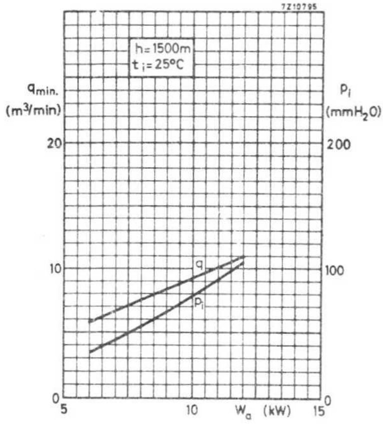
5) Measured with a saw tooth amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4,43 MHz sine wave with a 10% peak to peak value.

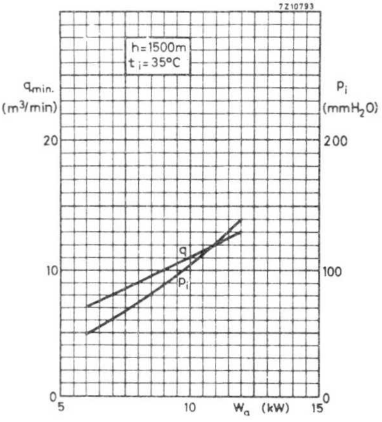
6) At c.w. output power = 7 kW

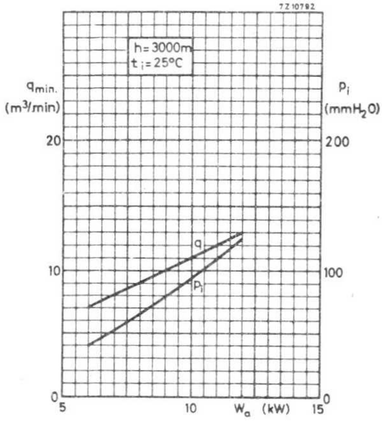
7) Three-tone test method (vision carrier -8 dB, sound carrier -7 dB, sideband signal -17 dB with respect to peak sync = 0 dB).

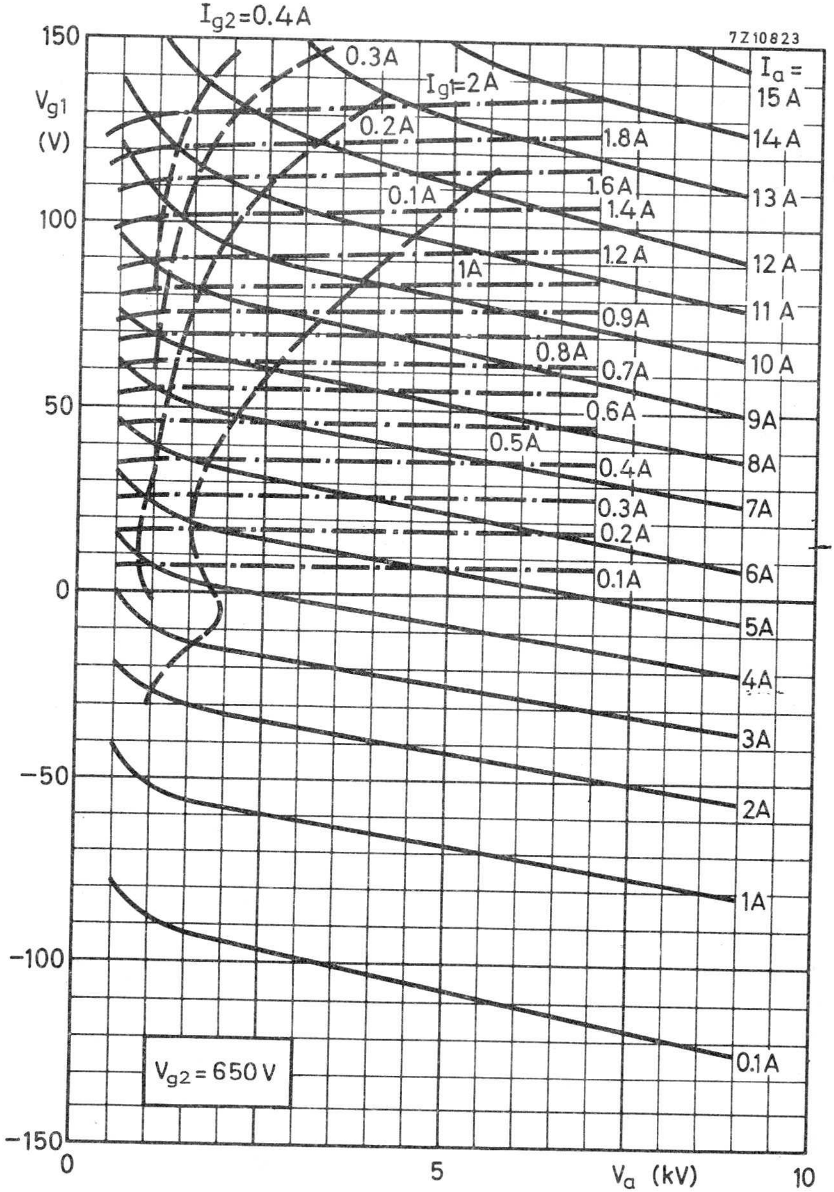


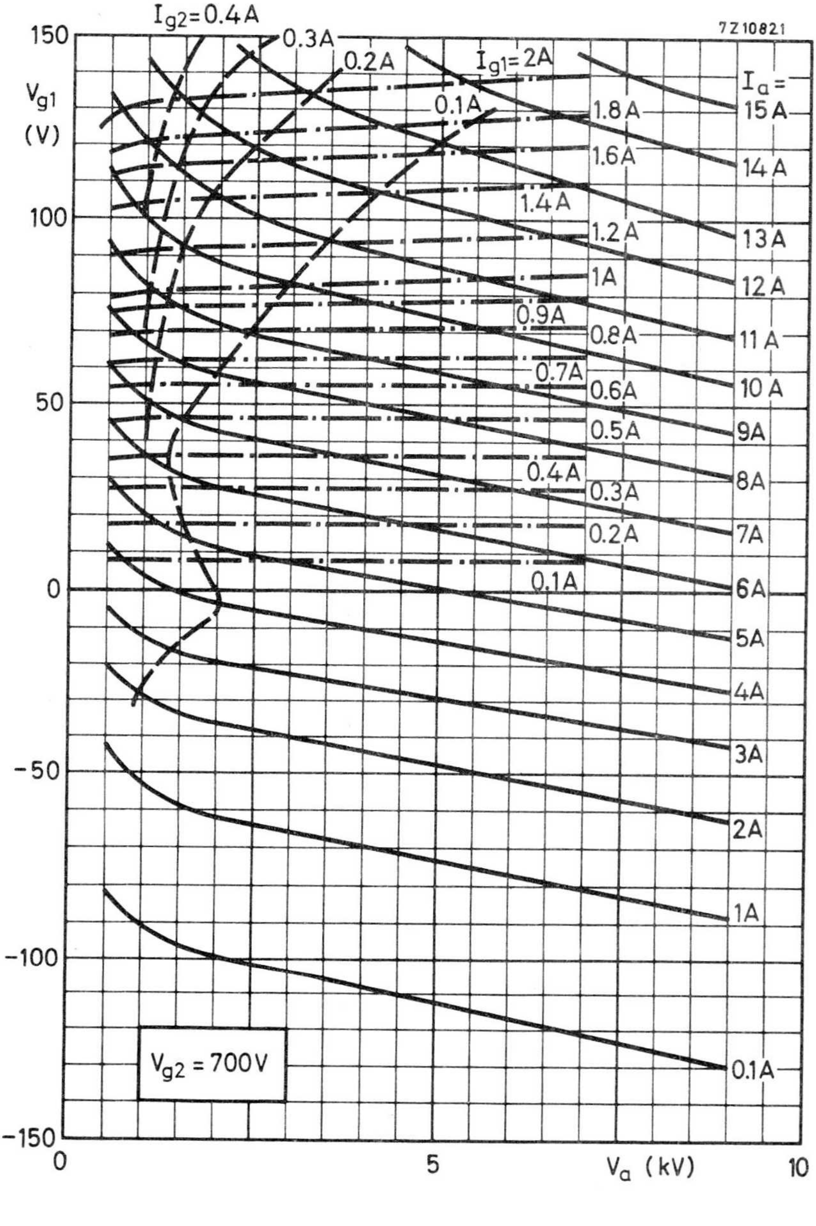

7Z10796
h=0 m
t i=55°C
$q_{min.}$ (m^3/min)
p_i (mmH_2O)
p_i
q
W_a (kW)


7Z10795
h=1500m
t i=25°C
$q_{min.}$ (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)

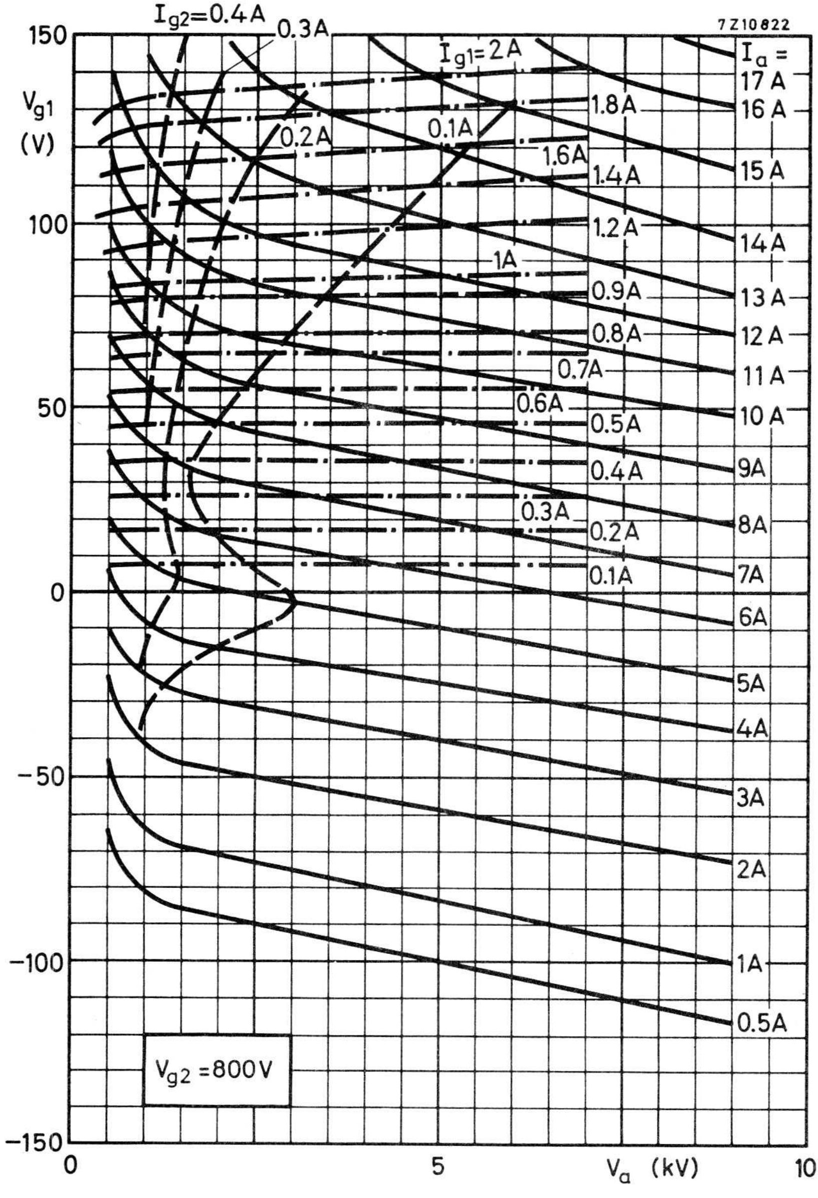

7Z10793
h=1500m
t i=35°C
$q_{min.}$ (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)


7Z10792
h=3000m
t i=25°C
$q_{min.}$ (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)


I_{g2}=0.4A
7Z10823
150
V_{g1}
(V)
100
50
0
−50
−100
−150
0
5
10
V_a (kV)
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
0.3A
0.2A
0.1A
1A
I_{g1}=2A
1.8A
1.6A
1.4A
1.2A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
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
150
100
50
0
−50
−100
−150
V_{g1} (V)
0
5
10
V_a (kV)
I_{g2}=0.4 A
0.3 A
0.2 A
0.1 A
I_{g1}=2 A
1.8 A
1.6 A
1.4 A
1.2 A
1 A
0.9 A
0.8 A
0.7 A
0.6 A
0.5 A
0.4 A
0.3 A
0.2 A
0.1 A
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_{g2} =800 V

AIR COOLED V.H.F. POWER TETRODE

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

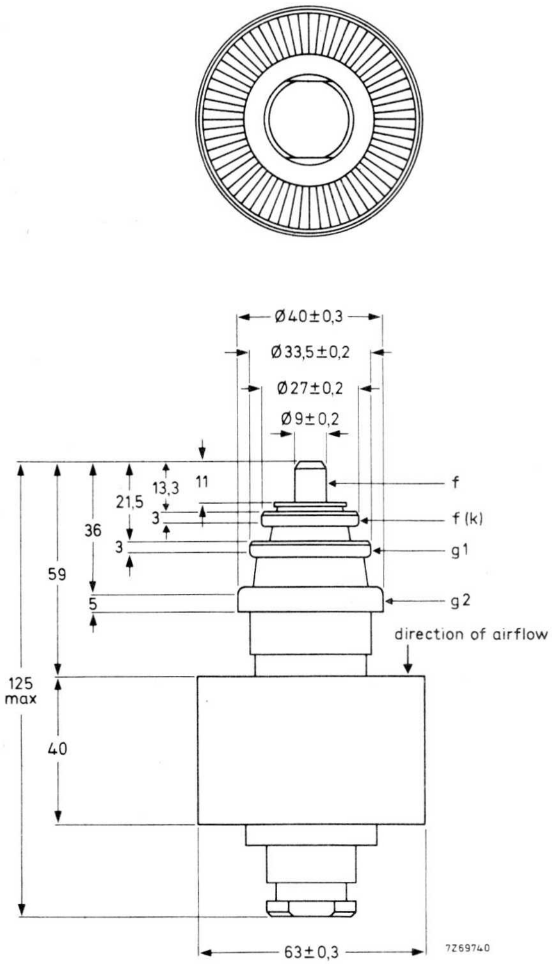
Band I amplifier circuit assembly (vision)	type 40755
Band I amplifier circuit assembly (sound)	type 40756
Band III amplifier circuit assembly (vision)	type 40743
Band III amplifier circuit assembly (sound)	type 40744

MECHANICAL DATA

Dimensions in mm

Net mass : 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_{ℓ} sync	1170	670	1500	W	
black	W_{ℓ} 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_{ℓ} sync	1500		670	W	
black	W_{ℓ} 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.

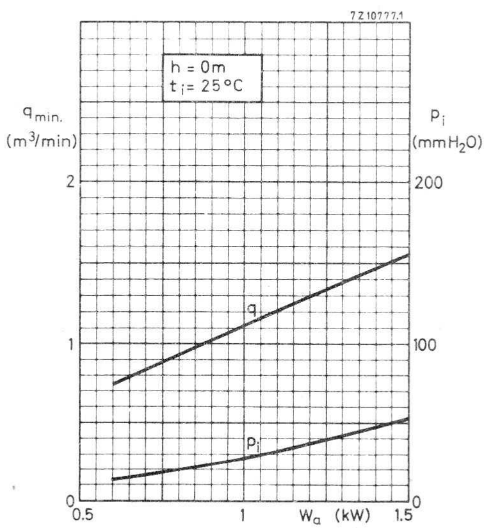
3) Black signal including line sync pulses.

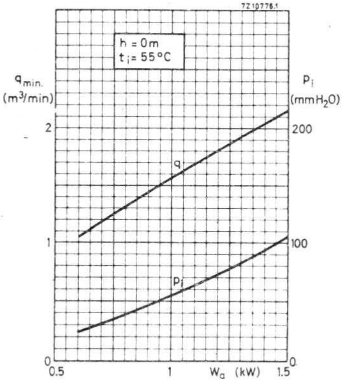
4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

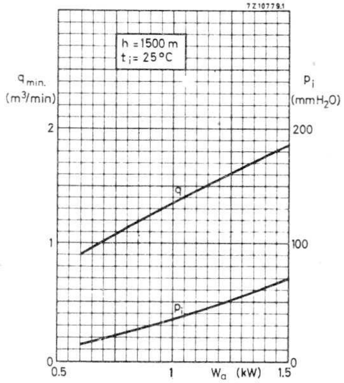
5) Measured with a saw tooth amplitude, running from 17 % to 75 % of the peak sync value, with superimposed a 4, 43 MHz sine wave with a 10 % peak to peak value.

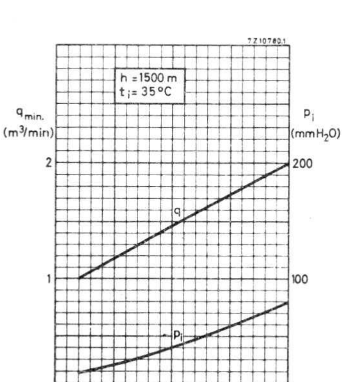
6) At c.w. output power = 550 W

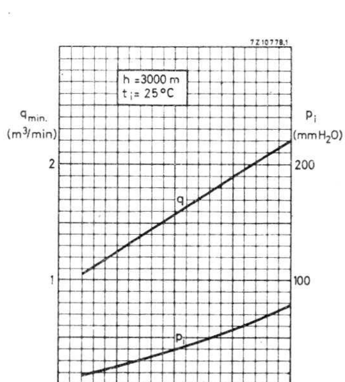
7) Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −17 dB with respect to peak sync = 0 dB).

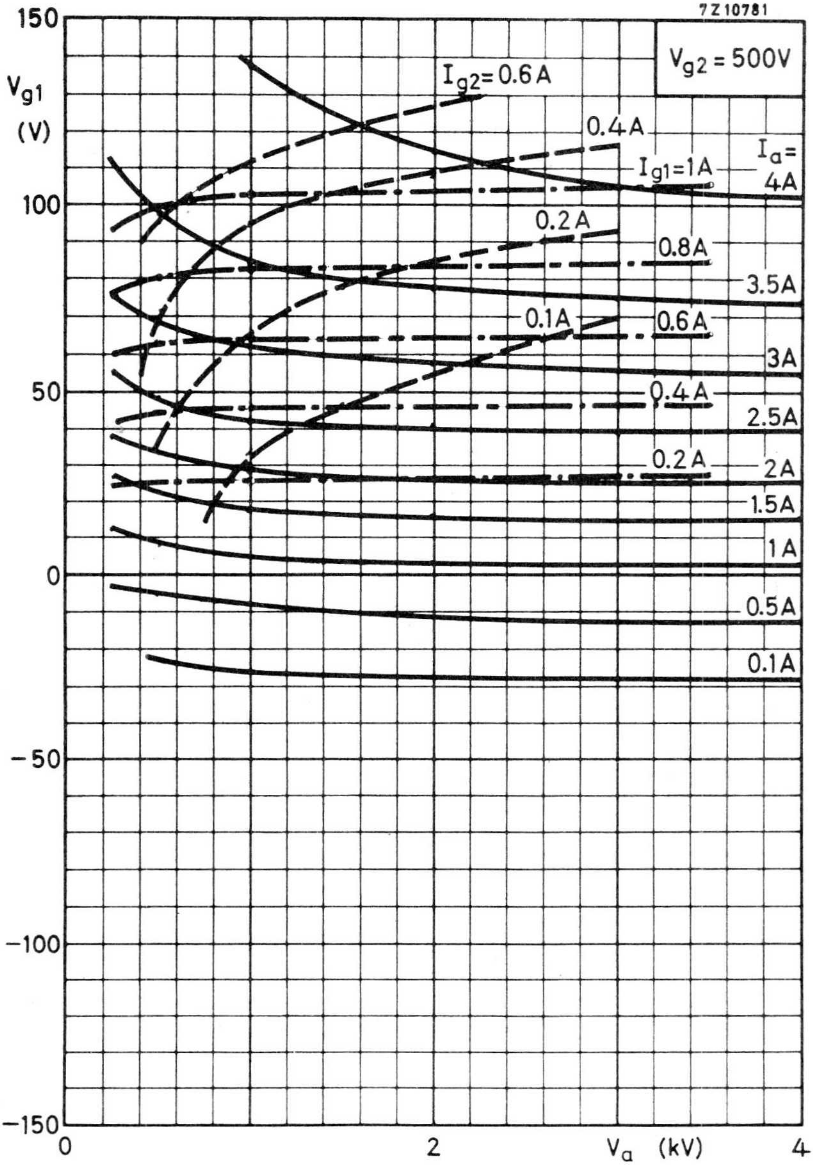


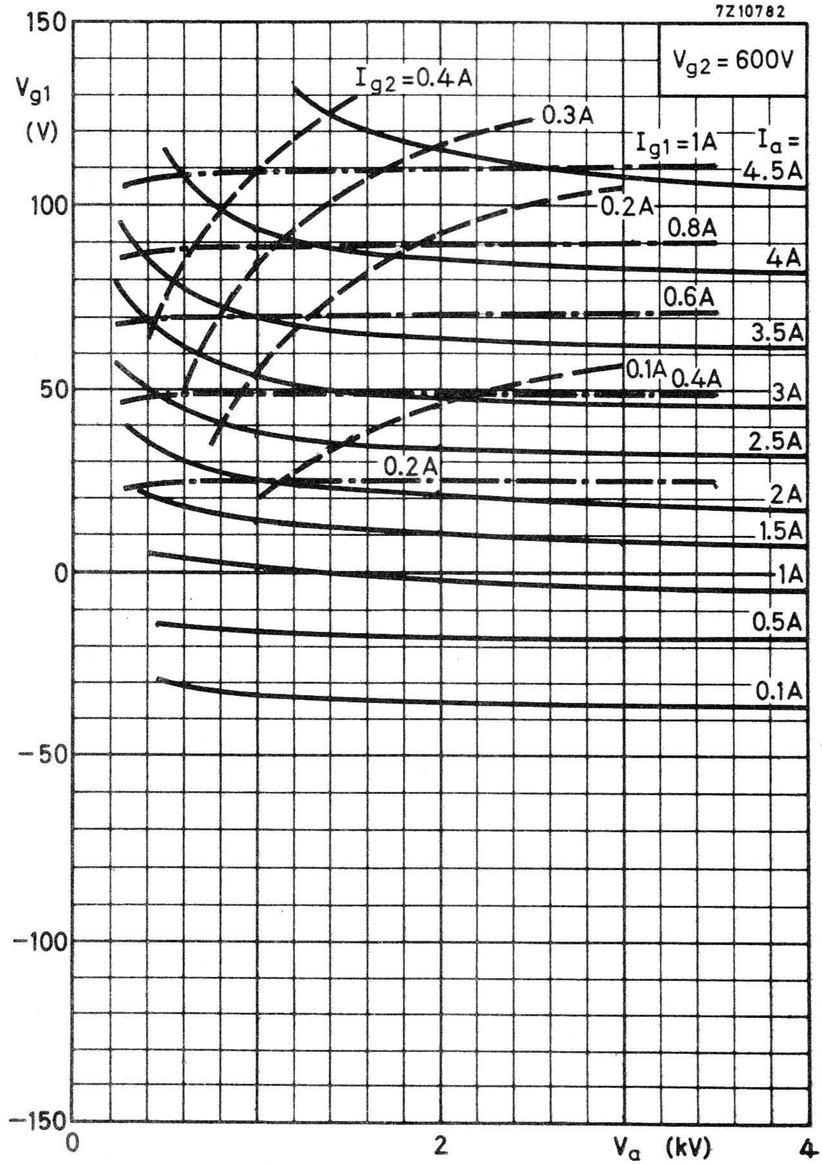

7Z10776.1
h = 0 m
t_i = 55 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
0
1
2
0.5
1
W_a (kW)
1.5
0
100
200

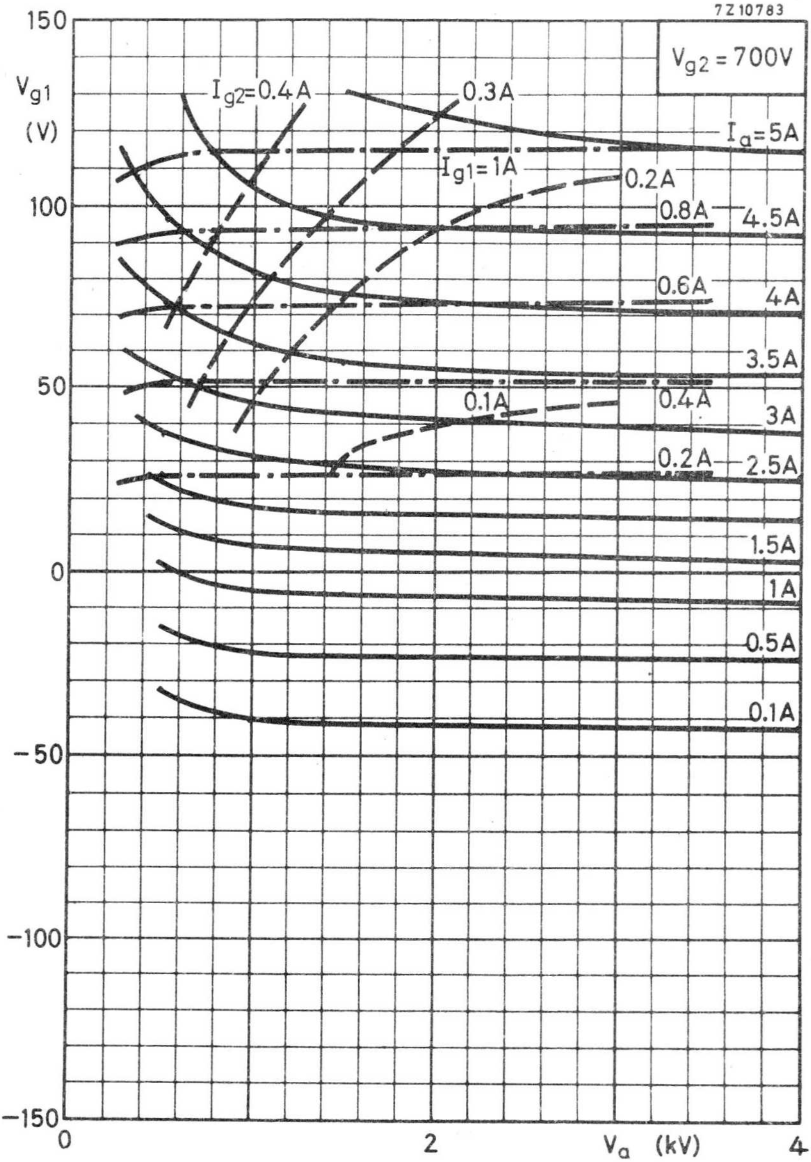

7Z10779.1
h = 1500 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
0
1
2
0.5
1
W_a (kW)
1.5
0
100
200


7Z10780.1
h = 1500 m
t_i = 35 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
0
1
2
0.5
1
W_a (kW)
1.5
0
100
200


7Z10778.1
h = 3000 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
0
1
2
0.5
1
W_a (kW)
1.5
0
100
200


7Z10781
V_{g2} = 500V
150
V_{g1}
(V)
100
50
0
-50
-100
-150
0
2
V_a (kV)
4
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


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
0.2A
I_{g1} = 1A
0.8A
0.6A
0.4A
I_a =
4.5A
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A


7Z10783
$V_{g2} = 700V$
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=5A
4.5A
4A
3.5A
3A
2.5A
1.5A
1A
0.5A
0.1A

R.F. POWER TETRODE

Mesh-type cathode version of QB4/1100.

With this tube in centre-tapped filament transformer arrangement the hum level is reduced to better than -60 dB.

For data and curves of this type please refer to type QB4/1100.

R.F. POWER TETRODE

Mesh-type cathode version of QB4/1100GA.

With this tube in centre-tapped filament transformer arrangement the hum level is reduced to better than -60 dB.

For data and curves of this type please refer to type QB4/1100GA.

AIR COOLED V.H.F. POWER TETRODE

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 (dB)
110	6	6	23
	7	11	22

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	μ_{g2g1}	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.

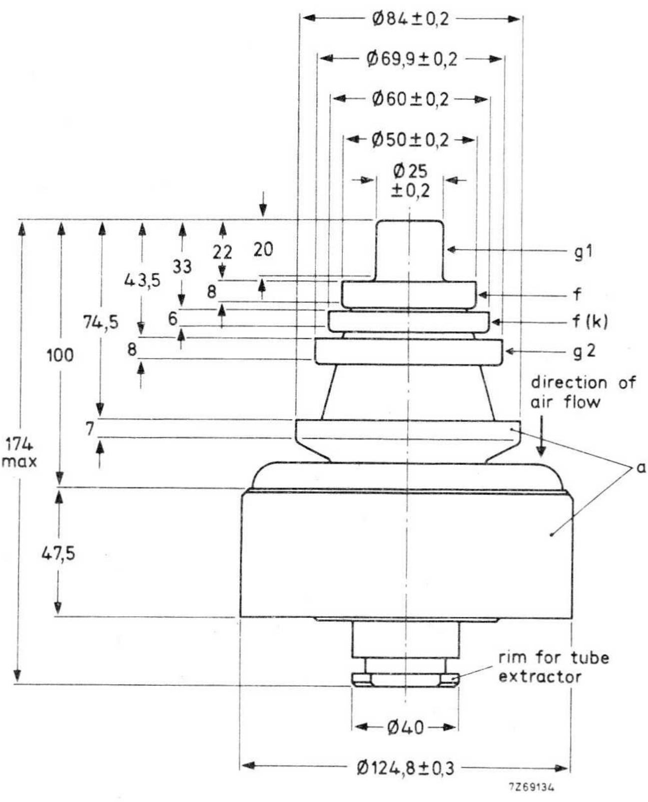
Direction of air flow: see outline drawing.

MECHANICAL DATA

Dimensions in mm

Net mass : approx. 3,1 kg

Mounting position: vertical with anode up or down.



ACCESSORIES

Band II amplifier circuit assembly type 40775

R.F. CLASS-B AMPLIFIER

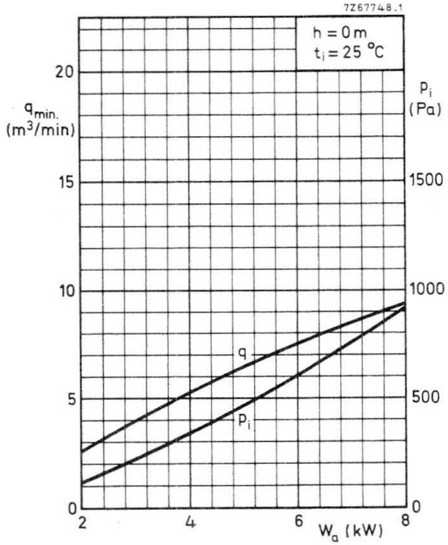
LIMITING VALUES (Absolute max. rating system)

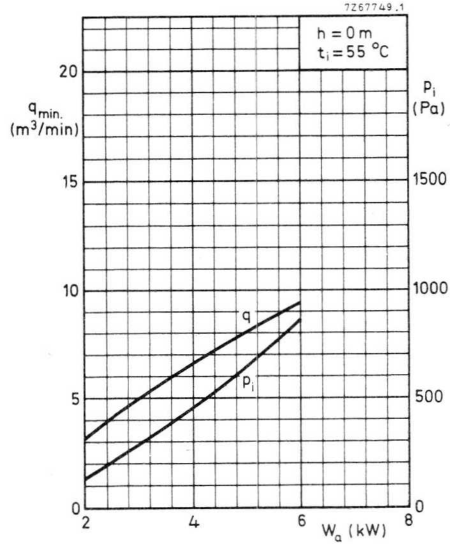
Frequency	f	up to	200	MHz
Anode voltage	V_a	max.	8,5	kV
Grid no.2 voltage	V_{g2}	max.	1	kV
Grid no.1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	8	kW
Grid no.2 dissipation	W_{g2}	max.	80	W
Grid no.1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

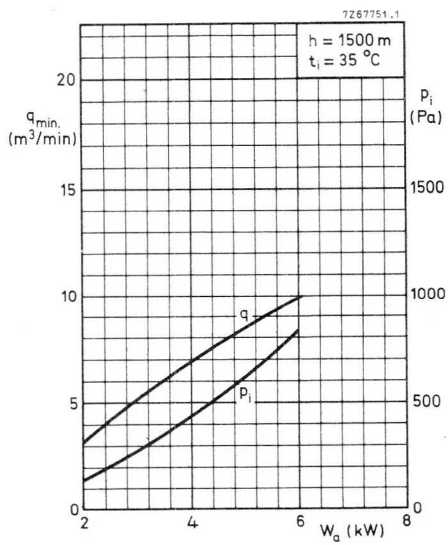
OPERATING CONDITIONS grounded cathode

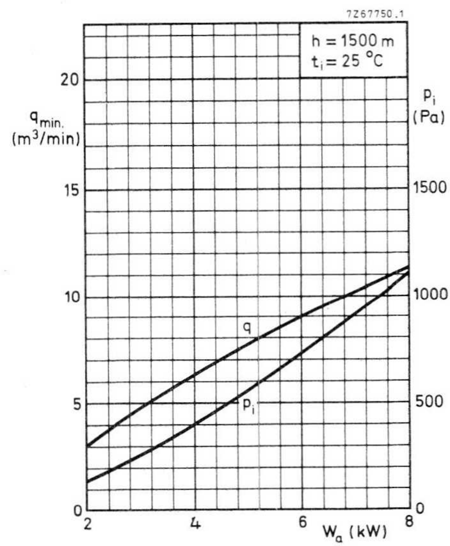
Frequency	f	87 to 110	87 to 110	MHz	
Anode voltage	V_a	7	6	kV	
Grid no.2 voltage	V_{g2}	700	700	V	
Grid no.1 voltage	V_{g1}	-105	100	V	[1]
Anode current, no-signal condition	I_a	600	600	mA	
Anode current	I_a	2,3	1,6	A	
Grid no.2 current	I_{g2}	40	70	mA	
Grid no.1 current	I_{g1}	150	90	mA	
Anode input power	W_{ia}	16,1	9,6	kW	
Anode dissipation	W_a	4,6	3,5	kW	
Output power in load	W_ℓ	11	6	kW	
Efficiency, total	η	68	63	%	
Driving power	W_{dr}	70	30	W	
Power gain	$\frac{W_\ell}{W_{dr}}$	22	23	dB	

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

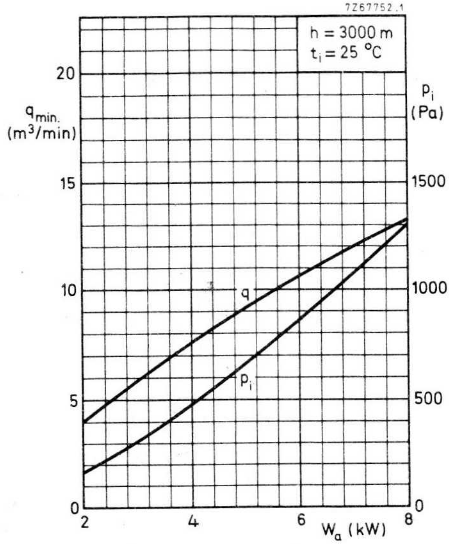

7Z67748.1
h = 0 m
t_i = 25 °C
$q_{min.}$ (m^3/min)
p_i (Pa)
q
p_i
W_a (kW)
20
15
10
5
0
1500
1000
500
0
2
4
6
8


7Z67749.1
h = 0 m
t_i = 55 °C
$q_{min.}$ (m^3/min)
p_i (Pa)
q
p_i
W_a (kW)
20
15
10
5
0
1500
1000
500
0
2
4
6
8

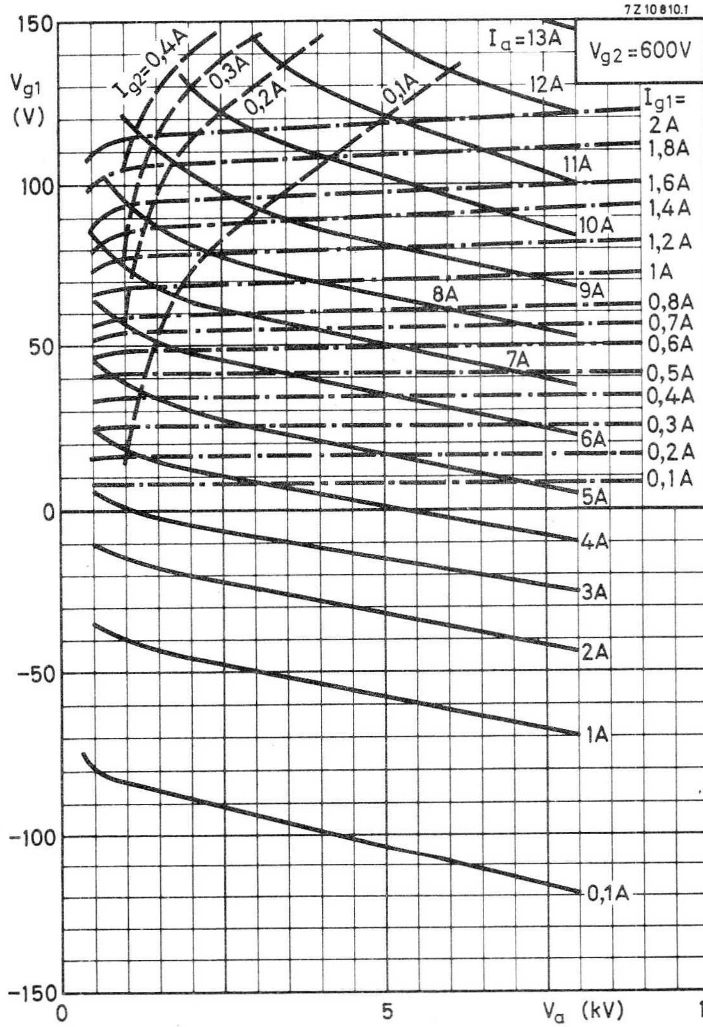

7Z67751.1
h = 1500 m
t_i = 35 °C
$q_{min.}$ (m^3/min)
p_i (Pa)
q
p_i
W_a (kW)
20
15
10
5
0
1500
1000
500
0
2
4
6
8

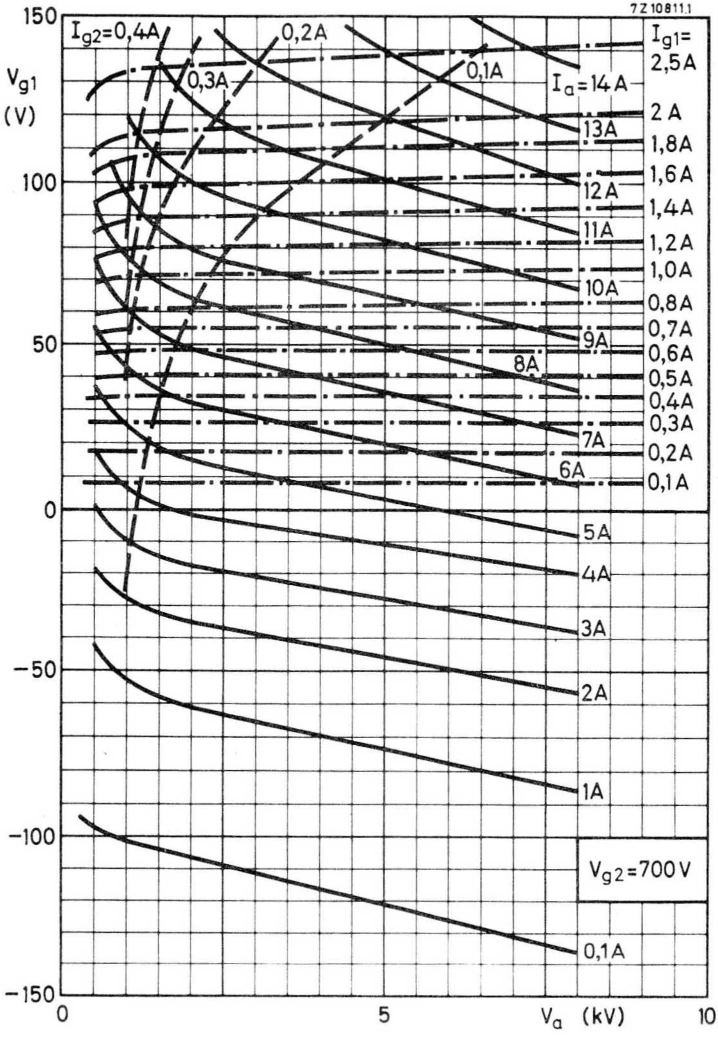

7Z67750.1
h = 1500 m
t_i = 25 °C
$q_{min.}$ (m^3/min)
p_i (Pa)
q
p_i
W_a (kW)
20
15
10
5
0
1500
1000
500
0
2
4
6
8

1 Pa ≈ 0, 1 mm H_2O.


7Z67752.1
h = 3000 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(Pa)
20
15
10
5
0
1500
1000
500
0
q
p_i
2
4
6
8
W_a (kW)

1 Pa ≈ 0,1 mm H_2O.


7Z10810.1
V_{g2} = 600V
V_{g1} (V)
150
100
50
0
-50
-100
-150
I_{g2}=0,4A
0,3A
0,2A
0,1A
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
0
5
V_a (kV)
10


7Z10811.1
150
100
50
0
−50
−100
−150
V_{g1}
(V)
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
0
5
10
V_a (kV)

AIR COOLED V.H.F. POWER TETRODE

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	I_{f_p}	max.	750	A
Cold filament resistance	R_{f_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	^{0}C
Recommended max. seal temperature	t	max.	200	^{0}C

COOLING

See cooling curves.
Direction of airflow: see outline drawing.

→ ACCESSORIES

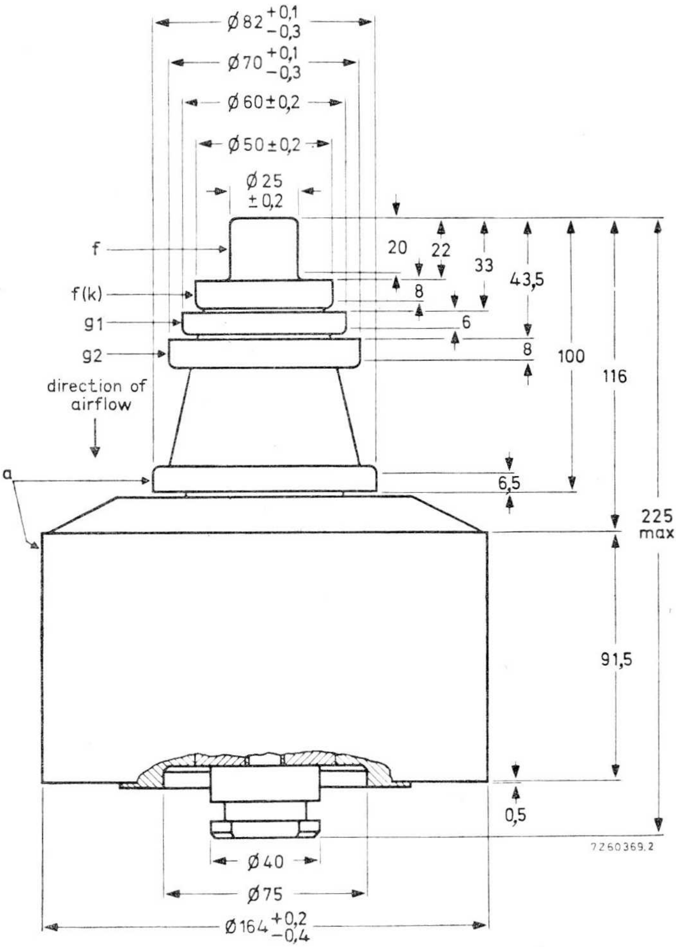
Band I amplifier circuit assembly (vision)	type 40759
Band I amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40768
Band III amplifier circuit assembly (sound)	type 40769

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	
Grid no. 1 voltage	V_{g1}	−88	−88	V	1)
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

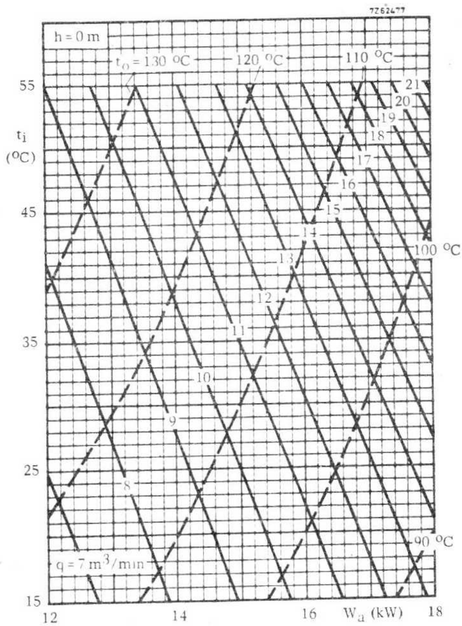
LIMITING VALUES (Absolute max. rating system)

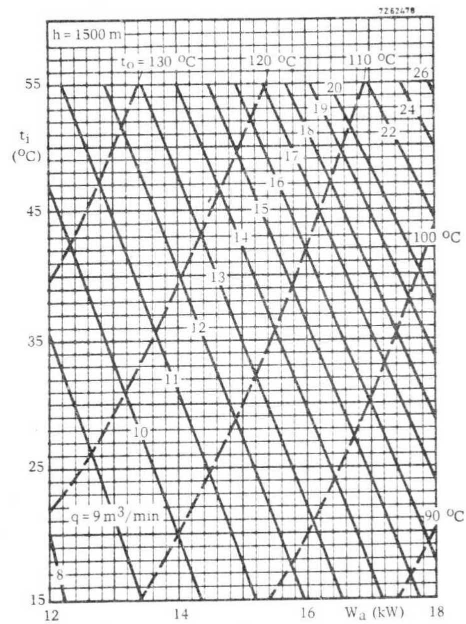
Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9,5	kV
Grid no. 2 voltage	V_{g2}	max.	1	kV
Grid no. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	7	A
Anode input power	W_{ia}	max.	42	kW
Anode dissipation	W_a	max.	18	kW
Grid no. 2 dissipation	W_{g2}	max.	100	W
Grid no. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	9	A

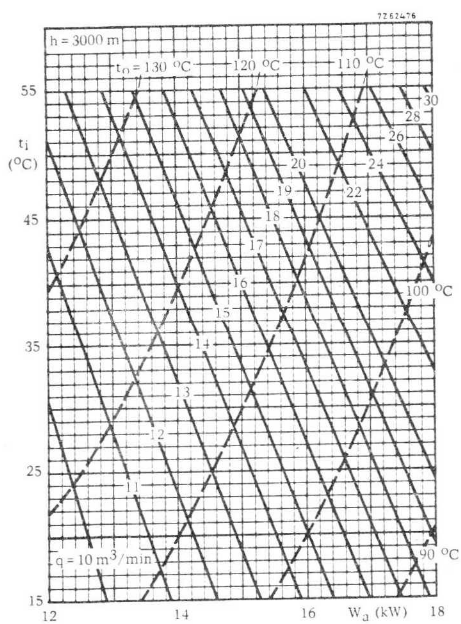
OPERATING CONDITIONS

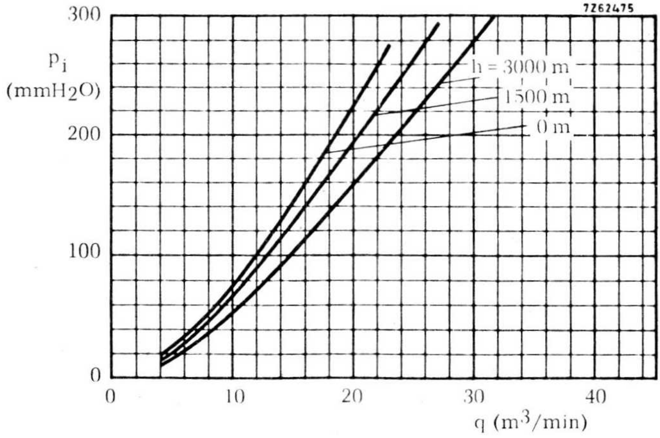
Frequency	f	260	MHz	
Anode voltage	V_a	8,5	kV	
Grid no. 2 voltage	V_{g2}	700	V	
Grid no. 1 voltage	V_{g1}	-106	V	1)
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	4,6	A	
Grid no. 2 current	I_{g2}	100	mA	
Grid no. 1 current	I_{g1}	325	mA	
Anode input power	W_{ia}	39,1	kW	
Anode dissipation	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		

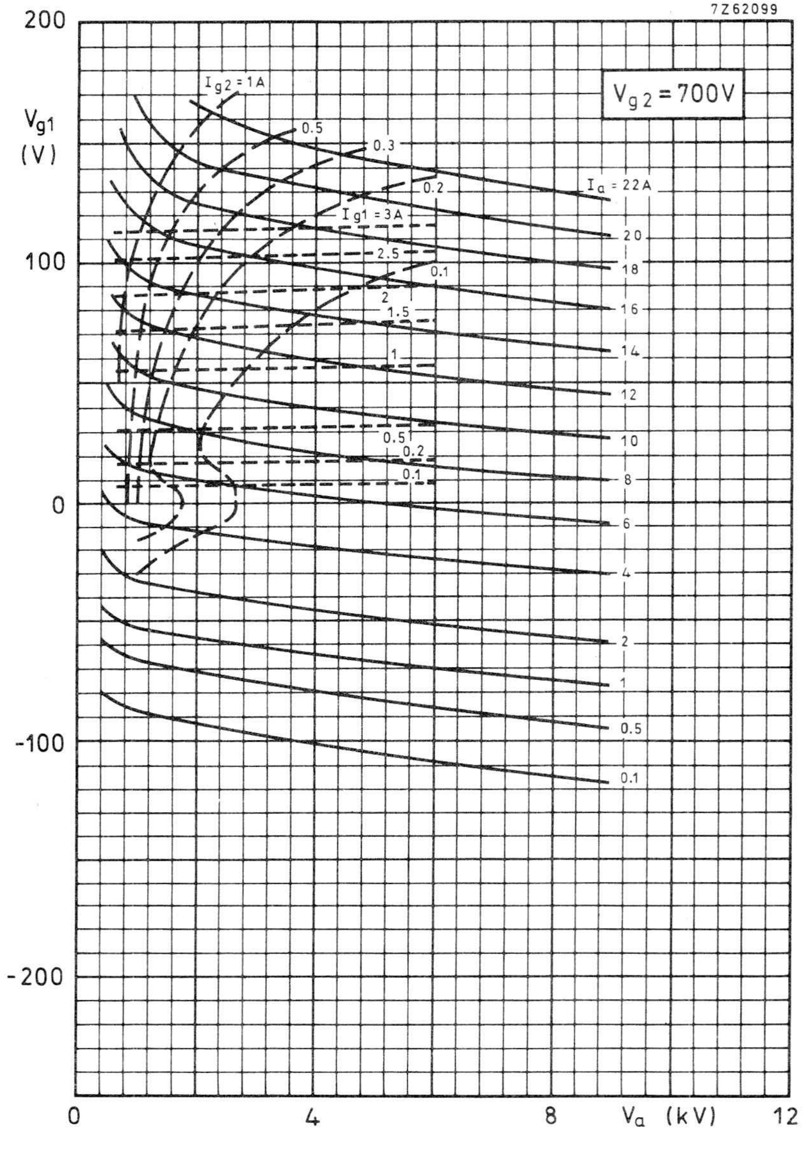
Note : See page 5


7Z62477
h = 0 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
21
20
19
18
17
16
15
14
13
12
11
10
9
8
t_i (°C)
55
45
35
25
15
q = 7 m³/min
12
14
16
18
W_a (kW)


7Z62478
h = 1500 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
26
24
22
20
19
18
17
16
15
14
13
12
11
10
8
t_i (°C)
55
45
35
25
15
q = 9 m³/min
12
14
16
18
W_a (kW)


7Z62476
h = 3000 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
30
28
26
24
22
20
19
18
17
16
15
14
13
12
11
t_i (°C)
55
45
35
25
15
q = 10 m³/min
12
14
16
18
W_a (kW)


7Z62475
300
200
100
0
p_i
(mmH_2O)
h = 3000 m
1500 m
0 m
0
10
20
30
40
q (m^3/min)


7Z62099
Vg2 = 700V
Vg1 (V)
200
100
0
-100
-200
Ig2 = 1A
0.5
0.3
0.2
0.1
Ig1 = 3A
2.5
2
1.5
1
0.5
0.2
0.1
Ia = 22A
20
18
16
14
12
10
8
6
4
2
1
0.5
0.1
0
4
8
Va (kV)
12

R.F. POWER TETRODE

Forced-air cooled tetrode intended for use as R.F. power amplifier and oscillator. The 7609 is shock and vibration resistant.

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		Cag_2 mod.		AB mod.		
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)[1]	W_o (W)[2]
< 150	2000	370	1600	230	2000	580	630
	1500	260	1200	160	1500	400	440
165	1250	195	1000	140	1000	230	270
	1000	150	800	100	800	170	215
	750	110	600	80			
	600	85	400	55			
500	1250	140					
	1000	120					
	800	95					
	600	50					

Freq. (MHz)	B television	
	V_a (V)	$W_o$sync (W)
216	1250	250
	1000	200
	750	135

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f		26.5	V
Heater current	I_f		570	mA
Waiting time	T_w	min.	30	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g1(a)}$	15.5	pF
Anode to all except grid No.1	$C_{a(g1)}$	4.0	pF
Anode to grid No.1	C_{ag1}	0.03	pF

[1]) Without grid current, two tubes.
[2]) With grid current, two tubes.

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500	V
Grid No. 2 voltage	V_{g_2}	250	V
Anode current	I_a	200	mA
Transconductance	S	12	mA/V
Amplification factor	$\mu_{g_2g_1}$	5	-

TEMPERATURE LIMITS (Absolute max. rating system)

Anode temperature measured on base end of anode surface at junction with fins	t_a	max. 250	^oC
Anode seal temperature	t_s	max. 200	^oC
Base seals and grid No. 2 seal temperature	t_s	max. 175	^oC

COOLING air inlet temperature t_i = 20 ^oC, altitude h = 0 m [1])

With an air system socket			
Air flow	q	0.16	m^3/min
Pressure drop	p_i	7	mm H_2O
Without an air system socket			
Air flow	q	0.15	m^3/min
Pressure drop	p_i	7	mm H_2O

1) At higher altitudes and ambient temperatures, an increase in air flow is necessary to maintain the respective seal temperatures and the anode temperature within the maximum ratings.

With an air system socket

The air is directed over the base seals, past the grid No. 2 seal, glass envelope and anode seal, and through the radiator to provide effective cooling with minimum air flow.

Without air system socket

Adequate cooling air must be directed over the base seals, past the envelope, and through the radiator.

ACCESSORIES

Socket	Johnson 124-110-1
Chimney	Johnson 124-111-1 or equivalent

SHOCK AND VIBRATION RESISTANCE

Shock

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

Vibration

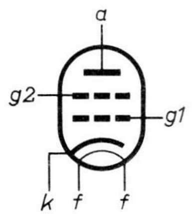
The tube is subjected to vibration frequencies from 25 Hz to 2000 Hz with an acceleration of 10 g.

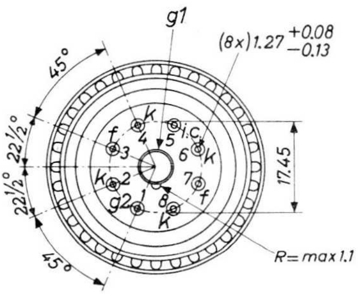
MECHANICAL DATA

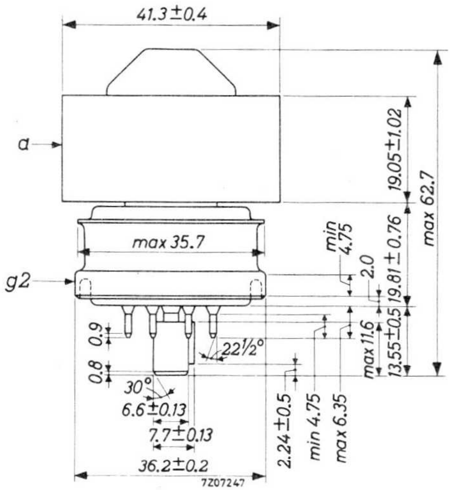
Dimensions in mm

Net weight : approx. 140 g

Mounting position: any







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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to 150	150 to 500	MHz
Anode voltage	V_a	max. 2000	1250	V
Anode current	I_a	max. 250	250	mA
Anode dissipation	W_a	max. 250	250	W
Grid No. 2 voltage	V_{g_2}	max. 300	300	V
Grid No. 2 dissipation	W_{g_2}	max. 12	12	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max. 250	250	V
Grid No. 1 dissipation	W_{g_1}	max. 2	2	W
Grid No. 1 circuit resistance	R_{g_1}	max. 25	25	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 150	150	V

OPERATING CONDITIONS

Frequency	f	up to 150	150	MHz
Anode voltage	V_a	2000	1500	V
Grid No. 2 voltage	V_{g_2}	250	250	V
Grid No. 1 voltage	V_{g_1}	-88	-88	V
Grid No. 1 driving voltage	$V_{g_{1p}}$	110	110	V
Anode current	I_a	250	250	mA
Grid No. 2 current	I_{g_2}	24	24	mA
Grid No. 1 current	I_{g_1}	8	8	mA
Driving power	W_{dr}	2.5	1.5	W
Anode input power	W_{i_a}	500	375	W
Output power	W_o	370	260	W

OPERATING CONDITIONS (continued)

Frequency	f	165	165	165	165	MHz
Anode voltage	V_a	1250	1000	750	600	V
Grid No.2 voltage	V_{g_2}	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	-90	-80	-80	-75	V
Grid No.1 driving voltage	$V_{g_{1p}}$	106	95	96	91	V
Anode current	I_a	200	200	200	200	mA
Grid No.2 current	I_{g_2}	20	31	37	37	mA
Grid No.1 current	I_{g_1}	11	10	11	11	mA
Driving power	W_{dr}	1.2	1	1	1	W
Anode input power	W_{i_a}	250	200	150	120	W
Output power	W_o	195	150	110	85	W

OPERATING CONDITIONS with coaxial cavity

Frequency	f	500	500	500	500	MHz
Anode voltage	V_a	1250	1000	800	600	V
Grid No.2 voltage	V_{g_2}	280	250	250	250	V
Grid No.1 voltage	V_{g_1}	-115	-110	-110	-110	V
Anode current	I_a	200	200	200	170	mA
Grid No.2 current	I_{g_2}	5	7	7	6	mA
Grid No.1 current	I_{g_1}	10	10	10	6	mA
Driving power	W_{dr}	30	25	20	15	W
Anode input power	W_{i_a}	250	200	160	100	W
Output power	W_o	140	120	95	50	W

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to 150	150 to 500	MHz
Anode voltage	V_a	max. 1600	1000	V
Anode current	I_a	max. 200	200	mA
Anode dissipation	W_a	max. 165	165	W
Grid No.2 voltage	V_{g_2}	max. 300	300	V
Grid No.2 dissipation	W_{g_2}	max. 10	10	W
Grid No.1 voltage, negative	$-V_{g_1}$	max. 250	250	V
Grid No.1 dissipation	W_{g_1}	max. 2	2	W
Grid No.1 circuit resistance	R_{g_1}	max. 25	25	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 150	150	V

OPERATING CONDITIONS

Frequency	f	up to 150	150	MHz
Anode voltage	V_a	1600	1200	V
Grid No.2 voltage	V_{g_2}	250	250	V
Grid No.1 voltage	V_{g_1}	-118	-118	V [1])
Anode current	I_a	200	200	mA
Grid No.2 current	I_{g_2}	23	23	mA
Grid No.1 current	I_{g_1}	5	5	mA
Driving power	W_{dr}	3	2	W
Anode input power	W_{i_a}	320	240	W
Output power	W_o	230	160	W
Modulation depth	m	100	100	%
Modulator output power	$W_{o\,mod}$	115	80	W
Grid No.2 mod. voltage, peak	$V_{g_{2p}\,mod}$	200	180	V

1) Obtained from a grid resistor or from a combination of grid resistor with either fixed supply or cathode resistor.

OPERATING CONDITIONS (continued)

Frequency	f	165	165	165	165	MHz
Anode voltage	V_a	1000	800	600	400	V
Grid No.2 voltage	V_{g_2}	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	-105	-100	-95	-90	V
Anode current	I_a	200	200	200	200	mA
Grid No.2 current	I_{g_2}	20	25	35	40	mA
Grid No.1 current	I_{g_1}	15	10	8	7	mA
Driving power	W_{dr}	2	1.5	1	1	W
Anode input power	W_{ia}	200	160	120	80	W
Output power	W_o	140	100	80	55	W
Modulation depth	m	100	100	100	100	%
Modulator output power	$W_{o\,mod}$	70	50	40	27.5	W
Grid No.2 mod.voltage, peak	$V_{g_{2p}\,mod}$	170	160	150	140	V

A.F. CLASS AB AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 dissipation	W_{g_1}	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

OPERATING CONDITIONS two tubes in push-pull

Anode voltage	V_a	1000		800		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	-43		-40		V
Load resistance	$R_{aa\sim}$	4250		4400		Ω
Driving voltage	V_{gg_p}	0	86	0	80	V
Anode current	I_a	2x82.5	2x225	2x105	2x218	mA
Grid No.2 current	I_{g_2}	–	2x26	–	2x38	mA
Grid No.1 current	I_{g_1}	0	0	0	0	mA
Anode input power	W_{i_a}	2x82.5	2x225	2x84	2x175	W
Anode dissipation	W_a	2x82.5	2x110	2x84	2x90	W
Output power	W_o	0	230	0	170	W

Anode voltage	V_a	2000		1500		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	-50		-50		V
Load resistance	$R_{aa\sim}$	8760		6570		Ω
Driving voltage	V_{gg_p}	0	100	0	100	V
Anode current	I_a	2x50	2x235	2x50	2x228	mA
Grid No.2 current	I_{g_2}	–	2x18	–	2x21	mA
Grid No.1 current	I_{g_1}	0	0	0	0	mA
Anode input power	W_{i_a}	2x100	2x470	2x75	2x340	W
Anode dissipation	W_a	2x100	2x180	2x75	2x140	W
Output power	W_o	0	580	0	400	W

OPERATING CONDITIONS (continued)

Anode voltage	V_a	1000		800		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	−45		−40		V
Load resistance	$R_{aa\sim}$	3950		3140		Ω
Driving voltage	V_{gg_p}	0	98	0	90	V
Driving power	W_{dr}	−	0.15	−	0.15	W
Anode current	I_a	2x83	2x247	2x105	2x250	mA
Grid No.2 current	I_{g_2}	−	2x29	−	2x40	mA
Anode input power	W_{i_a}	2x83	2x247	2x84	2x200	W
Anode dissipation	W_a	2x83	2x112	2x84	2x93	W
Output power	W_o	0	270	0	215	W

Anode voltage	V_a	2000		1500		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	−50		−50		V
Load resistance	$R_{aa\sim}$	8100		5970		Ω
Driving voltage	V_{gg_p}	0	106	0	106	V
Driving power	W_{dr}	−	0.2	−	0.2	W
Anode current	I_a	2x50	2x250	2x50	2x250	mA
Grid No.2 current	I_{g_2}	−	2x18	−	2x18	mA
Anode input power	W_{i_a}	2x100	2x500	2x75	2x375	W
Anode dissipation	W_a	2x100	2x185	2x75	2x155	W
Output power	W_o	0	630	0	440	W

R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE , negative modulation, positive synchronisation

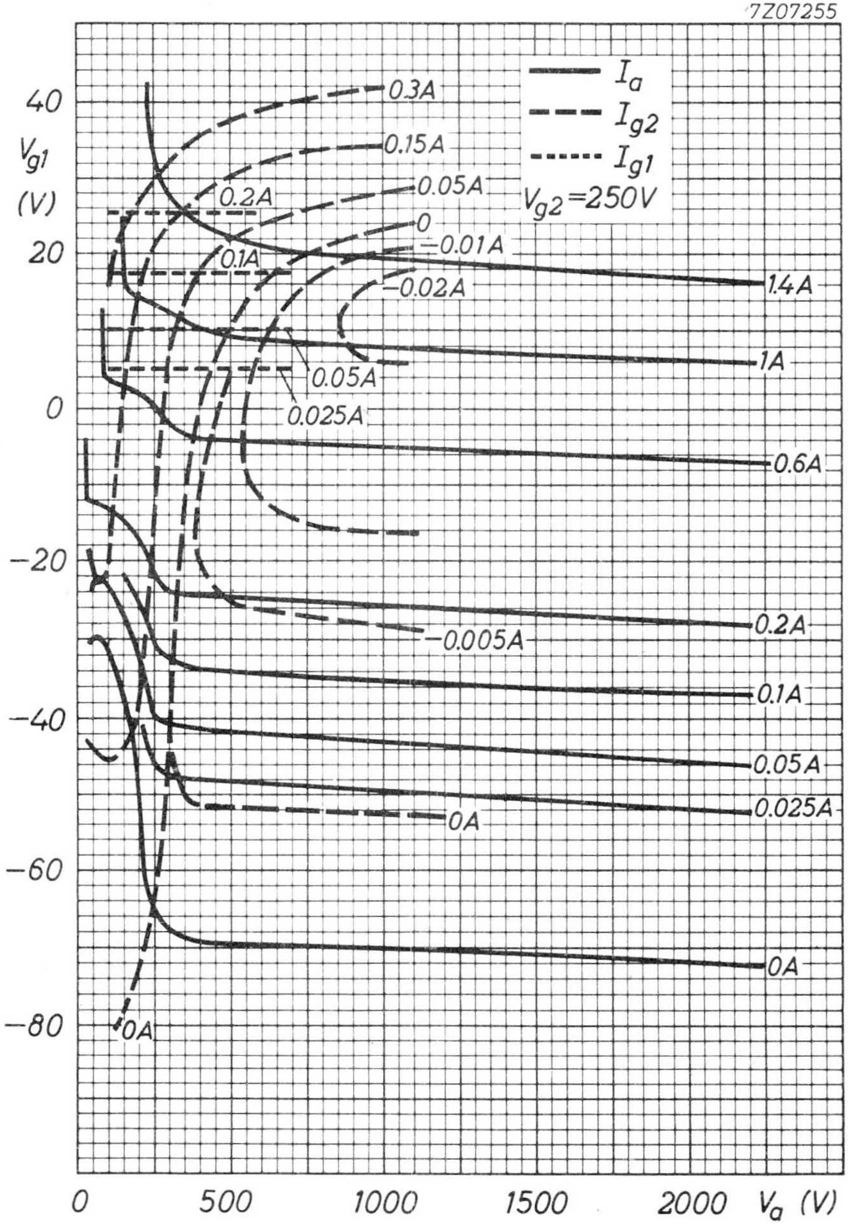
LIMITING VALUES (Absolute max. rating system)

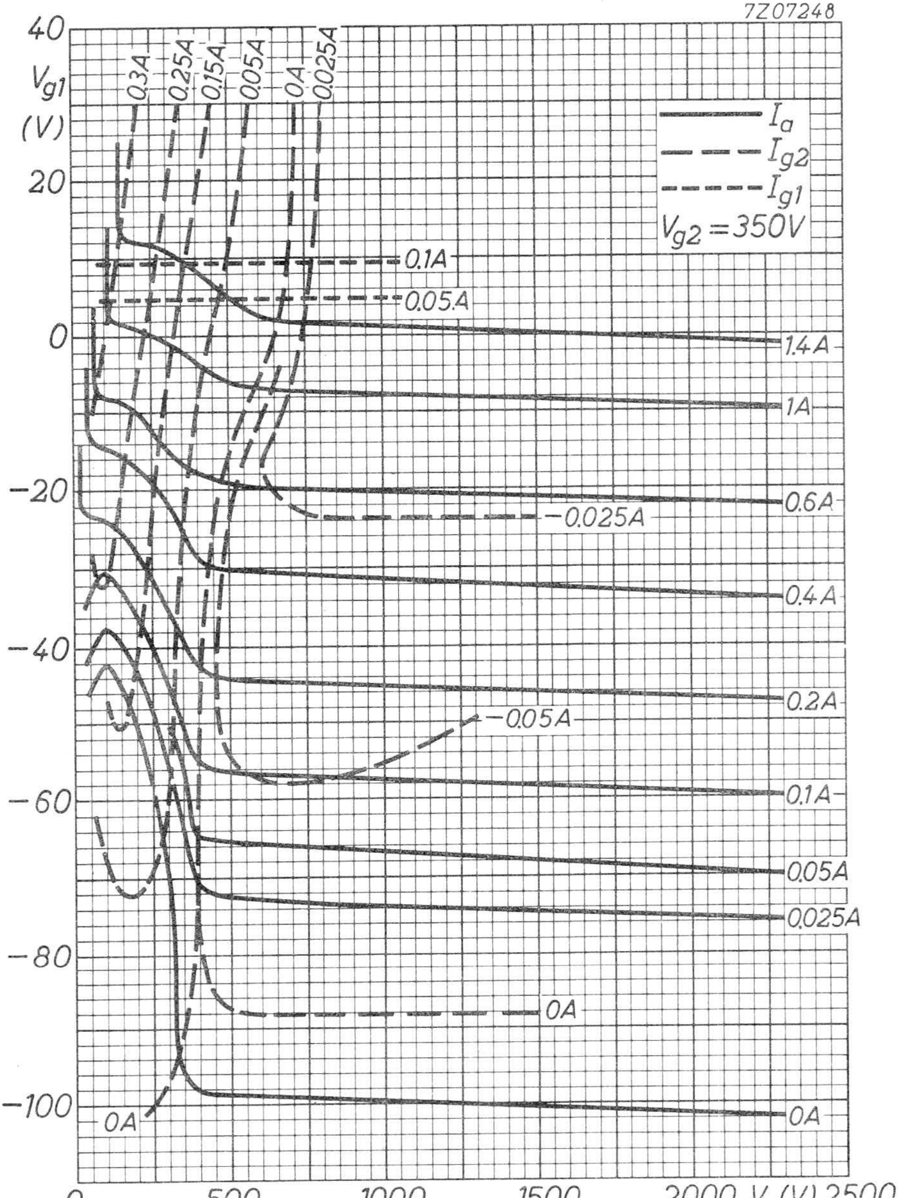
Frequency	f		54 to 216	MHz
Anode voltage	V_a	max.	1250	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	250	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 voltage, negative	$-V_{g_1}$	max.	400	V
Grid No.1 dissipation	W_{g_1}	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	max.	25	kΩ [1]
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

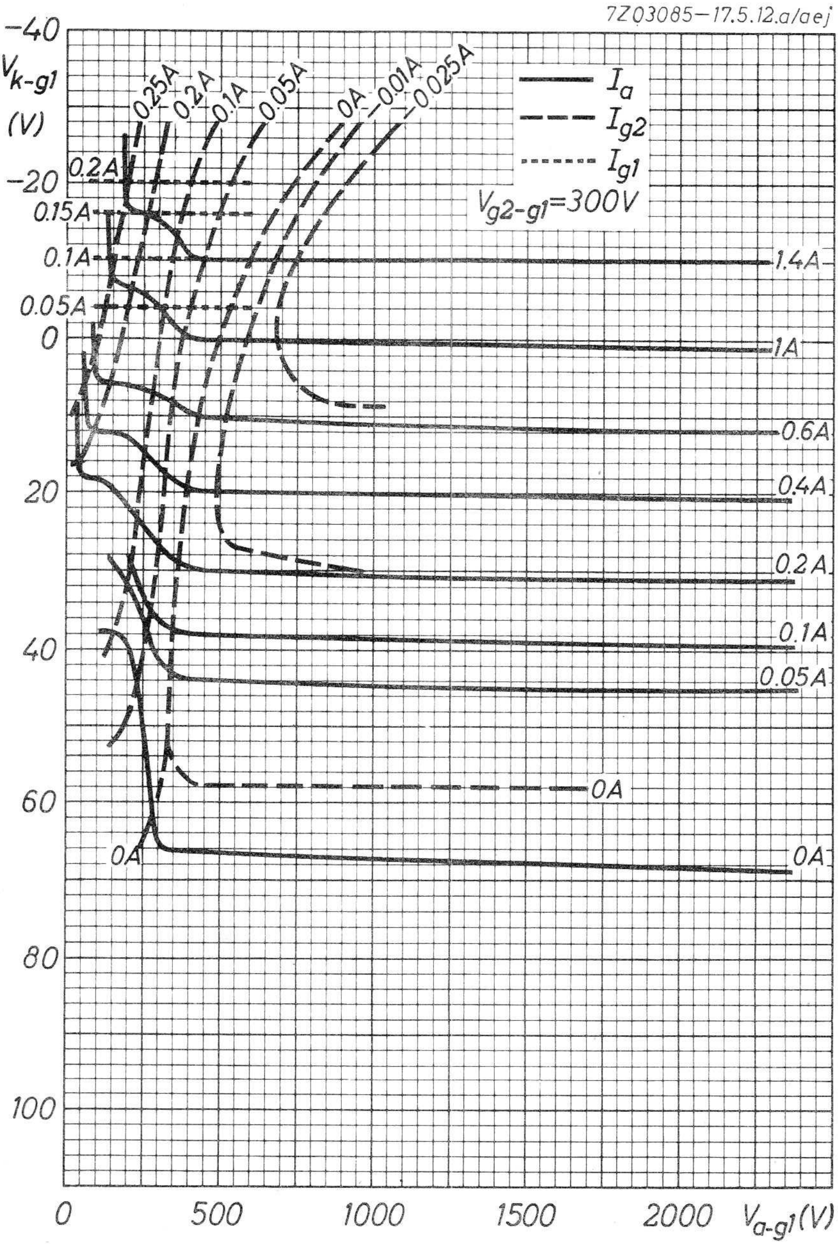
OPERATING CONDITIONS

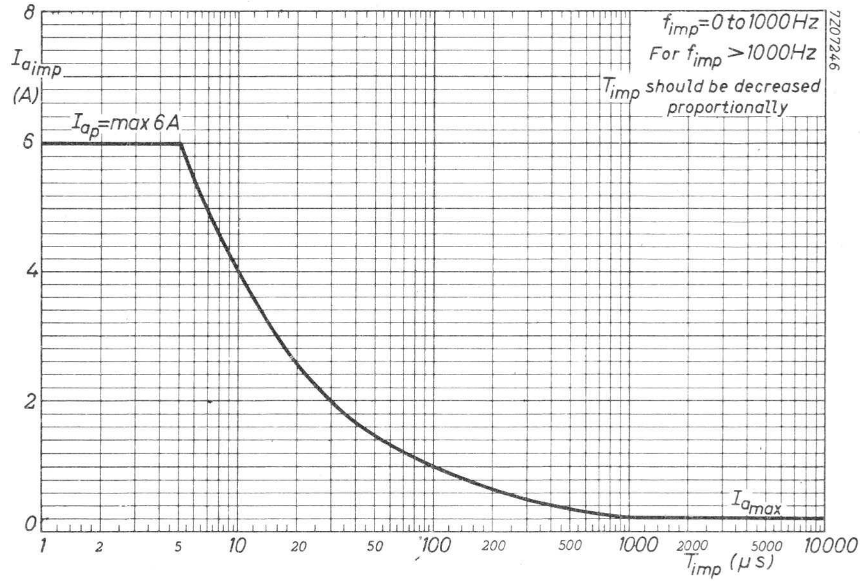
Bandwidth	B (−1.5 dB)		5	5	5	MHz
Anode voltage	V_a		1250	1000	750	V
Grid No.2 voltage	V_{g_2}		300	300	300	V
Grid No.1 voltage	V_{g_1}		−70	−65	−60	V
Driving voltage, peak to peak	$V_{g_{1pp}}$	sync	100	95	85	V
		black	75	70	65	V
Anode current	I_a	sync	305	330	335	mA
		black	230	240	245	mA
Grid No.2 current	I_{g_2}	sync	45	45	50	mA
		black	10	15	20	mA
Grid No.1 current	I_{g_1}	sync	25	20	15	mA
		black	4	4	4	mA
Driving power	W_{dr}	sync	9	8	7	W
		black	5.5	4.7	4.25	W
Output power in load	W_ℓ	sync	250	200	135	W
		black	140	110	75	W

[1]) Cathode bias is not recommended.


7Z07255
I_a
I_{g2}
I_{g1}
V_{g2}=250V
V_{g1} (V)
40
20
0
−20
−40
−60
−80
0.3A
0.15A
0.05A
0
−0.01A
−0.02A
0.2A
0.1A
0.05A
0.025A
1.4A
1A
0.6A
0.2A
−0.005A
0.1A
0.05A
0.025A
0A
0A
0A
0
500
1000
1500
2000
V_a (V)


7Z07248
40
V_{g1}
(V)
20
0
−20
−40
−60
−80
−100
0.3A
0.25A
0.15A
0.05A
0A
0.025A
I_a
I_{g2}
I_{g1}
V_{g2} = 350V
0.1A
0.05A
1.4A
1A
0.6A
−0.025A
0.4A
0.2A
−0.05A
0.1A
0.05A
0.025A
0A
0A
0A
0
500
1000
1500
2000
V_a (V)
2500


7Z03085—17.5.12.a/aej
-40
V_{k-g1}
(V)
-20
0.2A
0.15A
0.1A
0.05A
0
20
40
60
80
100
0.25A
0.2A
0.1A
0.05A
0A
0.01A
0.025A
I_a
I_{g2}
I_{g1}
V_{g2-g1}=300V
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0A
0A
0
500
1000
1500
2000
V_{a-g1}(V)



8
6
4
2
0
$I_{a_{imp}}$ (A)
I_{a_p}=max 6 A
f_{imp}=0 to 1000 Hz
For f_{imp} > 1000 Hz
T_{imp} should be decreased proportionally
7Z07246
$I_{a_{max}}$
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000
T_{imp} (μs)

R.F. POWER TETRODE

Forced-air cooled tetrode in ceramic-metal construction intended for use in S.S.B. transmitters.

	QUICK REFERENCE DATA		
Freq. (MHz)	S.S.B.		
	V_a (V)	W_ℓ (W)PEP	d_3 (dB)
7	2000	271	-26
7	2000	436	-23

HEATING: indirect; oxide coated cathode

Heater voltage	V_f	25.6	V ± 5% [1]
Heater current	I_f	560	mA
Waiting time	T_w	min. 30	s

CAPACITANCES

Grid No. 1 to all except anode	$C_{g_1}(a)$	17.0	pF
Anode to all except grid No. 1	$C_{a(g_1)}$	4.7	pF
Anode to grid No. 1	C_{ag_1}	0.06	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500		V
Grid No. 2 voltage	V_{g_2}	250	300	V
Anode current	I_a	200		mA
Grid No. 2 current	I_{g_2}	-	50	mA
Transconductance	S	12	-	mA/V
Amplification factor	$\mu_{g_2g_1}$		5.2	

TEMPERATURE LIMITS (Absolute max. rating system)

Temperature of all seals	t_s	max. 250	°C
Temperature of anode core	t_a	max. 250	°C

[1]) Short term variations of ± 10% will not damage the tube, but variations in performance must be expected.

COOLING: Forced air

Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q min	p_i
250 W 250 W	0 m 3000 m	50 °C 50 °C	0.15 m^3/min 0.19 m^3/min	15 mm H_2O 22 mm H_2O

ACCESSORIES

Socket — Johnson 124-110-1

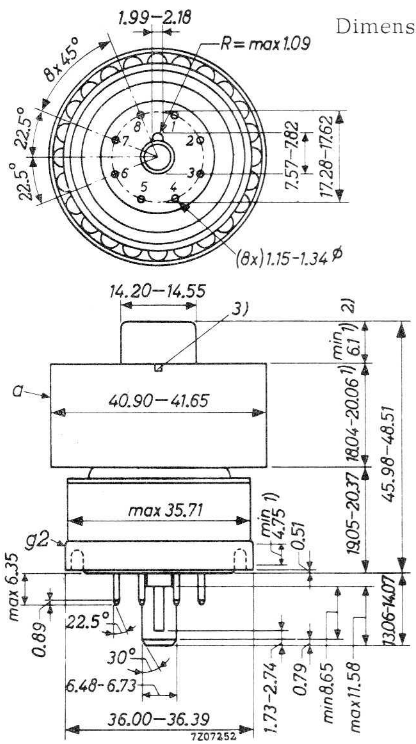
Chimney — Johnson 124-111-1 or equivalent

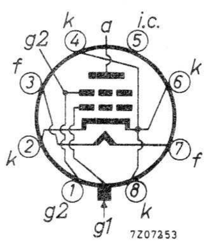
MECHANICAL DATA

Dimensions in mm

Net weight: 120 g

Mounting position: any





[1]) Contact surface

[2]) Use this contact surface for frequencies up to 30 MHz only

[3]) Index aligned with grid No. 1 guide lug

R.F. SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	500	MHz
Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 voltage, negative	$-V_{g_1}$	max.	150	V
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

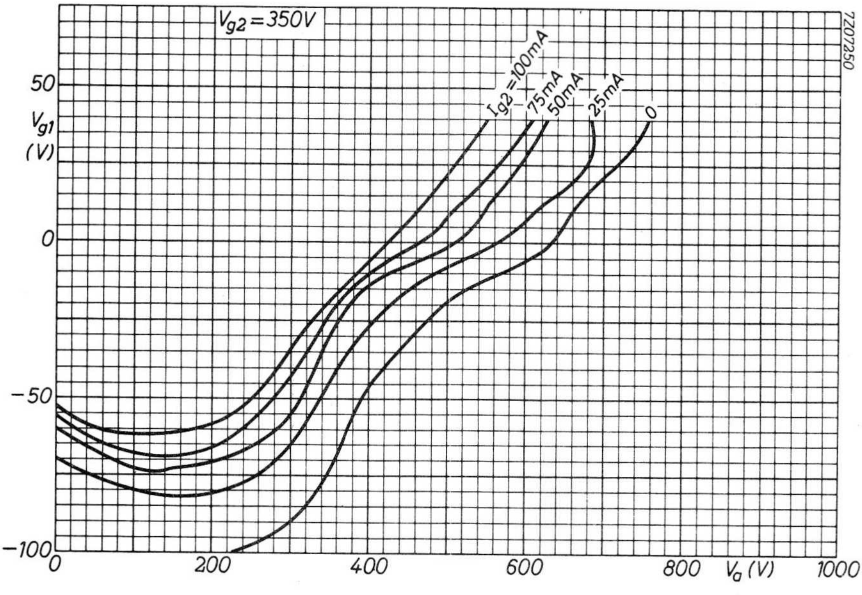
OPERATING CONDITIONS

Frequency	f		7		MHz
Anode voltage	V_a		2000		V
Grid No.2 voltage	V_{g_2}		350		V
Grid No.1 voltage	V_{g_1}		-57.5		V
Load resistance	$R_{a\sim}$		4000		Ω
		zero signal	single tone	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	45.3	45.3	V
Anode current	I_a	100	250	174	mA
Grid No.2 current	I_{g_2}	-1.22	-4.1	-31.5	mA
Anode input power	W_{i_a}	200	500	348	W
Output power in the load	W_ℓ (PEP)	-	271	271	W
Third order intermodulation distortion	d_3	-	-	-26	dB
Fifth order intermodulation distortion	d_5	-	-	-54	dB

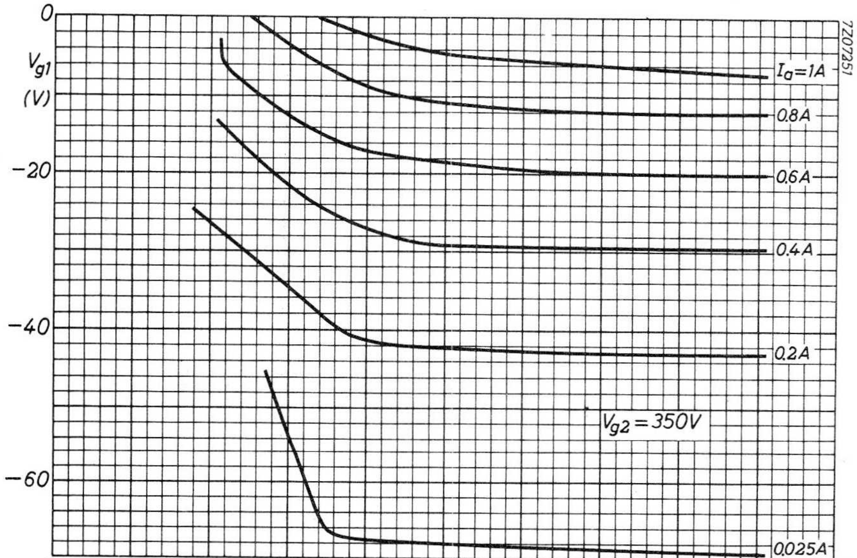
OPERATING CONDITIONS (continued)

Frequency	f		7		MHz
Anode voltage	V_a		2000		V
Grid No. 2 voltage	V_{g_2}		350		V
Grid No. 1 voltage	V_{g_1}		-72		V
Load resistance	$R_{a\sim}$		3570		Ω
		zero signal	single tone [1]	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	62	62	V
Anode current	I_a	75	310	204	mA
Grid No. 2 current	I_{g_2}	-0.85	14	2.4	mA
Anode input power	W_{i_a}	150	620	407	W
Output power in the load	W_ℓ (PEP)	-	436	436	W
Third order intermodulation distortion	d_3	-	-	-23	dB
Fifth order intermodulation distortion	d_5	-	-	-37	dB

[1]) Conditions in this column are permissible only for a signal having a peak to average power ratio which equals or exceeds 2 to 1 (e.g. two tone conditions) and for tune up during maximum 2 min.



$V_{g2}=350V$
7Z07250
$I_{g2}=100mA$
75mA
50mA
25mA
0
50
V_{g1} (V)
0
−50
−100
0
200
400
600
800
V_a (V)
1000



7Z07251
0
V_{g1} (V)
−20
−40
−60
$I_a=1A$
0.8A
0.6A
0.4A
0.2A
0.025A
$V_{g2}=350V$
0
200
400
600
800
V_a (V)
1000

Amplifier circuit assemblies

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 VISION AND COMBINED SOUND AND VISION

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)

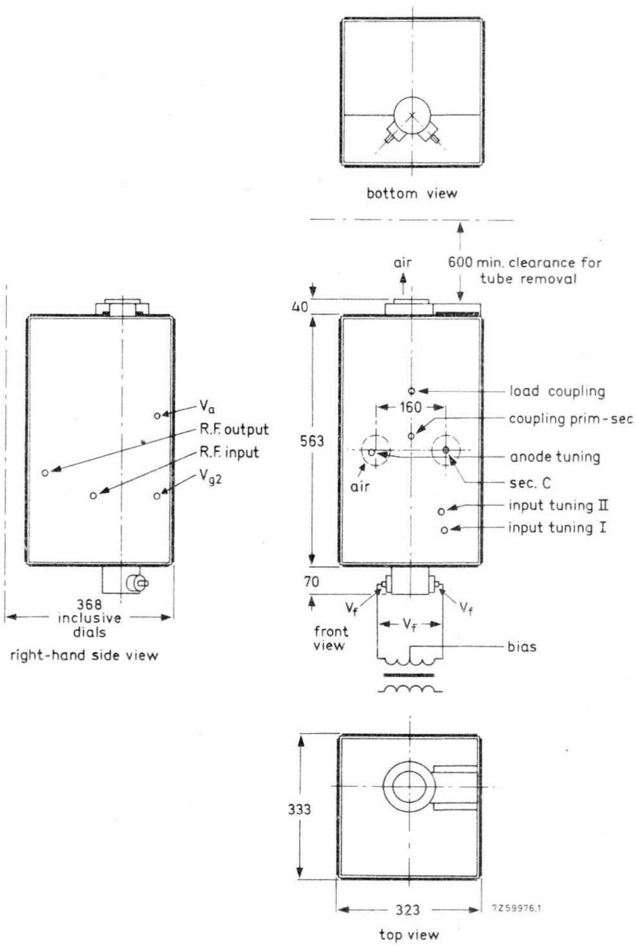
For detailed operating conditions reference is made to the data sheets for tube type YL14 YL1440.

Dimensions in mm

MECHANICAL DATA

Dimensions : approx. 673 x 333 x 323 mm^3

Net weight : approx. 38 kg



COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
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

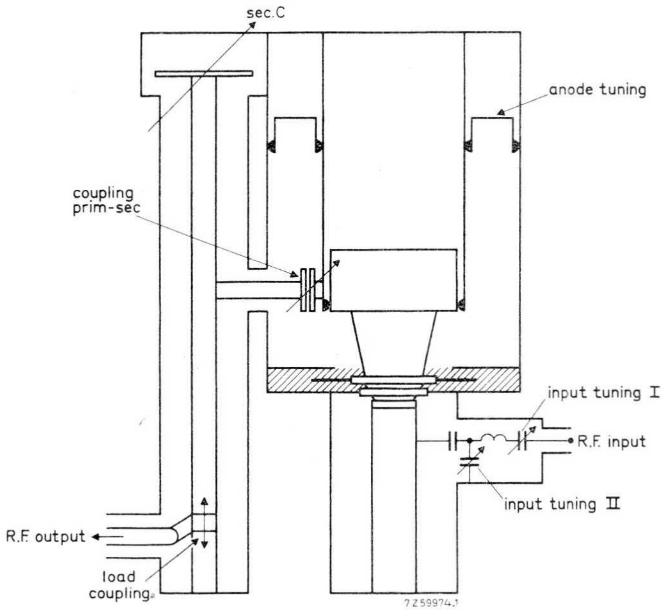
a) Delivered with the assembly

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

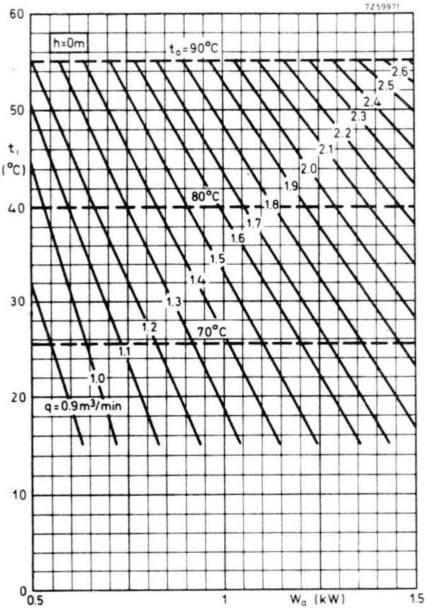
b) Recommended

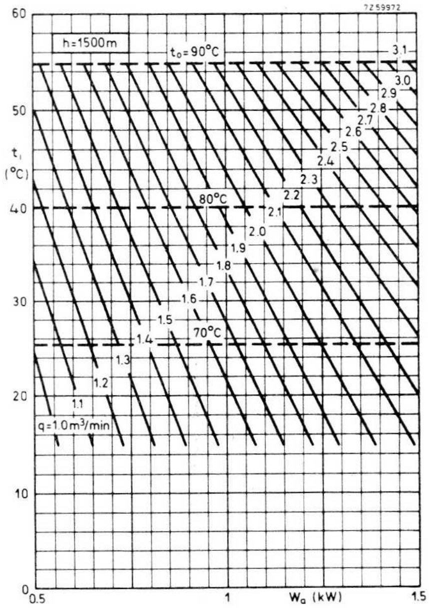
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 1201 (200 to 230 MHz) is recommended.

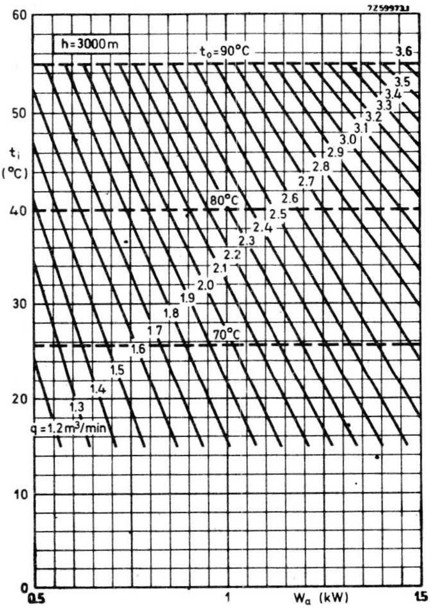
CIRCUIT DIAGRAM

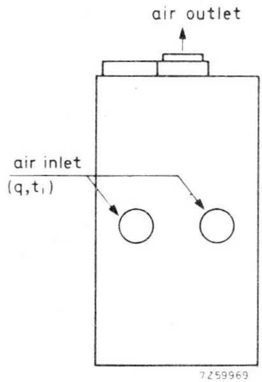


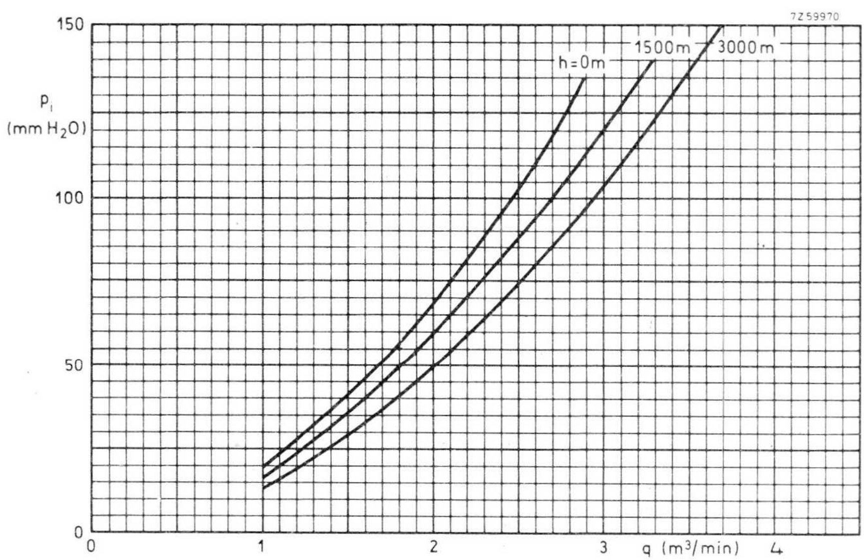
Cooling curves








air outlet
air inlet
(q, t_i)
7Z59969


7Z59970
150
100
50
0
p_i
(mm H2O)
h=0m
1500m
3000m
0
1
2
3
4
q (m³/min)

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 SOUND

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.

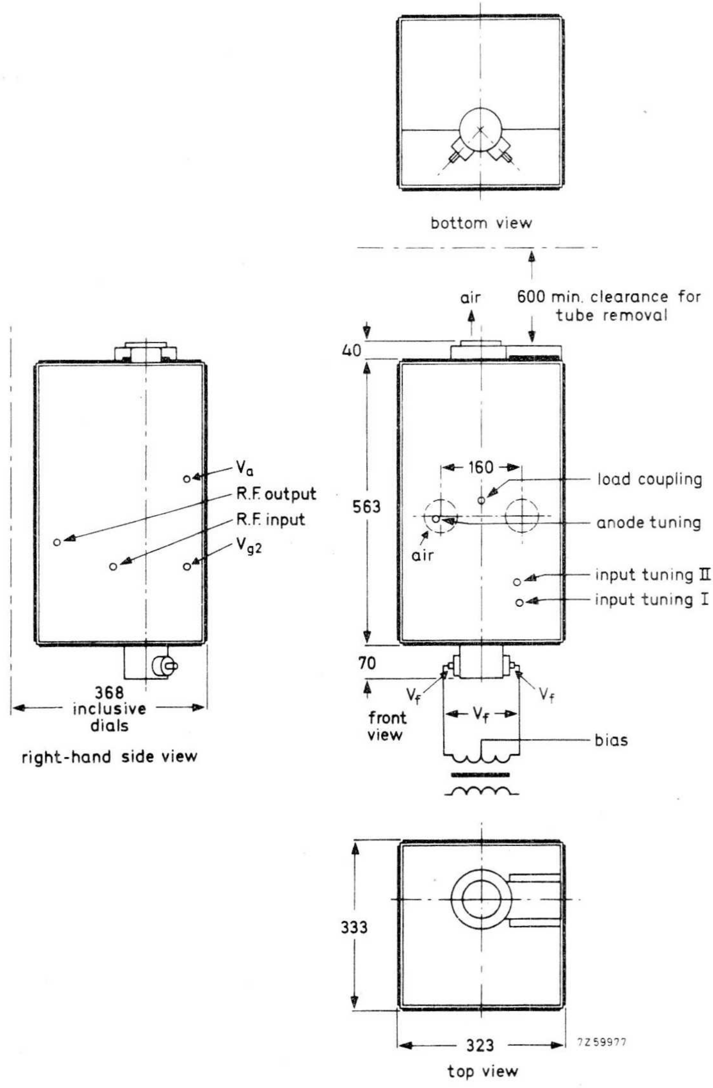
OPERATING CONDITIONS (For tube YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

MECHANICAL DATA

Dimensions in mm

Dimensions : approx. 673 x 333 x 323 mm^3
Net weight : approx. 33 kg



COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
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

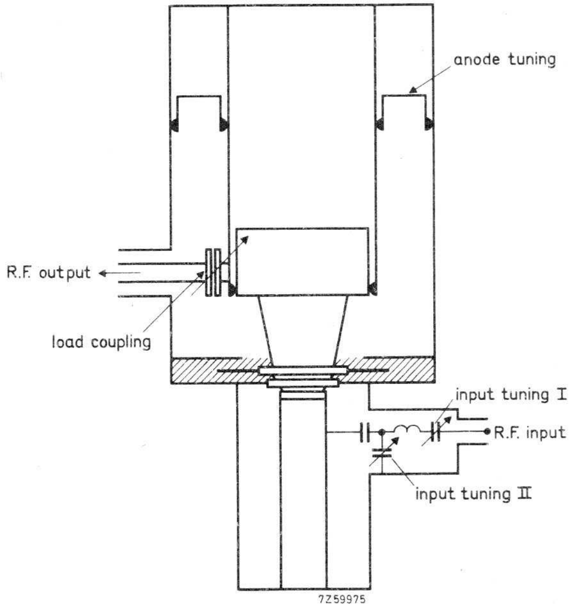
a) Delivered with the assembly

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

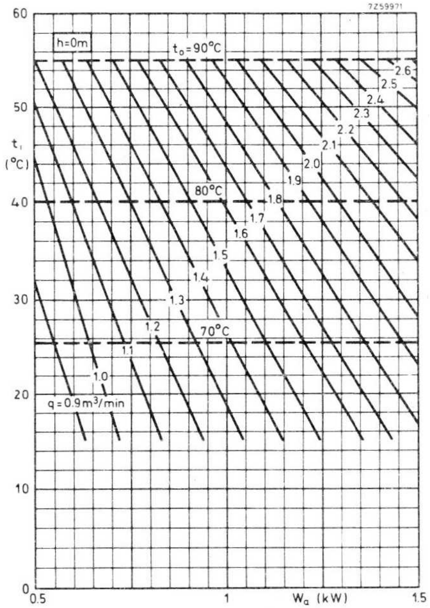
b) Recommended

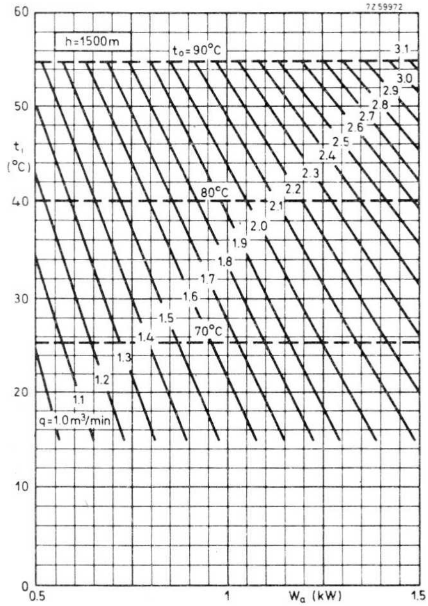
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

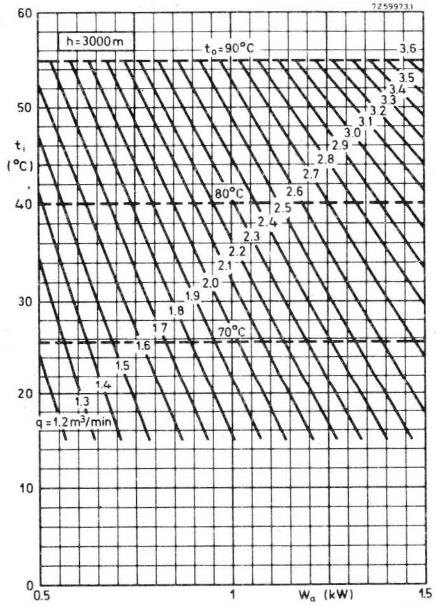
CIRCUIT DIAGRAM

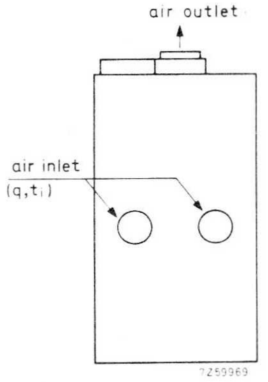


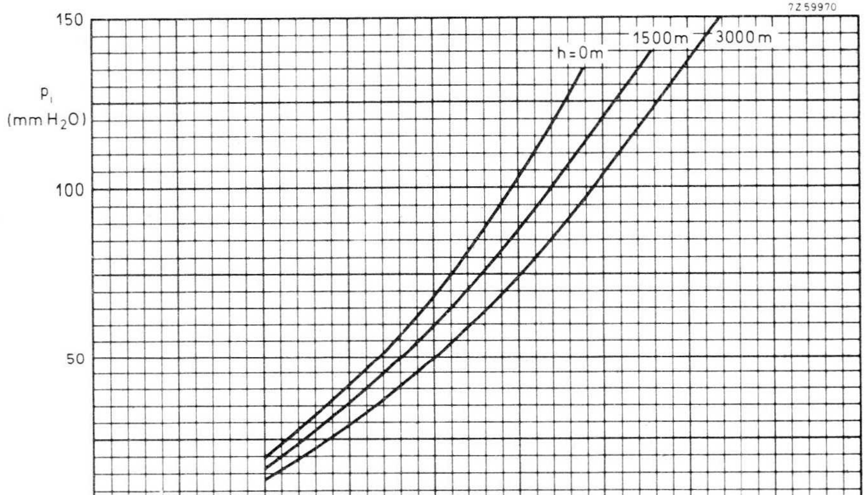
Cooling curves








air outlet
air inlet
(q,ti)
7Z59969


7Z59970
150
100
50
0
p_i
(mm H2O)
h=0m
1500m
3000m
0
1
2
3
4
q (m3/min)

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420 VISION AND COMBINED SOUND AND VISION

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

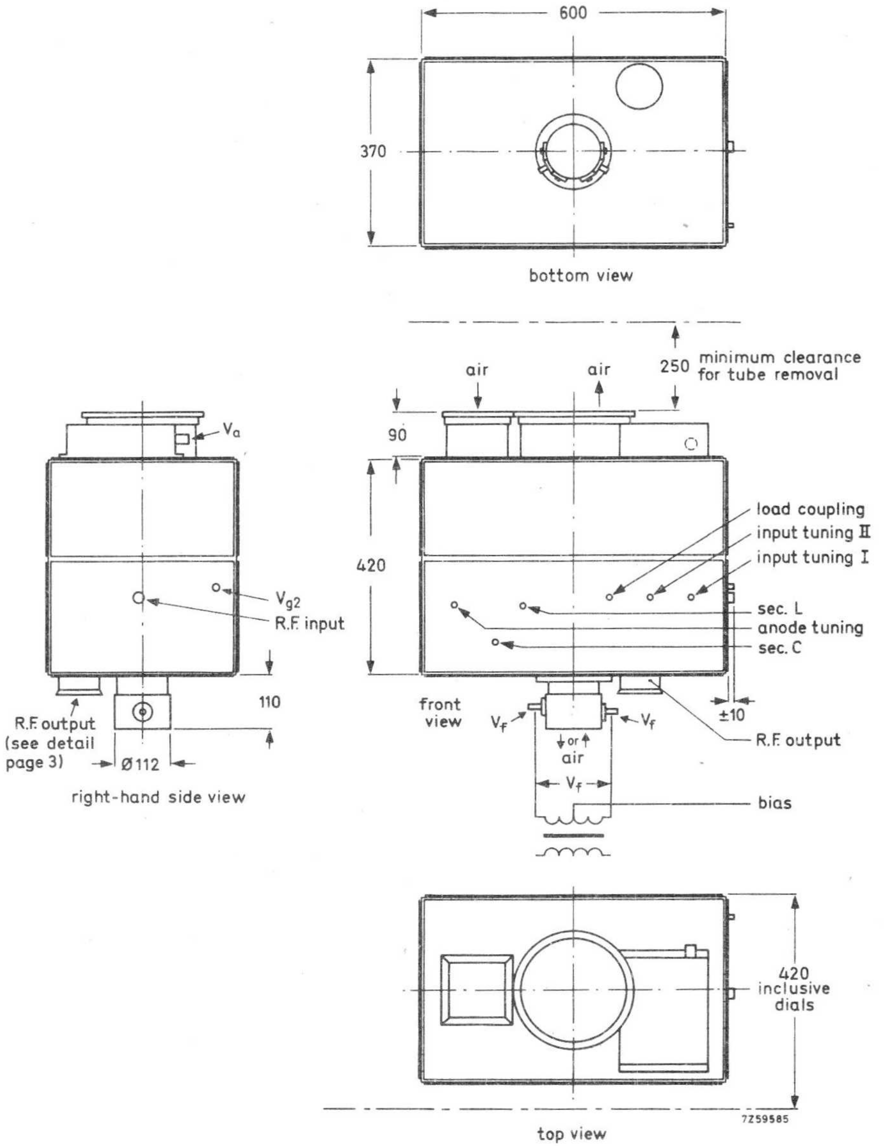
170 to 230 MHz continuously tunable.

OPERATING CONDITIONS (For YL1420)

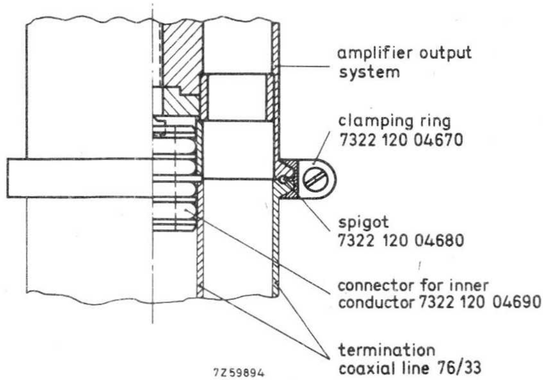
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

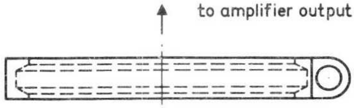
MECHANICAL DATA Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 67 kg

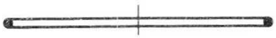


R.F. output connector

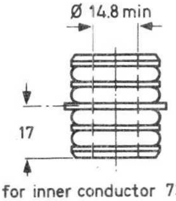




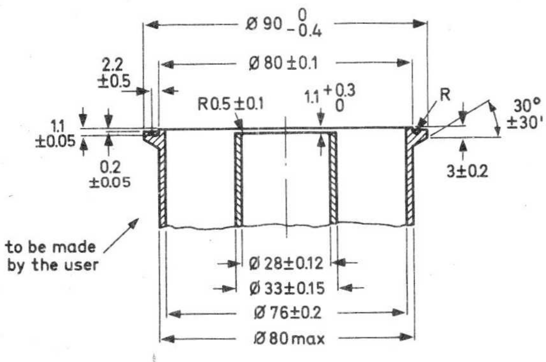
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

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 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

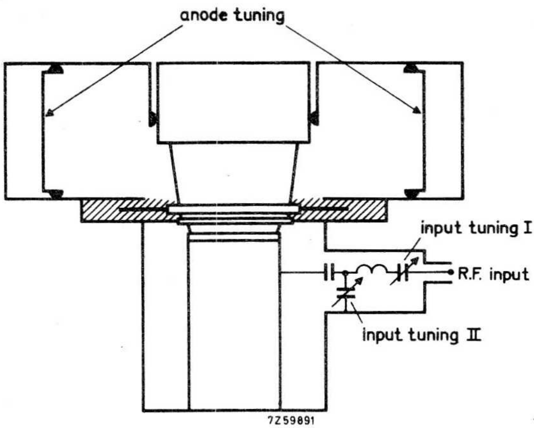
a) Delivered with the assembly

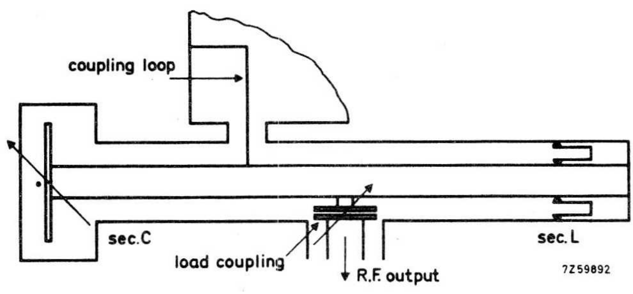
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for 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.

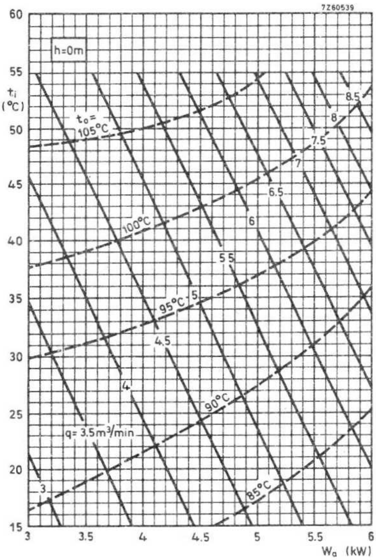
[1]) For 223.25 MHz a different coupling loop is needed, which can be delivered on request.

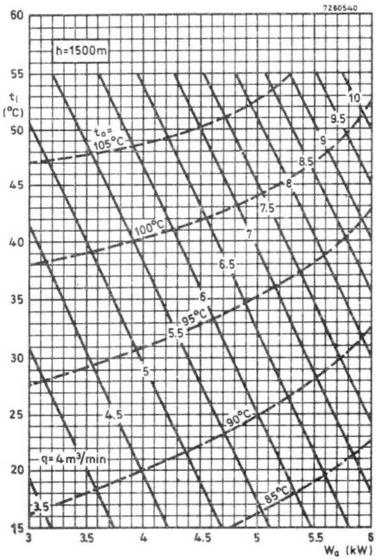
CIRCUIT DIAGRAM

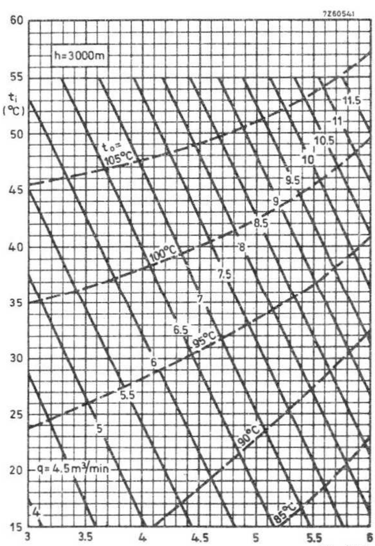


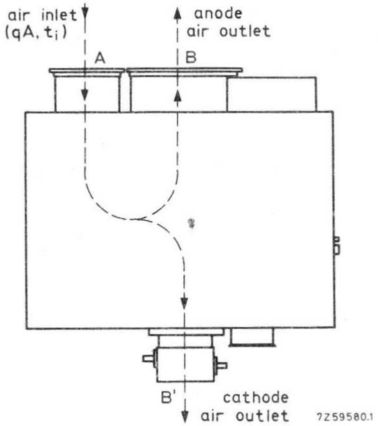


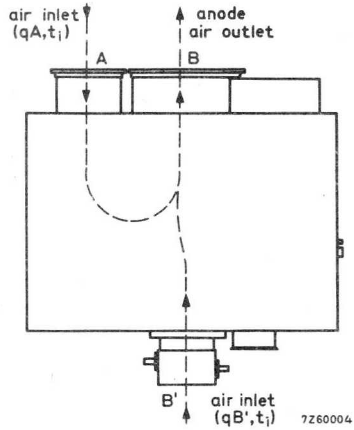
Cooling curves

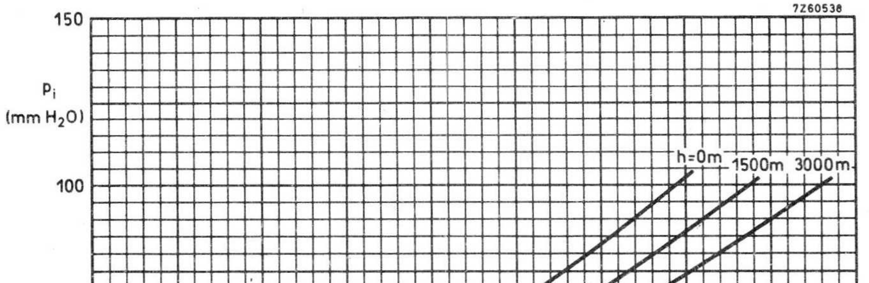












Pressure drop p_i across cavity with YL1420 as a function of airflow q.
p_i = pressure drop from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420 SOUND

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.

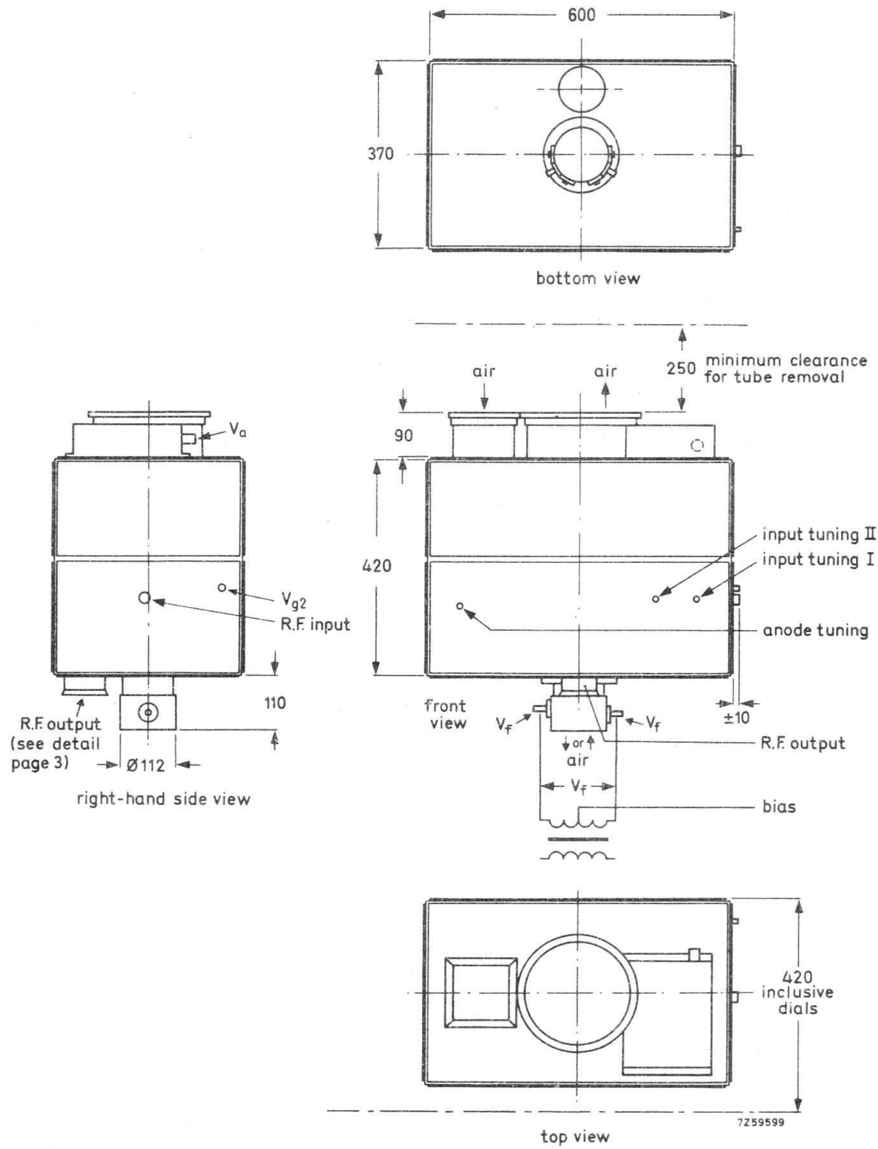
OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

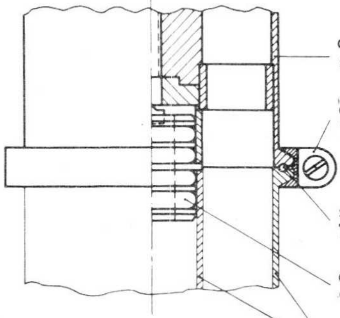
MECHANICAL DATA

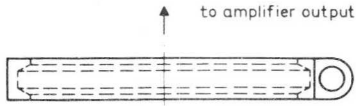
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 54 kg



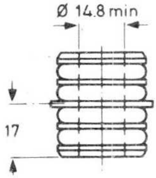
R.F. output connector



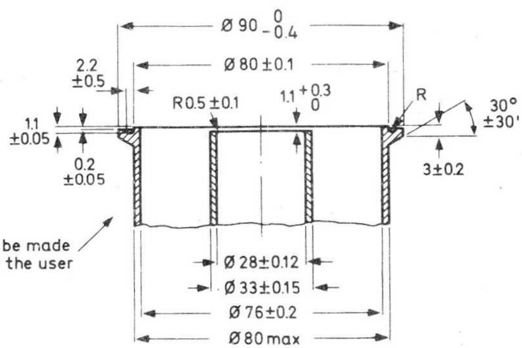


clamping ring 7322 120 04670

spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

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 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

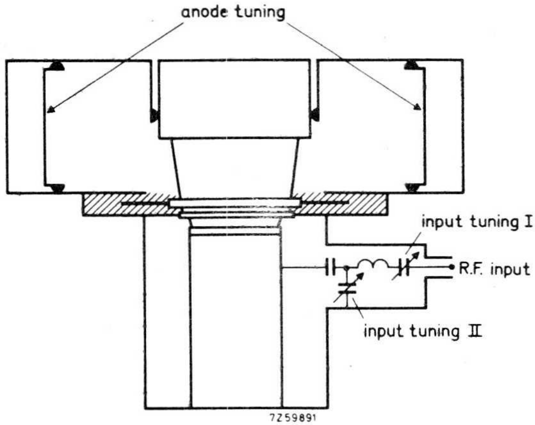
a) Delivered with the assembly

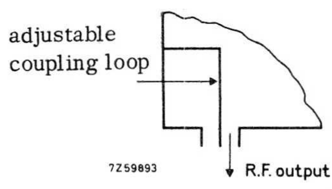
Tube extractor input connector	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

Recommended

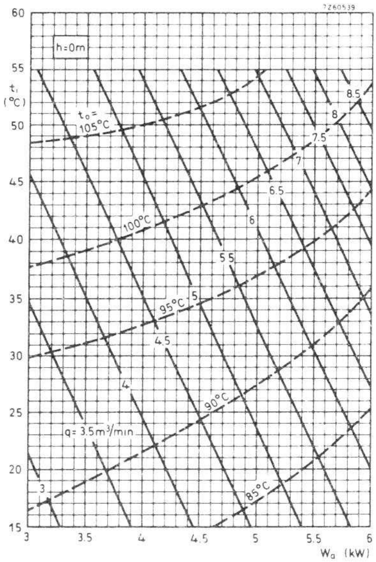
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

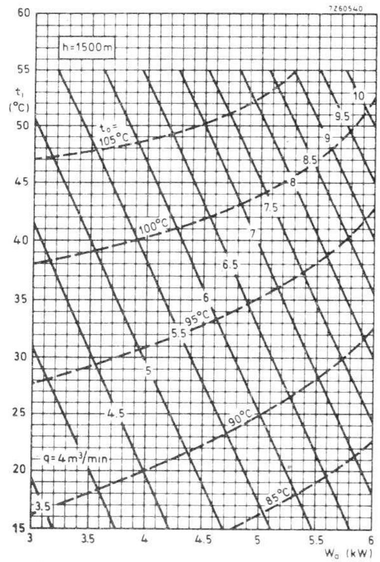
CIRCUIT DIAGRAM

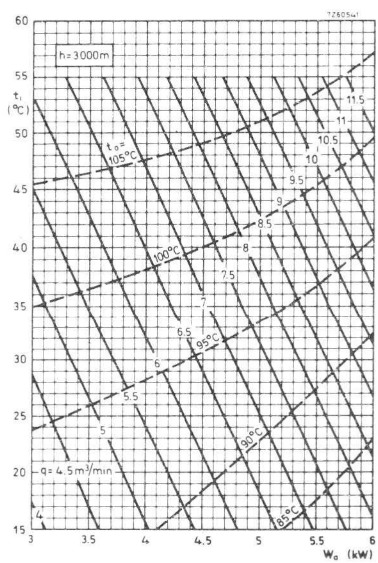


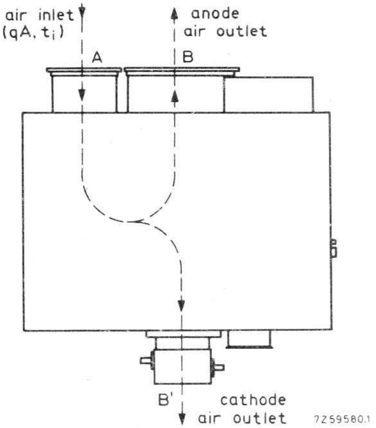


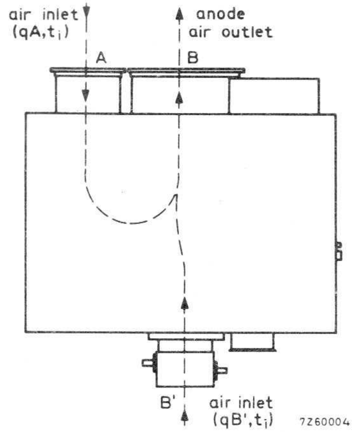
Cooling curves

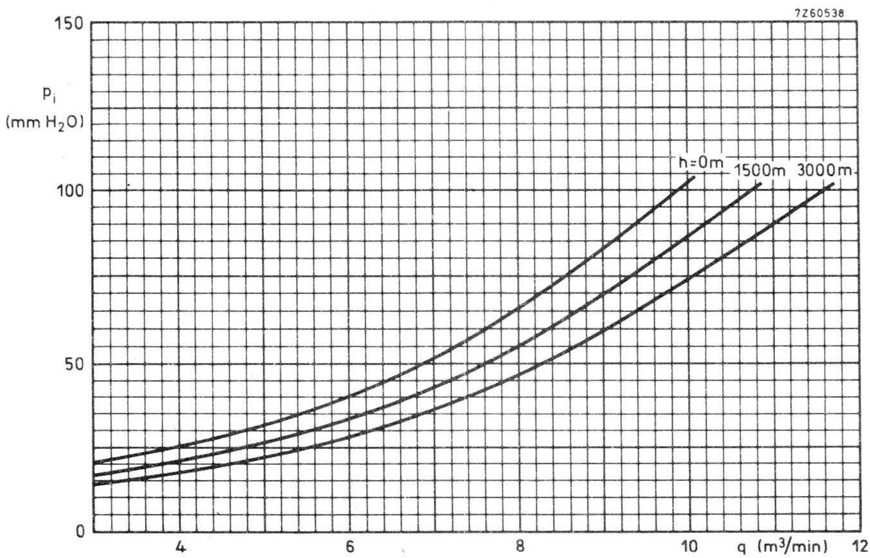












Pressure drop p_i across cavity with YL1420 as a function of airflow q.
p_i = pressure from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 VISION AND COMBINED SOUND AND VISION

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.

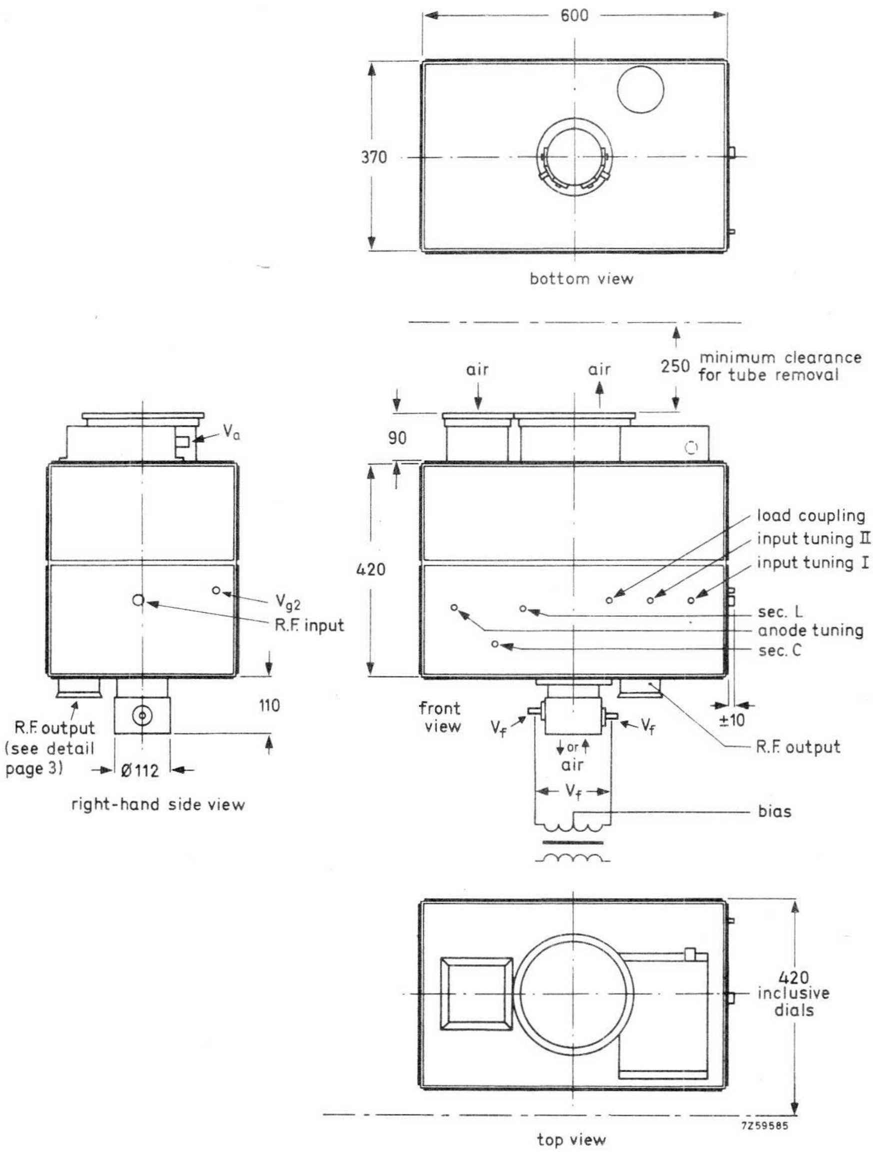
OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

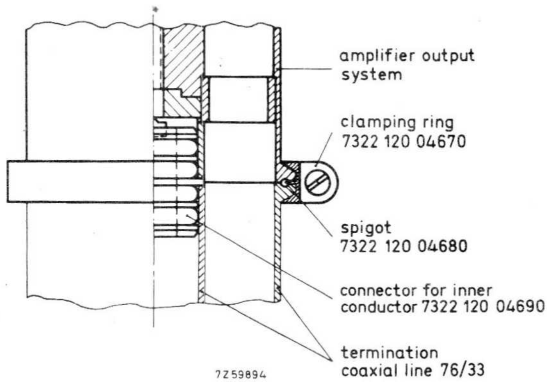
MECHANICAL DATA

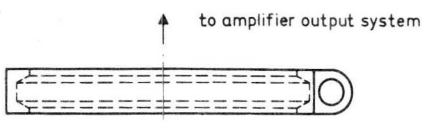
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 67 kg

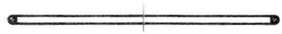


Output connector

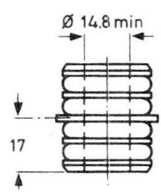




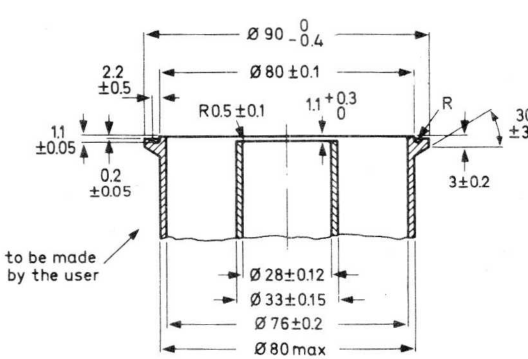
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

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 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 the assembly

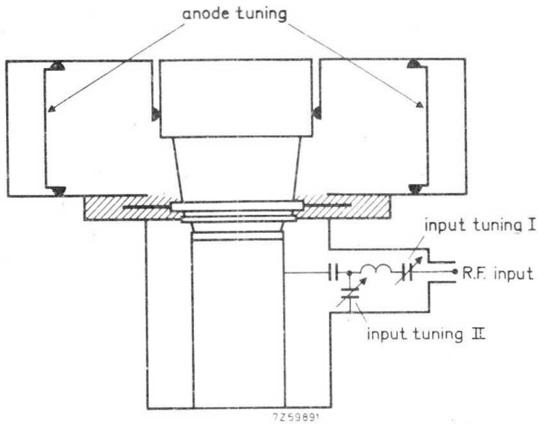
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for 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	

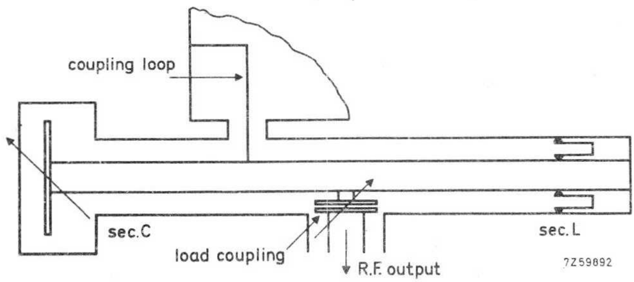
b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

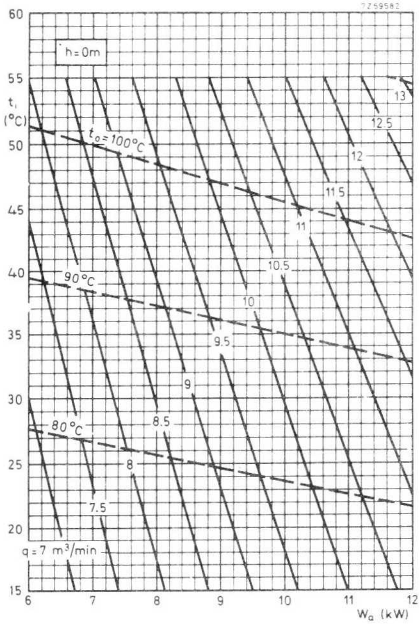
[1]) For 224.25 MHz a different coupling loop is needed, which can be delivered on request.

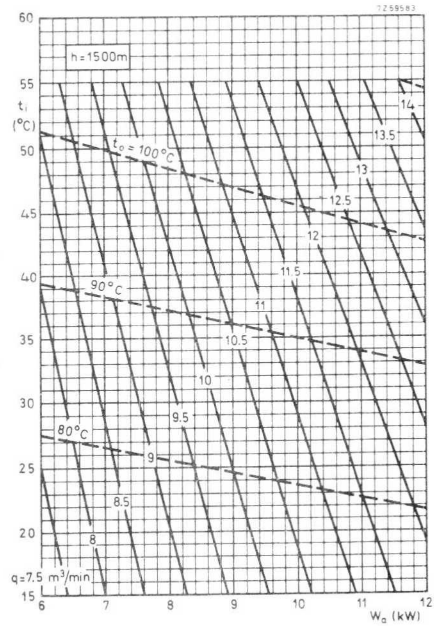
CIRCUIT DIAGRAM

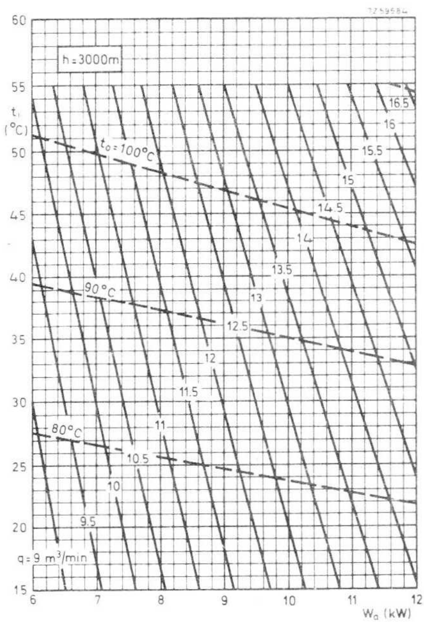


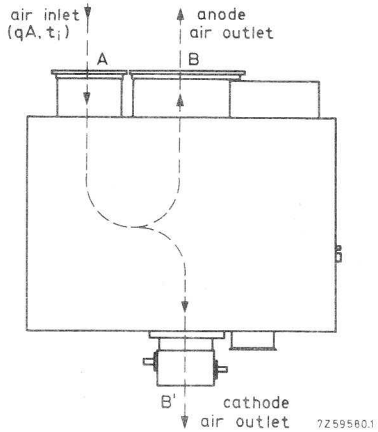


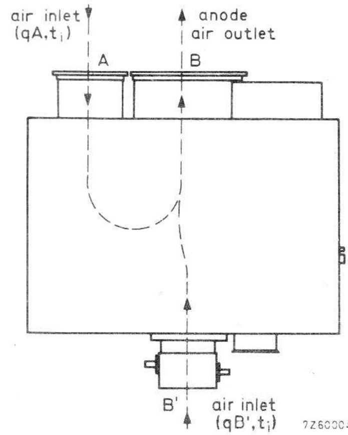
Cooling curves

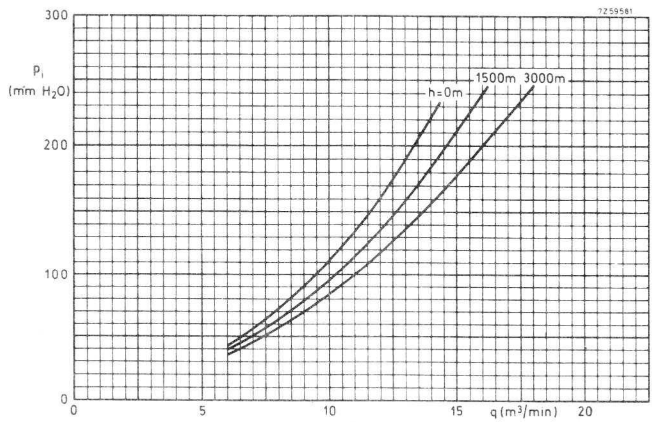










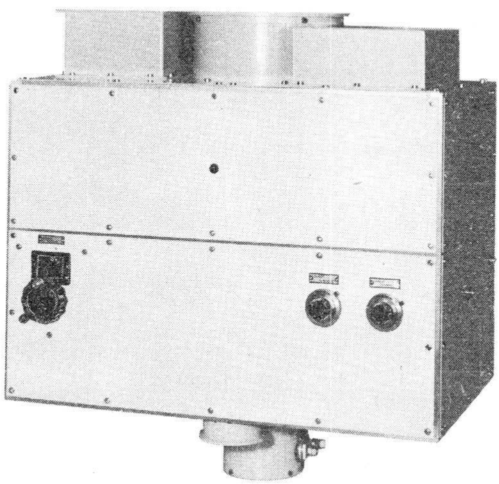


Pressure drop q_i across cavity with YL1430 as a function of airflow q.
p_i = pressure drop from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 SOUND

Continuously tunable cavity-type circuit assembly to be used with YL1430 to form a grounded-grid amplifier of frequency modulated signals in band III.

RZ 29115-9



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.

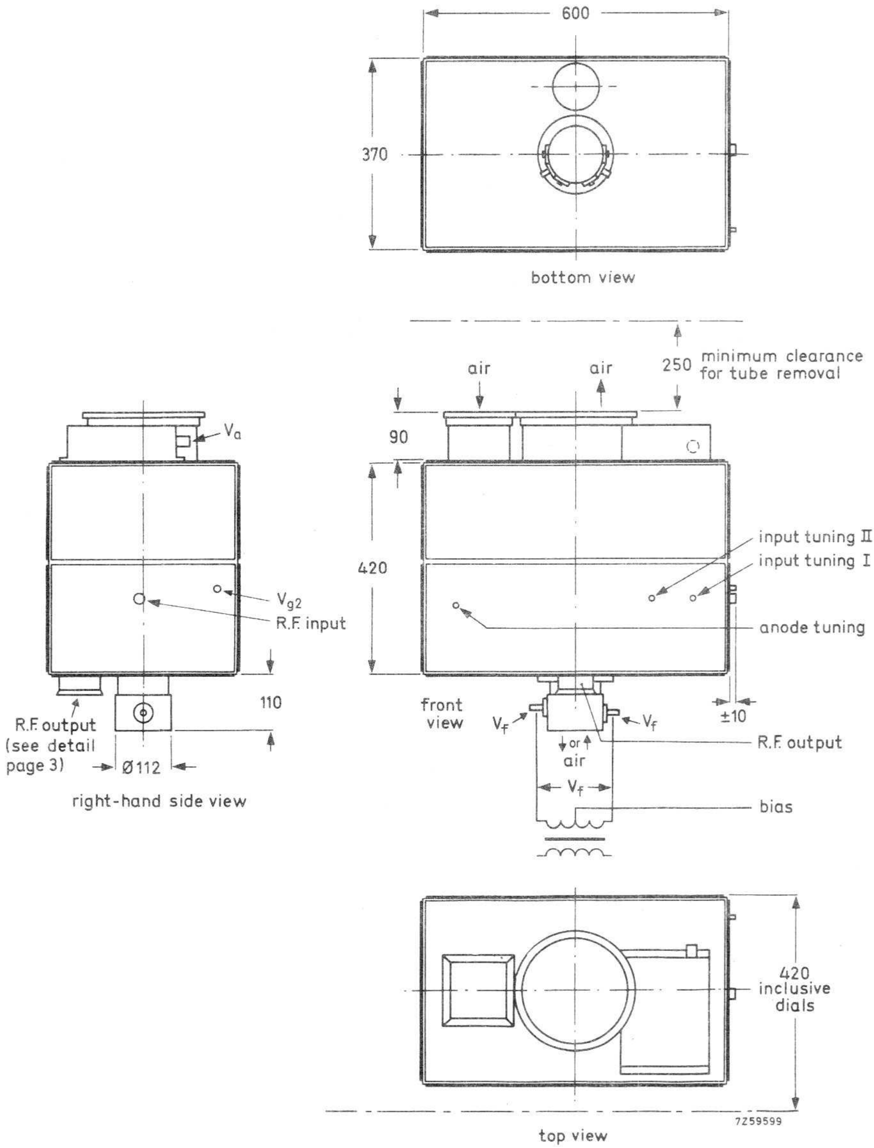
OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

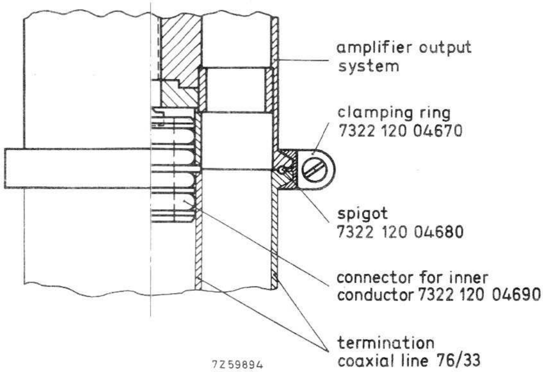
MECHANICAL DATA

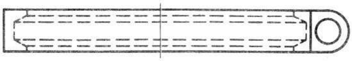
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 54 kg

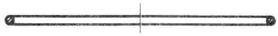


R.F. output connector

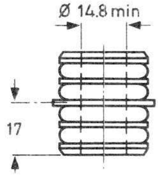




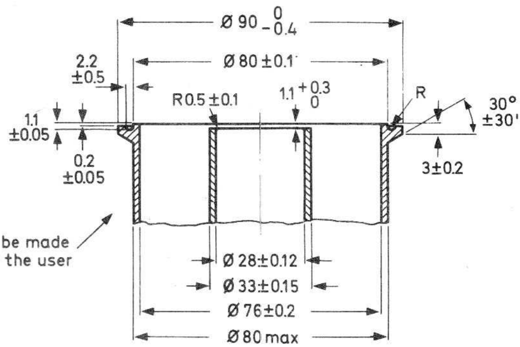
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

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 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

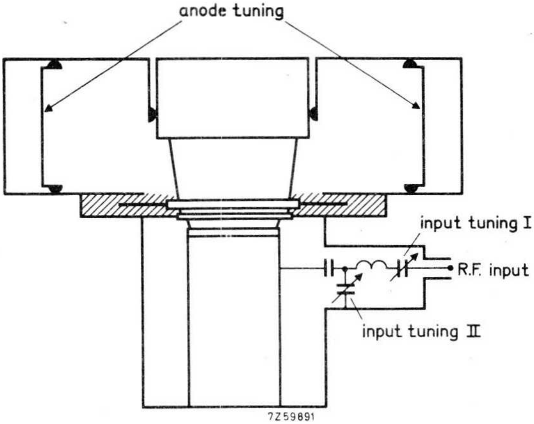
a) Delivered with the assembly

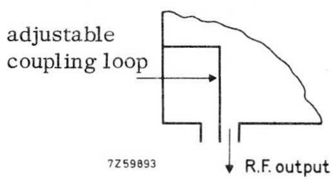
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

b) Recommended

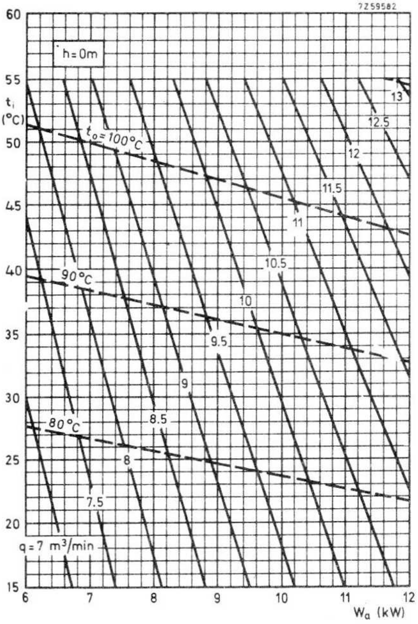
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

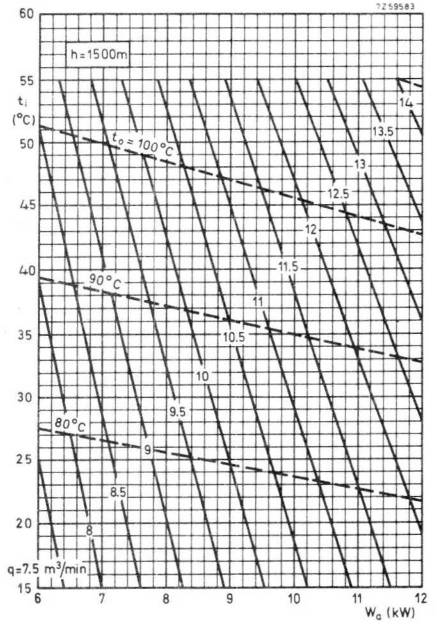
CIRCUIT DIAGRAM

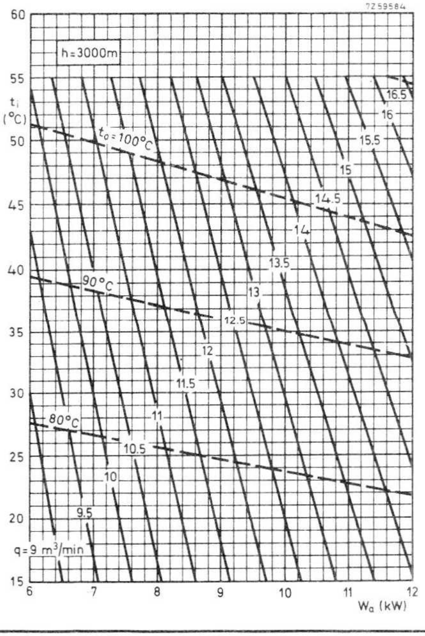


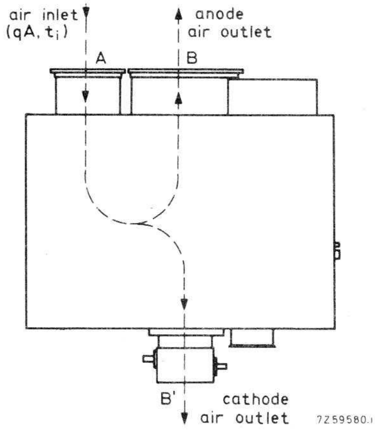


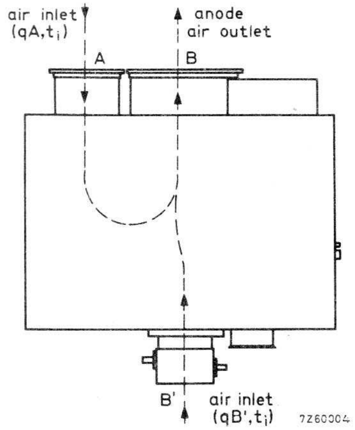
Cooling curves

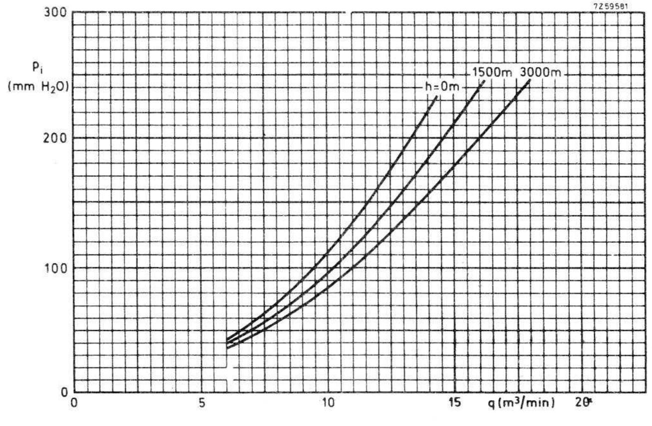












Pressure drop p_i across cavity with YL1430 as a function of air flow q.
p_i = pressure drop from plane A to plane B or B'.
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 VISION

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

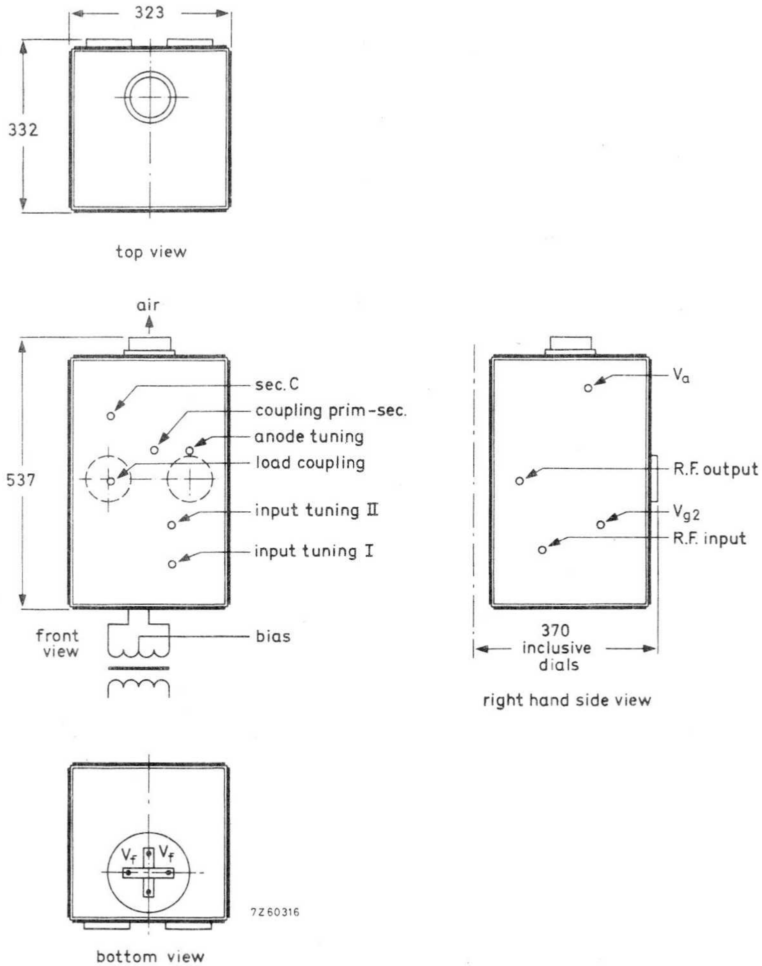
OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

MECHANICAL DATA

Dimensions in mm

Dimensions: approx. 516 x 323 x 323 mm^3
Net weight : approx. 23 kg



COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
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

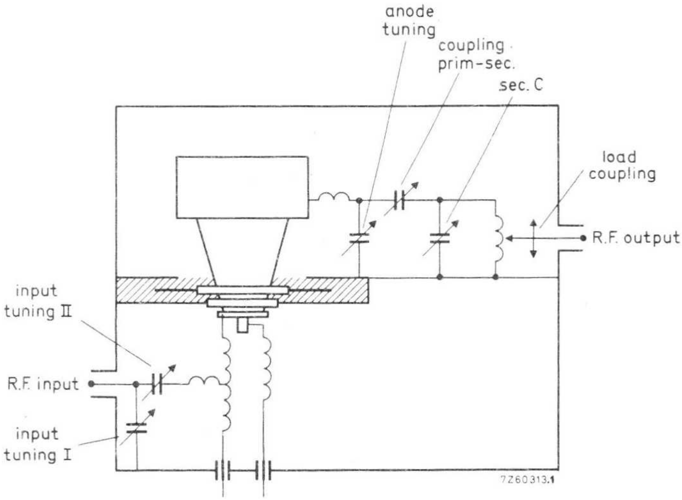
ADDITIONAL COMPONENTS

Delivered with the assembly

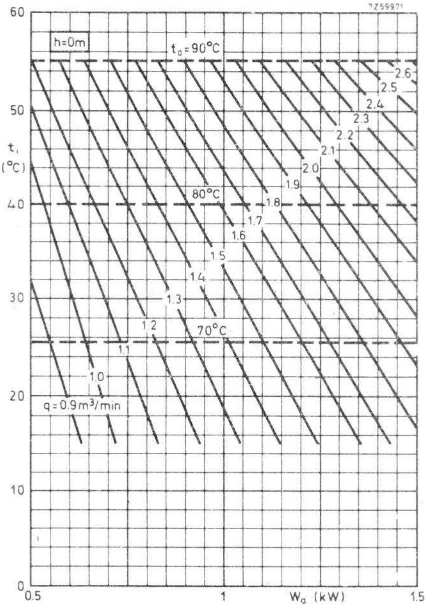
Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for vision carries	
5 coils for vision carrier frequencies 55.25; 61.25 to 62.25; 67.25; 77.25; 83.25 MHz	[1]
Spanner for fitting the coils	

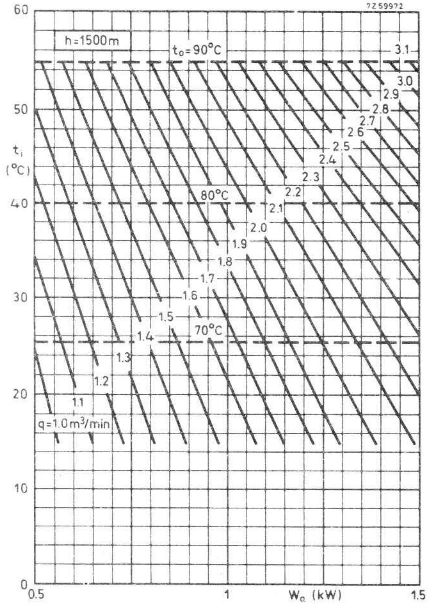
[1] Coils covering vision carrier frequencies other than specified can be delivered on request.

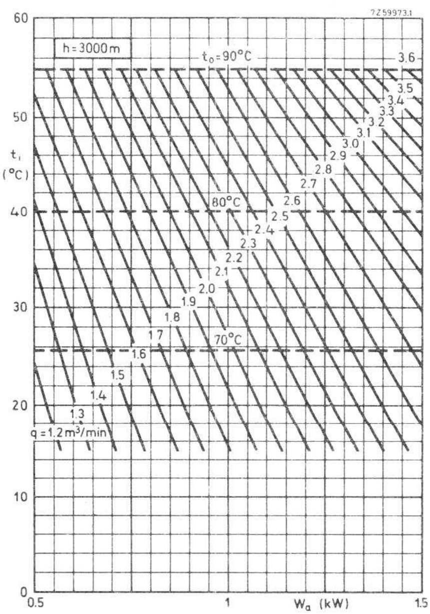
CIRCUIT DIAGRAM

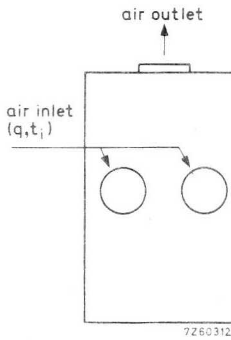


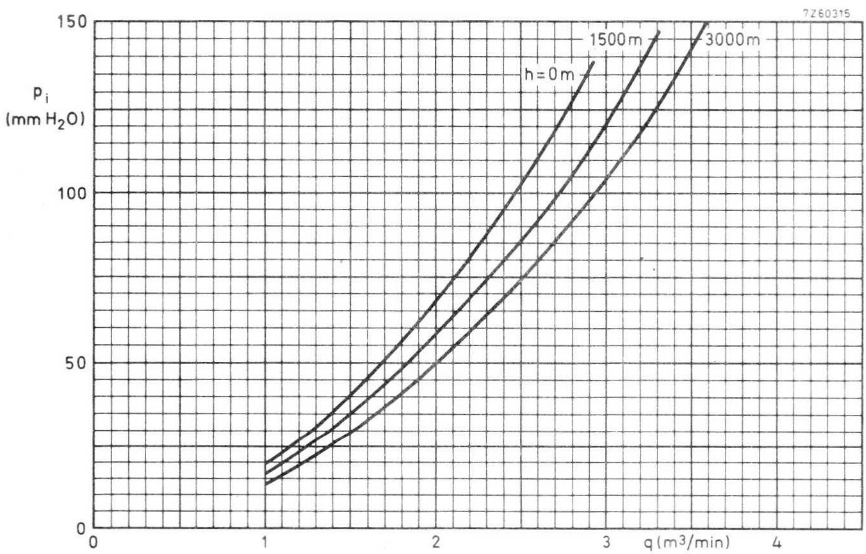
Cooling curves








air outlet
air inlet
(q,t$_i$)
7Z60312


7Z60315
150
100
50
0
p$_i$
(mm H$_2$O)
h = 0 m
1500 m
3000 m
0
1
2
3
4
q (m^3/min)

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 SOUND

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

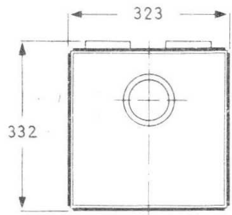
OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

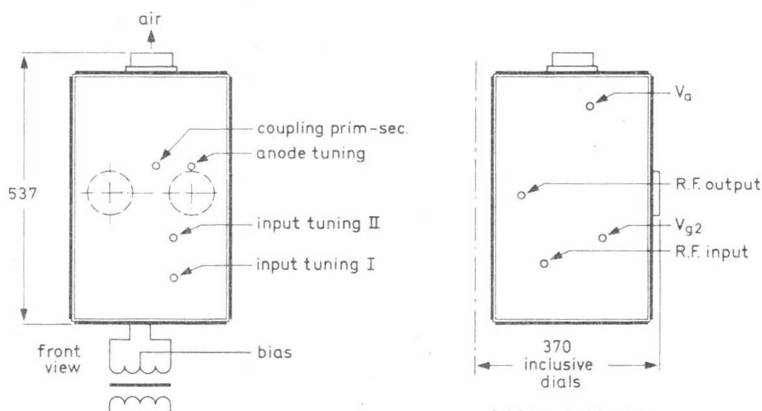
MECHANICAL DATA

Dimensions in mm

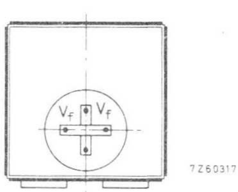
Dimensions: approx. 516 x 323 x 323 mm^3
Net weight : approx. 22.5 kg



top view



right hand side view



bottom view

COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
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

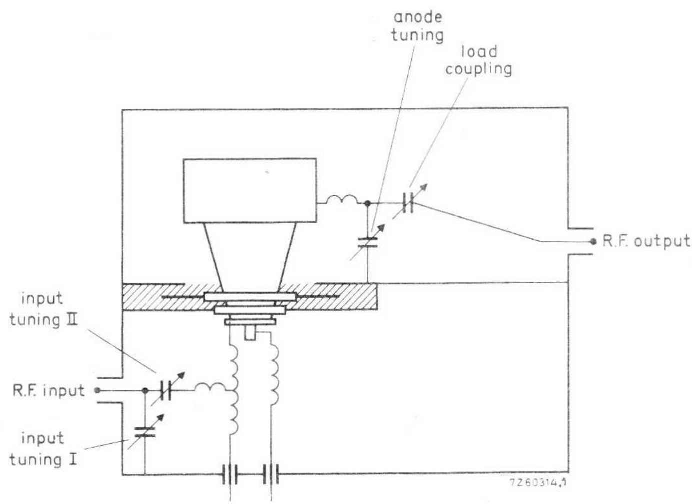
ADDITIONAL COMPONENTS

Delivered with the assembly

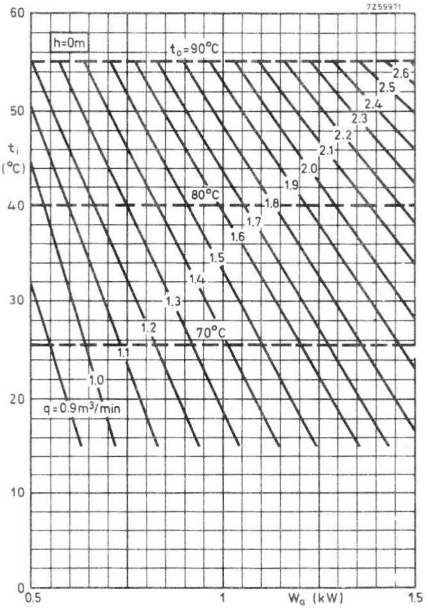
Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for sound carrier frequencies 59.75 to 60.75; 65.75 to 67.75; 71.75 81.75; 87.75 MHz	[1]
Spanner for fitting the coils	

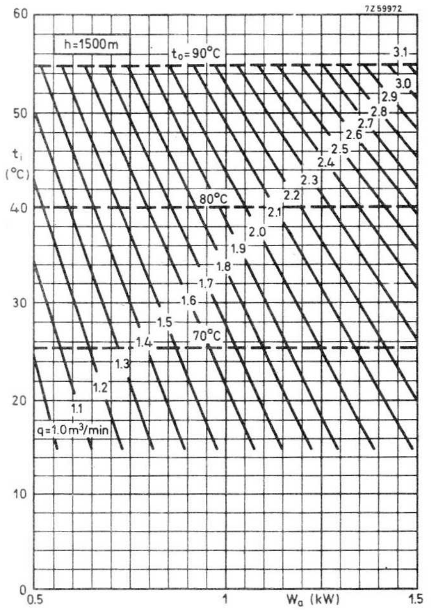
[1] Coils covering sound carrier frequencies other than specified can be delivered on request.

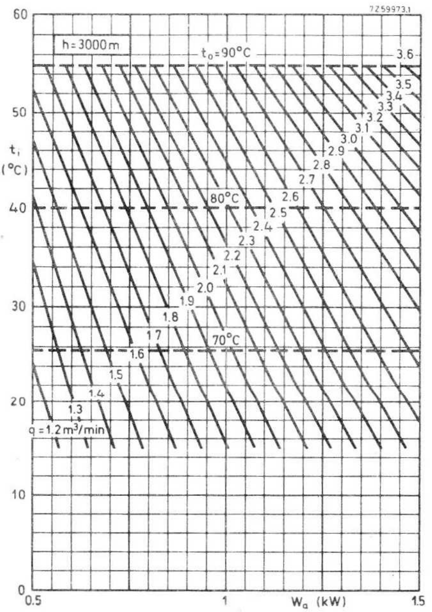
CIRCUIT DIAGRAM

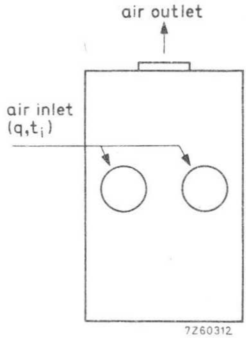


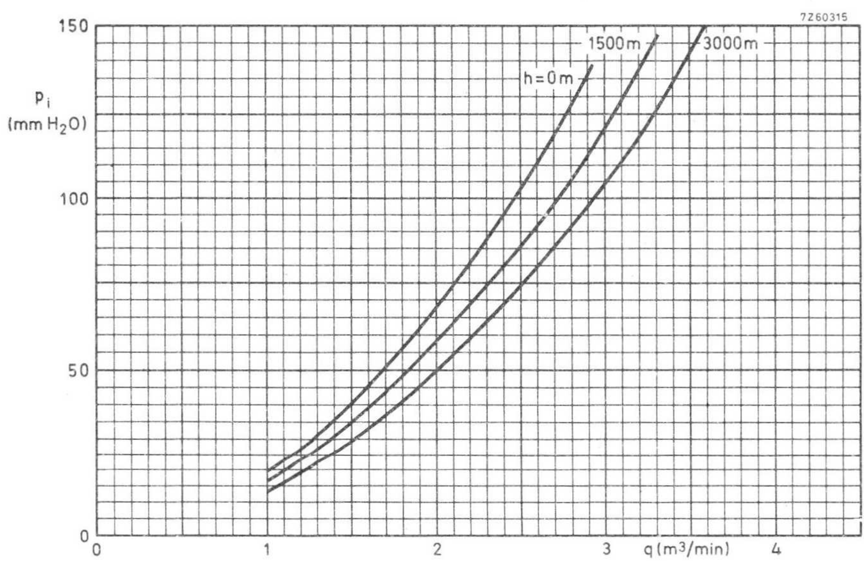
Cooling curves








air outlet
air inlet
(q,t$_i$)
7Z60312


7Z60315
150
100
50
0
p$_i$
(mm H$_2$O)
1500m
3000m
h=0m
0
1
2
3
4
q (m^3/min)

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420 VISION

Amplifier circuit assembly to be used with YL1420 to form a broad-band grounded-grid linear amplifier for television signals in Band I.

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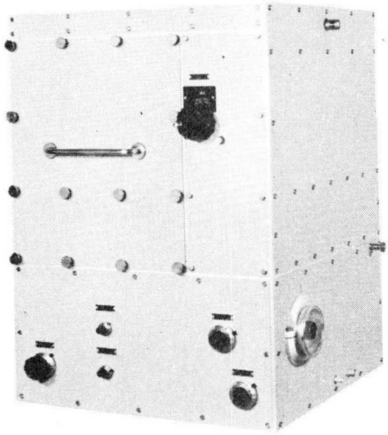


QUICK REFERENCE DATA			
Frequency (MHz)	Class AB linear amplifier (vision)		
	V_a(kV)	$W_{\ell\,sync}$ (kW)(CCIR system)	Power gain
83.25	4	6.25	18.5
55.25	4	6.25	16

FREQUENCY RANGE

55.25 to 67.25 MHz and } channel tuned
77.25 to 83.25 MHz

OPERATING CONDITIONS (For YL1420)

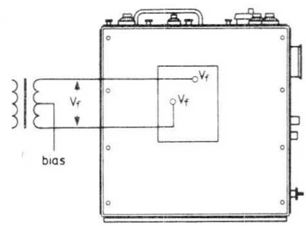
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

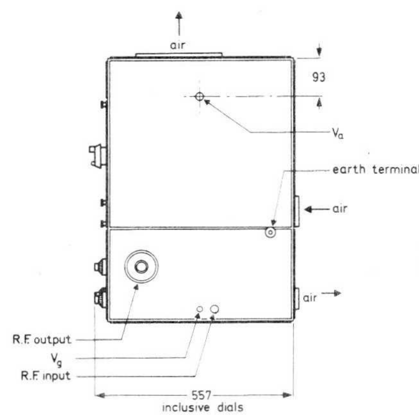
Dimensions in mm

Dimensions: approx. 700 x 500 x 500 mm^3

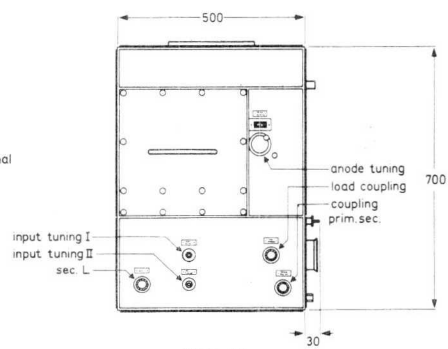
Net weight: approx. 70 kg



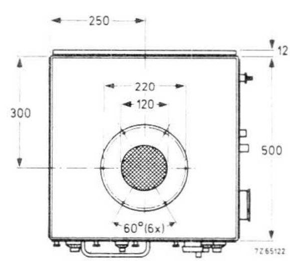
bottom view



right hand side view

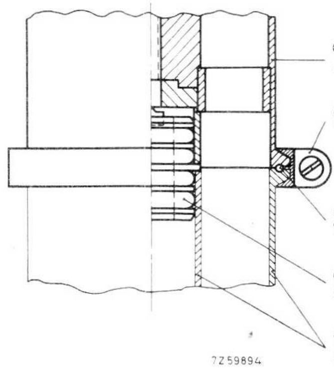


front view

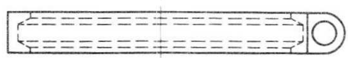


top view

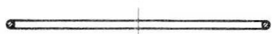
Output connector



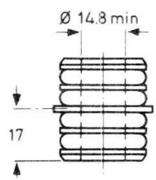
to amplifier output system



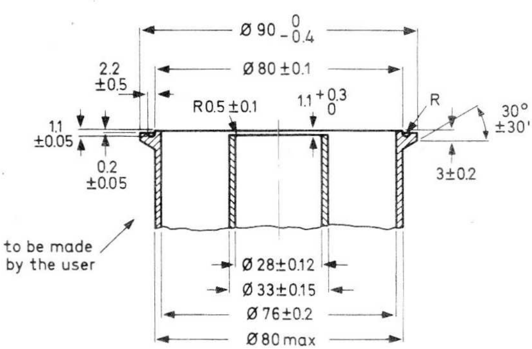
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

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 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

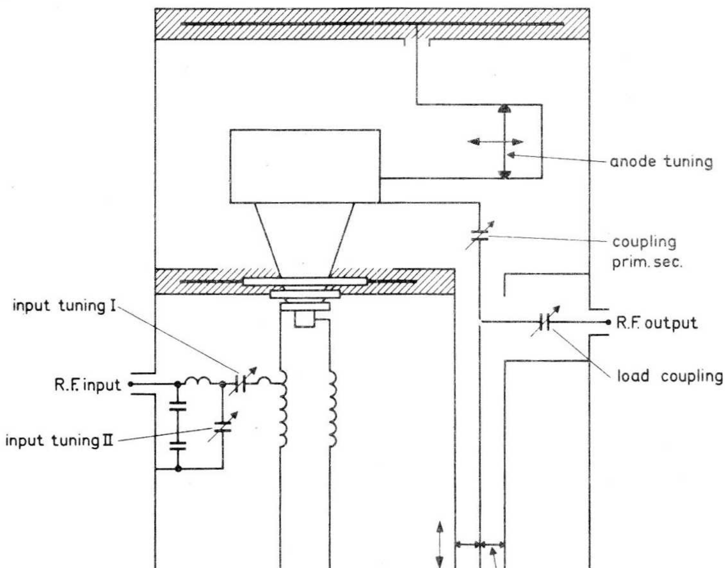
Tube extractor	7322 120 07850	
Mating male input connector	Radiall type N	
Output connector		
connector for inner conductor	7322 120 04690	
spigot for outer conductor	7322 120 04680	
clamping ring for outer conductor	7322 120 04670	
Mating connector for anode voltage	Radiall type R13060	
Mating connector for screen grid voltage	Radiall type R9510	
Anode coil covering frequency range 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

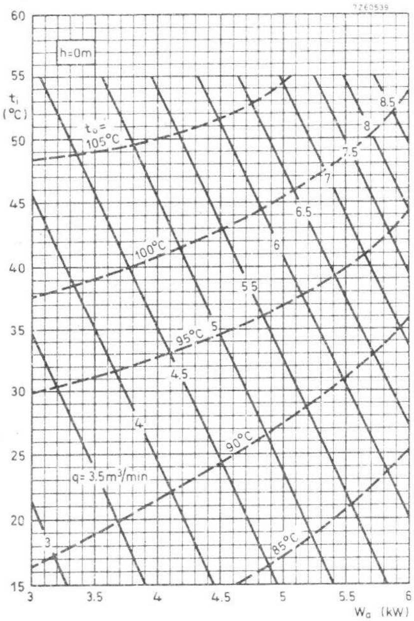
Anode coil covering frequency range 77.25 to 83.25 MHz	8222 032 11860	1)
Elbow for secondary circuit covering frequency range 77.25 to 83.25 MHz	8222 032 11790	

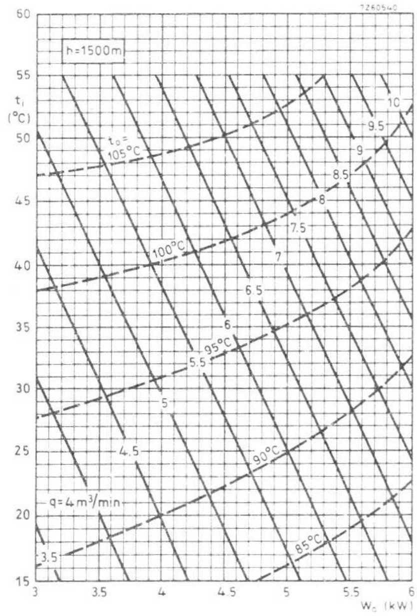
1) For use on carrier frequencies other than specified please contact the manufacturer.

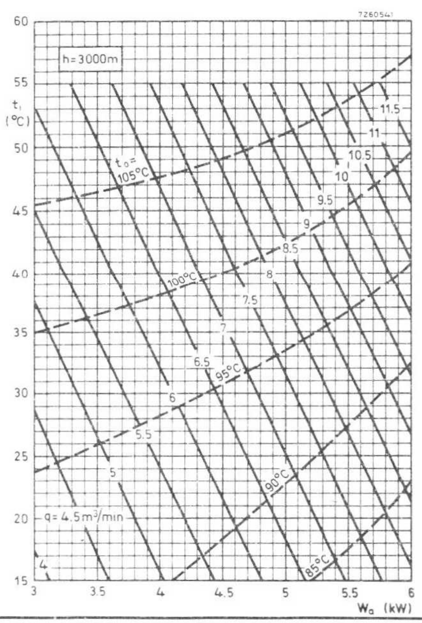
CIRCUIT DIAGRAM

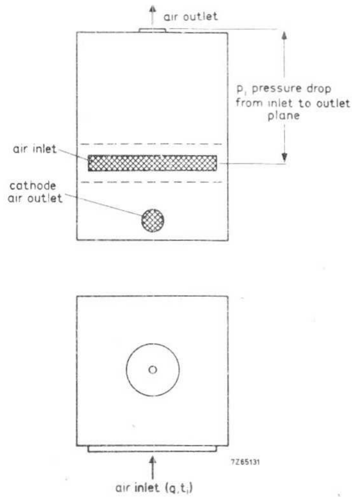


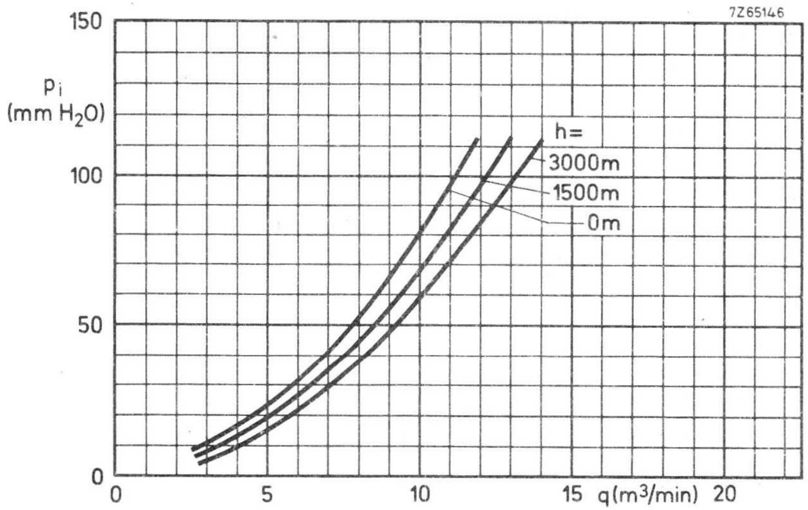
Cooling curves








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(m³/min)
20

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420 SOUND

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)

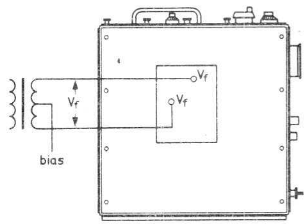
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

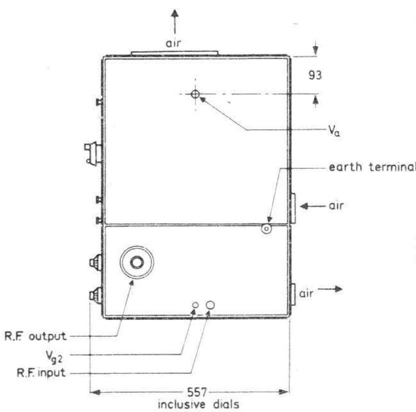
Dimensions in mm

Dimensions : approx. 700 x 500 x 500 mm^3

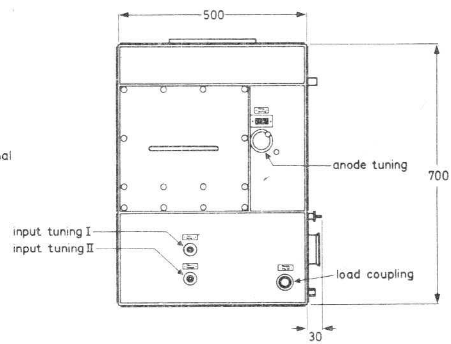
Net weight : approx. 58 kg



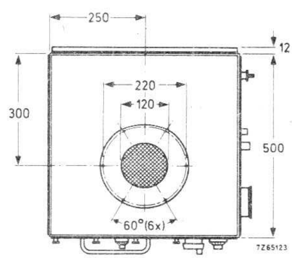
bottom view



right hand side view

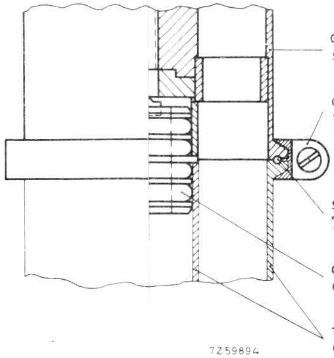


front view

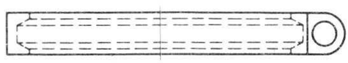


top view

Output connector

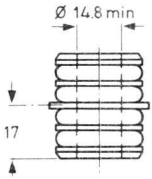


to amplifier output system

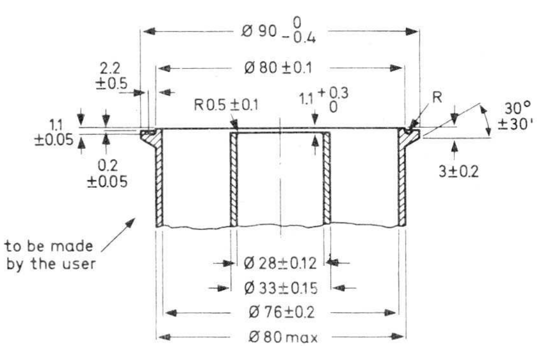


clamping ring 7322 120 04670

spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

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

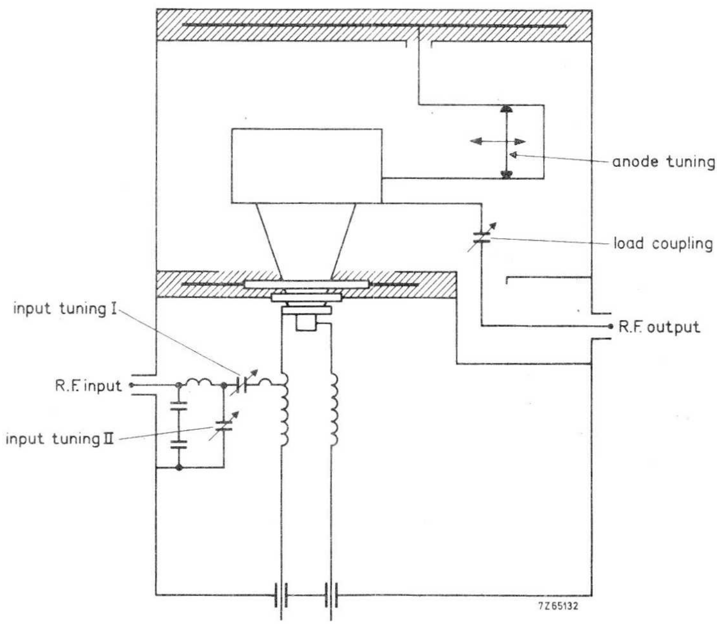
a) Delivered with assembly

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	----

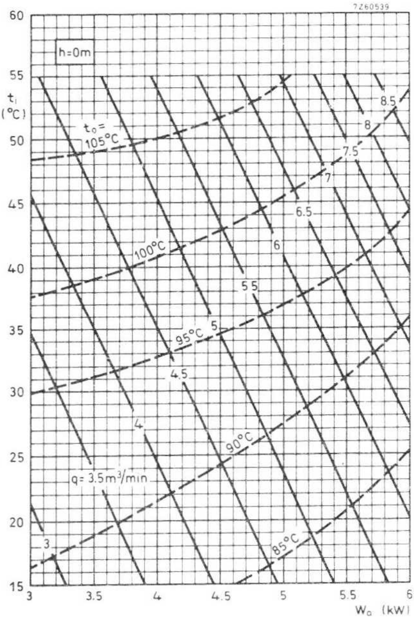
b) Not delivered with assembly

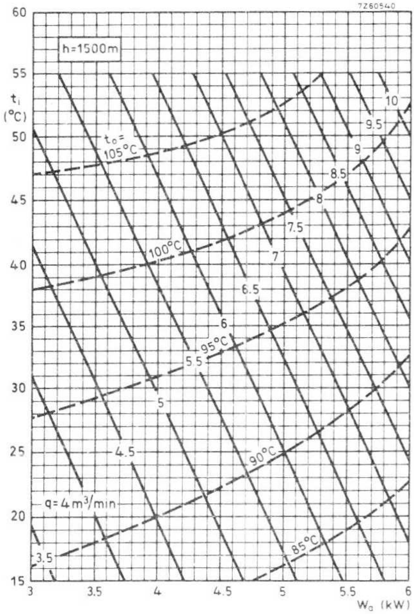
Anode coil covering frequency range 82 to 88 MHz	8222 032 11860

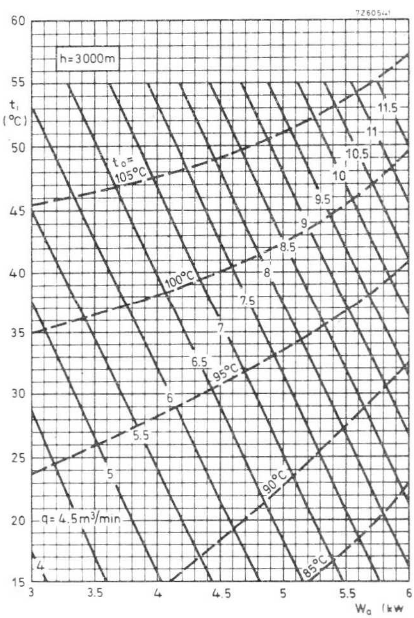
CIRCUIT DIAGRAM

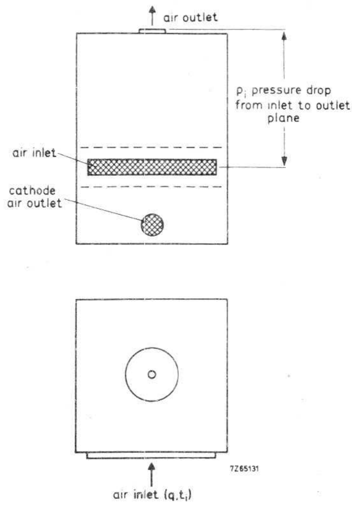


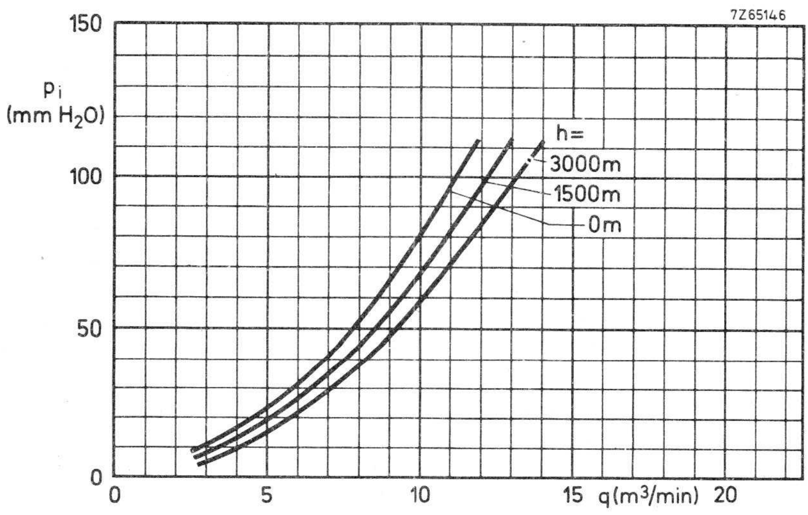
Cooling curves







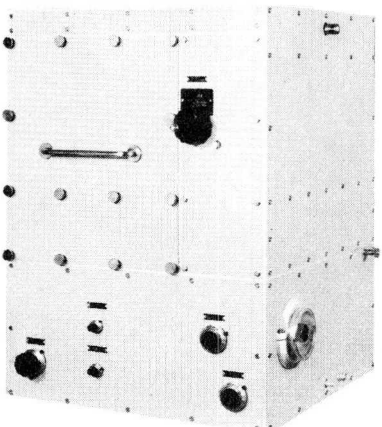

air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65146
150
p_i (mm H_2O)
100
50
0
h=
3000m
1500m
0m
0
5
10
15
q(m³/min)
20

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 OR YL1520

VISION

Amplifier circuit to be used with YL1430 or YL1520 to form a broad-band grounded grid linear amplifier for television signals in Band I.



RZ 29794-2

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)

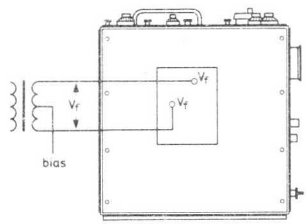
For detailed operating conditions reference is made to the data sheets for tube type YL1430 or YL1520.

MECHANICAL DATA

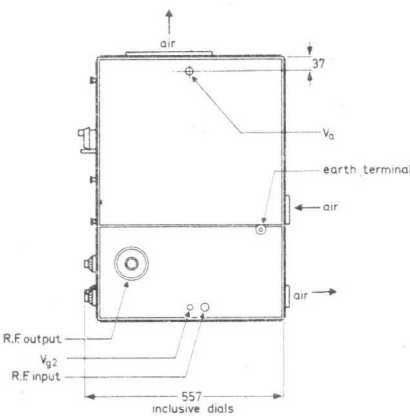
Dimensions in mm

Dimensions: approx. 700 x 500 x 500 mm^3

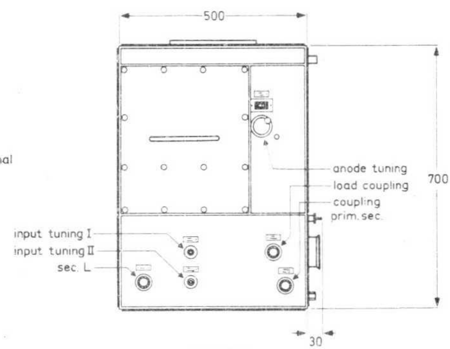
Net weight : approx. 70 kg



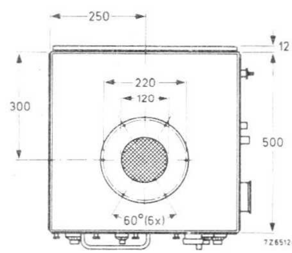
bottom view



right hand side view

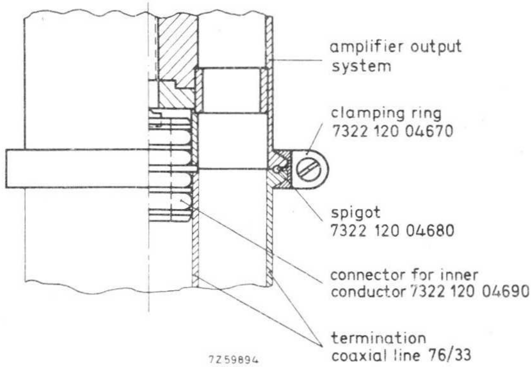


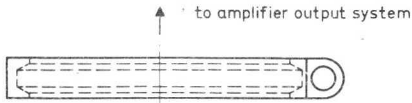
front view



top view

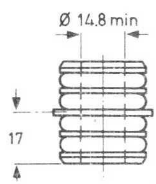
Output connector



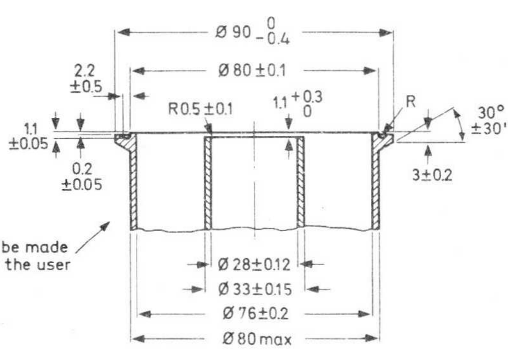


clamping ring 7322 120 04670

spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curve.
Direction of air flow: see page 8.

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

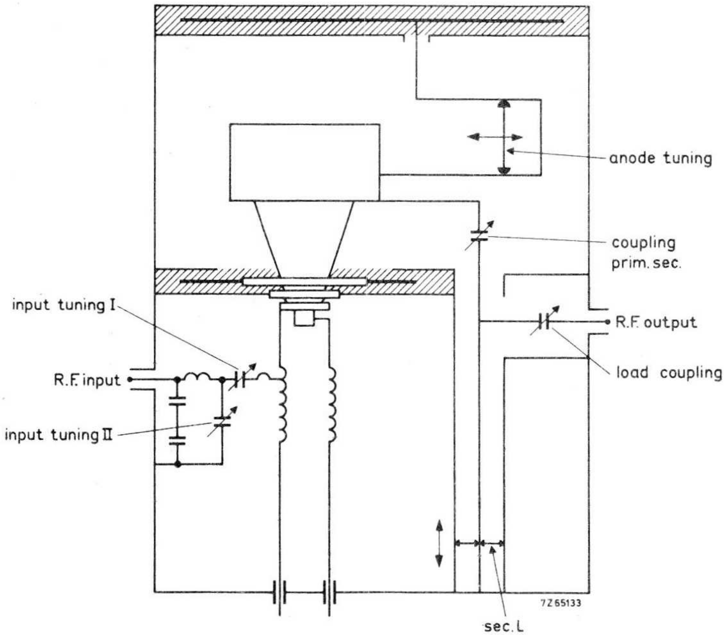
Tube extractor	7322 120 07850	
Mating male input connector	Radiall type N	
Output connector		
connector for inner conductor	7322 120 04690	
spigot for outer conductor	7322 120 04680	
clamping ring for outer conductor	7322 120 04670	
Mating connector for anode voltage	Radiall type R13060	
Mating connector for screen grid voltage	Radiall type R9510	
Anode coil covering frequency range 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

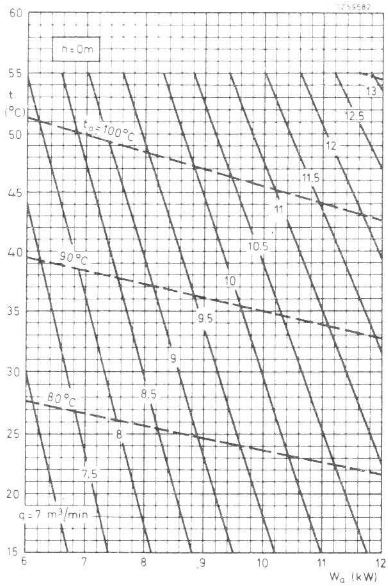
Anode coil covering frequency range 77.25 to 83.25 MHz for YL1430 and 67.25 to 83.25 MHz for YL1520	8222 032 11860	[1])
Elbow for secondary circuit covering frequency range 77.25 to 83.25 MHz for both types	8222 032 11790	

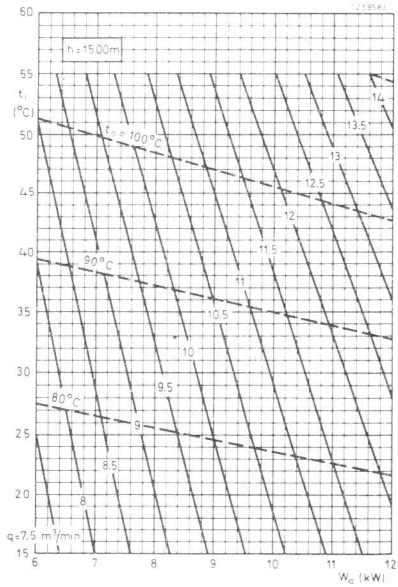
1) For use on carrier frequencies other than specified please contact the manufacturer.

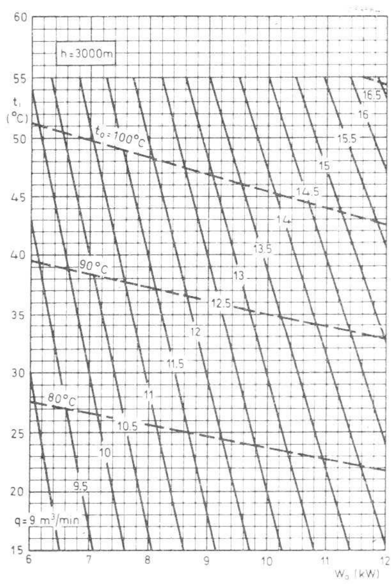
CIRCUIT DIAGRAM



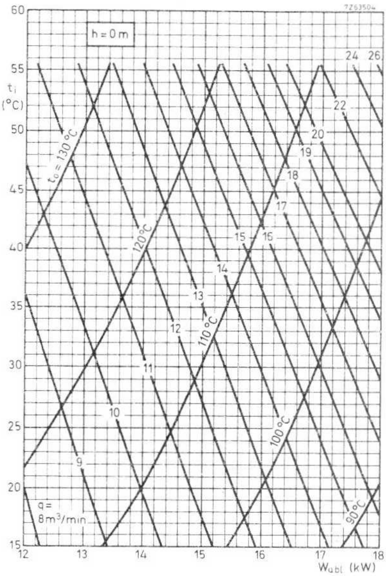
Cooling curves for amplifier 40759 fitted with tube YL1430

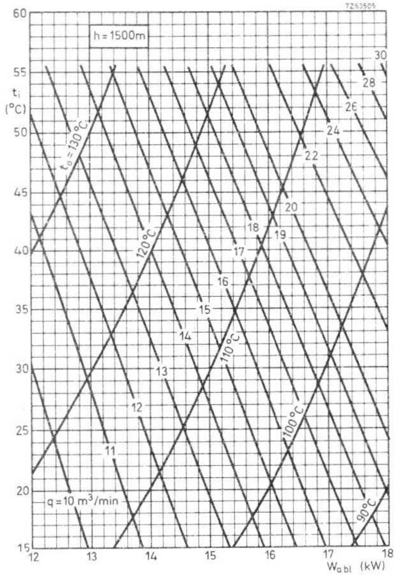


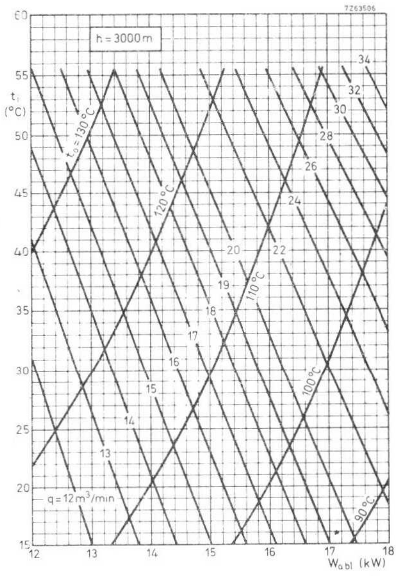


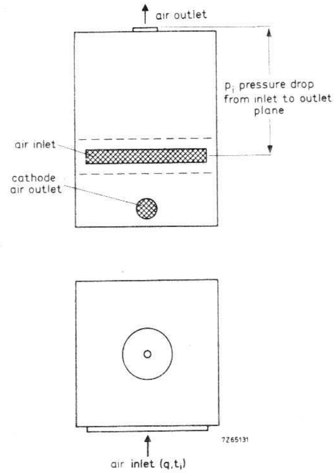


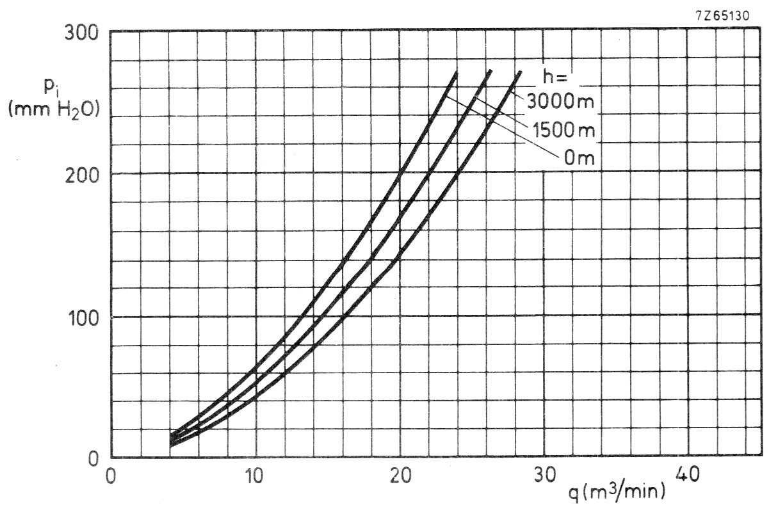
Cooling curves for amplifier 40759 fitted with tube YL1520





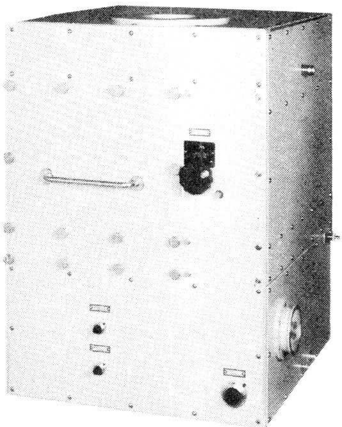



air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65130
p_i (mm H_2O)
300
200
100
0
0
10
20
30
40
q (m^3/min)
h=
3000 m
1500 m
0 m

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 OR YL1520 SOUND

Amplifier circuit assembly to be used with YL1430 or YL1520 to form a grounded-grid amplifier of frequency modulated signals in Band I.


RZ 30263-3

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)

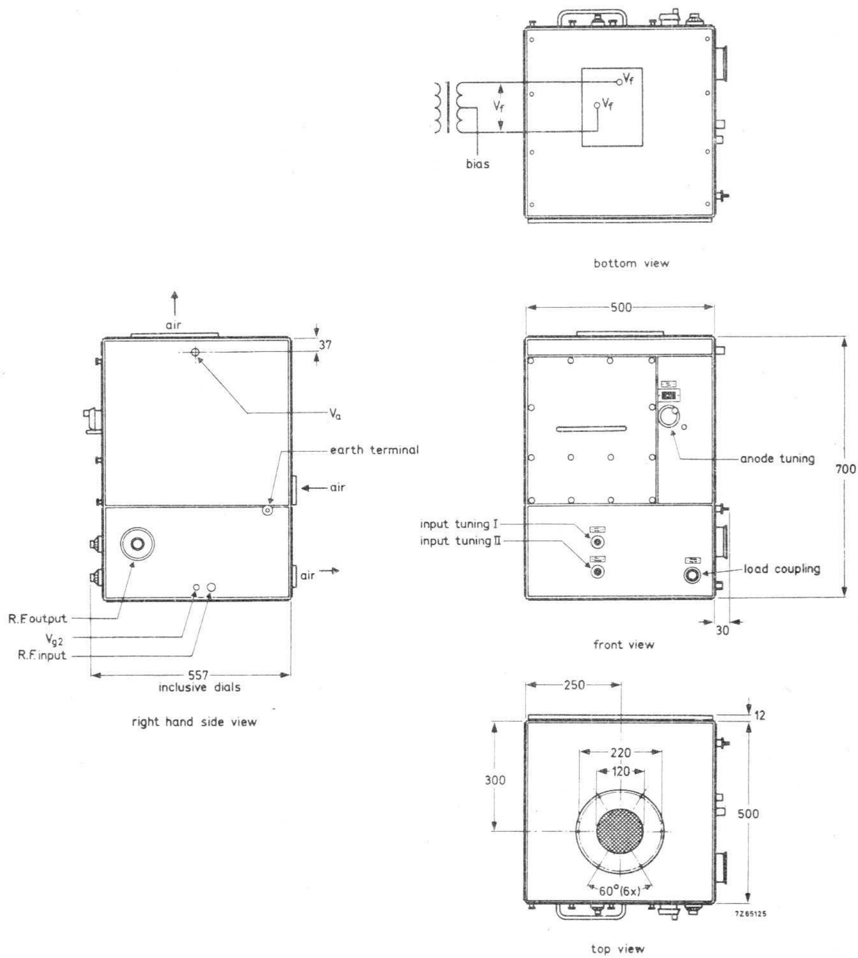
For detailed operating conditions reference is made to the data sheets for tube type YL1430 and YL1520.

MECHANICAL DATA

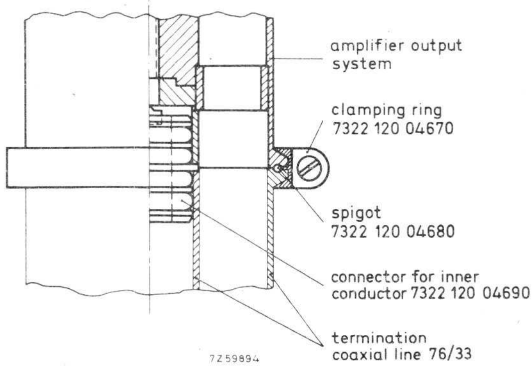
Dimensions in mm

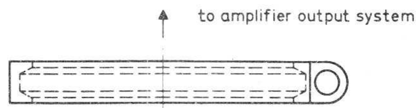
Dimensions in : approx. 700 x 500 x 500 mm^3

Net weight : approx. 58 kg

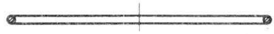


Output connector

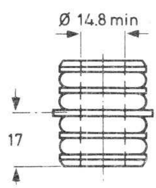




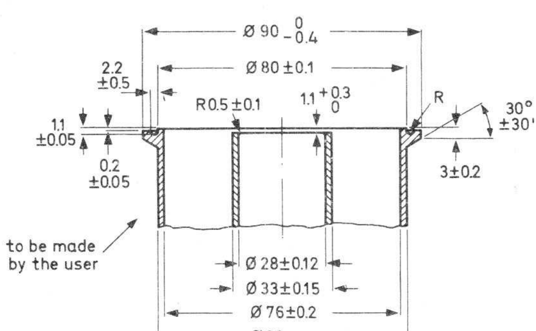
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of air flow: see page 8.

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

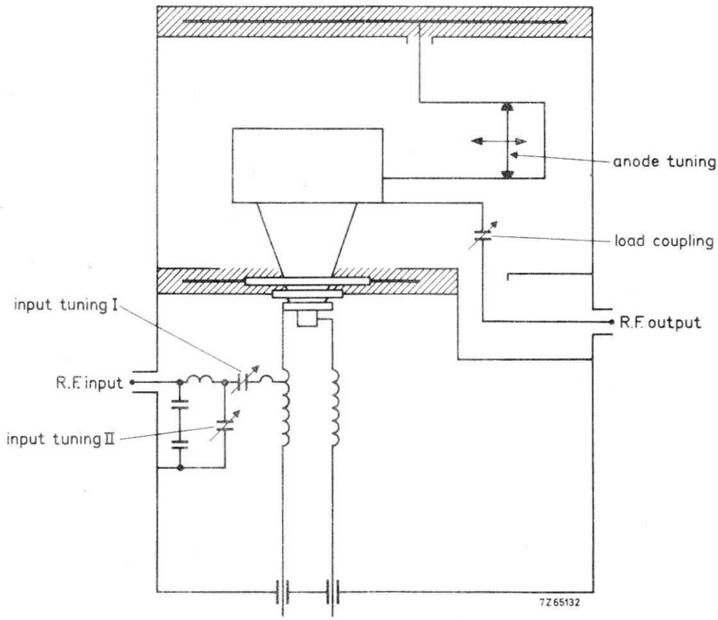
a) Delivered with assembly

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 for YL1430 and 53 to 66 MHz for YL1520	---

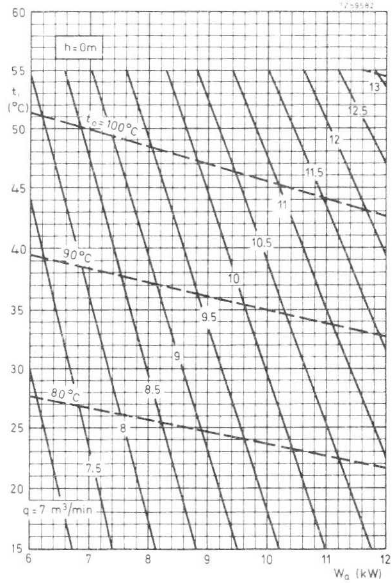
b) Not delivered with assembly

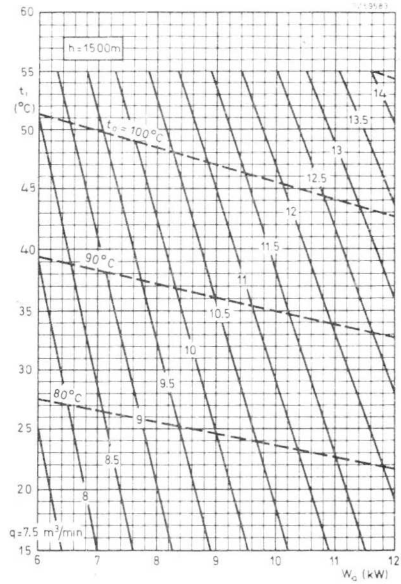
Anode coil covering frequency range 82 to 88 MHz for YL1430 and 70 to 88 MHz for YL1520	8222 032 11860
Shorting bar to use in addition with coils, for highest channel for YL1520	8222 032 57110

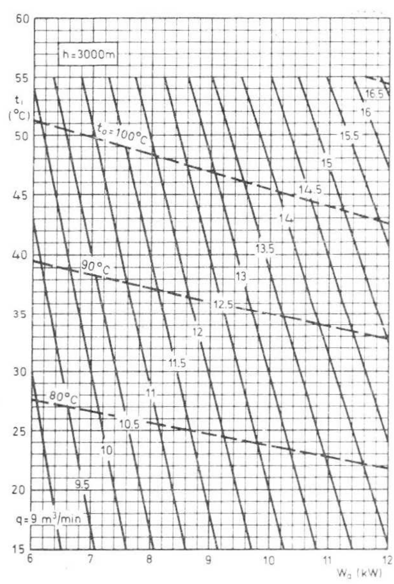
CIRCUIT DIAGRAM



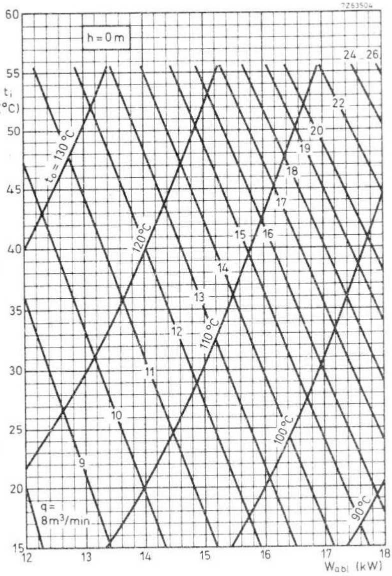
Cooling curves for amplifier 40760 fitted with tube YL1430

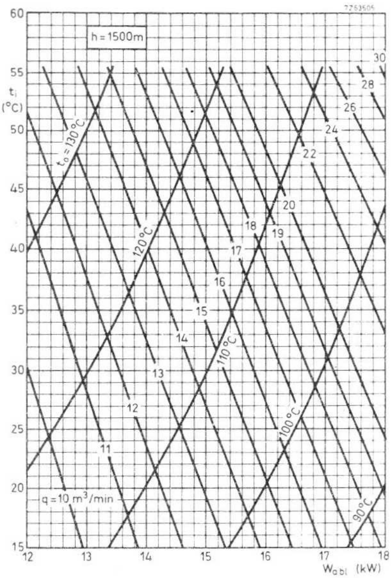


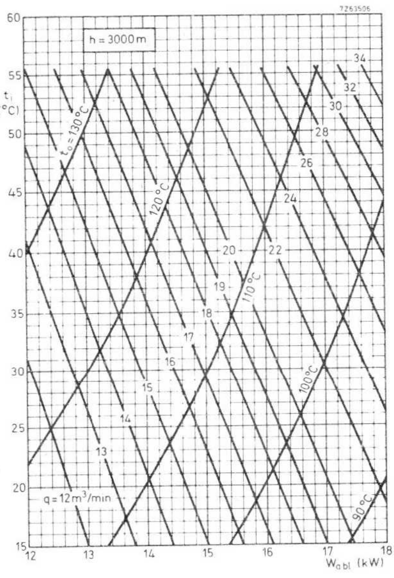


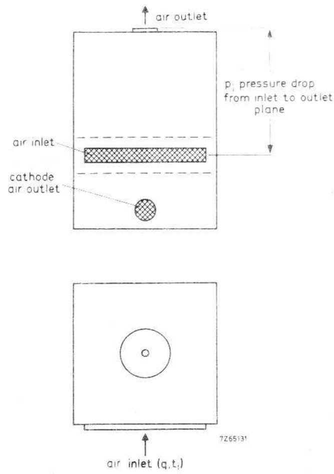


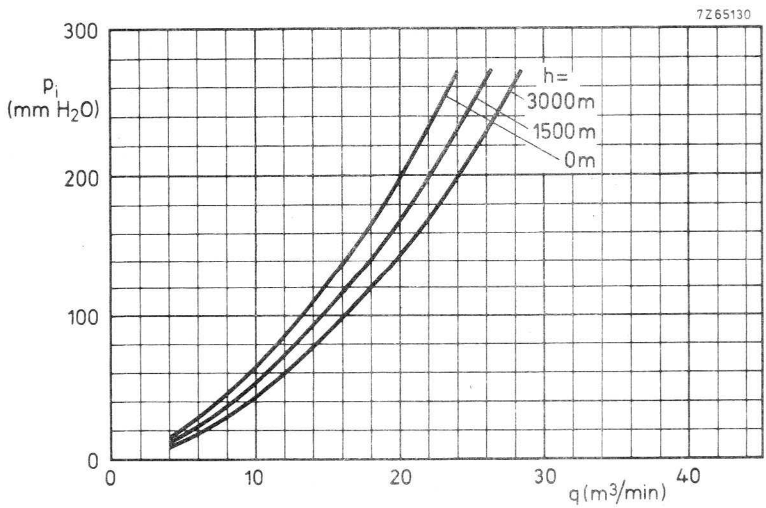
Cooling curves for amplifier 40760 fitted with tube YL1520








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
0
10
20
30
40
q (m^3/min)
h=
3000 m
1500 m
0 m

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1520*)
VISION AND COMBINED SOUND AND VISION

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.

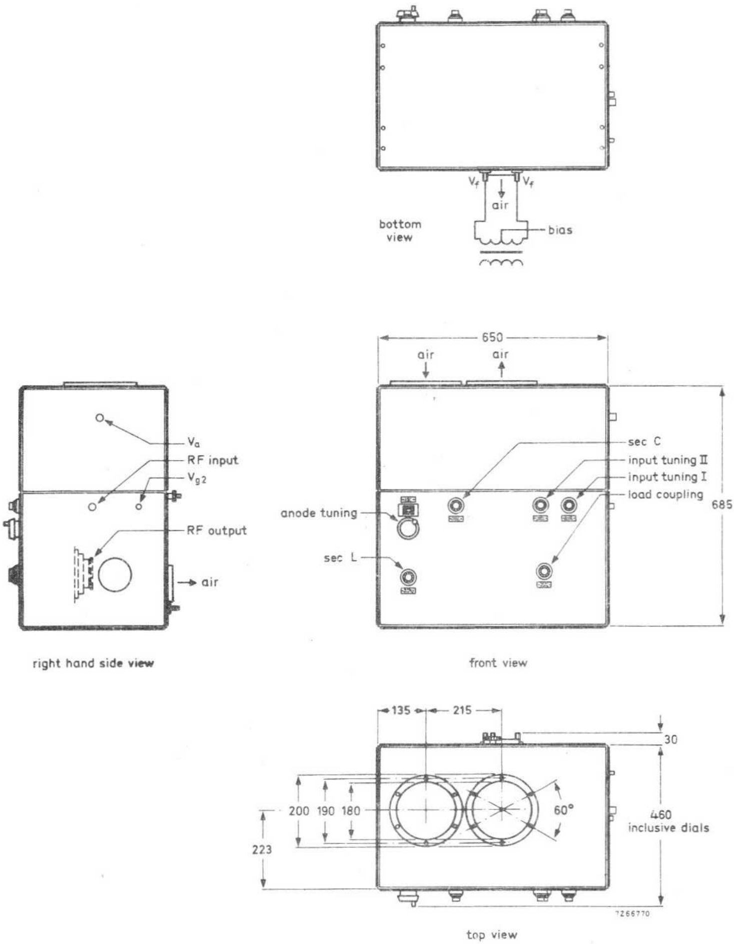
*) Slight modifications make this cavity usable for YL1430 in the range 205 to 260 MHz.

MECHANICAL DATA

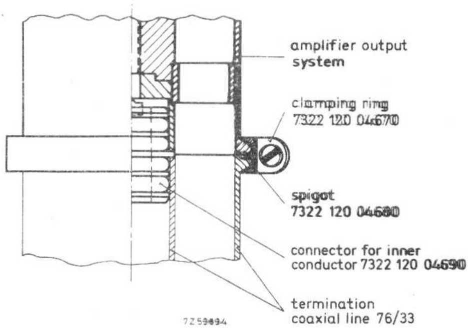
Dimensions in mm

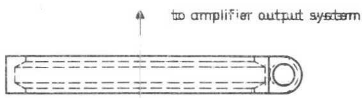
Dimensions: approx. 685 x 415 mm^3

Net weight: approx. 85 kg



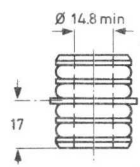
Output connector



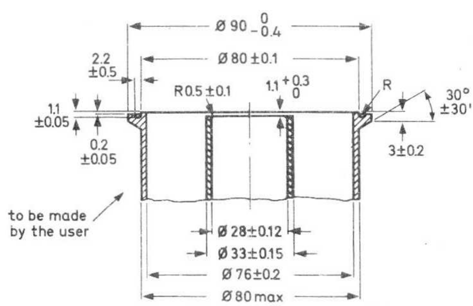


clamping ring 7322 120 04670

spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type HN)

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

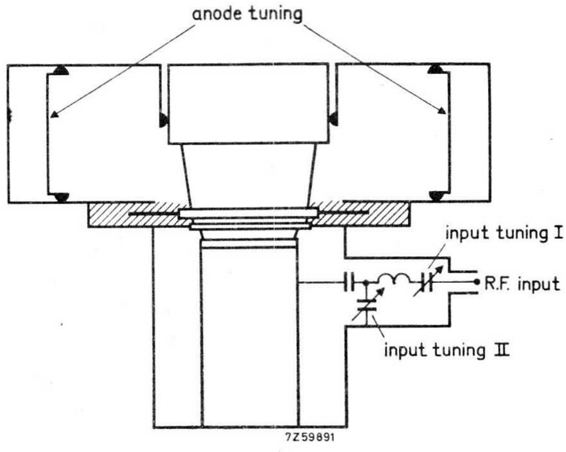
a) Delivered with the assembly

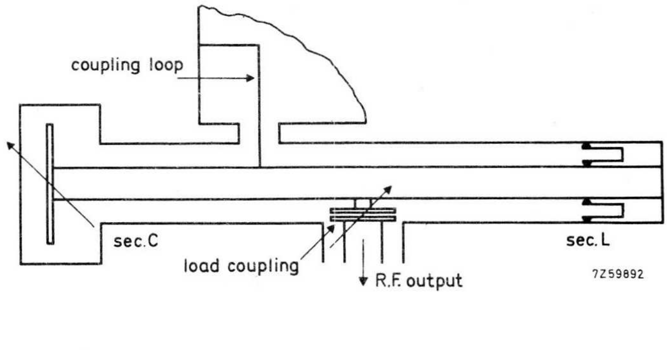
Tube extractor	7322 120 07850
Mating male input connector	Radiall type HN R7050
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175,25 MHz	7322 120 04730

b) Recommended

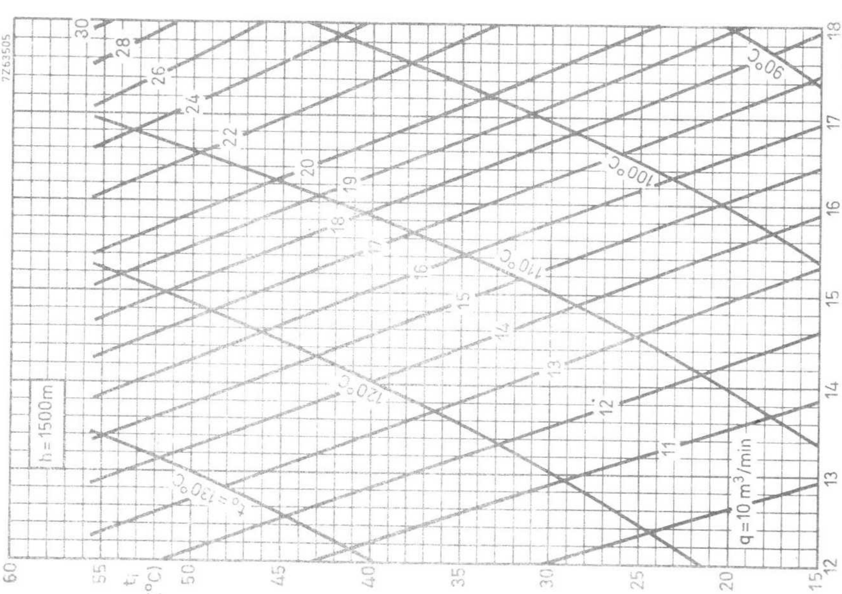
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

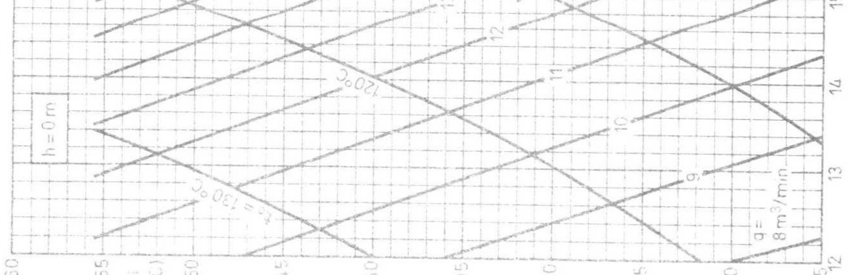
CIRCUIT DIAGRAM

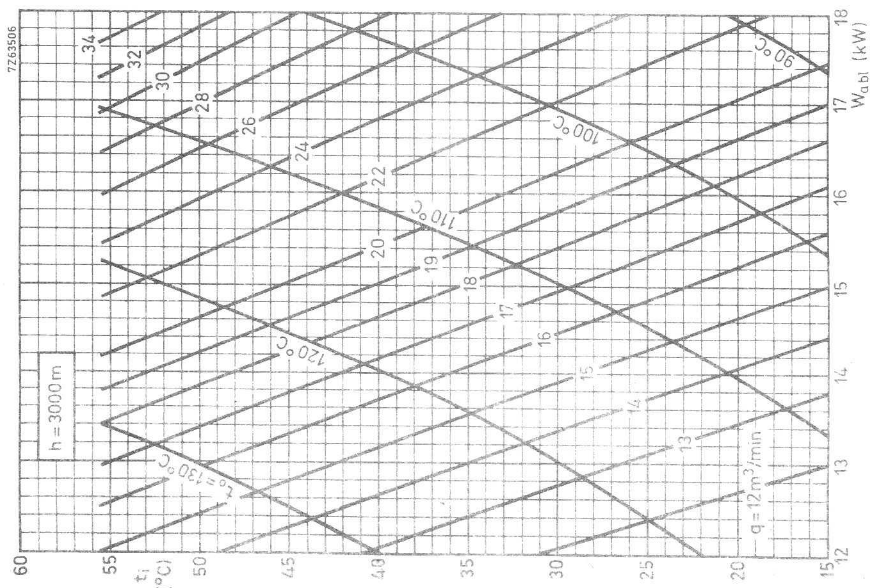




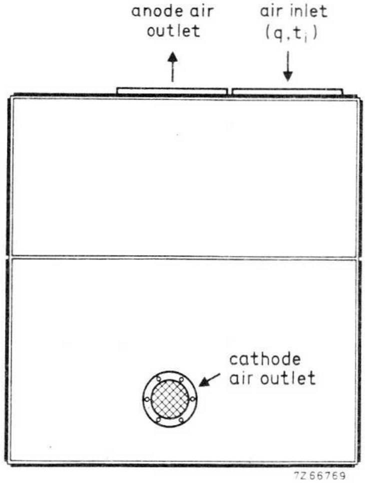
Cooling curves



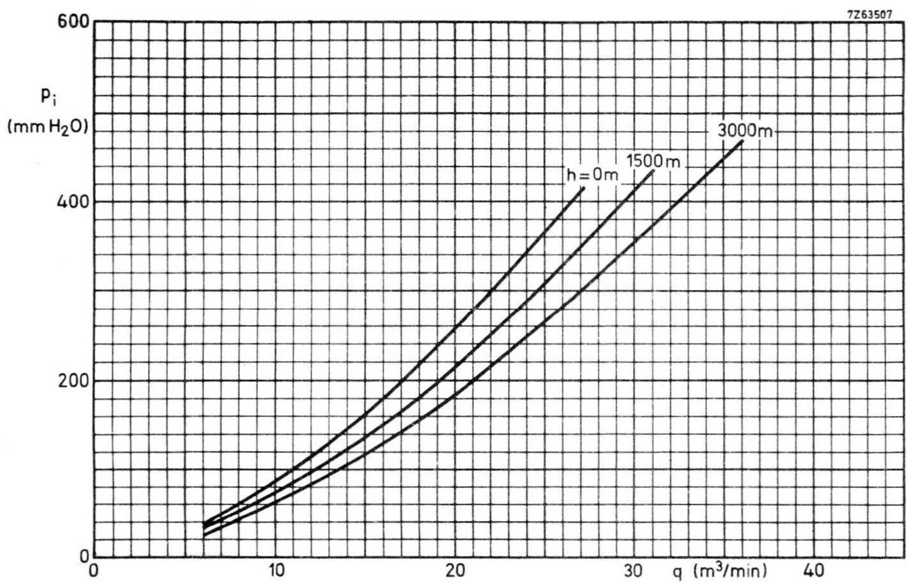




Cooling curves



anode air outlet
air inlet (q, t_i)
cathode air outlet
7Z66769



7Z63507
600
p_i
(mm H_2O)
400
200
0
3000m
1500m
h = 0m
0
10
20
30
q (m^3/min)
40

BAND II AMPLIFIER CIRCUIT ASSEMBLY FOR YL1470

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	22

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 5. 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

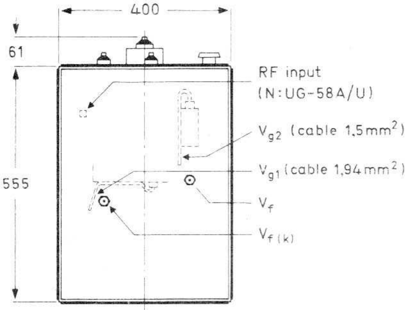
Input : max. permissible 1,3 for acceptable performance
Output: max. permissible 1,3 for acceptable performance

MECHANICAL DATA

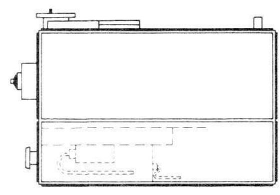
Dimensions in mm

Dimensions: approx. 400 x 380 x 615 mm

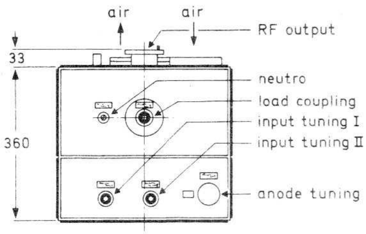
Net mass : approx. 54 kg

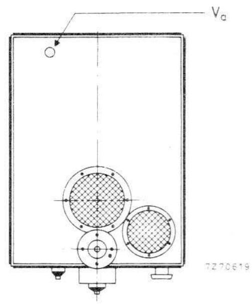


bottom view



right-hand side view





top view

ENVIRONMENTAL DATA

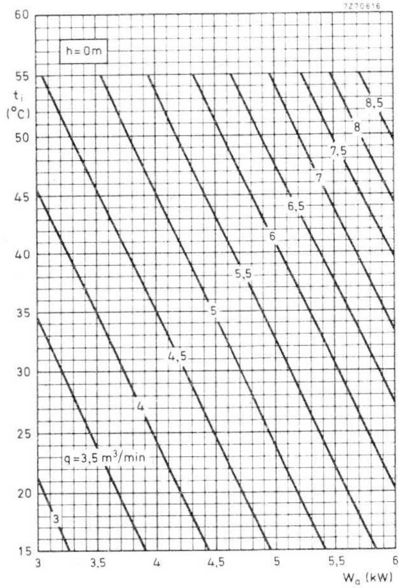
Ambient temperature:	0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90%

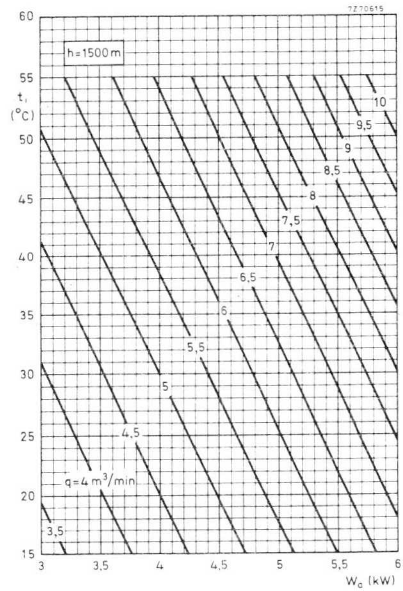
ADDITIONAL COMPONENTS

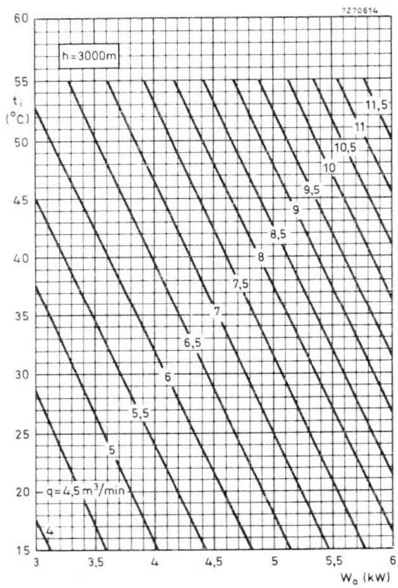
Supplied with the assembly

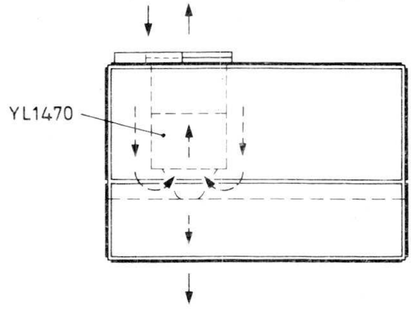
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating connector for anode voltage	Radiall type R 13060

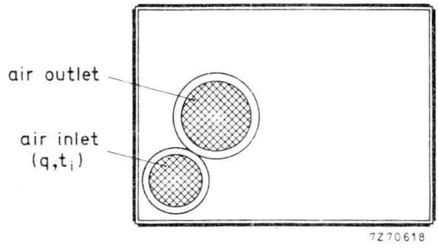
Cooling curves

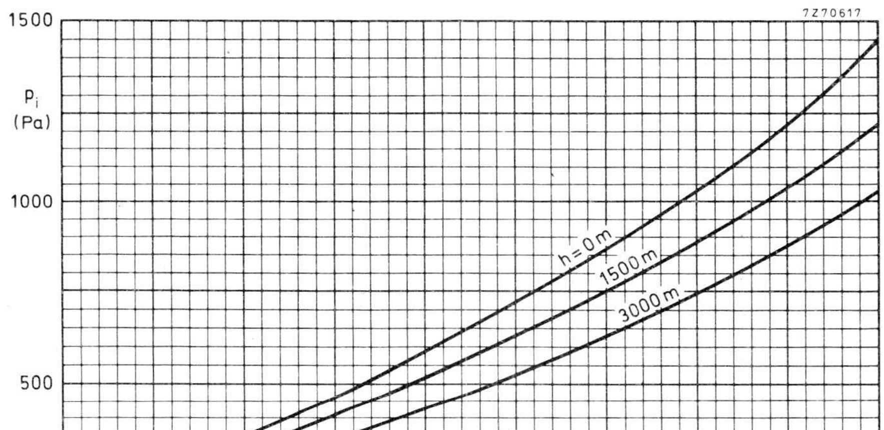






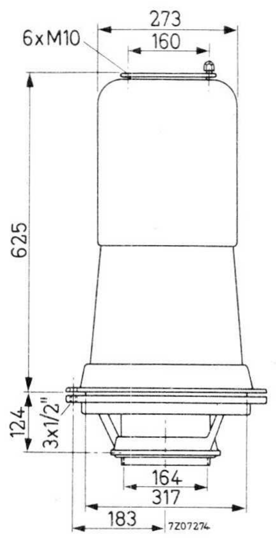

YL1470


air outlet
air inlet
(q,t_i)
7Z70618

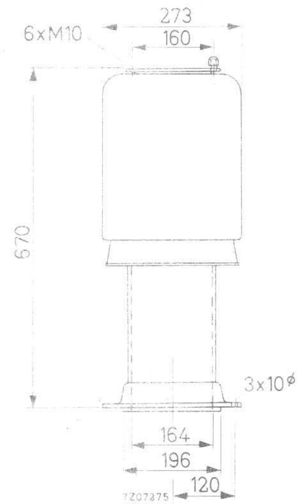

7Z70617
1500
p_i
(Pa)
1000
500
0
4
6
8
10
q (m³/min)
12
h = 0 m
1500 m
3000 m

Associated accessories

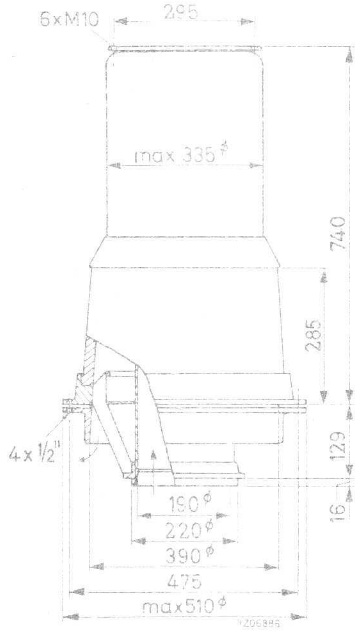
COOLER HOUSING FOR AIR COOLING



COOLER HOUSING FOR AIR COOLING

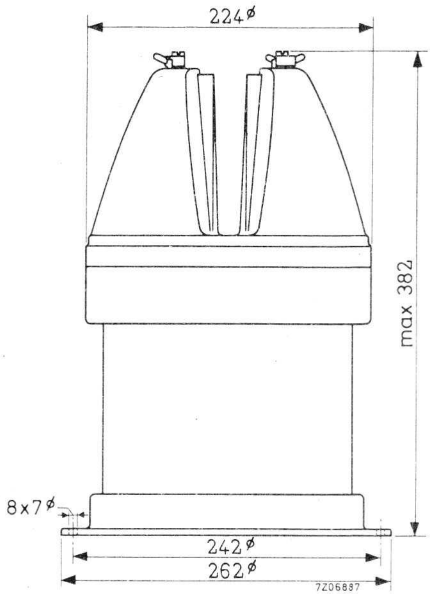


COOLER HOUSING FOR AIR COOLING



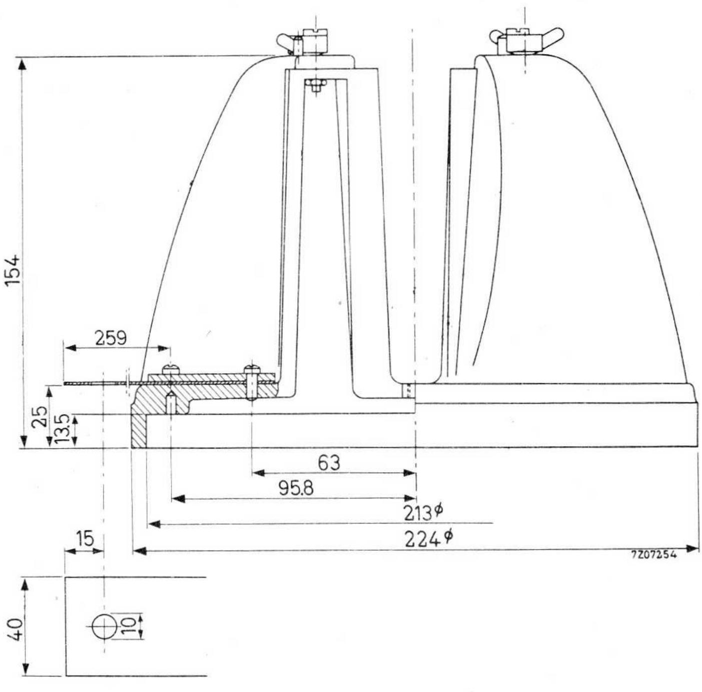
Net weight 72 kg

COOLER HOUSING FOR AIR COOLING

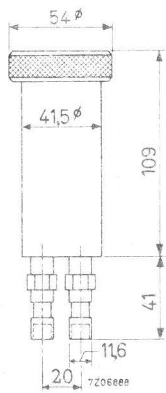


Net weight 7.4 kg

AIR DISTRIBUTOR
UPPER PART OF K508

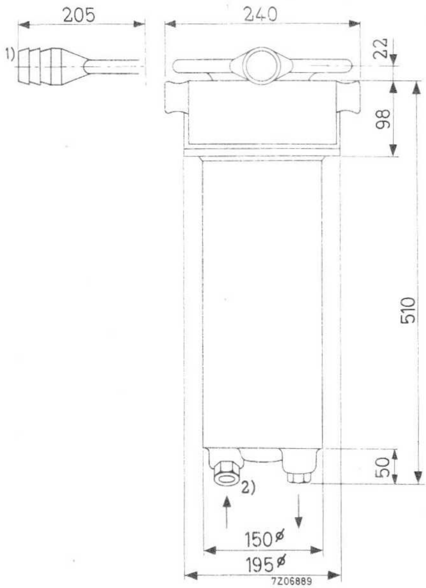


WATER JACKET



Net mass	0,52	kg
Absolute max. water pressure	6×10^5 Pa ($\approx$ 6 at)	

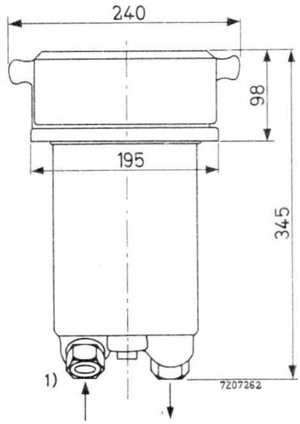
WATER JACKET



1) Use connecting hose with an inner diameter of 1 3/4"
2) Coupling for metal tubing with an outer diameter of 28mm

Net weight	20,5	kg
Absolute max. water pressure	6×10^5 Pa = 6	atm abs

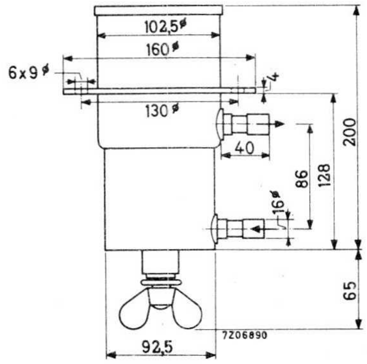
WATER JACKET



1) coupling for metal tubing with an outer diameter of 28mm

Net weight	16,7	kg
Absolute max. water pressure 6×10^5 Pa = 6		atm abs

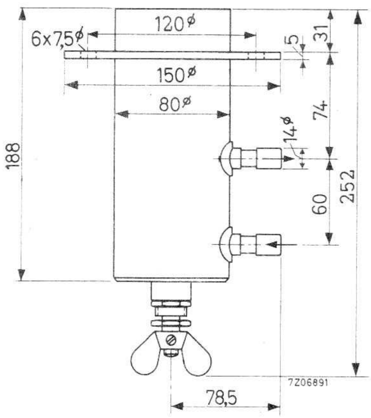
WATER JACKET



Net mass	2,6	kg
Absolute max. water pressure	6×10^5 Pa ≈ 6 at	

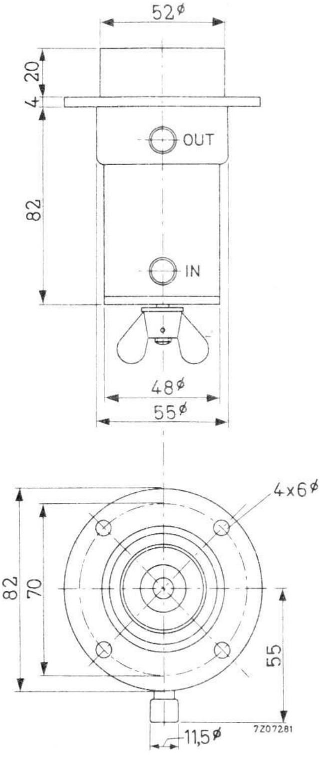
←

WATER JACKET



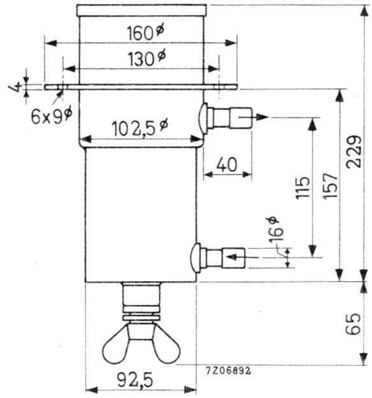
Net weight	2, 2	kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs	

WATER JACKET



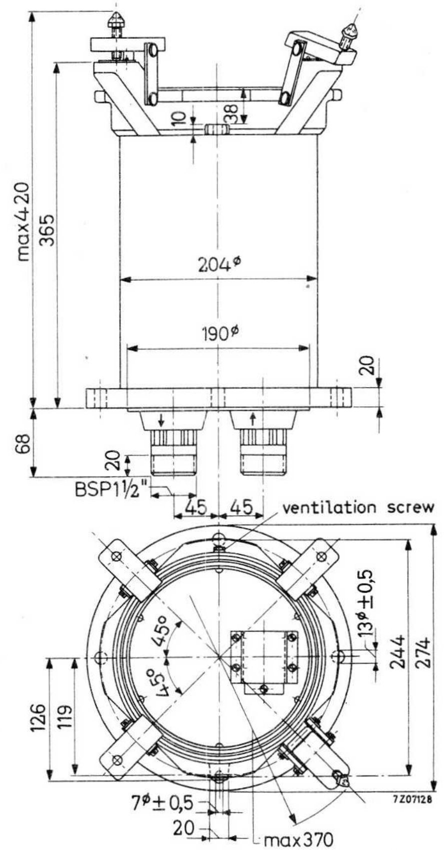
Net weight	0, 76	kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs	

WATER JACKET



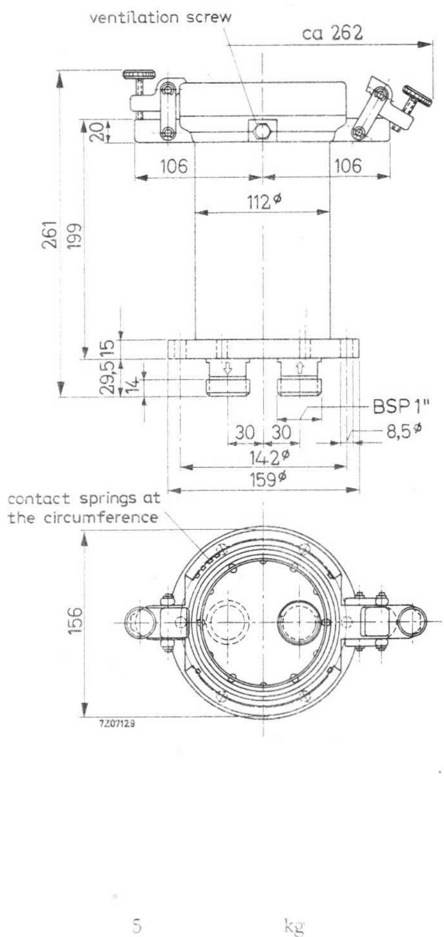
Net weight	2,7	kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs	

WATER JACKET



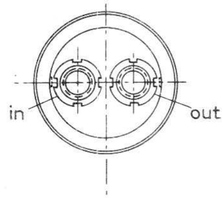
Net weight	30,5 kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs

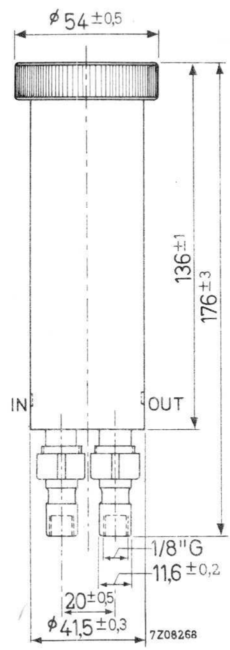
WATER JACKET



Net weight	5	kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs	

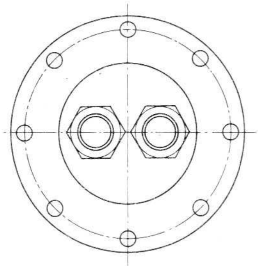
WATER JACKET

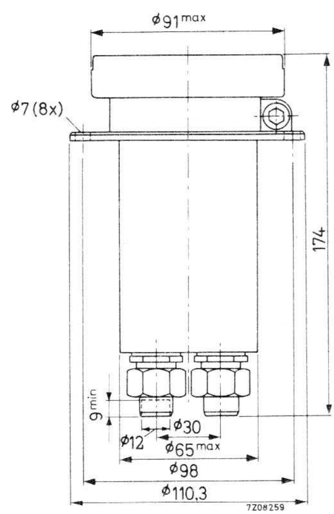




Net weight		kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs	

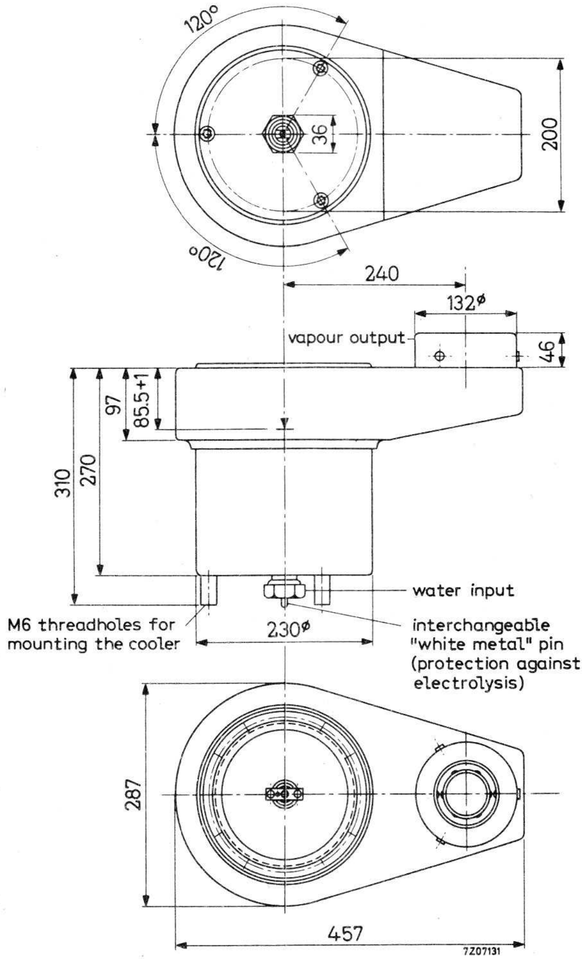
WATER JACKET





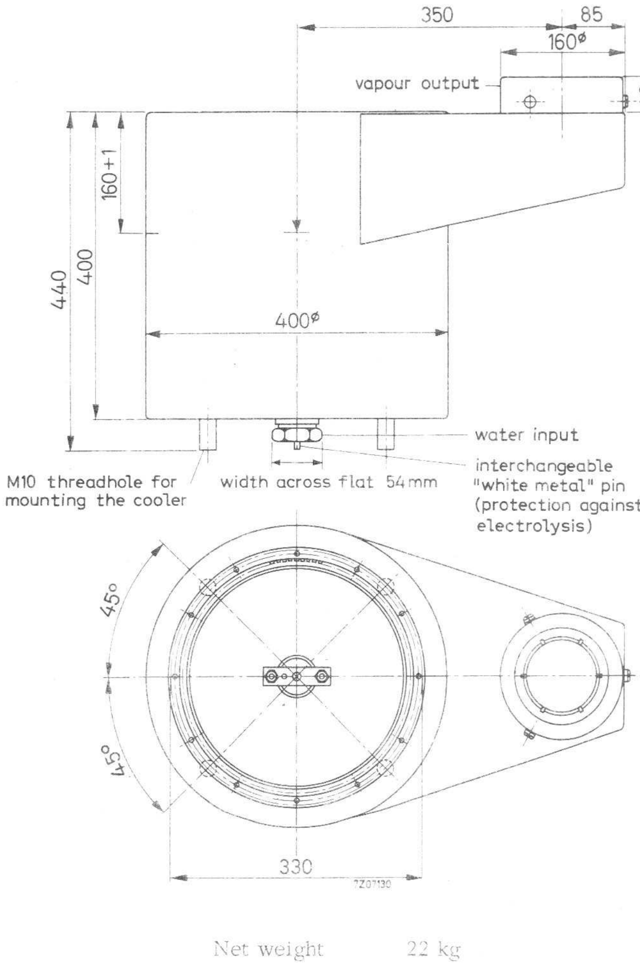
Net weight	2	kg
Absolute max. water pressure	6×10^5 Pa = 6 atm abs	

VAPOUR JACKET



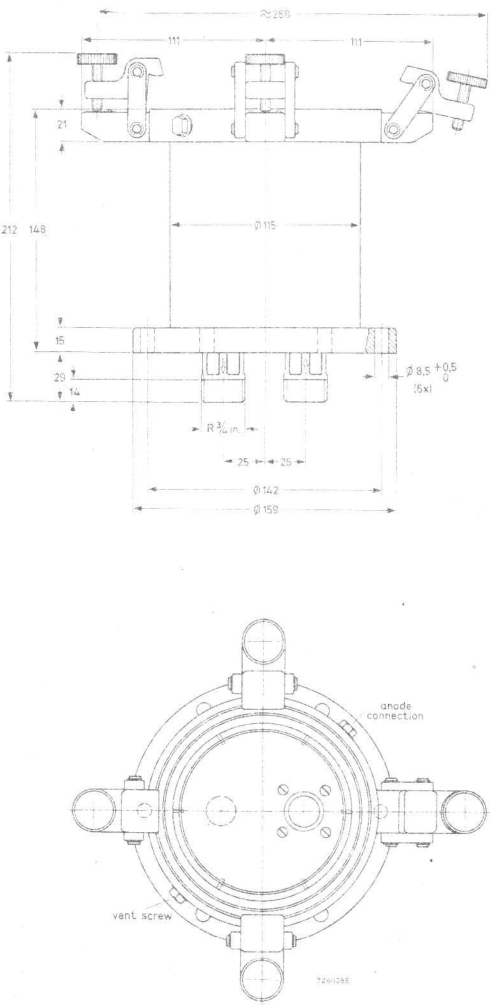
Net weight 8 kg

VAPOUR JACKET



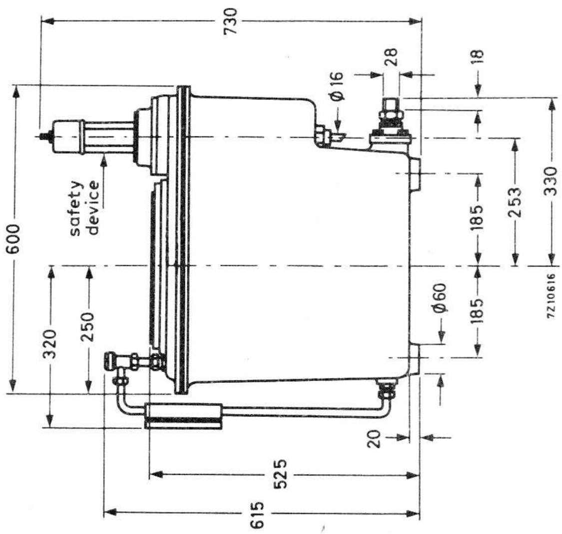
Net weight 22 kg

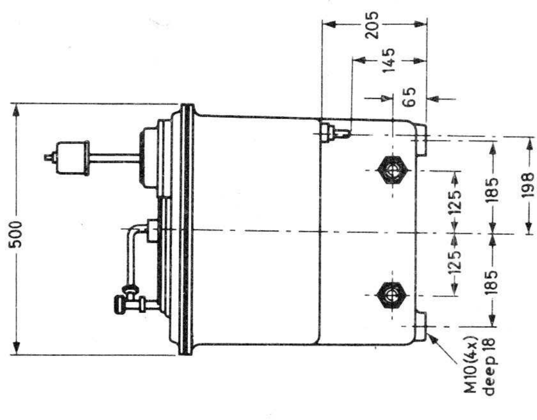
WATER JACKET



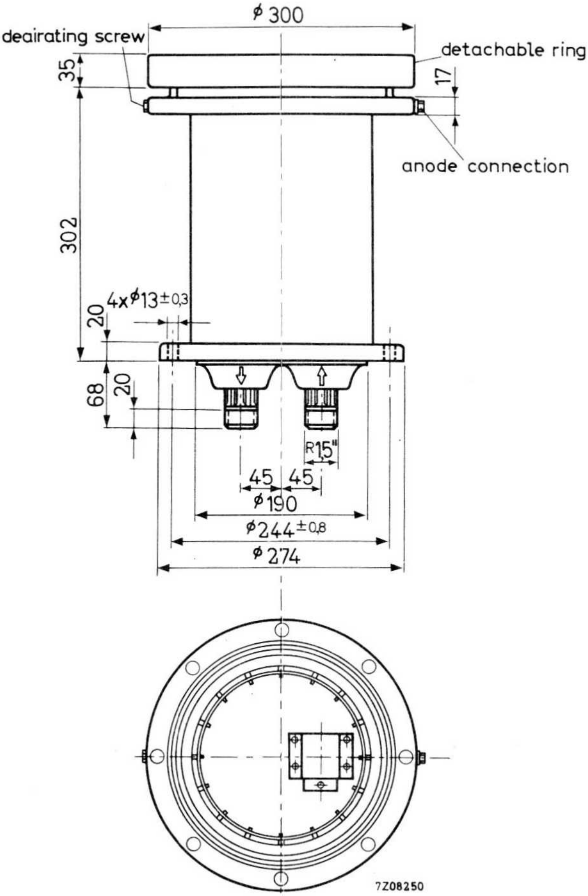
Net weight	6	kg
Absolute max. water pressure	$1,1 \times 10^6$ Pa = 10 atm abs	

BOILER—CONDENSOR





WATER JACKET

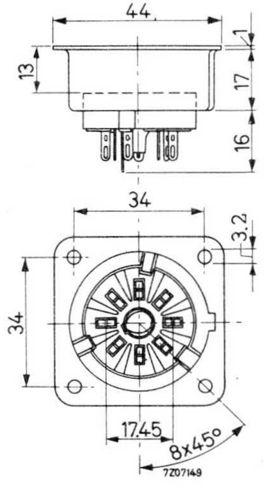


Net weight kg

Absolute max. water pressure 6×10^5 Pa = 6 atm abs

TUBE SOCKET

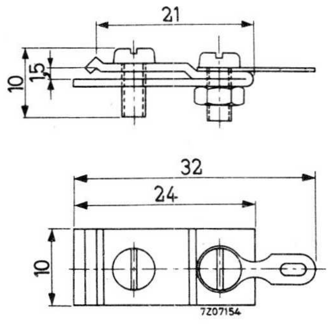
WITH 8 SPRING CONTACTS AND CENTRAL LOCATING
AND LOCKING DEVICE



Chassis hole 42 mm

ANODE CONNECTOR

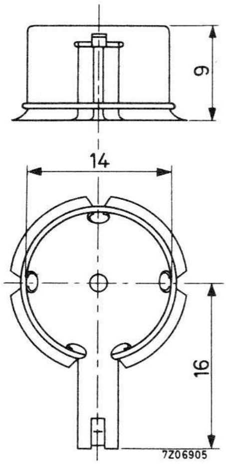
FOR 1,5 mm Ø TERMINALS



Material: brass, silver plated

TOP CAP CONNECTOR

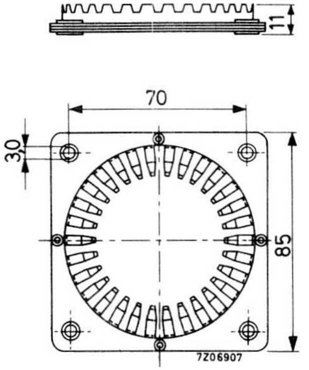
FOR TOP CAPS WITH 14.38 mm Ø (IEC 67-III-1b, type 3).



Material: brass, nickel plated

GRID CONNECTOR

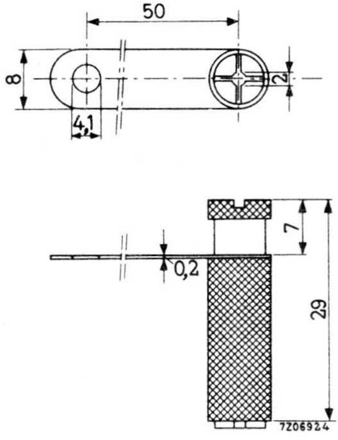
FOR 70 mm Ø TERMINALS



Material: brass, silver plated

ANODE CONNECTOR

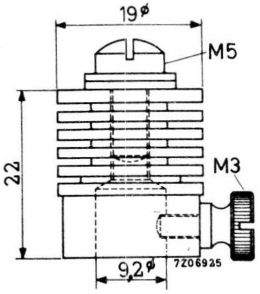
FOR 2 mm Ø TERMINALS



Material: brass, silver plated

ANODE CONNECTOR

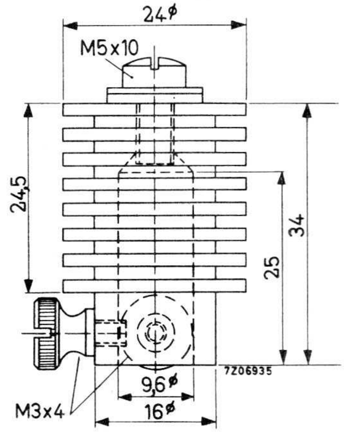
FOR 9 mm Ø TERMINALS



Material: brass, nickel plated

ANODE CONNECTOR

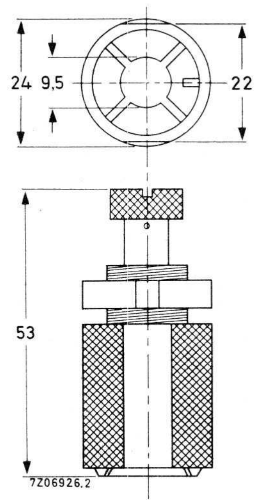
FOR 9,5 mm ∅ TERMINALS



Material: brass, nickel plated

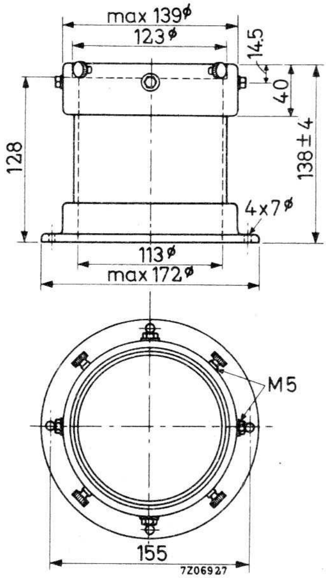
FILAMENT CONNECTOR

FOR 9,5 mm Ø TERMINALS



Material: brass, silver plated

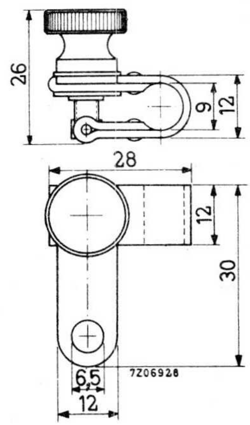
INSULATING PEDESTAL



Material: ceramic
Net weight: 2.1 kg

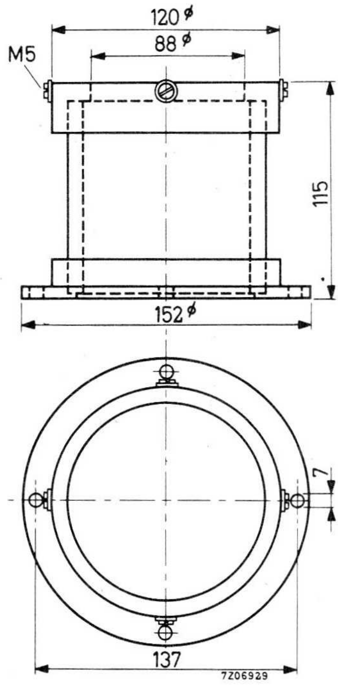
FILAMENT CONNECTOR

FOR 9,1 mm Ø TERMINALS



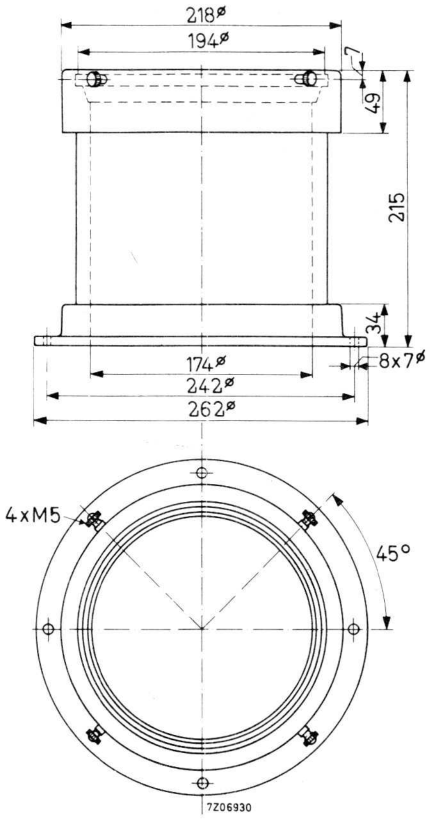
Material: Brass, nickel plated

INSULATING PEDESTAL



Material: ceramic
Net weight: 1.6 kg

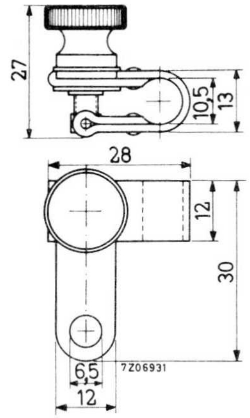
INSULATING PEDESTAL



Material: ceramic

FILAMENT CONNECTOR

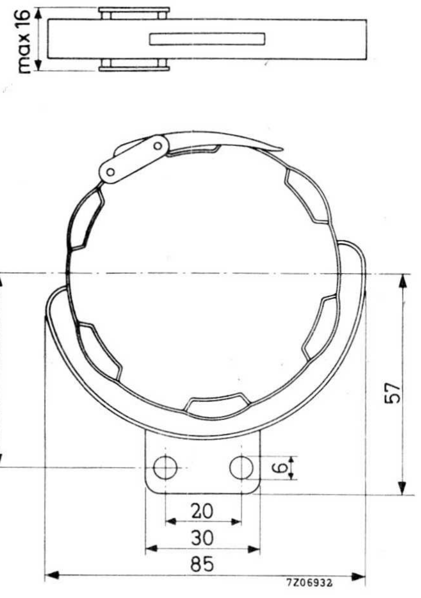
FOR 10,5 mm Ø TERMINALS



Material: brass, nickel plated

GRID CONNECTOR

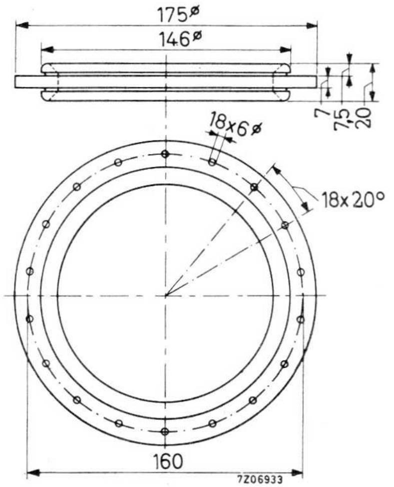
FOR 70 mm Ø TERMINALS



Material: brass, nickel plated

GRID AND ANODE CONNECTOR

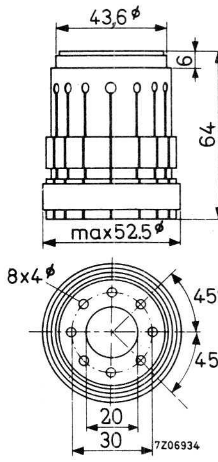
FOR 127 mm Ø TERMINALS



Material: brass, silver plated

FILAMENT CONNECTOR

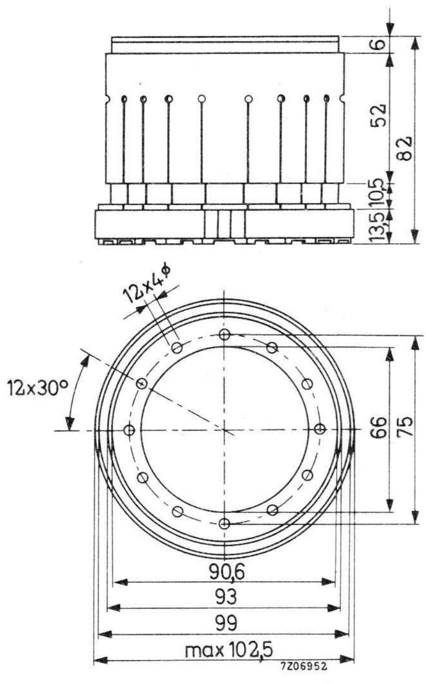
FOR 40, 5 mm Ø TERMINALS



Material: brass, silver plated

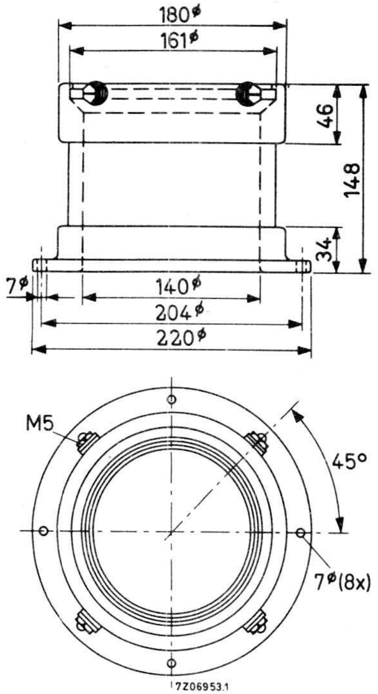
FILAMENT CONNECTOR

FOR 82 mm Ø TERMINALS



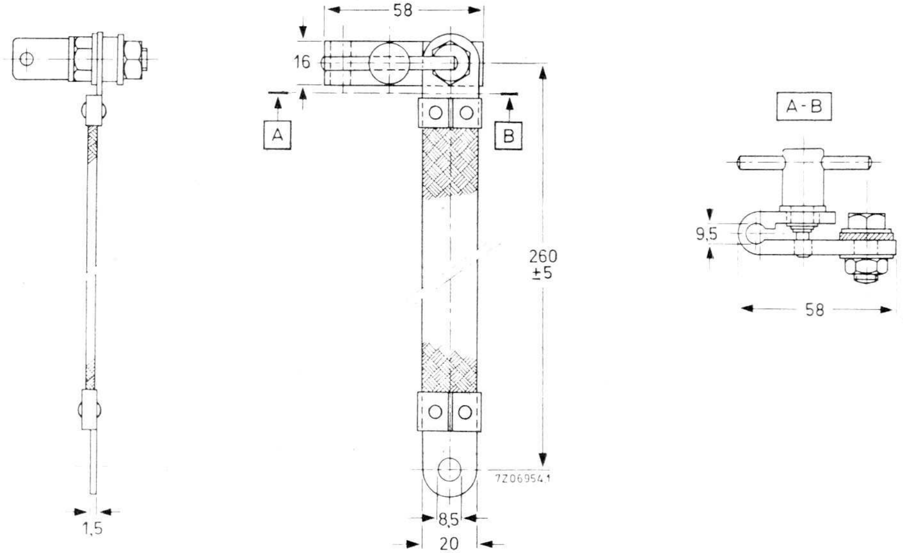
Material: brass, silver plated

INSULATING PEDESTAL



Material: ceramic
Net weight: 4.25 kg

FILAMENT CONNECTOR WITH CABLE

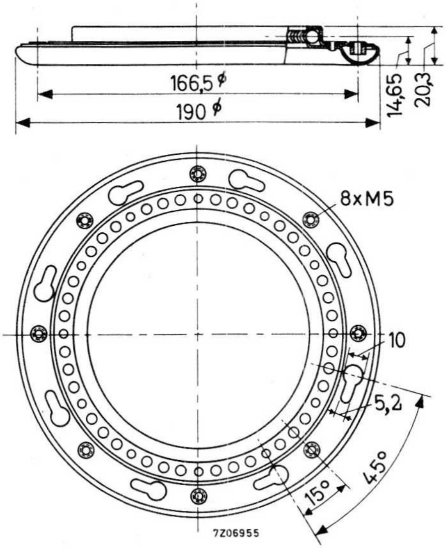


Material: cable - braided copper

connector - brass, nickel plated

GRID CONNECTOR

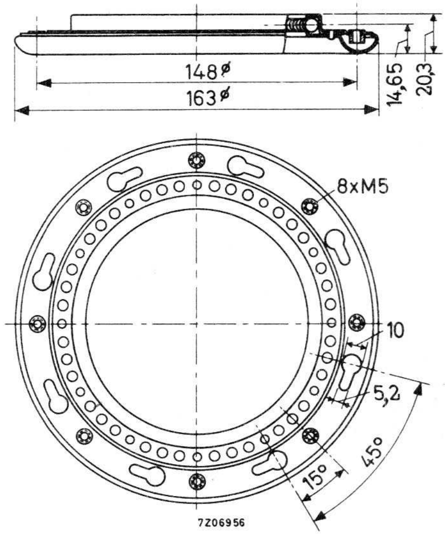
FOR 114 mm Ø TERMINALS



Material: brass, silver plated

GRID CONNECTOR

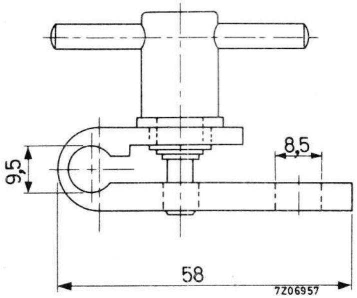
FOR 96 mm Ø TERMINALS



Material: brass, silver plated

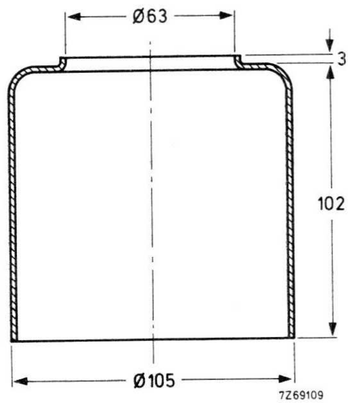
ANODE CONNECTOR

FOR 9,5 mm Ø TERMINALS



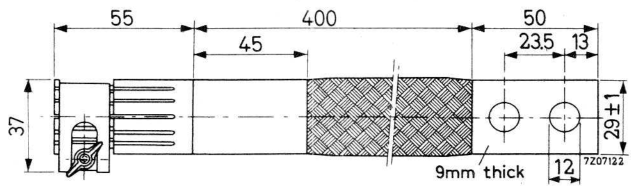
Material: brass, nickel plated

CHIMNEY

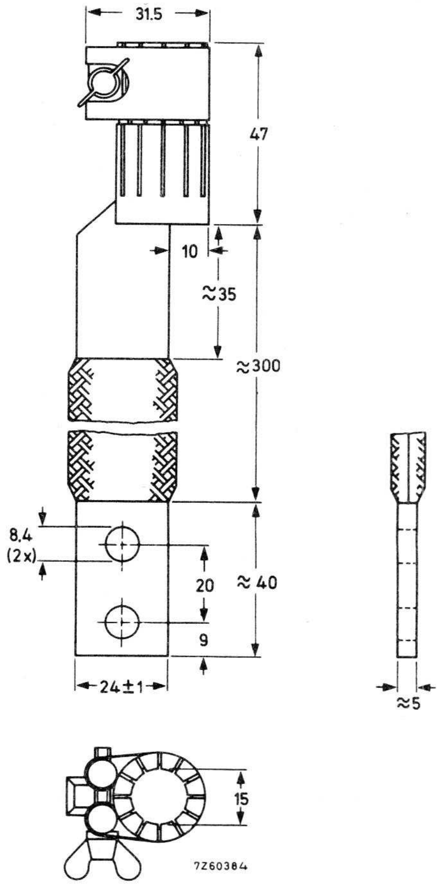


Material : glass

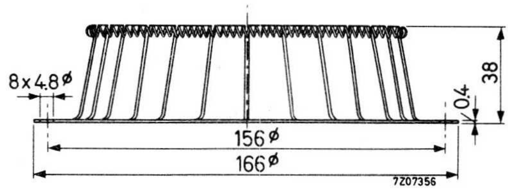
FILAMENT CONNECTOR WITH CABLE



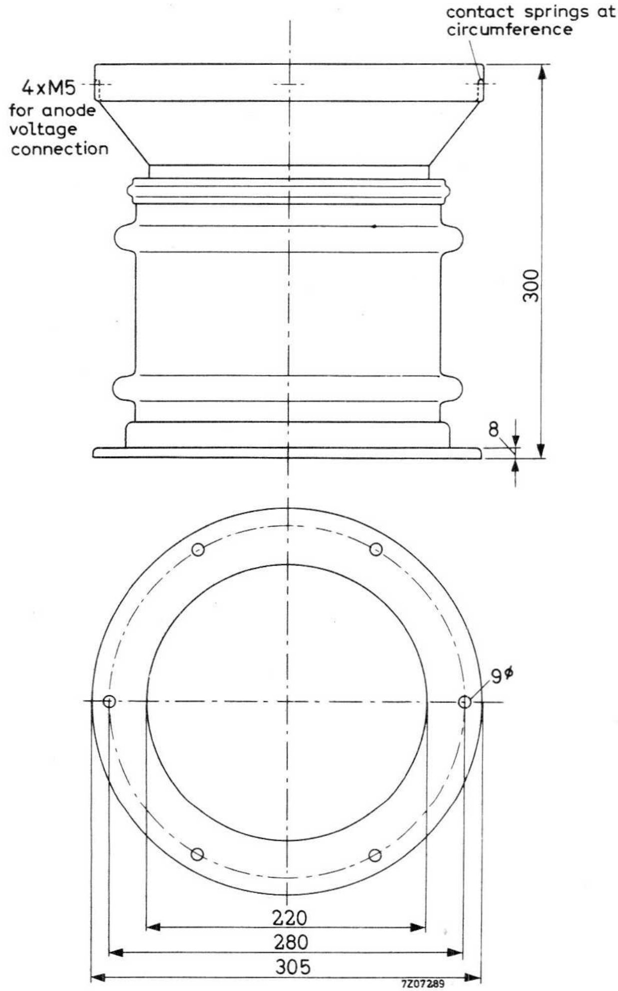
FILAMENT CONNECTOR WITH CABLE



GRID CONNECTOR

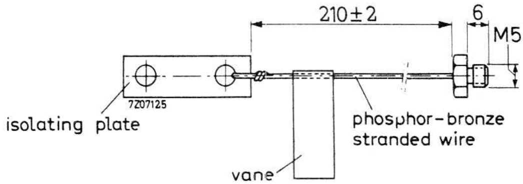


INSULATING PEDESTAL

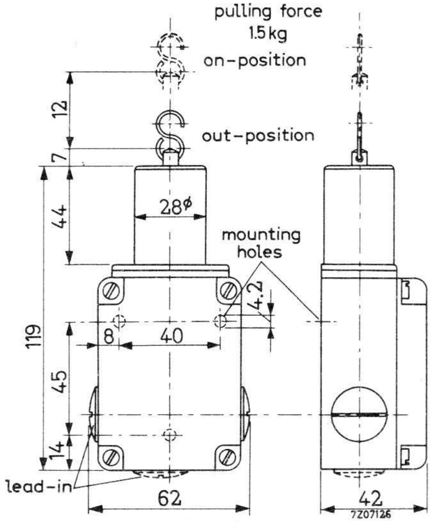


Net weight 9.2 kg

FUSE

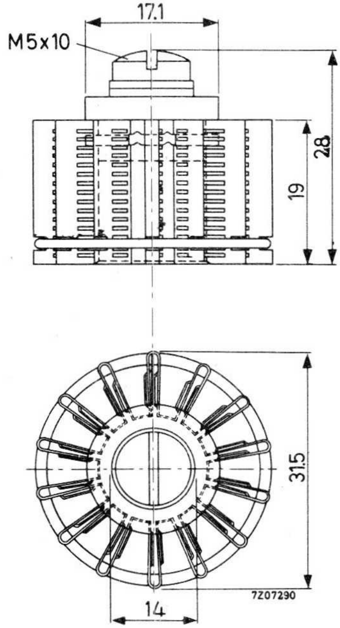

210±2
6
M5
7Z07125
isolating plate
phosphor-bronze
stranded wire
vane

PULL SWITCH FOR TUBE CUT-OUT



ANODE CONNECTOR

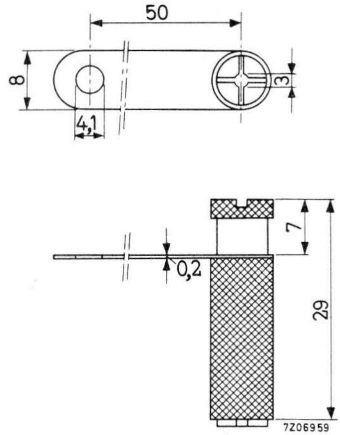
FOR TOP CAPS WITH 14..38 mm ϕ (IEC67-III-1b, type 3)



Material: brass, nickel plated

ANODE CONNECTOR

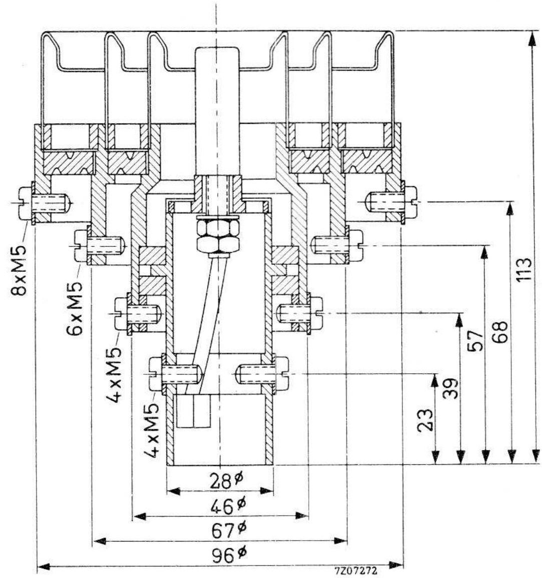
FOR 3 mm Ø TERMINALS



Material: brass, silver plated

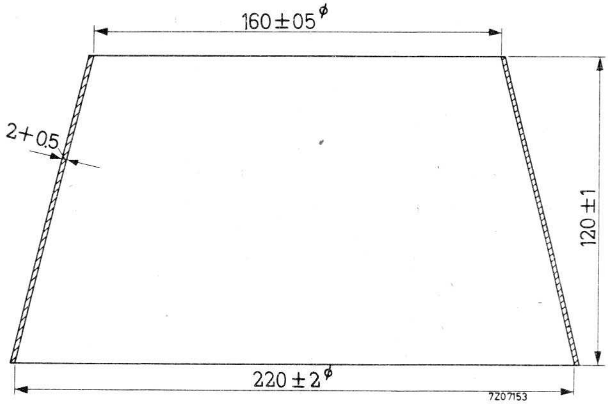
TUBE SOCKET

FOR 82 mm, 50 mm, 25,5 mm and 6 mm CONCENTRIC TERMINALS

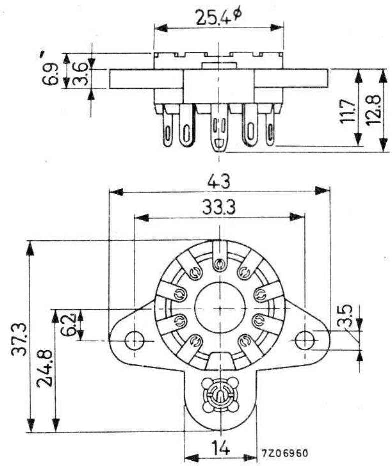


Material: synthetic resin insulating material
nickel plated contacts

CHIMNEY



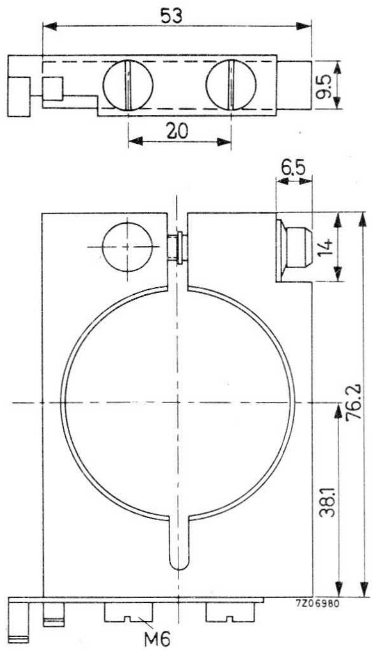
TUBE SOCKET FOR MAGNOVAL BASES



Material: synthetic resin insulating material
9 silver plated cup-shaped contacts

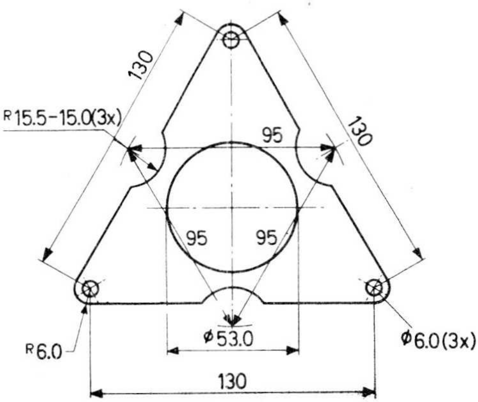
GRID CONNECTOR

FOR 48 mm ϕ TERMINALS



Material: brass, silver plated

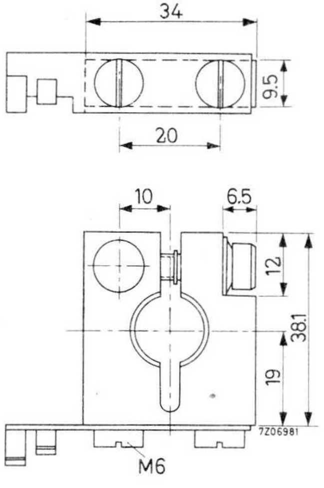
GRID CONNECTOR



Material: Brass

FILAMENT CONNECTOR

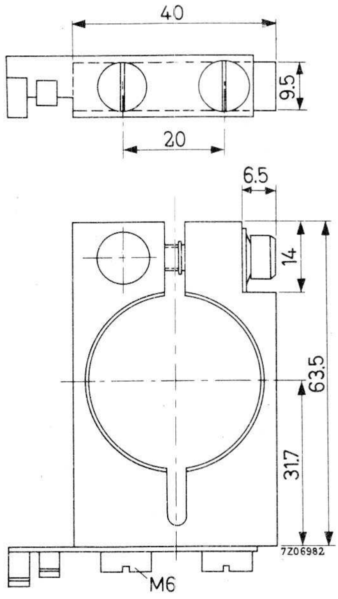
FOR 14.4 mm ϕ TERMINALS



Material: brass, nickel plated

FILAMENT CONNECTOR

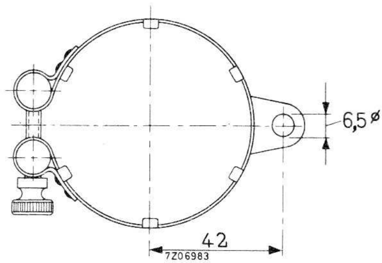
FOR 36 mm ϕ TERMINALS



Material: brass, nickel plated

GRID CONNECTOR

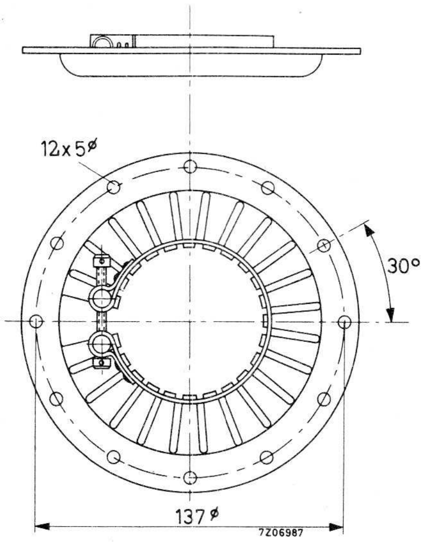
FOR 66 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 55 g

GRID CONNECTOR

FOR 66 mm ϕ TERMINALS

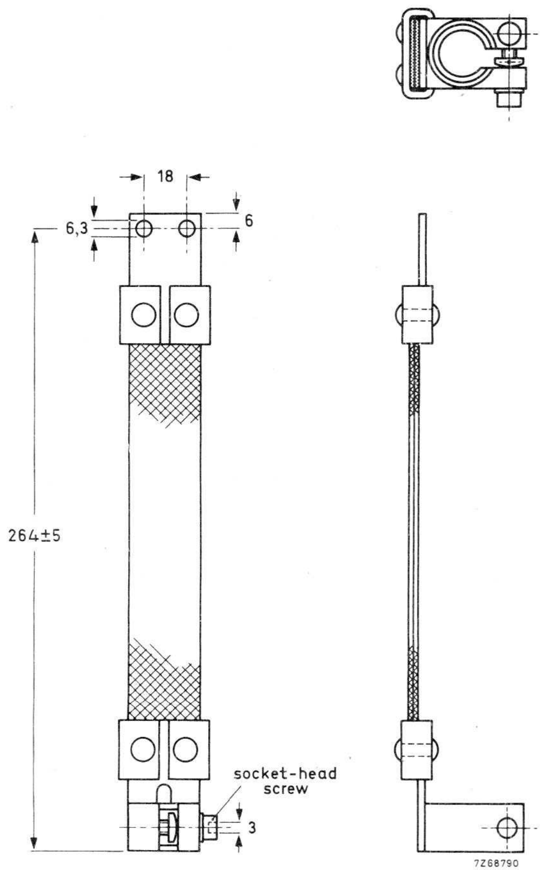


Material: brass, silver plated
Net weight: 240 g

FILAMENT CONNECTOR

FOR 25 mm dia TERMINALS

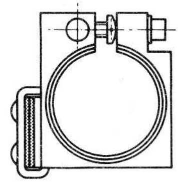
Net weight approx. 450 gr

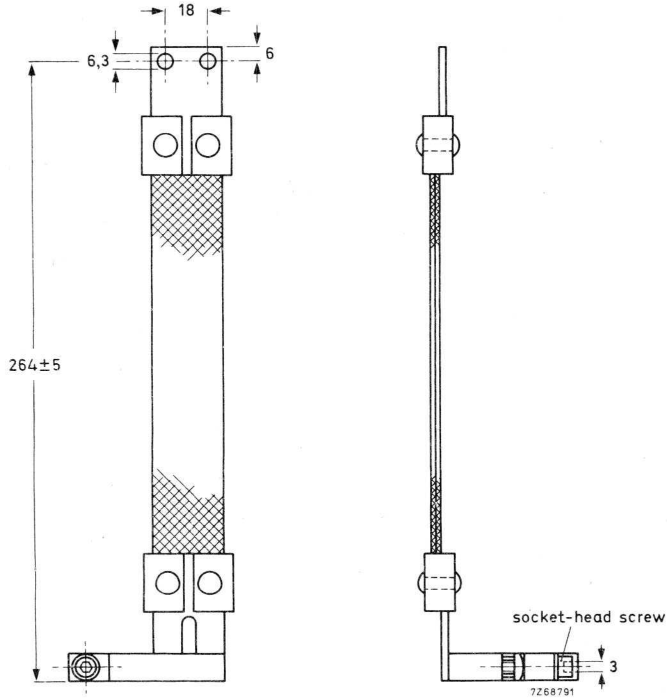


FILAMENT CONNECTOR

FOR 50 mm dia TERMINALS

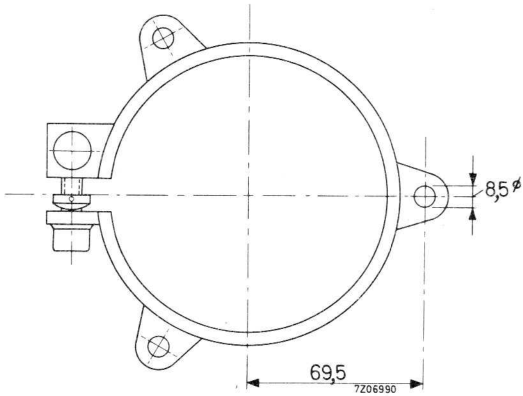
Net weight approx. 480 gr





GRID CONNECTOR

FOR 112 mm ϕ TERMINALS

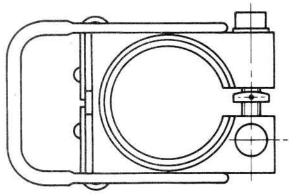


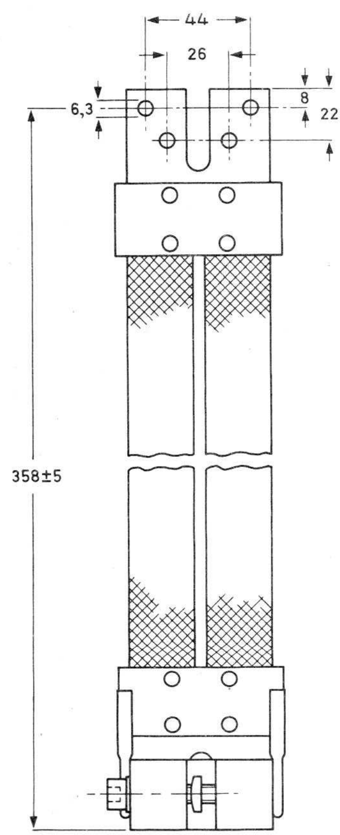
Material: brass, nickel plated
Net weight: 270 g

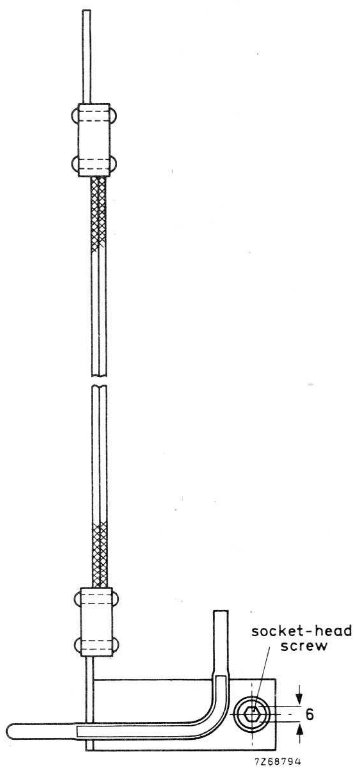
WATER COOLED FILAMENT CONNECTOR

FOR 54 mm dia TERMINALS

Net weight approx. 1380 gr



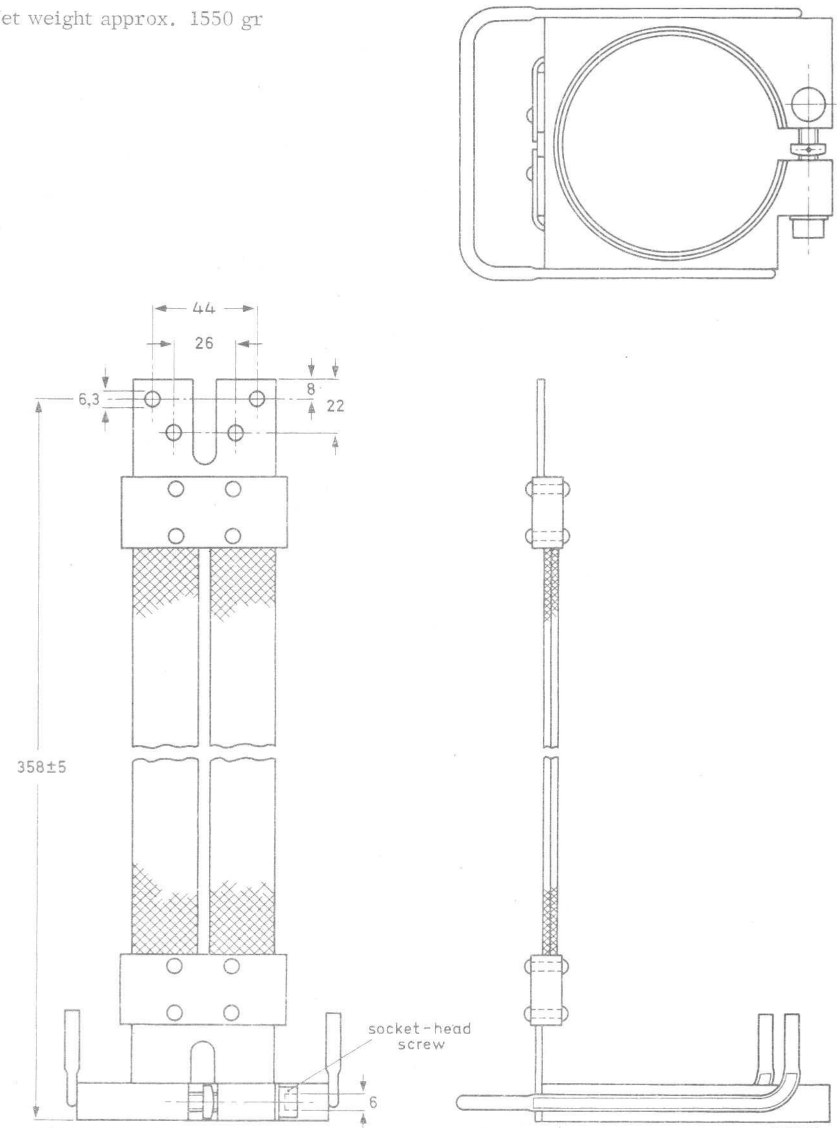




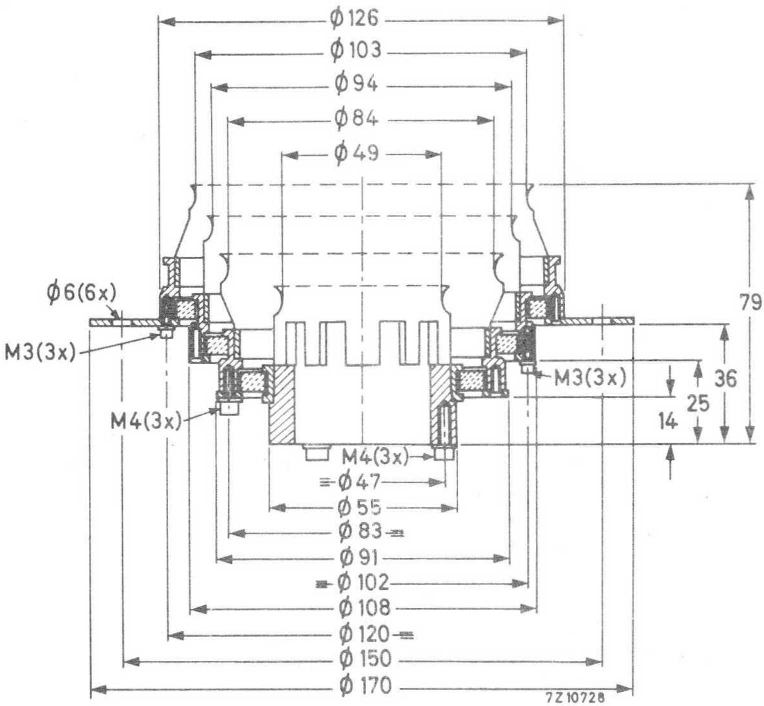
WATER COOLED FILAMENT CONNECTOR

FOR 96 mm dia TERMINALS

Net weight approx. 1550 gr



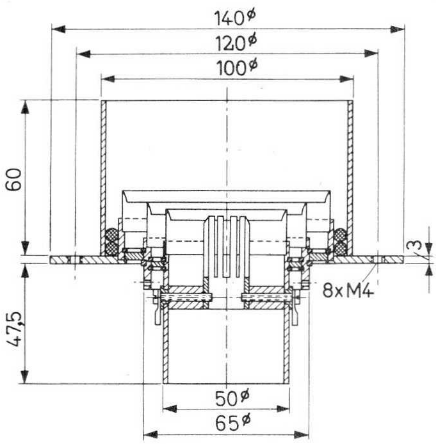
TUBE SOCKET FOR COAXIAL TUBES



Material: teflon insulating material
silver plated contact springs

TUBE SOCKET FOR COAXIAL TETRODES

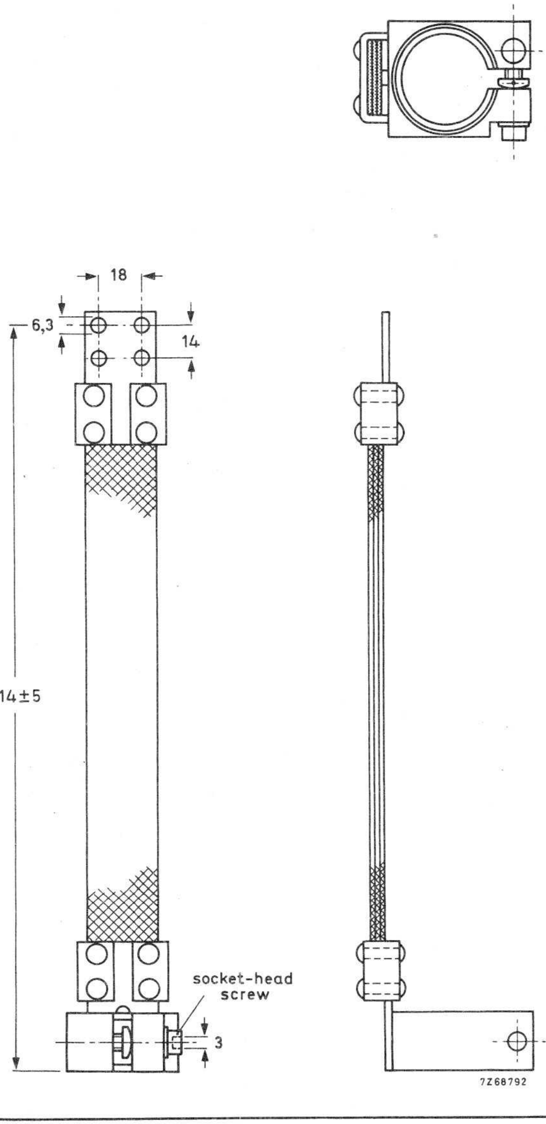
FOR 76,5 mm, 58,6 mm, 43,4 mm and 18,4 mm CONCENTRIC TERMINALS



FILAMENT CONNECTOR

FOR 42 mm dia TERMINALS

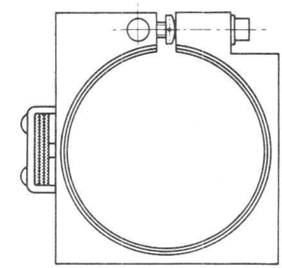
Net weight approx. 700 gr

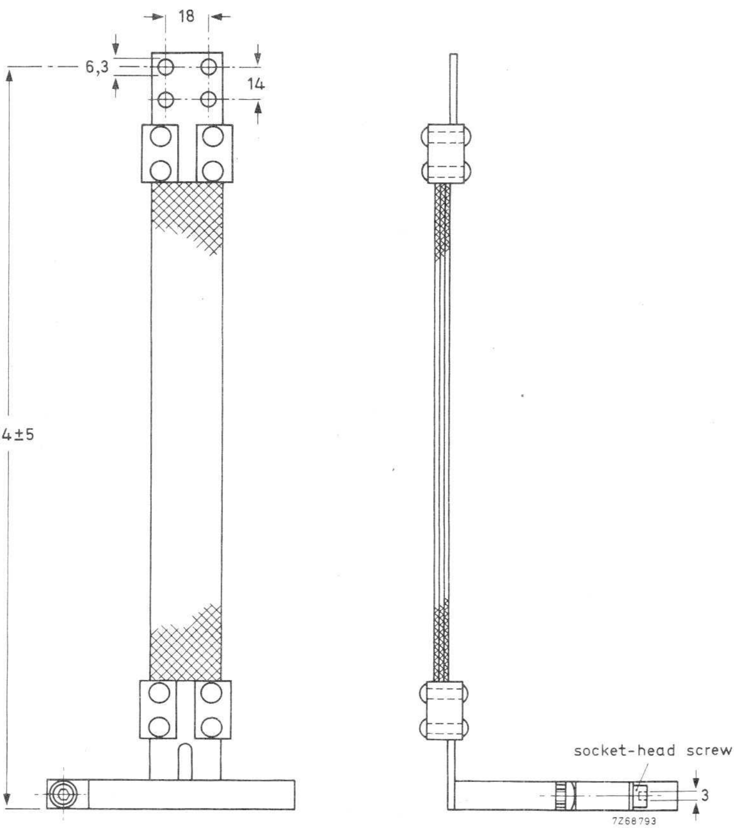


FILAMENT CONNECTOR

FOR 86 mm dia TERMINALS

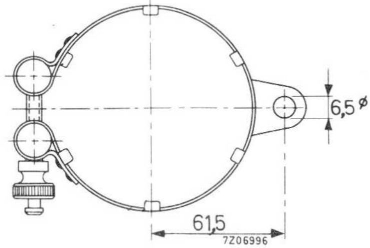
Net weight approx. 830 gr





GRID CONNECTOR

FOR 105 mm ϕ TERMINALS

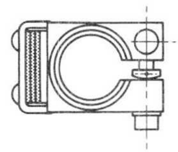


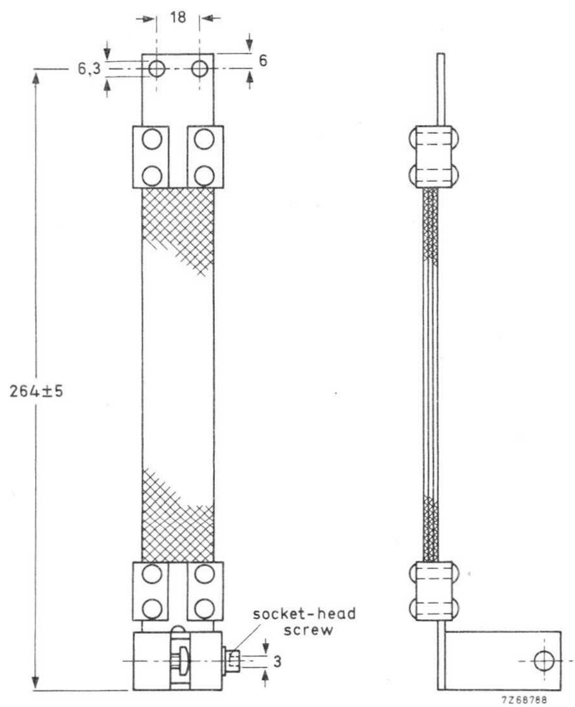
Material: brass, nickel plated

FILAMENT CONNECTOR

FOR 32 mm dia TERMINALS

Net weight approx. 600 gr

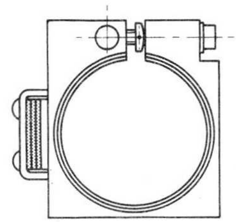


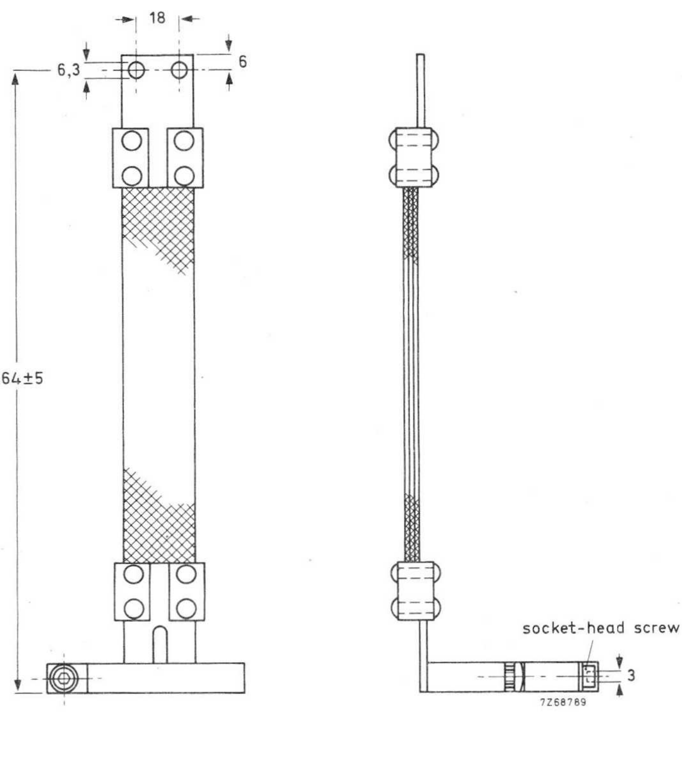


FILAMENT CONNECTOR

FOR 66 mm dia TERMINALS

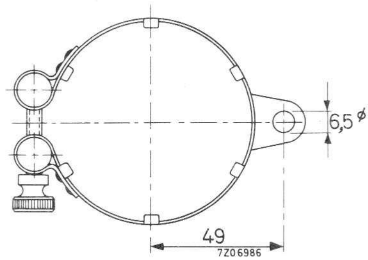
Net weight approx. 640 gr





GRID CONNECTOR

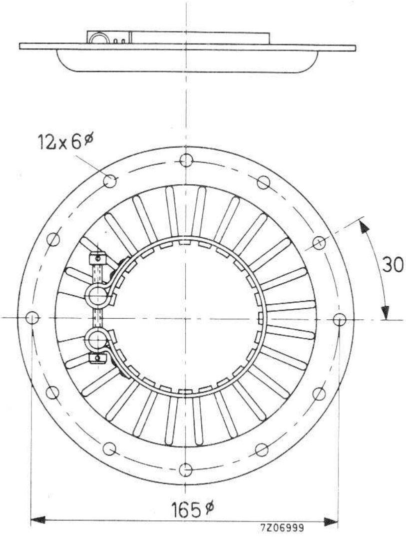
FOR 80 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 60 g

GRID CONNECTOR

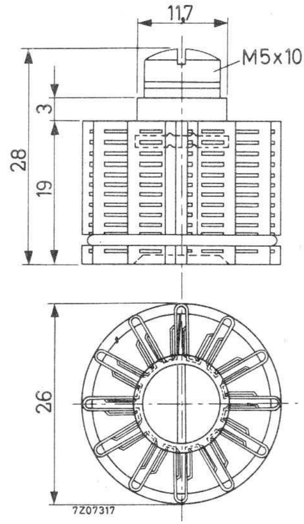
FOR 80 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 310 g

ANODE CONNECTOR

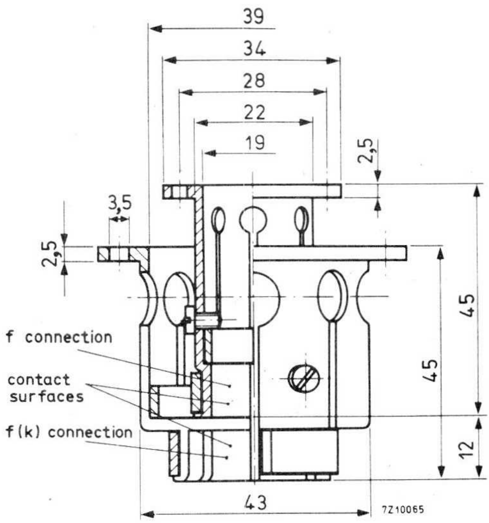
FOR TOP CAPS WITH 9,14 mm ϕ (IEC67-III-1b, type 2)

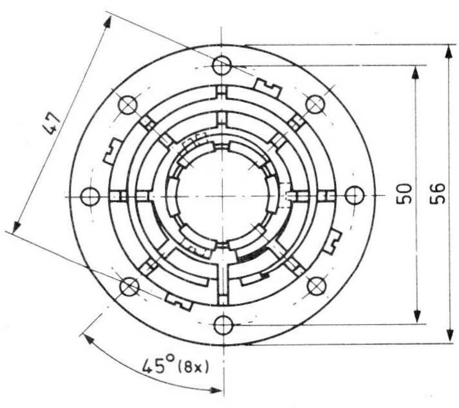


Material: copper, nickel plated

FILAMENT CONNECTOR

FOR 27 mm and 17 mm CONCENTRIC TERMINALS

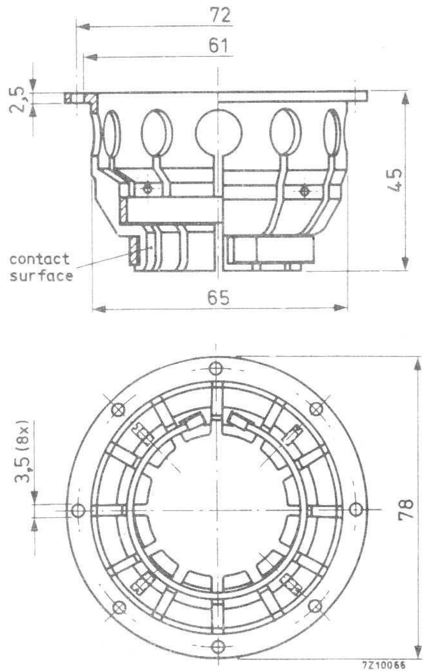




Net weight: approx. 0,2 kg

GRID CONNECTOR

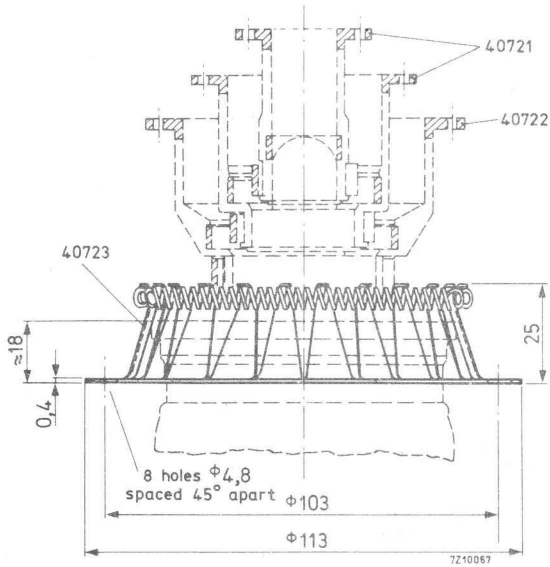
FOR 37 mm Ø TERMINALS



Net weight: approx. 0,2 kg

SCREEN GRID CONNECTOR

FOR 79 mm ∅ TERMINALS

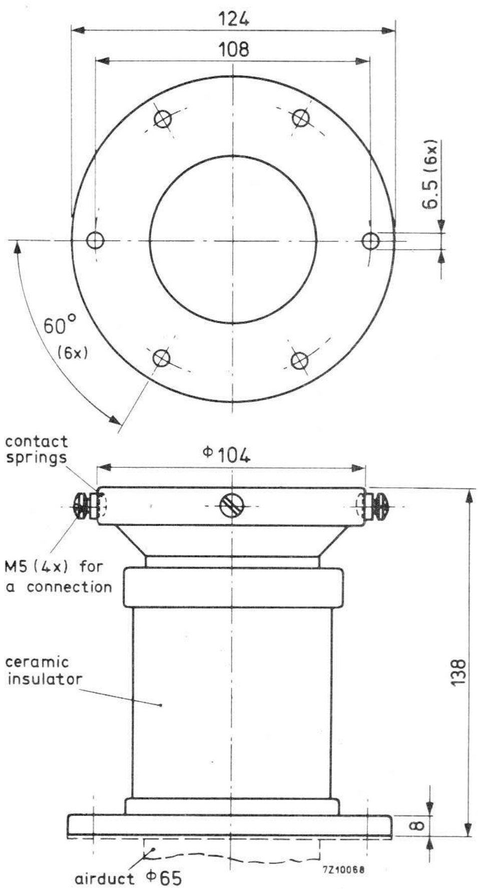


Net weight: approx. 0,1 kg

Caution

The tube must never be pulled through the spring ring.
So, if it has to be inserted from above, this should be done first, before the screen grid connection is made. Similarly, the tube can only be taken out after the screen grid connector has been removed.

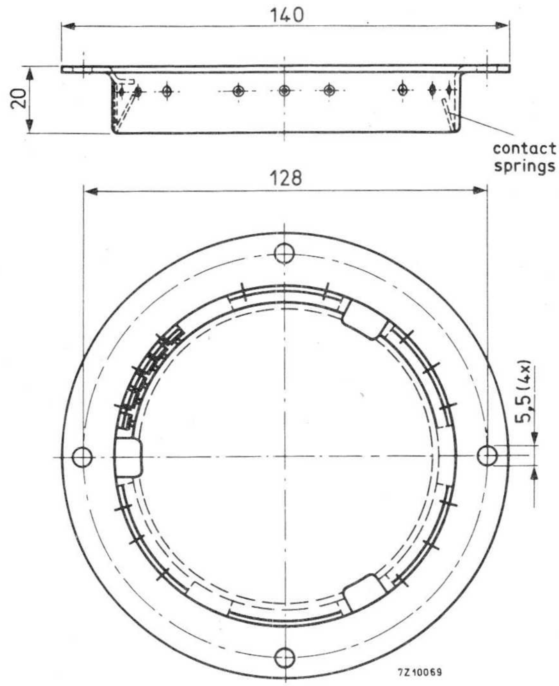
INSULATING PEDESTAL



Net weight: approx. 1.3 kg

GRID CONNECTOR

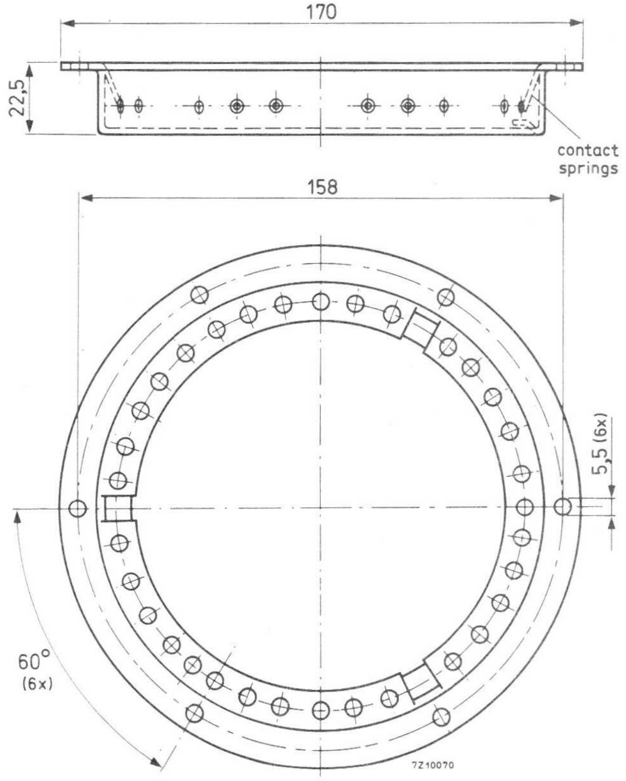
FOR 100 mm Ø TERMINALS



Net weight: approx. 0,14 kg

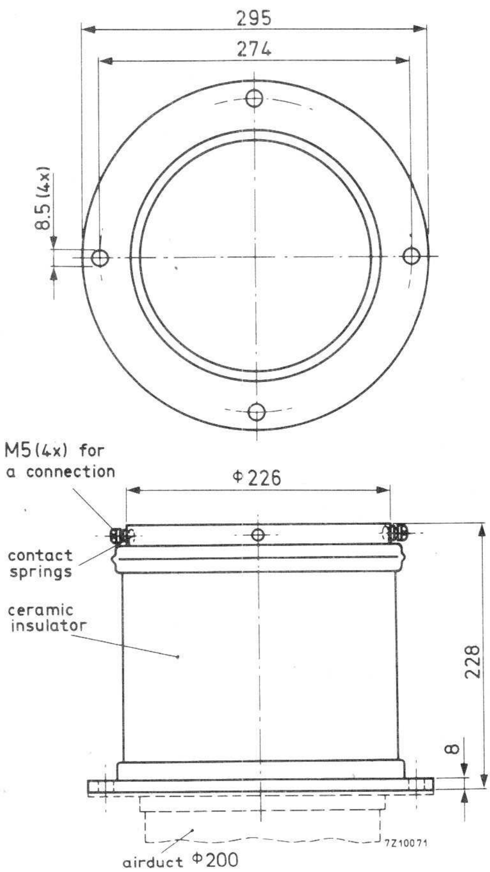
SCREEN GRID CONNECTOR

FOR 134 mm Ø TERMINALS



Net weight: approx. 0,2 kg

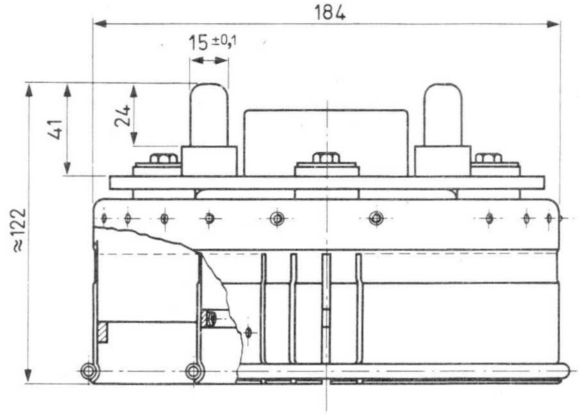
INSULATING PEDESTAL

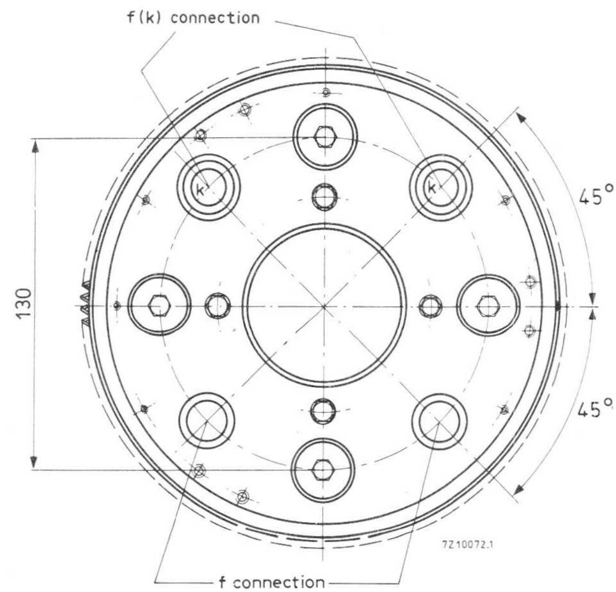


Net weight: approx. 8.2 kg

FILAMENT CONNECTOR

FOR 96 mm AND 40 mm CONCENTRIC TERMINALS

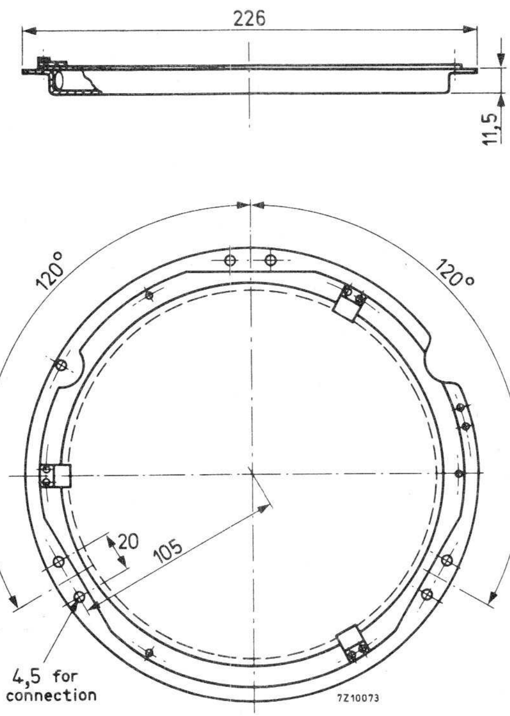




Net weight: approx. 2,5 kg

GRID CONNECTOR

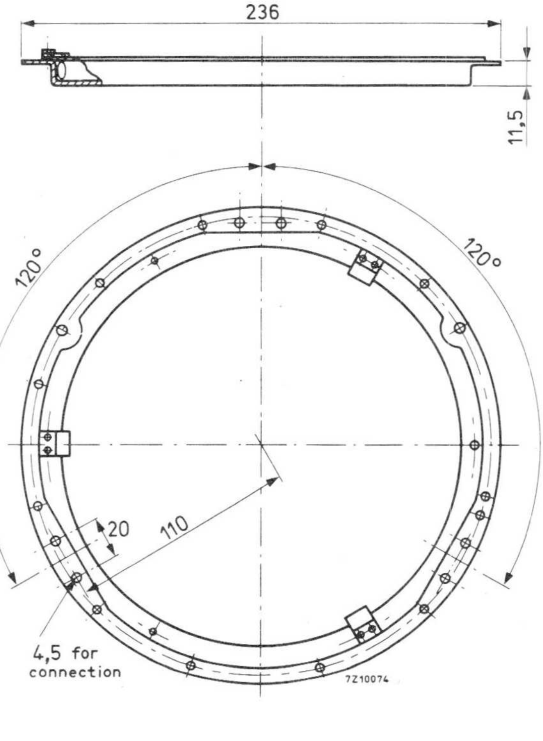
FOR 185 mm Ø TERMINALS



Net weight: approx. 0,35 kg

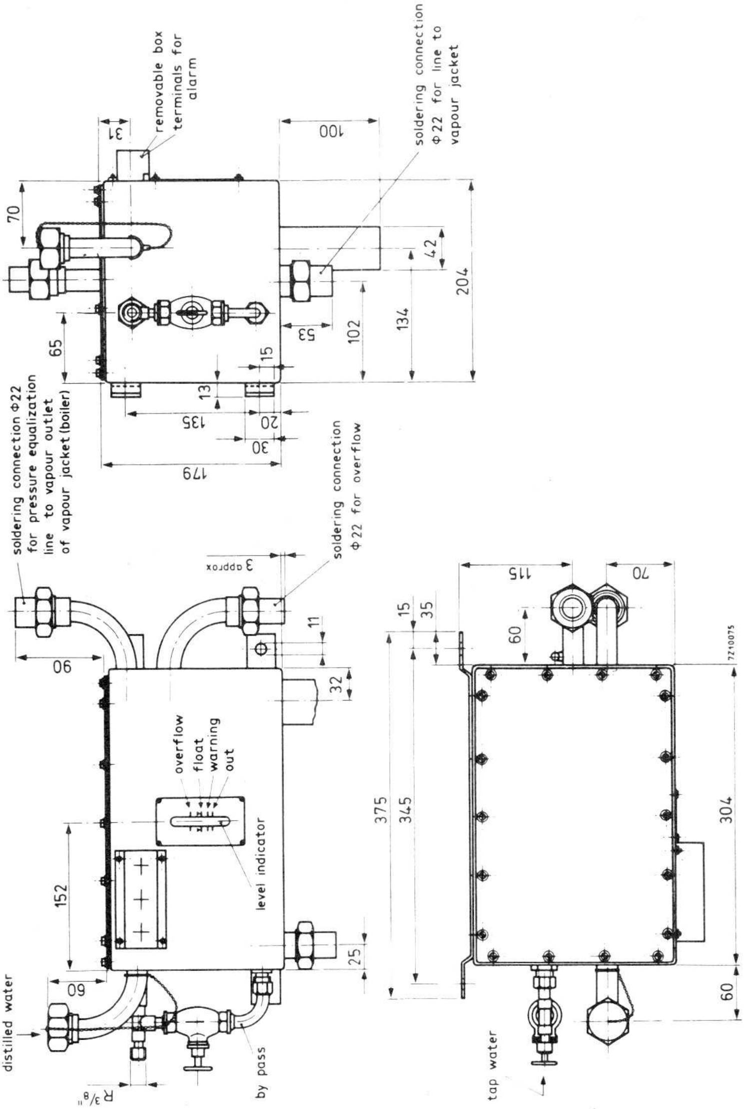
SCREEN GRID CONNECTOR

FOR 193,2 mm Ø TERMINALS



Net weight: approx. 0,4 kg

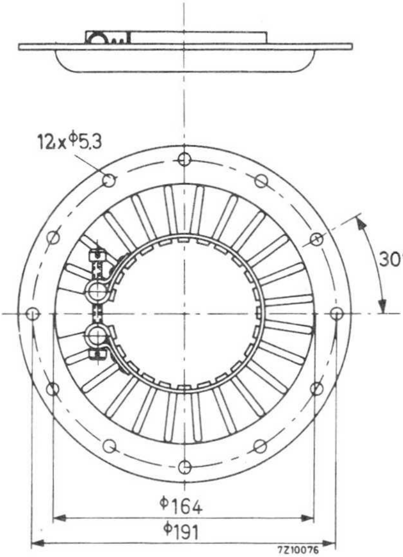
WATER LEVEL CONTROL



Material: Copper
Net weight: approx. 8.5 kg

GRID CONNECTOR

FOR 105 mm ϕ TERMINALS

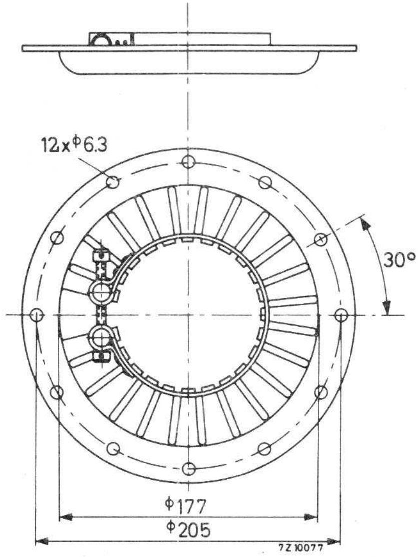


Material: brass, silver plated

Net weight: 450 g

GRID CONNECTOR

FOR 112 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 525 g

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K508	Acc	YD1160	Tran	YD1342	Tran
K509	Acc	YD1161	Tran	YD1343	Tran
K713	Acc	YD1162	Tran	YD1352S	Tran
K714	Acc	YD1170	Tran	YL1000	Tran
K715	Acc	YD1172	Tran	YL1010	Tran
K717	Acc	YD1173	Tran	YL1011	Tran
K720	Acc	YD1175	Tran	YL1012	Tran
K721	Acc	YD1177	Tran	YL1020	Tran
K722	Acc	YD1180	Tran	YL1030	Tran
K723	Acc	YD1182	Tran	YL1060	Tran
K724	Acc	YD1185	Tran	YL1070	Tran
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YD1010	Tran	YD1300	Tran	YL1182	Tran
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Acc = Accessories.
Tran = Transmitting tubes for communication; tubes for r.f. heating.

Type No.	Section	Type No.	Section	Type No.	Section
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Acc = Accessories.
Tran = Transmitting tubes for communication; tubes for r.f. heating.

Type No.	Section	Type No.	Section	Type No.	Section
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40694	Acc	40747	Amp		
40695	Acc	40748	Amp		
40696	Acc	40755	Amp		
40699	Acc	40756	Amp		
40704	Acc	40757	Amp		
40705	Acc	40758	Amp		
40706	Acc	40759	Amp		
40707	Acc	40760	Amp		
40708	Acc	40768	Amp		
40709	Acc	40775	Amp		
40710	Acc				
40711	Acc				
40712	Acc				
40721	Acc				
40722	Acc				
40723	Acc				
40724	Acc				
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40728	Acc				
40729	Acc				
40732	Acc				
40733	Acc				
40734	Acc				
40735	Acc				
40736	Acc				
40737	Acc				
40743	Amp				
40744	Amp				
40745	Amp				

Acc = Accessories.
Amp = Amplifier circuit assemblies.

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